

A Multidisciplinary Analysis of Coastal Storms in Western Britain, 1800-2020

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Abstract

This multidisciplinary study combines environmental science and environmental history to improve storm understanding in Western Britain from 1800 to 2020. Storms have persistently impacted coastal communities, infrastructure and environments in this region and climate change is predicted to increase storm threats and impacts.

A sedimentological study analysed saltmarsh storm impacts in Carmarthen Bay. High magnitude storm surge deposition in 1954, 1977 and 1981 was identified through sedimentological, meteorological and tidal gauge analyses. The results show storm surges irregularly contributed to sustaining saltmarsh elevation suggesting the value of continued research into saltmarsh storm impacts.

An archival newspaper analysis produced a comprehensive original storm database from 1800 to 2020. Three environmental history investigations followed.

The first investigation analysed a major storm using the concept of storm subcultures. The 1859 *Royal Charter* Storm and the ensuing developments in storm prediction were analysed. Storm catastrophes were shown to evoke long-term social, political and cultural responses. The event changed storm understanding and prediction with long-term community and governance implications. The analysis highlighted the importance of inclusive decision-making and adaptive storm subcultures.

The second study employed statistical and qualitative newspaper analyses of written storm representations from 1800 to 1953. Rapidly declining religious storm interpretations and progressively increasing scientific interpretations reflected changing beliefs in Britain. The analysis showed that epistemological change profoundly affected public storm representations and understandings.

A contemporary study analysed meteorological, tidal gauge and newspaper data from Storms Ciara and Dennis. While the storms were climate anomalies and the short-term response was effective, shortcomings in long-term climate change-related government policies likely enhanced vulnerability and therefore policy adaptation was recommended.

Multidisciplinary research ultimately improves the understanding of the often interconnected community and environmental storm impacts and can inform inclusive and

effective response. Further multidisciplinary research can therefore contribute towards enhancing resilience to increasing storm threats.

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Declaration

I declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for an award at any institution. All sources are acknowledged in the Bibliography.

Chapter 1: Introduction

1.1. Background and Motivation

Coastal storms pose a great and increasing threat to British communities (Lewis et al., 2011; Wadey et al., 2014; Lowe et al., 2018). Although knowledge of past storms is variable, geological and historical archival evidence indicates that storms have periodically impacted coastal environments and the human communities that inhabit them (Chaumillon et al., 2017; Garnier et al., 2018; Swindles et al., 2018). Such coastal storms have resulted in severe human and environmental loss with significant cultural and political implications (Johnson et al., 2005; Ruocco et al., 2011; Bauer, 2018).

Historical records highlight that major storms have periodically impacted Western Britain with events such as the Bristol Channel Floods of 1607 and Royal Charter Storm of 1859 respectively resulting in the loss of over 2,000 and 450 lives (Horsborough and Horritt, 2006; Morgan, 2015; Villiger et al., 2017). This enduring regional threat persists and is predicted to increase with climate-change driven sea level rise (SLR) and increases in atmospheric storminess (Palmer et al., 2018; Lowe et al., 2018). Recent reminders of the magnitude of the threat include the intense period of storms between the 3rd January and 3rd March 2014 in which economic losses between £487m and £681m were sustained (Environment Agency and Natural Wales, 2016). The similarly devastating damage caused by Storms Ciara and Dennis in February 2020 further illustrates this threat (Association of British Insurers, 2020).

This storm risk will have major implications in Western Britain for centuries (Halegatte *et al.*, 2013; Brown *et al.*, 2018), as entire communities may be forced to retreat from the coast such as in Fairbourne, North Wales (Phillips *et al.*, 2018; Buser, 2020). This will result in the loss of valuable coastal environments as well as cultural and human assets in the Fairbourne region which has prompted community political mobilisation in an attempt to change the future science-led no active intervention policy (Ballinger and Dodds, 2020). The prominence of such threats makes it important that storm trends and their impacts are better understood in the region. Although there have been previous attempts to reconstruct

past coastal storms in order to assess their potential twenty-first century consequences, the emphasis has primarily been placed on the storms with the very greatest social impacts or storms after 1950 (McEwen *et al.*, 2014; Haigh *et al.*, 2016; Villiger *et al.*, 2017). As a result, there is a lack of understanding of the nature and impact of the majority of past coastal storms in Western Britain, despite the availability of abundant archival and geomorphological storm evidence.

It is important that this understanding is improved so that changing coastal storms can be better understood and their environmental, cultural and human implications considered. This research employs a multidisciplinary approach combining environmental science and environmental history to improve the understanding of coastal storms and their impact in Western Britain from 1800 to 2020. The research originates from the White Rose College of the Arts and Humanities Flood Network which brought together researchers from different disciplines at the Universities of Leeds, Sheffield and York to improve the understanding of diverse storm and flood impacts. This produced original multidisciplinary research exhibiting the environmental, cultural and human implications of storms and flooding, with the aim of enhancing understanding of increasing climate changed-related threats.

1.2. Approach and Rationale

This multidisciplinary study utilises sedimentological, meteorological, tidal gauge and written newspaper evidence to analyse historical coastal storm impacts and effects in Western Britain. Western Britain represents an underresearched region exposed to increasing storm threat (Palmer *et al.*, 2018) with a wide availability of written archival and sedimentological evidence concerning storms. While the research was initially more environmental science focused, the restrictions imposed by the COVID-19 pandemic required refocusing of the project. Fieldwork and travel restrictions meant that the original main emphasis on sedimentology and environmental science was adapted so that increased focus was placed upon written archival research and the human and cultural implications of historical storms. This resulted in the research traversing more disciplines with an enhanced impetus on environmental history. The original approach of using mainly storm-related poetry and literature also changed to an approach focused on the analysis of storm-related

newspaper extracts and reports from 1800 to 2020. This adaptation occurred due to the wider resource availability, and increased the likelihood of correspondence with quantitative and sedimentological storm records, while newspaper reports have been evidenced to provide reliable, detailed and dated sources of qualitative and quantitative storm information (MacDonald *et al.*, 2010; Garnier *et al.*, 2018). Specifically, newspaper data was utilised to analyse storm community subcultures (Chapter Six), changing scientific and religious storm representations (Chapter Seven) as well as the factors that created the contemporary catastrophe of Storms Ciara and Dennis in February 2020 (Chapter Eight). This brought new disciplinary challenges not previously encountered, but the change of scope produced a broader more diverse thesis that gives more consideration to inherent and often interconnected environmental, cultural and human storm impacts.

Adopting a hybrid approach, the thesis firstly discusses the relevant literature to contextualise the main findings in the form of four papers and two chapters. The first paper (Chapter Four) is a multidisciplinary environmental science and environmental history study combining sedimentological, tidal gauge and meteorological evidence to enhance the understanding of coastal storm trends as well as their sedimentological and environmental impacts in Carmarthen Bay, south-west Wales. The sedimentological section focuses on storm surge evidence in the saltmarshes of the Three Rivers Estuarine Complex. This location was selected due to a combination of the limited storm surge sedimentological research in the area and the increasing risk of coastal storm inundation which poses a threat to the coastal environments and human communities (Palmer *et al.*, 2018; Natural Resources Wales, 2020). Specifically, regional storm surge skew (maximum observed sea level - maximum predicted sea level), is predicted to increase by 0.077 m by 2100 (1981-2000 baseline, MPI-ESM-LR-RCA4 model) and a regional SLR of >0.70 m is predicted by the UKCP18 models under the most likely RCP 8.5 scenario (Palmer *et al.*, 2018; Schwalm *et al.*, 2020). The paper analyses changes in coastal storm trends in Carmarthen Bay, identifying correspondence between sedimentological and archival records before considering the implications for saltmarsh sustainability. Considering the results of the study and future regional climate and marine predictions, the study recommends further research to explore the storm impacts on the saltmarshes of the Three Rivers Estuarine Complex to ensure their sustainability and continued provision of important ecosystem services.

Chapter Five highlights the extensive archival research undertaken on storm-related newspaper data from 1800 to 2020. This chapter exhibits the comprehensive original archival storm-related dataset created during the project and reveals the reported storm trends in Western Britain over the 220 year period. The research provides a novel insight into changing storm chronologies, impacts, characteristics and representation using a diverse range of reported qualitative, semi-quantitative and quantitative information. The dataset also provides important context to the archival Chapters Six, Seven and Eight which primarily utilise newspaper data, while also revealing other important storm-related information and trends. Newspaper information is analysed using relevant published research to assess the accuracy, correspondence and contributions of the archival dataset to improving historical and contemporary storm understandings.

The second paper (Chapter Six) employs an environmental history case study approach to analyse how a major storm event changed storm subcultures in the nineteenth century. The concept of storm subcultures draws on what Anderson (1965) originally termed disaster subcultures, which are defined as enduring trends of community and government response arising from an awareness of periodic storm threat. The analysis focuses on the *Royal Charter* Storm of 1859 and appraises its major impacts on communities and the government. The study was identified from the original newspaper database (Chapter Five) as a key historical event which changed community and government storm response and understanding. The selection was informed by a quantitative analysis of human storm impacts in the form of reported storm-related fatalities as well as a qualitative appraisal of historical community and government storm consequences and responses. The analysis shows how the *Royal Charter* Storm catastrophe evoked long-term social, political and cultural responses. Environmental history is shown to contribute to improving the understanding of the limitations of technocracy and the importance of community agency in enhancing hazard understanding and effective early warning systems. This understanding has important contemporary implications for governments which seek to foster sustainable storm subcultures and long-term community resilience.

The third paper (Chapter Seven) has an environmental history focus and analyses changing scientific and religious elements in storm representation in Western Britain between 1800 and 1953. The chapter primarily utilises a filtered version of the archived newspaper

database and relevant published research to analyse the impact of scientific development and religious decline on public storm representation. Original statistical and qualitative environment history analyses provide a new insight into the evolving public representation of storms over the 153 year period. February 1953 was chosen as the end date as it marks the occurrence of the infamous North Sea Flood catastrophe which catalysed a major change and well researched change in British storm representation and management (Lumbruso and Vinet, 2011; Hall, 2015). Chapter 7, therefore, fills a key knowledge gap by analysing representations up to this pivotal event. By considering the research on scientific (particularly meteorological) and religious developments of the period, the chapter undertakes a unique appraisal of the profound influence of religion and science on public storm representations. The research illustrates how wider epistemological change can profoundly affect the regional public representations of climate hazards and storms. It further stresses the importance of improving the understanding of epistemological and representational relationships to enhance the public understanding of storms and natural hazards.

Chapter Eight (the fourth paper) alternatively focuses on the contemporary storm catastrophe of Storms Ciara and Dennis in February 2020. A multidisciplinary approach combines quantitative meteorological and storm surge data with semi-quantitative and qualitative newspaper data. The research subsequently examines to what extent the storm catastrophe resulted from a meteorological climatic anomaly, short-term community and local authority response, as well as long-term national government policies. The study highlights how multidisciplinary research can offer novel and important contributions to improving the understanding of the factors that create a contemporary storm and natural hazard catastrophes.

The contributions of the chapters are subsequently discussed with an emphasis on how environmental history and environmental science can improve the understanding of storms and their variable environmental and societal impacts. The potential of further multidisciplinary historical storm and natural hazard research in Western Britain and more broadly is also discussed.

1.3. Aims and Objectives

The aim of the thesis is:

- To determine how multidisciplinary research can improve the understanding of coastal storm trends and their environmental, cultural and societal impacts in Western Britain from 1800 to 2020.

The aim is addressed by the following objectives:

- 1) To analyse past coastal storm trends using historical records.

Sedimentological, meteorological, tidal gauge and written newspaper data are used to identify and analyse coastal storm chronologies and trends. Tidal gauge and meteorological records are analysed to assess quantitative changes in storm surge and storm magnitude in south-west Wales and across Western Britain during Storms Ciara and Dennis. Sedimentological saltmarsh records are appraised to identify the impacts of past storms on coastal saltmarshes in Carmarthen Bay, south-west Wales. Qualitative and semi-quantitative newspaper reports from 1800 to 2020 are also studied to analyse the documented societal and cultural impacts of storms. The combined multidisciplinary approach provides original insights into past coastal storms in Western Britain.

- 2) To analyse sedimentological evidence and records of coastal storms in estuarine saltmarsh sediments.

Field, geochemical, particle size and radionuclide dating analyses of saltmarsh sediments are undertaken to determine potential evidence of past coastal storms in the saltmarshes of the Three Rivers Estuarine Complex, Carmarthen Bay.

Quantitative meteorological and tidal gauge records are used in conjunction with relevant research to identify the events sedimentological evidence likely originated from and increase the understanding of the environmental impacts of coastal storms on saltmarshes.

- 3) To improve the understanding of the documented impacts and effects of coastal storms in Western Britain between 1800-2020.

A comprehensive original archival database detailing semi-quantitative and qualitative newspaper storm reports in Western Britain between 1800-2020 was created. Trends in reported cultural, societal and environmental coastal storm impacts and effects are analysed.

- 4) To analyse the social, political and cultural responses to a major storm event and the subsequent implications for storm subcultures.

The social, political and cultural responses to a major nineteenth storm event and the implications for storm subcultures are analysed. Focus is placed on the underresearched *Royal Charter Storm* of 1859 and how the storm evoked community and government responses designed to decrease long-term vulnerability.

- 5) To examine how epistemological change influenced storm representation and understanding through the analysis of scientific and religious storm representations.

The changing scientific and religious elements of storm representations in British newspapers between 1800 to 1953 are analysed. The wider impact of epistemological change on storm representation and understanding is appraised.

- 6) To assess the factors that contributed to the contemporary catastrophe of Storms Ciara and Dennis in Western Britain.

Meteorological and storm surge data are combined with newspaper data concerning storm characteristics, short-term community and State response as well as long-term government policies to assess the factors that contributed to the catastrophe of Storms Ciara and Dennis in February 2020. The study examines the contribution of the different factors to the catastrophe.

- 7) To evaluate the benefits of multidisciplinary storm research.

How a diverse and inclusive multidisciplinary approach can offer unique and original contributions to improving the understanding of coastal storm trends and their environmental, cultural and human impacts is evaluated. The wider benefits of further historical and contemporary multidisciplinary storm and natural hazard research are appraised.

1.4. Thesis Structure

The hybrid thesis comprises ten chapters with chapters four, six, seven and eight comprising four diverse papers. The present chapter (One) introduces the research and states the aims and objectives.

Chapter Two comprises the literature review which provides context to the multidisciplinary research and approach. The chapter outlines the current research concerning coastal storms in the fields of environmental science and environmental history. The contributions of relevant subdisciplines are reviewed along with the value of wider multidisciplinary storm research.

Chapter Three comprises the methodology. The techniques and methods employed are described and explained. As Chapters Four, Six, Seven and Eight also have individual methods sections, the emphasis is placed on detailing methods which could not be fully described in the papers. Chapter Three, therefore, contains more information on the complex methods contributing towards the research of Chapter Four. The section also gives an overview of the methods of Chapters Six, Seven and Eight which are fully described in the respective chapters.

Chapter Four is a multidisciplinary paper which combines sedimentological, tidal gauge and meteorological evidence to improve the understanding of coastal storm trends and saltmarsh environmental impacts in the Three Rivers Estuarine Complex, Carmarthen Bay, south-west Wales. This addresses objectives one and two.

Chapter Five analyses the comprehensive original archival dataset concerning storm-related reports in Western Britain between 1800 to 2020. Reported trends of cultural, societal and environmental coastal storm impacts and effects are analysed in conjunction with relevant research to assess the accuracy, correspondence and contribution to storm understanding. This research thereby addresses objective three and also provides the background for Chapters Six, Seven and Eight.

Chapter Six is an environmental history paper. The research analyses how a key case study storm event majorly impacted storm subcultures in nineteenth century Britain. The chapter draws on the concept of disaster subcultures, which concern long-term regional subcultural

trends geared toward the solution of problems arising from the awareness of periodic disaster (Anderson, 1965). The case study is the *Royal Charter Storm* of 1859 and the chapter meets objective four concerning the social, political and cultural responses to storms.

Chapter Seven is the third paper, which appraises how the scientific and religious elements of storm representations changed in newspapers in Western Britain from 1800 to 1953. The effects of epistemological change on wider public storm representation and understanding are analysed thereby addressing objective five.

Chapter Eight (paper four) analyses the impacts and effects of Storms Ciara and Dennis in Western Britain in February 2020. By combining quantitative storm and storm surge data with semi-quantitative and qualitative newspaper reports, the chapter addresses objective six by examining the extent to which meteorological climate anomalies, short-term response or long-term government policy contributed to the catastrophe. How future high magnitude storm impacts and catastrophes can be best mitigated is subsequently considered.

Chapter Nine discusses the diverse contributions of the research with a focus on how environmental history and environmental science independently and collectively improve storm understanding. Emphasis is placed on how the research exhibits how coastal storms and their environmental, social, political and cultural implications have changed over time and the importance of this knowledge. The unique and original contributions of multidisciplinary research to improving the understanding of storms and natural hazards in Western Britain and other threatened regions are discussed thereby addressing objective seven. Chapter Ten concludes the thesis with a research summary and highlights the potential and high value of future multidisciplinary research on storms and natural hazards

1.5. Novelty and Setting

The research will use a multidisciplinary approach to investigate storms in Western Britain. It will combine techniques as varied as radionuclide sediment dating and the analyses of religious representations in historical newspapers to provide original and important insights into the nature and impact of coastal storms in the region. The findings of the

multidisciplinary study range from saltmarsh sedimentological storm impacts, storm subculture evolution, the effects of epistemological change on public storm representation and understanding, as well as the factors that produce contemporary storm catastrophe. The focus is specifically on reported coastal storms in Western Britain, defined as the area within 25 km of the coastline from the Celtic Sea to The Minch including all British islands.

Western Britain was selected as the regional focus for the following reasons. Major historical and recent storms have been analysed but no multidisciplinary study has comprehensively explored the diverse effects of storms in the region. Improving this understanding is important given that the enduring regional coastal storm and storm surge risk is predicted to increase with climate change (Lowe *et al.*, 2018; Palmer *et al.*, 2018). The lack of knowledge on storm trends is particularly notable given that there is widespread availability of historical archival records in the area, with newspaper reports consistently published since the start of the nineteenth century (GALE, 2022). Very limited sedimentological coastal storm research has also been undertaken in comparison to the East coast despite the periodic occurrence of major coastal storms (e.g. Zong and Tooley, 2003; Bankoff, 2013; Pfister *et al.*, 2015). This is particularly the case in south-west Wales, a region with a high coastal storm exposure (Natural Resources Wales, 2022). As a result, Chapter Four considers sedimentological storm evidence from the saltmarshes of the Three Rivers Estuarine Complex, Carmarthen Bay with meteorological storm evidence from Pembroke and storm surge tidal gauge data from Milford Haven.

Likewise, while research on social, political and cultural storm effects has been undertaken ranging from Henderson's (2017) appraisal of the role of witches in storm cultural understandings on the Isle of Bute in 1662 to McEwen *et al.*'s (2014) assessment of community knowledge value following the 2014 Somerset floods, the majority of the research focuses on select major events or stormy periods <1 year in length (e.g. Horsborough and Horritt, 2006; Sibley *et al.*, 2014). The creation of an original archival dataset enables novel analyses of diverse storm impact and effect trends from 1800 to 2020 and constitutes Chapter Five.

Chapter Six uses information sourced from the archival dataset and analyses the reported social, political and cultural impacts of storms to inform the selection of an underresearched case study. The case study is the *Royal Charter* Storm catastrophe which occurred off

Anglesey, North Wales in October 1859. Importantly, the event has wider major implications for coastal communities and national governance. The chapter presents an original insight into the effects of the storm on coastal communities and the national government while also highlighting its wider long-term influence on storm subcultures in Western Britain.

Chapter Seven offers a perspective on wider long-term (1800 to 1953) change in public storm representation including information from throughout Western Britain. The analysis of the changing religious and scientific elements of storm representations in historical newspapers gives an original insight into the effect of changing epistemology and ideas regarding weather, climate, storms and their influence on public representations and understanding. The chapter originally employs quantitative statistical and qualitative text analyses to analyse the effects of epistemological change on storm representation over the 153 years. The aim is to improve the knowledge of the public understanding of storms and their evolving impacts.

Chapter Eight adopts a contemporary focus and analyses Storm Ciara and Dennis in February 2020 using a combination of scientific and newspaper data. This enables an examination of the factors that contributed to the catastrophe across Western Britain, thereby uniquely improving the understanding of contemporary storm catastrophe while also highlighting how future multidisciplinary research can contribute to future catastrophe mitigation.

Chapters Six, Seven and Eight respectively consider the effects of major storms on communities and government, how epistemological change influences storm representations and understanding, as well as the factors that cause contemporary storm catastrophe. Chapter Four alternatively provides a novel insight into environmental storm impacts in an important and likely threatened saltmarsh ecosystem. The diverse study therefore addresses our limited understanding of the important and often interconnected impacts of storms on the coastal environments and communities climate change threatened Western Britain. It further exhibits the key and unique contributions of historical and contemporary multidisciplinary research to improving the understanding of storms and other natural hazards.

Chapter 2: Literature Review

This chapter reviews the literature on the research themes of this thesis. The diverse characteristics and effects of coastal storms and the findings of past relevant research are analysed. The value of the multidisciplinary storm and natural hazard research is also appraised.

2.1. Coastal Storms: Background and Characteristics

Geological and written records indicate that the coastal regions of the British Isles and North-west Europe have been periodically exposed to high magnitude storms throughout the Holocene (c.11,700 a BP - present) (Clarke and Rendell, 2009; Wefer *et al.*, 2013). The socio-economic consequences of these events have been diverse across space and time, ranging from the deaths of 2,000 people during the great storm and Bristol Channel flood of 1607 to the £363 m of damage caused by Storms Ciara and Dennis in the UK during February 2020 (Risk Management Solutions, 2007; Association of British Insurers, 2020). Coastal storms have also had great social and community impacts, influencing religious thought and scientific developments, particularly in the field of meteorology (Anderson, 2005; Walker, 2011). High magnitude storms can change the way communities and governments represent and respond to storm risk. Research on events from the Great Storm of 1703 to the North Sea Flood of 1953 has highlighted the devastating human impacts of coastal storms as these events contributed to changing representations of storms and, in the latter case, prompted major changes in defence and emergency planning policy (McRobie *et al.*, 2005; McKay, 2007; Hall, 2015). Although coastal storm management and response has improved drastically since 1953, a combination of climate change-driven sea level rise and increasing atmospheric storminess is predicted to increase the frequency of high magnitude storms (Lowe *et al.*, 2018). As a result, severe weather including coastal storms poses one of the greatest risks to the British population (The Cabinet Office, 2019).

The most recent regional UK climate projections (United Kingdom Climate Projections (UKCP18)) show that increasing atmospheric storminess will enhance human and environmental storm threats across Britain (Lowe *et al.*, 2018). In coastal areas enhanced storminess will increase storm surge skew (maximum observed sea level - maximum

predicted sea level) while progressive sea level rise will render coastal regions even more vulnerable to storm surge impacts and inundation (Lewis *et al.*, 2011; Palmer *et al.*, 2018). Storm surges occur under conditions of low barometric pressure and onshore winds resulting in water accumulation at the shore above the height of predicted tide (NTSLF, 2019). Surges can potentially result in widespread flooding of coastal areas, threatening communities and coastal environments (Tebaldi *et al.*, 2012; Yan *et al.*, 2016). Historical tidal gauge records, normalised for instrumental error and sea level rise can be used to improve the understanding of changing storm surge trends and allow comparison with future models (Dangendorf *et al.*, 2013; Haigh *et al.*, 2016). Wadey *et al.* (2014) exhibited that in South-west Britain this predicted trend of increasing storm surge frequency and magnitude is already prevalent, with the winter 2013/2014 period of extreme high water level being identified as the most extreme on record when clustering and magnitude is considered. Historical meteorological observations also provide another insight into the changing magnitude and frequency of storms over time. Meteorological data recorded from Meteorological Office observatories provide accurate data on changing storm trends and can contribute towards better understanding historical weather and storm trends (Allan *et al.*, 2006; Craig and Hawkins, 2020). However, multiple studies have identified issues regarding changing instrumental and weather locations, inaccurate observations, missing data and data conversion issues which can render a total reliance on historical meteorological records unreliable (e.g. Changnon and Kunkel, 2006; Mayernik *et al.*, 2017; Toride *et al.*, 2017).

Although tidal gauges and weather stations can provide accurate quantitative information, their spatial and temporal limitations mean a wider range of sources need to be considered to better understand changing coastal storms trends and their impacts (Barlow *et al.* 2013; Breilh *et al.* 2014). Semi-quantitative or qualitative archival records provide a novel insight into historical storm and flooding trends (Mock *et al.*, 2010; Hamdi *et al.*, 2018) (see Figure 2.1). This archival information can improve the understanding of changing storm trends over longer periods before reliable scientific observation became widespread (Gariner *et al.*, 2018). Qualitative written records and reports such as those in diaries and newspapers reveal the changing human impacts of storms ranging from economic estimates of property loss to the effects on personal and community perceptions (Pfister *et al.*, 2010; McEwen *et*

al., 2014; Morgan, 2015). For example, Archer *et al.* (2019) uses archival newspaper reports to appraise human flash flooding impacts and produce a new flood chronology for the north and south-west of England between 1700-2013 (see Figure 2.1). Bankoff (2013) also uses archival records from the medieval period to the twentieth century to demonstrate how communities in Eastern England developed ingrained cultural adaptations and disaster subcultures (Anderson, 1965) after periodic exposure to storms and floods. Archival records therefore possess a great potential to provide diverse insights into UK storm trends and impacts over different time periods.

Geomorphology and sedimentology can also provide unique evidence of storm effects before or in the absence of written records and indicate their environmental impacts (Toomey *et al.*, 2013; Leonardi *et al.*, 2018). Records comprising of storm surge signatures in the form of erosional contacts of abrupt coarse deposits can indicate the occurrence and impact of storm events (Tsompanoglou *et al.*, 2011; Swindles *et al.*, 2018). For instance, Brandon *et al.* (2013) used sedimentological evidence to reconstruct Florida hurricane activity over the last ~2500 years exhibiting a period of increased intense hurricane frequency between ~1700 and ~600 years B.P.

While each discipline offers highly valuable independent contributions to storm understanding, multidisciplinary research can provide new insights into the wider human and environmental impacts of storms (e.g. MacDonald *et al.*, 2010; Chaumillon *et al.*, 2017). The following sections explore how different research disciplines and fields have variably contributed to improving the understanding of the characteristics and effects of storms. The unique value of the wider multidisciplinary research is subsequently outlined.

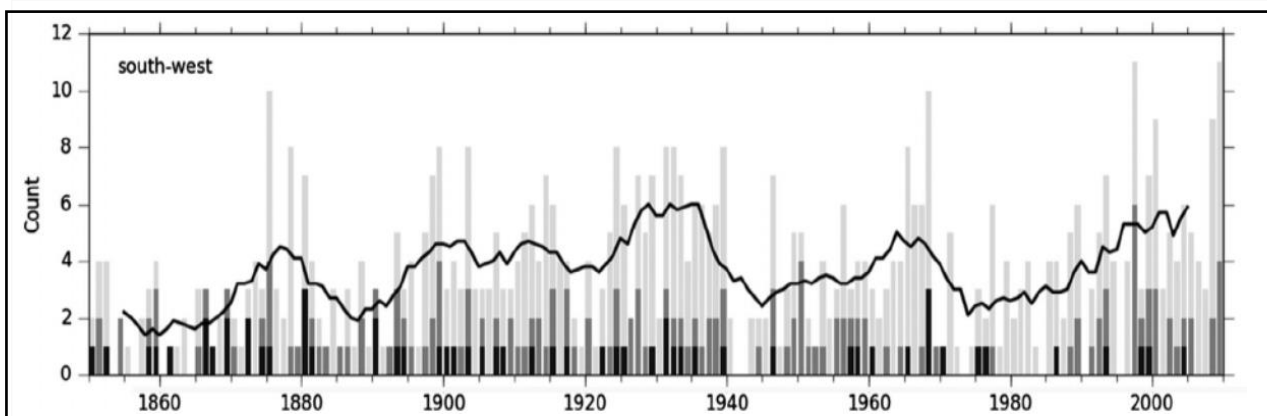


Figure 2.1. Flooding chronology in South-west England between 1850-2010 derived from archival newspaper records. Black line indicates 10 year running mean. High, intermediate and low social, cultural and economic impacts are displayed in black, dark grey and light grey respectively. Figure produced by Archer *et al.* (2019).

2.2. Coastal Storm Impacts

Storms and flooding present an increasingly serious concern for coastal communities and environments in Britain (e.g. Prime *et al.*, 2015; Lowe *et al.*, 2018; Burden *et al.*, 2020). In England alone an estimated 2.5 million properties were at risk of coastal and fluvial flooding between 2019 and 2020 with 852,000 at medium or high risk (Environment Agency, 2021). In Wales the situation is comparably serious as 161,200 properties are vulnerable to tidal or fluvial flooding with 71,050 specifically at risk of tidal inundation (Natural Wales, 2019). In Scotland the most recent national data indicate there will be increasingly frequent high magnitude storms and floods with 108,000 properties at risk of a 1 in 200 year flood. It is predicted 28,000 Scottish residents could be extremely and acutely disadvantaged by coastal flooding (Scottish Environmental Protection Agency, 2015).

Since the North Sea storm surge of 1953, which claimed 307 British lives and caused economic losses of £50 million (£1.04 billion in 2020) (Prichard, 2013), substantial research and investment has been made into reducing the socio-economic impact of coastal flooding. However, the influence of sea-level rise and increasing storminess in the UK (Haigh and Nicholls, 2017) has the potential to significantly increase the coastal flooding threat (Mokrech *et al.*, 2017). In England alone, it is predicted that if investment remains at 2009 levels (adjusting for inflation), 350,000 more properties (71.4% more) will become at risk of flooding during a 1 in 75-year event (Environment Agency, 2010). Therefore, there is a clear need to improve the understanding of coastal storm trends to ultimately ensure coastal communities can best adapt and have high resilience to future climate change pressures.

As a result of greater relative sea level rise, enhanced storm surge risk, the socio-economic importance of the Thames Estuary and the legacy of the 1953 event, there has been an increased emphasis on coastal storm research in Eastern Britain (e.g. Lewis and Kelman, 2009; Dawson *et al.*, 2011; Spencer *et al.*, 2014). In comparison, Western Britain remains underresearched despite evidence of periodic devastating high magnitude storm events including the 1607 Bristol Channel Flood, Great Storm of 1703 and Royal Charter Storm of 1987 (Horsburgh and Horitt, 2006; Haigh *et al.*, 2015; Villager *et al.*, 2017). The winter of 2013-14 served as a recent reminder of this threat as the highest ever water level was recorded at Newlyn, Cornwall along with the greatest recorded clustering of storm surge

events (Wadey *et al.*, 2014). Even despite enhancements in coastal management and understanding, an estimated £1.3 billion of damage was sustained across England and Wales alone (Environment Agency & Natural Resources Wales, 2021).

Storms can also have major geomorphological and sedimentological impacts in the coastal zone. However, storm impacts are dictated by the meteorological conditions as well as the geomorphological and geological settings which influence aeolian and storm surge wave exposure and the ability of storms to erode, deposit or transport differing classes and amounts of sediment (Bird, 2011; Pye and Blott, 2016). For instance, Dissanayake *et al.* (2015) highlighted that a sequence of three storms during the winter of 2013/14 prompted significant dune retreat and enhanced intertidal sandbar erosion at Southport, Merseyside. This storm-catalysed geomorphological change was predicted to potentially reduce the resilience of the dune system to future storm surges. During the same events in winter 2013/14, the refraction of westerly Atlantic storm waves in the south-facing bays in South-west Britain resulted in large incident wave angles and strong eastward littoral drift (Masselink *et al.*, 2017). South coast beaches exhibited geomorphological rotation, with the western part of the beaches eroding and the eastern part accreting (see Figure 2.2.(c)). In contrast, on west-facing beaches on the north Cornwall coast extensive beach and dune erosion was experienced (See Figure 2.2.(a)). These examples highlight how the geomorphological and geological settings and meteorological characteristics result in region-specific geomorphological storm impacts (Naylor *et al.*, 2017). The geomorphological storm response is inherently interconnected with diverse environmental impacts. Highfield *et al.* (2018) exhibit how Hurricane Ike resulted in saltmarsh loss on Galveston Island while Spencer *et al.* (2015) illustrate how the storm surge of 2008 catalysed dune loss in Eastern England. Storm surge-driven environmental loss also reduces the ecosystem services environments provide, affecting the natural and human populations (Balke *et al.*, 2016; Ermgassen *et al.*, 2021). In saltmarshes the impact of storms has been shown to be spatially and temporally variable (Tognin *et al.*, 2020; PannoZZo *et al.*, 2021) although the global work of Leonardi *et al.* (2016) show that marsh erosion and wave energy exhibit a significant linear relationship. This is a concern for coastal saltmarshes in Western Britain, where it is predicted storm frequency and magnitude will increase as a result of climate change (Lowe *et al.*, 2018).

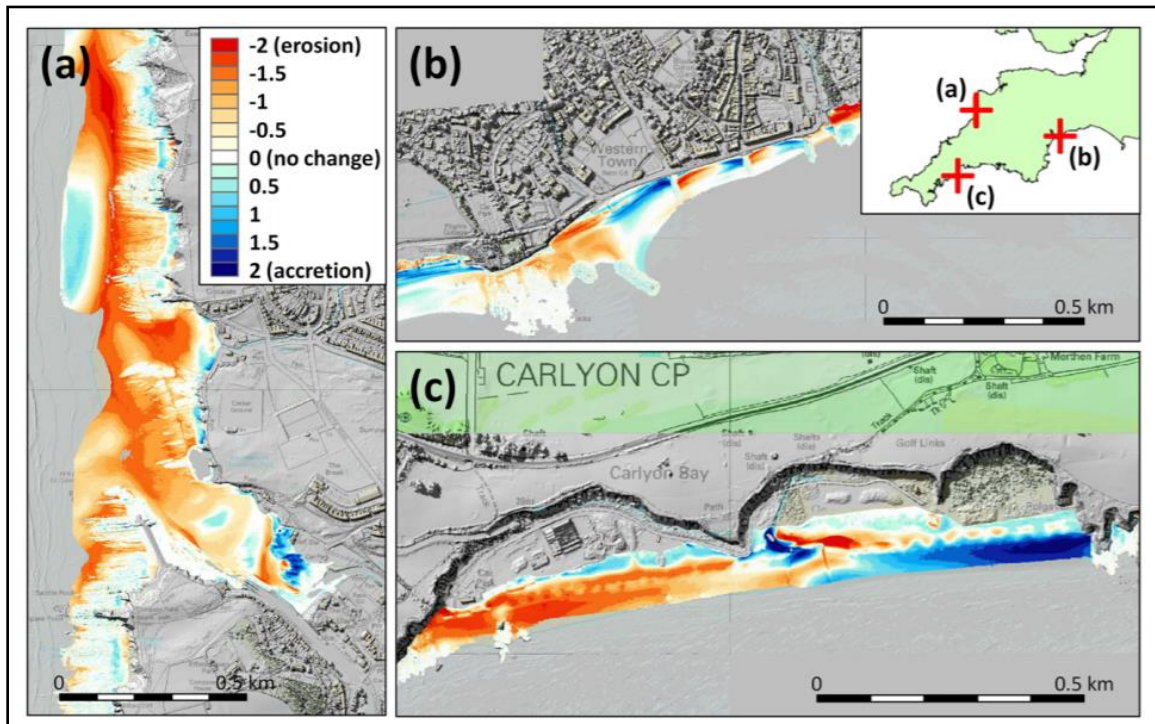


Figure 2.2. Elevation change derived from LiDAR for three beaches in SW England: (a) Bude, north Cornwall, flown on 08/10/2010 and 01/03/2014; (b) Sidmouth, south Devon, flown on 04/11/2013 and 09/02/2014; and (c) Carlyon, south Cornwall, flown on 21/03/2012 and 01/04/2014. Figure produced by Masselink *et al.* (2017).

Site-specific geomorphological and environmental effects of storms also have different impacts upon human communities (Hallegatte *et al.*, 2011; Fletcher *et al.*, 2016). In sole response to the winter floods of 2013/14, the government in England provided £130 million for flood recovery work, and a further £140 million for long-term (to 2100) defence repair and improvement as well as erosion risk management (Environment Agency, 2014). This illustrates the prominence of the storm threat in Western Britain which is predicted to increase (Lowe *et al.*, 2018; Palmer *et al.*, 2018). Therefore, there is a considerable need to better understand changing storm trends and their associated human and environmental impacts.

2.3. Future Coastal Storm Threats

2.3.1. Future Storminess

The most comprehensive contemporary assessment of changes in storminess in Western Britain is the United Kingdom Climate Projections 2018 (UKCP18). The projections are achieved through integrating the International Panel for Climate Change 5th Assessment (IPCC 2013) predictions of extreme weather with regional climatic models (Flato *et al.*, 2014; Lowe *et al.*, 2018). While regional UK predictions are yet to be made encompassing the IPCC's 6th assessment report (2021-2022), the Representative Concentration Pathways (RCPs) 2.6, 4.5 and 8.5 projections in the 5th Assessment approximately correspond with the newer Shared Socioeconomic Pathways (SSPs) 2.6, 4.5 and 8.5, although this is not a perfect relationship (Collins *et al.*, 2019; Chen *et al.*, 2021).

The UKCP18 predictions indicate an increase in the frequency of winter storms, which conforms with previous research undertaken by Zappa *et al.* (2013) who use the Coupled Model Intercomparison Projection (CIMP5) models to illustrate a 3% ($\pm 2\%$) increase in the frequency of winter storms by 2070-99 compared to 1976-2005, while intensity should also increase. The results agree with McDonald's (2011) earlier predictions that warming sea temperatures in the Atlantic resulting from climate change will enhance the probability that the North Atlantic Oscillation (NAO) is positive and shifted south in winter resulting in increasing storm frequency and intensity over the British Isles. Davies *et al.* (2021) exhibit how the exceptionally stormy UK winter of 2019/20 which encompassed Storms Dennis and Ciara demonstrated the impact of a positive NAO which is predicted to become increasingly common over the 21st century.

The UKCP18 projections also highlight that this increasing storminess will have a large impact in the coastal zone with storm surge magnitude greatly affected (Lowe *et al.*, 2018; Palmer *et al.*, 2018). The UKCP18 projections used five IPCC 2013 CIMP5 models which were downscaled with regional climatic models (SMHI RCA4) to predict future changes in storm surge skew at thirty-nine UK tidal gauges (Palmer *et al.*, 2018). Of the five simulations, three showed little clear change throughout the UK predicting negligible change in storm surge skew (5th to 95th percentile) in most coastal locations. Alternatively, the HadGEM2-ES-RCA4

simulation predicted a decrease in storm surge skew throughout the UK in the 21st century. However, the MPI-ESM-LR-RCA4 simulation, which was the most plausible model due to its consistency with simulated extremes, exhibited an increase in storm surge skew. The MPI-ESM-LR-RCA4 simulation showed that storm surge skew extremes in most coastal cells on the west coast of Britain would increase by 0.2-0.5 mm a⁻¹. However, in certain regions such as St. Brides Bay and Carmarthen Bay, storm surge skew is predicted to increase by 0.5-0.7 mm a⁻¹ while surge increase could exceed 1.0 mm a⁻¹ in the Argyll marine region, areas of the Solway and Morecambe Bay (Palmer *et al.*, 2018) (Figure 2.3).

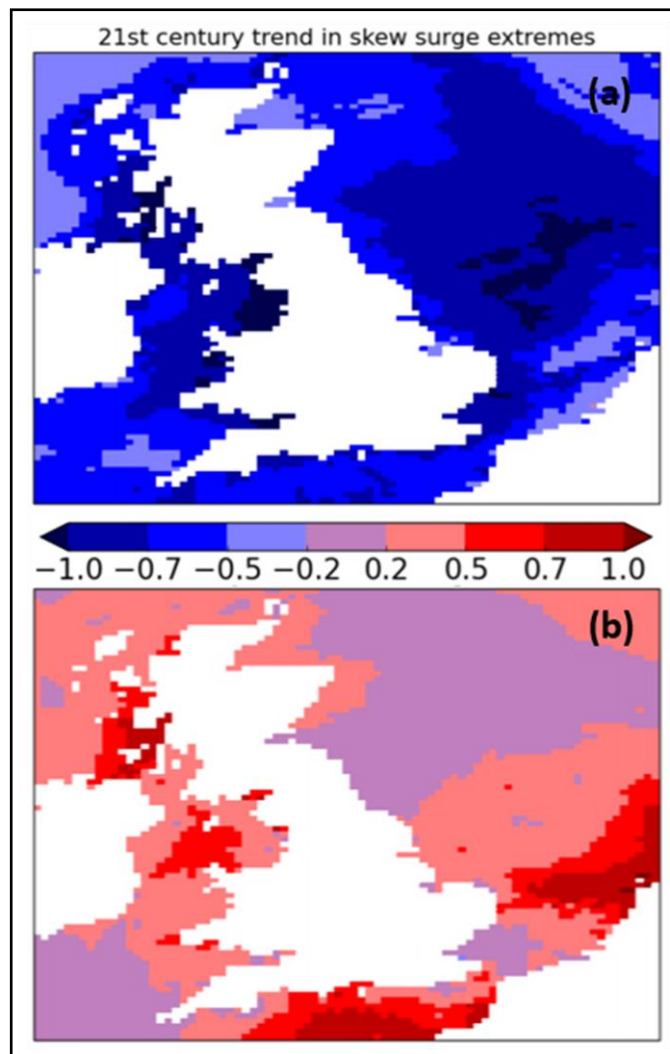


Figure 2.3. Projected annual 21st century trend in skew surge according to the HadGEM2-ES-RCA4 (a) and MPI-ESM-LR-RCA4 (b) simulations for a one-year return level storm. The colours indicate either increase or decrease of storm surge skew (mm a⁻¹). Figure produced by Palmer *et al.* (2018).

2.3.2. The Influence of Sea Level Rise

The predictions of storm surge skew do not include the influence of SLR, which will also enhance storm inundation elevations in the 21st century. The most recent regional UKCP18 projections which integrate IPCC 2013 global SLR predictions as well as updated estimates of the contribution from Antarctic ice dynamics and regional isostatic variability, highlight that sea level rise will occur throughout the British Isles in all modelled scenarios (Palmer *et al.*, 2018). However, the exact rate of rise is scenario and spatially dependent (Figure 2.4). The scenario-based predictions are dependent on future plausible global emissions which are indicated via the three IPCC RCPs (Flato *et al.*, 2014). The spatial variability in isostatic uplift also enhances regional variability with isostatic subsidence being greatest in areas with less ice sheet cover over the Last Glacial Period which ended c.11,700 (Shennan *et al.*, 2018). The UKCP18 projections indicate a mean relative SLR of 0.39 – 0.65 m from the 1981-2000 baseline by 2100 according to the 50th percentile RCP 2.6 and 8.5 projections.

However, the data displayed in Figure 2.4 indicate that this relative rise could be greater in the Bristol Channel area as the models predict a rise of 0.40-0.45 m and >0.70 m by 2100 according to the respective RCP 2.6 and the most likely 8.5 scenarios (Schwalm *et al.*, 2020). This is a large increase when the best estimate of a relative sea level rise of 0.76 mm a⁻¹ in the Bristol Channel over the last 4 ka is considered (Shennan and Horton, 2002; Shennan *et al.*, 2018). Under the RCP 8.5 scenario, even coastal areas with formerly greater ice sheet coverage such as Western Scotland are predicted to experience relative sea level rise of 0.5-0.85 m by 2100 from the 1981-2000 baseline. While this is less than in southern regions, this could arguably have a greater impact as Western Scotland has near-unanimously experienced relative sea level fall over the last 4 ka so a rise would render new, previously unexposed areas of the coastal zone highly vulnerable to the impacts of sea-level rise (Rennie and Hansom, 2011; Shennan and Horton, 2002; Shennan *et al.*, 2018). The extent of such a rise and potential sea level rise/fall trend reversals, previously never experienced by human populations, is predicted to have great impacts on human populations and coastal environments (Ahmadian *et al.*, 2014; Natural Resources Wales, 2020; Angus and Hansom, 2021), some of which are plausibly already being experienced (Kostianaia *et al.*, 2021).

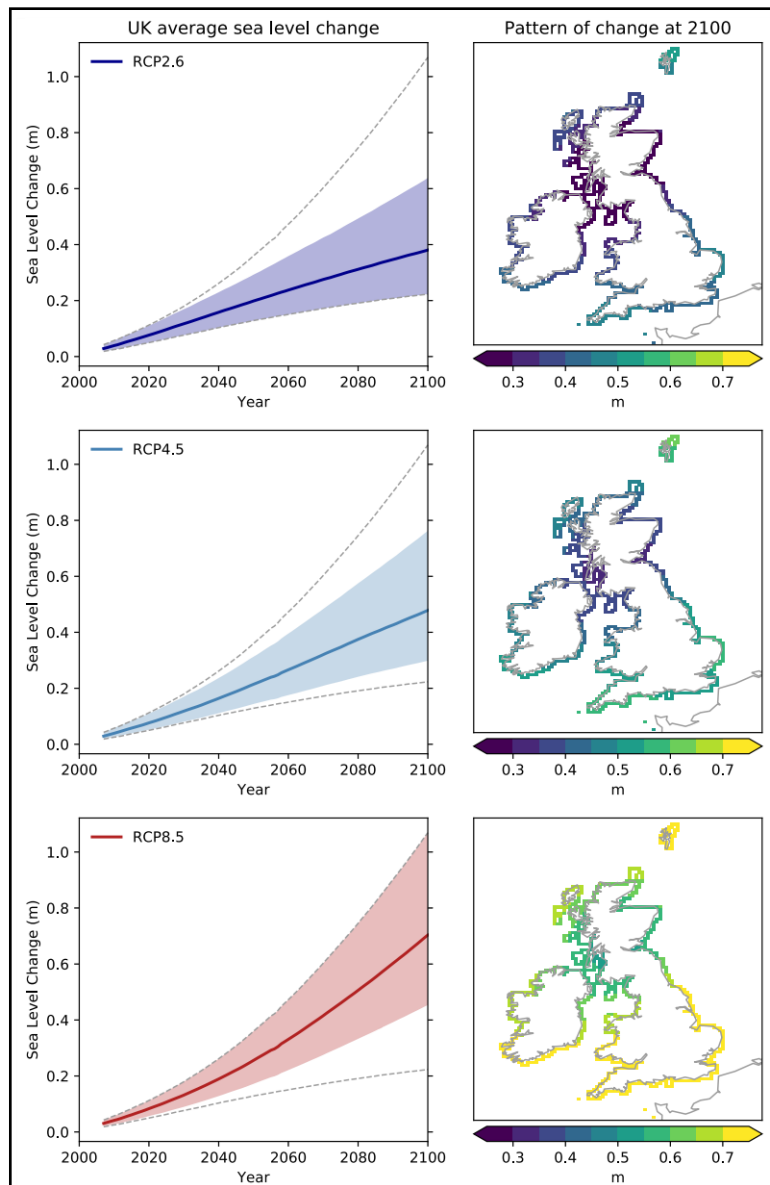


Figure 2.4. Projected 21st century sea level rise under different IPCC 2013 scenarios according to the UKCP 18 projections. The mean projected rate (colour line) and uncertainty (shading) is shown in the left panel whilst the dashed line represents the maximum possible uncertainty. Spatial variability in SLR under each scenario is shown in the right panel. Figure produced by Palmer *et al.* (2018).

In the context of coastal storms the direct result of SLR is an increase in the maximum overall storm surge elevation. This is already evident at the Newlyn tide gauge where sea level rise was cited as being the reason why three of the top twenty surge events on record (since 1915) occurred during the stormy period between the 3rd January and 3rd March 2014 (Wadey *et al.*, 2014). Even when the lowest RCP 2.6 projections (0.40 m) are combined with

the lowest HadGEM2-ES-RCA4 storm surge skew simulations (110a of 1 mm a⁻¹ fall = -0.11m), overall storm surge skew elevation still increases by 0.29 m in the Bristol Channel by 2100 from the 1981-2000 baseline (storm surge skew 1990 median). Alternatively, the higher end RCP 8.5 projections (≥ 0.7 m) and the MPI-ESM-LR-RCA4 storm surge skew simulations (110a of 7 mm a⁻¹ rise = 0.077m) indicate that an increase in overall storm surge elevation of ≥ 0.777 m from the 1981-2000 baseline is also plausible in the Bristol Channel.

This combination of uncertainties surrounding the SLR projections combined with changes in extreme weather and storm surge skew present challenges for coastal management authorities seeking to efficiently protect environments and coastal communities. As coastal defence construction and the implementation of managed realignment schemes can be expensive and potentially lead to social displacement and environmental loss (Pontee, 2013; Cooper *et al.* 2014; Thorne, 2014), it is important that a wide range of information concerning coastal storm trends and impacts is considered.

2.4. Written and Archival Evidence

2.4.1. Background to Storm Recording

Storms and major meteorological events have been recorded in writing and archived over the last millennium (e.g. MacDonald *et al.*, 2010; Lionello, 2012). This information can offer unique insights into how storm trends have changed over time as well as the changing relationship between storms and communities (Andrade *et al.*, 2008; Griffiths and Salisbury, 2013; Chaumillon *et al.*, 2017). Two of the earliest detailed records concern the Saint Marcellus' Flood which brought devastating south-westerly winds to Northern Europe on 16 January 1362, as well as the infamous All Saints' Flood of 11 November 1570 which claimed 10,000s lives (Battjes and Gerritsen, 2002; Soens, 2013). Even with the considerable scientific advances associated with the Enlightenment, storm documentation in Britain and Western Europe remained largely qualitative in nature and was heavily reliant on state officials and the clergy (Jankovic, 1998; Veale *et al.*, 2017). As a result, many early and pre-nineteenth storm reports understand them in relation to divine intervention, although differences in interpretation ranging from divine wrath to assistance vary between sources

and evolve over time (Rohr, 2005; McKay, 2007; Morgan *et al.*, 2015). The development of modern scientific analyses of natural phenomena in the eighteenth century saw increasing attempts to quantitatively assess meteorological change (Jankovic, 2000). New nation states and empires recognised the value of empirical science to trade and security, resulting in a profound change from the classical (Aristotelian) understanding of meteorology to the systematic recording of weather using standardised instruments such as the cup and vane anemometers (Golinski *et al.*, 2010; Azorin-Molina *et al.*, 2018). Oceanography also experienced a similar revolution: with trade and naval operations dependent on the understanding of tidal currents and trends across now global empires, daily records of sea level change began to be recorded in key Western Ports such as Amsterdam (1700) and Liverpool (1768) (Marsden and Smith, 2004; Grinsted *et al.*, 2010; Woodworth *et al.*, 2015). This growth of modern science produced an abundance of quantitative data from the early nineteenth century onwards which has been employed to analyse historical storm and storm surge trends in Western Europe (e.g. Mendez and Woodworth, 2010; Haigh *et al.*, 2017; Garnier *et al.*, 2018).

While pre c.1850s meteorological records tend to exhibit higher variability due to instrumental and data issues (e.g. Changnon and Kunkel, 2006; Toride *et al.*, 2017), accurate tidal records of observed high-water from the 1700s (Amsterdam) have enabled historical storm surge analyses in North-west Europe (Woodworth *et al.*, 2011). For instance, Dangendorf *et al.* (2014) identified an increase in storminess and storm surge magnitude between 1885-1900 and 1975-1995 by analysing the temporal trends in 95th and 99.9th percentile storm surge skew events in Cuxhaven, Germany. Likewise, Wadey *et al.* (2014) used Newlyn gauge data (1915-2014) to highlight that when SLR was offset, 1935-45 recorded the highest frequency of storm surge events with a return period (RP) of 5-10 years. However, the winter 2013/14 was the most extreme high water period on record when clustering and magnitude was considered.

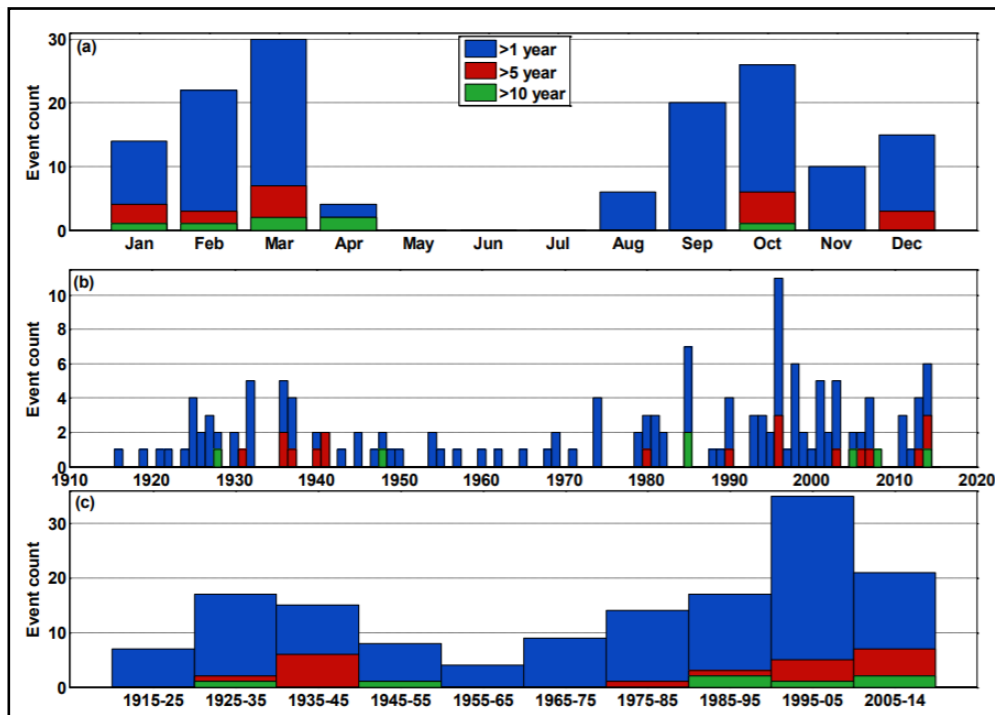


Figure 2.5. Historical temporal trends in storm surge probability between 1915 and 2014 when SLR is offset. Figure produced by Wadey *et al.* (2014).

Applying a similar approach using data from the forty UK tidal gauges, Haigh *et al.* (2016) concluded that between 1915 and 2015 the location of the storm (depression) centre, at the time of maximum skew surge, was closest to the UK on the south and west coasts than in any other region. They demonstrate how tidal gauge research can not only identify high magnitude events and provide an insight into storm trends but can also potentially aid the short-term forecasting of storm surge events.

Although the uncertainty surrounding meteorological records progressively increases with age due to measurement variability and an increasing reliance on human observations, historical meteorological records can still provide a novel insight into weather and storm trends over the last century. For instance, Allan *et al.* (2007) utilised historical Meteorological Office data from throughout the British Isles to identify a significant correlation between severe January-March storminess and both the Gibraltar–South-West Iceland and Azores–Iceland indices of the North Atlantic Oscillation (NAO) from 1920-2004. Gregow *et al.* (2017) further highlight the potential of 20th and 21st century meteorological data by using reanalysed historical datasets and historical storm statistics to indicate

increasing large scale windstorm damage in Western, Central and Northern European forests from 1951–2010.

Historical storm research can therefore improve the understanding of storm trends and enduring impacts while it can also contribute to informing future storm trends and predictions (Little *et al.*, 2015; Cannaby *et al.*, 2016). Although the value of quantitative storm data progressively reduces with time, the following section addresses other historical archival research approaches that can substantially improve long-term term (c.700 years from present) storm trends and impact understanding.

2.4.2. The Value of Archival Storm Evidence

Whilst meteorological tidal gauge records provide a valuable quantitative indicator of storm surge trends, it is rare that continuous and reliable unbroken records stretch back beyond c.1915 and 1850 for tidal gauge and meteorological records respectively (Batstone *et al.*, 2013; Toride *et al.*, 2017; Archer *et al.*, 2019). Therefore, in order to form a comprehensive understanding of how storm trends, magnitude and frequency has changed over longer periods (c.700 years from present), it is essential that other forms of written and archived information are incorporated into the analysis. An analysis of the potential of a range of written documents from 14th century estate records to 20th century meteorological reports by MacDonald *et al.* (2010) exhibited that near-continuous comprehensive written records had high potential to enable past climate reconstruction in Wales. Although records from c.1750 including both documentary and instrumental information were of the most use to climatic reconstruction, other forms of archival evidence had the ability to provide a detailed and novel insight into the cultural perception and response to storm events.

Hickey's (1997) analysis of written and archived records from 1500 to 1991 highlighted an increase in the frequency of high magnitude coastal storms and related-flooding prompting high erosion and deposition in Scotland between 1620-1700 and 1850-1875 (Hickey, 1997). However, the uncertainty surrounding the 1850-1875 stormy period was lower than the 1620-1700 period due to the wider availability of detailed meteorological and geographical reports. While quantitative information can act as an important reference, a reliance on such data is spatially and temporally constrictive. Alternatively, other studies relying on

semi-quantitative and qualitative data highlight the different insights provided by the data sources. For instance, Bryant and Haslett (2002) combined knowledge of the physical geography of the Bristol Channel coastline with qualitative information from newspaper and church archives to estimate the magnitude of the surge at Appledore during the Great Flood of 1607. Given records indicated that 'many houses' were 'overthrown and sunk' during the event (Haslett and Bryant, 2004, p. 82); following an analysis of historical predicted tides, historical construction information and the relative coastal elevation, it was possible to estimate that the surge height at Appledore was likely over 3 m (Bryant and Haslett, 2002; Haslett and Bryant, 2004). Such analyses using qualitative sources are not just confined to discrete events. Archer and Fowler (2021) use largely qualitative information from newspapers and journals to create flood and storm chronologies for Britain from 1700 to 2020, providing detailed insights on changing flood impacts and trends. When flood records were appropriately classified, they found the use of this qualitative information allowed a reliable longer term flood trend analyses which was not possible with quantitative data and could contribute to improving the contemporary risk assessment of flash floods. Such qualitative and semi-quantitative records are therefore useful when verifying storm return periods and also serve as important indicators of the longer-term occurrence, consequences and representation of storms and flooding (Barnes *et al.*, 2012; Garnier *et al.*, 2018). Van Bavel *et al.* (2020) illustrate the collective worth of combining diverse historical archival sources in a broad case study approach to provide new insights into a range of natural and human disasters ranging from the Black Death to the Fukushima disaster. The varied historical records give different perspectives into social, political and cultural hazard impacts and also show how different communities uniquely address these hazards and their consequences. Historical analysis of past disasters using a range of archival sources therefore ultimately provides a lens through which to understand the diverse and often interconnected effects of natural hazards on environments and communities when they may otherwise be hidden despite their contemporary relevance.

2.4.3. Storm Representation and Perception

While knowledge of storm trends and impacts is important, there is also increasing focus on how human representations and understandings of storms have evolved over time (e.g. Bankoff, 2013; Morgan, 2015). This is influenced by the nature and characteristics of storm recording and epistemic change regarding weather, climate and storms (Anderson *et al.*, 2005; Golinski *et al.*, 2010). Central to this shift in thinking and perception was the process of Enlightenment, particularly in the long eighteenth century, giving rise to modern empirical science which challenged enduring religious and philosophical approaches (Porter, 2019).

The Enlightenment contributed to a changing perception of storms from phenomena controlled by God to the modern scientific view of storms as predictable natural phenomena governed by the laws of atmospheric physics. Although there had been significant scientific meteorological understanding among the European intellectual elite from the 1600s, religious interpretations of weather predominated up to c.1770 (Feldman, 1983; Alcoforado and Nunes, 2013). Such religious storm representations had profound cultural and social impacts on the populations but also showed religious interpretation variability. Early modern British newspapers and pamphlets exhibit how major storms such as the 1607 Bristol Channel Floods, Thunderstorm of 1678 and the Great Storm of 1703 were widely thought to be divine punishment. Following the 1607 flood, a pamphlet exclaimed that the floods proceed from the Lord's own direction indicating the perception of wrath. Jankovic (2000) also examines qualitative information to highlight the direct impacts of religious interpretation, as the intensity of the thunderstorm of 17 January 1678 in England was such that many people believed the Day of Judgement had arrived and British society was consequently paralysed by divine fear. Daniel Defoe also famously exclaimed that the 1703 storm was the 'dreadfulest and most universal judgement' (Defoe, 1704) of man by God while the mariner Edward Barlow reiterated this view stating 'for doubtless that was a warning of God's anger against us, for a worse generation can scarce be in all wickedness' (Lubbock, 1934 in Pfister *et al.*, 2010, p. 300; Bauer, 2018). Such historical accounts repeatedly highlight the sense of futility and vulnerability of populations to storms, which are widely conceived as divine punishment (Pfister *et al.*, 2010). This perception of storms as punishment was not unanimous, however; Rohr (2005) shows how

16th to 18th century records indicate that Germanic communities looked for saintly assistance during floods, preferring divine assistance over punishment.

Although religious sentiment is dominant in the period, reports and newspapers articles concerning hurricanes and coastal storms on Anglophone communities in the British Greater Caribbean between 1624–1783 indicate changing storm perception and representation (Mulcahy, 2008). The identification of seasonal hurricanes gave rise to the understanding that the periodic storms were part of the natural order and their occurrence could be predicted and understood scientifically (Anderson, 2005; Dry, 2009).

2.4.4. Meteorological and Scientific Development

The nineteenth century heralded a turbulent period for the emerging science of meteorology. As aforementioned, the idea that weather trends could be understood through the systematic recording of detailed observations with subsequent contributions towards weather predictions had gained precedence in the eighteenth century. Many of the eighteenth and nineteenth ‘weather diarists’ who devoted considerable time to weather recording were literate educated amateurs who saw themselves as part of a national natural history program which contributed to the enterprise of improving the knowledge of nature (Golinski, 2010). Although the idea of contributing towards future weather prediction was commonly held, weather diarists were mostly prepared to wait until the laws of the weather could be determined from their records, in a similar way to how many astronomers of the previous centuries had compiled observations to determine the laws of the solar system. Despite the growing interest in empirical scientific meteorology which had resulted in eighteenth century meteorologists understanding British weather as being governed by an island climate, many observers somewhat paradoxically understood this as God’s gift to the nation (Golinski, 2010). Moreover, many of the growing body of weather observers throughout the eighteenth and nineteenth centuries were inspired by a sense of Christian spirituality and found religious expression in recording (Mahony and Endfield, 2018). This paradoxically produced the motivation and discipline for many observers to produce highly detailed and comprehensive weather records that could contribute towards furthering

meteorological science over religious understandings of the weather centred around divine fate and agency (e.g. Anderson, 2005; Rohr, 2005; Morgan, 2015).

Motivation to enhance meteorological science in the nineteenth century was however driven by more than religious duty and scientific inquisition. The British government and merchants recognised the benefits that meteorological advancement and accurate weather prediction could bring for enhancing the security and efficiency of maritime trade (Anderson, 2005). The importance of weather prediction was particularly paramount to Britain which, by the early nineteenth century, had the largest merchant navy marine in the world with an increasingly global reach due to the expansion of the British Empire and wider global trade (Mahony and Endfield, 2018).

While this impetus further contributed to the profound changes from the classic Aristotelian meteorological understanding which had been underway since the 1770s, the transformation to a scientific and empirical form of meteorology took place over the course of the early to mid-nineteenth century. Indeed, it was not until 1854 that the Meteorological Department for the Board of Trade in 1854 (to become the Meteorological Office) was founded by Robert Fitzroy (Burton, 1986; Jankovic, 2006). This period of increasing scientific understanding promoted, and was greatly assisted by, rapid technological development in the emerging field. Up until the early-mid nineteenth century empirical meteorologists were still largely reliant on partially subjective human observations with the exception of calibrated rain gauges and expensive (and therefore rare) mercury barometers. However, inventions such as Osler's self-recording pressure-plate anemometer and rain gauge in 1835 and Robinson's mechanical spinning cup anemometer in 1846 enabled the automatic, objective and considerably more accurate meteorological observation (Pindado *et al.*, 2014; Walker, 2016). While not every new instrument or technology offered a beneficial contribution to meteorology, the enhanced impetus on empirical meteorology drove rapid technological improvements which further contributed to the expansion and improvement of the science in the early to mid-nineteenth century (Marsden and Smith, 2005; Naylor, 2015).

Despite the large economic and political incentives that furthered merchant and government interest as well as accompanying technological development in the growing field of meteorology, many early nineteenth century amateur meteorologists took

pioneering roles in the advancement of the science (Kneale and Randall, 2014). Famously it was an amateur, Luke Howard, who in 1803 first identified and classified clouds and provided an initial understanding of cloud atmospheric physics (Hamblyn, 2002). The work of amateur meteorologists and early amateur societies such as the Meteorological Society of London (formed 1823) was also key to the shaping of professional and scientific endeavour through their careful and persistent observational work (Endfield and Morris, 2012). Likewise, the strong amateur base of empirical meteorology also developed popular support for the advancement of meteorological science as individuals could freely contribute to improving weather understanding and potentially reducing weather risk. Although certain amateurs such as Howard did attempt interpretation, most nineteenth century amateurs mainly focussed on the accurate collection and reporting of data, while data interpretation primarily remained the domain of professionals and the elite (Endfield and Morris, 2012).

Given the developing nature of meteorological science, it is unsurprising that frequent and sometimes fierce debates raged around the understanding and interpretation of weather (Cox, 2002; Anderson, 2005). As newspaper reports in Chapter Seven show (Section 7.4.2), while prominent scientists such as Sir W. Herschel's and James Pollard Espy held scientific views that partially confer with twenty-first century meteorological understanding, modern meteorology highlights that elements of their pioneering work was partially or sometimes wholly incorrect.

The meteorological dynamics and predictions of storms were of particular concern due to their potential to evoke social and financial loss (Lockett, 2012). Changing meteorological understandings, therefore, had implications that went beyond pure scientific debate as from a commercial point reputable weather statistics and developing understandings could be used by insurers to more accurately inform policies and premiums.

Consequently, the turbulent nature of the scientific meteorological debate and changing understandings could have significant economic implications. Most notably the 1830s insurance 'storm controversy' arose due to the distinction that the French Academy had made between electrical storms and tornados in the event of an insurance claim made in Paris. Specifically, conceptually and empirically distinguishing between heat and electricity in the causation of tornados was the subject of great scientific debate throughout the mid-

nineteenth century, although insurance companies had however already paid out under the electrical definition of a tornado's action (Hare *et al.*, 1852; Kneale and Randall, 2014).

Changes to the atmospheric understanding of a tornado, therefore, raised questions regarding what weather-related incidents insurance companies should cover and exhibited how developing meteorological understanding could have significant economic impacts.

The increasing economic and social importance of accurate weather and storm understanding and prediction was accompanied by the emergence of increasingly formal and elite meteorological associations and organisations. Most notably the British Meteorological Society (to become Royal) was formed in 1850 in order to further 'the advancement and extension of meteorological science by determining the laws of climate and of meteorological phenomena in general' (Royal Meteorological Society, 2012).

Subsequently, the British government created the Meteorological Department for the Board of Trade in 1854 with the primary intention of improving meteorological understanding to increase maritime trade security (Walker, 2011). A major objective of the new government department was to improve weather prediction which led to the creation of what Robert Fitzroy would newly term 'forecasts' (Teague and Galliccihio, 2017). While the government and scientific elite of the Royal Society did subsequently exert great control over meteorological development and storm prediction, Fitzroy initially attempted to improve coastal community understanding by supplying storm barometers to coastal communities and thereby maintained and improved amateur meteorological understanding (Dry, 2007). However, the competing methods and approaches advanced by prominent members of the Victorian scientific elite caused great national scientific controversy, particularly after the 1859 Royal Charter Storm and throughout the mid-nineteenth century which is explained in Section 2.4.5 and analysed in Chapter Six.

Despite the growing elitism of mid-nineteenth century meteorology, there is strong evidence that the amateur scientific movement continued to grow. Organisations such as the British Rainfall Organisation (founded in 1859) actively advised and encouraged everyone from 'the most eminent men of science to the merest dabblers in harmless hobbies' to participate in empirical meteorology (Pedgley, 2002).

Despite the widespread growth of meteorology at both amateur and professional levels there were still significant sections of the population who refused empirical scientific

meteorology. Even up until the 1870s scientific meteorology endured a reputational battle, with theological and astrological ideas offering genuine competition (Anderson, 2005). Religious representations would remain present in the nineteenth century as major newspapers and key clergymen interpreted the weather-related Irish famine (1845-1852) and 1860 English summer floods as divine judgment (Hilton, 2008). Even in 1879, Fitzroy's successor at the Meteorological Office, Robert Scott, would exclaim how even the 'smallest lurking germ' of prophecy endangered Victorian meteorology and highlighted the great importance of its public representation (Anderson, 2005). The subsequent section reviews the research on the development of meteorological science and storm prediction in more detail to provide context for Chapter Six.

2.4.5. Meteorological Science and Forecasting

Despite opposition throughout the nineteenth century, the meteorological pioneer Robert Fitzroy finally founded the Meteorological Office in 1854 representing an official recognition of the value of meteorology and weather prediction by the British government. Dry (2007) notes how during this period Fitzroy emphasised storm forecasting for the purpose of safeguarding coastal communities. Significantly he introduced storm barometers free of charge at fishing ports in 1854. The barometers were importantly independent of the Met Office formal storm signalling system which enabled coastal communities to make science-informed storm predictions and decisions (Dry, 2009). The Royal Charter storm of 1859 was a pivotal moment for the new science with the loss of 459 lives aboard the vessel having a major impact on the evangelical Fitzroy (Villiger, 2017). As a result, he changed the predictive approach in order to produce forecasts as soon as possible by placing more emphasis on 'storm telegraphy' over barometrical observations. Storm telegraphy involved the relay of telegraphs of general weather observations made at various stations throughout Western Europe to the Met Office and gave less consideration to barometric pressure variability (Fitzroy, 1863). Fitzroy also pioneered a national storm warning system in 1861 to produce the first national forecasts. Much unlike the decentralised approach of allowing communities to make their own science-informed decisions the new predictions were devised following a centralised Met Office analysis in London before being relayed to

ports and then communicated to coastal communities through a series of storm cones and lights (Burton, 1986). This loss of autonomy and the mandatory nature of the new centralised and formalised storm warnings which were heavily reliant on scientifically questionable storm telegraphy caused issues in certain coastal and scientific communities and catalysed a great debate surrounding the overall nature and purpose of meteorology in mid-late nineteenth century (Waal, 2020).

The pressure applied by the scientific communities and other external competitors who advanced ideas grounded in theology and religion eventually contributed to Fitzroy's suicide in 1865 (Gribbin and Gribbin, 2003; Anderson, 2005). Under the heavy influence of the elite Royal Society, the Met Office adopted a strictly scientific approach led by then-prominent Francis Galton who destroyed much of what Fitzroy had accomplished and ended storm prediction in 1866 (Walker, 2011). The discontinuation of forecasting with little consideration of the wider opinion of the British public was met with a large counter protest. This protest placed more emphasis on the importance of knowledge availability and the humanitarian potential of storm warnings (Walker, 2011). This ultimately resulted in the Met Office restarting national storm warnings. The responses to the *Royal Charter Storm*, therefore, represent one of the earliest recorded examples of the importance of community agency in hazard early warning systems decision making processes and this is explored in detail in Chapter Six.

By the mid-late nineteenth century the benefits of meteorology were increasingly accepted by the UK general public. As Eden (2009) shows (Figure 2.6) meteorological recording became increasingly popular throughout Britain as the Church's grip on education diminished. An increasingly educated population acknowledged that meteorology could offer significant contributions to British society whether through saving lives at sea, aiding the prediction of seasonal epidemics, or simply serving as a form of Victorian self-discipline and personal improvement (Golinski, 2010). By the late nineteenth century, notions of predictive competition were largely quashed as the developing meteorology cemented its status as a science on a par with medicine and engineering, while nation states and expanding empires increasingly recognised its important role in global trade and expansion (Anderson, 2005; Mahony and Endfield, 2018).

Despite the dual growth of amateur and professional meteorological organisations into the early twentieth century, the highly reputable and comprehensive databases held by organisations such as the British Rainfall Organisation resulted in the organisation being absorbed by the Met Office in 1919 (Morris and Endfield, 2012). This marked the beginning of a prolonged period of decline in amateur meteorology in an institutional sense (i.e. deliberately amateur organisations). The increasing professionalisation of meteorology in the twentieth century was accompanied by rapid technological improvements and theoretical change centred around numerical weather prediction which stemmed from Bjerknes' (1904) two-step procedure for model-based weather forecasting before Richardson (1922) first attempted to forecast the weather numerically (Palmer *et al.*, 2005; Schultz and Lynch, 2022). Growing computerised numerical weather prediction, which was first successfully performed by the Met Office in 1952 and expanded to global models in the 1980s, used increasingly expensive computer and satellite technology (the Met Office's current (project began 2020) supercomputer cost £854m) which partially decreased an amateur's ability to make major contributions to meteorological understanding (Edwards, 2010; Met Office, 2020). However, while professional organisations such as the Meteorological Office did dominate meteorology in the mid-late twentieth century, organisations such as Climatological Observers' Network (founded 1975) and Weather Observers Network (1999) strove to allow greater amateur participation (Morris and Endfield, 2012). Such organisations now allow amateurs internet access to data from advanced computerised meteorological models and to contribute to growing crowd-sourced databanks, thereby enabling amateurs to continue to make valid contributions to meteorological understanding into the twenty-first century (Gharesifard and Wehn, 2016).

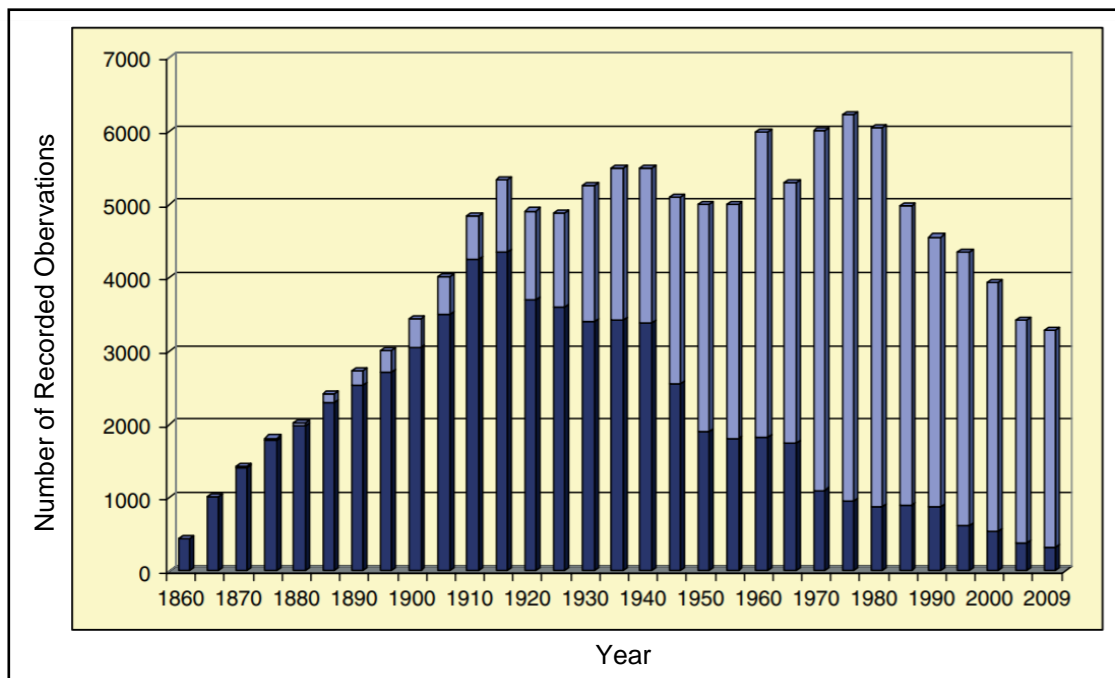


Figure 2.6. Meteorological observation stations in Britain between 1860-2009. Dark blue indicates private amateur individuals and light blue indicates municipal, institutional and commercial organisations. Private proportions are estimated from 1970 onwards. Figure produced by Eden (2009).

2.4.6. Storm Social and Cultural Impacts

Qualitative and semi-quantitative written records may also be highly valuable resources with the ability to portray the cultural consequences and responses to natural hazards (Favier and Granet-Abisset, 2009). Pfister *et al's* (2010) analysis of written journals concerning three independent 18th century storms in Europe revealed that the storms produced cultural shockwaves comparable to those resulting from war due to their major impacts. Records can also communicate the cultural reactions and perceptions of storms with direct impacts and enduring social, political and cultural repercussions. Historical newspaper and journal records can indicate the immediate impacts of storm events as is evidenced by the *Gazzetta della Spezia's* accounts of the disastrous impacts of the storm of October 1901 in Bocca di Magra which included the loss of 38 vessels which, devastating the local economy (Garnier *et al.*, 2018). The analysis of such qualitative records exhibiting the cultural reactions and responses to storms can also reveal long-term response trends

enabling the assessment of the potential scope of socio-cultural responses to events unlike those experienced within living memory (Pfister, 2011; Brázdil, 2016). For example, Bankoff (2013) notes that a periodic exposure to storms and flooding threats in Eastern England from the medieval period has produced what Anderson (1965, p. 4) originally termed a disaster subculture: a long-term trend 'geared towards the solution of problems, both social and non-social, arising from the awareness of some form of almost periodic disaster'. This non-discrete view of hazards resonates with Wisner *et al.* (2014) who advocate a paradigm shift from the concept of disasters as independent and peculiar, and instead consider how social and political frameworks inherently influence how hazards impact communities.

Archival material also has the potential to indicate the inherent connections between storm-induced cultural change and the connected political and economic regimes of the affected regions (Mauelshagen, 2009; Schwartz, 2016). Smith *et al.* (2012) use historical evidence to exhibit that the socio-economic ruin following the Great Caribbean Hurricane in 1831 had complex socio-political consequences. Government and plantation managers believed the storm weakened support for emancipation across the British West Indies which ultimately allowed the continued operation of slave plantations. Pearce (2018) suggests that a period of particularly destructive storms catalysed the 19th century growth of charity and collective social insurance prompting the founding of structured welfare organisations such as the *Shipwrecked Fishermen and Mariners' Royal Benevolent Society*. More recently McEwen *et al.*'s (2014) assessment of the value of community knowledge following the 2014 Somerset floods, highlighted the major social and political impacts of this event which arguably exposed the false economy of austerity and highlighted the enduring existence of disaster subcultures in 21st century British society.

A wide range of written sources can provide insights into the changing social, political and social impacts of storms. Evidence ranges from Depietri and McPhearson's (2018) assessment of fatalities and economic losses in New York resulting from climatic hazards using *New York Times* records from 1876 to 2014, to Pfiefer's (2015) analysis of the cultural reflections of the storm of 19 December 1660 represented in different Dutch poems. Newspapers are of particular value in detailing not only local and national impacts but also potentially providing first-hand accounts of survivors, community reflections, estimated economic losses and accompanying meteorological information (Llasat *et al.*, 2009; Businger

et al., 2018; Archer *et al.*, 2019). The fact that newspaper reports are dated and location specific also enables them to act as useful confirmation of the occurrence of historical storms and show how storm characteristics and impacts evolved through time, particularly after the wide distribution of printed news in the late 18th and early 19th centuries. Beyond being simple factual documents or reports, newspapers can also importantly enable an assessment of how the representations and interpretations of natural hazards and storms have changed, potentially giving insights on a range of topics including hazard causes, response liability and community resilience (Pantii and Wahl-Jorgensen, 2011; Trckova, 2012; Choudhury and Haque, 2018). Newspapers can therefore provide a useful insight for research spanning the sciences and humanities. For example, Zong and Tooley (2003) cross-checked meteorological observations with reports from *The Times* when analysing the storm tracks of events that had caused historic coastal flooding in Britain from 1785-2001, while Archer *et al.* (2019) used newspaper reports to build a detailed chronology of environmental and human flash flooding impacts in South-west and North-East England from 1700-2013. This wide-ranging insight gives newspapers great potential to act as reliable barometers of changing storm effects and can enable the creation of accurate long-term historical storm chronologies.

2.4.7. Contemporary Storm Reporting

Storm reporting in the late twentieth and twenty-first centuries brought a different perspective on storms and flooding. The shift towards online newspaper publication and the creation of live feeds, often incorporating social media information from a diverse range of sources has completely changed storm reporting, giving global and national audiences detailed and sometimes near immediate access to storm information (Kim *et al.*, 2018; Garde-Hansen, 2020). Such is the abundance, detail and promptitude of live reporting and social media that several studies suggest it can plausibly offer a useful contribution to natural hazard catastrophe impact identification and emergency response (e.g. Palen *et al.*, 2014; Smith *et al.*, 2017; Ewart, 2020). However, issues often arise concerning false or doctored information, making verification important, particularly when information is

limited or it emanates from previously unknown sources (Middleton *et al.*, 2013; Dailey, 2014; Saroj and Pal, 2020).

Major mass media news agencies and newspapers commonly employ report and media verification procedures which remove false information, enabling accurate reporting of events in an era of widespread disinformation (Dootson *et al.*, 2021; Jahng *et al.*, 2021). Therefore, while social media coverage of natural hazards can be useful, newspaper reports (sometimes including verified social media) often provide a more accurate picture of contemporary storms and floods. The diverse information provided by contemporary newspaper reports can also give historically unparalleled perspectives of storms with sources ranging from community eye-witnesses, emergency response agencies and government politicians all now capable of providing near immediate views on storm impacts and effects (Garde-Hansen, 2020; Takahashi *et al.*, 2020).

Although embedded tweets in live feeds provide personal perspectives, as with older publications, the reporting and representation can significantly alter depending on political bias and the event location. For instance, Solman and Henderson's (2019) analysis of UK newspaper reporting of 2015 floods in Northern England and Chennai, India note how newspapers gave greater prominence to the local aspects of the UK flooding and reinforced similarities between victims and readers by drawing upon personal accounts, emotions and suffering. By contrast, Chennai flood victims were portrayed as anonymous 'distant Others' with an emphasis on the flood drama rather than individual plight. Such reporting irregularities emphasise social and cultural differences between the UK and India, presenting UK flooding as exceptional and normalising Indian flooding (Solman and Henderson, 2019). The newspaper type (broadsheet/compact or tabloid) continues to heavily influence twenty-first century reporting, with tabloids more likely to focus on the dramatic impacts of events while broadsheets (compact) tend to offer more objective and detailed appraisals (Devitt and O'Neil, 2017; Porter and Evans, 2020). Even in detailed broadsheets, political bias is also widely evidenced to influence storm and flood reporting, with the role of climate change in extreme events being a somewhat controversial topic in contemporary reporting. Norton and Hulme (2019) note the politically centre-left broadsheet papers, *The Guardian* and *The Independent*, and the right-of centre broadsheet papers, *The Times* and *The Daily Telegraph* had partisan views concerning the influence of

climate change on storms and flooding in 2001, but this divide substantially decreased by 2015. Escobar and Dermitt (2015) further highlight how changing reporting stances have also influenced political and economic policy. They note how the increasingly reported role of climate change in flooding in UK broadsheets between 1985 and 2010 has contributed to a shift from flooding being represented as a distant agricultural issue to a personal threat to life and property which has had large UK political and insurance implications. This changing narrative in most broadsheets continues to have major implications on public risk perception although Colongna *et al.* (2017) note a disconnect still exists between the real climate change risks and the reported risk. Harcourt *et al.* (2020) also highlight that this disconnect can also extend to the UK government's ambitions concerning climate change related storm and flood adaptation and newspaper discourse on the topic. It is therefore important that research analysing the reported impacts and repercussions of contemporary storms in newspapers considers the political bias as well as the scientific and public awareness of the source. This bias is particularly notable in politically right-leaning newspapers which have contested widespread scientific consensus, mainly regarding climate change (particularly from 1985 to 2015), when they contradict the economic and political ambitions of paper owners (Gavin *et al.*, 2011; Saunders *et al.*, 2018). Alternatively, independent trust owned newspapers such as *The Guardian* which has a centre-left view, have consistently more objectively reported on scientific, environmental and climate change issues and are generally considered less constrained by commercial or political bias than other major UK newspapers (O'Neill, 2013; Painter and Gavin, 2016). In all, research utilising contemporary and historical newspapers can offer original insights into the impacts, effects and wider repercussions of storms and flooding (e.g. Devitt and O'Neill, 2017; Archer *et al.*, 2019; Junshen *et al.*, 2019), however, it is very important that research considers source bias and objectivity.

2.4.8. Overview

The research review indicates that written archival evidence can provide unique and important information enhancing the understanding of the storm trends and a wide range of impacts. Semi-quantitative and qualitative records of storms are highly useful when

verifying storm occurrences and return periods, while also providing an insight into human impacts and response to discrete and enduring hazards over space and time (Hickey, 1997; Bankoff, 2013; Businger *et al.*, 2018). In Western Europe, newspaper records from post-1800 are of particularly high value, being accurately dated, near-continuous and often featuring a wide range of information from scientific weather data to personal storm insights (e.g. MacDonald *et al.*, 2010; Garnier *et al.*, 2018). Historical newspapers, therefore, possess great potential to improve the understanding of coastal storm trends, human impacts and representational variability.

2.5. Sedimentological Evidence

2.5.1. Storm Signatures

Sedimentological evidence of coastal storms can indicate the occurrence of major inundation events throughout the Holocene and identify their sedimentological and environmental impacts (e.g. Horton *et al.*, 2009; Sorrel *et al.*, 2010; Pouzet and Maanan, 2018). Storms have the potential to leave geological signatures, the nature of which is determined by the regional sediment and tidal regimes, bathymetric and geological characteristics as well as storm meteorological characteristics (Atawater *et al.*, 2012; Phantuwongraj *et al.*, 2013; Naylor *et al.*, 2017). These factors dictate the erosional or depositional nature of the storm surge signature and determine the preservation of the sedimentary evidence.

Perhaps the clearest sedimentological evidence of the combined influence of coastal storms and sea level rise in the UK is the retreat of the North Sea coastline where sediment export and coastal recession is in excess of 200 m since 1885 in certain locations (Masselink and Russel, 2013). However, progressive erosion often removes any sedimentological evidence of past events (Anthony, 2013; Labuz, 2015). For sedimentological evidence of specific storms to be recorded, the evidence must be preserved in a coastal environment that is not continuously susceptible to storm erosion and can act as an archive of discrete events (Bartholdy *et al.*, 2010; Wilson *et al.*, 2014; Lowe *et al.*, 2018).

The majority of saltmarshes in North-west Europe have been demonstrated to be highly adaptable environments that have largely maintained geomorphological equilibrium despite climate change-driven changes in storminess and increasing sea level rise throughout the Holocene (D'Alpaos, 2011; Kirwan *et al.*, 2016; Horton *et al.*, 2018). Coastal saltmarshes are commonly found in estuaries and back barrier systems (French, 2019) and are typically colonised by halophytes that vary with salinity exposure, dictated by elevation, watercourse proximity and water table height (Silvestri *et al.*, 2005; Colmer and Flower, 2008; Kim *et al.*, 2013). The adaptability of a saltmarsh and the sediment stability provided by halophyte colonisation means that there is a higher chance of the storm signatures being recorded and preserved in saltmarshes than in exposed coastal environments (Shepard *et al.*, 2011; Barlow *et al.*, 2013).

Saltmarsh storm evidence can include the deposition of coarse sandy sediment horizons, sporadic deposition of discrete very coarse material (namely granules and pebbles) and erosional contacts depending on the life cycle of the storm energy-sediment interaction (Horton *et al.*, 2009; Croudace *et al.*, 2012; Leonardi *et al.*, 2018). Although erosional evidence of storm surges may be observed at the marsh and creek perimeters, the low elevation and gradient of saltmarshes can enable storm surge wave propagation over large areas resulting in the accretion of depositional evidence (Rupprecht *et al.*, 2017). Depending on the submarine geology, depositional evidence of storm surges is often in the form of poorly sorted fine to very coarse-grained sand horizons or more distinctive granules or pebbles which contrast with the fine-coarse grained silts typical of organic saltmarsh sediments (Williams, 2010; Leonardi *et al.*, 2016). Following a storm, saltmarsh halophytes, organic decomposition and continued silt accretion can provide a stabilising effect serving to preserve the storm surge deposits (Woodroffe and Long, 2009; Chaumillon *et al.*, 2017).. This stabilisation can preserve a sedimentological depositional record with deposits varying in thickness depending on sediment availability and storm magnitude (Tsompanoglou *et al.*, 2011; Hawkes and Horton, 2012). Relevant examples include, the identification of depositional evidence of the 1953 storm surge in a Holkham saltmarsh (Swindles *et al.*, 2018) (Figure 2.7) while Williams *et al.* (2009) identified an abrupt coarse sandy deposit from the 2005 Hurricane Rita in a Louisiana wetland. Alternatively, Otvos *et al.* (2011) showed how the presence of sand laminae in Gulf of Mexico saltmarshes could indicate

long-term coastal storm trends, identifying a period of frequent major hurricane occurrence between c.7.0 and 3.4 ka B.P. There is therefore great potential of sedimentological saltmarsh evidence to indicate changing coastal storm trends and environmental impacts.

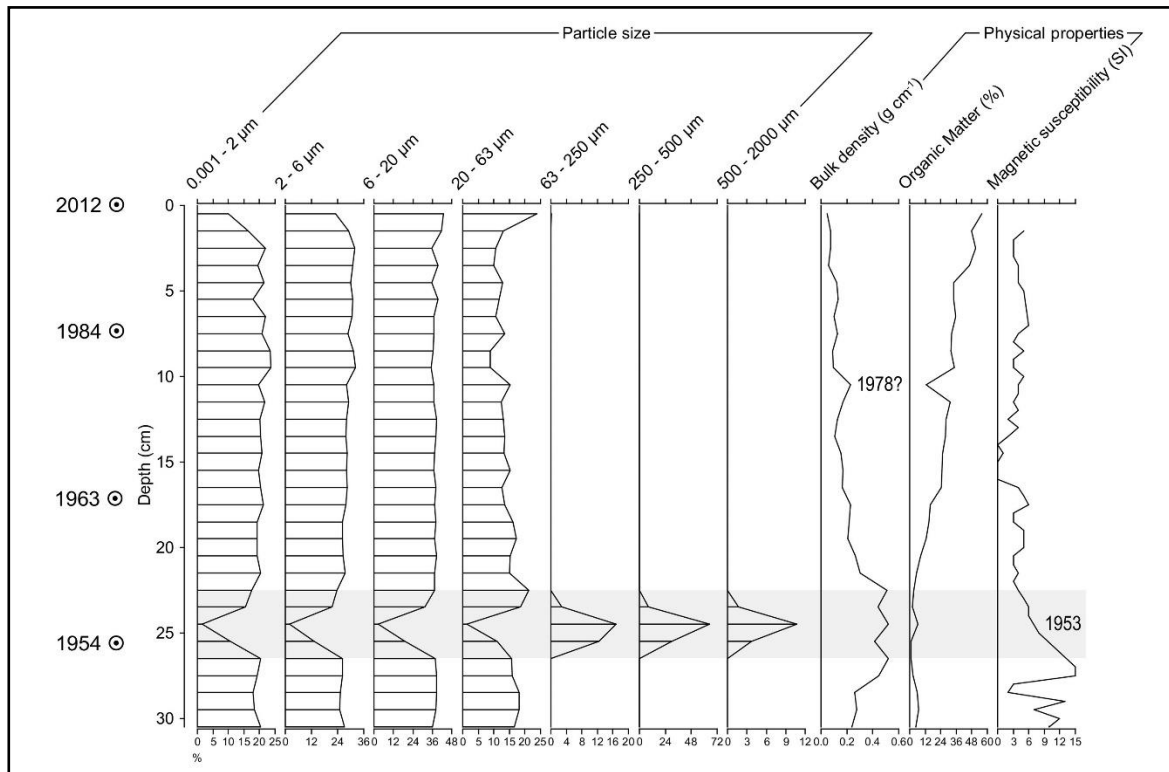


Figure 2.7. Grain size change in the Holkham marsh indicating sedimentological evidence of the 1953 storm surge event. Figure produced by Swindles *et al.* (2018).

2.5.2. Storm Surge Identification

The location of estuarine and back-barrier saltmarshes in a transition zone between the fluvial and coastal environments means that there is the potential for evidence of multiple types of high-energy events to be recorded (Bartholdy, 2012; Spencer and Harvey, 2012). When depositional evidence is considered, similarity in grain size and sorting between deposits of different origins can present a challenge (Chauge-Goff, 2010; Castagno *et al.*, 2021). Although distinguishing storm surges from tsunami deposits is less relevant in areas with low seismic activity such as Western Britain, there is a need to distinguish sedimentological evidence of coastal storms with an offshore marine origin from deposits created by aeolian deposition or fluvial flooding (Boldt *et al.*, 2010; Pilarczyk *et al.*, 2015).

Previous research has shown that foraminifera fossils can be used as a proxy of storm surge origin as certain foraminifera species are associated with different marine and terrestrial environments (Lane *et al.*, 2011). Therefore, an increase in the abundance of foraminifera associated with offshore environments in coastal deposits can serve as an indicator of the origin of a deposit (Hawkes and Horton, 2012). For example, research by Kosciuch *et al.* (2018) used microfossils to identify the depositional record of 2015 Tropical Cyclone Pam made in two Vanuatu coastal locations. However, the use of microfossils relies on the ability of the observer to identify differences in foraminifera via visual observation. There is therefore the potential for errors given the similarities of species which maybe indicative of different coastal sub-environments (Rosendahl *et al.*, 2007). Moreover, a comprehensive knowledge of the exact foraminifera species present in the offshore environments of the region concerned is required if they are to be used to accurately indicate the origin of the event (Pilarczyk *et al.*, 2015). Additionally, Williams *et al.* (2010) exhibit the organic nature of some foraminifera can result in issues of preservation due to differing levels of organic decomposition. These factors ultimately reduce the viability of using microfossils as reliable indicators of the origin of deposits when compared to other proxies.

An alternative approach is the use of geochemical proxies which can be an accurate indicator of the origin of high-energy depositional events (Goff *et al.*, 2004; Tsompanoglou *et al.*, 2011). Storm surges have been shown to cause complex changes in saltmarsh sediment geochemistry. Eight elemental indicators have been regularly exhibited to be reliable indicators of high energy events throughout a wide variety of regions with different climatic conditions and geologies (e.g. Komatsubara *et al.* 2008; Kolditz *et al.*, 2012; Martin *et al.*, 2014). The eight indicator elements and their use in storm surge origin indication are as follows:

Barium, bromine, calcium and strontium are reliable indicators of offshore marine flooding and evidence of storm and tsunami events (e.g. Schlichting, 2000; Szczuciński *et al.*, 2012; Goslin and Clemmensen, 2017). As barium and bromine are common salt water chemical constituents, they may possibly act as indicators of saline saturation in regularly inundated lower-middle marsh sub-environments (Moreno *et al.*, 2017). Calcium and strontium are consistently associated with an increase in calcareous material sourced primarily from

offshore environments making them reliable indicators of offshore origin (Ramirez-Herrera *et al.*, 2012).

Silicon and potassium are indicators of increases in grain size and the abundance of medium-coarse grained sand commonly seen in storm surge deposits and therefore a proxy for particle size (Williams *et al.*, 2011; Chague-Goff *et al.*, 2016). Increases in silicon and potassium are respectively associated with increases in the abundance of the minerals quartz and feldspars which are commonly found in sand. Therefore, changes in silicon and potassium have also been exhibited to validate particle size results (Schuerch *et al.*, 2012; Swindles *et al.*, 2018).

A high abundance of zirconium indicates the presence of resistant or heavy minerals in horizons in medium and coarse sands originating from an offshore marine environment and deposited in marsh environments under storm surge conditions (Dezileau *et al.*, 2011; Tsompanoglou *et al.*, 2011). Alternatively, a high abundance of titanium can indicate the presence of terrigenous sediment and fluvial flooding (Font *et al.*, 2013).

For geochemical proxies to be of use it is also essential that an understanding of the surrounding geology is known including the submarine geology of the offshore and estuarine environment, geology of upstream catchment and the geology of any terrestrial geological features which could contribute to aeolian deposits such as sand dunes (Croudace and Rothwell, 2015). When this understanding is combined with geochemical proxy evidence it is possible to identify the likely origin of a high energy event deposit and determine whether depositional evidence was produced by a storm surge event with an offshore marine origin. However, in order to improve the understanding of changing storm surge trends it is also important to determine the approximate time of saltmarsh storm deposition.

2.5.3. Sediment Dating

A range of sediment dating techniques have been previously applied to identify the approximate age of sedimentological evidence of high energy inundation events (Cunningham *et al.*, 2011; Bartholdy, 2012). The applicability of a specific dating technique is

dependent on the coastal environment as well as the type and age of sedimentological evidence concerned.

A widely applied sediment dating technique is optically stimulated luminescence (OSL) dating which has been selectively used in coastal dunes and saltmarshes to date high-energy event deposits (e.g. Nolte *et al.*, 2013; Spikse *et al.*, 2013). Fruegaard *et al.* (2013) used OSL dating to exhibit the occurrence of the storm of 1634 AD and indicated the major impact of the event on regional back-barrier geomorphology. However, previous research has shown OSL dating to be inaccurate when dating young sediments (<150 years) because of the incomplete resetting of the luminescence signals before or during deposition, or because of weak luminescence signals (Madsen, 2009; Costas *et al.*, 2012). Although OSL dating has an extensive temporal range that may extend back 19,000 years (Kim *et al.*, 2012), the accuracy of optical ages derived from tidal sediments largely depends upon the sediment transport processes which can have a temporal uncertainty of >20 years. This renders OSL best suited for analysing the sedimentological records of major storm surges over millennial time scales (Mauz *et al.*, 2010; Fruegaard *et al.*, 2015).

Accelerator Mass Spectrometry (AMS) ^{14}C dating can also show evidence of extreme climatic change throughout geological time as absolute ^{14}C dating has a temporal range of up to 60,000 years (Mellström *et al.*, 2013; Moss *et al.*, 2017). However, the use of ^{14}C dating alone to identify specific high energy inundation events is usually not feasible as the dates can be surrounded by considerable temporal uncertainty (± 30 -1200 years) (Lang *et al.*, 2003). Moreover, further issues produced from a flat region in the ^{14}C calibration curve over the last 100 years (Stuiver *et al.*, 1998) also render the method invalid when dating young sediments (<150 a). Attempts to solve the calibration issue by using ^{137}Cs bomb spike dating to act as a calibration proxy for the past 70 years have also proven unsuccessful due to the influence of past radionuclide output from consistent nuclear sources such as power stations (Marshall *et al.*, 2007).

Alternatively, radionuclide gamma dating primarily using ^{210}Pb and ^{137}Cs in areas where emittance of radionuclides has been monitored has proved successful when dating saltmarsh sediment and estimating accretion rates (e.g. Harvey *et al.*, 2007; Liu *et al.*, 2013; Fuller and Drexler, 2016). Radionuclide gamma dating works on the principle that the abundance (considering rate of decay) of both ^{210}Pb and ^{137}Cs may be correlated with

respective historic trends in radionuclide emittance and activity in order to determine the age of the sediment (Madsen *et al.*, 2005; Matisoff *et al.*, 2012). The radionuclide ^{210}Pb can provide accurate records of accretional history dating back 100-150 years (Appleby, 2002; Baskaran *et al.*, 2011; Barsanti *et al.*, 2020). Excess ^{210}Pb ($^{210}\text{Pb}_{\text{xs}}$) can be determined using the constant rate of supply (CRS) model (Croudace *et al.*, 2012) or plumb or Bayesian modelling (Aquino-Lopez *et al.*, 2020). The natural log of $^{210}\text{Pb}_{\text{xs}}$ can then be used to estimate sediment accumulation rates (SAR) and therefore saltmarsh sediment ages, providing accurate saltmarsh sediment dates (Angeli *et al.*, 2016; Iurian *et al.*, 2021). Cs-137 dating provides a higher temporal resolution which extends back to the beginning of nuclear testing and thus fallout in 1953 (Pedersen *et al.*, 2007; Svaeren, 2010). Emittance of ^{137}Cs from nuclear power stations and spikes relating to large emittance events can be correlated with abundances in saltmarsh sediments (allowing for transportation time) to provide accurate chronological date markers and corroborate ^{210}Pb models (Gray *et al.*, 1995; Swindles *et al.*, 2018; Croudace *et al.*, 2019). For instance, Croudace *et al.* (2012) used ^{210}Pb and ^{137}Cs dating in combination with geochemical techniques to identify that a sandy deposit within Bristol Channel estuarine sediments was most plausibly produced by the storm surge of 13 December 1981. The combined use of ^{210}Pb and ^{137}Cs can therefore be seen as appropriate when dating young sediments (<150 a) and attempting to identify sedimentological evidence of storm surges in coastal sediments and saltmarshes.

2.6. Theory and Value of Multidisciplinary Hazard Research

Contemporary natural hazard research seeking to be of wider value must recognise the diverse and often interconnected impacts of hazards on communities and the natural environment (e.g. Wisner *et al.*, 2014; Nogal *et al.*, 2016). The acceptance of inherently interconnected human and environmental relationships has led to an increased impetus on multidisciplinary research which seeks to explore these links, particularly in the context of climate change. The section explores the contributions of multidisciplinary research which draw upon disciplines that are relevant to the thesis.

Multidisciplinary research represents a form of integrative research which has been shown to be highly effective when assessing both historical and contemporary climate issues. By combining sedimentological evidence and written archival records, Chaumillion *et al.* (2017) utilise a multidisciplinary approach to improve storm understanding in Western France. Their research not only improved the understanding of regional and local long-term trends (200 to 500 years depending on location) in storm activity and impacts but also provided an insight into changing vulnerability in different coastal zones. When combined with high-resolution topographic data, the multidisciplinary storm evidence provided explanations for marine flooding processes in different specific coastal locations. This diverse evidence enables policy makers to make highly informed decisions regarding the design of sustainable long-term flood management strategies (Chaumillion *et al.*, 2017). Multidisciplinary research can also be useful when evaluating short-term responses to flooding (Genova *et al.*, 2015; Marfai *et al.*, 2015). For example, an analysis of the 2010 flash flood event in Draguignan, France, which combined written and verbal evidence of human responses with a meteorological analysis of the event, enabled the creation of a range of community coping responses for different local hydrometeorological conditions in order to prevent future flood fatalities (Ruin *et al.*, 2014). Paff *et al.* (2019) also used multidisciplinary research techniques to illustrate how climate change-driven increases in sea level, upwelling winds and exposure to storm surges had a diverse range of interconnected impacts on the geology, ecology and human populations of False Bay, South Africa between 1989 and 2019. They showed how multidisciplinary research and monitoring could ultimately contribute to achieving a better balance between developmental and environmental agendas.

Other forms of integrative research as well as multidisciplinary studies have been exhibited to offer valuable contributions to understanding storm and climate hazards. Interdisciplinary research which integrates approaches from different disciplines to advance understanding beyond single discipline research (Klein, 2020), is shown by Caretta (2021) to bring together the historically disparate fields from which the hydrosocial and social-hydro frameworks emerged from human geography and hydrology. Working across epistemologies enabled research integration, allowing a comprehensive understanding of the community implications of the 2016 West Virginia floods (Caretta, 2021). Transdisciplinary research alternatively unites intellectual frameworks to transcend single disciplinary research and

historically disparate stakeholders (i.e. communities and researchers) through all-encompassing synthesis (Klein, 2020) and can likewise offer important contributions to understanding. Notably, the COSELMAR (Understanding coastal and marine socio-ecosystems) project brought together scientific researchers and communities to provide new insights into socio-environmental marine issues to stimulate sustainable long-term community threat adaption (Guillotreau *et al.*, 2020).

Figure 2.8 diagrammatically demonstrates the conceptual differences between the main integrative research approaches (Adapted from Tress *et al.*, 2004 and Morton *et al.*, 2015). The research highlights how a multidisciplinary approach constitutes independent disciplinary research being brought together under one thematic umbrella to contribute towards a common goal. The approach and contributing disciplines and methods in this study are outlined in Figure 3.1. This multidisciplinary approach contrasts with interdisciplinary and transdisciplinary research where different knowledge and methods are combined to address a common issue.

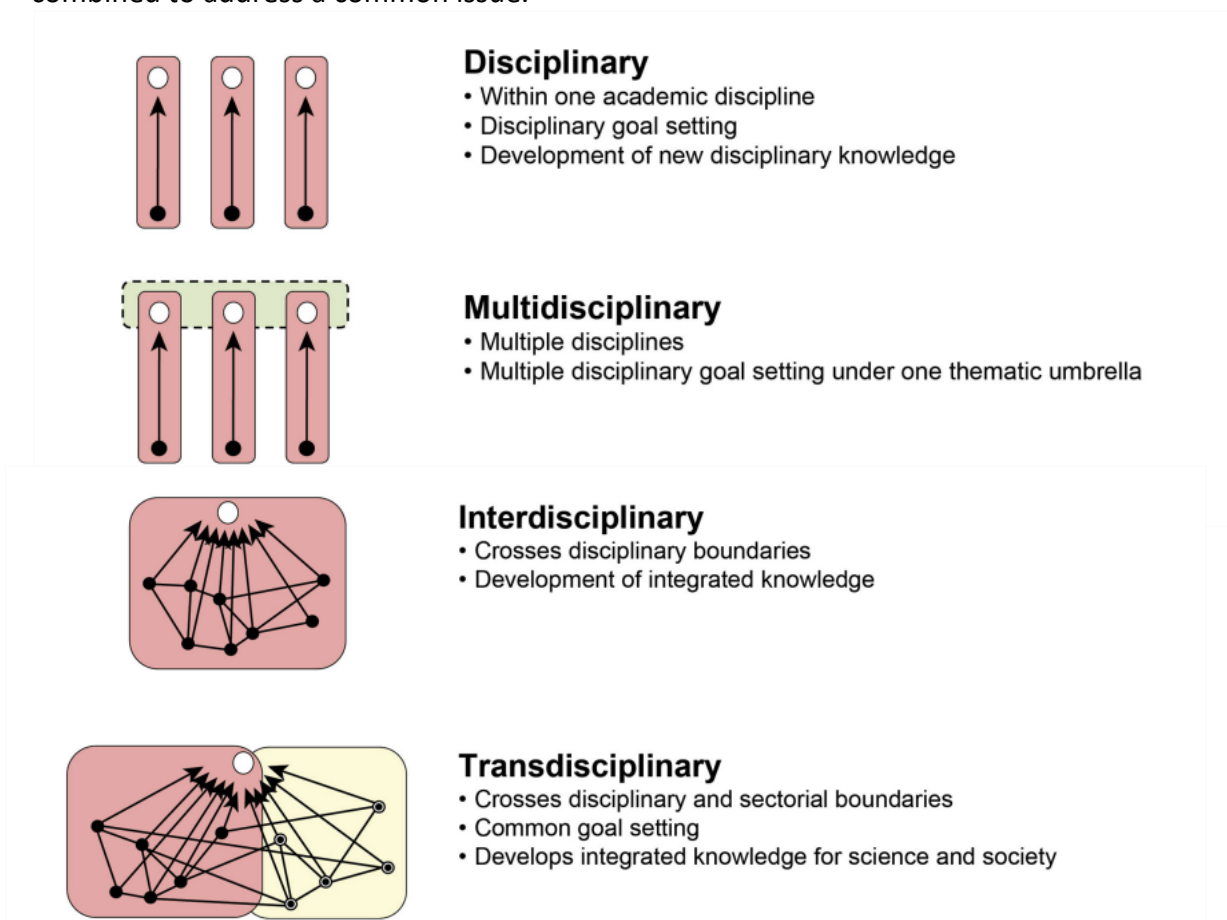


Figure 2.8. A conceptual summary of different integrative research approaches. Figure is adapted from Tress *et al.* (2004) and Morton *et al.* (2015).

There is also crossdisciplinary research which involves the identification, reflection, creation and transformation of research via an appraisal from other disciplines (Akkerman and Bakker, 2011). This is however more of a feedback mechanism to identify unforeseen issues, prompt adaption and aid disciplinary cohesion which collectively results in more effective contributions to hazard understanding and management (McPhillips *et al.*, 2018). Overall, the different integrative approaches all provide important diverse contributions to natural hazard research with community and environmental benefits. Multidisciplinary research enables independent disciplinary research before stimulating disciplinary cohesion which improves overall understanding of often complex and multifaceted environmental issues. This understanding is key given the diverse and often interconnected social, cultural, political and environmental impacts of storms and natural hazards.

While multidisciplinary approaches have the potential to achieve aims that other forms of research cannot, it is important that the combined material and disciplines are carefully considered so that the research can offer a useful and original contribution to improving hazard understanding (Merz, 2006; Rosenthal and Hart, 2012). For the multidisciplinary analyses of storm trends, several studies have identified the value of quantitative data accompanying written material when verifying and assessing future return periods, as well as gauging socio-economic and cultural response to storms of different magnitude and nature (MacDonald *et al.*, 2010; Garnier *et al.*, 2018). However, the availability of quantitative material is not essential, and it may restrict the temporal and spatial focus of research due to restrictions in data availability. For instance, Raska *et al.* (2013) show how numerous studies have exhibited the high value of combining various sources of written archival data which was mostly qualitative to increase the understanding of different geomorphological hazards in different regions. They also used qualitative information from the Czech Republic to produce novel flood, storm and geomorphological hazard chronologies from the medieval period to 1950 before concluding qualitative and archival documentary data could offer a valuable contribution to local hazard understanding and adaptation strategies.

Another benefit of multidisciplinary research is that it can enhance the awareness of the diversity and interconnected nature of natural hazard impacts amongst different audiences whether this be in academia, policy makers or the general public (Uiterkamp and Vlek, 2007;

Jones, 2015; Gilligan, 2021). For example, Camelo and Mayo's (2021) research on the Saffir-Simpson Hurricane Wind Scale (SSHWS) indicates that while improvements in storm surge messaging have improved risk communication and perception over time, truly effective resilience efforts will require comprehensive, multidisciplinary approaches from the initial research to public hazard communication. The effect of such inclusive multidisciplinary research is that all stakeholders are better informed of the complex hazard effects and therefore the detrimental and often interconnected environmental and human impacts are more likely reduced (Schumacher *et al.*, 2010; Wachinger *et al.*, 2012; Montz *et al.*, 2017).

2.7. Summary

This review highlights the relevant literature concerning coastal storm research from fields as diverse as sedimentology to medieval history. According to the IPCC and UKCP predictions, Western Britain will become increasingly exposed to coastal storm threats due to a combination of increasing atmospheric storminess and sea level rise (Lowe *et al.*, 2018; Palmer *et al.*, 2018; Collins *et al.*, 2019). Although these predictions are scenario dependent, the current climatic trends suggest the greatest magnitude of change experienced under SSPs 8.6 is more likely to materialise (Schwalm *et al.*, 2020) resulting in a great threat to environmental and human communities. It is therefore important coastal storm trends and their diverse impacts are better understood. Written archival research has the potential to make a major contribution to improving this understanding (Barnes *et al.*, 2012; Archer *et al.*, 2019). While archival research from c.1800 accompanied by quantitative information has been exhibited to be of particular use in climate reconstruction (MacDonald *et al.*, 2010; Garnier *et al.*, 2018), qualitative research has also been shown to be of high value, allowing the creation of longer-term chronologies as well as unique insights into the human and cultural storm impacts (Rohr *et al.*, 2005; Morgan, 2015; Raska *et al.*, 2013).

Sedimentological research has likewise been exhibited to provide highly useful information regarding storm trends and their environmental impacts throughout the Holocene as storms can leave different sedimentological signatures in various coastal environments (Horton *et al.*, 2009; Pouzet and Maanan, 2018). Saltmarshes can potentially act as particularly useful sedimentological archives of storms and surges which can leave evidence in the form of

coarse sandy sediment horizons, sporadic deposition of discrete very coarse material, or erosional contacts, depending on the life cycle of the storm energy-sediment interaction (Horton *et al.*, 2009; Croudace *et al.*, 2012; Leonardi *et al.*, 2018). As depositional evidence resulting from multiple types of high energy events often produces deposits of similar grain size and sorting, microfossils and geochemical proxies are often used to identify deposit origin (Tsompanoglou *et al.*, 2011; Pilarczyk *et al.*, 2014). To identify storm trends and corroborate storms between sedimentological archives and other records, the sediment must be accurately dated. While OSL and ^{14}C dating can be useful (Mellström *et al.*, 2013; Moss *et al.*, 2017), gamma dating using the radionuclides ^{210}Pb and ^{137}Cs has been found to have a higher temporal accuracy than other dating techniques when dating young (<150 a) sediments (Liu *et al.*, 2013; Andersen *et al.*, 2017). Although a range of disciplines offer valuable independent contributions to improving storm understanding, multidisciplinary research can uniquely improve the understanding of the diverse and often interconnected storm impacts on coastal communities and environments. This wider understanding can ultimately enhance long term resilience to the varied and increasing storm and climate threats (Chaumillion *et al.*, 2017; Camelo and Mayo, 2021).

Chapter 3: Methodology

3.1. Introduction

The following chapter outlines and justifies the methods and techniques employed in this research. Due to differences in the number of techniques employed and journal word restrictions, this section places more emphasis on the methods of Chapter Four, while the methods used in Chapters Six, Seven and Eight are detailed in the respective methods sections of the papers. This chapter focuses on the physical geography and environmental science methods adopted as well as detailing the historical archival methods employed.

3.2. Multidisciplinary Approach

The study employs a multidisciplinary approach to assessing the impacts of coastal storms in Western Britain from 1800 to 2020. This project understands multidisciplinary as combining the contributions of different academic disciplines to address a multifaceted issue. This is appropriate given the widespread and often interconnected potential impacts of storms on coastal populations, cultures and environments (e.g. Simonvic and Peck, 2013; Cramer *et al.*, 2018; Powell *et al.*, 2019). The research predominately draws on environmental science and environmental history to exhibit variable storm impacts and their interconnections. The methodologies employed are designed to present an original insight into coastal storms and highlight their interconnected impacts.

Section 3.3 concerns the physical geography and environmental science methods employed in Chapters Four. Section 3.4 is an overview of the archival environmental history methods used in the four papers. The quantitative methods used in the tidal gauge and meteorological analyses in Chapters Four and Eight are also detailed in Section 3.4. More context is provided in the methods section (4.2. Materials and Methods) of Chapters Four. An overview of quantitative and qualitative methods that were to used analyse trends in community storm impacts, the religious and scientific elements of storm representation and the factors contributing to the catastrophe of Storms Ciara and Dennis is provided. Further

detail is given in the methods sections of Chapter Six and Seven and the overall research approach is conceptually summarised in Figure 3.1.

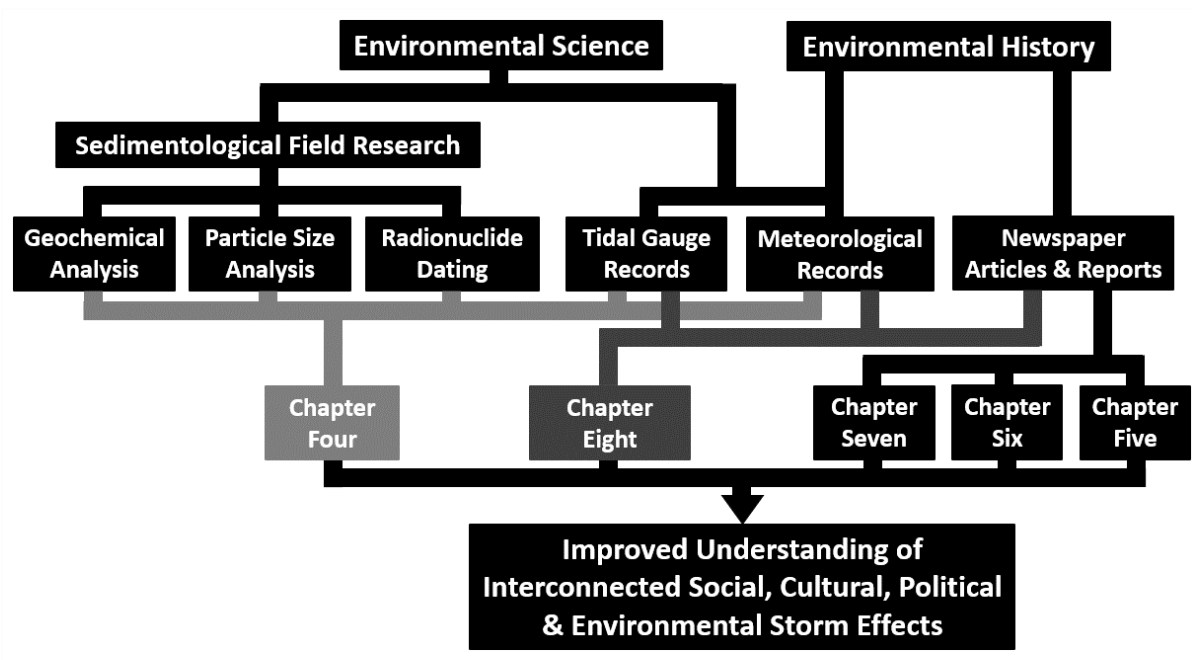


Figure 3.1. Conceptual diagram summarising the multidisciplinary research utilised in the thesis.

3.3. Sedimentological Analyses

The sedimentological analyses comprised field, geochemical, particle size and radionuclide dating methods. The techniques and methods employed in each stage are explained and justified below. A succinct summary can also be found in the Chapter Four methods section (2. Materials and Methods).

3.3.1. Fieldwork

Carmarthen Bay, South Wales was identified as an appropriate site to undertake research as it is situated in an underresearched area of high and increasing storm exposure (Lowe *et al.*, 2018; Palmer *et al.*, 2018; Natural Resources Wales, 2022) (see section 1.5 and Figure 3.2). The bay is influenced by Atlantic south-westerly swell waves and locally-generated wind waves which can catalyse geomorphological change during winter storms (Pye and Blott, 2009; Bennett *et al.*, 2019).

Areas exposed to prevailing south-westerly storms and surges were first identified in the Three Rivers Estuarine Complex and Loughor Estuary. The four sites were close to the main channels rendering them vulnerable to surge wave propagation. Three sites were located in

saltmarshes as their high exposure and the sediment stability provided by halophyte colonisation enhances their ability to preserve storm evidence (see section 2.5.1) (Shepard *et al.*, 2011; Barlow *et al.*, 2013). One site was located in the sandy mudflats due to the high exposure to south-westerly winds and surges and channel proximity.

The reconnaissance period was undertaken at two sites in the Three Rivers Estuarine Complex and two in the Loughor Estuary (see Figure 3.2). The aim was to identify evidence of storm surge signatures. Signatures depend on the life cycle of the storm energy-sediment interaction ranging from the deposition of coarse sandy sediment horizons, sporadic deposition of discrete very coarse material (namely granules and pebbles), micro-deposition of fine strata or erosional contacts (Horton *et al.*, 2009; Croudace *et al.*, 2012; Leonardi *et al.*, 2018).

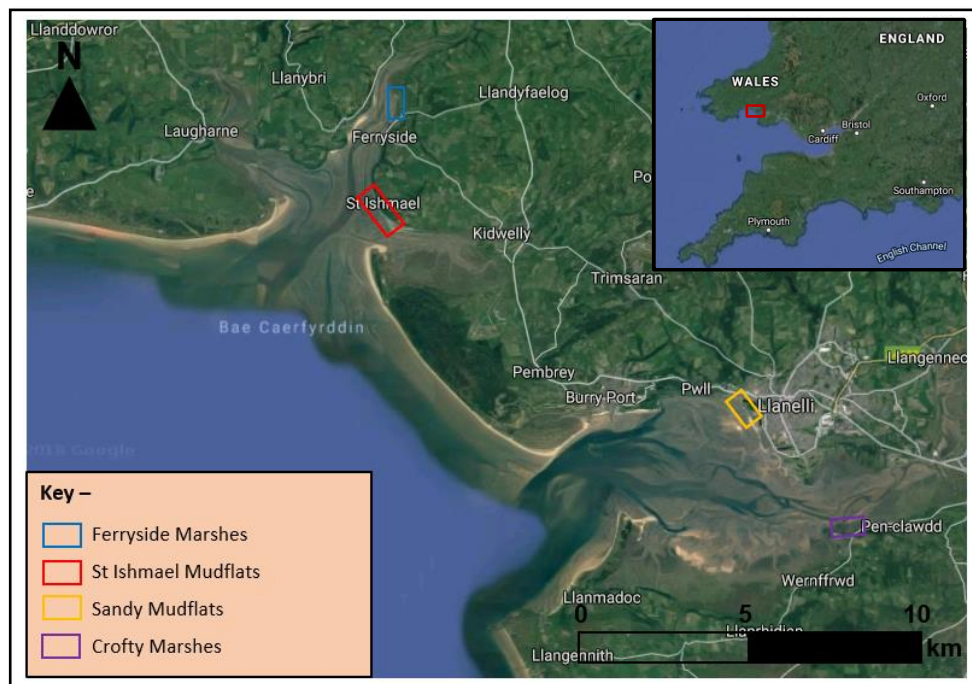


Figure 3.2. Location of the four sites in the Carmarthen Bay where the salt marsh stratigraphy was tested for storm surge signatures. Imagery sourced from Esri, DigitalGlobe, GeoEye and Earthstar Geographics (2020).

Fieldwork was undertaken in December 2018 during neap tides to reduce sediment saturation issues – and to improve safety. Gouge cores were taken from boreholes along two transects that ran parallel with the edge of the marsh with a 50 m distance separating each core laterally and from the marsh foreshore to backshore (see Figure 3.3 – St. Ishmael

example). The core positioning was designed to identify evidence of storms and any evidence of propagation (Williams, 2010; Tsompanoglou *et al.*, 2011). The stratigraphy testing was undertaken using a gouge auger comprising a 1 m long hardened steel alloy tube with c.40% of the tube wall removed forming an open chamber (Nelson, 2015). The design simplicity meant saltmarsh cores could be repeatedly manually extracted up to a depth of approximately 15 m (ground conditions permitting) to efficiently test the stratigraphy (British Standards Institute, 1999).

Potential storm surge signatures were identified following the extraction of cores measuring 0.49 to 2.32 m in length and were taken from 56 individual boreholes (14 at each site). The Troels-Smith (1955) classification was undertaken in the field to assess the physical properties of the cores and identify different sediment horizons (see Figure 3.4 for relevant key). This provided a semi-quantitative description of the core properties and allowed core stratigraphy to be compared to help determine subsequent sampling locations.



Figure 3.3. Location of boreholes taken at the St. Ishmael site. Location of the field site within the estuary (a), borehole location relative to salt marsh landcover (b) is shown.

The sampling locations were then chosen in areas of the marsh where the stratigraphy indicated storm surge evidence. This evidence took the form of abrupt, coarse grained, sandy sediment deposits which could plausibly be of storm surge origin (see section 2.5.2). Sedimentological properties were firstly determined following a visual and physical assessment, enabling the identification of potential storm surge signatures.

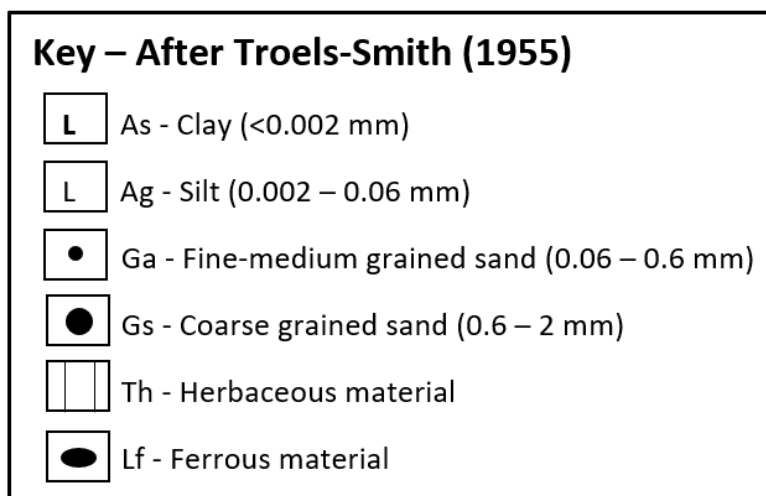


Figure 3.4. Key for sediment classification. Derived from Troels-Smith (1955).

To accurately determine the elevation of storm surge signatures, each borehole location and elevation were accurately determined using a differential Global Positioning System (dGPS) which allowed the location to be determined to an accuracy of ± 5 mm (Woodroffe and Barlow, 2015). First, a Trimble® SCS900 dGPS base station (see Figure 3.5) was set up. Via communication with GPS satellites, this established the precise location and elevation of the base station. The base was set up away from any vegetation and canopy cover in the back marsh, landward of all sites. A spirit level assured the base was level. The radio antenna, GPS and Bluetooth® connections were checked to ensure the device could communicate with the GPS satellites and mobile rover device. Three readings were then taken at each borehole with the rover which relayed the relative position and elevation of each borehole to the base station via Bluetooth® (Trimble®, 2019). This enabled the

identification of possible outliers. The rover connection was reset and recalibrated if any anomalous readings appeared.

Following the fieldwork, positional data were post-processed using Trimble® Site Controller Software (SCS) which computed corrected positions for the rover files via assessing the positional correspondence with accurate GPS base station data (Chivers, 2018). Post-processing removed any potential errors which could plausibly result from inaccurate field base station readings, allowing accurate (± 5 mm) positional readings to be determined. This ultimately enabled the position and elevation of each core and deposit to be determined.



Figure 3.5. The dGPS base station in operation.

The second field study was undertaken in February 2019 to obtain sedimentological evidence of the potential storm surges for laboratory analysis. The results of the initial fieldwork were used to inform the sampling locations. Sampling was undertaken at the Ferryside and St. Ishmael sites in the Three Rivers Estuarine Complex, where clear evidence of potential storm surge deposits in the form of abrupt, sandy horizons had been identified.

Sampling resolution was increased with 20 m intervals between boreholes (Figure 3.6). This maximised the chance of extracting clear sedimentological evidence of the storm surges.

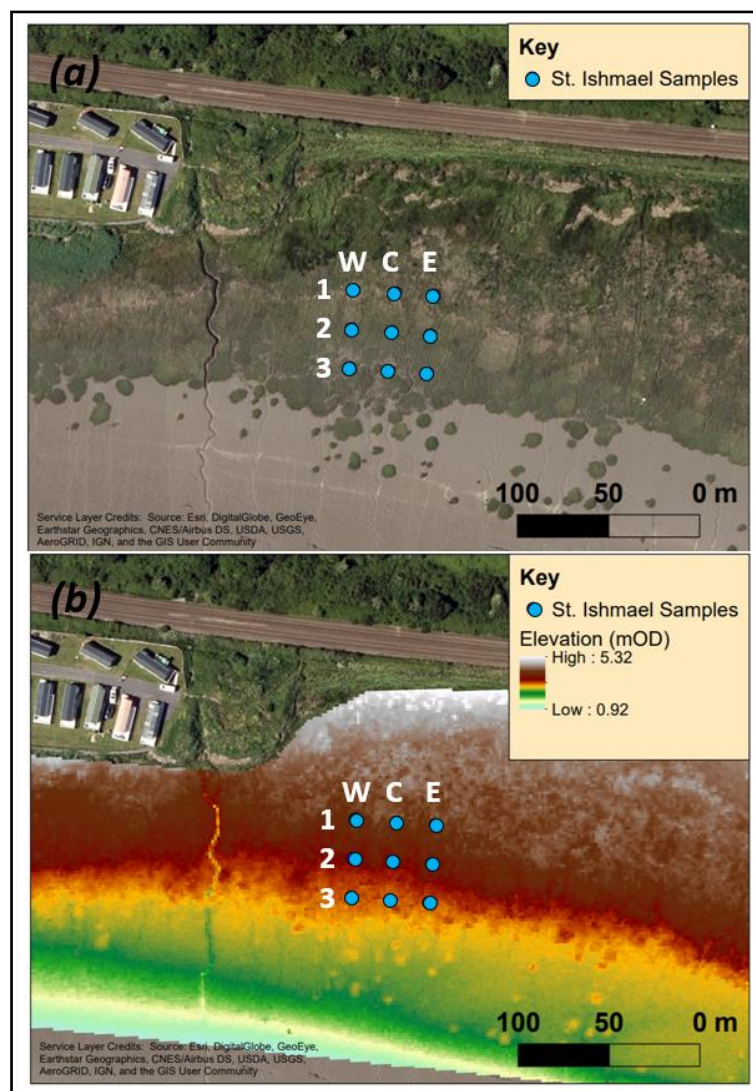


Figure 3.6. Location of boreholes taken during the sampling period on the St. Ishmael saltmarsh. Borehole location relative to salt marsh landcover (a) and elevation (derived from LiDAR) is exhibited.

A Russian peat corer with a chamber length of 0.5 m and diameter of 0.05 m was used to collect the sample cores that the laboratory analyses would be undertaken on. The Russian peat corer consisted of a half-barrel which pivoted around a flat fin plate (Franzén and Ljung 2009). During sampling, the core was rotated clockwise which enclosed the sediment sample in the chamber enabling sampling. Although more time consuming than the process using the gouge augur, samples were less susceptible to sampling contamination and compression (Frew, 2014). They therefore accurately represented the sediment stratigraphy which could be later analysed under laboratory conditions.

dGPS measurements for each sampled borehole were also recorded to accurately determine the position of the nine boreholes at the Ferryside and St. Ishmael site respectively. Following a Troels-Smith (1955) classification, five cores measuring from 0.79 m to 1.46 m in length which were representative of the stratigraphy and contained plausible storm surge evidence were taken back for laboratory analyses (see cores with G underneath in Chapter Four, Figure 4.1). Selected cores were transported horizontally and stored between 4-6°C following return from daily fieldwork and on return to university laboratories.

3.3.2. Geochemical Analysis

Elemental composition can act as proxy indicators of sedimentary deposits highlighting their potential origin (see section 2.5.2). This can enable deposits of storm surge origin to be distinguished from other events such as fluvial flooding and aeolian deposition (Croudace and Rothwell, 2015; Pilarczyk *et al.* 2015). To determine elemental composition throughout the core, an Itrax[®] X-ray fluorescence (XRF) geochemical analysis was undertaken on five cores. The Itrax[®] scanner was designed by Cox[®] analytical systems (Cox[®], 2019). The analysis was performed on the selected five cores at the British Ocean Sediment Core Research Facility (BOSCORF) at the National Oceanography Centre (NOC), Southampton. This analytical technique was selected as it was non-destructive and enabled elemental abundance to be accurately determined (Croudace *et al.*, 2019).

Eight indicator elements were selected to identify potential storm deposits. Barium, bromine, calcium and strontium were selected as reliable indicators of offshore marine flooding and evidence of storm and tsunami events (e.g. Schlichting, 2000; Szczuciński *et al.*, 2012; Goslin and Clemmensen, 2017). Silicon and potassium were selected as particle size indicators of sand commonly found in storm surge deposits (Williams *et al.*, 2011; Chague-Goff *et al.*, 2016). Titanium and zirconium were selected to respectively distinguish between events of fluvial and offshore marine origin (Dezileau *et al.*, 2011; Tsompanoglou *et al.*, 2011; Font *et al.*, 2013). The full justification for elements is provided in section 2.5.2.

As elemental abundance was outputted in counts as opposed to concentration, the elements were plotted as ratios against conservative elements rubidium and titanium. The use of conservative elements abundant throughout the core allowed input of element variability to be assessed relative to the overall elemental count (Weltje *et al.* 2015; Croudace *et al.* 2019). Lithophile Rb enabled elemental comparison due to its low environmental mobility and lack of anthropogenic enrichment (Kylander *et al.*, 2011; Weltje *et al.*, 2015). Ti was used as an immobile element due to its abundance and biological inactivity (Löwemark *et al.*, 2011; Weltje *et al.*, 2015).

Before scanning the core, the surface was smoothed so it was flat as possible to minimise measurement error that could occur due to an irregular surface (Lowemark *et al.* 2019). Each levelled core was placed onto the Itrax scanner and a thin cellophane film was applied to prevent radiation exposure degradation. Before scanning high-resolution images of the core were taken (see Figure 3.7), and the depth variability of the core surface was reviewed to ensure a complete scan. The scan was run at a resolution of 1 mm, as is recommended for geochemical analyses of estuarine sediment cores (Rothwell and Croudace, 2015). Although depth profiles indicated no disconformities, geochemical profiles were reviewed for abrupt spikes in argon, an element abundant in air, which would have indicated a break in the core and produced an anomalous measurement (Lowemark *et al.*, 2019).

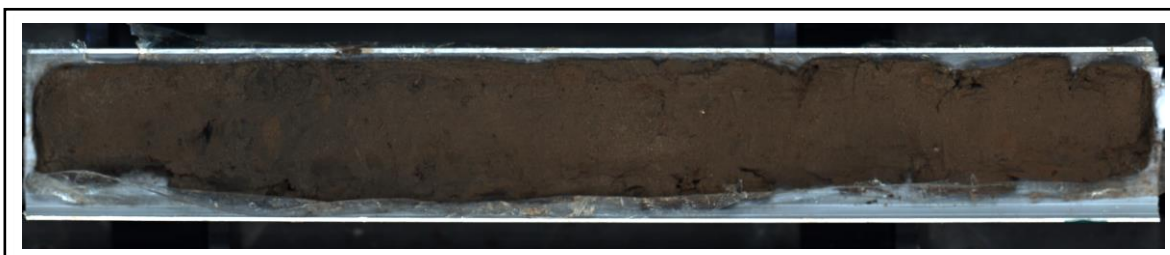


Figure 3.7. High-resolution optical image of the top 50 cm of core taken from the Ferryside Central 2 site. The image was taken on the Itrax® scanner at BOSCORF.

Following the successful scanning of all cores, the results for elemental abundance were outputted in counts and transferred to Microsoft® Excel. This enabled the count number variability for the 35 elements to be plotted against depth and initial trends and any plausible anomalies could be identified. The outputted validity, mean squared error and the counts per second values of each reading were reviewed. The relative abundances (i.e. indicator against Rb or Ti) of each element were presented as natural log (ln) ratios for comparative purposes (Weltje and Tjallainji, 2008) and to prepare the data for principal component analyses (PCA).

The principal focus was on the variability between the ln of the relative abundance of indicator elements at depths corresponding with the abrupt sandy deposits identified from field observation and the rest of the core. Spikes of Sr and Ca were of particular concern as well as the comparative relative abundance of Ti (against Rb) and Zr. K and Si abundance was also a key focus as the elements served as initial particle size indicators, although the following particle size analysis gave a more detailed insight. The results of the geochemical analyses are presented in Chapter Four, section 3.1.2 (chapter 4). On Microsoft® Excel the geochemical data were then plotted against core depth to determine geochemical variability relative to changes in observed stratigraphy and particle size.

3.3.3. Particle Size Analysis

The particle size analysis (PSA) was undertaken to accurately assess grain size variability within the five selected sediment cores. A Malvern® Mastersizer 3000 laser diffraction particle size analyser enabled grain size to be precisely and accurately determined (Switzer and Pile, 2015; Malvern Panalytical, 2019). This process measures the scattered light angle and intensity as a laser beam passes through a sediment sample in solution (Horiba Scientific, 2022). The data are then converted into particle size distribution measurements. The analyses produced three D-Values (D10, D50 and D90) giving the cumulative sample mass values for 10%, 50% and 90% of the sample (Blott and Pye, 2001).

First 5 mm³ samples were taken at 2 cm intervals throughout each core and placed in a water and hydrogen peroxide solution for 12 hours to remove organic matter that would potentially distort the particle size readings. The sediment samples in solution were then extracted using a pipette into a 10 ml test tube. Test tubes were then placed into a centrifuge and rotated at a rate of 4000 rotations per minute (rpm) for 8 minutes, covering approximately 2.01 m each rotation. Care was taken to ensure test tubes were distributed equally in the centrifuge to ensure an equal centrifugal force was applied. The result was that suspended sediment with a density greater than that of saltwater (1020-1029 kg m³) (Nayar *et al.* 2016) sank and was separated from the solution.

The Mastersizer 3000 was cleaned twice with 700 ml of non-deionised water, and twice with deionised water. Stirring speed was set to 4000 rpm for 50 seconds over the four individual periods. Following this a trial analysis was run at a stirring speed of 1500 rpm for 6 minutes with a test sand, for which the D10, D50 and D90 were known. Readings were then compared with the previous results to ensure machine functioning and programme selection. The machine was then again cleaned twice with 700 ml of non-deionised water, and twice with deionised water. The grain size analysis was then undertaken on the sediment samples from each 2 cm interval enabling D10, D50 and D90 to be determined. On Microsoft® Excel the PSA data were then plotted against core depth to determine grain size variability relative to changes in observed stratigraphy and geochemistry.

3.3.4. Principal Component Analyses

Dimension reducing principal component analyses (PCA) were undertaken to highlight the principal influences distinguishing the potential storm surge deposits. The analyses were undertaken using Paleontological Statistics (PAST) software version 3 which is designed for the statistical analysis of multivariate geological and palaeontological data (Hammer *et al.*, 2001; Hammer, 2019).

The PCA essentially finds hypothetical variables (components) accounting for the maximum possible variance in the multivariate data (Harper 1999). The new variables are linear combinations of the original variables and unitless. The PCA results were presented on 2D plots with two unitless axes representing the values of the principal components one (x-axis)

and two (y-axis) with the highest and second highest eigenvector values respectively. This means the x and y axes show the highest and second highest percentage of the overall statistical variance (Abdi and Williams, 2010) which are displayed next to the respective labels. The biplots showed the component one and two values for an indicator element relative to a conservative element or particle size. Samples taken from horizons that the geochemical and particle size analyses indicated were likely to be of storm surge origin are highlighted in red, whilst the surrounding silt/clay layers are highlighted in orange and light green. This was to identify if the samples from the potential storm surge horizons gravitated around the biplot values of particular indicator elements or grain size and this provided further evidence of their origin.

For comparison, all data relative to the conservative elements Rb and Ti were natural log (ln) transformed. The independent influence of geochemistry as well as the combined influence of geochemistry and particle size were then analysed.

3.3.5. Radionuclide Dating

To date the potential storm surge deposits, radionuclide dating analysis was undertaken at the Radiochemical and Decommissioning (Raddec) Solutions International laboratories. The gamma dating analyses measured the activity of the radionuclides ^{210}Pb and ^{137}Cs within two sediment cores. The rationale for selecting gamma radionuclide dating is explained in section 2.5.3. The selected cores were Ferryside East 3 and St. Ishmael Central 3 which measured 92 cm and 146 cm in length respectively. These cores were selected as the particle size and geochemical analyses indicated that they contained the clearest storm surge depositional evidence (see Chapter Four, section 3.1.2).

Pb-210 can provide longer-term records of accretional history dating back c.100 years while ^{137}Cs profiles can provide temporal data from 1950-present based on anthropogenic inputs (Appleby, 2002; Croudace *et al.*, 2012; Baskaran *et al.*, 2014; Andersen *et al.*, 2017). The radionuclide dating analysis used gamma spectrometry instead of the alternative alpha spectrometry as alpha dating involves the additional assumption of isotopic equilibrium between ^{210}Pb and ^{210}Po . This can create issues where sediments are enriched in ^{210}Po

because of its higher scavenging rate and subsequently the requisite equilibrium does not materialise, rendering the ^{210}Pb dates invalid (Zaborska *et al.*, 2007).

For the gamma analysis, samples were taken at 4 cm intervals from the cores from St. Ishmael Central 3 and Ferryside East 3. Following standard procedure, samples were placed into test tubes, frozen and then freeze-dried. Freeze-drying took 48 hours at a temperature below -25°C and a pressure of c. 0.05 ATM. Dried frozen sediments were then ground into a fine powder using a pestle and mortar.

Before the gamma dating, ground samples were stored for three weeks to allow complete ^{222}Rn decay to occur and to allow radioactive equilibrium to be reached. Care was taken to select samples from the organic silt surrounding abrupt sandy deposits so that a coherent age-depth chronology could be created.

Samples were then gamma counted at GAU-Radioanalytical Laboratories for 100,000 seconds. Total ^{210}Pb and ^{137}Cs were measured using well-type HPGe gamma spectrometry systems. Excess ^{210}Pb ($^{210}\text{Pb}_{\text{xs}}$) was then determined using the constant rate of supply (CRS) model (Croudace *et al.*, 2012). Bayesian and Plum models were also trialled but produced clearly anomalous values of sediment age which contradicted previous geological research (Pye and Blott, 2009; Bennett *et al.*, 2019; Aquino-Lopez *et al.*, 2020). Sample $^{210}\text{Pb}_{\text{xs}}$ was calculated by subtracting a modelled supported value of 0.01 Bq g^{-1} from total activity. The natural log of $^{210}\text{Pb}_{\text{xs}}$ was plotted against depth to produce an age-depth model and determine the depth and $\ln ^{210}\text{Pb}_{\text{xs}}$ gradient value. A standard age coefficient was calculated by dividing $\ln(2)$ by the half life of ^{210}Pb (22.3 a). Sediment accumulation rates (SAR) were then calculated by dividing the coefficient by the depth and $\ln ^{210}\text{Pb}_{\text{xs}}$ gradient value. The age uncertainty for each measurement was also calculated in the same way using ^{210}Pb uncertainty values for each measurement.

Cs-137 was used to identify chronological markers of key radionuclide events consistently identified in UK western saltmarshes. Out of the two cores, detectable ^{137}Cs was only identified in FS E3. The focus was on the identification of the start of nuclear testing 1952-54, the nuclear bomb pulse of 1963 and comparison of the ^{137}Cs chronology with documented ^{137}Cs discharges from Sellafield (Gray *et al.*, 1995; Tsompanoglou *et al.*, 2011; Swindles *et al.*, 2018). Correlating spikes in ^{137}Cs activity with these major events enabled

the creation of further age-depth models producing an overall age profile. Given transport uncertainty from Sellafield to the Three Rivers Estuary an uncertainty of ± 2 a was considered. Cs-137 dating served to calibrate the ^{210}Pb models and more accurately determine sediment and abrupt sandy deposit ages.

3.4. Archival Research

The archival analyses utilised written information from Western Britain to assess historic storm trends and impacts between January 1800 and December 2020. The diverse approach comprised of quantitative keyword and qualitative text analyses from the field of environmental history. Specific methods are outlined in detail in the methods sections of the respective chapters. The diversity and value of the archival dataset is also analysed independently in Chapter Five.

3.4.1. Quantitative Analysis

In Chapter Four the archival analyses examined quantitative data from south-west Wales in the form of tidal gauge and meteorological data. Tidal heights were collected from Milford Haven (July 1961 - December 2020) and Newlyn (April 1915 - June 1961) tidal gauges. The records were sourced from the British Oceanographic Data Centre (BODC) as they provided the longest spatially relevant observations (BODC, 2021). Storm surge height variability was calculated by subtracting observed tidal elevations from predicted tidal elevation determined from a gauge-specific POLTIPS (National Oceanographic Centre, 2021a) hindcast. Data were cross-checked with site-specific storm surge records of the greatest surges from the National Tidal and Sea Level Facility (NTLSF, 2021) and British Oceanographic Data Centre (BODC, 2021). Meteorological data from Pembroke weather station for wind speed (Beaufort Force), wind direction (22.5° compass bearing) and barometric pressure (mm Hg) were also compiled. This was sourced from the online Meteorological Office historic station data archives (Meteorological Office, 2022). The greatest mean hourly speed within each storm was recorded to gauge the maximum mean storm strength. Data from Prawle Point (Plymouth) 184.2 km south-south-east were also collected. A database of every reported storm was created to assess all storms recorded within periods corresponding with the sediment radionuclide dating range of the saltmarsh deposits. The refined tidal gauge and meteorological data were subsequently used to identify the most likely storms which produced the abrupt, coarse, sandy saltmarsh

sediment deposits. Of key consideration were wind speed magnitude, wind direction, storm surge height and observed overall surge height.

In Chapter Eight quantitative meteorological and storm surge data were also used to analyse the magnitude variability of Storms Ciara and Dennis throughout Western Britain.

Quantitative data were collected between 00:00 February 4 to 00:00 February 19 to ensure all variability during the two storms could be analysed. To analyse meteorological variability, wind speed (ms^{-1}) and precipitation (mm) data were collected from eight and seven Met Office stations respectively and distributed throughout Western Britain. These data were sourced from the Centre for Environmental Data Analysis (CEDA) archives. The two data types were selected as the majority of UK storm impacts result from high winds and flooding (Graham *et al.*, 2019; Koks, 2020). At the sites of Stornoway, Bishopton, Blackpool, Valley (Anglesey), Mumbles, Chivenor and Camborne, wind speed and precipitation was analysed at hourly intervals which was the shortest available interval range. At Usk, only hourly precipitation data were analysed due to wind speed data absences during the period. To analyse the meteorological storm variability relative to the climate at the sites, mean site data for precipitation and windspeed from February 1991-2020 was sourced from the Met Office. For windspeed maximum, mean and the number of hours where the windspeed was \geq Force 7 (13.9 ms^{-1}) was analysed relative to the February climate data. For precipitation, maximum hourly amount, mean, hours of rainfall and total precipitation were analysed. For the number of hours when the windspeed was \geq Force 7, hours of rainfall and total precipitation, the Met Office climate data were converted so that they represented an average 15 day period for accurate comparison (Met Office, 2022).

The storm surge data used in Chapter Eight were sourced from seven tidal gauges distributed throughout Western Britain. The selected gauges were. Stornoway, Millport, Heysham, Holyhead, Milford Haven, Hinkley Point and Newlyn. These gauges were chosen as they were all within 31 km of a meteorological station with the exception of Hinkley Point and Camborne which were 76 km apart (closest corresponding stations). The storm surge tidal gauge data comprised storm surge height data measured at 00:15 intervals (highest available) at seven tidal gauges from 00:00 04/02/2020 to 00:00 19/02/2020. For this 2020 data, storm surge height (residual) was calculated in the BODC (2022) datasets. To analyse storm surge magnitude at each site relative to the site storm surge climate, the maximum

storm surge recorded for both Storms Ciara and Dennis were compared and ranked against the monthly maximum surge recordings (BODC data) at each station from January 1990 to March 2022 (267 readings). Hinkley Point readings were from May 1990 to March 2022 (263). The maximum recorded values during February 2020 (during the storm period) were ranked relative to the monthly maximums while the maximum for the storm with the lower magnitude a hypothetical rank was calculated to appraise relative magnitude.

3.4.2. Qualitative and Semi-Quantitative Analysis

For the analyses of Chapters Six, Seven and Eight, newspaper reports from 1800 were selected as information sources. Although the original archival approach had been to use storm-related literature such as poetry and novels, the project's archival component subsequently focused entirely on newspaper extracts (MacDonald *et al.*, 2010; Garnier *et al.*, 2018). This was due to the wider resource availability, applicability and likelihood of correspondence with quantitative and sedimentological storm data.

As is indicated in sections 2.1, 2.4 and 2.7 the qualitative and semi-quantitative analyses of archival reports utilised newspaper evidence. While other studies have demonstrated the value of using other archival sources such as parish church records, personal diaries and naval logs to improve the understanding of past climate and weather trends and effects, newspaper records were preferred to such records (e.g. Blaser, 2014; Adamson, 2015; Lorrey and Chappell, 2016). This selection was informed by previous environmental history research that highlighted how the broader focus of newspapers meant they could provide insights into social, economic, political and environmental weather impacts (e.g. Archer *et al.*, 2019; Murphy *et al.*, 2020). While it was acknowledged newspaper storm reporting would change over time and could be influenced by the interpretations of individual correspondents as well as the spatial foci and political leanings of select newspapers, using a range of reputable newspaper provided spatially and temporally diverse insights into storms. Such newspaper insights were likely to be more diverse and focus on a broader range of topics than other sources such as personal diaries of clergymen or logs of naval officers which would likely have more individual bias and specific reporting foci. The use of more individual and (sometimes) independent archival sources also presents issues

regarding the creation of comprehensive databases over a 220 year period. There is also an increased likelihood of temporal and spatial variability in more individual records as entirely different sources with (likely) different understandings of the weather must be relied upon to create a complete dataset (e.g. Gimmi *et al.*, 2007; Harvey-Fishenden, 2021). Therefore, the analysis used a combination of reputable newspapers to record the changing storm trends and effects as they provided diverse insights into storm effects throughout Western Britain and were constantly subject to public and professional (i.e. editors) scrutiny. Consequently, newspapers were selected as they were more likely to accurately record regional storm trends and reflect the changing wider storm understanding throughout the period.

Utilising a range of newspaper sources (see below) also meant that the newspaper reports and extracts could often be cross-referenced and checked, especially in the event of a major storm. The keyword searches returned a range of articles from the different papers while major events often prompted multiple articles from the same publication. This meant that all stories relating to a storm could be qualitatively cross-referenced and checked which was of particular use when confirming the effects of the event whether they were economic loss, accounts of emotional hardship or fatalities. While all papers were known to be reputable and therefore treated as equally credible, when confirming statistics more importance was attached to the later reports published after the events due to the occasional tendency of reporting exacerbation immediately following a storm which still continues in the twenty-first century (Weather *et al.*, 2016; Mayeda *et al.*, 2019). Moreover, for particularly famous events such as the *Royal Charter Storm* of 1859, *Great Blizzard* of 1891 and *Great Storm* of 1987 peer reviewed research and published factual information was also used to ensure reporting accuracy. Therefore, the newspaper research enabled a novel insight into the social, cultural and environmental storm effects but could also often be verified by cross-referencing between different reports and papers as well as using reputable external research to ensure its reliability.

The year 1800 was selected as the start as it approximately marked the start of comprehensive newspaper records and reports that were available at the ProQuest and GALE archives with the number of newspapers, reports, reporting detail and scientific focus progressively increasing throughout the nineteenth century (GALE, 2022; ProQuest, 2022).

The increasing inclusion of scientific weather data between 1800 to 2020 in the selected reputable newspapers also meant there was the possibility to corroborate other forms of quantitative data (e.g. Met Office observations) with newspaper reports to exhibit the wider effects of storms. The comprehensive 220 year newspaper coverage, wider focus on the variable human and environmental effects of storms and the ability to check and examine content accuracy, therefore rendered newspapers the most appropriate written archival source to use in a multidisciplinary study investigating the often interconnected storm effects on the communities on environments in Western Britain.

The chosen newspaper reports selected in this study represented reliable dated sources of qualitative storm-related information as they were detailed and often contained accompanying quantitative information allowing historical storm chronologies as well as impact, response and representation trends to be assessed. Initially, archives at the City of Liverpool Central Library and Pembrokeshire Record Office were visited to affirm the appropriateness of information. Due to the restrictions imposed by the COVID-19 pandemic and wider resource availability, the online the GALE and ProQuest online repositories were primarily used to source storm-related information. The archives of the following newspapers were analysed: *The Bristol Mercury*, *Caledonian Mercury*, *Chester Guardian*, *Hampshire Telegraph*, *Kendal Chronicle*, *Lancaster Gazette*, *Liverpool Mercury*, *Morning Chronicle*, *Morning Post*, *Royal Cornwall Gazette*, *Observer & The Guardian*, *Trewan's Exeter Flying Post*, *Western Mail* and *Western Times*. After 2003, online newspaper reports were directly sourced from Theguardian.com due to the cessation of online newspaper archives and the greater quantity of information available via the website. All newspapers focused on Western Britain and had a wide coverage and high reputation. To initially identify storm-related information a quantitative keyword analysis was undertaken using the online repository search filters. To identify storm-related extracts, the initial search used the stem keywords: 'storm', 'tempest' and 'gale'. All reports were qualitatively reviewed to ensure relevance to meteorological storms in Western Britain.

Chapter Eight also utilised 34 newspaper reports from *The Guardian* and *The Observer* online to analyse Storms Ciara and Dennis. This specifically consisted of 32 articles and two live feeds published between February 4 to February 23, which captured all published information directly relating to the storms and their effects. The national compact

newspapers were chosen as they feature detailed information on the local and national storm impacts as well as accompanying scientific information (Llasat *et al.*, 2009; Businger *et al.*, 2018; Archer *et al.*, 2019). This qualitative and semi-quantitative data featured a range of factors from reports of localised community storm impacts to live warnings from the Environment Agency and climate change related policy views from reputable scientists. This ultimately enabled the chapter to examine to what extent meteorological variability, short-term response and long-term policies contributed to the catastrophe of Storms Dennis and Ciara.

3.4.2.1. Archival Data Review

The wider archival research methods produced an extensive original database of storm-related information from Western Britain from 1800 to 2020. Given the wide scope of the initial research brief, which enabled the inclusion of all forms of written storm-related material, the research adopted a broad approach to written data gathering. This enabled a full assessment of the amount and nature of storm-related material available in newspaper sources, which were chosen as accurate, descriptive and dated written sources of storm-related information (see Literature Review Section 2.4). The research approach was influenced by Archer *et al* (2019) who use a keyword analysis to succinctly identify storms and floods from hundreds of years of newspaper report data. However, due to the varied sources and journalistic approaches, the archival research was also influenced by MacDonald *et al* (2010) who devoted considerable time to the individual and qualitative review of archival newspaper reports in order to firstly understand reporting tendencies which subsequently informed the keyword analyses. This allowed newspaper reporting trends and foci to be identified and subsequently relevant papers could be produced.

In all, 1567 reports and extracts were identified which featured a diverse range of storm-related topics from religious poems to eye-witness accounts and scientists' views on the impact of climate change on future storm magnitude and frequency. Each report was fully reviewed before it was dated and recorded on an Excel[®] database where the storm-related material was summarised. In certain instances, the storm information consisted of a short paragraph in one newspaper. However, in the case of storms lasting several days, a

summary could include written information with different foci sourced from multiple newspapers over several days. Regarding storm events, every effect and consequence of the storm was recorded, whether this was the initial damage, the enduring impact on human wellbeing or the scientific or religious representation of the event. Care was taken to ensure the information concerning the effects and impacts of storm events related to Western Britain and the 25 km area surrounding the coast. When a location of a reported impact was unknown, its location was checked and measured with Google™ Maps to ensure spatial relevance. This produced comprehensive summaries of storms between 1800 and 2020, which detailed all the reported storm effects and consequences and thereby provided a unique dataset and insight into historical storms.

The dataset also comprised storm-related information which concerned wider storm interpretation and representation such as poems, reports on meteorological development or articles on storm and flood management. This information did not have to directly relate to a specific storm in Western Britain, but always remained relevant to wider storm understanding in the region. The inclusion of this material gave a broader insight into the evolving wider human, cultural and environmental impacts of storms in Western Britain which allowed the research to go beyond storm event impact analyses and enable the analyses of wider social, cultural, political and environmental storm effects.

To aid the selection of Chapter foci, each of the 1567 reports was qualitatively reviewed and categorised as relating to a storm event, wider storm interpretation, or both. This highlighted key newspaper data trends including consistent trends as well as gradual and sudden changes in storm reporting foci over the 200 years. These newspaper data are explored in detail in Chapter Five which chronologically explores the archival database in order to highlight trends in storm reporting and understanding and provide the background for Chapters Six to Eight and the wider thesis. The foci and themes of Chapter Five were selected following the initial qualitative analysis of written reports (each storm from 1800 to 2020) and were designed to best support the research of Chapters Six to Eight which largely utilised archival newspaper material (see 3.4.2.2 and chapter methodologies). Therefore the analysis in Chapter Five largely focused on reports that both conformed and contrasted with reported trends explored in Chapters Six to Eight. However, other themes which the qualitative analysis indicated regularly appeared in storm reports such as the Napoleonic

Wars (1803-1815) or the influence of live newspaper storm feeds in the 2010s were explored in detail as the qualitative analysis exhibited their key influence on storm effects and understanding. Chapter Five's changing focus throughout the 220 years was also designed to exhibit the extent that major societal events (from major European wars to the North Sea Flood of 1953) and changes in social, cultural, political and environmental understanding influenced storm reporting in Western Britain. This provided context for the research of Chapter Six to Eight while also providing novel insights on changing storm trends and understandings. The review and analysis of the reputable but previously little-utilised archival database in Chapter Five also highlight multiple trends and events that could not be analysed further due to thesis constraints but could be excellent foci for subsequent original environmental history research designed to improve storm and climate understanding in Britain. Therefore, Chapter Five provides thesis context, exhibits how key storm and societal events changed storm effects and understanding and acts as an indicator of potential original future research themes. The ensuing data refinement process for themes and foci of Chapters Six to Eight are outlined in the subsequent section.

3.4.2.2. Archival Data Refinement

To identify relevant archival information for Chapters Six, Seven and Eight, further filtering and method adaption was required. The archival analyses for Chapter Seven primarily focused on historical written newspaper data concerning storm impacts and responses. Quantitative data concerning storm-related fatalities were combined with a qualitative review of the aforementioned 1567 storm-related reports published between 1800 and 2020. Fatalities were selected as they proved the most objective and consistently reported factors over the 220 years. The data were used to help identify events which prompted major changes in reported community and government storm responses.

The community and state responses were analysed through the lens of storm subcultures, which are defined as long-term regional trends of societal response arising from periodic storm threats (Bankoff, 2013). This informed the selection and subsequent analysis of the

underresearched case study of *Royal Charter* Storm of 1859 which exhibited the great long-term effects of storms of coastal communities and national governments.

The Chapter Six focus was firstly identifying all storm events that had been reported since 1800, producing the dataset which is explored in detail in Chapter 5. Beginning in 1800, the initial qualitative analysis exhibited periodic examples of societal storm responses. Given the variability in sources and different interpretations of newspapers and correspondents, reported fatalities were collectively used as the most objective measure of storm human impacts. In the first half of the nineteenth century, responses were highly variable and near-unanimously took the form of *ad hoc* welfare or aid to storm victims with little reported organised or long-term responses (see Chapter Six, Figure 6.2). The corresponding storm fatality trend with events was likewise variable with no exceptionally deadly events (>50 fatalities) with the exception of the loss of HMS *Anson* in Mount's Bay, South-West England in December 1807 when 99 fatalities were recorded. The fatality dataset exhibited a notable outlier in October 1859 when 469 died throughout Britain during the *Royal Charter* Storm of October 1859. Subsequently, the first consistent reports concerning storm warnings and forecasts were regularly published in newspapers. Given the historical significance of forecasting and its enduring impact on human vulnerability (Anderson, 2005; Roberts, 2011), the *Royal Charter* Storm and subsequent forecasting response was selected as the case study. The analytical focus was the impact of Met Office storm prediction introduction on storm subcultures with a specific focus on how a new national government-led, technocratic and centralised input changed storm subcultures and influenced community resilience. This research has contemporary implications for community hazard understanding and inclusivity in the creation of effective early warning systems.

The Chapter Seven analysis included historical written newspaper data but instead focused on the variability of the religious and scientific elements of newspaper representation between January 1800 and February 1953. The analysis returned 1123 reports of which 177 contained religious or scientific representation. Representations refer to how storms are documented by correspondents and other contributors in newspapers. The approach explored 'what representations do rather than what they stand in for' (Anderson, 2019, p. 1122), as the analysis of Chapter Seven went beyond analysing reporting trends and considered how the changing scientific and religious weather representations illustrated

changing epistemological trends from 1800 to 1953. February 1953 was chosen as the end date as this marks the occurrence of the North Sea Flood. The catastrophic loss resulting from the event caused major changes in the British representation of storms, fundamentally changing storm perception (Hall, 2015). The ensuing analysis of representational trends was influenced by an individual qualitative analysis of reports (e.g. MacDonald *et al.*, 2010) which guided the wider quantitative keyword analysis of the dataset (e.g. Archer *et al.*, 2021) (see Chapter Seven methods for detail). The analysis focused on the changing religious and scientific elements of representations over time. This enabled a detailed appraisal of how wider epistemological change affected the public representations of storms. Given the overwhelming predominance of religious representation previous to 1800 (Jankovic, 2000; Hall, 2019), the religious decline and scientific rise in the period were regarded as a major representational and epistemological change. While there is abundant research regarding changing religious and scientific trends of storms (e.g. Anderson, 2005; Golinski, 2010), previous research predominantly focuses on broader changes in societal perception and conflicts surrounding interpretation. This research, in contrast, sought to trace regional representation with the newspaper reports giving broad perspectives from interviews with first-hand witnesses to the contributions of state officials, scientists and poets. This provided an original insight into the impacts of epistemological change on the religious and scientific elements on storm representations from throughout the society of Western Britain during a period characterised by major change. Enhancing the understanding of epistemological and representation relationships in this context is important given that the public understanding of storms and natural hazards has enduring and potential significant policy implications (Matasci *et al.*, 2014; Schmidt *et al.*, 2014; Dickinson, 2017).

Chapter Eight focused on 34 newspaper reports published between February 4 to February 23 from *The Guardian* and *The Observer* online which directly reported on the effects of Storms Ciara and Dennis. This data was identified using a Google™ site specific search for relevant articles and all articles were qualitatively assessed to verify their relevancy to the storm period. The ensuing collective assessment of the newspaper data with meteorological storm and tidal gauge storm surge data enabled an original assessment of whether the event was an unavoidable natural disaster or a climate catastrophe resulting from 'the

intersection of natural hazards ... with human populations in varying states of economic, social, and cultural vulnerability' (Anderson, 2011, p.1).

3.5. Summary

This chapter outlines the varied methods and techniques that comprise this multidisciplinary study on historical storms in Western Britain. Methods ranging from Itrax[®] geochemical analysis of saltmarsh sediments to the analysis of religious storm representations in the 1800s are shown to contribute towards producing a diverse study which contributes towards enhancing the understanding of the often complex and interconnected impacts on storms on coastal communities and environments. Further detail on the specific archival methods employed in Chapters Four, Six, Seven and Eight are given in the respective methodology sections.

Chapter 4: Sedimentological Archives of Coastal Storms in South-West Wales, UK

Paper Context

This chapter consists of a paper that has been published in the *Estuarine, Coastal and Shelf Science*.

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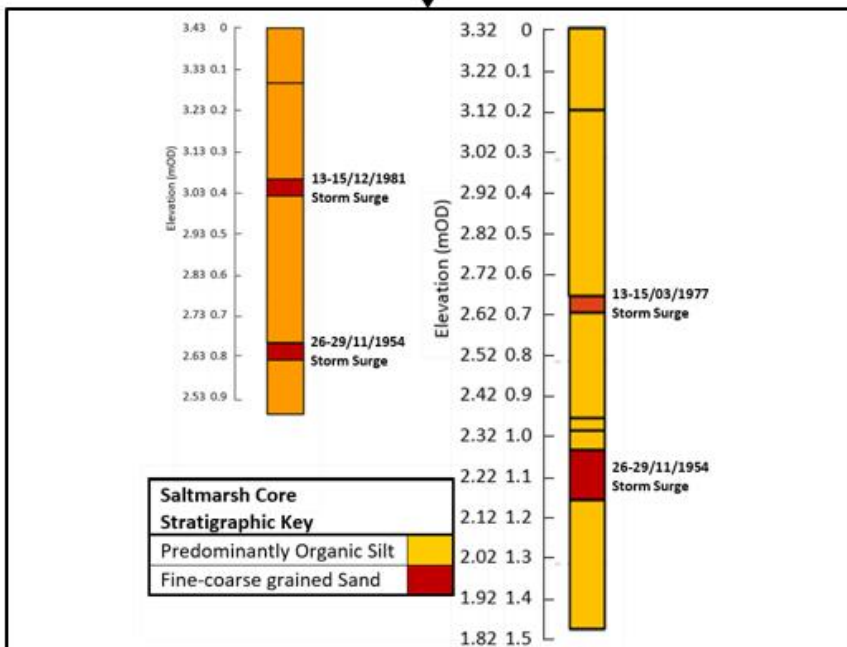
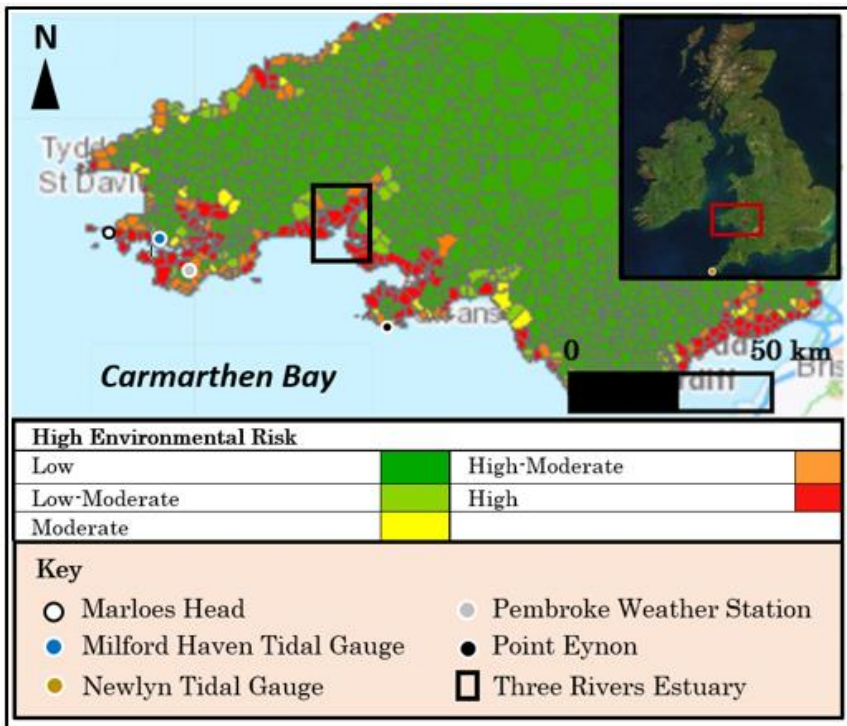
Jardine designed the study, undertook the fieldwork, conducted the data analyses and wrote the paper. Selby conceived the project that funded the research and contributed to the interpretation, Croudace provided assistance with the geochemical analysis and radionuclide dating while Higgins edited the paper.

Abstract

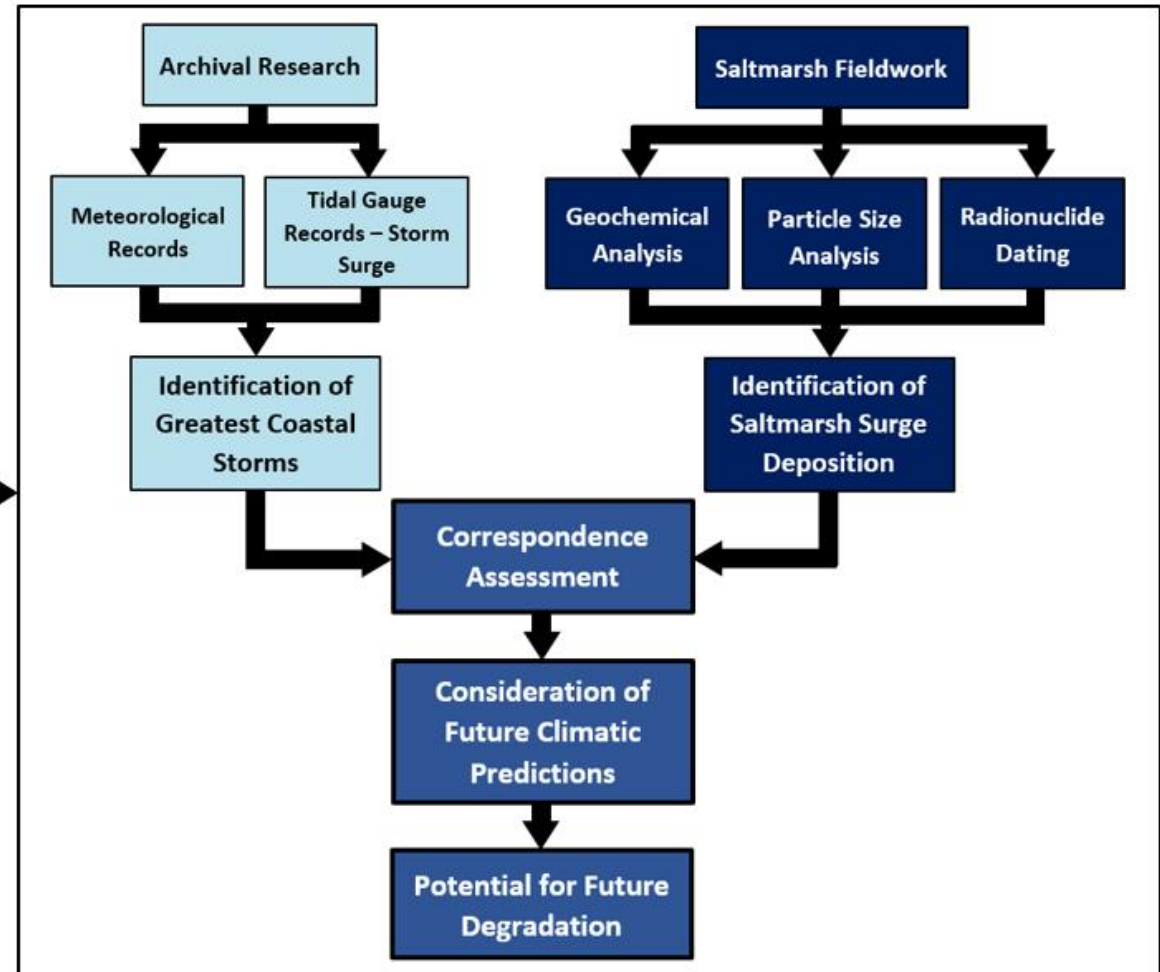
High magnitude coastal storms have persistently threatened human communities and environments. In the British Isles their frequency and magnitude are predicted to increase in the future with advancing climate change. This study analyses sedimentological evidence from south-west Wales to assess the impacts of high magnitude coastal storms in vulnerable coastal saltmarshes in the Three Rivers Estuarine Complex, Carmarthen Bay. Storm surge saltmarsh deposits were identified following geochemical and particle size analyses and dated using radionuclides ^{137}Cs and ^{210}Pb . The sedimentological evidence is compared with regional tidal gauge and meteorological records to assess variability in storm recording and corroborate the storms which produced the sedimentological deposits. Three episodes of high magnitude saltmarsh storm surge deposition are identified in 1954, 1977 and 1981. Evidence of storm erosion or alternative forms of storm deposition were not present. The sedimentological evidence highlights the comparative rarity of major depositional events in the saltmarshes between 1929-2019. The recorded depositional events combined with organic accretion have contributed to maintaining saltmarsh elevation relative to sea level.

There remains uncertainty surrounding the storm impacts on the saltmarshes of the Three Rivers Estuarine Complex. When the future 21st century threats of increasing regional atmospheric storminess and sea level rise are considered along with predictions of saltmarsh degradation, this study suggests further research is required to explore the sedimentological storm impacts. This could contribute to sustaining the vulnerable coastal saltmarsh environments and the important ecosystem services they provide.

Keywords: Storm surge, saltmarsh, sedimentology, coastal storm, saltmarsh sustainability



Graphical Abstract



4.1. Introduction

Coastal storms represent major hazards that are predicted to increase in frequency and magnitude with climate change (Haigh *et al.*, 2016; Palmer *et al.*, 2018). The United Kingdom Climate Projections 2018 (UKCP18) indicate sea level rise coupled with increasing atmospheric storminess will lead to greater detrimental impacts on coastal populations and environments (Burden *et al.*, 2018; Lowe *et al.*, 2018). As the threat of storms increases with climate change it is important to understand how coastal storms have impacted valuable coastal environments and appraise how these impacts may change in the future (Slingo *et al.*, 2014; Dawson *et al.*, 2016; Lowe *et al.*, 2018).

In Great Britain, climatic change is predicted to cause coastal saltmarsh loss to increase with a >80% probability of saltmarsh retreat, under the most likely IPCC Representative Concentration Pathway (RCP) 8.5 scenario (most similar to Shared Socioeconomic Pathways (SSP5) 8.5 in IPCC AR6) by 2100 (Horton *et al.*, 2018; Schwalm *et al.*, 2020; Chen *et al.*, 2021). The increasing frequency of high magnitude storms and sea level rise (SLR) could result in the degradation of valuable coastal environments which provide ecosystem services including blue carbon storage and sequestration, as well as coastal defence (e.g. Craft *et al.*, 2009; Pendleton *et al.*, 2012; Morris *et al.*, 2018). Saltmarsh sediments also provide valuable records of environmental change including storm surges (Pilarczyk *et al.*, 2014; Bunzel *et al.*, 2021). Saltmarsh storm evidence can range from the deposition of coarse sediment horizons, sporadic deposition of discrete very coarse material (namely granules and pebbles) or the creation of erosional contacts depending on the life cycle of the storm energy-sediment interaction (Leonardi *et al.*, 2018).

This multidisciplinary study investigated the impacts of coastal storms in south-west Wales where SLR and increasing atmospheric storminess are predicted to increase human and coastal environmental storm exposure (Palmer *et al.*, 2018; Natural Resources Wales, 2020). The study focuses on the sedimentological impact of coastal storms in the short term from 1929 (oldest radionuclide date) to 2019 (data retrieved) and considers future impacts up to 2100. In the region, saltmarshes are predicted to achieve the >80% retreat probability as early as 2060 (Horton *et al.*, 2018) while nationally significant infrastructures such as the

Hinkley Point C nuclear power plant and Port of Milford Haven could be vulnerable (Lyddon *et al.*, 2017; Poo *et al.*, 2020).

Sedimentological evidence of storm surges in the Three Rivers Estuarine Complex, Carmarthen Bay enables the impact of coastal storms on the saltmarsh environment to be assessed. Regional tidal gauge data from Newlyn (1915-1961) and Milford Haven (1961-2020) enable an assessment of storm surge and sedimentological correspondence. Meteorological data from the Meteorological Office station at Pembroke, south-west Wales (1861-2020) allows further correspondence analysis between the meteorological and sedimentological data. This combination of sedimentological, tidal gauge and meteorological evidence is used to assess the impacts of coastal storms on a vulnerable saltmarsh environment between 1929-2021, thereby addressing thesis objective two. The findings are considered along with future predictions of regional sea level rise and storminess until 2100 to appraise the future saltmarsh sustainability. This addresses objective seven as an evaluation of the wider benefits of multidisciplinary storm research is undertaken. Objective one is also addressed as historical records are used to analyse past coastal storm trends, while the research meets the overall thesis aim as it exhibits how a multidisciplinary approach can improve the understanding of coastal storm trends and impacts in Western Britain.

4.2. Materials and Methods

4.2.1. Study Location

4.2.1.1. Background and Rationale

The research focused on 189 km of coastline between Port Eynon, Swansea to Marloes Head, Pembrokeshire (Figure 4.1(i)). This area includes Carmarthen Bay which covers an area of 661.2 km² at mean high water (MHW). The region includes the Three Rivers Estuarine Complex Special Area of Conservation and Milford Haven, an important port (Port of Milford Haven, 2016).

Generalised Pareto Distribution (GPD) storm models indicate that a 1-in-10 year storm (in 2019) from the South West is characterised by winds of 26.6 ms⁻¹ producing waves of a height of 6.94 m in the centre of Carmarthen Bay (Bennett *et al.*, 2019). Weather data (2021) from Pembroke Dock record that the average wind speed is greatest in December and January registering Beaufort Force 5 (30 kph) although the 90th percentile exceeds Beaufort Force 6 (45 kph). For eight months of the year westerly (WSW-WNW) and southerly (SSE-SSW) winds prevail for >60% of days (Modern-Era Retrospective analysis for Research and Applications, Version 2, 2021).

Present coastal flood risk in Carmarthen Bay is very high as Natural Resources Wales (2020) Flooding Vulnerability Model exhibits 36/55 of the defined coastal zones are exposed to the highest possible environmental risk (Figure 4.1(i)). In the Three Rivers Estuarine Complex the 50-100 year coastal management policies are no active intervention and hold the line (Phillips *et al.*, 2012). The saltmarshes at Ferryside and St. Ishmael are located in areas where the policy is hold the line as they have a railway to landward which is protected by rock armour. Regional storm surge skew (maximum observed sea level – maximum predicted sea level), is also predicted to increase by 0.7 mm/yr by 2100 (1981-2000 baseline) according to the most realistic MPI-ESM-LR-RCA4 model (Palmer *et al.*, 2018). Regional UKCP18 models also estimate a relative SLR of >0.7 m by 2100 under the most likely RCP 8.5 scenario (most similar to SSP5 8.5) (Palmer *et al.*, 2018; Schwalm *et al.*, 2020).

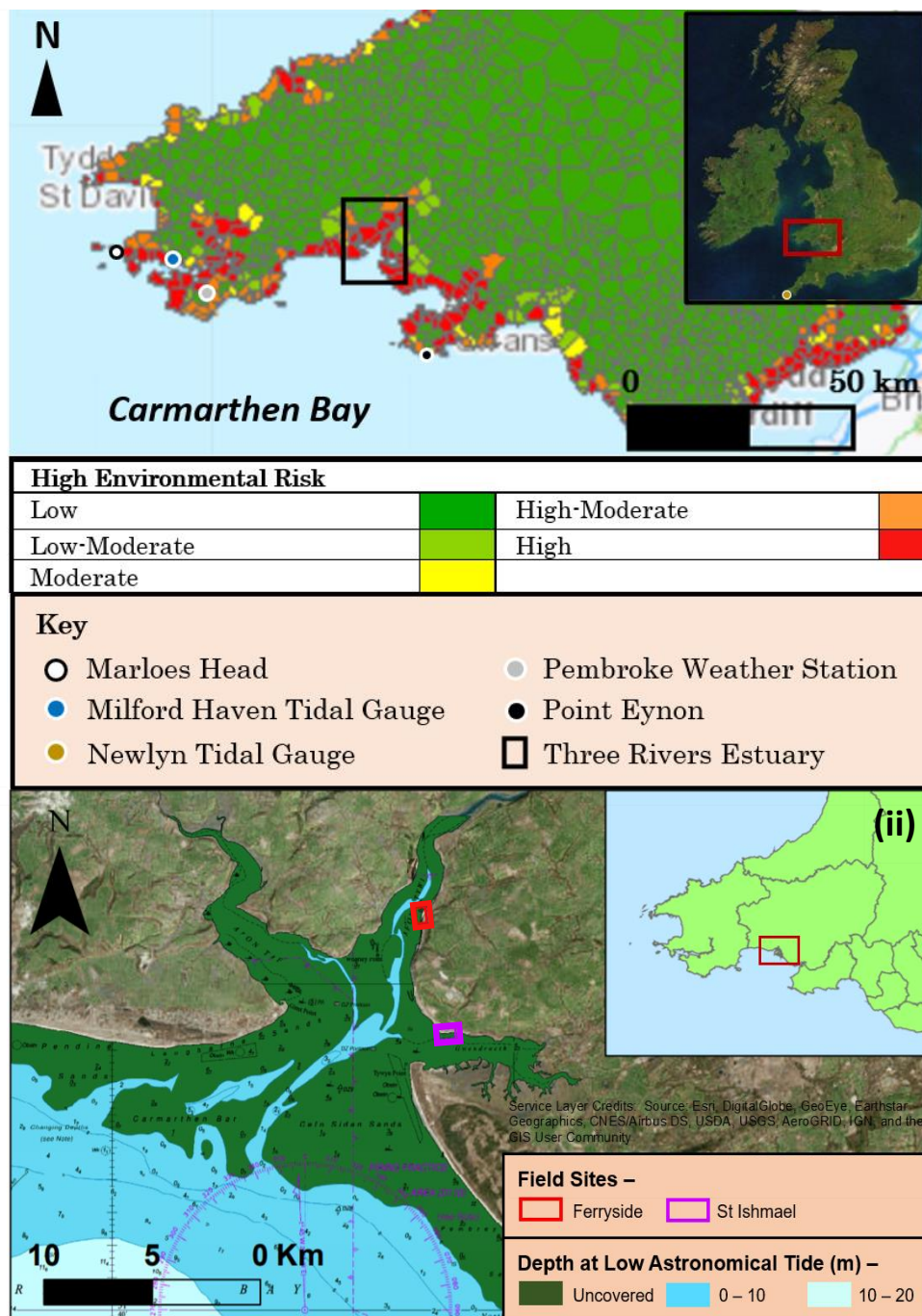


Figure 4.1(i-ii). (i) Study sites and areas exposed to high risk coastal flooding in 2020. (ii) Location of field sites in the Three Rivers Estuarine Complex, Carmarthen Bay. Depth at Lowest Astronomical Tide (LAT) highlights maximum tidal range and main channels. Risk map data from

4.2.1.2. Sedimentology and Geomorphology

The two field sites are located at Ferryside and St. Ishmael in the Three Rivers Estuarine Complex, Carmarthen Bay (Figure 4.1(ii)). The estuarine complex comprises the estuaries of the Rivers Taf, Tywi and Gwendraeth which are characterised by sand and mudflats, saltmarshes and intertidal channels (Bennett *et al.*, 2020).

The Ferryside and St. Ishmael sites are both located in saltmarsh environments in the Tywi and Gwendraeth estuaries respectively (see Figure 4.1(ii)) and classified as at the greatest environmental risk of coastal flooding (Natural Resources Wales, 2020). The dominant species *Spartina anglica* is partially responsible for rapid saltmarsh expansion and sediment accumulation in the estuarine complex, which has experienced little channel migration over the last c. 200 years (Bristow and Pile, 2003; Pye and Blott, 2009). Carmarthen Bay is influenced by Atlantic south-westerly swell waves and locally-generated wind waves which can catalyse geomorphological change during winter storms (Pye and Blott, 2009; Bennett *et al.*, 2019). The bay is underlain by Carboniferous and Devonian limestones and sandstones while sand predominates on the seafloor (Cooper and Maclaren, 2007; Countryside Council for Wales, 2009).

Site locations close to the main channels and below mean high water springs (4.10 mOD) (Carmarthenshire County Council, 2019) were selected as storm surge waves from the south-west would theoretically experience little dissipation at the estuarine mouth and propagate over the two sites (Möller *et al.*, 2014; Rupprecht *et al.*, 2017). This enhanced the likelihood of storm surges producing sedimentological evidence (Tsompanoglou *et al.*, 2011; Hawkes and Horton, 2012).

4.2.2. Fieldwork

The saltmarsh stratigraphy was first tested using a gouge corer at 50 m intervals along two transects parallel to the shore in the lower-middle saltmarsh in the Three Rivers Estuarine Complex and the Loughor Estuary. The core position and elevation were obtained to a

precision of ± 5 mm using a differential Global Positioning System (dGPS) (Woodroffe and Barlow, 2015). Stratigraphy was recorded using a modified Troels-Smith (1955) classification. This information was used to inform subsequent sampling sites at Ferryside and St. Ishmael. In February 2019 a Russian corer with a 0.07 m chamber diameter and 1 m length was used to extract nine representative sediment cores per site at 20 m intervals (3600 m² area) for laboratory analyses (Frew, 2014).

4.2.3. Laboratory analyses

4.2.3.1. Geochemical Analysis

Geochemical analysis of the sampled cores was undertaken to identify storm surge proxy elements (Williams, 2009; Otvos, 2011). X-ray fluorescence (XRF) geochemical analyses were undertaken using the Itrax[®] core scanner (Croudace *et al.*, 2006) based at the British Ocean Sediment Core Research Facility on five cores. The five selected cores contained abrupt sandy deposits at similar elevations within the stratigraphy. Due to the Itrax[®] measuring procedures, the focus was on the relative abundance of 7 indicator elements. Ba, Ca and Sr were used as reliable indicators of marine flooding and evidence of storm and tsunami events (e.g. Schlichting, 2000; Szczuciński *et al.*, 2012; Goslin and Clemmensen, 2017). Si and K were indicators of the abundance of medium-coarse grained sand common in storm surge deposits (Williams *et al.*, 2011; Chague-Goff *et al.*, 2016). Zr was used to indicate a higher relative abundance of resistant or heavy minerals from an offshore marine environment (Dezileau *et al.*, 2011; Tsompanoglou *et al.*, 2011). Ti abundance (against Rb) was alternatively used to indicate a fluvial origin as high Ti can indicate terrigenous input (Font *et al.*, 2013).

The geochemical data were normalised against lithophile Rb to enable elemental comparison due to its low environmental mobility and lack of anthropogenic enrichment (Kylander *et al.*, 2011; Weltje *et al.*, 2015). Ti was also used as an immobile element due to its abundance and biological inactivity (Löwemark *et al.*, 2011; Weltje *et al.*, 2015). The relative abundance of each element (i.e. indicator/Rb or Ti) were presented as natural log (ln) ratios for comparative purposes (Weltje and Tjallainji, 2008). The normalised (ln) geochemical data can be found in Appendix 1.1.

4.2.3.2. Particle Size Analysis

Particle size analyses (PSA) were undertaken on the five cores to establish the variability of particle size. A laser diffraction PSA was undertaken using a Malvern® Mastersizer 3000 enabling a precision of 1 mm to be achieved at a resolution of 2 cm throughout the core. The particle size analysis was cross-checked with the higher resolution geochemical particle size indicator elements to ensure no major changes in grain size were missed. The analyses produced three D-Values (D10, D50 and D90) giving the cumulative sample mass values for 10%, 50% and 90% (Blott and Pye, 2001). The particle size of the samples was categorised using the Wentworth (1922) classification. The particle size data can be found in Appendix 1.2.

4.2.3.3. Principal Component Analysis

Dimension reducing Principal Component Analysis (PCA) was undertaken using PAST® software to identify the main factors distinguishing the potential storm surge deposits. For comparison, all data relative to Rb and Ti were natural log (ln) transformed (Croudace and Rothwell, 2015). The independent influence of geochemistry as well as the combined influence of geochemistry and particle size were analysed.

4.2.3.4. Radionuclide Dating

Pb-210 and ¹³⁷Cs radionuclide dating were undertaken to evaluate sediment accumulation rates of the storm surge deposits and the age of layers. Pb-210 potentially provides information up to the last ~100 years while ¹³⁷Cs profiles can provide temporal data from 1950-present based on anthropogenic inputs (Appleby, 2002; Croudace *et al.*, 2012; Baskaran *et al.*, 2014; Andersen *et al.*, 2017).

Samples weighing >10g taken from 1 cm intervals were freeze-dried, placed in vials and gamma counted at GAU-Radioanalytical Laboratories for 100,000 seconds. Total ²¹⁰Pb and ¹³⁷Cs were measured using well-type HPGe gamma spectrometry systems. Sampling was undertaken at 4 cm intervals in each core. Excess ²¹⁰Pb (²¹⁰Pb_{xs}) was then determined using

the constant rate of supply (CRS) model (Croudace *et al.*, 2012). Sample $^{210}\text{Pb}_{\text{xs}}$ was calculated by subtracting a supported value of 0.01 Bq g^{-1} from total activity. The natural log of $^{210}\text{Pb}_{\text{xs}}$ was plotted against depth to produce an age-depth model and estimate sediment accumulation rates (SAR) and ages.

Cs-137 was used to identify chronological markers of key radionuclide events (e.g 1963 bomb pulse, Sellafield releases) consistently identified in UK western saltmarshes.

Comparison of the ^{137}Cs chronology with major ^{137}Cs discharges from Sellafield (Gray *et al.*, 1995; Tsompanoglou *et al.*, 2011; Swindles *et al.*, 2018) enabled the creation of age-depth models and calculation of independent SARs producing an overall age profile. The radionuclide activity data can be found in Appendix 1.2.

4.2.4. Tidal Gauge Data

To assess storm surge height correspondence, historical data concerning observed and predicted tidal heights were obtained. The observed tidal gauge data were collected from the Milford Haven (July 1961 - December 2020) and Newlyn (April 1915 - June 1961) tidal gauge records from the British Oceanographic Data Centre (BODC) as they provided the longest spatially relevant observations (BODC, 2021). Datum conversions and tidal information are shown in Table 4.1. The combined age range gave appropriate temporal coverage for the likely age of the Three Rivers Estuarine Complex sediments.

The maximum surge height was calculated by subtracting observed tidal elevations from predicted tidal elevation determined from a gauge-specific POLTIPS (National Oceanographic Centre, 2021a) hindcast. The hindcast was undertaken for the exact time the observed measurement was taken which varied accordingly with measurement intervals over time. The variability in maximum storm surge height and recorded elevation was then assessed for storm events. The data were cross-checked with site-specific storm surge records of the greatest surges from the National Tidal and Sea Level Facility (NTLSF, 2021) and British Oceanographic Data Centre (BODC, 2021) to ensure the calculated storm surge magnitudes were appropriate and there was relevant dataset correspondence. Baseline

surge magnitude ≥ 0.76 m at Milford Haven and ≥ 0.29 m at Newlyn were determined. These heights were selected as they represented the top 1% storm surge maximum height thresholds for each site. The top 1% surges were focused upon as this study appraises high magnitude saltmarsh storm surge inundation. The observed tidal height was also considered when appraising deposit and archival records as this influences sedimentological storm surge signatures.

Site	Conversion - Admiralty datum (mAD) to Ordnance datum (mOD)	Mean Low Water Neap (mAD)	Mean High Water Spring (mAD)	Highest Astronomical Tide (mAD)
Newlyn	-3.05 m	2.08	4.37	6.16
Milford Haven	-3.71 m	2.49	5.31	6.92

Table 4.1. Tidal information (2020) and datum conversion table and at Milford Haven and Newlyn. Data sourced from National Oceanographic Centre, 2021(a-b).

4.2.5. Meteorological Data

The study investigated storm frequency and magnitude recorded at the Pembroke Meteorological Office weather station. This initially concerned the period from 1861 (start of records) to 2020 as the meteorological analysis was undertaken before radionuclide dates were received. This time scale was appropriate given that previous research in the Three Rivers Estuarine Complex indicated that the saltmarsh sediments were deposited during this period (Pye and Blott, 2009). Regional storms were identified from daily newspapers reports and Meteorological Office weather observations found in newspapers in the British Library's digitised archives (GALE, 2021).

Meteorological data from Pembroke for wind speed (Beaufort Force), wind direction (22.5° compass bearing) and barometric pressure (mm Hg) were compiled. For the full period of meteorological recording (initially from 1861 as the deposit dates were not known) many of the archived windspeeds were only reported in Beaufort Force. This standardised unit was therefore used throughout for the purpose of consistency so some readings were converted into Beaufort Force on Excel®. The greatest mean hourly speed within each storm was recorded to gauge the maximum mean storm strength. This ensured that the data were not skewed by anomalous gusts and lulls, and accurately reflected storm magnitude. Data from Prawle Point (Plymouth) 184.2 km south-south-east were provisionally collected if there was an absence of data from Pembroke. A database of every reported storm was created. This database was used to assess all storms recorded within periods corresponding with the sediment radionuclide dating range of the saltmarsh deposits. Particular attention was paid to wind direction and strength as higher wind velocities from the SSE-WNW were most likely to result in storm sedimentological evidence due to the orientation and bathymetry of the estuarine complex.

4.2.6. Dataset Correspondence

The correspondence analysis between the sedimentological, tidal gauge and meteorological results focused on storms in the radionuclide age uncertainty ranges. Meteorological events were identified with wind magnitude and direction noted. Identified storm surges (top 1%) within the date range were then extracted from tidal gauge records. Meteorological records

that did not correspond with any tidal gauge record were discarded as a high magnitude surge inundation would be required to produce major (>3 cm) sandy saltmarsh deposits (Tsompanoglou *et al.*, 2011; Leonardi *et al.*, 2018). The following factors were determined the most important as they had the greatest influence on the likelihood of storms to produce sedimentological deposits:

- Wind speed magnitude
- Wind direction
- Storm surge height
- Observed overall surge height

Observed overall surge height was deemed the most important factor as a surge must penetrate inland and inundate the saltmarsh to produce clear sedimentological evidence (Hawkes and Horton, 2012; Garzon *et al.*, 2019; Moskalewicz, In press). Other spatially relevant sedimentological research was also considered. The discussion considers which storms most likely produced the identified sedimentological evidence and the potential future implications of storms on the saltmarsh environment.

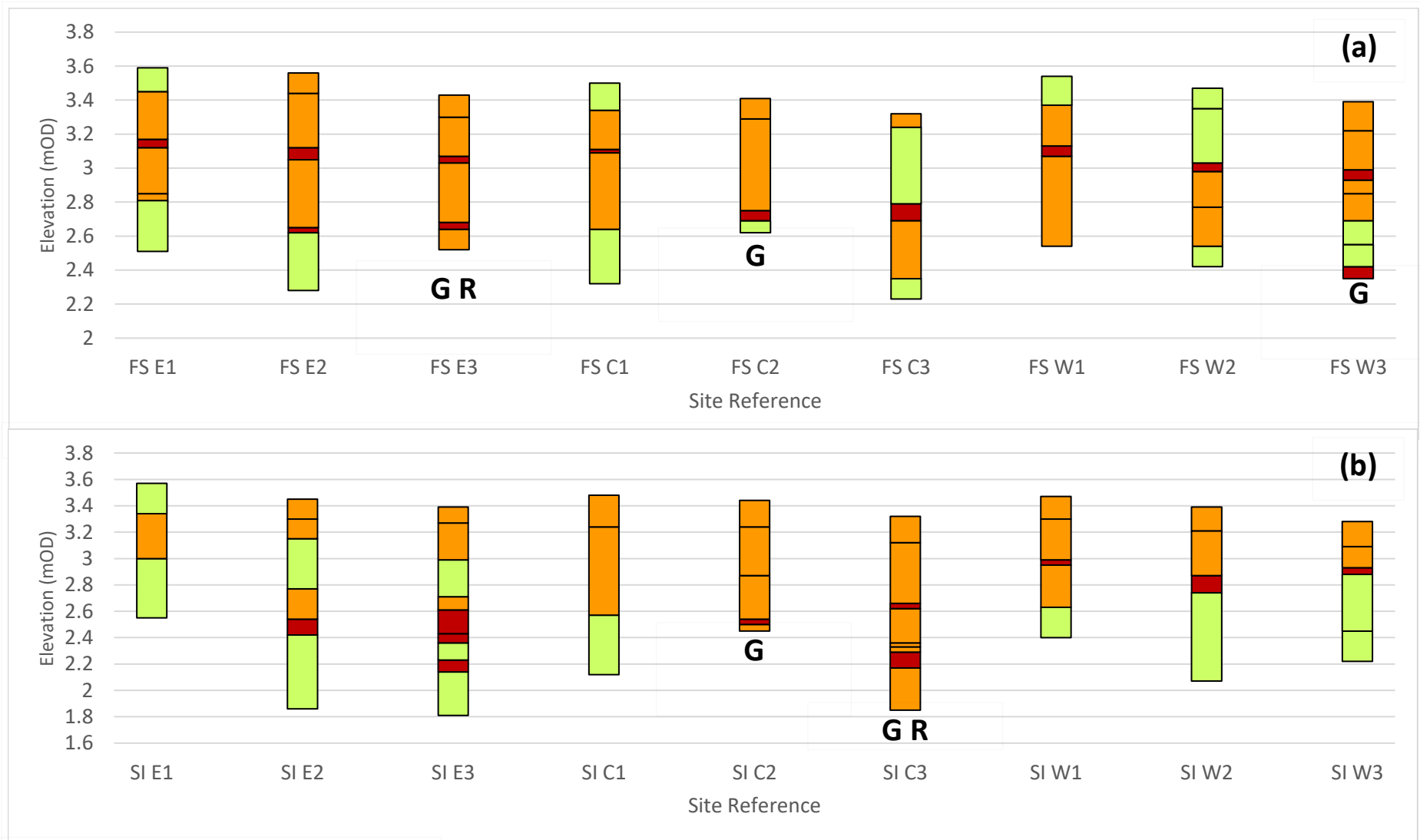
4.3. Results

4.3.1. Sedimentological

4.3.1.1. Stratigraphy

At Ferryside the basal unit was comprised of fine silts and clays (Troels-Smith, 1955). An abrupt sandy layer containing calcareous fragments was found in all nine cores with cores FSE2 and FSE3 containing two layers (Figure 4.2(a)). The Troels-Smith assessment indicated organic content increased in the surface horizons and a trend of gradual upward fining was observed. FSE3, FSC2 and FSW3 were selected for laboratory analyses as they possessed the clearest stratigraphic indication of potential storm surge evidence in the form of abrupt sandy deposits.

Seven St. Ishmael cores recorded organic clay-silt basal horizons whilst SIC2 and SIC3 had a coarser silt base. Large abrupt sand deposits >3 cm interspersed with silt layers were noted above the basal layer in seven cores (Figure 4.2(b)). No evidence of minor deposition or erosion was identified by the Troels-Smith classification. Cores SIC2 and SIC3 were selected for further laboratory analyses as they had the clearest stratigraphic indication of potential storm surge evidence.



Saltmarsh Core Stratigraphic Key	
Organic Silt-Clay	Light Green
Predominantly Organic Silt	Yellow
Fine-coarse grained Sand	Red

Figure 4.2. Stratigraphy for the (a) Ferryside and (b) St. Ishmael sites. G= Geochemical analyses undertaken. G R = Geochemical and radionuclide analyses undertaken.

4.3.1.2. Geochemical data

The geochemical analyses were undertaken on five cores. The relative abundance of the select geochemical indicator elements against Ti and Rb throughout the cores and within the fine-coarse grained sand deposits was the main focus. In the five cores, the fine-coarse grained sand deposits (red horizons in Figure 4.2) had a mean Ca count 94.2% and 77.6% higher against Ti and Rb compared to the respective overall relative elemental abundance throughout the cores. The mean Sr was 60.2% (Ti) and 46.9% (Rb) higher, whilst the increase in Ba was lesser increasing by 8.6% (Ti) and 1.9% (Rb). In the abrupt sand deposits, the mean K was 12.3% and 5.8% higher against Ti and Rb. The mean Si was 54.5% (Ti) and 42.3% (Rb) higher in the sandy deposits. For the fluvial (Ti) and offshore marine (Zr) indicators, Ti was 4.2% (Rb) lower whilst Zr was 5.2% (Rb) greater in sandy deposits. The analysis did not clearly indicate the presence of any other potential storm surge deposits or erosion.

Figure 4.3 gives a wider perspective of the geochemical variability exhibiting the abundance of the indicator elements against depth in the cores selected for radionuclide analyses. For comparison, geochemistry is normalised (natural log (ln)) against Rb.

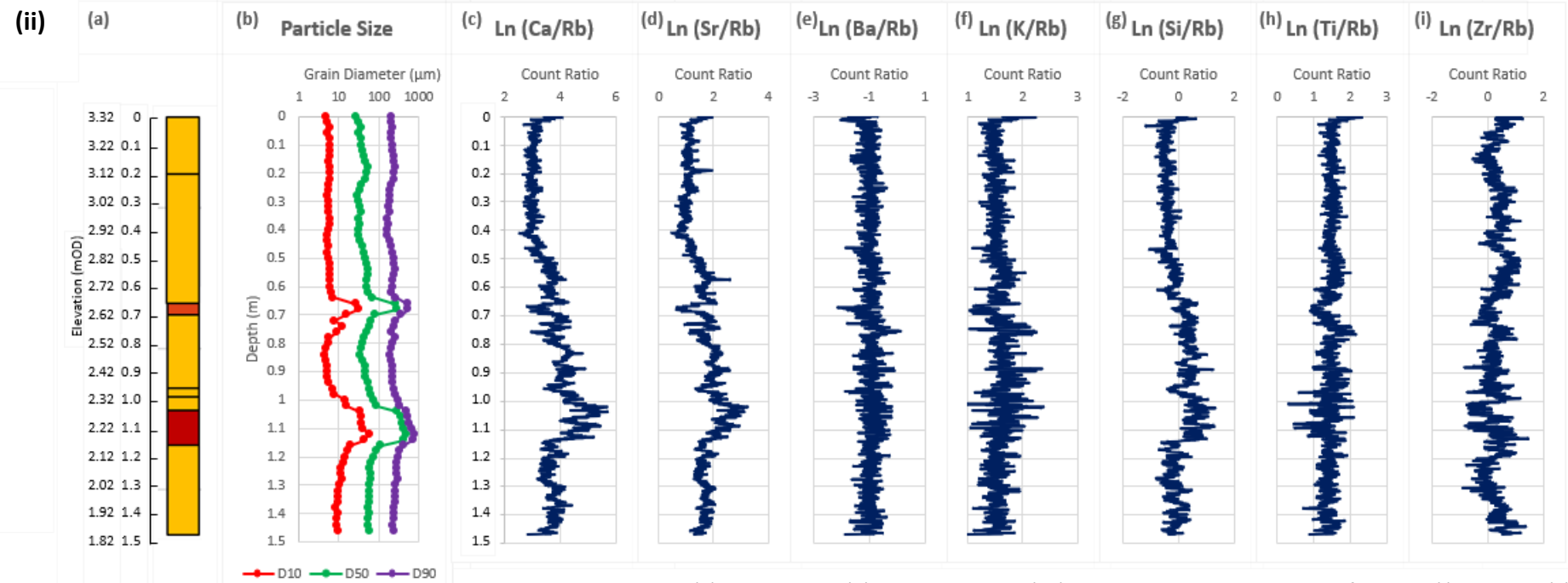
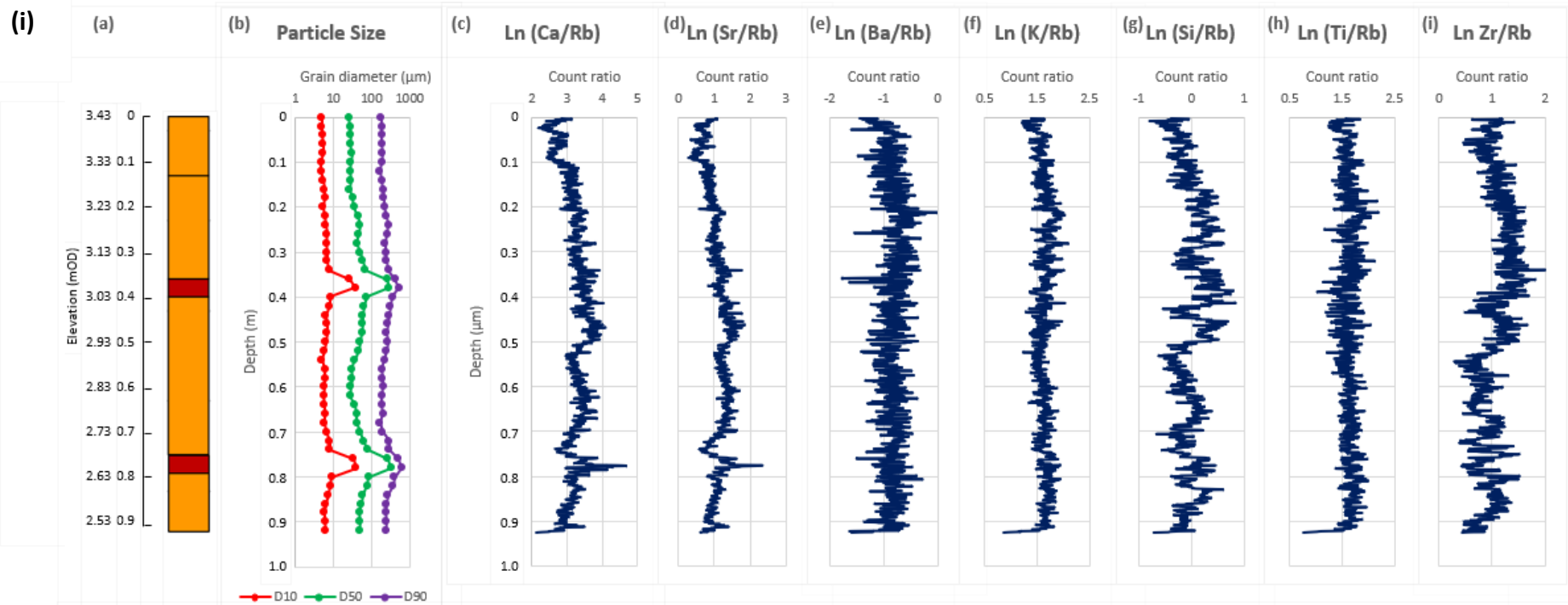


Figure 4.3. Variability in (a) stratigraphy, (b) particle size and (c-i) indicator element abundance for cores (i) FSE3 and (ii) SIC3.

The natural log of the elemental abundance relative to the conservative element Rb is shown for comparison.

4.3.1.3. Particle Size Analysis

The three Ferryside cores showed greater particle size variability in comparison with the two St. Ishmael cores. The particle size increases corresponded with the sandy horizons identified in the Troels-Smith (1955) observations ((Figure 4.3 (i-ii) (a and b)). Mean D50 values for abrupt sandy deposits are classified as medium sand and ranged from 263 μm (SIC2 2.50-2.54 mOD) to 331 μm (FSC2 2.67-2.75 mOD). D10 and D90 values highlighted the wide distribution of particle size within the sandy deposits as mean D10 values ranged from 28 μm to 41 μm (mean of averages = 34.6 μm). The mean D90 range from 469 μm to 632 μm (mean of averages = 544 μm) indicated the abundance of coarse sand (>500 μm). Figure 4.3((i-ii)(b)) illustrates the abrupt increases in particle size (D10, D50 and D90) in dated cores. There were no abrupt increases in particle size that could have been indicative of deposition in smaller storm surge events.

4.3.1.4. Principal Component Analysis

The geochemical principal component analyses highlighted that Sr, Ca and Si relative abundances were the most prominent elements distinguishing the abrupt, sandy deposits from the surrounding silt strata. Throughout the five cores particle size was consistently closer to the mean variance values for the sandy deposits than the values for all elements against Ti and Rb. An exception to the trend of particle size being the most prominent distinguishing overall factor for sandy deposits is found in FSW3 against Ti where Sr, Ca and Si have closer mean variance values.

4.3.1.5. Radionuclide Dating

Core FSE3:

The ^{210}Pb activity in FSE3 exhibited an upcore increase from the basal value of 0.022 Bq g^{-1} (± 0.0076) at 2.50 mOD. Activity gradually increased up core with the exception of the increase to 0.034 Bq g^{-1} at 2.58 mOD which had the largest uncertainty of 0.0091 Bq g^{-1} . Activity markedly increased at 3.34 mOD to 0.060 Bq g^{-1} (± 0.0033) reaching a maximum of 0.065 (± 0.0045) at 3.42 mOD (see Figure 4.4(i)(b)). As ^{137}Cs dating returned more accurate

chronological markers, ^{210}Pb was only used to calculate sediment accretion and age below 2.78 mOD. From 2.51-2.78 mOD the ^{210}Pb CRS model (age-depth linear trend $R^2 = 0.87$) returned a SAR of 1.04 cm/yr.

Key markers in the FSE3 ^{137}Cs chronology enabled dating markers to be identified. Study of the ^{137}Cs profile indicated that the variations correspond to the marine radioactivity discharge patterns from the Sellafield Reprocessing Plant with a maximal output between 1978-80 (Gray *et al.*, 1995). Uncertainty for ^{137}Cs measurement was constant at 0.0003 Bq g^{-1} and a 2 year transport lag uncertainty to the Bristol Channel from the Sellafield Plant (Tsompanoglou *et al.*, 2011; Swindles *et al.*, 2018) was accounted for. The first detectable ^{137}Cs activity was at 2.78 mOD corresponding with the onset of atmospheric thermonuclear testing (1952-54) (Figure 4.4(i)(c)). Rapid increases in activity to 0.0025 Bq g^{-1} at 2.86 mOD corresponded with the nuclear fallout maximum (1963). From 2.78-3.42 mOD similar ^{137}Cs SARs of 0.99, 1.02 and 0.96 cm/yr were produced for 0, +2a and -2a transport uncertainty respectively assuming the 3.03-3.07 mOD deposit was a discrete event. The combined ^{137}Cs and ^{210}Pb CRS models dated the sandy deposits at 2.64-2.68 mOD and 3.03-3.07 mOD as March 1949 ($69.8 \pm 10.2 - 10.7 \text{ a}$ from Feb 2019) and March 1984 ($34.8 \pm 3.2 - 3.3 \text{ a}$ from Feb 2019) respectively.

Core SIC3:

This contained no detectable ^{137}Cs (later discussed) and therefore only ^{210}Pb was used. Pb-210 increased gradually from a basal value of 0.031 Bq g^{-1} (± 0.0027) at 1.87 mOD before a rapid decrease to a minimum of 0.015 Bq g^{-1} (± 0.0029) at 1.99 mOD. The activity gradually increased upcore to 3.03 mOD (see Figure 4(ii)(b)). The ^{210}Pb CRS model (age linear trend $R^2 = 0.78$) for SIC3 returned a SAR of 1.43 cm/yr for the core. The base of SIC3 was the oldest sediment recorded dated January 1929 ($90.1 \pm 7.7 \text{ a}$) The sandy deposits at 2.17-2.29 mOD and 2.62-2.66 mOD were dated as March 1950 ($68.8 \pm 9.3 \text{ a}$) and April 1973 ($45.7 \pm 4.8 \text{ a}$).

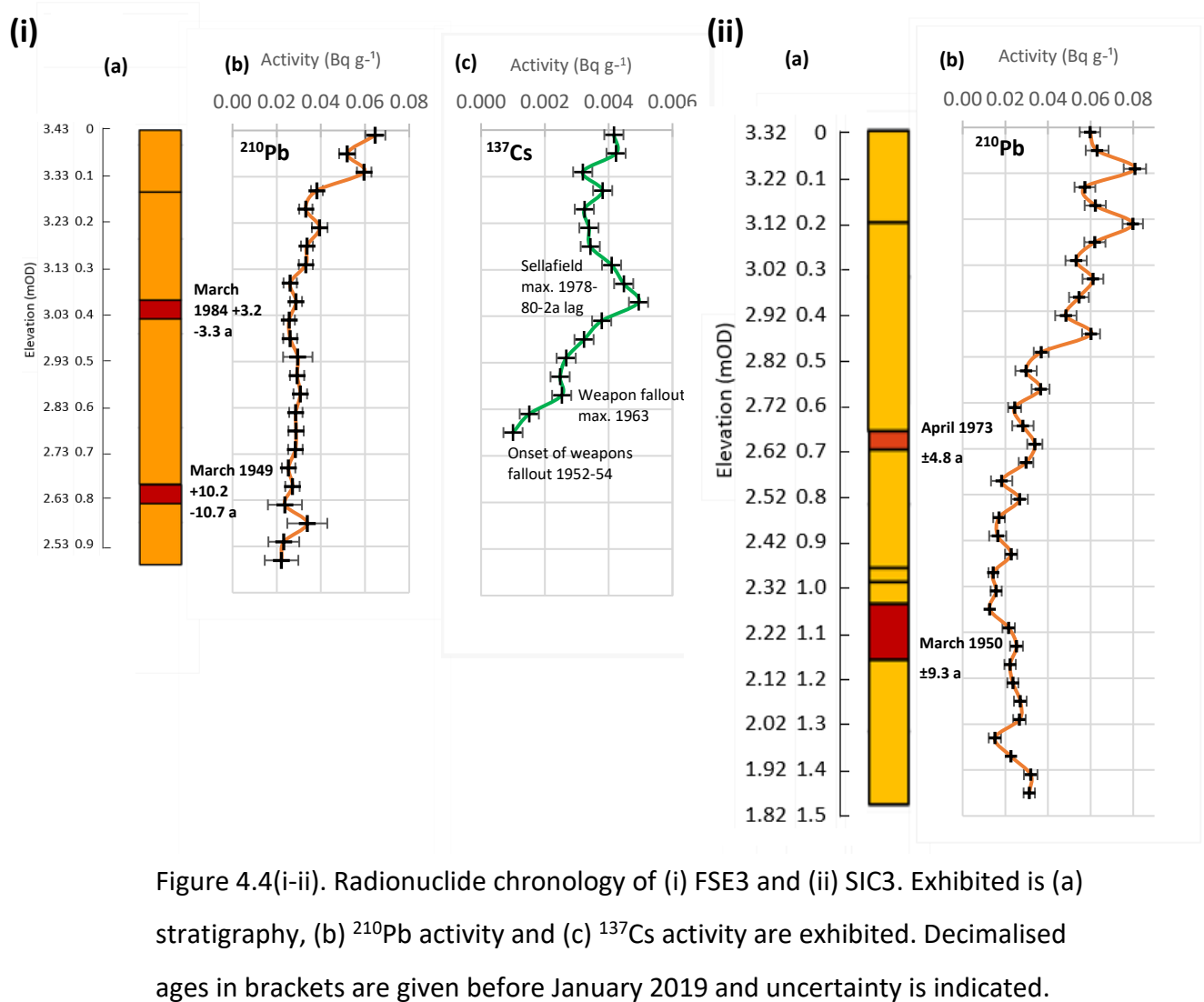


Figure 4.4(i-ii). Radionuclide chronology of (i) FSE3 and (ii) SIC3. Exhibited is (a) stratigraphy, (b) ^{210}Pb activity and (c) ^{137}Cs activity are exhibited. Decimalised ages in brackets are given before January 2019 and uncertainty is indicated.

4.3.2. Tidal Gauge Data

The tidal gauge analyses examined the greatest (top 1%) storm surges recorded at Newlyn (January 1915-June 1961) and Milford Haven (July 1961-December 2020). At Newlyn the greatest recorded elevation of 5.72 m AD was recorded on 17/10/1959 with a storm surge of 0.42 m. The greatest surge of 0.95 m occurred on 12/11/1915 (4.64 m AD). The greatest surge within the age range for both deposits FS E3 2.64-2.68 mOD and SI C3 2.17-2.29 mOD was 0.79 m on 29/11/1954 (5.44 m AD) (see Figure 4.5).

At Milford Haven the greatest recorded elevation of 7.72 m AD was recorded on 22/10/1961 corresponding with a 0.89 m surge. The greatest storm surges of 1.49 m and 1.26 m were recorded on 12/02/2014 (4.16 m AD) and 11/01/1962 (2.39 m AD). Figure 4.5 exhibits the tidal gauge data for storm surge height for classified high magnitude storms within each deposit date range. The greatest surge within the age range for the FS E3 3.03-3.07 mOD deposit was 0.92 m on 13/12/1981 (3.61 m AD). The greatest surge within the age range for the SI C3 2.62-2.66 mOD deposit was 1.18 m on 12/01/1974 (2.46 m AD).

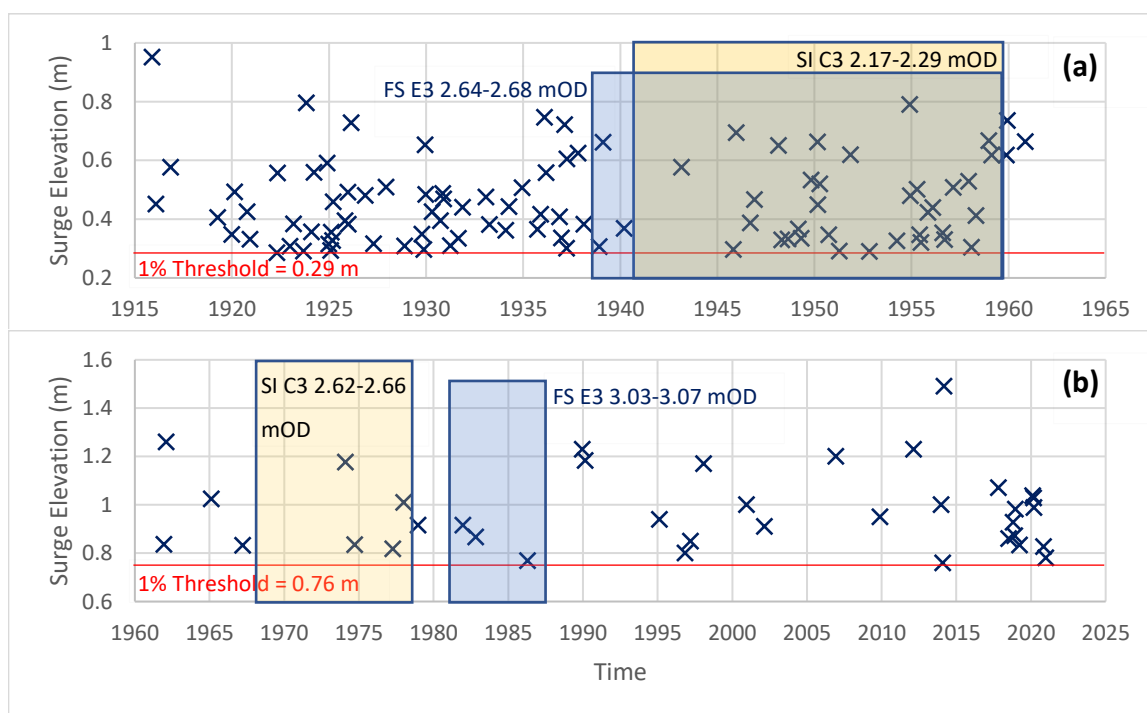


Figure 4.5. Top 1% storm surges recorded at Newlyn (a) and Milford Haven (b). Yellow and blue zones respectively represent the radionuclide age ranges for the deposits in SI C3 and FS E3.

4.3.3. Meteorological Data

A meteorological assessment of all reported storms at Pembroke returned 1094 storms between 1861-2020. The greatest magnitude storm recorded as Beaufort Force 11 occurred during the storm of 11-17/11/1929. The annual storm frequency ranged between 18-0, with 1931 and 1938 being the stormiest years. Figure 4.6 exhibits the meteorological data for wind magnitude for storms which correspond with the top 1% of storm surges. The strongest within the date range of the deposits FS E3 2.64-2.68 mOD and SI C3 2.17-2.29 mOD was Force 10 which occurred during the storm of 11-14/02/1950. For the deposit FS E3 3.03-3.07 mOD two Force 10 storms occurred during the storm of 13-15/12/1981 and 16-18/10/1982. For the deposit SI C3 2.62-2.66 mOD the strongest storms registered Force 9 during the storms of 5-16/11/1974 and 24-28/12/1977.

Figure 4.7 shows the refined meteorological data for storms within the deposit radionuclide date ranges which were most likely to have produced sedimentological evidence in the Three Rivers Estuarine Complex (see section 2.6). South-west and Force 7 is the most common direction and magnitude combination. The strongest storms registering Force 10 were recorded from the WNW, WSW and SSW.

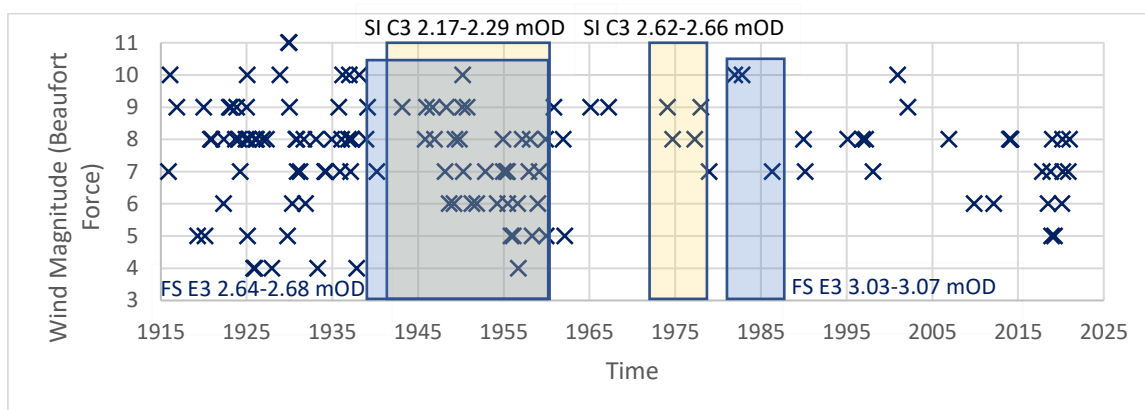


Figure 4.6. Observed windspeed at Pembroke during top 1% storm surges at Newlyn and Milford Haven. Yellow and blue zones respectively represent the radionuclide age ranges for the deposits in SI C3 and FS E3.

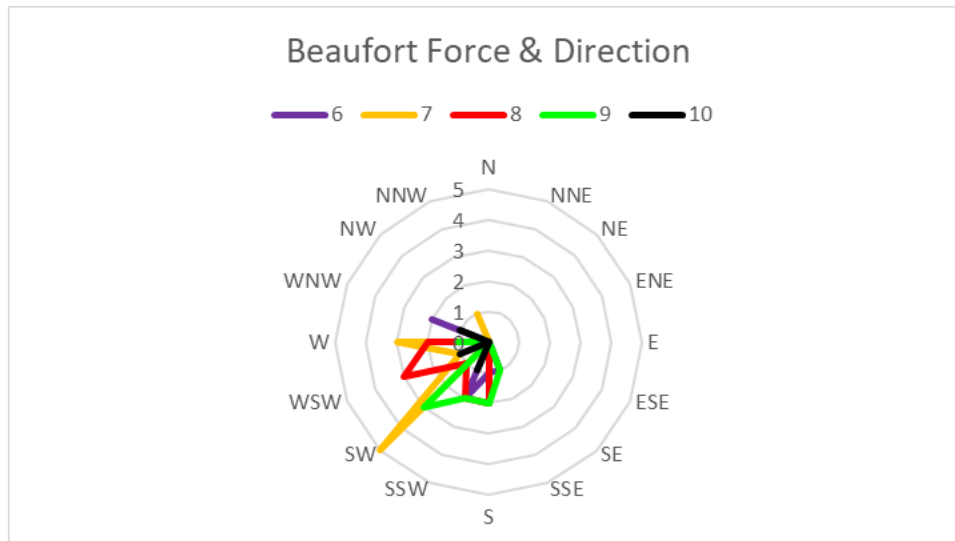


Figure 4.7. Frequency of storms of a specific wind strength and direction within the radionuclide date range for all four deposits that conform to the criteria in 4.2.6.

4.3.4. Storm Correspondence

The storm events within the age uncertainty range for the four abrupt, sandy deposits in the cores SIC3 and FSE3 were identified using meteorological, tidal surge characteristics. The events considered were classified in the top 1% of storm surges (observed-predicted tidal height) at either the Newlyn or Milford tidal gauges and sorted via overall observed height (see 3.5 for rationale).

4.3.4.1. Core FSE3

For the 2.64-2.68 mOD deposit ^{210}Pb dating produced an age uncertainty of 21.0 yrs (1.d.p - 1938.5-1959.5) including 34 storms (Figure 4.8(a)). The storms on 7-13/08/1948, 23-24/03/1955 and 4-5/11/1951 had the greatest overall observed surge heights of 5.2, 5.11 and 4.69 (m AD) at Newlyn. The greatest storm surges were recorded during the storms on 26-29/11/1954 (0.79 m), 18-19/12/1945 (0.69 m) as well as 2-5/02/1950 and 14-23/01/1939 (both 0.66 m). The greatest wind speed magnitude of force 10 was recorded

during the 11-14/02/1950 storm. Force 9 was registered during six storms. The greatest storm surge events coincided with force 8 (0.79 m) and force 9 events (0.66-0.69 m).

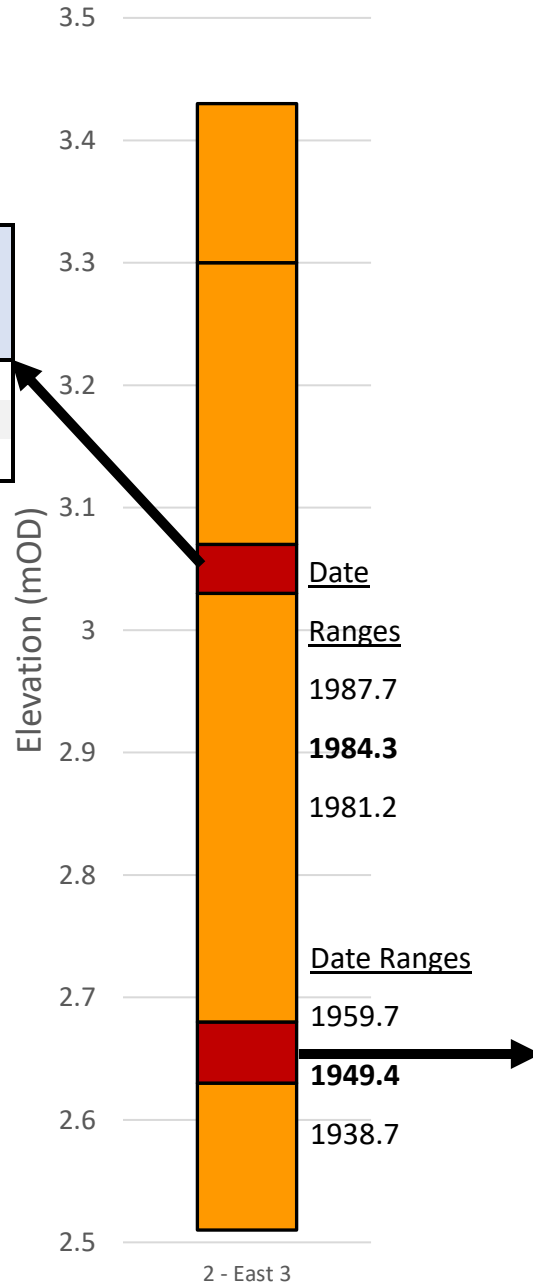
For the 3.03-3.07 mOD deposit ^{137}Cs dating produced an uncertainty of 6.5a (1981.0-1987.5) including 3 events. The 24-30/03/1986 storm had the greatest overall observed surge height of 6.86 m AD coinciding with a surge of 0.77 m at Milford and a force 7 from the South-West. The 13-15/12/1981 storm resulted in a 4.83 m AD observed elevation and the largest surge of 0.91 m during a force 10 from the West-north-west.

4.3.4.2. Core SIC3

The ^{210}Pb deposit between 2.17-2.29 mOD produced an age uncertainty of 18.6 a (1941.0-1959.6) within which time 32 storms occurred (Figure 4.8(b)). The storms of: 7-10/08/1948, 23-24/03/1955 and 4-5/11/1951 had the greatest overall observed surge heights of 5.2, 5.11 and 4.69 (m AD) at Newlyn. The greatest storm surge was recorded during the 26-29/11/1954 storm (0.79 m). The greatest storm wind speed magnitude was recorded during the storm of 11-14/02/1950 when a force 10 was registered at Pembroke once and a force 9 was registered six times. A wind direction between west and south was observed on 30/34 occasions.

The 2.62-2.66 mOD deposit ^{210}Pb dating produced an uncertainty of 9.6 yrs (1968.5-1978.1) within which period 4 storms occurred. The storm on 13-15/03/1977 had the greatest overall observed surge height of 6.43 m AD which coincided with a 0.82 m surge at Milford. The greatest storm surge of 1.18 m occurred on 5-16/01/1974. The storms (24-28/12/1977 and 5-16/01/1974) in which the greatest storm surges were recorded, occurred during a force 9 storm. The wind direction varied from the south to west-south-west.

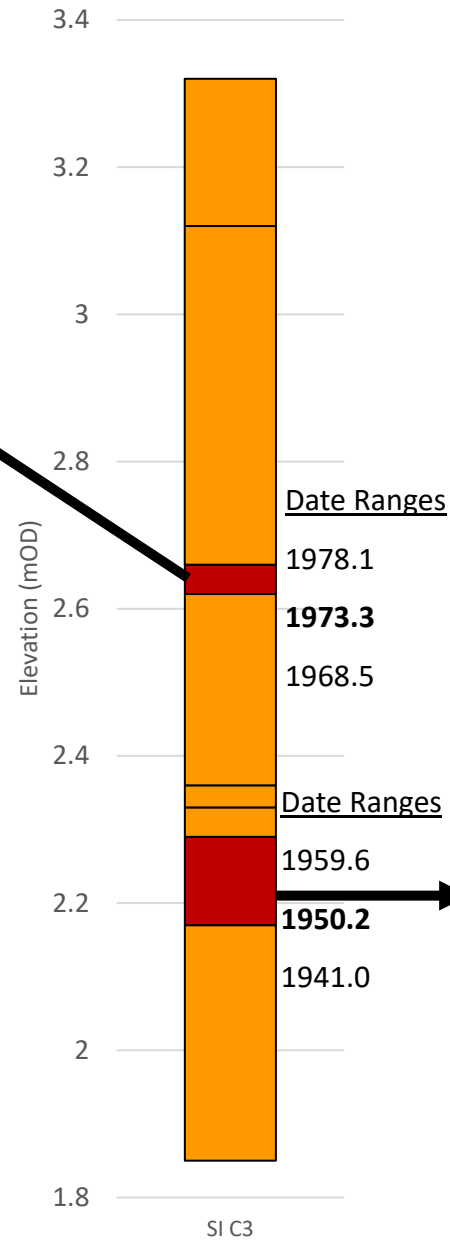
Date	Wind Speed Magnitude (Beaufort Force)	Direction wind	Storm Surge Height (m)	Observed Overall Height (m AOD)
24-30/03/1986	7	SW	0.769	6.859
16-18/10/1982	10	SSW	0.867	5.097
13-15/12/1981	10	WNW	0.915	4.83



Date	Wind Speed Magnitude (Beaufort Force)	Wind Direction	Storm Surge Height (m)	Observed Overall Height (m AOD)
7-13/08/1948	7	NNW	0.3321	5.2
23-24/03/1955	7	SW	0.501	5.11
4-5/11/1951	6	SSE	0.619	4.69
26-29/11/1954	8	WSW	0.79	4.65
18-22/11/1959	7	SW	0.618	4.6
4-8/12/1954	7	W	0.48	4.43
18-20/03/1950	7	WSW	0.52	4.25
23-27/10/1945	8	SW	0.296	4.19
22-28/10/1952	7	W	0.29	3.99
14-23/01/1939	9	SW	0.662	3.83
30-4/03-04/1948	9	W	0.329	3.81
18-19/12/1945	9	SW	0.6939	3.6
9-10/10/1956	5	SSW	0.439	3.59
24-25/11/1946	8	S	0.4669	3.44
30-31/01/1943	9	SW	0.576	3.41
5-11/08/1958	8	W	0.304	3.39
11-14/02/1950	10	WSW	0.449	3.26
15-19/09/1950	9	S	0.3469	3.17
2-5/02/1950	9	SSW	0.663	3.11
6-8/08/1955	6	SSW	0.32	2.92
8-9/02/1949	6	WNW	0.366	2.77
31-5/01-02/1957	8	SSW	0.508	2.75
4-6/04/1949	8	WSW	0.335	2.74
19-23/12/1958	6	SSW	0.667	2.6
25-2/01/1948	7	SW	0.651	2.54
25-29/11/1938	8	W	0.3059	2.44
1-2/11/1955	5	W	0.423	2.25
3-4/04/1958	5	SW	0.412	2.23
28-4/08-09/1946	9	SSE	0.387	2.1
3-9/03/1954	6	S	0.326	1.46
4-5/09/1956	4	SSW	0.33	1.46
29-30/07/1956	6	WNW	0.353	1.43
8-11/12/1957	7	SW	0.529	1.29
22-27/02/1940	7	W	0.368	0.97
25-26/10/1949	8	SSW	0.533	0.96

Figure 4.8(a). Correspondence between sedimentological, tidal gauge and meteorological data for core FSE3. Deposit radionuclide age ranges are displayed against the deposit.

Date	Wind Speed (Beaufort Force)	Wind Direction	Storm Surge Height (m)	Observed Overall Height (m AD)
13-15/03/1977	8	S	0.817	6.427
7-8/09/1974	8	WSW	0.835	3.535
24-28/12/1977	9	SSW	1.01	2.8
5-16/01/1974	9	S	1.177	2.457



Date	Wind Speed Magnitude (Beaufort Force)	Direction wind	Storm Surge Height (m)	Observed Overall Height (m AOD)
7-10/08/1948	7	NNW	0.332	5.2
23-24/03/1955	7	SW	0.501	5.11
4-5/11/1951	6	SSE	0.619	4.69
26-29/11/1954	8	WSW	0.79	4.65
18-22/01/1959	7	SW	0.618	4.6
4-8/12/1954	7	W	0.48	4.43
18-20/3/1950	7	WSW	0.52	4.25
23-27/10/1945	8	SW	0.296	4.19
22-28/10/1952	7	W	0.29	3.99
30-4/04/1948	9	W	0.329	3.81
18-19/12/1945	9	SW	0.6939	3.6
9-10/01/1956	5	SSW	0.439	3.59
24-25/11/1946	8	S	0.4669	3.44
30-31/01/1943	9	SW	0.576	3.41
5-11/01/1958	8	W	0.304	3.39
11-14/02/1950	10	WSW	0.449	3.26
15-19/09/1950	9	S	0.3469	3.17
2-5/02/1950	9	SSW	0.663	3.11
6-8/06/1955	6	SSW	0.32	2.92
8-9/02/1949	6	WNW	0.366	2.77
31-5/02/1957	8	SSW	0.508	2.75
4-6/04/1949	8	WSW	0.335	2.74
17-18/05/1955	7	SSE	0.346	2.72
19-23/12/1958	6	SSW	0.667	2.6
25-2/01-02/1948	7	SW	0.651	2.54
1-2/11/1955	5	W	0.423	2.25
3-4/04/1958	5	SW	0.412	2.23
28-4/08-09/1946	9	SSE	0.387	2.1
3-9/03/1954	6	S	0.326	1.46
4-5/09/1956	4	SSW	0.33	1.46
29-30/07/1956	6	WNW	0.353	1.43
8-11/12/1957	7	SW	0.529	1.29
25-26/10/1949	8	SSW	0.533	0.96

Figure 4.8(b). Correspondence between sedimentological, tidal gauge and meteorological data for the deposit between 2.17 – 2.29 mOD and 2.62 – 2.66 mOD in core SIC3. Deposit radionuclide age ranges are displayed against the deposit.

4.4. Interpretation and Discussion

The meteorological, tidal gauge and sedimentological results exhibit archival correspondence between the data. Although a high number of storms correspond with each storm surge deposit, the detailed dated archival records, combined with a prior understanding of storm surge saltmarsh interaction (Leonardi *et al.*, 2018; Garzon *et al.*, 2019), enables the identification of the most plausible corresponding storms. The implications of these results for saltmarsh sustainability in the Three Rivers Estuarine Complex are subsequently discussed.

4.4.1. Sedimentological Evidence and Archival Correspondence

4.4.1.1. Sedimentological Evidence and Deposit Origin

The stratigraphic analyses of the sampled cores exhibited abrupt sandy deposits measuring between 0.03-0.12 m. The PSAs (4.1.3) indicated that all sandy deposits were classified as medium-sand with D50 values ranging from 263 μm (SIC2 2.50-2.54 mOD) to 331 μm (FSC2 2.67-2.75 mOD). The D10 (mean of averages (moa) = 34.6 μm) and D90 (moa = 544 μm) range exhibited poor sorting. Poorly sorted sandy deposits several centimetres deep were initially indicative of plausible offshore marine surge deposition (Williams, 2010; Chaumillon *et al.*, 2017; Leonardi *et al.*, 2018).

The geochemical evidence (3.1.2) indicated a high relative abundance of Ca and Sr which suggests an offshore origin for the sandy deposits, most likely sourced from the sand dominated seabed of Carmarthen Bay (Cooper and Maclaren, 2007; Liu *et al.*, 2014). Mean Zr relative abundance was 5.2% (Rb) greater in the sandy deposits, whilst Ti was 4.2% lower (Rb) in deposits than the core average. This refutes aeolian and fluvial hypotheses (Tsompanoglou *et al.*, 2011; Goslin and Clemmensen, 2017). The mean increases in K and Si support the PSA suggesting deposition during a high energy surge (see Section 3.1.3) (Williams *et al.*, 2011; Chague-Goff *et al.*, 2016). PCAs indicate that particle size was the most prominent distinguishing factor for abrupt sandy deposits whilst Sr, Ca and Si were the most prominent distinguishing elements followed by Ba, Br, Ti and K against Ti (excluding indicator Ti) and Rb (Section 3.1.4).

The geology of the Tywi catchment contains a channel that flows through an alluvial valley between Ordovician Shale beds (British Geological Survey, 2021). Although Carmarthen Bay has formed upon a glacial sand and gravel deposit, the Tywi is largely deflected there and follows a highly sinuous course on approach (Ahmed and Hodge, 2017) reducing the transportation of glacial sediment downstream during fluvial floods. Red marl and sandstone as well as micaceous sandstone respectively comprise the bedrock of the elevated areas surrounding the Tywi and Gwendraeth estuaries. However, a combination of surrounding glacial boulder clay and coastal defence means neither substantially erodes the sandstone bedrock (British Geological Survey, 2021). Considering both the sedimentological evidence of this study and catchment geology, it is unlikely the deposits originate from a fluvial flood event. Alternatively, Carmarthen Bay is underlain by Carboniferous and Devonian limestones and sandstones beneath the sand-dominated seafloor (Cooper and Maclaren, 2007; Countryside Council for Wales, 2009). Given the geological predominance of sand on the seafloor, particularly from the south-south-east to west of the mouth of the estuarine complex, it is therefore most likely the deposits result from a high energy inundation event of offshore marine origin.

Although theories of tsunami deposits on the Bristol Channel coastline concerning the Great Flood of 1607 have been suggested (Bryant and Haslett, 2002), recent research suggests storm surges and meteotsunamis are the most likely sources (e.g. Horsburgh and Horritt., 2006; Westlake, 2019). When research concerning the hydrological and geomorphological storm impacts on the Three Rivers Estuarine Complex (Pye and Blott, 2009; Bennett *et al.*, 2019) is considered with the sedimentological evidence, it is most plausible the abrupt sandy deposits were produced during high magnitude storm surge events.

4.4.1.2. Sedimentological and Archival Correspondence

The number of storms corresponding with the dated deposits varies depending on the age-dependent radionuclide used (section 4.4). Despite an initially high number of corresponding events (max 34), when storm surge dynamics and other regional research is considered the number of plausible corresponding events is reduced to 1-3 depending on the deposit.

The stratigraphical evidence (3.1.1) indicates little geomorphological change with the exception of the abrupt sandy surge deposits. This corroborates with previous research that suggests limited geomorphological change in the estuarine complex before 1938 (oldest deposit uncertainty) as the saltmarshes accreted uniformly relative to SLR (Bristow and Pile, 2003; Pye and Blott, 2009). A prolonged period of surge inundation would theoretically allow the transportation and deposition of sand to the middle marsh at high tide (Hawkes and Horton, 2012; Garzon *et al.*, 2019). Coarse offshore marine sediment could not reach such elevations at lower tides (regardless of storm surge elevation) due to the high interception rate of the dominant *Spartina anglica* (Rupprecht *et al.*, 2017), and shortened inundation and depositional period (Williams and Flanagan, 2009; Leonardi *et al.*, 2018). Therefore, the evidence suggests only surges coinciding with large overall tidal elevations could be depositional events.

According to the radionuclide dates, FSE3 deposits between 2.64-2.68 mOD and 3.03-3.07 mOD exhibit temporal correspondence with 34 and three events respectively. While the event of 7-13/08/1948 corresponds with the largest observed tidal height of 5.20 m AD at Newlyn, this occurred with a comparatively small surge height of 0.33 m and a recorded wind direction NNW at Pembroke. As Ferryside is near the head of the Tywi estuary (Figure 4.1(ii)) and the predominant storm wave and wind direction in Carmarthen Bay for storms with a ≥ 1 year return period of 225° (SW) (Bennett *et al.*, 2019), this is unlikely to be the deposit source. Although the 4-5/11/1951 storm with the third highest observed surge height may have produced the deposit, location and bathymetry means SSE winds registering Force 6 are unlikely to have produced the deposit when storm wave propagation is considered. The large decrease in the observed elevation after the 4-5/11/1954 storm of 0.22 m rules out other events leaving the 23-24/03/1955 and 26-29/11/1954 storms.

The two events have wind directions that would likely permit storm wave propagation and offshore sediment transportation up the River Tywi. Whilst the event of 23-24/03/1955 corresponds with the second highest overall elevation at Newlyn of 5.11 m AD, it only ranks as the eighth greatest storm surge in the 21.0 year uncertainty period at 0.50 m. The event of the 26-29/11/1954 had an elevation of 4.65 m AD and a surge of 0.79 m which was the greatest in the period (mean = 0.47 m). The meteorological information indicates it corresponded with a Force 8 whereas the 23-24/03/1955 event occurred during a Force 7.

Given the rarity of deposits and the very high levels of wave energy needed to transport and deposit 0.04 m of coarse material on the Ferryside saltmarshes (Pye and Blott, 2009; Horton *et al.*, 2009; Swindles *et al.*, 2018), the evidence suggests the FSE3 2.64-2.68 mOD deposit most plausibly originates from the 26-29/11/1954 storm.

The ^{137}Cs dated deposit between 3.03-3.07 mOD in FSE3 had three corresponding storms. The meteorological characteristics of the two storms on 13-15/12/1981, 16-18/10/1982 were similar with a maximum wind strength magnitude of Force 10 from the WNW. The storm of 24-30/03/1986 corresponds with a lower storm strength of Force 7 from the SW. All would produce storm wave conditions in the Tywi estuary (Bennett *et al.*, 2019).

The surge of 13-15/12/1981 was the largest at 0.92 m being just below the mean of the top 1% surges (0.99 m). The overall height of the 24-30/03/1986 storm of 6.86 m made it the sixth largest at Milford Haven (1961-2020) during a top 1% storm surge (mean= 4.35 m) while the 16-18/10/1982 storm elevation was 5.10 m. Although the observed overall elevation of the 13-15/12/1981 was the smallest, there is clear additional evidence that this event had a profound geomorphological impact in the Bristol Channel. The study by Croudace *et al.* (2012) was the first and only to identify the broad tidal and sub-tidal erosional impact of the December 1981 storm surge in the Severn Estuary. The study provided convincing geochemical, sedimentological and radiochronological evidence to show a substantial hiatus in the sedimentary record from cores collected east of Cardiff and the Newport Deep. Sub-tidal erosion linked to the 1981 storm was also identified in cores from Bridgwater Bay (currently unpublished work; pers. comm. Croudace). The temporal correspondence, Force 10 windspeed magnitude and the fact the event also produced major geochemical and sedimentological discontinuities in the region, renders the 13-15/12/1981 storm the most plausible source of the 3.03-3.07 mOD deposit (see Table 4.2).

The two deposits in core SIC3 exhibit a similar trend of correspondence with the deposits between 2.17-2.29 mOD and 2.62-2.66 mOD corresponding with 32 and four storms respectively. For the 2.17-2.29 mOD deposit the ^{210}Pb dating uncertainty range of 18.6 years (1941.0-1959.6) means the top four observed storm surges are the same as those which correspond with the 2.64-2.68 mOD deposit in FSE3. The fifth greatest surge occurred during the 18-22/01/1959 storm, with an overall observed elevation of 4.6 m AD in a Force 7 from the SW which would hypothetically produce a storm surge wave in the mouth of River

Gwendraeth (see Figure 4.1). However, the surge elevation was only 0.62 m. Therefore, it is most plausible that this deposit was from the 26-29/11/1954 storm (Table 4.2).

The 2.62-2.66 mOD deposit had a ^{210}Pb age uncertainty between 1968.5-1978.1. The four events all have suitable meteorological characteristics to produce storm surge waves at the mouth of the River Gwendraeth. Although the event of the 13-15/03/1977 has the smallest storm surge elevation (0.82 m) the observed overall elevations of the three other events were ≤ 0.81 m, the mean of all recorded events (4.35 m AD). In contrast, the 13-15/03/1977 storm was the tenth greatest observed elevation at Milford Haven. Therefore, when the evidence is considered with the conditions of saltmarsh storm surge deposition (Horton *et al.*, 2009; Garzon *et al.*, 2019), it is most plausible the storm of 13-15/03/1977 produced the 2.62-2.66 mOD deposit (Table 4.2).

Table 4.2. Most plausible corresponding storm events for the four deposits in cores FSE3 and SIC3.

Core and Depth	Date	Wind Speed (Beaufort Force)	Wind Direction (Compass Bearing)	Storm Surge Height (m)	Observed Overall Height (m AD)
FSE3 3.03 – 3.07 mOD	13-15/12/1981	10	WNW	0.92	4.83
SIC3 2.62 – 2.66 mOD	13-15/03/1977	8	S	0.82	6.43
FSE3 2.64 – 2.68 mOD & SIC3 2.17 – 2.29 mOD	26-29/11/1954	8	WSW	0.79	4.65

4.4.2. Implications for Saltmarsh Sustainability

This research exhibits the potential of saltmarshes to preserve storm surge depositional evidence, however, the data shows this preservation is rare with just 3 events likely being preserved. While the data shows major storm surge deposition can contribute to sustaining saltmarsh elevation relative to sea level, storms have likely had a range of impacts on the saltmarshes of the Three Rivers Estuarine Complex. Plausible alternative impacts aside from major (>3 cm deposits) deposition include erosion, micro-deposition and the discrete deposition of very coarse sediment (granules and pebbles), while erosional events can also erode previous deposits (Horton *et al.*, 2009; Tsompanoglou *et al.*, 2011; Croudace *et al.*, 2012; Leonardi *et al.*, 2016). It is also highly plausible storms may have negligible sedimentological impacts if the meteorological, bathymetry and environmental conditions hinder surge wave propagation or are conducive to effective wave dissipation, preventing

substantial erosion or deposition (Spencer *et al.*, 2016; Rupprecht *et al.*, 2017). The combined sedimentological and archival findings highlight there still remains uncertainty surrounding the regional impacts (or non-impacts) on the Three Rivers Estuarine Complex saltmarshes with the rare occurrence of major deposition. This raises important questions regarding the future sedimentological and geomorphological impacts of coastal storms on the saltmarsh environments.

According to the climatic and surge models (Lowe *et al.*, 2018; Palmer *et al.*, 2018), as well meteorological and tidal gauge research (Slingo *et al.*, 2014; Wadey *et al.*, 2014), the frequency of high magnitude storms and storm surges is increasing and projected to further increase from the UKCP 1981-2000 baseline. The anticipated SLR of 0.7 m by 2100 according to the most probable (current emissions) IPCC RCP 8.5 (SSP5 8.5) scenario and storm surge skew increase of 0.07 mm/yr (Palmer *et al.*, 2018; Schwalm *et al.*, 2020) is likely to increase the magnitude and frequency of storm surges in Carmarthen Bay. Given this high likelihood of increasing storminess, the variable findings on sedimentological storm impacts and the current sedimentological evidence, it is plausible that the Three Rivers Estuarine Complex saltmarshes will increasingly experience highly variable sedimentological change. This could have diverse geomorphological and ecological effects on the Three Rivers Estuarine Complex and determine to what extent the saltmarshes can sustain themselves relative to rising sea levels.

Whilst accretion has matched and, in some cases, exceeded SLR due to anthropogenic interference in areas of the Three Rivers Estuarine Complex (Bennett *et al.*, 2020), whether this continues depends upon a range of climatological, hydrological and geomorphological factors. According to current research regional saltmarshes are predicted to recede and degrade as a result of SLR and climatic change in the Bristol Channel. Specifically, relative SLR in south-west Wales has a >80% probability of causing saltmarsh retreat and degradation under the RCP 8.5 (SSP5 8.5) scenario by 2060 (Horton *et al.*, 2018; Schwalm *et al.*, 2020). This is an issue at Ferryside and St. Ishmael at the Three Rivers Estuarine Complex as engineered coastal defences constrain the saltmarshes and the 50-100 year policy is to hold the line (Phillips *et al.*, 2012). Therefore, although storm surge deposition currently contributes to sustaining saltmarsh elevation, if relative SLR exceeds accretion, a combination of increased hydroperiod and storm erosional activity may lead to saltmarsh

degradation in anthropogenically constrained areas such as the Three Rivers Estuarine Complex (Bullimore, 2014). In these areas, saltmarshes cannot establish equilibrium as recession is prevented potentially catalysing environmental degradation through coastal squeeze and creek propagation (Hughes *et al.*, 2009; Doody, 2013; Crosby *et al.*, 2016).

Despite the regional modelled predictions (Horton *et al.*, 2018) it is also plausible that increased surge frequency could augment saltmarsh accretion through storm deposition (Williams and Flanagan, 2009; Leonardi *et al.*, 2018). Storm deposition of sediment ranging between 0.04 – 0.12 m thick could offer a great contribution to sustaining saltmarshes even if this occurred as irregularly as exhibited in this study. Given that since 4 kyr BP the best estimate for relative sea level rise in the Bristol channel is 0.76 mm/yr or 7.6 cm per 100 a (Shennan and Horton, 2002; Shennan *et al.*, 2018) it is theoretically plausible that storm surge deposits could offer a major contribution to sustain regional saltmarshes, regardless of increased SLR (Pannoza *et al.*, 2021). While possible, as this multidisciplinary study has demonstrated, very specific tidal, meteorological and geomorphological conditions are required for notable storm surge accretion to occur (de Groot *et al.*, 2011), so such events cannot be relied upon to sustain the saltmarshes. The balance between erosional and depositional events is also a key factor, determined by sediment supply as well as meteorological and geomorphological dynamics which requires further regional research. The predicted saltmarsh vegetation recession resulting from relative SLR could further reduce deposition and preservation of deposits as reduced vegetation dampening makes storm accretion less plausible (Woodroffe and Long, 2009; Chaumillon *et al.*, 2017; Horton *et al.*, 2018). This relationship is highly complex however, as storm surge deposition results in abrupt sediment geochemical and particle size change which would influence biological productivity (Capooci *et al.*, 2019). Therefore, changing storm surge deposition could itself contribute to biological changes that effect saltmarsh erodibility and sustainability. The predicted progressive changes in climate and weather trends until 2100 add another complex dimension as this could further influence saltmarsh biological productivity and influence the erosion-deposition balance (Zedler, 2009; Prahalad *et al.*, 2012). This diverse combination of influencing factors render future saltmarsh sustainability uncertain.

Alternatively, it has been shown that saltmarshes in North-west Europe such as those in the Three Rivers Estuarine Complex have historically widely sustained themselves relative to sea

level rise and the regional threat could be seen as overestimated (e.g. French, 2006; Kirwan *et al.*, 2016). Instead it is more often that direct human interference influencing sediment supply, tidal range and limiting transgression that causes degradation (Kirwan and Megongial, 2013; Vinent *et al.*, 2019). As Carmarthen Bay is a protected region it could therefore be argued that based on past evidence there is no reason why it should degrade, as a combination of progressive sedimentation and sporadic storm surge has previously maintained saltmarsh elevation. However, the substantial predicted increases in atmospheric storminess, sea level rise and associated saltmarsh degradation (Horton *et al.*, 2018; Lowe *et al.*, 2018) are unlike any seen from January 1929 – February 2019. Therefore, given the future climate and environmental response uncertainties combined with the uncertainty surrounding storm sedimentological saltmarsh impacts, major changes in the saltmarsh sustainability up to 2100 cannot be ruled out.

Although past evidence indicates that a combination of organic sediment accumulation and sporadic storm surge deposition has enabled the saltmarshes to sustain themselves relative to sea level rise, future regional predictions give cause for concern as high magnitude storms become more frequent. Predicted increases in storminess, sea level rise and saltmarsh degradation, could pose new threats to the regional saltmarshes. Given the uncertainties surrounding sedimentological storm saltmarsh impacts and the increasing frequency of high magnitude storms similar to Storm Eustice in 2022, it is important that storms are further investigated in the Three Rivers Estuarine Complex. This is essential to monitor the sustainability of a valuable blue carbon store that provides important saltmarsh ecosystem services to the natural and human populations (Craft *et al.*, 2009; Pendleton *et al.*, 2012; Gilby *et al.*, 2021).

4.5. Summary

This study uses meteorological, tidal gauge and sedimentological evidence to appraise the impact of coastal storms in the saltmarshes of the Three Rivers Estuarine Complex, Carmarthen Bay. The sedimentological research identifies that major storm surge deposition likely occurred between 1929-2019. The combined evidence indicates that the storms of the 26-29/11/1954 (two deposits), 13-15/03/1977 and 13-15/12/1981 are the most plausible

storms recorded in the sediments. No clear sedimentological evidence of storm erosion or alternative types of deposition was identified. The tidal and meteorological records exhibit the comparatively rare occurrence of major depositional events compared to the number of storms in the tidal and meteorological records. Therefore, considerable uncertainty still surrounds the sedimentological impacts of storms in the estuarine complex. The diverse range of plausible saltmarsh sedimentological impacts merit further investigation given the increasing regional storm prevalence. It could be argued the historical evidence highlights that organic accumulation and sporadic storm surge deposition could enable the saltmarshes to maintain elevation relative to rising sea levels. However, the predicted increases in regional relative sea level and high magnitude storm frequency coupled with the >80% probability of regional saltmarsh retreat (Horton *et al.*, 2018; Lowe *et al.*, 2018; Palmer *et al.*, 2018) give cause for concern in the 21st century. This is heightened by the limited ability of the saltmarshes to transgress and maintain equilibrium due to manmade coastal defences and the current 50-100 year coastal defence policy in the estuarine complex. When the sedimentological uncertainties and future threats are considered, this study suggests more research is required to explore the uncertain sedimentological impacts of storms in the region. This could contribute to sustaining the vulnerable coastal saltmarsh environments and the important ecosystem services they provide.

Chapter 5: Archival Analyses: Storm Newspaper Reporting, 1800-2020

5.1. Introduction

This chapter focuses on the written archival research undertaken concerning newspaper reports and extracts of storms in Western Britain published from January 1800 to December 2020. The chapter exhibits the varied storm-related reports from the period giving an insight into the changing impacts, characteristics and representation of storms. The reported information is also compared and analysed with relevant research to assess the accuracy, correspondence and contributions of the newspaper reports to improving historical and contemporary storm understandings. This analysis provides important background to the thesis, which utilises reliable newspaper material to improve the understanding of storm response (Chapter Six), scientific and religious storm representations (Chapter Seven) and factors contributing to contemporary storm catastrophe (Chapter Eight). The chapter also reveals other important storm-related material which could not be analysed in individual chapters due to thesis constraints. The focus of this information ranges from storm impacts on the British Navy during the Napoleonic Wars to the influence of mid-late twentieth century technology on lifesaving and could provide the basis for further historical storm research.

During the project, the archival aspect of the research underwent significant adaptation. The original approach of using mainly storm-related poetry and literature changed to an approach focused on the analysis of newspaper extracts and reports. This adaptation occurred due to the wider newspaper resource availability, applicability and likelihood of correspondence with quantitative and sedimentological storm records. Newspaper reports were chosen as they provide reliable, detailed and dated sources of qualitative and quantitative storm information (MacDonald *et al.*, 2010; Garnier *et al.*, 2018). Due to COVID-19 restrictions and the wider resource availability, the online GALE and ProQuest online repositories were primarily used to source storm-related information. The archives of

fourteen newspapers were analysed, which included the *Bristol Mercury*, *Liverpool Mercury*, *Western Times* and *The Observer & The Guardian*. This allowed the analyses of historical storm chronologies as well as key impact, response and representation trends. The chapter exhibits the changing focus and nature of storm reporting from 1800 to 2020. In this period, the main foci change from religious weather representations and dramatic storm reports to more succinct and societally inclusive reports defined by an increasing predominance of scientific interpretations linking severe storms to climate change. Overall, the chapter provides an original insight into the evolution of storms and storm reporting in Western Britain over the 220 year period and thereby addresses objective three by improving the understanding of the documented coastal storm impacts and highlighting reported cultural, societal and environmental storm effects. This research also addresses objective one as it uses written historical records to analyse past coastal storm trends. The full dataset can be found in Appendix 2.

5.2. Early-Mid Nineteenth Century: Religion, Conflict and Humanity

5.2.1 Religion and Fate

The storm reports of the early nineteenth century are mostly succinct, comprising fewer than 200 words and often concern the naval or maritime impacts of a storm. The reports of the first storm in the dataset, which lasted from January 1 to January 4 1800, reflect this. Specifically, the *Trewman's Exeter Flying Post* of January 2 (p.3) succinctly describes a distressed vessel 'having carried away her rudder in Torbay in a gale of wind' while the *Caledonian Mercury* of January 9 (p.3) paints a broader picture of the weather in Scotland which had 'set in with uncommon rigour' (p. 3). The 'continued gale' and snow from the SE completely interrupted carriage transport in an era before rail and as such the London post was delayed by several days. Such succinct shipping news reports were, however, often interspersed with longer descriptive passages detailing storm impacts in Western Britain. In the 'Plymouth' section of *Trewman's Exeter Flying Post*, a detailed and elaborate description of the weather conditions on the thunderstorm storm of 19 August 1800 was provided

before the effects were detailed. The correspondent noted the preconditions before the storm with a sudden increase in cloud cover and a drop in temperature. The storm itself was dramatically described as the correspondent remarked 'it blew a gale at N, accompanied by loud rolling claps of thunder, tremendously terrible, with vivid, quick flashes of dread lightning; hail and rain fell in heavy water spouts' (*Trewman's Exeter Flying Post*, 28 August 1800, p.3). The storm lasted several hours and the impacts were stated to be that several pleasure boats on the Tamar were 'almost enveloped'; however, the 'much frightened occupants, providentially escaped unhurt'. The storm likewise kept inhabitants of Plymouth up all night in a state of fear but again the correspondent stressed 'providentially' there was little damage to the shipping and on shore (*Trewman's Exeter Flying Post*, 28 August 1800, p.3). The use of providence in newspaper reports throughout the period is comprehensively analysed in Chapter Seven, which highlights the prominence of God in reporting in the early nineteenth century.

Whether providence was used as a form of emphasis, or it was genuinely believed God determined the occurrence and effects of a storm, often depends on the context of the report, publication stance and author (e.g. Anderson, 2005; Golinski, 2010; Jankovic, 2010). However, when the early nineteenth century reports are reviewed and considered in the context of the Christianity dominant period (Golinski, 2010), a genuine belief in divine agency is apparent. For example, the poem 'The Storm' published in the *Morning Post* in 1802 (p.2) leaves little doubt regarding religious interpretation. The poet represents God as having total power with the lines 'at his command, the torrent's rage descends'. However even in the context of the period and the other reports, 'The Storm' is particularly rare, as it goes beyond divine fate and in a more early modern style implies God's punishment with the lines 'When rous'd, and madd'ning with his might, the flood / Pours on the Naiad's haunt his ire' (*Morning Post*, 29 September 1802, p.2). The early 1800s reports instead commonly use providence to imply fate and most often protection. For instance, a *Lancaster Gazette* report describes the survival of a Liverpool man trapped under a roof that collapsed during the storm of January 20-21, 1802 as 'the most wonderful mark of preservation' as 'if by the special care of providence' (*Lancaster Gazette*, 30 January 1802, p.2). Similarly, when an infirm man floated to the safety of shore off Plymouth in the storm of 24-27 December

1803, the *Morning Post* (3 January 1804, p.2) remarked the 'special intervention of Providence' worked against fate as God was portrayed to have saved the man from 'the inevitable fate'.

5.2.2. Napoleonic Storms

While God's role is mentioned 22 times from 1800-32, the majority of reports avoid religious or scientific interpretation and instead focus on documenting human and asset losses on land but particularly at sea. Given the naval importance of Plymouth during the Napoleonic era and the fact that the then smaller port of Liverpool did not have its own major newspaper until 1811, it is unsurprising the predominant focus of storm reports between 1800-10 was on the effects of storms on shipping in South-west Britain. The reports often involved shipwreck and the loss of life. Examples include the *Morning Post* report of the storm of 12 to 14 April 1801 when a 'whole gale' from the East-north-east caused 'great many of the West India fleet in Torbay' to drive from their anchors and collide doing 'considerable damage' (*Morning Post*, 16 April 1801, p.3). The 'Ship News' column in the *Morning Post* of 12 January 1804 (p.3) likewise noted a 'dreadful gale of wind at SW' in Plymouth during the storm of 8 to 9 January. A sloop was supposed wrecked on the rocks under of the Plymouth Citadel as wreckage was seen scattered along the shore and it was believed 'every soul perished'. A large 84-gun line of battle ship was forced back by the 'tremendous gale' while other vessels returned to Plymouth damaged after chasing French frigates as Britain was at war with Napoleonic France (1803-1815).

The reports from before the Battle of Trafalgar (21 October 1805) also provide insights into the impacts of storms on the British Navy in the Age of Sail. This is shown by an article published a year before the battle in the *Morning Chronicle* on 17 October 1804 (p.3) which exclaimed 'Notwithstanding the indefatigable Admiral Cornwallis seems determined to return to his station off Brest yet the elements fight against him' as many of the vessels of the British Navy struggled to reach Torbay in the 'whole gale' from the SSW.

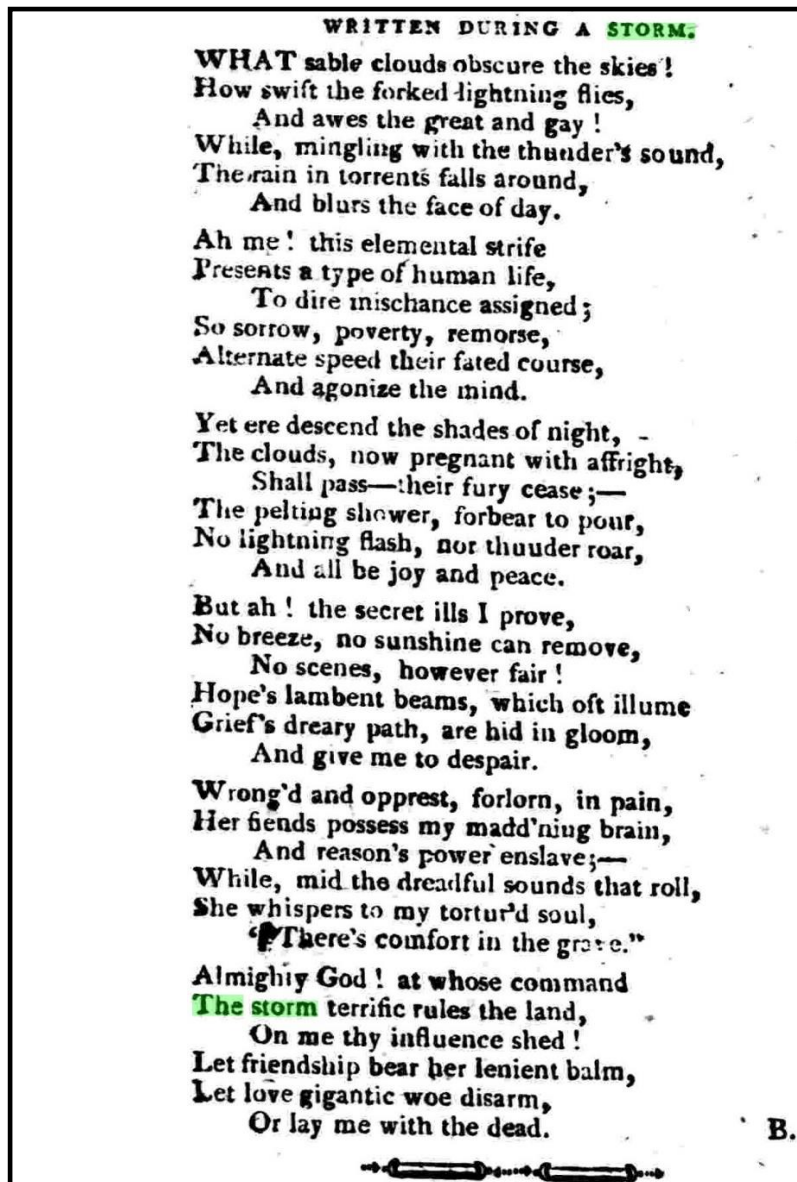


Figure 5.1. The stanza 'Written During a Storm' in the Lancaster Gazette of 20 July 1805.

The newspapers of the period also appear to draw parallels between meteorological storms and the ensuing wars which is most apparent in the stanza 'Written During a Storm' published in the *Lancaster Gazette* on 20 July 1805 (p.4) (see Figure 5.1).

The poet exclaimed the grandeur of nature with the lines "What sable clouds obscure the skies! / How swift the forked lightning flies, / And awes the great and gay!" A parallel between the fury of the storm and wider human life in the Napoleonic War period is made with the lines 'Ah me! this elemental strife / Presents a type of human life'. The poet continues to portray the storm as ominous in nature before stating such conditions 'Shall

pass - their fury cease; - /The pelting shower, forbear to pour, / No lightning flash, nor thunder roar, / And all be joy and peace' in what appears to be metaphor for peace at the end of the then waging war. The poem concludes by connecting divine will and fate to the storm (and perhaps war) as the poet exclaims: 'Almighty God! At whose command/ The storm terrific rules the land, / On me thy influence shed! / Let friendship bear her lenient balm, / Let love gigantic woe disarm, / Or lay me with the dead'. While this poem could be attempting to draw a parallel between the storms and the more general human suffering in the period, the poem 'Hold to the Laws, and Stand Fast by the Throne' published in the *Lancaster Gazette* on 22 February 1812 (p.4), near the height of Napoleon's power, appears to more directly use meteorological storms and shipwreck as a metaphor for Britain's imperial position and strength during the conflict. The poem firstly appears to make a direct reference to Napoleon with the line 'And the Tyrant still triumphs surrounded by slaves;' before using a storm to express Britain's imperial position: 'While the wrecks of proud empires lie scatte'd around, / And the tempest, still raging, drives dark o'er the plain, / Unshaken the bulwarks of Britain are found, / And undaunted her sons on the land and the main'.

The use of shipwreck and sailors' valiance in a storm as a metaphor no doubt resonated with readers throughout Britain. Indeed, while reports for the early nineteenth century continued to be naval and South-west focused, extracts from papers such as the *Lancaster Gazette* (Lancaster), *Morning Post* (London) and the *Caledonian Mercury* (Glasgow) suggest the wide and frequent regional storm impacts on land and particularly at sea. A *Lancaster Gazette* article published on 15 March 1806 (p.3), for instance, meticulously detailed all the storm impacts on shipping in the Irish Sea and North-west during the storm of 9-10 March. The report detailed and named a total of twelve vessels that had been severely damaged throughout Liverpool Bay and provided subsequent information on their recovery or wrecking. Often only broad summaries of shipwreck were provided. The report on the storm noted a 'a brig was seen to go down on Sunday morning on West Hoyle, with all the crew' but nothing more was yet known (*Lancaster Gazette*, 15 October 1806, p.3). Likewise, 'several puncheons of rum' found in the Mersey believed to be from the vessel 'Gypsey, from St. Vincent' were presumed as evidence the vessel had foundered with all men and a

Liverpool pilot (*Lancaster Gazette*, 15 October 1806, p.3). The captains and destinations were frequently named with several vessels bound for Western Africa and the Caribbean illustrating the growing global reach of the Port of Liverpool. Although who or what was aboard was not always mentioned, it is also likely the reports illustrate the final days of the legal slave trade in which Liverpool played an infamous role in up until the UK outlawed the trade of slaves (but not slavery itself) on 25 March 1807 (Williams, 2000; McDabe, 2011). The mention of storm-afflicted vessels sailing to and from Africa and the Caribbean after this date could indicate the diversified trade in palm oil or the continuation of the illegal slave trade which was widespread until the 1830s due to high financial incentives and poor law enforcement (Lynn, 2002; Sherwood, 2008).

Although the 1800-10 Western Britain storm reports in London-based papers such as the *Morning Post* and *Morning Chronicle* were largely focused on the impacts of storms in the South-west and Plymouth, presumably due to the military and national significance, these papers also provided information on major storm impacts elsewhere. The *Morning Post* of 11 September 1807 (p.3) featured a letter from Holyhead dated February 7 'describing the tremendous gale which blew on the preceding day'. The nine vessels which had suffered major damage or been wrecked were named and their damage was described where possible. Interestingly the report mirrored many other shipping reports of the period as even the most serious incident involving the loss of an unknown number of soldiers and cattle was reported with no more emphasis than other more minor instances of damage. This is perhaps reflective of the common occurrence of shipwrecking and loss of life around the British in the early nineteenth century (Larn *et al.*, 1981). While accurate records of all shipwrecks from this period are rare, the most comprehensive and reliable records from the Royal Navy indicate regular and high losses. In all 146 Navy vessels and an estimated 4968 men were lost through shipwreck between 1800-10, with the majority occurring in British waters (Stratton, 1853). Despite the rudimentary reports of the frequent loss of vessels and mention of fatalities, the newspaper reported number of fatalities in (only) Western Britain was largely low with an annual fatality rate of 18.2 between 1800-10. Whether the low reported fatalities was due to the lack of accessible information about the thousands of vessels sailing in British waters is hard to determine. However, the reports of the sinking of

HMS Anson in the storm of 27-29 December 1807 highlighted a notable exception and the event was to become a notable moment in British Naval history.

The significance of the sinking of the *HMS Anson* prompted several papers including the *Morning Post*, *Morning Chronicle* and *Trewman's Exeter Flying Post* to publish a series of reports. The first was published on 2 January 1808 (p.3) in the *Morning Chronicle* which detailed reports from Helston exclaiming of the 'loss of the Anson frigate, on the Bar Sand, two miles and a half south-west of this town'. The vessel had been driven off the French coast by a strong south-westerly and 'endeavoured to weather the Lizard, but could not; and after being embayed, and lost every anchor, came in before the gale'. The captain and first lieutenant were reported drowned along with the majority of the crew. A crew member was reported to say the vessel was 'in shivers' implying total destruction. The *Morning Post* (2 January 1808, p.4) also featured news from Falmouth which focused on the loss of all but one officer and an unknown number of men due to uncertainties regarding death and desertion in the era of press-ganging.

Later reports from the *Morning Post*, however, confirmed the tragedy and an article published on 5 January 1808 gave a full account of the events of her wrecking using then rare eye-witness evidence. The report noted Captain Lydiard had mistaken Land's End for the Lizard, prompting the crew's call of 'breakers!' as the vessel approached the sand bank where it was then wrecked (*Morning Post*, 5 January 1808, p.4). It was proclaimed 'never did the sea run more tremendously high' as the masts were felled and the captain 'seemed to have lost the use of his faculties' as he was rapidly engulfed. Stories of heroism did emerge, however, as a Methodist preacher led 'some brave hearts' in a rescue attempt which saved two women below although two children perished. Later regional reports from Falmouth stated the British fleet in the English Channel had been 'completely dispersed by the gale' with several Naval vessels damaged and it was estimated 'around 100 drowned' on *HMS Anson* down from original estimates of 150 (*Trewman's Exeter Flying Post*, 7 January 1808, p.4). The *Trewman's Exeter Flying Post* reported the court martial held in the Plymouth Hamoaze by the Hon Rear-Admiral Bertie on 6 January (*Trewman's Exeter Flying*

Post, 14 January 1808, p.4). The remaining sailors and officers were ‘unanimously acquitted’ except the master (navigation Warrant Officer) who the court believed had not fulfilled his duties.

Despite the ensuing protest and campaign, it is notable no newspaper mentioned the unceremonious burial of most of the deceased crew in pits dug on unconsecrated ground, while, in stark contrast, the officers were buried with full military honours in Falmouth (Spalding, 2015). This treatment of *HMS Anson’s* crew caused great controversy and ultimately led to the Burial of the Drowned Person Act of 1808, considered one of the first laws designed to improve the treatment of ordinary naval seamen (Spalding, 2015). While it is difficult to determine the exact reasons for the lack of reporting on a key societal issue, the likely bias of the early nineteenth century newspapers toward the middle classes and gentry combined with a great need for continued public support and sailors to man the Navy’s vessels in the ongoing Napoleonic War could be reasonable explanations (Rogers, 2007).

5.2.3. Liberal Press Storm Reporting: Humanity and Piracy

The emergence of the *Liverpool Mercury* in 1811 resulted in greater frequency of detailed storm reporting (see Figure 5.2). This was likely due to the growing global shipping trade in the Port of Liverpool producing a need for educated merchants to be regularly and reliably informed of vessels entering and leaving the port. However, the *Liverpool Mercury* was different from the previous newspapers as it represented the voice of middle class reform in a prominent port city and its reports exhibited the increasing importance of public opinion in politics (Smith, 2004; The British Newspaper Archive, 2018). This liberal stance and predominant focus on a region where shipping was of utmost important provided highly detailed insights on the impacts of storms as well as their consequences for sailors and coastal communities. Some of the *Liverpool Mercury* reports on storms in Western Britain from 1810s also add a new dimension to reporting with the inclusion of scientific meteorological information. This is evidenced by the ‘Meteorological Diary’ published on 25 October 1811 (p.3) which featured a tabulated observed wind speed and direction,

barometric pressure, rainfall and daily weather remarks. Instructions on interpretation were also provided while it was remarked the period of 12 to 13 October 1811 was 'the most severe storm of wind since the commencement of the year' (*Liverpool Mercury*, 25 October 1811, p.3).

The early *Liverpool Mercury* reports also contained a high number of storm-related poems. Examples include a poem by 'A' following a tour of North Wales published on 1 November 1811 (p.7) which alludes to the frequent storms and floods in the region. The poet exclaims 'O Cambria! Adieu to thy storm-beaten rocks, / To why deep retir'd vales, and thy floods'. 'Conway's blue wave' is referred to in a reference to the storm waves of the Irish Sea while Caernarvon is named 'Queen of the flood' in reference to the frequent fluvial flooding in the area. Despite the maritime setting, the early *Liverpool Mercury* report of the 1810s featured comprehensive storm reports from both on land and at sea.

The summer months regularly featured reports on thunderstorms which were often vividly described. A *Liverpool Mercury* report published 16 July 1816 (p.7) reported 'a very violent storm of rain and hail, accompanied by almost incessant thunder and lightning'. The storm continued with 'great violence' for half an hour before heavy rain. A report of the storm of 17-18 July 1816 went further (Figure 5.2), describing the thunderstorm and torrential rain as 'uncommonly grand and to many persons, no doubt terrific in the extreme' (*Liverpool Mercury*, 26 July 1816, p.6). The report described the sublime power and image of storm noting the 'lalac huc' [sic] and the powerful protracted thunder as 'rain descended in the most copious torrents'. This report went further to give a detailed insight on the storm effects on the people of Liverpool, as the correspondent noted 'had the morning of the 18th commenced in this formidable way the greatest fright and confusion would probably have ensued'. This was due to the fact 'the popular mind was prepared to expect on that day no less a catastrophe than the annihilation of our globe' based on a prophecy of a foreign philosopher. Such was the combined impact of the storm and superstition that some had taken themselves to the Liverpool Floating Bath as they preferred 'the chance of being

gradually stewed or boiled afloat, to the certainty of being instantaneously roasted ashore' (*Liverpool Mercury*, 26 July 1816, p.6).

While this report appears extreme when viewed from a twenty-first century scientific perspective, wider research indicates the report almost certainly refers to the so-called Bologna prophecy made in late spring during the infamous 'Year Without a Summer' (Vail, 1997; Munger, 2013). While pseudo-scientific, the prophecy the world would end on 18 July 1816 did gain traction as areas of Europe and particularly Italy began to experience increasing darkness in the summer months as ash and sulphur dioxide ejected from the 1815 eruption of the Mount Tambora volcano increasingly reduce solar insolation to the extent Genoa was in near total darkness by that date (Klingaman and Klingaman, 2013). The ensuing Year without a Summer brought global crop failure, famine and extreme climate anomalies (Veale and Endfield, 2017; Behringger, 2019). Higgins (2017) notes this marked change in climate and weather had substantial impacts on literature of the period with the 1816 to 1818 works of the prominent Lord Byron and Mary Shelley being heavily influenced by the prolonged darkness and ensuing catastrophes. When this wider climatic and cultural context during the then-unexplained Year Without a Summer is considered, the reaction and reporting can be considered less exaggerated.

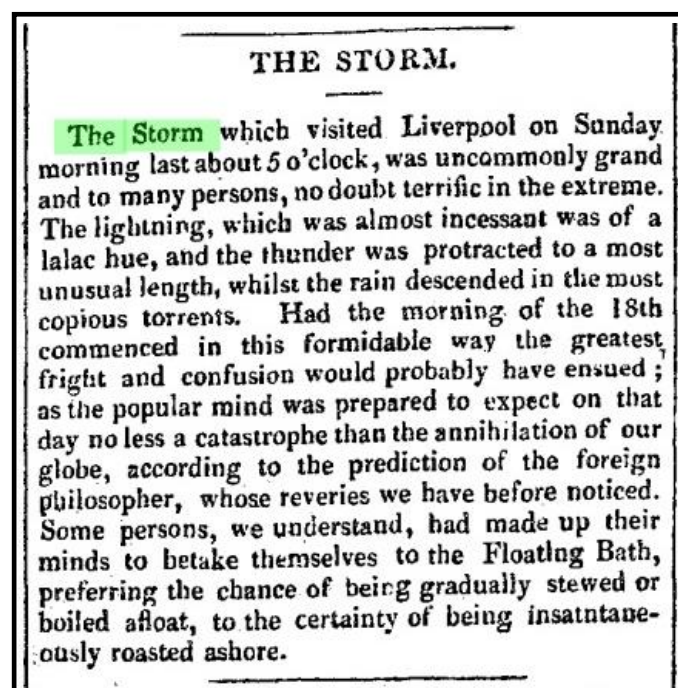


Figure 5.2. Report of the storm of 17-18 July 1816 (*Liverpool Mercury*, 26 July 1816, p.6)

The trend of dramatic reporting and the appearance of fate also frequently reappeared in reports throughout the period such as a *Liverpool Mercury* report of the storm of 7 July 1818. The extract details the effects of a 'storm of thunder and lightning, accompanied with a violent hurricane of wind and rain' at Penny Bridge, Cumbria. The passage of the 'electric fluid' through the house of the Rev. H. Ellerton was noted which had shattered windows and hit a servant girl 'who was instantly struck senseless and motionless' which rendered her partially paralysed and her back scorched. Another woman was however described to 'have been mercifully spared by the invisible, but the protecting hand of Providence'. Such dramatic reports and clear affirmations of the agency of God in storms continued into the 1820s, both in the *Liverpool Mercury* and other newspapers.

Alternatively, the *Bristol Mercury* reports represented the agency of God in a storm to further charitable support in the first report concerning organised maritime charity in the archives. The report of 14 August 1820 *Bristol Mercury* (p.4) specifically refers to a meeting of the Bristol Seaman's Friend Society and their intentions to Christianise Bristol mariners. The chairman stated not providing religious instruction to seaman was like 'a person rescued from a watery grave refusing to throw a rope for the assistance of a suffering companion'. A reverend and former Naval Officer stated religion onboard ships in the Napoleonic wars had shown 'poor seaman could be brought to feel the power of divine grace'. He alluded to a reportedly true story of an atheist who had experienced a divine awakening following shipwreck and had consequently survived and lived a fulfilled life. Likewise, another clergyman told of how a British captain heroically saved many lives from shipwrecked vessels off Memel after 'implored the assistance of the Divine Being' (*Bristol Mercury*, 14 August 1820, p.4). The issue of atheism was reportedly particularly great in Bristol and in response ten Bristol captains had already come forward to ask for religious instruction.

The clergyman and Naval Officers at the meeting also went further to highlight the range of benefits religion could bring to a vessel. In a near salesmen-like fashion, it was reported how

religious sailors were 'more capable of performing their duty' as those who trusted God were calm in times of peril. Sailors' capabilities in dangerous situations were also reportedly higher and religious sailors were better disciplined which resonates with the nineteenth century Naval concept of 'enlightened discipline' (Blake, 2014). The reports also showed how the clergy intended to benefit from this 'enlightenment' process in a wider sense as it was also postulated 'sailors might be made the means of diffusing the word of God in foreign parts'. This reflects the ambitions of many British missionaries of the period who sought to use sailors in a more imperialist sense as part of attempts to Christianise the British empire (Dutta, 2021).

The aforementioned *Bristol Mercury* report, however, represents the only occasion when the tangible benefits of Christianity were advertised in a such a way. The vast majority of the 34 religious reports published from 1820 continue to refer to the saving ability of Providence although with a diminished sense of wrath. In the early nineteenth century, God was related to maritime charity as was best evidenced in 'Mrs Henry Rolls' reported address to the Royal National Lifeboat Institution (RNLI) published on March 25, 1825. However, Rolls' address to the Victorian elite including merchants, aristocrats and naval officers relates to divine will in an attempt to appeal to the better side of human nature and encourage charitable support as she exclaims: 'No! – 'twas His hand, whom winds and waves obey, / Which drew forth to show the appointed way; / To bid Philanthropy's bright flame expand / And pour new glories o'er thy native land!' (Liverpool Mercury, 26 March 1823, p.6). Rolls connects charity with national and personal Christian enlightenment.

Despite an increasing frequency of scientific reports, religious representations implying God's saving grace and divine agency are regularly published throughout the 1820s. However, in certain cases even the direct charitable actions of people were represented as divine grace. Resonating with Rolls' sentiment, the 'humane attentions' philanthropy of a member of the societal elite, a Mrs Boodie at Mockbeggar Hall, towards shipwrecked seaman in the Mersey during the storm of 7 October 1825 was represented by the *Liverpool Mercury* (14 October 1825, p.6) as 'the interposition of Providence'. More simplistic

examples of 'providential escape' (Western Times, 29 March 1828, p.14) similar to the early nineteenth century reports sporadically featured throughout the 1820s, although by the 1830s religious representation became increasingly confined to poems and songs as opposed to storm reports.

In stark contrast to these religious reports and representations was the frequent mention of 'wreckers'. 'Wreckers' refer to groups of coastal communities who made a living from plundering from shipwrecked vessels (Pearce, 2010) and their actions and presence on the Mersey were reported during the storm of 7 October 1825. Wrecking could be both active and passive with methods ranging from opportunist theft to deliberate attempts to lure vessels into treacherous waters with false coastal lights followed by an aggressive and sometimes murderous assault of the subsequently shipwrecked vessel and her crew (Bathurst, 2005, p.xvi-vvii). While wrecking and nautical affairs were commonly sensationalised through poetry and drama in the period (Pearce, 2010; Schmidt, 2022), the newspaper records evidence exhibits wrecking did sporadically occur in Western Britain. The *Liverpool Mercury* report of the storm of 7 October 1825 (p.6) serves as an example, while the same report noted that on 23 October 1820 Mrs Boodie had previously provided for the remaining members of a crew when 'the mate died afterwards, through the inhumanity of the Wallasey wreckers'. More specifically, a *Liverpool Mercury* report of the destructive storm of 10 December 1823 in which ten vessels were shipwrecked told of the 'little urchins jumping among the waves, seizing upon pieces of timber, and dragging them into the sandhills' on the North shore of the Mersey (*Liverpool Mercury*, 12 December 1823, p.6). On the South shore, the *Liverpool Mercury* relayed the *Cheshire Courier's* report which exclaimed 'we have been informed but we hope the statement is untrue, that the wreckers on the Cheshire shore could only be kept from plundering the wreck of the Union by use of firearms'. Over the entire period from 1800, there are only six reported instances of attempted or enacted wrecking during storms, however, and in the majority of instances wrecking appears to be borne out of opportunist desperation such as during the storm of 8 October 1832 which exclaimed 'hundreds of spectators and wreckers were seen traversing the shore' following a Mersey shipwreck (*Liverpool Mercury*, 12 October 1832, p.6). This said, reports of Cornish Wreckers attacking the coastguard and shorelines which 'thronged

with wretches hardened as the rooks that surrounded them, wholly intent on plunder’ indicate the widespread nature of the issue and dependencies of coastal communities on wrecking. Indeed, while the low number of reports could be a product of the storm focus of the archival analysis or the reporting focus of the papers, wrecking following storms was a national and empire-wide issue in the early and mid-nineteenth century (Duncan and Gibbs, 2015).

The prominence of the issue was made clear in published poetry and addresses. The first reported example is the poem ‘The Wreck-Pirate!’ published in the Lancaster Gazette on 2 March 1811. This sets the precedent for many of the literary pieces via emphasising the cruelty, inhumanity and irreligious nature of wrecking. The poet exclaimed how a wreckers’ heart ‘feels no pity for a Seaman’s woes!’ and wreckers were ‘Eager for plunder, as the brute for blood’. The ‘hellish mischief’ of the wrecker was also echoed in the poetic address of Mrs Henry Rolls to the RNLI on 25 March 1825 who described the wreckers as ‘In form alone allied to human race! ... who have never known / God's awful name, or bow’d before his throne?’ The *Liverpool Mercury* went to the extent of featuring a poem specifically focused on the actions of wreckers during the storm of 7 October 1825. Wreckers were depicted as ‘Human hyenas’ intent on ‘Rapine and discord, – plunder, lust of gold, / Pervade by turns the eager demon mob’. In contrast, a direct reference is made to the humanity of Mrs Boodie ‘lady of the ancient hall, / The shipweck’d seaman cheer’d with oil and wine’ which was ultimately regarded as a ‘Samaritan design’ in the face of the widespread evil perpetrated by the wreckers.

With the exception of misplaced fears of a shipwrecked captain who originally mistook the coastguard for the infamous ‘Cornish wreckers’ during a storm in the Bristol Channel between 13-14 January 1865, the only other subsequent storm-related reported featuring wreckers is found across multiple *Western Mail* articles published in October 1886. The reports concerned the wrecking of the four-masted vessel *Tevoitdale* on the Cefn Sidan Sands in the mouth of the Three Rivers estuary and the actions of the communities of St Ishmael and Ferryside during the storm of 15-19 October 1886.

The *Western Mail's* initial account of the storm did mention plundering had taken place, with cargo being removed as well as valuables from sailors being stolen much to the distress of the remaining two survivors from a crew of nineteen (*Western Mail*, 18 October 1886, p.2). A later article published on 20 October remarked of the rarity of this act in 1886 noting 'we have not yet returned to the good old custom of deliberate wrecking' before noting how the coastal population of 'gallant little Wales has taken a decided step in that direction' (*Western Mail*, 18 October 1886, p.2). A more detailed account of the action of the wreckers was published in a letter from 'Rhediol' to the Editor of the *Western Mail* published 20 October 1886 (p.3). Again adopting a religious approach, the reader sarcastically remarked 'We are often told that Wales has been Evangelised by Dissenters; but I am afraid that we halooed before we are out of the wood'. Rhediol proclaimed the Welsh had always been wreckers stating in an derogatory imperialist tone 'we ought to send missionaries' to Wales instead of foreign countries. To support this idea of the Welsh wrecking culture, Rheidol cited undated historic occasions of a Carmarthenshire chapel emptying mid-service so the congregation of wreckers could plunder a vessel. Rhediol also noted that in 1813 a vessel named *La Jeune Emma* carrying Napoleon's niece Adeline Coquelin was lured onto the rocks by wreckers and plundered from. Unlike the other tales, there is evidence that the Cefn Sidan Sands were a dangerous place where the 'People with Little Hatchets' wrecking gang succeeded in luring many vessels including *La Jeune Emma* onto the perilous sands (Watkins, 2014). However, Rheidol's assertions that Adeline Coquelin had her ears and fingers cut off by wreckers to steal her jewellery are not evidenced elsewhere, while Watkins (2014) notes many villagers went to the assistance of the shipwrecked vessel. It therefore appears although the assertions were partially truthful, the generalisations of widespread wrecking as well as the 'ungodly' nature of Welsh coastal communities reported following the storm of 15-19 October 1886 stem from myth and legend.

It should also be noted that the lack of Welsh newspapers and the sensitivity of this issue in the period make it unsurprising that the case of *La Jeune Emma* does not feature in the records of 1813, while limited wrecking reports from throughout Western Britain likely indicates Rheidol's exaggeration. However, this instance of reversion to what, in 1886, was

considered a devious historic practise, could have resulted in this excessive condemnation. A review of changing British policies – including the founding of the Preventive Water Guard 1809 and His Majesty’s Coastguard in 1822 which were charged with preventing smuggling, wrecking and assisting shipwrecks – likely explains the reduced number of reports and extracts as wrecking and smuggling declined as a result of better policing (Pearce, 2010; Kim, 2020).

5.2.4. Quantification and Folklore

Reports of the late 1820s and 1830s assumed a more direct focus on storms and their impacts with the combination of the now prominent *Liverpool Mercury*, *Bristol Mercury* and *Western Times* providing insights of regional and national impacts. Similarly, to the *Liverpool Mercury*, the *Bristol Mercury* likewise adopted a liberal view and largely represents reformist middle class interests which had a considerable influence on provincial public opinion (Brett, 1995; Hobbs, 2009). The *Western Times* also had a similar stance and was formed in 1827 as a ‘free and independent Press in which liberal principles might be boldly and fearlessly avowed and advocated’ (The British Newspaper Archives, 2022). The paper was chiefly influenced by the liberal radical Thomas Latimer from 1829. Latimer supported parliamentary reform and sought greater local government transparency and accountability against all injustice (The British Newspaper Archives, 2022). Therefore, the majority of the papers featured in the early to mid-twentieth century reflect a liberal perspective for the period. While this could appear biased, the greater focus on public issues and welfare likely allows greater insights into societal storm impacts than more commercially focused conservative papers which feature in later reports.

The period was defined by reports that put more emphasis on the quantification of storms and their impacts than in the early nineteenth century. Storm reporting varied between succinct reports of storm impacts appearing in meteorological diaries and agricultural reports to detailed and dramatic events of major storms which often resulted in fatalities. Arguably the most unique report in the context of the period was published in the *Liverpool Mercury* on 28 December 1827 (p.6) following the storm period 19-27 December 1827 and

was entitled 'Encroachments of the Sea - Mutations on the Wirral Peninsula'. The article was unique as it actively discussed geomorphological change around the Wirral peninsula and the correspondent noted over the last '50 years, the sea has made great encroachments on the coast, from Leasowe Castle to the mouth of the River Dee'. Although this knowledge seemed to be more based on folklore than science, the report also acknowledged the 'tradition' that the Mersey was once 'forest and pasture land'. How much the correspondent could have known in 1833 is uncertain and the source of this 'tradition' is uncited, although such statements do loosely correspond with the expanded coastal plain occupied by peatland, forest and grassland habitats after the Holocene glacial maximum (Roberts *et al.*, 2006; Plater *et al.*, 2010). The report also more directly attempted to quantify the storm surge in the first instance of this in the archives, noting that the storm caused the tidal to rise 'four or five feet above its expected height' with the surge breaking through the sand dunes (Leasowes) which 'inundated the common for nearly half a mile beyond its ordinary boundary'. This evidence was again blended with folklore as 'an old man residing on the margin of the marsh' noted that sea encroachments had been such that the old lighthouse was nearly 'half a mile farther out on the beach than the present one'. Because of this somewhat suspect evidence, it was stated that 'in a short time, the sea will break through the Leasowes and make its way to Liverpool' and destroy the navigation of the Mersey. The *Liverpool Mercury* consequently stated 'we would press upon the Corporation and the landholders of Cheshire, the necessity of taking some steps to stop its further ingress, before it becomes impracticable' (*Liverpool Mercury*, 28 December 1827, p.6).

There is some evidence that this folklore was based on fact: studies of the coastal geomorphology of the Wirral peninsula and Liverpool Bay do indicate numerous storm surge events on the North Wirral shore (previously Cheshire) and rapid geomorphological change primarily resulting from dredging and channelisation (Blott *et al.*, 2008; Way, 2013). However, the forced movement of the lighthouse half a mile inshore over a period of 50 years. and the possibility of all navigation in the Mersey being impacted by storm surge and, marine intrusion breaching on the Wirral, appears an exaggeration given the sparse evidence. This account reflected several reports of the period which integrated scientific

evidence but still considered folklore. The inclusion of folklore served to exaggerate the report even if the knowledge was doubtful at the time.

The reporting of the storm of 16-17 January 1831 in which the *Bristol Mercury* (19 August 1831, p.1) and *Liverpool Mercury* reported 38 deaths further highlights this blended nature of dramatisation and emerging quantifiable scientific observations. The *Liverpool Mercury* (19 August 1831, p.8) went to lengths to represent the grandeur and power of the storm with the initial thunder reporting as the start of an 'elemental war' while the proceeding thunder appeared to 'shake it [Liverpool] to its very foundation'. Despite this dramatic reporting style, the *Liverpool Mercury* went to length to report flood depths of eight feet in places while the report also referred to the 20-year long observations of a shop owner who stated the floodwaters were 18 inches deeper than ever previously recorded. However, despite this attempt to provide a quantitative indicator, the reports stated the effects of the thunderstorm had 'considerably exceeded the memorable one of 1789' without any form of verified comparison.

In a similar manner, the *Bristol Mercury's* 'appalling accounts of the effects of the hurricane' in the Irish and Celtic Seas of 18-22 February 1833 blended a combination of statistics and dramatisation to report on the 'melancholy loss of life and shipping in the Channel' (*Bristol Mercury*, 2 March 1833, p.4). In all at least 41 deaths were reported in Western Britain as reports from Exeter estimated £10,000 (£830,000 in 2021) worth of damage. At Bovey Tracey, Devon, it was exclaimed the loss of 300 apple trees had wider economic implications as the trees 'would have produced nearly two hundred hogsheads (60,000 litres) of cider' which would result in great losses for the region's cider producers. The article also referenced an account from the insurance market Lloyd's of London that stated 100 vessels had been wrecked nationwide as the article used statistics to quantitatively exhibit the widespread storm impacts.

5.3. Mid-Late Nineteenth Century: Scientific Emergence and Charitable Growth

5.3.1. Storms and Meteorology

The late 1830s to 1850s was mainly characterised by reporting which combined quantitative indicators with dramatic and occasionally religious rhetoric. The reporting of the storm of 28-30 November 1838, however, provided evidence of the increasing use of more detailed scientific indicators than previously published outside meteorological diaries. The storm was firstly described as 'unprecedented in boisterousness and violence' (*Western Times*, 1 December 1838, p.3) and a *Liverpool Mercury* (7 December 1838, p.6) report noted storm surge conditions in Swansea as the tide rose '7 feet 2 inches about its proper level'. The barometer reportedly fell to 28 inHg which was stated to be 'a very extraordinary occurrence in this part of the country'. The article entitled the 'Great Fall of the Mercurial Column of the Barometer' also went further to scientifically explain the device. Quoting 'the article Meteorology, in Brewster's Encyclopaedia' the report stated the 'greatest depression of the barometer' observed in the UK 'for many years' was on the 5 March 1818 when a violent South-west wind blew and the barometer fell to 28.155 inHg at sea level. A 'violent hurricane' in Southern England along with widespread storm surges followed. However, it was remarked 'it frequently happens, indeed that the barometer sinks during a gale of wind at a distance, while the atmosphere at the place of observation is calm and settled' and an example of a very low pressure in Liverpool coinciding with a great storm in Norway was given. It was stated this had broadly been the case during the storm of 28-30 November 1838 as the barometer sinking to 28.1 inHg in Liverpool had coincided with storms in Wales, yet the report doubted whether the Liverpool barometer reaching a low as extreme as 28.1 inHg was correct. Despite the illustration and explanation of sound meteorological knowledge, the report then deviated as it attempted to relate a 1755 barometric pressure drop in the UK and the ensuing Lisbon earthquake. Although this incorrect direct link between atmospheric pressure and major earthquakes evidences the developing nature of scientific understanding, the 5 March 1818 storm quoted in reports does directly correspond with the report 'The Hurricane' which details widespread destruction in London

and Southern England (*Liverpool Mercury*, 13 March 1818, p.6), thereby reflecting the reporting validity.

The continued regular reporting of barometric pressure and storm surge heights above predicted tide reflects in the 1840s and 1850s what Jankovic (2010) terms the 'quantifying spirit'. This was part of the scientific meteorological movement which began in the late seventeenth century and was underpinned by the belief that only when meteorology fully embraced quantitative data would it show its real scientific worth (Golinski, 2010). Indeed, while the early reports indicate a little emphasis on quantification in early nineteenth century, reporting focus on meteorological science consistently increases throughout the century (see Chapter Eight). The emphasis on quantification in storm reporting and the appearance of more scientific instruments and publishing of 'Meteorological Results' became increasingly common in the 1850s. For instance, the use of pressure plates, which measured a maximum gust of 33 pounds per square foot, and 'Osler's Self-Registering Anemometer', which measured daily horizontal motion of air were noted during the storm of 25-26 July 1853 (*Liverpool Mercury*, 1 March 1853, p.5). Despite attempts to advance quantitative meteorology for the primary purpose of enhancing safety of property and lives at sea (Roberts, 2011, p.17-30), the reports from 1850 to 1859 indicate the statistical approach to storms initially had little impact on fatalities. The archived reports indicated in Western Britain alone there were 616 fatalities in the period. However, the vast majority of these occurred during the infamous *Royal Charter* storm of 25-26 October 1859 during which 459 people onboard the vessel *Royal Charter* perished along with another 10 throughout Western Britain. The great catastrophe was widely reported as the *Western Times* (5 November 1859, p.3) exclaimed 'a more complete annihilation of a ship was never seen' while the *Liverpool Mercury* (28 October 1859, p.2) exclaimed of 'frightfully mutilated' bodies that littered the shores.

As Chapter Seven explains, the *Royal Charter* storm had major long-term impacts on coastal community and national government storm understanding and prediction. Following the introduction of 'storm telegraphy', its temporary removal after Fitzroy's death and

subsequent reinstatement in 1867 following a prolonged campaign, the new forecasts sporadically featured in the reports of the 1860s and 1870s. Although forecasts were mostly for Liverpool and reported in the *Liverpool Mercury*, the emergence of storm warnings elsewhere promised by the Met Office was also evidenced by a *Western Times* report (15 January 1869, p.5) which noted the lifeboat institution in Exeter had received the 'Pressure falling fast in Ireland, and south-east gale there. Drum Hoisted' (Figure 5.3).

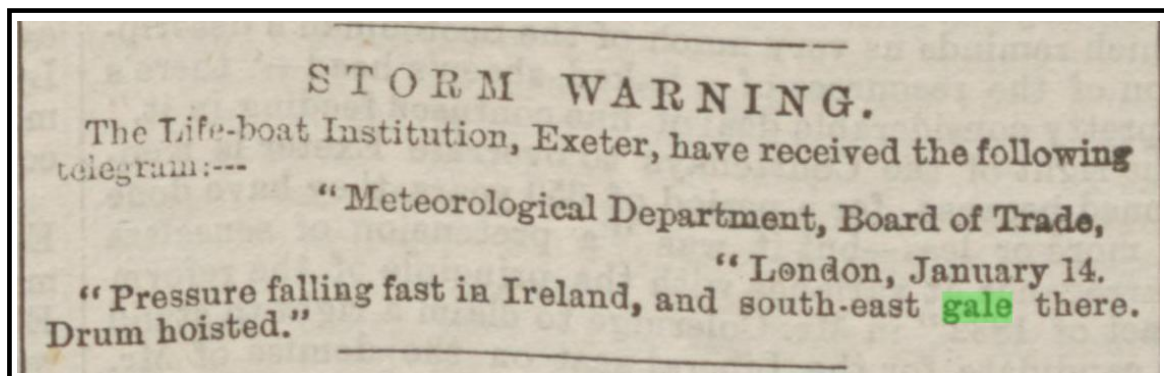


Figure 5.3. Storm warning issued to the RNLI in Exeter from the Meteorological Department of the Board of Trade in the *Western Times* (p.5) on 15 January 1869.

The storm reports progressively featured more detailed and likely accurate scientific data. The *Liverpool Mercury* reports, in particular, regularly emphasised the reliability of the data sourced from the Bidston Observatory, which was professionally run by the Mersey Docks and Harbour Board. For major storms, these observations were periodically directly relayed in independent extracts which accompanied reports that were more qualitative and emotive in nature. For instance, on 21 September 1869 the *Liverpool Mercury* (p.6) featured an observer's meteorological report to the 'Underwriters' Rooms, Liverpool' detailing the storm of 18-21 September 1869. The report stated the wind strength was the 'heaviest that we have had here since February last' and was strongest from 17:00 to 20:00. Quantitative measurements were given to gauge this strength with the report noting 'frequent pressures of 35 to 45 pounds on the square foot' while 'upwards of 200 miles of air passed over the Observatory'. Wind direction variability and barometric pressure readings which were also present in early to mid 1800s reports, also remained as the pressure dropped to a low of 29.22 inHg. Liverpool-specific reports were also complimented by tabulated weather reports

(Figure 5.4.) sent via telegraph from observatories across the British Isles and North-west France highlighting variability in pressure, maximum wind speed, wind direction, rain and weather observations during the storm period (*Liverpool Mercury*, 21 September 1869, p.7). A succinct 'remarks' section was also published to aid general interpretation and this form of weather report featured daily in the *Liverpool Mercury* from the late 1860s. This provided readers with an insight into regional weather and storm variability which was considerably more scientific and detailed than in previous reports. The reports still retained a sense of thrill and often featured extracts from papers in impacted regions such as a relayed *Glasgow Herald* report of the 18-19 September storm which emphasised 'boisterous weather' and 'perfect deluge of rain' over Greenock (*Liverpool Mercury*, 21 September 1869, p.6).

WEATHER REPORT.										
MONDAY, SEPT. 20, EIGHT O'CLOCK A.M.										
PLACE.	B.	T.	W. B.	W.	F.	E.	D.	W.	R.	S.
Wick	29 13	51	60	N.W.	5	4	N.W.	mr	0 15	2
Nairn	29 22	51	49	W.S.W.	3	0	S.W.	o	0 20	2
Aberdeen ..	29 30	51	48	N.W.	3	7	N.W.	o	0 14	2
Leith	29 19	53	48	N.W.	7	9	S.W.	b	0 08	..
Shields	29 32	50	47	N.N.W.	0	0	W.	ob	..	3
Scarboro' ..	29 30	52	49	W.	4	8	S.W.	cb	0 05	4
Yarmouth ..	29 20	52	49	S.W.	4	7	W.	o	..	4
Ardrossan ..	29 39	52	48	N.W.	0	11	N.W.	o	0 23	5
Greencastle	29 45	49	48	W.	2	9	N.W.	rc	0 45	..
Holyhead ..	29 43	51	48	W.	4	9	W.S.W.	rc	0 02	..
Liverpool ..	29 48	..	..	W.	4	10	W.	oo	0 07	3
Valentia ..	29 54	54	50	N.	3	6	N.W.	rb	0 02	2
Cape Clear ..	..	..	..	..	..	..	..	..	..	..
Roche's Pt.	29 59	49	47	W.N.W.	1	5	N.W.	c	..	2
Pembroke ..	29 06	53	46	N.N.W.	3	8	W.	c	..	3
Penzance ..	29 54	59	51	S.E.	4	7	W.N.W.	cr	0 13	4
Plymouth ..	29 59	59	50	E.S.E.	2	6	W.	crf	..	2
Portsmouth	29 00	53	50	W.N.W.	1	7	W.N.W.	co	..	1
London	29 57	52	48	W.N.W.	1	8	N.W.	rbo	0 03	..
C. Gris Nez.	29 40	55	50	W.N.W.	7	8	W.S.W.	rc	0 03	5
Brest	29 32	70	70	E.S.E.	7	7	E.S.E.	r	0 08	3
L'Orient ..	29 51	55	55	S.	5	8	W.N.W.	cr	0 04	4
Rochefort ..	29 09	61	60	W.	5	8	W.	o	..	4
Blairritz ..	29 07	75	62	W.	4	..	..	m	..	5
Toulon ....	..	..	..	..	..	..	..	..	..	..

Barometer corrected and reduced to 32 deg. at sea level. Thermometer exposed in shade. Extreme force with its direction during last 24 hours. Z.—calm. Weather: b.—blue sky; c.—clouds (detached); f.—fog; h.—hail; l.—lightning; m.—misty (hazy); o.—overcast (dull); r.—rain; s.—snow; t.—thunder. Rainfall, snow or hail (melted), during last 24 hours. Sea disturbance.

REMARKS.—The diminution of pressure noted on Saturday became very great that evening, all the northern readings being below 29 inches.

Figure 5.4. Weather report published in the *Liverpool Mercury* (p.7) on 21 September 1869.

5.3.2. Conservative Storm Reporting

The 1870s saw the appearance of a new paper in the archives in the form of the Cardiff-based *Western Mail* which provided new insights into storms, particularly in South Wales and the South-west. Unlike the more liberal *Liverpool Mercury*, the new *Western Mail* was owned by John Crichton-Stuart, 3rd Marquess of Bute between 1869 and 1877 (Jones, 2003). As it was designed to promote the political aspirations of the Marquess, who, as the owner of the Port of Cardiff and mineral rich land in South Wales, was one of the richest men in the world (Crook, 2013), it initially adopted a more conservative stance (Jones, 2003). Given this background, it was unsurprising that the newspaper's initial storm reports which appear in the archives from January 1870 were mostly focused on the impact of storms on shipping in the Bristol Channel, Wales and the South-west.

Detailed and evidence-based reporting of maritime storm events and the work of lifesaving institutions was regularly published in the *Western Mail* throughout the 1870s. For the destructive storm of 12-14 October 1870, the paper featured three articles detailing every major known impact throughout Western Britain with storm devoted reports published each day from 13 to 15 February. Despite the dramatic titles including 'Great Gale at Cardiff' (*Western Mail*, 13 October 1870, p.2) and 'The Disastrous Gales' (*Western Mail*, 14 October 1870, p.3), the dramatic emphasis was moderated in the predominately factual and highly descriptive reports. The vast majority of vessels wrecked, sunk or ashore were named and the fate and state of their crew were detailed. The actions of specific lifeboats throughout Western Britain were also regularly mentioned regardless of their effectiveness. For instance, in St. David's it was remarked when the smack *Transit* was seen struggling in 'a fearful gale from the WSW' off Cardigan 'on seeing her signals of distress the lifeboat *Augusta*' which had been donated to the RNLI by the Earl of Dartmouth 'went out through a heavy sea, and was happily the means of saving the crew' (*Western Mail*, 15 October 1870, p.3). While mainly maritime focused, the reports also reported the destruction on land, going to the extent to describe 'the two most serious cases of damage' in Cardiff and elsewhere which included the specific sequence of events and ensuing damage done to three public houses (*Western Mail*, 14 October 1870, p.3). This said, the reports were not

merely just detailed event descriptions: one exclaimed that during the storm at Aberystwyth there was 'a grand aurora borealis, which shed its lurid light over the foaming crest of the waves, setting before the spectators a panorama seldom equalled' (*Western Mail*, 15 October 1870, p.3).

The comprehensive reports of major events were supplemented by more frequent and succinct reports often detailing the economic and shipping-related impacts of storms in the 1870s. This more commercially orientated focus aligned with the conservative nature of the paper. While poetry and non-fictional literature were less frequent than in the reports of the early eighteenth century, they did occasionally feature in the *Western Mail*. Such an example is Carl Morganwg's story 'Death in Life' published on 24 December 1874 (p.4). With no reference to recent events, Morganwg's emphatically depicted a storm as a 'war of air and water' generated by 'madly howling storm god' who 'dares the world to mortal combat' in a by then rare instance of storm-related fiction. Another notable evolution in reporting was the increased foci on the communities and responsibility for storm impacts, particularly in South Wales and the South-west. An example is evidenced in the report of the storm of 24 to 26 January 1875 which detailed a great storm and storm surge in South Wales. The sea at Ferryside was 'one mass of foam' and heavy damage was inflicted across the region with Milford Haven and Haverfordwest being particularly hard hit while six vessels and at least three lives were lost at seas with many more feared dead (*Western Mail*, 27 January 1875, p.3)

The *Western Mail* also emphasised the great loss of at least twenty families who lived in cottages on the Tenby marshes. However, in a deviation from the regular succinct and commercially-orientated reporting, the report highlighted one of the first instances of a failure of early coastal management and planning as it specifically emphasised the flooded communities were 'induced to build their houses there on the understanding that they should suffer no inconvenience from the water' (*Western Mail*, 27 January 1875, p.2). While the eventual outcomes was not reported, this acknowledgement of human responsibility marked an anomaly in a period where reports largely represented storm loss as unfortunate

and unpreventable. The wider research indicates this representation is somewhat of an outlier in the time period. While government coastal management and defence is recorded since the middle ages and the Victorians placed a strong emphasis on coastal engineering, this was primarily for the purpose of protecting and defending ports, valuable land and key infrastructure (e.g. Stammers, 2007; Bankoff, 2013; Adams and Heidarzadeh, 2021). Although Bankoff (2013) also notes how historic periodic exposure to high magnitude storms and flooded have prompted European communities to develop disaster subcultures which are centred around the collective defence and management of coastal environments, the report of 27 January 1875 indicates a different approach. Instead, the report absolves the families of responsibility and instead exhibits more similarity with a post-North Sea Flood (1953) UK response to storm and flood management as a higher power in the form of either the constructors or government are portrayed as being responsible (Bulter *et al.*, 2011; Hall, 2011; Soetanto *et al.*, 2017).

This emerging concept of devolved community responsibility for the impacts of storms and flooding is also apparent in the reporting of the Bridgend Floods of 27 to 29 August 1877. According to an anonymous contributor in the 'To the Editor' section of the *Western Mail*, the event resulted in the 'utter wreck and ruin' of the town of Bridgend and caused 'overwhelming sorrow and commiseration' (*Western Mail*, 1 September 1877, p.3). Likewise, the *Western Mail* exclaimed many in the Rhondda Valley spent the night of the 27th 'struggling for life with the treacherous mass of boiling waves' as one man died and the vast majority of low-lying house and businesses were damaged (*Western Mail*, 29 August 1877, p.3). Following this disaster, the emphasis was placed on the wider responsibility for the recovery and welfare of the town and its inhabitants as opposed to planning and defence. The contributor employed a combination of satire and direct ridicule to attack the authorities and response committee who were reported to constitute thirteen magistrates and two hundred professionals. They sarcastically mocked the 'magnificent sum of £15' (£1765 in 2022) that had so far been donated despite their estimation that £30,000 (£3,500,000) would be insufficient (*Western Mail*, 1 September 1877, p.3). The contributor directly attacked the authorities and 'leading figures' convened at the supposed flood response meeting noting their filibustering and reluctance to start a relief fund. The

contributor laid bare the disrespect of the authorities which included what the attendees considered humorous references to the floods being an expiation for 'the immorality of drunken wreckers of the Newbridge fields'. They concluded that hundreds of pounds were needed now, but such negligence and reluctance would soon lead to the event being overlooked and forgotten.

The *Western Mail* (4 September 1877, p.4) also further raised the issue of long-term flood protection. The paper noted how a locally prominent clergyman had highlighted the reluctance of the agent of Lord Dunraven, who owned much of the town, and the Chairman of the prominent regional Board of Health, to act or even consider the new flood defence and drainage plans. Instead, the paper implied it would take the cooperation of landlords and various regional boards to ensure protection from 'periodical floods' which was a 'sanitary necessity'. This sequence of reports shows that while the authorities and 'leading figures' were reportedly unwilling to address the issues of short-term flood response and long-term protection, both the *Western Mail* and broader public opinion voiced in letters and extracts were underlined by a belief in collective authority and community responsibility. This deviates considerably from reports of the early nineteenth century which alternatively represent any form of charity or donations from the societal elite or authorities as great humane acts of kindness. Instead, the reports of the 1860s and 1870s more frequently imply authorities and State bodies, who appear largely comprised of the societal elite, have an inherent form of collective responsibility for threatened communities.

The final months of 1877 also highlight the continued ambition and success of the nation-state to improve the reintroduced storm warnings for wider human and commercial benefit. The *Western Mail* featured an article from the Board of Trade (Met Office) proclaiming the accuracy of all issued storm warnings for 1876 was 83.9%, which the board emphasised 'was higher than any previous year' (*Western Mail*, 2 November 1877, p.4). Unlike the other newspapers which had previously only relayed State forecasts from the Board of Trade, the *Western Mail* also adopted a broader approach by regularly featuring storm warnings telegraphed by from the *New York Herald* offices in London. These warnings were succinct,

ranging from three to five short sentences, and mainly concerned Atlantic depressions forecast to impact Britain and Western Europe. The consequences of the depression were also often translated into more practical means. For instance, a *New York Herald* forecast of a large depression relayed in the *Western Mail* on 25 October 1877 (p.4) was entitled 'A Coming Storm' which would be 'probably severe' and 'strike the British coast 27th' bringing 'rains; heavy gales, south-east to north-west'. The threat it posed was also clearly outlined for the benefit of mariners as the telegraph stated the storm was 'dangerous to vessels bound to American ports north of latitude 35'. Similar *New York Herald* storm warnings featured throughout the 1880s, highlighting the reduced dependence on the Met Office and the global nature of forecasts that could be rapidly and regularly telegraphed.

This frequent appearance of such weather telegraphs comes over a decade after the laying of the first permanent transatlantic cable in 1866 (Müller, 2010). On review, it is more likely falling trans-Atlantic cable rates, and the aggressive global expansionist policies of the *New York Herald's* ambitious editor James Gordon Bennett Jr. led to the appearance of forecasts rather than an increased impetus on vulnerability and resilience (Pettitt, 2018). Therefore, while appearing partly contradictory to the newspaper's ethos, it is plausible that the greater number of commercial links possessed by the *Western Mail* enabled the paper to feature novel and important weather information for communities and commerce. This information is a factor which likely contributed to the conservative paper's success amongst a traditionally liberal Welsh readership (Cayford, 1992).

5.3.3. Lifesaving and Collective Welfare

Wider storm reporting of the 1880s indicates reports largely adopted a similar detailed and factual approach with regular quantification of storm characteristics and impacts mixed with dramatic emphasis. A notable feature of the reports is the increased frequency of the mention of the lifeboats in reports. Attempted lifeboat action was mentioned in 16 of the 36 storm-related reports of the decade. The actions and gallantry of the lifeboats and their crews regularly received high praise, such as in a report of the storm of 23 to 2 October 1882 during which the Penrhyn Castle lifeboat was launched into 'a mountainous sea' in

Cardigan Bay (Western Mail, 3 November 1882, p.3). The report acclaimed the 'self-denying heroism' of the crew who 'plied the boat to the rescue over the surging deep' and heroically saved the crew of a wrecked vessel.

The reports of the *Liverpool Mercury* (11 December 1886, p.5) declared 'a more harrowing story than that which came from Southport yesterday has rarely been told' before describing how the crews launched into a sea which resembled a 'cauldron'. As they progressed through the breakers to the distressed vessel *Mexico*, the lifeboats *Eliza Fernley* of Southport and *Laura Janet* of St. Annes were hit broadside and capsized without self-righting as they were designed to do. This resulted in the loss of 14 of the 16 Southport lifeboatmen (depicted in Figure 5.5) and all of the 13-strong St. Annes crew. The *Western Mail* (11 December 1886, p.5) featured a report from a survivor, John Jackson, who described his experience during the capsizing before he staggered home 'half dead with cold and the effects of the immersion'. An account from local secretary of the RNLI, Dr Pilkington, J.P. was also provided who told of his participation with the police in the search for the wrecked lifeboat. The discovery and recovery of the extent of the disaster were also revealed while Pilkington himself almost drowned. The more expansive *Western Mail* (11 December 1886, p.5) report also featured an extract from a 'Central News' telegram in which it was correctly proclaimed the RNLI records showed the number of lifeboatmen fatalities was unprecedented. Notably, while the *Liverpool Mercury* highlighted the failure of the two boats to recover themselves after capsizing would shake the previously steadfast confidence in the crafts, the report noted lifeboats elsewhere performed well. The report, therefore, concluded the situation was not 'ground for discouragement' before stressing the risk of death was known by all lifeboatmen.



Figure 5.5. Illustration of the capsizing of the *Eliza Fearnley* off Southport (*Illustrated London News*, 18 December 1886, p.2)

Despite the *Liverpool Mercury's* assurances of widespread confidence in the seaworthiness of the institution's lifeboats, the reports evidenced that this was not the case. During a great storm on 7 to 8 November 1890, *Western Mail* reports noted the Llandudno lifeboat initially refused to deploy and it was only 'after an hour's quarrelling' that the chairmen convinced the coxswain to launch and eventually rescue a stricken vessel. Likewise, during the same storm, the death of Viscount Cantelupe aboard his yacht in the Irish Sea was seen as unavoidable 'as the sea ran so high, the wind was blowing with such terrific force and the night was so dark that to launch a lifeboat at that moment would be reckless folly' (*Western Mail*, 8 November 1890, p.5).

The ensuing storm of 9-17 March 1891 also had widespread impacts both at sea and on land throughout the UK. Such was its severity that it was later to be known as the Great Blizzard of 1891 (Brown, 2016). The reports noted the snowstorm engulfed much of South-west

England and South Wales with scores of deaths resulting from hypothermia, housing destruction and shipwreck (*Western Mail*, 14 March 1891, p.5). At Pembroke, it was remarked a snowstorm this bad had not been experienced since 1855 while 5-6ft of snow fell across South Wales with gangs of men constantly at work clearing snow in the Cardiff streets (*Western Mail*, 11 March 1891, p.5). In South-west Britain at least 14 vessels were lost at sea. One report of the storm reprinted in *The Guardian* on 11 March 1954 (p.5) further noted 'an unbridled hurricane raged across the West' grinding all businesses and travel to a halt as the winds at times resembled 'the frantic yells and fiendish laughter of millions of liberated maniacs'. Further research indicates that the reports were no exaggeration, as the blizzard ravaged South-west Britain with two depressions successively moving east across Southern Britain while easterly gales turned the snowstorm into a blizzard (Brown, 2016). The blizzard was most severe in Devon and Cornwall, where mean snow depths were estimated at 60 cm producing great disruption to communication inland where the Plymouth-London express was engulfed by snow, many people died of hypothermia and c.6,000 livestock perished (Brown, 2016; Historic UK, 2021). At sea, the newspaper reports highlighted this great loss of life from shipwreck. This included the loss of 24 lives off Start Point, Devon as the *SS Marana* was wrecked while the ship, *Bay of Panama* was wrecked at Nare Head, Cornwall and 23 sailors died as they drowned or froze to death (National Maritime Museum, 2010). However, due to a rapid community response, the coastguard did manage to heroically save seventeen via breeches buoy (Hart, 1994; Royal Duchy, 2019). Lifeboat accounts were confined to the East coast where another tragedy occurred as three more lifeboatmen perished during an attempted rescue at Dengemarsh (RNLI, 2021). Ultimately, the estimated 200 human fatalities, widespread disruption and economic loss rendered the Great Blizzard one of the greatest UK storms on record (Eden, 2008; *The Times*, 2021).

Wider research indicates that the RNLI took notice of the mounting lifeboat losses and rising concerns as in September 1890 the institution introduced their first steam-sail boat, *Duke of Northumberland* (RNLI, 2022a). In a marked design revolution, the steel-hulled vessel was 50 ft long, 30 imperial tons in weight and had an average speed of 7 knots (Hudson *et al.*, 1993). Despite this revolution, the reports indicated that the wider introduction of these

much more expensive vessels that required a permanent harbour was highly restricted. The reports indicated the limited introduction of the new steam vessels with a *Liverpool Mercury* report on the RNLI annual meeting at the Adelphi Hotel, London noting the Prince of Wales' satisfaction with the new the steam lifeboat *Duke of Northumberland* (*Liverpool Mercury*, 9 September 1892, p.3). The *Duke of Northumberland*, was deployed in Western Britain being initially based at Holyhead before a transfer to New Brighton on the Mersey (RNLI, 2022b). On eight occasions, the report illustrated the effectiveness and regular use of the steam vessel during the 1890s. The mention of its first action came during the storm of 27 January to 2 February 1894. The storm resulted in the wrecking of a schooner in the shallows of the mouth of the Mersey and two lifeboats were deployed (*Liverpool Mercury*, 29 January 1894, p.5). The report stated that the steam lifeboat had been deployed after the sail and oar propelled Liverpool lifeboat which was under tow and 'fully a mile and a half to two miles ahead' by the time the steam lifeboat left port. However, unlike the Liverpool lifeboat which needed to be towed upwind and deployed in deep water, the 'New Brighton boat steamed direct for her, right over the bank in a heavy surf' and consequently arrived considerably before the Liverpool lifeboat and rescued all six crew. The rescued crew spoke 'in the highest terms of praise of the steam lifeboat's abilities, both as a seaboat, and her lifesaving qualities' and the *Liverpool Mercury* noted it was the first occasion 'in which her abilities were practically tested, and they have proved eminently satisfactory' (*Liverpool Mercury*, 29 January 1894, p.5).

The success of the steam lifeboat on the Mersey also sparked a debate about the wider long-term feasibility of using sail and oar propelled vessels for lifesaving and piloting purposes. This followed an incident during a severe gale from the west-north-west between 4-8 December 1895 in the approaches to the Mersey off the North Wales (*Liverpool Mercury*, 9 December 1895, p.5). A sailing pilot vessel was run over by a steamer it was trying to assist leaving sixteen men to drift helplessly in the pilot boat's punt for a night before a fortunate rescue. The report noted the men's families had been 'prostrated by grief'. This added fuel to the prominent steam versus sailing pilot boats debate. The *Liverpool Mercury* detailed both sides of the argument, noting 'the pilot boat service of the Mersey is not an institution of yesterday', while also pointing out that 'for half a century and

upwards the splendid seaworthiness of our Mersey pilot schooners has been in evidence' (*Liverpool Mercury*, 9 December 1895, p.5). While the report credited the well-designed sail vessels and highly skilled helmsmen, it stated 'circumstances must occasionally arise under which a sailing vessel is put to an enormous disadvantage in comparison with a vessel propelled by screw or paddle' and the incident was clear evidence of this. The lack of weather-related incidents with the steam powered Mersey tugs was seen as further evidence of steam's superiority, which eclipsed any traditional arguments concerning the long-term success of sailing vessels. It was also noted that, despite the initially 'strenuous objections to the introduction of the steam lifeboat', by 1895 even the 'most obdurate critics' admitted the steam lifeboat was 'far superior' against even 'the best manoeuvred sailing lifeboats'. The *Liverpool Mercury* exhibited strong support for steam vessels noting that despite high initial costs, 'in the long run it is obvious that such a change would prove economical'. The report concluded that fewer steam vessels would be required and their higher seaworthiness would allow larger vessels to be assisted with impunity 'which no sailing vessel, however well managed, could possibly aspire to'.

This increasing emphasis on steam vessels was reflected by the RNLI policies as the institution commissioned five more steam powered lifeboats before moving to petrol powered motor lifeboats in 1905 (RNLI, 2022c). The new steam vessels and expanded nature of lifeboat institutions (RNLI and independent) meant saving lives at sea became increasingly expensive and therefore significant fundraising was required (Kavanagh, 2004). Although the RNLI traditionally relied on an elite base for donations, the Manchester industrialist Sir Charles Macara, championed a different approach to acquiring donations with the new concept of 'Lifeboat Saturday' (Smith, 2021). Like the introduction of steam lifeboats, this event also stemmed from the Southport and St Anne's lifeboats disaster, as Macara had initially led a successful public appeal which raised £30,000 for the 16 widows and 50 children of the deceased crew. This inspired the first ever lifeboat street collection, which took place in Manchester on 10 October 1891 and consisted of a parade of bands, floats and lifeboats as well as an ensuing public collection (RNLI, 2022d). The event was a tremendous success, raising £5,454 1s 4d which dwarfed previous RNLI efforts and the movement expanded until the RNLI fully took over it 1896. Despite the frustration of

Macara and others with RNLI donation expenditure and allocation policies, the new movement enabled the institution to invest in lifesaving technology and better maintain facilities. It also increased public engagement with lifesaving at sea in growing cities and ultimately prompted the RNLI to diversify and improve their charitable approach (Smith, 2021).

The newspaper reports highlighted the success of the collections and their broader societal and cultural influences. The *Western Mail* (14 October 1893, p.5) featured a poem aimed at attracting donations for the cause which began by pleading 'A cause that second stands to none; / The Lifeboat! thrills not every throbbing heart'. The poem highlighted the bravery of the lifeboatmen as the 'wild storm raves' with 'rath around them: plunging through the gloom' before emphasising the imminent threat to life each lifeboatman faced as 'their vessel ploughs the cruel, greedy waves, / Each moment threatening to become their tomb'. A report of the annual meeting of the Liverpool and New Brighton RNLI branch also noted the wider impact of the movement on the public approach to lifeboat donation as the chairman stated the position of the branch 'was substantially better financially than in previous years' thanks to large donations from the public and sports clubs (*Liverpool Mercury*, 10 February 1894, p.5). The contrasting fall in donations from the church also prompted some in attendance to suggest a 'Lifeboat Sunday' may be introduced to enhance support from congregations.

Despite Macara's issues with RNLI funding allocation (Smith, 2021), the reports indicated that Lifeboat Saturday continued to be tremendously successful as the inhabitants 'turned out in their thousands' to see the Cardiff procession and 'show their sympathy with the noble cause by liberally responding to the appeals' (*Western Mail*, 29 July 1895, p.3). The day consisted of a mock lifeboat rescue, parade and military fanfare and the *Western Mail* remarked 'the demonstration and fete must be pronounced to be a gratifying success'. Evidence of the subsequent widespread adoption of 'Lifeboat Sunday' six days before 'Lifeboat Saturday' was noted as during sermons at parishes throughout the Southwest ministers expressed the importance of donating to the RNLI by making Christian connections

to charity and religion. The relationship between lifesaving, global trade expansion and livelihoods was also again made as one minister noted even ‘the most inland village of our land’ was now dependent on global commerce. In another sermon, a minister exclaimed lifesaving was a ‘beautiful idea of the work of the Church of Christ’ and donations were unanimously encouraged on the grounds they were humane and conformed with God’s will.

Charity was also abundant in other forms throughout the 1890s and into the 1900s with frequent reports from the meetings of societies such as the *Liverpool Shipwreck and Humane Society* (LSHS). Twelve reports detailed the actions of the LSHS from 1893 to 1900 which primarily concerned rewarding those who had saved life, acted charitably in other ways or needed aid. A report on a meeting of the society published on 18 March 1893 (*Liverpool Mercury*, p.3) noted the awards ‘for courage and humanity in saving life’. This included the awarding of silver medals for sailors credited for saving life during a storm in the Irish Sea while monetary awards were given to Liverpool citizens who had saved life ashore including 15 shillings (£95 in 2022) awarded to a man who saved a woman in a canal lock from ‘imminent danger of being drowned’.

This generosity is likely reflective of the wealthy members’ support from the societal elite as a *Liverpool Mercury* published on 20 December 1895 (p.4) reveals a meeting was ‘chaired by Admiral Gough’ in the Underwriters' Committee Room. A review of the society’s history indicates, much like the RNLI, the predominant reliance on elite donors was largely the case up until the late 1890s (LSHS, 2022). While the society was founded in response to the great storm of 7-8 January 1839 which resulted in huge losses of life and property on sea and on land (Barclay, 2009, p.143), there were notable instances of the society’s failure or limited response to storm disasters (Pearce, 2021). Pearce (2021) notes the *Liverpool Mercury* played a particularly prominent role in criticising the LSHS following the shipwreck of the Lord Nelson on 16 November 1840 as the paper attacked the society for not having ‘provided a place of refuge,’ for shipwrecked survivors despite the ‘handsome funds placed at their disposal’ for such purposes (*Liverpool Mercury*, 11 December 1840, p.3). These factors, combined with the increasing wider charitable emphasis on awards and rewards in

the late nineteenth century (Barclay, 2009), plausibly explain why the LSHS appeared in the *Liverpool Mercury* considerably after its foundation.

Growing support from State bodies for incidences on the coast and inland was also evident. Most notably, the Bristol and Bath Floods of 1894 catalysed the first major reported long-term (two years) local authority response. The storm lasted occurred between 12 to 14 November and caused widespread flooding in the Bristol and Bath districts as the *Bristol Mercury* (15 November 1894, p.5). Rivers in the South-West reached ‘the highest level known for many years’ and 140 houses in the low-lying suburbs of Bristol flooded to a depth of several feet. At Bath, the flooding was worse than anticipated with the main streets inundated and property gutted by torrential flows. Unlike in previous reports, the local authorities in Bath led by the Mayor authorised the administration of temporary relief with instant effect while in Bristol as a relief body of State-employed workmen rendered aid. A correspondent exclaimed it was imperative to ensure that defects were ‘to be made good’ (*Bristol Mercury*, 15 November 1894, p.5).

On 16 November 1894 it was reported (*Bristol Mercury*, p.5) the floods received ‘considerable attention’ at the meeting of the local government agency the ‘Bristol Sanitary Authority’ which included doctors, community leaders and engineers. The focus was on flood management as the *Bristol Mercury* exclaimed: ‘Nothing can be done to prevent a recurrence of these casualties until the reconstruction of this culvert is undertaken by a public body armed with powers to deal with the matter’ (*Bristol Mercury*, 16 November 1894, p.5). Evidence of modern water governance structures also emerged as the attendees recognised the requirement of community and parliamentary permissions to make such modifications. Overall, it was concluded ‘unless they could devise some scheme of moving the floodwater ... it would be impossible to prevent the catastrophe occurring again’ (*Bristol Mercury*, 16 November 1894, p.5). This highlighted that the local authority had assumed responsibility for community storm vulnerability.

Over seven months after the flooding, an article concerning the progression of the Bristol Floods Committee was published on 27 July 1895. The affected inhabitants were 'waiting anxiously for some move to be made' (*Bristol Mercury*, 27 July 1895, p.6). It was noted an engineer and the sanitary council had submitted and approved a report on the drainage design but action was yet to be taken. During the secondary review, only the engineer's report was referred to as a means to instigate action. Storm water was to be directly diverted using hard engineering measures totalling £46,000 (£6,100,000). In a subsequent meeting on 30 November 1895, it was announced the floods committee 'had decided to recommend the Council to carry out both of these schemes in their entirety, and thus for once and all do away with the mischief' (*Bristol Mercury*, 30 November 1895, p.1).

The final report noted the unanimous committee acceptance of the fluvial engineer's report (*Bristol Mercury*, 9 May 1896, p.3). The designated experts also agreed with the fluvial engineer's proposals to construct floodwater relief culverts. It was now specified that such modification and expense required an application to the House of Commons for greater power devolution and work was to begin following this approval.

Despite the community and liberal press pressure, the response was clearly expert-centric and technocratic and typifies a Victorian engineering flooding response (Ewen, 2014; Matless, 2019). This form of technocracy was, however, markedly different from the centralised national government forecasting pioneered by Fitzroy in 1860s, being local authority led. While there is evidence of local environmental and human consideration, a divide between the experts on the committee and the communities clearly existed. This strategy also indicated the move from the traditional and now re-emerging idea of communities 'living with water' and instead resonates with wider Victorian and twentieth-century philosophies of 'control' and flood 'defence' (Weil, 2006; McEwen *et al.*, 2014). Despite the differences from twenty first century approaches, the consideration of engineering and political issues illustrates the changing nature of storm and flood management. Moreover, while management was exclusive and technocratic, the localised detail and investment into management highlights progression from previous floods.

5.4. Early-Late Twentieth Century: Scientific Predominance, Social Inclusivity, Technocracy and Disaster

5.4.1. Science, Disaster and the War Periods

Reporting in the 1900s exhibited similar characteristics to the reports of the 1890s with an emphasis on objective reporting and science, yet dramatic reporting of storm power and grandeur remained. While reported fatalities remained common, with 201 reported from 1900 to 1909, fatalities rarely exceed 10 per storm with an average of 2.5. However, two exceptions to this trend occurred at the beginning and end of the decade.

During the storm of 27-29 December 1900, several serious disasters occurred off the coasts of Wales and South-west England. Off Holyhead, it was reported that a ship was overwhelmed by the storm and huge waves hurled all onboard 'into the furious sea' resulting in the loss of an estimated 37 lives (*Western Mail*, 29 December 1900, p.3). The wrecking of a barque off Bude resulted in a further nine fatalities, while three more lives were lost at Trevine despite the heroic efforts of the coastal community who managed to save four of the crew. The continuing gallantry of the lifeboatmen was also evidenced by 'another fine story of heroism' from Aberystwyth where the lifeboat deployed to aid three onboard a fishing smack 'when the storm was raging wildest'. In the rescue three of the lifeboat men were washed overboard and it was exclaimed it was 'nothing short of a miracle that in such a sea and in the inky darkness of the night they were rescued by their comrades'. Charity was evident as sailors of a vessel shipwrecked off Milford Haven were taken to the *Deep Sea Fishermen's Institute* and given food and drink while telegrams were despatched on their behalf. The local agent of the *Shipwrecked Mariners' Society* further covered all their costs at the institute despite the fact the crew were not members and humanely paid for their journeys home. Despite widespread reports of the 'extraordinary appearance' of flying debris, roofs lifted off, felled telegraph lines and huge storm surges across the country and a death toll of 49 at sea, it was remarked 'the immunity from loss of life on land is remarkable' (*Western Mail*, 29 December 1900, p.5).

From 1901 the source of the analysed reports changed to *The Guardian* due to differences in archival resource time span. *The Guardian* at the turn of the nineteenth century had a strong liberal focus predominately due to the influence of editor C.P. Scott (Read, 1995; Hampton, 2001). In this sense, the paper had aims and an agenda similar to the liberal and reformist *Liverpool Mercury* and *Bristol Mercury* as opposed to the more conservative *Western Mail* and *Western Times*.

The Guardian produced detailed reports on the other anomalously deadly event at the end of the decade during the storm of 2 to 3 December 1909. *The Guardian* described the event as a 'record cyclone' producing 'extraordinary variations in barometric pressure' as the barometric pressure was recorded to have dropped as low as 27.33 inHg and 27.38 inHg in Belfast (4 December 1909, p.6). The vast majority of the recorded fatalities (40) occurred due to the loss of the famous Isle of Man steamer the *Ellan Vannin* in Liverpool Bay which had 36 people onboard. Unlike any previous report, *The Guardian* (8 December 1909, p.10) issued a detailed report on the investigation carried out by divers which ascertained the vessel had been split in two and 'it would appear to be beyond doubt that there was a collision and that the *Ellan Vannin* was run into by a vessel'. This submarine investigation also ascertained attempts to lower the lifeboats had been made and the lack of bodies trapped in the hold enabled investigations to declare it was unlikely no one had met 'their fate in that terrible fashion' of being trapped below. Despite operations to determine whether another vessel had sunk nearby which commenced on 8 December, no vessel was found and it was subsequently ascertained the *Ellan Vannin* had split in two due to the tremendous impact when she was forced onto a Mersey sandbank. A telegram from Ramsey said that 20 women had been widowed and 70 children sadly orphaned and great commiseration was felt in both Liverpool and the Isle of Man (*The Guardian*, 8 December 1909, p.10).

Subsequent reporting and research highlight the regional significance of the sinking of the *Ellan Vannin* and note that the vessel was wrecked as it was forced onto the sandbank in a hurricane Beaufort Force 12 with waves in excess of 24 feet (7 m) noted in Liverpool Bay

(Henry, 1973) (depicted in Figure 5.6). A Board of Trade inquiry, therefore, did not attribute any blame to the captain or crew and a significant public subscription fund, not dissimilar to Macara's original fund for the Southport and St Anne's lifeboats disaster, was set up for the widows and orphans (Stafford, 1999). The fund found widespread support throughout society with considerable donations coming from sources including the prominent writer Hall Caine to Everton Football Club who played a charity exhibition match (Allen, 1997; Vamplew, 2016). The event also had wider cultural effects, with Caine and Josephine Kermode both writing poems on the disaster which mourned the loss while commemorating the heroism of the crew of the *Ellan Vannin* and Manx steam packets (Stafford, 1999).



Figure 5.6. Artistic depiction of the *Ellan Vannin* on her last fateful voyage during the storm of with the 2 to 3 December 1909. The mountainous seas with waves reaching 25ft and the Mersey lightship are depicted. Source: Poll, 1915.

Increasing scientific and statistical evidence featured in *The Guardian* reports of the early 1900s, which increasingly contained quantifiable, comparative and rational explanations of storms. Science and statistics were also often used to emphasise storm power and grandeur. During the storm of the February 16-21, 1910, an average wind speed of 50 mph at Blackpool produced 'huge waves which rushed landward with terrific power' presenting 'a magnificent spectacle' (*The Guardian*, 18 February 1910, p.8). Likewise, a report on the storm of 19 April 1911 noted that the barometer reaching 28.7 inHg was 'an unusual figure for the middle of April and is not common even in the winter' before exclaiming the roof of

a house on fire was torn off and as 'a rain of molten lead which poured' down (*The Guardian*, 20 April 1911, p.7). This reporting represented the increasingly rational scientific development in the period and the widespread scientific public recognition, yet the appreciation of immense storm power is retained (Pedgely, 2002).

The period of the First World War represented a notable decrease in reports and detail which is unsurprising given the reduced number of resources that could be employed and shifting reporting foci (Met Office, 2018). Detail and frequency did substantially increase after the war, with 228 storm-related reports in the 1920s compared to just 12 in the war period. Reports retained the sense of drama mixed with scientific objectivity and continued to highlight the persisting hazard posed by storms, primarily to shipping. Fatalities markedly decreased, which was often attributed to a combination of gallantry and the effectiveness of lifesavers at sea. Only five times in the decade were double figure fatalities reported, although notable fatal incidents persisted. Perhaps the most infamous incident of the early 1920s was the Rhoscolyn lifeboat disaster during the storm of 1 to 4 December 1920 in which five lifeboatmen died along with four men on the shipwrecked *SS Timbo* off Anglesey. *The Guardian* (20 December 1920, p.3) remarked 'The story of the North Wales disaster describes gallantry worthy of the best traditions of the Lifeboat Institution' and detailed the attempts of the lifeboat to establish a lifeline during which the five perished. A survivor exclaimed of the 'desperate fight for our lives' and the 'simply terrible' situation. Later reports noted the RNLI had awarded orders of merits and grants to the rescuers of the eight survivors while pensions were given to the widows of lost married men (*The Guardian*, 20 December 1920, p.3).

Unlike previous tragedies, there is little research indicating a direct major response to the tragedy although the lifeboat station at Rhoscolyn was shut soon after in 1924 (Jones and Rowlinson, 2015). This could be potentially explained by a combination of the considerable victim support provided by the RNLI and the increasing prevalence of safer, faster and more durable motor lifeboats which meant fewer stations were required (Fraser, 1998). The motor vessels which could travel much quicker than sail and oar vessels at a speed of 7

knots (Hudson *et al.*, 1993) were evident during the storm of 1 to 4 December 1920 as the Fishguard motor lifeboat reportedly rescued seven men on a vessel wrecked on the dangerous Fishguard Needles (*The Guardian*, 5 December 1920, p.3). The RNLI's recognition of the superiority of motor vessels was shown by their changing fleet which, by 1924, was one fifth motor vessels, while the last RNLI sail and oar propelled horse-powered launch occurred in 1936 (Hudson *et al.*, 1993; RNLI, 2022e).

Further 1920s reports reveal the increasing general scientific knowledge of storms, weather and climatic trends. After a period of three storms in close succession in December 1924, *The Guardian* meteorological correspondent stated that the final low pressure of the storm period which produced very strong winds initially formed near the Azores before moving up to Scotland (*The Guardian*, 3 January 1925, p.9). A hurricane force 12 gust was noted at Plymouth while gusts of 64 mph were noted at Chester and 60 mph was observed at Holyhead and Liverpool. A sense of relative perspective was also provided as it was noted these figures were far from remarkable in terms of wind speed records but the expansive nature of the storm meant it would 'take its place among the remarkable gales of the century'. Likewise, following a fourth storm in November 1926, *The Guardian's* meteorological correspondent exclaimed the 'ceaseless visitation of abnormally deep depressions which is giving rise to this serious state of affairs it is impossible to surmise (*The Guardian*, 15 November 1926, p.12). November 1926 was described as 'the worst ever recorded since observations were first made. Its series of gales and its terrific rainfall mark it already well above the ordinary experience for this month'. A high magnitude storm of 11 to 17 December 1929 which produced winds of 69 mph, 65 mph and 60 mph at Sealand, Eskdalemuir and the Scillies was also noted to stem from 'a very intense and very fast moving depression' from the mid-Atlantic. The depression travelled 1200 miles in 18 hours and was reportedly formed by a convergence of two air currents from sub-tropical and polar regions. Such meteorologically and climatically informative reports were not always blandly scientific. For instance, a December 1929 report which adopted a slightly humorous tone by exclaiming 'Not even the approach of Christmas could infuse a spirit of goodwill into a singularly wild and riotous December' as 'One of those fashionable Atlantic 'depressions' which was promptly dispatched to this country' (*The Guardian*, 27 December 1929, p.10).

The 1930s saw the continuation of detailed storm reporting as community impacts, economic costs and scientific explanations regularly featured in the 150 reports. This said dramatic storm reporting with a primarily qualitative emphasis was still evidenced such as during a ‘terrific thunderstorm’ in Lancashire on 14 June 1931 which produced a flood which attained ‘riverlike proportions and ran a course of over a quarter of a mile’ (*The Guardian*, 15 June 1931, p.9). The majority of the reports, however, regularly incorporated scientific information to help a likely more educated public understand the magnitude and duration of storms. The more frequent reporting of storm impacts and effects in more remote and rural locations was also comparably new when compared to early reports which primarily focused on impacts in and around major towns and to shipping in the Irish and Celtic Sea.

The most unique community insight followed the start of World War Two, when *The Guardian* published an account of a storm on the Isle of Eigg on 21 December 1939. The passage of a ferry carrying essential provisions to the island during the storm was dramatically described as ‘the white crests of the waves seemed to grow more vivid as the darkness fell’ as the ferry tentatively approached through ‘turbulent waters’ (*The Guardian*, 23 December 1939, p.12). Parallels with the war were made, as the correspondent noted the ‘machine-gun rattle of the slates’ and the sea came ‘crashing round and round our little shores’. The disappearance of the ferry from view and the added lurking menace of Nazi U-boats was also emphasised as the correspondent noted ‘those round black objects wandering idly in the smothering waves. And men in open boats drifting away from sinking vessels, peering hopelessly into the impenetrable storm’. However, the tone promptly changed with the arrival of the morning postman who stoutly remarked ‘A dirty night’ and the correspondent stated how his ‘stolid bearing shamed us somewhat out of our agitation’ (*The Guardian*, 23 December 1939, p.12). While the report likely uses the storm on Eigg as a metaphor for Britain’s wartime position against Nazi Germany, it provides a unique insight into the potential danger and emotional effects of storms in remote parts of Western Britain during the war. This frequent reporting on storms in more remote communities reflects the paper’s liberal emphasis and reporting of diverse social and cultural experiences (Owen, 2012).

The Guardian's commitment to the 'facts' which editor C.P. Scott deemed so important was also illustrated in the late 1930s as the paper considered popular weather legends and myths with scientific explanations (Read, 1995). A March 1937 report began with the Sir Francis Bacon statement that a dry March will 'foreshadow a wholesome Summer', and therefore 'by the proverbial wisdom of our ancestors 'March dust' is worth a king's ransom to the farmer' (*The Guardian*, 12 March 1937, p.12). However, *The Guardian* quipped the issue in March 1937 was 'to sift the dust from the snow'. The report then returned to a more scientific stance stating 'if statistics can be trusted at all, it seems, more than likely that Britain's siege by snow, rain, sleet, and howling tempest is about to be raised, after the worst weather of its type for sixty-seven years' (*The Guardian*, 12 March 1937, p.12). A subsequent report on 26 September 1937 addressed the 'meteorological myth' of the equinoctial gales (*The Guardian*, 26 September 1937, p.20). The paper provided historical context noting no ancient Greek and Roman scientific writer had mentioned such gales and the idea had originated from Bohun who in 1671 stated 'About the time of either Aequinox [sic] are the most flatulent seasons of the yeere [sic]'. The introduction of radio weather forecasts on public perception was also mentioned as the correspondent humorously stated 'we are all weather prophets (or were before we were pauperised by the six o'clock news)'. It was, however, stated the average observer could still contribute to improving weather knowledge by sending standardised observations to professional meteorologists (*The Guardian*, 26 September 1937, p.20).

The reports of the 1930s were also novel due to the inclusion of photographs. The first published photo of a storm impact in Western Britain followed the storm of 6 to 7 September 1936 in which a Lytham windmill was depicted badly damaged following the event (Figure 5.7). This inclusion of photographs was notable as they uniquely highlight storm devastation and have unique emotional effects (Höijer, 2010; Krause *et al.*, 2012).

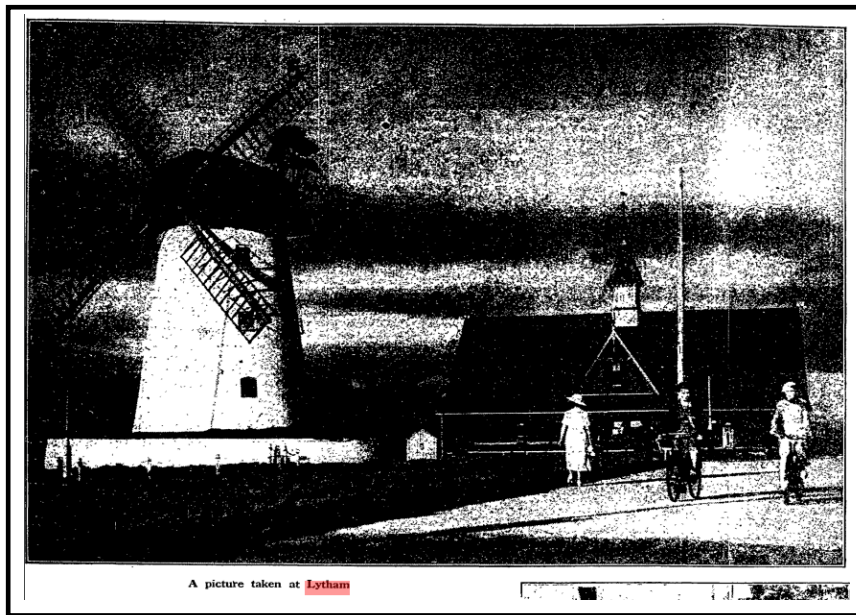


Figure 5.7. First newspaper report photograph of storm damage in Western Britain of the damaged Lytham Windmills (*The Guardian*, 8 September 1936, p.7).

World War Two understandably saw much reduced storm reporting with only eleven reports over the period. The vast majority of reports contained limited information on impacts and meteorological data, particularly between 1939-1943, when the outcome of the war was still uncertain. This likely reflects State and voluntary press censorship designed to limit any communication of meteorological information which could aid enemy forces or information highlighting potential societal weaknesses resulting from storms (Irum and Laila, 2015; Irving and Townsend, 2016). The few reports were generally succinct and described the locations of gales and floods as well as widely observed impacts. Notably, *The Guardian* (9 June 1944, p.3) did report the famous storm which delayed the D-Day landings from 5 June 1944 to 6 June 1944 when conditions were better suited but still stormy (Fleming, 2004). The storm hit the UK a day after the landings and *The Guardian* ran the headline 'Disastrous Storm'. While the focus was largely on the major losses of life and property sustained inland in Northern England and Wales, very strong winds were recorded on the North-west coast.

5.4.2. Post-War: Disaster to Catastrophe

The post-war period after victory in Europe coincided with the restart of frequent more detailed reporting with six reports after May 1945 and twelve in 1946. Succinct yet detailed reporting often supported with meteorological information continued throughout the late 1940s and 1950s, although the dramatic emphasis frequently observed in early twentieth- and nineteenth century reports was rare. Despite the reported minor damage and low fatalities during most storms in the period, two major events occurred.

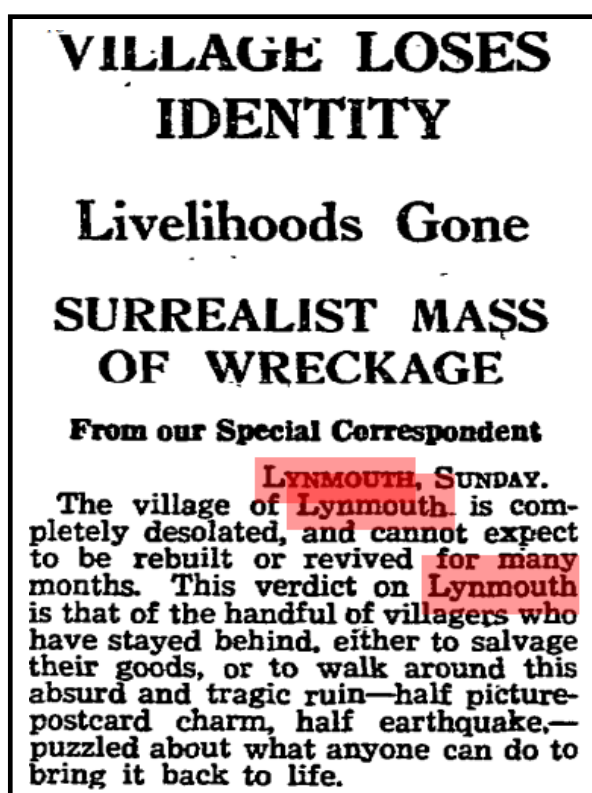


Figure 5.8. Initial report of the 1952 Lynmouth flood (*The Guardian*, 18 August 1952, p.5).

The first was the notorious Lynmouth Flood of 15 to 16 August 1952 during which torrential rain reportedly produced a flood that destroyed 100 buildings and claimed 34 lives (18 August 1952, *The Guardian*, p.5) (Figure 5.8). *The Guardian* firstly graphically expressed the devastation using a major cultural movement of the period with the subheading ‘Surrealist Mass of Wreckage’ (18 August 1952, *The Guardian*, p.5). The article further emphasised the ‘absurd and tragic ruin – half picture postcard charm – half earthquake’ in an effort to illustrate the near incomprehensibility of the scene and the seeming loss of Lynmouth’s

identity. The article then reverted to a more factual approach, determining the dual cause as 90 inches of rain falling within 24 hours on the already saturated surface of Exmoor but also noted how a recently engineered culvert had become choked causing a blockage which exacerbated flooding. Regarding the response, the report mentioned the first instance of the official declaration of a flood emergency noting 'The area has been declared an emergency one. Special constabulary have been drafted into the district. The military have been called in, and amphibious vehicles have been sent' (18 August 1952, *The Guardian*, p.5). On 3 September 1952 (*The Guardian*, p.4) it was further reported that a major State response was underway as eight permanent and twenty temporary houses were to be built for the homeless. Despite the evidence of considerably more State storm response and assistance than in previous storm reports, a public relief appeal also rose to £395,552 with donations coming from across British society.

Shortly after another tragic event appeared in the reports in the form of the loss of the *MV Princess Victoria* off Dumfries and Galloway in the storm of 30 January to February 2 1953 (*The Guardian*, 2 February 1953, p.6). In what remains the greatest loss of life in British waters (Carter *et al.*, 2019), 133 reportedly perished and despite the efforts of lifeboats, a destroyer and merchant ships only 43 were saved. This event also coincided with the infamous North Sea Flood and a reflective Cold War era report which also referenced the Lynmouth disaster remarked how the events highlighted that 'Natural calamity is a salutary reminder of the littleness of man: he may harness atomic energy, but a gale from the North still makes the seas perilous and can demolish his dwelling-places far inland' (*The Guardian*, 2 February 1953, p.6). This new implication of the insurmountable power of nature intriguingly resonates with religion-related concepts of fate, while also reflecting contemporary views of the limits of science (Slingo and Palmer, 2011; Alley *et al.*, 2019). Despite the correspondent's interpretation, such a high frequency of major UK storm disasters prompted major State management, engineering and social responses designed to mitigate and prevent a similar future disaster. Most notably the North Sea Flood highlighted major inadequacies in sea defences and disaster policy and the resultant Waverley Report formed the basis of modern science-informed UK disaster policy (Hall, 2015). The inquest into the sinking of the *MV Princess Victoria*, which found a combination of weak stern

hatches and poor deck drainage caused the sinking, also prompted engineering revision into vessel design (Anyanwu and Okoroji, 2014). The wider event also served as a catalyst for social change triggering a rise in blame and a growth in public expectation for effective State protection and response to major natural disasters and catastrophes (Hall, 2011; O'Hara, 2017).

The reports and relevant research indicate that the destructive events and responses of the post-war period appear to mark a transition in the government and cultural perception of storms and floods. The major policy changes of the 1950s marked a clear national acceptance that storms and floods were not merely disasters, defined as unfortunate and predestined occurrences (McRobie, 2005; Hall, 2015; Higgins, 2017). Instead, the policy changes showed recognition that storms and floods were instead environmental catastrophes stemming from 'the intersection of natural hazards ... with human populations in varying states of economic, social, and cultural vulnerability' (Anderson, 2011, p.1).

5.4.3. Technocracy: Benefits and Limitations

The later reports of the 1950s indicated a low fatality rate with only 12 of 70 events (February 1953 to December 1959) registering a fatality and no single storm had more than 2 deaths. Reports were predominantly succinct and scientific with references to climate records and meteorological data. Despite reduced fatalities, storms continued to have significant socio-economic impacts in the UK.

The reports confirming the high magnitude and widespread impacts of the storm of 26-29 November 1954 in Western Britain was of particular relevance to the wider thesis. Specifically, the meteorological, tidal gauge and sedimentological Chapter Four results exhibit the event likely corresponded with storm surge depositional evidence recorded in cores FSE3 (2.64 – 2.68 mOD) and SIC3 (2.17 – 2.29 mOD) in the Three Rivers Estuarine Complex saltmarshes. The newspaper reports noted how 'gales at seas and floods ashore' brought distress across much of Britain during the severe storm (*The Guardian*, 27

November 1954, p.1). Torrential rain produced flash floods at Gunnislake, Cornwall which caused waters to rise to a depth of three feet in homes and the parish hall was used as an evacuation centre. Likewise in Lancashire, 7,000 acres of farmland were submerged and the Glastonbury Caves were flooded 'as they were a million years ago'. The report also noted technological change as it featured the first instance of a marine rescue attempt by helicopter as a Liberian Tanker foundered in the Irish Sea although the crew were eventually rescued by lifeboat. There was also increasingly frequent mention of the impacts of storms on air services. For example, the strong winds during the storm of 7 September 1954 were accredited to have reduced flight times from Manchester to Belfast by 28 minutes (*The Guardian*, 10 September 1954, p.6). Likewise, the snowstorm of 4 to 8 December 1954 resulted in the cancellation of all Northern air services (*The Guardian*, 5 December 1954, p.1).

The reports of the 1950s and 1960s were increasingly focused on storm impacts on holidaymakers and marine incidences featuring smaller leisure craft. During the storm of 9 - 14 August 1957, it was reported an RAF Shackleton aircraft was deployed to identify stricken yachts taking part in the biannual Fastnet Race in the Celtic Sea (*The Guardian*, 13 August 1957, p.10). Such were the conditions and 'mountainous seas' only 18 of 43 starters finished although all returned safely with no casualties unlike in future editions of the race. At New Brighton, it was reported that 'holidaymakers helped to mop out flood water from hotels and boarding houses' following torrential rain which flooded shops to the depth of a foot as the fire brigade answered more than 20 calls (*The Guardian*, 13 August 1957, p.10). The famous Blackpool Pleasure Beach was also regularly featured in reports of great storm surges but often sustained major damage such as in the storms of 25-26 August 1957 and 24 September and 3 October 1958 during which the fairground and illuminations sustained £1,000s worth of damage (*The Guardian*, 31 August 1957, p.3; *The Guardian*, 4 October 1958, p.5). This appearance of tourists and holidaymakers in reports most likely reflected the increasing post-war liberties of the working classes who transformed resorts such as Blackpool, Morecambe, New Brighton and Tenby into major holiday destinations (Walton, 2000).

This growth in popularity prompted a need for coastal infrastructure which, in accordance with the policies of era, was often defended by hard engineering structures (French, 2002; Phillips and Jones, 2006). Such 'hard' structures designed to 'defend' against storms and inundation faced significant issues during major storms and surges which often featured in reports (Thomas *et al.*, 2016; Farr, 2017). During the storm of the 25-26 August 1957, the great storm surges destroyed the end of the uninsured defences at Morecambe with damages estimated at £10,000 (*The Guardian*, 27 August 1957, p.10). The limitations of such engineered defences were however most evident during the Storm of 7 - 8 March 1962 when the defences at Penzance were breached during a storm surge and an estimated £200,000 was done and the mayor rapidly opened a disaster fund (*The Guardian*, 9 March 1962, p.1). *The Guardian* (9 March 1962, p.1) reported a witness stated 'the promenade looks as if it had been hit by an earthquake or major blitz' to aptly convey the destruction to the readers of the era, while the station and many businesses were closed for prolonged periods due to the major damage. Further research indicates the Penzance storm and surge was a very high magnitude with south-westerly winds registering 93 mph on the Scillies (Haigh *et al.*, 2017). At Milford Haven, a maximum water level with a 21-year return period was recorded while even at the east-facing Nelwyn gauge, surges twice peaked at 0.8 m and 0.7 m (Haigh *et al.*, 2017). However, unlike the major response to the storms of 1953, such was the underfunded and poor response, breaches in the promenade caused by the 1962 storm were not satisfactorily addressed and 40 years later remained areas of vulnerability (Cornwall Council, 2003). The continuing costly government commitment to hold-the-line hard engineering policies was evident even 15 years later: the reports following the Storm of 10 to 13 November 1977 noted how the government suggested it may give 'special financial assistance to Lancashire seaside resorts' (*The Guardian*, 16 November 1977, p.28). This was due to the severe damage sustained in Blackpool and Flyde and Wyre district where the authorities requested repair funds exceeding £1 million. The Prime Minister stated 'Government facilities can be made available if necessary' but as of 16 November many weakened coastal defences were plugged only with sandbags. North-West MPs also appealed not only for direct financial aid but for the use of the job creation scheme to repair the damage which was estimated to cost another £1 million (*The Guardian*, 16 November 1977, p.28).

The subsequent reports of the late 1960s and 1970s continued with the succinct and scientific approach detailing socio-economic storm impacts throughout Western Britain. The reports exhibited a marked increase in State-led storm lifesaving response efforts on land but particularly at sea. In an effort to save a small fleet of boats engulfed by a Force 8 storm off the Cornish coast, navy helicopters, tugs and lifeboats were all deployed to assist the distressed vessels (*The Guardian*, 19 June 1971, p.1). While two died, 30 were saved by the rescue efforts which were believed to have greatly mitigated the disaster. Likewise, during the Storm of 5 to 16 January 1974, two Navy helicopters rescued seven survivors and two dead from an overwhelmed Danish vessel in the Celtic Sea (*The Guardian*, 17 January 1974, p.1). While the Royal Navy Helicopter Search and Rescue service had assisted with civilian storm rescue and response since 1953, the service was revolutionised by the introduction of the revolutionary West Sea King helicopter in 1969 (Morris, 2015). The Sea King was considerably better designed and more effective in perilous offshore rescues than previous helicopters (Morris, 2015) which likely explains the increased mention of military-assisted storm rescue operations.

While the impacts were comparatively minor, the storm of 13-15/03/1977 also featured in a diverse range of *Guardian* reports. This was significant given the meteorological, tidal gauge and sedimentological data in Chapter Four exhibit the event likely produced the depositional evidence recorded in core SIC3 2.62 – 2.66 mOD in the Three Rivers Estuarine Complex saltmarshes. The varied reports noted how the storm produced conditions that ‘were conducive to desperation’ in a football game in Bristol (*The Guardian*, 16 March 1977, p.16). Winds ‘approaching gale force blew gusts of rain’ towards one goal creating a considerable advantage (*The Guardian*, 16 March 1977, p.16). Elsewhere, a ‘Country Diary’ extract noted how a ‘force seven gale pounded the Cumbrian coast’ while walkers in Cumbria were unable to stand such were the force of the gusts (*The Guardian*, 14 March 1977, p.10). The storm was also noted to have swept Scotland and a hailstorm affected rugby (*The Guardian*, 14 March 1977, p.17). A weather report from March 17 also depicted a great low (984 millibars) south of Iceland with close isobars highlighting the large pressure

gradient and strong winds over South Wales and Western Britain (*The Guardian*, 17 March 1977, p.22).

Perhaps the most infamous marine tragedy proved to be the storm of 19 to 30 December 1981 during which hurricane force 12 winds were recorded (*The Guardian*, 21 December 1981, p.1). Overall 52 people died in the event, with 30 lost after the vessel *Marina di Equa* was lost in the Western Approaches and reports indicated only an empty life raft was sighted by search and rescue aircraft. However, it was the tragedy of the loss of the Penlee lifeboat, *Solomon Browne*, and her eight crew which deployed in Mount's Bay, Cornwall to aid the *Union Star*, that caused perhaps the greatest sorrow. An official inquest concluded the *Union Star* and her eight crew were also lost due to engine failure caused by salt water contamination while the 'dangerous lee shore; the extreme severity of the weather, wind and sea' all contributed to the catastrophe (*The Guardian*, 19 March 1982, p.26). The lifeboat was subsequently lost after it was 'overwhelmed and capsized in the waves as she made persistent and gallant endeavours to save the lives of all from the *Union Star*'. The disaster fund donations for the relatives of the victims exceeded £3 million. The correspondent remarked the events served as 'a grim reminder of the power of the seas off Cornwall' (*The Guardian*, 31 December 1981, p.2). While the direct response to the tragedy was to replace the lifeboat with a larger, more-sea worthy vessel based at Newlyn, the main impact was that the incident ultimately highlighted to the public how RNLI lifeboatmen were still willing to make the ultimate sacrifice to save lives at sea (Dalziel and Pelot, 2019). In a wider context, independent research notes the winter of 1981-82 and the Penlee lifeboat disaster storm were exceptional compared to climatic records with the strong winds and persistent low temperatures contributing to the large UK-wide impact (Sholl, 2020).

The storm of 13-15 December 1981 'which brought near-Siberian conditions' also had large impacts in the South-west and was relevant to the wider thesis (*The Guardian*, 14 December 1981, p.1). Powercuts were experienced throughout the West Country and 500,000 people were affected. Major roads and railways throughout the South-west were also closed and blocked causing major disruption. At sea, the Torbay lifeboat assisted a vessel in danger

while a rescue operation by a fleet of ships and helicopters in ‘diabolical conditions’ saved 36 from a stricken Ecuadorian ship off the Dorset coast (*The Guardian*, 14 December 1981, p.1). Great storm surges breached seawalls in multiple places in the Bristol Channel with Weston-Super-Mare particularly badly hit as many inundated houses were evacuated and the ‘police appealed for small boats and inflatables to be taken to the Western General Hospital, near the seafront’ (*The Guardian*, 14 December 1981, p.1). Houses were also flooded in Burnham-on-Sea and in the Cumberland Basin near Bristol. Chapter Four and Croudace *et al.* (2012) also exhibits that this storm had a notable environmental impact. Force 10 winds from WNW were recorded at Pembroke which produced a storm surge of 0.92 m at Milford Haven (Jardine *et al.*, 2022). Radionuclide dating indicates this most likely resulted in abrupt coarse sediment deposition in the saltmarshes of the Three Rivers Estuarine Complex while Croudace *et al.* (2012) show the same event produced a substantial hiatus in the sedimentary record from cores collected east of Cardiff and the Newport Deep. The collective evidence, therefore, shows this storm most likely had a widespread human and environmental impact in the Bristol Channel. In a broader context, *The Guardian* also ran the headline ‘Britain sliding towards a little Ice Age’ (*The Guardian*, 14 December 1981, p.3). While this appears odd in a twenty-first century context, a combination of limited (<10%) genuine scientific research and biased oil-backed studies, promoted this consensus in the 1970s and early 1980s (Petterson, 2008; Bonneuil *et al.*, 2021). This makes the ‘Ice Age’ assertion appear partially reasonable when the research of the period is considered.

In a similar manner to the 1970s, storm reporting continued to be succinct and scientific with frequent mention of major military-assisted lifesaving attempts. Most notably, the impacts and forecasting repercussions of the Great Storm of 1987 between 15 to 18 October received comprehensive coverage although the South and East of England were most affected. *The Guardian* emphasised how the 1 in 200 year storm had ‘paralysed financial markets’ and £1.4 bn of UK losses were estimated (*The Guardian*, 17 October 1987, p.37; *The Guardian*, 17 October 1987, p.38). Despite the infamous predictions and widespread criticism of the forecasts (Shutts, 1990), *The Guardian* produced a figure showing the storm path (Figure 5.9) and emphasised how the explosive cyclogenesis termed

'weather explosion' was 'virtually unpredictable: the product of a freak interaction between the original, harmless depression, a complex of surrounding weather systems, warm air above the Channel and the jet stream'. Subsequent reports also noted the ensuing forecasting debate as it was reported that 'continental weathermen' had predicted the storm 36 hours before British meteorologists. It was, however, suggested that while it had been a lack of foresight on the Met Office's behalf, 'what would one have done even if they knew of such impending tempestuousness?' The Met Office set up an internal inquiry and the Ministry of Defence set up an external inquiry into the failed predictions, which was a result of the 'alarm in Whitehall at the scale of destruction caused by the lack of storm warnings' (*The Guardian*, 21 October 1987, p.3). Further political ramifications were also noted as councils were also blamed by the Environment Secretary who stated councils should have had contingency measures and would not be exempt from overspending penalties during the initial clean up operation. Relevant research notes the Met Office and the BBC's Michael Fish drew heavy criticism for the failed predictions (Houghton, 1988; Hall, 2017). This criticism promptly catalysed major changes in Met Office climate and weather monitoring including the establishment of the National Severe Weather Warning Service, the retraining of forecasters and the addition of a new predictive supercomputer which produced substantially more warnings and increased forecasting accuracy (Neal *et al.*, 2014; Met Office, 2022a).

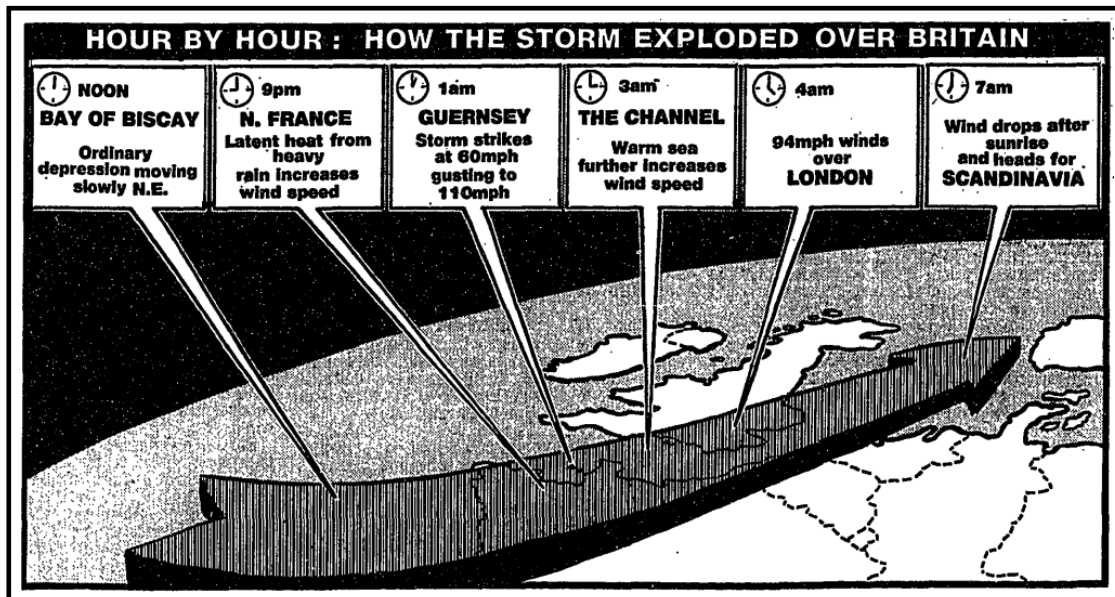


Figure 5.9. Diagram noting the weather events and path of the Great Storm of 1987
(*The Guardian*, 17 October 1987, p.1)

5.5. Late Twentieth to Twenty First Century: Climate Change, Social Media and Live Storm Reporting

5.5.1. Storms and Climate Change

The issue of the Met Office forecast again arose after another failure to predict the infamous Burns Day storm of 24 to 27 January 1990 (*The Guardian*, 26 February 1990, p.1). The storm was deadly with the loss of 47 lives although most fatalities were recorded outside Western Britain (*The Guardian*, 5 January 1990, p.2). The damage was also very extensive: insurance companies estimated damages of £3.37 bn, which was to later be confirmed as the UK's most expensive storm ever (Cerrato *et al.*, 2020). This was also the first *Guardian* report that directly linked storm severity and climate change. *The Guardian* reported scientists 'believe the storms may be a result of the Greenhouse effect as the collision of warm air in the tropics and cold air at the poles causes depressions that sweep across the Atlantic'. Professor Peter Evans stated 'The theory is that the vortexes become deeper and the isobars closer together and therefore the storms more violent' (*The Guardian*, 26 January 1990, p.3). The theory subsequently led the newspaper to hypothesise as to whether the recent occurrence of two exceptionally severe storms were early signs of increasing atmospheric storminess resulting from global warming. This said, *The Guardian*

emphasised the developing stage of the science and theory. A review of hurricane dynamics published on 28 August 1992 (*The Guardian*, p.33) noted that although the theory was grounded in sound atmospheric physics, definite conclusions between hurricane frequency and global warming could not yet be drawn. While the reports clearly emphasised that this was only theory, from a twenty-first century perspective they exhibit foresight given the likely future predictions of global warming increasing the frequency of high magnitude storms in the UK (Lowe *et al.*, 2018; Met Office, 2022b).

The early and mid-1990s reports, however, seldom refer to the link between global anthropogenic global warming and increasing storminess, with more of a focus on increasing forecasting capabilities resulting from computing development. The link featured shortly after the signing of the Kyoto Protocol, in reports of a stormy period from 25 December 1997 to 5 January 1998 in which nine fatalities and widespread disruption and damage were documented throughout Western Britain (*The Guardian*, 28 December 1997, p.2; *The Guardian*, 5 January 1998, p.1). Somewhat bizarrely, a subsequent article noted the stormy period had revealed the ‘peculiarly British love of thoroughly nasty weather’ before exclaiming ‘the good news is that with global warming Britain is likely to be hit by ever weirder weather and tornadoes, as the Met men say, there's more to come’ (*The Guardian*, 11 January 1998, p.7).

Global warming was increasingly accepted as a contributing factor to increasing storminess in the reports of the late 1990s and 2000s. These reports also began to acknowledge a need for political action to prompt climate change adaptation designed to reduce the consequences of this increasingly severe weather. A report following the storm of 29 to 30 October 2000, for instance, noted ‘green lobby groups were today urging politicians to act now over wild weather conditions’ (*The Guardian*, 30 October 1998, p.25). The recent storm was called ‘just a taste of things to come’ according to Friends of the Earth. In contrast, the Environment Secretary Michael Meacher, said: ‘It would be wrong, every time there is a climatic impact, to assume that it is climate change, global warming’. He did, however, acknowledge that the gales ‘almost certainly have climate change as a contributory cause’

before noting that much was being done to prevent people from being flooded, especially in high-risk areas including a £4bn investment into flood defences over the coming three years (*The Guardian*, 30 October 1998, p.25). Subsequent reports indicated the acceptance of the link between climate change and extreme weather by National and Global agencies. Flash flooding in Western Scotland on 5 July 2001 from which caused many families to flee their homes following the longest drought since 1976 prompted the UK Environment Agency (EA) to declare climate change was a key reason for the increasingly extreme conditions (*The Guardian*, 6 July 2001, p.6). Likewise, an article on wider climate change published on 22 August 2002 (*The Guardian*, p.17) noted that the UN Secretary General Kofi Annan had declared humans were ‘changing the natural balance of the Earth’. The Red Cross and Red Crescent had also reportedly observed increasing catastrophes. Specifically, 17/23 of the worst floods of the last 50 years had occurred since 1992 while the fact the 1990s contained 6 out of the top 10 of the warmest years ever recorded was also seen as evidence of the positive relationship between climate change and extreme weather (*The Guardian*, 22 August 2002, p.17).

5.5.2. Online and Live Reporting

Online reporting from 2003 onwards indicated high magnitude storms continued to cause major hazards in Western Britain with the storm of 9 to 10 January 2005 proving particularly deadly as eight lives were lost following torrential rain and widespread flooding in Carlisle (*The Guardian*, 12 January 2005). The EA and Met Office had issued widespread public flood warnings and alerts in England while the Scottish Environment Protection Agency issued 21 flood watches and 13 more serious flood warnings (*The Guardian*, 10 January 2005). This Carlisle flood report was the first to feature examples of government agency flood warnings designed to aid public preparedness and in certain instances evacuation. The warnings evidenced a form of recognition of the need for clear public communication of often complicated scientific forecasts at a local level (Parker *et al.*, 2007). While the likes of the reported ‘flood watches’ and ‘flood warnings’ have been modified since (O’Shea *et al.*, 2020), their appearance represents the State development of a ‘translational discourse’ (Faulkner *et al.*, 2009) designed to ultimately reduce local community vulnerability.

Reports of the 2000s were, however, not solely focused on major storms with nationwide impacts. On 24 September 2007, *The Guardian* noted how 11 small tornadoes had struck the UK on 23 September and a fire brigade spokesman stated 35 houses had been affected and '10 were severely damaged'. In 2010, detailed reporting on the very heavy rain and ensuing flooding on the Cornish Peninsula noted the direct cause was more than 40 mm of rainfall in 2 hours (*The Guardian*, 18 November 2010). St Blazey, St Austell, Mevagissey and Lostwithiel were particularly badly hit and more than 100 properties were flooded. These reports amongst larger national reports evidenced *The Guardian's* continued commitment to reporting societal storm impacts at local levels in more remote areas.

A key new feature in *The Guardian* reporting emerged following the Storm of 2 to 3 January 2012 in the form of a 'live blog' (*The Guardian*, 3 January 2012). The blog ran for the duration of 3 January from 09:58 to 16:41 and featured news from throughout the UK on the storm impacts. The blog relied heavily on Twitter and featured information from different sources including government agencies, businesses, politicians and different correspondents (e.g. sport) to communicate the widespread impacts of the storm. Accompanying reports noted gales of 106 mph and heavy hourly rainfalls of 5 mm in Cornwall and 6 mm in South Wales which caused widespread devastation throughout Western Britain. This reporting exemplifies the major impact of social media (particularly Twitter) on catastrophe reporting (e.g. Palen and Hughes, 2018; Solomon and Henderson, 2019). It exhibits how social media has enabled the rapid dissemination of catastrophe impacts and responses from different sources which was not previously possible and therefore provides the public with a more varied (but not necessarily accurate) picture of catastrophe (Haddow and Haddow, 2013; Karami *et al.*, 2020).

The ensuing *Guardian* reports both in live feed and standard form likewise often cited social media outlets to exhibit storm information from different sources. The beginning of the Met Office storm naming project with Storm Abigail which hit Western Britain between 12 to 13 November 2015 heightened this social media input as *The Guardian* (09:00 13 November

2015) drew on a range of sources to communicate the impacts and effects. Reports featured social media information from the Met Office warning of amber 'be prepared' warnings in place. Tweets from travel companies and dramatic photography of the nationwide impacts were also reposted. Despite the increased social media coverage, reports still contained independent input from a meteorologist who warned of '100-150 mm [of rainfall] over west Cumbria and widely 50-75mm' (*The Guardian*, 12:33 13 November 2015). The reports also underlined the purpose of storm naming noting 'officials hope the initiative will help raise awareness of severe weather and ensure greater public safety' while clear public warnings and advice were also relayed. Subsequent research and the continuation of the Met Office storm naming highlights the positive impact of the naming project which not only makes storms more tangible and understandable but also enables the rapid dissemination of national agency warnings designed to safeguard the public from storm threats (Charlton-Perez *et al.*, 2019).

The following reports featured a combination of more impactful named storms and regional events which were mostly comprehensively reported on with reports drawing on a range of sources. Following particularly impactful storms, there was an increasing narrative suggesting government policies were enhancing current and future community vulnerability. After Storm Frank between 29 to 31 December 2015, *The Guardian* (30 December 2015) reported the Chancellor, George Osborne, was accused of 'jeopardising Britain's crumbling flood defences over the past five years by prioritising cuts to the deficit' while the research of environmental economics expert, Professor Simon Wren-Lewis, was shown to highlight infrastructure spending may need to rise sharply to adapt to climate change. Likewise, after a review of the EA strategy on 9 May 2019 the chairman of the EA was also quoted as stating 'we can't win a war against water by building away climate change with infinitely high flood defences'. He stressed 'consistent standards for flood and coastal resilience' were required that ultimately enabled communities to understand their risk and give them more control regarding adaptation and response. It was further emphasised action 'now without delay' and 'a different philosophy' was greatly needed to build 'climate resilient' communities, homes and businesses (*The Guardian*, 9 May 2019).

This consensus was also underlined following Storms Ciara and Dennis in February 2020, which represented the final major storms of the research period. The 34 reports including two live feeds highlighted the extent of the catastrophe in Western Britain which are analysed in detail Chapter Eight. *The Guardian* reports and embedded social media posts from government agencies in live feeds indicated a record 594 flood warnings and alerts were recorded on 16 February and The Met Office issued its first red warning for rainfall in South Wales in an attempt to communicate the grave danger (*The Guardian*, 20:05 16 February 2020). The storms claimed four lives in the region while it was estimated £425 m worth of insured damage was sustained through a combination of wind-related and flooding damages in Storms Ciara and Dennis respectively. Reportedly 599 and c.800 properties had been respectively flooded in England and Wales with the vast majority of Welsh incidents occurring in the Rhondda Valley where many were evacuated (*The Guardian*, 16:24 19 February 2020). Although rescue services and communities received widespread praise for their effective response and flood defences protected 25,000 UK properties, the scale of loss prompted widespread criticism of government policies in subsequent *Guardian* reports. Several reports featuring scientific evidence from experts in an array of disciplines implied government shortcomings in flooding management, energy, planning and the broader economic approach to climate change had enhanced community storm vulnerability with the chief scientist at Greenpeace reported as stating: 'It's high time both local and central government started treating the climate emergency as if it was real – because it is' (*The Guardian*, 18:24 19 February 2020; *The Guardian*, 12:28 23 February 2020; *The Observer*, 06:12 23 February 2020). As Chapter 8 highlights, wider research supports *The Guardian* narratives that widespread climate change-related policy adaptation must occur if UK infrastructure and communities are to be adequately protected from likely more frequent high magnitude storms (e.g. Lowe *et al.*, 2018; Elliot, 2022; Newson *et al.*, 2022).

5.6. Summary

This analysis highlights the diverse and evolving characteristics, impacts and representation of storms from 1800 to 2020. The chapter firstly exhibits how the storms of the early nineteenth century were frequently interpreted as a product of God's will and death or life

as governed by divine fate. The storms of the Napoleonic period are shown to have produced major issues for the British Navy as well as providing opportunities for piracy and wrecking. The mid-nineteenth century witnessed improvements in meteorology and increasing scientific predominance and awareness. However, the deadly *Royal Charter Storm* of 1859 is exhibited to have drastically changed weather forecasting, which subsequently became a key topic of national debate in the 1860s. The analysis shows how the emergence of the conservative *Western Mail* alongside the pre-existing liberal newspapers provided new insights into scientific and forecasting development and the wider economic and commercial effects of storms of the 1870s and 1880s. The chapter demonstrates how late nineteenth century saw the actions and gallantry of lifeboatmen and the RNLI grow in prominence while the Bristol and Bath Floods of 1894 also marked the first clear long-term storm mitigation and prevention response which contrasted earlier independent and often insufficient responses as reported during the Bridgend Flood of 1877.

The research indicates early twentieth century reports from *The Guardian* were more scientific and succinct than in the previous century, while more emphasis was placed on storm impacts in remote communities. The war periods saw reduced reporting which was followed by three major post-war storm catastrophes in 1952 and 1953 which prompted a rise in technocracy. Although the comparatively low fatality rate and reports of numerous successful air-aided rescue operations exhibited the merits of technocratic improvements, a combination of major coastal defence issues and inaccurate forecasting of the Great Storm of 1987 and Burns' Day Storm of 1990 evidenced major limitations. From 1990, the analysis highlights that the relationship between anthropogenic climate change, storms and extreme weather became an increasingly frequent topic as the likelihood of the relationship between the factors grew more certain. The twenty first century switch to online reporting and the use of live storm blogs and feeds featuring information from social media from January 2012 is shown to have also changed the dynamics of reporting which subsequently drew on a range of diverse sources. The analysis of the final reports of the period exhibits that reporting placed an increased emphasis on the growing scientific climate consensus, often showing exactly how key shortcomings in government climate adaptation and environmental policies enhance community and infrastructure vulnerability.

Chapter 6: The *Royal Charter* Storm of 1859 and Storm Prediction: Coastal Communities, Technocracy and Storm Subcultures

Paper Context

This chapter consists of a paper that has been edited following reviewer revisions and will be resubmitted on reviewer request to *Environment and History*. The referencing style conforms with the journal requests.

Jardine designed the study, undertook the archival data gathering, conducted the analyses and wrote the paper. Selby and Higgins contributed to the case study interpretation and assisted in the editing of the paper.

Abstract

Major coastal storms have profoundly impacted the communities of Western Britain and have shaped enduring storm subcultures. Storm subcultures are understood as long-term regional social, political and cultural response trends arising from periodic storm threats. Analysis of the *Royal Charter* Storm of 1859 and the ensuing response to the event highlight that storm catastrophes can evoke long-term social, political and cultural responses. The *Royal Charter* Storm is shown to have changed storm understanding, prediction and warnings in Britain with key long-term implications for coastal communities and national governance. The research further highlights how open knowledge exchange, inclusive decision making and partial community autonomy is essential for effective early warning systems and long-term hazard mitigation. Historical and current appraisals of policy illustrate the shortcomings of centralised, top-down technocracy and the importance of adaptive inclusive storm subcultures. Environmental history is shown to contribute to improving the understanding of the importance of community agency in enhancing hazard understanding and forming effective early warning systems. This understanding is important to ensure that national governments learn from past storm experiences and pursue

inclusive policies that best foster sustainable storm subcultures and long-term community resilience.

Keywords

Storms, disaster subcultures, environmental history, technocracy, community resilience.

6.1. Introduction

Throughout 25 and 26 October 1859, Western Britain was visited by ‘a gale of wind sterner and more destructive than any tempest which we have experienced’.¹ The storm was one of the deadliest ever recorded in Britain and was notable for the loss of the ship *The Royal Charter* off Anglesey, North Wales which alone accounted for 459 deaths.² Three days later there was ‘scarcely a vestige of the *Royal Charter* remaining’ while ‘frightfully mutilated’ bodies littered the shores.³ This event became ‘a topic of mournful recollection with all the elders of the long shore-men and sea-faring people’ and prompted major changes in storm response and prediction.⁴ The most prominent response came from Admiral Robert Fitzroy, the father of the Meteorological (Met) Office. Under his direction the early Meteorological (Met) Office began issuing official ‘storm warnings’ in 1861 using barometrical and telegraph information from throughout the UK and Western Europe. The new centralised storm warnings issued directly by the Met Office in London represented one of the first national early warning systems (EWS) and changed the way coastal communities and the UK government understood storm meteorology and threats.⁵

Previous historical studies have illustrated that research into past high magnitude storms can unearth the profound social, political and cultural implications of storms which remain relevant. Morgan shows how the Bristol Channel floods of 1607 evoked a contested response divided between divine attribution and more rational practical approaches, while Silver reveals how the Great Storm of 1703 catalysed a form of populist rhetoric response and post-disaster community building.⁶ Despite scientific developments, storms have

¹ *Western Times* (Exeter), 5 November 1859, 3.

² L. Villiger, M. Schwander, L. Schürch, L. Stanisc and S. Brönnimann, The “Royal Charter” Storm of 1859, in: S. Brönnimann (Ed.), *Historical Weather Extremes in Reanalyses*, Bern, 2017, 35-45.

³ *Bristol Mercury* (Bristol), 29 October 1859, 4.

⁴ *Western Times* (Exeter), 29 October 1859, 5; H. Roberts, The 150th Anniversary of the first public weather forecast, *Weather* 66(8) (2011) 221-222.

⁵ Walker, M., 2011. History of the meteorological office, *Cambridge University Press* (2011) 3-26.

⁶ J.E. Morgan, Understanding flooding in early modern England, *Journal of Historical Geography* 50 (2015) 37-50; S.Silver, Making Weather: Communication Networks and the Great Storm of 1703, *Eighteenth-Century Fiction* 30 (2018) 495-518.

continued to have significant socio-economic and political impacts in Britain: for example, Hall shows how the catastrophic 1953 North Sea flood resulted in an increased public demand and expectation for more efficient and effective disaster response from the UK government.⁷ The wider socio-economic and political impacts of high magnitude storms remain great. The estimated £425 m losses resulting from Storms Ciara and Dennis in February 2020 served as a stark reminder of storm vulnerability in Britain and subsequently increased political pressure to improve storm and climate change-related adaptation.⁸ Such high magnitude events highlight the enduring impacts of coastal storms and illustrate the importance of understanding their often complex effects as the storm threat likely increases in Western Britain due to climate change.⁹

While future modelling of storm and climatic variability is important in informing storm response, an environmental history approach can improve the understanding of social, political and cultural effects of storms.¹⁰ The appraisal of the effects and impacts of past storms on British society provides an important insight into how society has variably perceived and therefore responded to storms over time. Such analyses can also highlight how British society has adapted to storms and floods as well as underline the enduring enviro-cultural relationships resulting from exposure. Bankoff's research on historical flooding in Eastern England exhibits how these relationships have been influenced by the persisting North Sea flood risk and are vital to community resilience as culture is ultimately the medium through which risk perception and management decisions are made.¹¹ Bankoff's research uses written archival sources to show that, since the thirteenth century, the communities of The Fens have had to find ways of adapting to a dynamic flood risk. In this process, communities and governments become partners in the construction of a very particular type of heavily defended and engineering landscape. Persisting efforts required to defend the landscape have subsequently produced a unique culture of social cohesion,

⁷ A. Hall, The rise of blame and recreancy in the United Kingdom: A cultural, political and scientific autopsy of the North Sea flood of 1953, *Environment and History* 17 (2011) 379-408.

⁸ M. M.Siegert, S.Bacon, D.Barnes, I.Brooks, H.Burgess, F.Cottier, D.Depledge, K.Dodds, M.Edwards, R.Essery, and K.Heywood, The Arctic and the UK: climate, research and engagement, *Grantham Institute Discussion Paper* 7 (2020) 2-6; T. Antippas, V. Jack, V. M.R.Kumar, and N.Dutt, Lessons on climate change resilience, in: S.Sussman, N.Tophoff, R.Dorofte, P.Rombach, P.King and C.Murgu (Eds), *Review of European & Transatlantic Affairs* 4(1), 2020, 142-166.

⁹ J.A.Lowe, D.Bernie, P.Bett, L.Bricheno, S.Brown, D.Calvert, R.Clark, K.Eagle, T.Edwards, G.Fosser and F.Fung, 2018, *UKCP 18 science overview report 2.0*, Met Office Hadley Centre: Exeter, UK, 2018, 2-15.

¹⁰ P.J.Knight, T.Prime, J.M.Brown, K.Morrissey, and A.J.Plater. Application of flood risk modelling in a web-based geospatial decision support tool for coastal adaptation to climate change, *Natural Hazards and Earth System Sciences* 15 (2015) 1457-1471; J.Dronkers and T.Stojanovic, Socio-economic impacts—Coastal management and governance. In: Quante.M and Colijn.F (Eds), *North Sea Region Climate Change Assessment*, Springer, Cham, 2016, 475-488.

¹¹ G.Bankoff, The 'English Lowlands' and the North Sea basin system: A history of shared risk, *Environment and History* 19 (2013) 3-37.

economic cooperation and political governance which continues today. Analyses of historical storm effects and responses can therefore provide important insights into what Moore and Anderson originally term 'disaster subcultures' which concern long-term regional cultural trends 'geared towards the solution of problems, both social and non-social, arising from the awareness of some form of almost periodic disaster.'¹² This resonates with Wisner *et al.*, who advocate a paradigm shift from the concept of disasters as isolated and unpreventable incidents, and instead consider how social frameworks inherently influence how hazards affect society.¹³ As opposed to conceiving hazards as just disasters, defined as unfortunate and predestined occurrences, events are instead seen as environmental catastrophes stemming from 'the intersection of natural hazards ... with human populations in varying states of economic, social, and cultural vulnerability'.¹⁴ A comprehensive understanding of what this article terms storm subcultures is therefore important if community storm vulnerability is to be understood and communities are to remain resilient to storm hazards exacerbated by climate change.¹⁵

Historical British newspapers can provide key and detailed insights into the changing societal storm impacts.¹⁶ This study appraises a nineteenth century case study that highlights the developments of key storm enviro-cultural relationships in Western Britain. The study reviews the effect of the *Royal Charter* storm on storm prediction due to the major influence of the event on storm forecasting methods as well as the national government and coastal community roles in the predictive process. The study illustrates how an early British natural hazard EWS rapidly changed as a result of the catastrophe. The research exhibits how differing degrees of coastal community and national government agency impacted the effectiveness of storm warnings and highlights how the case study underlines the continued importance of adaptive and inclusive EWSs and natural hazard mitigation strategies.

¹² H.E. Moore, *And the Winds Blew*, Austin, TX, 1964, 1-5; W.A. Anderson, 1965. Some observations on a disaster subculture: the organizational response of Cincinnati, Ohio, to the 1964 flood, *Columbus: Research Notes, Disaster Research Centre, Ohio State University* (1965) 3.

¹³ B. Wisner, P. Blaikie, T. Cannon and I. Davis, *At risk: natural hazards, people's vulnerability and disasters*, Second Edition, Routledge, New York, 2015 3-5.

¹⁴ Higgins, D., 2017. *British Romanticism, Climate Change, and the Anthropocene: Writing Tambora*. Springer. 7-8; Anderson, M.D., 2011. *Disaster writing: The cultural politics of catastrophe in Latin America*. University of Virginia Press. 1.

¹⁵ Palmer, M., Howard, T., Tinker, J., Lowe, J., Bricheno, L., Calvert, D., Edwards, T., Gregory, J., Harris, G., Krijnen, J. and Pickering, M., 2018. *UKCP 18 marine report 2.0*, Met Office Hadley Centre: Exeter, UK, 2018, 10-27.

¹⁶ N. Macdonald, C.A. Jones, S.J. Davies, S.J. and C.A. Charnell-White, Historical weather accounts from Wales: an assessment of their potential for reconstructing climate, *Weather* 65 (2010) 72-81.

While much was learned from major events including the 1953 North Sea Flood and 1607 Bristol Channel Floods, overall there has been substantially less research devoted to improving the understanding of social, political and cultural storm trends in Western Britain when compared to Eastern Britain due to the different regional legacies of the 1953 Flood.¹⁷ This omission is significant given the period 1800 to 2020 is defined by increasing atmospheric storminess combined with progressively more accurate and detailed records revealing social, political and cultural storm effects.¹⁸ Archival records can increase understanding of the reciprocal relationship between storms and society with potential contemporary value.¹⁹ For example, Archer's work on newspaper records of English floods and their impacts trends from c.1700 to 2013 has direct implications for contemporary management.²⁰ Moreover, Dry's historical analysis of letters, newspapers and publications from the mid-nineteenth century illustrates how the Met Office issuing of barometers to ports in 1854 enabled communities to make autonomous science-informed decisions which enhanced safety at sea.²¹

Enhancing the understanding of changing social, political and cultural storm effects has clear contemporary relevance as the International Panel for Climate Change (IPCC) note that communities are key players in addressing increasingly localised climate impacts.²² It is therefore essential to better understand how communities and governments adapt, address and build resilience to changing weather and climate threats to ultimately reduce vulnerability.

This study therefore analyses historical storm impacts in Western Britain to improve the understanding of the relationships between storms and British society. This environmental

¹⁷ D.M. Lumbroso and F. Vinet, A comparison of the causes, effects and aftermaths of the coastal flooding of England 1953 and France 2010, *Natural Hazards and Earth System Sciences* 11 (2011) 2321-2333; S.K. Haslett and B.R. Wong, Recalculation of minimum wave heights from coastal boulder deposits in the Bristol Channel and Severn Estuary, UK: implications for understanding the high-magnitude flood event of AD 1607, *Atlantic Geology* 57 (2021) 193-207. Hall, The rise of blame and recreancy in the United Kingdom: A cultural, political and scientific autopsy of the North Sea flood of 1953, 379-408.

¹⁸ L. Veale, G. Endfield, S. Davies, N. Macdonald, S. Naylor, M.J. Royer, J. Bowen, R. Tyler-Jones and C. Jones, Dealing with the deluge of historical weather data: the example of the TEMPEST database, *Geo: Geography and Environment* 4 (2017) 39.

¹⁹ E. Garnier, P. Ciavola, T. Spencer, O. Ferreira, C. Armaroli and A. McIvor, Historical analysis of storm events: case studies in France, England, Portugal and Italy. *Coastal Engineering* 134 (2018) 10-23.

²⁰ Archer, D., O'donnell, G., Lamb, R., Warren, S. and Fowler, H.J., 2019. Historical flash floods in England: New regional chronologies and database. *Journal of Flood Risk Management*, 12, p.e12526.

²¹ S. Dry, Fishermen and forecasts: how barometers helped make the Meteorological Department safer in Victorian Britain, Discussion Paper 46, Centre for Analysis of Risk and Regulation, London School of Economics and Political Science, 2007, 15-21.

²² M. Hurlbert, J. Krishnaswamy, E. Davin, F.X. Johnson, C.F. Mena, J. Morton, S. Myeong, D. Viner, K. Warner, A. Wreford, S. Zakieldeem, Z. Zommers, Risk Management and Decision making in Relation to Sustainable Development, in: P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D.C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley (Eds), *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*, 2019, 694-699.

history approach appraises how a key storm event has contributed to the evolution of storm subcultures. The key focus is the roles of coastal communities and the national government in storm understanding and prediction which remains highly relevant. The study area concerns areas within 25 km of the coastline from the Celtic Sea to The Minch including all British islands (see Figure 6.1). Western Britain was selected due to the intertwined regional history of storms and society and the dearth of storm research compared to Eastern Britain.²³ Despite a reduced regional focus, research ranging from Henderson's appraisal of the role of witches in storm cultural understandings on the Isle of Bute in 1662 to McEwen *et al's*. assessment of the value of community knowledge following the 2014 Somerset floods, highlights the continued existence of storm subcultures.²⁴ This study appraises how the *Royal Charter Storm* and the subsequent response to the event uniquely and majorly influenced storm understanding, response and prediction. The study ultimately highlights the collective role of coastal communities and national governments in fostering effective and enduring storm subcultures. The research, therefore, addresses objective four as it analyses the social, political and cultural responses to a major storm event and the subsequent implications for storm subcultures and long-term hazard vulnerability.

²³ C. Pfister, E. Garnier, M.J. Alcoforado, D.Wheeler, J. Luterbacher, M.F. Nunes, and J.P Taborda,. The meteorological framework and the cultural memory of three severe winter-storms in early eighteenth-century Europe. *Climatic Change* 101 (2010) 281-310; Bankoff, The 'English Lowlands' and the North Sea basin system: A history of shared risk, 3-37.

²⁴ I. Henderson, Witch Belief in Scottish Coastal Communities, in: D. Worthington (Ed) *The New Coastal History: Cultural and Environmental Perspectives from Scotland and Beyond*, Palgrave Macmillan, Cham, Switzerland, 233-249.: *The New Coastal History*, Palgrave Macmillan, Cham, 2017, 233-249; L. McEwen, O. Jones and I. Robertson, 'A glorious time?' Some reflections on flooding in the Somerset Levels, *The Geographical Journal*, 180 (2014) 326-337.



Figure 6.1. Study spatial focus.

6.2. Case Study Selection

To identify storms a detailed review of archival newspaper material concerning storms and storm response between 1800-2020 was undertaken (see Chapter 5). Relevant storm extracts were identified using the GALE and ProQuest online repositories.²⁵ The archival analysis concerned fourteen newspapers such as the: *The Bristol Mercury*, *Caledonian Mercury*, *Liverpool Mercury*, *Observer & The Guardian* and *Western Times*. These newspapers focused on Western Britain with a wide coverage, different political leanings and high reputation. The sources detailed societal effects and response to coastal storms in Western Britain enabling the identification of events with long-term impacts (i.e. fatality reduction). Following the analyses of the 1567 storm reports in the period (see Chapter 5), it was possible to appraise trends in storm effects and select a key case study. The main indicators of storm effects considered were fatalities and socio-economic losses although reporting variability enhanced the emphasis on reported fatalities. Societal storm response including forecasts, welfare provision and storm management were considered.

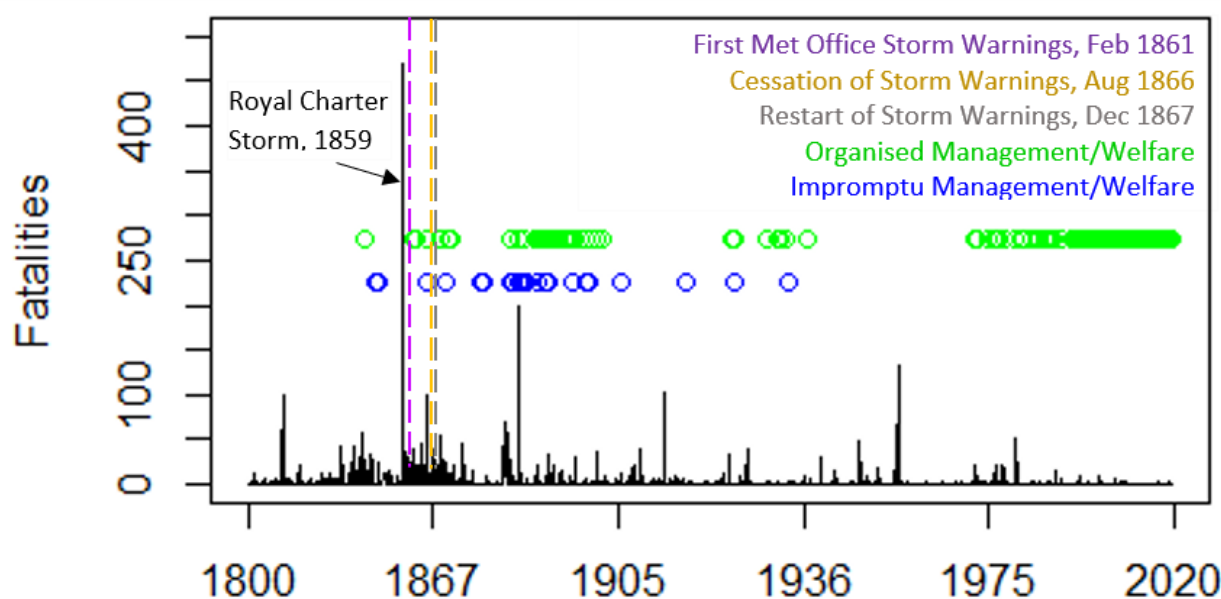


Figure 6.2. Variability in reported fatalities in Western Britain between 1800-2020.

The data in Figure 6.2. highlights major storm effects principally concerning fatalities as well as national government, local authority and community storm response. The most prominent data feature is the 469 deaths throughout Western Britain during the *Royal*

²⁵ GALE Primary Sources, British Library Newspapers, <https://www.gale.com/intl/primary-sources/british-library-newspapers> last accessed 9 February 2021; ProQuest Historical Newspaper, The Guardian and The Observer, <https://www.proquest.com/hnpguardianobserver/> last accessed 10 February 2021.

Charter Storm of 1859. The *Royal Charter* storm, therefore, had the highest quantifiable human impact and resulted in the subsequent introduction of a new and ambitious national government EWS. Moreover, the diverse social, political and cultural effects of the event and EWS evidenced in archival newspapers and relevant research made the *Royal Charter* storm a suitable case study which was relevant to contemporary storm subcultures.²⁶

6.3. ‘A more complete annihilation of a ship was never seen’:

The Royal Charter Storm, October 1859

Although considerable historical focus has been placed upon historical storms, the *Royal Charter* storm of 1859 remains largely neglected despite being the deadliest British storm of the nineteenth century. Recent research includes Pearce’s contribution, which highlights how the storm produced a national response.²⁷ The focus, however, is placed on the social and material space of the sea through the analysis of the response of the *Shipwrecked Fishermen and Mariners’ Royal Benevolent Society*. Villiger *et al.* and Lamb and Frydendahl have researched the storm but primarily focus on meteorology.²⁸ This renders one of the deadliest British storms in history largely unresearched when the long-term societal impacts are considered.

The fatality data in Figure 6.2. highlight the prominence of this storm in the 220-year period as 1859 stands out as the deadliest overall year. The storm extracts indicate that the vast majority of the estimated fatalities recorded (459) occurred on the *Royal Charter* ship between 25-26 October (10 elsewhere).²⁷ Such was the significance that all newspapers provided comprehensive accounts detailing the human effects.

On the ship alone reports indicate that only thirty-nine of 498 were saved. An estimated £500,00–£800,000 (equivalent to £63,300,000–£101,300,000 in 2020) worth of valuables were lost.²⁹ A combination of the strong north-westerly winds estimated as 12-16 m s⁻¹ (23-

²⁶ C. Pearce, Extreme weather and the growth of charity: Insights from the Shipwrecked Fishermen and Mariners’ Royal Benevolent Society, 1839–1860. In *Cultural Histories, Memories and Extreme Weather* (2017) 55-77; Villiger, Schwander, Schürch, Stanisic and Brönnimann, The “Royal Charter” Storm of 1859, 35-45; H. Roberts, The 150th Anniversary of the first public weather forecast, *Weather* 66 (2011) 221-222.

²⁷ Pearce, Extreme weather and the growth of charity: Insights from the Shipwrecked Fishermen and Mariners, 55-77.

²⁸ H.Lamb and K.Frydendahl, *Historic Storms of the North Sea, British Isles and Northwest Europe*. Cambridge University Press, Cambridge, 1991, 135; Villiger, Schwander, Schürch, Stanisic and Brönnimann, The “Royal Charter” Storm of 1859, 35-45.

²⁹ *Liverpool Mercury* (Liverpool), 28 October 1859, 2.

32 knots) and the unforgiving rocky shore of Lynas point led to the rapid destruction of the new vessel.³⁰

The *Western Times* accounts state that the ship dragged anchors creeping ever closer to the shore.³¹ Despite the initial containment of anxiety, the ship was thrown broadside on impact and great panic ensued. The *Liverpool Mercury* details that one of the first responses was from a clergyman who began praying before 'his exhortations were interrupted by the violent thumping of the vessel on the rocks and the heavy seas which came dashing into the cabin'.³² The scene was 'of the most heartrending description: children and parents, husbands and wives, were clinging to each other in affectionate embrace' as the ship split in two.

The initial focus on the religious response perhaps best represents how the efforts of those onboard were futile in the face of the storm and powerless to prevent the disaster. Religion in this situation helps portray the event as an unpreventable disaster as opposed to a catastrophe in which social and cultural factors play a key role.³³ When the wider religious context is considered, the evidence suggests clergymen of the mid-nineteenth century would have considered the storm to be of divine origin.³⁴ This said, meteorological science was widely established and accepted by the mid-late 1800s so context considered, the newspaper focus on the providential response was likely to emphasise human futility and powerlessness against the storm rather than convey a belief in divine storm agency.³⁵

The pitiful situation is made further apparent in the *Morning Chronicle* which exclaimed there was 'scarcely a vestige of the *Royal Charter* remaining'.³⁶ A graphic scene was depicted of 'frightfully mutilated' bodies filling the local churchyard. Although survivors were treated with compassion, there is scant mention of any organised welfare provision nor had storm warnings been issued. The devastation led a correspondent to exclaim 'that a

³⁰ Villiger et al., *Historical Weather Extremes in Reanalyses*, 35-45.

³¹ *Western Times* (Exeter), 5 November 1859, 3.

³² *Liverpool Mercury*, Liverpool, 28 October 1859, 2.

³³ Anderson, M.D., 2011. *Disaster writing: The cultural politics of catastrophe in Latin America*. University of Virginia Press. 1.

³⁴ B. Hilton, *The age of atonement: the influence of evangelicalism on social and economic thought, 1795-1865*, Clarendon Press, Oxford, 1988, 105-107; P. Williamson, State prayers, fasts and thanksgivings: public worship in Britain 1830-1897, *Past and Present* 200 2008 121-174.

³⁵ J. Golinski, *British weather and the climate of enlightenment*, University of Chicago Press, 2010, 29-37.

³⁶ *Morning Chronicle* (London), 30 October 1859, 5.

more complete annihilation of a ship was never seen' and the storm was pronounced the most 'memorable and destructive gale' for a generation.³⁷

Such human suffering and loss had brought the threat of coastal storms to the forefront of public consciousness. Unlike in previously devastating storms, the focus following the *Royal Charter* storm was primarily on the socio-economic devastation. The societal repercussions of the devastation and shock is best communicated by a poem named *Royal Charter* published on 5 November 1859. The poet exclaims: 'the winds awoke the other day, / And from their couches leaping / Cried out, 'We'll have a tragic play, / And set the world a weeping'.³⁸ The storm is portrayed like the devil emerging 'from his lair' and the poet concludes by personally condemning the elements stating: 'O cruel winds, your play is done, /Your tragedy is ended, /Which many a sad and sorrowing one /With bitter tears attended'. This poem made the grievance of the nation profoundly clear whilst conceptualising the storm as a powerful external enemy. There is no attribution of blame, with the elements themselves being condemned for their deeds. This perception was not unanimously shared, however, and this sense of an inescapable storm vulnerability was to change.

Perhaps most importantly the prominent Admiral Robert Fitzroy was also shocked by the reports. Fitzroy was head of the Meteorological Department for the Board of Trade which was the first government department dedicated to meteorology and would later expand and be renamed the Met Office.³⁹ Inspired by a Christian humanitarian ethos, Fitzroy became convinced that a warning system could have prevented the catastrophe.⁴⁰ As a result, British society and the State fundamentally changed the approach to storm prediction with the initiation of Fitzroy's storm warnings first published in newspapers in 1861. The introduction of storm warnings marked the rise of a storm subculture defined by the scientific State recognition of storms as what Anderson (1965) terms an 'almost periodic disaster threat' and a 'frequent life experience'.⁴¹ British storm subcultures became no longer the sole domain of local 'experts' in coastal and maritime communities, with the centralised Met Office assuming a major direct influence. The key developments following

³⁷ *Western Times* (Exeter), 5 November 1859, 3.

³⁸ *Bristol Mercury* (Bristol), 5 November 1859, 2.

³⁹ Walker, History of the meteorological office, 3-26.

⁴⁰ J. Burton, 1986, Robert FitzRoy and the early history of the Meteorological Office, *The British Journal for the History of Science* (1986) 147-176.

⁴¹ W.A. Anderson, 1965. Some observations on a disaster subculture: the organizational response of Cincinnati, Ohio, to the 1964 flood. *Columbus: Research Note # 6*, Disaster Research Centre, Ohio State University (1965) 3.

the introduction of storm warnings and the growing State influence on British storm subcultures comprise the next sub-sections.

6.4. Initial Storm Warning Systems, February 1861

The Met Office storm warnings were published in newspapers from August 1861. However, this was six months after the first use of storm warnings at ports on 6 February 1861 when distinctive storm cones and lights were initially used.⁴² The new storm warnings importantly prioritised ‘storm telegraphy’ over barometrical readings which had previously been given more importance.⁴³ Storm telegraphy relied on the relay of telegraphs of general weather observations made at various stations throughout Western Europe to the Met Office, which gave less consideration to barometric pressure variability.⁴⁴ These general observations would prove easier to interpret and therefore enable the Met Office in London to produce the rapid results Fitzroy desired. The warnings were issued only after Met Office officials in London had analysed observations. Only after this centralised analysis were warnings then relayed to ports chosen by London-based officials.⁴⁵ This centralised and formalised setup combined with the limited scientific basis of storm telegraphy would prove a great issue.

Even before the warnings had made print there was reported evidence of their effects on coastal communities after the storm of 9–10 February 1861. An extract written by Admiral Fitzroy on 13 February 1861 evidences the first recognition of storm warnings across British society as Fitzroy wrote an explanatory extract clarifying that all major ports had received storm warnings but issues regarding communication and translating the information into warnings had apparently ensued. The warning message read ‘Caution: Gale threatening from south-west and then northward. Show signal drum’.⁴⁶ A detailed explanation of signal interpretation was then provided. Prominently, Fitzroy stated ‘these cautionary warning signals advert to winds during part of the next following two or three days; and therefore

⁴² J.M.C. Burton, The foundation and early years of the Meteorological Office. Part II, *Weather* 39 (1984) 7-11.

⁴³ S. Dry, Safety networks: fishery barometers and the outsourcing of judgement at the early Meteorological Department, *The British Journal for the History of Science* 42 (2009): 35-50.

⁴⁴ FitzRoy, R., 1863. *The weather book: a manual of practical meteorology* (Vol. 2). Longman, Green, Longman, Roberts, & Green; Cervený, R., Balling, R., Lawson, M. and Cervený, N., 2020. Meteorology's Emerald Jewel: Valentia Observatory. *Weatherwise*, 73(1), pp.14-19.

⁴⁵ E.D. Waal, Politics over Epistemology? The reception of Robert Fitzroy's weather forecasts in Victorian Britain between 1860 and 1866, Thesis, Utrecht University, 2020, 47-79.

⁴⁶ *Liverpool Mercury* (Liverpool), 13 February 1861, 3.

due vigilance should prevail'. Further scientific guidance is given concerning barometric change and gales before Fitzroy concluded 'the influence of either is shown by instruments some hours, if not days, before actual alteration is visible to ordinary notice'.⁴⁰ Despite the eloquent explanation, the rigorous justification highlighted major issues facing Fitzroy concerning hazard and uncertainty communication. Although initial reactions to the forecasts did not indicate that scientific and coastal communities were opposed to them, the fundamental change in the source, nature and communication of knowledge was an issue.⁴⁷

In 1854, Fitzroy had famously introduced barometers into poor fishing and coastal ports and provided interpretation instruction.⁴⁸ The barometers were importantly independent of the Met Office formal storm signalling system which enabled communities to successfully use meteorological science to inform fishing choices and enhance local subcultures. However, the 1861 adoption of mandatory, centralised and formalised storm warnings which were heavily reliant on scientifically questionable storm telegraphy changed the dynamic between State and communities. While the 1854 Met Office insertion of barometers had fostered scientific integration which complimented local expertise and enhanced storm subcultures, the 1861 storm warnings largely removed this important community input.

Despite the great developments in meteorology and hazard communication, such issues of stakeholder engagement equality and communication still resonate in twenty-first century British society. Studies in England have highlighted that communication issues induce doubt in flood risk management agencies and EWSs which remain associated with reduced community agency and higher vulnerability.⁴⁹ Moreover, wider contemporary research highlights how effective community stakeholder engagement enhances hazard, exposure and vulnerability understandings as well as also improving hazard observation and analysis which ultimately contribute to higher EWS effectiveness.⁵⁰

In this sense, Fitzroy's problems represent an early example of the enduring issues concerning hazard understanding, stakeholder equality and knowledge communication.

⁴⁷ N. Shaw, A Century of Meteorology, *Nature* (1931) 3-4.;

⁴⁸ Dry, Fishermen and forecasts: how barometers helped make the Meteorological Department safer in Victorian Britain, 15-21.

⁴⁹ K. Burningham, J. Fielding and D. Thrush, 'It'll never happen to me': understanding public awareness of local flood risk, *Disasters* 32 (2008) 216-238; J. Harvatt, J. Petts and J. Chilvers, Understanding householder responses to natural hazards: flooding and sea-level rise comparisons, *Journal of Risk Research* 14 (2011) 63-83.

⁵⁰ Šakić Trogrlić, R., van den Homberg, M., Budimir, M., McQuistan, C., Sneddon, A. and Golding, B., 2022. Early warning systems and their role in disaster risk reduction. In *Towards the "Perfect" Weather Warning* (pp. 11-46). Springer, Cham.

Despite significant meteorological advances, key issues resulted as storm prediction changed from a localised, science-informed and led community process (de-centralised port barometers) to a centralised, technocratic and scientifically questionable approach in the form of Met Office storm telegraphy.

Although the communication of storm warnings remained problematic, early success in prediction accuracy heightened Fitzroy's credibility and he became a hero among fishermen who came to entrust him with their safety.⁵¹ However, a combination of limited barometric measurement and an over-reliance on 'storm telegraphy' which solely concerned sending storm information from other ports by telegraph began to erode his credibility.⁵² Signs of this criticism were to appear in the *Liverpool Mercury* on 28 September 1861 in the form of new advice on interpreting the storm warning system (see Figure 6.3.). The correspondent noted instructions issued in several key ports during the recent storms had been attracting 'a good deal of attention among seafaring people'.⁵³ Fitzroy was again forced to emphasise 'only the greater and more general disturbances of the atmosphere are to be made known by this method (warning signals) not merely local, or sudden changes'. The prediction of localised changes was instead the responsibility of local observers. Storm signs were noted as 'much inequality of atmospheric pressure or temperature, great depression or elevation of the barometer'.⁴⁶ Despite the consistent rationale, a period defined by inaccurate forecasts would have a tragic effect on Fitzroy's health.⁵⁴ The pressure intensified as fishing fleets were now stripped of their independence to interpret suitable conditions with their barometers. Instead, they were forced to obey the formal centralised storm warnings from the Met Office in London which often relied on less accurate storm telegraphy. Consequently, fleet owners objected due to losses resulting from inaccurate and centralised predictions.⁵⁵

Although Fitzroy attempted to improve transparency and heighten agency by supplying barometers to ports, he suffered from the effects of attempting to rapidly change established coastal storm subcultures.⁴⁴ Inaccuracies also led to the rebuking of his theories

⁵¹ Dry, Safety networks: fishery barometers and the outsourcing of judgement at the early Meteorological Department, 35-50.

⁵² P. Moore, *The weather experiment. The pioneers who sought to see the future*, Chatto & Windus, Random House UK, London, 2015, 9-25.

⁵³ *Liverpool Mercury* (Liverpool), 28 September 1861, 3.

⁵⁴ Waal, Politics over Epistemology? The reception of Robert Fitzroy's weather forecasts in Victorian Britain between 1860 and 1866, 47-79.

⁵⁵ J. Kington in M. Hulme and E. Barrow (Eds), *Climates of the British Isles: Present, Past and Future*. Routledge, London, 1997, 147.

by scientists and prominent astrologers.⁵⁶ This culminated in his suicide on 30 April 1865. The death of Fitzroy, the most prominent advocate of storm telegraphy, fundamentally changed meteorology and storm prediction. With the criticism and alternative theories in mind, the Met Office fundamentally changed its approach to forecasting majorly altering the relationships between storms, the national government and coastal communities.

EXPLANATION OF THE SIGNALS.

A staff and two canvas shapes being provided, the following use will be made of them occasionally—perhaps once or twice in a month.

One shape, that of a drum or cylinder, has the appearance of a black square of three feet (seen from any point of view) when suspended.

The other shape, a cone three feet high, appears triangular (from any point of view) when suspended.

A cone, with the point upwards, shows that a gale is *probable* from the northward.

A cone, with the point downwards, shows that a gale is *probable* from the southward.

A drum, alone, shows that dangerous winds may be expected from nearly opposite quarters successively.

A cone and drum give warning of dangerous wind, its probable *first* direction being shown by the position of the cone—point up, and above the drum, for polar or northerly wind—down, and below, for southerly.

Whenever such a signal is shown (in consequence of a telegram from London) it will be kept up (shown distinctly) till dusk of *that day only*, unless otherwise instructed afterwards.

Figure 6.3. A *Liverpool Mercury* article published on 28 September 1861 detailing Admiral Fitzroy's storm-warning signals.

6.5. Post-Fitzroy Revision of Approach, August 1866

Following five years of storm warnings of variable accuracy and effectiveness, August 1866 was to mark a sea change in British weather forecasting and storm perception. On 22 August, the *Liverpool Mercury* featured an article concerning a pivotal Royal Society meeting concerning the future of forecasting.⁵⁷ The fellows of the Royal Society were of great importance as they dictated the future strategy of the Met Office. Much of the emphasis

⁵⁶ K. Anderson, The weather prophets: science and reputation in Victorian meteorology, *History of Science* 37 (1999) 179-216.

⁵⁷ *Liverpool Mercury* (Liverpool), 22 August 1866, 3.

was placed upon Fitzroy's contentious system of 'weather telegraphy'. The review occurred as it had 'long been recognised that it would be desirable to collect and digest, upon a uniform plan'.⁵⁰

Although his name was not mentioned this reappraisal was a wider result of Sir Francis Galton's long running battle with the now deceased Fitzroy. For Fitzroy the science of meteorology had been a means to practical ends with a primary concern on saving lives at sea. Galton alternatively prioritised the advancement of knowledge and improvement of meteorological understanding.⁵⁸ For Galton public and practical use was merely a secondary benefit and his April 1866 report evaluating the previous work of the Met Office virtually demolished everything Fitzroy had accomplished.⁵⁹ It was therefore unsurprising fellows of the Royal Society in attendance at the meeting suggested 'phenomena as ocean currents, magnetic variations, the fluctuations of temperature in the atmosphere and in the sea ... might be investigated with advantage on a much larger scale'.⁶⁰ This purely scientific approach was to be given precedence over storm telegraphy which relied on external weather observations via telegram. The new approach instead aimed to 'map out all the accessible parts of the ocean, to provide accurate instruments for the use of officers in the navy and merchant services'. According to the committee, a 'firm statistical basis ... would be laid for the science of meteorology and the art of navigation'.⁵³

This statistics-driven method had been the initial approach of the department and the data was 'mostly, if not entirely, of good quality'. However, the *Royal Charter* storm had changed this. Fitzroy's impatience with the slow progress of statistics-driven meteorology resulted in a focus on providing daily forecasts with a reliance on telegraphy. The committee reported this information was of questionable accuracy. According to the Meteorological Department, as of 1860 to 1866 weather telegraphs in Britain had been 75% accurate regarding force alone and 36% correct regarding direction. The wreck department statistics were more damning, however, stating that 78% of readings were incorrect. The Royal Society, therefore, reached the conclusion 'there is no sound basis on which they are founded' and storm warnings were to be immediately discontinued.⁵³

⁵⁸ Walker, *History of the Meteorological Office*, 60-78.

⁵⁹ J.M.C. Burton, *The history of the British Meteorological Office to 1905*, PhD Thesis, Open University (United Kingdom), 1989, 56.

⁶⁰ *Liverpool Mercury* (Liverpool), 22 August 1866, 3.

With this decision, the Royal Society adopted an almost entirely technocratic long-term approach to storm forecasts. Although warning cessation now gave fleet owners the ability to deploy as they pleased, the decision effectively eliminated the meteorological contribution of coastal communities in an era when scientific meteorology was still developing. This was particularly contentious as early storm warning success had fostered a degree of dependence between State and coastal communities.⁶¹ Therefore, to the majority of communities, the decision reversed years of valuable State assistance upon which their storm subcultures had become dependent.

The *Liverpool Mercury* correspondent postulated that seafarers would ‘generally consider weather from elsewhere’ but, given the evidence, they concluded ‘we cannot but concur in the view of the committee, that official prophecies of weather should be abandoned’.⁵³ Fitzroy’s ‘ill-founded pretences’ were denounced, and it was agreed the State should not ‘publish formal opinions every morning which science does not warrant and which experience generally confutes’.⁵³ Storm warnings were abandoned with a return to devising accurate science-informed storm forecasts in the longer term. This drastic change which to some represented the relinquishment of the Met Office in its centralised role of reducing coastal community storm vulnerability using storm telegraphy and barometric observations catalysed a national response.

6.6. Criticism and the Return of Storm Telegraphy, September–December 1867

A year after the cessation of reported storm warnings, a report of the ‘sectional meetings of the British Association’ was published on 11 September 1867.⁶² Importantly, the British Association for the Advancement of Science (BSA) was a rival scientific association to the Royal Society formed in 1831 by nineteenth scientists who had become disillusioned with the elitist and conservative attitude of the Royal Society.⁶³ Unlike the Royal Society, the BSA

⁶¹ Dry, Fishermen and forecasts: how barometers helped make the Meteorological Department safer in Victorian Britain, 15-21.

⁶² *Liverpool Mercury* (Liverpool), 11 September 1867, 5.

⁶³ Orange, A.D., 1972. The origins of the British Association for the Advancement of Science. *The British journal for the history of science*, 6(2), pp.152-176.

sought to enhance scientific involvement and knowledge throughout wider society, enabling women to engage in debates and lectures which were held in urban and rural centres to enhance inclusivity.⁶⁴ The BSA meeting revealed the strong opposition against the cessation of the storm warnings. The focus was a debate concerning the paper of the prominent naturalist and MP Colonel W H Sykes' entitled 'Storm Warnings, their Importance and Practicability'.⁵⁵ Sykes exhibited how it had become widely felt that both the State and communities now held a dual responsibility for coastal storm resilience.

The paper began with a background to meteorological development and an appraisal of Fitzroy's contribution. Between 1862-65 'Admiral Fitzroy gave 405 warnings, 305 of which were correct, representing, it was quite safe to infer, a saving from shipwreck of 305 ships and nobody knew how many lives'.⁵⁵ Following this questionable inference Sykes exclaimed 'such results were surely a sufficient justification for the continuance of the storm warnings' discontinued by the Royal Society. Most poignantly Sykes had no hesitation in stating that the cessation was the 'pedantic affection of science – literally, the coxcombry of science' which was greeted by laughter and applause.⁵⁵

In response, a scientific committee from the Royal Society stated their proposal of 'a continuance of the system of warnings, to establish eight observatories for the purpose of making records which fifteen years hence they expected would furnish such data as would enable them to promulgate storm warnings philosophically and not empirically'. Sykes defiantly retorted if meteorologists had not been able to do this in fifty years then fifteen would make little difference. After referring to the opinions in favour of storm signals, he concluded by reinforcing his support for storm telegraphy stating: 'Storm signalling was really practicable; it had been proved so'. He emphatically concluded by asking whether the Met Office would 'rest its actions on individual convictions and continue the suspension of the signals, or listen to the claims of humanity and the just claims of the public interest'.⁵⁵ Here Sykes effectively voiced the major concern of coastal communities who were without any official weather forecasting.

⁶⁴ Higgitt, R. and Withers, C.W., 2008. Science and sociability: Women as audience at the British Association for the Advancement of Science, 1831–1901. *Isis*, 99(1), pp.1-27; Withers, Charles, Rebekah Higgitt, and Diarmid Finnegan. "Historical geographies of provincial science: themes in the setting and reception of the British Association for the Advancement of Science in Britain and Ireland, 1831–c. 1939." *The British Journal for the History of Science* 41, no. 3 (2008): 385-415.

After widespread support from prominent members of the audience, Dr Balfour Stewart, the secretary of the meteorological committee of the Royal Society, stated that despite 'some misapprehension about the amount of valuable information ... the committee would be prepared to establish telegraph stations all over the country, more particularly in the west'.⁵⁵ With this information, the meteorological department would rapidly telegraph warnings to concerned ports.

The tangible influence of Sykes' paper on policy was confirmed on 21 December 1867, when the *Liverpool Mercury* published an announcement declaring the 'renewal of the system of storm-signals' from T. H. Farren of the Board of Trade (comprised the Met Office).⁶⁵ This proclaimed that the Board of Trade 'are now prepared to issue, free of cost, to ports or fishing stations which are accessible by telegraph, notices of serious atmospheric disturbance'. The first of these was issued on 10 January 1868 and a storm-warning service has continued ever since.⁶⁶ The extracts importantly did not state the new storm warnings were mandatory, therefore communities and fleets could use a combination of the centralised Met Office information with their own barometric and local observations to collectively inform their decisions.

Farren's announcement essentially marked a somewhat paradoxical triumph of humanitarianism over statistics, when one considers it was Fitzroy's initial humane impetus that prompted the scientific development that led to storm prediction.⁶⁷ Sykes championed a well-supported cause that prioritised knowledge accessibility and inclusivity over top-down technocracy. In this era of meteorological development, Sykes demonstrated a desire to reduce vulnerability through community engagement and knowledge dissemination.

Whilst many interested in Met Office storm warnings present at the BSA meetings would have likely had incentives to restart storm warnings, a genuine desire to reduce community storm vulnerability is evident. Most prominently Admiral Sir E. Belcher voiced the desires and concerns of coastal communities: 'even birds, fishes reptiles, gave warning of gales; and a man of intellect, assisted by the barometer and the electric telegraph, could have no difficulty in affording to mariners most valuable information'.⁶⁸ Moreover, the focus on

⁵⁵ *Liverpool Mercury* (Liverpool), 21 December 1867, 5.

⁶⁶ Royal Meteorological Society, History of Meteorology and Physical Oceanography Special Interest Group, *Annual Report* 160 (2010) 16.

⁶⁷ K. Groves, Current forecasting capability at the Met Office. *Weather* 59 (2004) 295-298.

⁶⁸ *Liverpool Mercury* (Liverpool), 11 September 1867, 5.

community vulnerability reflects the more inclusive approach of the BSA (compared to the Royal Society), which further suggests those in attendance mainly held a genuine belief that storm telegraphy and barometer-informed storm warnings could ultimately aid coastal communities.

This reintroduction campaign highlights that the national government-controlled Met Office had become an important part of the risk decision making process in coastal communities and therefore had a greater impact on storm subcultures. Despite the initial resistance and variable accuracy of Fitzroy's 1861 storm telegraph, the campaign illustrates that coastal communities valued the centralised Met Office warnings alongside their local knowledge and autonomous barometric observations. This consequently likely influenced their decision making and awareness of storms and ultimately their resilience. The sudden removal of storm warnings at the direction of the Royal Society which typically largely considered only technocratic feedback from elite British scientists evidently, disturbed the established storm subculture equilibrium. By 1866 this equilibrium was partially dependent on direct national government input (barometer and telegraph informed storm warnings), internal community knowledge and science-informed community decisions made using Met Office-supplied barometers which allowed the partial outsourcing of judgment.⁶⁹ Most poignantly, Sykes illustrates that the storm warnings had created a new relationship between storms, the national government and coastal communities. Storm mitigation and resilience was no longer the domain of just coastal communities using traditional and barometer informed knowledge, the national government in the form of the Met Office now played an important role. The national protest championed by Sykes and other prominent figures resulted from a EWS policy change that largely considered only scientific and technocratic feedback. The study therefore represents a very early example of the extensive repercussions that can result from overly centralised and technocratic EWS policy change which does not fully consider and incorporate the preferences and needs of affected communities. It further highlights how coastal communities value extensive and diverse knowledge inputs but require a degree of autonomy in decision making processes if they are to engage with science and vulnerability is to be effectively reduced.

⁶⁹ Dry, Safety networks: fishery barometers and the outsourcing of judgement at the early Meteorological Department, 35-56.

6.7. Conclusions

The historical case study analysis highlights how a major storm can fundamentally change the relationship between storms, coastal communities and the national government. The human suffering and socio-economic loss produced by the *Royal Charter* storm of 1859 evoked diverse responses from the national government and coastal communities which changed storm subcultures. The analysis exhibits that high impact storms and natural hazards can change hazard prediction and the nature of EWSs with diverse social, political and cultural effects.

While reduced coastal storm mortality since 1953 is a testament to the increased understanding of the complex reciprocal relationship between storms and British society, likely increases in atmospheric storminess bringing more impactful storms raise concerns. Although improvements in forecasting and mitigation have reduced storm catastrophes, recent events such as the 2014 Somerset Levels Flooding and Storms Ciara and Dennis in 2020 illustrate the need to for cohesive community and government action aimed at reducing storm and flood vulnerability in Western Britain.

The case study analysis illustrates that open knowledge exchange, inclusivity in decision making processes and partial community autonomy is essential in fostering sustainable storm subcultures. From the storm warning debate between 1861-1867 to the criticism of the response to Storms Ciara and Dennis in 2020, limited community agency in EWS decision making processes is shown to decrease important relationships between communities and national governments which can substantially affect long-term vulnerability. The conclusions resonate with the IPCC 2019 findings which highlight that governments must understand the vital importance of community agency when addressing climate hazards.⁷⁰ This considered, the value of environmental history as a means for understanding disaster subcultures has the potential to go beyond coastal storms in Western Britain. Similar research could improve the understanding of the key roles that inclusive community disaster subcultures have to play in EWS and hazard mitigation

⁷⁰ Hurlbert, Krishnaswamy, Davin, Johnson, Mena, Morton, Myeong, Viner, Warner, Wreford, Zakieldeen, and Zommers, Risk Management and Decision making in Relation to Sustainable Development, 694-699.

decision making processes which could ultimately enhance future community resilience to a range of natural hazards.

Historical and current evidence exhibits how governance that values community disaster subcultures and considers their evolution facilitates the development of inclusive decision-making processes which enhance long-term community resilience. This is essential as communities and governments alike learn to adapt to and live with increasing storm threats.

Chapter 7: Historical Storm Representation in Western Britain, 1800-1953: Science and Spirituality

Paper Context

This chapter consists of a paper that will be submitted to the *Journal of Historical Geography*. The referencing style conforms with the journal requests.

Jardine designed the study, undertook the archival data gathering, conducted the analyses and wrote the paper. Higgins contributed to the interpretation and Selby assisted in the editing of the paper.

Abstract

Representations of storms and climate hazards majorly influence how the public understand weather and climate threats. Improving the understanding of written storm representations through historical research can increase the awareness of the important, complex and persisting effects of storms on the British public. By employing an original mixed methods approach that combines statistical and qualitative analyses of archival newspaper material, this study appraises how written religious and scientific storm representations changed between 1800 and 1953 in Western Britain. Throughout the period, newspaper storm representations and understandings are shown to reflect wider epistemological change. Reported storm representations are defined by a progressive increase in scientific storm interpretations while religious interpretations exhibit a comparatively rapid decline which confers with scientific growth and religious diminishment in British society. The analysis highlights that wider epistemological change can greatly affect public representations of storms. It is important therefore that epistemological and written representation relationships are better understood in order to improve the public understanding of the diverse and evolving effects of storms and natural hazards.

Keywords

Representation, environmental history, storms, public understanding.

7.1. Introduction

The reporting and representation of storms and natural hazards has a major impact on how the public perceives the threats they pose.⁷¹ An improved understanding of historical representation provides an important insight into the evolving relationships between storms and British society.⁷² This research employs an original approach combining statistical and qualitative text analyses to appraise changing storm representations between January 1800 to February 1953 in Western Britain, as reported in major newspapers. The study addresses objective five as it focuses on the changing prominence of scientific and religious discourse in representations over the 153-year period, and therefore analyses the relationship between wider epistemological change and newspaper reporting of storms.

In the context of this research, the term ‘representations’ refers to how storms are documented by correspondents and other contributors in written discourse. The approach is influenced by Anderson (2019) exploring ‘what representations do rather than what they stand in for’, as the chapter considers how documented representations correspond with changing scientific and religious trends.⁷³ Research illustrating the value of exploring historical representations include Morgan’s (2015) demonstration of how early modern archival evidence can provide a new perspective on past flooding experiences and give an insight into the evolution of flood representation.⁷⁴ Bankoff (2013) further highlights how environmental history can assist in the understanding of various storm disasters.⁷⁵ He illustrates how periodic exposure to storms has resulted in the creation of enduring ‘disaster subcultures’ in North Sea communities which enhance community resilience. McEwen *et al.* (2014) also exhibit how different ‘forms of archive can capture, and share reflections on’

⁷¹ Anne M. Leitch and Erin L. Bohensky, "Return to 'a new normal': Discourses of resilience to natural disasters in Australian newspapers 2006–2010," *Global Environmental Change* 26 (2014): 14-26; Catherine Devitt and Eoin O’Neill, "The framing of two major flood episodes in the Irish print news media: Implications for societal adaptation to living with flood risk." *Public Understanding of Science* 26 (2017): 872-888.

⁷² Christian Rohr, "The Danube floods and their human response and perception (14th to 17th C)," *History of Meteorology* 2 (2005): 71-86; Christian Pfister, Emmanuel Garnier, Maria-João Alcoforado, Dennis Wheeler, Jürg Luterbacher, Maria Fatima Nunes, and João Paulo Tabora, "The meteorological framework and the cultural memory of three severe winter-storms in early eighteenth-century Europe," *Climatic Change* 101 (2010): 281-310.

⁷³ Ben Anderson, "Cultural geography II: The force of representations," *Progress in Human Geography* 43 (2019): 1120-1132.

⁷⁴ John E. Morgan, "Understanding flooding in early modern England," *Journal of Historical Geography* 50 (2015): 37-50

Sean Silver, "Making Weather: Communication Networks and the Great Storm of 1703," *Eighteenth-Century Fiction* 30 (2018): 495-518.

⁷⁵ Greg Bankoff, "The 'English Lowlands' and the North Sea Basin System: A History of Shared Risk," *Environment and History* 19 (2013): 3–37.

flooded landscapes with 'the potential to form a key resource' in communities exposed to increasing flood risks.⁷⁶

Pearce (2018) has also analysed newspaper reports concerning the activities and appeals of the Shipwrecked Fishermen and Mariners' Royal Benevolent Society during the nineteenth century to show how the society greatly increased public awareness and attitudes surrounding shipwreck and storm danger.⁷⁷ Her research exhibits how extreme weather events of the 1800s significantly influenced the development and growth of charity in Victorian Britain. Pearce (2010) also uses a combination of written historical information to assess the myths and reality of Cornish Wreckers whose activities were directly associated with storms and shipwrecks in South-west Britain.⁷⁸ The research project 'TEMPEST' undertaken by Veale *et al.* (2017) shows how written archival material sourced from a period greater than 400 years can offer personalised and geo-referenced insights into the relationship between UK society and extreme weather with clear contemporary benefit.⁷⁹

Given the wide availability of archival evidence in Western Britain, it is important that this comprehensive resource is explored to better understand human storm histories and the evolving relationship between storms and society. The period of research between 1800 and 1953 was chosen for two reasons. Firstly, January 1800 approximately represents the beginning of consistently published storm newspapers available in archives. February 1953 was chosen as the end date as this marks the occurrence of the infamous North Sea Flood. The catastrophic losses of the event catalysed a major change in the British approach to storms and fundamentally impacted how storms were represented and perceived.⁸⁰ The research presented here, therefore, seeks to understand how representations changed and were influenced by wider epistemological change up to this pivotal point.

The time period 1800-1853 was also selected as it contains high variability in the religious and scientific weather representations. While scientific meteorological understandings existed amongst pioneers from the 1600s, religious interpretations were highly prevalent up

⁷⁶ Lindsey McEwen, Owain Jones, and Iain Robertson, "A glorious time? Some reflections on flooding in the Somerset Levels," *The Geographical Journal* 180 (2014): 326-337.

⁷⁷ Pearce, C.J., 2018. Extreme weather and the growth of charity: insights from the Shipwrecked fishermen and Mariners' Royal Benevolent Society, 1839-1860. In *Cultural Histories, Memories and Extreme Weather: A Historical Geography Perspective* (pp. 55-77). Routledge.

⁷⁸ Pearce, C.J., 2010. *Cornish Wrecking, 1700-1860: Reality and Popular Myth*. Boydell & Brewer. 1-12.

⁷⁹ Veale, L., Endfield, G., Davies, S., Macdonald, N., Naylor, S., Royer, M.J., Bowen, J., Tyler-Jones, R. and Jones, C., 2017. Dealing with the deluge of historical weather data: the example of the TEMPEST database. *Geo: Geography and Environment*, 4(2), p.e00039.

⁸⁰ Alexander Hall, "Plugging the gaps: the North Sea Flood of 1953 and the creation of a national coastal warning system," *Journal of Public Management & Social Policy* 22 (2015): 1-20.

to the late 1700s and early 1800s.⁸¹ For instance, Morgan (2015) exhibits how the 1607 Bristol Channel Floods were widely thought to be divine punishment.⁸² Rohr (2005) also shows how Germanic records from the sixteenth to eighteenth centuries indicate that communities sought the help of a saint during a flood, preferring divine assistance over punishment.⁸³

In contrast, the late eighteenth and nineteenth centuries brought growing recognition of the value of science. Meteorological development in the 1770s driven by expanding nation states resulted in a profound change from the classical Aristotelian meteorological understanding.⁸⁴ although it was not until 1854 that Robert Fitzroy founded the Meteorological Office (Met Office), representing clear state recognition of weather prediction.⁸⁵ This long period of progress indicated the reputational battle the discipline endured, with theological and astrological ideas offering genuine competition.⁸⁶ Religious representations would remain present in the nineteenth century as major newspapers and key clergymen interpreted the weather-related Irish famine (1845-1852) and 1860 English summer floods as divine judgment.⁸⁷

This degree of scientific and religious variability means focused research is required to identify prevailing trends, outliers and pivotal events influencing public weather and storm representation. To appraise representational change, this original study firstly undertakes a statistical analysis of reported religious and scientific trends which subsequently informs a qualitative analysis of representational change. The chapter shows how major epistemological changes concerning science and religion can influence public storm representation. The study shows how mixed methods environmental history research can improve the understanding of how wider epistemological change influences the public representation and ultimately understanding of storms.

⁸¹ Theodore S. Feldman, *The history of meteorology, 1750-1800: A study in the quantification of experimental physics* (Berkeley: University of California, 1983), 2-9.

Maria-Joao Alcoforado and Fatima Nunes. "The restart of meteorological observations in the 19th century in Lisbon: the contribution of Marino Miguel Franzini 1779-1861," *EGU General Assembly Conference Abstracts* (2013): 5583.

⁸² Morgan, "Understanding flooding in early modern England," 37-50.

⁸³ Christian Rohr, "The Danube floods and their human response and perception (14th to 17th C)," *History of Meteorology* 2 (2005): 71-86.

⁸⁴ Vladimir Jankovic, "The end of classical meteorology, c. 1800," *Geological Society, London, Special Publications* 256 (2006): 91-99.

⁸⁵ James M.C. Burton, "Robert FitzRoy and the early history of the Meteorological Office," *The British Journal for the History of Science* 19 (1986): 147-176.

⁸⁶ Katharine Anderson, *Predicting the weather: Victorians and the science of meteorology* (Chicago: University of Chicago Press, 2005), 3-34.

⁸⁷ Boyd Hilton, "From Retribution to Reform," in *The Age of Revolution*, ed. Lesley M. Smith, (London: MacMillan Education, 1987), 43.

Philip Williamson. "State prayers, fasts and thanksgivings: public worship in Britain 1830-1897," *Past and Present* 200 (2008): 121-174.

7.2. Analytical Approach

Western Britain has historically experienced regular high magnitude storms with large human impacts that have been variably represented.⁸⁸ Despite the wealth of archival information, storms in Western Britain are under researched compared to Eastern Britain, where the legacy of the 1953 North Sea Flood is present and there is a greater regional risk.⁸⁹ However, historical evidence and future predictions indicate that the communities of Western Britain are exposed to a high storm risk which must be assessed.⁹⁰

This chapter stems from a wider multidisciplinary environmental science and history study on coastal storms in Western Britain. Western Britain is defined as all areas within 25 km of the coast from the Celtic Sea in the South West to The Minch in North West Scotland including all British islands. Despite the contributions of other environmental history research, emphasis has largely been placed on flooding and storms that occurred outside the coastal zone.⁹¹ In contrast, this study focuses on all reports relevant to coastal storms to assess the wider role of science and religion on storm representation.

An analysis of newspaper storm-related articles between January 1800 and February 1953 was undertaken. Overall, 1123 storm-related publications were firstly identified using the British Library Newspapers GALE online archives and the ProQuest historical newspapers database.⁹² The newspapers selected provided detailed and varied coverage of storm-related events across Western Britain and had a reputation for high reporting accuracy.⁹³ Extracts gave a broad view of changing representations throughout society, ranging from

⁸⁸ David Worthington, "Introducing the new coastal history: Cultural and environmental perspectives from Scotland and beyond," in *The New Coastal History*, (Cham: Palgrave Macmillan, 2017) 3-30.

⁸⁹ Allan McRobie, Tom Spencer, and Herman Gerritsen, "The big flood: North Sea storm surge," *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 363 (2005): 1263-1270; Hall, "Plugging the gaps: the North Sea Flood of 1953 and the creation of a national coastal warning system," 1-20.

⁹⁰ Jason A. Lowe, Dan Bernie, Philip Bett, Lucy Bricheno, Simon Brown, Daley Calvert, Robin Clark, UKCP 18 science overview report 2.0, Met Office Hadley Centre, 2018, 2-15; Keith Adams and Mohammad Heidarzadeh, "A multi-hazard risk model with cascading failure pathways for the Dawlish (UK) railway using historical and contemporary data," *International Journal of Disaster Risk Reduction* 56 (2021): 102082.

⁹¹ Neil Macdonald and Heather Sangster, "High-magnitude flooding across Britain since AD 1750," *Hydrology and Earth System Sciences* 21 (2017): 1631-1650.

David Archer, Greg O'donnell, Rob Lamb, Sarah Warren, and Hayley J. Fowler, "Historical flash floods in England: New regional chronologies and database," *Journal of Flood Risk Management* 12 (2019): e12526.

⁹² British Library Newspapers, GALE Primary Sources, <https://www.gale.com/intl/primary-sources/british-library-newspapers> (last accessed February 9, 2021); The Guardian and The Observer, ProQuest Historical Newspaper, <https://www.proquest.com/hnpguardianobserver/> (last accessed February 10, 2021).

⁹³ Ian, G., Paul, A., Andrew, H., Amelia, J.J., Daniel, K., Catherine, P., Paul, R. and Cj, R., 2016. From digital resources to historical scholarship with the British library 19th century newspaper collection. *Journal of the Siberian Federal University. Humanitarian sciences*, 9(4), pp.994-1006; Graham, T. and Wright, S., 2015. A tale of two stories from "Below the Line" comment fields at the Guardian. *The International Journal of Press/Politics*, 20(3), pp.317-338.

interviews with first-hand witnesses to the contributions of state officials, scientists and poets.

The representation data were then classified with a keyword analysis which informed the subsequent qualitative assessment. Each identified extract was checked to ensure the keyword highlighted genuine storm representations instead of points of dramatic emphasis. All 1123 storm-related reports were also qualitatively checked to ensure complete identification. Overall, 177 contained religious or scientific representation. Representations all involved storm-related (i.e. flooding) interpretation. For example, a simple recording of barometric pressure would not be included.

Annual representations were firstly calculated and plotted against time (Figure 7.1(a)). The data were then adjusted against the number of published storm-related extracts to account for temporal publication variability and better highlight religious and scientific trends (Figure 7.1(b)). In the context of this research adjusted representations means the number of religious or scientific representations divided by the overall number of recorded storm-related extracts over a set time period (i.e. year or decade). To better gauge long-term change, representation trends over the fifteen decades (1800-1950) and 1950-1953 were then displayed (Figure 7.2(a)). The data were then adjusted relative to storm-related extract publication (religious representations divided by overall storm-related extracts in a set period). Adjusted representation trends (Figures 7.2(c-d)) were then plotted and analysed. Analyses were undertaken using Mann-Kendall correlation tests on SPSS® to assess representation correlation (Tau) against time and relationship significance.

Stem keywords were initially used to identify representations. The keywords 'God', 'Almighty', 'Lord', 'Deity', 'Creator', 'prodigious', 'religion' and 'divine' were used to determine religious representations. The keywords 'meteorology', 'barometric', 'science', 'predict', 'engineering', 'experiment', 'technology', 'Meteorological Office', 'Fitzroy', 'climatic' and 'atmospheric' were used to identify scientific representations. Variations of each keyword were also included. Although astrological representations were published they were often confined to sensational pamphlets and therefore have been omitted.⁹⁴

⁹⁴ Katharine Anderson, "The weather prophets: science and reputation in Victorian meteorology," *History of Science* 37 (1999): 179-216.

However, the wider influence of astrological weather representations on religious and scientific representations is considered.

7.3. Representation Statistics

The data indicate temporal trends in religious and scientific representation. The data comprising the observed representation scatter plot in Figure 7.1(a) initially highlights high annual variability and gives a broad overview of temporal trends. The adjusted data in Figure 7.1(b) provides a normalised view of trends and exhibits a clear decrease in religious representations (red) over the 153 years.

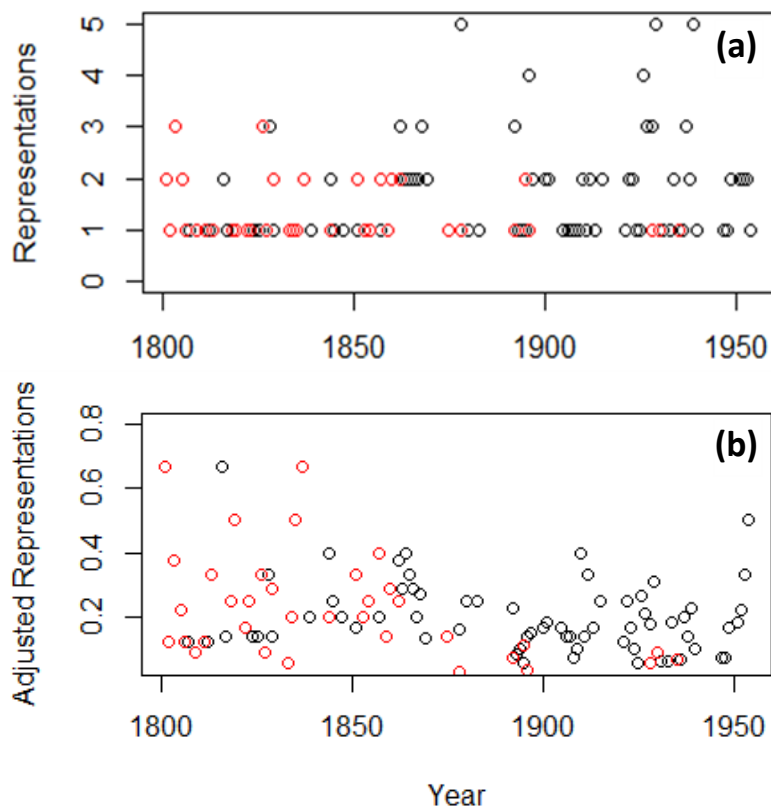


Figure 7.1. Annual variability in observed reported representations (a) and annual variability in reported representations adjusted for numbers of extracts produced per annum (b) for divine (red) and scientific (black) representations.

The data in Figure 7.2(a) exhibit the high variability in reported divine representations and the overall decrease over time from ten in 1800-1809 and zero representations are noted between 1900-10, 1910-20, 1940-50 and 1950-53. This trend is also reflected by the

adjusted representations data (Figure 7.2(c)), which exhibit an overall decrease over the period despite the isolated increase to 0.18 during 1850-59. Mann-Kendall Tau correlation values of -0.579 (observed) and -0.627 (adjusted), which are significant to 0.05 (<5% chance of random occurrence) further exhibit diminishing divine representations (Table 7.1).⁹⁵

Table 7.1. Mann-Kendall Tau correlation values and statistical significance for observed and adjusted representation values from 1800 to 1953.

Representational Change		Religious	Scientific
Observed	Tau	-0.579	0.332
	Significance	0.003	0.078
Adjusted	Tau	-0.627	0.217
	Significance	<0.001	0.247

Scientific representations exhibit a comparatively high degree of variability. Decadal adjusted representations indicate an increase over the period, while observed representations exhibit an increase with high variability and an inter-decadal range of 22 (Figure 7.2(b and d)). Mann-Kendall tests indicate an insignificant ($p=0.247$) Tau value of 0.217 for adjusted representations, while observed scientific representations have a higher Tau (0.332) which is significant to 0.1 ($p=0.078$).

⁹⁵ For reference 1, 0 and -1 would respectively represent perfect positive, no and perfect negative correlation.

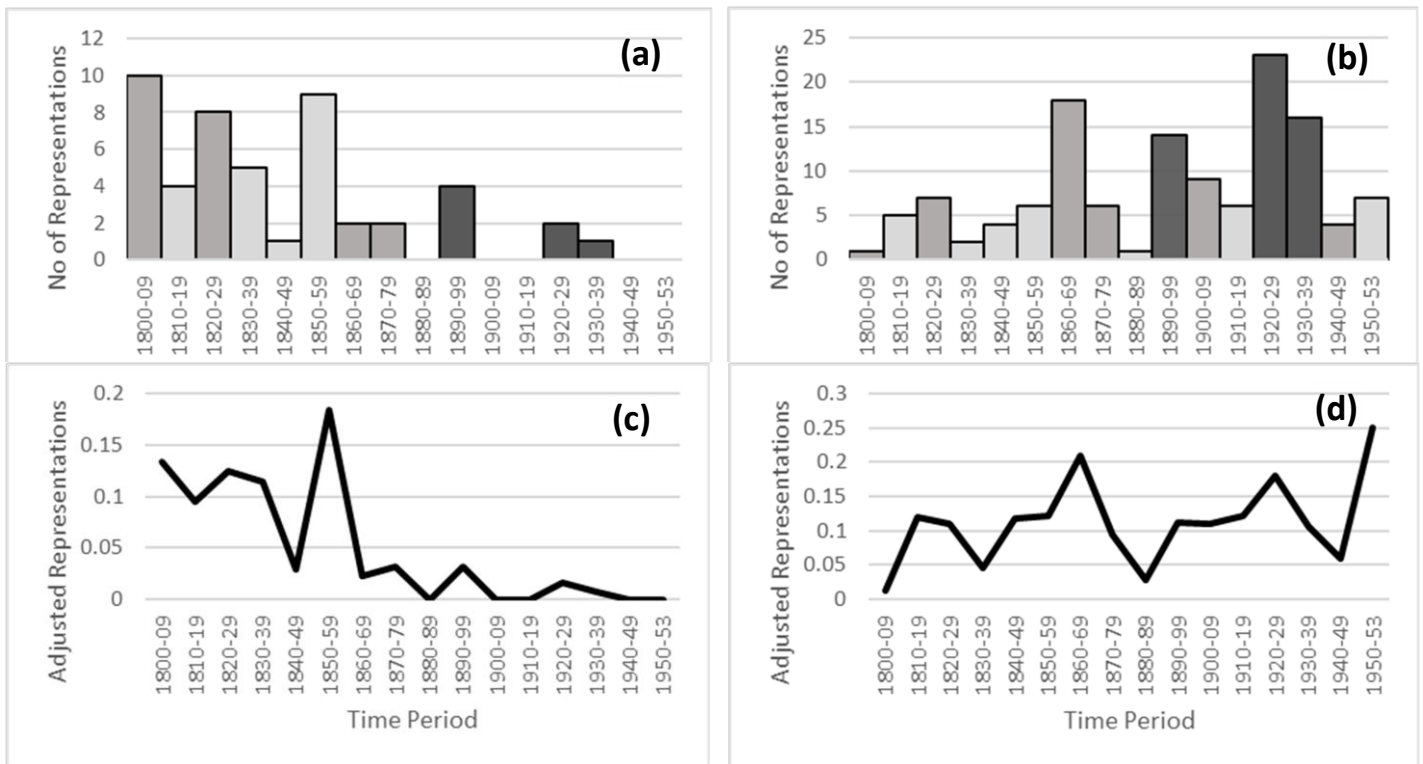


Figure 7.2. Observed representation for divine (a) and scientific representations (b). Bar colours indicate the number of overall extracts published per period: light grey (≤ 51), grey (52-101) and dark grey (102-151). Decadal variability for adjusted divine representations (c) and adjusted scientific representations (d) are also exhibited.

7.4. Discussion and Analysis

The representations exhibit opposing trends with divine representations (observed and adjusted) possessing the clearest significant 153-year trend decreasing at a greater rate than the more variable scientific representations increased. The contradicting trends and important reports exhibiting representational change are subsequently analysed and the wider epistemological change considered.

7.4.1. Divine Decline

7.4.1.1. Religious Predominance, Fate and God's Will: Early Nineteenth Century

The first decade of the study period has the greatest number (10) of reported religious representations which predominate over scientific (1). The year 1802 stands out with three divine representations. Of the ten divine extracts from 1800-09, three concern religious storm poems while seven concern direct acknowledgement of providential storm intervention. This belief of the 'special intervention of Providence' and an active interventionist God predominates. Humans are depicted to be at the mercy of, or aided by, God, who is represented as the architect of the storm.⁹⁶ The seven acknowledgements of providential intervention and aid are written almost as undisputed fact and found in informative sections such as 'Port News'.⁹⁷

Divine intervention is also widely used to explain unlikely storm escapes. For instance, the survival and rescue of a Liverpool man whose roof had collapsed upon him during the storm of January 20-21, 1802 was portrayed as 'the most wonderful mark of preservation' as 'if by the special care of providence'.⁹⁸ Similarly, when an infirm man floated to the safety of shore off Plymouth, it was remarked the 'special intervention of Providence' saved him from 'the inevitable fate'.²⁴ The reports appear to diverge from the British medieval and early modern ideas of divine wrath and punishment.⁹⁹ Instead, representations resonate more

⁹⁶ *Morning Post* (London), "Ship News," December 29, 1803, 3.

⁹⁷ *Trewman's Exeter Flying Post* (Exeter, Devon), "Port News," November 3, 1808, 3.

⁹⁸ *Lancaster Gazette* (Lancaster, Lancashire), "The Recent Storm," January 30, 1802, 3.

⁹⁹ Jan Golinski, *British weather and the climate of enlightenment* (Chicago: University of Chicago Press, 2010), 29-37; Morgan, "Understanding flooding in early modern England," 37-50.

with Rohr's (2005) findings of the presiding view of divine assistance rather than punishment.¹¹ The representations also mostly reflect the findings of Mulcahy (2005) who notes that the concept of divine assistance and agency in storms was prevalent in British and American cultures in the Caribbean and Southern United States.¹⁰⁰ Bearing strong resemblance to the 1800-09 representations, the *South Carolina Gazette* reported the change in direction of a 1752 hurricane was 'as single an instance of the immediate interposition of divine providence that ever appeared'.²⁸ This similarity highlights that interpretations of an interventionist God remained prevalent in wider nineteenth century culture.

7.4.1.2. Divine Aid or Punishment?: Early to Mid-Nineteenth Century

Further analysis unearths the representation of both apparent good fortune and the humane actions of the rescuers as of divine origin. In an example of the latter, an 1808 article remarks 'providentially the officers and crew were all saved' when their vessel sank off Plymouth.²⁵ A review of other periods of high divine attribution also highlights this represented relationship between human agency, welfare and providence. During a violent gale on October 7, 1825, a vessel was driven ashore on the Wirral peninsula with only one survivor. In a letter to the Editor of the *Liverpool Mercury* the survivor attributed his preservation to 'the humane attentions' of Mrs Boodie at Mockbeggar Hall.¹⁰¹ However, her charity is represented as 'the interposition of Providence'. In this sense humane actions are represented in a way that rescuers are partially stripped of agency and emphasis placed on the stewardship of God. The subsequently published poem in the *Liverpool Mercury* entitled 'Wreckers', also similarly refers to her act.¹⁰² The poet remarks that the 'lady of the ancient hall' had a 'Samaritan design'. This was starkly contrasted with the 'savage' pillaging 'wreckers' represented as a 'horrid stain' which 'clings to thy rocky shore' of the 'Most Christian Isle!'

Although representations of God's aid predominate in the early nineteenth century storm extracts, there are also lingering examples of the representation of divine wrath. The sonnet

¹⁰⁰ Matthew Mulcahy, *Hurricanes and society in the British Greater Caribbean, 1624–1783* (Baltimore: John Hopkins University Press, 2005), 53-56.

¹⁰¹ *Liverpool Mercury* (Liverpool, Merseyside), "Melancholy Accidents," October 14, 1825, 6.

¹⁰² *Liverpool Mercury* (Liverpool, Merseyside), "Wreckers," October 21, 1825, 6.

named 'The Storm' published on September 29, 1802 conveys this sense of almighty power.¹⁰³ Despite the struggles of a sailor in the storm, the poet represents the sailor as at the mercy of God who is depicted to have total power with the lines 'at his command, the torrent's rage descends'. In the context of this period, 'The Storm' is particularly rare, as it goes beyond the representation of divine fate. Instead, it resonates with British medieval and early modern reports implying God's punishment with the lines 'When rous'd, and madd'ning with his might, the flood / Pours on the Naiad's haunt his ire'.³¹

Other poetic pieces such as the 1805 stanza 'Written During a Storm' in the *Lancaster Gazette* allude to the power of God as the poet exclaims: 'Almighty God! At whose command / The storm terrific rules the land'.¹⁰⁴ However, direct evidence of divine storm wrath is mostly absent. The other exception to this is the poem 'The Late Tempests' published in the *Bristol Mercury* during the final period (1850-59) of high divine representation (9 representations). The poet exclaims: 'So resolutely rage the winds of heaven! Dark ministers they seem, to whom is given / The mandate of the Mighty one, to heap / Destruction on our dwellings-yea, to sweep' representing the last clear inference between storms and human vice.¹⁰⁵

While the poets clearly make their divine representations clear it is possible poetry has more latitude than prose in purveying what even at the time were somewhat unfashionable ideas.¹⁰⁶ Alternatively, evidence of scepticism of traditional representations of divine storm wrath is also specifically noted in a report of a deadly Irish Sea storm in November 1825. The correspondent actively suggests 'they shall be slow to entertain' the 'suspected of the superstition that these disasters are ominous of the wickedness of the times' as so many 'bright spirits have been extinguished'.¹⁰⁷ In this sense, the storm is not disassociated from the divine but the sense of punishment is dismissed seemingly based on theological reasoning that so many humane people would not have incurred God's wrath. This reflects the dwindling status of divine punishment during the 153-year period.

¹⁰³ *Morning Post* (London), "The Storm," September 29, 1802, 2.

¹⁰⁴ *Lancaster Gazette* (Lancaster, Lancashire), "Written During a Storm," July 20, 1805, 4.

¹⁰⁵ *Bristol Mercury* (Bristol), "The Late Tempests," December 13, 1856, 6.

¹⁰⁶ Stephen K. Heninger Jr, Susan C. Staub, John T. Shawcross, and Anne Lake Prescott. "The Interface Between Poetry and History: Gascoigne, Spenser, Drayton," *Studies in Philology* (1990): 109-135.

¹⁰⁷ *Liverpool Mercury* (Liverpool, Merseyside), "Accidents," November 11, 1825, 3.

A novel insight into religious storm perception and representation is provided by the Italian Count Pecchio in the *Western Times* on November 17, 1832. Pecchio specifically noted that to the British sailor 'religion is a comfort as well as a terror to their minds'.¹⁰⁸ The Count recorded a storm experience exclaiming the sailor 'struggles against death to the very last moment', stating it was only 'when he has tried in vain ... that he resigns himself to his fate, raises his eyes to heaven, and awaits with reverence the will of Providence'. Here the sailor is represented as God fearing but ultimately trusts human over divine agency. Wider research suggests that the sailors described by the reports may have been more pious than most people of the period. Many British sailors at that time had been formerly impressed into the Navy where religion was often used to enhance 'enlightened discipline' while missionaries targeted merchant sailors to further expand Christianity.¹⁰⁹ Religion was therefore widely forced upon sailors as a mode of control, likely explaining why God was often a last resort.

In a more direct sense, the representation of a sailor's struggle for life on the Mersey during the severe storm of September 21-22, 1850 highlights this limited belief in divine agency. The report, based on sailors' primary evidence, exclaimed how a drowning sailor 'gave way to despair, and called upon God to protect his wife and family'.¹¹⁰ In the proceeding Mersey storm, a similar first-hand representation was detailed as a sailor exclaimed it was only as 'The dreadful death-cries reached my ears above the howling of the storm' did those left alive 'then addressed ourselves to the Almighty to receive our souls'.¹¹¹ These accounts affirm Pecchio's representation of the sailor's use of the divine in desperation appearing to infer an underlying Christian belief but little recognition of divine agency. It is important to consider, however, that these first-hand accounts only give a partial insight into the religious representations of sailors.

Relevant research indicates that the reports communicating the widespread irreligious (i.e. wrecking) behaviour of British coastal communities are likely accurate. Deliberate wrecking was so commonplace that coastal communities paradoxically sometimes turned to God for

¹⁰⁸ *Western Times* (Bristol), "English Observance of the Sabbath," November 17, 1832, 2.

¹⁰⁹ Richard Blake, *Religion in the British Navy 1815-1879: Piety and Professionalism* (Woodbridge: Boydell & Brewer Ltd, 2014), 106. Manikarnika Dutta, "The Sailors' Home and moral regulation of white European seamen in nineteenth-century India," *Cultural and Social History* 18 (2021): 201-220.

¹¹⁰ *Liverpool Mercury* (Liverpool, Merseyside), "Extraordinary Gale in the Channel," September 24, 1850, 5.

¹¹¹ *Liverpool Mercury* (Liverpool, Merseyside), "The Gale," October 11, 1850, 3.

wrecking assistance with infamous prayers such as 'Oh please Lord, let us all pray for those on the sea; But if there's got to be wrecks please send them to we'.¹¹² This evidence suggests that Rolls' demeaning theological representation of wreckers and the tendency of sea-faring communities to turn to God only in desperation were reflective of the religious interpretations of the communities. This reflection of God reveals the growing sense of 'general providence' defined as 'uniform benevolence discernible in the design of universe governed by regular laws'.¹¹³ Notions of an intervening active God capable of directly saving or punishing are largely replaced with ideas of divine will and conscious human agency.

While the range of nineteenth century divine storm explanations may appear variable and in some instances contradictory, this can be explained by the key roles of theologians in meteorological understanding. Recording and understanding the weather was to some a way to better understand the actions of God, while others viewed weather recording as a means of civilised and enlightened development view in a more secular and scientific manner.¹¹⁴ It is therefore understandable that the recorded storm representations in Western Britain exhibit different forms of religious representation. That said, the religious reports do increasingly exhibit the predominance of general providence over an interventionist God, illustrating the impact of evolving enlightened religious thinking on public storm representation.

7.4.1.3. God, Storms and Charity: Mid to Late Nineteenth Century

Besides offering explanations about storms, religion is also used to illustrate enduring storm response in the form of charity. This is demonstrated in a poetic address from Mrs Henry Rolls at the first anniversary of the Royal National Lifeboat Institution (RNLI) published on March 25, 1825 during a decade of religious predominance over science. In the address concerning wrecking, God is utilised for emotional impact. Rolls exclaims that the actions of wreckers were 'Not the wrath of heaven which bade thee know' and alternatively utilises

¹¹² Pearce, C.J., 2010. *Cornish Wrecking, 1700-1860: Reality and Popular Myth*. Boydell & Brewer. 1-12.

Brad Duncan and Martin Gibbs, *Please god send me a wreck: Responses to shipwreck in a 19th century Australian community* (London: Springer, 2015), 201-204.

¹¹³ Golinski, *British weather and the climate of enlightenment*, 51.

¹¹⁴ Vladimir Janković, *Reading the skies: a cultural history of English weather, 1650-1820* (Manchester: Manchester University Press, 2000), 5-21. Joseph Hardwick and Randall J. Stephens, "Acts of God: Continuities and change in Christian responses to extreme weather events from early modernity to the present," *Wiley Interdisciplinary Reviews: Climate Change* 11 (2020): e631.

the Almighty in order to appeal to better side of human nature by concluding: ‘No! – ‘twas His hand, whom winds and waves obey, / Which drew forth to show the appointed way; / To bid Philanthropy’s bright flame expand / And pour new glories o’er thy native land!’.¹¹⁵

This represents the best example of the direct use of God to promote conscious human agency. The storm remains divine but God appears devolved of responsibility for any suffering. Instead, God is represented to desire charitable action which will consequently enlighten Britain. Here God is used for moral purposes to provoke humane response, yet the underlying premise of overriding divine power is maintained. Rolls therefore subscribes to a belief in general providence by portraying how divine will can be perceived and cause a human response.

This morality focused address to the ‘enlighten’d sons of British sires’ also resonates with idea that British concepts of weather and charity were inherently associated with an enlightened character.¹¹⁶ Rolls appears to emphasise the sophistication of charity, represented as ‘noble strife’, while the wreckers are contrasted as inhuman ‘wretches ... in form alone allied to human race!’ Although there is an emphasis on the moral obligation of the elite, Rolls ultimately appeals to a sense of human fraternity with the line ‘And in each and every sufferer, hail a brother man!’.⁴⁴ The representation therefore emphasises the religious and societal obligations of the elite to garner RNLI support. The storm remains divine but is represented as an opportunity for personal enlightenment through charity which will ultimately ‘pour new glories o’er thy native land!’ Rolls’ address aptly illustrates the impact of enlightenment on religious interpretation as she stresses the ability to perceive divine will while the storm possesses an indiscriminate divine mission.

This association between maritime charity and an enlightened character amongst the societal elite is also represented throughout the late nineteenth century and early twentieth century in charity meeting reports. Despite the maintained focus on the righteousness and humanity of charity, there is a progressive representational change. The RNLI and Liverpool Shipwreck and Humane Society (part of Royal Humane Society) reports of the 1880s and 1890s increasingly focus on the actions of the lifesavers themselves representing independent agency. Saviours are directly persistently praised for ‘courage and humanity in

¹¹⁵ *Liverpool Mercury* (Liverpool, Merseyside), “Lines,” March 25, 1823, 6.

¹¹⁶ Golinski, *British weather and the climate of enlightenment*, 29-37.

saving human life' and offered tangible rewards.¹¹⁷ No direct mention of God is made, highlighting an evolving idea of charity as an act which was more passively associated with Christian values. Barclay's research on lifesaving and the Royal Humane Society (RHS) supports this theory noting how the relationship between lifesaving and Christianity in late Victorian Britain was highly complex and increasingly centred around the growing concept of Muscular Christianity.¹¹⁸ As the influence of religion on British life declined with the church's relinquishment of major functions (e.g. education), the 'real life' stories of bravery and self sacrifice promoted by organisations like the RHS were used to more broadly advocate Christian values amongst the increasingly literate working classes and youth.¹¹⁹

7.4.1.4. Divine Anomalies: Early to Mid-Twentieth Century

The twentieth century data support the decreasing trend of divine representation with just three representations. There is also a high degree of variability in divine representation amongst these later observations. Perhaps the most interesting and diverse of the representations concerns the only non-Christian religious observation on December 25-26, 1934. On a stricken vessel in the Celtic Sea, an 'Arab seaman, with the ceremonial attached to the religious rites which he observes, broke a live chicken's neck and threw the body overboard with a prayer for deliverance.¹²⁰ This bears similarity with sailors' divine representations of the nineteenth century indicating underlying divine belief but little sense of divine agency. This report represents the last divine observation in a period characterised by a steep decline in divine representations. Although the research period mostly concerns the post-Enlightenment period after 1815, there is still evidence of lingering belief in an interventionist God. However, the dominance of general providence in the reports does widely reflect changing religious thinking throughout British society. Religious representations are in overall decline throughout the period, becoming very rare by the twentieth century as they are replaced by scientific representations.

¹¹⁷ *Liverpool Mercury* (Liverpool, Merseyside), "Liverpool Shipwreck and Humane Society," March 18, 1893, 4.

¹¹⁸ Barclay, C.P., 2009. *Heroes of Peace: the Royal Humane Society and the Award of Medals in Britain, 1774-1914* (Doctoral dissertation, University of York). 19-21.

¹¹⁹ S. Brown, *Providence and Empire: Religion, Politics and Society in the United Kingdom, 1815-1914* (Harlow, 2008). 141-192.

Barclay, *Heroes of Peace: the Royal Humane Society and the Award of Medals in Britain, 1774-1914*, 19-21.

¹²⁰ *The Guardian* (London), "Ship's Steering Gear Lost and Officer Injured," December 22, 1934, 6.

7.4.2. The Growth of Storm Science

The period 1800-1953 shows a progressive increase in scientific storm-related representations. The statistical data and Mann-Kendall tests adjusted for publication numbers indicate scientific representations exhibit higher variability than divine and predominate from 1860 (see Figures 7.1 and 7.2). Although lulls in reporting for the periods during the two World Wars (1910-19 and 1940-49) likely contribute to reduced statistical significance of the increasing trends, the Tau values of 0.247 (adjusted) and 0.217 (observed) and qualitative data indicate the progressive rise of scientific storm representation.

7.4.2.1. Emergence and Experimentation: Early to Mid-Nineteenth Century

The beginning of the nineteenth century represents a period of religious predominance over science in the storm newspaper reports. Despite the rise of meteorological science from the 1770s, between 1800 and 1829 there are only thirteen scientific representations compared to twenty-two divine.⁹ The first scientific representation from the first decade recorded on June 2, 1806 is particularly interesting as it is more comprehensive than most scientific understandings throughout the 153 years. The *Lancaster Gazette* report of the July 11, 1806 thunderstorm over Ulverston scientifically described the dissipation of electric current.¹²¹ The correspondent remarked ‘this is a remarkable instance of the various directions into which the electric matter may be divided, when a great body of it strikes a building where there are no conducting substances to carry it into the earth sufficiently deep to prevent its return’. This scientific understanding was then further translated into practical advice suggesting that the evidence ‘afford some confirmation to the general opinion of electricians, that the middle of a room is the safest place during a thunderstorm’.⁴⁷ This scientific translation into clear practical advice for the reader largely remains absent or limited even in late twentieth and twenty-first century natural hazard reporting.¹²² This scientific representation in a period of divine predominance is exceptional.

¹²¹ *Lancaster Gazette* (Lancaster, Lancashire), “Thunderstorm,” August 2, 1806, 4.

¹²² Gene Rowe, Lynn Frewer, and Lennart Sjöberg, “Newspaper reporting of hazards in the UK and Sweden,” *Public understanding of science* 9 (2000): 59.
Carolina Höppner, Michael Bründl, and Marcus Buchecker, Risk communication and natural hazards, CapHaz-Net WP5 report., 2010, 108-111.

A review of scientific representations indicates that variable understanding could have been due to the storm type and associated phenomena. The second scientific report in the archives concerning the storm of the May 12-13, 1811 likewise gives a detailed insight into thunderstorms and atmospheric physics.¹²³ With traces of slight scientific hesitancy, the correspondent stated 'it appeared evident that, in this thunderstorm, the clouds were positively, and the earth negatively, electrified'. A later article published on September 1, 1826 concerning an apparatus named the 'Air Thermometer' which showed 'the effect of electricity or lightning in displacing the air' also exhibits a clear representation of scientific and meteorological development.¹²⁴ However, the now disproven conclusion of the apparatus designer that electricity could produce gusts highlighted the developmental stage of science. Nevertheless, the comparative abundance of scientific knowledge concerning thunderstorms and absence of information on typical low-pressure storms highlights early discrepancies in scientific understanding.

Similar reported scientific weather endeavours reaching incorrect conclusions or over generalising also emerged throughout this period. The most notable was Sir W. Herschel's 'Weather likely to follow during the Quarter' in the *Bristol Mercury* on September 1, 1823 (Figure 7.3).¹²⁵ By incorporating the 'philosophical considerations of the attractions of Sun and moon' on climate, Herschel produced generalised daily predictions of weather for two hour periods during the coming quarter as shown in Figure 7.3. Although modern science illustrates these astronomical predictions were overly bold and incorrect, the predictions were driven by a correct core scientific belief that 'The variations of the atmosphere ... seem to succeed each other by chance: but there is no such thing as chance'.⁵¹ The belief that weather variations could 'be connected together by one great common principle' was where Herschel's overestimated his predictive powers. Both Herschel and the *Bristol Mercury* did, however, represent the uncertainty surrounding weather prediction with the newspaper expressing they did not 'pretend to vouch for the accuracy of this table'. Despite caution, the article concludes by representing the impact of recent scientific breakthroughs before promoting meteorological development.

¹²³ *Caledonian Mercury* (Glasgow), "Thunderstorm," May 18, 1811, 3.

¹²⁴ *Liverpool Mercury* (Liverpool, Merseyside), "Phenomena of Thunderstorms," September 1, 1826, 6.

¹²⁵ *Bristol Mercury* (Bristol), "The Weather," September 1, 1823, 4.

Time of New or Full Moon, or of entering the First or Last Quarter.	Weather likely to follow during the Quarter.	
	IN SUMMER.	IN WINTER.
12 Noon to 2 P.M.	Very rainy	Snow or Rain.
2 P.M. to 4 —	Changeable.....	Fair and Mild.
4 — to 6 —	Fair	Fair.
6 — to 10 —	Fair, if wind N. W.	Fair, Frosty, if N. or N. E.
	Rainy, if S. or S. W.	Rain or snow, if S. or S. W.
10 — to 12 Mid.	Fair	Fair and Frosty.
12 Mid. to 2 A.M.	Fair	Hard frost, unless S. or W.
2 A.M. to 4 —	Cold, with showers	Snow, and Stormy.
4 — to 6 —	Rain	Snow, and Stormy.
6 — to 8 —	Wind and Rain...	Stormy.
8 — to 10 —	Changeable	Cold Rain, if wind W.
		Snow, if E.
10 — to 12 Noon	Frequent showers	Cold, with high wind.

Figure 7.3. Sir W. Herschell's 'Weather likely to follow during the Quarter' published in the *Bristol Mercury* on 1 September 1823.

The reports represent the increasing scientific storm understanding in the period while also showing that high variability in understanding produced diverse scientific representations. This trend reflects the meteorological debates while attempts to improve the scientific understanding of an increasingly educated audience resonate in a period in which knowledge authority and engineering the public space of science was of high importance.¹²⁶

Beyond representing the importance of education, newspapers also encourage scientific participation even in decades of divine predominance. The *Liverpool Mercury* on July 4, 1817, for instance, issued a plea for 'intelligent persons, whose veracity the public could depend upon' to contribute towards 'an enumeration of the various meteorological phenomena'.¹²⁷ This request interestingly followed a storm that the newspaper could only report had 'exceeded anything in the recollection of the oldest inhabitant'.

This referral to memories of the oldest inhabitant represents an emphasis on objective scientific information rather than subjective observation which were common throughout the nineteenth century. In eleven cases between 1802 to 1877, storm impacts were described as the worst seen by the oldest inhabitants suggesting reporting exacerbation and

¹²⁶ Jonathan Topham, "Science and popular education in the 1830s: the role of the Bridgewater Treatises," *The British journal for the history of science* 25 (1992): 397-430.

¹²⁷ *Liverpool Mercury* (Liverpool, Merseyside), "The Weather," July 4, 1817, 3.

the questionable accuracy of spoken records and folklore. Although potentially useful in showcasing community representations of storms, there is plentiful evidence that such information is often exaggerated to suit purposes from conjuring divine fear in the Middle Ages to ‘selling disaster’ in the era of climate change.¹²⁸ The seemingly direct plea to encourage semi-objective weather observation in the *Liverpool Mercury* can therefore be seen as an early recognition of scientific valuable over unverifiable rhetoric resonating with the scientific drive of the period, which was heavily influenced by the ‘quantifying spirit’.¹²⁹ This was underpinned by the belief that only when meteorology fully embraced quantitative data would it show its real scientific worth.¹³⁰

From a contemporary perspective, the encouragement of community engagement in science was also beyond its time. However, it should be noted the call for ‘intelligent persons’ would have likely only resonated with a select educated few.¹³¹ Meteorology is portrayed as evolving and inclusive which is particularly outstanding in a period of reported divine predominance.

Although the evolution of the science is represented throughout nineteenth century report, it is most widely reported between 1840 and 1869. One example includes Professor Epsy’s sandstorm condensation theory which according to *Liverpool Mercury* perfectly explained a Lancashire sandstorm in early August 1846.¹³² Likewise, the report of the storm of February 25-26, 1853 highlights the use and value of Osler’s self-recording pressure-plate and anemometer at the Liverpool Observatory.¹³³ However, the greatest period of meteorological development and debate occurred between October 1859 and December 1867 and was centred around the use, rigor and value of Admiral Fitzroy’s storm warning system.

Why this development and attempt to understand ‘unruly weather’ through a scientific lens occurred is a matter of debate, however it very likely stemmed from a new enlightened

¹²⁸ Morgan, Understanding flooding in early modern England, 37-50

Jeroen Waner and Ingrid Boas, "Securitisation of climate change: the risk of exaggeration," *Ambiente & Sociedade* 20 (2017): 203-224.

Paul Solman and Lesley Henderson, "Flood disasters in the United Kingdom and India: A critical discourse analysis of media reporting," *Journalism* 20 (2019): 1648-1664.

¹²⁹ Janković, *Reading the skies: a cultural history of English weather, 1650-1820*, 5-21.

¹³⁰ Feldman, *The history of meteorology, 1750-1800: A study in the quantification of experimental physics*, 2-9; Golinski, *British weather and the climate of enlightenment*, 6.

¹³¹ Jan Golinski, "Time, Talk, and the Weather in Eighteenth-Century Britain 1," in *Weather, climate, culture* (London: Routledge, 2003), 17-38.

¹³² *Liverpool Mercury* (Liverpool, Merseyside), "Remarkable Storms in Liverpool," August 7, 1846, 4.

¹³³ *Liverpool Mercury* (Liverpool, Merseyside), "Meteorological Results," March 1, 1853, 7.

emphasis on order and reason which gained widespread traction in the late 1700s and 1800s.¹³⁴ The accompanying rise of general providence gave many a newfound humane scientific motivation.¹³⁴ According to the prominent 1860s theologian William Robertson Smith, scientific prediction was distinctly different to prophecy as religious understanding was of 'a different order' to scientific knowledge.¹³⁵ Predictive science was therefore not heretical, and Christians could engage in meteorology for human benefit. Admiral Fitzroy embraced this ethos, devoting his life to meteorology and the Meteorological Office with the primary intention of preserving life at sea and in coastal communities.¹³⁶

7.4.2.2. Scientific Prediction and Warnings: Mid to Late Nineteenth Century

The period 1850-1879 represents a marked change in storms and meteorological representation and the period when scientific representations surpass divine. The mid-late nineteenth century represented the widespread acceptance of long nurtured scientific meteorology by the British state with the founding of the Meteorological Department for the Board of Trade (former name for Meteorological Office) in 1854.¹³⁷ Anderson (1999) argues that Victorian British society increasingly saw the forecaster or 'weather prophet' as a complex honourable figure, a view which enhanced the meteorological scientific impetus. This growth of meteorology also resulted in internal competition between scientific meteorologists, while competing theories with theological and astrological groundings remained prevalent until the late 1870s.¹³⁸ Under the direction of Fitzroy the early Met Office would drastically change its approach in 1861 as it began issuing official 'storm warnings' using barometric and telegraphic information from throughout the UK and Western Europe. Understanding why forecasting issues arose is highly complex, although the loss of 459 lives on the vessel *Royal Charter* in October 1859 had a major impact.¹³⁹ Fitzroy was devastated by the catastrophe and responded by focusing on storm warnings and predictions designed to avert similar future storm catastrophes. These new warnings

¹³⁴ Lorraine Daston, "Marvelous facts and miraculous evidence in early modern Europe," *Critical Inquiry* 18 (1991): 112-113.

¹³⁵ Anderson, *Predicting the weather: Victorians and the science of meteorology*, 34.

¹³⁶ Sarah Dry, "Safety networks: fishery barometers and the outsourcing of judgement at the early Meteorological Department," *The British Journal for the History of Science* 42 (2009): 35-50.

¹³⁷ Helen Roberts, "The 150th Anniversary of the first public weather forecast," *Weather* 8, (2011): 221-222.

¹³⁸ Anderson, *Predicting the weather: Victorians and the science of meteorology*, 14-19.

¹³⁹ Leonie Villiger, Mikhaël Schwander, Lorena Schürch, Lucija Stanisic, and Stefan Brönnimann. "The 'Royal Charter' Storm of 1859, Historical Weather Extremes in Reanalyses," *Geographica Bernensia* 92 (2017) 35-45.

issued in 1861 however, placed a large emphasis on general weather observations simply relayed by telegraph and the ensuing scrutiny and criticism of these warnings which were mandatory for shipping were so severe it contributed to the decline and eventual suicide of Fitzroy in 1865.¹⁴⁰ His successor Robert Scott subsequently exclaimed how even the 'smallest lurking germ' of prophecy endangered Victorian meteorology and highlighted the great importance of its public representation.¹⁴¹

The first article concerning Fitzroy's storm warnings was published on February 13, 1861.¹⁴² The focus was on warnings displayed at ports on February 6, 1861 before the storm of February 9-10. Fitzroy explained the storm warnings' purpose after coastal communities and fleet owners had problems interpreting and understanding the new warnings. He pronounced 'these cautionary warning signals advert to winds during part of the next following two or three days; and therefore due vigilance should prevail'.⁶⁷ This explanation was a sign of the new issues the Met Office faced with the installation of a new formalised, centralised and mandatory early warning system.¹⁴³ The new system caused issues amongst coastal communities as since 1854 the Met Office introduction of barometers, disconnected from any centralised system had enabled communities to autonomously make science-informed predictions which informed their decisions. The new centralised system importantly placed more emphasis on 'storm telegraphy' over barometrical readings.¹⁴⁴ Storm telegraphy alternatively, relied on the relay of telegraphs of general weather observations made at various stations throughout Western Europe to the Met Office which then converted the information into forecasts to be distributed as it considered appropriate.¹⁴⁵ The unsurprising predictive inaccuracy and mandatory nature of storm warnings soon resulted in substantial opposition largely from merchants and fishing fleet owners who complained of financial losses resulting from inaccurate, centralised and mandatory predictions.¹⁴⁶

¹⁴⁰ John Gribbin and Mary Gribbin, *Fitzroy: The Remarkable Story of Darwin's Captain and the Invention of the Weather Forecast* (London: Reanimus Press, 2003), 320; Sarah Dry, "Fishermen and forecasts: how barometers helped make the Meteorological Department safer in Victorian Britain," (Discussion Paper 46, Centre for Analysis of Risk and Regulation, London School of Economics and Political Science, 2007), 15-21.

¹⁴¹ Anderson, *Predicting the weather: Victorians and the science of meteorology*, 14.

¹⁴² *Liverpool Mercury* (Liverpool, Merseyside), "Storm Warning Signals," February 13, 1861, 3

¹⁴³ Sarah Dry, "Fishermen and forecasts: how barometers helped make the Meteorological Department safer in Victorian Britain," (Discussion Paper 46, Centre for Analysis of Risk and Regulation, London School of Economics and Political Science, 2007), 15-21.

¹⁴⁴ Sarah Dry, "Safety networks: fishery barometers and the outsourcing of judgement at the early Meteorological Department," *The British Journal for the History of Science* 42, (2009): 35-50.

¹⁴⁵ Anderson, *Predicting the weather: Victorians and the science of meteorology*, 156-159.

¹⁴⁶ Sarah Dry, Safety networks: fishery barometers and the outsourcing of judgement at the early Meteorological Department, 35-50.

This controversy catalysed great debate surrounding the nature of meteorology, forecasts and their purpose and this is directly and indirectly represented in the newspaper reports. High-profile meteorological debates retained great significance following Fitzroy's death. The *Liverpool Mercury* article of August 22, 1866 concerning a Royal Society meteorological meeting gave a detailed insight into the rapidly changing representation of the science.¹⁴⁷ The Royal Society denounced Fitzroy's weather telegraph and 'ill-founded pretences'. Instead, the elite scientists sought a return to establishing a 'firm statistical basis ... for the science of meteorology' and daily forecasts were to be abandoned. With this action the Met Office seemed to partially relinquish the evangelical, humane purposes of its founding, instead representing itself as a purely scientific institution. Wider research shows this change was driven by the then-eminent Francis Galton who 'virtually demolished everything he [Fitzroy] had accomplished'.¹⁴⁸ Despite the best efforts of the correspondent to provide balance, faced with the presented scientific evidence they agreed with the consensus. The article therefore best represents the direct impact of scientific development on public weather representation when the credibility and reputation of scientific meteorology were at the forefront of the public consciousness.

During the next twelve months, reports indicate this change of emphasis only featuring meteorological observations without forecasts. Although reporting remained objective without mention of the impact of forecasting cessation, the period was documented as being particularly deadly. In all 98 fatalities were recorded in Western Britain and papers remarked at the 'formidable list of disasters'.¹⁴⁹

Subsequent reporting evidenced that the prediction debate remained prominent with a report on the 'sectional meetings of the British Association'.¹⁵⁰ Importantly the British Association for the Advancement of Science (BSA) rivalled the Royal Society. The BSA was less elite and sought to enhance scientific involvement and knowledge throughout wider British society.¹⁵¹ Central to the meeting was MP Colonel W H Sykes' paper entitled 'Storm Warnings, their Importance and Practicability'. His representation of meteorology was

¹⁴⁷ *Liverpool Mercury* (Liverpool, Merseyside), "Storm Signals," August 22, 1863, 6.

¹⁴⁸ James M.C. Burton, "The history of the British Meteorological Office to 1905," (PhD Thesis., Open University, 1989), 40-63.

¹⁴⁹ *Liverpool Mercury* (Liverpool, Merseyside), "The Gale," April 12, 1867, 5.

¹⁵⁰ *Liverpool Mercury* (Liverpool, Merseyside), "Storm Warnings," September 11, 1867, 5.

¹⁵¹ Higgitt, R. and Withers, C.W., 2008. Science and sociability: Women as audience at the British Association for the Advancement of Science, 1831–1901. *Isis*, 99(1), pp.1-27; Withers, Charles, Rebekah Higgitt, and Diarmid Finnegan. "Historical geographies of provincial science: themes in the setting and reception of the British Association for the Advancement of Science in Britain and Ireland, 1831–c. 1939." *The British Journal for the History of Science* 41, no. 3 (2008): 385-415.

markedly different to the Royal Society's, exclaiming that they must 'listen to the claims of humanity and the just claims of the public interest' and immediately restart forecasting.⁷³ This was widely approved by the audience who included naval officers, merchants and clergymen. Applying pressure on the Met Office and Royal Society to reintroduce storm warnings for the benefit of communities eventually yielded results. An article from the Met Office published on December 21, 1867 proclaimed the department was 'now prepared to issue, free of cost, to ports or fishing stations which are accessible by telegraph, notices of serious atmospheric disturbance on the coasts'.¹⁵² The new storm warnings were notably not stated as mandatory, and therefore allowed coastal communities to use a combination of the centralised Met Office information with their own barometric and local observations to collectively inform their decisions. The reinstatement campaign also shed light on both the representation of meteorological science and contested Victorian concepts of its purpose. The articles exhibit the direct link between scientific policy and public storm representation and show how within fourteen months British meteorology experienced a revolution which changed the public representations of storms and their predictability.

Following this episode, the notion of meteorology as an uncertain fringe discipline further diminished. The Board of Trade (Met Office) occasionally reinforced the development of the predictions by publishing forecasting accuracy reviews in newspapers. For instance, the 1876 annual review highlighted the accuracy of all storm warnings was 83.9%, which the department stressed was 'higher than any previous year'.¹⁵³ In a more sensationalist manner, a *Western Mail* report exclaimed how the 'weather prophets would seem to be attaining a pitch of perfection in their predictions'. This report also was the first to directly attribute forecasting to reduced storm loss, reinforcing the sense of predictive honour but also somewhat paradoxically referencing prophecy. The report indicates that while meteorology was recognised as a valid independent field, the public representation of astrological or religious 'prophecy' still lingered. Robert Scott's 1879 exclamation about the importance of ridding forecasting of the 'smallest lurking germ' of prophecy likely confirms this.¹⁵⁴

¹⁵² *Liverpool Mercury* (Liverpool, Merseyside), "Renewal of the System of Storm-Signals," December 21, 1867, 5.

¹⁵³ *Western Mail* (Cardiff), "Storm Warnings," November 16, 1877, 4.

¹⁵⁴ Anderson, *Predicting the weather: Victorians and the science of meteorology*, 14.

Despite the continued Met Office progression and the reputational rise of meteorology, the late nineteenth century marks a period where boundless predictive enthusiasm was replaced by scientific realism. Fitzroy's notions of producing a perfect predictive barometer and efforts to predict long-term seasonal weather appeared increasingly difficult.¹⁵⁵ Examples of this changing sentiment are also evident in the newspaper reports in the form of a realistic article in the *Bristol Mercury* on October 14, 1891. The correspondent firstly humorously stated that 'The Meteorological Department is, as a general rule, bold in prophesying. Its predictions may not always be accurate; indeed its critics have made out a case for taking them in a reverse sense' emphasising during a recent storm forecasters were 'completely at sea, or rather in a gale'.¹⁵⁶ Despite partial criticism, the article importantly communicates public knowledge of the inherent difficulties of weather prediction, affirming the 'astonishing variety and change was precisely of the kind that could not have been foreseen'. This representation of the impossibility of perfect prediction long before Lorenz (1963) highlighted the limits of atmospheric prediction, may be seen as testimony to the wider scientific progress of meteorologists.¹⁵⁷ The reports also represent changing public perceptions of the limits of meteorology resonating with the move from idealised perfection to a rational approach of progressive uncertainty reduction.¹⁵⁸ This continued, yet variable progress, is well reflected by the scientific variability and increasing dominance of scientific over religious storm representations in the late nineteenth century newspapers.

7.4.2.3. Scientific Predominance: Early to Mid-Twentieth Century

The rational approach to meteorology in the late nineteenth and twentieth century signified the decline of the Victorian ideas of mastering the weather. Anduaga (2019) notes how this transition to a rational approach of 'taming the weather' was moulded by the growth of nation-state building and science in the Western World.¹⁵⁹ This produced a sense of self-perceived civility, which resonated with the growth of the nation-state and empires as the

¹⁵⁵ Robert Fitzroy, *On Weather Glasses*, 1863, 329-30; Sarah Carson, "Anticipating the monsoon: the necessity and impossibility of the seasonal weather forecast for South Asia, 1886–1953," *The British Journal for the History of Science* 54 (2021): 305-325.

¹⁵⁶ *Bristol Mercury* (Bristol), "Tempestuous Weather," October 14, 1891, 8.

¹⁵⁷ Edward N. Lorenz, "Deterministic nonperiodic flow," *Journal of atmospheric sciences* 20, (1963): 130-141.

¹⁵⁸ Fiona Williamson, "Uncertain Skies. Forecasting Typhoons in Hong Kong, ca. 1874-1906," *Quaderni storici* 52 (2017): 777-802.

¹⁵⁹ Aitor Anduaga, *Politics, Statistics and Weather Forecasting, 1840–1910: Taming the Weather* (London: Routledge, 2019), 1-4.

‘atmosphere, like empire, required discipline on a monumental scale’.¹⁶⁰ This air of statistical, scientific emphasis is also increasingly evident in storm reports of the period. Reports (adjusted for publication number) increasingly contain quantifiable, comparative and rational explanations of storms. However, science and statistics were also often used to emphasise storm power and grandeur. *The Guardian’s* 1929 annual weather review noted an ‘exceptional’ stormy spell at the end of the year which brought ‘winds of record-breaking speed’ with a 110 mph gust in the Isle of Scilly.¹⁶¹ Likewise, during the storm of February 16-21 1910, an average wind speed of 50 mph at Blackpool produced ‘huge waves which rushed landward with terrific power’ presenting ‘a magnificent spectacle’.¹⁶² This representation of storm grandeur throughout the 153 years in both scientific and religious reports remains clearly present in twentieth-century reports. Science and statistics were used to highlight this grandeur while retaining objectivity representing the increasingly rational scientific development in the period. The widespread scientific public recognition, of the immense power of storms is retained.¹⁶³

This growth in objectivity and the wider dissemination of meteorological information is also evidenced in a *Guardian* article concerning the first State radio gale warnings on October 1, 1926.¹⁶⁴ The wider scientific societal weather understanding was also highlighted in a 1937 article denouncing the ‘meteorological myth’ of equinoctial gales. By this period, *The Guardian* had a specialised meteorological correspondent who humorously exclaimed ‘we are all weather prophets (or were before we were pauperised by the six o'clock news)!’.¹⁶⁵ Despite the vast scientific change over more than a century, the article is similar to one of the earliest scientific articles from the *Liverpool Mercury* on July 4, 1817 as it highlights the importance of public weather observation to assist the ‘learned men who look from real observatories’ in improving storm understanding.⁸⁶ This approach resonates with the evolving representation of the science as a more inclusive discipline: the pre-eminent meteorologist George Symons argued that ‘the most eminent men of science to the merest

¹⁶⁰ Anderson, *Predicting the weather: Victorians and the science of meteorology*, 284; Martin Mahony and Georgina Endfield, "Climate and colonialism," *Wiley Interdisciplinary Reviews: Climate Change* 9 (2018): e510.

¹⁶¹ *The Guardian* (Manchester), "Weather Records of 1929," January 6, 1930, 5.

¹⁶² *The Guardian* (Manchester), "A Sea Spectacle at Blackpool," February 18, 1910, 8.

¹⁶³ David E. Pedgley, "A short history of the British Rainfall Organization," *Occasional Papers on Meteorological History* 5 (2002): 1-3; Emily Brady, *The sublime in modern philosophy: Aesthetics, ethics, and nature* (New York: Cambridge University Press: 2013), 155-169.

¹⁶⁴ *The Guardian* (Manchester), "Gale Warnings to be Broadcast," September 30, 1926, 10.

¹⁶⁵ *The Guardian* (Manchester), "The Open Air: Storm," September 26, 1937, 30.

dabblers in harmless hobbies' could all contribute to meteorology.¹⁶⁶ The 1937 article also reflects how scientific dissemination had become widespread, with scientists, governments and the general public alike all realising the importance of accurate and interpretable forecasts.¹⁶⁷

The period 1937-1953 predominantly comprises the consistent publishing of meteorological data and associated explanations although the World War II period is an exception with limited and succinct storm reporting. One of the final reports stands out, however, as it exhibits an emergence of a different form of environmental and scientific representation. The report followed the catastrophic sinking of the MV *Princess Victoria* off Dumfries and Galloway during the storm of 30 January to February 2 1953 in which 133 people lost their lives in the greatest loss of life in British waters (*The Guardian*, 2 February 1953, p.6; Carter *et al.*, 2019).¹⁶⁸ This event was caused by the storm that produced the infamous North Sea Flood of Eastern Britain. A reflective Cold War era report, also referencing the deadly (34) 1952 Lynmouth Flood, remarks how the events highlighted that 'Natural calamity is a salutary reminder of the littleness of man: he may harness atomic energy, but a gale from the north still makes the seas perilous and can demolish his dwelling-places far inland'.¹⁶⁹ The report interestingly recognises scientific predominance yet implies that a degree of storm fate persists. This representation of the overriding power of storms is particularly interesting as it resonates with religion-related concepts of fate, while also reflecting growing contemporary views of the limits of scientific prediction.¹⁷⁰ This clear recognition of human futility and the limits of science marks a distinct end to the 153-year period, highlighting the enduring relationships between epistemological change and storm representations.

¹⁶⁶ Hugh Robert Mill, "The scientific work of George James Symons, FRS," *Meteorological Magazine* 73 (1938): 165-168.

¹⁶⁷ Pauline Halford, *Storm warning: The origins of the weather forecast*, (Stroud: Sutton Publishing, 2004), 251-273.

¹⁶⁸ Carter, T., Williams, J.G. and Roberts, S.E., 2019. Crew and passenger deaths from vessel accidents in United Kingdom passenger ships since 1900. *International maritime health*, 70(1), pp.1-10.

¹⁶⁹ *The Guardian* (Manchester), "Storm," February 2, 1953, 6.

¹⁷⁰ Morgan, Understanding flooding in early modern England, 37-50; Julia Slingo and Tim Palmer, "Uncertainty in weather and climate prediction," *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 369 (2011): 4751-4767; Richard B. Alley, Kerry A. Emanuel, and Fuqing Zhang, "Advances in weather prediction," *Science* 363 (2019): 342-344.

7.5. Summary

Throughout the 153 year period, reported storm representations indicate clear trends of scientific growth and religious decline and largely reflect wider epistemological change in the form of the rising prominence of science and the diminishing status of religion in Britain. However, public religious and scientific storm representations also exhibit great variability over the time. Religious storm representations predominate in the early nineteenth century. Although general providence had gained prominence before 1800, examples of the representation of an interventionist God with direct control over storms and their consequences were evidenced. It is likely that early nineteenth century dramatic reporting and poetry had more latitude than prose in purveying religious ideas which rapidly became less prevalent in newspaper reports of the early to mid 1800s. General providence becomes increasingly prominent in reports ranging from sailors' accounts and public speeches until the 1850s. The representations of divine will and punishment are replaced with representations expressing the general guidance of God and human interpretations of God's will. This change and variability in religious representation reflects wider theological developments and rise in general providence after the enlightenment period (c.1815). Although religious representations remain prevalent between 1800-1859, their decline coincides with a comparatively progressive increase in scientific prominence.

Despite modern meteorology development in the 1770s, reported evidence of the public scientific representations exhibit high variability and are less prevalent than religious representation in the three decades between 1800 and 1829. Early thunderstorm representations occasionally communicate a high degree of scientific understanding and even attempt to translate science for the benefit of the public who are later encouraged to participate in meteorology. Scientific representations between 1800 and 1859, however, remain highly variable and gradually increase in comparison to religious decline which reflects the developing nature of meteorological science in the period. Reported representations of the meteorological debate and scientific conflict peak in the 1860s, with Fitzroy's storm warnings and the integrity of forecasts and meteorology being key areas of concern in the first decade where science predominates over religion. During this period, the conflict surrounding storm warnings is reported and the public representation of the

value and purpose of storm prediction changes markedly, directly reflecting the turbulent period for the science. While subsequent mid-late 1800s reports clearly represent meteorology and storm prediction as an honourable and valid science, religious and astrological connotations associated with prophecy still linger.

The late nineteenth and twentieth century reports reflect a period of progressive scientific growth and near complete predominance over religion. Victorian ideals of scientific perfection fade and these notions are replaced with a more rational scientific view of storms and their prediction. While storm representations become increasingly scientific, an appreciation of the grandeur and power of storms is retained.

This historical research illustrates how wider epistemological change and variability can substantially influence public storm representations and understanding. Given the wealth of historical evidence in Britain, it is important that further research employing both statistical and qualitative methods is undertaken to better examine changing epistemological and representational relationships. This could ultimately improve the public understanding of the diverse threats and impacts of storms and natural hazards.

Chapter 8: A Multidisciplinary Investigation of Storms Ciara and Dennis, February 2020

Paper Context

This chapter consists of a paper that will be submitted to *Climate Risk Management*. Jardine designed the study, undertook the archival data gathering, conducted the analyses and wrote the paper. Higgins and Selby contributed to the interpretation and assisted in the editing of the paper.

Abstract

High magnitude storms have periodically impacted the communities of Western Britain and this storm threat is predicted to increase with predicted future climate change. Understanding the factors that contribute to storm catastrophe is essential to mitigating the effects of future events. This multidisciplinary study collectively analyses meteorological, tidal gauge and newspaper data from the Storms Ciara and Dennis that occurred in February 2020 to assess the environmental, social and political impacts of the catastrophe in Western Britain. The analysis shows that while the storm period was a meteorological climate anomaly and short-term local authority and community responses were effective, shortcomings in governmental long-term climate change-related policies likely enhanced detrimental storm effects on impacted communities. The study findings, therefore, confer with the wider research concerning UK government policy and climate change and suggest substantive long-term policy change is required to adequately address climate change-related risk and reduce community storm vulnerability in Western Britain.

Keywords

Storms, Storm Dennis and Ciara, catastrophe, climate change, government policy.

8.1. Introduction

Climate change is predicted to increase the frequency of high magnitude storms throughout the UK and Western Europe in the twenty-first century (Haigh *et al.*, 2016; Palmer *et al.*, 2018). Climate and weather records are being more frequently broken, and the British population is suffering more regularly from the subsequent effects of the destruction and degradation of the built and natural environments (Masselink *et al.*, 2020; Kostianaia *et al.*, 2021; Meteorological Office, 2021). The winter of 2019-20 represents a key example, as regions across the UK experienced the impacts of storms and flooding. The UK had the wettest February since records began (1862), with a monthly mean total precipitation of 209.1 mm, which was a 237% positive anomaly relative to the 1981-2010 February baseline (Met Office, 2020a). The Meteorological (Met) Office identified six named storms in this period, defined as events which were predicted to have a likely significant impact on the UK and potentially pose a risk to human life (Met Office, 2022a).

While all six storms collectively produced an exceptionally stormy winter and had substantial impacts, Storms Ciara and Dennis had the greatest consequences for the communities, local authorities, governments and environments of the UK (Davies *et al.*, 2021). Ciara was firstly identified as a system in the North Atlantic on February 3 before undergoing cyclogenesis (Lavers *et al.*, 2020). Striking the UK on February 8-9, it brought very heavy rain and windspeeds of 93 mph were recorded at Aberdaron. More than 200 flood warnings were issued across England (*The Guardian*, 2020a). Ciara alone caused an estimated £200m of insurance claims: approximately 539,000 people were without power and three people died (*The Guardian*, 2020b). Storm Dennis was subsequently identified on February 11 and struck the UK between February 14-16, thereby further compounding the situation. Western Britain was hit particularly hard with the worst of the suffering occurring in South Wales. Warnings of imminent danger to life were issued before historic flooding occurred with the Rivers Taff and Wye reaching the highest levels ever recorded (*The Guardian*, 2020c). In the worst hit area of the Rhondda Valley, 800 homes were evacuated. PricewaterCoopers (PwC) estimated a further £175-225m worth of damage across Britain, and five fatalities were confirmed (*The Guardian*, 2020d). From February 3, the two storms prompted major community, local authority and national government responses in order to

predict, prevent, mitigate and recover from the events. Despite the high magnitude of the storms, the damage and destruction across the UK were partially attributed to government failings (*The Guardian*, 2020e).

The 2019/20 winter and the two storms have been analysed from a primarily meteorological perspective (Sefton *et al.*, 2020; Davies *et al.*, 2021), while Robbie (2020) stated that the storm highlighted the need to adapt legal frameworks so that communities can adapt to frequent future flooding which she terms 'live better with water'. However, no study has attempted to collectively analyse the diverse factors which contributed to the catastrophe. This multidisciplinary research, therefore, employs a mixed methods approach to better understand the characteristics, causes and impacts of the Storms Dennis and Ciara in Western Britain in February 2020. By combining the disciplines of environmental science and environmental history, the study utilises meteorological, tidal gauge, newspaper (*The Guardian & The Observer*) data to analyse the event.

Wind speed, precipitation and storm surge data as well as semi-quantitative and qualitative newspaper data concerning the storm impacts, short-term community and State (local authorities and national governments) response as well as long-term government policies are examined. Kelman (2020, p.1) states that 'our actions turn natural hazards into catastrophes' while Anderson (2011, p.1) notes that natural hazards are not unfortunate unpreventable disasters and instead are catastrophes resulting from 'the intersection of natural hazards ... with human populations in varying states of economic, social, and cultural vulnerability'. This research, therefore, examines to what extent meteorological variability, short-term response and long-term policies contributed to the catastrophe of Storms Dennis and Ciara thereby addressing thesis objective six. The study also meets objective seven and the thesis aim as it ultimately evaluates and underlines the importance of multidisciplinary research in improving the understanding of extreme weather events and exhibits the diverse range of factors that contribute to catastrophe.

8.2. Methods and Approach

To examine the meteorological characteristics, human impacts as well as State and community response to the two storms, quantitative and qualitative data were analysed. The quantitative data comprised meteorological and tidal gauge records collected from eight and seven stations respectively in Western Britain to exhibit storm characteristics variability (see Figures 8.1 and 8.2). Tidal gauge data were selected to indicate storm surge magnitude variability as surges have resulted in great damage and human loss in coastal areas (Horn, 2015; Haigh *et al.*, 2016).

The storm surge tidal gauge data comprises storm surge heights measured at 00:15 intervals (highest available) at seven tidal gauges from 00:00 04/02/2020 to 00:00 19/02/2020. Storm surge height (residual) at each gauge was calculated by the British Oceanic Data Centre (BODC) by subtracting observed and predicted tidal height. Data were sourced from the BODC (2022) archives. The selected gauges from North to South were located at: Stornoway, Millport, Heysham, Holyhead, Milford Haven, Hinkley Point and Newlyn (see Figure 8.1). The gauges were chosen as their distribution indicated storm surge magnitude variability throughout Western Britain. To indicate relative storm surge magnitude at each site, the maximum storm surge recorded for both Storms Ciara and Dennis were compared and ranked against the monthly maximum surge recordings (BODC data) at each station from January 1990 to March 2022 (267 maximum monthly readings). Due to a data range difference, the Hinkley Point maximum monthly readings were from May 1990 to March 2022 (i.e. 263 readings as opposed to 267 for all other stations).. The maximum recorded value during February 2020 which always occurred within the storm window, was indicated along with the corresponding storm and maximum monthly rank. For the storm with the lower maximum storm surge magnitude, which was not recorded in the BODC maximum monthly surge dataset, the magnitude and calculated rank is given relative to the monthly maximum.

The meteorological storm data comprise hourly wind speed (ms^{-1}) and precipitation (mm) records observed at Met Office stations and sourced from the Centre for Environmental

Data Analysis (CEDA) archives. Wind speed and precipitation were selected as the majority of storm damage in the UK results from wind and precipitation-related damage (Graham *et al.*, 2019; Koks, 2020). The selected sites from North to South were: Stornoway, Bishopton, Blackpool, Valley (Anglesey), Aberporth, Chivenor and Camborne (see Figure 8.2). Data from Usk, Monmouthshire were included as it was the closest station with available data to the highly impacted Rhondda Valley; however, only precipitation data were available for February 2020. The only dataset anomaly was a short period of no data for Chivenor from 10:00 10/02 till 09:00 11/02. The sites at the closest possible proximity to the tidal gauges were selected to assess meteorological and storm surge correspondence.

To analyse the human impacts as well as the community and State response to Storms Dennis and Ciara, newspaper data from *The Guardian* online were reviewed. These data also included information from *The Observer* and *The Guardian Weekly*, which are also owned by *The Guardian* Media Group. The national compact newspapers were chosen as they feature detailed information on the local and national storm impacts as well as accompanying scientific information (Llasat *et al.*, 2009; Businger *et al.*, 2018; Archer *et al.*, 2019). *The Guardian* was selected as it represents a high circulation British compact newspaper with the greatest environmental and climate change focus and is generally considered less constrained by commercial or political bias than most other major UK newspapers (O'Neill, 2013; Painter and Gavin, 2016). Relevant data were identified using Google™'s filtered keyword search of *The Guardian* online. The keyword search required articles to include either the keywords: 'storm' or 'flood' and 'Dennis' or 'Ciara'. The period February 4 to February 23 was selected in order to capture all published information directly relating to the storms and their effects. After February 23, reports specifically relating to the two storms ceased. The search returned 32 online articles including two live feeds pages published on February 9 and February 16 for Storms Ciara and Dennis respectively, each individually containing five interactive pages. The articles provided detailed insights into the meteorological characteristics, impacts, direct responses and wider (including long-term) repercussions and responses to the storm period. Articles drew on information from a range of sources including first-hand community witnesses, emergency services, senior governmental (and shadow) ministers and scientists giving a wide perspective on the storms.

The analysis of the storm reports focused on the correspondence of scientific storm variability with the storm impacts, immediate response of the communities and the State as well as the role of long-term government policies regarding severe weather and climate change. Storm magnitude variability as exhibited by the scientific data was firstly analysed. The correspondence between the scientific data, the impacts and responses reported in *The Guardian* was then examined. The discussion subsequently draws on wider research to assess the factors that contributed to the catastrophe.

8.3. Meteorological and Tidal Gauge Results

The results are divided into two sections for meteorological and tidal gauge data spanning the storm period from 00:00 February 4 to 00:00 February 19. This scientific data is subsequently analysed with the qualitative and semi-quantitative storm reports from *The Guardian* and *The Observer* in section 8.4. where the key factors that contributed to the catastrophe are analysed. The meteorological and tidal gauge data can be found in Appendix 3.

8.3.1. Meteorological Data

The hourly Met Office meteorological data gathered from the CEDA archives exhibit variability in precipitation and wind speed during the storm. Over the eight sites throughout Western Britain, precipitation varied with respect to the maximum hourly amount, mean, hours of rainfall and total precipitation (see Figure 8.1 and Table 8.1). The maximum hourly precipitation of 7.8 mm was recorded at Usk at 15:00 on 15/02/2020 during Storm Dennis. Blackpool received only the fifth highest maximum hourly precipitation of 6.0 mm, but this value represented the greatest hourly precipitation relative to the mean total precipitation over a 15 day period in February from 1991 to 2020 at 17.7% (maximum/15 day total). The lowest maximum precipitation was recorded at Chivenor at 3.4 mm. Chivenor also had the lowest hourly maximum value relative to the mean total precipitation received over a 15 days in February (1991-2020) at 9.2%.

The mean hourly precipitation during the storm period was highest at Usk (0.51 mm) and lowest at Valley (0.14 mm). The lowest total hours of rainfall were also recorded at Valley (54 hours) while Stornoway had the greatest number of hours of rainfall at 149 over the 15 days. The total precipitation during the storm period was highest at Usk at 190.6 mm and lowest at Valley at 51.2 mm. Relative to the mean total precipitation for a 15 day period in February (1991-2020), Usk also received the greatest total rainfall increase at 140.7 mm (282.3%). The percentage increase at Usk was 132.3% greater than the second highest of 150.0% at Bishopton. Valley had the smallest increase relative to the mean total precipitation in a 15 day period in February at 18.3 mm and 55.6%. Despite having the second lowest increase in total precipitation (35.4 mm), relative to a mean 15 day period in February, Chivenor had the fourth highest percentage increase at 95.7%.

Table 8.1. Precipitation statistics for the seven sites between 00:00 04/02 to 00:00 19/02. For precipitation (mm), maximum hourly amount, mean, hours of rainfall and total precipitation are shown. For comparison the mean total precipitation adjusted for a 15 day period (equal length) in the month of February from 1991 to 2020 is displayed along with differences between the storm period in mm and %. The 15 day period value is calculated from Met Office (2022) mean February total precipitation data assuming an average day length of 28.27 which accounts for the eight leap years (29 day months) during the period.

Site Location	Precipitation (mm)							
	Storm Period				1991-2020 Comparison			
	Maximum Hourly Amount	Mean	Hours of Rainfall	Total Precipitation	Mean Total Precipitation (15 Day)	Δ	Δ (%)	
Stornoway	6.6	0.32	149	113.8	59.4	54.4	91.7	
Bishopton	7.4	0.46	140	165.8	66.3	99.5	150.0	
Blackpool	6.0	0.23	61	82	33.9	48.1	141.5	
Valley	5.0	0.14	54	51.2	32.9	18.3	55.6	
Mumbles Head	5	0.20	78	71	39.1	31.9	81.6	
Usk	7.8	0.51	108	190.6	49.9	140.7	282.3	
Chivenor	3.4	0.20	91	72.4	37.0	35.4	95.7	
Camborne	6.2	0.27	100	90	50.2	39.8	79.3	

Wind speed was measured at hourly intervals at seven Met Office stations and exhibited statistical variability when maximum, mean and number of hours of wind speed \geq Force 7 were considered (see Table 8.2). Force 7 (13.9 ms^{-1}) was selected as this is classified as a moderate gale on the Beaufort Scale. The greatest maximum wind speed of 27.3 ms^{-1} was recorded at 17:00 on 15/02/2020 at Mumbles Head which equates to a Force 10 on the Beaufort Scale. The lowest maximum wind speed of 14.4 ms^{-1} was recorded at Bishopton at 18:00 on 08/02/2020 of Force 7. Bishopton also experienced the smallest time period when a wind speed \geq Force 7 was recorded, with the maximum reading being the only hour wind speed that exceeded this threshold. The greatest number of hours when wind speed was \geq Force 7 were recorded at Mumbles Head (106 hours) and Valley (103 hours). Mean wind speed over the 15 day period was also greatest at Mumbles Head (11.3 ms^{-1}) with the second highest recorded at Valley (11.2 ms^{-1}). As with maximum wind speed, Bishopton had the lowest mean wind speed of 6.3 ms^{-1} . When compared to the mean wind speed recorded in February from 1991 to 2020, Mumbles Head and Valley exhibited the greatest absolute difference with the mean wind speed during the storm period at 4.0 ms^{-1} greater than the 1991-2020 February mean. The lowest difference in mean wind speed between the storm period and the February mean was observed at Stornoway (1.9 ms^{-1}) which was also the smallest percentage difference relative to the 1991-2020 mean at 26.8%. At Blackpool, the mean wind speed during the storm period was 3.7 ms^{-1} greater than the 1991-2020 February mean which was the greatest percentage increase of 62.3%.

Table 8.2. Wind speed statistics for the seven sites between 00:00 04/02 to 00:00 19/02. For wind speed (ms^{-1}), maximum wind speed, hours when wind speed was \geq Force 7 (13.9 ms^{-1}) and mean are exhibited. For comparison, the mean February wind speed from 1991 to 2020 is displayed along with differences in ms^{-1} and %.

Site Location	Wind Speed (ms^{-1})					
	Storm Period			1991-2020 February Comparison		
	Max Wind Speed	Hours \geq Force 7 (13.9 ms^{-1})	Mean	Mean	Δ	Δ (%)
Stornoway	19.5	42	9.2	7.3	1.9	26.8
Bishopton	14.4	1	6.3	4.5	1.8	40.8
Blackpool	20.1	78	9.8	6.0	3.7	62.3
Valley	23.7	103	11.2	7.2	4.0	55.5
Mumbles Head	27.3	106	11.3	7.3	4.0	54.8
Chivenor	21.1	53	9.3	5.9	3.3	55.9
Camborne	17.0	42	9.0	6.1	2.8	45.8

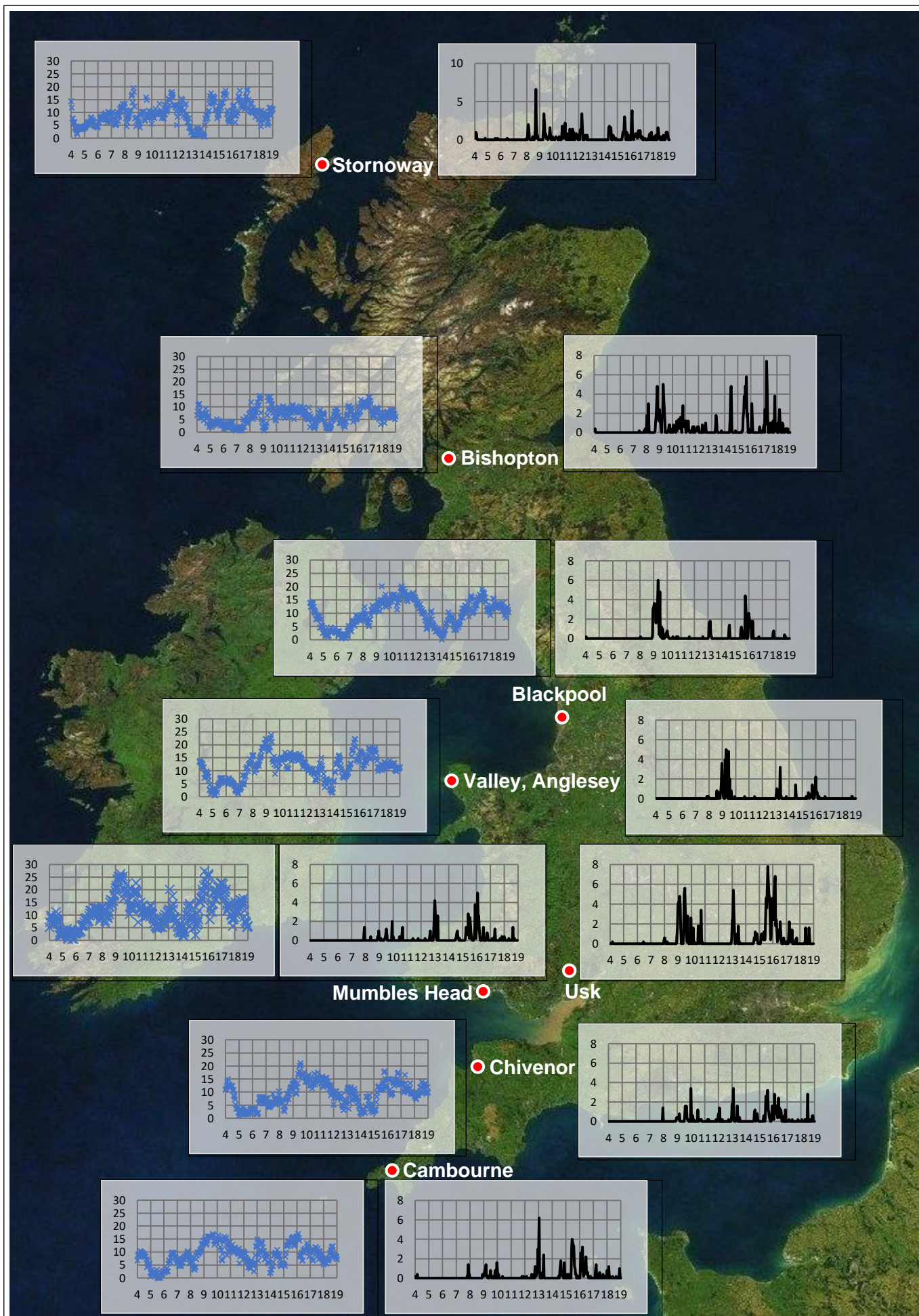


Figure 8.1. Wind speed (light blue scatter) and precipitation (black line) variability for Storms Dennis and Ciara at the seven Meteorological Office stations. Data were collected at 01:00 intervals from 00:00 February 4 to 00:00 February 19. For wind speed graphs, wind speed (ms^{-1}) is shown on the y axes. For precipitation graphs, precipitation (mm) is shown on the y axes. x axes represents time (date). Data were sourced from the Centre for Environmental Data Analysis archives.

8.3.2. Tidal Gauge Data

The BODC tidal gauge data exhibit the variability in storm surge maximum magnitude at the seven sites at 00:15 intervals throughout Western Britain. The maximum surge during each storm was the main variable considered as the mean surge readings can often be distorted by changes in wind direction relative to the coastline and tide gauge creating both positive and negative surges. The greatest storm surge height was recorded at Heysham during Storm Ciara at 15:45 on 09/02/2020 measuring 1.610 m (see Table 8.3). This ranked as the 21st greatest monthly maximum surge recorded at Heysham out of the 267 recorded from January 1990 to March 2022. The second greatest storm surge of 1.458 m was recorded at Hinkley Point also during Storm Ciara at 12:15 on 09/02/2020. This ranked as the 14th greatest station monthly maximum recorded from May 1990 to March 2022 (263 readings). The greatest storm surge recorded during Storm Dennis of 1.409 m was also observed at Heysham at 18:45 on 15/02/2020. This was equivalent to the 32nd greatest monthly maximum surge recorded at Heysham. The surge height of 1.409 m was also the greatest calculated surge magnitude during Storm Ciara. The lowest maximum storm surge magnitude for both storms Dennis and Ciara was recorded at Newlyn, the only east facing gauge. During Storm Dennis, a maximum surge height of 0.616 m was recorded at 13:30 on 15/02/2020 ranking as the 30th greatest maximum monthly surge recorded at Newlyn from January 1990 to March 2022. For Storm Ciara a maximum surge height of 0.493 m was recorded at Newlyn which was equivalent to the 83rd greatest maximum monthly surge.

When storm surge magnitude relative to maximum monthly surge ranks is considered across all gauges, the greatest relative maximum surges were recorded during Storm Dennis at Stornoway (1.009 m) and Holyhead (1.159 m) both of which ranked 4th out of 267 (see Table 8.3). For Storm Ciara, the greatest surge relative to maximum monthly rank was recorded at Hinkley Point ranking 14th of 263. The greatest calculated storm surge magnitude relative to monthly rank was recorded at Holyhead during Storm Ciara at 13:00 09/02/2020 as 10th of 267. The smallest maximum storm surge relative to maximum monthly rank of 30th across all gauges was recorded at Newlyn. The smallest calculated surge magnitude rank relative to monthly maximums across all gauges was also recorded at Newlyn as 83rd of 267.

Table 8.3. Maximum storm surge magnitude statistics for Storms Ciara and Dennis. The rank of the maximum surge recorded in both storms is given relative to monthly maximum surge recordings at each station from January 1990 to March 2022 (267 maximum monthly readings). Hinkley Point readings are from May 1990 to March 2022 (263 readings). The maximum recorded value within the month of February 2020 is given along with the corresponding storm. Given the maximum monthly value can only correspond with either Dennis or Ciara, for the storm with the lower maximum magnitude (i.e. not recorded as a monthly max) the surge magnitude and equivalent calculated rank (*) is given relative to monthly maximums.

Gauge Location	Date	Time	Overall Observed Height (m AD)	Surge Height (m)	Storm	Max Surge Monthly Rank
Stornoway	16/02/2020	18:30:00	2.741	1.009	Dennis	4
Stornoway	09/02/2020	13:00:00	1.560	0.832	Ciara	15*
Millport	09/02/2020	09:15:00	3.540	1.123	Ciara	29
Millport	15/02/2020	16:45:00	4.665	1.104	Dennis	32*
Heysham	09/02/2020	15:45:00	4.375	1.610	Ciara	21
Heysham	15/02/2020	18:45:00	7.113	1.409	Dennis	32*
Holyhead	15/02/2020	17:45:00	4.726	1.159	Dennis	4
Holyhead	09/02/2020	13:00:00	4.719	1.115	Ciara	10*
Milford Haven	09/02/2020	12:15:00	1.808	1.052	Ciara	16
Milford Haven	15/02/2020	16:45:00	2.529	1.003	Dennis	23*
Hinkley Point	09/02/2020	14:30:00	3.867	1.448	Ciara	14
Hinkley Point	15/02/2020	16:45:00	2.529	1.003	Dennis	23*
Newlyn	15/02/2020	13:30:00	3.033	0.616	Dennis	30
Newlyn	09/02/2020	11:30:00	1.224	0.493	Ciara	83*

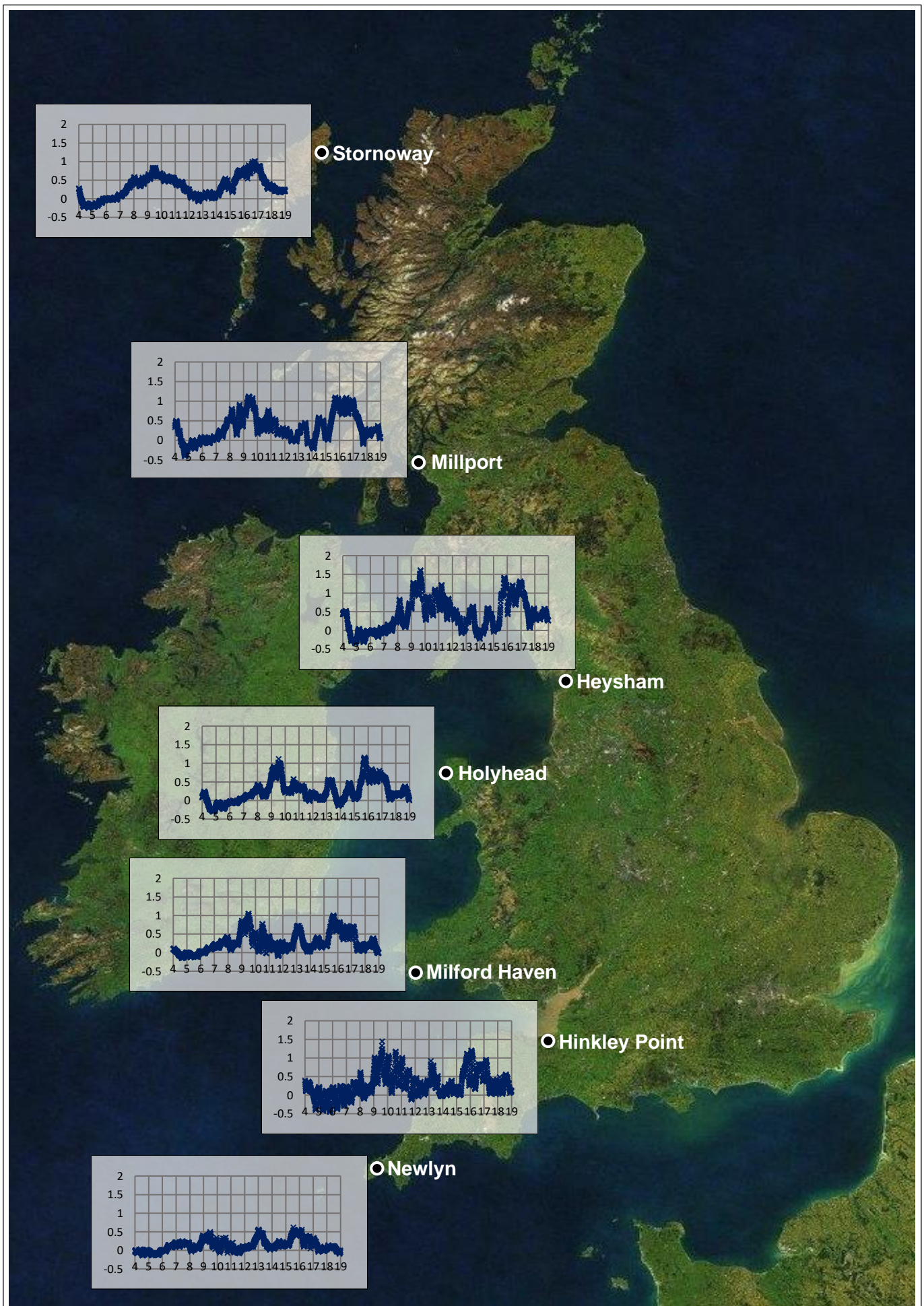


Figure 8.2. Storm surge height variability for Storms Dennis and Ciara at the seven tidal gauges. Data were collected at 00:15 intervals from 00:00 04/02/2020 to 00:00 19/02/2020. The y axes represent storm surge height (m) and data were supplied by the BODC. Surge height (residual) was calculated by the BODC by subtracting observed from predicted tidal heights (predicted). The x axes represent time (date).

8.4. Analysis and Discussion

This section collectively analyses the scientific storm data and the 34 newspaper articles concerning the impacts and effects of Storms Ciara and Dennis. It considers to what extent the catastrophe was a result of meteorological and surge variability, short-term local authority and community response and long-term government policy. The short-term response refers to the immediate response during the storm period including the issuing of forecasts, the preventative actions of the Environment Agency (EA) and the local authority storm response. Long-term policy refers to the influence of governmental policies during Storms Dennis and Ciara and on other extreme climate, storm and flooding events. Policies including flood management, energy, planning and the climate change agenda are evaluated.

8.4.1. Impending Storm

The issuing of UK-wide wind warnings by the Met Office a day after the identification of a deep low pressure system in the North Atlantic on February 4 marked the first recognition of the storm (Met Office, 2020b). The Met Office warnings sought to initially raise awareness to heighten short-term community, local authority and government storm preparedness. On February 4 the scientific data exhibited comparatively low precipitation at most sites with a daily hourly maximum of 1 mm (02:00) and total of 3 mm at Stornoway. Windspeed at most sites was also low in the context of the period although hourly wind speed reached highs of 14.4 ms⁻¹ and 14.9 ms⁻¹ at Stornoway (00:00) and Chivenor (04:00). Storm surge magnitude daily maximas of 0.502 m and 0.522 m were also recorded at Millport (02:00) and Heysham (04:45) (all data temporal trends summarised in Figure 8.7). However, the comparatively low magnitude did not merit reporting in *The Guardian*. The naming of the Storm Ciara by the Met Office on February 5 designated the likely high impact and also showed the first attempt to communicate the impending storm threats (Met Office, 2022a). As Met Office storm naming enhances public engagement and enables quicker dissemination of storm information (Charlton-Perez *et al.*, 2019), the storm naming represents a clear attempt to heighten general storm threat awareness and preparedness.

Despite clear warnings, *The Guardian* did not feature any storm-specific articles until February 7 although an article primarily focused on the English Channel migrant crisis noted the rough seas created by the pre-storm conditions while a sporting article noted how the storm was likely to be the 'UK's strongest storm since 2012' (*The Guardian*, 18:44 7 February 2020). The scientific data for February 7 also reflected the coming storm as the magnitude increased at most sites. Hourly wind speed maximums of 15.9 ms^{-1} (23:00) and 13.4 ms^{-1} (20:00) were noted at Valley and Stornoway and storm surge magnitude increased with maxima of 0.540 m (21:00) and 0.509 m (23:30) at Millport and Stornoway. Precipitation increased more abruptly with the greatest hourly rainfall of 1.4 mm at Mumbles and Chivenor (23:00) and Camborne (21:00) despite 0 mm of rainfall at every site except Bishopton before 19:00.

Only at 12:36 on February 8 was an article published stressing the likely ensuing major disruption. This article featured a combination of warnings detailing the likely storm magnitude, spatial extent and tangible impacts and emphasised the coming 'blizzard-like conditions' (*The Guardian*, 12:36 8 February 2020). Met Office public information was communicated and the chief forecaster was quoted as stating 'The whole of the UK is covered with yellow wind warnings, which means gusts of 50-60 mph regardless of where you are, and potentially up to 70 mph in coastal areas'. Public storm impacts were also highlighted by different governmental organisations such as Network Rail. The information from multiple governmental agencies demonstrated clear pre-emptive efforts to enhance threat awareness and public communication. Storm naming and the use of colour-coded warnings exemplify this as both enable the public to use heuristic processing (i.e. simplified learning) to understand storm severity and threat (Lin *et al.*, 2018). The scientific storm data from February 8 likewise resonates with the increasing level of threat as the magnitude of all variables increased from the previous days.

8.4.2. Storm Ciara

The rapid escalation of storm magnitude during the evening of February 8 and February 9 was clearly indicated by the data (Figure 8.7). The wind speed data exhibited that the storm

was of a very high magnitude as the mean windspeed for February 9 at Mumbles and Valley were 22.0 ms^{-1} and 16.3 ms^{-1} compared to the 1991-2020 February mean of 7.3 ms^{-1} and 7.2 ms^{-1} . At the two sites the daily mean windspeeds were 201.7% and 126.4% greater than the respective means, rendering them considerable weather anomalies. Storm surges of 1.610m (15:45), 1.448 m (14:30), 1.115 (13:00) and 1.052 (12:15) also exhibited considerable anomalies with the 21st, 14th, 10th and 16th greatest monthly surges recorded at Heysham, Hinkley Point, Holyhead and Milford Haven (January and May 1990 to March 2022). Storm surge magnitude during Ciara was anomalously high with six of seven stations (except Newlyn) recording a magnitude in the top 12.1% of the greatest monthly surges. Precipitation on February 9 also rose starkly with highs of 6 mm and 5.6 mm at Blackpool (08:00) and Usk (12:00). Total rainfall at Blackpool and Usk for February 9 was 124.4% and 93.0% of the 15 day 1991-2020 mean exhibiting the exceptionally high precipitation anomalies during Ciara.

The Guardian's reporting on February 9 showed the rising national significance and impact of Storm Ciara as a live feed designated entirely to the storm ran from 15:39 until 23:12 (*The Guardian*, 23:15 9 February 2020). The feed noted the large scale deployment of emergency services resulting from increasing flooding and wind speed magnitude. The first national agency response warning came from Scottish Environment Protection Agency (SEPA) which corresponded with the high precipitation recorded in Scotland. SEPA firstly warned of the imminent danger by issuing 63 flood warnings and 15 flood alerts to promote awareness and in some cases immediate pre-emptive action. Scotland's transport secretary also supported warnings from national agencies by emphasising the importance of heeding instructions. Dramatic photographs and social media posts from national agencies such as Transport for Wales were also embedded in the feed. The posts further emphasised public warnings to avoid travel and highlighted the tangible danger to life. The embedded use of social media continued as by 19:04 *The Guardian* reissued the Met Office amber weather warnings and promoted the Met Office's #WeatherAware. The EA South-East likewise urged public caution with the publishing of warning diagrams (Figure 8.3) and maps noting the 204 flood warnings and 234 alerts across England. The frequent and informative social media posts from governmental agencies reflected an awareness of the high value of social media

to communicate important storm information to the public in an attempt to effectively reduce their vulnerability (Ulvi *et al.*, 2019). The concise posts also highlighted recognition of the need for rapid and clear communication during the event to the large and diverse audiences of social media (Roy *et al.*, 2020). The embedded feed, therefore, evidences attempts of clear response communication designed to effectively reduce public vulnerability.

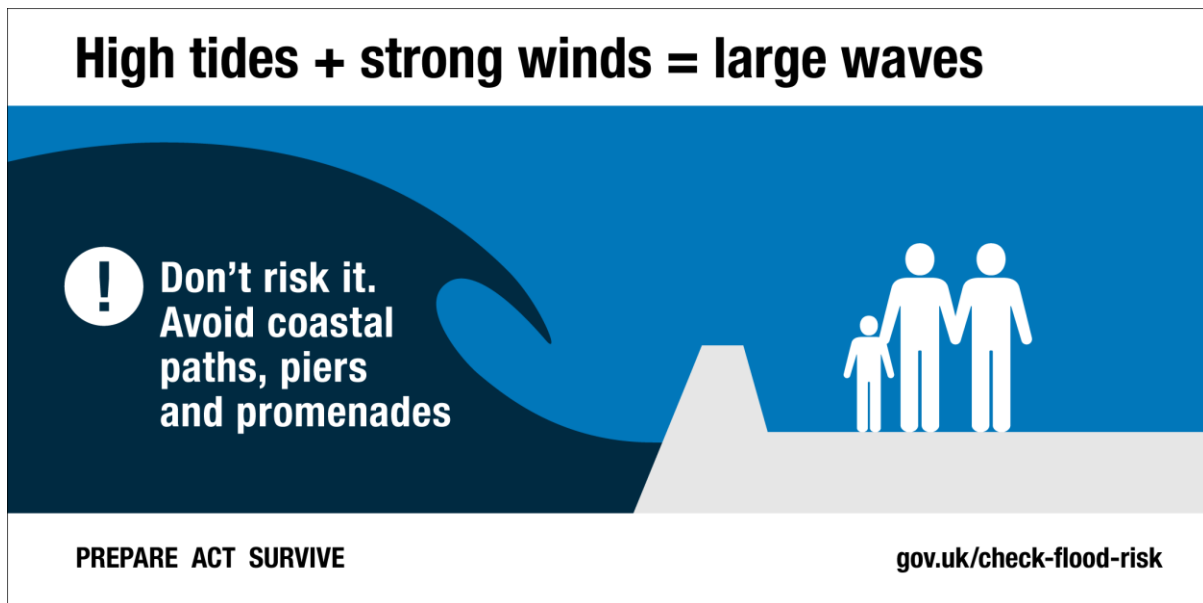


Figure 8.3. A storm surge warning to the general public from the Environment Agency SE featured in *The Guardian's* live feed on February 9.

Reports at 02:36 on February 10 noted storm impacts, however, the main focus remained on the short-term predictions and widespread warnings (*The Guardian*, 02:36 10 February 2020). Met Office warnings were emphasised and well illustrated by a *Guardian* graphic (Figure 8.4) showing the widespread storm threat. The report also featured the first attempt to relate the effects and magnitude of Storm Ciara to long-term governmental response. The shadow environment secretary criticised the government stating Ciara showed a need for greater long-term government investment to enhance the resilience to increasing high magnitude storms driven by the climate crisis. This statement aligned with the United Kingdom Climate Projections 2018 (UKCP18) which predict climate change will likely result in increases in atmospheric storminess, including precipitation, wind strength and storm surge magnitude (Lowe *et al.*, 2018; Palmer *et al.*, 2018). Regarding long-term UK government policy there is also a widely held consensus that fiscal austerity has, and continues to limit climate change adaption and has increased UK community exposure to

high magnitude storms (e.g. Den Uyl and Russel, 2018; Onyango, 2019; McGinlay, 2021; Somerville, 2021).

Subsequent reports on February 10 noted 62 flood warnings in Scotland and 178 in England and Wales. Met Office yellow wind and snow warnings also remained for North-west England and Scotland respectively. The first UK government response was the Bellwin Scheme activation which allowed local authorities to apply for extra storm response funds and be reimbursed was noted. The Bellwin Scheme is a centralised economic instrument that reimburses local authorities for expenditure on immediate action to safeguard life, property or prevent suffering and major inconvenience when budgets are exceeded (Sandford, 2015; Gralepois, 2019). Since its introduction in 1989 the scheme has adapted in response to events to improve the effectiveness of local authority and emergency service response to natural catastrophes (Raadgever *et al.*, 2018). Key revisions were made following the winter 2013/14 storms which reduced Bellwin thresholds, paid grants at 100% above the threshold and extended spending periods (Bennett and Hartwell-Naguib, 2014). This evidence, exhibits UK government short-term catastrophe response adaptability, but the frequent strategy of policy revision following catastrophe perhaps suggests a partially reactive and short-term strategy as opposed to a proactive long-term approach (Onyango, 2019).

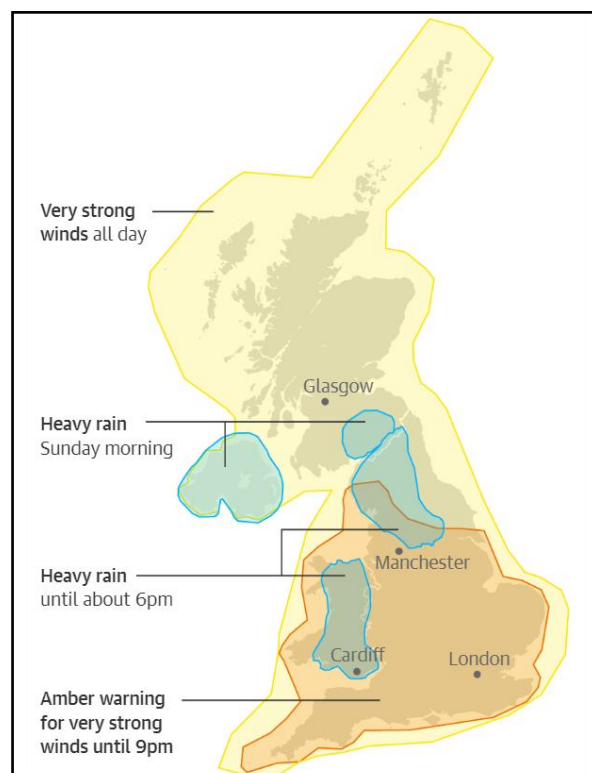


Figure 8.4. Annotated storm warning figure created by *The Guardian* using Met Office Data (*The Guardian*, 10 February 2020).

The scientific data from February 10 corresponded with the high number of weather warnings. At Blackpool in North-west England, the wind rose to a site high of 20.1 ms^{-1} (23:00) while a storm surge peak of 1.214 m followed at Heysham at 05:00 February 11 (see Figure 8.7). Precipitation on February 10 also conformed with Met Office predictions as the data indicated that precipitation at Stornoway and Bishopton was a clear positive anomaly with a daily rainfalls of 9.2 mm and 18.2 mm which were 132.5% and 311.7% greater than the February 1991-2020 daily mean. Despite no impact reporting, *The Guardian* acknowledged that a range of communities had been impacted by Ciara and displayed a willingness to understand the effects by asking readers to share their experiences (*The Guardian*, 15:03 11 February 2020). The further decrease in magnitude was evidenced by the scientific data which showed all variables decreasing until 18:00 to 21:00 on February 12 with the exception of Stornoway precipitation. The decreasing magnitude evidenced by the data was also reflected in a report at 13:04 on February 12 which predominantly focused on the impending Storm Dennis. Warnings from the Met Office and EA of snow, ice and winds were reported (*The Guardian*, 13:04 12 February 2020). While the EA noted the rainfall and ground saturation from Ciara would exacerbate Storm Dennis flooding, the Met Office chief meteorologist stated Dennis was 'not expected to be as severe as Ciara'. On the evening of February 12 and on February 13, increases in all variables were noted. Total precipitation of 19.4 mm and 19 mm and 15.2 mm between 14:00 February 12 to 14:00 February 13 were recorded at Usk and Camborne indicating the continuation of the storm, particularly in South Wales and South-west Britain. Although this was not the greatest precipitation in 24 hours, rainfall of 19.4 mm (Usk) and 19 mm (Camborne) was 483.2% and 483.7% greater than the 1991-2020 means.

Following a decrease in all variables in the afternoon of February 13, February 14 was characterised by gradual rises in wind speed and storm surge to maximums of 17.5 ms^{-1} (10:00) and 15.9 ms^{-1} (11:00) at Stornoway and Valley while storm surge height peaked later at 0.591 m (12:15) and 0.595 m (14:00) at Bishopton and Heysham. No precipitation was recorded until 1.6 mm was noted at Stornoway at 08:00 and ensuing rapid increases subsequently occurred with a daily maximum of 4.8 mm (12:00) at Bishopton.

The main reporting emphasis was on the arrival of Storm Dennis and the ‘danger to life’ Met Office warnings (*The Guardian*, 11:50 14 February 2020). The EA warnings also reiterated the threat highlighting the widespread impacts by issuing sixteen flood warnings for ‘expected’ flooding and 109 less serious flood alerts. *The Guardian* indicated the wider role of ‘climate breakdown’ increasing storm severity with extreme rainfall producing ‘far higher levels of flooding’, although the article (11:50) stopped short of directly attributing the storm period to climate change. This lack of absolute attribution also conforms with the scientific research on the wider 2019/20 storm period which exhibited that, while anthropogenic climate change will likely increase UK storm severity and rainfall extremes, the stormy winter 2019/20 alone is not proof of such climate change. However, it importantly contributes to the growing evidence that climate change has increased the likelihood of extreme rainfall events and high magnitude storms (Davies *et al.*, 2021). Subsequent reporting (17:05) centred on a PwC report, however, did not mention climate change and instead focused on the £150-200m in estimated insurance claims while the climate modeller Risk Management Solutions noted the storm ‘exhibited characteristics typical of European windstorms’ (*The Guardian*, 17:05 14 February 2020). The two articles published at 11:50 and 17:05 exhibit corroboration with wider climate science (Painter *et al.*, 2021) but a lack of complete attribution to climate change and factual reporting indicates objectivity.

8.4.3. Storm Dennis

The scientific data of February 15 denoted the accuracy of the Storm Dennis predictions as magnitude rose rapidly for all three variables. Wind speed rapidly increased (see Figure 8.7(b)) with an overall storm period of maxima of 27.3 ms^{-1} at Mumbles Head (17:00) while a daily maximum of 22.1 ms^{-1} was recorded at Valley (15:00). Storm surge magnitude increased to a site maximum of 1.159 m at Holyhead. Most prominently hourly precipitation reached an overall storm period maximum of 7.8 mm at Usk (15:00) while Bishopton received 5.8 mm (16:00). *The Guardian’s* initial reporting at 15:15 reflected the observed increases in magnitude with a focus on visual storm representations of the high winds as well as fluvial and storm surge inundation throughout Western Britain (Figure 8.5) (*The*

Guardian, 15:15 15 February 2020). Likewise, an 18:58 report highlighted the dramatic storm impacts predominately using photos showing the flooding storms power and effects throughout the region (*The Guardian*, 18:58 15 February 2020). While the first reports may have been media heavy because accurate written reports were in progress, *The Guardian* may have adopted this approach as evidence indicates that imagery and videos effectively attract initial attention and awareness while stimulating public engagement (Wang *et al.*, 2018; Schafer, 2020).



Figure 8.5. Storm surge conditions and public observers in Porthcawl, Wales on February 15 featured in *The Guardian*.

At 07:22 on February 16 *The Guardian* published a predominately written report on Storm Dennis focused on the numerous public risks indicated by 472 EA flood warnings (103) and alerts (369) in England and Wales along with eight Met Office weather warnings (*The Guardian*, 07:22 16 February 2020). The subsequent live blog which ran from 09:02 to 20:05 was devoted to the combination of impact reporting, warnings and response from governmental agencies as well as the national political response (*The Guardian*, 20:05 16 February 2020). The feed highlighted the widespread action of the government agencies concerned with short-term storm response and relief as UK warnings and alerts reached a record 594 by 12:48. Likewise, the ‘major response’ of South Wales police and the Met Office issuing of a red warning for South Wales was also emphasised. Much of the impact reporting was focused on South Wales where hundreds had been affected by flooding in the Rhondda Valley and the police reported a death in the River Tawe (*The Guardian*, 20:05 16

February 2020). The feed also featured accompanying tweets from the relevant organisations which clearly outlined public risks and ways to reduce vulnerability through a combination of risk maps and warning posts. This again signified recognition of the importance of clarity and the use of social media for rapid and effective public risk communication (Panagiotopoulos *et al.*, 2016).

The feed also featured tweets and statements exhibiting the responses of the MPs of the affected regions. The Pontypridd MP, Alex Davies-Jones MP, initially posted regarding her liaison with the Rhondda Town Council and Welsh Government over how to best help all those affected by flooding which she called 'truly heart breaking' (*The Guardian*, 20:05 16 February 2020). This was followed by an 11:09 announcement of her crowdfunding scheme before (15:46) she announced 600 people had been forced to evacuate. Davies-Jones however exclaimed that the short-term response from communities and local government agencies had been 'brilliant'. Fellow Labour (opposition) MP for Rhondda, Chris Bryant, also set up a fund for the hardest hit and the poorest without flood insurance (*The Guardian*, 20:05 16 February 2020). This represented the first instance of localised short-term response during the storm period from Westminster MPs whose actions signified that not even the effective regional short-term response could prevent a local emergency. The government insisted its preparedness and response were sufficient and did not declare a national emergency but acknowledged the local emergency in South Wales. Instead the environment secretary stated full mitigation was impossible due to the long-term 'nature of climate change'.

The scientific data exhibited the extreme weather anomalies in South Wales. Hourly precipitation at Usk totalled 6.8 mm at 04:00 and 94 mm of rain fell throughout February 15 and 16. This was 1320.1% greater than the 1991-2020 mean February two day total (6.6 mm) and conferred with the long-term climate change trend predictions regarding increasing storm precipitation (Met Office, 2022b). Storm surge magnitude at Hinkley Point increased to 1.133 m at 01:15 as the site readings exhibited an expected lag from the Mumbles Head peak windspeed. At Heysham and Blackpool the surge morning peak was

1.204 m at 09:15 while wind speed peaked at 04:00 at 16.5 ms^{-1} . After 12:00 on February 16 wind speed and storm surge magnitude increased at most sites as wind speed rose to 22.6 ms^{-1} at Mumbles Head (22:00) and storm surge reached a maximum of 1.314 m at Heysham (22:30). This period of prolonged high magnitude storm wind speed and surge as well as the precipitation anomalies further conforms with UKCP 18 predicted trends of climate change-catalysed increases in storm magnitude in Western Britain (Lowe *et al.*, 2018; Davies *et al.*, 2021).

8.4.4. Aftermath and Response

February 17 was largely defined by decreases in wind speed and storm surge height across all sites although 22.6 ms^{-1} (01:00) was recorded at Mumbles Head while storm surges of 1.277 m (00:00) and 0.939 m (03:15) were noted at Heysham and Hinkley Point. At most sites precipitation was consistently lower than on February 15 and 16, however Bishopton was an exception with hourly peaks of 7.4 mm (05:00) and 3.8 mm (20:00). At Usk, an hourly max of 2.2 mm (05:00) was also recorded, and rainfall was did not exceed 0.8 mm at every site except at Bishopton after 10:00.

The Guardian's reporting focus likewise reiterated the decreasing short-term impacts. A 07:40 article on February 17 focused on the wider £1.2 bn Met Office forecasting supercomputer project, noting how this technological innovation could contribute to improved forecasting and preparedness (*The Guardian*, 07:40 17 February 2020). At 13:25 the focus shifted to addressing key questions concerning Storm Ciara and Dennis and their impacts. *The Guardian* emphasised that the exceptionally high magnitude of storms had increased vulnerability while stressing that physical defences were only part of the armoury (*The Guardian*, 13:25 17 February 2020). However, the EA's long-term defence plans were shown to have great importance as 150,000 homes had been protected between 2015-18 and 499 more projects would protect 341,875 homes between 2019-21 (see Figure 8.6). While the government response to 'is the money being spent in the right places?' was that it invested in 'areas of the highest priority' *The Guardian* noted critics believed that there was a bias towards urban areas and areas of high value leaving rural communities exposed. *The*

Guardian's critique cited flood expert Professor Hannah Cloke (University of Reading) who stressed the need for increased 'natural flood management' although Professor Robert Wilby (University of Loughborough) noted more than natural measures would be required to mitigate storms like Ciara and Dennis. Uncited experts also demanded more contingency planning, local resilience measures and defence management. Balance to this technocracy and nature-based argument was also provided as it was stated the Met Office's supercomputer would improve storm forecasting for areas most at risk. Funding restrictions and short-sighted funding plans were also noted as key limitations preventing the required adaptation. Ground saturation was noted as the immediate cause of the floods which resulted from exceptional winter rainfall. *The Guardian* stated that the long-term cause was largely 'due to the climate emergency' and referred to Met Office evidence noting the increasing number of storms in the North Atlantic and high magnitude rainfall events.

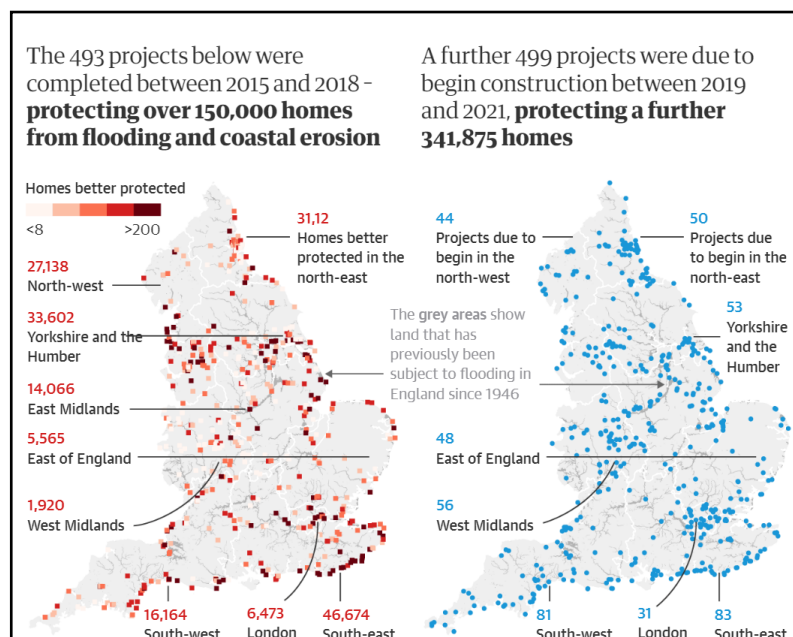


Figure 8.6. Environment Agency flooding defence and management projects in England between 2015-2018 and 2019-2021 in *The Guardian* on February 17. *Guardian* graphic created with EA information.

The 13:25 report complies with the relevant research concerning short-term characteristics and the effects of Storms Ciara and Dennis. The anomalously high Autumn 2019 rainfall was a major contributor to the flooding, as the subsequent intense heavy rain during the storm period fell on highly saturated ground and therefore rapidly entered rivers and

overwhelmed defences (Davies *et al.*, 2021; Sefton *et al.*, 2021). While there is a broad agreement regarding the influence of long-term climatic change on increasing storm severity and precipitation in the UK (Lowe *et al.*, 2018), most research stops short of direct attribution. Davies *et al.* (2021, p.396) note that climate variability was the primary factor that produced Storms Ciara and Dennis while stating anthropogenic climate change would increase the likelihood of 'extreme rainfall like that in February 2020'. Sefton *et al.* (2021) specifically emphasise the correspondence of the Winter 2019/20 precipitation findings with climate change predictions, but avoid direct attribution, noting that although most studies partially attribute major storms to climate change, differentiating extreme events from natural variability remains complex. However, all the research suggests that Storms Dennis and Ciara conform with the observed and predicted climate trends of increasing UK storm severity.

The subsequent storm-related *The Guardian* article in the opinion column represented the first clear criticism. The article 'Flooding in the UK isn't an act of God, it's an act of government' written by Simon Jenkins and published at 13:56 on February 17 mostly conformed with scientific expertise in an attack on the government's climate change and flooding adaption policies. Jenkins aligned with the science stating 'whatever may be the role of the climate emergency' before exclaiming the high number of storm and flood-related disasters highlighted the need for a major policy change (*The Guardian*, 13:56 17 February 2020). Specifically, the need for more natural flood management over technocracy was stressed. While this view largely agreed with the reported views of expert Professor Cloke, Professor Wilby noted such measures alone would be ineffective against high magnitude storms (*The Guardian*, 13:25 17 February 2020). A broader overview of the research highlights a similar consensus. Wallace *et al.* (2021) support the idea of introducing more nature-based flood measures as they found during Storms Ciara and Dennis overland flow was reduced by hedgerows compared to open pasture in Cumbria. Hankin *et al.*'s (2021) study of Ciara and Dennis also evidences that well-designed nature based solutions could complement traditional strategies and would reduce exposure and the need for flood defence with thirty-year economic benefits of c.€0.7 m in the Eddleston Water and Culm catchments. Nature-based solution benefits are reinforced by Norbury *et al.* (2021) who

exhibited willowed engineered log jams (WELJs) could reduce peak discharge by 27.3% and thus notably reduce flood risk.

Despite the shift to a long-term focus, a subsequent article (*The Guardian*, 15:38 17 February) highlighted that the remnants of Storm Dennis still posed threats with 250 UK-wide EA flood warnings in place, while the plight of flooded communities in South Wales and national travel disruption continued. At 16:23 a more balanced article drawing on information from governmental agencies and climate experts discussed the long-term climate and flooding policy. *The Guardian* reemphasised the environment secretary's affirmations that 'the nature of climate change' prevented complete protection and the government 'had done everything with a significant sum of money' and more funding was to be allocated (*The Guardian*, 16:23 17 February). The article however focused on supporting the argument for more natural drainage systems to mitigate the 'impact of crisis'. After first noting the predicted uncertainty concerning future rainfall and runoff according to the James Hutton Institute, *The Guardian* continued to support the science-based case for increased nature-based solutions. An expert in coastal defence stated that the UK's coastal defences were insufficient when future climate change was considered and called for more 'non-structural solutions' using 'holistic and integrated' frameworks (*The Guardian*, 16:23 17 February). Scientists in the Climate Coalition also highlighted that a major flood had occurred annually since 2007 and expressed the role of anthropogenic climate change in increasing rainfall magnitude. The article, however, concluded by referring to objective scientific predictions as only some Met Office models suggested climate change would increase future storminess but extreme rainfall events would become more frequent.

The subsequent *The Guardian* opinion article (18:56 17 February) adopted a more critical stance. The article focused on critiquing a range of government policies related to climate change. While the Prime Minister's absence in areas flooded during Dennis was criticised, the long-term governmental approach was the main focus. The contradictory nature of the government claiming it had done everything to prevent flooding and its failure to meet emission targets for 2025 and 2030 was firstly highlighted. The article then stressed that the

likely evidence of climate change meant climate and energy policies needed to change. The actions of past conservative governments were also condemned for 'reckless' funding cuts. Planning law and 'intelligent land and river management' were identified as requiring major change to decrease climate change vulnerability (*The Guardian*, 18:56 17 February). Regarding UK government economic, energy and long-term climate change policies, research indicates that the government should consider implementing additional long-term policies that reduce the effect of the UK's economic policy uncertainty and lower long-term carbon emissions (Adedoyin and Zakari, 2020).

Jennings *et al.* (2021) also exhibit that the current economic and industrial structure of the UK produces significant government challenges if climate goals are to be addressed while also meeting other public objectives concerning health and employment. At a regional level co-benefits of climate action are better incorporated into the decision-making process in the short-term while at the national level greater collaboration between departments increases the chance of the co-benefits of climate action being considered. Increased power devolution is also cited as key to enhancing long-term climate resilience as it allows local authorities to adopt longer-term policy approaches and harness the benefits of sustainable management. Jennings *et al.* (2021) also note the diverse short and long-term co-benefits of wider UK government policy change which range from improving energy security to lowering NHS extreme weather admissions. In response to the demand for strategic change, the UK government produced the first Net Zero Strategy in 2021 (UK Government, 2021). The strategy fundamentally seeks to reach net zero carbon emissions and end the UK's domestic contribution to man-made climate change by 2050. The Ten Point Plan aims to mobilise £26 bn of government capital to radically change energy supply, transport, infrastructure and employment to meet this goal. While the plan is acknowledged as major and suitably ambitious, independent groups such as the Climate Change Committee (CCC) have identified key issues centred around the lack of detail surrounding the planned delivery in key sectors. Moreover, the CCC has criticised the lack of a net zero test to ensure policy suitability and alignment with consumer demand (CCC, 2021). As a result, planned legal challenges have been upheld in the UK high court (*The Guardian*, 2022; Sky News, 2022). Therefore, while there is evidence of significant governmental attempts to address

and mitigate the UK contribution to and the effects of the climate crisis, a range of policies at both national and regional levels likely remain insufficient to achieve vital targets.

The final objective report directly focused on the storms published at 20:38 on February 17 remained highly critical, blending reporting of the storm impacts as well as the short-term response and long-term issues related to climate change adaptation and policy. While the UK government and Welsh government reiterated the success of flood defences and their response, the Welsh first minister noted policy change was required in the short and long-term which resonated with the view of the Pontypridd MP (*The Guardian*, 20:38 17 February).

Magnitude decreases of all three variables on February 18 evidenced by the scientific data marked the end of Storm Dennis (see Figure 8.7). Neither wind speed or storm surge exceeded 16.5 ms^{-1} or 0.576 m. Hourly precipitation exhibited several exceptions most notably at Chivenor and Bishopton where maxima of 2.8 mm (12:00) and 2.4 mm (05:00) were recorded with 0.8 mm twice recorded at Usk. These data combined with the widespread saturation reflected the continuing EA warnings in the 08:47 article which noted 450 alerts and warnings remained with South Wales under particular threat (*The Guardian*, 08:47 18 February).

The decreasing storm magnitude was reflected in the reporting which adopted a more reflective tone. The main impacts were in the Rhondda Valley where 600 people were evacuated and 1000 homes affected. Although EA and Met Office warnings persisted the focus increasingly turned to the large socio-economic losses, especially in South Wales. Rhondda Cynon Taf council released a reserve £1m and a further £10m was promised for Welsh councils although the council leader estimated a bill of 'millions and millions of pounds' (*The Guardian*, 16:24 19 February). Water supply issues were noted in Monmouthshire and travel to key sporting fixtures in Wales was impacted resulting in further socio-economic losses. The effects resonate with wider research concerning the

increasing socio-economic impacts resulting from the heightened number of high magnitude storms and precipitation events which conform with climate change predictions (Speight and Kurska, 2021). Since the floods of summer 2007 an estimated 88,683 UK properties have been flooded during five 'record-breaking' storm periods, consistent with climate change projections (Speight and Kurska, 2021). During just one event, the winter storms of 2013/14, the UK government estimated England and Wales alone sustained economic losses of £1.3bn (HM Government, 2016). *The Guardian* report at 14:13 on February 20 likewise initially noted the high economic cost of Storm Dennis as PwC reportedly estimated a national insured loss of between £175m and £225m (*The Guardian*, 14:13 20 February). The highest PwC estimate for insured losses from Ciara and Dennis, therefore, totalled £425m. Insured storm losses however represented a fraction of the overall loss as uninsured losses as well as losses to commerce and trade are usually far greater (Lamond and Penning-Roswell, 2014; Adam *et al.*, 2016; Smith *et al.*, 2021). The estimates highlight the large socio-economic costs sustained during or immediately after storm and floods which conform with likely climate change predictions.

By 18:24 on February 19 reporting concentrated on long-term planning and climate change adaptation policy with multiple shortcomings in governance underlined. Emphasis was placed on 'official figures' of the 84,000 new homes built in areas at the highest risk of flooding which represented 1 in 10 of all new builds since 2013 (*The Guardian*, 18:24 19 February). While *The Guardian's* analysis importantly ignored the presence of all existing flood defences and therefore likely overemphasised the risk, their general concerns regarding development in high risk areas were echoed by flood expert Professor Wilby who noted how construction on floodplains compounded risk. The concerns of a lead councillor were also raised who noted local authorities' predicament between satisfying government housing quotas and building on low risk land. *The Guardian* also featured the Ministry of Housing, Communities and Local Government response proclaiming housing should be built in low flood risk areas and high risk development could only take place when absolutely necessary and after all resilience measures had been taken. The current vulnerability induced by the storm period was stated to be in part due to funding limitations with *The Guardian* and expert Professor Cloke noting that more funding, particularly for nature-based

solutions, would aid preparedness and decrease community risk. The critique of government housing policies continued on February 21 as *The Guardian* reported the Bright Blue thinktank had identified that 70,000 new homes built after January 1 2009 did not qualify for the government Flood Re insurance scheme. Placing a personal responsibility on homeowners to assess flood risk was branded 'heartless', however, a government investigation was underway (*The Guardian*, 00:01 21 February).

The combined critique over two articles published in *The Observer* and *The Guardian* on February 23 reinforced the issues of inadequate government planning policies and long-term climate change adaptation (*The Guardian*, 12:28 23 February; *The Observer*, 06:12 23 February). The *Observer* focused on the concerns of experts regarding the inadequacy of current UK flood and storm management. Professor Cloke advocated a 'complete overhaul' of defences while Dr Heidarzadeh (Brunel University), a coastal flood expert, noted decades-old defences could not 'address the current climate situation' due to increasing major storms and floods (*The Observer*, 06:12 23 February). The environment secretary's proposition to introduce more nature-based solutions was criticised as Professor Falconer (University of Cardiff), noted such measures would 'certainly be insufficient when addressing the 30% increase in winter rainfall' predicted by the Met Office in certain areas. Expert Professor Sear (University of Southampton) also noted the political implications of addressing flooding, stating that politicians must understand 'the facts of flooding' before policy adoption.

A review of policy highlights that the government has exhibited climate change adaptation. Specifically, the EA has produced extensive information and guidance for authorities seeking funding to adapt to climate change-driven increases in flood and coastal erosion risk (HM Government, 2022). The policy dictates that the allocation of EA funding is based on site-specific assessments using science-guided 'climate change allowances' that concern anticipated changes for: peak river flow, peak rainfall intensity, sea level rise as well as offshore wind speed and extreme wave height. According to the EA, this ensures that government funding is allocated in areas where 'it provides the biggest benefit' although

exceptions to the main use of climate change allowances may be granted (HM Government, 2022). While Newson *et al.*'s (2022) scientific review of river flood risk management in England highlights government agencies have increasingly incorporated climate science into policy, more emphasis and resources must be devoted to improving the integration between policy, strategic planning and local delivery to prompt an effective climate change response. An enhanced impetus on stakeholder engagement and community participation in science-guided schemes is also key to ensuring their long-term effectiveness (Buser, 2020; Bang and Burton, 2021). McGinlay *et al.* (2021) further conform with *The Guardian* narrative noting that UK government austerity reduces the chance of integration and community involvement, ultimately increasing climate change-related vulnerability to storms and floods.

The final article published at 12:28 similarly highlighted the inadequacy of government policies but placed a greater focus on current planning policies. An analysis by *The Guardian* and Greenpeace which ignored current flood defences concluded 11,410 new homes were planned in areas with the highest flooding risk. The chief scientist at Greenpeace UK noted this underlined the major shortcomings of the planning policies which would exacerbate the impacts of more frequent future flooding resulting from climate change. Council members in affected areas likewise condemned the plans while the government policy to avoid development in high risk areas was reiterated. The final comments from the chief scientist at Greenpeace UK implied that the government was not taking climate change seriously and prioritised home builders profits over future flood protection, as he stated local authority and EA budget cuts favoured developers over community vulnerability. This concluded *The Guardian's* coverage of the storm period.

Regarding planning and housing policies, the wider research regarding climate change adaptation in the UK broadly agrees with *The Guardian's* consensus. In coastal urban regions planning system adaptation is focused on experienced hazards and is incremental rather than transformative, while climate change adaptation is seriously limited by government emphasis on housing and economic growth as well as the developer's economic focus

(Young and Essex, 2019). This reactive policy adjustment was evident in the February 2020 storm reports. Only after the event were extensive flood investigations permitted and undertaken at a local level to 'truly learn the lessons' and ultimately improve infrastructure and planning to reduce future impacts (Natural Resources Wales, 2020a; Rhondda Cynon Taf County Council, 2021). Further, Van der Plank *et al.* (2021) note coastal risk management must adapt to integrate planning, engineering and insurance approaches to be highly effective against climate change. Limited climate change risk planning also places a disproportionate number of poorer, vulnerable neighbourhoods at risk, serving to increase the impact (Rozer and Surminski, 2021). Consequently, there must be a heightened government impetus to improve planning as well as to increase the availability of protection and insurance to ultimately reduce likely climate change-induced risks (Rozer and Surminski, 2021; Elliot, 2022).

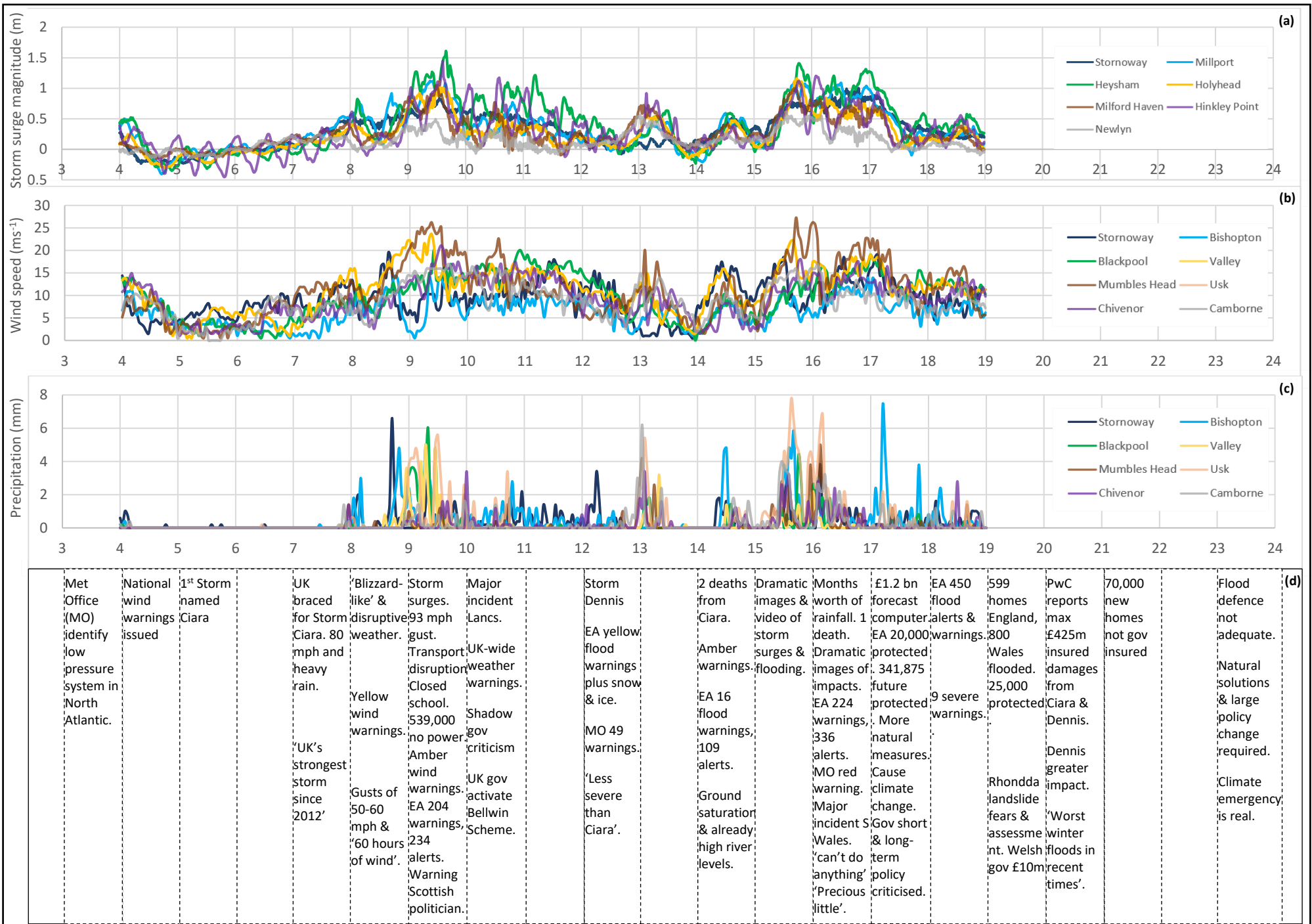


Figure 8.7. Timeline of variability in storm surge magnitude in m (a), wind speed in ms⁻¹ (b), precipitation in mm (c) as well as the corresponding key reported storm impacts and government response (d). The x-axis of graphs represents time (date).

8.5. Conclusions

The combined data highlight that Storms Ciara and Dennis represent a high magnitude storm period that had large socio-economic impacts throughout Western Britain and the UK. The impacts merited major immediate community, local authority and government responses as well as bringing a range of long-term government policies into question.

All three forms of scientific data exhibit that the storm period was of very high magnitude and a statistical climate anomaly. The maximum and mean wind speed data for the seven sites respectively indicate the very high intensity and the sustained duration of the high magnitude winds. A maximum wind speed of 27.3 ms^{-1} was recorded at Mumbles Head (17:00 February 15) while mean wind speed across all seven sites was on average 3.1 ms^{-1} or 48.8% greater than the combined 1991-2020 February mean. Mean magnitude was most anomalous at Blackpool, where the site mean wind speed was 62.3% greater than the 1991-2020 February mean. Storm surge data magnitude was also anomalously high. Site maximums were predominately recorded during Ciara on February 9 when an overall maximum of 1.610 m was recorded at Heysham (15:45). A surge within the top 30 greatest monthly surges (January/May 1990 and March 2022) was recorded at all stations during the storm period with the fourth greatest monthly surges being recorded at Stornoway and Holyhead. Precipitation also exhibited very high positive anomalies. Very high magnitude hourly rainfall was recorded throughout, with a maximum of 7.8 mm at Usk (15:00 February 15). Across all eight sites the storm period precipitation was on average 58.5 mm or 122.2% higher than the mean February 15 day 1991-2020 total precipitation. At Usk, the precipitation anomaly was greatest being 140.7 mm or 282.3% higher than the February 1991-2020 mean (Table 8.1). *The Guardian* reports conferred with the meteorological data and evidenced the widespread meteorological impacts in Western Britain with a particular focus on flooding in South Wales.

While wind strength and tidal surges values were substantially greater than the February means, precipitation, particularly at Usk, is shown to be the greatest anomaly. This conforms with UKCP18 climate change predictions of likely increases in twenty-first century storminess in Western Britain (Lowe *et al.*, 2018; Palmer *et al.*, 2018) as well as Met Office

predictions of climate change increasing winter rainfall by 30% by 2070 in certain regions (Met Office, 2022b).

The Guardian storm reports indicate considerable evidence of proactive storm warnings, efficient public hazard communication as well as effective storm and flood response by local authorities, emergency services and communities. This short-term response was widely praised by politicians and council leaders featuring in *The Guardian* reports as well as in objective reviews undertaken by national and local governments (Griffiths, 2020; *The Guardian*, 2020; Natural Resources Wales, 2020b). Despite this praise, *The Guardian* and government/local authority reports indicate that the high magnitude of the storm overwhelmed mitigation and prevention efforts in certain areas prompting two major incidents to be declared and ultimately producing the catastrophe (e.g. Rhondda Taf Council, 2020; Natural Resources Wales, 2020b). The wide consensus shared by reports and research, therefore, puts the long-term government mitigation and adaptation policies into question, especially when the correspondence between the storm period magnitude and known future UK climate predictions is considered.

During and particularly after the storm period, *The Guardian* criticised the shortcomings in the UK government's long-term climate change adaptation policy. The articles underlined several climate change-related policy shortcomings including riverine and coastal management, energy, planning and the broader economic approach to environmental issues. In rare instances, *The Guardian* reports could be seen to have placed too much emphasis on the greatest plausible risk estimates. Namely, present and future assessments of housing construction in high risk flood areas importantly ignored current defences despite the expert consensus that both natural and engineered flood defence are required. However, the vast majority of reports conformed with the scientific consensus with even 'opinion' articles being careful not to directly attribute Storms Dennis and Ciara to climate change, instead indicating the similarity between the period and climate change predictions (Lowe *et al.*, 2018; Sefton *et al.*, 2020; Davies *et al.*, 2021).

A comprehensive review of the wider research reveals correspondence with *The Guardian* narratives. The independent research likewise suggests multiple long-term government policies must undergo extensive revision and, in some sectors, complete change if the communities and infrastructure of the UK are to be climate change resilient (e.g. Young and

Essex, 2019; Elliot, 2022). As climate change will likely increase high magnitude storm frequency and winter rainfall magnitude, *The Guardian* and the independent research share the consensus that events similar to Storm Dennis and Ciara will become more prevalent in Western Britain, and by the mid to late twenty-first century will likely no longer be climate anomalies (Lowe *et al.*, 2018; Met Office, 2022b). While it is clear communities, local authorities and government agencies will continue to do everything possible to mitigate and effectively respond to storm and flood threats, *The Guardian* articles reflect most current research recommendations that more substantive long-term government policy change is required across multiple sectors to adequately address climate change risk (CCC, 2021; Elliot, 2022). Although the government has made significant attempts to address the UK contribution to and the effects of the climate crisis (HM Government, 2022), a range of policies at national and regional levels likely remain insufficient (McGinlay *et al.*, 2021; Van der Plank *et al.*, 2021; Newson *et al.*, 2022). Further policy adaptation will likely reduce the impacts of the increasingly frequent extreme weather and high magnitude events similar to Storms Dennis and Ciara. This will increase the ability of key stakeholders to mitigate and prevent climate catastrophe, and ultimately enhance infrastructure and community climate change resilience.

Chapter 9: Discussion

9.1 Introduction

This discussion collates the project's research findings and considers the wider benefits and future potential of multidisciplinary research into coastal storms. 'Multidisciplinary' is defined as an approach that combines the contributions of different academic disciplines to address a multifaceted issue. The findings discussed in Chapters Four to Eight are examined in relation to wider relevant multidisciplinary storm and natural hazard research. This chapter assesses (1) how an approach combining environmental science and environmental history enabled the project's aim and objectives to be achieved and (2) how multidisciplinary approaches can contribute to improving wider storm and natural hazard understanding.

The overall aim of the thesis is:

- To determine whether multidisciplinary research can improve the understanding of the environmental, cultural and human impacts of coastal storms in Western Britain from 1800 to 2020.

The aim is addressed by the following objectives:

- 1) To analyse past coastal storm trends using varied historical records.
- 2) To analyse sedimentological evidence and records of coastal storms in estuarine saltmarsh sediments.
- 3) To improve the understanding of the impacts and effects of coastal storms in Western Britain between 1800-2020 using written archival evidence.
- 4) To analyse social, political and cultural responses to storms and the impact of major storm events on storm subcultures.
- 5) To examine how epistemological change influenced storm representation through the analysis of the scientific and religious elements in representations of storms.

- 6) To assess the factors that contributed to the contemporary catastrophe of Storms Ciara and Dennis in Western Britain.
- 7) To evaluate the benefits of multidisciplinary storm research.

9.1. Historical Multidisciplinary Storm Research in Western Britain

9.1.1 Multidisciplinary Contributions to Coastal Storm Research

The research comprising Chapters Four to Eight highlights the diverse impacts and effects of coastal storms in Western Britain from 1800 to 2020. The chapters exhibit how a range of archives from saltmarsh sediments to written newspaper records can individually and collectively improve the understanding of storm trends and impacts. The research provides a novel insight into storm trends and their environmental, social, political and cultural effects. The temporal focus of the project from 1800 to 2020 increases the originality of the project as previously only limited historical storm research has been undertaken in Western Britain despite a persistent and growing storm threat (Morgan, 2015; Villiger *et al.*, 2017; Lowe *et al.*, 2018). By combining two different disciplines in the form of environmental science and environmental history, the project provides new insights into storms in the region. It highlights the unique value of multidisciplinary research into coastal storms and notes the future potential for further multidisciplinary natural hazard research. Despite the inherent challenges in this approach, multidisciplinary research is shown to generate new insights into coastal storms that improve historical understanding with contemporary benefit.

9.1.1.1. Multidisciplinary Environmental Science

The research in Chapter Four adopts a multidisciplinary environmental science and historical data approach with a focus on the changing sedimentological and environmental impacts of storms on the Three Rivers Estuarine Complex saltmarshes from January 1929 to February 2019 (complete radionuclide dating range). Objective one is addressed using a combination

of tidal gauge, meteorological data, and sedimentological evidence, while historical newspaper reports are used for event conformation (see Chapter Five). In Chapter Four, historical tidal gauge observed height data combined with a POLTIPS gauge-specific tidal hindcast. This enabled the reliable identification of past coastal storms and storm surges of different magnitudes in Milford Haven and Newlyn. Historical meteorological data from Pembroke also further verified storm occurrence while providing a quantitative indication of storm magnitude variability. Combined meteorological and tidal gauge datasets also enabled a cross-comparison of storm weather and storm surge magnitude giving a detailed insight into their variability in Carmarthen Bay and South-west Wales. Likely sedimentological storm surge depositional evidence that was identified following field, geochemical, particle size and radionuclide analyses from the Three Rivers Estuarine Complex, Carmarthen Bay also provided further insights into high magnitude coastal storms and their impacts, thereby addressing objective one. When combined with the analysed tidal gauge and meteorological data, the dated sedimentological evidence in the form of coarse, abrupt sandy deposits was determined to most plausible originate from the storms of: 13-15/12/1981, 13-15/03/1977 and 26-29/11/1954. The data was compared to other research in the area (Croudace *et al.*, 2012; currently unpublished work; pers. comm. Croudace) and archival newspaper evidence to confirm the likelihood that the depositional evidence was of storm surge origin and corresponded with the respective storms.

The research presented in Chapter Four also addresses objective two by highlighting very likely depositional evidence of storm surges in saltmarsh sediments of the Three Rivers Estuarine Complex. Objective seven is also partly addressed as the multidisciplinary approach is shown to provide the basis for an informed and important appraisal of the impact of storms on regional saltmarsh sustainability. This is particularly significant given the manmade engineered constraints preventing saltmarsh retreat and future predictions of likely increasing storminess and saltmarsh degradation in South Wales by 2060 under the now most likely RCP 8.5 scenario (most similar to AR6 ~SSPs 8.5) (Horton *et al.*, 2018; Lowe *et al.*, 2018; Chen *et al.*, 2021). The appraisal indicates the increasing vulnerability of regional saltmarshes and the vital ecosystem services they provide to future climate change and therefore recommends that more must be done to monitor and ensure their sustainability.

9.1.1.2. Multidisciplinary Environmental History

Chapter Five adopts an environmental history approach focussing on the changing impacts, characteristics and representation of storms in Western Britain as reported in newspaper reports from 1800 to 2020. Overall 1567 storm-related accounts which were relevant to Western Britain were identified and analysed although the majority of the accounts combine multiple articles which are from different sources or published at different times/dates. The reported information and trends from a range of newspapers with different political perspectives were analysed using to assess the accuracy, correspondence and contributions of the newspaper reports to improving wider historical and contemporary storm understandings. The chapter also provides important context with regard to the government and community roles in coastal storm resilience as well as storm religious and scientific representations which are further analysed in Chapters Six and Seven respectively.

The analysis showed how the newspaper reports of the early 1800s regularly represented storms as of divine origin, with different reports explaining storms as a product of God's will with divine fate often portrayed as determining life or death. Reports from the first decade commonly followed more than three days after the event and, in the context of the 220 year period, were more dramatic in nature and lacked quantitative detail. Occasional reporting of public storm perceptions unrelated to Christianity or modern meteorology also featured with the most notable being the appearance of the pseudo-scientific Bologna prophecy in a storm report during the infamous 'Year Without a Summer' of 1816. Reports of the early nineteenth century also indicated the major social, political and military implications of storms in Western Britain. The analysis showed how storms had major impacts on the British Navy during the Napoleonic Wars providing opportunities for piracy and wrecking which were major social and civil problems. Despite storm-related criminality, the reports also highlighted early evidence of charity and humanity in the form of both reactionary responses to storm catastrophes and the actions of formal institutions such as the early RNLI.

The analysis of mid-nineteenth century (1830-1870) reports highlighted the increased prominence of scientific meteorology in reports as scientific storm representations and

explanations increasingly dominate over religious (see Chapter Six). Despite scientific predominance, reporting was often dramatic in nature and reports featuring folklore and religion were sporadically published. The subsequent *Royal Charter* Storm of 1859, which was the deadliest recorded in Western Britain with 469 reported deaths, drastically changed the scientific approach to storm meteorology and prediction, and became a key topic of contentious debate in the reports of the 1860s.

The Chapter Seven case study analysed the consequences of the *Royal Charter* Storm as well as how the ensuing changes to storm prediction and warnings impacted the communities of Western Britain and their storm subcultures. Storm subcultures are understood as long-term social, political and cultural response trends arising from periodic storm threats emanating from Anderson's (1965) original disaster subcultures concept. The *Royal Charter* Storm was shown to have changed storm understanding, prediction and warnings in Britain with key long-term implications for coastal communities and national governance. Incorporation of contemporary research exhibited that from the storm warning debate between 1861-1867 to the criticism of the response to Storms Ciara and Dennis in 2020, limited community agency in Early Warning System decision making processes decreases important relationships between communities and national governments, which can substantially affect long-term community vulnerability. The results of the analysis conformed with current appraisals of policy illustrating the shortcomings of centralised, top-down technocracy and the importance of adaptive inclusive storm subcultures. The research further contributes to improving the understanding of the importance of open knowledge exchange, inclusivity in decision making processes and partial community autonomy in enhancing hazard understanding and early warning system effectiveness. This understanding is important to ensure that governments learn from historic storms and adopt policies that foster sustainable storm subcultures and long-term community resilience. The case study analysis, therefore, addresses objective four as it highlights how storm events can have major social, political and cultural impacts which consequently have a complex influence on storm subcultures.

The end of comprehensive reporting on the storm warnings debate coincided with the emergence of the conservative *Western Mail* in 1869. The information presented in Chapter Five showed how this new newspaper provided different perspectives on storms and

flooding throughout the 1870s and 1880s. Chapter Five placed a large impetus on storm prediction featuring storm warning extracts from the *New York Herald* which represented the first predictions that were independent of the Met Office. The *Western Mail* also published highly detailed reports of the economic and commercial storm effects. Post-1880 reports increasingly featured the actions of charitable organisations with reports regularly detailing the actions of the RNLI. The heroism of the lifeboatmen was a regular reporting focus while reports also provided comprehensive insights on lifeboat tragedies and the wider RNLI responses and evolution in the period. Local authority flood and storm management was also first featured in the form of the response to the Bristol and Bath Floods of 1894. This response represented the first comprehensive long-term storm mitigation programme and contrasted with the earlier independent and ad hoc storm responses which were often reported to be insufficient with minimal emphasis on long-term strategy.

The early twentieth century reports were predominately sourced from *The Guardian*, which published near unanimously scientific and more succinct reports which were less dramatic than the 1800s reports. The newspaper storm report analysis (Chapter Five) highlighted that reporting increasingly featured the social, economic and cultural impacts of storms in remote communities giving a wider perspective on storm effects throughout Western Britain. Reduced reporting in the war periods was followed by two major post-war storm catastrophes in 1952 and 1953 which prompted major changes in storm and flood management which became increasingly technocratic.

Although technological improvements in meteorological storm prediction, defence engineering and lifesaving technology were noted and the storm fatality rate was lower than in previous periods, major coastal defence issues and inaccurate forecasting of the Great Storm of 1987 and Burns' Day Storm of 1990 evidenced major technocratic limitations. The newspaper report analysis (Chapter Five) showed how reporting from 1990 increasingly highlighted the relationship between anthropogenic climate change, storms and extreme weather. Climate change is mentioned progressively frequently in the twenty-first century as the scientific understanding connecting high magnitude storms and climate change grew more certain. Reports featuring experts increasingly exhibited how shortcomings in government climate adaptation and environmental policies enhance

vulnerability. The newspaper analysis highlighted that from January 2012 live blogs and feeds featuring information from social media changed the dynamics of major storm reporting in Western Britain as reports increasingly incorporated live (or almost) information from more diverse sources. Sources ranging from the Environment Agency to public eyewitnesses were shown to give a wider perspective on the causes, characteristics and impacts of storm catastrophes.

The comprehensive archival research and analysis evidenced the major changes in storm reporting, impacts and understandings over the 220 year period. The analysis showed how between 1800 and 2020 newspaper reporting illustrated how the understanding of coastal storms and their impacts have drastically changed. Storm understanding was shown to progress from the religious interpretations of the early 1800s to a predominant scientific meteorological understanding by the mid to late nineteenth century. The progressively increased use of quantified storm observations in reports gave an original insight into scientific storm understanding and the relationship between storm magnitude and impacts over the period. The *Royal Charter* Storm of 1859 was also shown to serve as a major catalyst of scientific storm prediction despite the controversy surrounding the Met Office's predictive strategies of the 1860s. Further technological advances of the late nineteenth and twentieth centuries were shown to have majorly contributed to storm impact prevention and mitigation. However, the late twentieth and twenty-first centuries are characterised by an increased understanding of the limits of technology and the strengthening link between anthropogenic climate change and high magnitude storms. The analysis highlighted the high variability of storm impacts throughout the region during the 220 years although a trend of decreasing fatality is prevalent following the post-war period catastrophes of the 1952 Lynmouth Flood and the 1953 sinking of *MV Princess Victoria*. The reports of the mid to late-twentieth century also serve to complement the results of Chapter Four, providing additional detail about the social and cultural impacts and effects of the storms of 13-15/12/1981, 13-15/03/1977 and 26-29/11/1954 which likely correspond with depositional storm surge evidence in the saltmarshes of the Three Rivers Estuarine Complex.

Despite the reported trend of decreasing fatalities in the mid and late 1900s, the analysis indicated economic impacts in the form of infrastructure and property damage as well as storm management, and response costs remain sporadically high as evidenced by reports of

the Burns' Day storm of January 1990 (estimated c.£3 bn) and Storms Ciara and Dennis in February 2020 (max estimated insured £425 m). The progressive decrease in time between the storm and report publication and the growth in available information which increased exponentially with online reporting and the start of live storm feeds in 2012, contributed to major changes in storm representation and understanding. The increasingly wide range of contributing sources enabled readers to progressively better understand the diverse causes, characteristics and impacts of events. The analysis ultimately highlighted how understanding has transitioned from a perspective of storms as unpreventable and unfortunate divine disasters, to a scientific view where storms are increasingly seen as climate catastrophes resulting from 'the intersection of natural hazards ... with human populations in varying states of economic, social, and cultural vulnerability' (Anderson, 2011, p.1).

This wider change in representation and understanding was analysed in further detail in Chapter Seven which focused on changing religious and scientific representations. Keyword coding of the reports enabled the identification of 177 scientific and religious reports published between 1800 and 1953. The statistical analysis of observed reports and reports adjusted for publication exhibited a rapid decrease in divine representations whilst scientific reports increased comparatively gradually with more temporal variability. These findings informed a qualitative analysis of selected archival newspaper material which aptly highlighted storm representation variability over the 153 years. Religious representations changed from portrayals of God's will and fate in the early 1800s while general providence became increasingly prominent until the 1850s before divine representations declined. These religious representational trends reflect competing theological ideas and the general decrease in religious prominence in British society. Scientific representations alternatively comparatively gradually increase throughout the entire period. Between 1800 and 1859 scientific representations were highly variable and gradually increased reflecting the development of meteorological science in the period. Scientific representations further increased in the 1860s when heated debates concerning meteorology and the purpose of Fitzroy's storm warnings as science became more prominent than religion. The late nineteenth and twentieth century reports reflect a period of progressive scientific growth and near complete predominance over religion, although occasional religious

representations were evident. Portrayals of scientific perfection fade and are replaced with a more rational scientific view of storms and their prediction although representations of storm grandeur and power remained. This representational change reflected wider epistemological change and highlighted how such collective change in the two factors can majorly influence public understanding of storms. The research of Chapter Seven, therefore, addressed objective five as it exhibited how scientific and religious epistemological change clearly influenced storm representation. Given this relationship, the research recommends that epistemological and written representation relationships are better understood to improve the public understanding of the diverse and ever-changing effects of storms.

The wider archival analysis in Chapter Five indicated the total prominence of the scientific storm representations and understanding in the reports of the mid-twentieth to twenty-first centuries. The chapter revealed how the two major post-war storm catastrophes at Lynmouth in August 1952 and across Britain in February 1953 prompted a rise in technocracy which coincided with reduced storm fatality rates. However, the reports of the late twentieth century which evidence a combination of major coastal defence issues and inaccurate forecasting of the Great Storm of 1987 and Burns' Day Storm of 1990 highlighted persisting technocratic and scientific limitations. While storm prediction subsequently considerably improved, major issues regarding technocracy as well as national government and local authority storm and flood management were evident post-1990. Reporting of the late twentieth and twenty-first centuries increasingly highlighted the relationship between anthropogenic climate change, storms and extreme weather, reflecting the growing certainty of the scientific climate consensus. Consequently, reports progressively focused more on how government policies affecting climate change including energy and planning as well as more direct flood and storm management affected UK storm catastrophes. The research of Chapter Five, therefore, addresses objective three as it shows the major contributions written archival evidence can offer to improving the understanding of the diverse impacts and effects of coastal storms in Western Britain between 1800-2020.

9.1.1.3. Contemporary Environmental Science and History

Chapter Eight uses a combination of meteorological (precipitation and wind speed), tidal gauge (storm surge height) and written archival newspaper data to analyse the factors that contributed to a twenty-first century catastrophe in the form of Storms Ciara and Dennis in February 2020. Meteorological and tidal gauge data were sourced from eight sites throughout Western Britain and when compared against site-specific data from 1990 and 1991 respectively, the data clearly indicated the storm period was a statistical climate anomaly with rainfall at Usk being the greatest anomaly. However, the data do conform with UKCP18 climate change predictions of likely increases in twenty-first century storminess (wind speed and storm surge) in Western Britain (Lowe *et al.*, 2018; Palmer *et al.*, 2018) as well as Met Office predictions of climate change increasing winter rainfall by 30% by 2070 in certain regions (Met Office, 2022). *The Guardian* storm reports indicate considerable evidence of proactive early warning systems as well as effective storm and flood response by local authorities, emergency services and communities. However, *The Guardian* reports published during the storm period (two live feeds) and subsequent government/local authority reports highlighted that the high magnitude storms overwhelmed mitigation and prevention efforts in certain areas prompting two ‘major incidents’ to be declared and ultimately producing the catastrophe (e.g. Rhondda Taf Council, 2020; Natural Resources Wales, 2020b). The wide consensus shared by reports and research, therefore, puts the long-term government mitigation and adaptation policies into question. The correspondence between the storm period magnitude and known future UK climate predictions, further raised concerns as to whether the UK government are adapting policies with full consideration of predicted climate change threats. The newspaper reports, wider research regarding UK government climate change-related policies and findings of Chapter Eight, therefore, suggest multiple long-term government policies must undergo extensive revision if UK communities and infrastructure are to become more resilient to climate change storm and flood risk (e.g. Young and Essex, 2019; Elliot, 2022). Further policy adaptation will likely reduce the impacts of the increasingly frequent extreme weather events similar to Storms Dennis and Ciara. This multidisciplinary research, therefore, meets objective six as it highlighted and analysed the factors that induced storm catastrophe and ultimately suggests that policy adaption that better considers climate change will enable

national governments, local authorities and communities to collectively mitigate and prevent climate catastrophe.

9.1.1.4. Contributions of Multidisciplinary Environmental Science and History

Overall the diverse research comprising the thesis highlights the wide-ranging environmental, social, political and cultural implications of storms which need to be considered and addressed as the storm threat increases as a result of climate change (Lowe *et al.*, 2018; Palmer *et al.*, 2018). The overall thesis further exhibits the collective and independent value of the different research fields in the analysis of storm chronologies, implications and impacts. The thesis therefore addresses objective one and the overall aim by using varied historical records and multidisciplinary research techniques to improve the understanding of the environmental and human impacts of coastal storms in Western Britain from 1800 - 2020. The research presented in the individual chapters further exhibits the numerous benefits of diverse multidisciplinary storm research illustrating the complex, enduring and often interconnected impacts of storms on environments, communities and culture. Despite the differences expected with varied research the research and findings of the individual chapters have clear links. The following sub-section addresses objective seven and evaluates the wider benefits provided by this multidisciplinary study.

9.1.2 Research Interconnections

The collective and combined use of varied historical evidence in this thesis highlights the diverse impacts of storms throughout Western Britain. While Chapters Four and Five both offer original contributions to improving the understanding of storm saltmarsh environmental impacts and historical storm effects and implications from 1800 to 2020 respectively, the wider multidisciplinary thesis uniquely highlights the connections between the research. Specifically, the thesis highlights how the storms of 13-15/12/1981, 13-15/03/1977 and 26-29/11/1954 not only had substantial sedimentological depositional on saltmarshes but also had diverse social, economic and cultural impacts throughout Western Britain. The impacts include storm surge breaching at Weston-Super-Mare that prompted

evacuations (1981), winds that prevented walking in Cumbria and majorly hampered sport (1977) as well as the flooding of 7,000 acres in Lancashire, evacuations after flash floods in Cornwall and the air rescue of the crew of a foundering tanker in the Irish Sea (1954). The multidisciplinary approach exhibits how storms can have direct interconnected impacts on the human population and environments of Western Britain which would not be possible with intradisciplinary research. Enhancing the understanding of this interconnectivity is important to ensuring communities, local authorities and national governments devise holistic storm and flood impact mitigation and prevention policies that consider the full range of storm impacts as opposed to only considering the environment or social threats.

This value is further evidenced by the research of Chaumillion *et al.* (2017) who used both multidisciplinary and interdisciplinary techniques to improve coastal storm understanding in Western France. Combining different forms of evidence was shown to improve the verification of storm occurrence and return period while also revealing forgotten or unarchived events and providing novel insights into their environmental and socio-economic impacts (Chaumillion *et al.* 2017). Other research also similarly shows that improving the understanding of regional and local long-term storm chronologies and impact trends using multidisciplinary techniques provides benefits beyond historical understanding.

Multidisciplinary research using scientific data regarding magnitude variability and qualitative data concerning community impacts, highlights how storms have diverse and interconnected impacts and implications which should be considered in long-term management strategies if they are to best enhance resilience (Barriendos *et al.*, 2014; Genevo *et al.*, 2015).

The value of improving the understanding of the interconnectivity of social, cultural, political and environmental storm impacts and their current and future implications is further heightened when the concept of ecosystem services is considered. Ecosystem services are the 'natural capital stocks' provided by ecosystems which are critical to the functioning of the Earth's life support system and contribute, both directly and indirectly, significantly to economic production and human welfare (Costanza *et al.*, 1997). Chapter Four identifies the specific vital importance of saltmarshes and the ecosystem services they provide. Saltmarsh ecosystem services go beyond clear storm surge defence, habitat provision and seawater

regulation, and also directly impact upon human populations and their culture (e.g. Barbier *et al.*, 2011; Cacador *et al.*, 2016; Kelleway *et al.*, 2017).

Importantly saltmarshes provide cultural services vital to community wellbeing and can hold a spiritual value and sense of place (Seabrook, 2012; Friess *et al.*, 2020). The loss of such saltmarsh environments and their services has been specifically highlighted as a concern in Wales as McKinley *et al.* (2018) state that the large threats of environmental and climate change on saltmarsh sustainability should be considered more within supporting legislation. When the inherent links between saltmarsh sustainability and ecosystem service provision are considered, there is a relationship between saltmarsh environmental quality and cultural wellbeing in coastal communities (Clarke *et al.*, 2021).

As Chapter Six demonstrates, this well-being and resilience are partially dependent on the evolution of storm subcultures which influence how the communities, local authorities and the national government respond and adapt to human-environmental change. Major storms such as the *Royal Charter* Storm of 1859 can produce change which influences how subcultures respond and understand future storm events which consequently influences resilience. The research presented in Chapter Six uses the historic case study of storm warnings to show how open knowledge exchange, inclusive decision making and partial community autonomy is essential in this response process. There has also been an increasing consensus that the State and communities must foster resilience by adopting policies that enhance community input while also enhancing sustainable ecosystem provision from natural environments (Sutton-Grier *et al.*, 2015; Bankoff, 2017). Central to this is the move away from rigid technocratic philosophies of flood ‘control’ and ‘defence’ (Samuels *et al.*, 2020) which Chapters Seven and Eight illustrate have and continue to cause major social, political and cultural issues, often a great expense to coastal communities. Instead, increasing climate change-induced threats mean that communities and the government must collectively plan and adapt to learn to ‘live with water’ and storms by adopting sustainable and often nature based approaches which can best mitigate future threats and enhance community resilience (Garde-Hansen *et al.*, 2017; Lowe *et al.*, 2018; Norbury *et al.*, 2021; Rozer and Surminski, 2021).

When the concepts of ecosystem services and storm subcultures are brought together, there is a clear socio-cultural and environmental relationship connecting the two. In the

case of the Three Rivers Estuary, the saltmarshes ecosystem provision of valuable services form an inherent part of the storm subculture which contributes towards enduring human and cultural resilience. Research in Carmarthen Bay further echoes McKinley *et al.*'s national findings as Davidson and Griffin (2018) highlight the vital provision of ecosystem services in the area to both human and natural populations. The predicted saltmarsh degradation with climate change is therefore a potential threat to the regional storm subcultures which have evolved with a degree of dependency on the natural environments. Given the partial social, cultural and economic reliance on the coastal environment, the predicted degradation could result in the potential loss of human and cultural wellbeing amongst the threatened coastal communities of Ferryside and St. Ishmael (Carmarthenshire County Council, 2019; Natural Resources Wales, 2020).

Although interconnected environmental, economic, social and cultural risks persist in the Three Rivers Estuarine Complex and throughout Western Britain (Lowe *et al.*, 2018), how risks impact upon the regional communities to a large extent depends on how they are understood and addressed (Wisner *et al.*, 2014; Kreibich *et al.*, 2017). Chapter Six highlights how open knowledge exchange and inclusive decision making best enable hazard impacts to be fully considered. This increases the chances of effective hazard management and resilience planning for the mutual benefits of environments and communities.

For management to be effective, communities, local authorities and the national government must all understand the complex nature of the climate threat and its impacts. As Chapter Seven and relevant early warning systems research illustrates, accurate storm representation and communication are essential to public understanding and response to climate hazards (Carvalho, 2007; Shehta and Hopmann, 2012). Despite external influences, as Chapter Eight exhibits, news outlets still have a major impact on public storm understanding (Pasquare and Oppizzi, 2012; Cody *et al.*, 2015; Devitt and O'Neill, 2017). While Chapter Seven's focus is on scientific and religious elements of representations, the research demonstrates how storm representation reflect wider epistemic trends while major implications for public understanding. Chapters Five and Eight further highlight a near-unanimous scientific storm representation in left-leaning British newspapers. The representation of the vital relationship between storms and climate change remains

contentious due to variable framings of ‘natural disasters’ and partially man-made climate catastrophes (Bohensky and Leitch, 2014; Norton and Hulme, 2019; Boudet *et al.*, 2020).

As Chapter Seven and wider research concerning representation and community hazard understanding exhibit, news representation, understanding and stakeholder response are fundamentally interlinked (Boykoff & Rajan, 2007; Takasahi and Meisner, 2013). It is therefore important that storm reporting accurately represents increasing storms, not as discrete one-off events but as anthropogenic climate change-driven threats that will likely increase in frequency, magnitude and impact (Wisner *et al.*, 2014; Lowe *et al.*, 2018). This representation of the predominant scientific consensus, which Chapter Eight shows is underpinned by increasing climate change storm risk and a need for more nature-based solutions, is important if threatened communities and governments are to make scientifically informed decisions that mutually increase long-term community and environmental resilience (Cologna *et al.*, 2017; Devitt and O’Neil, 2017).

Wider research notes that better-informed and engaged communities are further likely to directly push for science-backed and therefore sustainable action (Adger *et al.*, 2013; Bamberg *et al.*, 2015). This informed community impetus can also directly alter State management policies as whilst coastal management policies are partly dictated by the scientific consensus (Finlayson *et al.*, 2017; Bennett *et al.*, 2020), policy implementation is majorly impacted by political policies influenced by public knowledge (Schmidt *et al.*, 2014; Luis *et al.*, 2015). At present, the implementation of sustainable policies such as coastal retreat is rare because politically influenced local authorities view success in terms of welfare maximisation or minimising negative press representation associated with poor understanding (Gibbs, 2016). The trait of what Dachary-Bernard *et al.* (2019) term ‘unaware individualism’ and an optimism bias often leads to public rejection and therefore political unwillingness to adopt sustainable approaches. Alternatively, informed and therefore adaptation willing communities which recognise long-term climate change threats, the importance of sustaining coastal environments and their valuable ecosystem services, are less likely to resist adaptive resilience-building policies. Schliephack and Dickinson (2017) further note how representation can crucially catalyse public support for such sustainable coastal strategies and emphasise the importance of considered news rhetoric on understanding. Clear, consistent and transparent news reporting representations are

therefore important for building trust between scientists, policy makers and communities which can allow sustainable strategies to be embraced and adopted (Weisner and Schernewski, 2013; Matasci *et al.*, 2014). Accurate representation which reflects current scientific understanding and appreciates the tangible harm that can stem from bias (Gavin *et al.*, 2011; Sutton and Douglas, 2020) such as that exhibited by *The Guardian* in Chapters Five and Eight, is therefore key in the process of bridging the knowledge gaps between science, governments and communities. Bridging these gaps in understanding can ultimately contribute to policies that acknowledge the climate change catastrophe and prompt resilience building, thereby sustaining mutually important coastal community subcultures and natural environment ecosystem services.

The thesis highlights the complex and important relationships that exist between coastal storms, environments and communities. The multidisciplinary approach illustrates how storm subcultures are partially dependent on coastal environment sustainability and ecosystem service provision. However, coastal environment and saltmarsh sustainability is to an extent dictated by the actions of subcultures comprised of communities, local authorities and national governments whose understanding and policies can be influenced by wider storm representation. Given the importance of the community and environment relationships, it is therefore key that revised policies that fully consider climate change are adopted in order to enhance the sustainability of threatened coastal environments which provide a range of unique and often irreplaceable social, economic and cultural services. This thesis, therefore, illustrates the importance of understanding the highly diverse effects of coastal storms in Western Britain which are often interconnected and collectively influence coastal environments and communities with key implications for management and governance. Consequently, the next section addresses the importance of continued multidisciplinary research into storms and natural hazards.

9.2 The Potential of Historical Multidisciplinary Research

This section mainly addresses objective seven, indicating how multidisciplinary research can contribute to improving storm understanding and ultimately enhance long-term social, cultural and environmental resilience. The research undertaken demonstrates the multi-

faceted impacts of storms and floods on coastal communities and the environment, while also illustrating inherent human-environmental interconnections and dependencies that are essential to resilience. Despite the diverse nature of the research ranging from religious representation to saltmarsh sedimentology, the thesis only addresses a fraction of the storm impacts and effects in one vulnerable region. Given the predicted increase in storm and climate hazard threats throughout the UK (Lowe *et al.*, 2018; Palmer *et al.*, 2018), there is high potential for further multidisciplinary research to improve the understanding of storm impacts and contribute towards contemporary resilience. This value is further evidenced by Chaumillion *et al.*'s (2017) multidisciplinary and interdisciplinary historical storm study in Western France. The use of diverse historical data is shown to assist in verifying the reoccurrence and impacts of past storms of differing magnitudes while the combination of sedimentology and historical written records can specifically aid the reconstruction of millennial-scale climate variability and storm activity. Such research can therefore contribute towards producing vulnerability indices that inform coastal management policy with tangible benefits for coastal communities and environments. Multidisciplinary approaches therefore have the potential to contribute toward assessments that inform coastal management with tangible beneficial implications for coastal communities and environments (Chaumillion *et al.*, 2017).

Multidisciplinary research can also improve the understanding of other hazards for contemporary benefit. Netti *et al.* (2012) for instance propose a Multidisciplinary Decision Support System (MDSS) that analyses rainfall-induced shallow flowslides on steep slopes covered by pyroclastic deposits. The MDSS provides technical information for agencies responsible for human vulnerability and land management, bridging the gap between science, human vulnerability and mitigation policy. Such an approach allows issues to be collectively addressed considering different points of view with varied skillsets being jointly employed to effectively reduce vulnerability. Given that community hazard resilience and well-being fundamentally depends on the resilience of the physical infrastructure, natural environments and the human socio-economic cultural context (Doorn *et al.*, 2019), effective resilience strategies require inclusive multidisciplinary approaches. The ReNovRisk programme focused on tropical cyclones and their impacts on the South-West Indian Ocean basin exemplifies this (Tulet *et al.*, 2021). The programme involves the collective study of

the geomorphological, environmental and socio-economic impacts of cyclones and research from various disciplines including climatology, sedimentology and economics has contributed towards reducing interconnected community and environmental cyclone vulnerability. Regarding coastal saltmarshes, Myers *et al.*'s (2019) also stress how multidisciplinary research can elucidate the interconnected resilience dependencies of human communities, cultures and natural environments and ultimately inform sustainable adaptive management. Multidisciplinary approaches therefore can foster wider hazard understanding and inclusive sustainable management. This benefits environments and the ecosystem services they provide by positively impacting the coastal communities and their enduring subcultures that are integral for resilience.

Likewise, Chapter Seven's focus on the religious and scientific storm representations illustrates the importance of written representations on community hazard understanding, which has subsequent implications for policy. Camelo and Mayo (2021) note how the systems that define storm surge risk require multidisciplinary approaches to risk representation and communication so as to improve understanding and produce truly effective resilience. Multidisciplinary research of both historical (Chapter Seven) and contemporary (Chapter Eight) storm and natural hazard representations can therefore offer contributions to improving and nurturing science-informed hazard understandings with subsequent positive implications for policy and community resilience.

Other forms of integrative research as well as multidisciplinary studies can benefit impact hazard understanding and response. Caretta (2021) shows how interdisciplinary research, which integrates approaches from different disciplines to advance understanding beyond single discipline research (Klein, 2020), can bring together the historically disparate fields from which the hydrosocial and social-hydro frameworks emerged from human geography and hydrology. Working across epistemologies enabled the integration of approaches, ultimately creating a more comprehensive understanding of community implications following the West Virginia floods of 2016 (Caretta, 2021). Transdisciplinary research, which unites intellectual frameworks to transcend single disciplinary research through all-encompassing synthesis (Klein, 2020), also offers valid contributions. For instance, the COSELMAR project blended scientific expertise and community stakeholder engagement to provide original insights into socio-environmental marine issues with the purpose of

enhancing long-term coastal community adaption to varied future threats (Guillotreau *et al.*, 2020). Crossdisciplinary research involves the identification, reflection, creation and transformation of research via appraisal from other disciplines (Akkerman and Bakker, 2011). This vital feedback on storm and natural hazard research can identify unforeseen issues, prompt adaption and aid disciplinary cohesion which collectively results in more effective contributions to hazard understanding and management (McPhillips *et al.*, 2018). The different approaches all provide key and diverse contributions to natural hazard research and can enhance human and environmental resilience and sustainability. Multidisciplinary research plays an important role by encouraging disciplinary cohesion and reciprocal understanding. This is vital given the wide-ranging and interconnected social, cultural, political and environmental impacts of storms and natural hazards.

9.3. Summary

Multidisciplinary research must be more widely employed as climate hazards will intensify and impact more natural environments and human communities with interlinked effects. If climate-relevant research is to have a tangible impact on policy with mutually beneficial human and environmental effects, research must be geared to the needs of impacted communities and policymakers (Hallegatte and Mach, 2016). Multidisciplinary research should play an increasingly important role in the process as it demonstrates the interconnected impacts of hazards and could ultimately influence whether human communities, cultures and the environments they depend upon appropriately adapt to the increasing myriad of climate threats predicted by the IPCC 6th assessment report (Collins *et al.*, 2019). This thesis exhibits how combining a range of approaches and disciplines can offer key and original contributions to the understanding of climate hazards and illustrates the implications for communities and policy makers. However, this only represents a fraction of the potential contribution multidisciplinary research could offer not only to enhancing the understanding of coastal storms in Western Britain, but hazards more generally in the face of diverse and increasing climate threats to communities and environments.

Chapter 10: Conclusions

The research presented in this thesis demonstrated how multidisciplinary research that employs diverse methods offers an original contribution to improving storm understanding in Western Britain. The four papers (Chapters Four, Six, Seven and Eight) individually combine varied methods to respectively improve the understanding of the impacts of storms on saltmarshes, changes in storm subcultures, the evolution of written storm representations and contemporary storm catastrophe. Chapter Five provides context to Chapters Six to Eight and illustrates the wealth of valuable storm and climate information available in historical newspaper archives. The multidisciplinary analysis in the individual chapters and Chapter Nine highlighted the interconnections between the varied findings and their relevance for present-day coastal communities and environments. How the research addresses the aims and objectives are outlined below.

The overall research collectively addressed objective one by analysing coastal storm trends using historical records from 1800 to 2020. Tidal gauge data, meteorological data, saltmarsh sediments and newspaper reports, are all evidenced to independently and collectively contribute to analysing storm chronologies, impacts and implications. The diverse sources used in multidisciplinary research can verify storm trends, event occurrences and provide new insights into the varied storm effects on coastal communities and environments which are partially interdependent.

The research of Chapter Four addressed objective two by identifying and analysing evidence of coastal storms in the saltmarshes of the Three Rivers Estuarine Complex, Carmarthen Bay. The sedimentological study employed field, geochemical, particle size and radionuclide dating techniques to identify depositional saltmarsh storm surge evidence. A collective analysis combining tidal gauge and meteorological data enabled likely corroboration between the storm events of 26-29/11/1954 (two deposits), 13-15/03/1977 and 13-15/12/1981 and the deposits. The insights provided by the archival review of newspaper reports from 1800 to 2020 in Chapter Five further exhibited that the three storms had social impacts in Western Britain. Therefore the multidisciplinary research illustrated the variable storm effects on communities and environments.

The analysis of the original newspaper dataset in Chapter Five highlighted the diverse and evolving storm characteristics, impacts and representation. The analysis combined the archival evidence and relevant research to originally improve the understanding of coastal storm effects in Western Britain from 1800 to 2020, thereby addressing objective three.

The Chapter Five research also provided context for Chapter Six which analysed how a key storm event produced social, political and cultural responses with major implications for storm subcultures. Statistical and qualitative analyses of the archival dataset resulted in the selection of the *Royal Charter* Storm of 1859 as a case study. The analysis highlighted that the event changed storm understanding, prediction and warnings in Britain with key long-term implications for coastal communities and national governance. The analysis illustrated the limitations of top-down technocracy and the enduring importance of community autonomy and adaptive inclusive storm subcultures, thereby addressing objective four.

The archival newspaper dataset also provided the basis for research of Chapter Seven which focused on reported scientific and religious representational change from 1800-1953. A combination of statistical and qualitative analyses exhibited how reported religious storm representations rapidly declined from 1800 which was contrasted by a comparatively gradual rise in scientific representations. The analysis addressed objective five by exhibiting how representational trends reflect epistemological change in the form of the rising prominence of science and the diminishing status of religion in Britain. The research recommends the relationships between epistemological changes and written media representations need to be better understood to improve the public understanding of storms and natural hazards.

Chapter Eight adopted a contemporary focus using a combination of meteorological, tidal gauge and newspaper report data to assess the factors that contributed to the catastrophe of Storms Ciara and Dennis in Western Britain in February 2020. The research thereby addressed objective six. The analysis exhibited that while the storm period was a meteorological climate anomaly and short-term local authority and community responses were effective, shortcomings in government long-term climate change-related policies likely enhanced the catastrophe. Consequently, this study supports the wider research narrative suggesting that substantive long-term UK government policy change is required across multiple sectors to adequately address climate change risk in Western Britain.

The overall aim and objective seven were collectively addressed by the research of Chapters Four to Nine. Diverse multidisciplinary research is shown to have improved the understanding of the impacts of storms on the coastal community and environments of Western Britain from 1800 to 2020. While each chapter offers independent contributions to understanding, the discussion exhibited how multidisciplinary research can uniquely improve the understanding of the interconnected social, political, cultural and environmental impacts and effects of storms.

The analysis highlighted the complex, important and often mutually beneficial relationships between coastal environments, their ecosystem services and community resilience. Written storm representations are shown to have an important role in enhancing storm understanding with direct consequences for community and environmental resilience.

Overall this original study strengthens the growing narrative in favour of increasing multidisciplinary research as it exhibits how a multidisciplinary approach can highlight the diverse and often complex interconnected impacts and effects of storms on communities and environments in Western Britain. These interconnections and related interdependencies must be considered if future storm and climate change adaptation in the region is to be effective. Multidisciplinary research is further shown to have high potential to inform climate change-related storm adaptation strategies, ensuring that they consider the diverse implications of climate threats. When the increasing and often interconnected climate change impacts are considered, it is strongly recommended that multidisciplinary approaches are more widely adopted to address diverse climate threats. This multidisciplinary understanding can ultimately contribute towards enhancing collective community and environmental resilience.

Appendices

Appendix 1: Chapter Four

Appendix 1 exhibits the geochemical (1.1), particle size (1.2) and radionuclide data (1.3) used in the sedimentological analysis of saltmarsh storm evidence in the Three Rivers Estuarine Complex, Carmarthen Bay (Chapter Four).

1.1. Geochemical

The following tables exhibit the geochemical variability throughout the five cores selected for laboratory analysis. The natural log of the indicator element abundance determined by ITRAX® scanning is tabulated against conservative lithophile element Ti and Rb. The natural log was used to enable data comparison.

1.1.1. FS W3

Appendix Table 1.1. Natural log of key indicator element abundance variability against conservative lithophile element Ti in core FS W3 in the Three Rivers Estuarine Complex saltmarshes.

Depth (mm)	Si/Ti	K/Ti	Ca/Ti	Br/Ti	Sr/Ti	Zr/Ti	Ba/Ti
1	-1.9007	-0.1265	1.2442	-1.4247	-0.5427	-1.1897	-1.8706
2	-1.8608	-0.2002	1.07331	-1.6564	-0.8894	-1.4051	-2.1197
3	-1.783	-0.0695	1.34074	-1.4925	-0.6402	-1.1923	-1.9429
4	-1.8381	-0.0272	1.35362	-1.4337	-0.6038	-1.0409	-1.8737
5	-1.7425	-0.0036	1.25911	-1.3942	-0.6091	-1.2844	-2.0379
6	-1.8968	-0.0621	1.14871	-1.4037	-0.6492	-1.163	-2.1389
7	-1.9691	-0.0369	1.1999	-1.4475	-0.4835	-0.8862	-1.8445
8	-1.9686	-0.0337	1.13719	-1.4549	-0.547	-0.9443	-1.7846
9	-1.9325	0.02278	1.21603	-1.3879	-0.5752	-0.7934	-1.8347
10	-2.0192	-0.0776	1.14686	-1.5895	-0.5807	-0.8675	-1.9595
11	-1.9675	-0.0179	1.1225	-1.2879	-0.5316	-0.9799	-2.1928
12	-1.9556	-0.0214	1.2006	-1.3342	-0.4138	-0.7294	-2.25
13	-2.0548	-0.1741	1.20072	-1.4515	-0.5219	-0.9838	-2.4178
14	-2.0833	-0.168	1.19454	-1.3533	-0.5063	-0.7918	-2.4283
15	-2.104	-0.0655	1.16459	-1.5197	-0.5117	-0.8117	-2.3842
16	-1.9529	-0.0834	1.24569	-1.563	-0.5451	-0.763	-2.6007

17	-2.1011	-0.0467	1.20487	-1.5359	-0.5044	-0.7131	-2.5956
18	-2.2673	-0.126	1.16967	-1.6417	-0.5733	-0.8553	-2.7155
19	-2.3201	-0.1981	1.23305	-1.4928	-0.4078	-0.8355	-2.478
20	-2.2492	-0.1531	1.19951	-1.4919	-0.5034	-0.8866	-2.2602
21	-2.2321	-0.1312	1.24838	-1.2656	-0.4697	-0.9263	-2.3024
22	-2.1933	-0.0949	1.24159	-1.2236	-0.5201	-0.9595	-2.2258
23	-2.098	-0.1296	1.21218	-1.2897	-0.5354	-1.0652	-2.5345
24	-2.1629	-0.1448	1.15509	-1.3703	-0.6585	-1.1338	-3.0002
25	-2.1396	-0.1764	1.25279	-1.3234	-0.5459	-1.1922	-2.7411
26	-1.9404	-0.0404	1.25054	-1.0474	-0.4837	-1.3498	-2.5986
27	-1.8875	-0.0195	1.29244	-1.1368	-0.3497	-1.0067	-2.104
28	-1.9616	-0.0453	1.26056	-1.1551	-0.5009	-1.0282	-2.4643
29	-1.7652	0.06869	1.2972	-1.0727	-0.3968	-0.9706	-2.1221
30	-1.9044	-0.0767	1.16867	-1.3689	-0.5702	-1.3314	-2.4352
31	-2.0786	-0.0002	1.21717	-1.2474	-0.6655	-1.2594	-2.2975
32	-1.9405	-0.0383	1.23287	-1.4368	-0.8336	-1.3432	-2.7289
33	-1.9081	-0.1267	1.28018	-1.5572	-0.7608	-1.1906	-2.5563
34	-2.024	-0.1029	1.28158	-1.51	-0.7553	-1.2179	-2.416
35	-2.042	-0.1043	1.1978	-1.4895	-0.8085	-1.6268	-2.6464
36	-1.8576	-0.0505	1.18883	-1.4577	-0.8398	-1.4883	-2.6613
37	-2.1676	-0.0815	1.12828	-1.4526	-0.8092	-1.5039	-2.7121
38	-1.966	-0.0171	1.25285	-1.4096	-0.6082	-1.0963	-2.5155
39	-2.052	-0.0308	1.28146	-1.339	-0.6804	-1.2878	-2.5755
40	-2.2027	-0.0474	1.08416	-1.3446	-0.8479	-1.4862	-2.6198
41	-2.1495	-0.0469	1.11876	-1.3319	-0.8099	-1.7877	-2.8286
42	-2.1324	-0.0574	1.04732	-1.4008	-0.8043	-1.536	-2.6653
43	-2.1515	-0.0288	1.08841	-1.1839	-0.739	-1.688	-2.488
44	-2.0025	0.02049	1.03568	-1.159	-0.7188	-1.6983	-2.5387
45	-2.0861	-0.0068	1.10175	-1.2609	-0.7093	-1.5532	-2.5678
46	-1.883	0.00171	1.18287	-1.3866	-0.7787	-1.6152	-2.4809
47	-2.0234	0.0021	1.14551	-1.2553	-0.7207	-1.669	-2.3409
48	-2.0626	-0.0049	1.07319	-1.3565	-0.6947	-1.4738	-2.6737
49	-2.2554	-0.0536	1.12159	-1.442	-0.7244	-1.232	-2.3144
50	-2.0711	0.00555	1.07893	-1.3573	-0.7335	-1.5746	-2.2304
51	-2.098	-0.0448	1.14092	-1.3542	-0.793	-1.7117	-2.4534
52	-2.1071	-0.1571	1.08582	-1.6593	-0.9458	-1.4487	-2.7294
53	-1.8193	0.01482	1.2232	-1.4239	-0.8368	-1.7132	-2.4106
54	-1.8287	-0.063	1.22075	-1.7376	-0.8402	-1.6756	-2.6462
55	-1.8497	-0.1633	1.26813	-1.5965	-0.7717	-1.5321	-2.613
56	-1.8565	-0.1272	1.29806	-1.6155	-0.8261	-1.4309	-2.6738
57	-1.8193	-0.0164	1.24581	-1.566	-0.8047	-1.3163	-2.3352
58	-1.9757	-0.0138	1.22261	-1.4771	-0.7937	-1.4459	-2.7779
59	-1.7064	0.04858	1.34115	-1.4127	-0.6872	-1.2527	-2.5173
60	-1.8352	-0.0599	1.27378	-1.5678	-0.8016	-1.4941	-2.417
61	-1.7736	0.06317	1.33951	-1.5512	-0.6117	-1.0675	-2.2631
62	-1.6696	-0.0459	1.2395	-1.6673	-0.7841	-1.134	-2.5071

63	-1.7053	-0.0108	1.42884	-1.4861	-0.6763	-1.0793	-2.5839
64	-1.6704	0.02752	1.38278	-1.3454	-0.5879	-1.1967	-2.3766
65	-1.7012	-0.023	1.37535	-1.46	-0.5094	-1.1806	-2.7711
66	-1.9266	-0.0866	1.33571	-1.5949	-0.6201	-1.1184	-2.4109
67	-1.8967	-0.0899	1.39116	-1.5664	-0.5114	-1.083	-2.383
68	-2.029	0.01361	1.36111	-1.4938	-0.4374	-0.638	-2.6074
69	-2.24	-0.1776	1.15741	-1.4402	-0.6062	-0.9563	-2.5872
70	-2.2556	-0.2105	1.1799	-1.4345	-0.6676	-0.574	-2.2842
71	-2.1697	-0.1973	1.2582	-1.4873	-0.5269	-0.7911	-2.5046
72	-2.1459	-0.1303	1.2248	-1.437	-0.5477	-0.6718	-2.3267
73	-2.0226	-0.0019	1.36456	-1.3723	-0.3743	-0.7394	-2.5254
74	-1.9497	-0.0424	1.37305	-1.2895	-0.4464	-0.8719	-2.5301
75	-1.9686	-0.1042	1.20918	-1.2776	-0.5005	-0.8484	-2.3088
76	-2.0192	-0.1268	1.29295	-1.4669	-0.4787	-0.7623	-2.6142
77	-1.7951	0.01671	1.36683	-1.3257	-0.4358	-0.6648	-2.5422
78	-1.8878	-0.0721	1.22783	-1.4961	-0.4858	-0.8853	-2.4722
79	-2.0439	-0.0547	1.35956	-1.4064	-0.4017	-0.7475	-2.1799
80	-2.1714	-0.1449	1.31766	-1.7042	-0.5446	-0.6573	-2.4116
81	-2.025	-0.1358	1.26028	-1.5066	-0.4183	-0.7352	-2.6835
82	-2.0753	-0.2293	1.11298	-1.5169	-0.4695	-0.6562	-2.4949
83	-1.8717	-0.0665	1.15762	-1.4241	-0.374	-0.6176	-2.4434
84	-1.8225	-0.0315	1.4104	-1.4946	-0.4774	-0.685	-2.5775
85	-1.9083	-0.0623	1.27133	-1.6117	-0.4843	-0.6947	-2.6354
86	-1.6696	-0.0414	1.42349	-1.74	-0.6694	-0.8999	-3.0047
87	-1.6438	-0.0208	1.4456	-1.8089	-0.6524	-0.9683	-2.8207
88	-1.6493	-0.029	1.42094	-1.7508	-0.6349	-0.9202	-2.8881
89	-1.7675	-0.1362	1.29203	-1.8028	-0.6433	-1.0093	-2.4531
90	-1.5475	0.00101	1.46865	-1.7874	-0.591	-0.6808	-2.5257
91	-1.5562	0.08208	1.65086	-1.9885	-0.437	-0.3682	-2.4027
92	-1.3955	0.08947	1.75103	-1.8978	-0.3274	-0.1738	-2.2013
93	-1.3983	0.01811	1.74801	-2.081	-0.4032	-0.0509	-2.1751
94	-1.406	-0.1755	1.64116	-2.0105	-0.4506	-0.3422	-2.5761
95	-1.5144	-0.2163	1.72096	-1.9128	-0.491	-0.3265	-2.8127
96	-1.6363	-0.0638	1.70524	-1.8538	-0.4536	-0.2562	-2.5822
97	-1.6461	-0.052	1.43284	-1.7414	-0.4971	-0.5883	-2.099
98	-1.7895	-0.1173	1.24186	-1.5122	-0.8161	-0.9017	-2.4805
99	-1.6792	0.05213	1.43989	-1.3507	-0.4243	-0.5978	-2.1407
100	-1.6275	0.01359	1.5432	-1.4003	-0.4993	-0.5911	-2.3953
101	-1.5819	-0.0175	1.59907	-1.6105	-0.7196	-0.8756	-2.5754
102	-1.597	-0.0161	1.61269	-1.5571	-0.63	-0.6384	-2.5402
103	-1.577	0.00322	1.6133	-1.5391	-0.6013	-0.6423	-2.6511
104	-1.5994	-0.0064	1.61476	-1.5477	-0.594	-0.6794	-2.7877
105	-1.5897	0.01251	1.61653	-1.5097	-0.5751	-0.6615	-2.7656
106	-1.6979	-0.0775	1.43231	-1.5263	-0.5746	-0.8944	-2.4041
107	-1.6804	0.01501	1.52001	-1.3938	-0.6404	-0.9294	-2.4383
108	-1.7128	-0.0328	1.44056	-1.6596	-0.7105	-0.7522	-2.622

109	-1.7585	-0.0988	1.42882	-1.5407	-0.7863	-0.9403	-2.4632
110	-1.6628	0.01187	1.53738	-1.5376	-0.6668	-0.7789	-2.1938
111	-1.722	0.03487	1.409	-1.2532	-0.5961	-0.8261	-2.2001
112	-1.6874	0.07999	1.41473	-1.5067	-0.6463	-0.7846	-2.275
113	-1.6731	0.06285	1.41012	-1.4826	-0.6466	-0.7743	-2.2711
114	-1.6431	0.03889	1.40272	-1.4752	-0.6649	-0.7665	-2.2609
115	-1.5558	0.10619	1.49101	-1.414	-0.5932	-0.6565	-2.1036
116	-1.5382	0.10355	1.53989	-1.4087	-0.5962	-0.6426	-2.0673
117	-1.6967	0.11035	1.57819	-1.4049	-0.5923	-0.5969	-2.4052
118	-1.7857	0.0426	1.45986	-1.5019	-0.6738	-0.832	-2.1804
119	-1.9713	-0.1268	1.19026	-1.6441	-0.8812	-0.9654	-2.4431
120	-1.8627	0.04685	1.26019	-1.2303	-0.6484	-0.8203	-2.4699
121	-1.9688	-0.1578	1.38152	-1.4263	-0.758	-0.6368	-2.7471
122	-2.0921	-0.1193	1.41224	-1.471	-0.7652	-0.8379	-2.5853
123	-1.744	0.01149	1.4817	-1.5689	-0.6616	-0.7682	-3.1775
124	-2.0158	-0.1934	1.31833	-1.808	-0.8731	-0.871	-2.4595
125	-1.65	0.01577	1.50908	-1.6265	-0.6231	-0.8003	-2.5032
126	-1.3833	0.11368	1.8117	-1.5424	-0.5108	-0.5062	-2.2506
127	-1.4609	0.05974	1.76627	-1.5541	-0.4848	-0.5741	-2.2463
128	-1.4585	0.01018	1.73512	-1.5719	-0.554	-0.7116	-2.1485
129	-1.6188	-0.014	1.40954	-1.7436	-0.4889	-0.6209	-2.2483
130	-1.8311	-0.1028	1.26992	-1.9564	-0.6912	-0.5173	-2.1214
131	-1.7301	-0.0969	1.37861	-1.7195	-0.6504	-0.3621	-2.3262
132	-1.7583	-0.0514	1.47035	-1.5646	-0.6107	-0.6897	-2.1589
133	-1.6819	-0.055	1.45377	-1.799	-0.7254	-0.6415	-2.4086
134	-1.7865	-0.0638	1.46727	-1.7928	-0.7932	-0.8199	-2.2637
135	-1.9215	-0.1117	1.44531	-1.6999	-0.7236	-0.2212	-2.2894
136	-2.0302	-0.2166	1.18268	-1.825	-0.8234	-0.5554	-3.0506
137	-2.0087	-0.1485	1.2024	-1.8829	-0.8822	-0.4548	-2.2778
138	-1.7503	0.03214	1.46537	-1.7029	-0.7943	-0.5145	-2.1547
139	-1.6787	0.03402	1.44555	-1.6662	-0.7397	-0.3434	-2.0826
140	-1.8739	-0.1521	1.32581	-1.7108	-0.7869	-0.7888	-2.4998
141	-1.8853	-0.0813	1.34035	-1.6531	-0.8	-0.621	-2.517
142	-1.8646	-0.0814	1.37807	-1.7336	-0.7714	-0.5934	-2.5976
143	-1.6825	0.03327	1.46988	-1.5529	-0.7115	-0.784	-2.2791
144	-1.7948	-0.0742	1.24175	-1.6993	-0.927	-0.8656	-2.3326
145	-1.7305	-0.0525	1.32101	-1.5204	-0.8494	-0.5819	-2.3458
146	-1.8052	-0.099	1.261	-1.8476	-0.9503	-0.7147	-2.1313
147	-1.5112	-0.0369	1.44527	-1.7423	-0.8411	-0.6505	-2.4005
148	-1.478	0.06084	1.52405	-1.8303	-0.7037	-0.5835	-2.4972
149	-1.6851	-0.1677	1.23844	-1.8209	-1.0327	-0.7737	-2.4713
150	-1.693	-0.1445	1.33409	-1.9709	-1.1458	-0.5761	-2.5475
151	-1.5014	0.00279	1.43517	-1.9164	-1.0555	-0.6429	-2.4191
152	-1.5804	-0.0615	1.33684	-1.7994	-1.112	-0.6588	-2.5197
153	-1.535	-0.0424	1.35479	-1.7515	-1.0579	-0.6063	-2.5196
154	-1.4958	-0.0327	1.34749	-1.7175	-1.0216	-0.5633	-2.5396

155	-1.5335	-0.039	1.287	-1.7281	-1.0289	-0.5659	-2.661
156	-1.5524	-0.0651	1.24274	-1.7386	-1.0276	-0.5671	-2.7893
157	-1.5603	-0.0708	1.23999	-1.7428	-1.0358	-0.5696	-2.8114
158	-1.512	0.03439	1.49065	-1.5266	-0.7233	-0.6046	-2.7263
159	-1.7758	-0.14	1.1525	-1.7568	-0.9284	-0.8603	-2.8129
160	-1.5322	0.00776	1.38443	-1.5658	-0.8095	-0.6369	-2.7452
161	-1.574	-0.0979	1.38293	-1.6447	-1.0526	-0.8382	-2.8793
162	-1.6457	-0.135	1.11979	-1.7716	-1.2096	-0.8464	-2.3229
163	-1.6709	-0.0758	1.25302	-1.5792	-1.0988	-0.6407	-2.7639
164	-1.637	-0.0395	1.28968	-1.587	-1.1405	-0.7646	-2.6328
165	-1.5493	0.02801	1.18967	-1.4135	-0.8952	-0.5078	-2.4838
166	-1.4078	0.1663	1.28863	-1.371	-0.8606	-0.4009	-2.2869
167	-1.55	0.03646	1.24494	-1.2487	-0.94	-0.1527	-2.3466
168	-1.4601	0.11054	1.29971	-1.3851	-0.9737	-0.427	-2.4359
169	-1.5694	0.06961	1.10561	-1.4937	-1.1514	-0.7491	-2.5765
170	-1.6289	-0.0143	1.12389	-1.4958	-1.021	-0.6072	-2.9034
171	-1.7979	-0.0314	1.26198	-1.5058	-0.8594	-0.3565	-2.5274
172	-1.4586	0.00048	1.29338	-1.3211	-0.6129	-0.3075	-2.3417
173	-1.4513	0.02931	1.32139	-1.3113	-0.591	-0.2819	-2.3441
174	-1.4766	0.02373	1.32769	-1.3648	-0.572	-0.2863	-2.4268
175	-1.4606	0.05426	1.34898	-1.3556	-0.558	-0.2554	-2.4373
176	-1.4493	0.07476	1.37438	-1.3474	-0.5138	-0.2461	-2.4481
177	-1.7041	-0.0245	1.23605	-1.3303	-0.8184	-0.4046	-2.3681
178	-1.4995	0.12053	1.1647	-1.0975	-0.8456	-0.5938	-2.0584
179	-1.7227	-0.0889	1.07574	-1.4326	-1.1083	-1.0018	-2.5853
180	-1.643	0.06525	1.19205	-1.3044	-0.9324	-0.6488	-2.2368
181	-1.7263	-0.0062	1.29498	-1.2908	-0.868	-0.5324	-2.3234
182	-1.8685	-0.0455	1.21062	-1.2627	-1.003	-0.7062	-2.5552
183	-1.9673	-0.122	1.10307	-1.4948	-1.0508	-0.7158	-2.6816
184	-2.0245	-0.1352	0.91575	-1.4986	-1.1415	-0.4407	-3.0721
185	-2.0503	-0.1315	1.04698	-1.3572	-0.9735	-0.5887	-2.5956
186	-2.0412	-0.1315	1.13028	-1.6582	-0.9884	-0.7514	-2.4873
187	-2.2263	-0.241	1.06278	-1.6449	-1.0736	-0.8451	-3.3558
188	-1.949	-0.0939	1.05365	-1.5248	-1.0622	-0.5647	-2.6559
189	-1.9439	-0.1272	1.01594	-1.52	-1.1015	-0.6803	-2.669
190	-1.7339	-0.0531	1.09948	-1.5117	-1.0354	-0.5111	-2.6568
191	-1.5436	0.04744	1.15232	-1.3465	-0.9177	-0.6079	-2.1786
192	-1.7305	0.0234	1.03884	-1.2429	-1.2161	-0.7953	-2.3503
193	-1.6371	0.02113	1.14166	-1.4289	-0.9638	-0.6945	-2.187
194	-1.7781	-0.0648	1.05845	-1.5326	-0.932	-0.5538	-2.3971
195	-1.8884	-0.0377	1.07178	-1.3816	-0.916	-0.5603	-2.5267
196	-1.7316	-0.0482	1.15353	-1.38	-0.8525	-0.5557	-2.3026
197	-1.6005	0.0321	1.29686	-1.3812	-0.8084	-0.6804	-2.3506
198	-1.5375	0.0213	1.26923	-1.4225	-0.8233	-0.6175	-2.026
199	-1.5442	0.00547	1.3102	-1.2313	-0.7362	-0.385	-2.1951
200	-1.6818	-0.008	1.25007	-1.2907	-0.6931	-0.3353	-2.2119

201	-1.7367	-0.0785	1.19124	-1.377	-0.8256	-0.3888	-2.5166
202	-1.8288	-0.1546	1.02089	-1.4542	-0.8223	-0.2969	-2.8315
203	-1.8519	-0.1506	1.04934	-1.5186	-0.8311	-0.4918	-2.6319
204	-1.6224	0.02344	1.36472	-1.3445	-0.571	-0.0738	-2.4166
205	-1.8998	-0.2028	1.09104	-1.4156	-0.8599	-0.4744	-2.431
206	-1.8795	-0.0383	1.19845	-1.3714	-0.6766	-0.3421	-2.3922
207	-1.8107	-0.1138	1.06344	-1.4942	-0.8897	-0.5176	-2.288
208	-1.7851	0.02392	1.10501	-1.4476	-0.9718	-0.5809	-2.1013
209	-1.7117	0.01689	1.13615	-1.5991	-0.9522	-0.6037	-2.2177
210	-1.8198	-0.0548	1.04756	-1.5508	-0.9756	-0.6018	-2.5709
211	-1.8143	-0.0009	1.11225	-1.6142	-0.8468	-0.5574	-2.2901
212	-2.029	-0.1896	0.93602	-1.7379	-1.12	-0.7775	-2.5484
213	-1.8966	-0.0853	1.15862	-1.4818	-0.9269	-0.6211	-2.7374
214	-1.9945	-0.1334	1.06234	-1.4951	-0.9475	-0.6351	-2.8012
215	-2.0185	-0.0332	0.99271	-1.3998	-0.9158	-0.399	-2.6006
216	-1.7318	0.00154	1.08447	-1.2537	-0.806	-0.6845	-2.5698
217	-2.0021	-0.1421	0.88725	-1.3732	-0.8876	-0.7439	-2.6628
218	-2.0005	-0.1422	1.01694	-1.4092	-0.8621	-0.6582	-2.2689
219	-2.0015	-0.1608	0.92973	-1.4424	-0.9212	-0.5062	-2.4179
220	-2.1792	-0.2488	1.04737	-1.5472	-0.8989	-0.6325	-2.6873
221	-1.9586	-0.0421	1.13682	-1.2505	-0.7662	-0.4102	-2.64
222	-1.516	0.06142	1.18644	-1.3132	-0.7834	-0.5553	-2.1922
223	-1.7909	-0.0175	1.13358	-1.1413	-0.573	-0.2189	-2.3589
224	-1.8774	-0.0212	1.10553	-1.1011	-0.8454	-0.3693	-2.2019
225	-1.929	-0.1377	0.99723	-1.3174	-0.9927	-0.7119	-2.3201
226	-1.5783	-0.0263	1.16998	-1.3036	-0.8476	-0.3846	-2.3105
227	-1.9318	-0.0106	1.18458	-1.3194	-0.7886	-0.2886	-2.4869
228	-1.7898	-0.0936	1.19685	-1.3061	-0.7405	-0.2309	-2.2458
229	-1.8325	-0.0929	1.18567	-1.469	-0.8959	-0.4701	-2.4354
230	-1.6737	-0.0007	1.36839	-1.2346	-0.7622	-0.1579	-2.1982
231	-1.719	-0.1719	1.20292	-1.4356	-0.9773	-0.5696	-2.4033
232	-1.6494	-0.0069	1.2904	-1.3016	-0.8068	-0.4342	-2.3943
233	-1.6712	-0.0534	1.17838	-1.4501	-0.9002	-0.6856	-2.3456
234	-1.4419	0.04219	1.25434	-1.5213	-0.9441	-0.5776	-2.5121
235	-1.4664	0.04474	1.42949	-1.5081	-0.7514	-0.408	-2.5693
236	-1.5182	-0.0485	1.34709	-1.4545	-0.6904	-0.2065	-2.4698
237	-1.3788	0.0695	1.40256	-1.0326	-0.2585	-0.1336	-2.2589
238	-1.3979	0.10696	1.54778	-1.0217	-0.3106	-0.2686	-1.9757
239	-1.3959	0.15803	1.5918	-0.7027	-0.2816	0.11246	-2.1192
240	-1.5722	0.0259	1.54998	-1.1501	-0.5181	-0.3684	-2.4808
241	-1.6871	-0.1216	1.28429	-1.5027	-0.6153	-0.4141	-2.2642
242	-1.4444	0.14454	1.48439	-1.387	-0.5651	-0.2835	-2.2257
243	-1.5623	0.13202	1.21066	-1.2855	-0.5752	-0.2821	-2.4062
244	-1.7198	0.07738	1.29729	-1.3092	-0.2951	0.26469	-2.1108
245	-1.974	-0.1887	1.16306	-1.5298	-0.6254	-0.3733	-2.5608
246	-1.5489	0.03016	1.43329	-1.4897	-0.5018	-0.2561	-2.242

247	-1.9296	-0.1154	1.21103	-1.5247	-0.575	-0.2755	-2.5066
248	-2.1594	-0.2911	1.02107	-1.5947	-0.7474	-0.2466	-2.6525
249	-2.1894	-0.2587	1.02881	-1.7863	-0.8797	-0.5201	-2.4307
250	-1.8929	-0.1282	1.20151	-1.5018	-0.767	-0.1128	-2.1538
251	-1.9335	-0.0128	1.21171	-1.536	-0.711	-0.1736	-2.1716
252	-2.0001	-0.0734	1.06603	-1.7582	-0.9454	-0.2985	-2.2642
253	-2.0084	-0.1055	1.18008	-1.535	-1.0287	-0.2592	-2.2098
254	-2.1075	-0.0953	1.07506	-1.7991	-1.0653	-0.5475	-2.598
255	-2.0624	-0.0552	1.2577	-1.7725	-0.8851	-0.4239	-2.5395
256	-2.0661	-0.1502	1.26584	-1.5758	-1.0275	-0.5849	-2.3843
257	-1.9058	0.03681	1.13861	-1.5441	-0.9044	-0.4564	-2.2234
258	-1.9799	-0.0667	1.12716	-1.6262	-1.0214	-0.7258	-2.2227
259	-1.9127	-0.064	1.21066	-1.5569	-0.9883	-0.6318	-2.7984
260	-1.9262	0.0346	1.30775	-1.5138	-0.8806	-0.564	-2.6297
261	-1.8684	-0.0053	1.42398	-1.6647	-0.7774	-0.5157	-2.6734
262	-1.8214	-0.072	1.17867	-1.8429	-1.0036	-0.6318	-2.473
263	-1.9029	-0.0402	1.15891	-1.7018	-1.1883	-0.6872	-2.5762
264	-2.0464	-0.2095	0.93589	-1.99	-1.3558	-0.9068	-2.484
265	-1.9252	-0.1153	1.1401	-1.8429	-1.1632	-0.6783	-2.3528
266	-1.8454	0.04655	1.28012	-1.5162	-0.9602	-0.554	-2.3923
267	-1.964	-0.0708	1.06531	-1.8152	-1.144	-0.9895	-2.6383
268	-1.958	-0.0833	1.28865	-1.9535	-1.1545	-0.8238	-2.7473
269	-1.7935	-0.0159	1.12582	-1.8125	-1.1838	-0.826	-2.4602
270	-1.9481	-0.1099	1.08519	-1.7741	-1.1271	-0.7634	-2.5501
271	-1.8438	-0.0481	1.11908	-1.8992	-1.0203	-0.6302	-2.3146
272	-1.846	-0.1313	1.12361	-1.844	-1.1064	-1.0238	-2.5115
273	-1.9192	-0.1187	1.0338	-1.9081	-1.1445	-0.705	-2.5454
274	-1.9413	-0.1018	1.13955	-1.7149	-1.027	-0.6599	-2.3468
275	-2.1073	-0.1072	1.08905	-1.4242	-1.0174	-0.4858	-2.2149
276	-2.0577	-0.1812	1.0943	-1.45	-1.0283	-0.9017	-2.8865
277	-2.1381	-0.2076	1.10404	-1.5393	-1.1242	-0.6726	-2.538
278	-1.9174	-0.1323	1.26772	-1.6036	-1.0371	-0.7679	-2.3583
279	-1.7832	-0.0606	1.30025	-1.7227	-1.0589	-0.7666	-2.6652
280	-2.0135	-0.2622	1.17647	-2.1184	-1.3146	-0.5061	-2.6678
281	-1.7656	0.03934	1.21959	-1.7234	-1.0262	-0.4535	-2.3777
282	-1.5311	0.09261	1.23024	-1.7314	-1.0129	-0.3456	-2.535
283	-1.7283	-0.0941	1.01849	-1.7621	-1.1188	-0.8987	-2.6141
284	-1.5946	0.06542	1.21282	-1.7164	-0.9673	-0.6928	-2.4188
285	-1.5889	0.06934	1.2518	-1.7069	-0.9178	-0.6289	-2.3941
286	-1.541	0.06091	1.30803	-1.7089	-0.9219	-0.5652	-2.2847
287	-1.5284	0.05688	1.38884	-1.6985	-0.8733	-0.5315	-2.2646
288	-1.4998	0.06747	1.43719	-1.6961	-0.8658	-0.4373	-2.2534
289	-1.4678	0.06714	1.49368	-1.7015	-0.8627	-0.4113	-2.2519
290	-1.4369	0.06825	1.52863	-1.4732	-0.8735	0.06272	-2.4863
291	-1.6105	-0.0503	1.28942	-1.7349	-0.9464	-0.7094	-2.3397
292	-1.8002	-0.0382	1.30369	-1.6687	-0.8998	-0.3828	-2.4858

293	-1.7737	-0.008	1.52149	-1.692	-0.8259	-0.3524	-2.1273
294	-1.5888	0.06663	1.56285	-1.5802	-0.8078	-0.0225	-2.2536
295	-1.4838	0.13906	1.45782	-1.5853	-0.7269	-0.3372	-1.9844
296	-1.6047	0.05713	1.38549	-1.8331	-0.8152	-0.197	-2.4959
297	-1.612	-0.0653	1.51102	-1.7571	-0.9591	-0.6554	-2.4603
298	-1.5543	-0.0605	1.50116	-1.8974	-0.8647	-0.4601	-2.4702
299	-1.4818	0.08955	1.61077	-1.6428	-0.7592	-0.4412	-2.383
300	-1.6335	0.10608	1.50234	-1.7846	-0.8374	-0.4452	-2.3868
301	-1.7837	0.07629	1.6159	-1.4645	-0.6587	-0.3071	-2.5684
302	-1.7929	-0.0482	1.58489	-1.7315	-0.8098	-0.2345	-2.6467
303	-1.9146	-0.0818	1.47209	-1.8323	-0.9497	-0.3723	-2.3464
304	-1.9599	-0.1037	1.26165	-1.6817	-0.9504	-0.6106	-2.5401
305	-1.8502	-0.0573	1.45278	-1.7076	-0.8522	-0.2245	-2.2178
306	-1.9773	-0.2101	1.09041	-1.8958	-1.0429	-0.406	-2.2511
307	-1.9465	-0.1522	1.20739	-1.8308	-0.9432	-0.2948	-2.2367
308	-2.0562	-0.273	1.14256	-1.8549	-1.0079	-0.3589	-2.2595
309	-1.8255	0.0176	1.45499	-1.6891	-0.7032	-0.0486	-1.9531
310	-1.6955	-0.1207	1.3868	-1.7924	-0.9006	-0.6152	-2.1727
311	-1.5146	0.00891	1.52132	-1.724	-0.8779	-0.2632	-2.263
312	-1.5873	-0.1044	1.49934	-1.8901	-0.8946	-0.5378	-2.2294
313	-1.5512	0.0291	1.59138	-1.8373	-0.7061	-0.191	-2.3696
314	-1.8055	-0.0649	1.29538	-2.2306	-0.9282	-0.4421	-2.4904
315	-1.4106	0.14353	1.41267	-1.7233	-0.7295	-0.3023	-2.3739
316	-1.3873	0.10893	1.42589	-1.899	-0.867	-0.4196	-2.2814
317	-1.5881	-0.0325	1.3269	-1.8518	-1.0177	-0.4346	-2.5563
318	-1.7997	-0.1201	1.28896	-1.932	-0.9391	-0.234	-2.597
319	-1.9327	-0.1095	1.42071	-1.7044	-0.7608	-0.0721	-2.2938
320	-1.913	-0.1245	1.33297	-1.7222	-0.8572	-0.1266	-2.6809
321	-1.7183	-0.082	1.34733	-1.8272	-0.9005	-0.274	-2.6354
322	-1.4608	-0.0059	1.55554	-1.7463	-0.8721	-0.546	-2.3477
323	-1.2209	0.15111	1.71854	-1.7175	-0.7139	-0.0781	-2.3787
324	-1.397	0.03652	1.45161	-1.9495	-0.9678	-0.4245	-2.3688
325	-1.4568	-0.0001	1.47485	-1.8172	-0.9321	-0.2206	-2.3492
326	-1.5025	-0.0067	1.44734	-2.1176	-0.9376	-0.1325	-2.4834
327	-1.5294	0.02384	1.42797	-1.9387	-1.0729	-0.3406	-2.508
328	-1.6844	-0.1371	1.33663	-2.0437	-0.947	-0.2472	-2.3384
329	-1.4814	0.10623	1.74921	-1.5966	-0.6515	0.17137	-2.2549
330	-1.7808	-0.2284	1.30531	-2.0509	-0.9658	-0.3388	-2.4627
331	-1.5149	0.05809	1.61128	-1.6279	-0.7248	-0.1285	-2.3037
332	-1.4476	0.09453	1.47341	-1.6892	-0.8329	-0.2475	-2.3172
333	-1.4906	0.16975	1.64517	-1.6001	-0.6358	-0.1206	-2.3278
334	-1.4139	0.12491	1.58992	-1.6317	-0.6461	-0.1246	-2.2736
335	-1.5411	-0.0132	1.55376	-1.9342	-0.8748	-0.1986	-2.3023
336	-1.4922	-0.0671	1.65738	-1.85	-0.7382	-0.0395	-2.2306
337	-1.612	-0.1283	1.46335	-1.886	-0.9004	-0.1192	-2.5434
338	-1.4665	0.12831	1.61589	-1.8238	-0.6734	-0.0351	-2.2856

339	-1.6439	-0.0276	1.55498	-1.7259	-0.8223	-0.0975	-2.2747
340	-1.5285	-0.0423	1.44747	-1.7919	-0.86	-0.0716	-2.3607
341	-1.6762	-0.0246	1.5859	-1.9564	-0.8021	-0.3325	-2.5093
342	-1.6958	-0.0154	1.55218	-2.0347	-0.8085	-0.2875	-2.2868
343	-1.6836	0.04087	1.60867	-1.8257	-0.669	-0.2002	-2.5349
344	-1.7904	-0.103	1.50492	-2.1762	-0.7853	-0.3195	-2.4431
345	-1.7119	-0.1195	1.52475	-2.0891	-0.7537	-0.2245	-2.7571
346	-1.7481	-0.0993	1.43926	-2.1016	-0.7102	-0.4197	-2.6725
347	-1.5059	0.00087	1.80642	-1.8354	-0.6183	-0.3148	-2.3426
348	-1.6167	-0.0462	1.62637	-1.8494	-0.7035	-0.3582	-2.251
349	-1.6565	0.02842	1.65948	-1.695	-0.583	-0.3188	-2.4667
350	-1.5914	0.02403	1.68221	-1.931	-0.6077	-0.411	-2.5701
351	-1.6716	0.0831	1.74977	-1.8319	-0.6172	-0.3993	-2.3246
352	-1.7426	0.14272	1.68188	-1.8283	-0.4272	-0.1097	-1.994
353	-1.7507	0.13876	1.81159	-1.7042	-0.4112	-0.1833	-1.9869
354	-1.756	0.12781	1.79829	-1.7372	-0.4232	-0.2393	-2.0112
355	-1.7818	0.11456	1.78973	-1.7557	-0.4237	-0.2773	-2.0486
356	-1.7923	0.10739	1.78106	-1.7626	-0.4379	-0.291	-2.0937
357	-1.8151	0.08816	1.77543	-1.7686	-0.448	-0.3074	-2.1087
358	-1.8173	0.00632	1.59281	-1.7133	-0.5525	-0.2577	-2.2206
359	-1.9419	-0.0077	1.56729	-2.0003	-0.5743	-0.481	-2.4382
360	-1.7352	0.02088	1.67909	-1.7313	-0.5475	-0.5889	-2.3466
361	-1.8989	-0.0874	1.57185	-1.7678	-0.5662	-0.5142	-2.4823
362	-1.7606	-0.0269	1.65322	-1.905	-0.4754	-0.3352	-2.2223
363	-1.8578	0.04441	1.65168	-1.7168	-0.4587	-0.2678	-2.3554
364	-2.0517	-0.1487	1.48694	-1.8223	-0.6247	-0.5924	-2.6898
365	-1.9609	-0.2518	1.38684	-2.1517	-0.7682	-0.6258	-2.7186
366	-2.0683	-0.2533	1.36828	-2.1678	-0.7738	-0.6551	-2.5131
367	-2.063	-0.2153	1.4734	-2.2347	-0.6593	-0.4752	-2.7174
368	-1.8345	-0.0621	1.66288	-2.028	-0.5121	-0.5433	-2.3961
369	-1.9785	-0.1466	1.59632	-1.9849	-0.5434	-0.4068	-2.3474
370	-1.9474	-0.151	1.52336	-2.0217	-0.5049	-0.4516	-2.3839
371	-1.8154	-0.0872	1.62173	-1.9812	-0.4406	-0.3978	-2.3559
372	-1.9467	-0.1463	1.46452	-2.0304	-0.4094	-0.2981	-2.167
373	-1.8606	-0.0395	1.61423	-1.8115	-0.3216	-0.0666	-2.2011
374	-1.8571	-0.0621	1.62487	-1.8133	-0.3648	-0.3269	-2.1982
375	-1.8439	-0.0836	1.59927	-1.8152	-0.5109	-0.5333	-2.1209
376	-1.9215	-0.1126	1.67991	-1.8651	-0.5328	-0.5843	-2.3649
377	-1.8736	-0.0645	1.56554	-2.0668	-0.4738	-0.3256	-2.451
378	-1.7046	-0.0248	1.69606	-1.8293	-0.5057	-0.3283	-2.3151
379	-1.5698	-0.0557	1.81525	-2.1962	-0.3017	-0.6821	-3.0662
380	-1.5624	-0.044	1.70586	-2.1356	-0.5562	-0.7393	-2.661
381	-1.6393	-0.0494	1.67396	-1.95	-0.4853	-0.6659	-2.7815
382	-1.6179	-0.0151	1.69835	-2.0145	-0.494	-0.4923	-2.2062
383	-1.6954	-0.1415	1.44336	-2.286	-0.631	-0.7754	-2.3333
384	-1.535	-0.0001	1.67999	-2.0954	-0.5606	-0.7278	-2.1258

385	-1.6153	-0.1599	1.6173	-2.2499	-0.5531	-0.7295	-2.2042
386	-1.4706	0.03178	1.76832	-2.0763	-0.4719	-0.5225	-2.3601
387	-1.6132	-0.0291	1.87789	-2.2317	-0.3862	-0.4704	-2.5807
388	-1.8184	-0.0483	1.69426	-1.9084	-0.3944	-0.3815	-2.5389
389	-1.8994	-0.0905	1.56296	-2.1568	-0.435	-0.4619	-2.2955
390	-1.7492	-0.107	1.60593	-2.224	-0.4706	-0.5056	-2.4874
391	-1.7879	-0.1142	1.66894	-2.283	-0.5139	-0.363	-2.5575
392	-1.7662	-0.0416	1.70776	-2.2259	-0.4533	-0.5032	-2.5064
393	-1.7475	-0.1218	1.75225	-2.3399	-0.4889	-0.6183	-2.4587
394	-1.6911	-0.0454	1.79867	-2.077	-0.4461	-0.3844	-2.5213
395	-1.7188	-0.1175	1.78659	-2.247	-0.4804	-0.403	-2.3885
396	-1.6857	-0.0606	1.83627	-2.2258	-0.4556	-0.5546	-2.2869
397	-1.6144	-0.0235	1.91657	-2.0005	-0.35	-0.406	-2.6067
398	-1.74	-0.1508	1.6988	-2.1559	-0.2976	-0.3128	-2.3059
399	-1.7627	-0.1029	1.98816	-1.9301	-0.2056	-0.5141	-2.1906
400	-1.5989	-0.0417	2.19864	-1.8592	-0.1234	-0.2766	-2.264
401	-1.7813	-0.1467	1.70022	-1.75	-0.4759	-0.3077	-2.218
402	-1.6922	-0.2195	1.73734	-2.4086	-0.5363	-0.3452	-2.1519
403	-1.4031	-0.0891	1.80104	-2.2158	-0.4736	-0.2179	-2.2889
404	-1.5742	-0.1268	1.87355	-2.1017	-0.3179	-0.3457	-2.4595
405	-1.2932	0.12799	2.17598	-1.9236	-0.1113	-0.2588	-2.0635
406	-1.1447	0.08834	2.36016	-2.2089	-0.0788	-0.0447	-2.3843
407	-0.9799	0.23496	2.48865	-2.0296	0.00763	-0.1093	-2.1241
408	-1.3433	-0.0964	2.10666	-2.0891	-0.1881	-0.2411	-2.3032
409	-1.6518	-0.1296	2.01382	-2.37	-0.1488	-0.254	-2.4502
410	-1.4381	0.12699	2.1212	-2.07	-0.0182	-0.1877	-2.508
411	-1.4365	-0.0008	1.96844	-2.23	-0.2503	-0.5264	-2.6122
412	-1.6173	-0.1035	2.23617	-2.0228	-0.0071	-0.5056	-2.3456
413	-0.9264	0.42537	2.67272	-1.8479	0.36673	-0.2962	-2.5154
414	-1.2427	0.08342	2.46659	-1.9526	0.06221	-0.2749	-2.9167
415	-1.6426	-0.014	2.52407	-0.8396	0.11249	-0.3374	-2.2765
416	-1.5166	0.08011	2.15355	-1.8748	-0.1346	-0.3041	-2.4079
417	-1.6892	-0.0327	1.79294	-1.9745	-0.3312	-0.6141	-2.522
418	-1.7812	-0.1176	1.72599	-2.1247	-0.4988	-0.5148	-2.2657
419	-1.403	-0.0011	1.81991	-2.0107	-0.4355	-0.4824	-2.2957
420	-1.2808	0.16584	2.12811	-2.0608	-0.2964	-0.5591	-2.3084
421	-1.1654	0.18881	2.29887	-1.9204	-0.1831	-0.361	-2.5659
422	-0.9294	0.28037	2.34392	-1.8207	-0.0763	-0.2777	-2.1877
423	-0.9415	0.10561	2.52074	-1.9946	-0.0451	-0.4309	-2.5599
424	-1.2178	-0.1151	2.07887	-2.3974	-0.3411	-0.5713	-2.4962
425	-1.0982	-0.0872	2.25796	-2.1589	-0.1724	-0.6366	-2.4308
426	-0.7944	0.12928	2.47024	-1.7212	0.03419	-0.1114	-2.1501
427	-0.7092	0.19973	2.73042	-1.7982	0.11098	0.03237	-2.0176
428	-0.4355	0.47037	2.78542	-1.6815	0.45205	0.47975	-1.9166
429	-0.9209	-0.1293	2.42588	-1.9696	-0.0643	-0.1183	-2.799
430	-0.7438	0.20976	2.63969	-1.6094	0.061	0.09016	-2.4399

431	-0.8591	0.23359	2.50343	-2.0379	-0.0315	-0.1462	-2.461
432	-0.6848	0.21989	2.60631	-1.7996	0.16615	-0.0206	-2.2761
433	-0.7188	0.28286	2.68988	-1.8266	-0.0103	-0.227	-2.3201
434	-0.7697	0.18615	2.58541	-2.0422	-0.0285	-0.6636	-2.6967
435	-1.0869	-0.1255	2.39919	-2.327	-0.0568	-0.5674	-2.472
436	-0.7235	0.32459	2.68852	-1.6799	0.42266	0.01486	-2.096
437	-1.024	0.26958	2.63334	-1.8829	0.45615	-0.2925	-2.4014
438	-1.4592	-0.0087	2.53843	-1.9935	0.44694	-0.2859	-2.344
439	-1.3191	-0.0734	2.59624	-1.9565	0.33859	-0.5191	-2.1307
440	-0.9539	0.22109	2.70266	-1.5966	0.483	-0.2256	-2.1333
441	-0.7786	0.38281	2.8747	-1.6611	0.52804	0.11686	-2.2227
442	-0.7516	0.13863	2.59217	-2.0995	0.28388	-0.4395	-2.3974
443	-0.8201	0.09554	2.6199	-2.1764	0.20241	-0.7687	-2.3215
444	-0.2786	0.53922	3.21582	-1.2554	0.78198	-0.3717	-1.7038
445	-0.4063	0.43055	2.99276	-1.4662	0.62445	-0.3796	-1.9771
446	-0.4513	0.36443	2.81634	-1.8171	0.42007	-0.809	-2.4021
447	-0.4208	0.29427	2.84055	-2.1547	0.3624	-0.8451	-2.4164
448	-0.6852	0.2904	2.73844	-2.297	0.29076	-0.7983	-2.2851
449	-0.6141	0.29482	2.73822	-2.1037	0.25242	-0.8527	-2.4235
450	-0.5173	0.31351	2.78769	-1.9492	0.29853	-0.8294	-2.5958
451	-0.6954	0.28351	3.04763	-1.8989	0.44947	-0.1622	-2.5152
452	-1.1233	0.09282	2.66448	-2.1959	0.22535	-0.3957	-2.9033
453	-1.074	0.16725	2.47142	-2.3234	0.10002	-0.1763	-2.5958
454	-1.1093	0.31603	2.42775	-1.7789	0.3086	-0.0221	-2.1217
455	-1.2719	0.11238	2.25242	-1.8773	0.07354	-0.2784	-2.4621
456	-1.5508	-0.0158	1.95325	-2.2053	-0.2767	-0.4902	-3.0015
457	-1.4672	0.09164	1.95303	-2.0288	-0.2184	-0.3481	-2.3302
458	-1.6318	-0.1457	1.73205	-2.5909	-0.5104	-0.6654	-2.7298
459	-1.5403	-0.1347	1.94581	-2.2867	-0.3746	-0.5908	-2.8338
460	-1.0629	0.19301	2.35334	-2.0665	-0.0957	-0.1195	-2.6925
461	-1.0708	0.16463	2.27963	-2.0788	-0.2538	-0.2753	-2.5504
462	-1.1685	0.08034	2.03948	-2.1686	-0.4103	-0.5054	-2.4528
463	-1.2276	-0.2513	1.952	-2.6186	-0.462	-0.2826	-2.6263
464	-0.8582	0.20875	2.59172	-2.1993	0.09807	0.16886	-2.316
465	-1.0368	0.12685	2.44255	-2.2147	-0.0707	-0.0779	-2.0438
466	-1.0565	0.24983	2.26426	-2.1435	-0.0398	-0.1978	-2.5002
467	-1.2742	0.04007	2.19919	-2.2632	-0.1655	-0.1768	-2.5354
468	-1.2106	0.11372	2.22918	-2.3604	-0.1582	-0.236	-2.7628
469	-1.4157	-0.0235	2.0604	-2.382	-0.3004	-0.332	-2.4873
470	-1.2498	0.11956	2.11427	-2.0943	-0.2071	-0.2684	-2.4779
471	-1.2742	0.11248	2.14472	-2.3392	-0.2509	-0.3566	-2.2446
472	-1.3156	-0.0026	2.05509	-2.2981	-0.3476	-0.624	-2.7174
473	-1.1617	0.15106	2.08547	-1.902	-0.13	-0.4558	-2.246
474	-1.49	-0.0155	1.95127	-2.4988	-0.3571	-0.3924	-2.2367
475	-1.27	0.13862	2.22016	-2.174	-0.0652	-0.2485	-2.3506
476	-1.6804	-0.2169	2.02561	-2.4225	-0.2551	-0.6909	-2.5756

477	-1.6065	0.00409	2.32382	-1.9832	0.05912	-0.2104	-2.2554
478	-1.7079	0.03204	2.08103	-2.0709	-0.0512	-0.173	-2.171
479	-1.6634	-0.0057	2.16093	-2.0364	-0.132	-0.6037	-2.1175
480	-1.6619	-0.0199	2.01374	-2.1516	-0.2098	-0.5543	-2.4796
481	-1.746	-0.0471	2.05188	-2.0978	-0.0704	-0.4061	-2.4054
482	-1.5601	0.03221	2.06011	-2.0273	0.01093	-0.2808	-2.5613
483	-1.821	-0.0792	2.0742	-2.0882	-0.1018	-0.6297	-2.4056
484	-1.6381	-0.0329	2.01699	-2.1536	-0.1101	-0.4277	-2.3501
485	-1.4447	0.11543	2.19481	-1.6684	0.19334	-0.134	-2.2062
486	-1.3798	0.21767	2.29182	-2.0741	0.23694	-0.1793	-2.2632
487	-1.5164	0.05961	2.01635	-2.0091	0.05323	-0.7513	-2.4369
488	-1.4918	0.09997	2.14539	-2.2166	0.11034	-0.4973	-2.3401
489	-1.553	-0.0053	2.08305	-2.0709	0.00751	-0.4111	-2.4976
490	-1.5379	0.05739	2.18122	-2.1396	0.13945	-0.3739	-2.6877
491	-1.4005	0.10376	2.41638	-1.8151	0.32179	-0.5478	-2.271
492	-1.2775	0.17777	2.44416	-1.8042	0.29976	-0.6063	-2.2021
493	-0.9997	0.24785	2.58264	-1.6678	0.34376	-0.3495	-2.1972
494	-0.8798	0.17057	2.62918	-1.7988	0.28479	-0.568	-2.1258
495	-0.764	0.27357	2.74301	-1.2932	0.41064	-0.2278	-1.9553
496	-1.0102	0.10383	2.3506	-1.1601	0.07804	-0.4416	-2.302
497	-1.0084	0.12851	2.49901	-0.5848	0.24218	-0.5312	-2.3031
498	-1.0428	0.34004	2.21017	0.0483	0.56839	0.20825	-1.4526
499	-1.819	-0.0586	1.91481	-1.5881	0.28491	-0.0687	-1.7561
500	-1.7416	0.00359	1.84847	-1.6037	-0.0032	-0.385	-2.2634
501	-1.5692	0.01991	2.09213	-1.5922	0.27658	-0.2093	-2.1115
502	-1.6808	-0.0595	2.455	-1.5298	0.05405	-0.1921	-2.1876
503	-1.6869	-0.0679	2.40888	-1.5353	-0.1225	-0.5803	-2.4551
504	-1.7127	-0.0114	2.19777	-1.5434	-0.062	-0.4413	-2.6772
505	-1.7853	-0.0427	2.24355	-1.7394	0.00167	-0.6939	-2.6938
506	-1.8689	-0.0361	2.20062	-1.8765	0.16826	-0.539	-2.6655
507	-1.7057	0.00504	2.17798	-2.1431	0.13345	-0.4435	-2.7571
508	-1.6944	0.10836	2.08677	-1.6703	0.1317	-0.2775	-2.7836
509	-1.6118	0.10723	2.06356	-2.0278	0.00047	-0.3276	-2.693
510	-1.5738	0.05798	2.17439	-1.8357	-0.0339	-0.4924	-2.7352
511	-1.7279	-0.0016	2.11501	-2.0196	0.10427	-0.2999	-2.7304
512	-1.543	0.06353	2.11157	-1.7902	0.00807	-0.4419	-2.8596
513	-1.7274	-0.1274	1.65601	-2.0395	-0.4461	-0.751	-3.2073
514	-1.7391	0.01595	1.61836	-1.8417	-0.3109	-0.7016	-3.013
515	-1.7311	0.01717	1.58508	-1.8527	-0.4264	-0.816	-2.8849
516	-1.9636	-0.0874	1.51799	-1.8639	-0.3465	-0.755	-2.7968
517	-2.0236	-0.0879	1.58441	-1.6804	-0.3381	-0.9078	-2.8441
518	-1.7945	0.0016	1.49404	-1.6013	-0.4181	-0.6186	-2.8251
519	-1.8	-0.0289	1.48463	-1.6908	-0.5092	-0.7406	-2.5593
520	-1.5924	0.16155	1.6572	-1.3902	-0.3011	-0.4786	-2.5982
521	-1.7123	0.1043	1.63336	-1.7075	-0.2978	-0.5119	-3.229
522	-1.7332	0.07876	1.72678	-1.7986	-0.2009	-0.3474	-2.2007

523	-1.7628	0.02644	1.59778	-2.0334	-0.2776	-0.5202	-2.5012
524	-1.765	-0.0475	1.62286	-2.0446	-0.3757	-0.4493	-2.5666
525	-1.775	-0.022	1.57533	-1.9287	-0.282	-0.6977	-2.4479
526	-1.791	-0.0227	1.47997	-1.9314	-0.3567	-0.7277	-2.5509
527	-1.8222	-0.0343	1.51243	-1.8716	-0.3622	-0.6529	-2.6763
528	-1.8923	-0.0187	1.50844	-1.9222	-0.3308	-0.679	-2.5481
529	-1.8245	0.05182	1.60542	-1.4485	-0.2822	-0.5268	-2.4016
530	-1.6413	0.11612	1.54644	-1.7039	-0.3208	-0.8142	-2.2344
531	-1.6908	0.16041	1.64068	-1.8408	-0.291	-0.7745	-2.1352
532	-1.6603	0.09819	1.61837	-1.591	-0.3884	-0.7152	-2.143
533	-1.8437	-0.0289	1.54138	-1.9379	-0.4729	-0.7687	-2.7425
534	-1.7664	-0.067	1.49356	-2.0156	-0.5451	-0.8074	-2.6096
535	-1.8365	-0.0945	1.55145	-1.9201	-0.5643	-0.7797	-2.4858
536	-1.8919	0.01305	1.66997	-1.7549	-0.4414	-0.738	-2.4639
537	-1.9321	-0.053	1.59802	-1.9173	-0.46	-0.8407	-2.5008
538	-1.9158	-0.0967	1.58713	-1.9222	-0.5261	-0.9552	-2.9286
539	-1.9203	-0.0759	1.6319	-1.7795	-0.5014	-0.7391	-3.1061
540	-2.0609	-0.1521	1.51235	-1.8303	-0.5944	-0.7563	-2.9451
541	-1.8354	-0.0096	1.64541	-1.9738	-0.4908	-0.672	-2.2732
542	-1.8586	0.00327	1.65929	-1.9517	-0.4778	-0.6355	-2.6426
543	-1.835	0.03101	1.66434	-1.9271	-0.4712	-0.6283	-2.5838
544	-1.8256	0.04115	1.68076	-1.8927	-0.4637	-0.6099	-2.5567
545	-1.8069	0.04577	1.7048	-1.8777	-0.4481	-0.5958	-2.5295
546	-1.8308	0.04983	1.7263	-1.8568	-0.4405	-0.5946	-2.5249
547	-1.8303	-0.0436	1.5969	-1.8246	-0.4263	-0.5913	-2.4962
548	-1.7098	0.09023	1.74573	-1.7009	-0.3033	-0.4755	-2.3657
549	-1.8419	-0.1149	1.63583	-1.7857	-0.5513	-1.0108	-2.6234
550	-1.8132	-0.0746	1.58059	-1.9495	-0.4548	-0.934	-2.77
551	-1.7263	0.02552	1.6195	-1.5935	-0.2781	-0.6079	-2.3043
552	-1.718	-0.027	1.83762	-1.7606	-0.2767	-0.6827	-2.4466
553	-1.8752	-0.0589	1.69878	-1.8681	-0.2757	-0.4954	-2.4964
554	-1.8386	-0.073	1.70947	-1.7264	-0.2517	-0.5465	-2.6104
555	-1.8501	-0.0616	1.7053	-1.7594	-0.2424	-0.5653	-2.6444
556	-1.8267	-0.0325	1.72462	-1.7495	-0.1992	-0.5719	-2.7555
557	-1.8384	-0.0517	1.65722	-1.7892	-0.1962	-0.6548	-2.8478
558	-1.8213	-0.0353	1.67366	-1.7901	-0.1775	-0.721	-2.8188
559	-1.8088	-0.0251	1.68365	-1.7886	-0.1641	-0.7772	-2.8245
560	-1.7214	0.09741	1.87035	-1.683	-0.0424	-0.2551	-2.2449
561	-1.8659	-0.2012	1.41662	-1.9001	-0.3409	-0.7809	-2.4472
562	-2.031	-0.089	1.58551	-1.5444	-0.1326	-0.3577	-2.5611
563	-2.012	-0.0423	1.63787	-1.664	-0.2556	-0.5902	-2.5549
564	-1.756	0.13702	1.8271	-1.7753	-0.0706	-0.6178	-2.238
565	-2.0361	-0.085	1.44309	-1.7776	-0.3706	-0.8086	-2.586
566	-1.8205	0.08127	2.1528	-1.747	0.02304	-0.5899	-2.4504
567	-1.7257	0.13786	2.41227	-1.8923	0.09072	-0.7892	-2.156
568	-1.7944	-0.0332	1.81161	-1.9975	-0.0893	-1.4318	-2.9392

569	-1.7964	-0.0652	1.60785	-1.756	0.00254	-1.1533	-2.9066
570	-1.9561	-0.1246	1.48692	-1.9291	-0.2065	-1.1737	-3.2636
571	-1.7619	0.05576	1.67824	-1.9308	-0.3047	-0.9488	-2.3732
572	-1.9356	-0.1619	1.59172	-2.0413	-0.4612	-1.0342	-2.6529
573	-1.7867	-0.0485	1.68692	-2.0683	-0.362	-0.8441	-2.4331
574	-1.7727	-0.0582	1.76842	-1.8967	-0.3097	-0.7862	-3.0229
575	-1.6759	0.02675	1.89715	-1.8953	-0.124	-0.5776	-2.4296
576	-1.7655	0.04011	1.86268	-2.1108	-0.1918	-0.758	-2.3367
577	-1.9588	-0.0355	1.75349	-1.6991	-0.2737	-0.8205	-2.3864
578	-1.9425	-0.1178	1.77478	-1.7353	-0.3437	-0.9363	-2.4697
579	-1.9772	-0.0958	1.78697	-1.5907	-0.2421	-0.7846	-2.4781
580	-2.0145	-0.0968	1.66063	-2.2637	-0.3412	-0.8842	-2.6657
581	-2.1074	-0.0861	1.74082	-2.1074	-0.2398	-0.8011	-2.5618
582	-2.0069	-0.0223	1.8369	-1.968	-0.0991	-0.7051	-2.5538
583	-1.9521	-0.0013	1.74293	-1.8894	-0.0883	-0.786	-2.1782
584	-1.8418	0.02787	1.81087	-1.9978	-0.1379	-0.7173	-2.529
585	-2.0049	-0.2445	1.73483	-1.9414	-0.3079	-0.8927	-2.6337
586	-1.8713	-0.0524	1.95056	-1.9884	-0.1997	-0.9444	-2.729
587	-1.9229	-0.0106	1.93719	-1.9363	-0.1781	-0.8243	-2.4606
588	-1.9536	-0.1151	1.69583	-2.098	-0.2908	-0.8385	-2.9904
589	-1.7159	-0.0038	1.92189	-2.1597	-0.1065	-0.5635	-2.5927
590	-1.839	-0.0661	1.95962	-2.0521	-0.1858	-0.8054	-2.8724
591	-2.0216	-0.2245	1.67756	-2.1566	-0.2945	-0.8943	-2.5986
592	-1.8161	0.03262	1.88643	-1.4872	-0.1438	-0.6204	-2.3161
593	-1.7772	0.01488	1.85511	-1.8731	-0.1765	-0.8381	-2.4208
594	-1.9337	-0.0507	1.75356	-1.9183	-0.2333	-1.0333	-2.4336
595	-1.9489	-0.0794	1.77396	-1.9081	-0.2763	-1.0023	-2.5685
596	-1.728	0.08134	1.93689	-1.5946	-0.0341	-0.6578	-2.5186
597	-1.8768	0.02896	1.88584	-1.8527	-0.1311	-0.6345	-2.6832
598	-1.8635	0.00172	1.82739	-1.6454	-0.1405	-0.8409	-2.6752
599	-1.8352	-0.0312	1.87822	-1.7071	-0.1531	-0.8208	-2.3815
600	-1.765	-0.0307	1.8552	-1.5733	-0.1375	-1.2012	-2.4698
601	-1.795	-0.0956	1.82724	-1.9405	-0.1707	-0.8389	-2.5122
602	-1.6833	0.03482	1.92092	-1.6947	-0.0728	-0.7938	-2.3311
603	-1.7664	-0.1289	1.96948	-1.4925	-0.1566	-0.8275	-2.8069
604	-1.6487	-0.0593	1.91426	-1.9826	-0.1296	-0.7313	-2.4786
605	-1.6755	-0.0051	2.07836	-1.7456	-0.0674	-0.751	-2.4447
606	-1.7079	0.04678	1.92989	-1.863	-0.1059	-0.9274	-2.6025
607	-1.8431	-0.1213	1.7437	-1.889	-0.307	-1.0428	-2.85
608	-1.8773	-0.0448	1.7242	-1.92	-0.2443	-1.2373	-2.4577
609	-1.7197	0.08648	1.95846	-1.6931	-0.0762	-1.1352	-2.6339
610	-1.8091	-0.0768	1.68396	-1.6244	-0.2835	-1.0286	-2.7445
611	-1.8363	-0.1069	1.60659	-1.8864	-0.3432	-0.8978	-2.7673
612	-1.8111	-0.0358	1.75109	-1.9233	-0.2458	-0.53	-2.8139
613	-1.9618	-0.021	1.66177	-1.9543	-0.2211	-0.8913	-2.7138
614	-1.8638	-0.059	1.68236	-1.744	-0.3715	-1.1304	-2.6814

615	-1.9369	-0.116	1.50777	-1.8342	-0.4938	-1.1685	-2.7601
616	-1.8636	-0.0213	1.66498	-1.9057	-0.4036	-1.1351	-2.3567
617	-1.8387	-0.0091	1.66169	-1.8839	-0.3468	-0.8753	-2.3408
618	-1.8471	-0.0629	1.48123	-1.8382	-0.4727	-1.0047	-2.6471
619	-1.7778	0	1.65108	-1.9437	-0.3277	-1.0773	-2.2876
620	-1.913	-0.1141	1.64487	-1.9291	-0.4051	-0.9272	-2.5483
621	-1.8238	-0.056	1.77176	-1.8061	-0.257	-1.1209	-2.3642
622	-1.8815	-0.0789	1.69913	-1.8057	-0.3358	-1.1646	-2.6463
623	-1.8292	-0.0278	1.61978	-1.4307	-0.3504	-1.0682	-2.5557
624	-1.748	0.03079	1.66758	-1.5677	-0.2585	-0.9776	-2.3322
625	-1.7061	0.06759	1.73992	-1.6793	-0.2246	-1.0292	-2.3683
626	-1.7912	0.05372	1.70036	-1.5278	-0.3347	-0.9323	-2.4175
627	-1.8517	-0.0278	1.61216	-1.5352	-0.4088	-0.8099	-2.3234
628	-1.839	-0.0459	1.57054	-1.5062	-0.3958	-0.9008	-2.7061
629	-1.8144	0.03548	1.65644	-1.7208	-0.3023	-0.7603	-2.2628
630	-1.9143	0.04823	1.57355	-1.614	-0.2552	-0.9063	-2.4929
631	-1.9941	-0.0395	1.58764	-1.7335	-0.3685	-0.8573	-2.3388
632	-1.9322	-0.1072	1.52582	-1.8938	-0.399	-1.0716	-2.6674
633	-1.8331	0.00911	1.57921	-1.8233	-0.3379	-0.9501	-2.7583
634	-1.824	0.00531	1.57608	-1.8001	-0.3283	-0.9463	-2.6985
635	-1.8262	0.00154	1.56178	-1.7905	-0.337	-0.9479	-2.6443
636	-1.8489	-0.0159	1.53707	-1.7973	-0.3589	-0.962	-2.6238
637	-1.8494	-0.0147	1.54066	-1.778	-0.3644	-0.9589	-2.6063
638	-1.8459	-0.0114	1.4907	-1.7681	-0.3641	-0.9521	-2.5984
639	-1.8411	-0.0682	1.50747	-1.7493	-0.4311	-1.1225	-2.354
640	-1.7384	0.01286	1.63912	-1.5455	-0.3943	-1.1459	-2.57
641	-1.886	-0.0324	1.5368	-1.8525	-0.474	-1.2608	-3.307
642	-1.7907	-0.008	1.5227	-1.7947	-0.4176	-1.1008	-2.5259
643	-1.6923	0.02326	1.57653	-2.0998	-0.3987	-1.0832	-2.533
644	-1.6873	0.09063	1.63203	-1.8996	-0.3249	-1.0751	-2.4631
645	-1.7304	0.03912	1.55734	-1.7127	-0.3697	-1.1872	-2.5577
646	-1.749	0.00672	1.5997	-1.906	-0.4601	-1.2587	-2.5521
647	-1.7509	0.04592	1.64028	-1.8625	-0.4222	-0.9679	-2.5661
648	-1.8261	-0.0522	1.63843	-1.8947	-0.5319	-1.0834	-2.6206
649	-1.721	0.04155	1.6867	-1.8261	-0.3821	-0.9852	-2.4956
650	-2.0228	-0.1224	1.58722	-2.2805	-0.5144	-0.8803	-2.686
651	-1.7941	-0.0354	1.63584	-2.1076	-0.3583	-0.8496	-2.7523
652	-1.7712	-0.0578	1.67738	-1.9087	-0.4038	-0.6306	-2.8219
653	-1.8601	-0.0954	1.67111	-2.1423	-0.4285	-0.7686	-2.8278
654	-1.7744	-0.0744	1.75147	-2.1548	-0.3734	-0.6272	-2.6426
655	-1.7478	0.07753	1.77813	-1.9701	-0.1916	-0.4059	-2.0999
656	-1.6345	0.00016	1.76971	-2.0985	-0.3312	-0.8195	-2.3579
657	-1.5796	0.13594	1.81366	-2.0385	-0.2277	-0.8521	-2.1558
658	-1.7788	-0.023	1.72994	-2.1429	-0.3495	-0.7535	-2.6117
659	-1.8114	-0.0875	1.60521	-2.1202	-0.4137	-0.6384	-2.7409
660	-1.7858	-0.1034	1.69769	-2.0243	-0.4021	-0.7951	-2.6021

661	-1.8991	-0.0593	1.68493	-1.9959	-0.3819	-0.6356	-2.755
662	-1.8403	-0.0708	1.57937	-2.1348	-0.4208	-0.6751	-2.8666
663	-1.9024	-0.1877	1.51944	-2.0852	-0.4584	-0.8287	-2.8204
664	-1.9195	-0.2364	1.51498	-2.2373	-0.5101	-0.6891	-2.7565
665	-1.926	-0.2275	1.58463	-2.3015	-0.5916	-0.8258	-3.1709
666	-1.7638	-0.0946	1.49391	-1.9486	-0.4975	-0.6417	-2.6588
667	-1.7004	-0.0879	1.5259	-1.8391	-0.3487	-0.6377	-2.326
668	-1.9484	-0.2088	1.40297	-2.0175	-0.6199	-0.7305	-2.9523
669	-1.724	-0.0092	1.63829	-2	-0.4128	-0.6633	-2.4892
670	-1.7876	0.01525	1.62578	-1.8719	-0.4643	-0.5551	-2.4563
671	-1.7336	-0.0566	1.55485	-2.076	-0.5343	-0.7122	-3.1474
672	-1.7392	-0.0158	1.66129	-1.8701	-0.4843	-0.5951	-2.3368
673	-1.8659	-0.1143	1.37938	-1.7366	-0.7043	-0.5657	-2.3722
674	-1.8046	-0.0834	1.38927	-1.7955	-0.7152	-0.5666	-2.4215
675	-1.8019	-0.0623	1.3995	-1.8548	-0.7144	-0.557	-2.4786
676	-1.7928	-0.0387	3.70292	-1.9158	-0.7249	-0.5767	-2.5231
677	-1.7165	-0.0304	1.4064	-1.9721	-0.7356	-0.5872	-2.568
678	-1.8996	-0.0972	1.37756	-1.9869	-0.8677	-0.6798	-2.979
679	-1.9398	-0.1237	1.40495	-1.8548	-0.7663	-0.8278	-2.5986
680	-1.775	0.13194	1.66359	-1.7346	-0.5758	-0.4337	-2.2155
681	-1.5883	0.10071	1.71975	-1.7036	-0.4535	-0.4704	-2.2822
682	-1.6246	-0.0076	1.58202	-2.0376	-0.6389	-0.7186	-2.7143
683	-1.4324	0.15187	1.7249	-1.8614	-0.4916	-0.6833	-2.4216
684	-1.5676	0.10683	1.67517	-1.7606	-0.4415	-0.493	-2.5018
685	-1.5641	-0.0012	1.66064	-1.872	-0.5126	-0.504	-2.5856
686	-1.5493	0.07351	1.66063	-1.8782	-0.4646	-0.3934	-2.3357
687	-1.6251	0.03702	1.60118	-2.0144	-0.5252	-0.6416	-2.8024
688	-1.6412	-0.0085	1.53388	-1.9361	-0.4945	-0.5694	-2.561
689	-1.5857	0.10809	1.69637	-2.043	-0.3705	-0.4436	-2.1066
690	-1.7421	-0.0316	1.63349	-2.1716	-0.4552	-0.6074	-2.4884
691	-1.8077	-0.1153	1.37008	-2.2734	-0.6499	-0.7974	-2.8433
692	-1.7779	-0.036	1.47318	-2.0821	-0.5395	-0.72	-2.5819
693	-1.8443	-0.0643	1.3333	-1.8776	-0.5814	-0.5437	-2.5717
694	-1.8124	-0.0578	1.41662	-1.9695	-0.5597	-0.4562	-2.8564
695	-1.7081	0.04435	1.58053	-1.9702	-0.3966	-0.4943	-2.5092
696	-1.7966	-0.0745	1.40654	-2.1117	-0.4911	-0.6531	-2.6931
697	-1.8106	-0.043	1.41429	-2.1981	-0.594	-0.7228	-2.6479
698	-1.834	-0.0923	1.36893	-2.2999	-0.4954	-0.6509	-2.388
699	-1.7455	0.01732	1.52235	-2.0235	-0.3673	-0.5823	-2.3597
700	-1.689	0.04297	1.58931	-1.9896	-0.3142	-0.3955	-2.4362
701	-1.7533	-0.0724	1.63901	-2.1953	-0.4975	-0.4377	-2.5802
702	-1.6729	-0.0555	1.55867	-2.2427	-0.4141	-0.4178	-2.8747
703	-1.8284	-0.0882	1.5221	-2.0595	-0.4771	-0.5851	-2.6486
704	-1.7745	-0.0076	1.61144	-2.248	-0.3888	-0.547	-3.0681
705	-1.6858	-0.0291	1.54939	-2.0857	-0.4949	-0.7366	-2.7977
706	-1.7839	0.0593	1.6518	-2.1096	-0.3199	-0.5145	-2.2825

707	-1.8104	-0.0265	1.55588	-2.0179	-0.4391	-0.6687	-2.3704
708	-1.7577	0.07172	1.63016	-2.2553	-0.3662	-0.6079	-2.2859
709	-1.7982	-0.01	1.6111	-2.1296	-0.4068	-0.6707	-2.5789
710	-1.6734	0.05167	1.57751	-1.9643	-0.4271	-0.5345	-2.7201
711	-1.6493	0.09253	1.64757	-1.9769	-0.3769	-0.381	-2.5757
712	-1.6532	0.03039	1.64963	-1.9776	-0.3416	-0.6403	-2.3278
713	-1.8518	-0.0964	1.51007	-2.0771	-0.5313	-0.5829	-2.3954
714	-1.7414	-0.0719	1.61491	-1.9926	-0.5292	-0.5892	-2.4107
715	-1.742	-0.0352	1.63552	-1.9725	-0.4949	-0.5649	-2.4214
716	-1.745	-0.0194	1.63703	-1.9901	-0.4881	-0.5669	-2.4938
717	-1.7327	0.00239	1.65582	-1.9822	-0.4674	-0.5586	-2.5693
718	-1.7208	0.02592	1.67627	-1.9945	-0.4489	-0.539	-2.5767
719	-1.6268	0.0301	1.6825	-1.9414	-0.4425	-0.5377	-2.6121
720	-1.7116	-0.0033	1.56007	-1.9818	-0.4646	-0.2039	-2.3147
721	-1.6494	0.1006	1.65486	-1.8884	-0.2763	-0.4085	-2.5232
722	-1.6014	0.08257	1.72794	-1.8812	-0.2787	-0.4887	-2.2199
723	-1.8925	-0.1244	1.5942	-2.2617	-0.4259	-0.7671	-2.8223
724	-1.6404	0.03463	1.92211	-1.8893	-0.2134	-0.7481	-2.4206
725	-1.6513	0.00098	1.82146	-2.167	-0.3342	-0.5584	-2.4169
726	-1.6061	0.02976	1.87574	-1.9238	-0.1453	-0.6629	-2.6376
727	-1.6507	0.00185	1.90077	-2.0419	0.07362	-0.8182	-2.676
728	-1.3503	0.14094	2.01941	-1.9079	0.235	-0.8308	-2.2517
729	-1.3389	0.12121	1.97353	-2.0504	0.14934	-0.7568	-2.5511
730	-1.6218	0.00458	1.73902	-2.3952	0.03003	-0.6463	-2.4888
731	-1.6058	0.06699	1.85265	-1.925	-0.2162	-0.6835	-2.1743
732	-1.5665	0.12963	1.83914	-2.2245	-0.1932	-0.4749	-2.0988
733	-1.6339	-0.0508	1.85796	-2.2237	-0.0128	-0.579	-2.3374
734	-1.6563	-0.0523	1.81455	-2.271	-0.1831	-0.5372	-2.5161
735	-1.6045	-0.0095	1.70831	-2.1604	-0.278	-0.759	-2.4978
736	-1.4573	0.06891	1.70663	-1.9321	-0.3275	-0.5418	-2.4107
737	-1.642	-0.0893	1.53217	-2.1819	-0.4396	-0.6824	-2.6708
738	-1.7	-0.018	1.57993	-1.7208	-0.4423	-0.7046	-2.6046
739	-1.6851	-0.0372	1.57629	-2.1365	-0.4929	-0.6288	-2.4203
740	-1.5242	-0.0232	1.69814	-1.9492	-0.3796	-0.7024	-2.6104
741	-1.5844	-0.0727	1.66848	-2.1209	-0.3993	-0.9197	-2.8196
742	-1.5254	0.09037	1.69202	-1.9451	-0.4003	-0.9247	-2.4427
743	-1.5491	0.06737	1.65762	-2.0847	-0.4251	-0.7337	-2.416
744	-1.4742	0.22058	1.85273	-1.8481	-0.2093	-0.5488	-2.1211
745	-1.4569	0.11069	1.9113	-1.8917	-0.2449	-0.5656	-2.3784
746	-1.5158	0.00581	1.84073	-1.9272	-0.3939	-0.4969	-2.525
747	-1.4007	0.10731	2.14865	-1.9753	-0.0065	-0.4044	-2.3728
748	-1.478	0.06405	1.80378	-2.2227	-0.2405	-0.5116	-2.6696
749	-1.3811	0.12473	1.73575	-2.039	-0.2024	-0.449	-2.4561
750	-1.1279	0.27937	2.05861	-1.9789	-0.1229	-0.2862	-2.3798
751	-0.9661	0.29836	2.20394	-1.8337	-0.1156	-0.1908	-2.6922
752	-1.1369	0.30502	2.21957	-1.8194	0.15634	-0.0418	-2.0145

753	-0.916	0.32514	2.31687	-1.8235	0.17596	-0.4447	-2.2538
754	-0.9908	0.34274	2.31195	-1.9099	0.18938	-0.2879	-2.5932
755	-0.964	0.22208	2.28101	-1.7542	-0.0262	-0.4233	-2.4741
756	-0.9478	0.33484	2.31226	-1.7197	0.10167	-0.2322	-2.1224
757	-1	0.43871	2.44154	-1.7031	0.2203	-0.1319	-2.0733
758	-1.5718	0.01171	1.89794	-2.3369	-0.2608	-0.4311	-2.6387
759	-1.2979	0.20194	1.95804	-1.8492	-0.0983	-0.3699	-2.2873
760	-1.7007	-0.1798	1.71667	-2.2881	-0.5453	-0.3187	-2.7332
761	-1.4568	0.10834	1.92917	-2.2631	-0.2052	-0.1611	-2.3335
762	-1.4425	0.13385	1.88751	-1.8719	-0.2378	-0.2634	-2.4884
763	-1.3317	0.25025	2.04113	-1.8988	-0.1714	-0.3004	-2.428
764	-1.7157	-0.0938	1.75614	-2.3433	-0.5379	-0.7368	-2.6727
765	-1.4997	0.05546	1.94976	-1.9733	-0.4273	-0.4987	-2.607
766	-1.4666	0.00057	2.01436	-2.1087	-0.4009	-0.5098	-2.6953
767	-1.5676	0.10683	1.67517	-1.7606	-0.4415	-0.493	-2.5018
768	-1.5641	-0.0012	1.66064	-1.872	-0.5126	-0.504	-2.5856
769	-1.3006	-0.0297	2.04818	-1.7363	-0.0151	-0.7219	-2.0627
770	-1.6113	-0.1376	1.72156	-2.047	-0.3479	-0.7101	-2.8793
771	-1.6877	-0.0473	1.81938	-1.9751	-0.3315	-0.8739	-3.0519
772	-1.7023	-0.046	1.76352	-1.9437	-0.3755	-1.0129	-2.951
773	-1.6607	-0.0688	1.77792	-1.9724	-0.5074	-0.9625	-3.086
774	-1.6589	0	1.80057	-2.1815	-0.4831	-0.8653	-3.1025
775	-1.7822	-0.1751	1.68437	-2.2743	-0.6274	-1.094	-3.4186
776	-1.6134	0.03941	1.72859	-1.7471	-0.4098	-0.6848	-3.4612
777	-1.7371	-0.074	1.61073	-2.2113	-0.5682	-0.7506	-3.6671
778	-1.5754	0.0534	1.74984	-2.123	-0.4043	-0.7648	-3.4958
779	-1.5696	0.07726	1.75047	-1.7945	-0.2928	-0.6588	-3.1239
780	-1.6474	0.08919	1.84361	-1.77	-0.2417	-0.6158	-2.6603
781	-1.7315	-0.0142	1.71945	-1.9308	-0.4322	-0.6811	-2.9655
782	-1.7728	-0.1123	1.74327	-2.035	-0.4872	-0.8269	-2.9614
783	-1.6917	0.0574	1.85386	-1.8608	-0.2652	-0.6663	-2.6217
784	-1.6093	-0.0291	1.7231	-2.0453	-0.4614	-0.857	-2.9645
785	-1.6927	-0.1606	1.53896	-2.1073	-0.7348	-1.067	-2.978
786	-1.6673	-0.0965	1.80237	-2.3612	-0.4383	-0.5765	-2.2024
787	-1.8407	-0.1336	1.77925	-2.1381	-0.3943	-0.6117	-2.5613
788	-1.6184	0.03819	1.64872	-1.8714	-0.3599	-0.4513	-2.502
789	-1.5891	0.04256	1.68903	-2.0093	-0.3465	-0.645	-2.3758
790	-1.4567	-0.0161	1.68095	-1.8823	-0.5351	-0.6235	-2.368
791	-1.5034	0.11302	1.84178	-1.6586	-0.2594	-0.484	-2.1027
792	-1.8287	-0.0859	1.4804	-2.0171	-0.3923	-0.58	-2.5259
793	-1.7214	0.06533	1.55671	-1.9785	-0.3897	-0.4415	-2.4707
794	-1.8019	-0.0348	1.57791	-1.9903	-0.4332	-0.5847	-2.681
795	-1.9279	0.04883	1.54331	-2.0324	-0.4215	-0.64	-2.2347
796	-1.8479	0.07848	1.59826	-1.8601	-0.3735	-0.5669	-2.2997
797	-2.0265	-0.1579	1.4263	-2.2488	-0.5746	-0.9412	-2.4681
798	-1.8485	0.02051	1.54738	-2.0216	-0.4819	-0.6639	-2.3717

799	-1.6973	0.03524	1.65916	-1.8988	-0.4297	-0.845	-2.3513
800	-1.6928	0.01143	1.62554	-1.9901	-0.5011	-0.7312	-2.4242
801	-1.7513	0.02665	1.6271	-2.0276	-0.5312	-0.645	-2.4196
802	-1.7269	0.0181	1.56748	-2.4616	-0.5259	-0.768	-2.4741
803	-1.6586	0.03119	1.75871	-1.9346	-0.4297	-0.6925	-2.5178
804	-1.7985	-0.0255	1.66101	-2.0422	-0.5048	-0.8743	-2.5807
805	-1.7108	-0.0169	1.571	-2.0949	-0.5306	-0.8331	-2.5339
806	-1.8868	-0.097	1.43704	-2.1787	-0.608	-0.7898	-2.4616
807	-1.8045	-0.0331	1.5583	-2.0951	-0.5036	-0.5761	-2.5257
808	-1.8361	-0.0253	1.57959	-1.423	-0.4748	-0.5473	-2.2227
809	-1.7699	-0.0437	1.54985	-1.9682	-0.5435	-0.8422	-2.5773
810	-1.7173	0.00082	1.98396	-2.1518	-0.2087	-0.8514	-2.4232
811	-1.6156	0.00033	1.80756	-2.1069	-0.0667	-0.7967	-2.3832
812	-1.8634	-0.1203	1.54909	-2.136	-0.3559	-0.782	-2.4103
813	-1.5716	0.14598	1.83416	-2.0183	-0.2626	-0.3884	-2.5189
814	-1.6945	0.0572	1.76053	-2.0258	-0.4161	-0.7066	-2.5371
815	-1.7374	0.03658	1.66808	-1.8531	-0.5434	-0.5819	-2.462
816	-1.7812	-0.0254	1.58374	-1.8683	-0.5514	-0.8186	-2.5559
817	-1.6922	0.05163	1.71653	-1.9155	-0.3822	-0.7217	-2.5076
818	-1.5939	0.14555	1.82982	-1.7181	-0.3238	-0.7705	-2.2702
819	-1.6967	-0.072	1.89037	-2.0587	-0.211	-1.2161	-2.3661
820	-1.684	-0.0321	1.82374	-1.6762	-0.3354	-1.2149	-2.3884
821	-1.7702	-0.0915	1.75083	-1.8725	-0.4877	-1.3389	-2.5414
822	-1.6646	-0.0026	1.57554	-1.7737	-0.512	-0.9208	-2.2312
823	-1.655	0.0298	1.6194	-2.0045	-0.5236	-0.7895	-2.3908
824	-1.5806	0.05215	1.79599	-2.0012	-0.4851	-0.6265	-2.2709
825	-1.4811	0.02542	1.54706	-2.2277	-0.6738	-0.6571	-2.6035
826	-1.5124	-0.0879	1.55029	-1.9794	-0.6267	-0.5081	-2.5201
827	-1.539	-0.0335	1.43161	-2.0383	-0.7891	-0.6084	-2.7391
828	-1.5965	-0.0033	1.52304	-1.9836	-0.7393	-0.7424	-2.584
829	-1.6572	0.03822	1.60386	-1.8091	-0.6843	-0.7301	-2.4474
830	-1.7411	0.02512	1.5512	-2.1571	-0.629	-0.797	-2.611
831	-1.5538	0.08247	1.72095	-1.8841	-0.4545	-0.6078	-2.409
832	-1.5305	0.03649	1.66075	-1.8185	-0.5249	-0.6085	-2.5234
833	-1.6857	0.00617	1.50026	-2.0247	-0.5888	-0.5977	-2.538
834	-1.5517	0.12053	1.71479	-1.895	-0.4738	-0.5057	-2.1393
835	-1.7018	-0.0439	1.53446	-2.0684	-0.6042	-0.639	-2.2809
836	-1.799	-0.0386	1.4238	-2.1124	-0.6228	-0.6642	-2.5402
837	-1.7138	-0.1579	1.25542	-2.2887	-0.894	-0.7296	-2.7232
838	-1.4561	0.10227	1.55475	-2.123	-0.5966	-0.3946	-2.3864
839	-1.5074	-0.0067	1.53595	-2.2096	-0.6648	-0.4179	-2.4248
840	-1.4763	-0.007	1.4833	-2.1635	-0.604	-0.6486	-2.6053
841	-1.5062	-0.0196	1.52731	-2.2053	-0.7125	-0.5846	-2.4487
842	-1.4448	0.04986	1.61376	-2.2908	-0.5929	-0.5141	-2.2908
843	-1.5698	-0.0871	1.51327	-2.3776	-0.7194	-0.8849	-3.0453
844	-1.4948	-0.0522	1.54757	-2.3568	-0.6717	-0.6544	-2.2621

845	-1.421	0.03809	1.64446	-2.3238	-0.6489	-0.7195	-2.5064
846	-1.5747	0.01439	1.87384	-2.0064	-0.5238	-0.7358	-2.4021
847	-1.4201	-0.1244	1.61376	-2.1268	-0.6115	-0.445	-2.3893
848	-1.2183	0.10284	1.77999	-2.251	-0.4884	-0.4709	-2.2214
849	-1.2188	-0.0411	1.90489	-2.2877	-0.3591	-0.3611	-2.4312
850	-1.048	0.12066	1.89068	-2.0905	-0.3767	-0.2616	-2.6466
851	-1.3818	-0.0639	1.66825	-2.2567	-0.5827	-0.3903	-2.5422
852	-1.363	0.02127	1.58899	-2.2812	-0.6019	-0.4529	-2.3794
853	-1.2089	0.10215	1.812	-2.129	-0.4323	-0.3929	-2.3021
854	-1.2301	0.1144	1.81838	-2.1816	-0.2472	-0.6319	-2.2252
855	-1.4854	-0.178	1.61837	-2.4364	-0.4915	-0.627	-2.3609
856	-1.4468	-0.0524	1.7868	-2.4567	-0.4699	-0.6029	-2.4308
857	-1.3429	0.02419	1.73547	-2.5306	-0.5299	-0.4522	-2.3747
858	-1.4419	-0.0805	1.75403	-2.6517	-0.6123	-0.5291	-2.7675
859	-1.3336	-0.0066	1.64385	-2.5629	-0.5697	-0.4271	-2.6809
860	-1.1421	0.23369	1.89506	-2.2772	-0.3831	-0.3722	-2.3603
861	-1.25	0.12411	1.74916	-2.3496	-0.4957	-0.2262	-2.2793
862	-1.3575	-0.0122	1.71506	-2.3534	-0.6203	-0.3487	-2.5149
863	-1.4355	-0.1876	1.4961	-2.5993	-0.744	-0.7189	-3.0411
864	-1.2824	0.00213	1.65286	-2.5492	-0.65	-0.5702	-2.3844
865	-1.1219	0.14996	1.83246	-2.2915	-0.4454	-0.6149	-2.3726
866	-1.3346	-0.1014	1.60604	-2.0679	-0.7165	-0.7423	-2.4628
867	-1.2019	0.11744	1.80899	-2.3489	-0.4078	-0.6819	-2.5467
868	-1.2202	0.05342	1.74288	-2.2804	-0.4547	-0.796	-2.5043
869	-1.1016	0.048	1.8502	-2.187	-0.373	-0.4537	-2.2861
870	-1.0208	0.16396	2.33005	-1.9283	-0.0756	-0.5327	-2.4121
871	-1.3611	-0.1216	1.72472	-2.3266	-0.3993	-0.7248	-2.8306
872	-1.2372	0.0674	2.08361	-2.047	-0.2687	-0.716	-2.4364
873	-1.5515	-0.1184	1.61107	-2.3544	-0.5055	-0.803	-2.5218
874	-1.516	-0.089	1.74974	-2.4183	-0.7218	-0.9358	-2.5537
875	-1.4466	0.01502	1.62216	-2.289	-0.5952	-0.7208	-2.6661
876	-1.5721	-0.0079	1.635	-2.2263	-0.5857	-0.7455	-2.8813
877	-1.4775	0.09759	1.69646	-2.1306	-0.5298	-0.6448	-2.7852
878	-1.6049	-0.0991	1.48475	-2.3586	-0.7372	-0.6477	-3.0057
879	-1.5698	-0.0871	1.51327	-2.3776	-0.7194	-0.8849	-3.0453
880	-1.4948	-0.0522	1.54757	-2.3568	-0.6717	-0.6544	-2.2621
881	-1.421	0.03809	1.64446	-2.3238	-0.6489	-0.7195	-2.5064
882	-1.5747	0.01439	1.87384	-2.0064	-0.5238	-0.7358	-2.4021
883	-1.4907	0.08868	1.79758	-2.0741	-0.2851	-1.1576	-2.2562
884	-1.3678	0.16513	1.9649	-1.9355	-0.1259	-0.8579	-2.2672
885	-1.3416	0.18319	2.04055	-2.2223	-0.0991	-0.8042	-2.2314
886	-1.3999	0.09796	1.93533	-2.0534	-0.2733	-0.909	-2.6392
887	-1.5561	0.10185	1.76968	-2.1677	-0.3412	-1.0249	-2.5965
888	-1.6595	-0.022	1.48607	-2.1056	-0.6607	-0.6262	-2.8272
889	-1.6722	-0.1792	1.55125	-2.2744	-0.716	-0.5696	-2.8899
890	-1.8339	-0.2853	1.27939	-2.6208	-0.9489	-0.986	-2.9201

891	-1.5337	-0.1036	1.58548	-2.3268	-0.7828	-0.6184	-2.4577
892	-1.6233	-0.1247	1.46153	-2.6031	-0.8052	-0.5909	-2.8327
893	-1.6213	-0.1833	1.55026	-2.4692	-0.8232	-0.497	-2.7933
894	-1.3227	0.10258	1.79135	-2.2731	-0.5274	-0.4108	-2.3085
895	-1.3818	0.04648	1.75731	-2.1226	-0.4664	-0.288	-2.3686
896	-1.586	0.01755	1.71045	-2.1265	-0.5676	-0.8215	-2.5538
897	-1.6776	0.02632	1.56769	-2.0699	-0.5141	-0.9387	-2.6775
898	-1.5004	0.09302	1.77693	-2.034	-0.3769	-0.8506	-2.5595
899	-1.5325	0.10799	1.86916	-2.0291	-0.3847	-0.8049	-2.3029
900	-1.5139	0.15483	1.8324	-1.8922	-0.253	-0.5575	-2.1204
901	-1.6133	0.08964	1.7041	-1.925	-0.2592	-0.6956	-2.3104
902	-1.5881	0.02757	1.6765	-2.0174	-0.2999	-0.9571	-2.5537
903	-1.4482	-0.027	1.70728	-2.1994	-0.3533	-0.8443	-2.6379
904	-1.3351	0.04695	1.99848	-2.1495	-0.2561	-0.9249	-2.3865
905	-1.3285	0.0427	1.92441	-2.1816	-0.2495	-0.863	-2.2233
906	-1.3004	0.01005	1.93941	-1.9864	-0.2369	-0.7895	-2.5713
907	-1.2517	0.05595	2.04889	-2.0743	-0.1929	-0.9217	-2.8338
908	-1.4191	0.00104	1.96577	-1.9935	-0.2396	-0.8598	-2.472
909	-1.3845	0.09502	1.89577	-2.063	-0.1424	-0.6287	-2.5752
910	-1.3606	0.15801	2.05359	-1.7949	-0.0743	-0.774	-2.169
911	-1.5503	0.00072	1.89073	-1.9991	-0.2398	-0.9788	-2.3976
912	-1.5518	0.01428	1.97766	-2.2602	-0.2451	-0.8781	-2.3705
913	-1.6842	-0.1537	1.7307	-2.2437	-0.3776	-1.0963	-3.1474
914	-1.5485	-0.0152	1.94467	-2.0331	-0.268	-0.9521	-2.6895
915	-1.4866	0.01141	1.9373	-2.0719	-0.273	-0.7516	-2.6677
916	-1.4326	-0.0097	1.93158	-2.2353	-0.3491	-1.0156	-2.7494
917	-1.3082	0.05544	1.87202	-2.187	-0.337	-1.0701	-2.7784
918	-1.3256	-0.0171	1.86682	-2.2918	-0.3251	-0.8225	-2.7742
919	-1.3468	0.05747	1.73909	-2.2781	-0.3228	-1.0756	-2.4117
920	-1.3658	0.08061	1.81474	-2.2203	-0.1722	-0.8692	-2.4427
921	-1.4202	0.06927	1.97035	-2.2834	-0.2572	-0.7224	-2.2048
922	-1.28	0.04249	1.94379	-2.2566	-0.2663	-0.7204	-2.4559
923	-1.2902	0.0654	1.97835	-2.0597	-0.2231	-0.6304	-2.2369
924	-1.0676	0.23913	2.07774	-2.1394	-0.0755	-0.5164	-2.2323
925	-1.2313	0.03897	1.98951	-2.0804	-0.1878	-0.7517	-2.3903
926	-1.2664	0.04722	1.97226	-2.3198	-0.1661	-0.8269	-2.706
927	-1.1642	0.03084	2.1649	-2.2391	-0.1591	-0.9082	-2.5538
928	-1.3701	-0.1051	2.04679	-2.4982	-0.1815	-0.6554	-2.6321
929	-1.5802	-0.1684	1.64392	-2.2894	-0.2981	-0.9084	-2.9168
930	-1.5776	-0.0666	1.83769	-2.2236	-0.2943	-1.0046	-2.5772
931	-1.5012	0.0348	2.11521	-2.2759	-0.1215	-0.8831	-2.5812
932	-1.7194	-0.0324	1.99507	-2.2931	-0.3189	-0.8282	-2.5976
933	-1.8072	-0.0686	1.59355	-2.2733	-0.4011	-1.0399	-2.3716
934	-1.6831	0.07522	1.80063	-2.0754	-0.2723	-1.0036	-2.6265
935	-1.4907	0.08868	1.79758	-2.0741	-0.2851	-1.1576	-2.2562
936	-1.3678	0.16513	1.9649	-1.9355	-0.1259	-0.8579	-2.2672

937	-1.3416	0.18319	2.04055	-2.2223	-0.0991	-0.8042	-2.2314
938	-1.3999	0.09796	1.93533	-2.0534	-0.2733	-0.909	-2.6392
939	-1.5561	0.10185	1.76968	-2.1677	-0.3412	-1.0249	-2.5965
940	-1.5271	0.12994	1.91133	-1.9092	-0.2507	-0.9203	-2.4733
941	-1.685	-0.0282	1.78768	-2.1427	-0.4092	-1.2452	-2.6697
942	-1.4558	0.14286	1.77415	-2.2194	-0.2403	-0.9656	-2.4765
943	-1.565	0.09067	1.85246	-2.1365	-0.1695	-1.113	-2.3488
944	-1.4766	0.11499	1.95762	-2.0654	-0.2686	-1.1062	-2.4988
945	-1.4858	0.07406	1.88765	-2.1994	-0.3254	-0.8429	-2.4276
946	-1.4635	0.07154	1.89088	-2.1206	-0.3296	-0.629	-2.5699
947	-1.4222	0.13203	1.76184	-2.0883	-0.3332	-0.5303	-2.4838
948	-1.5747	0.02708	1.55605	-1.9627	-0.4205	-0.5798	-2.4949
949	-1.6061	0.09349	1.64783	-1.9464	-0.4128	-0.6894	-2.707
950	-1.6564	0.05177	1.71208	-1.9292	-0.4506	-0.6917	-2.5214
951	-1.4695	0.12257	1.61997	-1.9096	-0.4302	-0.7277	-2.3579
952	-1.6644	-0.0301	1.57065	-2.0633	-0.5418	-0.8501	-2.4839
953	-1.4207	0.15444	1.67743	-2.0084	-0.4205	-0.6543	-2.4257
954	-1.3597	0.10265	1.78081	-2.0938	-0.4115	-0.7326	-2.478
955	-1.4007	0.05278	1.62067	-2.3436	-0.5518	-0.7233	-2.8456
956	-1.5848	0.01183	1.51941	-2.1456	-0.5807	-0.7503	-2.3761
957	-1.5096	0.03563	1.54305	-2.1154	-0.5618	-1.0819	-2.6469
958	-1.4703	0.0942	1.47465	-2.3017	-0.542	-0.9129	-3.4649
959	-1.4601	0.16698	1.61528	-2.022	-0.4747	-0.8404	-2.6405
960	-1.3824	0.15378	1.56524	-2.0664	-0.422	-0.7017	-2.2098
961	-1.4245	0.21399	1.6752	-2.1131	-0.4073	-0.8394	-2.4389
962	-1.4034	0.14614	1.7016	-2.2367	-0.4617	-0.9859	-2.3199
963	-1.4722	0.08392	1.7011	-2.2357	-0.4428	-0.7652	-2.5727
964	-1.5277	0.09515	1.65679	-2.2706	-0.52	-0.9454	-2.3502
965	-1.4991	-0.0756	1.99626	-2.4109	-0.402	-0.9804	-3.0092
966	-1.446	0.05779	2.21325	-2.2457	-0.1343	-1.0179	-2.5695
967	-1.5381	-0.0131	2.02327	-2.1612	-0.3018	-0.7948	-2.623
968	-1.693	-0.011	1.59607	-2.0996	-0.549	-0.7467	-2.3348
969	-1.6987	0.06727	1.60505	-2.1371	-0.5066	-0.6849	-2.2052
970	-1.788	-0.0216	1.44891	-2.0936	-0.6485	-0.8857	-2.4516
971	-1.6403	0.00443	1.46609	-2.0867	-0.7226	-0.7537	-2.5985
972	-1.4629	0.09715	1.68116	-2.2067	-0.5309	-0.3068	-2.5121
973	-1.4927	-0.0092	1.60355	-2.3359	-0.5906	-0.5587	-2.3482
974	-1.429	0.05483	1.70625	-2.1375	-0.4727	-0.3302	-2.5001
975	-1.4361	0.08887	1.67121	-2.2076	-0.5253	-0.3357	-2.4966
976	-1.4914	0.00195	1.67281	-2.3479	-0.6281	-0.5064	-2.5459
977	-1.2931	0.12122	1.78887	-1.9182	-0.3385	-0.1738	-2.6002
978	-1.5308	0.03365	1.65769	-2.0678	-0.513	-0.7036	-2.805
979	-1.4844	-0.0352	1.52644	-1.9874	-0.6132	-0.4305	-2.5958
980	-1.57	-0.0586	1.55025	-1.9995	-0.632	-0.5861	-2.7092
981	-1.5123	-0.0287	1.56564	-2.0958	-0.5635	-0.5508	-2.673
982	-1.2751	0.13397	1.58726	-1.9529	-0.4294	-0.4936	-2.6709

983	-1.4239	0.01868	1.64154	-2.1618	-0.5954	-0.4277	-2.5248
984	-1.4328	0.06585	1.49746	-2.1043	-0.6882	-0.5008	-2.868
985	-1.4318	0.09498	1.54547	-1.9976	-0.5948	-0.4364	-2.4013
986	-1.4353	0.09119	1.54864	-1.8219	-0.6121	-0.5527	-2.3879
987	-1.4123	0.09218	1.35425	-1.7385	-0.7384	-0.6653	-2.2975
988	-1.6016	-0.129	1.37196	-2.1295	-0.5346	-0.3752	-2.7511
989	-1.7425	0.00357	1.37826	-1.9603	-0.558	-0.3887	-2.6851
990	-1.5311	0.08895	1.67767	-1.756	-0.5183	-0.6311	-2.5236
991	-1.4924	0.07084	1.65026	-1.8275	-0.5585	-0.6757	-2.4969
992	-1.3721	0.14116	1.65722	-1.8145	-0.3212	-0.4593	-2.1897
993	-1.4766	0.11499	1.95762	-2.0654	-0.2686	-1.1062	-2.4988
994	-1.6782	-0.0803	1.51237	-1.9743	-0.526	-0.7324	-2.7583
995	-1.7102	-0.0783	1.4107	-2.0195	-0.7269	-0.5161	-2.5718
996	-1.2698	0.16335	1.88251	-1.4819	-0.4396	-0.3949	-2.3666
997	-1.3817	0.03781	1.81608	-1.9443	-0.506	-0.4755	-2.933
998	-1.5043	0.00921	1.56832	-2.0236	-0.6726	-0.3875	-2.3609
999	-1.6263	-0.0395	1.46469	-1.9095	-0.6981	-0.1654	-2.675
1000	-1.6342	-0.0755	1.41684	-2.176	-0.7703	-0.7908	-2.7714
1001	-1.337	0.05228	1.83361	-2.1289	-0.5545	-0.2311	-2.9574
1002	-1.2836	0.00142	1.6934	-1.8646	-0.5787	-0.2652	-2.3654
1003	-1.431	-0.0023	1.61772	-2.1844	-0.5608	-0.5833	-2.3583
1004	-1.5005	-0.0749	1.58227	-2.2024	-0.6146	-0.3254	-2.6764
1005	-1.3974	0.00437	1.78184	-2.0984	-0.3949	-0.3782	-2.7414
1006	-1.5218	-0.023	1.5466	-1.9957	-0.4423	-0.6242	-2.7869
1007	-1.6645	0.04015	1.57517	-2.1146	-0.6163	-0.5775	-2.6148
1008	-1.5693	0.07987	1.50304	-1.9702	-0.6482	-0.5996	-2.4551
1009	-1.6202	0.03774	1.52107	-1.759	-0.6828	-0.5202	-2.3319
1010	-1.6238	0.04723	1.45843	-1.8848	-0.6568	-0.7807	-2.5965
1011	-1.5095	0.05773	1.57681	-1.725	-0.558	-0.6969	-2.3752
1012	-1.6167	0.07891	1.58588	-1.721	-0.5968	-0.9192	-2.2424
1013	-1.5641	-0.0549	1.35614	-1.8799	-0.7336	-0.8104	-2.5739
1014	-1.613	-0.0045	1.52186	-1.9877	-0.589	-0.8683	-2.4938
1015	-1.3987	0.11079	1.69993	-1.7942	-0.5118	-1.0296	-2.6354
1016	-1.5864	0.05953	1.59383	-2.0367	-0.6704	-0.9395	-2.5783
1017	-1.4559	0.08036	1.62172	-1.9051	-0.6216	-1.0953	-2.7886
1018	-1.4377	0.07429	1.60314	-1.8168	-0.4894	-1.1045	-2.493
1019	-1.45	0.15112	1.79082	-1.6541	-0.2698	-0.8905	-2.3356
1020	-1.549	-0.0792	1.65257	-1.9661	-0.6341	-1.2083	-2.4269
1021	-1.6094	0.02878	1.56709	-2.1043	-0.5281	-0.8165	-2.5115
1022	-1.5888	0.05294	1.66058	-1.9486	-0.567	-0.9811	-2.5392
1023	-1.5157	0.16514	1.68504	-2.1139	-0.4399	-0.8121	-2.3268
1024	-1.606	0.0495	1.66159	-1.9416	-0.4589	-0.9043	-2.3597
1025	-1.4873	0.13443	1.68503	-1.9541	-0.4205	-0.9153	-2.4701
1026	-1.553	0.05834	1.72412	-2.2303	-0.309	-0.8183	-2.4001
1027	-1.6807	-0.0259	1.68738	-2.2152	-0.4313	-1.0207	-2.7922
1028	-1.5733	0.07852	1.58371	-1.9404	-0.3046	-0.8223	-2.4061

1029	-1.6905	0.04686	1.52918	-1.9327	-0.3346	-0.8625	-2.4911
1030	-1.7527	-0.0081	1.40662	-2.1853	-0.5406	-1.0606	-2.6433
1031	-1.693	0.04188	1.42615	-1.9759	-0.4924	-0.8502	-2.8122
1032	-1.6829	-0.0986	1.38443	-2.1497	-0.6441	-0.9453	-2.7159
1033	-1.509	0.05168	1.62553	-2.2008	-0.4722	-0.6017	-2.4492
1034	-1.4569	0.07595	1.68663	-1.6376	-0.451	-0.7523	-2.4926
1035	-1.4403	-0.0102	1.79617	-2.2516	-0.4924	-0.8125	-2.5733
1036	-1.5528	-0.1049	1.66072	-2.2654	-0.5599	-0.8268	-2.5898
1037	-1.5168	0.00852	1.68053	-2.0605	-0.527	-1.0811	-2.5297

Appendix Table 1.2. Natural log of key indicator element abundance variability against conservative lithophile element Rb in core FS W3 in the Three Rivers Estuarine Complex saltmarshes.

Depth (mm)	Si/Rb	K/Rb	Ca/Rb	Ti/Rb	Br/Rb	Sr/Rb	Zr/Rb	Ba/Rb
1	-1.9007	1.09739	2.46808	1.22388	-0.2008	0.68119	0.03415	-0.6467
2	-1.8608	1.24326	2.51672	1.44342	-0.213	0.55402	0.03831	-0.6763
3	-1.783	1.25426	2.66447	1.32373	-0.1688	0.6835	0.13146	-0.6192
4	-1.8381	1.25051	2.63132	1.2777	-0.156	0.67388	0.23683	-0.596
5	-1.7425	1.24892	2.51166	1.25255	-0.1417	0.64342	-0.0318	-0.7853
6	-1.8968	1.16642	2.37728	1.22857	-0.1752	0.57934	0.06553	-0.9103
7	-1.9691	1.07146	2.30825	1.10834	-0.3392	0.62486	0.22212	-0.7362
8	-1.9686	1.16311	2.33404	1.19685	-0.2581	0.64982	0.25256	-0.5878
9	-1.9325	1.13226	2.32551	1.10948	-0.2784	0.5343	0.31603	-0.7252
10	-2.0192	1.06353	2.28796	1.1411	-0.4484	0.56042	0.27356	-0.8184
11	-1.9675	1.20753	2.34795	1.22545	-0.0624	0.69386	0.24552	-0.9674
12	-1.9556	1.11955	2.34159	1.141	-0.1932	0.72725	0.4116	-1.109
13	-2.0548	1.20156	2.57637	1.37566	-0.0758	0.8538	0.39182	-1.0421
14	-2.0833	1.32446	2.68703	1.49249	0.13923	0.98615	0.70074	-0.9358
15	-2.104	1.29966	2.52976	1.36517	-0.1546	0.85343	0.55345	-1.0191
16	-1.9529	1.15067	2.47971	1.23403	-0.329	0.6889	0.47106	-1.3667
17	-2.1011	1.45124	2.70282	1.49795	-0.038	0.99356	0.78481	-1.0977
18	-2.2673	1.2548	2.55048	1.38081	-0.2609	0.80747	0.52552	-1.3347
19	-2.3201	1.0506	2.48174	1.24869	-0.2441	0.84087	0.4132	-1.2293
20	-2.2492	1.09648	2.44907	1.24956	-0.2423	0.74612	0.36298	-1.0106
21	-2.2321	1.24002	2.61958	1.3712	0.10561	0.9015	0.4449	-0.9312
22	-2.1933	1.18495	2.52141	1.27982	0.05621	0.75976	0.32033	-0.946
23	-2.098	1.24829	2.59006	1.37788	0.08815	0.8425	0.31269	-1.1566
24	-2.1629	1.32495	2.62487	1.46977	0.09951	0.81129	0.33602	-1.5304
25	-2.1396	1.17104	2.60023	1.34744	0.02401	0.80156	0.1552	-1.3937
26	-1.9404	1.30462	2.59561	1.34506	0.29763	0.86132	-0.0047	-1.2535
27	-1.8875	1.11291	2.42488	1.13244	-0.0044	0.78272	0.12572	-0.9716
28	-1.9616	1.18512	2.49094	1.23038	0.07524	0.72948	0.20218	-1.2339
29	-1.7652	1.19114	2.41965	1.12245	0.04974	0.72569	0.15188	-0.9996
30	-1.9044	1.21025	2.45564	1.28696	-0.0819	0.71678	-0.0444	-1.1483
31	-2.0786	1.38925	2.60658	1.38941	0.14205	0.72392	0.12999	-0.9081
32	-1.9405	1.57234	2.84355	1.61068	0.17386	0.77707	0.26744	-1.1183
33	-1.9081	1.57788	2.98476	1.70459	0.1474	0.94383	0.51396	-0.8517
34	-2.024	1.4925	2.87694	1.59536	0.0854	0.84004	0.3775	-0.8206
35	-2.042	1.5512	2.85336	1.65555	0.16605	0.84708	0.02879	-0.9909
36	-1.8576	1.57058	2.80993	1.6211	0.16337	0.78135	0.13276	-1.0402
37	-2.1676	1.56223	2.77202	1.64374	0.19117	0.83456	0.13984	-1.0683
38	-1.966	1.29006	2.55996	1.30711	-0.1025	0.69894	0.21086	-1.2083
39	-2.052	1.42508	2.73733	1.45587	0.11689	0.77546	0.16803	-1.1196
40	-2.2027	1.55726	2.68881	1.60465	0.26009	0.75674	0.11841	-1.0151

41	-2.1495	1.47565	2.64133	1.52256	0.19069	0.71265	-0.2651	-1.306
42	-2.1324	1.40769	2.51241	1.4651	0.06429	0.66077	-0.0709	-1.2002
43	-2.1515	1.36654	2.4837	1.39529	0.21137	0.65632	-0.2927	-1.0927
44	-2.0025	1.36068	2.37586	1.34018	0.1812	0.62135	-0.3582	-1.1985
45	-2.0861	1.40983	2.51837	1.41661	0.15572	0.7073	-0.1366	-1.1512
46	-1.883	1.50757	2.68874	1.50586	0.11926	0.7272	-0.1093	-0.975
47	-2.0234	1.50805	2.65145	1.50594	0.25066	0.7852	-0.1631	-0.835
48	-2.0626	1.50463	2.58272	1.50953	0.15303	0.8148	0.03571	-1.1641
49	-2.2554	1.38516	2.56035	1.43876	-0.0032	0.71434	0.20679	-0.8756
50	-2.0711	1.37194	2.44532	1.36639	0.00906	0.63284	-0.2082	-0.864
51	-2.098	1.57339	2.7591	1.61818	0.26399	0.82521	-0.0935	-0.8352
52	-2.1071	1.50087	2.74384	1.65801	-0.0013	0.71221	0.20932	-1.0714
53	-1.8193	1.60047	2.80885	1.58565	0.16177	0.74886	-0.1276	-0.825
54	-1.8287	1.69785	2.98164	1.7609	0.02326	0.92065	0.08533	-0.8853
55	-1.8497	1.50521	2.93659	1.66846	0.07197	0.89678	0.13637	-0.9446
56	-1.8565	1.4543	2.8796	1.58155	-0.034	0.75543	0.15066	-1.0922
57	-1.8193	1.66525	2.92746	1.68165	0.11562	0.87696	0.36531	-0.6536
58	-1.9757	1.77764	3.01407	1.79146	0.31434	0.99774	0.34554	-0.9865
59	-1.7064	1.69255	2.98511	1.64396	0.23123	0.95672	0.39128	-0.8733
60	-1.8352	1.51578	2.84949	1.57571	0.0079	0.77413	0.08165	-0.8413
61	-1.7736	1.56022	2.83657	1.49706	-0.0541	0.88536	0.42957	-0.766
62	-1.6696	1.48123	2.76664	1.52715	-0.1401	0.74303	0.3932	-0.9799
63	-1.7053	1.45728	2.89691	1.46807	-0.018	0.79177	0.38876	-1.1158
64	-1.6704	1.56578	2.92104	1.53826	0.19287	0.9504	0.34157	-0.8383
65	-1.7012	1.27645	2.67475	1.29941	-0.1605	0.78998	0.11883	-1.4717
66	-1.9266	1.42176	2.84404	1.50834	-0.0866	0.88825	0.38998	-0.9026
67	-1.8967	1.30281	2.78392	1.39276	-0.1737	0.88136	0.30975	-0.9903
68	-2.029	1.31456	2.66206	1.30095	-0.1929	0.86351	0.66295	-1.3064
69	-2.24	1.60605	2.94104	1.78363	0.34339	1.17744	0.82734	-0.8036
70	-2.2556	1.28475	2.67516	1.49527	0.06081	0.82765	0.92123	-0.7889
71	-2.1697	1.43543	2.89092	1.63273	0.14538	1.10578	0.84163	-0.8719
72	-2.1459	1.4686	2.8237	1.59889	0.16187	1.0512	0.92709	-0.7278
73	-2.0226	1.34463	2.71111	1.34655	-0.0258	0.97228	0.6071	-1.1789
74	-1.9497	1.35296	2.7684	1.39535	0.10587	0.94892	0.52344	-1.1348
75	-1.9686	1.36927	2.68268	1.4735	0.19594	0.97301	0.62508	-0.8352
76	-2.0192	1.40555	2.82528	1.53232	0.06544	1.05366	0.77	-1.0818
77	-1.7951	1.28656	2.63669	1.26986	-0.0559	0.83411	0.60504	-1.2724
78	-1.8878	1.27186	2.57183	1.344	-0.1521	0.85819	0.45872	-1.1282
79	-2.0439	1.2628	2.6771	1.31755	-0.0889	0.91584	0.57008	-0.8623
80	-2.1714	1.27596	2.7385	1.42083	-0.2834	0.87623	0.76357	-0.9908
81	-2.025	1.3056	2.70163	1.44135	-0.0652	1.02309	0.70619	-1.2422
82	-2.0753	1.03342	2.37572	1.26274	-0.2541	0.79323	0.60653	-1.2321
83	-1.8717	1.27984	2.50395	1.34633	-0.0777	0.97233	0.72873	-1.097
84	-1.8225	1.31782	2.75969	1.34929	-0.1453	0.87187	0.66432	-1.2282
85	-1.9083	1.5121	2.84572	1.57439	-0.0373	1.09005	0.87965	-1.061
86	-1.6696	1.53132	2.99625	1.57276	-0.1673	0.90341	0.67285	-1.432

87	-1.6438	1.77807	3.24444	1.79884	-0.01	1.14641	0.83058	-1.0219
88	-1.6493	1.69212	3.14206	1.72112	-0.0297	1.08626	0.80093	-1.167
89	-1.7675	1.54553	2.97373	1.6817	-0.1211	1.03839	0.67237	-0.7714
90	-1.5475	1.69822	3.16586	1.69721	-0.0902	1.10623	1.01643	-0.8285
91	-1.5562	1.57534	3.14412	1.49326	-0.4952	1.05623	1.12511	-0.9094
92	-1.3955	1.65992	3.32148	1.57045	-0.3274	1.24305	1.3966	-0.6308
93	-1.3983	1.67268	3.40258	1.65457	-0.4264	1.25134	1.60365	-0.5205
94	-1.406	1.50312	3.31982	1.67866	-0.3318	1.22803	1.3365	-0.8975
95	-1.5144	1.43291	3.37022	1.64925	-0.2635	1.15824	1.32273	-1.1635
96	-1.6363	1.59913	3.36813	1.66289	-0.1909	1.20926	1.40672	-0.9193
97	-1.6461	1.58537	3.07021	1.63737	-0.104	1.14027	1.04904	-0.4616
98	-1.7895	1.4914	2.85056	1.60869	0.09649	0.79259	0.70699	-0.8718
99	-1.6792	1.39291	2.78067	1.34078	-0.0099	0.91649	0.74301	-0.7999
100	-1.6275	1.24237	2.77198	1.22878	-0.1715	0.72943	0.63772	-1.1665
101	-1.5819	1.82184	3.43843	1.83936	0.22887	1.11973	0.96371	-0.736
102	-1.597	1.68921	3.31798	1.70529	0.14822	1.07533	1.06688	-0.8349
103	-1.577	1.49485	3.10493	1.49163	-0.0475	0.89032	0.84934	-1.1594
104	-1.5994	1.46457	3.08579	1.47102	-0.0767	0.87702	0.79161	-1.3167
105	-1.5897	1.40221	3.00622	1.3897	-0.12	0.81458	0.72821	-1.3759
106	-1.6979	1.26732	2.77715	1.34483	-0.1815	0.77026	0.45039	-1.0593
107	-1.6804	1.50852	3.01352	1.49351	0.09972	0.85313	0.56411	-0.9448
108	-1.7128	1.53162	3.00503	1.56446	-0.0951	0.85401	0.81229	-1.0576
109	-1.7585	1.63415	3.16178	1.73295	0.19223	0.94664	0.79261	-0.7302
110	-1.6628	1.4215	2.94701	1.40963	-0.128	0.74284	0.63076	-0.7842
111	-1.722	1.46886	2.843	1.434	0.1808	0.83786	0.60788	-0.7661
112	-1.6874	1.48092	2.81566	1.40093	-0.1058	0.7546	0.61633	-0.8741
113	-1.6731	1.50903	2.85631	1.44618	-0.0364	0.79954	0.6719	-0.8249
114	-1.6431	1.47377	2.8376	1.43488	-0.0403	0.76995	0.66838	-0.8261
115	-1.5558	1.51754	2.90237	1.41136	-0.0027	0.81813	0.75487	-0.6923
116	-1.5382	1.42305	2.85939	1.3195	-0.0892	0.72328	0.67691	-0.7478
117	-1.6967	1.44351	2.91134	1.33315	-0.0718	0.74089	0.73622	-1.0721
118	-1.7857	1.45052	2.86778	1.40792	-0.094	0.73415	0.57592	-0.7724
119	-1.9713	1.59176	2.90881	1.71855	0.07448	0.83731	0.75317	-0.7246
120	-1.8627	1.75759	2.97092	1.71074	0.48041	1.06235	0.89041	-0.7592
121	-1.9688	1.55596	3.09528	1.71376	0.28742	0.95575	1.07694	-1.0334
122	-2.0921	1.47551	3.00709	1.59485	0.12385	0.82963	0.75699	-0.9905
123	-1.744	1.47213	2.94233	1.46063	-0.1083	0.79904	0.69239	-1.7169
124	-2.0158	1.4907	3.00247	1.68414	-0.1239	0.81102	0.8131	-0.7754
125	-1.65	1.63968	3.13299	1.62391	-0.0026	1.00078	0.82362	-0.8792
126	-1.3833	1.53403	3.23205	1.42036	-0.1221	0.9096	0.91418	-0.8302
127	-1.4609	1.67172	3.37825	1.61197	0.05786	1.12717	1.03789	-0.6344
128	-1.4585	1.59954	3.32448	1.58936	0.01744	1.03538	0.87774	-0.5592
129	-1.6188	1.58635	3.00989	1.60035	-0.1433	1.11145	0.97948	-0.6479
130	-1.8311	1.38065	2.75332	1.4834	-0.473	0.79219	0.96615	-0.638
131	-1.7301	1.33587	2.81136	1.43275	-0.2867	0.78235	1.07061	-0.8935
132	-1.7583	1.53999	3.06172	1.59137	0.02676	0.98072	0.90172	-0.5676

133	-1.6819	1.58796	3.09675	1.64298	-0.156	0.91759	1.00147	-0.7656
134	-1.7865	1.75898	3.29006	1.82279	0.02998	1.02962	1.00287	-0.4409
135	-1.9215	1.56964	3.12666	1.68135	-0.0186	0.95771	1.46011	-0.608
136	-2.0302	1.56454	2.96381	1.78113	-0.0439	0.95776	1.22578	-1.2695
137	-2.0087	1.57423	2.92514	1.72274	-0.1602	0.84051	1.26789	-0.5551
138	-1.7503	1.61187	3.0451	1.57973	-0.1231	0.78544	1.06525	-0.575
139	-1.6787	1.65795	3.06947	1.62393	-0.0423	0.88422	1.28055	-0.4586
140	-1.8739	1.43685	2.9148	1.58899	-0.1218	0.80208	0.80019	-0.9108
141	-1.8853	1.51598	2.93768	1.59732	-0.0558	0.79736	0.97637	-0.9197
142	-1.8646	1.41384	2.87328	1.49521	-0.2384	0.72378	0.90179	-1.1024
143	-1.6825	1.69516	3.13177	1.66189	0.10898	0.95043	0.87786	-0.6172
144	-1.7948	1.69564	3.01155	1.7698	0.07051	0.84277	0.90417	-0.5628
145	-1.7305	1.48834	2.86187	1.54086	0.02045	0.69149	0.959	-0.805
146	-1.8052	1.73149	3.09147	1.83047	-0.0172	0.88021	1.11578	-0.3008
147	-1.5112	1.68962	3.17183	1.72656	-0.0157	0.88546	1.07604	-0.674
148	-1.478	1.67485	3.13806	1.61401	-0.2163	0.91036	1.03052	-0.8832
149	-1.6851	1.66841	3.07452	1.83607	0.01514	0.80335	1.06236	-0.6352
150	-1.693	1.71422	3.19284	1.85875	-0.1122	0.71294	1.28263	-0.6888
151	-1.5014	1.62118	3.05356	1.61839	-0.298	0.56287	0.97545	-0.8007
152	-1.5804	1.68068	3.07898	1.74214	-0.0572	0.63015	1.08332	-0.7775
153	-1.535	1.63062	3.02783	1.67303	-0.0784	0.61511	1.06674	-0.8466
154	-1.4958	1.63093	3.01116	1.66367	-0.0539	0.64205	1.10036	-0.8759
155	-1.5335	1.53847	2.86451	1.57752	-0.1506	0.54858	1.01166	-1.0835
156	-1.5524	1.54029	2.84815	1.60542	-0.1332	0.57778	1.03829	-1.1839
157	-1.5603	1.62771	2.93849	1.6985	-0.0443	0.66274	1.12888	-1.1129
158	-1.512	1.59178	3.04805	1.55739	0.03077	0.83407	0.95276	-1.1689
159	-1.7758	1.63245	2.92496	1.77246	0.01567	0.84409	0.91213	-1.0405
160	-1.5322	1.67135	3.04802	1.6636	0.0978	0.85412	1.02674	-1.0816
161	-1.574	1.70006	3.18092	1.79799	0.15328	0.74538	0.95979	-1.0813
162	-1.6457	1.75879	3.01358	1.89379	0.12224	0.68422	1.04743	-0.4291
163	-1.6709	1.61939	2.94819	1.69516	0.11596	0.5964	1.05448	-1.0687
164	-1.637	1.62512	2.95432	1.66464	0.07762	0.52416	0.90002	-0.9682
165	-1.5493	1.56228	2.72394	1.53427	0.12082	0.6391	1.02648	-0.9496
166	-1.4078	1.70227	2.8246	1.53597	0.16496	0.67533	1.13508	-0.7509
167	-1.55	1.58555	2.79404	1.54909	0.30044	0.60908	1.39638	-0.7975
168	-1.4601	1.74299	2.93216	1.63245	0.24733	0.65873	1.20546	-0.8035
169	-1.5694	1.78686	2.82286	1.71725	0.22356	0.56589	0.96817	-0.8592
170	-1.6289	1.75254	2.89071	1.76681	0.27102	0.74582	1.15961	-1.1366
171	-1.7979	1.5712	2.86462	1.60264	0.09685	0.74328	1.24612	-0.9248
172	-1.4586	1.27709	2.56999	1.27661	-0.0445	0.66371	0.96914	-1.0651
173	-1.4513	1.35548	2.64756	1.32617	0.01483	0.7352	1.04425	-1.0179
174	-1.4766	1.32862	2.63258	1.30489	-0.0599	0.73294	1.01862	-1.1219
175	-1.4606	1.27462	2.56933	1.22036	-0.1353	0.66236	0.965	-1.2169
176	-1.4493	1.20962	2.50924	1.13486	-0.2126	0.62109	0.88877	-1.3133
177	-1.7041	1.45963	2.72022	1.48418	0.15389	0.66581	1.07954	-0.8839
178	-1.4995	1.49676	2.54092	1.37623	0.27869	0.53058	0.78239	-0.6821

179	-1.7227	1.7339	2.89851	1.82277	0.3902	0.71445	0.82098	-0.7625
180	-1.643	1.74294	2.86974	1.67769	0.37331	0.7453	1.02891	-0.5591
181	-1.7263	1.74001	3.0412	1.74621	0.45542	0.87822	1.21385	-0.5772
182	-1.8685	1.53536	2.79144	1.58082	0.3181	0.57779	0.87458	-0.9744
183	-1.9673	1.43202	2.65714	1.55407	0.05924	0.50331	0.83831	-1.1275
184	-2.0245	1.4465	2.49742	1.58167	0.08303	0.44019	1.14099	-1.4905
185	-2.0503	1.58062	2.75909	1.71211	0.35491	0.73862	1.12344	-0.8835
186	-2.0412	1.42528	2.68711	1.55683	-0.1014	0.56841	0.80547	-0.9304
187	-2.2263	1.54377	2.84753	1.78475	0.1398	0.71116	0.93969	-1.571
188	-1.949	1.5892	2.73679	1.68314	0.15837	0.62091	1.11845	-0.9727
189	-1.9439	1.4708	2.61396	1.59802	0.07805	0.4965	0.91773	-1.071
190	-1.7339	1.51956	2.67219	1.57271	0.06099	0.53731	1.0616	-1.084
191	-1.5436	1.50987	2.61474	1.46242	0.1159	0.54468	0.85452	-0.7162
192	-1.7305	1.59999	2.61542	1.57658	0.33365	0.36046	0.78133	-0.7737
193	-1.6371	1.53662	2.65714	1.51548	0.08657	0.55173	0.82101	-0.6715
194	-1.7781	1.69538	2.81862	1.76017	0.22761	0.82819	1.2064	-0.6369
195	-1.8884	1.53357	2.64308	1.5713	0.18969	0.65534	1.01101	-0.9554
196	-1.7316	1.38199	2.58376	1.43024	0.05028	0.57775	0.87449	-0.8723
197	-1.6005	1.57182	2.83658	1.53971	0.15854	0.7313	0.85931	-0.8109
198	-1.5375	1.50672	2.75465	1.48542	0.06295	0.66217	0.86791	-0.5406
199	-1.5442	1.33777	2.6425	1.3323	0.10097	0.59609	0.94731	-0.8628
200	-1.6818	1.5566	2.81468	1.56461	0.27389	0.87147	1.22929	-0.6473
201	-1.7367	1.53351	2.80321	1.61198	0.235	0.78641	1.22314	-0.9046
202	-1.8288	1.43914	2.61466	1.59377	0.13956	0.77151	1.29687	-1.2377
203	-1.8519	1.40241	2.60238	1.55304	0.0344	0.7219	1.06126	-1.0788
204	-1.6224	1.38365	2.72493	1.36021	0.01572	0.78918	1.2864	-1.0564
205	-1.8998	1.43346	2.7273	1.63627	0.22064	0.77635	1.16186	-0.7947
206	-1.8795	1.39143	2.62821	1.42976	0.05835	0.75312	1.08768	-0.9624
207	-1.8107	1.497	2.67424	1.61079	0.11656	0.72112	1.09324	-0.6772
208	-1.7851	1.51398	2.59506	1.49005	0.04247	0.51824	0.9091	-0.6112
209	-1.7117	1.43368	2.55294	1.4168	-0.1823	0.46456	0.81306	-0.8009
210	-1.8198	1.62148	2.72385	1.67629	0.12551	0.70069	1.07449	-0.8947
211	-1.8143	1.44117	2.55433	1.44208	-0.1721	0.59526	0.88464	-0.8481
212	-2.029	1.51927	2.64485	1.70882	-0.0291	0.58882	0.93135	-0.8396
213	-1.8966	1.42569	2.66959	1.51097	0.0292	0.58408	0.88987	-1.2264
214	-1.9945	1.45682	2.6526	1.59025	0.09516	0.64279	0.95514	-1.211
215	-2.0185	1.5053	2.53122	1.53851	0.1387	0.62267	1.13947	-1.0621
216	-1.7318	1.54205	2.62498	1.54051	0.28678	0.73447	0.85598	-1.0293
217	-2.0021	1.38986	2.41922	1.53197	0.15878	0.6444	0.78802	-1.1308
218	-2.0005	1.45112	2.61024	1.5933	0.18415	0.73117	0.93515	-0.6756
219	-2.0015	1.3233	2.41386	1.48413	0.04175	0.56291	0.97793	-0.9338
220	-2.1792	1.28904	2.58519	1.53782	-0.0094	0.6389	0.90531	-1.1495
221	-1.9586	1.35703	2.53595	1.39913	0.14868	0.63294	0.98894	-1.2408
222	-1.516	1.41394	2.53896	1.35251	0.03935	0.56916	0.79723	-0.8397
223	-1.7909	1.15279	2.30387	1.17029	0.02897	0.5973	0.95137	-1.1886
224	-1.8774	1.18422	2.31099	1.20546	0.10435	0.36006	0.83611	-0.9964

225	-1.929	1.26487	2.39983	1.4026	0.08518	0.40992	0.69071	-0.9175
226	-1.5783	1.62007	2.81631	1.64633	0.34269	0.79869	1.26175	-0.6642
227	-1.9318	1.37047	2.56563	1.38105	0.06167	0.59243	1.09242	-1.1059
228	-1.7898	1.19668	2.48716	1.29031	-0.0158	0.5498	1.05939	-0.9555
229	-1.8325	1.34238	2.62095	1.43528	-0.0337	0.5394	0.96518	-1.0001
230	-1.6737	1.47223	2.84136	1.47297	0.23839	0.71078	1.3151	-0.7252
231	-1.719	1.37839	2.75318	1.55026	0.11469	0.57292	0.98064	-0.8531
232	-1.6494	1.20601	2.50329	1.21289	-0.0887	0.40614	0.77866	-1.1814
233	-1.6712	1.561	2.79274	1.61436	0.1643	0.71418	0.9288	-0.7313
234	-1.4419	1.57478	2.78693	1.53259	0.01129	0.58851	0.95495	-0.9795
235	-1.4664	1.55552	2.94026	1.51078	0.00267	0.75941	1.10276	-1.0585
236	-1.5182	1.44682	2.84243	1.49534	0.04089	0.80492	1.28887	-0.9745
237	-1.3788	1.11114	2.4442	1.04165	0.00901	0.78314	0.90803	-1.2172
238	-1.3979	1.25103	2.69186	1.14407	0.12242	0.83352	0.87547	-0.8316
239	-1.3959	1.30442	2.73819	1.14639	0.44365	0.86481	1.25886	-0.9728
240	-1.5722	1.37387	2.89795	1.34797	0.19791	0.82983	0.97957	-1.1329
241	-1.6871	1.20584	2.6117	1.32741	-0.1753	0.71209	0.91332	-0.9368
242	-1.4444	1.32694	2.66679	1.18239	-0.2046	0.61729	0.89893	-1.0433
243	-1.5623	1.29457	2.37321	1.16255	-0.1229	0.5874	0.88042	-1.2436
244	-1.7198	1.09548	2.31539	1.0181	-0.2911	0.72299	1.28278	-1.0927
245	-1.974	1.27349	2.62529	1.46223	-0.0676	0.83684	1.08892	-1.0986
246	-1.5489	1.39525	2.79837	1.36508	-0.1246	0.86325	1.10901	-0.8769
247	-1.9296	1.38122	2.70762	1.49659	-0.0281	0.9216	1.22108	-1.01
248	-2.1594	1.46065	2.77286	1.75179	0.15709	1.00438	1.50516	-0.9007
249	-2.1894	1.39206	2.67954	1.65073	-0.1356	0.77101	1.13066	-0.7799
250	-1.8929	1.23716	2.56683	1.36532	-0.1365	0.59832	1.25251	-0.7885
251	-1.9335	1.57146	2.796	1.58428	0.04829	0.87327	1.41073	-0.5874
252	-2.0001	1.37241	2.51184	1.4458	-0.3124	0.5004	1.14734	-0.8184
253	-2.0084	1.49385	2.77941	1.59933	0.06431	0.57058	1.34014	-0.6105
254	-2.1075	1.57968	2.74999	1.67494	-0.1241	0.60967	1.12745	-0.9231
255	-2.0624	1.50979	2.82272	1.56503	-0.2074	0.67994	1.14113	-0.9745
256	-2.0661	1.53502	2.95102	1.68518	0.10934	0.65766	1.10027	-0.6991
257	-1.9058	1.48447	2.58627	1.44766	-0.0964	0.54327	0.99125	-0.7757
258	-1.9799	1.63263	2.82647	1.69931	0.0731	0.67786	0.97347	-0.5234
259	-1.9127	1.53921	2.81388	1.60322	0.04631	0.61496	0.97144	-1.1952
260	-1.9262	1.51726	2.79041	1.48266	-0.0312	0.60206	0.91861	-1.147
261	-1.8684	1.68393	3.11325	1.68927	0.02455	0.91191	1.1736	-0.9841
262	-1.8214	1.59081	2.84151	1.66285	-0.18	0.65922	1.03103	-0.8101
263	-1.9029	1.57243	2.7715	1.61259	-0.0892	0.42425	0.92541	-0.9636
264	-2.0464	1.62894	2.77438	1.83849	-0.1515	0.48265	0.93166	-0.6455
265	-1.9252	1.62888	2.8843	1.7442	-0.0987	0.58102	1.06591	-0.6086
266	-1.8454	1.59622	2.82978	1.54966	0.03351	0.58945	0.99568	-0.8426
267	-1.964	1.70737	2.84347	1.77815	-0.037	0.63412	0.78863	-0.8601
268	-1.958	1.6504	3.02234	1.7337	-0.2198	0.5792	0.90994	-1.0136
269	-1.7935	1.61611	2.75783	1.63201	-0.1805	0.44817	0.80601	-0.8282
270	-1.9481	1.65772	2.85279	1.7676	-0.0065	0.64053	1.00425	-0.7825

271	-1.8438	1.4963	2.66352	1.54443	-0.3548	0.52411	0.91425	-0.7702
272	-1.846	1.48081	2.73574	1.61213	-0.2319	0.50574	0.58832	-0.8994
273	-1.9192	1.61264	2.76512	1.73132	-0.1768	0.58685	1.0263	-0.8141
274	-1.9413	1.4396	2.68094	1.54139	-0.1735	0.51436	0.88147	-0.8054
275	-2.1073	1.4914	2.68765	1.5986	0.17439	0.58116	1.11276	-0.6163
276	-2.0577	1.51331	2.78882	1.69452	0.24454	0.66622	0.79285	-1.192
277	-2.1381	1.3666	2.67819	1.57415	0.03485	0.44991	0.90153	-0.9639
278	-1.9174	1.47209	2.87214	1.60442	0.00081	0.56731	0.83652	-0.7539
279	-1.7832	1.45773	2.81858	1.51833	-0.2044	0.45942	0.75171	-1.1469
280	-2.0135	1.63216	3.07084	1.89437	-0.224	0.57975	1.38822	-0.7735
281	-1.7656	1.7326	2.91285	1.69326	-0.0301	0.66707	1.23971	-0.6845
282	-1.5311	1.64536	2.78298	1.55274	-0.1787	0.5398	1.20712	-0.9823
283	-1.7283	1.8158	2.92836	1.90987	0.14781	0.79107	1.0112	-0.7043
284	-1.5946	1.54902	2.69642	1.4836	-0.2328	0.51635	0.79082	-0.9352
285	-1.5889	1.57379	2.75624	1.50444	-0.2025	0.5866	0.87554	-0.8896
286	-1.541	1.76879	3.01591	1.70788	-0.001	0.78594	1.14271	-0.5768
287	-1.5284	1.72699	3.05896	1.67012	-0.0284	0.79683	1.13857	-0.5945
288	-1.4998	1.68761	3.05733	1.62014	-0.076	0.75429	1.18285	-0.6332
289	-1.4678	1.85976	3.2863	1.79262	0.09115	0.92989	1.38135	-0.4593
290	-1.4369	1.64822	3.1086	1.57997	0.10679	0.70643	1.64269	-0.9063
291	-1.6105	1.48176	2.82151	1.53209	-0.2028	0.58574	0.82269	-0.8076
292	-1.8002	1.54771	2.88964	1.58595	-0.0827	0.68614	1.20319	-0.8998
293	-1.7737	1.47938	3.00889	1.4874	-0.2046	0.66153	1.13495	-0.6399
294	-1.5888	1.42426	2.92047	1.35762	-0.2226	0.54981	1.33512	-0.896
295	-1.4838	1.49306	2.81182	1.354	-0.2313	0.62707	1.01677	-0.6304
296	-1.6047	1.42136	2.74972	1.36423	-0.4688	0.54899	1.16721	-1.1317
297	-1.612	1.45902	3.03531	1.52429	-0.2328	0.56518	0.86887	-0.936
298	-1.5543	1.49376	3.05544	1.55427	-0.3431	0.68959	1.09413	-0.9159
299	-1.4818	1.55367	3.07489	1.46411	-0.1787	0.70489	1.02291	-0.9189
300	-1.6335	1.69065	3.08691	1.58457	-0.2	0.74721	1.13936	-0.8022
301	-1.7837	1.58349	3.1231	1.5072	0.04267	0.84846	1.20015	-1.0612
302	-1.7929	1.50761	3.14072	1.55583	-0.1756	0.74599	1.32135	-1.0909
303	-1.9146	1.63709	3.19103	1.71893	-0.1133	0.7692	1.34668	-0.6275
304	-1.9599	1.58392	2.94931	1.68766	0.00594	0.73727	1.07711	-0.8524
305	-1.8502	1.50323	3.01329	1.56051	-0.1471	0.70832	1.33598	-0.6573
306	-1.9773	1.32132	2.62178	1.53137	-0.3644	0.48843	1.12534	-0.7197
307	-1.9465	1.56271	2.92235	1.71495	-0.1158	0.7718	1.42017	-0.5218
308	-2.0562	1.56115	2.97671	1.83415	-0.0207	0.82629	1.47529	-0.4253
309	-1.8255	1.39659	2.83398	1.37899	-0.3102	0.67576	1.33035	-0.5741
310	-1.6955	1.49413	3.00164	1.61485	-0.1775	0.71422	0.99963	-0.5579
311	-1.5146	1.62956	3.14197	1.62065	-0.1034	0.74271	1.35749	-0.6424
312	-1.5873	1.4585	3.06228	1.56294	-0.3272	0.66837	1.02512	-0.6665
313	-1.5512	1.77769	3.33997	1.74858	-0.0887	1.04252	1.55761	-0.6211
314	-1.8055	1.5837	2.94398	1.6486	-0.582	0.7204	1.2065	-0.8418
315	-1.4106	1.56117	2.83032	1.41765	-0.3056	0.68815	1.11532	-0.9562
316	-1.3873	1.81125	3.12821	1.70232	-0.1966	0.8353	1.28276	-0.5791

317	-1.5881	1.83066	3.1901	1.8632	0.01145	0.84551	1.42857	-0.6931
318	-1.7997	1.66084	3.06988	1.78092	-0.1511	0.84182	1.54694	-0.8161
319	-1.9327	1.69	3.22019	1.79948	0.0951	1.03865	1.72737	-0.4943
320	-1.913	1.68133	3.13884	1.80586	0.08367	0.94862	1.67922	-0.8751
321	-1.7183	1.77374	3.20302	1.85569	0.02848	0.95522	1.58166	-0.7797
322	-1.4608	1.71381	3.27525	1.71971	-0.0266	0.84765	1.17372	-0.628
323	-1.2209	1.66951	3.23694	1.5184	-0.1991	0.80451	1.44027	-0.8603
324	-1.397	1.64252	3.0576	1.60599	-0.3435	0.63823	1.18153	-0.7628
325	-1.4568	1.74431	3.2193	1.74445	-0.0727	0.8124	1.52387	-0.6048
326	-1.5025	1.84187	3.2959	1.84857	-0.269	0.91098	1.71609	-0.6348
327	-1.5294	1.77328	3.17742	1.74944	-0.1892	0.67657	1.40889	-0.7586
328	-1.6844	1.53058	3.00431	1.66768	-0.3761	0.72071	1.42045	-0.6707
329	-1.4814	1.67303	3.31601	1.5668	-0.0298	0.91528	1.73817	-0.6881
330	-1.7808	1.5539	3.08762	1.78231	-0.2686	0.81652	1.44351	-0.6804
331	-1.5149	1.82526	3.37845	1.76717	0.13924	1.04237	1.6387	-0.5365
332	-1.4476	1.94061	3.31949	1.84608	0.15686	1.01315	1.59856	-0.4711
333	-1.4906	1.65257	3.12799	1.48282	-0.1172	0.84705	1.36224	-0.845
334	-1.4139	1.79415	3.25916	1.66924	0.03756	1.0231	1.54461	-0.6044
335	-1.5411	1.57114	3.1381	1.58434	-0.3498	0.70959	1.3857	-0.7179
336	-1.4922	1.69866	3.42312	1.76574	-0.0843	1.02754	1.72626	-0.4648
337	-1.612	1.68935	3.28101	1.81766	-0.0684	0.91726	1.69846	-0.7257
338	-1.4665	1.64136	3.12894	1.51305	-0.3107	0.83966	1.47795	-0.7725
339	-1.6439	1.78873	3.37127	1.81629	0.09035	0.99399	1.7188	-0.4584
340	-1.5285	1.55965	3.04942	1.60195	-0.19	0.74194	1.53036	-0.7587
341	-1.6762	1.85562	3.46609	1.88019	-0.0762	1.07809	1.54765	-0.6291
342	-1.6958	1.75548	3.32304	1.77086	-0.2638	0.96232	1.48333	-0.516
343	-1.6836	1.82483	3.39263	1.78396	-0.0418	1.11497	1.5838	-0.7509
344	-1.7904	1.73746	3.34537	1.84045	-0.3358	1.05517	1.52096	-0.6026
345	-1.7119	1.68488	3.32908	1.80433	-0.2848	1.05065	1.57986	-0.9527
346	-1.7481	1.739	3.2776	1.83834	-0.2633	1.12811	1.41864	-0.8341
347	-1.5059	1.65029	3.45584	1.64942	-0.1859	1.0311	1.33467	-0.6931
348	-1.6167	1.67812	3.35072	1.72435	-0.125	1.02084	1.3661	-0.5267
349	-1.6565	1.68584	3.3169	1.65742	-0.0376	1.07438	1.33863	-0.8093
350	-1.5914	1.65661	3.3148	1.63259	-0.2984	1.0249	1.22157	-0.9376
351	-1.6716	1.64408	3.31075	1.56099	-0.271	0.94383	1.16173	-0.7636
352	-1.7426	1.63811	3.17727	1.49539	-0.3329	1.06821	1.38565	-0.4986
353	-1.7507	1.64852	3.32136	1.50977	-0.1944	1.09861	1.32644	-0.4772
354	-1.756	1.56973	3.24021	1.44192	-0.2953	1.01868	1.20267	-0.5692
355	-1.7818	1.55771	3.23289	1.44316	-0.3125	1.01946	1.16586	-0.6055
356	-1.7923	1.5778	3.25147	1.47041	-0.2922	1.0325	1.17943	-0.6233
357	-1.8151	1.54774	3.23501	1.45958	-0.309	1.0116	1.15215	-0.6491
358	-1.8173	1.79369	3.38017	1.78736	0.07403	1.23486	1.52971	-0.4332
359	-1.9419	1.61329	3.18825	1.62096	-0.3794	1.04663	1.14001	-0.8172
360	-1.7352	1.57691	3.23513	1.55604	-0.1753	1.00854	0.96714	-0.7905
361	-1.8989	1.56451	3.22379	1.65194	-0.1159	1.08571	1.13772	-0.8303
362	-1.7606	1.44632	3.12644	1.47322	-0.4318	0.99782	1.13801	-0.7491

363	-1.8578	1.55308	3.16034	1.50867	-0.2081	1.04999	1.24087	-0.8467
364	-2.0517	1.52684	3.16253	1.67559	-0.1467	1.05086	1.08324	-1.0142
365	-1.9609	1.53569	3.17434	1.7875	-0.3642	1.0193	1.16175	-0.9311
366	-2.0683	1.79754	3.41907	2.05079	-0.117	1.27701	1.39571	-0.4623
367	-2.063	1.46693	3.15562	1.68222	-0.5525	1.02288	1.20705	-1.0352
368	-1.8345	1.73954	3.46454	1.80166	-0.2263	1.28954	1.25834	-0.5945
369	-1.9785	1.5405	3.28342	1.68711	-0.2978	1.14369	1.28032	-0.6603
370	-1.9474	1.58664	3.26097	1.73761	-0.284	1.23274	1.28597	-0.6463
371	-1.8154	1.62017	3.32913	1.7074	-0.2738	1.26677	1.30962	-0.6485
372	-1.9467	1.53451	3.14533	1.6808	-0.3496	1.27143	1.38272	-0.4862
373	-1.8606	1.55732	3.21108	1.59685	-0.2147	1.27524	1.53021	-0.6043
374	-1.8571	1.71596	3.40295	1.77807	-0.0353	1.4133	1.45118	-0.4201
375	-1.8439	1.6291	3.31193	1.71267	-0.1025	1.20178	1.17936	-0.4082
376	-1.9215	1.48762	3.28009	1.60018	-0.2649	1.06742	1.01585	-0.7648
377	-1.8736	1.70271	3.33271	1.76716	-0.2996	1.29332	1.44152	-0.6838
378	-1.7046	1.53112	3.252	1.55594	-0.2734	1.05027	1.22761	-0.7592
379	-1.5698	1.98842	3.85939	2.04414	-0.1521	1.74242	1.36209	-1.0221
380	-1.5624	1.96041	3.71024	2.00438	-0.1312	1.44813	1.26508	-0.6566
381	-1.6393	1.66646	3.38985	1.71589	-0.2341	1.23061	1.04995	-1.0656
382	-1.6179	1.75512	3.46856	1.77021	-0.2443	1.27623	1.27793	-0.436
383	-1.6954	1.69073	3.27555	1.83219	-0.4538	1.2012	1.05676	-0.5011
384	-1.535	1.71687	3.39702	1.71702	-0.3784	1.15638	0.98918	-0.4087
385	-1.6153	1.8426	3.61982	2.00252	-0.2474	1.44941	1.27301	-0.2017
386	-1.4706	1.77164	3.50818	1.73986	-0.3365	1.26799	1.21733	-0.6202
387	-1.6132	1.52694	3.4339	1.55601	-0.6757	1.1698	1.08559	-1.0247
388	-1.8184	1.95034	3.69288	1.99862	0.09022	1.60421	1.61711	-0.5402
389	-1.8994	1.73594	3.38944	1.82648	-0.3303	1.39145	1.3646	-0.469
390	-1.7492	1.69582	3.4087	1.80278	-0.4213	1.33215	1.29721	-0.6846
391	-1.7879	1.7777	3.56083	1.89188	-0.3911	1.37799	1.52893	-0.6656
392	-1.7662	1.67267	3.42198	1.71422	-0.5117	1.26096	1.21102	-0.7921
393	-1.7475	1.63942	3.51346	1.7612	-0.5787	1.27235	1.1429	-0.6975
394	-1.6911	1.73947	3.58349	1.78482	-0.2922	1.33874	1.4004	-0.7365
395	-1.7188	1.77854	3.68265	1.89606	-0.3509	1.41566	1.49302	-0.4925
396	-1.6857	1.69186	3.58872	1.75245	-0.4733	1.29689	1.19783	-0.5344
397	-1.6144	1.64854	3.58865	1.67209	-0.3284	1.32209	1.26605	-0.9346
398	-1.74	1.57263	3.42223	1.72343	-0.4325	1.4258	1.41064	-0.5825
399	-1.7627	1.59126	3.68231	1.69415	-0.2359	1.48854	1.18009	-0.4964
400	-1.5989	1.50098	3.74128	1.54264	-0.3166	1.41929	1.26602	-0.7214
401	-1.7813	1.48526	3.33217	1.63196	-0.118	1.15601	1.32426	-0.5861
402	-1.6922	1.59471	3.5516	1.81426	-0.5943	1.27799	1.46907	-0.3376
403	-1.4031	1.69531	3.5855	1.78446	-0.4314	1.31083	1.56657	-0.5045
404	-1.5742	1.66722	3.66755	1.794	-0.3077	1.47613	1.4483	-0.6655
405	-1.2932	1.62365	3.67164	1.49566	-0.428	1.38436	1.23689	-0.5679
406	-1.1447	1.83224	4.10406	1.7439	-0.465	1.66514	1.69915	-0.6404
407	-0.9799	1.90123	4.15492	1.66627	-0.3634	1.6739	1.55698	-0.4578
408	-1.3433	1.6285	3.83152	1.72486	-0.3643	1.53672	1.48371	-0.5783

409	-1.6518	1.64079	3.78419	1.77037	-0.5997	1.62161	1.51637	-0.6799
410	-1.4381	1.54683	3.54104	1.41984	-0.6502	1.40168	1.2321	-1.0882
411	-1.4365	1.74821	3.71741	1.74897	-0.4811	1.49867	1.22257	-0.8632
412	-1.6173	1.48709	3.82672	1.59054	-0.4323	1.58347	1.08496	-0.755
413	-0.9264	1.57516	3.82251	1.14979	-0.6981	1.51652	0.85355	-1.3656
414	-1.2427	1.62369	4.00686	1.54027	-0.4123	1.60248	1.26541	-1.3764
415	-1.6426	1.39021	3.92823	1.40416	0.56453	1.51665	1.06676	-0.8723
416	-1.5166	1.61767	3.69111	1.53756	-0.3372	1.40297	1.2335	-0.8703
417	-1.6892	1.47943	3.30505	1.51211	-0.4624	1.1809	0.89802	-1.0099
418	-1.7812	1.89275	3.73638	2.01039	-0.1143	1.51155	1.49562	-0.2553
419	-1.403	1.79921	3.6202	1.80029	-0.2104	1.3648	1.31789	-0.4954
420	-1.2808	1.81167	3.77395	1.64584	-0.415	1.34942	1.08676	-0.6626
421	-1.1654	1.68758	3.79765	1.49877	-0.4216	1.31572	1.13779	-1.0671
422	-0.9294	1.78144	3.84499	1.50106	-0.3196	1.42476	1.22339	-0.6866
423	-0.9415	1.85659	4.27173	1.75099	-0.2436	1.70592	1.32011	-0.8089
424	-1.2178	1.77004	3.964	1.88513	-0.5123	1.54408	1.31385	-0.611
425	-1.0982	1.67475	4.01993	1.76197	-0.3969	1.58954	1.12535	-0.6688
426	-0.7944	1.87862	4.21958	1.74934	0.02817	1.78352	1.63792	-0.4007
427	-0.7092	1.62092	4.1516	1.42119	-0.377	1.53216	1.45355	-0.5964
428	-0.4355	1.60417	3.91922	1.1338	-0.5477	1.58585	1.61354	-0.7828
429	-0.9209	1.7449	4.30005	1.87417	-0.0955	1.80986	1.75589	-0.9248
430	-0.7438	1.92073	4.35066	1.71097	0.10154	1.77197	1.80113	-0.7289
431	-0.8591	2.2541	4.52394	2.02051	-0.0174	1.98898	1.87431	-0.4405
432	-0.6848	1.71672	4.10314	1.49683	-0.3028	1.66298	1.47619	-0.7792
433	-0.7188	2.0293	4.43632	1.74644	-0.0802	1.73611	1.5194	-0.5737
434	-0.7697	1.91157	4.31083	1.72542	-0.3168	1.69688	1.06183	-0.9713
435	-1.0869	1.54045	4.06516	1.66598	-0.661	1.60922	1.09861	-0.806
436	-0.7235	1.59461	3.95854	1.27002	-0.4099	1.69268	1.28487	-0.826
437	-1.024	1.52426	3.88802	1.25468	-0.6282	1.71083	0.9622	-1.1467
438	-1.4592	1.50054	4.04765	1.50923	-0.4843	1.95616	1.22334	-0.8347
439	-1.3191	1.47821	4.14788	1.55164	-0.4049	1.89022	1.03249	-0.5791
440	-0.9539	1.57366	4.05523	1.35257	-0.2441	1.83557	1.12693	-0.7808
441	-0.7786	1.49284	3.98473	1.11003	-0.551	1.63807	1.22689	-1.1127
442	-0.7516	1.50938	3.96292	1.37075	-0.7288	1.65463	0.93128	-1.0267
443	-0.8201	1.77165	4.29601	1.67611	-0.5003	1.87852	0.90738	-0.6454
444	-0.2786	1.53433	4.21093	0.99512	-0.2603	1.77709	0.62346	-0.7087
445	-0.4063	1.55542	4.11764	1.12488	-0.3414	1.74933	0.74532	-0.8522
446	-0.4513	1.71348	4.16538	1.34904	-0.4681	1.76911	0.54008	-1.0531
447	-0.4208	1.65422	4.2005	1.35995	-0.7948	1.72235	0.51481	-1.0564
448	-0.6852	1.84048	4.28852	1.55008	-0.747	1.84084	0.75176	-0.735
449	-0.6141	1.67561	4.119	1.38079	-0.7229	1.63321	0.52804	-1.0427
450	-0.5173	1.6696	4.14379	1.35609	-0.5931	1.65463	0.52672	-1.2397
451	-0.6954	1.50088	4.26501	1.21738	-0.6815	1.66684	1.05517	-1.2979
452	-1.1233	2.00457	4.57622	1.91175	-0.2841	2.1371	1.51605	-0.9916
453	-1.074	1.63744	3.94162	1.4702	-0.8532	1.57022	1.29389	-1.1256
454	-1.1093	1.82852	3.94024	1.51249	-0.2664	1.82109	1.49042	-0.6092

455	-1.2719	1.65555	3.7956	1.54318	-0.3342	1.61671	1.26478	-0.919
456	-1.5508	1.81062	3.77965	1.82641	-0.3789	1.54971	1.33619	-1.1751
457	-1.4672	1.88129	3.74267	1.78964	-0.2391	1.57125	1.44157	-0.5405
458	-1.6318	1.83562	3.71337	1.98132	-0.6095	1.47096	1.31593	-0.7485
459	-1.5403	1.80038	3.88094	1.93513	-0.3516	1.56052	1.34428	-0.8986
460	-1.0629	1.80782	3.96815	1.61481	-0.4517	1.51913	1.49528	-1.0777
461	-1.0708	1.87322	3.98822	1.70859	-0.3702	1.4548	1.43329	-0.8418
462	-1.1685	1.93574	3.89488	1.8554	-0.3132	1.44506	1.35	-0.5974
463	-1.2276	1.68769	3.89097	1.93896	-0.6797	1.47701	1.65638	-0.6874
464	-0.8582	1.68823	4.0712	1.47949	-0.7198	1.57756	1.64835	-0.8366
465	-1.0368	1.90182	4.21753	1.77497	-0.4397	1.70424	1.69707	-0.2688
466	-1.0565	1.88943	3.90386	1.6396	-0.5039	1.59981	1.44176	-0.8606
467	-1.2742	1.91713	4.07625	1.87706	-0.3861	1.7116	1.70022	-0.6583
468	-1.2106	1.78404	3.89949	1.67032	-0.6901	1.51214	1.43435	-1.0925
469	-1.4157	1.79946	3.88331	1.82291	-0.5591	1.52249	1.49093	-0.6644
470	-1.2498	1.7361	3.73081	1.61654	-0.4778	1.40945	1.34815	-0.8613
471	-1.2742	1.69858	3.73081	1.5861	-0.7531	1.3352	1.22948	-0.6585
472	-1.3156	1.90387	3.96154	1.90645	-0.3917	1.55888	1.28241	-0.8109
473	-1.1617	1.76918	3.70359	1.61812	-0.2839	1.48814	1.16231	-0.6278
474	-1.49	1.73859	3.70537	1.7541	-0.7447	1.39696	1.36167	-0.4826
475	-1.27	1.59514	3.67668	1.45652	-0.7174	1.39128	1.20806	-0.894
476	-1.6804	1.80496	4.04748	2.02187	-0.4006	1.76674	1.33094	-0.5537
477	-1.6065	1.44299	3.76272	1.4389	-0.5443	1.49802	1.22848	-0.8165
478	-1.7079	1.54283	3.59182	1.5108	-0.5601	1.45964	1.3378	-0.6602
479	-1.6634	1.63935	3.80596	1.64503	-0.3914	1.51303	1.04133	-0.4724
480	-1.6619	1.65467	3.68827	1.67453	-0.4771	1.46475	1.12027	-0.8051
481	-1.746	1.63256	3.73151	1.67962	-0.4182	1.60921	1.27352	-0.7258
482	-1.5601	1.79817	3.82606	1.76595	-0.2614	1.77689	1.48517	-0.7953
483	-1.821	1.8695	4.02289	1.94869	-0.1395	1.84685	1.31896	-0.4569
484	-1.6381	1.90626	3.9561	1.93911	-0.2145	1.82903	1.51143	-0.411
485	-1.4447	1.60598	3.68535	1.49054	-0.1779	1.68388	1.35653	-0.7156
486	-1.3798	1.73634	3.81048	1.51866	-0.5555	1.7556	1.33932	-0.7445
487	-1.5164	1.69162	3.64836	1.63201	-0.3771	1.68523	0.88069	-0.8049
488	-1.4918	1.78158	3.827	1.68162	-0.535	1.79196	1.18434	-0.6585
489	-1.553	1.81664	3.905	1.82195	-0.249	1.82945	1.41086	-0.6757
490	-1.5379	1.62212	3.74595	1.56473	-0.5749	1.70418	1.19081	-1.123
491	-1.4005	1.55327	3.86589	1.44951	-0.3656	1.7713	0.90173	-0.8215
492	-1.2775	1.51244	3.77882	1.33467	-0.4695	1.63442	0.72832	-0.8674
493	-0.9997	1.77976	4.11455	1.53191	-0.1358	1.87567	1.18237	-0.6653
494	-0.8798	1.79249	4.25111	1.62193	-0.1768	1.90672	1.05389	-0.5039
495	-0.764	1.50229	3.97174	1.22873	-0.0645	1.63937	1.00088	-0.7266
496	-1.0102	1.42479	3.67156	1.32096	0.16084	1.399	0.87932	-0.9811
497	-1.0084	1.23634	3.60684	1.10783	0.52303	1.35001	0.5766	-1.1952
498	-1.0428	0.73397	2.6041	0.39393	0.44222	0.96232	0.60218	-1.0587
499	-1.819	0.79103	2.7644	0.84958	-0.7385	1.1345	0.78093	-0.9065
500	-1.7416	1.26521	3.11009	1.26162	-0.3421	1.25837	0.87663	-1.0018

501	-1.5692	1.15875	3.23097	1.13884	-0.4534	1.41542	0.9295	-0.9727
502	-1.6808	1.15727	3.67177	1.21677	-0.313	1.27081	1.0247	-0.9709
503	-1.6869	1.34426	3.82106	1.41218	-0.1231	1.2897	0.83185	-1.0429
504	-1.7127	1.77055	3.97972	1.78195	0.23854	1.71994	1.34061	-0.8953
505	-1.7853	1.97398	4.26025	2.0167	0.27731	2.01837	1.32283	-0.6771
506	-1.8689	1.69715	3.9339	1.73328	-0.1432	1.90154	1.19428	-0.9323
507	-1.7057	1.85211	4.02505	1.84707	-0.2961	1.98052	1.40355	-0.91
508	-1.6944	1.53209	3.5105	1.42373	-0.2466	1.55543	1.14626	-1.3598
509	-1.6118	1.55438	3.51072	1.44715	-0.5807	1.44762	1.11956	-1.2458
510	-1.5738	1.65045	3.76685	1.59246	-0.2433	1.55855	1.10009	-1.1428
511	-1.7279	1.48834	3.60498	1.48997	-0.5296	1.59424	1.19003	-1.2404
512	-1.543	1.5613	3.60934	1.49778	-0.2924	1.50584	1.0559	-1.3619
513	-1.7274	1.77173	3.55511	1.8991	-0.1404	1.45298	1.14811	-1.3082
514	-1.7391	1.57828	3.18068	1.56232	-0.2794	1.25143	0.86072	-1.4507
515	-1.7311	1.65494	3.22285	1.63776	-0.215	1.21133	0.82175	-1.2472
516	-1.9636	1.53717	3.14257	1.62458	-0.2393	1.27805	0.8696	-1.1722
517	-2.0236	1.52592	3.19824	1.61383	-0.0666	1.27573	0.70603	-1.2302
518	-1.7945	1.66268	3.15511	1.66108	0.05978	1.24295	1.0425	-1.164
519	-1.8	1.58939	3.1029	1.61827	-0.0725	1.10908	0.87766	-0.941
520	-1.5924	1.67628	3.17194	1.51474	0.12455	1.21365	1.03614	-1.0835
521	-1.7123	1.77978	3.30884	1.67548	-0.032	1.37768	1.16356	-1.5535
522	-1.7332	1.47149	3.11952	1.39273	-0.4058	1.1918	1.04531	-0.808
523	-1.7628	1.49127	3.06261	1.46483	-0.5686	1.18721	0.94466	-1.0363
524	-1.765	1.55252	3.22285	1.59999	-0.4446	1.2243	1.15071	-0.9666
525	-1.775	1.49059	3.08789	1.51256	-0.4161	1.2306	0.81488	-0.9353
526	-1.791	1.69706	3.19976	1.71979	-0.2116	1.36305	0.99204	-0.8311
527	-1.8222	1.44102	2.98779	1.47536	-0.3963	1.11317	0.82246	-1.2009
528	-1.8923	1.38837	2.91548	1.40704	-0.5151	1.07621	0.72803	-1.141
529	-1.8245	1.37483	2.92843	1.32301	-0.1255	1.04077	0.79619	-1.0786
530	-1.6413	1.54959	2.9799	1.43346	-0.2705	1.11264	0.61925	-0.8009
531	-1.6908	1.68215	3.16242	1.52174	-0.3191	1.23077	0.74726	-0.6134
532	-1.6603	1.53485	3.05503	1.43666	-0.1544	1.0483	0.72142	-0.7064
533	-1.8437	1.66393	3.2342	1.69282	-0.2451	1.21991	0.92407	-1.0497
534	-1.7664	1.57372	3.13431	1.64075	-0.3749	1.09565	0.83335	-0.9688
535	-1.8365	1.65026	3.29619	1.74474	-0.1753	1.18045	0.96508	-0.7411
536	-1.8919	1.56465	3.22157	1.5516	-0.2033	1.11022	0.81362	-0.9123
537	-1.9321	1.65297	3.30399	1.70596	-0.2113	1.24594	0.86531	-0.7949
538	-1.9158	1.63292	3.31673	1.72959	-0.1926	1.20345	0.77435	-1.199
539	-1.9203	1.53796	3.24581	1.61391	-0.1655	1.11249	0.87481	-1.4922
540	-2.0609	1.6416	3.30601	1.79366	-0.0366	1.19931	1.03741	-1.1515
541	-1.8354	1.54129	3.19628	1.55087	-0.4229	1.06005	0.8789	-0.7223
542	-1.8586	1.59205	3.24807	1.58878	-0.3629	1.11099	0.95328	-1.0539
543	-1.835	1.6924	3.32574	1.6614	-0.2657	1.19022	1.0331	-0.9224
544	-1.8256	1.69351	3.33312	1.65236	-0.2404	1.18868	1.04245	-0.9043
545	-1.8069	1.66633	3.32536	1.62056	-0.2571	1.17242	1.02478	-0.9089
546	-1.8308	1.68977	3.36624	1.63994	-0.2169	1.19948	1.04533	-0.8849

547	-1.8303	1.55315	3.19363	1.59673	-0.2279	1.17041	1.00543	-0.8995
548	-1.7098	1.4535	3.109	1.36327	-0.3376	1.06	0.8878	-1.0025
549	-1.8419	1.61419	3.36491	1.72908	-0.0566	1.17777	0.71828	-0.8944
550	-1.8132	1.66912	3.32427	1.74368	-0.2059	1.28889	0.80969	-1.0264
551	-1.7263	1.53589	3.12987	1.51037	-0.0831	1.23232	0.90246	-0.7939
552	-1.718	1.47524	3.33982	1.5022	-0.2584	1.22547	0.81954	-0.9443
553	-1.8752	1.77345	3.53108	1.83231	-0.0358	1.55659	1.33691	-0.6641
554	-1.8386	1.32845	3.11087	1.40141	-0.325	1.14967	0.8549	-1.209
555	-1.8501	1.25608	3.02295	1.31765	-0.4418	1.07529	0.7524	-1.3267
556	-1.8267	1.38629	3.14342	1.41881	-0.3307	1.21961	0.84695	-1.3366
557	-1.8384	1.40549	3.11438	1.45715	-0.332	1.26097	0.80238	-1.3906
558	-1.8213	1.38438	3.09331	1.41966	-0.3705	1.24217	0.69865	-1.3991
559	-1.8088	1.45797	3.16671	1.48306	-0.3056	1.31894	0.70591	-1.3414
560	-1.7214	1.57989	3.35283	1.48247	-0.2006	1.44008	1.22739	-0.7624
561	-1.8659	1.41277	3.03056	1.61394	-0.2862	1.27304	0.83303	-0.8333
562	-2.031	1.19472	2.86927	1.28376	-0.2606	1.15121	0.92611	-1.2773
563	-2.012	1.55443	3.23456	1.59669	-0.0673	1.34113	1.00648	-0.9582
564	-1.756	1.48751	3.17759	1.35049	-0.4248	1.27991	0.73272	-0.8875
565	-2.0361	1.86448	3.39254	1.94944	0.17185	1.5788	1.14081	-0.6366
566	-1.8205	2.06287	4.1344	1.9816	0.23464	2.00464	1.3917	-0.4688
567	-1.7257	2.19625	4.47066	2.05839	0.16611	2.14911	1.26917	-0.0976
568	-1.7944	2.36785	4.21266	2.40104	0.40354	2.31179	0.9692	-0.5382
569	-1.7964	1.88075	3.55376	1.94591	0.18989	1.94845	0.79259	-0.9606
570	-1.9561	1.84764	3.45916	1.97224	0.04312	1.76572	0.79851	-1.2913
571	-1.7619	1.6655	3.28798	1.60974	-0.321	1.30509	0.66098	-0.7634
572	-1.9356	1.48752	3.24109	1.64938	-0.3919	1.18821	0.61522	-1.0036
573	-1.7867	1.78718	3.52264	1.83572	-0.2326	1.47376	0.99163	-0.5973
574	-1.7727	1.68996	3.51657	1.74814	-0.1486	1.43847	0.96193	-1.2748
575	-1.6759	1.70079	3.57118	1.67404	-0.2213	1.55005	1.0964	-0.7555
576	-1.7655	1.79985	3.62242	1.75973	-0.3511	1.5679	1.00174	-0.577
577	-1.9588	1.64524	3.43423	1.68074	-0.0184	1.407	0.86023	-0.7057
578	-1.9425	1.60787	3.50043	1.72565	-0.0096	1.38193	0.78933	-0.744
579	-1.9772	1.5339	3.41667	1.6297	0.03899	1.38756	0.84512	-0.8484
580	-2.0145	1.71399	3.47142	1.81079	-0.4529	1.46962	0.92654	-0.8549
581	-2.1074	1.57851	3.40543	1.66462	-0.4428	1.42483	0.86351	-0.8971
582	-2.0069	1.60645	3.46563	1.62872	-0.3393	1.52967	0.92363	-0.9251
583	-1.9521	1.58043	3.32469	1.58176	-0.3076	1.49346	0.79574	-0.5964
584	-1.8418	1.66096	3.44395	1.63308	-0.3647	1.49515	0.91581	-0.8959
585	-2.0049	1.69604	3.67535	1.94052	-0.0009	1.63265	1.0478	-0.6931
586	-1.8713	1.65343	3.65639	1.70583	-0.2826	1.50616	0.76146	-1.0232
587	-1.9229	1.74468	3.69243	1.75524	-0.181	1.57712	0.93096	-0.7054
588	-1.9536	1.67524	3.48617	1.79035	-0.3076	1.49956	0.95186	-1.2
589	-1.7159	1.72505	3.65074	1.72885	-0.4309	1.62235	1.16535	-0.8638
590	-1.839	1.67515	3.7009	1.74127	-0.3108	1.55552	0.93585	-1.1311
591	-2.0216	1.65827	3.56037	1.88281	-0.2738	1.5883	0.98851	-0.7157
592	-1.8161	1.66402	3.51782	1.6314	0.14417	1.48756	1.01098	-0.6847

593	-1.7772	1.6399	3.48013	1.62502	-0.248	1.44855	0.78694	-0.7958
594	-1.9337	1.72006	3.52429	1.77072	-0.1476	1.53743	0.73745	-0.6628
595	-1.9489	1.73343	3.58683	1.81287	-0.0952	1.53661	0.81055	-0.7556
596	-1.728	1.54767	3.40323	1.46634	-0.1283	1.43225	0.8085	-1.0523
597	-1.8768	1.71513	3.57201	1.68617	-0.1665	1.55505	1.05166	-0.997
598	-1.8635	1.73242	3.55809	1.7307	0.08532	1.59021	0.88984	-0.9445
599	-1.8352	1.62238	3.53178	1.65356	-0.0535	1.50045	0.83277	-0.7279
600	-1.765	1.6445	3.53035	1.67515	0.10184	1.53769	0.47399	-0.7947
601	-1.795	1.55927	3.48211	1.65487	-0.2856	1.48417	0.81601	-0.8573
602	-1.6833	1.73932	3.62542	1.7045	0.00978	1.63171	0.91073	-0.6266
603	-1.7664	1.54869	3.64707	1.67759	0.1851	1.52097	0.85013	-1.1293
604	-1.6487	1.57221	3.54581	1.63155	-0.3511	1.50193	0.90028	-0.847
605	-1.6755	1.73116	3.8146	1.73624	-0.0093	1.66889	0.98526	-0.7085
606	-1.7079	1.77728	3.6604	1.7305	-0.1325	1.62464	0.80307	-0.872
607	-1.8431	1.71995	3.58499	1.84129	-0.0477	1.53428	0.79851	-1.0087
608	-1.8773	1.56188	3.33092	1.60672	-0.3133	1.36247	0.36944	-0.851
609	-1.7197	1.68555	3.55753	1.59907	-0.0941	1.5229	0.4639	-1.0348
610	-1.8091	1.86002	3.62081	1.93685	0.31242	1.65335	0.90824	-0.8077
611	-1.8363	1.82467	3.53813	1.93154	0.04515	1.58829	1.03372	-0.8357
612	-1.8111	1.70435	3.49124	1.74015	-0.1832	1.4943	1.21011	-1.0738
613	-1.9618	1.60342	3.28618	1.62441	-0.3299	1.40328	0.73314	-1.0894
614	-1.8638	1.51268	3.25406	1.57171	-0.1723	1.20018	0.44129	-1.1097
615	-1.9369	1.51854	3.1423	1.63453	-0.1997	1.14074	0.46598	-1.1256
616	-1.8636	1.5688	3.25512	1.59014	-0.3155	1.18653	0.45503	-0.7665
617	-1.8387	1.71531	3.3861	1.72441	-0.1595	1.37759	0.84914	-0.6164
618	-1.8471	1.53529	3.07939	1.59816	-0.24	1.12543	0.59343	-1.0489
619	-1.7778	1.64276	3.29384	1.64276	-0.3009	1.31508	0.56544	-0.6448
620	-1.913	1.60767	3.36669	1.72182	-0.2073	1.31675	0.79465	-0.8265
621	-1.8238	1.60216	3.42988	1.65812	-0.148	1.40111	0.53723	-0.7061
622	-1.8815	1.65262	3.43063	1.7315	-0.0742	1.39566	0.5669	-0.9148
623	-1.8292	1.62737	3.27494	1.65516	0.22441	1.30479	0.587	-0.9005
624	-1.748	1.53322	3.17001	1.50243	-0.0653	1.24389	0.52484	-0.8298
625	-1.7061	1.64415	3.31649	1.57656	-0.1027	1.35199	0.54741	-0.7917
626	-1.7912	1.69291	3.33955	1.63919	0.11143	1.30445	0.70692	-0.7783
627	-1.8517	1.52196	3.16187	1.54971	0.01453	1.14091	0.73978	-0.7737
628	-1.839	1.4895	3.10591	1.53536	0.0292	1.13957	0.63461	-1.1708
629	-1.8144	1.63818	3.25914	1.6027	-0.1181	1.3004	0.84237	-0.6601
630	-1.9143	1.61186	3.13717	1.56362	-0.0504	1.30846	0.65734	-0.9292
631	-1.9941	1.67092	3.29802	1.71038	-0.0231	1.34185	0.85313	-0.6284
632	-1.9322	1.63863	3.27165	1.74583	-0.1479	1.34688	0.67426	-0.9216
633	-1.8331	1.678	3.2481	1.66889	-0.1544	1.33103	0.71876	-1.0894
634	-1.824	1.66761	3.23839	1.66231	-0.1378	1.334	0.71599	-1.0362
635	-1.8262	1.66989	3.23013	1.66835	-0.1222	1.33139	0.7205	-0.9759
636	-1.8489	1.72972	3.2827	1.74563	-0.0517	1.38672	0.78364	-0.8782
637	-1.8494	1.65673	3.21208	1.67143	-0.1066	1.30702	0.71255	-0.9349
638	-1.8459	1.67507	3.17713	1.68643	-0.0817	1.32228	0.73429	-0.9119

639	-1.8411	1.60687	3.18253	1.67506	-0.0743	1.244	0.55259	-0.6789
640	-1.7384	1.63694	3.26319	1.62407	0.07858	1.22977	0.47818	-0.9459
641	-1.886	1.74516	3.31433	1.77753	-0.075	1.30348	0.51677	-1.5295
642	-1.7907	1.64754	3.17823	1.65553	-0.1392	1.23792	0.55476	-0.8704
643	-1.6923	1.54837	3.10165	1.52512	-0.5746	1.1264	0.44193	-1.0078
644	-1.6873	1.67183	3.21324	1.58121	-0.3184	1.25633	0.5061	-0.8819
645	-1.7304	1.43247	2.95069	1.39335	-0.3194	1.02361	0.20612	-1.1643
646	-1.749	1.69925	3.29224	1.69254	-0.2135	1.2324	0.43379	-0.8596
647	-1.7509	1.64477	3.23914	1.59886	-0.2636	1.17663	0.63095	-0.9673
648	-1.8261	1.55414	3.24474	1.60631	-0.2884	1.07443	0.52296	-1.0143
649	-1.721	1.73075	3.3759	1.6892	-0.1369	1.30709	0.70397	-0.8064
650	-2.0228	1.75789	3.46747	1.88025	-0.4003	1.36582	0.99997	-0.8058
651	-1.7941	1.77902	3.45022	1.81438	-0.2932	1.4561	0.96476	-0.9379
652	-1.7712	1.74327	3.47844	1.80106	-0.1076	1.39726	1.17042	-1.0208
653	-1.8601	1.83875	3.60523	1.93412	-0.2082	1.50558	1.16555	-0.8937
654	-1.7744	1.57322	3.39904	1.64758	-0.5072	1.27416	1.02036	-0.995
655	-1.7478	1.59491	3.29551	1.51738	-0.4527	1.32579	1.11143	-0.5825
656	-1.6345	1.5789	3.34846	1.57874	-0.5198	1.24751	0.75924	-0.7792
657	-1.5796	1.76691	3.44462	1.63096	-0.4076	1.4033	0.7789	-0.5249
658	-1.7788	1.70325	3.4562	1.72627	-0.4167	1.37676	0.97275	-0.8854
659	-1.8114	1.6463	3.33903	1.73382	-0.3864	1.32013	1.09547	-1.0071
660	-1.7858	1.70381	3.50487	1.80718	-0.2171	1.40511	1.01207	-0.7949
661	-1.8991	1.78911	3.53336	1.84843	-0.1475	1.46648	1.2128	-0.9065
662	-1.8403	1.74331	3.39352	1.81415	-0.3206	1.39336	1.13906	-1.0524
663	-1.9024	1.6467	3.35383	1.83439	-0.2508	1.37597	1.00568	-0.986
664	-1.9195	1.58673	3.33816	1.82318	-0.4141	1.31303	1.13408	-0.9333
665	-1.926	1.68689	3.49905	1.91442	-0.3871	1.32286	1.08866	-1.2565
666	-1.7638	1.80093	3.38942	1.89551	-0.0531	1.39803	1.25378	-0.7633
667	-1.7004	1.68482	3.29865	1.77274	-0.0663	1.424	1.13501	-0.5533
668	-1.9484	1.63838	3.25013	1.84716	-0.1703	1.22727	1.11666	-1.1052
669	-1.724	1.70877	3.35629	1.718	-0.282	1.30524	1.05472	-0.7712
670	-1.7876	1.63582	3.24634	1.62056	-0.2513	1.15623	1.06543	-0.8357
671	-1.7336	1.52176	3.13325	1.5784	-0.4976	1.04407	0.86618	-1.569
672	-1.7392	1.68029	3.35734	1.69605	-0.1741	1.21178	1.10091	-0.6408
673	-1.8659	1.51508	3.0088	1.62943	-0.1072	0.92513	1.06369	-0.7428
674	-1.8046	1.64884	3.1215	1.73223	-0.0632	1.01702	1.16562	-0.6893
675	-1.8019	1.59891	3.06069	1.66119	-0.1936	0.94678	1.10416	-0.8174
676	-1.7928	1.58343	5.32504	1.62212	-0.2937	0.89719	1.04542	-0.901
677	-1.7165	1.57616	3.01297	1.60657	-0.3655	0.87093	1.01939	-0.9614
678	-1.8996	1.65381	3.12854	1.75098	-0.2359	0.88328	1.07118	-1.228
679	-1.9398	1.68453	3.21313	1.80818	-0.0466	1.04184	0.98042	-0.7904
680	-1.775	1.67945	3.2111	1.54751	-0.1871	0.97166	1.11381	-0.668
681	-1.5883	1.54091	3.15994	1.44019	-0.2634	0.98673	0.96975	-0.8421
682	-1.6246	1.79285	3.38247	1.80045	-0.2372	1.16151	1.08183	-0.9138
683	-1.4324	1.81179	3.38482	1.65992	-0.2015	1.16828	0.97658	-0.7617
684	-1.5676	1.65602	3.22436	1.54919	-0.2114	1.10768	1.05622	-0.9526

685	-1.5641	1.66266	3.32448	1.66384	-0.2082	1.15124	1.15987	-0.9218
686	-1.5493	1.58062	3.16774	1.50711	-0.3711	1.04248	1.11366	-0.8286
687	-1.6251	1.81736	3.38152	1.78035	-0.234	1.25516	1.13876	-1.022
688	-1.6412	1.7262	3.26853	1.73465	-0.2014	1.24013	1.16524	-0.8263
689	-1.5857	1.75419	3.34246	1.6461	-0.3969	1.27559	1.2025	-0.4605
690	-1.7421	1.60664	3.27172	1.63823	-0.5334	1.18301	1.03084	-0.8502
691	-1.8077	1.75704	3.24243	1.87234	-0.4011	1.22243	1.0749	-0.9709
692	-1.7779	1.8601	3.36923	1.89606	-0.186	1.35657	1.1761	-0.6858
693	-1.8443	1.94269	3.34032	2.00702	0.12937	1.42566	1.46329	-0.5647
694	-1.8124	1.78445	3.25892	1.8423	-0.1272	1.28262	1.38607	-1.0141
695	-1.7081	1.68359	3.21977	1.63925	-0.331	1.24262	1.14491	-0.87
696	-1.7966	1.59462	3.07567	1.66912	-0.4425	1.17805	1.016	-1.024
697	-1.8106	1.67906	3.13632	1.72203	-0.476	1.12802	0.99928	-0.9258
698	-1.834	1.63766	3.09891	1.72998	-0.5699	1.23459	1.07912	-0.658
699	-1.7455	1.61724	3.12228	1.59992	-0.4236	1.23262	1.01759	-0.7598
700	-1.689	1.67901	3.22534	1.63604	-0.3536	1.32187	1.24057	-0.8002
701	-1.7533	1.67595	3.38734	1.74833	-0.447	1.25086	1.31062	-0.8319
702	-1.6729	1.7396	3.35378	1.79511	-0.4475	1.38101	1.37733	-1.0796
703	-1.8284	1.71981	3.33013	1.80803	-0.2514	1.33097	1.22295	-0.8406
704	-1.7745	1.70072	3.31977	1.70833	-0.5397	1.31954	1.16137	-1.3598
705	-1.6858	1.61846	3.19691	1.64751	-0.4382	1.1526	0.91089	-1.1502
706	-1.7839	1.50365	3.09614	1.44434	-0.6653	1.12441	0.92982	-0.8381
707	-1.8104	1.73208	3.31451	1.75862	-0.2593	1.31956	1.08992	-0.6118
708	-1.7577	1.59746	3.1559	1.52574	-0.7295	1.15955	0.91788	-0.7602
709	-1.7982	1.72525	3.34633	1.73524	-0.3943	1.32848	1.06458	-0.8437
710	-1.6734	1.7452	3.27104	1.69353	-0.2708	1.26648	1.15903	-1.0265
711	-1.6493	1.62286	3.1779	1.53033	-0.4466	1.1534	1.14931	-1.0454
712	-1.6532	1.49778	3.11702	1.46739	-0.5102	1.12575	0.82704	-0.8604
713	-1.8518	1.68483	3.29133	1.78126	-0.2958	1.24996	1.1984	-0.6141
714	-1.7414	1.69714	3.38398	1.76907	-0.2235	1.23986	1.17989	-0.6416
715	-1.742	1.64139	3.31216	1.67664	-0.2958	1.1817	1.11174	-0.7448
716	-1.745	1.65571	3.31212	1.67509	-0.315	1.18698	1.10814	-0.8187
717	-1.7327	1.63912	3.29256	1.63673	-0.3454	1.16933	1.07816	-0.9326
718	-1.7208	1.64323	3.29357	1.6173	-0.3772	1.16836	1.07828	-0.9594
719	-1.6268	1.52684	3.17924	1.49674	-0.4447	1.05421	0.95902	-1.1154
720	-1.7116	1.55549	3.11884	1.55877	-0.4231	1.09415	1.35483	-0.7559
721	-1.6494	1.50273	3.05699	1.40213	-0.4863	1.12579	0.9936	-1.121
722	-1.6014	1.49758	3.14295	1.41501	-0.4662	1.13629	0.92627	-0.8049
723	-1.8925	1.66456	3.38317	1.78898	-0.4727	1.36311	1.02185	-1.0333
724	-1.6404	1.56931	3.45679	1.53467	-0.3546	1.32123	0.78659	-0.886
725	-1.6513	1.59921	3.41968	1.59823	-0.5687	1.26401	1.03984	-0.8186
726	-1.6061	1.66016	3.50614	1.6304	-0.2933	1.48507	0.9675	-1.0072
727	-1.6507	1.65084	3.54977	1.64899	-0.3929	1.72261	0.83082	-1.027
728	-1.3503	1.97895	3.85743	1.83801	-0.0699	2.07302	1.00725	-0.4136
729	-1.3389	2.01123	3.86355	1.89002	-0.1603	2.03937	1.13317	-0.6611
730	-1.6218	1.64375	3.3782	1.63917	-0.7561	1.6692	0.99286	-0.8496

731	-1.6058	1.60411	3.38978	1.53712	-0.3879	1.32097	0.8536	-0.6372
732	-1.5665	1.82694	3.53646	1.69731	-0.5272	1.50408	1.22241	-0.4015
733	-1.6339	1.82991	3.73863	1.88067	-0.343	1.86788	1.30167	-0.4568
734	-1.6563	1.76826	3.6351	1.82055	-0.4505	1.63741	1.28338	-0.6956
735	-1.6045	1.70329	3.42113	1.71283	-0.4475	1.43487	0.95387	-0.785
736	-1.4573	1.8447	3.48242	1.77579	-0.1563	1.44833	1.234	-0.6349
737	-1.642	1.86811	3.48957	1.95741	-0.2244	1.51781	1.27502	-0.7134
738	-1.7	1.72263	3.32052	1.7406	0.0198	1.29827	1.03595	-0.864
739	-1.6851	1.74343	3.35697	1.78068	-0.3558	1.2878	1.1519	-0.6396
740	-1.5242	1.81181	3.53313	1.83499	-0.1142	1.45543	1.13258	-0.7755
741	-1.5844	1.98832	3.72945	2.06097	-0.0599	1.66163	1.1413	-0.7586
742	-1.5254	1.71734	3.319	1.62698	-0.3181	1.22664	0.70231	-0.8157
743	-1.5491	1.69212	3.28237	1.62475	-0.46	1.19966	0.89105	-0.7913
744	-1.4742	1.70096	3.33311	1.48038	-0.3677	1.27106	0.93156	-0.6407
745	-1.4569	1.74978	3.55039	1.63909	-0.2526	1.39421	1.07349	-0.7393
746	-1.5158	1.84374	3.67866	1.83793	-0.0892	1.44405	1.34108	-0.6871
747	-1.4007	1.75363	3.79497	1.64632	-0.329	1.6398	1.24197	-0.7265
748	-1.478	1.85641	3.59614	1.79236	-0.4304	1.55182	1.28074	-0.8773
749	-1.3811	1.80722	3.41824	1.68249	-0.3566	1.4801	1.23352	-0.7736
750	-1.1279	1.80718	3.58643	1.52781	-0.451	1.40489	1.24162	-0.852
751	-0.9661	1.79956	3.70514	1.5012	-0.3325	1.38558	1.31038	-1.191
752	-1.1369	1.49469	3.40923	1.18967	-0.6298	1.34601	1.14785	-0.8248
753	-0.916	1.46784	3.45957	1.1427	-0.6808	1.31867	0.69803	-1.1111
754	-0.9908	1.44723	3.41645	1.10449	-0.8054	1.29388	0.81662	-1.4887
755	-0.964	1.40207	3.461	1.17999	-0.5742	1.15377	0.75673	-1.2941
756	-0.9478	1.28177	3.2592	0.94693	-0.7728	1.0486	0.71478	-1.1755
757	-1	1.33824	3.34107	0.89953	-0.8036	1.11983	0.76761	-1.1738
758	-1.5718	1.56797	3.45421	1.55627	-0.7806	1.29543	1.1252	-1.0824
759	-1.2979	1.66316	3.41926	1.46122	-0.388	1.36294	1.09132	-0.8261
760	-1.7007	1.51065	3.40715	1.69048	-0.5977	1.14513	1.37181	-1.0427
761	-1.4568	1.52472	3.34555	1.41638	-0.8468	1.21123	1.2553	-0.9171
762	-1.4425	1.66368	3.41734	1.52983	-0.3421	1.29204	1.26642	-0.9586
763	-1.3317	1.69265	3.48353	1.4424	-0.4564	1.27101	1.14203	-0.9856
764	-1.7157	1.61275	3.46274	1.7066	-0.6367	1.16869	0.96984	-0.9661
765	-1.4997	1.73014	3.62444	1.67467	-0.2986	1.2474	1.17602	-0.9324
766	-1.4666	1.87605	3.88983	1.87547	-0.2333	1.47459	1.3657	-0.8199
767	-1.5676	2.07409	3.64243	1.96727	0.20663	1.52576	1.47429	-0.5346
768	-1.5641	2.07796	3.73979	2.07914	0.20712	1.56654	1.57517	-0.5065
769	-1.3006	1.67628	3.7542	1.70602	-0.0303	1.69094	0.98411	-0.3567
770	-1.6113	1.81974	3.67885	1.95729	-0.0897	1.60944	1.24723	-0.922
771	-1.6877	1.85175	3.71842	1.89904	-0.076	1.56751	1.02515	-1.1529
772	-1.7023	1.93582	3.74532	1.9818	0.03805	1.60628	0.96894	-0.9692
773	-1.6607	2.00447	3.85115	2.07323	0.10087	1.56581	1.11072	-1.0128
774	-1.6589	2.06636	3.86694	2.06636	-0.1151	1.58329	1.2011	-1.0361
775	-1.7822	2.04028	3.89973	2.21536	-0.0589	1.58795	1.12133	-1.2032
776	-1.6134	2.05644	3.74562	2.01703	0.26988	1.60723	1.33221	-1.4442

777	-1.7371	2.20925	3.89401	2.28329	0.07203	1.71505	1.53264	-1.3838
778	-1.5754	2.00348	3.69992	1.95008	-0.173	1.5458	1.1853	-1.5457
779	-1.5696	1.86695	3.54016	1.78969	-0.0048	1.49684	1.13085	-1.3342
780	-1.6474	1.84275	3.59717	1.75356	-0.0164	1.51181	1.13771	-0.9068
781	-1.7315	1.89799	3.63167	1.91222	-0.0185	1.48007	1.23114	-1.0533
782	-1.7728	1.81377	3.66937	1.9261	-0.1089	1.43887	1.09924	-1.0353
783	-1.6917	1.86845	3.66491	1.81104	-0.0497	1.54588	1.14473	-0.8107
784	-1.6093	1.84003	3.59225	1.86915	-0.1761	1.40778	1.0122	-1.0953
785	-1.6927	1.87272	3.57226	2.0333	-0.074	1.29851	0.96629	-0.9447
786	-1.6673	1.64916	3.54805	1.74568	-0.6155	1.30738	1.16916	-0.4568
787	-1.8407	1.69168	3.60457	1.82532	-0.3128	1.43099	1.21364	-0.736
788	-1.6184	1.73612	3.34665	1.69793	-0.1735	1.33799	1.24664	-0.8041
789	-1.5891	1.84517	3.49164	1.80261	-0.2067	1.45614	1.1576	-0.5732
790	-1.4567	1.74776	3.44479	1.76384	-0.1185	1.22876	1.14037	-0.6041
791	-1.5034	1.56475	3.29352	1.45173	-0.2068	1.19237	0.96775	-0.651
792	-1.8287	1.87984	3.44609	1.96569	-0.0514	1.57336	1.38571	-0.5602
793	-1.7214	1.83436	3.32574	1.76903	-0.2094	1.37937	1.32754	-0.7017
794	-1.8019	1.77449	3.38716	1.80925	-0.1811	1.37602	1.22452	-0.8717
795	-1.9279	1.74844	3.24291	1.69961	-0.3328	1.27808	1.05957	-0.535
796	-1.8479	1.78685	3.30663	1.70837	-0.1517	1.33484	1.14145	-0.5914
797	-2.0265	1.67016	3.25432	1.82803	-0.4208	1.25342	0.88687	-0.6401
798	-1.8485	1.73802	3.26489	1.71751	-0.3041	1.2356	1.0536	-0.6542
799	-1.6973	1.74882	3.37274	1.71358	-0.1852	1.28388	0.8686	-0.6377
800	-1.6928	1.74341	3.35751	1.73198	-0.2581	1.2309	1.00082	-0.6922
801	-1.7513	1.6906	3.29105	1.66395	-0.3637	1.13275	1.01895	-0.7557
802	-1.7269	1.61688	3.16625	1.59878	-0.8629	1.07289	0.83073	-0.8753
803	-1.6586	1.77484	3.50237	1.74366	-0.191	1.31398	1.05115	-0.7741
804	-1.7985	1.72638	3.41291	1.7519	-0.2903	1.24712	0.87758	-0.8288
805	-1.7108	1.7318	3.31965	1.74865	-0.3462	1.21806	0.91557	-0.7852
806	-1.8868	1.54676	3.08077	1.64373	-0.5349	1.03578	0.85394	-0.8179
807	-1.8045	1.63551	3.22692	1.66862	-0.4264	1.16502	1.0925	-0.857
808	-1.8361	1.49327	3.09819	1.5186	0.09564	1.0438	0.97133	-0.7041
809	-1.7699	1.68919	3.28272	1.73287	-0.2353	1.1894	0.89066	-0.8444
810	-1.7173	1.71081	3.69395	1.70999	-0.4418	1.50126	0.8586	-0.7132
811	-1.6156	1.84472	3.65195	1.84439	-0.2625	1.77767	1.04767	-0.5388
812	-1.8634	1.83884	3.50825	1.95916	-0.1768	1.60327	1.17715	-0.4511
813	-1.5716	1.71928	3.40747	1.57331	-0.445	1.31073	1.18493	-0.9456
814	-1.6945	1.56524	3.26856	1.50803	-0.5178	1.0919	0.80148	-1.029
815	-1.7374	1.62845	3.25995	1.59187	-0.2612	1.04852	1.00998	-0.8701
816	-1.7812	1.66173	3.2709	1.68717	-0.1811	1.13575	0.86854	-0.8687
817	-1.6922	1.68056	3.34545	1.62892	-0.2866	1.24675	0.90722	-0.8787
818	-1.5939	1.83736	3.52164	1.69182	-0.0263	1.36802	0.92129	-0.5784
819	-1.6967	1.69095	3.65332	1.76295	-0.2957	1.552	0.54681	-0.6031
820	-1.684	1.52194	3.37775	1.55401	-0.1222	1.21856	0.33908	-0.8344
821	-1.7702	1.60944	3.45181	1.70098	-0.1716	1.21332	0.36207	-0.8404
822	-1.6646	1.63989	3.21806	1.64252	-0.1312	1.13053	0.72177	-0.5887

823	-1.655	1.70515	3.29475	1.67535	-0.3292	1.15175	0.88588	-0.7154
824	-1.5806	1.63849	3.38233	1.58634	-0.4149	1.10126	0.95984	-0.6845
825	-1.4811	1.66951	3.19114	1.64408	-0.5836	0.9703	0.987	-0.9595
826	-1.5124	1.729	3.36715	1.81686	-0.1625	1.19013	1.30878	-0.7032
827	-1.539	1.82703	3.29214	1.86053	-0.1778	1.0714	1.25212	-0.8786
828	-1.5965	1.78801	3.31431	1.79127	-0.1923	1.05192	1.04884	-0.7928
829	-1.6572	1.71815	3.28379	1.67993	-0.1292	0.99565	0.94985	-0.7675
830	-1.7411	1.71561	3.2417	1.6905	-0.4666	1.06146	0.89354	-0.9205
831	-1.5538	1.62065	3.25913	1.53818	-0.346	1.0837	0.93043	-0.8708
832	-1.5305	1.77775	3.402	1.74126	-0.0772	1.21633	1.1328	-0.7821
833	-1.6857	1.54268	3.03677	1.53652	-0.4882	0.94769	0.93878	-1.0015
834	-1.5517	1.66444	3.25869	1.5439	-0.3511	1.07008	1.03822	-0.5954
835	-1.7018	1.55582	3.13421	1.59975	-0.4687	0.99553	0.9608	-0.6812
836	-1.799	1.73012	3.19255	1.76875	-0.3437	1.14595	1.10456	-0.7715
837	-1.7138	1.76117	3.17447	1.91905	-0.3696	1.02503	1.18941	-0.8041
838	-1.4561	1.80833	3.26081	1.70606	-0.4169	1.10944	1.31143	-0.6803
839	-1.5074	1.64709	3.18973	1.65378	-0.5558	0.98901	1.23591	-0.771
840	-1.4763	1.76263	3.25292	1.76962	-0.3939	1.16566	1.12099	-0.8357
841	-1.5062	1.72223	3.26912	1.74181	-0.4635	1.02933	1.1572	-0.7069
842	-1.4448	1.74187	3.30578	1.69202	-0.5988	1.09909	1.17788	-0.5988
843	-1.5698	1.65023	3.25064	1.73737	-0.6402	1.01795	0.8525	-1.3079
844	-1.4948	1.67565	3.27544	1.72787	-0.6289	1.05621	1.07344	-0.5342
845	-1.421	1.7404	3.34677	1.70231	-0.6215	1.05342	0.98284	-0.8041
846	-1.5747	1.56601	3.42546	1.55162	-0.4548	1.02778	0.81582	-0.8505
847	-1.4201	1.56429	3.30244	1.68868	-0.4382	1.07717	1.24373	-0.7006
848	-1.2183	1.74399	3.42114	1.64115	-0.6099	1.1528	1.17022	-0.5802
849	-1.2188	1.56324	3.50925	1.60436	-0.6834	1.2453	1.24327	-0.8269
850	-1.048	1.75871	3.52872	1.63804	-0.4525	1.26139	1.37641	-1.0085
851	-1.3818	1.75019	3.48229	1.81404	-0.4427	1.2313	1.42379	-0.7282
852	-1.363	1.79465	3.36237	1.77338	-0.5078	1.1715	1.32043	-0.606
853	-1.2089	1.79692	3.50678	1.69478	-0.4343	1.26248	1.30186	-0.6073
854	-1.2301	1.82612	3.53009	1.71172	-0.4698	1.46453	1.07981	-0.5135
855	-1.4854	1.86983	3.66621	2.04785	-0.3885	1.55639	1.42083	-0.313
856	-1.4468	1.6662	3.50543	1.71864	-0.7381	1.24872	1.11573	-0.7122
857	-1.3429	1.74324	3.45452	1.71905	-0.8115	1.18911	1.26683	-0.6556
858	-1.4419	1.89582	3.73038	1.97635	-0.6754	1.36406	1.44724	-0.7912
859	-1.3336	1.80002	3.45047	1.80661	-0.7563	1.23689	1.37954	-0.8743
860	-1.1421	1.84979	3.51116	1.61611	-0.6611	1.23297	1.2439	-0.7442
861	-1.25	1.84103	3.46608	1.71692	-0.6327	1.22125	1.49071	-0.5624
862	-1.3575	1.86152	3.58875	1.87369	-0.4797	1.25337	1.52502	-0.6412
863	-1.4355	1.82599	3.50965	2.01355	-0.5858	1.26954	1.29466	-1.0276
864	-1.2824	1.68186	3.33259	1.67973	-0.8695	1.02977	1.10952	-0.7047
865	-1.1219	1.75939	3.44189	1.60944	-0.6821	1.16408	0.99449	-0.7632
866	-1.3346	1.78516	3.4926	1.88656	-0.1814	1.17007	1.14425	-0.5763
867	-1.2019	1.70932	3.40086	1.59187	-0.757	1.18406	0.90994	-0.9548
868	-1.2202	1.59517	3.28463	1.54175	-0.7387	1.08708	0.74572	-0.9626

869	-1.1016	1.75885	3.56106	1.71085	-0.4761	1.3379	1.25713	-0.5753
870	-1.0208	1.83078	3.99687	1.66682	-0.2615	1.59125	1.13409	-0.7453
871	-1.3611	1.80642	3.65275	1.92803	-0.3986	1.52871	1.20319	-0.9026
872	-1.2372	1.72494	3.74115	1.65754	-0.3895	1.38883	0.94154	-0.7789
873	-1.5515	1.70534	3.43486	1.82378	-0.5306	1.31826	1.02077	-0.6981
874	-1.516	1.91322	3.75195	2.00222	-0.4161	1.2804	1.06644	-0.5515
875	-1.4466	1.71568	3.32282	1.70066	-0.5883	1.1055	0.97986	-0.9654
876	-1.5721	1.9147	3.55756	1.92256	-0.3037	1.33681	1.17704	-0.9588
877	-1.4775	1.79559	3.39446	1.698	-0.4326	1.16823	1.05319	-1.0872
878	-1.6049	1.85277	3.43658	1.95183	-0.4067	1.2146	1.30413	-1.0538
879	-1.5698	1.79796	3.39837	1.88511	-0.4925	1.16569	1.00023	-1.1602
880	-1.4948	1.88197	3.48176	1.93419	-0.4226	1.26254	1.27976	-0.3279
881	-1.421	1.85302	3.45939	1.81493	-0.5088	1.16604	1.09546	-0.6914
882	-1.5747	1.77818	3.63763	1.7638	-0.2427	1.23995	1.02799	-0.6383
883	-1.4907	1.82531	3.53421	1.73663	-0.3375	1.45152	0.57904	-0.5196
884	-1.3678	1.7919	3.59167	1.62677	-0.3087	1.50083	0.76889	-0.6404
885	-1.3416	1.83906	3.69642	1.65586	-0.5665	1.55679	0.85168	-0.5756
886	-1.3999	1.64104	3.4784	1.54307	-0.5103	1.26982	0.63411	-1.0962
887	-1.5561	1.80531	3.47315	1.70347	-0.4642	1.36223	0.67857	-0.893
888	-1.6595	1.95729	3.46533	1.97926	-0.1264	1.31852	1.35311	-0.848
889	-1.6722	1.80611	3.53651	1.98526	-0.2892	1.26927	1.41567	-0.9046
890	-1.8339	1.8121	3.37676	2.09737	-0.5235	1.14843	1.11137	-0.8228
891	-1.5337	1.74669	3.43574	1.85027	-0.4766	1.06745	1.23186	-0.6074
892	-1.6233	1.7942	3.38042	1.91889	-0.6842	1.11371	1.32798	-0.9138
893	-1.6213	1.88598	3.61949	2.06923	-0.3999	1.24601	1.57219	-0.7241
894	-1.3227	1.84676	3.53553	1.74418	-0.529	1.21681	1.33334	-0.5643
895	-1.3818	1.6939	3.40473	1.64742	-0.4752	1.18105	1.3594	-0.7212
896	-1.586	1.80871	3.50161	1.79115	-0.3354	1.22356	0.96965	-0.7627
897	-1.6776	1.86135	3.40272	1.83502	-0.2348	1.32089	0.89628	-0.8424
898	-1.5004	1.70277	3.38667	1.60975	-0.4242	1.23285	0.75914	-0.9498
899	-1.5325	1.64904	3.41022	1.54106	-0.488	1.15639	0.73611	-0.7618
900	-1.5139	1.7805	3.45806	1.62566	-0.2666	1.37264	1.06819	-0.4948
901	-1.6133	1.81783	3.43229	1.72819	-0.1968	1.46903	1.03255	-0.5822
902	-1.5881	1.7745	3.42343	1.74693	-0.2705	1.44701	0.78982	-0.8068
903	-1.4482	1.67186	3.40613	1.69885	-0.5006	1.34557	0.85451	-0.9391
904	-1.3351	1.7148	3.66633	1.66785	-0.4816	1.41171	0.74299	-0.7187
905	-1.3285	1.85347	3.73518	1.81077	-0.3709	1.56124	0.94777	-0.4125
906	-1.3004	1.73068	3.66003	1.72063	-0.2657	1.48375	0.93118	-0.8507
907	-1.2517	1.73641	3.72935	1.68046	-0.3939	1.48757	0.7588	-1.1534
908	-1.4191	1.5938	3.55852	1.59275	-0.4007	1.35318	0.73297	-0.8793
909	-1.3845	1.71774	3.51849	1.62272	-0.4403	1.4803	0.99407	-0.9525
910	-1.3606	1.67571	3.57129	1.5177	-0.2772	1.44338	0.74367	-0.6513
911	-1.5503	1.5641	3.45411	1.56338	-0.4357	1.3236	0.58463	-0.8342
912	-1.5518	1.58762	3.55099	1.57333	-0.6869	1.32823	0.69525	-0.7972
913	-1.6842	1.68008	3.5645	1.8338	-0.4099	1.45622	0.73749	-1.3136
914	-1.5485	1.90182	3.86173	1.91706	-0.116	1.64902	0.96499	-0.7724

915	-1.4866	1.66534	3.59123	1.65393	-0.418	1.38098	0.90229	-1.0138
916	-1.4326	1.77301	3.71433	1.78276	-0.4525	1.43367	0.76712	-0.9666
917	-1.3082	1.83658	3.65317	1.78114	-0.4059	1.44413	0.71103	-0.9973
918	-1.3256	1.78907	3.67299	1.80617	-0.4856	1.48105	0.98365	-0.968
919	-1.3468	1.8579	3.53952	1.80043	-0.4777	1.4776	0.72487	-0.6112
920	-1.3658	1.58519	3.31931	1.50457	-0.7157	1.33241	0.63533	-0.9381
921	-1.4202	1.70052	3.60161	1.63125	-0.6522	1.37405	0.90881	-0.5736
922	-1.28	1.70524	3.60654	1.66275	-0.5938	1.39649	0.9424	-0.7931
923	-1.2902	1.62394	3.53689	1.55854	-0.5012	1.33547	0.92814	-0.6784
924	-1.0676	1.75853	3.59714	1.5194	-0.62	1.44386	1.00296	-0.7129
925	-1.2313	1.69555	3.64608	1.65657	-0.4238	1.46874	0.90488	-0.7338
926	-1.2664	1.73041	3.65545	1.68319	-0.6366	1.51712	0.85631	-1.0228
927	-1.1642	1.76232	3.89638	1.73149	-0.5076	1.57241	0.82325	-0.8223
928	-1.3701	1.74844	3.90029	1.8535	-0.6447	1.67196	1.19812	-0.7786
929	-1.5802	1.59194	3.40421	1.76029	-0.5291	1.46222	0.85192	-1.1565
930	-1.5776	1.71852	3.62283	1.78515	-0.4385	1.49081	0.78055	-0.792
931	-1.5012	1.59496	3.67537	1.56016	-0.7158	1.43862	0.67704	-1.021
932	-1.7194	1.72241	3.74986	1.75479	-0.5383	1.43592	0.92662	-0.8428
933	-1.8072	1.68152	3.34367	1.75012	-0.5232	1.34906	0.7102	-0.6215
934	-1.6831	1.55828	3.28369	1.48306	-0.5924	1.21076	0.47945	-1.1435
935	-1.4907	1.73669	3.44558	1.64801	-0.4261	1.36289	0.49042	-0.6082
936	-1.3678	1.75833	3.5581	1.5932	-0.3423	1.46727	0.73532	-0.674
937	-1.3416	1.75311	3.61047	1.56992	-0.6524	1.47085	0.76574	-0.6615
938	-1.3999	1.8878	3.72516	1.78984	-0.2635	1.51658	0.88087	-0.8494
939	-1.5561	1.80366	3.4715	1.70182	-0.4659	1.36057	0.67691	-0.8946
940	-1.5271	1.66249	3.44388	1.53255	-0.3766	1.28189	0.61229	-0.9408
941	-1.685	1.6757	3.49153	1.70385	-0.4389	1.29465	0.45864	-0.9659
942	-1.4558	1.65254	3.28383	1.50969	-0.7097	1.26943	0.54406	-0.9668
943	-1.565	1.69638	3.45816	1.60571	-0.5308	1.43624	0.49276	-0.7431
944	-1.4766	1.70006	3.54269	1.58507	-0.4804	1.31647	0.47885	-0.9138
945	-1.4858	1.63024	3.44384	1.55619	-0.6433	1.2308	0.71327	-0.8714
946	-1.4635	1.75481	3.57415	1.68327	-0.4373	1.35364	1.05427	-0.8866
947	-1.4222	1.84381	3.47362	1.71178	-0.3765	1.37859	1.18147	-0.7721
948	-1.5747	1.72231	3.25128	1.69523	-0.2675	1.27468	1.11544	-0.7997
949	-1.6061	1.58043	3.13477	1.48694	-0.4594	1.07416	0.79754	-1.2201
950	-1.6564	1.62476	3.28507	1.57299	-0.3562	1.12242	0.8813	-0.9484
951	-1.4695	1.81827	3.31566	1.6957	-0.2139	1.26546	0.96795	-0.6622
952	-1.6644	1.62802	3.22881	1.65816	-0.4051	1.11638	0.80801	-0.8257
953	-1.4207	1.69306	3.21605	1.53862	-0.4697	1.11816	0.88429	-0.8871
954	-1.3597	1.81202	3.49018	1.70937	-0.3844	1.29791	0.97675	-0.7686
955	-1.4007	1.81452	3.38242	1.76175	-0.5818	1.20992	1.03849	-1.0838
956	-1.5848	1.68235	3.18992	1.67052	-0.4751	1.08985	0.92021	-0.7056
957	-1.5096	1.72599	3.23341	1.69036	-0.425	1.12853	0.60841	-0.9566
958	-1.4703	1.90416	3.28461	1.80996	-0.4917	1.26801	0.89709	-1.6549
959	-1.4601	1.69229	3.14059	1.52531	-0.4967	1.05057	0.68488	-1.1152
960	-1.3824	1.63223	3.0437	1.47846	-0.5879	1.05643	0.77673	-0.7313

961	-1.4245	1.6909	3.15212	1.47692	-0.6362	1.06958	0.63747	-0.9619
962	-1.4034	1.64629	3.20175	1.50015	-0.7365	1.03846	0.51429	-0.8198
963	-1.4722	1.66464	3.28182	1.58072	-0.655	1.13793	0.81556	-0.992
964	-1.5277	1.95264	3.51427	1.85748	-0.4131	1.33744	0.91206	-0.4927
965	-1.4991	1.84978	3.92161	1.92535	-0.4855	1.52332	0.9449	-1.0839
966	-1.446	1.7718	3.92727	1.71402	-0.5316	1.5797	0.69611	-0.8555
967	-1.5381	1.79372	3.83013	1.80686	-0.3544	1.50508	1.01209	-0.8161
968	-1.693	1.60957	3.21661	1.62054	-0.4791	1.07157	0.87384	-0.7142
969	-1.6987	1.5565	3.09428	1.48923	-0.6479	0.98263	0.80437	-0.7159
970	-1.788	1.85181	3.32237	1.87346	-0.2202	1.22495	0.98778	-0.5781
971	-1.6403	1.8834	3.34506	1.87896	-0.2078	1.15638	1.12531	-0.7195
972	-1.4629	1.78474	3.36874	1.68758	-0.5192	1.15668	1.38076	-0.8245
973	-1.4927	1.88834	3.50111	1.89756	-0.4383	1.30696	1.33886	-0.4506
974	-1.429	1.6996	3.35103	1.64477	-0.4927	1.17209	1.31456	-0.8554
975	-1.4361	1.85813	3.44047	1.76926	-0.4383	1.24399	1.43361	-0.7273
976	-1.4914	1.76968	3.44055	1.76774	-0.5802	1.13965	1.26132	-0.7782
977	-1.2931	1.6453	3.31295	1.52408	-0.3942	1.18562	1.35024	-1.0761
978	-1.5308	1.62826	3.2523	1.59462	-0.4732	1.08161	0.89099	-1.2104
979	-1.4844	1.59262	3.15421	1.62777	-0.3596	1.01459	1.19729	-0.9681
980	-1.57	1.73321	3.34201	1.79176	-0.2077	1.15975	1.20563	-0.9175
981	-1.5123	1.68916	3.28345	1.71781	-0.378	1.15427	1.16697	-0.9552
982	-1.2751	1.83218	3.28547	1.69822	-0.2547	1.26882	1.20461	-0.9727
983	-1.4239	1.75488	3.37773	1.7362	-0.4256	1.14084	1.30846	-0.7886
984	-1.4328	1.68919	3.1208	1.62334	-0.4809	0.93513	1.12255	-1.2446
985	-1.4318	1.60195	3.05243	1.50697	-0.4906	0.9122	1.07054	-0.8944
986	-1.4353	1.61305	3.0705	1.52185	-0.3	0.90971	0.96912	-0.866
987	-1.4123	1.87245	3.13451	1.78027	0.04176	1.04185	1.11492	-0.5173
988	-1.6016	1.52975	3.03072	1.65876	-0.4708	1.12415	1.28357	-1.0924
989	-1.7425	1.60605	2.98074	1.60248	-0.3578	1.04449	1.21376	-1.0826
990	-1.5311	1.74024	3.32896	1.65129	-0.1047	1.13298	1.02017	-0.8723
991	-1.4924	1.8039	3.38332	1.73306	-0.0945	1.17456	1.05733	-0.7638
992	-1.3721	1.79518	3.31124	1.65402	-0.1605	1.33283	1.19468	-0.5357
993	-1.4766	1.86356	3.70619	1.74857	-0.3169	1.47997	0.64235	-0.7503
994	-1.6782	1.76129	3.354	1.84164	-0.1327	1.31559	1.10926	-0.9167
995	-1.7102	1.74721	3.23617	1.82547	-0.194	1.09861	1.30936	-0.7464
996	-1.2698	1.66489	3.38405	1.50154	0.01964	1.06195	1.10666	-0.8651
997	-1.3817	1.70567	3.48395	1.66787	-0.2764	1.16183	1.19238	-1.2651
998	-1.5043	1.6859	3.24501	1.67669	-0.3469	1.00408	1.28915	-0.6842
999	-1.6263	1.64817	3.15236	1.68767	-0.2218	0.98955	1.52229	-0.9873
1000	-1.6342	1.7683	3.26061	1.84377	-0.3323	1.07349	1.05298	-0.9276
1001	-1.337	1.81714	3.59847	1.76486	-0.364	1.21032	1.53372	-1.1926
1002	-1.2836	1.769	3.46099	1.76758	-0.0971	1.18886	1.50241	-0.5978
1003	-1.431	1.74376	3.36374	1.74602	-0.4384	1.18524	1.16269	-0.6122
1004	-1.5005	1.79908	3.45621	1.87395	-0.3284	1.2593	1.54858	-0.8024
1005	-1.3974	1.60717	3.38464	1.6028	-0.4956	1.20788	1.22465	-1.1386
1006	-1.5218	1.71355	3.28319	1.73659	-0.2592	1.2943	1.11241	-1.0503

1007	-1.6645	1.65181	3.18683	1.61166	-0.503	0.99534	1.03418	-1.0031
1008	-1.5693	1.79552	3.21869	1.71566	-0.2546	1.06746	1.11606	-0.7395
1009	-1.6202	1.68581	3.16914	1.64807	-0.1109	0.96532	1.12787	-0.6838
1010	-1.6238	1.65826	3.06946	1.61103	-0.2738	0.95428	0.83033	-0.9855
1011	-1.5095	1.80805	3.32712	1.75031	0.02528	1.19235	1.05338	-0.6249
1012	-1.6167	1.67286	3.17982	1.59394	-0.127	0.9971	0.67476	-0.6484
1013	-1.5641	1.75454	3.16563	1.80949	-0.0705	1.07593	0.99909	-0.7644
1014	-1.613	1.77155	3.29792	1.77606	-0.2116	1.18704	0.90774	-0.7178
1015	-1.3987	1.80717	3.39631	1.69638	-0.0978	1.18459	0.66674	-0.9391
1016	-1.5864	1.75759	3.29188	1.69806	-0.3386	1.02769	0.75853	-0.8803
1017	-1.4559	1.73546	3.27681	1.65509	-0.25	1.03352	0.55982	-1.1335
1018	-1.4377	1.72654	3.2554	1.65226	-0.1645	1.16282	0.54779	-0.8407
1019	-1.45	1.57194	3.21164	1.42082	-0.2333	1.15104	0.53035	-0.9147
1020	-1.549	1.65164	3.38337	1.7308	-0.2353	1.09666	0.52249	-0.6961
1021	-1.6094	1.76725	3.30556	1.73847	-0.3658	1.21038	0.92195	-0.7731
1022	-1.5888	1.68913	3.29678	1.6362	-0.3124	1.06918	0.65509	-0.903
1023	-1.5157	1.87356	3.39347	1.70843	-0.4055	1.26851	0.89634	-0.6184
1024	-1.606	1.60452	3.21661	1.55502	-0.3866	1.09611	0.65074	-0.8047
1025	-1.4873	1.83895	3.38956	1.70453	-0.2496	1.28405	0.78919	-0.7656
1026	-1.553	1.71312	3.37889	1.65477	-0.5755	1.34581	0.83645	-0.7453
1027	-1.6807	1.73356	3.44685	1.75947	-0.4557	1.32817	0.7388	-1.0327
1028	-1.5733	1.73478	3.23997	1.65626	-0.2841	1.35163	0.83397	-0.7499
1029	-1.6905	1.69909	3.18142	1.65223	-0.2805	1.31761	0.7897	-0.8389
1030	-1.7527	1.71232	3.12702	1.72039	-0.4649	1.17977	0.65977	-0.9229
1031	-1.693	1.65172	3.03599	1.60984	-0.366	1.11744	0.75963	-1.2024
1032	-1.6829	1.79839	3.28143	1.897	-0.2527	1.25288	0.95168	-0.8189
1033	-1.509	1.69733	3.27118	1.64565	-0.5552	1.17346	1.04396	-0.8036
1034	-1.4569	1.61674	3.22741	1.54078	-0.0968	1.08975	0.78852	-0.9519
1035	-1.4403	1.6279	3.43425	1.63808	-0.6135	1.14567	0.82558	-0.9352
1036	-1.5528	1.47571	3.2413	1.58058	-0.6849	1.0207	0.75373	-1.0092
1037	-1.5168	1.57579	3.2478	1.56727	-0.4933	1.04023	0.48618	-0.9624

1.1.2. FS C2

Appendix Table 1.3. Natural log of key indicator element abundance variability against conservative lithophile element Ti in core FS C2 in the Three Rivers Estuarine Complex saltmarshes.

Depth (mm)	Si/Ti	K/Ti	Ca/Ti	Br/Ti	Sr/Ti	Zr/Ti	Ba/Ti
1	-2.215	-0.0362	1.13665	-1.1489	-0.6147	-1.357	-2.587
2	-1.9911	-0.087	1.1737	-1.2297	-0.7664	-1.9641	-3.0415
3	-1.9938	-0.0578	1.13667	-1.1431	-0.9049	-1.818	-3.9727
4	-2.0421	-0.0357	1.1072	-1.1078	-0.9068	-1.6709	-3.8189
5	-2.031	-0.0221	1.0557	-0.9801	-0.9271	-1.8485	-3.4487
6	-1.8774	0.0123	1.16983	-0.8624	-0.8789	-2.2051	-2.9189
7	-1.9502	-0.0418	1.16903	-1.0072	-0.8317	-1.8461	-3.0444
8	-1.9719	-0.0226	1.16397	-1.1072	-0.7791	-1.872	-2.9706
9	-1.9746	-0.0485	1.15368	-1.1031	-0.7482	-1.7967	-3.1687
10	-1.8653	-0.0085	1.10431	-1.1807	-0.6527	-1.6627	-2.5856
11	-1.8755	0.0403	1.31753	-0.7023	-0.558	-1.4066	-2.4412
12	-1.7809	0.04057	1.27205	-0.8224	-0.6206	-1.503	-2.4652
13	-1.7426	0.08526	1.41097	-0.9009	-0.557	-1.2958	-2.4302
14	-1.8995	-0.0254	1.15364	-0.9712	-0.6499	-1.8005	-2.8597
15	-1.9864	-0.0504	1.12033	-1.2194	-0.7311	-1.5842	-2.6304
16	-1.9169	0.01915	1.28852	-1.1852	-0.594	-1.3026	-2.4799
17	-1.9998	0	1.28523	-1.2244	-0.6322	-1.2271	-2.8044
18	-1.9735	-0.0505	1.25065	-1.0443	-0.6752	-1.4236	-2.7062
19	-1.8581	0.02079	1.27848	-0.998	-0.5785	-1.613	-2.7415
20	-1.8145	0.0552	1.37864	-1.1017	-0.5159	-1.7122	-2.4196
21	-1.8615	-0.0209	1.25608	-1.0998	-0.6543	-1.5493	-2.7696
22	-1.9265	-0.0343	1.21951	-1.1386	-0.7122	-1.7847	-2.6366
23	-2.0293	-0.044	1.21736	-0.8974	-0.7519	-1.8773	-2.5578
24	-2.0035	-0.0097	1.13985	-1.0382	-0.7635	-1.8746	-2.5901
25	-2.0502	-0.0147	1.19882	-0.8197	-0.5555	-1.4879	-2.7777
26	-1.9042	0.07041	1.17344	-1.1399	-0.6808	-0.3975	-2.2607
27	-2.0813	-0.1771	1.0182	-1.431	-0.9059	-0.7235	-2.4719
28	-1.9203	-0.0263	1.1753	-1.1114	-0.73	-0.5253	-2.2915
29	-1.9936	-0.1977	0.99369	-1.4206	-1.2285	-0.8666	-2.4944
30	-1.9261	0.03488	1.27747	-1.1103	-0.5817	-1.4237	-2.4871
31	-2.09	-0.0574	1.18162	-0.9928	-0.6512	-1.4846	-2.5856
32	-2.0503	-0.0187	1.36366	-1.0481	-0.6168	-1.4864	-2.4052
33	-2.1391	-0.1644	1.05614	-1.3889	-0.7758	-1.7482	-2.5465
34	-1.9667	-0.0013	1.28791	-1.2013	-0.5835	-1.3329	-2.4408
35	-2.0629	-0.062	1.17665	-1.3563	-0.7184	-1.5318	-2.6031
36	-2.201	-0.1183	1.15116	-1.4185	-0.7061	-1.1513	-2.5433
37	-2.0007	-0.0068	1.23808	-1.1868	-0.589	-1.1009	-2.3905
38	-2.1211	-0.1002	1.1123	-1.313	-0.7427	-1.428	-2.4406
39	-2.1151	-0.0591	1.25038	-1.3188	-0.6289	-1.3922	-2.6818

40	-2.0886	0.00866	1.18786	-1.3169	-0.5602	-1.1455	-2.4036
41	-1.9832	-0.0168	1.29178	-1.3773	-0.5979	-1.5156	-2.5691
42	-2.0829	-0.0863	1.2477	-1.4029	-0.6416	-1.3801	-2.5349
43	-2.1813	-0.1737	1.04505	-1.3153	-0.7918	-1.5998	-2.8577
44	-1.9541	-0.0741	1.24416	-1.4021	-0.6579	-1.2457	-2.7173
45	-1.8573	0.00815	1.28153	-1.3288	-0.5659	-1.4429	-2.9176
46	-1.9825	0.0308	1.26466	-1.1857	-0.5252	-1.0349	-2.4722
47	-2.0181	-0.0317	1.18995	-1.3186	-0.6182	-1.1478	-2.646
48	-2.1249	-0.1241	1.27896	-1.4219	-0.6116	-1.1749	-2.6967
49	-1.9519	-0.0257	1.29186	-1.3469	-0.5473	-1.2714	-2.4133
50	-2.0489	-0.0452	1.22233	-1.27	-0.598	-1.2605	-2.5523
51	-1.9982	-0.0521	1.32743	-1.3991	-0.5146	-1.1306	-2.8147
52	-1.9494	-0.0109	1.34548	-1.3152	-0.6716	-1.0964	-2.7543
53	-1.9746	-0.0126	1.18477	-1.3522	-0.6037	-1.2327	-2.3707
54	-1.935	0.08719	1.336	-1.338	-0.5702	-1.1379	-2.2276
55	-1.8787	0.0152	1.38998	-1.2979	-0.563	-1.328	-2.4156
56	-1.921	-0.0775	1.24215	-1.3881	-0.2616	-1.4638	-2.6006
57	-1.8935	-0.0707	1.16736	-1.4436	-0.6789	-1.391	-3.013
58	-1.8339	0.03912	1.24068	-1.4978	-0.6331	-1.5109	-2.795
59	-2.0569	0.00133	1.24251	-1.4187	-0.6392	-1.2949	-2.6258
60	-2.0793	-0.0866	1.17304	-1.3083	-0.6536	-1.3703	-2.9769
61	-1.9298	0.00076	1.18441	-1.3006	-0.6634	-1.3878	-2.9634
62	-1.9373	0.03081	1.09341	-1.1429	-0.6447	-1.3339	-3.2841
63	-1.7959	-0.002	1.22782	-1.2408	-0.6706	-1.4573	-2.6271
64	-2.0187	-0.1016	1.11383	-1.3034	-0.8348	-1.541	-3.2981
65	-1.8313	0.00354	1.13515	-1.358	-0.6925	-1.4971	-2.4705
66	-1.8842	-0.0062	1.30365	-1.3174	-0.6173	-1.3803	-2.7698
67	-1.8607	0.0564	1.29781	-1.405	-0.6121	-1.2886	-2.4859
68	-1.8086	0.09174	1.41335	-1.5456	-0.575	-1.1226	-2.1489
69	-1.9216	0.01453	1.27944	-1.3238	-0.6429	-1.4071	-2.5878
70	-1.9952	-0.0129	1.15569	-1.383	-0.6839	-1.4897	-2.7555
71	-1.9387	0.07211	1.2639	-1.3191	-0.6164	-1.1523	-2.2976
72	-1.8954	-0.0018	1.27329	-1.3397	-0.7441	-1.2456	-2.9629
73	-1.8107	0.06508	1.31751	-1.3809	-0.6644	-1.5313	-2.7265
74	-1.9091	0.02106	1.2551	-1.2921	-0.7131	-1.3548	-2.8468
75	-1.8127	-0.0215	1.13183	-1.37	-0.7579	-1.3207	-2.6019
76	-1.8601	0.02313	1.25268	-1.2467	-0.754	-1.3041	-2.5933
77	-1.8898	0.05418	1.20301	-1.3104	-0.6448	-1.3227	-2.9677
78	-1.9841	-0.0202	1.08704	-1.3079	-0.755	-1.2994	-2.9457
79	-1.9484	0.02	1.10771	-1.3312	-0.7153	-1.3631	-2.6372
80	-1.9814	-0.0375	1.07963	-1.2735	-0.7738	-1.3835	-2.7857
81	-2.1294	-0.0474	1.03756	-1.1991	-0.7097	-1.4834	-2.4764
82	-1.9479	0.0645	1.19694	-1.1118	-0.5981	-1.1303	-2.33
83	-1.8863	0.07939	1.31361	-1.2318	-0.5629	-1.2727	-2.5621
84	-1.9896	-0.0288	1.23339	-1.4202	-0.7416	-1.5543	-2.3857
85	-1.8842	-0.0062	1.30365	-1.3174	-0.6173	-1.3803	-2.7698
86	-1.8607	0.0564	1.29781	-1.405	-0.6121	-1.2886	-2.4859
87	-1.8086	0.09174	1.41335	-1.5456	-0.575	-1.1226	-2.1489

88	-1.7928	0.04792	1.19691	-1.5733	-0.7419	-1.244	-2.7327
89	-1.6369	0.129	1.40389	-1.4303	-0.6936	-1.2833	-2.269
90	-1.8101	0.04247	1.39414	-1.5191	-0.7517	-1.659	-2.8057
91	-1.7999	0.1406	1.51361	-1.6317	-0.4435	-1.4456	-2.6849
92	-1.9315	-0.1061	1.61259	-1.4086	-0.5231	-0.5285	-2.584
93	-2.1346	-0.275	1.4688	-1.6328	-0.5931	-0.7238	-2.9904
94	-1.8101	0.00597	1.59932	-1.2952	-0.3311	-0.7366	-2.3722
95	-1.8405	-0.0263	1.52447	-1.5393	-0.4421	-0.9117	-2.2307
96	-1.6943	0.08474	1.55488	-1.6797	-0.5351	-1.2384	-2.971
97	-1.7866	-0.0058	1.34606	-1.6482	-0.5336	-1.033	-2.4017
98	-1.6628	0.13269	1.59146	-1.5154	-0.4731	-1.2087	-2.2612
99	-1.6789	0.08701	1.54175	-1.3523	-0.4829	-1.1278	-2.5474
100	-1.7432	0.0419	1.4877	-1.6565	-0.4304	-1.0803	-2.5345
101	-1.8938	-0.032	1.29977	-1.7416	-0.43	-1.0189	-2.4293
102	-1.8695	0.03816	1.41276	-1.4947	-0.5172	-1.106	-2.2739
103	-1.7159	0.10238	1.54777	-1.3792	-0.4206	-0.7999	-2.4885
104	-1.7475	-0.0328	1.39448	-1.5831	-0.4563	-0.9867	-2.9027
105	-1.941	-0.1866	1.41895	-1.7602	-0.6427	-1.2304	-2.8637
106	-1.8022	0.0176	1.634	-1.4295	-0.3221	-0.4964	-2.6649
107	-1.812	-0.0397	1.53702	-1.233	-0.3487	-0.7594	-2.62
108	-1.7107	0.11336	1.48614	-1.2729	-0.3564	-0.6782	-2.1348
109	-1.7321	0.04341	1.38191	-1.4784	-0.4036	-0.8176	-2.577
110	-1.694	0.08528	1.47802	-1.1854	-0.4757	-0.859	-2.3761
111	-1.7693	-0.0481	1.39837	-1.3922	-0.4259	-0.8889	-2.4709
112	-1.8793	0.01111	1.4774	-1.3956	-0.3133	-0.6729	-2.2868
113	-1.8817	0.05638	1.63822	-1.3942	-0.1991	-0.763	-2.3028
114	-2.2334	-0.2958	1.37572	-1.4737	-0.443	-1.0234	-2.6578
115	-2.0061	-0.1874	1.34863	-1.3144	-0.3765	-0.6048	-2.4886
116	-1.9574	-0.0885	1.41197	-1.5718	-0.3959	-0.7598	-2.2726
117	-1.8161	0.07441	1.56432	-1.3273	-0.4363	-0.638	-2.3032
118	-1.961	-0.0764	1.41052	-1.4199	-0.5307	-1.1108	-3.2411
119	-2.0118	-0.0996	1.40451	-1.4633	-0.6581	-0.9613	-3.2933
120	-1.9116	-0.0408	1.36093	-1.4826	-0.6411	-1.0622	-2.3861
121	-1.9177	-0.0713	1.27168	-1.4783	-0.5764	-0.8901	-2.5189
122	-1.7789	-0.0107	1.38722	-1.0513	-0.2058	-0.5667	-2.5387
123	-1.6686	0.02211	1.48967	-0.9309	-0.1402	-0.4442	-2.3655
124	-1.8115	-0.0413	1.35773	-1.1452	-0.3251	-0.5658	-2.5964
125	-1.8253	-0.0674	1.3431	-1.1545	-0.3348	-0.6498	-2.4569
126	-1.6209	0	1.49361	-1.1936	-0.259	-0.7231	-2.362
127	-1.87	-0.0963	1.23635	-1.4526	-0.3579	-0.6681	-2.5721
128	-1.9028	-0.0078	1.49805	-1.1542	-0.1868	-0.4618	-2.2293
129	-1.9281	-0.0194	1.42527	-1.2593	-0.354	-0.658	-2.4666
130	-1.81	0.00622	1.45485	-1.3532	-0.3338	-0.5933	-2.3401
131	-1.8645	-0.035	1.29283	-1.4552	-0.4628	-0.825	-2.453
132	-1.8313	-0.0158	1.40282	-1.4408	-0.4273	-0.7899	-2.4807
133	-2.0711	-0.1718	1.3541	-1.4993	-0.6047	-0.9921	-2.6717
134	-1.9574	-0.0885	1.41197	-1.5718	-0.3959	-0.7598	-2.2726
135	-1.8161	0.07441	1.56432	-1.3273	-0.4363	-0.638	-2.3032

136	-1.861	0.02476	1.49443	-1.4988	-0.4773	-0.8102	-2.7488
137	-1.8979	0.01046	1.43582	-1.3731	-0.4534	-1.0278	-2.4586
138	-2.0104	-0.1401	1.25827	-1.6188	-0.5476	-0.7661	-2.843
139	-1.9176	-0.0398	1.37659	-1.5179	-0.5631	-1.0997	-2.605
140	-1.8247	-0.0037	1.46065	-1.4353	-0.5741	-0.9463	-2.3119
141	-1.8938	0.04404	1.48273	-1.1799	-0.4131	-1.0176	-2.5226
142	-1.9218	-0.0457	1.40884	-1.5158	-0.4021	-0.7771	-3.1729
143	-1.961	-0.0764	1.41052	-1.4199	-0.5307	-1.1108	-3.2411
144	-2.0118	-0.0996	1.40451	-1.4633	-0.6581	-0.9613	-3.2933
145	-1.9466	-0.0302	1.32643	-1.5336	-0.4852	-1.066	-3.2225
146	-1.9019	0.04561	1.49324	-1.4727	-0.5884	-0.9142	-2.5007
147	-1.8524	0.05754	1.44612	-1.5531	-0.6075	-0.8659	-2.59
148	-1.9956	-0.1886	1.31595	-1.7636	-0.6948	-1.0286	-2.7388
149	-2.0289	-0.0974	1.44502	-1.5123	-0.6621	-0.803	-2.5865
150	-1.7471	-0.0431	1.5292	-1.4387	-0.5148	-0.7422	-2.8612
151	-1.6964	0.01625	1.63755	-1.4539	-0.4506	-0.546	-2.61
152	-1.8758	-0.0251	1.52593	-1.501	-0.4197	-0.7056	-2.5823
153	-1.9126	-0.0643	1.51121	-1.506	-0.5754	-0.9483	-2.3514
154	-1.8711	-0.0223	1.52692	-1.4688	-0.5804	-0.9841	-2.5955
155	-1.9523	0.01179	1.49081	-1.4164	-0.5104	-0.9149	-2.3803
156	-1.9142	-0.0189	1.25125	-1.5347	-0.6261	-0.9682	-2.6415
157	-1.9887	-0.04	1.4377	-1.4348	-0.6506	-0.9134	-2.5534
158	-1.8394	-0.0111	1.46229	-1.4215	-0.6775	-1.1022	-2.4935
159	-1.9116	-0.0408	1.36093	-1.4826	-0.6411	-1.0622	-2.3861
160	-1.9177	-0.0713	1.27168	-1.4783	-0.5764	-0.8901	-2.5189
161	-1.8858	0.07053	1.40637	-1.3199	-0.5719	-0.9887	-2.5478
162	-1.7625	0.01492	1.33212	-1.5172	-0.6673	-1.0894	-2.493
163	-1.8868	-0.041	1.30609	-1.4899	-0.7019	-1.0413	-2.8563
164	-2.2098	-0.1963	1.35947	-1.4523	-0.7362	-1.2009	-2.7839
165	-1.9908	-0.0587	1.14014	-1.3408	-0.7703	-1.0858	-2.7921
166	-1.9306	-0.0631	1.1647	-1.51	-0.8019	-1.0562	-2.8597
167	-2.0896	-0.1834	1.09659	-1.5879	-0.8681	-0.9581	-3.0065
168	-1.9592	-0.0557	1.24836	-1.4832	-0.7149	-1.121	-2.2766
169	-2.1417	-0.1009	1.17792	-1.4293	-0.7917	-1.189	-2.4718
170	-2.1431	-0.1511	1.02004	-1.4904	-0.8666	-1.1328	-2.781
171	-2.0154	-0.082	1.23035	-1.2106	-0.6702	-0.7955	-2.3698
172	-2.0026	-0.0558	1.2636	-1.2663	-0.638	-1.1799	-2.7569
173	-2.0043	-0.0999	1.25442	-1.533	-0.7579	-1.0955	-3.0444
174	-1.8895	0.0467	1.30672	-1.2976	-0.6496	-0.8882	-2.414
175	-2.0244	-0.0679	1.26112	-1.322	-0.7826	-1.1662	-2.8232
176	-2.0364	-0.0267	1.24706	-1.4689	-0.7582	-1.377	-2.6703
177	-2.1347	-0.1168	1.25986	-1.3465	-0.715	-1.1922	-3.0096
178	-2.0108	-0.0085	1.31855	-1.3372	-0.6409	-0.9327	-2.6607
179	-2.0884	0.03973	1.29776	-1.5273	-0.6271	-0.7733	-2.4599
180	-2.0805	-0.1913	1.41404	-1.6174	-0.6556	-1.0118	-2.6742
181	-1.9229	-0.0299	1.30119	-1.209	-0.4446	-0.6644	-2.491
182	-2.1231	-0.0211	1.28089	-1.3102	-0.5991	-1.0013	-2.5921
183	-2.1538	-0.1087	1.32249	-1.392	-0.6005	-0.9597	-2.7898

184	-2.0091	-0.098	1.26238	-1.4511	-0.5681	-0.9618	-2.2323
185	-2.0154	-0.0404	1.40851	-1.3001	-0.3544	-0.6959	-2.8075
186	-2.1373	-0.0652	1.15921	-1.099	-0.5207	-0.8433	-2.3245
187	-2.0273	-0.0444	1.24646	-1.17	-0.6119	-1.044	-2.4423
188	-2.0043	-0.0826	1.10275	-1.3355	-0.731	-0.8716	-2.8668
189	-1.9347	-0.0018	1.26816	-1.1999	-0.5582	-0.8896	-2.649
190	-1.9496	-0.0409	1.24472	-1.094	-0.511	-1.0038	-2.253
191	-2.0281	-0.1108	1.16435	-1.2606	-0.6004	-1.1648	-2.3843
192	-1.9871	-0.006	1.4204	-1.2515	-0.5158	-0.8172	-2.2142
193	-1.95	-0.1192	1.33473	-1.355	-0.6296	-1.3058	-2.4119
194	-1.9583	-0.0848	1.34583	-1.3441	-0.5915	-0.9297	-2.4886
195	-1.9388	-0.063	1.23782	-1.2828	-0.5776	-0.9884	-2.6183
196	-2.0581	-0.0072	1.31545	-1.2533	-0.6144	-0.8127	-2.3256
197	-2.041	-0.0132	1.3194	-1.3994	-0.6444	-1.0955	-2.4413
198	-1.9791	-0.0302	1.23274	-1.334	-0.6993	-1.1073	-2.8915
199	-2.0848	-0.1082	1.15905	-1.4257	-0.8688	-1.0984	-2.663
200	-2.0179	-0.0328	1.15249	-1.4144	-0.6924	-0.8484	-2.5195
201	-1.859	-0.071	1.72	-1.8352	-0.3943	-0.7252	-2.6406
202	-1.9176	-0.0626	1.69409	-1.666	-0.3181	-0.6986	-2.5076
203	-2.1301	-0.2561	1.35752	-1.8885	-0.4986	-0.841	-2.5576
204	-1.859	-0.071	1.72	-1.8352	-0.3943	-0.7252	-2.6406
205	-1.9989	-0.0444	1.24646	-1.17	-0.6119	-1.044	-2.4423
206	-2.0214	-0.0594	1.2082	-1.2671	-0.5222	-0.929	-2.4847
207	-2.0725	-0.1494	1.16529	-1.3915	-0.6769	-1.1217	-2.2568
208	-1.9679	-0.1638	1.40263	-1.4435	-0.7135	-1.1131	-2.6855
209	-1.9315	-0.1061	1.61259	-1.4086	-0.5231	-0.5285	-2.584
210	-2.1346	-0.275	1.4688	-1.6328	-0.5931	-0.7238	-2.9904
211	-1.8101	0.00597	1.59932	-1.2952	-0.3311	-0.7366	-2.3722
212	-1.8405	-0.0263	1.52447	-1.5393	-0.4421	-0.9117	-2.2307
213	-2.1167	-0.2048	1.2998	-1.7225	-0.5932	-0.8106	-2.5851
214	-1.8292	0.08822	1.74269	-1.4817	-0.2467	-0.4786	-2.3577
215	-1.7764	0.00413	1.81847	-1.5315	-0.3803	-0.5577	-2.4406
216	-2.0174	-0.2332	1.44639	-1.8798	-0.5233	-0.667	-3.3398
217	-1.9167	-0.0711	1.50078	-1.7829	-0.4977	-0.7517	-2.5879
218	-2.1301	-0.2561	1.35752	-1.8885	-0.4986	-0.841	-2.5576
219	-1.859	-0.071	1.72	-1.8352	-0.3943	-0.7252	-2.6406
220	-1.9176	-0.0626	1.69409	-1.666	-0.3181	-0.6986	-2.5076
221	-1.9655	-0.2142	1.61183	-1.8173	-0.471	-0.8269	-2.5858
222	-1.886	-0.18	1.63802	-1.7193	-0.4501	-0.5319	-2.7541
223	-1.5866	-0.0431	1.77861	-1.6072	-0.4843	-0.4789	-2.5434
224	-1.7174	-0.1608	1.67375	-1.5272	-0.3076	-0.6316	-2.7207
225	-1.9825	-0.3643	1.57739	-1.8605	-0.2925	-0.9876	-2.4757
226	-1.4764	0.02588	2.02897	-1.6756	-0.0175	-0.4079	-2.3555
227	-1.6371	-0.1828	1.79514	-2.0588	-0.387	-0.7837	-2.4961
228	-1.7645	-0.2675	1.50456	-2.2715	-0.5518	-0.8944	-2.4719
229	-1.4788	0.05668	1.9311	-1.7319	-0.2237	-0.6363	-2.6727
230	-1.5178	0.00753	1.71515	-1.8149	-0.2667	-0.6663	-2.7202
231	-1.4839	0.00316	1.72015	-1.9173	-0.4093	-0.5265	-2.7421

232	-1.5482	-0.0956	1.6674	-2.0514	-0.4655	-0.5448	-2.797
233	-1.7063	-0.0583	1.76134	-1.8337	-0.2282	-0.6056	-2.5318
234	-1.7283	-0.0484	1.70696	-1.6954	-0.3914	-0.7795	-2.5717
235	-1.4701	-0.0011	1.98294	-1.8332	-0.3492	-0.715	-2.6513
236	-1.5883	-0.0614	1.74968	-2.0798	-0.4274	-0.8379	-2.3334
237	-1.6069	-0.1304	1.68408	-2.1194	-0.4716	-0.9037	-2.4635
238	-1.6784	-0.1767	1.63952	-2.1253	-0.4908	-0.9165	-2.4601
239	-1.7419	-0.2286	1.5799	-2.1428	-0.5042	-0.9252	-2.4806
240	-1.7961	-0.2767	1.48643	-2.1682	-0.5326	-0.9426	-2.492
241	-1.8286	-0.3056	1.42407	-2.1698	-0.6562	-0.9394	-2.5293
242	-1.5045	0.03689	1.76383	-2.0818	-0.4056	-0.4818	-2.3594
243	-1.5067	-0.1306	1.82769	-1.8421	-0.3084	-0.1949	-2.5977
244	-1.4965	-0.079	1.7784	-1.773	-0.375	-0.3357	-2.2742
245	-1.5149	-0.1035	1.79566	-2.0039	-0.4493	-0.5037	-2.2382
246	-1.6291	-0.2237	1.79911	-1.9111	-0.3658	-0.4811	-2.6604
247	-1.6355	-0.1174	1.75915	-1.7844	-0.3725	-0.3737	-2.4032
248	-1.6052	-0.0396	1.81895	-1.8331	-0.4458	-0.6125	-2.4235
249	-1.5932	0.06499	1.80007	-1.7867	-0.3055	-0.5102	-2.4132
250	-1.7434	-0.1077	1.69773	-1.81	-0.4846	-0.8382	-2.5746
251	-1.8635	-0.2288	1.42689	-2.0094	-0.7074	-1.0434	-2.5919
252	-1.7845	-0.0744	1.55649	-1.6631	-0.5324	-0.8274	-2.6578
253	-1.7324	0.07926	1.74506	-1.5099	-0.3338	-0.6357	-2.3494
254	-1.75	-0.0604	1.62377	-1.614	-0.4489	-0.6193	-2.4421
255	-1.7856	-0.0765	1.41288	-1.4904	-0.5777	-0.8952	-2.3909
256	-1.8098	-0.0305	1.52625	-1.4363	-0.5813	-0.9921	-2.2835
257	-1.8701	-0.1574	1.50119	-1.6857	-0.6109	-0.7889	-2.6653
258	-1.7426	0.02294	1.50598	-1.4764	-0.4682	-0.5994	-2.6785
259	-1.772	0.04028	1.64302	-1.4122	-0.3939	-0.7542	-2.305
260	-1.9477	-0.1421	1.39432	-1.6046	-0.6605	-0.873	-2.6994
261	-1.8944	-0.1032	1.32866	-1.4099	-0.6447	-1.0279	-2.5708
262	-1.8955	-0.0043	1.35717	-1.3828	-0.5923	-0.95	-2.4725
263	-1.9746	-0.0832	1.32775	-1.5472	-0.7772	-1.2109	-3.0788
264	-1.7989	0.00712	1.42208	-1.3993	-0.6763	-1.065	-2.1947
265	-1.8863	-0.0316	1.30315	-1.5042	-0.7029	-1.1613	-2.4265
266	-1.9076	-0.0225	1.3031	-1.4765	-0.6593	-1.011	-2.4994
267	-1.8893	-0.0128	1.3834	-1.4178	-0.6446	-1.0125	-2.6476
268	-1.9149	-0.1515	1.23887	-1.6649	-0.7023	-0.8998	-2.7682
269	-1.7829	0.04674	1.52024	-1.5223	-0.5252	-0.9287	-2.448
270	-1.9846	-0.1934	1.25666	-1.6506	-0.7053	-1.1995	-2.9538
271	-1.8901	-0.0694	1.28125	-1.5474	-0.7179	-1.1494	-2.9897
272	-1.8536	-0.0291	1.33684	-1.437	-0.5935	-1.117	-2.6741
273	-1.9912	-0.13	1.22559	-1.6345	-0.7722	-0.9683	-2.8956
274	-1.8308	0.03917	1.48424	-1.5628	-0.5681	-1.0342	-2.6141
275	-1.8235	0.00183	1.36248	-1.4225	-0.5824	-1.0258	-2.3668
276	-2.0155	-0.193	1.22409	-1.6064	-0.8036	-1.1915	-2.7636
277	-1.912	-0.0289	1.32684	-1.5151	-0.6393	-1.2091	-2.6098
278	-1.949	-0.0368	1.35428	-1.5466	-0.6404	-0.9248	-2.6016
279	-2.0193	-0.0463	1.36265	-1.4483	-0.685	-0.9641	-3.0321

280	-1.8339	0.01314	1.22172	-1.5199	-0.6415	-0.9664	-2.392
281	-1.7789	-0.0251	1.31177	-1.5888	-0.6921	-1.0096	-2.8092
282	-1.9002	0.03749	1.39462	-1.3725	-0.5959	-1.0174	-2.2176
283	-1.8945	0.0134	1.33498	-1.2903	-0.6043	-0.9198	-2.3989
284	-1.988	-0.0442	1.25226	-1.4185	-0.6861	-1.1676	-2.6568
285	-1.9714	-0.0612	1.2429	-1.4546	-0.6817	-1.0637	-2.9255
286	-2.1507	-0.0884	1.18096	-1.5181	-0.7369	-1.0288	-3.095
287	-1.941	-0.0009	1.16335	-1.3575	-0.5792	-1.0239	-2.4476
288	-1.9207	-0.0471	1.13751	-1.4406	-0.6035	-1.007	-2.4469
289	-1.9499	-0.0614	1.12542	-1.3882	-0.6343	-0.9843	-2.4903
290	-1.998	-0.0721	1.12309	-1.3168	-0.6673	-0.9792	-2.535
291	-1.9917	-0.1044	1.10194	-1.4527	-0.7097	-0.9962	-2.603
292	-2.0012	-0.1262	1.09274	-1.5263	-0.7277	-1.0059	-2.6175
293	-1.9514	-0.0213	1.32028	-1.4909	-0.5309	-0.9447	-2.5409
294	-1.932	-0.0797	1.28087	-1.4877	-0.5629	-1.0321	-2.5191
295	-2.0213	-0.0468	1.19415	-1.3615	-0.5513	-0.8373	-2.4489
296	-2.1463	-0.1405	1.16515	-1.3841	-0.6084	-1.0011	-2.4116
297	-2.013	-0.139	1.23971	-1.3885	-0.5455	-0.7356	-2.5568
298	-2.1159	-0.1987	1.25602	-1.4793	-0.6121	-0.8807	-2.4148
299	-2.1633	-0.2361	1.27694	-1.3891	-0.5367	-0.7746	-2.716
300	-2.0832	-0.1774	1.32881	-1.4384	-0.4754	-0.7212	-2.4665
301	-2.1245	-0.0668	1.26572	-1.3562	-0.4278	-0.6303	-2.5641
302	-2.0755	-0.1135	1.20183	-1.2805	-0.4629	-0.8927	-2.5614
303	-2.3205	-0.2648	1.12017	-1.5441	-0.6393	-1.025	-2.5486
304	-2.0905	-0.0586	1.21103	-1.2468	-0.4547	-0.7626	-2.4889
305	-2.1537	-0.1101	1.16211	-1.2912	-0.5439	-1.3043	-2.5026
306	-2.0183	-0.0752	1.25133	-1.2096	-0.5168	-0.8605	-2.7525
307	-1.9792	-0.0862	1.19053	-1.212	-0.6132	-0.7565	-2.8033
308	-1.971	0.01748	1.28988	-1.0846	-0.503	-0.7496	-2.2671
309	-2.1442	-0.0595	1.06949	-1.117	-0.5616	-0.9615	-2.7271
310	-2.0458	-0.0791	1.07491	-1.0663	-0.5882	-0.9466	-2.6524
311	-2.1577	-0.0624	1.16844	-1.1278	-0.6267	-0.9937	-2.4712
312	-2.1167	-0.1142	1.06994	-1.1827	-0.6125	-0.7288	-2.5799
313	-2.0078	-0.0857	1.14451	-1.1806	-0.5776	-0.7233	-2.5761
314	-2.0124	0.00293	1.19975	-1.1976	-0.4904	-0.8258	-2.3095
315	-1.9653	-0.0397	1.19884	-1.3038	-0.6053	-1.1033	-2.5301
316	-1.9316	0.02545	1.2503	-1.1379	-0.5676	-0.8706	-2.3713
317	-2.0032	-0.0872	1.12895	-1.3581	-0.596	-0.8372	-2.5449
318	-1.8596	0.02641	1.24665	-1.3235	-0.5488	-0.8273	-2.3584
319	-1.9846	0.03323	1.17029	-1.229	-0.506	-0.8865	-2.428
320	-1.9817	-0.0282	1.17711	-1.2982	-0.5732	-0.7344	-2.3653
321	-2.0482	-0.1145	1.08146	-1.309	-0.6489	-0.7843	-2.581
322	-1.9922	-0.0925	1.1346	-1.2235	-0.7879	-0.9522	-2.7739
323	-2.0281	-0.0088	1.23509	-1.2317	-0.6574	-0.8834	-2.7337
324	-2.0264	-0.0743	1.13822	-1.1674	-0.6247	-0.7892	-2.531
325	-1.9536	-0.0621	1.11081	-0.9428	-0.5097	-0.7541	-3.0255
326	-1.9859	-0.121	1.07736	-1.174	-0.7434	-0.767	-2.5882
327	-1.7552	-0.0086	1.23355	-1.076	-0.6059	-1.0111	-2.5468

328	-1.7273	0.0506	1.29572	-1.2881	-0.7553	-0.7963	-2.1986
329	-1.9472	-0.1372	1.1184	-1.3436	-0.8107	-0.8269	-2.5154
330	-1.939	-0.0583	1.33849	-1.2539	-0.7352	-0.8089	-2.4373
331	-1.8328	-0.0186	1.20649	-1.1983	-0.613	-0.9635	-2.8649
332	-2.0479	-0.0758	1.08665	-1.2817	-0.783	-0.7968	-2.6701
333	-1.9237	0.01809	1.25399	-1.1842	-0.6551	-0.9413	-2.4312
334	-1.8906	0.05193	1.233	-1.1876	-0.7049	-0.923	-2.4386
335	-2.1453	-0.1543	0.99609	-1.3223	-0.8778	-0.9727	-3.0552
336	-2.0522	-0.0765	1.20102	-1.2359	-0.6892	-0.7397	-2.165
337	-2.2894	-0.1719	1.00182	-1.2372	-0.8697	-0.9659	-2.6611
338	-2.0205	-0.0343	1.15977	-1.3497	-0.8778	-0.7963	-2.7477
339	-1.9808	0.014	1.15378	-1.2405	-0.6702	-0.7971	-2.4949
340	-1.9376	-0.0334	1.19546	-1.4109	-0.8197	-0.891	-2.7777
341	-1.981	0.02002	1.24351	-1.3921	-0.6619	-0.7943	-2.4878
342	-2.2181	-0.2288	0.86199	-1.5367	-0.8717	-0.799	-2.8045
343	-1.9979	-0.0861	1.03574	-1.5553	-0.8294	-0.8969	-2.6634
344	-1.8373	-0.0576	1.19499	-1.5125	-0.901	-0.8023	-2.4035
345	-1.9948	-0.051	1.17131	-1.646	-0.905	-0.907	-2.4612
346	-1.846	-0.0265	1.1591	-1.4646	-0.8393	-0.7498	-2.5066
347	-1.7941	-0.042	1.11799	-1.4841	-0.8493	-0.7087	-2.474
348	-1.7667	-0.0233	1.24026	-1.1645	-0.7104	-0.7739	-2.4338
349	-1.6527	-0.0336	1.02892	-1.4304	-0.9657	-0.6371	-2.669
350	-1.8234	-0.1184	1.08182	-1.4536	-0.9852	-0.8878	-2.6424
351	-1.7206	-0.1024	1.18891	-1.363	-0.9523	-0.8743	-2.6831
352	-1.7853	-0.0755	0.99337	-1.2129	-0.861	-0.7296	-2.4752
353	-1.6717	0.01366	1.1313	-1.1507	-0.7169	-0.6191	-2.1167
354	-1.9845	-0.0585	1.14137	-1.0732	-0.6814	-0.7555	-2.1262
355	-1.9105	0.01965	1.02794	-1.1997	-0.7064	-0.8803	-2.4888
356	-1.8894	0.02055	0.96394	-0.8787	-0.776	-1.0647	-2.5681
357	-2.0229	-0.2143	0.78955	-1.3474	-0.9475	-0.9921	-3.0401
358	-1.8929	-0.037	1.12452	-1.2457	-0.6442	-0.7893	-2.2396
359	-1.9194	0.00689	1.25883	-1.1356	-0.6113	-0.9212	-2.3759
360	-1.9722	-0.0056	1.27762	-1.1868	-0.6166	-0.6085	-2.3081
361	-1.8842	-0.0388	1.29342	-1.0442	-0.5598	-1.0579	-2.3983
362	-1.9731	-0.0668	1.27532	-1.1851	-0.7025	-0.7304	-2.5421
363	-2.2654	-0.1138	1.04938	-1.2199	-0.8082	-0.7107	-2.494
364	-2.1239	-0.2016	1.01676	-1.4003	-1.0194	-0.8697	-2.7203
365	-2.1055	-0.1492	1.00344	-1.3189	-0.8185	-0.7409	-2.4714
366	-1.9042	0.07041	1.17344	-1.1399	-0.6808	-0.3975	-2.2607
367	-2.0813	-0.1771	1.0182	-1.431	-0.9059	-0.7235	-2.4719
368	-1.9203	-0.0263	1.1753	-1.1114	-0.73	-0.5253	-2.2915
369	-1.9936	-0.1977	0.99369	-1.4206	-1.2285	-0.8666	-2.4944
370	-1.742	-0.0075	1.11045	-1.4082	-0.9955	-0.6757	-2.2368
371	-1.6412	0.08782	1.26155	-1.4234	-0.9713	-0.4586	-2.179
372	-1.5553	0.13252	1.25344	-1.2542	-0.8914	-0.1824	-2.013
373	-1.9218	-0.013	1.16086	-1.3579	-0.7877	-0.4134	-2.4317
374	-2.1454	-0.036	1.14293	-1.4399	-0.8964	-0.6419	-2.4033
375	-1.9529	0.02934	1.08391	-1.2856	-0.8135	-0.4132	-2.2122

376	-1.8526	-0.0287	1.12952	-1.4132	-1.0083	-0.8078	-2.1366
377	-2.0614	-0.0942	1.02328	-1.3965	-0.9146	-0.6709	-2.6607
378	-1.8235	0.04302	1.13075	-1.3405	-0.9691	-0.7825	-2.7252
379	-2.0233	-0.0424	0.96885	-1.6564	-1.0255	-0.579	-2.5833
380	-1.9451	-0.0615	1.00314	-1.6133	-1.0375	-0.8213	-2.803
381	-1.7918	0.05459	1.0931	-1.4829	-0.953	-0.6145	-2.5288
382	-1.8462	0.01201	1.25656	-1.6607	-0.6864	-0.4429	-2.3775
383	-1.9864	-0.1762	1.15276	-1.8138	-0.8469	-0.7058	-2.7095
384	-2.0229	-0.2143	0.78955	-1.3474	-0.9475	-0.9921	-3.0401
385	-1.8462	0.01201	1.25656	-1.6607	-0.6864	-0.4429	-2.3775
386	-1.9714	-0.0616	1.04235	-1.6562	-1.0404	-0.6757	-2.6489
387	-1.7577	0.09201	1.33717	-1.4517	-0.8245	-0.3755	-2.6694
388	-1.9569	-0.0821	1.13341	-1.5367	-0.9156	-0.6666	-2.8216
389	-1.8864	0.05949	1.18	-1.2366	-0.6322	-0.4183	-2.1351
390	-1.6506	0.09664	1.32738	-1.1255	-0.7256	-0.5434	-2.66
391	-1.8171	-0.0144	1.21004	-1.368	-0.9449	-0.6113	-2.6192
392	-1.8777	0.00372	1.07084	-1.3052	-0.7661	-0.5787	-2.4054
393	-1.8426	-0.0171	1.18846	-1.5558	-0.7588	-0.8152	-2.3663
394	-1.9	-0.1602	0.89555	-1.8443	-0.8326	-0.7512	-2.2532
395	-1.9323	-0.1709	0.90462	-1.7351	-0.8259	-0.7539	-2.6505
396	-1.7581	-0.0075	1.19376	-1.5607	-0.6243	-0.537	-2.6355
397	-1.9037	-0.0063	1.33501	-1.4493	-0.6756	-0.6158	-2.3778
398	-1.5033	0.09558	1.21095	-1.4885	-0.6723	-0.7186	-2.423
399	-1.8016	-0.1173	1.08523	-1.6326	-0.8912	-1.0058	-2.4228
400	-1.8844	-0.1162	0.94698	-1.689	-0.968	-0.8619	-2.3596
401	-1.7584	-0.0729	1.03217	-1.66	-0.9476	-0.7836	-2.547
402	-1.6496	0.02375	1.13433	-1.5621	-0.8403	-0.642	-2.6957
403	-1.749	0.10585	1.33627	-1.4689	-0.5998	-0.7749	-2.2973
404	-1.8593	-0.1354	1.15842	-1.4981	-0.7936	-0.912	-2.6056
405	-1.9168	-0.0103	1.37444	-1.4542	-0.7546	-0.4086	-2.6751
406	-1.8191	0.04894	1.36574	-1.3933	-0.546	-0.6418	-2.4595
407	-1.979	-0.0528	1.26011	-1.633	-0.8344	-0.6992	-2.8259
408	-1.9632	-0.0871	1.24089	-1.6838	-0.7665	-0.6716	-2.7296
409	-1.9267	-0.0833	1.29368	-1.6779	-0.8342	-0.8181	-2.7866
410	-1.9956	-0.0415	1.18889	-1.5716	-0.7671	-0.8379	-2.2257
411	-1.8462	0.01201	1.25656	-1.6607	-0.6864	-0.4429	-2.3775
412	-1.9864	-0.1762	1.15276	-1.8138	-0.8469	-0.7058	-2.7095
413	-1.84	-0.0697	1.21334	-1.7799	-0.9098	-0.9345	-2.7158
414	-1.7064	-0.0124	1.42687	-1.7305	-0.8132	-0.638	-2.598
415	-1.7262	-0.0848	1.34274	-1.8628	-0.8819	-0.711	-2.9248
416	-1.7349	0.05058	1.38572	-1.7788	-0.6874	-0.6451	-2.4788
417	-1.7038	0.03959	1.49544	-1.9299	-0.5766	-0.525	-2.2357
418	-1.5676	-0.0196	1.53411	-1.7665	-0.5559	-0.6002	-2.396
419	-1.7199	-0.1186	1.49727	-1.9852	-0.6779	-0.6243	-2.3039
420	-1.6576	0.08849	1.57338	-1.7629	-0.4878	-0.233	-2.676
421	-1.6591	-0.0131	1.55659	-1.8896	-0.534	-0.4502	-2.2915
422	-1.632	0.0675	1.49797	-1.74	-0.5217	-0.3737	-2.3358
423	-1.5058	-0.0567	1.36929	-1.8768	-0.7258	-0.7666	-2.6829

424	-1.2772	0.24648	1.56439	-1.8602	-0.4627	-0.3673	-2.2555
425	-1.3281	0.10895	1.64587	-1.5785	-0.5272	-0.4573	-2.2841
426	-1.3761	0.09446	1.64465	-1.6144	-0.5644	-0.5075	-2.2742
427	-1.393	0.06616	1.68021	-1.6439	-0.5873	-0.5478	-2.297
428	-1.4008	0.06946	1.68669	-1.6635	-0.5933	-0.5551	-2.3276
429	-1.4338	0.10072	1.65397	-1.7319	-0.6251	-0.5919	-2.2751
430	-1.3901	0.15553	1.56708	-1.6776	-0.5281	-0.7346	-2.2613
431	-1.5174	0.06772	1.6201	-1.5216	-0.4878	-0.5913	-2.5133
432	-1.4909	0.01851	1.36699	-1.8925	-0.6738	-0.5902	-2.7833
433	-1.4246	0.06797	1.56992	-1.7934	-0.5591	-0.5061	-2.5128
434	-1.5272	-0.0946	1.51532	-1.6456	-0.6527	-0.5548	-2.958
435	-1.6272	-0.1376	1.42421	-1.6926	-0.6676	-0.6026	-2.7808
436	-1.5054	0.0948	1.59004	-1.7987	-0.5479	-0.3904	-2.6818
437	-1.5555	-0.0076	1.47594	-1.7757	-0.4833	-0.3442	-2.6279
438	-1.542	-0.0031	1.67131	-1.73	-0.3398	-0.265	-2.6271
439	-1.6871	-0.0524	1.57744	-1.834	-0.405	-0.6573	-2.6813
440	-1.6124	-0.1049	1.56737	-1.7689	-0.5212	-0.3599	-2.6258
441	-1.6321	-0.0305	1.52621	-1.568	-0.5239	-0.47	-2.527
442	-1.6239	0.00071	1.45124	-1.711	-0.4238	-0.3789	-2.2386
443	-1.7486	-0.0174	1.46543	-1.8938	-0.4532	-0.6477	-2.4488
444	-1.6174	0.15024	1.60481	-1.469	-0.3458	-0.402	-2.2255
445	-1.5066	0.10017	1.62361	-1.4495	-0.3817	-0.4059	-2.3822
446	-1.5043	0.08268	1.73795	-1.5803	-0.4171	-0.477	-2.2834
447	-1.4185	0.08799	1.63874	-1.6269	-0.4014	-0.3276	-2.5682
448	-1.5372	0.02945	1.50019	-1.6553	-0.3917	-0.3753	-2.5332
449	-1.4644	0.02773	1.66027	-1.5673	-0.4098	-0.4571	-2.2153
450	-1.6437	0.0282	1.44095	-1.7206	-0.5835	-0.5519	-2.4043
451	-1.6727	0.00249	1.47638	-1.5872	-0.4753	-0.4659	-2.3332
452	-1.6253	-0.0817	1.42419	-1.764	-0.6285	-0.493	-2.4191
453	-1.7571	-0.0984	1.38011	-1.8196	-0.6133	-0.7421	-2.5996
454	-1.6167	0.06889	1.51551	-1.6693	-0.436	-0.4289	-2.441
455	-1.6946	0.00261	1.39814	-1.7645	-0.4763	-0.7651	-2.704
456	-1.7402	0.04594	1.47816	-1.6316	-0.436	-0.4283	-2.8892
457	-1.7874	-0.0097	1.54685	-1.515	-0.3979	-0.3265	-2.54
458	-1.9011	-0.1123	1.30382	-1.584	-0.6428	-0.468	-2.8154
459	-1.6852	0.01017	1.42017	-1.5861	-0.4961	-0.3391	-2.8451
460	-1.7386	-0.0087	1.41426	-1.5774	-0.5431	-0.4082	-2.3567
461	-1.6441	-0.0319	1.44605	-1.6966	-0.4152	-0.5645	-2.3754
462	-1.7169	0.00844	1.38408	-1.5798	-0.4002	-0.3783	-2.3447
463	-1.6705	0.07332	1.38802	-1.6094	-0.2851	-0.0904	-2.6135
464	-1.5753	0.11269	1.92038	-1.7739	-0.0189	-0.3893	-2.2995
465	-1.6811	0.03218	1.95003	-1.8407	-0.0589	-0.335	-2.6832
466	-1.821	-0.0124	1.69848	-2.1609	-0.2848	-0.4367	-2.6255
467	-1.6448	0.20422	1.85468	-2.0815	-0.0904	-0.3781	-2.303
468	-1.2427	0.19714	2.06097	-1.9849	-0.0645	-0.3895	-3.2025
469	-1.428	0.07094	2.07941	-1.8515	-0.1601	-0.5909	-3.4275
470	-1.6109	-0.1035	1.73823	-2.1187	-0.3953	-0.7994	-3.7075
471	-1.4364	0.08294	1.88651	-1.8341	-0.2424	-0.6167	-3.5657

472	-1.5912	0.04788	1.80605	-1.8614	-0.1997	-0.6246	-2.7609
473	-1.4818	0.12898	1.79026	-1.7735	-0.1449	-0.4952	-3.1776
474	-1.3883	0.05754	1.8476	-1.9881	-0.1416	-0.7502	-2.7404
475	-1.3377	0.13515	2.117	-2.0221	0.05116	-0.5877	-3.0259
476	-1.4619	0.07121	1.74634	-1.8415	-0.1343	-0.7217	-2.5724
477	-1.4401	0.15293	1.86506	-1.8397	-0.1519	-0.4849	-2.7472
478	-1.6628	0.01313	1.58621	-1.717	-0.2953	-0.7019	-2.5148
479	-1.4752	0.04767	1.74463	-2.0925	-0.165	-0.9083	-2.6453
480	-1.629	-0.0409	1.76922	-2.2288	-0.276	-0.8684	-3.0247
481	-1.4116	0.0589	1.98527	-1.9459	-0.0293	-0.531	-2.7173
482	-1.6417	0.01821	1.89329	-2.0445	0.0801	-0.6633	-2.4793
483	-1.5535	0.01067	1.85641	-1.9434	-0.0456	-0.7961	-2.7722
484	-1.6654	-0.1158	1.73269	-2.1562	-0.3012	-0.7334	-2.666
485	-1.5381	0.05795	1.90339	-1.8008	-0.1221	-0.7932	-2.5261
486	-1.7343	-0.0814	1.71982	-2.0378	-0.3841	-0.5509	-2.8088
487	-1.7152	-0.0522	1.77233	-2.0835	-0.3341	-0.5367	-2.8833
488	-1.8325	-0.0022	1.48965	-2.1049	-0.3398	-0.7101	-2.9817
489	-1.7067	-0.0191	1.61524	-1.944	-0.2667	-0.6266	-2.5758
490	-1.5869	0.12174	1.80031	-1.8046	-0.122	-0.5781	-2.3263
491	-1.6637	0.019	1.66438	-1.9689	-0.143	-0.7186	-2.6204
492	-1.6794	0.08701	1.90328	-1.7589	-0.0256	-0.4978	-2.7196
493	-1.4929	0.2188	2.00731	-1.82	0.09212	-0.24	-2.7096
494	-1.3925	0.23649	2.10904	-2.0547	0.11096	-0.2143	-2.5142
495	-1.6896	0.09972	1.98487	-1.8482	0.04303	-0.3926	-2.921
496	-1.3615	0.27874	2.0791	-1.9008	0.05726	-0.2019	-2.8443
497	-1.7663	-0.0929	1.65303	-1.9867	-0.2765	-0.341	-2.8894
498	-1.5753	0.11269	1.92038	-1.7739	-0.0189	-0.3893	-2.2995
499	-1.6811	0.03218	1.95003	-1.8407	-0.0589	-0.335	-2.6832
500	-1.69	0.09692	1.87487	-1.888	-0.0993	-0.4598	-2.6574
501	-1.8224	0.02916	2.00909	-2.02	-0.1717	-0.4663	-2.8622
502	-1.6854	0.04681	2.19645	-2.0476	-0.054	-0.4359	-3.3377
503	-1.734	-0.0848	2.00755	-1.9569	-0.1889	-0.5869	-2.9532
504	-1.8442	-0.0812	1.59398	-2.2945	-0.2979	-0.6383	-2.879
505	-1.5999	0.0559	1.92949	-2.1343	-0.1489	-0.6286	-2.4609
506	-1.6846	0.06807	1.74182	-1.9784	-0.1912	-0.5329	-2.711
507	-1.7388	-0.0033	1.6948	-2.073	-0.3015	-0.5428	-2.7162
508	-1.6124	0.14526	2.03504	-1.8917	-0.0316	-0.2486	-2.7203
509	-1.8125	-0.1306	1.59551	-2.1523	-0.3517	-0.5863	-3.0262
510	-1.8351	0.01536	1.86889	-2.1077	-0.1746	-0.6107	-2.8666
511	-1.7357	-0.0764	1.8644	-1.9791	-0.205	-0.4294	-2.6046
512	-1.677	-0.0258	1.89533	-1.9239	-0.0981	-0.4229	-2.7184
513	-1.6351	0.10774	1.97838	-1.8849	0.06311	-0.2014	-2.196
514	-1.586	0.00239	1.95262	-1.9599	-0.0503	-0.1907	-2.5094
515	-1.5258	0.12332	1.90524	-2.0193	-0.1101	-0.1377	-2.3584
516	-1.644	0.03699	1.75808	-2.0279	-0.2466	-0.3541	-2.7755
517	-1.821	-0.0124	1.69848	-2.1609	-0.2848	-0.4367	-2.6255
518	-1.6448	0.20422	1.85468	-2.0815	-0.0904	-0.3781	-2.303
519	-1.8344	-0.0062	1.52558	-2.4326	-0.4259	-0.706	-2.964

520	-1.6842	0.11025	1.75631	-2.1494	-0.2281	-0.3542	-2.248
521	-1.7537	-0.0679	1.58326	-2.2149	-0.3618	-0.5834	-2.9153
522	-1.7907	-0.0452	1.58528	-2.4202	-0.4916	-0.4921	-2.5286
523	-1.4312	0.19759	1.98813	-1.9457	-0.1238	-0.4327	-2.0419
524	-1.4778	0.14919	2.01833	-2.1069	-0.0557	-0.4277	-2.2046
525	-1.7162	0.05596	1.58756	-2.1352	-0.3391	-0.7359	-2.3406
526	-1.6612	0.14019	1.62419	-1.9903	-0.2505	-0.3548	-2.4572
527	-1.8325	-0.0022	1.48965	-2.1049	-0.3398	-0.7101	-2.9817
528	-1.7387	-0.0259	1.57167	-2.3576	-0.4444	-0.5755	-2.7842
529	-1.665	0.06681	1.73437	-2.154	-0.3008	-0.2983	-2.5271
530	-1.661	0.02022	1.73177	-2.0603	-0.2549	-0.6815	-2.6072
531	-1.5913	0.09248	1.67433	-2.0778	-0.2915	-0.5456	-2.8291
532	-1.5233	0.17717	1.9622	-2.0093	-0.1104	-0.5018	-2.5186
533	-1.844	-0.1358	1.60256	-2.2093	-0.4934	-0.6243	-3.1445
534	-1.6566	0.04235	1.74213	-2.249	-0.3248	-0.6902	-2.6545
535	-1.7409	0.00763	1.74222	-2.0776	-0.378	-0.6665	-2.5232
536	-1.7867	-0.0423	1.78549	-2.1441	-0.3643	-0.4803	-2.4302
537	-1.5225	0.11842	1.8967	-1.9049	-0.1916	-0.5017	-2.6862
538	-1.5781	0.12802	1.84074	-1.9448	-0.2297	-0.5291	-2.3922
539	-1.7054	0.01989	1.79566	-2.0303	-0.3018	-0.5674	-2.5986
540	-1.7343	-0.0814	1.71982	-2.0378	-0.3841	-0.5509	-2.8088
541	-1.7152	-0.0522	1.77233	-2.0835	-0.3341	-0.5367	-2.8833
542	-1.7099	-0.0963	1.65616	-2.3773	-0.4129	-0.7151	-2.6744
543	-1.6209	0.00823	1.85841	-2.0439	-0.2588	-0.3499	-2.4661
544	-1.7383	-0.0723	1.72983	-2.2222	-0.3569	-0.6557	-3.0288
545	-1.7097	-0.0715	1.70848	-2.2922	-0.3839	-0.5109	-2.6009
546	-1.7208	-0.0514	1.61862	-2.0797	-0.481	-0.6477	-3.1855
547	-1.6281	-0.0308	1.77852	-2.2665	-0.4285	-0.6425	-3.0345
548	-1.5972	0.02766	1.90932	-2.0444	-0.2705	-0.5859	-2.5095
549	-1.5074	0.07304	1.8871	-1.9734	-0.19	-0.4689	-2.6318
550	-1.7251	-0.1468	1.7594	-2.3428	-0.3931	-0.8689	-2.6752
551	-1.5625	0.07171	2.03619	-2.0507	-0.185	-0.6076	-2.8757
552	-1.4668	0.16749	1.87606	-1.7989	-0.1123	-0.2955	-2.3884
553	-1.3883	0.05754	1.8476	-1.9881	-0.1416	-0.7502	-2.7404
554	-1.3377	0.13515	2.117	-2.0221	0.05116	-0.5877	-3.0259
555	-1.6167	-0.1032	1.83191	-1.6693	-0.2033	-0.4289	-2.441
556	-1.6946	-0.1751	1.73701	-1.7645	-0.2429	-0.7651	-2.704
557	-1.7907	-0.0452	1.58528	-2.4202	-0.4916	-0.4921	-2.5286
558	-1.4312	0.19759	1.98813	-1.9457	-0.1238	-0.4327	-2.0419
559	-1.4568	0.18091	1.99668	-1.97	-0.1603	-0.4365	-2.0654
560	-1.5602	0.03794	1.81334	-2.1183	-0.2637	-0.641	-2.5361
561	-1.6597	-0.0473	1.73729	-2.5192	-0.372	-0.7607	-2.6462
562	-1.7267	0.01514	1.79149	-2.3077	-0.2616	-0.317	-2.7767
563	-1.5978	-0.0219	1.79528	-2.1784	-0.3058	-0.5032	-2.3965
564	-1.3284	0.12039	2.05958	-1.9373	-0.0842	-0.3771	-2.6146
565	-1.7467	-0.0866	1.62484	-2.0962	-0.352	-0.641	-2.6061
566	-1.445	0.10693	1.94942	-2.0582	-0.1447	-0.4956	-2.4124
567	-1.3926	0.02911	2.07288	-2.0858	-0.0435	-0.3812	-2.4234

568	-1.5871	-0.1983	1.82322	-2.0402	-0.2038	-0.3485	-3.5451
569	-1.4067	-0.0171	1.9698	-1.9432	0.006	-0.3561	-2.4332
570	-1.2905	0.17883	2.01148	-1.7874	0.09184	0.07778	-2.191
571	-1.1539	0.24497	1.92707	-1.8053	0.13926	-0.0104	-2.2358
572	-1.1822	0.23998	2.08255	-1.7891	0.19582	-0.0416	-2.5489
573	-1.3599	0.14948	2.14064	-1.5819	0.07712	-0.0546	-2.5762
574	-1.6645	-0.0802	1.77414	-1.7901	-0.252	-0.2467	-2.8222
575	-1.7143	-0.2002	1.66768	-2.37	-0.3056	-0.506	-2.4928
576	-1.6269	-0.0146	1.74162	-2.0408	-0.0736	-0.3776	-2.3213
577	-1.7598	-0.0797	1.60661	-2.1326	-0.296	-0.4892	-2.8674
578	-1.6663	-0.0148	1.7918	-2.1918	-0.1689	-0.0956	-2.7305
579	-1.7784	-0.042	1.74878	-2.2174	-0.2422	-0.4144	-2.8746
580	-1.8161	-0.0863	1.5379	-2.2895	-0.3546	-0.2967	-2.951
581	-1.8357	-0.0327	1.57428	-2.3097	-0.3584	-0.4578	-2.5719
582	-1.8661	-0.0741	1.59483	-2.2202	-0.4355	-0.3467	-2.4295
583	-1.75	-0.0388	1.66161	-2.1152	-0.2654	-0.2913	-2.676
584	-1.7071	-0.0327	1.65391	-2.3432	-0.2637	-0.4456	-2.7228
585	-1.787	0.06671	1.6139	-2.2748	-0.2462	-0.402	-2.6834
586	-1.6265	0.08971	1.71812	-2.041	-0.1438	-0.3529	-2.3851
587	-1.6457	0.01832	1.77092	-2.0134	-0.1381	-0.4487	-2.589
588	-1.6757	0.12588	1.80897	-1.9911	-0.1052	-0.5077	-2.4296
589	-1.5085	0.25599	1.83674	-1.9507	-0.1273	-0.1727	-2.3143
590	-1.6932	-0.042	1.78166	-2.1922	-0.2897	-0.4028	-2.5704
591	-1.4778	0.14919	2.01833	-2.1069	-0.0557	-0.4277	-2.2046
592	-1.5054	0.11322	2.05452	-2.0221	-0.0535	-0.3652	-2.5277
593	-1.6144	0.13208	1.77531	-1.9795	-0.2058	-0.4893	-2.4158
594	-1.8715	-0.0193	1.66908	-2.1356	-0.3865	-0.5199	-2.4686
595	-1.8291	-0.1009	1.72	-2.0385	-0.1253	-0.3031	-2.4907
596	-1.6165	0.05671	2.0391	-2.1415	0.07532	-0.1997	-2.3459
597	-1.7357	-0.0764	1.8644	-1.9791	-0.205	-0.4294	-2.6046
598	-1.7357	0.05502	1.78861	-1.8614	-0.1288	-0.4787	-3.2213
599	-1.7422	0.00944	1.9579	-2.1048	-0.0336	-0.1979	-2.4779
600	-1.4503	0.18376	2.16236	-1.8821	0.18053	-0.0884	-2.2023
601	-1.6547	0.02823	2.01422	-1.8388	-0.0043	-0.2605	-2.616
602	-1.6228	0.02998	1.84296	-2.1715	-0.0752	-0.5197	-2.628
603	-1.6836	-0.0495	1.69595	-2.159	-0.2827	-0.3751	-2.8468
604	-1.7628	-0.1798	1.79915	-2.253	-0.337	-0.5876	-2.6206
605	-1.5406	0.06969	2.0305	-1.754	-0.0976	-0.2153	-2.6509
606	-1.5881	0.07457	2.00588	-1.4758	-0.1129	-0.3502	-2.6912
607	-1.4909	0.2049	2.0919	-1.9559	-0.0581	-0.0802	-2.5667
608	-1.5639	0.00088	1.91435	-2.0956	-0.1832	-0.1813	-2.7298
609	-1.8172	-0.1361	1.91793	-2.1398	-0.2361	-0.5975	-2.8046
610	-1.5845	0.00576	1.99351	-2.0127	-0.1467	-0.4538	-2.6215
611	-1.4022	0.13419	2.09642	-1.9011	0.13104	-0.1214	-2.5777
612	-1.7237	-0.1649	1.82775	-2.2006	-0.2825	-0.3748	-2.8955
613	-1.7532	-0.0431	1.81114	-1.9197	-0.1267	-0.321	-2.431
614	-1.6457	0.01832	1.77092	-2.0134	-0.1381	-0.4487	-2.589
615	-1.6757	0.12588	1.80897	-1.9911	-0.1052	-0.5077	-2.4296

616	-1.5085	0.25599	1.83674	-1.9507	-0.1273	-0.1727	-2.3143
617	-1.75	-0.0388	1.66161	-2.1152	-0.2654	-0.2913	-2.676
618	-1.8291	-0.1009	1.72	-2.0385	-0.1253	-0.3031	-2.4907
619	-1.6165	0.05671	2.0391	-2.1415	0.07532	-0.1997	-2.3459
620	-1.4136	0.14272	2.12944	-1.8562	0.16626	-0.2867	-2.2266
621	-1.537	0.0074	2.12021	-2.2195	0.03228	-0.1645	-2.3721
622	-1.5144	0.04731	2.3217	-1.9609	0.10779	0.07195	-2.4168
623	-1.6735	-0.0592	1.99661	-1.9089	0.02003	-0.1666	-2.8876
624	-1.7737	-0.0461	1.87632	-1.9215	-0.2284	-0.3646	-2.8723
625	-1.7289	-0.0524	1.93051	-1.7922	-0.0813	-0.2527	-2.9266
626	-1.5817	0.06154	1.80841	-1.7476	-0.1206	-0.4289	-2.5062
627	-1.629	-0.0014	1.86491	-1.7435	-0.2444	-0.4883	-2.6029
628	-1.4948	0.18232	1.92371	-2.0612	-0.118	-0.5427	-2.312
629	-1.6797	0.03935	1.7178	-2.1567	-0.3406	-0.5672	-2.7275
630	-1.8237	-0.027	1.61071	-2.1107	-0.4291	-0.7093	-2.8337
631	-1.6561	0.18682	1.76296	-1.9724	-0.2267	-0.5496	-2.4253
632	-1.926	-0.0878	1.48656	-2.1449	-0.4291	-0.6862	-2.8875
633	-1.6321	-0.0305	1.52621	-1.568	-0.5239	-0.47	-2.527
634	-1.6239	0.00071	1.45124	-1.711	-0.4238	-0.3789	-2.2386
635	-1.4644	0.02773	1.66027	-1.5673	-0.4098	-0.4571	-2.2153
636	-1.6437	0.0282	1.44095	-1.7206	-0.5835	-0.5519	-2.4043
637	-1.6727	0.00249	1.47638	-1.5872	-0.4753	-0.4659	-2.3332
638	-1.6144	0.13208	1.77531	-1.9795	-0.2058	-0.4893	-2.4158
639	-1.8715	-0.0193	1.66908	-2.1356	-0.3865	-0.5199	-2.4686
640	-1.7015	0.01001	1.86524	-2.1751	-0.2798	-0.7599	-2.2725
641	-1.6215	0.02607	1.86663	-1.8766	-0.2423	-0.599	-2.3605
642	-1.7246	0.12823	1.91882	-1.7701	-0.2767	-0.63	-2.4408
643	-1.5384	0.14256	1.89586	-1.7382	-0.2521	-0.5147	-2.2546
644	-1.7271	0.03346	1.71159	-1.8649	-0.3843	-0.6038	-2.4525
645	-1.8395	0.00141	1.75387	-1.8839	-0.3102	-0.5235	-2.7104
646	-1.8294	-0.0108	1.82507	-1.9106	-0.2839	-0.5498	-2.3419
647	-1.6026	0.07504	1.84912	-1.9466	-0.1768	-0.4963	-2.5317
648	-1.578	0.1567	1.94715	-1.6738	-0.1565	-0.5616	-2.5926
649	-1.7307	0.09926	1.88492	-1.8135	-0.0778	-0.6036	-2.6875
650	-1.6836	0.01716	1.89234	-1.906	-0.1308	-0.6802	-2.469
651	-1.6602	0.0828	1.86582	-1.9569	-0.1434	-0.3861	-2.5265
652	-1.7261	-0.0054	1.80273	-2.516	-0.2613	-0.477	-2.6268
653	-1.542	0.08707	2.03663	-2.1296	-0.0962	-0.5309	-2.6869
654	-1.6049	0.00619	1.93893	-1.9712	-0.2014	-0.5071	-2.5618
655	-1.7883	-0.1482	1.67831	-2.3181	-0.4299	-0.4574	-3.0844
656	-1.6193	-0.0739	1.69994	-2.1225	-0.3396	-0.6429	-2.6209
657	-1.6039	0.07106	1.69374	-2.1492	-0.3471	-0.6193	-2.503
658	-1.8499	-0.0693	1.55586	-2.1749	-0.3785	-0.538	-2.6785
659	-1.7793	-0.0399	1.5959	-2.0141	-0.3568	-0.5624	-2.6185
660	-1.7201	0.02777	1.4869	-2.0206	-0.4702	-0.4867	-2.1732
661	-1.6804	0.06335	1.36622	-2.0075	-0.4996	-0.8154	-3.1275
662	-1.612	0.16673	1.55341	-1.7769	-0.4237	-0.7423	-2.6085
663	-1.8126	-0.0064	1.40866	-2.0471	-0.5607	-0.8571	-2.6119

664	-1.8758	-0.0265	1.53758	-1.8712	-0.3284	-0.8119	-2.5234
665	-1.7167	0.13546	1.80582	-1.8036	-0.2179	-0.7263	-2.1185
666	-1.6442	0.06997	1.79775	-1.9514	-0.2853	-0.7537	-2.3934
667	-1.6794	0.07523	1.69683	-1.7879	-0.3168	-0.7876	-2.6906
668	-1.6501	0.1752	1.96491	-1.6771	-0.1602	-0.7051	-2.6363
669	-1.7451	-0.0145	2.01785	-1.8389	-0.1881	-0.816	-2.6807
670	-1.5562	0.03997	1.88567	-1.9763	-0.1839	-0.8069	-2.5153
671	-1.3973	0.18204	2.13062	-1.6153	-0.0514	-0.6873	-2.5535
672	-1.3899	0.13245	2.14196	-1.927	-0.0301	-0.7334	-2.6872
673	-1.5046	0.08383	1.96822	-2.091	-0.1244	-0.6184	-3.0123
674	-1.5143	0.20063	2.20272	-1.6622	0.04648	-0.9691	-2.5796
675	-1.5425	0.06965	2.12499	-1.8696	-0.0285	-0.7931	-2.3453
676	-1.7669	-0.0912	1.92779	-2.2421	-0.2412	-1.0697	-2.7953
677	-1.3813	0.12191	2.00126	-1.7047	0.02275	-0.7577	-2.7069
678	-1.5504	0.04384	2.08077	-1.6973	-0.066	-1.2847	-2.6918
679	-1.4307	0.10619	2.1668	-1.6321	0.12632	-1.0584	-2.665
680	-1.3423	0.14918	2.38085	-2.0362	0.36241	-1.6036	-2.5682
681	-1.3679	0.25102	2.38515	-1.7769	0.36888	-1.1724	-3.1147
682	-1.3605	0.14404	2.27771	-1.8327	0.12146	-1.4672	-2.9133
683	-1.3481	0.1061	2.87718	-1.6342	0.35026	-1.8008	-2.6578
684	-1.1579	0.19138	3.80927	-1.6603	0.71293	-1.759	-2.5458
685	-1.1575	0.08552	4.12308	-1.9438	0.98217	-1.8043	-3.1781
686	-1.2197	0.08715	3.38074	-1.3187	0.65445	-1.1389	-3.3565
687	-1.4979	-0.0049	2.17014	-1.769	0.0667	-1.5923	-2.7498
688	-1.3699	0.1007	2.13693	-1.9315	0.05229	-1.1997	-2.3314
689	-1.141	0.40754	2.47073	-1.6515	0.32227	-0.9054	-2.7319
690	-1.4389	0.1532	2.11499	-1.72	-0.0188	-1.2212	-2.4864
691	-1.3063	0.26579	2.24607	-1.1433	0.04365	-1.2333	-2.4714
692	-1.5674	0.00273	2.05667	-1.7285	-0.1484	-1.0125	-3.3156
693	-1.4124	0.14369	2.08558	-1.8483	-0.1352	-1.0213	-2.6615
694	-1.1183	0.41091	2.37899	-1.5127	0.15047	-0.8791	-2.3612
695	-1.2544	0.08854	2.06202	-2.0053	-0.1778	-1.1849	-2.6034
696	-1.2512	0.28824	2.25717	-1.35	0.023	-0.8058	-2.3247
697	-1.3614	0.30262	2.12859	-1.3008	0.03779	-1.215	-2.6253
698	-1.5562	0.3704	2.12051	-1.4944	0.05414	-1.4017	-2.4615
699	-1.5349	0.32158	2.0649	-1.5831	-0.0245	-1.2137	-2.557
700	-1.5232	0.2535	2.15493	-1.595	-0.1033	-1.1639	-2.8099
701	-1.3571	0.36419	2.23557	-1.5955	-0.0404	-1.3533	-2.4648
702	-1.5431	0.19137	2.14468	-1.6569	-0.0581	-1.5787	-2.739
703	-1.4203	0.2542	2.40482	-1.6544	0.1081	-1.2935	-2.3667
704	-1.5024	0.21588	2.37071	-1.7485	0.09002	-1.57	-2.7374
705	-1.2354	0.3304	2.33537	-1.4928	0.07345	-1.2097	-2.5244
706	-1.2097	0.37318	2.41522	-1.5926	0.11095	-1.359	-2.3935
707	-1.1822	0.34064	2.36188	-1.7501	0.11546	-1.3729	-2.5152
708	-1.3186	0.26304	2.26045	-1.7141	0.00478	-1.601	-2.846
709	-1.1769	0.45635	2.45296	-1.5977	0.3428	-1.313	-2.5489
710	-1.244	0.41873	2.27061	-1.8521	0.00565	-1.5072	-2.6795
711	-1.1522	0.38963	2.38029	-1.909	0.17008	-1.1695	-2.3471

712	-1.3392	0.30782	2.25814	-1.8101	0.02444	-1.5121	-2.5573
713	-1.417	0.24857	2.18375	-1.7667	-0.0804	-1.3738	-2.7445
714	-1.3605	0.14404	2.27771	-1.8327	0.12146	-1.4672	-2.9133
715	-1.3899	0.13245	2.14196	-1.927	-0.0301	-0.7334	-2.6872
716	-1.5046	0.08383	1.96822	-2.091	-0.1244	-0.6184	-3.0123
717	-1.5108	0.03849	1.65092	-1.5622	-0.4878	-0.5983	-2.4942
718	-1.6719	-0.2106	1.61295	-1.766	-0.7261	-0.7311	-2.6752
719	-1.512	0.18976	1.88883	-1.8238	-0.3952	-1.3671	-2.7087
720	-1.5883	0.17253	2.00685	-1.9618	-0.4558	-1.1878	-2.4377
721	-1.455	0.23013	2.03505	-1.7628	-0.3037	-1.0458	-2.483
722	-1.3477	0.17439	1.88338	-1.9489	-0.2382	-1.2946	-2.7558
723	-1.1025	0.32666	2.14711	-1.8913	-0.1028	-0.9144	-2.7563
724	-1.0969	0.27694	2.17727	-1.4832	-0.0395	-1.1501	-2.5346
725	-1.0154	0.42413	2.42938	-1.5547	0.22585	-0.889	-2.3333
726	-1.2566	0.21584	2.08424	-1.8384	-0.0628	-1.2359	-2.4406
727	-1.2421	0.13368	2.10872	-1.8213	-0.0499	-1.188	-2.8123
728	-1.1924	0.18962	2.14909	-1.7142	-0.037	-0.6725	-2.058
729	-1.3735	0.16769	1.97692	-1.8908	-0.1514	-0.6034	-2.1501
730	-1.3112	0.16159	1.97641	-1.8454	-0.2396	-0.8756	-2.5025
731	-1.4369	0.10899	1.94639	-1.5355	-0.071	-0.6009	-2.5355
732	-1.299	0.13739	1.99518	-1.8535	-0.0853	-0.4905	-2.6462
733	-1.5249	0.09394	1.97219	-1.8385	-0.1498	-0.7639	-2.5373
734	-1.5666	0.01079	1.88863	-1.8887	-0.2098	-0.7931	-3.2141
735	-1.662	0.04088	1.80813	-1.9136	-0.2426	-0.7939	-3.0892
736	-1.6835	0.03587	1.77785	-1.8244	-0.2596	-0.7439	-2.9425
737	-1.676	0.02221	1.65846	-1.8153	-0.3981	-0.81	-2.5717
738	-1.6904	0.11607	1.73933	-1.8741	-0.3353	-0.736	-2.5467
739	-1.6959	0.03726	1.68721	-1.8119	-0.3425	-0.7247	-2.7569
740	-1.6538	0.0504	1.76566	-1.9412	-0.244	-0.6909	-2.6064
741	-1.6717	0.02541	1.70132	-1.5315	-0.2587	-0.9614	-2.663
742	-1.739	-0.0098	1.74013	-1.3699	-0.2367	-1.0476	-2.5263
743	-1.5753	0.06232	1.79759	-1.6232	-0.1868	-0.7989	-2.4928
744	-1.7223	-0.0334	1.676	-1.7725	-0.3371	-0.8526	-2.4875
745	-1.6081	0.07506	1.83791	-1.8036	-0.2358	-0.8546	-2.2269
746	-1.8183	-0.0371	1.65139	-1.6897	-0.3334	-1.1534	-2.5906
747	-1.5869	0.0764	1.86309	-1.3659	-0.1727	-0.9201	-2.5099
748	-1.8419	-0.0692	1.70059	-1.7449	-0.3142	-1.0201	-2.6965
749	-1.6826	0.04859	1.74001	-1.7162	-0.239	-0.8824	-2.7875
750	-1.7011	-0.0211	1.63249	-1.6949	-0.2502	-0.8818	-2.7674
751	-1.927	-0.0857	1.65725	-1.7531	-0.2716	-0.9139	-2.5718
752	-1.7239	0.02087	1.75134	-1.6766	-0.2093	-0.8374	-2.7394
753	-1.6219	0.02861	1.72641	-1.8503	-0.2824	-1.0034	-2.5706
754	-1.6808	0.00204	1.8301	-1.8022	-0.2372	-0.9316	-2.5087
755	-1.6612	0.06269	1.74809	-1.7747	-0.2508	-0.844	-2.7733
756	-1.6816	-0.0288	1.77557	-1.9239	-0.3166	-1.0221	-2.9362
757	-1.6591	0.01231	1.86098	-1.761	-0.1828	-0.7989	-2.6161
758	-1.7262	-0.0109	1.81327	-1.6949	-0.3106	-0.9332	-2.7299
759	-1.7114	0.03764	1.75951	-1.7207	-0.3139	-1	-2.37

760	-1.8499	-0.1251	1.5139	-1.978	-0.5188	-0.9419	-2.6417
761	-1.7941	-0.0552	1.61097	-1.7142	-0.4103	-1.2174	-2.6912
762	-1.6541	0.03211	1.80046	-1.7998	-0.3382	-0.9779	-2.3106
763	-1.6857	-0.0136	1.69556	-1.6983	-0.3583	-0.9735	-2.6158
764	-1.6578	0.06683	1.67655	-1.731	-0.403	-0.8493	-2.6963
765	-1.7207	0.00522	1.64889	-1.8434	-0.436	-0.8949	-2.4253
766	-1.8588	-0.1978	1.38203	-1.6455	-0.6945	-0.9442	-2.9341
767	-1.6268	0.0793	1.615	-1.6786	-0.4914	-0.7434	-2.5637
768	-1.6848	0.07477	1.6385	-1.7693	-0.5223	-0.6175	-2.6598
769	-1.6764	-0.0672	1.60417	-1.8397	-0.5972	-0.7558	-2.5493
770	-1.5473	0.03812	1.81957	-1.6709	-0.4527	-0.6133	-2.5267
771	-1.5108	0.03849	1.65092	-1.5622	-0.4878	-0.5983	-2.4942
772	-1.7451	-0.2106	1.61295	-1.766	-0.7261	-0.7311	-2.6752
773	-1.5985	0.00996	1.81163	-1.8876	-0.5561	-0.5916	-2.7597
774	-1.5773	0.03379	1.82322	-1.6443	-0.4007	-0.4652	-2.5949
775	-1.8494	-0.0399	1.71244	-1.8693	-0.682	-0.605	-2.3676
776	-1.8759	0.10039	1.87689	-2.0332	-0.534	-0.5282	-2.4948
777	-1.9001	-0.1169	1.79364	-2.1197	-0.7122	-1.0185	-2.7107
778	-1.8411	-0.0703	1.67457	-1.9748	-0.768	-0.6852	-2.7484
779	-1.4824	0.09425	1.64631	-1.8709	-0.3781	-0.4606	-2.396
780	-1.1507	0.16454	1.69881	-1.6232	-0.1805	-0.3034	-2.2237
781	-0.9775	0.10699	1.56442	-1.4346	0.46719	0.10818	-2.5277

Appendix Table 1.4. Natural log of key indicator element abundance variability against conservative lithophile element Rb in core FS C2 in the Three Rivers Estuarine Complex saltmarshes.

Depth (mm)	Si/Rb	K/Rb	Ca/Rb	Ti/Rb	Br/Rb	Sr/Rb	Zr/Rb	Ba/Rb
1	-0.7859	1.39289	2.56575	1.42909	0.28017	0.81438	0.07213	-1.1579
2	-0.5392	1.36487	2.6256	1.45189	0.22218	0.68552	-0.5122	-1.5896
3	-0.4198	1.51629	2.71073	1.57406	0.43094	0.66917	-0.2439	-2.3987
4	-0.4627	1.54373	2.68662	1.57942	0.47159	0.67267	-0.0915	-2.2394
5	-0.4343	1.57457	2.65241	1.59671	0.61663	0.66965	-0.2518	-1.852
6	-0.3374	1.55237	2.7099	1.54007	0.67766	0.66116	-0.6651	-1.3788
7	-0.213	1.69541	2.90623	1.73721	0.73002	0.90555	-0.1089	-1.3072
8	-0.4199	1.52936	2.71593	1.55196	0.44477	0.77289	-0.32	-1.4186
9	-0.4409	1.4852	2.68738	1.5337	0.4306	0.78549	-0.263	-1.635
10	-0.4151	1.44165	2.55447	1.45017	0.26943	0.79744	-0.2126	-1.1355
11	-0.6014	1.31439	2.59162	1.27409	0.57182	0.71611	-0.1325	-1.1671
12	-0.2973	1.52416	2.75563	1.48358	0.66123	0.86301	-0.0194	-0.9816
13	-0.3361	1.4918	2.81751	1.40655	0.50562	0.84958	0.11074	-1.0236
14	-0.3332	1.54094	2.72	1.56637	0.59521	0.91643	-0.2341	-1.2933
15	-0.4621	1.47399	2.64468	1.52435	0.30492	0.79329	-0.0598	-1.1061
16	-0.5405	1.39552	2.66488	1.37636	0.19114	0.78232	0.0738	-1.1036
17	-0.6496	1.35011	2.63534	1.35011	0.12575	0.71789	0.12299	-1.4543
18	-0.4513	1.47175	2.7729	1.52225	0.47799	0.8471	0.09864	-1.184

19	-0.54	1.3388	2.5965	1.31802	0.32	0.7395	-0.295	-1.4235
20	-0.5194	1.35034	2.67378	1.29514	0.19346	0.77925	-0.417	-1.1245
21	-0.3809	1.45973	2.73672	1.48064	0.38082	0.8263	-0.0687	-1.2889
22	-0.4541	1.43816	2.69197	1.47245	0.33387	0.76025	-0.3123	-1.1642
23	-0.6701	1.31528	2.57659	1.35924	0.4618	0.6073	-0.518	-1.1985
24	-0.5664	1.42736	2.57694	1.43709	0.39888	0.67361	-0.4375	-1.153
25	-0.7348	1.30069	2.51417	1.31535	0.49564	0.75988	-0.1725	-1.4624
26	-0.9021	1.07259	2.17562	1.00218	-0.1377	0.32134	0.60463	-1.2585
27	-0.6589	1.24532	2.44063	1.42243	-0.0086	0.51654	0.69894	-1.0495
28	-0.8643	1.02962	2.23123	1.05594	-0.0555	0.32594	0.53063	-1.2356
29	-0.5574	1.23853	2.42988	1.43619	0.01562	0.20773	0.56963	-1.0582
30	-0.5957	1.3653	2.6079	1.33042	0.22017	0.7487	-0.0932	-1.1566
31	-0.7277	1.30482	2.54386	1.36224	0.36943	0.71103	-0.1224	-1.2234
32	-0.7567	1.27486	2.65727	1.2936	0.24551	0.67676	-0.1928	-1.1116
33	-0.5496	1.42508	2.64561	1.58947	0.20053	0.81371	-0.1587	-0.957
34	-0.441	1.52444	2.81367	1.52576	0.32446	0.94231	0.19289	-0.915
35	-0.7066	1.29435	2.53298	1.35633	0	0.63789	-0.1755	-1.2468
36	-0.9173	1.1654	2.43488	1.28372	-0.1348	0.57765	0.1324	-1.2595
37	-0.7305	1.26347	2.50836	1.27028	0.08349	0.68133	0.16934	-1.1203
38	-0.8338	1.18719	2.39964	1.28734	-0.0257	0.54465	-0.1406	-1.1533
39	-0.7151	1.3409	2.65034	1.39996	0.08112	0.77104	0.00772	-1.2819
40	-0.7517	1.34552	2.52472	1.33686	0.01996	0.77667	0.1914	-1.0667
41	-0.2336	1.73276	3.04134	1.74956	0.37228	1.15169	0.23392	-0.8196
42	-0.3962	1.60031	2.93434	1.68664	0.28374	1.04499	0.3065	-0.8482
43	-0.5356	1.47197	2.69075	1.64571	0.33045	0.85387	0.04592	-1.212
44	-0.331	1.54899	2.86729	1.62312	0.22102	0.96525	0.3774	-1.0942
45	-0.3989	1.46646	2.73984	1.45831	0.12953	0.89244	0.01543	-1.4593
46	-0.5913	1.42191	2.65578	1.39112	0.20542	0.86589	0.35619	-1.081
47	-0.5708	1.41562	2.63724	1.44729	0.12866	0.82911	0.29952	-1.1987
48	-0.4949	1.50582	2.90891	1.62995	0.20804	1.01839	0.45509	-1.0667
49	-0.6253	1.30084	2.61838	1.32652	-0.0204	0.77926	0.05517	-1.0867
50	-0.7823	1.22136	2.48894	1.26661	-0.0034	0.66862	0.00612	-1.2857
51	-0.5628	1.38334	2.76285	1.43542	0.03631	0.92084	0.30484	-1.3792
52	-0.6143	1.3241	2.68052	1.33504	0.01979	0.66342	0.2386	-1.4192
53	-0.4037	1.55833	2.75575	1.57098	0.2188	0.96731	0.33828	-0.7997
54	-0.5764	1.44586	2.69468	1.35868	0.02068	0.78846	0.22075	-0.8689
55	-0.2931	1.60075	2.97553	1.58555	0.28768	1.02252	0.2575	-0.83
56	-0.4442	1.39936	2.719	1.47685	0.08871	1.21523	0.01306	-1.1238
57	-0.3803	1.44244	2.68053	1.51317	0.06957	0.83424	0.12221	-1.4998
58	-0.4824	1.39061	2.59216	1.35148	-0.1463	0.71839	-0.1594	-1.4435
59	-0.5924	1.46583	2.70701	1.4645	0.04577	0.82534	0.16964	-1.1613
60	-0.5985	1.39421	2.65381	1.48077	0.17248	0.82713	0.11043	-1.4962
61	-0.7363	1.19421	2.37785	1.19344	-0.1071	0.53007	-0.1944	-1.7699
62	-0.7169	1.25122	2.31382	1.22041	0.07755	0.57572	-0.1135	-2.0637
63	-0.4762	1.31771	2.54751	1.31969	0.0789	0.64912	-0.1376	-1.3074
64	-0.3694	1.54764	2.76308	1.64925	0.34581	0.81444	0.10821	-1.6488
65	-0.1632	1.67162	2.80323	1.66808	0.3101	0.97558	0.17099	-0.8024
66	-0.2454	1.63253	2.9424	1.63875	0.32135	1.02148	0.25848	-1.1311

67	-0.2324	1.68468	2.9261	1.62828	0.22331	1.01619	0.33965	-0.8576
68	-0.0353	1.86499	3.18661	1.77325	0.22769	1.19821	0.65063	-0.3757
69	-0.2874	1.64872	2.91364	1.63419	0.31044	0.99132	0.22706	-0.9536
70	-0.4078	1.57458	2.74313	1.58744	0.20445	0.90356	0.09769	-1.1681
71	-0.2808	1.73004	2.92183	1.65793	0.33878	1.04151	0.50559	-0.6397
72	-0.2601	1.63348	2.90857	1.63528	0.29562	0.89114	0.38968	-1.3276
73	-0.1095	1.76624	3.01868	1.70116	0.32024	1.03681	0.16987	-1.0253
74	-0.0543	1.87586	3.1099	1.8548	0.56269	1.1417	0.5	-0.992
75	-0.0505	1.74064	2.89398	1.76216	0.39218	1.0043	0.44146	-0.8397
76	-0.2029	1.68032	2.90987	1.6572	0.41053	0.90321	0.35306	-0.9361
77	-0.4254	1.51852	2.66735	1.46434	0.15396	0.81953	0.1416	-1.5034
78	-0.261	1.70286	2.81014	1.72311	0.4152	0.96812	0.42372	-1.2226
79	-0.4351	1.53336	2.62106	1.51336	0.1822	0.79805	0.15028	-1.1238
80	-0.3505	1.59344	2.71054	1.63091	0.35742	0.85709	0.2474	-1.1548
81	-0.4534	1.62862	2.71357	1.67601	0.4769	0.96628	0.19258	-0.8004
82	-0.4647	1.54772	2.68015	1.48321	0.37137	0.88508	0.35289	-0.8468
83	-0.3783	1.58746	2.82167	1.50807	0.27623	0.94513	0.23538	-1.0541
84	-0.3823	1.57856	2.84071	1.60732	0.1871	0.86571	0.05303	-0.7784
85	-0.323	1.55495	2.86482	1.56117	0.24377	0.9439	0.18089	-1.2086
86	-0.4166	1.50051	2.74192	1.44411	0.03914	0.83201	0.15547	-1.0418
87	-0.1696	1.73072	3.05233	1.63898	0.09342	1.06393	0.51636	-0.51
88	-0.2281	1.61257	2.76156	1.56466	-0.0086	0.82275	0.32066	-1.168
89	-0.042	1.72386	2.99874	1.59485	0.16454	0.90127	0.31153	-0.6742
90	-0.1602	1.69235	3.04403	1.64989	0.13075	0.8982	-0.0091	-1.1558
91	-0.3185	1.62198	2.995	1.48138	-0.1503	1.0379	0.03582	-1.2035
92	-0.595	1.23041	2.94914	1.33655	-0.072	0.81347	0.80806	-1.2474
93	-0.6005	1.25907	3.00289	1.5341	-0.0987	0.941	0.81033	-1.4563
94	-0.5179	1.29819	2.89154	1.29222	-0.003	0.9611	0.55564	-1.08
95	-0.3099	1.50427	3.05501	1.53054	-0.0087	1.08843	0.61884	-0.7001
96	-0.2461	1.53301	3.00315	1.44827	-0.2314	0.91321	0.20985	-1.5227
97	-0.3393	1.44151	2.7934	1.44733	-0.2008	0.91375	0.41436	-0.9544
98	-0.3589	1.43657	2.89533	1.30387	-0.2115	0.83076	0.09519	-0.9573
99	-0.2089	1.55701	3.01175	1.47	0.11769	0.98707	0.34225	-1.0774
100	-0.3982	1.38693	2.83273	1.34503	-0.3114	0.91464	0.26475	-1.1895
101	-0.3261	1.53562	2.86741	1.56765	-0.174	1.13763	0.5487	-0.8616
102	-0.4092	1.49847	2.87307	1.46031	-0.0344	0.94313	0.35434	-0.8136
103	-0.3424	1.47593	2.92132	1.37355	-0.0056	0.95291	0.57369	-1.1149
104	-0.1598	1.5549	2.98214	1.58766	0.0046	1.1314	0.60095	-1.315
105	-0.2224	1.53209	3.1376	1.71865	-0.0415	1.07594	0.48821	-1.145
106	-0.5439	1.27589	2.89229	1.25829	-0.1712	0.93621	0.76185	-1.4066
107	-0.4159	1.35644	2.93321	1.39618	0.16319	1.04751	0.63674	-1.2238
108	-0.3285	1.49555	2.86833	1.38219	0.10925	1.02582	0.70401	-0.7526
109	-0.0741	1.70137	3.03987	1.65796	0.17953	1.25435	0.84038	-0.9191
110	-0.0961	1.6831	3.07585	1.59782	0.41247	1.12216	0.73883	-0.7782
111	-0.0431	1.67811	3.12461	1.72624	0.33403	1.30038	0.83735	-0.7447
112	-0.4522	1.43816	2.90445	1.42705	0.0314	1.11373	0.75418	-0.8597
113	-0.6446	1.29347	2.87531	1.23709	-0.1571	1.03797	0.47408	-1.0657
114	-0.5368	1.40083	3.07236	1.69665	0.22296	1.25368	0.67328	-0.9612

115	-0.6787	1.14008	2.67611	1.32748	0.01305	0.95101	0.72264	-1.1611
116	-0.613	1.25601	2.75643	1.34446	-0.2273	0.94854	0.58466	-0.9281
117	-0.4599	1.4307	2.92061	1.35629	0.02894	0.91999	0.71833	-0.9469
118	-0.6252	1.2594	2.74634	1.33582	-0.0841	0.80507	0.22507	-1.9053
119	-0.7417	1.17052	2.6746	1.27009	-0.1932	0.61198	0.30884	-2.0232
120	-0.5101	1.36077	2.76248	1.40156	-0.081	0.76051	0.33933	-0.9845
121	-0.555	1.29131	2.63432	1.36264	-0.1157	0.78628	0.47256	-1.1562
122	-0.5761	1.19203	2.58996	1.20274	0.15139	0.99699	0.63603	-1.3359
123	-0.4927	1.19801	2.66556	1.17589	0.24502	1.03565	0.73168	-1.1896
124	-0.4467	1.32357	2.72256	1.36484	0.21968	1.03976	0.79904	-1.2316
125	-0.5497	1.20816	2.6187	1.2756	0.1211	0.94084	0.62581	-1.1813
126	-0.3269	1.29402	2.78763	1.29402	0.10046	1.03506	0.57097	-1.068
127	-0.637	1.13668	2.46935	1.233	-0.2196	0.87507	0.56492	-1.3391
128	-0.7783	1.11668	2.62252	1.12447	-0.0297	0.93763	0.66264	-1.1048
129	-0.6737	1.23504	2.67967	1.2544	-0.0049	0.90043	0.5964	-1.2122
130	-0.6863	1.1299	2.57852	1.12367	-0.2295	0.78983	0.53039	-1.2164
131	-0.497	1.33244	2.66025	1.36742	-0.0878	0.90466	0.5424	-1.0856
132	-0.53	1.28547	2.7041	1.30129	-0.1395	0.87398	0.51139	-1.1794
133	-0.5942	1.3051	2.83096	1.47687	-0.0224	0.87221	0.4848	-1.1948
134	-0.4573	1.41168	2.9121	1.50013	-0.0717	1.10421	0.74033	-0.7725
135	-0.2782	1.6124	3.10231	1.53799	0.21065	1.1017	0.90003	-0.7652
136	-0.3712	1.51447	2.98414	1.48971	-0.0091	1.01242	0.67949	-1.2591
137	-0.3119	1.59642	3.02178	1.58596	0.21282	1.13259	0.55815	-0.8726
138	-0.475	1.39522	2.79364	1.53537	-0.0834	0.98782	0.76929	-1.3076
139	-0.5497	1.32804	2.74447	1.36788	-0.15	0.80483	0.26822	-1.2371
140	-0.2069	1.61413	3.07843	1.61778	0.18249	1.04367	0.67146	-0.6942
141	-0.3831	1.55477	2.99346	1.51073	0.33083	1.09763	0.49313	-1.0118
142	-0.3105	1.5656	3.02014	1.6113	0.09552	1.2092	0.83423	-1.5616
143	-0.4676	1.41701	2.90395	1.49343	0.07349	0.96268	0.38268	-1.7477
144	-0.2997	1.6125	3.11658	1.71207	0.24881	1.05396	0.75082	-1.5812
145	-0.1646	1.75186	3.10846	1.78202	0.24844	1.29683	0.71603	-1.4405
146	0.07083	2.0183	3.46594	1.9727	0.50002	1.38433	1.0585	-0.528
147	-0.1729	1.73703	3.12561	1.6795	0.12641	1.07195	0.8136	-0.9105
148	0.0791	1.88606	3.39062	2.07467	0.31106	1.37982	1.04607	-0.6641
149	-0.3342	1.59735	3.13975	1.69473	0.18248	1.03261	0.89178	-0.8918
150	0.22778	1.93178	3.50404	1.97483	0.53609	1.46006	1.23263	-0.8864
151	0.03024	1.74289	3.36419	1.72664	0.27277	1.27599	1.18068	-0.8834
152	0.0307	1.88135	3.43242	1.90649	0.40547	1.48675	1.20085	-0.6758
153	-0.2364	1.61192	3.18746	1.67625	0.17029	1.10084	0.72794	-0.6751
154	-0.3377	1.5111	3.06034	1.53342	0.06464	0.95297	0.5493	-1.0621
155	-0.2435	1.7205	3.19952	1.70871	0.29231	1.19828	0.7938	-0.6715
156	-0.2091	1.68618	2.95635	1.7051	0.17042	1.07897	0.73692	-0.9364
157	-0.2825	1.6661	3.14385	1.70615	0.27138	1.05555	0.79275	-0.8473
158	-0.2311	1.59724	3.07064	1.60835	0.18684	0.93084	0.50611	-0.8851
159	-0.1803	1.69059	3.09231	1.73138	0.24879	1.09033	0.66915	-0.6547
160	-0.3094	1.53689	2.87989	1.60822	0.12993	1.03186	0.71814	-0.9106
161	-0.4042	1.55213	2.88798	1.4816	0.16172	0.90969	0.49295	-1.0662
162	-0.0868	1.69064	3.00784	1.67573	0.15854	1.00846	0.58633	-0.8173

163	-0.0211	1.82468	3.17176	1.86567	0.37574	1.16374	0.82432	-0.9906
164	-0.4426	1.57088	3.12661	1.76714	0.3148	1.03094	0.5662	-1.0168
165	-0.252	1.68007	2.87894	1.7388	0.39805	0.96853	0.65304	-1.0533
166	-0.2703	1.5972	2.82499	1.66029	0.15033	0.85843	0.60404	-1.1994
167	-0.0582	1.84801	3.12804	2.03145	0.44356	1.16337	1.0733	-0.9751
168	-0.3957	1.5079	2.81193	1.56357	0.08042	0.8487	0.44254	-0.713
169	-0.0798	1.96096	3.23978	2.06186	0.63252	1.27015	0.87291	-0.41
170	-0.469	1.523	2.69412	1.67408	0.1837	0.80743	0.54127	-1.1069
171	-0.498	1.43534	2.74771	1.51735	0.3068	0.84717	0.7219	-0.8524
172	-0.4779	1.46897	2.78834	1.52474	0.25846	0.88677	0.34484	-1.2321
173	-0.4226	1.48186	2.8362	1.58178	0.04883	0.82385	0.48631	-1.4626
174	-0.5034	1.43281	2.69282	1.3861	0.08849	0.73653	0.49794	-1.0279
175	-0.6576	1.29885	2.62791	1.3668	0.04478	0.58421	0.20061	-1.4564
176	-0.6635	1.34623	2.61995	1.37289	-0.096	0.61467	-0.0041	-1.2975
177	-0.4839	1.53404	2.9107	1.65084	0.3043	0.93584	0.45865	-1.3587
178	-0.5604	1.4419	2.76898	1.45044	0.11322	0.80953	0.51774	-1.2103
179	-0.451	1.67715	2.93518	1.63742	0.11014	1.01035	0.86407	-0.8225
180	-0.5661	1.32309	2.92847	1.51443	-0.1029	0.85882	0.5026	-1.1598
181	-0.6689	1.22415	2.5552	1.25401	0.04497	0.80943	0.58964	-1.237
182	-0.8795	1.22252	2.52451	1.24361	-0.0666	0.64451	0.24235	-1.3485
183	-0.9415	1.1037	2.53484	1.21235	-0.1796	0.61186	0.25266	-1.5775
184	-0.6841	1.22711	2.58744	1.32507	-0.1261	0.75694	0.36324	-0.9072
185	-0.8556	1.11936	2.56832	1.15981	-0.1403	0.80541	0.46387	-1.6476
186	-0.8009	1.27115	2.49556	1.33634	0.23735	0.81562	0.493	-0.9882
187	-0.6064	1.37659	2.66741	1.42095	0.25096	0.80909	0.37696	-1.0213
188	-0.6309	1.29083	2.47617	1.37343	0.03797	0.64247	0.5018	-1.4934
189	-0.5192	1.41372	2.68369	1.41553	0.21565	0.85732	0.52598	-1.2334
190	-0.4639	1.44471	2.73034	1.48562	0.39166	0.97466	0.48179	-0.7674
191	-0.6484	1.26892	2.54402	1.37968	0.11908	0.77932	0.21489	-1.0046
192	-0.7656	1.21551	2.64189	1.22148	-0.03	0.70569	0.40426	-0.9927
193	-0.8241	1.00679	2.46068	1.12595	-0.229	0.49639	-0.1798	-1.286
194	-0.6537	1.2198	2.65038	1.30456	-0.0396	0.71306	0.37483	-1.1841
195	-0.6091	1.26668	2.56748	1.32966	0.04683	0.75205	0.34128	-1.2886
196	-0.7539	1.297	2.61967	1.30422	0.05096	0.68983	0.49149	-1.0214
197	-0.6115	1.41634	2.74889	1.42949	0.03004	0.7851	0.33395	-1.0118
198	-0.5019	1.44697	2.70989	1.47715	0.14315	0.77785	0.36985	-1.4143
199	-0.5463	1.43027	2.6975	1.53845	0.11277	0.66962	0.44	-1.1245
200	-0.589	1.39613	2.58143	1.42893	0.01454	0.73648	0.58052	-1.0906
201	-0.6662	1.12172	2.91274	1.19274	-0.6425	0.79844	0.46757	-1.4479
202	-0.6856	1.1695	2.92615	1.23206	-0.4339	0.91393	0.53344	-1.2755
203	-0.8577	1.01626	2.62988	1.27237	-0.6161	0.77374	0.43141	-1.2852
204	-0.6545	1.13348	2.9245	1.2045	-0.6307	0.8102	0.47932	-1.4361
205	-0.3486	1.60586	2.89668	1.65022	0.48023	1.03836	0.60623	-0.792
206	-0.7779	1.18413	2.45174	1.24353	-0.0236	0.72137	0.31453	-1.2412
207	-0.6191	1.30388	2.61861	1.45331	0.0618	0.77638	0.33163	-0.8035
208	-0.6498	1.15438	2.72081	1.31818	-0.1253	0.60463	0.20511	-1.3673
209	-0.5488	1.27659	2.99532	1.38272	-0.0258	0.85965	0.85424	-1.2012
210	-0.6043	1.25519	2.99902	1.53022	-0.1026	0.93712	0.80645	-1.4602

211	-0.5698	1.24622	2.83957	1.24025	-0.055	0.90913	0.50367	-1.132
212	-0.4825	1.33169	2.88243	1.35796	-0.1813	0.91585	0.44626	-0.8727
213	-0.7036	1.20833	2.71294	1.41313	-0.3094	0.8199	0.60254	-1.1719
214	-0.4697	1.44775	3.10222	1.35953	-0.1222	1.11286	0.88093	-0.9982
215	-0.412	1.36853	3.18287	1.3644	-0.1671	0.98406	0.80669	-1.0762
216	-0.4255	1.35865	3.03826	1.59187	-0.288	1.06858	0.92488	-1.7479
217	-0.6321	1.21357	2.78546	1.28468	-0.4982	0.78702	0.53302	-1.3032
218	-0.5831	1.29089	2.90451	1.54699	-0.3415	1.04837	0.70604	-1.0106
219	-0.3812	1.40681	3.19783	1.47783	-0.3574	1.08353	0.75265	-1.1628
220	-0.5119	1.34313	3.09977	1.40568	-0.2603	1.08756	0.70706	-1.1019
221	-0.4667	1.28455	3.11063	1.4988	-0.3185	1.02779	0.67194	-1.087
222	-0.2166	1.48941	3.30742	1.6694	-0.0499	1.2193	1.13748	-1.0847
223	-0.2544	1.28913	3.11087	1.33226	-0.2749	0.84797	0.85336	-1.2111
224	-0.4663	1.09036	2.92491	1.25116	-0.276	0.94355	0.61956	-1.4696
225	-0.4212	1.19703	3.1387	1.5613	-0.2992	1.26882	0.57375	-0.9144
226	-0.4193	1.08296	3.08605	1.05708	-0.6186	1.0396	0.64922	-1.2984
227	-0.2312	1.22315	3.2011	1.40596	-0.6528	1.01892	0.62225	-1.0901
228	-0.2121	1.28485	3.05691	1.55235	-0.7192	1.00052	0.65794	-0.9195
229	-0.1917	1.34377	3.21818	1.28708	-0.4448	1.06339	0.65081	-1.3856
230	-0.0999	1.42545	3.13307	1.41792	-0.397	1.15119	0.75158	-1.3023
231	0.02119	1.50821	3.2252	1.50505	-0.4122	1.0957	0.97855	-1.237
232	-0.0411	1.41145	3.17444	1.50703	-0.5443	1.0415	0.96222	-1.2899
233	-0.2988	1.34916	3.1688	1.40746	-0.4263	1.17926	0.80191	-1.1243
234	-0.4433	1.23667	2.99201	1.28505	-0.4103	0.89369	0.50554	-1.2866
235	-0.1633	1.3057	3.28977	1.30684	-0.5264	0.95761	0.59183	-1.3444
236	-0.2605	1.26641	3.07747	1.32779	-0.752	0.90043	0.4899	-1.0056
237	-0.1743	1.30217	3.1167	1.43262	-0.6868	0.96099	0.52892	-1.0309
238	-0.3084	1.19327	3.00946	1.36994	-0.7554	0.87914	0.4534	-1.0902
239	-0.2277	1.28555	3.09407	1.51417	-0.6286	1.01002	0.58899	-0.9664
240	-0.1339	1.38548	3.14864	1.66221	-0.506	1.12959	0.71964	-0.8298
241	-0.1477	1.37527	3.10498	1.68091	-0.4889	1.02473	0.74151	-0.8484
242	-0.2606	1.28077	3.00771	1.24388	-0.8379	0.83831	0.76209	-1.1155
243	0.00096	1.3771	3.3354	1.50771	-0.3344	1.19934	1.31285	-1.09
244	-0.1851	1.23243	3.0898	1.3114	-0.4616	0.93639	0.9757	-0.9628
245	0.08716	1.49855	3.39767	1.60202	-0.4019	1.15273	1.09831	-0.6362
246	-0.249	1.15639	3.17922	1.38011	-0.531	1.01429	0.89904	-1.2803
247	-0.3261	1.19187	3.06846	1.30931	-0.475	0.93683	0.9356	-1.0939
248	-0.0259	1.53971	3.39826	1.57931	-0.2538	1.13348	0.96679	-0.8442
249	-0.3148	1.34334	3.07842	1.27835	-0.5083	0.97282	0.76814	-1.1349
250	-0.2969	1.33884	3.14423	1.4465	-0.3635	0.9619	0.60835	-1.1281
251	-0.0157	1.61895	3.27462	1.84772	-0.1617	1.14033	0.8043	-0.7442
252	-0.3776	1.33245	2.96339	1.4069	-0.2562	0.87454	0.57949	-1.2509
253	-0.5621	1.24949	2.91529	1.17023	-0.3397	0.83647	0.5345	-1.1792
254	-0.3982	1.29144	2.97558	1.35181	-0.2622	0.90292	0.73254	-1.0903
255	-0.2417	1.46736	2.95674	1.54385	0.05341	0.96613	0.64868	-0.847
256	-0.3472	1.43208	2.98882	1.46257	0.02632	0.88132	0.47047	-0.821
257	-0.447	1.26577	2.92436	1.42317	-0.2625	0.81223	0.63424	-1.2421
258	-0.3561	1.40942	2.89247	1.38648	-0.09	0.91825	0.78708	-1.292

259	-0.4796	1.33267	2.93541	1.29239	-0.1198	0.89845	0.5382	-1.0126
260	-0.4136	1.39195	2.92842	1.5341	-0.0705	0.87358	0.6611	-1.1653
261	-0.3624	1.42888	2.86073	1.53207	0.12218	0.88739	0.5042	-1.0388
262	-0.4819	1.4093	2.77081	1.41364	0.03079	0.82138	0.46368	-1.0589
263	-0.4281	1.46328	2.87427	1.54652	-0.0007	0.76929	0.33565	-1.5323
264	-0.4917	1.31431	2.72928	1.30719	-0.0921	0.63091	0.24219	-0.8875
265	-0.5169	1.33789	2.67262	1.36947	-0.1347	0.6666	0.20819	-1.0571
266	-0.5841	1.30097	2.62659	1.32349	-0.153	0.66423	0.31247	-1.1759
267	-0.5677	1.30882	2.70503	1.32163	-0.0961	0.67701	0.30911	-1.326
268	-0.2894	1.47397	2.86439	1.62552	-0.0394	0.92326	0.7257	-1.1427
269	-0.3125	1.51713	2.99063	1.47039	-0.0519	0.94516	0.54172	-0.9776
270	-0.2394	1.5519	3.00195	1.74529	0.09466	1.04	0.54579	-1.2085
271	-0.2621	1.55858	2.90926	1.62801	0.08057	0.91007	0.47856	-1.3617
272	-0.2579	1.56671	2.93261	1.59577	0.15876	1.0023	0.47875	-1.0783
273	-0.2019	1.65936	3.01493	1.78935	0.15488	1.01715	0.82108	-1.1063
274	-0.3489	1.52111	2.96618	1.48194	-0.0808	0.9138	0.44778	-1.1321
275	-0.2	1.62533	2.98599	1.6235	0.20098	1.04106	0.59767	-0.7433
276	-0.3772	1.44528	2.86233	1.63824	0.03179	0.83463	0.4467	-1.1254
277	-0.486	1.39707	2.75282	1.42598	-0.0891	0.78665	0.21687	-1.1838
278	-0.2499	1.66227	3.05339	1.69912	0.15249	1.05873	0.77436	-0.9025
279	-0.4628	1.51024	2.91919	1.55654	0.10825	0.8715	0.59248	-1.4755
280	-0.3292	1.51785	2.72644	1.50471	-0.0152	0.86326	0.53828	-0.8873
281	-0.1087	1.64509	2.98193	1.67016	0.08138	0.97805	0.66053	-1.139
282	-0.4484	1.48934	2.84647	1.45185	0.0794	0.85596	0.43445	-0.7657
283	-0.5362	1.37175	2.69333	1.35835	0.06802	0.75401	0.43855	-1.0406
284	-0.5406	1.40318	2.69966	1.4474	0.02887	0.76128	0.27982	-1.2094
285	-0.4971	1.41309	2.71722	1.47432	0.01976	0.79261	0.41063	-1.4512
286	-0.6251	1.43721	2.70659	1.52563	0.00754	0.78873	0.4968	-1.5694
287	-0.4335	1.50655	2.67081	1.50747	0.15001	0.92827	0.48354	-0.9401
288	-0.4312	1.44236	2.62698	1.48946	0.04883	0.88597	0.48244	-0.9574
289	-0.3033	1.58513	2.77197	1.64655	0.25836	1.01225	0.66221	-0.8437
290	-0.3831	1.54276	2.73797	1.61488	0.29808	0.94754	0.63564	-0.9201
291	-0.4075	1.47982	2.68614	1.5842	0.13153	0.87454	0.58796	-1.0188
292	-0.4501	1.42486	2.64382	1.55108	0.02477	0.82335	0.54518	-1.0665
293	-0.3742	1.55595	2.89749	1.5772	0.08632	1.04635	0.6325	-0.9637
294	-0.4759	1.37645	2.73697	1.4561	-0.0316	0.89325	0.42403	-1.063
295	-0.3829	1.59161	2.83256	1.63841	0.27693	1.08707	0.80106	-0.8105
296	-0.4535	1.55236	2.85799	1.69283	0.30878	1.08445	0.69174	-0.7188
297	-0.5485	1.32545	2.70419	1.46447	0.076	0.91895	0.72886	-1.0924
298	-0.6901	1.22702	2.68179	1.42577	-0.0536	0.81365	0.54505	-0.989
299	-0.7102	1.21702	2.73005	1.45311	0.06398	0.91645	0.67854	-1.2629
300	-0.7774	1.1284	2.63458	1.30578	-0.1327	0.83039	0.58456	-1.1607
301	-0.8864	1.17121	2.50374	1.23802	-0.1182	0.81018	0.6077	-1.3261
302	-0.7821	1.17988	2.4952	1.29336	0.0129	0.83046	0.40064	-1.268
303	-0.8455	1.21017	2.59515	1.47498	-0.0692	0.83571	0.45003	-1.0736
304	-0.7949	1.23697	2.50664	1.29561	0.04879	0.84094	0.533	-1.1933
305	-0.795	1.24853	2.52072	1.35862	0.06746	0.81475	0.05433	-1.144
306	-0.871	1.07205	2.3986	1.14727	-0.0623	0.63048	0.2868	-1.6052

307	-0.712	1.18094	2.45772	1.26719	0.0552	0.65398	0.51069	-1.5361
308	-0.6606	1.32792	2.60033	1.31045	0.22588	0.80743	0.56088	-0.9566
309	-0.6869	1.39778	2.52676	1.45727	0.34027	0.89563	0.49578	-1.2698
310	-0.5976	1.36909	2.52306	1.44816	0.38188	0.85997	0.50152	-1.2043
311	-0.7972	1.29813	2.52896	1.36052	0.23268	0.73385	0.3668	-1.1107
312	-0.6448	1.35773	2.54184	1.4719	0.28917	0.85941	0.74307	-1.108
313	-0.5934	1.32872	2.5589	1.41438	0.23382	0.83674	0.69108	-1.1617
314	-0.7095	1.30585	2.50267	1.30292	0.10528	0.81256	0.47711	-1.0066
315	-0.6785	1.24703	2.48561	1.28676	-0.017	0.6815	0.18349	-1.2433
316	-0.397	1.56003	2.78487	1.53458	0.39664	0.96696	0.66401	-0.8367
317	-0.4812	1.43481	2.651	1.52205	0.16393	0.92602	0.68483	-1.0228
318	-0.3605	1.52547	2.74571	1.49906	0.17554	0.9503	0.67175	-0.8594
319	-0.6537	1.36415	2.50122	1.33092	0.10196	0.82495	0.44442	-1.097
320	-0.7343	1.21914	2.4245	1.24739	-0.0508	0.67421	0.51295	-1.1179
321	-0.3741	1.55956	2.75556	1.6741	0.36511	1.02519	0.88982	-0.9069
322	-0.41	1.48977	2.71684	1.58224	0.35876	0.79437	0.63	-1.1917
323	-0.6405	1.3787	2.62261	1.38752	0.15579	0.7301	0.50409	-1.3462
324	-0.7561	1.19595	2.40848	1.27026	0.10281	0.64552	0.48103	-1.2608
325	-0.5063	1.38516	2.5581	1.44729	0.50447	0.9376	0.69315	-1.5783
326	-0.7096	1.15532	2.35363	1.27628	0.10231	0.53284	0.50927	-1.3119
327	-0.444	1.30271	2.54482	1.31127	0.23525	0.70541	0.30013	-1.2356
328	-0.4662	1.31165	2.55676	1.26105	-0.027	0.50576	0.46473	-0.9376
329	-0.6799	1.13015	2.38575	1.26734	-0.0763	0.45665	0.44045	-1.2481
330	-0.5621	1.3186	2.71542	1.37693	0.12302	0.64172	0.56798	-1.0604
331	-0.6132	1.20103	2.42612	1.21963	0.02129	0.60666	0.25616	-1.6452
332	-0.7142	1.25779	2.42029	1.33364	0.05191	0.55063	0.53683	-1.3364
333	-0.664	1.27781	2.5137	1.25971	0.07548	0.60466	0.31845	-1.1715
334	-0.7291	1.21343	2.3945	1.1615	-0.0261	0.4566	0.23849	-1.2771
335	-0.7539	1.23715	2.38756	1.39147	0.06917	0.51363	0.41876	-1.6638
336	-0.6676	1.30809	2.5856	1.38458	0.14871	0.69542	0.64489	-0.7804
337	-0.7652	1.35235	2.52607	1.52426	0.2871	0.65455	0.55839	-1.1368
338	-0.6494	1.33684	2.53092	1.37115	0.02145	0.49333	0.57488	-1.3766
339	-0.6436	1.35122	2.491	1.33721	0.09676	0.66705	0.54014	-1.1577
340	-0.6062	1.29787	2.52677	1.33131	-0.0796	0.5116	0.4403	-1.4464
341	-0.5651	1.43591	2.65939	1.41588	0.02374	0.75395	0.62158	-1.0719
342	-0.7156	1.27374	2.3645	1.50251	-0.0342	0.6308	0.7035	-1.302
343	-0.4244	1.48743	2.60924	1.5735	0.0182	0.74414	0.67664	-1.0899
344	-0.2732	1.50655	2.75914	1.56415	0.05168	0.66311	0.76183	-0.8394
345	-0.3869	1.55683	2.77919	1.60788	-0.0381	0.70284	0.70091	-0.8533
346	-0.1103	1.70924	2.89486	1.73577	0.27112	0.89647	0.98599	-0.7708
347	-0.185	1.56716	2.72711	1.60912	0.12507	0.75986	0.90046	-0.8649
348	-0.2675	1.47591	2.73949	1.49923	0.33474	0.78882	0.72529	-0.9346
349	-0.0988	1.52029	2.58277	1.55385	0.12349	0.58812	0.91674	-1.1152
350	-0.1442	1.56077	2.761	1.67918	0.2256	0.69397	0.79136	-0.9632
351	-0.0469	1.57138	2.86266	1.67375	0.31075	0.72147	0.79949	-1.0094
352	-0.2812	1.42855	2.49745	1.50408	0.29114	0.64305	0.77444	-0.9711
353	-0.3594	1.32594	2.44358	1.31228	0.16154	0.59536	0.69315	-0.8045
354	-0.6815	1.24455	2.44445	1.30308	0.22988	0.62163	0.54759	-0.8231

355	-0.6289	1.30127	2.30956	1.28162	0.08189	0.57523	0.40132	-1.2071
356	-0.4846	1.42539	2.36878	1.40484	0.52617	0.62888	0.34018	-1.1633
357	-0.0761	1.73257	2.73638	1.94683	0.59945	0.99938	0.95477	-1.0932
358	-0.5516	1.3043	2.46582	1.3413	0.09564	0.69714	0.552	-0.8983
359	-0.5285	1.3978	2.64975	1.39091	0.25534	0.77958	0.46971	-0.985
360	-0.5527	1.41393	2.6971	1.41948	0.23273	0.80292	0.81102	-0.8887
361	-0.5724	1.27297	2.60517	1.31175	0.2675	0.75192	0.25382	-1.0866
362	-0.7572	1.14912	2.49127	1.21596	0.03088	0.51347	0.48556	-1.3261
363	-0.8476	1.30403	2.46722	1.41785	0.19797	0.60961	0.70712	-1.0762
364	-0.6456	1.27663	2.49502	1.47826	0.07796	0.45884	0.60859	-1.242
365	-0.7909	1.16544	2.31812	1.31468	-0.0042	0.49619	0.57382	-1.1567
366	-0.6258	1.34887	2.4519	1.27846	0.13856	0.59763	0.88091	-0.9822
367	-0.6488	1.25544	2.45075	1.43255	0.00156	0.52666	0.70906	-1.0394
368	-0.7342	1.15973	2.36134	1.18605	0.0746	0.45605	0.66074	-1.1055
369	-0.4851	1.31079	2.50215	1.50845	0.08788	0.28	0.6419	-0.9859
370	-0.4811	1.25339	2.37131	1.26085	-0.1474	0.26539	0.58511	-0.976
371	-0.2266	1.50243	2.67616	1.41461	-0.0087	0.44332	0.95605	-0.7644
372	-0.2129	1.47494	2.59587	1.34242	0.08823	0.45099	1.16001	-0.6706
373	-0.5792	1.32956	2.50345	1.34259	-0.0153	0.55492	0.92916	-1.0891
374	-0.7272	1.38221	2.56111	1.41818	-0.0217	0.52175	0.77629	-0.9851
375	-0.4968	1.48544	2.54001	1.4561	0.17052	0.64259	1.04294	-0.7561
376	-0.2714	1.55251	2.71071	1.58119	0.16798	0.57292	0.7734	-0.5554
377	-0.4677	1.4996	2.61705	1.59377	0.19725	0.6792	0.92288	-1.0669
378	-0.4029	1.46359	2.55132	1.42056	0.08004	0.45144	0.63809	-1.3047
379	-0.3724	1.60853	2.61978	1.65093	-0.0055	0.62545	1.07189	-0.9323
380	-0.5172	1.36644	2.43105	1.4279	-0.1854	0.39037	0.60665	-1.3751
381	-0.4182	1.42813	2.46664	1.37354	-0.1093	0.42056	0.759	-1.1552
382	-0.4481	1.41011	2.65466	1.39809	-0.2626	0.71168	0.95523	-0.9794
383	-0.3342	1.47597	2.80498	1.65222	-0.1616	0.8053	0.94643	-1.0573
384	-0.3914	1.41726	2.42107	1.63152	0.28414	0.68407	0.63945	-1.4086
385	-0.4659	1.39228	2.63683	1.38027	-0.2804	0.69385	0.93741	-0.9972
386	-0.4002	1.50967	2.61361	1.57126	-0.0849	0.53082	0.89556	-1.0777
387	-0.3509	1.49882	2.74398	1.40681	-0.0449	0.58235	1.03136	-1.2626
388	-0.3178	1.55706	2.77254	1.63913	0.10245	0.7235	0.97255	-1.1825
389	-0.6193	1.32665	2.44715	1.26715	0.03051	0.63494	0.84885	-0.8679
390	-0.3661	1.38121	2.61195	1.28457	0.15904	0.55895	0.74112	-1.3754
391	-0.3206	1.48207	2.70652	1.49648	0.12851	0.55155	0.88515	-1.1228
392	-0.5517	1.32978	2.3969	1.32606	0.02083	0.55995	0.74738	-1.0793
393	-0.3987	1.42684	2.63239	1.44394	-0.1118	0.68518	0.62876	-0.9224
394	-0.0843	1.65554	2.7113	1.81575	-0.0286	0.98318	1.06452	-0.4375
395	-0.1821	1.57926	2.65479	1.75017	0.0151	0.92432	0.99626	-0.9003
396	-0.1349	1.61568	2.81695	1.62319	0.06252	0.99893	1.0862	-1.0123
397	-0.2602	1.63717	2.97848	1.64346	0.19421	0.96784	1.02765	-0.7343
398	0.03121	1.63013	2.7455	1.53455	0.04605	0.86224	0.81596	-0.8884
399	-0.0169	1.66751	2.87	1.78477	0.15216	0.89356	0.77896	-0.6381
400	-0.0886	1.67964	2.74281	1.79583	0.10685	0.82788	0.93397	-0.5638
401	-0.0191	1.66638	2.77146	1.73929	0.07925	0.79165	0.95571	-0.8077
402	0.13918	1.81256	2.92314	1.78881	0.22668	0.94851	1.14684	-0.9069

403	-0.2342	1.6206	2.85102	1.51475	0.04585	0.915	0.73988	-0.7826
404	-0.0332	1.69063	2.98448	1.82606	0.32797	1.03246	0.91404	-0.7795
405	-0.461	1.44558	2.8303	1.45586	0.00162	0.70123	1.04726	-1.2192
406	-0.3807	1.48731	2.80411	1.43837	0.04502	0.89232	0.79657	-1.0211
407	-0.2434	1.68277	2.99569	1.73558	0.10259	0.90122	1.03639	-1.0903
408	-0.3023	1.57386	2.90185	1.66096	-0.0229	0.89449	0.98938	-1.0686
409	-0.289	1.55437	2.93135	1.63768	-0.0402	0.80348	0.81956	-1.1489
410	-0.2785	1.67553	2.90595	1.71706	0.14543	0.94997	0.87915	-0.5087
411	-0.159	1.69923	2.94378	1.68722	0.02654	1.0008	1.24436	-0.6903
412	-0.1548	1.65543	2.98444	1.83168	0.01787	0.98477	1.12589	-0.8778
413	0.04969	1.81997	3.10298	1.88964	0.10978	0.97989	0.95515	-0.8261
414	-0.0309	1.66312	3.10239	1.67552	-0.055	0.86235	1.03752	-0.9225
415	0.17975	1.82124	3.24874	1.906	0.04316	1.02411	1.19501	-1.0188
416	0.03516	1.82067	3.15581	1.77009	-0.0087	1.08269	1.12502	-0.7087
417	-0.0412	1.70219	3.15804	1.6626	-0.2673	1.08603	1.13756	-0.5731
418	0.15035	1.69835	3.25206	1.71794	-0.0486	1.16202	1.11772	-0.6781
419	0.24526	1.84649	3.4624	1.96513	-0.0201	1.28724	1.34087	-0.3388
420	-0.2102	1.53583	3.02071	1.44734	-0.3156	0.95956	1.21438	-1.2287
421	0.22233	1.86836	3.43804	1.88145	-0.0082	1.34744	1.43125	-0.41
422	0.19071	1.89016	3.32063	1.82266	0.08271	1.30099	1.44896	-0.5131
423	0.37541	1.82449	3.25046	1.88116	0.00439	1.15531	1.11461	-0.8017
424	0.44946	1.97317	3.29109	1.72669	-0.1335	1.26404	1.3594	-0.5288
425	0.41316	1.85024	3.38717	1.74129	0.16282	1.21414	1.28403	-0.5428
426	0.54291	2.01344	3.56363	1.91898	0.30454	1.35455	1.41147	-0.3552
427	0.3053	1.7645	3.37855	1.69834	0.0544	1.11105	1.15049	-0.5987
428	0.29668	1.76696	3.38419	1.69749	0.03396	1.10422	1.14235	-0.6301
429	0.218	1.75254	3.30579	1.65182	-0.08	1.02671	1.05991	-0.6232
430	0.18392	1.72959	3.14114	1.57406	-0.1036	1.04597	0.83945	-0.6872
431	0.01914	1.60427	3.15665	1.53655	0.01492	1.04871	0.94522	-0.9768
432	0.45003	1.95946	3.30794	1.94095	0.04843	1.26711	1.35079	-0.8423
433	0.28809	1.78071	3.28265	1.71274	-0.0807	1.15368	1.20661	-0.8001
434	0.28916	1.72168	3.33163	1.81631	0.17074	1.16357	1.26151	-1.1416
435	0.21613	1.7057	3.2675	1.84329	0.15065	1.17569	1.2407	-0.9375
436	-0.07	1.53023	3.02546	1.43542	-0.3633	0.88755	1.04501	-1.2464
437	0.18765	1.73554	3.2191	1.74316	-0.0326	1.25987	1.39894	-0.8847
438	-0.0167	1.52228	3.19668	1.52537	-0.2046	1.18554	1.26038	-1.1018
439	0.0343	1.66897	3.29883	1.72139	-0.1126	1.31642	1.06405	-0.9599
440	0.19404	1.70161	3.37383	1.80647	0.03753	1.28528	1.44658	-0.8193
441	0.04791	1.64955	3.20624	1.68003	0.11201	1.15618	1.21007	-0.847
442	0.0054	1.62997	3.08049	1.62926	-0.0817	1.20541	1.25031	-0.6093
443	-0.2153	1.51593	2.99875	1.53333	-0.3605	1.08015	0.88564	-0.9155
444	-0.0618	1.70577	3.16034	1.55553	0.0865	1.20978	1.15355	-0.67
445	0.04239	1.64916	3.17259	1.54899	0.09946	1.16728	1.14309	-0.8332
446	0.09101	1.67803	3.33329	1.59534	0.01506	1.17827	1.11837	-0.6881
447	0.09918	1.60565	3.15641	1.51767	-0.1092	1.11624	1.19008	-1.0505
448	0.11246	1.67912	3.14986	1.64967	-0.0056	1.25797	1.27435	-0.8836
449	0.04079	1.53289	3.16543	1.50516	-0.0621	1.09536	1.04805	-0.7101
450	-0.2502	1.42167	2.83442	1.39347	-0.3271	0.81	0.84154	-1.0108

451	-0.0473	1.62793	3.10181	1.62543	0.03821	1.1501	1.15952	-0.7077
452	-0.0347	1.50887	3.01481	1.59061	-0.1734	0.96208	1.0976	-0.8285
453	-0.0363	1.62233	3.10087	1.72077	-0.0988	1.10749	0.9787	-0.8789
454	0.0634	1.74904	3.19566	1.68015	0.01085	1.24415	1.2512	-0.7608
455	-0.0452	1.65202	3.04755	1.64941	-0.1151	1.17308	0.88435	-1.0546
456	-0.0223	1.76386	3.19608	1.71792	0.08637	1.28195	1.28964	-1.1712
457	-0.1407	1.63703	3.19358	1.64673	0.13169	1.24881	1.32026	-0.8932
458	-0.1031	1.68571	3.10179	1.79797	0.21402	1.15516	1.32997	-1.0174
459	0.02706	1.72245	3.13245	1.71228	0.1262	1.2162	1.37316	-1.1328
460	0.17626	1.90609	3.32908	1.91482	0.33744	1.37173	1.50659	-0.4418
461	-0.0637	1.54849	3.02645	1.5804	-0.1162	1.16518	1.01588	-0.795
462	-0.2666	1.45873	2.83437	1.45029	-0.1296	1.05011	1.07199	-0.8944
463	-0.2518	1.49203	2.80673	1.41871	-0.1907	1.13361	1.32832	-1.1948
464	-0.2668	1.42124	3.22892	1.30854	-0.4653	1.28962	0.91924	-0.991
465	-0.1836	1.52968	3.44753	1.4975	-0.3432	1.43856	1.16245	-1.1857
466	-0.1678	1.64079	3.35168	1.65321	-0.5077	1.36836	1.2165	-0.9723
467	-0.2539	1.59511	3.24556	1.39089	-0.6906	1.3005	1.01274	-0.9121
468	0.05586	1.49571	3.35954	1.29857	-0.6864	1.23409	0.90906	-1.904
469	0.01756	1.51647	3.52494	1.44553	-0.406	1.28541	0.85458	-1.982
470	0.10885	1.61621	3.45796	1.71973	-0.399	1.32442	0.92028	-1.9878
471	0.09176	1.61115	3.41471	1.52821	-0.3059	1.28579	0.91152	-2.0375
472	-0.0561	1.58294	3.3411	1.53505	-0.3264	1.3354	0.91044	-1.2258
473	0.10924	1.71999	3.38127	1.59101	-0.1825	1.44612	1.09581	-1.5866
474	0.20111	1.64691	3.43697	1.58937	-0.3987	1.44777	0.83914	-1.1511
475	0.12458	1.59745	3.5793	1.4623	-0.5598	1.51346	0.87464	-1.5636
476	0.03262	1.56574	3.24087	1.49453	-0.347	1.36022	0.77279	-1.0779
477	-0.0516	1.54141	3.25354	1.38849	-0.4512	1.23656	0.9036	-1.3587
478	-0.189	1.48687	3.05995	1.47374	-0.2432	1.17848	0.77181	-1.0411
479	0.04965	1.57253	3.26948	1.52486	-0.5676	1.35985	0.61651	-1.1204
480	0.14441	1.73252	3.54263	1.7734	-0.4554	1.49739	0.90502	-1.2513
481	0.04237	1.51284	3.4392	1.45394	-0.492	1.42468	0.9229	-1.2634
482	-0.2918	1.36802	3.2431	1.34981	-0.6947	1.42992	0.68651	-1.1295
483	-0.1177	1.44646	3.2922	1.43579	-0.5077	1.39019	0.63971	-1.3364
484	-0.1726	1.37697	3.22544	1.49276	-0.6634	1.1916	0.75935	-1.1733
485	-0.1608	1.43528	3.28072	1.37733	-0.4235	1.25525	0.58409	-1.1488
486	-0.2421	1.41084	3.21205	1.49223	-0.5455	1.10814	0.94131	-1.3166
487	-0.0407	1.62224	3.44676	1.67443	-0.4091	1.34034	1.13776	-1.2088
488	-0.1911	1.63916	3.13105	1.6414	-0.4635	1.30162	0.93126	-1.3403
489	-0.1659	1.52171	3.156	1.54077	-0.4032	1.27412	0.91413	-1.035
490	-0.2221	1.48652	3.16509	1.36478	-0.4398	1.24273	0.78663	-0.9615
491	-0.2532	1.42951	3.07489	1.41051	-0.5584	1.26747	0.69193	-1.2099
492	-0.4408	1.32562	3.14189	1.23861	-0.5203	1.21304	0.74078	-1.481
493	-0.4404	1.27128	3.05979	1.05248	-0.7675	1.14459	0.81249	-1.6571
494	-0.3462	1.28281	3.15536	1.04632	-1.0083	1.15728	0.83204	-1.4679
495	-0.5506	1.23876	3.12391	1.13904	-0.7091	1.18207	0.74642	-1.782
496	-0.0356	1.60471	3.40506	1.32596	-0.5748	1.38322	1.1241	-1.5183
497	-0.331	1.34253	3.08842	1.43539	-0.5514	1.15885	1.09439	-1.454
498	-0.1751	1.51291	3.32059	1.40022	-0.3737	1.38129	1.01091	-0.8993

499	-0.2383	1.47497	3.39282	1.44279	-0.398	1.38385	1.10774	-1.2404
500	-0.4066	1.3803	3.15825	1.28337	-0.6046	1.1841	0.82354	-1.374
501	-0.4451	1.40652	3.38645	1.37735	-0.6427	1.20567	0.9111	-1.4848
502	-0.1405	1.59175	3.74139	1.54494	-0.5026	1.49096	1.10907	-1.7927
503	-0.2425	1.40671	3.49908	1.49153	-0.4654	1.30265	0.90467	-1.4617
504	-0.2759	1.4871	3.1623	1.56832	-0.7262	1.27039	0.92999	-1.3107
505	-0.27	1.38574	3.25932	1.32983	-0.8045	1.18093	0.70127	-1.131
506	-0.3203	1.43238	3.10614	1.36432	-0.6141	1.17315	0.83142	-1.3467
507	-0.3398	1.39576	3.09389	1.39909	-0.6739	1.09762	0.85632	-1.3171
508	-0.407	1.3507	3.24047	1.20543	-0.6863	1.17385	0.95681	-1.5149
509	-0.407	1.2749	3.00102	1.40551	-0.7468	1.05384	0.81919	-1.6207
510	-0.5572	1.29333	3.14685	1.27797	-0.8297	1.10336	0.66729	-1.5886
511	-0.3851	1.2743	3.21507	1.35068	-0.6284	1.1457	0.92126	-1.2539
512	-0.29	1.36111	3.28228	1.38695	-0.537	1.28883	0.96407	-1.3315
513	-0.5362	1.2066	3.07724	1.09886	-0.7861	1.16198	0.89747	-1.0971
514	-0.46	1.1284	3.07863	1.12601	-0.8339	1.07574	0.93528	-1.3833
515	-0.0967	1.55233	3.33425	1.42901	-0.5903	1.31895	1.29128	-0.9294
516	0.02213	1.70316	3.42424	1.66616	-0.3617	1.41954	1.31211	-1.1094
517	-0.0661	1.74247	3.45336	1.75489	-0.406	1.47004	1.31818	-0.8707
518	-0.1601	1.68891	3.33937	1.48469	-0.5968	1.3943	1.10655	-0.8183
519	0.07889	1.90709	3.43882	1.91325	-0.5194	1.48735	1.20727	-1.0507
520	-0.1731	1.62131	3.26737	1.51106	-0.6383	1.28294	1.15688	-0.737
521	0.11358	1.79938	3.45059	1.86732	-0.3475	1.50555	1.28387	-1.0479
522	-0.0127	1.73285	3.36328	1.778	-0.6422	1.28642	1.28593	-0.7506
523	0.04219	1.671	3.46155	1.47342	-0.4723	1.34957	1.04068	-0.5684
524	0.06014	1.68713	3.55626	1.53793	-0.569	1.48226	1.11025	-0.6666
525	-0.1203	1.65183	3.18344	1.59588	-0.5394	1.25677	0.86	-0.7448
526	-0.1473	1.65408	3.13807	1.51389	-0.4764	1.26341	1.15905	-0.9434
527	-0.0962	1.73403	3.22591	1.73626	-0.3686	1.39649	1.02613	-1.2455
528	-0.0459	1.66683	3.26443	1.69276	-0.6648	1.24839	1.11729	-1.0915
529	-0.0867	1.64508	3.31264	1.57827	-0.5758	1.27747	1.27998	-0.9489
530	-0.0104	1.67079	3.38235	1.65058	-0.4097	1.39567	0.96911	-0.9566
531	-0.0154	1.66839	3.25023	1.57591	-0.5019	1.28443	1.03026	-1.2532
532	-0.1059	1.59455	3.37957	1.41738	-0.5919	1.30699	0.9156	-1.1012
533	-0.0571	1.6511	3.38946	1.7869	-0.4224	1.29348	1.16258	-1.3576
534	0.15308	1.85203	3.55181	1.80968	-0.4393	1.48492	1.11952	-0.8448
535	-0.0083	1.74029	3.47488	1.73266	-0.345	1.35461	1.06613	-0.7905
536	-0.1633	1.58101	3.40885	1.62335	-0.5208	1.25905	1.14304	-0.8069
537	-0.062	1.57893	3.35721	1.46051	-0.4444	1.26894	0.95881	-1.2257
538	-0.0946	1.61144	3.32417	1.48343	-0.4613	1.25372	0.95435	-0.9088
539	-0.1196	1.60564	3.38141	1.58575	-0.4445	1.28399	1.01831	-1.0129
540	-0.2122	1.44074	3.24195	1.52212	-0.5156	1.13804	0.9712	-1.2867
541	-0.0489	1.61411	3.43862	1.6663	-0.4172	1.3322	1.12963	-1.217
542	-0.1604	1.45315	3.20562	1.54946	-0.8279	1.13659	0.83434	-1.1249
543	-0.0309	1.59823	3.4484	1.58999	-0.4539	1.33117	1.24014	-0.8761
544	-0.1549	1.5111	3.31325	1.58342	-0.6388	1.22653	0.92771	-1.4454
545	-0.1068	1.53137	3.31134	1.60287	-0.6893	1.21902	1.09199	-0.998
546	-0.065	1.60446	3.27448	1.65586	-0.4239	1.17483	1.00821	-1.5296

547	0.20429	1.8016	3.61094	1.83243	-0.4341	1.40389	1.18996	-1.202
548	0.04727	1.67209	3.55376	1.64443	-0.4	1.37389	1.05855	-0.8651
549	0.01491	1.59532	3.40937	1.52227	-0.4512	1.33227	1.05336	-1.1095
550	0.0329	1.6112	3.51744	1.75804	-0.5848	1.36494	0.88917	-0.9172
551	-0.1365	1.49776	3.46224	1.42604	-0.6247	1.241	0.81843	-1.4497
552	0.01062	1.64492	3.35349	1.47743	-0.3215	1.36517	1.18193	-0.911
553	-0.0485	1.39732	3.18737	1.33977	-0.6483	1.19817	0.58954	-1.4007
554	-0.0197	1.45315	3.43499	1.318	-0.7041	1.36916	0.73034	-1.7079
555	0.01982	1.53333	3.46848	1.63657	-0.0327	1.43326	1.20762	-0.8044
556	0.04732	1.56679	3.47893	1.74192	-0.0226	1.49899	0.97686	-0.9621
557	0.1211	1.86664	3.49707	1.91179	-0.5084	1.42021	1.41972	-0.6168
558	0.08349	1.7123	3.50285	1.51471	-0.431	1.39087	1.08198	-0.5272
559	0.04693	1.68468	3.50046	1.50378	-0.4662	1.34346	1.0673	-0.5617
560	-0.0653	1.53285	3.30826	1.49491	-0.6234	1.23119	0.85396	-1.0412
561	0.04622	1.65867	3.44322	1.70593	-0.8133	1.33393	0.94518	-0.9402
562	-0.0362	1.70562	3.48198	1.69049	-0.6173	1.42888	1.37347	-1.0862
563	0.06419	1.64009	3.45727	1.66199	-0.5164	1.35615	1.15877	-0.7345
564	-0.0281	1.42072	3.35992	1.30033	-0.637	1.21614	0.9232	-1.3143
565	-0.2287	1.43146	3.1429	1.51806	-0.5782	1.16606	0.8771	-1.088
566	-0.2197	1.33226	3.17475	1.22533	-0.8329	1.08059	0.72974	-1.187
567	-0.1765	1.24527	3.28904	1.21615	-0.8696	1.1726	0.83497	-1.2072
568	-0.4738	0.91493	2.93648	1.11326	-0.9269	0.90946	0.76477	-2.4318
569	-0.3193	1.07037	3.05726	1.08747	-0.8557	1.09346	0.73134	-1.3458
570	-0.328	1.1413	2.97395	0.96247	-0.8249	1.05431	1.04025	-1.2285
571	-0.1599	1.23891	2.92101	0.99394	-0.8114	1.1332	0.98357	-1.2418
572	-0.1722	1.24998	3.09256	1.01	-0.7791	1.20582	0.96838	-1.5389
573	-0.4221	1.0873	3.07845	0.93781	-0.6441	1.01494	0.88319	-1.6384
574	-0.2952	1.28897	3.14335	1.36921	-0.4209	1.11725	1.12252	-1.453
575	-0.1801	1.33395	3.20186	1.53418	-0.8358	1.22853	1.02819	-0.9586
576	-0.351	1.26131	3.01753	1.27591	-0.7649	1.20233	0.89828	-1.0454
577	-0.2718	1.40831	3.09458	1.48797	-0.6447	1.192	0.99875	-1.3795
578	-0.2908	1.36074	3.16729	1.37549	-0.8163	1.20659	1.27989	-1.355
579	-0.4051	1.33138	3.12215	1.37337	-0.844	1.13122	0.95895	-1.5012
580	-0.2913	1.43852	3.06272	1.52483	-0.7646	1.17024	1.22812	-1.4261
581	-0.303	1.50001	3.10699	1.53271	-0.777	1.17429	1.07487	-1.0392
582	-0.2067	1.58528	3.2542	1.65937	-0.5608	1.22389	1.31267	-0.7701
583	-0.2722	1.43901	3.13946	1.47784	-0.6373	1.21246	1.18652	-1.1982
584	0.02127	1.69566	3.38224	1.72833	-0.6148	1.4646	1.28269	-0.9945
585	-0.2375	1.61616	3.16335	1.54945	-0.7253	1.30327	1.14745	-1.134
586	-0.1984	1.51779	3.14621	1.42808	-0.613	1.28433	1.07515	-0.957
587	-0.1863	1.47776	3.23036	1.45944	-0.554	1.32136	1.01071	-1.1295
588	-0.2303	1.57124	3.25433	1.44536	-0.5457	1.34019	0.93765	-0.9842
589	-0.0555	1.709	3.28975	1.45301	-0.4977	1.32569	1.28031	-0.8613
590	-0.2215	1.42974	3.25342	1.47176	-0.7205	1.18202	1.069	-1.0986
591	0.07681	1.70379	3.57293	1.5546	-0.5523	1.49893	1.12692	-0.65
592	-0.0328	1.58575	3.52704	1.47253	-0.5496	1.41905	1.10732	-1.0552
593	0.00867	1.75515	3.39839	1.62308	-0.3564	1.41724	1.13377	-0.7927
594	-0.0836	1.76863	3.45697	1.78789	-0.3477	1.4014	1.26797	-0.6807

595	-0.316	1.41228	3.23314	1.51314	-0.5253	1.38787	1.21007	-0.9775
596	-0.3014	1.37181	3.3542	1.31511	-0.8264	1.39043	1.11537	-1.0308
597	-0.2206	1.43874	3.37952	1.51512	-0.464	1.31014	1.0857	-1.0895
598	-0.3631	1.4276	3.16119	1.37258	-0.4889	1.24383	0.8939	-1.8487
599	-0.494	1.25759	3.20605	1.24815	-0.8567	1.21451	1.05029	-1.2297
600	-0.4498	1.18425	3.16285	1.00049	-0.8816	1.18102	0.91207	-1.2018
601	-0.4042	1.27874	3.26472	1.2505	-0.5883	1.24623	0.99	-1.3655
602	-0.3128	1.34003	3.15301	1.31005	-0.8614	1.23483	0.79033	-1.318
603	-0.0988	1.53538	3.28082	1.58487	-0.5741	1.30222	1.20982	-1.2619
604	0.00432	1.58736	3.56628	1.76713	-0.4859	1.43018	1.17957	-0.8534
605	0.13549	1.74578	3.70659	1.67609	-0.0779	1.57849	1.46083	-0.9748
606	-0.3205	1.34221	3.27353	1.26765	-0.2082	1.15478	0.91743	-1.4236
607	-0.0546	1.64122	3.52823	1.43632	-0.5195	1.37819	1.35616	-1.1304
608	-0.2137	1.35115	3.26463	1.35027	-0.7453	1.16712	1.16896	-1.3795
609	-0.35	1.33104	3.38506	1.46713	-0.6726	1.23106	0.86962	-1.3374
610	0.04043	1.63071	3.61846	1.62495	-0.3877	1.47829	1.17119	-0.9965
611	-0.1293	1.40703	3.36927	1.27285	-0.6282	1.40389	1.15143	-1.3049
612	-0.1493	1.40953	3.40221	1.57446	-0.6261	1.292	1.19969	-1.321
613	-0.1269	1.58322	3.43746	1.62632	-0.2934	1.49965	1.30535	-0.8047
614	-0.1644	1.49961	3.25221	1.48129	-0.5321	1.34321	1.03256	-1.1077
615	-0.4029	1.39864	3.08173	1.27276	-0.7183	1.16759	0.76505	-1.1568
616	0.02728	1.79176	3.37251	1.53577	-0.4149	1.40845	1.36307	-0.7786
617	-0.0023	1.70888	3.40933	1.74771	-0.3675	1.48233	1.45639	-0.9283
618	-0.2519	1.4764	3.29726	1.57726	-0.4612	1.45199	1.27419	-0.9134
619	-0.1626	1.51065	3.49304	1.45394	-0.6876	1.52926	1.2542	-0.892
620	-0.193	1.36324	3.34996	1.22052	-0.6357	1.38678	0.93379	-1.006
621	-0.3645	1.17993	3.29274	1.17252	-1.047	1.2048	1.00798	-1.1996
622	-0.2217	1.33995	3.61434	1.29264	-0.6682	1.40043	1.36459	-1.1241
623	-0.2767	1.33756	3.39342	1.39681	-0.5121	1.41684	1.23019	-1.4908
624	-0.2742	1.45347	3.37584	1.49953	-0.4219	1.27115	1.13488	-1.3728
625	-0.1188	1.55765	3.54058	1.61007	-0.1821	1.52878	1.35735	-1.3165
626	0.17065	1.81392	3.56079	1.75238	0.00479	1.63176	1.32344	-0.7538
627	0.12792	1.75552	3.62187	1.75696	0.01345	1.51261	1.26871	-0.8459
628	0.35512	2.03224	3.77363	1.84992	-0.2112	1.73192	1.3072	-0.4621
629	0.14647	1.86557	3.54402	1.82621	-0.3305	1.48562	1.259	-0.9013
630	0.0922	1.88884	3.52657	1.91586	-0.1949	1.48671	1.20659	-0.9178
631	0.09265	1.93557	3.5117	1.74875	-0.2237	1.52201	1.19916	-0.6766
632	-0.2106	1.62761	3.202	1.71544	-0.4295	1.28633	1.02922	-1.172
633	0.14202	1.74366	3.30035	1.77414	0.20611	1.25029	1.30417	-0.7529
634	-0.0965	1.52804	2.97857	1.52733	-0.1836	1.10349	1.14838	-0.7112
635	0.01456	1.50666	3.1392	1.47893	-0.0883	1.06913	1.02182	-0.7363
636	-0.221	1.45091	2.86365	1.4227	-0.2979	0.83924	0.87077	-0.9816
637	-0.185	1.49021	2.9641	1.48772	-0.0995	1.01239	1.02181	-0.8455
638	-0.2393	1.50718	3.15041	1.3751	-0.6044	1.16926	0.88579	-1.0407
639	-0.2448	1.60746	3.29581	1.62672	-0.5089	1.24023	1.1068	-0.8418
640	-0.2512	1.4603	3.31553	1.45029	-0.7248	1.17048	0.69038	-0.8222
641	-0.1987	1.44883	3.28938	1.42275	-0.4538	1.18048	0.82375	-0.9378
642	-0.2265	1.62633	3.41692	1.4981	-0.272	1.22141	0.86815	-0.9427

643	-0.1368	1.54416	3.29747	1.40161	-0.3366	1.14946	0.88691	-0.8529
644	0.05809	1.81865	3.49679	1.7852	-0.0797	1.40091	1.18138	-0.6673
645	-0.307	1.53389	3.28635	1.53248	-0.3514	1.22232	1.00902	-1.1779
646	-0.2127	1.60587	3.44175	1.61669	-0.2939	1.33274	1.06685	-0.7252
647	-0.2349	1.44274	3.21682	1.36769	-0.5789	1.19088	0.87135	-1.164
648	-0.2745	1.46016	3.25061	1.30346	-0.3703	1.147	0.74187	-1.2892
649	-0.2231	1.60686	3.39252	1.5076	-0.3059	1.42976	0.90403	-1.1799
650	-0.2736	1.42718	3.30236	1.41002	-0.4959	1.2792	0.72981	-1.059
651	-0.1441	1.59896	3.38198	1.51616	-0.4407	1.37274	1.13002	-1.0103
652	-0.1916	1.52899	3.33716	1.53442	-0.9816	1.27309	1.05745	-1.0923
653	-0.2339	1.3952	3.34476	1.30813	-0.8215	1.21192	0.77726	-1.3788
654	-0.0249	1.58615	3.51889	1.57996	-0.3913	1.37853	1.07289	-0.9819
655	-0.1043	1.53581	3.36228	1.68397	-0.6341	1.2541	1.22657	-1.4004
656	0.16409	1.70946	3.48331	1.78336	-0.3392	1.44375	1.14044	-0.8375
657	0.25057	1.92557	3.54825	1.85451	-0.2947	1.50746	1.23519	-0.6484
658	-0.2456	1.53495	3.16007	1.60421	-0.5707	1.22573	1.06626	-1.0743
659	-0.1945	1.54491	3.18072	1.58483	-0.4292	1.22807	1.02246	-1.0337
660	-0.0699	1.67794	3.13708	1.65018	-0.3704	1.18003	1.16344	-0.5231
661	-0.0065	1.73724	3.0401	1.67389	-0.3336	1.1743	0.8585	-1.4536
662	0.10348	1.88219	3.26887	1.71546	-0.0615	1.29177	0.97315	-0.893
663	-0.2198	1.58636	3.00142	1.59276	-0.4543	1.03207	0.73568	-1.0192
664	-0.346	1.50335	3.06738	1.5298	-0.3414	1.2014	0.71787	-0.9936
665	-0.3445	1.50775	3.17811	1.37229	-0.4313	1.15442	0.64603	-0.7462
666	-0.0786	1.63553	3.36331	1.56556	-0.3858	1.28021	0.81186	-0.8279
667	-0.0196	1.73503	3.35664	1.6598	-0.1281	1.343	0.87224	-1.0307
668	-0.097	1.72833	3.51805	1.55313	-0.124	1.39296	0.84804	-1.0832
669	-0.356	1.3746	3.40696	1.38911	-0.4498	1.20101	0.57312	-1.2916
670	-0.129	1.46715	3.31285	1.42718	-0.5491	1.24327	0.62025	-1.0881
671	-0.0268	1.55252	3.5011	1.37048	-0.2448	1.31905	0.68319	-1.183
672	0.27141	1.79374	3.80326	1.6613	-0.2657	1.63124	0.92794	-1.0259
673	0.00727	1.59572	3.4801	1.51189	-0.5791	1.38751	0.89349	-1.5004
674	-0.0587	1.65621	3.6583	1.45558	-0.2066	1.50206	0.4865	-1.124
675	-0.1058	1.50639	3.56173	1.43674	-0.4329	1.40825	0.64368	-0.9086
676	-0.0794	1.59624	3.61526	1.68747	-0.5546	1.44628	0.61776	-1.1078
677	0.13462	1.63785	3.5172	1.51594	-0.1888	1.5387	0.75823	-1.191
678	0.17847	1.77271	3.80964	1.72887	0.03156	1.66289	0.44412	-0.963
679	0.03717	1.57405	3.63466	1.46786	-0.1642	1.59418	0.40947	-1.1971
680	0.0987	1.59014	3.82181	1.44096	-0.5953	1.80337	-0.1627	-1.1272
681	0.09263	1.71156	3.84568	1.46054	-0.3163	1.82942	0.28816	-1.6542
682	0.21975	1.72425	3.85791	1.5802	-0.2525	1.70166	0.11296	-1.3331
683	0.04109	1.49525	4.26633	1.38915	-0.2451	1.73941	-0.4117	-1.2686
684	0.35015	1.69943	5.31732	1.50806	-0.1523	2.22098	-0.251	-1.0377
685	0.29783	1.54081	5.57837	1.45529	-0.4885	2.43745	-0.3491	-1.7228
686	0.39681	1.70363	4.99723	1.61649	0.29783	2.27093	0.47763	-1.7401
687	0.24305	1.73609	3.91109	1.74095	-0.028	1.80765	0.14861	-1.0088
688	0.13204	1.60263	3.63886	1.50194	-0.4296	1.55423	0.30224	-0.8294
689	-0.0978	1.45076	3.51394	1.04322	-0.6083	1.36549	0.13785	-1.6887
690	-0.1469	1.44522	3.40701	1.29202	-0.428	1.27318	0.07081	-1.1944

691	0.00796	1.58006	3.56033	1.31427	0.17101	1.35792	0.081	-1.1571
692	-0.1687	1.40151	3.45545	1.39878	-0.3297	1.25033	0.38631	-1.9168
693	-0.0476	1.50846	3.45034	1.36476	-0.4836	1.22959	0.34342	-1.2967
694	0.00558	1.53478	3.50286	1.12387	-0.3888	1.27434	0.24481	-1.2373
695	0.01816	1.36114	3.33462	1.2726	-0.7327	1.09485	0.08766	-1.3308
696	-0.2845	1.25497	3.2239	0.96673	-0.3832	0.98972	0.16097	-1.358
697	0.01385	1.67786	3.50383	1.37524	0.07441	1.41303	0.16026	-1.2501
698	0.09322	2.0198	3.76991	1.6494	0.15501	1.70354	0.24769	-0.8121
699	-0.0989	1.7576	3.50092	1.43602	-0.1471	1.41157	0.22232	-1.121
700	-0.0381	1.73861	3.64004	1.48511	-0.1099	1.38181	0.32126	-1.3248
701	0.20624	1.92752	3.79889	1.56333	-0.0322	1.52293	0.21002	-0.9015
702	0.18477	1.91927	3.87258	1.7279	0.07102	1.66983	0.14918	-1.0111
703	0.28935	1.9639	4.11452	1.7097	0.0553	1.8178	0.41618	-0.657
704	0.11046	1.82878	3.98361	1.6129	-0.1356	1.70292	0.04286	-1.1245
705	0.23128	1.79707	3.80205	1.46668	-0.0261	1.54013	0.25702	-1.0577
706	0.28745	1.87036	3.9124	1.49717	-0.0954	1.60812	0.13821	-0.8963
707	0.32995	1.85284	3.87408	1.51219	-0.2379	1.62766	0.13932	-1.003
708	0.15312	1.73474	3.73215	1.4717	-0.2424	1.47648	-0.1293	-1.3743
709	-0.1084	1.52483	3.52145	1.06848	-0.5293	1.41128	-0.2445	-1.4804
710	0.20708	1.8698	3.72168	1.45107	-0.401	1.45672	-0.0562	-1.2284
711	0.24692	1.78869	3.77936	1.39907	-0.5099	1.56915	0.22955	-0.948
712	0.24882	1.89586	3.84619	1.58804	-0.222	1.61248	0.07596	-0.9692
713	0.08397	1.74954	3.68472	1.50097	-0.2657	1.42058	0.12721	-1.2435
714	0.34284	1.84734	3.981	1.70329	-0.1294	1.82476	0.23605	-1.21
715	0.11287	1.6352	3.64472	1.50276	-0.4243	1.47271	0.7694	-1.1844
716	0.04867	1.63712	3.5215	1.55328	-0.5377	1.42891	0.93488	-1.459
717	0.11864	1.66797	3.28041	1.62948	0.06724	1.14172	1.03122	-0.8647
718	0.20252	1.66382	3.4874	1.87446	0.1085	1.14837	1.14338	-0.8008
719	-0.0258	1.67598	3.37504	1.48622	-0.3375	1.091	0.11912	-1.2224
720	0.068	1.82887	3.66318	1.65633	-0.3055	1.20057	0.46855	-0.7814
721	0.06469	1.74983	3.55475	1.5197	-0.2431	1.21598	0.47392	-0.9633
722	0.21872	1.7408	3.44979	1.56641	-0.3825	1.32825	0.27178	-1.1894
723	0.53503	1.96419	3.78464	1.63753	-0.2538	1.53473	0.72308	-1.1188
724	0.3497	1.72353	3.62385	1.44658	-0.0366	1.40713	0.29643	-1.088
725	0.48918	1.92873	3.93398	1.5046	-0.0501	1.73045	0.61557	-0.8287
726	0.24612	1.71855	3.58695	1.50272	-0.3357	1.43988	0.26682	-0.9379
727	0.41465	1.79039	3.76544	1.65671	-0.1646	1.60677	0.46872	-1.1556
728	0.37698	1.75902	3.71849	1.5694	-0.1448	1.53241	0.89688	-0.4886
729	0.19785	1.73904	3.54826	1.57135	-0.3195	1.41991	0.96799	-0.5787
730	0.47725	1.95006	3.76488	1.78847	-0.0569	1.54892	0.91291	-0.714
731	-0.0837	1.46214	3.29954	1.35315	-0.1823	1.28218	0.75225	-1.1823
732	0.10587	1.54227	3.40006	1.40488	-0.4486	1.31954	0.91441	-1.2413
733	0.02763	1.64644	3.52469	1.5525	-0.286	1.40271	0.78861	-0.9848
734	-0.0032	1.57417	3.452	1.56337	-0.3254	1.35358	0.77026	-1.6508
735	0.01583	1.71867	3.48592	1.67779	-0.2359	1.43517	0.88386	-1.4114
736	-0.0157	1.70364	3.44562	1.66777	-0.1566	1.40819	0.9239	-1.2747
737	-0.0017	1.69655	3.3328	1.67434	-0.1409	1.27625	0.86438	-0.8973
738	-0.1493	1.65717	3.28043	1.54109	-0.333	1.20579	0.80513	-1.0056

739	-0.1	1.63307	3.28302	1.59581	-0.2161	1.25332	0.87107	-1.1611
740	-0.0994	1.60481	3.32007	1.55441	-0.3868	1.31041	0.86354	-1.052
741	-0.2253	1.47177	3.14768	1.44636	-0.0852	1.18765	0.48499	-1.2166
742	-0.1467	1.58253	3.33242	1.59229	0.2224	1.35563	0.5447	-0.934
743	-0.0806	1.55701	3.29227	1.49468	-0.1285	1.30791	0.69575	-0.9981
744	-0.0043	1.68466	3.39402	1.71802	-0.0544	1.38094	0.86545	-0.7695
745	-0.101	1.58221	3.34506	1.50716	-0.2965	1.27134	0.65258	-0.7198
746	-0.1678	1.61335	3.30186	1.65047	-0.0392	1.31709	0.49708	-0.9401
747	-0.0248	1.63845	3.42514	1.56205	0.19613	1.38936	0.64198	-0.9479
748	-0.129	1.64367	3.41345	1.71286	-0.032	1.39866	0.69273	-0.9836
749	-0.2246	1.50661	3.19803	1.45802	-0.2582	1.21898	0.57559	-1.3295
750	-0.2582	1.42181	3.07541	1.44292	-0.252	1.19274	0.56108	-1.3245
751	-0.4728	1.36845	3.1114	1.45414	-0.2989	1.18253	0.54022	-1.1177
752	-0.3597	1.38499	3.11546	1.36412	-0.3125	1.15483	0.52668	-1.3753
753	0.00442	1.65488	3.35268	1.62627	-0.2241	1.3439	0.62284	-0.9444
754	-0.1125	1.57033	3.39839	1.5683	-0.2339	1.33109	0.63665	-0.9404
755	-0.2136	1.51029	3.19568	1.44759	-0.3271	1.19681	0.60358	-1.3257
756	-0.0683	1.58439	3.3888	1.61323	-0.3107	1.29666	0.59114	-1.323
757	-0.3805	1.29096	3.13962	1.27864	-0.4823	1.09583	0.47976	-1.3375
758	-0.303	1.41222	3.23642	1.42315	-0.2717	1.11252	0.48997	-1.3067
759	-0.3386	1.41043	3.1323	1.37279	-0.3479	1.0589	0.37275	-0.9973
760	-0.1749	1.54988	3.18892	1.67501	-0.303	1.15617	0.73314	-0.9666
761	-0.1114	1.62755	3.29371	1.68273	-0.0314	1.27246	0.46529	-1.0085
762	-0.1895	1.4967	3.26505	1.46459	-0.3352	1.12637	0.48672	-0.846
763	-0.0762	1.59583	3.305	1.60944	-0.0889	1.2511	0.63595	-1.0063
764	-0.1068	1.61782	3.22754	1.55099	-0.18	1.14801	0.70167	-1.1453
765	-0.1931	1.53285	3.17652	1.52763	-0.3158	1.09166	0.63271	-0.8977
766	-0.186	1.47504	3.05487	1.67283	0.02734	0.97829	0.72868	-1.2613
767	-0.2762	1.42986	2.96556	1.35056	-0.328	0.85913	0.60719	-1.2131
768	-0.2446	1.51496	3.07869	1.44019	-0.3291	0.91784	0.82266	-1.2196
769	0.07676	1.6859	3.35728	1.75311	-0.0866	1.15592	0.99728	-0.7962
770	-0.162	1.42346	3.20491	1.38534	-0.2856	0.93263	0.77202	-1.1413
771	-0.1671	1.38222	2.99466	1.34373	-0.2185	0.85597	0.74547	-1.1505
772	-0.1789	1.35555	3.17913	1.56619	-0.1998	0.8401	0.83511	-1.109
773	0.05888	1.66734	3.46901	1.65738	-0.2302	1.10132	1.06578	-1.1023
774	0.06937	1.68046	3.46989	1.64667	0.00242	1.24594	1.18144	-0.9483
775	0.07579	1.88528	3.63767	1.92523	0.05589	1.24327	1.32018	-0.4424
776	-0.1086	1.86766	3.64415	1.76727	-0.2659	1.23326	1.23906	-0.7275
777	0.02397	1.80716	3.71774	1.9241	-0.1956	1.21192	0.90559	-0.7866
778	0.05499	1.82581	3.57069	1.89612	-0.0787	1.1281	1.21093	-0.8523
779	0.0428	1.61943	3.17149	1.52518	-0.3457	1.14708	1.06457	-0.8708
780	0.05744	1.37267	2.90693	1.20813	-0.4151	1.0276	0.90473	-1.0156
781	-0.398	0.68643	2.14386	0.57944	-0.8552	1.04663	0.68762	-1.9483

1.1.3. FS E3

Appendix Table 1.5. Natural log of key indicator element abundance variability against conservative lithophile element Ti in core FS E3 in the Three Rivers Estuarine Complex saltmarshes.

Depth (mm)	Si/Ti	K/Ti	Ca/Ti	Br/Ti	Sr/Ti	Zr/Ti	Ba/Ti
1	-1.962	-0.1962	1.27438	-1.3047	-0.5013	-0.4041	-3.0199
2	-1.7582	0	1.33842	-1.155	-0.5782	-0.4594	-2.7217
3	-1.8992	-0.2027	1.28455	-1.6205	-0.7622	-0.6504	-3.2361
4	-2.0907	-0.2744	0.98555	-1.5647	-0.848	-1.0537	-2.8182
5	-1.8452	0.00406	1.28665	-1.3255	-0.6068	-0.5004	-2.6902
6	-1.8955	-0.0961	1.23762	-1.3732	-0.7527	-0.545	-2.8776
7	-2.0955	-0.0844	1.10079	-1.0617	-0.4998	-0.2141	-2.5893
8	-1.7939	-0.0293	1.27942	-1.1922	-0.6185	-0.4821	-2.8419
9	-2.0118	-0.1024	1.2569	-1.2348	-0.6092	-0.3405	-2.3794
10	-2.1582	-0.1398	1.184	-1.2964	-0.6251	-0.0845	-2.3721
11	-1.9323	-0.0584	1.34936	-1.1572	-0.5045	-0.3142	-2.532
12	-2.0746	-0.1822	1.26928	-1.213	-0.6599	-0.2709	-2.5338
13	-1.8346	-0.0662	1.24285	-1.1066	-0.7881	-0.335	-2.2047
14	-1.837	-0.1087	1.19135	-1.1141	-0.8572	-0.3125	-2.4223
15	-2.06	-0.1887	0.88797	-1.188	-0.983	-0.3203	-2.6632
16	-1.9469	-0.1609	0.95829	-1.2298	-0.8887	-0.6074	-2.7731
17	-1.9228	-0.0479	1.10205	-1.0948	-0.8111	-0.5319	-2.6398
18	-1.8461	-0.0082	1.06649	-1.2073	-0.8023	-0.4218	-2.4051
19	-1.7596	0.03068	1.14508	-0.9245	-0.5232	-0.2471	-2.3494
20	-1.7531	-0.0424	0.93712	-1.1094	-0.8948	-0.6501	-2.1643
21	-1.7907	-0.04	0.88961	-0.9992	-0.9401	-0.6303	-2.6332
22	-1.776	0.00453	0.92724	-0.7804	-0.7528	-0.3571	-2.3575
23	-1.7213	0.01759	1.00572	-0.7078	-0.7389	-0.4752	-2.6258
24	-1.7037	0.08132	1.12816	-0.8428	-0.7906	-0.5418	-2.6617
25	-1.7639	-0.0104	0.8712	-1.1128	-0.7886	-0.4726	-2.346
26	-1.8009	0.017	1.02341	-1.1165	-0.8389	-0.7066	-2.9312
27	-1.8321	-0.0282	1.04594	-1.2468	-0.8268	-0.3978	-2.4131
28	-1.708	0.06761	1.0857	-1.1466	-0.7121	-0.3546	-2.2216
29	-1.9536	-0.2256	0.86606	-1.3675	-0.9415	-0.69	-2.4866
30	-1.6378	0.04652	1.07879	-1.4851	-0.7531	-0.5689	-2.3805
31	-1.8004	-0.0501	1.16007	-1.5339	-0.8102	-0.5817	-2.4721
32	-1.7794	-0.0812	1.05182	-1.7566	-0.9054	-0.6362	-2.286
33	-1.7714	-0.0051	1.25418	-1.6625	-0.7415	-0.4593	-2.3455

34	-1.8083	-0.0351	1.11936	-1.6378	-0.823	-0.5745	-2.5241
35	-1.8559	-0.0303	1.08862	-1.6302	-0.808	-0.5662	-2.3384
36	-1.7962	-0.0951	1.22389	-1.6267	-0.941	-0.7183	-2.6191
37	-1.8818	-0.0649	1.14915	-1.6933	-0.8968	-0.7473	-2.2582
38	-2.0043	-0.0532	1.12551	-1.6788	-1.053	-0.8346	-2.4688
39	-1.9605	-0.085	1.20082	-1.818	-0.8731	-0.8174	-2.5153
40	-1.8197	0.03683	1.30977	-1.8337	-0.8437	-0.5331	-2.3528
41	-1.8642	-0.0378	1.12878	-1.8005	-0.8698	-0.6751	-2.3774
42	-1.8215	-0.0023	1.20826	-1.8507	-0.8556	-0.6915	-2.2706
43	-1.8515	-0.0818	1.11582	-1.89	-0.8775	-0.7741	-2.529
44	-1.9152	0.02233	1.14092	-1.8087	-0.8468	-0.4661	-2.5426
45	-1.7757	0.0363	1.1268	-1.78	-0.8423	-0.6078	-2.3903
46	-1.9979	-0.0558	0.98691	-1.751	-1.0105	-0.7005	-2.6861
47	-1.9883	-0.0127	1.1386	-1.4587	-0.8693	-0.7946	-2.3331
48	-1.7895	0.02076	1.20672	-1.221	-0.838	-0.8371	-2.3272
49	-1.8086	0.02309	1.21652	-1.1851	-1.1031	-0.8467	-2.3804
50	-1.9145	0.01064	1.30128	-1.3558	-1.0836	-0.8659	-2.5411
51	-1.7676	-0.0182	1.23274	-1.4437	-0.9692	-0.7376	-2.5381
52	-1.6855	0.0335	1.32786	-1.2862	-0.8381	-0.5743	-2.4142
53	-1.8504	0.00706	1.26634	-1.3473	-0.9167	-0.7366	-2.5726
54	-1.7866	-0.058	1.15691	-1.1292	-1.0901	-0.5919	-2.4865
55	-1.9145	-0.1788	0.96263	-1.4105	-1.0612	-1.0608	-2.4463
56	-1.7408	-0.0449	1.26339	-1.4637	-0.9632	-0.8162	-2.7326
57	-1.7057	-0.0698	1.22701	-1.4929	-0.9885	-0.8482	-2.6047
58	-1.8122	-0.1208	1.23511	-1.5034	-1.0623	-0.9324	-2.8032
59	-1.7485	-0.0934	1.20744	-1.3665	-1.0922	-1.2343	-2.5615
60	-1.6731	-0.049	1.11744	-1.2724	-1.0684	-0.824	-2.7097
61	-1.6501	-0.0115	1.15103	-1.3176	-0.9471	-0.8469	-2.5395
62	-1.6617	0.04509	1.38866	-1.4372	-0.9586	-0.6303	-2.1982
63	-1.5665	-0.0087	1.30553	-1.623	-0.8547	-0.7556	-2.4758
64	-1.6923	0.03496	1.20613	-1.6789	-0.6736	-0.7578	-2.6473
65	-1.5039	0.15178	1.30841	-1.4696	-0.7563	-0.7132	-2.4628
66	-1.6086	-0.0021	1.25652	-1.5546	-0.7948	-0.4933	-2.3503
67	-1.6556	-0.0798	1.18205	-1.5428	-0.8453	-0.549	-2.3514
68	-1.9105	-0.1605	0.95563	-1.4652	-1.016	-0.3992	-2.4292
69	-1.6147	0.09426	1.27888	-1.304	-0.8758	-0.6062	-2.0553
70	-1.5739	0.11683	1.2383	-1.2464	-0.9755	-0.5502	-2.1444
71	-1.6568	0.00783	1.24759	-1.3429	-0.9971	-0.7439	-2.1449
72	-1.7628	-0.0649	1.04863	-1.4291	-1.0597	-0.648	-2.7879
73	-1.7962	-0.0831	0.99283	-1.3805	-1.0719	-0.6501	-2.5383
74	-1.8564	-0.0048	0.96787	-1.3088	-1.0788	-0.6026	-2.8403
75	-1.6505	0.03057	1.2171	-1.1992	-0.9762	-0.8643	-2.6214
76	-1.6629	0.07133	1.01613	-1.2029	-0.9986	-0.6131	-2.2733
77	-1.8018	-0.0132	1.02346	-1.3033	-1.1469	-0.6796	-2.494
78	-1.8807	-0.0647	0.98952	-1.28	-1.0453	-0.7621	-2.3086
79	-1.805	-0.0002	1.00439	-1.249	-1.1329	-0.7353	-2.4821

80	-2.1294	-0.1146	1.00467	-1.5545	-1.2319	-0.7905	-2.5612
81	-1.8687	-0.0212	0.9095	-1.4064	-1.1466	-0.8638	-2.6509
82	-1.7771	-0.0228	0.9351	-1.4747	-1.0852	-0.6058	-2.4551
83	-1.8376	-0.0321	1.04819	-1.429	-1.1034	-0.6487	-2.6507
84	-1.7947	-0.0882	0.91119	-1.4065	-1.1635	-0.7043	-2.9422
85	-1.8212	0.00485	1.14509	-1.2776	-1.0662	-0.4495	-2.9317
86	-1.8029	-0.0464	1.00455	-1.3367	-1.1507	-0.5516	-2.366
87	-1.8875	-0.0187	1.04786	-1.3395	-0.9403	-0.5967	-2.2734
88	-1.8281	-0.0825	0.94633	-1.5088	-1.0677	-0.5769	-2.2505
89	-1.745	0.01462	1.07914	-1.4687	-1.0804	-0.6187	-2.319
90	-1.7509	-0.0167	1.1069	-1.2995	-1.041	-0.5137	-2.3877
91	-1.8413	-0.0258	1.1549	-1.4355	-1.0896	-0.7161	-2.1662
92	-1.8495	-0.0702	0.95465	-1.5793	-0.9964	-0.7726	-2.8676
93	-1.9443	-0.1475	0.94642	-1.7099	-1.3255	-0.7973	-2.307
94	-1.7553	-0.0235	1.17099	-1.6091	-1.0222	-0.4946	-2.56
95	-1.7988	-0.0707	1.00381	-1.7766	-1.0534	-1.0031	-2.5701
96	-1.7791	-0.0166	1.02943	-1.715	-0.987	-0.7979	-2.3289
97	-1.9172	-0.0441	1.11391	-1.9249	-1.0955	-0.7461	-2.2701
98	-1.9202	-0.1302	0.92617	-2.0229	-1.133	-0.5451	-2.3642
99	-1.7281	-0.0422	0.9955	-1.8692	-0.9166	-0.7755	-2.4994
100	-1.8068	-0.0384	1.22504	-1.8977	-1.0039	-0.5093	-2.7811
101	-1.8609	-0.0735	1.20811	-2.0862	-1.0523	-0.8066	-2.7584
102	-1.7683	0.04361	1.2315	-1.8509	-0.8353	-0.4053	-2.3735
103	-1.8382	0.03611	1.25682	-1.9291	-0.8643	-0.5428	-2.4012
104	-1.8787	-0.0759	1.12386	-1.891	-0.9788	-0.61	-2.6502
105	-1.8876	-0.1091	1.14292	-2.3813	-0.9792	-0.462	-2.7054
106	-1.6444	0.06531	1.4637	-2.0131	-0.7714	-0.3943	-2.3977
107	-1.7813	-0.0988	1.27895	-1.9416	-0.9563	-0.6773	-2.6253
108	-1.8479	-0.068	1.19781	-1.7721	-0.9471	-0.6015	-2.9079
109	-1.6848	0.16265	1.32778	-1.5518	-0.7434	-0.4771	-2.1415
110	-2.0217	-0.0825	1.15378	-1.7043	-0.8951	-0.6295	-2.4669
111	-1.7846	0.0155	1.56029	-1.9213	-0.6449	-0.4273	-2.5631
112	-1.7879	-0.0662	1.59058	-1.676	-0.7442	-0.6104	-2.949
113	-1.5901	-0.0115	1.62256	-1.8195	-0.7673	-0.6599	-2.6037
114	-1.6287	0.02694	1.55669	-1.7277	-0.691	-0.2776	-2.3999
115	-1.5611	0.08723	1.62285	-1.7763	-0.6759	-0.4908	-2.3839
116	-1.557	0.18056	1.61817	-1.6201	-0.5333	-0.5636	-2.1876
117	-1.6229	-0.077	1.63419	-1.8585	-0.6954	-0.4545	-2.5187
118	-1.6843	-0.0086	1.62222	-1.8633	-0.7771	-0.5661	-2.5519
119	-1.5675	0.06573	1.77681	-1.8836	-0.5784	-0.3833	-2.6864
120	-1.4022	0.07401	1.51518	-1.7048	-0.7131	-0.7848	-2.3564
121	-1.5218	-0.0559	1.34735	-1.4944	-0.8844	-0.4647	-2.6871
122	-1.4022	0.07401	1.51518	-1.7048	-0.7131	-0.7848	-2.3564
123	-1.5218	-0.0559	1.34735	-1.4944	-0.8844	-0.4647	-2.6871
124	-1.6068	0.05614	1.63608	-1.5042	-0.6869	-0.4599	-2.2161
125	-2.0394	-0.098	1.45045	-1.9274	-0.8245	-0.3991	-2.5073

126	-1.696	-0.0267	1.44836	-1.6259	-0.8601	-0.3437	-2.2066
127	-1.8255	0.03721	1.57938	-1.6923	-0.7616	-0.2607	-2.1982
128	-1.9548	-0.0029	1.33607	-1.8795	-0.8073	-0.618	-2.4527
129	-1.8365	-0.0028	1.41835	-1.8903	-0.8218	-0.6747	-2.5777
130	-1.6212	0.11194	1.61694	-1.8145	-0.6614	-0.3706	-2.967
131	-1.8342	-0.19	1.14482	-2.138	-1.027	-0.6195	-2.7853
132	-1.7715	-0.0178	1.38094	-1.7339	-0.8197	-0.4262	-2.5231
133	-1.8113	-0.1406	1.34316	-1.9446	-0.9661	-0.7163	-2.5099
134	-1.5181	0.18207	1.55952	-1.8007	-0.6344	-0.0227	-2.2826
135	-1.4494	0.13369	1.56562	-1.8422	-0.7513	-0.3809	-2.186
136	-1.8103	-0.1647	1.27649	-2.0088	-0.9983	-0.768	-2.5814
137	-1.7051	0.03185	1.63758	-2.0014	-0.7565	-0.4696	-2.5932
138	-1.5889	0.10455	1.64913	-1.788	-0.6098	-0.4079	-2.2746
139	-1.838	-0.1292	1.39669	-1.9689	-0.8627	-0.6359	-2.4612
140	-1.7622	0.17283	1.67886	-1.783	-0.5618	-0.2459	-2.0153
141	-1.7544	-0.0043	1.5813	-1.8556	-0.7258	-0.5628	-2.1954
142	-1.7084	-0.0108	1.59764	-1.9888	-0.8284	-0.6337	-2.2769
143	-1.7401	0.01538	1.42438	-2.1658	-0.846	-0.4475	-2.6389
144	-1.486	0.03482	1.58493	-1.9218	-0.7171	-0.4393	-2.3626
145	-1.7596	-0.1232	1.2981	-1.9825	-0.7646	-0.1386	-2.2664
146	-1.6229	-0.077	1.63419	-1.8585	-0.6954	-0.4545	-2.5187
147	-1.6843	-0.0086	1.62222	-1.8633	-0.7771	-0.5661	-2.5519
148	-1.5675	0.06573	1.77681	-1.8836	-0.5784	-0.3833	-2.6864
149	-1.6534	0.08962	1.65546	-1.8978	-0.634	-0.2321	-2.1867
150	-1.6317	0.03317	1.60595	-2.0167	-0.7014	-0.455	-2.1843
151	-1.8847	-0.2015	1.38475	-1.9563	-0.8992	-0.6931	-2.1869
152	-1.6344	0.05793	1.49137	-1.9373	-0.7226	-0.4923	-2.6352
153	-1.8427	-0.129	1.40479	-1.9646	-0.7718	-0.8101	-2.4647
154	-1.8239	-0.0158	1.57482	-1.7744	-0.611	-0.4533	-2.5826
155	-1.8415	-0.0229	1.47662	-1.6177	-0.6022	-0.463	-2.1106
156	-1.7255	0.05932	1.44732	-1.6509	-0.6902	-0.5759	-2.3574
157	-1.79	0.09474	1.40529	-1.5583	-0.8589	-0.5848	-2.2862
158	-1.7785	0.03085	1.41095	-1.5389	-0.7651	-0.5617	-2.4578
159	-1.8421	-0.0658	1.1319	-1.9416	-1.015	-0.8154	-2.5878
160	-1.6343	0.07997	1.53437	-1.7381	-0.7155	-0.4	-2.7252
161	-1.4365	0.21414	1.64781	-1.8184	-0.6695	-0.408	-2.2951
162	-1.5607	-0.0707	1.39568	-2.1052	-0.9542	-0.6688	-2.8812
163	-1.5868	-0.1034	1.22837	-2.1002	-1.0112	-0.6222	-2.5217
164	-1.4196	0.03728	1.49223	-1.7775	-0.8921	-0.5958	-2.5132
165	-1.4266	0.03672	1.3243	-1.847	-0.8142	-0.6951	-2.2795
166	-1.3689	0.09197	1.63274	-1.6219	-0.6785	-0.4354	-2.4227
167	-1.3972	0.04295	1.54228	-1.8209	-0.8421	-0.5505	-2.3272
168	-1.3772	0.151	1.74166	-1.7874	-0.6657	-0.248	-2.2325
169	-1.4849	-0.0827	1.46155	-2.2226	-0.9132	-0.582	-2.7086
170	-1.1977	0.19551	1.69607	-1.784	-0.7039	-0.2598	-2.4495
171	-1.3658	0.02698	1.50989	-1.9055	-0.5933	-0.4923	-2.3698

172	-1.0219	0.37287	1.84254	-1.6182	-0.4003	-0.4237	-1.9229
173	-1.3039	0.1106	1.72979	-1.9647	-0.6931	-0.3035	-2.0485
174	-1.3	0.14513	1.69441	-1.8447	-0.644	-0.2231	-2.5319
175	-1.3259	0.04612	1.46547	-1.8926	-0.7613	-0.393	-3.036
176	-1.0395	0.27635	1.64161	-1.4159	-0.5636	-0.5576	-2.3968
177	-1.1993	0.10984	1.63918	-1.3923	-0.7224	-0.6374	-2.2544
178	-1.1555	0.18318	1.75236	-1.4942	-0.6316	-0.5534	-2.1706
179	-1.3722	0.05734	1.4943	-1.8065	-0.5753	-0.0681	-2.4902
180	-1.4022	0.07401	1.51518	-1.7048	-0.7131	-0.7848	-2.3564
181	-1.5218	-0.0559	1.34735	-1.4944	-0.8844	-0.4647	-2.6871
182	-1.4507	0.05546	1.51032	-1.6452	-0.6101	-0.3043	-2.169
183	-1.5146	-0.0509	1.563	-1.8603	-0.5578	-0.2383	-2.2058
184	-1.673	-0.0561	1.51607	-1.9507	-0.73	-0.2291	-2.5944
185	-1.71	-0.0789	1.43201	-2.087	-0.8834	-0.5634	-2.3356
186	-1.819	-0.3535	1.13952	-2.3425	-1.171	-1.0064	-2.8658
187	-1.4103	0.09635	1.64097	-2.0751	-0.5958	-0.178	-2.3879
188	-1.2626	0.13616	1.65814	-2.0641	-0.6228	-0.1691	-2.1195
189	-1.4246	0.03605	1.58044	-1.9499	-0.7075	-0.5038	-2.3495
190	-1.4559	0.01876	1.50056	-1.9239	-0.7418	-0.5811	-2.3131
191	-1.4582	0.00099	1.4315	-1.9096	-0.9704	-0.5721	-3.0054
192	-1.7403	-0.2067	1.22826	-2.1602	-0.944	-0.7279	-2.7127
193	-1.4454	-0.0253	1.41732	-1.9947	-0.8354	-0.6148	-2.6228
194	-1.4551	0.03155	1.34906	-1.956	-0.7406	-0.375	-2.476
195	-1.3096	0.12172	1.50929	-1.6983	-0.4433	-0.6513	-2.5023
196	-1.3196	0.09527	1.44825	-1.8991	-0.614	-0.2196	-2.1812
197	-1.4873	-0.0547	1.44239	-2.2441	-0.7868	-0.5426	-2.4994
198	-1.4147	-0.0499	1.50307	-1.9828	-0.6699	-0.3032	-2.3334
199	-1.5514	-0.0222	1.45679	-1.786	-0.5778	-0.1302	-2.2188
200	-1.4432	0.01872	1.45106	-1.6592	-0.5152	0.05215	-2.1027
201	-1.8212	-0.035	1.47983	-2.0432	-0.7101	-0.6241	-2.6239
202	-1.8689	-0.0794	1.43802	-2.0735	-0.7848	-0.4758	-2.2986
203	-1.5218	-0.0559	1.34735	-1.4944	-0.8844	-0.4647	-2.6871
204	-1.4507	0.05546	1.51032	-1.6452	-0.6101	-0.3043	-2.169
205	-1.8421	-0.0658	1.1319	-1.9416	-1.015	-0.8154	-2.5878
206	-1.3118	0.12293	1.72514	-1.6851	-0.444	-0.1071	-2.2492
207	-1.6843	-0.0086	1.62222	-1.8633	-0.7771	-0.5661	-2.5519
208	-1.5675	0.06573	1.77681	-1.8836	-0.5784	-0.3833	-2.6864
209	-1.6534	0.08962	1.65546	-1.8978	-0.634	-0.2321	-2.1867
210	-1.6317	0.03317	1.60595	-2.0167	-0.7014	-0.455	-2.1843
211	-1.8847	-0.2015	1.38475	-1.9563	-0.8992	-0.6931	-2.1869
212	-1.6344	0.05793	1.49137	-1.9373	-0.7226	-0.4923	-2.6352
213	-1.8427	-0.129	1.40479	-1.9646	-0.7718	-0.8101	-2.4647
214	-1.8239	-0.0158	1.57482	-1.7744	-0.611	-0.4533	-2.5826
215	-1.8415	-0.0229	1.47662	-1.6177	-0.6022	-0.463	-2.1106
216	-1.7255	0.05932	1.44732	-1.6509	-0.6902	-0.5759	-2.3574
217	-1.79	0.09474	1.40529	-1.5583	-0.8589	-0.5848	-2.2862

218	-1.7785	0.03085	1.41095	-1.5389	-0.7651	-0.5617	-2.4578
219	-1.8421	-0.0658	1.1319	-1.9416	-1.015	-0.8154	-2.5878
220	-1.6343	0.07997	1.53437	-1.7381	-0.7155	-0.4	-2.7252
221	-1.4365	0.21414	1.64781	-1.8184	-0.6695	-0.408	-2.2951
222	-1.5607	-0.0707	1.39568	-2.1052	-0.9542	-0.6688	-2.8812
223	-1.5868	-0.1034	1.22837	-2.1002	-1.0112	-0.6222	-2.5217
224	-1.4196	0.03728	1.49223	-1.7775	-0.8921	-0.5958	-2.5132
225	-1.4266	0.03672	1.3243	-1.847	-0.8142	-0.6951	-2.2795
226	-1.3689	0.09197	1.63274	-1.6219	-0.6785	-0.4354	-2.4227
227	-1.3972	0.04295	1.54228	-1.8209	-0.8421	-0.5505	-2.3272
228	-1.3086	0.10602	1.74352	-1.7962	-0.5825	-0.3728	-2.3417
229	-1.43	-0.0379	1.51416	-1.8828	-0.7615	-0.4528	-2.6388
230	-1.3391	0.13091	1.73452	-1.7595	-0.5827	-0.0869	-2.5905
231	-1.4126	0.10658	1.63869	-1.8512	-0.6891	-0.291	-2.2779
232	-1.5772	-0.0023	1.26601	-1.9291	-0.9063	-0.5981	-2.3125
233	-1.5022	0.12104	1.50019	-1.7461	-0.6535	-0.3158	-2.3113
234	-1.6626	0.13808	1.5305	-1.6488	-0.6058	-0.2632	-1.9825
235	-1.5862	0.06553	1.55653	-1.9377	-0.7094	-0.4395	-2.1091
236	-1.7322	-0.0263	1.51991	-2.0115	-0.6907	-0.1603	-2.2524
237	-1.5673	-0.0774	1.40943	-1.9665	-0.7931	-0.4774	-2.2447
238	-1.5908	-0.0899	1.55858	-2.1258	-0.711	-0.407	-2.4056
239	-1.6221	-0.0051	1.45961	-2.0679	-0.6862	-0.4602	-2.442
240	-1.4262	0.19248	1.74412	-1.5281	-0.4329	-0.0217	-2.1729
241	-1.5558	0.04775	1.53552	-1.8241	-0.5512	-0.1327	-2.1606
242	-1.1896	0.22872	1.84315	-1.7658	-0.5288	-0.2247	-2.1167
243	-1.5372	-0.0462	1.56591	-1.899	-0.7935	-0.3696	-2.3696
244	-1.199	0.14751	1.79654	-1.969	-0.7722	-0.4513	-2.3145
245	-1.4693	0.00189	1.52243	-2.1437	-0.915	-0.6292	-2.6831
246	-1.3786	0.11521	1.82569	-2.1486	-0.7623	-0.5436	-2.7249
247	-1.4948	-0.0751	1.59051	-2.0932	-0.8794	-0.4077	-2.6325
248	-1.3172	0.08514	1.89958	-1.9053	-0.5978	-0.3217	-2.3807
249	-0.9699	0.21584	2.02288	-1.409	-0.0881	0.26547	-2.0809
250	-1.0222	0.24825	1.98126	-1.5388	-0.3867	0.14601	-2.0234
251	-1.1613	0.09849	1.71595	-1.9236	-0.6164	-0.2066	-2.5121
252	-1.3353	-0.1085	1.59819	-2.3913	-0.7895	-0.345	-2.6043
253	-1.0899	0.21285	1.79013	-1.8967	-0.4696	-0.0183	-2.2324
254	-1.4242	-0.2559	1.49156	-2.4172	-0.785	-0.286	-2.9386
255	-1.2975	0.01311	1.61065	-2.0216	-0.5762	-0.2004	-2.2855
256	-1.1191	0.20048	1.76404	-1.8355	-0.3802	-0.2226	-2.2256
257	-1.4381	-0.0237	1.59142	-1.8058	-0.7003	-0.4166	-3.1696
258	-1.4082	-0.0208	1.51861	-1.9359	-0.7672	-0.4678	-2.6691
259	-1.2566	0.05174	1.68748	-1.5912	-0.6971	-0.2913	-2.4429
260	-1.1911	0.19813	1.7604	-1.7626	-0.6085	-0.3633	-2.3454
261	-1.2218	0.18548	1.75165	-1.768	-0.4766	-0.1633	-2.1635
262	-1.3086	0.10602	1.74352	-1.7962	-0.5825	-0.3728	-2.3417
263	-1.43	-0.0379	1.51416	-1.8828	-0.7615	-0.4528	-2.6388

264	-1.3391	0.13091	1.73452	-1.7595	-0.5827	-0.0869	-2.5905
265	-1.4126	0.10658	1.63869	-1.8512	-0.6891	-0.291	-2.2779
266	-1.5772	-0.0023	1.26601	-1.9291	-0.9063	-0.5981	-2.3125
267	-1.5022	0.12104	1.50019	-1.7461	-0.6535	-0.3158	-2.3113
268	-1.6626	0.13808	1.5305	-1.6488	-0.6058	-0.2632	-1.9825
269	-1.5862	0.06553	1.55653	-1.9377	-0.7094	-0.4395	-2.1091
270	-1.7322	-0.0263	1.51991	-2.0115	-0.6907	-0.1603	-2.2524
271	-1.5673	-0.0774	1.40943	-1.9665	-0.7931	-0.4774	-2.2447
272	-1.5908	-0.0899	1.55858	-2.1258	-0.711	-0.407	-2.4056
273	-1.6221	-0.0051	1.45961	-2.0679	-0.6862	-0.4602	-2.442
274	-1.4262	0.19248	1.74412	-1.5281	-0.4329	-0.0217	-2.1729
275	-1.5558	0.04775	1.53552	-1.8241	-0.5512	-0.1327	-2.1606
276	-1.1896	0.22872	1.84315	-1.7658	-0.5288	-0.2247	-2.1167
277	-1.5372	-0.0462	1.56591	-1.899	-0.7935	-0.3696	-2.3696
278	-1.199	0.14751	1.79654	-1.969	-0.7722	-0.4513	-2.3145
279	-1.4693	0.00189	1.52243	-2.1437	-0.915	-0.6292	-2.6831
280	-1.3786	0.11521	1.82569	-2.1486	-0.7623	-0.5436	-2.7249
281	-1.4948	-0.0751	1.59051	-2.0932	-0.8794	-0.4077	-2.6325
282	-1.3172	0.08514	1.89958	-1.9053	-0.5978	-0.3217	-2.3807
283	-1.1818	0.19706	1.9337	-1.8925	-0.6381	-0.3065	-2.4893
284	-1.3034	0.17733	1.79076	-1.843	-0.5776	-0.4403	-2.2806
285	-1.5757	-0.1364	1.62512	-2.2903	-0.8418	-0.5396	-2.4564
286	-1.2499	0.20482	1.8428	-1.6654	-0.4945	-0.2858	-2.6149
287	-1.3256	0.12471	1.71162	-2.0237	-0.6073	-0.1974	-2.3372
288	-1.4533	0.03196	1.52618	-1.888	-0.6336	-0.3799	-2.6208
289	-1.5978	0.03552	1.58742	-1.5969	-0.486	-0.1674	-2.3535
290	-1.7001	0.06479	1.62305	-1.5574	-0.625	-0.1507	-2.1548
291	-1.6977	0.14207	1.77373	-1.6899	-0.6147	-0.1549	-2.1054
292	-1.816	-0.0794	1.52572	-2.0576	-0.8607	-0.5149	-2.3485
293	-1.6751	-0.0103	1.44486	-1.9316	-0.7135	-0.5395	-2.2611
294	-1.9661	-0.1613	1.34574	-1.8731	-0.7715	-0.4297	-2.3738
295	-2.1075	-0.2753	1.21133	-2.1555	-0.8931	-0.359	-2.7717
296	-1.5575	0.09348	1.86485	-1.6599	-0.362	0.03832	-2.1184
297	-1.5448	0.1339	1.70823	-1.986	-0.5937	-0.2881	-2.2145
298	-1.7525	-0.0324	1.63617	-2.0051	-0.6182	-0.2884	-2.171
299	-1.8751	-0.2715	1.41845	-2.1019	-0.8382	-0.6064	-2.394
300	-1.7497	-0.1206	1.39404	-1.9505	-0.7378	-0.5349	-2.343
301	-1.8977	-0.2101	1.34853	-2.1022	-0.7691	-0.3205	-2.3516
302	-1.9323	-0.1136	1.50967	-2.0755	-0.7749	-0.666	-2.4455
303	-1.8536	-0.0183	1.54713	-1.9499	-0.6482	-0.4441	-2.3745
304	-1.8867	-0.0126	1.52388	-1.7793	-0.6395	-0.1692	-2.3959
305	-1.7047	0.04483	1.55684	-1.9866	-0.5097	-0.208	-2.3239
306	-1.9742	-0.1053	1.37736	-1.8103	-0.6871	-0.3265	-2.671
307	-1.8212	-0.035	1.47983	-2.0432	-0.7101	-0.6241	-2.6239
308	-1.8689	-0.0794	1.43802	-2.0735	-0.7848	-0.4758	-2.2986
309	-1.7207	0.04765	1.58356	-2.0265	-0.6048	-0.2692	-2.1767

310	-1.4691	0.0651	1.54042	-1.9755	-0.6242	-0.4061	-2.4478
311	-1.4829	0.05315	1.7395	-1.4652	-0.5198	-0.165	-2.0033
312	-1.5944	0.00846	1.67829	-0.7955	-0.536	-0.1748	-2.0407
313	-1.5695	0.04441	1.727	-1.9754	-0.5113	-0.282	-2.4228
314	-1.6133	-0.0103	1.66158	-1.9946	-0.6313	-0.3624	-2.3798
315	-1.5128	0.06961	1.64679	-1.9571	-0.6547	-0.4648	-2.2741
316	-1.9384	-0.1102	1.36191	-2.0278	-0.919	-0.4924	-2.7176
317	-1.7858	-0.0085	1.56362	-2.0689	-0.82	-0.2703	-2.7669
318	-1.8136	-0.0332	1.57242	-1.966	-0.7653	-0.3935	-2.3586
319	-2.1437	-0.3317	1.33628	-2.3945	-0.9798	-0.7783	-2.6731
320	-1.7528	-0.0271	1.7021	-1.8096	-0.5867	-0.2588	-2.2682
321	-1.6862	-0.0035	1.64139	-1.8398	-0.6598	-0.3574	-2.6184
322	-1.4754	0.10059	1.76282	-2.0432	-0.5006	-0.152	-2.3428
323	-1.4637	-0.0323	1.59525	-2.0227	-0.5231	-0.1814	-2.4104
324	-1.4367	-0.0002	1.79546	-2.0046	-0.3446	-0.203	-2.5735
325	-1.4934	-0.0956	1.54544	-2.197	-0.5815	-0.4129	-2.5651
326	-1.6663	0.00497	1.65906	-2.1358	-0.4891	-0.3964	-2.1662
327	-1.9822	-0.261	1.45231	-2.0969	-0.6484	-0.5301	-2.6296
328	-1.7536	-0.1565	1.62776	-2.1381	-0.5698	-0.5042	-2.5856
329	-1.6605	0.02377	1.64631	-2.1237	-0.6085	-0.0854	-2.4697
330	-1.8888	-0.2125	1.49397	-2.0887	-0.5817	0.00654	-2.7818
331	-1.8777	-0.1538	1.47453	-2.1603	-0.655	-0.588	-2.2133
332	-1.7678	-0.0712	1.74366	-2.0893	-0.4744	-0.5349	-2.4911
333	-1.4484	0.17303	2.05229	-1.9011	-0.1118	-0.2495	-2.0218
334	-1.4122	0.10434	2.12391	-1.9105	-0.1471	-0.3128	-2.3253
335	-1.7101	-0.1211	1.67358	-2.2682	-0.4515	-0.6439	-2.1919
336	-1.5381	0.18758	1.97959	-1.7208	-0.2012	0.35317	-2.0902
337	-1.456	0.15187	1.78956	-1.8607	-0.4359	0.08877	-2.1128
338	-1.4557	0.03155	1.74884	-1.9745	-0.3996	-0.1824	-2.1172
339	-1.6029	-0.0602	1.51665	-2.275	-0.6832	0.17495	-2.6737
340	-1.5042	-0.0174	1.88554	-2.0755	-0.2616	-0.1648	-2.3492
341	-1.3958	0.03312	1.7501	-2.0222	-0.4506	-0.3347	-2.389
342	-1.4564	-0.0017	1.79279	-1.9742	-0.5158	-0.5636	-2.622
343	-1.4153	0.11294	1.74256	-1.8857	-0.5403	-0.4799	-2.4917
344	-1.1659	0.22963	2.05447	-1.7083	-0.2864	-0.4459	-2.2561
345	-1.3905	-0.0199	1.79042	-2.2773	-0.597	-0.4076	-2.6099
346	-1.4502	0.08096	1.67328	-2.1822	-0.5703	-0.4327	-2.3871
347	-1.5495	-0.1347	1.60931	-2.3431	-0.5918	-0.5825	-2.7077
348	-1.4592	0.03169	1.66512	-2.1464	-0.4865	-0.5922	-2.568
349	-1.4191	-0.1158	1.79583	-2.3673	-0.5256	-0.6032	-2.4435
350	-1.1695	0.03009	2.09961	-2.3704	-0.2198	-0.1863	-2.6479
351	-1.1559	0.14844	1.9924	-2.2721	-0.1617	-0.0341	-2.4556
352	-1.3794	-0.0881	1.91791	-2.2886	-0.4552	-0.4155	-2.7088
353	-1.1836	0.08275	2.14566	-2.3491	-0.2864	-0.5281	-2.5909
354	-1.461	-0.0626	1.89218	-2.2312	-0.3959	-0.5034	-2.4531
355	-1.5206	0.12399	1.91472	-1.7575	-0.24	-0.132	-2.0081

356	-1.6645	0.00685	1.69519	-1.91	-0.3418	-0.3324	-2.1372
357	-1.6661	-0.2714	1.29853	-1.9652	-0.7987	-0.554	-3.3503
358	-1.3499	-0.0283	1.55586	-1.9756	-0.4631	-0.1462	-3.3635
359	-1.0374	0.07737	1.79786	-2.0178	-0.3316	0.07113	-2.3277
360	-1.0307	0.1582	1.90354	-2.2433	-0.3038	0.1444	-2.8306
361	-0.9858	0.22919	2.08828	-1.9029	-0.1873	0.36463	-2.6161
362	-1.5816	-0.1968	1.6226	-2.2888	-0.6761	-0.2164	-2.2688
363	-1.2759	-0.0303	1.69301	-2.2194	-0.4967	-0.0374	-2.183
364	-0.8885	0.19756	2.21287	-1.7935	-0.0982	0.21584	-2.4415
365	-1.3146	-0.0934	1.97669	-2.5426	-0.4535	-0.2365	-2.3615
366	-0.6464	0.51531	2.52795	-1.7416	-0.01	0.49246	-1.6282
367	-0.8758	0.27774	2.41261	-1.7326	-0.0629	-0.0521	-2.9746
368	-1.0494	0.20058	1.93137	-2.2343	-0.3337	-0.2115	-2.3769
369	-1.2483	-0.0198	1.83006	-2.1607	-0.5579	-0.2597	-2.5524
370	-1.2024	0.11954	1.85565	-2.2652	-0.5033	-0.2569	-2.1009
371	-1.0222	0.24825	1.98126	-1.5388	-0.3867	0.14601	-2.0234
372	-1.1613	0.09849	1.71595	-1.9236	-0.6164	-0.2066	-2.5121
373	-1.3086	0.10602	1.74352	-1.7962	-0.5825	-0.3728	-2.3417
374	-1.3391	0.13091	1.73452	-1.7595	-0.5827	-0.0869	-2.5905
375	-1.4126	0.10658	1.63869	-1.8512	-0.6891	-0.291	-2.2779
376	-1.1492	0.05629	2.03944	-1.9266	-0.3713	-0.1656	-2.1834
377	-1.3639	0.05575	1.70922	-2.0635	-0.4619	-0.3069	-2.635
378	-1.7147	-0.2141	1.38568	-2.2239	-0.6278	-0.3689	-2.9544
379	-1.1727	0.05052	1.78103	-2.0949	-0.5616	-0.3558	-2.282
380	-1.1071	0.15587	1.73672	-1.9838	-0.3767	-0.5169	-2.3605
381	-1.2335	0.1343	1.8009	-2.1526	-0.2835	0.12218	-2.3288
382	-1.1658	0.13595	2.09384	-2.1082	-0.2614	-0.1196	-2.4056
383	-1.1919	0.11868	1.85012	-2.1725	-0.44	-0.2361	-2.3817
384	-1.3083	-0.2107	1.74796	-2.4385	-0.5877	-0.2243	-2.4698
385	-0.8981	0.05715	2.09175	-2.2134	-0.4447	-0.0298	-2.3645
386	-0.7795	-0.0413	2.08618	-2.003	-0.2898	0.06472	-2.6207
387	-0.4436	0.37249	2.41075	-1.7109	-0.0069	0.23951	-2.0225
388	-0.3869	0.32639	2.40643	-1.7402	0.08229	0.34163	-2.0991
389	-0.7698	-0.0921	1.93199	-2.0998	-0.3371	-0.293	-2.3742
390	-0.5324	0.12986	2.32849	-1.9398	-0.0866	-0.1814	-2.1634
391	-0.7743	-0.0725	2.16351	-2.1328	-0.303	-0.7186	-2.0564
392	-0.7037	0.1267	2.06218	-2.0316	-0.2419	0.05556	-2.0256
393	-0.7119	0.04706	2.05192	-1.7223	-0.2258	0.03687	-2.55
394	-1.0749	0.1407	1.87724	-1.9071	-0.5125	-0.2673	-2.225
395	-1.3835	-0.0811	1.48401	-2.1354	-0.7551	-0.1115	-2.4266
396	-1.2755	-0.0209	1.55979	-2.3381	-0.7237	-0.4422	-2.3753
397	-1.1467	0.05454	1.62492	-1.9765	-0.6476	-0.0183	-2.2369
398	-1.3867	0.13807	2.07225	-1.807	-0.2373	-0.2868	-2.1858
399	-1.1888	0.1883	1.95408	-2.0639	-0.1624	-0.4703	-2.2193
400	-1.3029	0.0393	1.91971	-1.9237	-0.3082	-0.355	-2.3418
401	-1.486	-0.0356	1.86982	-2.0926	-0.4291	-0.3549	-2.4568

402	-1.2933	0.13124	2.08456	-1.95	-0.3189	-0.4599	-2.3313
403	-1.441	-0.011	1.75649	-2.0199	-0.5327	-1.0181	-2.6963
404	-1.4937	-0.0328	1.93292	-1.9688	-0.3091	-0.4799	-2.332
405	-1.2521	0.03334	2.01869	-2.0577	-0.2892	-0.5604	-2.3513
406	-1.0946	0.21217	2.19992	-1.9365	-0.1365	-0.4183	-2.3313
407	-1.2122	0.02091	1.96667	-2.2345	-0.3017	-0.814	-2.2597
408	-0.962	0.25087	2.24586	-2.0364	-0.1345	-0.2889	-2.1602
409	-0.9877	0.12146	2.19321	-2.034	-0.163	-0.386	-2.2724
410	-1.076	0.12693	2.28003	-2.1503	-0.1298	-0.446	-2.0509
411	-1.2559	0.06731	2.01076	-2.0324	-0.2017	-0.3013	-2.3372
412	-1.1554	0.11478	2.0266	-2.3262	-0.1909	-0.351	-2.5805
413	-1.0239	0.18278	2.17543	-2.1231	-0.1616	-0.5504	-2.246
414	-1.3091	0.08066	2.08373	-2.3234	-0.2276	-0.5063	-2.2519
415	-1.2976	-0.0983	2.07682	-2.1269	-0.2709	-0.4725	-2.2395
416	-1.2037	0.16311	2.18088	-2.0944	-0.0386	-0.6474	-2.6166
417	-0.8645	0.3226	2.28894	-1.9876	0.03731	-0.2124	-2.4185
418	-1.1842	0.27196	2.20168	-1.8272	-0.0039	-0.4812	-1.8813
419	-1.4759	-0.0505	1.73901	-2.3116	-0.3144	-0.5157	-2.5331
420	-1.5465	-0.0029	1.84851	-2.0041	-0.2326	-0.4502	-2.4103
421	-1.6357	0.08654	1.84367	-1.6569	-0.2323	-0.6988	-2.5152
422	-1.6348	0.17633	1.79785	-1.5183	-0.2279	-0.3883	-2.3091
423	-1.7077	0.06042	1.94266	-1.6593	-0.1821	-0.4792	-2.4098
424	-1.6825	-0.0253	1.76176	-2.096	-0.4246	-0.8598	-2.5564
425	-1.6307	0.00084	1.98526	-1.7582	-0.287	-0.7307	-2.7633
426	-1.8109	0.07784	1.8571	-1.7805	-0.1211	-0.5218	-2.2657
427	-1.7218	-0.103	1.56636	-2.1464	-0.4525	-0.793	-2.5002
428	-1.8142	0.0694	1.9113	-1.8745	-0.2407	-0.5276	-2.1505
429	-1.8771	-0.0157	1.74233	-2.1473	-0.4233	-0.6108	-2.6466
430	-1.9687	-0.0359	1.92082	-2.0026	-0.2857	-1.0329	-2.6083
431	-2.0425	-0.2263	1.57014	-2.3067	-0.5649	-1.1756	-2.5325
432	-1.659	0.06678	1.92814	-1.8031	-0.218	-0.4717	-2.2058
433	-1.6857	-0.0228	1.99035	-1.6721	-0.1289	-0.2519	-2.2959
434	-1.5454	0.11744	1.98778	-1.7821	-0.0487	-0.7096	-2.2067
435	-2.0404	-0.2711	1.82048	-2.0234	-0.3777	-0.6782	-2.8349
436	-1.68	0.03469	2.12238	-1.9823	0.14052	-0.8148	-2.422
437	-1.7135	0.02349	1.91327	-2.1204	-0.2447	-0.7259	-2.5673
438	-1.6937	0.03304	1.79965	-2.3675	-0.4143	-0.7284	-2.27
439	-1.5229	0.13032	1.98702	-1.9079	-0.2703	-0.6294	-2.4376
440	-1.4204	0.13586	1.96845	-1.8332	-0.1987	-0.3802	-2.2919
441	-1.3514	0.19166	2.06122	-1.9785	-0.1784	-0.3463	-2.5993
442	-1.4438	0.18942	2.15585	-1.8063	-0.013	-0.396	-2.1295
443	-1.7196	-0.0966	1.70014	-1.9248	-0.3977	-0.7033	-2.5033
444	-1.8627	-0.0067	2.0492	-1.8547	-0.0765	-0.2519	-2.2615
445	-2.005	-0.1736	1.98018	-2.2264	-0.206	-0.4432	-2.2435
446	-1.6103	0.05336	2.16226	-1.8844	0.04741	-0.4503	-1.8872
447	-1.5538	-0.1188	2.16092	-2.0727	-0.1317	-0.395	-2.3106

448	-1.541	-0.1261	1.95303	-2.1163	-0.2324	-0.1458	-2.3515
449	-1.6413	-0.244	1.83149	-2.2067	-0.4528	-0.7101	-2.6799
450	-1.0947	0.25014	2.16187	-1.7885	0.02258	-0.1101	-2.166
451	-0.9999	0.25904	2.18982	-1.617	0.05287	-0.1001	-2.1596
452	-1.2291	0.08761	2.03086	-2.2179	-0.1761	-0.4602	-2.7558
453	-1.315	-0.0664	2.05467	-2.2783	-0.2183	-0.6615	-2.8346
454	-1.1793	0.11302	2.07922	-2.0912	-0.064	-0.4976	-2.4687
455	-1.156	0.05131	2.17412	-2.1426	-0.1835	-0.3701	-2.4754
456	-0.9927	0.27444	2.36503	-1.9054	0.04027	-0.1756	-2.3028
457	-1.1297	0.06511	2.07337	-2.133	-0.1668	-0.2754	-2.2715
458	-1.1758	-0.0195	2.19396	-2.381	-0.2247	-0.5042	-2.278
459	-0.9798	0.14446	2.35127	-2.3981	-0.038	-0.2004	-2.3594
460	-1.021	0.13981	2.23752	-2.3077	-0.0727	-0.1866	-2.2814
461	-1.0642	0.10264	2.21572	-2.2331	-0.1239	-0.3541	-2.4377
462	-1.4565	-0.1146	1.98085	-2.1356	-0.1869	-0.3809	-2.6275
463	-1.9673	-0.3784	1.65473	-2.4634	-0.3771	-0.6218	-2.6001
464	-1.397	-0.0583	2.07279	-2.1319	-0.0881	-0.2284	-2.5634
465	-1.4456	-0.1954	2.02638	-2.4029	-0.3309	-0.5313	-2.7301
466	-1.2495	-0.0314	2.11254	-2.2813	-0.0755	-0.4684	-2.267
467	-1.0467	0.1649	2.33668	-1.9109	0.06159	-0.3645	-2.4695
468	-1.381	-0.0725	2.1849	-2.1844	-0.1368	-0.5626	-2.4198
469	-0.9549	0.2177	2.4409	-2.0145	0.11318	-0.2161	-2.2008
470	-1.2356	0.01542	2.11647	-1.9348	-0.1509	-0.1171	-2.3745
471	-1.1369	0.12878	2.26354	-1.9224	-0.0184	-0.1584	-2.1169
472	-1.2874	0.01616	2.04008	-2.1302	-0.1431	-0.134	-1.9944
473	-1.156	0.05131	2.17412	-2.1426	-0.1835	-0.3701	-2.4754
474	-0.9927	0.27444	2.36503	-1.9054	0.04027	-0.1756	-2.3028
475	-1.0223	0.24216	2.33133	-1.9009	0.0231	-0.1701	-2.3081
476	-1.1289	0.04834	2.06549	-2.156	0.05991	-0.3263	-2.6386
477	-1.2453	0.17484	2.30745	-1.7849	0.11974	-0.3235	-2.2988
478	-1.528	-0.2129	1.90668	-2.127	-0.2221	-0.452	-2.5428
479	-1.2433	-0.047	2.38302	-1.8543	0.03761	-0.3291	-2.424
480	-1.5462	-0.2974	1.93743	-2.0249	-0.2909	-0.5481	-2.5654
481	-1.3041	0.09898	2.30999	-1.7734	0.09509	-0.3105	-2.0756
482	-1.2523	-0.0099	2.41367	-2.0202	0.01835	-0.1652	-2.618
483	-1.4876	-0.0687	2.261	-1.775	-0.0887	-0.1935	-2.8782
484	-1.0908	0.21183	2.41125	-1.8748	0.19783	-0.1515	-2.011
485	-1.2338	0.17775	2.32078	-1.3853	0.19484	-0.1324	-2.4311
486	-1.1867	0.16957	2.35905	-1.6645	0.10446	-0.2162	-2.0058
487	-1.5193	-0.236	1.95576	-2.2875	-0.2538	-0.2884	-2.4336
488	-1.7083	-0.3846	1.76154	-2.3482	-0.4054	-0.6092	-2.4622
489	-1.1395	0.13592	2.36429	-1.8597	0.12072	-0.0696	-2.025
490	-1.2539	-0.1112	2.15648	-1.8677	-0.0989	-0.137	-2.3979
491	-1.1772	0.08123	2.15615	-1.9511	-0.1091	-0.3716	-2.3637
492	-1.386	-0.1634	1.9628	-2.0943	-0.358	-0.4427	-2.902
493	-1.4229	-0.14	2.02629	-2.1487	-0.2812	-0.9232	-2.6492

494	-1.1904	-0.0004	2.22692	-2.0264	-0.0797	-0.2473	-2.6967
495	-1.0679	0.05546	2.3266	-2.1475	-0.0664	-0.2501	-2.8111
496	-1.2356	0.01542	2.11647	-1.9348	-0.1509	-0.1171	-2.3745
497	-1.1369	0.12878	2.26354	-1.9224	-0.0184	-0.1584	-2.1169
498	-1.2874	0.01616	2.04008	-2.1302	-0.1431	-0.134	-1.9944
499	-1.526	-0.0898	1.91736	-2.0644	-0.2285	-0.346	-2.2351
500	-1.5543	-0.0553	2.01004	-2.0597	-0.0466	-0.3528	-1.9356
501	-1.8544	-0.2193	1.93983	-1.8403	-0.2983	-0.5874	-2.3352
502	-1.65	0.00509	2.16803	-1.5672	-0.151	-0.3498	-2.1196
503	-1.7011	-0.1476	1.65575	-2.0027	-0.4468	-0.4678	-2.6325
504	-1.6242	0.00803	1.91503	-1.7763	-0.2974	-0.4654	-2.8662
505	-1.8679	-0.1991	1.54785	-2.1337	-0.5383	-0.7511	-2.8224
506	-1.6094	0.00816	1.80266	-1.8765	-0.3104	-0.6595	-2.6919
507	-1.8802	-0.1016	1.60801	-1.9197	-0.4924	-0.6374	-2.5362
508	-1.864	-0.0008	1.74459	-1.9354	-0.3072	-0.4414	-2.4592
509	-1.888	-0.1147	1.64644	-1.8805	-0.3716	-0.8386	-2.4841
510	-1.7663	0.00969	1.79656	-1.9122	-0.252	-0.5381	-2.296
511	-1.8388	-0.1495	1.53756	-1.9904	-0.4995	-0.6963	-2.6067
512	-1.9772	-0.1102	1.62722	-2.0291	-0.3773	-0.6599	-2.5263
513	-1.7433	-0.0212	1.805	-1.8511	-0.3073	-0.5751	-2.4995
514	-1.987	-0.1696	1.61326	-2.0843	-0.4994	-0.8949	-2.5275
515	-2.0043	-0.15	1.67311	-1.9527	-0.5047	-0.6407	-2.5525
516	-1.7609	-0.0497	1.69329	-2.0002	-0.3726	-0.637	-2.6534
517	-1.6507	0.01519	1.83314	-1.817	-0.2944	-0.4535	-2.4299
518	-1.8113	-0.1165	1.66341	-1.961	-0.4587	-0.4452	-2.181
519	-1.8537	-0.2119	1.53972	-2.0227	-0.5276	-0.5766	-2.5038
520	-1.812	-0.0936	1.68644	-2.051	-0.442	-0.6398	-2.5317
521	-1.6242	0.00803	1.91503	-1.7763	-0.2974	-0.4654	-2.8662
522	-1.8679	-0.1991	1.54785	-2.1337	-0.5383	-0.7511	-2.8224
523	-1.2523	-0.0099	2.41367	-2.0202	0.01835	-0.1652	-2.618
524	-1.2338	0.17775	2.32078	-1.3853	0.19484	-0.1324	-2.4311
525	-1.7214	-0.0675	1.67174	-1.7943	-0.4581	-0.4848	-2.4469
526	-1.7502	-0.0608	1.64081	-1.8211	-0.4492	-0.6687	-2.2546
527	-1.8875	-0.0671	1.41761	-1.9059	-0.5143	-0.8579	-2.4742
528	-1.9351	-0.0639	1.64629	-1.5207	-0.423	-0.6642	-2.3806
529	-2.0968	-0.1182	1.4184	-1.6796	-0.5642	-0.9388	-2.3779
530	-2.167	-0.095	1.43647	-1.5294	-0.5007	-0.8883	-2.5198
531	-2.0936	-0.0582	1.4924	-1.6413	-0.4625	-0.9509	-2.5444
532	-2.0527	-0.0147	1.54138	-1.7321	-0.4701	-0.864	-2.3279
533	-1.8873	-0.0464	1.50504	-1.7646	-0.4361	-0.8203	-2.5334
534	-1.9954	-0.0748	1.54272	-1.8306	-0.4105	-0.8201	-2.6736
535	-2.0963	-0.1077	1.46021	-1.8188	-0.493	-0.7903	-2.5223
536	-1.8399	0.06399	1.61317	-1.8389	-0.3295	-0.7279	-2.1321
537	-1.8693	0.0551	1.64427	-1.7055	-0.3118	-0.6998	-2.2763
538	-2.0075	-0.0485	1.54423	-1.8661	-0.4116	-0.8337	-2.5041
539	-2.0522	-0.1195	1.42798	-1.9257	-0.5359	-0.977	-2.4524

540	-1.9659	-0.1323	1.54514	-1.9533	-0.4847	-0.8934	-2.8336
541	-2.0393	-0.0876	1.49945	-1.729	-0.4839	-1.0858	-2.6392
542	-1.9039	-0.0073	1.61736	-1.7822	-0.3753	-0.8333	-2.4635
543	-1.7116	0.0651	1.72948	-1.7585	-0.3047	-1.0822	-2.2055
544	-1.7863	0.04125	1.64511	-1.8158	-0.442	-1.1501	-2.5543
545	-1.9832	-0.0101	1.58153	-1.9149	-0.4202	-0.9442	-2.6886
546	-1.8256	0.04817	1.70747	-1.7176	-0.2964	-1.0702	-2.5683
547	-1.9986	-0.0932	1.59236	-2.0084	-0.4061	-0.9032	-2.6776
548	-1.8426	0.03951	1.61865	-1.7896	-0.2799	-0.7843	-2.389
549	-1.823	-0.0038	1.71883	-1.5744	-0.2291	-0.8166	-2.3579
550	-1.8461	-0.1362	1.56858	-1.7446	-0.3943	-0.8723	-2.6469
551	-1.812	-0.0032	1.78876	-1.5568	-0.1808	-0.6013	-2.5738
552	-1.6867	0.08812	1.84772	-1.6925	-0.1202	-0.801	-2.2244
553	-1.728	-0.1058	1.61295	-1.8728	-0.3876	-1.2283	-2.6049
554	-1.5843	0.02512	1.77376	-1.62	-0.125	-0.9219	-2.609
555	-1.7944	-0.1256	1.62489	-1.7944	-0.4486	-0.8337	-2.3534
556	-2.0039	-0.1567	1.51354	-1.8384	-0.506	-1.2386	-2.5003
557	-1.8931	-0.1352	1.60491	-1.603	-0.3695	-0.8619	-2.3286
558	-1.8908	-0.0192	1.54815	-1.6384	-0.4184	-0.8566	-2.3011
559	-2.02	-0.1416	1.41842	-1.6425	-0.5603	-1.1547	-2.425
560	-2.0923	-0.0981	1.56083	-1.635	-0.4569	-0.918	-2.5188
561	-1.9363	-0.0229	1.60618	-1.4379	-0.2908	-0.7842	-2.652
562	-1.9936	-0.0535	1.52744	-1.754	-0.3734	-0.8096	-2.7237
563	-1.6669	0.053	1.76848	-1.5401	-0.2853	-0.7422	-2.1687
564	-1.6849	-0.052	1.73869	-1.684	-0.3227	-0.921	-2.095
565	-1.7083	-0.0316	1.66656	-1.7133	-0.3812	-1.0408	-2.4746
566	-1.6019	0.05851	1.83274	-1.6342	-0.2374	-0.8411	-2.4966
567	-1.6375	-0.0067	1.73367	-1.4718	-0.2779	-0.8955	-2.3852
568	-1.6703	-0.0764	1.64975	-1.7118	-0.3603	-0.9423	-2.4662
569	-1.6521	0.05595	1.79404	-1.6256	-0.2174	-0.6298	-2.3975
570	-1.7566	-0.0278	1.77299	-1.7976	-0.2738	-0.6328	-2.3613
571	-1.8193	-0.0344	1.69812	-1.9426	-0.323	-0.8289	-2.6647
572	-1.851	-0.0576	1.83617	-1.86	-0.2632	-0.7719	-2.3909
573	-1.7281	0.00611	2.00845	-1.6014	-0.0745	-0.7923	-2.2816
574	-1.8113	-0.1165	1.66341	-1.961	-0.4587	-0.4452	-2.181
575	-1.8537	-0.2119	1.53972	-2.0227	-0.5276	-0.5766	-2.5038
576	-1.6713	-0.0108	1.72619	-1.6149	-0.3231	-0.7397	-2.3818
577	-1.6159	0.0306	1.72598	-1.6197	-0.3616	-1.072	-2.2624
578	-1.7659	-0.0503	1.56076	-1.6908	-0.338	-0.8561	-2.4863
579	-1.8868	-0.0816	1.7263	-1.7333	-0.3125	-0.8797	-2.2311
580	-1.7343	-0.084	1.54927	-1.8698	-0.4022	-1.0114	-2.6514
581	-1.8356	-0.0623	1.59645	-1.6818	-0.3354	-0.8491	-2.5278
582	-1.7794	0.01809	1.76191	-1.6792	-0.2791	-0.698	-2.3126
583	-1.7261	0.00096	1.74404	-1.8419	-0.3295	-0.7375	-2.4274
584	-1.6655	-0.0111	1.683	-1.6931	-0.3221	-0.8753	-2.4946
585	-1.6131	-0.0553	1.76773	-1.9235	-0.375	-1.0777	-2.5891

586	-1.7652	-0.1874	1.65977	-1.9056	-0.4067	-0.804	-2.9293
587	-1.8246	-0.1325	1.69078	-1.9989	-0.3991	-0.7654	-2.9268
588	-1.695	0.01551	1.63037	-1.7623	-0.2185	-0.5607	-2.7524
589	-1.9398	-0.2063	1.60873	-1.9608	-0.483	-0.9142	-2.6152
590	-1.9226	-0.1083	1.55401	-1.8189	-0.3762	-0.7651	-2.6147
591	-1.7249	0.02472	1.82148	-1.7597	-0.2434	-0.7138	-2.2753
592	-1.9356	-0.0459	1.65918	-1.7611	-0.3769	-0.7994	-2.4015
593	-1.9034	-0.0051	1.58251	-1.7158	-0.3576	-0.8424	-2.3877
594	-1.7706	0.10853	1.67596	-1.7543	-0.2335	-0.9491	-2.6479
595	-1.8986	0.02211	1.58785	-1.8145	-0.2948	-0.8084	-2.3987
596	-1.8877	-0.0269	1.62123	-1.5712	-0.353	-0.8795	-2.586
597	-1.9065	-0.0404	1.59638	-1.8226	-0.3792	-0.8354	-2.5525
598	-1.9608	-0.0354	1.64864	-1.7171	-0.3563	-0.8887	-2.3136
599	-1.7566	-0.0278	1.77299	-1.7976	-0.2738	-0.6328	-2.3613
600	-1.8193	-0.0344	1.69812	-1.9426	-0.323	-0.8289	-2.6647
601	-1.8035	-0.0258	1.66477	-1.8426	-0.3664	-0.6458	-2.7012
602	-1.7889	0.05953	1.64303	-1.8018	-0.2429	-0.6775	-2.2875
603	-1.9092	-0.0787	1.6033	-1.952	-0.3804	-1.0042	-2.5957
604	-1.8186	0.00571	1.68999	-2.0949	-0.2685	-0.6036	-2.373
605	-1.7601	-0.0242	1.7229	-1.7267	-0.2753	-0.8823	-2.4967
606	-1.8221	-0.0664	1.66899	-1.8031	-0.3294	-0.8835	-2.4802
607	-1.9015	-0.0078	1.75817	-1.7262	-0.2137	-0.8446	-2.6965
608	-1.7187	0.06062	1.94972	-1.5909	0.02655	-0.7866	-2.4073
609	-1.6906	-0.005	2.06515	-2.0158	-0.0405	-0.8107	-2.3699
610	-1.8522	-0.0459	2.08048	-1.461	0.00809	-0.6161	-2.1857
611	-2.0134	-0.011	1.97158	-1.1805	-0.0917	-0.6546	-2.3814
612	-2.0574	-0.1646	1.75975	-1.9352	-0.2943	-0.776	-2.7024
613	-1.9392	-0.1114	1.79732	-1.854	-0.2555	-0.9161	-2.1152
614	-1.8633	0.04491	1.88352	-1.7499	-0.2285	-0.929	-2.4284
615	-1.851	-0.0576	1.83617	-1.86	-0.2632	-0.7719	-2.3909
616	-1.7281	0.00611	2.00845	-1.6014	-0.0745	-0.7923	-2.2816
617	-1.5921	0.00791	1.86725	-1.7078	-0.1167	-0.7915	-2.3122
618	-1.5069	0.03962	1.91331	-1.8093	-0.1378	-0.7015	-2.1811
619	-1.4927	0.06189	2.05748	-1.7042	-0.1194	-0.8937	-2.1787
620	-1.4675	0.03882	1.98682	-1.7145	-0.15	-0.953	-2.532
621	-1.5052	-0.0087	1.9666	-1.5409	-0.182	-0.7212	-2.5618
622	-1.4512	0.03639	1.87367	-1.6469	-0.1794	-0.9086	-2.276
623	-1.5361	0.02383	2.29277	-1.9479	-0.1412	-0.8991	-2.3449
624	-1.6688	-0.0401	1.81842	-2.0329	-0.3352	-0.9449	-2.6792
625	-1.8795	-0.0543	1.46565	-1.9529	-0.6423	-0.9961	-2.3197
626	-1.7257	-0.0269	1.41409	-1.9816	-0.7182	-1.1738	-2.1687
627	-1.526	-0.0011	1.85981	-1.7432	-0.2036	-0.7813	-2.3598
628	-1.4802	0.00535	1.90758	-1.9231	-0.1795	-0.9074	-2.483
629	-1.516	-0.0262	1.93879	-1.743	-0.2051	-0.9096	-2.4854
630	-1.4366	-0.004	1.87412	-1.6489	-0.1439	-0.8763	-2.4363
631	-1.5887	-0.0714	1.83772	-1.8761	-0.1976	-0.7138	-2.3912

632	-1.429	0.08755	2.10388	-1.611	-0.0315	-0.6462	-2.1271
633	-1.5188	-0.0649	1.96448	-1.6427	-0.131	-0.6398	-2.6665
634	-1.5022	0.02448	1.94792	-1.6242	-0.0628	-0.4743	-2.3275
635	-1.7563	-0.137	1.62494	-1.6711	-0.2575	-1.0085	-2.7186
636	-1.6465	-0.0239	1.71834	-1.7647	-0.2706	-0.9158	-2.6516
637	-1.6752	-0.1197	1.65789	-1.8951	-0.4448	-1.1086	-3.0349
638	-1.6271	-0.0672	1.75261	-1.8188	-0.3537	-1.2001	-3.0121
639	-1.5398	0.00945	1.78428	-1.9127	-0.3106	-0.9948	-2.4048
640	-1.4613	0.00624	1.99946	-1.8425	-0.227	-0.8134	-2.2373
641	-1.4795	0.00932	1.91313	-1.7336	-0.3011	-0.9741	-2.4019
642	-1.561	-0.0731	1.71963	-2.0515	-0.4138	-1.1393	-2.4684
643	-1.5877	-0.0525	1.68116	-1.9591	-0.4356	-1.1155	-2.5072
644	-1.5537	-0.0461	1.70616	-1.8988	-0.4082	-1.0271	-2.5065
645	-1.4743	0.02969	1.82941	-1.8621	-0.3366	-1.0557	-2.7092
646	-1.5503	0.00912	1.75015	-1.7559	-0.3556	-1.0004	-2.3989
647	-1.5154	0.09056	1.73784	-1.8	-0.2908	-0.9341	-2.2355
648	-1.4622	0.07857	1.84249	-1.678	-0.2121	-1.0264	-2.2975
649	-1.5621	-0.0241	1.82419	-2.0397	-0.3834	-1.1367	-2.4178
650	-1.4844	0.02605	1.89201	-1.793	-0.2599	-0.9942	-2.3651
651	-1.5228	0.07013	1.79305	-1.7426	-0.2682	-0.9837	-2.4979
652	-1.5355	0.02598	2.04293	-1.5095	-0.2737	-1.0172	-2.4872
653	-1.4857	-0.04	2.10243	-1.9586	-0.0786	-0.6835	-2.4513
654	-1.544	-0.0241	1.88523	-1.8941	-0.2795	-1.0854	-2.4376
655	-1.6215	-0.1078	1.69123	-1.9098	-0.3522	-1.2272	-3.0167
656	-1.5361	0.02383	2.29277	-1.9479	-0.1412	-0.8991	-2.3449
657	-1.6688	-0.0401	1.81842	-2.0329	-0.3352	-0.9449	-2.6792
658	-1.5194	0.0038	1.86539	-1.8849	-0.2971	-1.0282	-2.6074
659	-1.5508	0.01805	1.81049	-1.8616	-0.2948	-1.0819	-2.6386
660	-1.4673	0.10027	1.83	-1.7721	-0.3238	-1.1489	-2.5146
661	-1.5072	0.13135	1.83364	-1.6036	-0.2407	-0.9886	-2.1988
662	-1.4767	0.08745	1.87909	-1.7317	-0.2635	-0.7789	-2.2809
663	-1.4642	0.14789	1.86761	-1.6645	-0.2457	-0.8103	-2.4342
664	-1.6327	-0.0451	1.69103	-1.9846	-0.3562	-0.9605	-2.5515
665	-1.3977	0.10265	1.78744	-1.7834	-0.1953	-0.5304	-2.4844
666	-1.5526	-0.0359	1.75447	-1.8257	-0.3909	-0.5328	-2.7691
667	-1.4383	0.07805	1.83605	-1.7804	-0.2245	-0.3949	-2.3905
668	-1.5209	-0.0597	1.83495	-1.9202	-0.3614	-0.7512	-2.6827
669	-1.5562	-0.0378	2.09152	-1.8116	-0.1844	-0.4396	-2.1482
670	-1.5006	0.02108	2.02276	-1.8604	-0.2529	-0.7522	-2.608
671	-1.6507	-0.0182	1.85681	-1.9578	-0.2995	-0.3898	-2.6195
672	-1.5779	-0.1033	1.74219	-1.979	-0.3826	-0.6462	-2.3301
673	-1.5838	-0.03	1.77063	-2.1165	-0.3466	-0.6087	-2.2906
674	-1.6497	-0.0966	1.67394	-1.8696	-0.4876	-0.5343	-2.7646
675	-1.5351	0.039	1.69753	-1.6104	-0.1646	-0.397	-2.6752
676	-1.7307	-0.0556	1.83912	-1.6192	-0.2539	-0.5442	-2.5044
677	-1.6375	-0.088	1.68727	-1.6977	-0.4481	-0.8359	-3.0562

678	-1.4313	0.10354	1.75442	-1.5427	-0.4209	-0.5674	-2.3982
679	-1.6212	-0.1737	1.62185	-1.8275	-0.5144	-0.7533	-2.272
680	-1.5488	-0.1412	1.70249	-1.7661	-0.5166	-0.5009	-2.7186
681	-1.5789	-0.068	1.59254	-1.8559	-0.4454	-0.5137	-2.7989
682	-1.9093	-0.0796	1.63027	-2.0305	-0.5289	-0.7045	-2.7761
683	-1.8832	-0.106	1.49583	-1.8164	-0.6027	-0.6519	-2.9818
684	-1.9921	-0.0207	1.59817	-1.9198	-0.4174	-0.59	-2.6557
685	-2.1439	-0.1258	1.56384	-2.0471	-0.3886	-0.7031	-2.4827
686	-1.9336	0.01318	1.65731	-2.0265	-0.2429	-0.4998	-2.4087
687	-1.7639	-0.0035	1.51239	-2.097	-0.4713	-0.7028	-2.3691
688	-1.7794	0.01055	1.61021	-1.9254	-0.4934	-0.8157	-2.4079
689	-1.8688	-0.0115	1.46012	-1.8116	-0.501	-0.544	-2.3546
690	-2.0789	-0.184	1.3855	-1.8948	-0.6576	-0.9167	-2.3242
691	-1.9416	0.03779	1.512	-1.9742	-0.4557	-0.849	-2.2593
692	-1.8844	-0.0222	1.54282	-1.9279	-0.4508	-0.6365	-2.4209
693	-2.1245	-0.1571	1.41034	-2.1461	-0.5446	-0.8514	-2.4064
694	-2.0362	-0.0782	1.42258	-1.9868	-0.549	-0.67	-2.8051
695	-2.0593	-0.1162	1.49207	-2.0744	-0.4653	-0.6665	-2.7288
696	-1.6747	-0.0143	1.78573	-2.1164	-0.3159	-0.7943	-2.6273
697	-1.6493	-0.0142	1.70007	-2.137	-0.2334	-0.9493	-2.7631
698	-1.5337	0.10499	1.91458	-1.8957	-0.0347	-0.9928	-2.3514
699	-1.762	-0.0026	1.48333	-2.0254	-0.3733	-0.8404	-2.2774
700	-2.0104	-0.1434	1.35389	-2.0873	-0.1975	-0.8462	-2.6952
701	-1.9354	-0.0295	1.43634	-2.06	-0.5238	-0.4782	-2.4684
702	-2.1383	-0.1132	1.36862	-2.048	-0.5228	-1.0164	-2.3492
703	-1.9214	-0.0032	1.46819	-1.837	-0.4263	-0.6736	-2.2053
704	-1.9093	0.02403	1.46636	-1.9534	-0.5242	-0.9411	-2.1683
705	-2.1695	-0.0875	1.3993	-2.0238	-0.5081	-0.4693	-2.4202
706	-2.1054	-0.1979	1.47893	-2.0243	-0.5821	-0.655	-2.3564
707	-1.6318	0.08912	1.68687	-1.937	-0.478	-0.6383	-2.3549
708	-1.8901	-0.1272	1.45094	-1.8672	-0.5632	-0.8507	-2.7551
709	-1.9029	-0.0512	1.62749	-1.7285	-0.4862	-0.7883	-2.3716
710	-1.8086	-0.0539	1.60378	-2.1844	-0.5404	-0.6402	-2.5195
711	-1.7884	-0.0605	1.51352	-1.9337	-0.5186	-0.6857	-2.357
712	-1.9498	-0.0249	1.54204	-2.0536	-0.5052	-0.4888	-2.1706
713	-1.8058	0.02354	1.52816	-1.9737	-0.5663	-0.6611	-2.3843
714	-1.9199	-0.0649	1.35905	-1.9965	-0.6842	-0.8763	-2.4173
715	-1.7079	-0.0039	1.66827	-2.0473	-0.6063	-0.787	-2.2348
716	-1.7191	-0.0087	1.76843	-1.9239	-0.5164	-0.6783	-2.1174
717	-1.9952	-0.2307	1.40427	-2.1199	-0.7408	-0.9767	-2.4539
718	-1.8082	-0.0654	1.45931	-2.0014	-0.7699	-1.0345	-2.446
719	-1.868	0.00197	1.4296	-1.9443	-0.7514	-1.1372	-2.4595
720	-1.8795	-0.0543	1.46565	-1.9529	-0.6423	-0.9961	-2.3197
721	-1.7257	-0.0269	1.41409	-1.9816	-0.7182	-1.1738	-2.1687
722	-1.5655	0.00494	1.51294	-2.0115	-0.6659	-0.9946	-2.2948
723	-1.6977	-0.0856	1.39877	-2.0026	-0.7836	-0.8052	-2.3333

724	-1.6532	0.01975	1.44029	-2.0448	-0.7083	-0.8674	-2.2941
725	-1.7162	0.00854	1.43944	-2.1682	-0.7428	-1.2102	-2.3101
726	-1.7302	0.00498	1.39385	-2.1609	-0.7474	-0.9829	-2.3928
727	-1.9009	-0.0426	1.21725	-2.1359	-0.8487	-0.9202	-2.6839
728	-1.8425	0.00968	1.29401	-2.1743	-0.7733	-0.832	-2.4909
729	-1.6608	0.03032	1.41025	-2.1087	-0.8329	-1.0755	-2.6014
730	-1.6996	0.07645	1.38403	-1.8754	-0.6674	-0.784	-2.3911
731	-1.7429	0.00777	1.4952	-1.8508	-0.6564	-0.5483	-2.2904
732	-1.6911	0.0108	1.51896	-1.7583	-0.6649	-0.3422	-2.2681
733	-1.7344	-0.0486	1.37755	-2.0818	-0.7293	-0.3978	-2.2334
734	-1.7845	-0.1188	1.27251	-2.2805	-0.8857	-0.8049	-2.598
735	-1.9709	-0.2602	1.1604	-2.197	-1.024	-0.5832	-2.7519
736	-1.8128	-0.0922	1.4084	-1.955	-0.8003	-0.3355	-2.358
737	-1.8279	-0.0309	1.28639	-2.0377	-0.8465	-0.4229	-2.2969
738	-1.7941	-0.0791	1.21008	-2.0041	-0.9114	-0.8137	-2.6579
739	-2.0082	-0.1375	1.10114	-2.201	-0.8754	-0.9949	-2.4209
740	-2.1061	-0.0813	1.1726	-2.0186	-0.8947	-0.8242	-2.3894
741	-2.0272	-0.0134	1.27269	-2.1565	-0.8626	-0.7912	-2.3758
742	-1.812	0.03781	1.30869	-1.8627	-0.7407	-0.514	-2.512
743	-1.9573	-0.007	1.20546	-2.1899	-0.8259	-1.0508	-2.3817
744	-1.9853	-0.0175	1.20764	-2.1922	-0.8806	-0.8372	-2.6537
745	-1.9454	0.01092	1.154	-2.156	-0.9248	-0.7795	-2.8901
746	-1.9921	-0.0478	1.15272	-2.3022	-0.9995	-0.6691	-2.6905
747	-1.9017	-0.0119	1.15133	-2.178	-0.9061	-0.4197	-2.3819
748	-1.8224	0.06943	1.3812	-2.1464	-0.7402	-0.4218	-2.354
749	-1.9119	-0.0587	1.25667	-2.4133	-0.935	-0.6739	-2.6377
750	-2.0939	-0.2044	1.05345	-2.5427	-0.9984	-0.4298	-2.8207
751	-1.9683	-0.0729	1.33421	-2.33	-0.8425	-0.4348	-2.4644
752	-1.8856	-0.0124	1.31103	-2.384	-0.8362	-0.6674	-2.7507
753	-1.7755	0.06196	1.35313	-2.2323	-0.767	-0.3157	-2.3345
754	-2.0639	-0.2172	1.11304	-2.2601	-0.9636	-0.6049	-2.7378
755	-1.9072	0.00063	1.21997	-2.256	-0.8837	-0.594	-2.6306
756	-1.9454	-0.0652	1.36263	-2.3733	-0.7492	-0.5553	-2.6268
757	-1.9059	-0.0539	1.34198	-2.229	-0.7953	-0.7506	-2.5042
758	-1.2399	0.23274	2.30437	-1.8894	-0.1411	-0.9241	-2.4313
759	-1.24	0.22761	2.31505	-1.9658	-0.1114	-0.8793	-2.3444
760	-1.3823	0.05489	2.04539	-1.9522	-0.0858	-0.6842	-3.2113
761	-1.7119	-0.0758	1.53139	-2.2026	-0.4399	-1.0031	-2.7967
762	-1.4992	-0.0208	1.72375	-2.0568	-0.3499	-0.7994	-2.7527
763	-1.3642	0.05152	1.89919	-1.8969	-0.3333	-0.7826	-2.5666
764	-1.3767	-0.1007	1.86527	-2.0293	-0.3731	-0.6678	-2.6948
765	-1.4646	-0.2017	1.7444	-2.124	-0.3024	-0.6892	-2.7174
766	-1.5314	-0.0903	1.84109	-1.9003	-0.3977	-0.7999	-2.3386
767	-1.5088	-0.071	1.71503	-1.8715	-0.3191	-0.7609	-2.5993
768	-1.3666	0.06611	1.77109	-1.5293	-0.3445	-0.6881	-2.1486
769	-1.4817	0.03579	1.75938	-1.5269	-0.2386	-0.7747	-2.3796

770	-1.5957	-0.0428	1.5641	-1.7985	-0.2391	-0.9304	-2.6062
771	-1.4089	0.10007	2.00629	-1.5819	0.03038	-0.7524	-2.5814
772	-1.4313	0.14363	2.10658	-1.5697	-0.1098	-0.9808	-2.5805
773	-1.4169	-0.038	2.04759	-1.6235	-0.1301	-0.7545	-2.7519
774	-1.6433	-0.091	1.88623	-1.7888	-0.0873	-1.2218	-2.3097
775	-1.3803	0.11497	2.58661	-1.8059	0.508	-1.0009	-2.45
776	-1.4337	0.04785	2.9475	-1.9131	0.44547	-0.9558	-2.6578
777	-1.6633	0.00334	2.48294	-1.8268	0.13326	-1.2069	-2.7997
778	-1.6355	-0.008	2.5672	-1.7435	0.00187	-1.2263	-2.8839
779	-1.7091	0.03242	1.6896	-1.8822	-0.2666	-1.2222	-2.3421
780	-1.712	-0.0054	1.4305	-1.8948	-0.4838	-1.041	-2.4676
781	-1.5637	0.10473	1.48555	-1.8329	-0.4482	-0.9575	-2.1157
782	-1.5621	0.1463	2.10996	-1.7776	-0.2622	-0.827	-2.0311
783	-1.8345	-0.062	1.64608	-1.7713	-0.4092	-0.9495	-2.5381
784	-1.7813	-0.0193	1.70653	-1.8211	-0.4185	-0.8776	-2.5018
785	-1.5546	-0.0163	2.28448	-1.9743	-0.4453	-0.731	-2.6473
786	-1.2593	0.15326	1.83041	-1.8119	-0.5057	-0.961	-2.7216
787	-1.3544	-0.0249	1.78349	-1.9692	-0.5505	-0.6359	-2.3843
788	-1.1833	0.07966	1.82647	-1.893	-0.3831	-0.4775	-2.3907
789	-1.3766	0.06676	1.88553	-1.8362	-0.4982	-0.9363	-2.6467
790	-1.4968	0.08137	1.47862	-1.9945	-0.5887	-1.0418	-2.2292
791	-1.5774	0.03451	1.49003	-2.0704	-0.6291	-1.0512	-2.6723
792	-1.4639	0.10951	1.58903	-1.7901	-0.5392	-0.9583	-2.5107
793	-1.5048	0.0872	1.56158	-1.8681	-0.4614	-0.8512	-2.6452
794	-1.4258	0.08184	1.69453	-1.8126	-0.5215	-1.0521	-2.6812
795	-1.556	0.05992	1.69357	-2.0716	-0.4672	-1.0935	-2.5727
796	-1.4764	0.0451	1.82214	-2.0771	-0.4511	-1.002	-2.4878
797	-1.3914	0.09019	1.9498	-1.9798	-0.3198	-0.926	-2.4049
798	-1.9395	-0.0606	1.27585	-2.4127	-0.9036	-0.5906	-2.3688
799	-2.1202	-0.1266	1.13443	-2.554	-0.9951	-0.3871	-2.3003
800	-1.9327	-0.042	1.40395	-2.4092	-0.7542	-0.451	-2.665
801	-2.0317	-0.1187	1.41496	-2.5543	-0.8644	-0.3803	-2.5609
802	-1.8414	0.04207	1.41826	-2.3344	-0.6663	-0.6402	-2.6221
803	-2.0139	-0.028	1.29606	-2.1184	-0.7248	-0.4863	-2.701
804	-2.0557	-0.1559	1.3082	-2.2795	-0.8579	-0.7106	-2.373
805	-1.8991	-0.0911	1.22783	-2.3964	-0.973	-0.6372	-2.5468
806	-1.8641	-0.0091	1.34313	-2.3297	-0.8344	-0.4591	-2.2314
807	-1.8178	-0.0455	1.3925	-2.2001	-0.7045	-0.6319	-2.6511
808	-1.7913	0.05861	1.39858	-2.3621	-0.66	-0.5614	-2.7064
809	-1.7924	0.01694	1.48785	-2.1191	-0.6246	-0.548	-2.8616
810	-2.0725	-0.167	1.22723	-1.9907	-0.8419	-1.0434	-3.1425
811	-1.9163	-0.1153	1.19069	-2.0152	-0.6396	-0.5756	-2.4411
812	-1.8891	-0.0629	1.3789	-2.1866	-0.6796	-0.5995	-2.5516
813	-1.8756	-0.0102	1.36683	-2.1768	-0.6044	-0.7373	-2.7735
814	-1.8437	0.00714	1.50453	-2.1016	-0.5495	-0.4193	-2.4184
815	-1.7888	0.00758	1.5386	-2.1974	-0.5255	-0.7781	-2.6082

816	-1.7228	0.06972	1.54216	-1.9307	-0.4675	-0.81	-2.368
817	-1.7252	0.05088	1.52706	-1.8372	-0.4746	-0.6571	-2.2871
818	-1.9132	-0.0509	1.4283	-1.9279	-0.6872	-0.8696	-2.5748
819	-1.8786	-0.1457	1.37934	-1.9228	-0.7233	-0.9989	-2.4317
820	-1.7927	0.00027	1.51009	-2.0323	-0.6361	-0.7502	-2.5428
821	-1.6629	0.13192	1.72037	-1.9285	-0.4708	-0.5941	-2.209
822	-1.6919	0.00044	1.70736	-1.9699	-0.5473	-0.6771	-2.1457
823	-1.617	0.03548	1.77807	-1.9185	-0.3999	-0.7832	-2.3079
824	-1.6524	0.07487	1.67188	-1.7236	-0.5338	-0.9095	-2.4841
825	-1.7674	-0.0718	1.62128	-1.8287	-0.5882	-1.0442	-2.7467
826	-1.4203	0.10623	1.90302	-1.5923	-0.324	-0.7591	-2.3928
827	-1.4355	0.12603	1.72697	-1.7294	-0.3625	-0.8499	-2.3153
828	-1.1833	0.07966	1.82647	-1.893	-0.3831	-0.4775	-2.3907
829	-1.1899	0.03859	1.72431	-1.5136	-0.4762	-0.6443	-2.5633
830	-1.6495	-0.197	1.42312	-1.8148	-0.8105	-0.8114	-2.7981
831	-1.4438	0.05674	1.50161	-2.1843	-0.6887	-0.5465	-2.355
832	-1.5443	-0.0456	1.39682	-2.2651	-0.7391	-0.7561	-2.5951
833	-1.4826	-0.031	1.46959	-2.1923	-0.7112	-0.5842	-2.9603
834	-1.6064	-0.1982	1.32842	-2.363	-0.8967	-0.884	-2.7257
835	-1.4934	0.01612	1.46705	-2.2593	-0.7022	-0.7104	-2.5024
836	-1.5901	-0.0965	1.29536	-2.2054	-0.7957	-0.7079	-2.6356
837	-1.5231	0.01708	1.43291	-2.1588	-0.6272	-0.6893	-2.7245
838	-1.4321	0.04932	1.55483	-2.207	-0.6199	-0.4854	-2.5733
839	-1.5259	0.04163	1.41086	-2.1875	-0.6963	-0.7865	-2.2276
840	-1.5263	0.02401	1.43681	-2.0881	-0.7087	-0.8401	-2.7057
841	-1.4779	0.05994	1.50585	-1.9981	-0.5783	-0.6582	-2.4666
842	-1.4361	-0.0003	1.45096	-2.0182	-0.601	-0.525	-2.3211
843	-1.5026	-0.0174	1.44471	-2.1429	-0.7505	-0.4716	-2.2527
844	-1.5223	0.00614	1.52642	-2.0701	-0.7375	-0.6204	-2.4058
845	-1.5174	-0.0563	1.52434	-1.9735	-0.7578	-0.8554	-2.7029
846	-1.5734	-0.0349	1.50576	-1.9798	-0.7904	-0.686	-2.7262
847	-1.6069	-0.0924	1.31289	-1.9953	-0.8152	-0.7496	-2.4409
848	-1.4357	0.0272	1.48477	-1.8284	-0.6617	-0.5143	-2.394
849	-1.5846	-0.0525	1.49979	-1.8118	-0.6915	-0.6304	-2.3461
850	-1.4321	0.08395	1.46978	-2.0104	-0.6608	-0.5479	-2.371
851	-1.4565	0.10272	1.39961	-1.7809	-0.6113	-0.5972	-2.3708
852	-1.4336	0.1152	1.49133	-1.7254	-0.5961	-0.5172	-2.4138
853	-1.5988	-0.0465	1.38461	-2.0007	-0.7765	-0.5577	-2.3991
854	-1.3659	0.13456	1.53975	-1.8359	-0.5619	-0.4582	-2.4004
855	-1.5923	0.06513	1.42782	-2.0395	-0.7247	-0.6754	-2.5917
856	-1.5106	0.04441	1.42698	-2.004	-0.7559	-0.4807	-2.3974
857	-1.5041	0.03873	1.56946	-2.2158	-0.7227	-0.5526	-2.5249
858	-1.6268	-0.1086	1.46491	-2.173	-0.7627	-0.489	-2.3956
859	-1.5132	-0.053	1.4154	-2.2537	-0.7207	-0.5535	-2.3618
860	-1.5512	-0.0861	1.57948	-1.7817	-0.6163	-0.3408	-2.246
861	-1.6717	-0.0733	1.43848	-1.3932	-0.6792	-0.5908	-2.7289

862	-1.6572	-0.0678	1.46509	-2.0947	-0.7149	-0.5727	-2.6212
863	-1.9507	-0.1191	1.17887	-1.9726	-0.835	-0.547	-2.6581
864	-1.856	0.05998	1.3399	-1.7864	-0.703	-0.5943	-2.2862
865	-1.9456	-0.0141	1.2635	-1.8935	-0.7928	-0.4874	-2.5902
866	-1.8704	-0.0134	1.35111	-1.7304	-0.756	-0.4958	-2.3027
867	-1.6769	0.0566	1.50213	-1.5774	-0.6084	-0.3989	-2.1692
868	-1.9016	-0.1257	1.24719	-2.0615	-0.8923	-0.72	-2.6867
869	-1.7777	-0.014	1.27499	-1.8813	-0.7817	-0.6644	-2.5888
870	-1.8241	-0.0857	1.19715	-1.9726	-0.7504	-0.7577	-2.506
871	-1.6889	-0.001	1.33421	-1.8534	-0.7679	-0.5935	-2.782
872	-1.6578	0.04353	1.36668	-1.888	-0.7268	-0.497	-2.3234
873	-1.7304	-0.0064	1.27822	-1.8784	-0.8013	-0.7222	-2.586
874	-1.798	-0.0332	1.26816	-1.9099	-0.7784	-0.3724	-2.4276
875	-1.9718	-0.1149	1.09853	-1.9205	-0.8663	-0.6577	-2.5958
876	-1.8418	-0.0204	1.24299	-1.6572	-0.7002	-0.6501	-2.5188
877	-1.8929	-0.0108	1.2164	-1.6532	-0.76	-0.4364	-2.6233
878	-1.8453	-0.0065	1.33796	-1.6218	-0.7288	-0.6126	-2.7113
879	-1.6598	0.16146	1.45558	-1.5627	-0.5928	-0.5141	-2.228
880	-1.7455	0.07083	1.16463	-1.6591	-0.7005	-0.6101	-2.291
881	-1.6879	0.01345	1.25893	-2.016	-0.773	-0.7868	-2.5135
882	-1.6866	0.06328	1.47737	-1.9177	-0.5845	-0.6398	-2.6498
883	-1.4369	0.04617	1.59934	-1.736	-0.5452	-0.6951	-2.2995
884	-1.72	-0.0151	1.29229	-1.7677	-0.7472	-0.7361	-2.6885
885	-1.6678	0.12187	1.35548	-1.492	-0.7452	-0.7904	-2.6376
886	-1.8895	0.00194	1.20964	-1.6614	-0.8001	-0.8842	-2.535
887	-1.8601	0.02656	1.34107	-1.7207	-0.7512	-0.723	-2.46
888	-1.8293	-0.0055	1.25397	-1.8749	-0.834	-0.8067	-2.4577
889	-1.814	-0.0283	1.33247	-1.9068	-0.7735	-0.6763	-2.6752
890	-1.7651	-0.0173	1.36039	-1.6251	-0.7453	-0.6263	-2.4642
891	-1.8734	-0.0031	1.17411	-2.0635	-0.8342	-0.541	-2.434
892	-1.8797	-0.0641	1.09085	-2.0027	-1.0281	-0.8269	-2.5775
893	-1.8372	0.0208	1.26565	-1.7829	-0.8139	-0.6152	-2.5861
894	-1.8124	-0.0093	1.28139	-1.8399	-0.8722	-0.917	-2.6037
895	-1.8115	-0.0546	1.25381	-1.8635	-0.8937	-0.7307	-2.7677
896	-2.0884	-0.2718	0.9213	-2.186	-1.1057	-0.8633	-2.9569
897	-1.8611	-0.0225	1.12273	-1.8112	-0.9183	-0.9183	-2.9737
898	-1.8231	-0.1059	1.03577	-1.9325	-0.9788	-1.1974	-3.0024
899	-1.7849	0.01608	1.20486	-1.7699	-0.8026	-0.9379	-2.5292
900	-1.7202	0.04683	1.27499	-1.7587	-0.8103	-1.0343	-2.73
901	-1.7458	-0.0004	1.24183	-1.732	-0.931	-1.1913	-3.0297
902	-1.7228	0.07245	1.35153	-1.6088	-0.6636	-0.8486	-2.753
903	-1.7538	-0.0323	1.14951	-1.8802	-0.7639	-0.9018	-2.7615
904	-1.7083	0.03217	1.1399	-1.8354	-0.7672	-0.9333	-2.2541
905	-1.6431	0.16461	1.24102	-1.4702	-0.5405	-0.7383	-2.1633
906	-1.7376	0.11836	1.38931	-1.6663	-0.4451	-0.8897	-2.2146
907	-1.8309	-0.0139	1.29948	-1.9254	-0.5953	-1.186	-2.388

908	-1.761	0.03825	1.83873	-1.8139	-0.351	-0.9303	-2.39
909	-1.7568	0.0505	1.57766	-1.8277	-0.3901	-0.9413	-2.1993
910	-1.9324	-0.0422	1.14963	-2.0303	-0.743	-1.1099	-2.7422
911	-1.7585	0.03034	1.52653	-1.8511	-0.4646	-0.9411	-2.6315
912	-1.8729	0.05843	1.72982	-1.6474	-0.3675	-0.8619	-2.4178
913	-1.8393	0.00733	1.46592	-1.8877	-0.5041	-0.9682	-2.6766
914	-1.7785	0.04408	1.26329	-1.9843	-0.5829	-0.9601	-2.5017
915	-1.8884	0.02226	1.22166	-2.2194	-0.6152	-0.8369	-2.5066
916	-1.7759	0.01024	1.11271	-1.9496	-0.7538	-0.7728	-2.3138
917	-1.8254	0.06838	1.2147	-1.9157	-0.7624	-0.8428	-2.3792
918	-1.6507	0.0447	1.36209	-1.9436	-0.5908	-0.8034	-2.4343
919	-1.6959	0.00088	1.34355	-1.9686	-0.6425	-0.8246	-2.4973
920	-1.4774	0.01565	1.3913	-1.9763	-0.5318	-0.6926	-2.24
921	-1.4221	0.01415	1.30528	-1.8323	-0.6685	-1.0101	-2.5934
922	-1.3757	0.04832	1.39349	-1.8433	-0.401	-0.451	-2.7312
923	-1.4273	0.16076	1.47428	-1.5167	-0.2059	-0.1557	-2.2151
924	-1.3134	0.08479	1.38167	-1.3932	-0.2718	-0.3056	-2.3147
925	-1.4777	0.08662	1.36039	-1.4505	-0.1436	-0.3221	-2.3601

Appendix Table 1.6. Natural log of key indicator element abundance variability against conservative lithophile element Rb in core FS E3 in the Three Rivers Estuarine Complex saltmarshes.

Depth (mm)	Si/Rb	K/Rb	Ca/Rb	Ti/Rb	Br/Rb	Sr/Rb	Zr/Rb	Ba/Rb
1	-0.3844	1.38138	2.85194	1.57756	0.27287	1.07621	1.17345	-1.4423
2	-0.1405	1.61764	2.95606	1.61764	0.46266	1.03948	1.1582	-1.104
3	-0.0538	1.64272	3.12997	1.84542	0.22489	1.08321	1.19498	-1.3907
4	-0.402	1.41435	2.6743	1.68875	0.12404	0.8407	0.63502	-1.1295
5	-0.4462	1.40307	2.68566	1.39901	0.07355	0.79216	0.89862	-1.2912
6	-0.1744	1.62499	2.95869	1.72107	0.34792	0.96833	1.1761	-1.1566
7	-0.7883	1.22281	2.40798	1.30719	0.24554	0.80737	1.09312	-1.2821
8	-0.2614	1.50327	2.81197	1.53256	0.34036	0.91411	1.0505	-1.3093
9	-0.5658	1.34359	2.70285	1.44594	0.21115	0.83672	1.10549	-0.9334
10	-0.6553	1.36309	2.68685	1.50285	0.20649	0.87776	1.41834	-0.8692
11	-0.6653	1.20854	2.6163	1.26694	0.1097	0.76239	0.95269	-1.265
12	-0.5757	1.31658	2.76811	1.49883	0.28579	0.83897	1.22793	-1.035
13	-0.4524	1.31602	2.62507	1.38222	0.27559	0.59409	1.04727	-0.8225
14	-0.4873	1.24106	2.5411	1.34974	0.23564	0.49252	1.03724	-1.0725
15	-0.5783	1.29293	2.36961	1.48164	0.29359	0.49866	1.16138	-1.1815
16	-0.2129	1.57312	2.69233	1.73404	0.50428	0.84538	1.12666	-1.0391
17	-0.3909	1.48404	2.63396	1.53191	0.43709	0.72084	1.00003	-1.1079
18	-0.5925	1.24537	2.32005	1.25356	0.04627	0.45129	0.83176	-1.1515
19	-0.3953	1.39499	2.5094	1.36432	0.43982	0.84107	1.11719	-0.9851
20	-0.2977	1.41306	2.39259	1.45548	0.34605	0.56063	0.8054	-0.7089

21	-0.3168	1.43391	2.36351	1.4739	0.47467	0.53381	0.84365	-1.1593
22	-0.515	1.26557	2.18829	1.26105	0.48068	0.5082	0.90399	-1.0964
23	-0.3707	1.36823	2.35637	1.35065	0.64288	0.61171	0.87547	-1.2752
24	-0.2396	1.54542	2.59226	1.4641	0.62127	0.67346	0.92226	-1.1976
25	-0.3307	1.42288	2.30448	1.43328	0.32046	0.64467	0.96072	-0.9127
26	-0.4684	1.34953	2.35594	1.33253	0.21604	0.49364	0.62596	-1.5987
27	-0.4884	1.31558	2.38971	1.34376	0.09696	0.51701	0.94592	-1.0694
28	-0.3714	1.40417	2.42226	1.33656	0.18999	0.62446	0.98191	-0.885
29	-0.2767	1.4513	2.54292	1.67686	0.30938	0.73535	0.98687	-0.8098
30	-0.2428	1.44156	2.47383	1.39504	-0.09	0.64193	0.82612	-0.9854
31	-0.2431	1.50711	2.71732	1.55725	0.02338	0.7471	0.97555	-0.9148
32	-0.2104	1.48779	2.62084	1.56902	-0.1876	0.66363	0.93277	-0.717
33	-0.1552	1.61105	2.87038	1.6162	-0.0463	0.87473	1.15692	-0.7293
34	-0.266	1.50722	2.66167	1.54231	-0.0955	0.71929	0.96778	-0.9818
35	-0.3226	1.50299	2.6219	1.53328	-0.097	0.72531	0.96712	-0.8051
36	-0.0111	1.69003	3.00905	1.78516	0.15847	0.84414	1.06689	-0.8339
37	-0.2006	1.6163	2.83037	1.68122	-0.0121	0.78446	0.93388	-0.577
38	-0.2705	1.68051	2.85925	1.73374	0.05498	0.68076	0.89919	-0.735
39	-0.2579	1.61754	2.90338	1.70256	-0.1155	0.82945	0.88513	-0.8128
40	-0.0949	1.76166	3.0346	1.72483	-0.1089	0.88115	1.19169	-0.628
41	-0.225	1.60135	2.76795	1.63917	-0.1614	0.76936	0.96405	-0.7382
42	-0.0445	1.77463	2.98522	1.77697	-0.0738	0.92137	1.08543	-0.4936
43	-0.0931	1.67654	2.8742	1.75839	-0.1316	0.88087	0.98429	-0.7706
44	-0.2598	1.67778	2.79637	1.65546	-0.1532	0.8087	1.18938	-0.8872
45	-0.1778	1.63415	2.72465	1.59785	-0.1821	0.75552	0.99001	-0.7924
46	-0.4055	1.53658	2.57934	1.59242	-0.1585	0.58195	0.89192	-1.0937
47	-0.5244	1.45122	2.60252	1.46392	0.00522	0.59466	0.66932	-0.8692
48	-0.445	1.36524	2.55121	1.34448	0.12351	0.50651	0.50737	-0.9827
49	-0.3772	1.45451	2.64794	1.43142	0.2463	0.32835	0.58468	-0.949
50	-0.3197	1.60543	2.89606	1.59479	0.23902	0.51119	0.72887	-0.9463
51	-0.2006	1.54884	2.79981	1.56707	0.12337	0.59788	0.82947	-0.971
52	-0.0153	1.70374	2.99811	1.67024	0.384	0.83216	1.09591	-0.744
53	-0.3885	1.46903	2.72831	1.46197	0.11463	0.54525	0.72541	-1.1106
54	-0.1363	1.59236	2.80724	1.65033	0.52117	0.56021	1.05842	-0.8362
55	-0.3867	1.34903	2.49049	1.52787	0.11737	0.46665	0.46704	-0.9185
56	-0.1011	1.59483	2.90309	1.6397	0.17596	0.6765	0.82353	-1.0929
57	-0.0609	1.57501	2.87184	1.64484	0.15196	0.65637	0.79665	-0.9599
58	-0.0563	1.63501	2.99095	1.75584	0.25247	0.69352	0.82343	-1.0474
59	-0.0358	1.61927	2.92009	1.71266	0.34619	0.6205	0.47835	-0.8489
60	0.01259	1.63678	2.80318	1.68574	0.41338	0.61732	0.86178	-1.024
61	-0.0995	1.53905	2.70161	1.55057	0.23296	0.6035	0.70366	-0.989
62	-0.0627	1.64413	2.9877	1.59904	0.16186	0.64047	0.96875	-0.5992
63	0.108	1.66583	2.98007	1.67454	0.05154	0.81989	0.91893	-0.8013
64	-0.0042	1.72307	2.89424	1.68811	0.0092	1.0145	0.93031	-0.9592
65	-0.049	1.60666	2.76329	1.45488	-0.0148	0.69853	0.74172	-1.0079
66	-0.1322	1.47429	2.73293	1.47642	-0.0781	0.68163	0.98315	-0.8739

67	0.01425	1.59006	2.85187	1.66982	0.12701	0.82449	1.12079	-0.6816
68	-0.3503	1.3997	2.51585	1.56022	0.095	0.54417	1.16099	-0.869
69	-0.1174	1.59149	2.77611	1.49723	0.1932	0.62148	0.89099	-0.558
70	-0.1662	1.52454	2.646	1.4077	0.16132	0.43224	0.85749	-0.7367
71	-0.2375	1.42719	2.66694	1.41936	0.07643	0.42221	0.67548	-0.7256
72	-0.212	1.48589	2.59941	1.55078	0.12165	0.49106	0.9028	-1.2371
73	-0.1626	1.55044	2.62634	1.63351	0.25301	0.56158	0.98345	-0.9048
74	-0.2324	1.61924	2.5919	1.62404	0.31524	0.54523	1.02145	-1.2163
75	-0.2027	1.47835	2.66488	1.44778	0.24853	0.47157	0.58345	-1.1736
76	-0.224	1.51023	2.45503	1.4389	0.23604	0.4403	0.82576	-0.8344
77	-0.2593	1.52922	2.56593	1.54246	0.23914	0.39551	0.86284	-0.9516
78	-0.1592	1.65683	2.71103	1.72151	0.44153	0.67622	0.95941	-0.5871
79	-0.2762	1.52859	2.53314	1.52875	0.27973	0.39581	0.79349	-0.9534
80	-0.4376	1.57722	2.69645	1.69178	0.13724	0.45985	0.90124	-0.8694
81	-0.2889	1.55857	2.4893	1.5798	0.17336	0.4332	0.71599	-1.0711
82	-0.0732	1.68106	2.63894	1.70384	0.22911	0.61859	1.09806	-0.7513
83	-0.2756	1.52987	2.61021	1.56201	0.133	0.45859	0.91328	-1.0887
84	-0.1322	1.57426	2.57369	1.66251	0.25604	0.49902	0.95817	-1.2796
85	-0.3518	1.4742	2.61444	1.46935	0.19171	0.4032	1.01987	-1.4623
86	-0.3097	1.44688	2.4978	1.49325	0.15651	0.3425	0.94167	-0.8727
87	-0.4617	1.40717	2.47372	1.42585	0.0864	0.48556	0.82911	-0.8475
88	-0.2371	1.50857	2.53737	1.59105	0.0822	0.52336	1.01415	-0.6595
89	-0.392	1.36763	2.43215	1.35301	-0.1157	0.27264	0.73435	-0.966
90	-0.2595	1.47461	2.59824	1.49134	0.19183	0.45036	0.97766	-0.8964
91	-0.359	1.4565	2.63722	1.48232	0.04678	0.39276	0.76618	-0.6839
92	-0.3218	1.45754	2.48234	1.52769	-0.0516	0.53129	0.75509	-1.3399
93	-0.233	1.56391	2.65778	1.71136	0.00147	0.38587	0.91408	-0.5956
94	-0.2487	1.48308	2.67755	1.50656	-0.1026	0.48434	1.01193	-1.0534
95	0.09799	1.82612	2.90059	1.89679	0.12022	0.84334	0.89373	-0.6733
96	-0.2047	1.55777	2.60379	1.57436	-0.1406	0.58739	0.77646	-0.7546
97	-0.2357	1.63744	2.79546	1.68155	-0.2434	0.58602	0.93544	-0.5885
98	-0.1497	1.64022	2.69662	1.77046	-0.2524	0.63742	1.22535	-0.5938
99	-0.0597	1.6262	2.66388	1.66838	-0.2008	0.75178	0.89283	-0.8311
100	-0.1137	1.65475	2.91821	1.69317	-0.2045	0.6893	1.1839	-1.0879
101	0.00423	1.79162	3.07324	1.86513	-0.221	0.81281	1.05856	-0.8933
102	-0.2566	1.55531	2.74321	1.5117	-0.3392	0.67635	1.1064	-0.8618
103	-0.2227	1.65158	2.8723	1.61548	-0.3137	0.75117	1.07264	-0.7857
104	-0.1544	1.64829	2.84809	1.72423	-0.1667	0.74542	1.1142	-0.9259
105	0.02472	1.80321	3.05524	1.91232	-0.469	0.93316	1.45027	-0.7931
106	0.09367	1.80338	3.20178	1.73807	-0.2751	0.9667	1.34382	-0.6596
107	-0.1145	1.56802	2.94574	1.66679	-0.2748	0.7105	0.98944	-0.9585
108	-0.1167	1.66314	2.92899	1.73118	-0.041	0.7841	1.12972	-1.1767
109	-0.2451	1.60228	2.76741	1.43963	-0.1121	0.69619	0.96251	-0.7019
110	-0.3035	1.63562	2.87193	1.71814	0.01387	0.82307	1.08867	-0.7488
111	-0.1471	1.65296	3.19775	1.63746	-0.2839	0.99257	1.21013	-0.9256
112	-0.0438	1.67787	3.33469	1.74411	0.0681	0.99994	1.13367	-1.2049

113	0.0813	1.65992	3.29395	1.67139	-0.1481	0.90409	1.01151	-0.9323
114	-0.0993	1.55631	3.08605	1.52937	-0.1984	0.83837	1.25181	-0.8705
115	-0.1162	1.53215	3.06778	1.44492	-0.3313	0.76899	0.95415	-0.939
116	-0.0673	1.67025	3.10786	1.48969	-0.1304	0.95643	0.92608	-0.6979
117	0.0241	1.57001	3.28121	1.64702	-0.2115	0.95161	1.19253	-0.8717
118	-0.0424	1.63334	3.26415	1.64194	-0.2213	0.86481	1.07579	-0.91
119	-0.0446	1.58863	3.29971	1.5229	-0.3607	0.94451	1.13964	-1.1635
120	0.20489	1.68111	3.12229	1.60711	-0.0977	0.89402	0.8223	-0.7493
121	-0.0404	1.42553	2.8288	1.48145	-0.013	0.59702	1.01675	-1.2057
122	0.11587	1.59209	3.03327	1.51808	-0.1868	0.805	0.73328	-0.8383
123	-0.0447	1.42124	2.82451	1.47715	-0.0173	0.59273	1.01246	-1.21
124	0.00745	1.67039	3.25033	1.61425	0.11009	0.92737	1.15438	-0.6019
125	-0.3339	1.60755	3.15598	1.70553	-0.2219	0.88103	1.30643	-0.8018
126	0.02395	1.69327	3.16834	1.71998	0.09413	0.85983	1.37629	-0.4866
127	-0.3906	1.47209	3.01426	1.43488	-0.2575	0.67332	1.1742	-0.7634
128	-0.3094	1.64262	2.98155	1.64548	-0.2341	0.83819	1.02744	-0.8072
129	-0.0958	1.73787	3.15901	1.74066	-0.1497	0.91887	1.06598	-0.8371
130	0.06388	1.79698	3.30198	1.68504	-0.1295	1.02362	1.3144	-1.282
131	-0.0306	1.61356	2.94842	1.8036	-0.3344	0.77656	1.18414	-0.9817
132	-0.08	1.67358	3.07236	1.69141	-0.0425	0.87169	1.26523	-0.8317
133	-0.1929	1.47783	2.96159	1.61843	-0.3262	0.65236	0.90213	-0.8914
134	-0.0722	1.628	3.00545	1.44593	-0.3547	0.81155	1.42323	-0.8367
135	0.15531	1.73842	3.17035	1.60473	-0.2375	0.85347	1.22383	-0.5813
136	-0.0066	1.63896	3.08018	1.80369	-0.2051	0.8054	1.03569	-0.7778
137	-0.0565	1.68044	3.28617	1.64859	-0.3528	0.89211	1.17899	-0.9446
138	-0.0346	1.65882	3.20341	1.55428	-0.2337	0.94451	1.14635	-0.7203
139	-0.2387	1.47005	2.99593	1.59924	-0.3697	0.73656	0.96334	-0.8619
140	-0.4499	1.48514	2.99117	1.31231	-0.4707	0.75049	1.06641	-0.703
141	-0.0936	1.65659	3.24214	1.66084	-0.1948	0.93501	1.09804	-0.5346
142	-0.1678	1.52979	3.1382	1.54055	-0.4483	0.71218	0.90687	-0.7363
143	-0.1983	1.55718	2.96618	1.54181	-0.624	0.69581	1.09428	-1.0971
144	0.20155	1.72235	3.27247	1.68754	-0.2343	0.97043	1.24822	-0.675
145	-0.1855	1.45089	2.87223	1.57413	-0.4084	0.80954	1.43552	-0.6923
146	-0.1473	1.39859	3.10979	1.4756	-0.3829	0.78019	1.0211	-1.0431
147	0.11884	1.79458	3.4254	1.80318	-0.0601	1.02605	1.23704	-0.7487
148	-0.0036	1.6296	3.34068	1.56387	-0.3197	0.98548	1.18061	-1.1225
149	-0.2758	1.46724	3.03309	1.37762	-0.5202	0.74365	1.1455	-0.8091
150	0.09428	1.75914	3.33191	1.72596	-0.2908	1.02453	1.27099	-0.4583
151	-0.2126	1.47057	3.05687	1.67211	-0.2842	0.77296	0.97896	-0.5148
152	0.02917	1.72148	3.15492	1.66355	-0.2737	0.94092	1.17125	-0.9716
153	-0.2199	1.49379	3.02762	1.62283	-0.3417	0.85105	0.81276	-0.8418
154	-0.335	1.47317	3.06375	1.48893	-0.2855	0.87794	1.03561	-1.0937
155	-0.252	1.56668	3.06618	1.58956	-0.0281	0.9874	1.12654	-0.521
156	-0.2821	1.50271	2.89071	1.44339	-0.2075	0.75314	0.8675	-0.914
157	-0.1609	1.72385	3.03441	1.62912	0.07084	0.77022	1.04435	-0.6571
158	-0.1044	1.70501	3.08511	1.67416	0.13523	0.90907	1.11245	-0.7836

159	0.01808	1.79436	2.99208	1.86017	-0.0814	0.84519	1.04477	-0.7276
160	-0.0893	1.62499	3.0794	1.54502	-0.193	0.82956	1.14506	-1.1802
161	0.17327	1.82393	3.25759	1.60979	-0.2086	0.94024	1.20179	-0.6853
162	0.3391	1.82914	3.29551	1.89983	-0.2054	0.94563	1.23101	-0.9814
163	0.40483	1.88822	3.22002	1.99165	-0.1085	0.98047	1.36949	-0.5301
164	0.32664	1.78353	3.23849	1.74626	-0.0312	0.85417	1.15051	-0.7669
165	0.19604	1.65936	2.94694	1.62264	-0.2244	0.80847	0.92755	-0.6569
166	0.24508	1.70594	3.24671	1.61397	-0.0079	0.93549	1.17859	-0.8087
167	0.33211	1.77222	3.27155	1.72927	-0.0916	0.88714	1.17873	-0.5979
168	0.1829	1.71107	3.30173	1.56007	-0.2273	0.89441	1.31205	-0.6724
169	0.31559	1.71781	3.26205	1.8005	-0.4221	0.88726	1.21849	-0.9081
170	0.28051	1.67368	3.17424	1.47817	-0.3058	0.77429	1.21839	-0.9714
171	0.15814	1.55093	3.03384	1.52395	-0.3816	0.93061	1.03168	-0.8459
172	0.33712	1.73186	3.20152	1.35898	-0.2592	0.95867	0.93529	-0.564
173	0.32117	1.73572	3.35491	1.62512	-0.3396	0.93197	1.32157	-0.4233
174	0.2778	1.72296	3.27225	1.57784	-0.2669	0.93388	1.35469	-0.954
175	0.47561	1.84767	3.26702	1.80154	-0.091	1.04028	1.40854	-1.2344
176	0.49937	1.81522	3.18047	1.53886	0.12293	0.97528	0.98122	-0.8579
177	0.24184	1.55097	3.08031	1.44113	0.04879	0.71876	0.80378	-0.8133
178	0.48153	1.82018	3.38937	1.637	0.1428	1.00544	1.08361	-0.5336
179	0.10372	1.5333	2.97027	1.47596	-0.3305	0.9007	1.40782	-1.0143
180	0.25257	1.72878	3.16996	1.65478	-0.0501	0.94169	0.86998	-0.7016
181	0.27699	1.74291	3.14618	1.79883	0.30439	0.9144	1.33413	-0.8883
182	-0.0475	1.45866	2.91351	1.4032	-0.242	0.7931	1.09893	-0.7658
183	0.11245	1.57619	3.19008	1.62708	-0.2332	1.06926	1.38879	-0.5787
184	-0.1063	1.51062	3.08283	1.56676	-0.3839	0.83673	1.33767	-1.0276
185	0.03512	1.66624	3.17712	1.74511	-0.3418	0.86175	1.18174	-0.5905
186	0.35569	1.82118	3.31419	2.17466	-0.1679	1.0037	1.1683	-0.6912
187	0.19222	1.69882	3.24343	1.60247	-0.4727	1.00665	1.42451	-0.7854
188	0.28917	1.68797	3.20995	1.55181	-0.5122	0.92898	1.38267	-0.5677
189	0.15594	1.61663	3.16102	1.58058	-0.3693	0.87307	1.07676	-0.7689
190	0.18291	1.65759	3.13939	1.63883	-0.2851	0.89703	1.05774	-0.6742
191	0.50217	1.96139	3.3919	1.96041	0.05079	0.99006	1.3883	-1.045
192	0.1279	1.66149	3.09641	1.86815	-0.292	0.9241	1.14022	-0.8446
193	0.40362	1.82369	3.26629	1.84898	-0.1457	1.01361	1.23414	-0.7738
194	0.2039	1.69056	3.00807	1.65901	-0.297	0.91841	1.28403	-0.817
195	0.2368	1.66811	3.05568	1.54639	-0.1519	1.10311	0.8951	-0.956
196	0.2674	1.68228	3.03527	1.58702	-0.3121	0.97302	1.36745	-0.5941
197	0.12082	1.55338	3.0505	1.60811	-0.636	0.82128	1.06548	-0.8913
198	0.32608	1.69091	3.24387	1.74081	-0.2419	1.07087	1.4376	-0.5925
199	-0.0683	1.46097	2.93996	1.48317	-0.3029	0.90538	1.35297	-0.7356
200	0.12351	1.58545	3.01779	1.56673	-0.0925	1.05154	1.61888	-0.5359
201	-0.0343	1.75193	3.26672	1.78689	-0.2563	1.0768	1.16275	-0.837
202	0.07689	1.86639	3.3838	1.94577	-0.1277	1.16096	1.46993	-0.3528
203	-0.0498	1.41611	2.81938	1.47203	-0.0224	0.5876	1.00733	-1.2151
204	-0.0929	1.4133	2.86816	1.35784	-0.2874	0.74774	1.05357	-0.8112

205	0.01288	1.78916	2.98688	1.85497	-0.0866	0.83999	1.03957	-0.7328
206	0.18249	1.61726	3.21946	1.49433	-0.1908	1.05036	1.38728	-0.7549
207	0.23332	1.90906	3.53987	1.91766	0.05438	1.14053	1.35151	-0.6343
208	0.20148	1.83472	3.5458	1.76899	-0.1146	1.1906	1.38574	-0.9174
209	0.17981	1.9228	3.48865	1.83318	-0.0646	1.19921	1.60106	-0.3535
210	0.30565	1.97051	3.54328	1.93733	-0.0794	1.2359	1.48236	-0.247
211	0.31099	1.99414	3.58044	2.19569	0.23936	1.29653	1.50254	0.00877
212	0.30881	2.00113	3.43456	1.9432	0.00591	1.22056	1.45089	-0.692
213	0.09449	1.80814	3.34197	1.93718	-0.0274	1.1654	1.12711	-0.5275
214	0.07296	1.88111	3.47169	1.89687	0.12246	1.28588	1.44356	-0.6857
215	0.05075	1.86938	3.36888	1.89227	0.27458	1.29011	1.42924	-0.2183
216	0.10853	1.89331	3.28131	1.83399	0.18308	1.14374	1.2581	-0.5234
217	0.1531	2.03784	3.3484	1.94311	0.38483	1.08421	1.35833	-0.3431
218	0.01303	1.82243	3.20252	1.79158	0.25265	1.02649	1.22986	-0.6662
219	0.21211	1.98839	3.18611	2.0542	0.11261	1.03922	1.2388	-0.5336
220	0.20889	1.92318	3.37758	1.84321	0.10515	1.12775	1.44325	-0.882
221	0.26832	1.91898	3.35264	1.70484	-0.1136	1.03529	1.29684	-0.5903
222	0.45995	1.95	3.41637	2.02068	-0.0845	1.06648	1.35186	-0.8606
223	0.46064	1.94404	3.27583	2.04747	-0.0527	1.03629	1.4253	-0.4742
224	0.43601	1.8929	3.34786	1.85562	0.07816	0.96354	1.25987	-0.6575
225	0.39707	1.8604	3.14798	1.82368	-0.0233	1.0095	1.12858	-0.4559
226	0.50719	1.96804	3.50881	1.87607	0.25421	1.1976	1.44069	-0.5466
227	0.47507	1.91518	3.4145	1.87222	0.05135	1.03009	1.32168	-0.455
228	0.30329	1.71786	3.35536	1.61184	-0.1844	1.02936	1.23906	-0.7299
229	0.41236	1.80441	3.3565	1.84234	-0.0404	1.08085	1.38959	-0.7964
230	0.38538	1.85541	3.45901	1.7245	-0.035	1.14182	1.63755	-0.866
231	0.22627	1.74549	3.2776	1.63891	-0.2123	0.94981	1.34796	-0.639
232	0.29119	1.86602	3.13435	1.86834	-0.0608	0.96204	1.27027	-0.4441
233	0.07309	1.69636	3.07551	1.57532	-0.1708	0.92181	1.25949	-0.736
234	0.00897	1.80962	3.20204	1.67153	0.02276	1.06571	1.40832	-0.311
235	0.0813	1.73299	3.224	1.66747	-0.2702	0.95803	1.228	-0.4416
236	0.05056	1.75641	3.30266	1.78275	-0.2288	1.09207	1.62246	-0.4696
237	0.26489	1.75484	3.24166	1.83223	-0.1343	1.03911	1.35483	-0.4124
238	0.10784	1.60875	3.25724	1.69866	-0.4271	0.98766	1.29163	-0.7069
239	0.05852	1.67556	3.14027	1.68066	-0.3873	0.99451	1.2205	-0.7613
240	0.0028	1.6215	3.17314	1.42902	-0.0991	0.99612	1.40731	-0.7439
241	0.07657	1.68013	3.1679	1.63238	-0.1918	1.0812	1.4997	-0.5282
242	0.40145	1.81975	3.43418	1.59103	-0.1747	1.06222	1.36631	-0.5256
243	0.38461	1.87559	3.48769	1.92179	0.02282	1.12825	1.55222	-0.4478
244	0.52343	1.86992	3.51896	1.72242	-0.2466	0.95024	1.27113	-0.5921
245	0.48196	1.95319	3.47373	1.95131	-0.1924	1.03632	1.3221	-0.7318
246	0.34905	1.84287	3.55336	1.72766	-0.421	0.96534	1.18407	-0.9972
247	0.32869	1.74836	3.41396	1.82345	-0.2698	0.94405	1.41575	-0.8091
248	0.20806	1.61044	3.42487	1.5253	-0.38	0.92754	1.20356	-0.8554
249	0.20452	1.39029	3.19733	1.17445	-0.2345	1.0863	1.43992	-0.9065
250	0.32127	1.59171	3.32473	1.34346	-0.1954	0.95681	1.48948	-0.6799

251	0.61524	1.875	3.49245	1.77651	-0.1471	1.16014	1.56994	-0.7356
252	0.44124	1.66806	3.37471	1.77652	-0.6148	0.98706	1.43155	-0.8277
253	0.4604	1.76311	3.34039	1.55026	-0.3465	1.08065	1.53192	-0.6822
254	0.3101	1.47838	3.22588	1.73432	-0.6829	0.94931	1.44837	-1.2042
255	0.33673	1.64732	3.24487	1.63422	-0.3874	1.05806	1.43386	-0.6513
256	0.29228	1.61189	3.17546	1.41141	-0.4241	1.03118	1.18886	-0.8142
257	0.19829	1.61274	3.22782	1.6364	-0.1694	0.93611	1.21977	-1.5332
258	0.25564	1.64306	3.18247	1.66386	-0.272	0.89668	1.19606	-1.0052
259	0.32041	1.62875	3.2645	1.57702	-0.0141	0.87994	1.28574	-0.8659
260	0.38143	1.77065	3.33291	1.57252	-0.1901	0.96401	1.20919	-0.7729
261	0.25288	1.6602	3.22637	1.47472	-0.2933	0.99811	1.31141	-0.6887
262	0.20052	1.6151	3.25259	1.50907	-0.2871	0.92659	1.13629	-0.8327
263	0.35909	1.75114	3.30323	1.78907	-0.0937	1.02757	1.33632	-0.8497
264	0.33702	1.80706	3.41066	1.67614	-0.0833	1.09346	1.5892	-0.9144
265	0.10984	1.62906	3.16117	1.52248	-0.3288	0.83338	1.23153	-0.7554
266	0.21287	1.78771	3.05604	1.79003	-0.1391	0.88373	1.19195	-0.5224
267	0.15969	1.78297	3.16212	1.66193	-0.0842	1.00841	1.3461	-0.6494
268	-0.0727	1.72796	3.12038	1.58988	-0.0589	0.98405	1.32666	-0.3926
269	0.20835	1.86004	3.35105	1.79451	-0.1432	1.08508	1.35505	-0.3146
270	-0.1363	1.56953	3.11579	1.59587	-0.4157	0.90519	1.43559	-0.6565
271	0.14193	1.63187	3.1187	1.70927	-0.2572	0.91614	1.23186	-0.5354
272	0.01237	1.51329	3.16177	1.60319	-0.5226	0.89219	1.19616	-0.8024
273	-0.1514	1.46569	2.9304	1.47079	-0.5971	0.78463	1.01063	-0.9712
274	-0.1076	1.51111	3.06275	1.31863	-0.2094	0.88573	1.29692	-0.8543
275	0.01611	1.61967	3.10744	1.57192	-0.2522	1.02075	1.43924	-0.5887
276	0.23563	1.65393	3.26836	1.42521	-0.3406	0.8964	1.20049	-0.6915
277	0.17606	1.66703	3.27914	1.71323	-0.1857	0.91969	1.34366	-0.6564
278	0.57858	1.92508	3.57411	1.77757	-0.1914	1.0054	1.32628	-0.5369
279	0.50264	1.97388	3.49442	1.97199	-0.1717	1.05701	1.34278	-0.7111
280	0.6088	2.10262	3.8131	1.98741	-0.1612	1.22508	1.44381	-0.7375
281	0.39133	1.811	3.4766	1.88609	-0.2071	1.00669	1.47839	-0.7465
282	0.44123	1.84361	3.65805	1.75847	-0.1468	1.16072	1.43673	-0.6222
283	0.57458	1.95342	3.69005	1.75635	-0.1362	1.11829	1.44988	-0.7329
284	0.49013	1.9709	3.58432	1.79357	-0.0494	1.21595	1.35322	-0.487
285	0.25348	1.6928	3.45434	1.82922	-0.4611	0.98739	1.28967	-0.6271
286	0.33424	1.78897	3.42695	1.58415	-0.0813	1.08965	1.29837	-1.0307
287	0.20964	1.65999	3.24691	1.53528	-0.4884	0.92803	1.33784	-0.802
288	0.18607	1.67128	3.1655	1.63932	-0.2487	1.00571	1.25945	-0.9815
289	0.17803	1.8114	3.3633	1.77588	0.17901	1.2899	1.6085	-0.5776
290	0.00332	1.76823	3.32649	1.70344	0.14605	1.07848	1.55271	-0.4514
291	-0.088	1.75171	3.38337	1.60964	-0.0803	0.99494	1.45471	-0.4957
292	-0.1904	1.5462	3.15134	1.62562	-0.4319	0.76493	1.11068	-0.7229
293	-0.1047	1.56006	3.01523	1.57037	-0.3612	0.85684	1.03089	-0.6907
294	-0.1087	1.69614	3.20317	1.85742	-0.0157	1.0859	1.4277	-0.5163
295	-0.2125	1.61962	3.10626	1.89494	-0.2606	1.00182	1.5359	-0.8768
296	-0.0122	1.63876	3.41013	1.54528	-0.1146	1.18332	1.5836	-0.5731

297	-0.0226	1.65614	3.23048	1.52225	-0.4638	0.92853	1.23411	-0.6923
298	0.03608	1.75621	3.42478	1.78861	-0.2165	1.17045	1.50021	-0.3824
299	-0.1594	1.44419	3.13413	1.71568	-0.3862	0.87747	1.10932	-0.6784
300	-0.001	1.62812	3.14278	1.74873	-0.2018	1.01098	1.21384	-0.5942
301	-0.031	1.65658	3.21524	1.86671	-0.2355	1.09763	1.5462	-0.4849
302	-0.2116	1.60707	3.23032	1.72065	-0.3549	0.94573	1.05462	-0.7249
303	-0.3151	1.52022	3.08566	1.53853	-0.4113	0.89035	1.09442	-0.8359
304	-0.255	1.61909	3.15558	1.6317	-0.1476	0.9922	1.46246	-0.7642
305	-0.1783	1.57129	3.0833	1.52646	-0.4601	1.01676	1.31845	-0.7975
306	-0.2731	1.59579	3.07843	1.70108	-0.1092	1.01393	1.37455	-0.9699
307	0.04832	1.83456	3.34935	1.86951	-0.1736	1.15943	1.24538	-0.7544
308	0.04996	1.83946	3.35687	1.91885	-0.1546	1.13403	1.443	-0.3797
309	-0.0461	1.72228	3.25819	1.67463	-0.3519	1.0698	1.4054	-0.502
310	0.22367	1.75783	3.23315	1.69273	-0.2828	1.06857	1.28662	-0.7551
311	-0.0154	1.52066	3.20701	1.46751	0.00229	0.94772	1.30247	-0.5358
312	-0.0383	1.56458	3.2344	1.55612	0.76065	1.02011	1.38136	-0.4846
313	-0.032	1.58189	3.26448	1.53748	-0.4379	1.02618	1.25548	-0.8853
314	0.09446	1.6975	3.36936	1.70777	-0.2868	1.07645	1.34533	-0.672
315	0.4073	1.98973	3.56691	1.92012	-0.037	1.26541	1.45536	-0.354
316	-0.1963	1.63198	3.10404	1.74213	-0.2857	0.82314	1.2497	-0.9754
317	0.02694	1.80424	3.37635	1.81272	-0.2562	0.99276	1.54246	-0.9542
318	-0.0201	1.76028	3.36592	1.7935	-0.1725	1.0282	1.39996	-0.5651
319	-0.0202	1.79176	3.45971	2.12342	-0.2711	1.14367	1.34513	-0.5496
320	-0.2848	1.44093	3.1701	1.468	-0.3416	0.88131	1.20923	-0.8002
321	0.11239	1.79511	3.44002	1.79862	-0.0412	1.13879	1.44121	-0.8198
322	0.18637	1.76233	3.42456	1.66174	-0.3814	1.16116	1.50978	-0.6811
323	0.3154	1.7468	3.37432	1.77907	-0.2436	1.256	1.59769	-0.6313
324	0.18561	1.62214	3.41779	1.62232	-0.3822	1.27769	1.41934	-0.9512
325	0.22877	1.62663	3.26763	1.72219	-0.4749	1.14072	1.30931	-0.8429
326	-0.1003	1.57093	3.22502	1.56596	-0.5699	1.07684	1.16959	-0.6002
327	-0.361	1.36021	3.07353	1.62121	-0.4757	0.97286	1.09115	-1.0084
328	0.0516	1.64878	3.433	1.80525	-0.3328	1.23545	1.30104	-0.7803
329	-0.1536	1.53066	3.15321	1.5069	-0.6168	0.89843	1.42147	-0.9628
330	-0.2181	1.4582	3.1647	1.67073	-0.4179	1.08901	1.67726	-1.1111
331	-0.0099	1.71399	3.34233	1.8678	-0.2925	1.2128	1.27979	-0.3455
332	-0.0422	1.65441	3.46926	1.72559	-0.3637	1.25116	1.19071	-0.7655
333	0.00963	1.63102	3.51027	1.45798	-0.4431	1.34614	1.20845	-0.5638
334	0.00487	1.52145	3.54103	1.41712	-0.4934	1.27003	1.10429	-0.9082
335	0.11264	1.70155	3.49628	1.8227	-0.4455	1.37116	1.1788	-0.3692
336	-0.2654	1.46026	3.25227	1.27268	-0.4481	1.07146	1.62585	-0.8175
337	0.13454	1.74241	3.38009	1.59054	-0.2701	1.15462	1.67931	-0.5223
338	0.1281	1.61536	3.33266	1.58382	-0.3907	1.18426	1.40146	-0.5334
339	0.21919	1.7619	3.33879	1.82214	-0.4528	1.13892	1.99709	-0.8516
340	0.53338	2.02025	3.92315	2.03761	-0.0379	1.77603	1.87282	-0.3116
341	0.33219	1.7611	3.47809	1.72799	-0.2942	1.2774	1.39327	-0.661
342	0.52445	1.97909	3.77359	1.9808	0.00664	1.46502	1.41724	-0.6412

343	0.18123	1.70945	3.33907	1.5965	-0.2892	1.0562	1.11659	-0.8952
344	0.34901	1.74452	3.56936	1.51489	-0.1934	1.22849	1.06901	-0.7412
345	0.49603	1.86664	3.67698	1.88656	-0.3907	1.28952	1.47898	-0.7233
346	0.20017	1.73135	3.32366	1.65039	-0.5318	1.08004	1.21768	-0.7367
347	0.31087	1.72567	3.46967	1.86036	-0.4827	1.26854	1.27784	-0.8473
348	0.20737	1.69828	3.33171	1.66659	-0.4799	1.18006	1.07443	-0.9014
349	0.55267	1.85597	3.76758	1.97176	-0.3955	1.44619	1.36857	-0.4717
350	0.46446	1.66409	3.73361	1.634	-0.7364	1.41422	1.44768	-1.0139
351	0.47121	1.77553	3.61949	1.62709	-0.645	1.46543	1.59299	-0.8285
352	0.53456	1.82589	3.83189	1.91398	-0.3746	1.45879	1.49851	-0.7949
353	0.5334	1.79977	3.86268	1.71702	-0.6321	1.43057	1.1889	-0.8739
354	0.31528	1.71367	3.66842	1.77624	-0.4549	1.38037	1.2728	-0.6769
355	-0.0857	1.55889	3.34962	1.4349	-0.3226	1.19487	1.30288	-0.5732
356	-0.11	1.56126	3.2496	1.55441	-0.3556	1.21263	1.22197	-0.5828
357	0.22765	1.62243	3.19232	1.89379	-0.0715	1.09504	1.33975	-1.4565
358	0.2591	1.58068	3.16485	1.60899	-0.3666	1.14584	1.46281	-1.7545
359	0.46215	1.57693	3.29742	1.49956	-0.5182	1.16799	1.57069	-0.8282
360	0.5446	1.73348	3.47881	1.57527	-0.668	1.27149	1.71967	-1.2553
361	0.45735	1.67232	3.53142	1.44314	-0.4597	1.25581	1.80777	-1.173
362	0.17677	1.56157	3.38099	1.75839	-0.5304	1.08227	1.54197	-0.5104
363	0.33872	1.58435	3.30761	1.6146	-0.6048	1.11794	1.57717	-0.5684
364	0.58447	1.67056	3.68587	1.473	-0.3205	1.37475	1.68883	-0.9685
365	0.51034	1.73146	3.80159	1.8249	-0.7177	1.37135	1.58839	-0.5366
366	0.5106	1.67234	3.68498	1.15703	-0.5846	1.14699	1.64949	-0.4711
367	0.46954	1.62307	3.75795	1.34533	-0.3872	1.28243	1.29325	-1.6292
368	0.42744	1.67745	3.40824	1.47687	-0.7575	1.14314	1.26533	-0.9
369	0.41596	1.64447	3.4943	1.66424	-0.4965	1.10632	1.40459	-0.8882
370	0.40898	1.73087	3.46699	1.61133	-0.6538	1.10806	1.35441	-0.4896
371	0.32127	1.59171	3.32473	1.34346	-0.1954	0.95681	1.48948	-0.6799
372	0.61524	1.875	3.49245	1.77651	-0.1471	1.16014	1.56994	-0.7356
373	0.20052	1.6151	3.25259	1.50907	-0.2871	0.92659	1.13629	-0.8327
374	0.33702	1.80706	3.41066	1.67614	-0.0833	1.09346	1.5892	-0.9144
375	0.10984	1.62906	3.16117	1.52248	-0.3288	0.83338	1.23153	-0.7554
376	0.4717	1.67723	3.66038	1.62095	-0.3056	1.24968	1.45536	-0.5625
377	0.31154	1.73124	3.38471	1.67548	-0.3881	1.21359	1.36858	-0.9595
378	0.08593	1.58661	3.18634	1.80066	-0.4232	1.17287	1.43173	-1.1538
379	0.52841	1.75166	3.48217	1.70114	-0.3937	1.13959	1.34537	-0.5808
380	0.50941	1.77236	3.35322	1.61649	-0.3673	1.23982	1.09962	-0.744
381	0.06399	1.43177	3.09837	1.29746	-0.8552	1.01397	1.41965	-1.0314
382	0.33701	1.63878	3.59667	1.50283	-0.6054	1.24146	1.38325	-0.9028
383	0.38837	1.69897	3.43041	1.58029	-0.5923	1.14025	1.34416	-0.8014
384	0.53515	1.63279	3.59141	1.84345	-0.595	1.25576	1.6192	-0.6264
385	0.72099	1.67619	3.71079	1.61905	-0.5944	1.1743	1.5892	-0.7455
386	0.79228	1.53047	3.65793	1.57175	-0.4312	1.28197	1.63647	-1.049
387	0.66992	1.48601	3.52427	1.11352	-0.5974	1.10667	1.35304	-0.909
388	0.64805	1.36137	3.44142	1.03499	-0.7052	1.11727	1.37662	-1.0641

389	0.70949	1.38724	3.41128	1.47929	-0.6205	1.14222	1.1863	-0.8949
390	0.72077	1.38302	3.58165	1.25316	-0.6866	1.16659	1.0718	-0.9102
391	0.67963	1.38149	3.61745	1.45394	-0.6789	1.15091	0.73539	-0.6025
392	0.63274	1.46317	3.39866	1.33648	-0.6952	1.0946	1.39204	-0.6891
393	0.73426	1.49318	3.49803	1.44612	-0.2762	1.22031	1.48299	-1.1039
394	0.44218	1.65781	3.39434	1.51711	-0.39	1.00457	1.24983	-0.7079
395	0.37322	1.67557	3.2407	1.75669	-0.3787	1.00159	1.64523	-0.6699
396	0.456	1.71065	3.29131	1.73151	-0.6066	1.00781	1.28929	-0.6438
397	0.56368	1.76488	3.33526	1.71034	-0.2661	1.06271	1.69204	-0.5266
398	0.03462	1.55935	3.49353	1.42128	-0.3858	1.18394	1.13446	-0.7645
399	0.23371	1.61084	3.37663	1.42254	-0.6414	1.2601	0.9522	-0.7968
400	0.28381	1.62597	3.50638	1.58667	-0.337	1.27845	1.23168	-0.7552
401	0.3319	1.78228	3.68771	1.8179	-0.2747	1.3888	1.46296	-0.6389
402	0.28809	1.71259	3.66591	1.58135	-0.3686	1.26249	1.12143	-0.75
403	0.36512	1.7951	3.56259	1.8061	-0.2138	1.2734	0.78796	-0.8902
404	0.02754	1.48844	3.45421	1.52129	-0.4475	1.21217	1.04141	-0.8107
405	0.21842	1.50382	3.48918	1.47048	-0.5872	1.18128	0.91004	-0.8808
406	0.37344	1.68018	3.66793	1.46801	-0.4685	1.33147	1.04974	-0.8633
407	0.26487	1.49801	3.44377	1.47711	-0.7574	1.17542	0.66315	-0.7826
408	0.36254	1.57542	3.57041	1.32455	-0.7118	1.1901	1.0356	-0.8356
409	0.58343	1.69263	3.76437	1.57116	-0.4628	1.40814	1.18512	-0.7012
410	0.47556	1.67848	3.83159	1.55156	-0.5987	1.4218	1.10552	-0.4993
411	0.33419	1.65742	3.60088	1.59012	-0.4422	1.3884	1.28882	-0.7471
412	0.41031	1.68051	3.59233	1.56574	-0.7605	1.37481	1.2147	-1.0148
413	0.83589	2.0426	4.03525	1.85982	-0.2633	1.69824	1.30939	-0.3861
414	0.37153	1.76127	3.76433	1.68061	-0.6428	1.45304	1.17435	-0.5713
415	0.32963	1.52894	3.70407	1.62726	-0.4997	1.35636	1.15475	-0.6122
416	0.18436	1.55115	3.56893	1.38805	-0.7064	1.34947	0.74064	-1.2285
417	0.37828	1.56533	3.53168	1.24273	-0.7449	1.28005	1.03031	-1.1758
418	0.2676	1.72373	3.65344	1.45177	-0.3754	1.44789	0.97058	-0.4295
419	0.34321	1.76869	3.55817	1.81916	-0.4925	1.50476	1.30348	-0.7139
420	-0.0602	1.4833	3.33475	1.48624	-0.5179	1.25369	1.03609	-0.924
421	-0.2239	1.49829	3.25542	1.41175	-0.2452	1.17945	0.71293	-1.1034
422	-0.0326	1.77854	3.40006	1.60221	0.08393	1.37431	1.21394	-0.7069
423	-0.1534	1.61471	3.49695	1.55428	-0.105	1.37214	1.07505	-0.8556
424	-0.0367	1.62056	3.40761	1.64585	-0.4501	1.22129	0.78602	-0.9106
425	0.13622	1.76781	3.75223	1.76697	0.00878	1.47996	1.03631	-0.9963
426	-0.5379	1.35089	3.13015	1.27305	-0.5075	1.15196	0.75127	-0.9927
427	-0.0591	1.55971	3.22911	1.66275	-0.4836	1.21027	0.86976	-0.8374
428	-0.2314	1.65222	3.49413	1.58283	-0.2917	1.3421	1.05525	-0.5677
429	-0.271	1.59043	3.3485	1.60616	-0.5411	1.1829	0.99541	-1.0404
430	-0.3553	1.57759	3.53427	1.61345	-0.3891	1.32774	0.58053	-0.9949
431	-0.1425	1.67365	3.47012	1.89998	-0.4068	1.33509	0.72434	-0.6325
432	-0.1712	1.55451	3.41587	1.48773	-0.3154	1.26971	1.01606	-0.718
433	-0.3777	1.28513	3.29832	1.30797	-0.3642	1.17908	1.05609	-0.9879
434	-0.3382	1.32466	3.19499	1.20721	-0.5749	1.15855	0.49759	-0.9995

435	-0.1264	1.64287	3.73445	1.91397	-0.1094	1.53628	1.23582	-0.921
436	-0.0465	1.66821	3.7559	1.63353	-0.3487	1.77404	0.81871	-0.7885
437	-0.162	1.57505	3.46483	1.55156	-0.5688	1.3069	0.8257	-1.0157
438	-0.1277	1.59905	3.36566	1.56601	-0.8015	1.15173	0.83761	-0.704
439	-0.0121	1.64114	3.49784	1.51082	-0.3971	1.24056	0.88139	-0.9268
440	0.10706	1.66335	3.49594	1.5275	-0.3057	1.32881	1.14725	-0.7644
441	0.13565	1.67869	3.54826	1.48704	-0.4915	1.30859	1.14076	-1.1123
442	-0.2183	1.41486	3.38129	1.22543	-0.5808	1.21248	0.82941	-0.9041
443	-0.171	1.45205	3.24874	1.5486	-0.3762	1.15095	0.84535	-0.9547
444	-0.2722	1.58386	3.63973	1.59052	-0.2642	1.51399	1.33859	-0.671
445	-0.3839	1.44741	3.60123	1.62105	-0.6054	1.41507	1.17787	-0.6225
446	-0.0769	1.58678	3.69568	1.53342	-0.351	1.58083	1.08316	-0.3538
447	0.04571	1.48063	3.76039	1.59947	-0.4732	1.46778	1.20444	-0.7111
448	0.16416	1.57912	3.6582	1.70517	-0.4111	1.47282	1.55938	-0.6464
449	0.10474	1.5021	3.57756	1.74607	-0.4606	1.2933	1.03594	-0.9338
450	0.32686	1.67174	3.58347	1.4216	-0.3669	1.44418	1.31146	-0.7444
451	0.37817	1.63713	3.56791	1.37809	-0.2389	1.43096	1.27799	-0.7816
452	0.32903	1.64575	3.58901	1.55814	-0.6597	1.38204	1.09798	-1.1977
453	0.45493	1.70346	3.82455	1.76989	-0.5085	1.55161	1.10837	-1.0647
454	0.68999	1.9823	3.9485	1.86928	-0.2219	1.80531	1.3717	-0.5994
455	0.28686	1.49416	3.61697	1.44285	-0.6997	1.25932	1.07279	-1.0326
456	0.30909	1.57621	3.6668	1.30177	-0.6036	1.34204	1.1262	-1.0011
457	0.51993	1.71478	3.72304	1.64967	-0.4833	1.48289	1.37431	-0.6218
458	0.47943	1.63572	3.84918	1.65522	-0.7257	1.43049	1.15099	-0.6228
459	0.39847	1.52278	3.72959	1.37831	-1.0198	1.34027	1.17795	-0.9811
460	0.65484	1.81562	3.91333	1.67581	-0.6319	1.6031	1.4892	-0.6056
461	0.44298	1.60984	3.72293	1.5072	-0.7259	1.38327	1.1531	-0.9305
462	0.58829	1.93018	4.02565	2.04479	-0.0908	1.85789	1.66391	-0.5827
463	0.04998	1.63888	3.67203	2.0173	-0.4461	1.64015	1.39552	-0.5828
464	0.26708	1.60581	3.7369	1.66411	-0.4678	1.57606	1.43566	-0.8993
465	0.47912	1.72934	3.95114	1.92476	-0.4781	1.59382	1.39343	-0.8054
466	0.28661	1.50475	3.64868	1.53614	-0.7452	1.46063	1.06776	-0.7308
467	0.49297	1.70457	3.87634	1.53966	-0.3713	1.60125	1.17513	-0.9298
468	0.53112	1.83966	4.09704	1.91214	-0.2723	1.77534	1.34957	-0.5077
469	0.43805	1.61069	3.83388	1.39299	-0.6215	1.50616	1.17693	-0.8078
470	0.40122	1.65225	3.7533	1.63683	-0.298	1.48597	1.51968	-0.7377
471	0.47154	1.73719	3.87195	1.60841	-0.314	1.58999	1.45005	-0.5084
472	0.14045	1.44404	3.46796	1.42788	-0.7023	1.28479	1.29392	-0.5665
473	0.33056	1.53786	3.66067	1.48655	-0.656	1.30302	1.11649	-0.9889
474	0.37011	1.63722	3.72781	1.36278	-0.5426	1.40305	1.18721	-0.94
475	0.22886	1.4933	3.58248	1.25115	-0.6498	1.27425	1.08108	-1.0569
476	0.24167	1.41893	3.43608	1.37059	-0.7854	1.43049	1.04433	-1.268
477	0.29035	1.71045	3.84306	1.5356	-0.2493	1.65534	1.21212	-0.7632
478	0.18579	1.50085	3.62046	1.71378	-0.4132	1.4917	1.2618	-0.829
479	0.22747	1.42376	3.85377	1.47075	-0.3836	1.50836	1.14166	-0.9533
480	0.11751	1.36633	3.60111	1.66369	-0.3612	1.37276	1.11558	-0.9017

481	0.14108	1.54412	3.75512	1.44513	-0.3282	1.54023	1.13466	-0.6305
482	0.12783	1.37026	3.79381	1.38014	-0.64	1.39849	1.21491	-1.2379
483	0.21649	1.63541	3.96507	1.70407	-0.0709	1.61541	1.51059	-1.1741
484	0.17491	1.47757	3.67699	1.26574	-0.6091	1.46356	1.11419	-0.7453
485	0.10795	1.51951	3.66254	1.34176	-0.0436	1.5366	1.20933	-1.0894
486	0.39269	1.74896	3.93844	1.57939	-0.0851	1.68386	1.36318	-0.4264
487	0.1312	1.41451	3.60623	1.65047	-0.6371	1.39667	1.36205	-0.7831
488	0.18673	1.51043	3.65656	1.89502	-0.4532	1.48962	1.28582	-0.5671
489	0.21169	1.48713	3.7155	1.35121	-0.5085	1.47193	1.28158	-0.6738
490	0.30733	1.45001	3.71767	1.56118	-0.3066	1.46228	1.42418	-0.8367
491	0.31479	1.57322	3.64814	1.49199	-0.4592	1.38294	1.12042	-0.8717
492	0.38929	1.61184	3.73807	1.77527	-0.319	1.41729	1.33256	-1.1268
493	0.36598	1.64888	3.81521	1.78892	-0.3598	1.50774	0.86574	-0.8603
494	0.51523	1.70523	3.93253	1.70561	-0.3208	1.62592	1.4583	-0.991
495	0.43857	1.56197	3.83312	1.50651	-0.641	1.44013	1.25639	-1.3046
496	0.37172	1.62274	3.72379	1.60732	-0.3275	1.45646	1.49018	-0.7672
497	0.35832	1.62397	3.75873	1.49519	-0.4272	1.47677	1.33683	-0.6217
498	0.34981	1.6534	3.67732	1.63724	-0.4929	1.49415	1.50328	-0.3571
499	0.15088	1.58701	3.5942	1.67683	-0.3876	1.44837	1.33087	-0.5583
500	-0.0942	1.40488	3.47021	1.46017	-0.5996	1.41354	1.10737	-0.4755
501	-0.1391	1.496	3.65512	1.71529	-0.125	1.41696	1.12792	-0.6199
502	-0.1222	1.53286	3.6958	1.52777	-0.0394	1.3768	1.17794	-0.5918
503	0.09416	1.64768	3.45102	1.79527	-0.2074	1.34846	1.32742	-0.8372
504	0.00838	1.6406	3.5476	1.63257	-0.1437	1.33513	1.16719	-1.2336
505	0.013	1.6818	3.42874	1.88089	-0.2528	1.3426	1.12982	-0.9415
506	-0.1256	1.49203	3.28652	1.48387	-0.3926	1.1735	0.82433	-1.2081
507	-0.2209	1.55777	3.26738	1.65937	-0.2603	1.16698	1.02193	-0.8769
508	-0.4445	1.41874	3.16413	1.41954	-0.5159	1.11237	0.97819	-1.0397
509	-0.092	1.68136	3.44246	1.79602	-0.0845	1.42438	0.95741	-0.688
510	-0.1874	1.58859	3.37546	1.5789	-0.3333	1.32689	1.04081	-0.7171
511	-0.0815	1.60786	3.29487	1.75731	-0.2331	1.25783	1.06102	-0.8494
512	-0.2305	1.63652	3.37391	1.74669	-0.2824	1.36942	1.08683	-0.7796
513	-0.1969	1.52515	3.35133	1.54632	-0.3048	1.23903	0.97118	-0.9532
514	-0.1904	1.62702	3.40984	1.79659	-0.2877	1.29715	0.90167	-0.7309
515	-0.3845	1.4698	3.2929	1.61979	-0.3329	1.11513	0.97909	-0.9327
516	-0.1324	1.57871	3.32173	1.62844	-0.3717	1.25588	0.9914	-1.025
517	-0.094	1.57187	3.38982	1.55668	-0.2603	1.26227	1.10322	-0.8732
518	-0.1624	1.53235	3.31225	1.64884	-0.3122	1.19012	1.20366	-0.5322
519	-0.1113	1.53046	3.28206	1.74234	-0.2804	1.21476	1.16575	-0.7615
520	-0.1127	1.6057	3.38572	1.69929	-0.3517	1.25731	1.05946	-0.8324
521	-0.1686	1.46362	3.37062	1.45559	-0.3207	1.15816	0.99022	-1.4106
522	-0.0347	1.63409	3.38103	1.83318	-0.3005	1.29489	1.08212	-0.9892
523	-0.008	1.23446	3.65801	1.24434	-0.7758	1.26269	1.07911	-1.3737
524	-0.0181	1.39342	3.53645	1.21567	-0.1697	1.41051	1.08324	-1.2155
525	-0.2551	1.39871	3.13797	1.46624	-0.3281	1.00811	0.98148	-0.9806
526	-0.2706	1.41878	3.12039	1.47958	-0.3415	1.0304	0.81093	-0.775

527	-0.2891	1.53137	3.01604	1.59843	-0.3075	1.08414	0.74057	-0.8757
528	-0.2848	1.58633	3.29653	1.65024	0.12954	1.22724	0.98606	-0.7303
529	-0.5177	1.46091	2.99752	1.57912	-0.1004	1.01491	0.64035	-0.7987
530	-0.5416	1.53049	3.06193	1.62546	0.09602	1.12472	0.73719	-0.8944
531	-0.6185	1.41697	2.96757	1.47517	-0.1662	1.01262	0.52425	-1.0692
532	-0.5073	1.53065	3.08676	1.54538	-0.1867	1.07526	0.68142	-0.7825
533	-0.2892	1.55171	3.10314	1.5981	-0.1665	1.16198	0.77781	-0.9353
534	-0.2668	1.6538	3.27131	1.72859	-0.102	1.31808	0.90854	-0.945
535	-0.456	1.53261	3.10057	1.64036	-0.1785	1.14737	0.85005	-0.8819
536	-0.4271	1.4768	3.02598	1.41281	-0.4261	1.0833	0.68495	-0.7193
537	-0.5108	1.41354	3.00271	1.35844	-0.347	1.04667	0.65861	-0.9178
538	-0.4013	1.55767	3.15035	1.60612	-0.26	1.19452	0.77238	-0.898
539	-0.4016	1.53113	3.07859	1.65061	-0.2751	1.1147	0.67356	-0.8018
540	-0.2918	1.54185	3.21926	1.67411	-0.2792	1.18943	0.78074	-1.1595
541	-0.4006	1.55108	3.13812	1.63867	-0.0903	1.1548	0.55283	-1.0005
542	-0.3243	1.57238	3.19702	1.57966	-0.2026	1.20435	0.74635	-0.8839
543	-0.3235	1.45312	3.1175	1.38801	-0.3704	1.08328	0.30581	-0.8175
544	-0.1993	1.62827	3.23212	1.58701	-0.2287	1.14503	0.43688	-0.9672
545	-0.2568	1.71634	3.30795	1.72642	-0.1885	1.30625	0.78222	-0.9622
546	-0.4382	1.43562	3.09492	1.38745	-0.3301	1.09107	0.31725	-1.1808
547	-0.3146	1.59079	3.27633	1.68398	-0.3244	1.27792	0.78076	-0.9936
548	-0.3861	1.49606	3.07519	1.45654	-0.3331	1.17663	0.67229	-0.9324
549	-0.3922	1.427	3.14963	1.43079	-0.1437	1.20174	0.61421	-0.9271
550	-0.2913	1.41863	3.12339	1.55481	-0.1898	1.16056	0.68256	-1.0921
551	-0.4146	1.3942	3.18615	1.39738	-0.1595	1.21659	0.79612	-1.1764
552	-0.2059	1.56891	3.32851	1.48079	-0.2117	1.36056	0.67977	-0.7437
553	-0.1066	1.5156	3.23436	1.6214	-0.2514	1.23378	0.39308	-0.9835
554	-0.1411	1.46836	3.217	1.44324	-0.1767	1.31824	0.5213	-1.1658
555	-0.2301	1.43876	3.18924	1.56435	-0.2301	1.11571	0.7307	-0.789
556	-0.2796	1.5676	3.23784	1.72429	-0.1141	1.21832	0.48574	-0.776
557	-0.2212	1.53678	3.27685	1.67194	0.06889	1.30245	0.81007	-0.6566
558	-0.4482	1.42339	2.99076	1.44261	-0.1958	1.02425	0.586	-0.8585
559	-0.3387	1.53975	3.09974	1.68132	0.03879	1.12103	0.52666	-0.7437
560	-0.52	1.47417	3.13311	1.57228	-0.0627	1.11539	0.65433	-0.9465
561	-0.2289	1.68449	3.31362	1.70743	0.26956	1.41668	0.9232	-0.9446
562	-0.4252	1.51494	3.09591	1.56847	-0.1855	1.19508	0.75888	-1.1552
563	-0.2238	1.49611	3.21159	1.44311	-0.097	1.15778	0.70093	-0.7256
564	-0.0651	1.56772	3.35845	1.61976	-0.0643	1.29703	0.69872	-0.4753
565	-0.1761	1.50059	3.19877	1.53221	-0.1811	1.15103	0.49143	-0.9424
566	-0.0766	1.58382	3.35805	1.52531	-0.1089	1.28793	0.68419	-0.9713
567	-0.0388	1.59194	3.33235	1.59868	0.12693	1.32078	0.70323	-0.7865
568	-0.0461	1.54769	3.27385	1.6241	-0.0877	1.26381	0.68181	-0.8421
569	-0.3321	1.37594	3.11402	1.31998	-0.3056	1.10259	0.69015	-1.0776
570	-0.1054	1.62346	3.42424	1.65124	-0.1463	1.37743	1.01845	-0.7101
571	-0.1214	1.66346	3.39599	1.69787	-0.2447	1.37484	0.86896	-0.9668
572	-0.2511	1.54233	3.43609	1.59992	-0.2601	1.33676	0.82804	-0.7909

573	-0.1474	1.58689	3.58922	1.58078	-0.0206	1.50625	0.78846	-0.7008
574	-0.0625	1.63223	3.41213	1.74872	-0.2123	1.29	1.30354	-0.4323
575	0.02221	1.66399	3.41559	1.87587	-0.1468	1.34829	1.29928	-0.6279
576	-0.1969	1.46364	3.20063	1.47444	-0.1405	1.15131	0.73471	-0.9074
577	-0.0996	1.54685	3.24223	1.51625	-0.1035	1.15466	0.44422	-0.7461
578	-0.1561	1.55944	3.17051	1.60976	-0.081	1.27176	0.75363	-0.8766
579	-0.2572	1.54799	3.3559	1.6296	-0.1037	1.31711	0.74987	-0.6015
580	-0.1402	1.51005	3.14337	1.5941	-0.2757	1.19193	0.58268	-1.0573
581	-0.1874	1.58585	3.24465	1.6482	-0.0336	1.31279	0.79914	-0.8796
582	-0.0763	1.72119	3.46501	1.7031	0.02391	1.42403	1.00506	-0.6095
583	-0.0964	1.6307	3.37378	1.62974	-0.2121	1.30025	0.89221	-0.7977
584	0.04999	1.70444	3.39853	1.71554	0.02244	1.39341	0.84019	-0.7791
585	0.09622	1.65401	3.47702	1.70929	-0.2142	1.33425	0.63161	-0.8798
586	-0.1636	1.41425	3.26138	1.6016	-0.304	1.19495	0.79759	-1.3277
587	-0.0567	1.63547	3.45875	1.76797	-0.2309	1.36882	1.00261	-1.1588
588	-0.1249	1.58568	3.20053	1.57016	-0.1922	1.35171	1.00945	-1.1823
589	0.00189	1.73543	3.55045	1.94172	-0.0191	1.45868	1.02753	-0.6735
590	-0.2555	1.55881	3.22109	1.66708	-0.1518	1.29091	0.90195	-0.9476
591	-0.1018	1.64776	3.44451	1.62303	-0.1366	1.37959	0.90925	-0.6523
592	-0.232	1.6577	3.36278	1.7036	-0.0575	1.32668	0.90425	-0.6979
593	-0.2609	1.63746	3.22503	1.64253	-0.0733	1.28494	0.80012	-0.7452
594	-0.212	1.66717	3.2346	1.55864	-0.1956	1.3251	0.60956	-1.0892
595	-0.3635	1.55715	3.12289	1.53504	-0.2795	1.24024	0.72669	-0.8636
596	-0.1877	1.67313	3.32121	1.69998	0.12878	1.34696	0.82044	-0.886
597	-0.1229	1.74315	3.37995	1.78357	-0.039	1.40437	0.94816	-0.7689
598	-0.3862	1.53921	3.22328	1.57464	-0.1424	1.21837	0.68591	-0.7389
599	-0.1327	1.5961	3.39688	1.62389	-0.1737	1.35008	0.9911	-0.7375
600	-0.1972	1.5877	3.32023	1.62211	-0.3205	1.29907	0.79319	-1.0426
601	0.04006	1.81776	3.5083	1.84353	0.00091	1.47718	1.19769	-0.8576
602	-0.0895	1.75893	3.34243	1.6994	-0.1024	1.45654	1.02192	-0.5881
603	0.05777	1.88826	3.5703	1.967	0.01501	1.5866	0.96277	-0.6287
604	-0.1118	1.71247	3.39675	1.70676	-0.3881	1.43825	1.10315	-0.6662
605	-0.0593	1.67657	3.42372	1.70081	-0.0259	1.42552	0.81855	-0.7958
606	-0.0612	1.69453	3.42987	1.76088	-0.0422	1.43151	0.87733	-0.7193
607	-0.3549	1.53881	3.30477	1.5466	-0.1796	1.33289	0.70204	-1.1499
608	-0.0604	1.71898	3.60807	1.65835	0.06744	1.6849	0.87173	-0.7489
609	0.06046	1.74608	3.81625	1.7511	-0.2647	1.71057	0.94037	-0.6188
610	-0.2227	1.58369	3.71005	1.62957	0.16857	1.63766	1.01348	-0.5561
611	-0.3751	1.62731	3.60985	1.63827	0.45774	1.5466	0.9837	-0.7431
612	-0.465	1.42775	3.35212	1.59236	-0.3428	1.29805	0.81637	-1.11
613	-0.2882	1.53961	3.44836	1.65104	-0.203	1.39555	0.7349	-0.4641
614	-0.1134	1.79484	3.63344	1.74992	0	1.52138	0.82094	-0.6785
615	-0.3388	1.45467	3.34843	1.51226	-0.3478	1.2491	0.74038	-0.8786
616	-0.2758	1.45848	3.46081	1.45236	-0.149	1.37784	0.66005	-0.8292
617	-0.0952	1.50487	3.36421	1.49696	-0.2108	1.38025	0.70548	-0.8152
618	-0.0268	1.51962	3.39332	1.48001	-0.3293	1.34221	0.77852	-0.7011

619	0.03465	1.58928	3.58487	1.52739	-0.1768	1.408	0.63365	-0.6513
620	0.12629	1.63258	3.58059	1.59376	-0.1207	1.44377	0.6408	-0.9383
621	0.13855	1.63507	3.61036	1.64376	0.10285	1.46171	0.92254	-0.9181
622	0.21016	1.69777	3.53505	1.66138	0.01451	1.48196	0.75281	-0.6146
623	0.08069	1.64058	3.90951	1.61674	-0.3311	1.47558	0.71767	-0.7281
624	0.03466	1.66336	3.5219	1.70348	-0.3294	1.36832	0.75856	-0.9757
625	-0.0816	1.74369	3.2636	1.79795	-0.1549	1.15566	0.80184	-0.5217
626	0.0711	1.76986	3.21086	1.79677	-0.1849	1.0786	0.62299	-0.372
627	0.08715	1.61204	3.47298	1.61317	-0.1301	1.4096	0.83185	-0.7466
628	0.24028	1.72585	3.62807	1.7205	-0.2026	1.54101	0.81308	-0.7625
629	0.19658	1.68643	3.65142	1.71263	-0.0304	1.50749	0.80298	-0.7728
630	0.05991	1.49255	3.37068	1.49656	-0.1524	1.35263	0.62029	-0.9397
631	0.09679	1.61403	3.5232	1.68548	-0.1906	1.48786	0.97168	-0.7057
632	0.12282	1.63938	3.65571	1.55183	-0.0592	1.52032	0.90567	-0.5753
633	-0.0542	1.39979	3.42917	1.46469	-0.178	1.33366	0.82493	-1.2018
634	-0.0401	1.48653	3.40997	1.46205	-0.1622	1.39926	0.98776	-0.8654
635	-0.275	1.34435	3.10631	1.48138	-0.1897	1.2239	0.47284	-1.2372
636	0.01353	1.63616	3.3784	1.66006	-0.1046	1.38949	0.7443	-0.9916
637	0.06832	1.62376	3.40137	1.74347	-0.1516	1.29869	0.63484	-1.2914
638	0.12992	1.68982	3.50965	1.75705	-0.0618	1.4034	0.5569	-1.255
639	0.16653	1.71578	3.49061	1.70633	-0.2064	1.39573	0.71155	-0.6985
640	0.0453	1.51281	3.50603	1.50657	-0.3359	1.27961	0.69315	-0.7308
641	0.14944	1.63828	3.54209	1.62896	-0.1047	1.32789	0.65486	-0.7729
642	0.12655	1.61444	3.40719	1.68756	-0.364	1.27372	0.54823	-0.7808
643	0.08636	1.6215	3.35518	1.67403	-0.2851	1.23844	0.5585	-0.8331
644	0.11445	1.62207	3.37432	1.66816	-0.2307	1.25994	0.64105	-0.8383
645	0.2484	1.75234	3.55206	1.72266	-0.1395	1.3861	0.667	-0.9865
646	0.13578	1.69516	3.43619	1.68604	-0.0698	1.33041	0.68562	-0.7128
647	0.02905	1.63502	3.28229	1.54445	-0.2555	1.25364	0.6103	-0.6911
648	0.19933	1.74006	3.50398	1.66149	-0.0165	1.44941	0.63512	-0.636
649	0.17229	1.71032	3.55861	1.73442	-0.3053	1.35099	0.59776	-0.6833
650	0.17081	1.6813	3.54726	1.65525	-0.1377	1.39533	0.66107	-0.7099
651	0.08991	1.68288	3.4058	1.61275	-0.1298	1.34452	0.62908	-0.8852
652	0.1865	1.748	3.76495	1.72202	0.21254	1.44835	0.70479	-0.7651
653	0.17693	1.62263	3.76508	1.66265	-0.2959	1.58407	0.97917	-0.7886
654	0.38881	1.90868	3.81806	1.93282	0.03868	1.65335	0.84744	-0.5048
655	0.26502	1.77866	3.57773	1.8865	-0.0233	1.53428	0.65931	-1.1302
656	0.01419	1.57408	3.84302	1.55025	-0.3976	1.40908	0.65118	-0.7946
657	0.01646	1.64516	3.5037	1.68528	-0.3476	1.35011	0.74036	-0.9939
658	0.28235	1.80555	3.66715	1.80176	-0.0832	1.50467	0.7736	-0.8056
659	0.14126	1.71014	3.50259	1.6921	-0.1695	1.39734	0.61017	-0.9465
660	0.14081	1.70839	3.43813	1.60812	-0.1639	1.2843	0.45926	-0.9065
661	0.14086	1.77936	3.48165	1.64801	0.04438	1.40729	0.65939	-0.5508
662	0.03959	1.60369	3.39533	1.51624	-0.2155	1.25276	0.73731	-0.7647
663	0.0888	1.70084	3.42056	1.55295	-0.1116	1.30726	0.74269	-0.8812
664	0.08561	1.67321	3.40936	1.71834	-0.2663	1.36213	0.75785	-0.8331

665	0.03507	1.53538	3.22017	1.43273	-0.3507	1.23745	0.90233	-1.0517
666	0.12881	1.64554	3.43589	1.68141	-0.1442	1.29053	1.14866	-1.0877
667	0.04999	1.56632	3.32432	1.48827	-0.2921	1.26374	1.0934	-0.9023
668	0.13596	1.59711	3.49179	1.65684	-0.2633	1.29547	0.90563	-1.0259
669	0.1037	1.62212	3.75142	1.65989	-0.1517	1.47551	1.22027	-0.4884
670	0.3247	1.84641	3.84809	1.82533	-0.0351	1.57245	1.07315	-0.7827
671	-0.0884	1.5441	3.41913	1.56232	-0.3955	1.26279	1.17253	-1.0572
672	0.19031	1.66496	3.51042	1.76824	-0.2108	1.38568	1.12199	-0.5619
673	-0.0043	1.54952	3.35012	1.57949	-0.5371	1.23292	0.9708	-0.7111
674	0.04196	1.59505	3.36561	1.69168	-0.178	1.20406	1.15736	-1.0729
675	-0.07	1.50408	3.16261	1.46508	-0.1453	1.30049	1.0681	-1.2101
676	-0.049	1.62606	3.52082	1.6817	0.06255	1.42775	1.13752	-0.8227
677	0.10831	1.6578	3.43303	1.74577	0.04807	1.29763	0.90991	-1.3105
678	0.03978	1.5746	3.22547	1.47106	-0.0716	1.05011	0.90366	-0.9271
679	0.13795	1.58539	3.38096	1.75911	-0.0684	1.24475	1.00579	-0.5129
680	0.1698	1.5774	3.42105	1.71857	-0.0476	1.20199	1.21766	-1.0001
681	0.10475	1.61568	3.27619	1.68366	-0.1723	1.23825	1.16992	-1.1153
682	-0.0598	1.76991	3.47977	1.8495	-0.181	1.32062	1.14502	-0.9266
683	-0.0355	1.74169	3.34349	1.84766	0.03129	1.24498	1.1958	-1.1341
684	-0.1969	1.77453	3.39339	1.79522	-0.1245	1.37778	1.2052	-0.8605
685	-0.3199	1.69809	3.38775	1.82391	-0.2231	1.43527	1.12085	-0.6588
686	-0.3318	1.61498	3.25911	1.6018	-0.4247	1.35885	1.10202	-0.8069
687	-0.0502	1.71014	3.22607	1.71368	-0.3833	1.24241	1.0109	-0.6554
688	0.0063	1.79623	3.39589	1.78568	-0.1398	1.29229	0.97	-0.6222
689	-0.0815	1.77569	3.24735	1.78723	-0.0244	1.28619	1.24325	-0.5674
690	-0.2558	1.63904	3.20856	1.82306	-0.0717	1.16551	0.90632	-0.5011
691	-0.3193	1.66006	3.13427	1.62227	-0.352	1.16654	0.7733	-0.6371
692	-0.3124	1.54975	3.11476	1.57195	-0.356	1.12118	0.93542	-0.8489
693	-0.3911	1.57633	3.14374	1.7334	-0.4127	1.18876	0.88196	-0.673
694	-0.3449	1.61302	3.11382	1.69124	-0.2955	1.14224	1.02121	-1.1139
695	-0.2526	1.69041	3.2987	1.80664	-0.2677	1.34131	1.14012	-0.9221
696	0.18539	1.84574	3.6458	1.86007	-0.2564	1.54416	1.06573	-0.7672
697	0.2238	1.85886	3.57313	1.87306	-0.2639	1.63963	0.9238	-0.89
698	0.00927	1.64794	3.45753	1.54295	-0.3528	1.50821	0.55016	-0.8084
699	-0.118	1.64143	3.12739	1.64406	-0.3813	1.27079	0.8037	-0.6333
700	-0.2172	1.64977	3.14709	1.7932	-0.2941	1.59569	0.94697	-0.902
701	-0.2748	1.63105	3.09687	1.66054	-0.3994	1.13671	1.18238	-0.8079
702	-0.3739	1.65119	3.133	1.76438	-0.2836	1.24156	0.74794	-0.5848
703	-0.3831	1.53514	3.00652	1.53833	-0.2987	1.11204	0.86475	-0.667
704	-0.2027	1.73068	3.17301	1.70665	-0.2467	1.18245	0.76556	-0.4617
705	-0.6586	1.42346	2.91021	1.51091	-0.5129	1.00283	1.04159	-0.9093
706	-0.3821	1.52546	3.20228	1.72335	-0.301	1.14129	1.06832	-0.633
707	-0.163	1.55783	3.15559	1.46872	-0.4682	0.99074	0.83041	-0.8861
708	-0.177	1.58588	3.16399	1.71305	-0.1542	1.14989	0.8623	-1.042
709	-0.1927	1.65904	3.33777	1.71027	-0.0183	1.22406	0.92199	-0.6613
710	-0.1043	1.65048	3.30813	1.70435	-0.48	1.16392	1.06414	-0.8151

711	0.03734	1.7653	3.33926	1.82575	-0.108	1.30716	1.14001	-0.5313
712	-0.4125	1.51246	3.07937	1.53733	-0.5162	1.03217	1.04852	-0.6333
713	-0.1193	1.71006	3.21468	1.68651	-0.2872	1.12021	1.02537	-0.6978
714	-0.1237	1.73128	3.15519	1.79614	-0.2003	1.11194	0.9198	-0.6211
715	-0.1952	1.50886	3.18101	1.51274	-0.5346	0.90641	0.7257	-0.7221
716	-0.262	1.44845	3.22557	1.45714	-0.4668	0.94077	0.77889	-0.6602
717	-0.2746	1.48985	3.1248	1.72053	-0.3994	0.9797	0.74381	-0.7333
718	-0.1551	1.58775	3.11242	1.65311	-0.3483	0.8832	0.61861	-0.7929
719	-0.2219	1.64809	3.07572	1.64612	-0.2982	0.89469	0.5089	-0.8133
720	-0.2378	1.58743	3.10735	1.64169	-0.3112	0.9994	0.64558	-0.678
721	-0.1485	1.55021	2.99121	1.57711	-0.4045	0.85895	0.40334	-0.5916
722	0.07654	1.64694	3.15494	1.642	-0.3695	0.97611	0.64737	-0.6528
723	-0.2019	1.41023	2.89462	1.49584	-0.5068	0.71224	0.69067	-0.8374
724	-0.1056	1.56733	2.98787	1.54758	-0.4972	0.83928	0.68022	-0.7466
725	-0.1133	1.61143	3.04233	1.6029	-0.5653	0.86005	0.39274	-0.7072
726	-0.1112	1.62395	3.01282	1.61897	-0.542	0.87158	0.6361	-0.7738
727	-0.2503	1.6081	2.86792	1.65067	-0.4852	0.80197	0.73046	-1.0333
728	-0.23	1.62223	2.90657	1.61255	-0.5617	0.83928	0.78056	-0.8783
729	0.06491	1.75598	3.13592	1.72566	-0.383	0.89277	0.65013	-0.8758
730	-0.1967	1.57939	2.88697	1.50295	-0.3724	0.83559	0.71895	-0.8882
731	-0.2796	1.47103	2.95846	1.46326	-0.3875	0.80683	0.91492	-0.8271
732	0.04619	1.74808	3.25625	1.73728	-0.0211	1.07236	1.39507	-0.5308
733	-0.0869	1.59885	3.02498	1.64743	-0.4343	0.91814	1.24961	-0.5859
734	-0.0411	1.62459	3.01588	1.74338	-0.5371	0.85764	0.93852	-0.8546
735	-0.1663	1.54433	2.96495	1.80456	-0.3924	0.78061	1.22136	-0.9473
736	-0.1855	1.5351	3.03566	1.62726	-0.3277	0.82698	1.29172	-0.7308
737	-0.2595	1.53749	2.85478	1.5684	-0.4693	0.72187	1.14552	-0.7285
738	-0.3102	1.40486	2.69401	1.48393	-0.5202	0.57256	0.67023	-1.174
739	-0.4369	1.43388	2.67248	1.57135	-0.6296	0.69593	0.57645	-0.8496
740	-0.4491	1.57568	2.8296	1.65701	-0.3616	0.76228	0.83285	-0.7324
741	-0.5517	1.46203	2.74814	1.47546	-0.6811	0.61285	0.6843	-0.9003
742	-0.3245	1.52533	2.79621	1.48752	-0.3751	0.74679	0.97349	-1.0245
743	-0.3471	1.60321	2.81569	1.61023	-0.5796	0.78431	0.55943	-0.7714
744	-0.3984	1.56945	2.79458	1.58694	-0.6053	0.70632	0.74973	-1.0668
745	-0.3636	1.59271	2.73578	1.58178	-0.5742	0.65699	0.8023	-1.3083
746	-0.1683	1.77594	2.97646	1.82374	-0.4785	0.82427	1.15459	-0.8668
747	-0.2632	1.62652	2.78978	1.63845	-0.5395	0.73231	1.21877	-0.7434
748	-0.2134	1.67847	2.99024	1.60904	-0.5374	0.86889	1.18724	-0.745
749	-0.0346	1.81852	3.13392	1.87725	-0.536	0.94228	1.20338	-0.7605
750	-0.1506	1.73892	2.99675	1.94331	-0.5994	0.94487	1.5135	-0.8774
751	-0.0441	1.85125	3.25838	1.92417	-0.4059	1.08165	1.48941	-0.5403
752	-0.0745	1.79866	3.12213	1.8111	-0.5729	0.97486	1.14369	-0.9396
753	-0.0834	1.75408	3.04524	1.69211	-0.5402	0.92516	1.37643	-0.6424
754	-0.1654	1.68141	3.01164	1.89859	-0.3615	0.93495	1.29371	-0.8392
755	-0.1499	1.75798	2.97732	1.75735	-0.4987	0.87364	1.16338	-0.8733
756	-0.2072	1.67296	3.10078	1.73815	-0.6352	0.9889	1.1829	-0.8887

757	-0.0104	1.8416	3.23751	1.89553	-0.3335	1.1002	1.14492	-0.6087
758	0.26605	1.73872	3.81035	1.50598	-0.3834	1.36488	0.58187	-0.9253
759	0.31082	1.77839	3.86583	1.55078	-0.415	1.43939	0.6715	-0.7937
760	0.33238	1.76954	3.76004	1.71465	-0.2376	1.6289	1.03042	-1.4966
761	0.2709	1.90694	3.51414	1.98275	-0.2198	1.54286	0.97962	-0.814
762	0.33183	1.81015	3.55473	1.83098	-0.2258	1.48111	1.03155	-0.9217
763	0.12172	1.53745	3.38513	1.48594	-0.411	1.15264	0.70336	-1.0806
764	0.31731	1.59327	3.55925	1.69398	-0.3353	1.32092	1.02615	-1.0008
765	0.24302	1.50598	3.45205	1.70765	-0.4163	1.40526	1.0184	-1.0097
766	0.13598	1.57706	3.50844	1.66735	-0.233	1.26966	0.86742	-0.6712
767	0.10883	1.54663	3.33271	1.61768	-0.2538	1.29861	0.85682	-0.9817
768	0.17564	1.60836	3.31335	1.54225	0.01297	1.19773	0.85419	-0.6064
769	0.03548	1.55298	3.27657	1.51719	-0.0097	1.27857	0.74247	-0.8624
770	0.05821	1.61108	3.21802	1.65392	-0.1446	1.41482	0.72347	-0.9522
771	0.11473	1.62366	3.52988	1.52359	-0.0583	1.55397	0.7712	-1.0578
772	0.18916	1.76409	3.72704	1.62046	0.05075	1.51068	0.63969	-0.9601
773	0.13558	1.51447	3.6001	1.55251	-0.071	1.42239	0.79796	-1.1994
774	0.03044	1.58276	3.55995	1.67373	-0.115	1.58644	0.45189	-0.636
775	0.45046	1.94571	4.41734	1.83074	0.02479	2.33874	0.82981	-0.6192
776	0.3006	1.78213	4.68177	1.73428	-0.1788	2.17974	0.77845	-0.9235
777	-0.0166	1.65006	4.12966	1.64672	-0.1801	1.77998	0.43985	-1.153
778	0.09444	1.72191	4.29715	1.72995	-0.0136	1.73183	0.50368	-1.154
779	0.16561	1.90711	3.56429	1.87468	-0.0075	1.60812	0.65246	-0.4674
780	-0.1373	1.56937	3.00527	1.57478	-0.32	1.09101	0.53381	-0.8929
781	-0.0796	1.58886	2.96968	1.48414	-0.3487	1.03595	0.52665	-0.6315
782	-0.1801	1.52834	3.492	1.38204	-0.3955	1.11982	0.55507	-0.649
783	-0.2882	1.48434	3.19243	1.54635	-0.2249	1.13711	0.59681	-0.9918
784	-0.1134	1.64861	3.37446	1.66793	-0.1532	1.24941	0.79036	-0.8339
785	0.31625	1.85455	4.15532	1.87084	-0.1035	1.4255	1.13982	-0.7765
786	0.43355	1.84614	3.52329	1.69288	-0.119	1.1872	0.73185	-1.0287
787	0.42916	1.7586	3.56704	1.78354	-0.1856	1.23301	1.14764	-0.6007
788	0.37428	1.63728	3.38409	1.55762	-0.3354	1.17452	1.08011	-0.833
789	0.36732	1.81067	3.62944	1.74391	-0.0923	1.24574	0.80766	-0.9028
790	0.09777	1.67593	3.07319	1.59457	-0.3999	1.00588	0.55274	-0.6346
791	0.04008	1.65197	3.10749	1.61746	-0.4529	0.98839	0.56626	-1.0549
792	0.17537	1.74882	3.22834	1.63931	-0.1508	1.10007	0.68105	-0.8714
793	0.17417	1.76622	3.2406	1.67902	-0.1891	1.21759	0.82785	-0.9662
794	0.23615	1.74375	3.35644	1.66191	-0.1507	1.14039	0.60978	-1.0193
795	0.12408	1.74001	3.37366	1.68009	-0.3915	1.21286	0.58656	-0.8926
796	0.11962	1.64109	3.41814	1.596	-0.4811	1.1449	0.59399	-0.8918
797	0.28684	1.76838	3.628	1.67819	-0.3016	1.35844	0.75223	-0.7267
798	-0.1988	1.68013	3.01661	1.74077	-0.6719	0.83713	1.15019	-0.6281
799	-0.2127	1.78087	3.0419	1.90747	-0.6466	0.91234	1.52039	-0.3928
800	-0.3789	1.51179	2.95773	1.55378	-0.8554	0.79962	1.10276	-1.1112
801	-0.1812	1.73178	3.26547	1.85052	-0.7038	0.9861	1.4702	-0.7104
802	-0.2629	1.62054	2.99673	1.57847	-0.7559	0.91213	0.93824	-1.0436

803	-0.3006	1.68536	3.00938	1.71331	-0.4051	0.98856	1.22702	-0.9877
804	-0.1706	1.72919	3.19325	1.88505	-0.3944	1.02711	1.17446	-0.4879
805	0.00825	1.81632	3.13522	1.90739	-0.489	0.93436	1.27017	-0.6394
806	0.09432	1.94926	3.30153	1.95841	-0.3713	1.12399	1.49932	-0.273
807	-0.0337	1.73854	3.17658	1.78407	-0.4161	1.07961	1.15212	-0.8671
808	0.06165	1.91161	3.25158	1.853	-0.5091	1.19302	1.29157	-0.8534
809	-0.0388	1.77056	3.24146	1.75362	-0.3655	1.12897	1.2056	-1.108
810	-0.0683	1.83717	3.23139	2.00417	0.01348	1.1623	0.96072	-1.1383
811	-0.1907	1.61026	2.91629	1.7256	-0.2896	1.08597	1.14996	-0.7155
812	-0.0316	1.79463	3.23646	1.85756	-0.3291	1.17792	1.25805	-0.694
813	-0.1069	1.75844	3.13549	1.76866	-0.4082	1.16426	1.03139	-1.0049
814	-0.2064	1.64446	3.14185	1.63732	-0.4643	1.08778	1.21801	-0.7811
815	-0.1256	1.67078	3.2018	1.6632	-0.5342	1.1377	0.88513	-0.945
816	-0.1735	1.61898	3.09141	1.54926	-0.3814	1.08176	0.73926	-0.8187
817	-0.1615	1.61454	3.09072	1.56366	-0.2736	1.0891	0.90658	-0.7234
818	-0.2918	1.57049	3.04967	1.62137	-0.3065	0.93414	0.75176	-0.9535
819	-0.0763	1.6566	3.18164	1.8023	-0.1205	1.07899	0.80342	-0.6294
820	0	1.793	3.30282	1.79272	-0.2396	1.15663	1.04257	-0.7501
821	-0.1967	1.59809	3.18654	1.46617	-0.4624	0.99537	0.87209	-0.7428
822	-0.0126	1.67974	3.38666	1.6793	-0.2906	1.13198	1.00223	-0.4664
823	-0.0523	1.6002	3.34279	1.56472	-0.3537	1.16479	0.78148	-0.7432
824	0.00667	1.73394	3.33095	1.65908	-0.0645	1.12529	0.74956	-0.825
825	0.03631	1.73194	3.42501	1.80374	-0.025	1.21557	0.75951	-0.9429
826	0.02306	1.5496	3.34638	1.44336	-0.1489	1.11931	0.68426	-0.9494
827	0.10234	1.66387	3.26481	1.53784	-0.1916	1.17536	0.68798	-0.7774
828	0.37428	1.63728	3.38409	1.55762	-0.3354	1.17452	1.08011	-0.833
829	0.59804	1.82654	3.51226	1.78796	0.27437	1.31178	1.14369	-0.7754
830	0.21879	1.67122	3.29138	1.86826	0.05346	1.05777	1.05689	-0.9298
831	0.24827	1.74877	3.19364	1.69204	-0.4923	1.00332	1.14555	-0.6629
832	0.37594	1.87463	3.31702	1.92021	-0.3449	1.18113	1.16406	-0.6749
833	0.2243	1.67586	3.1765	1.70691	-0.4854	0.99575	1.12276	-1.2534
834	0.32308	1.73135	3.25794	1.92952	-0.4334	1.03282	1.0455	-0.7962
835	0.22191	1.73146	3.18238	1.71533	-0.544	1.01316	1.00492	-0.7871
836	0.23759	1.73124	3.12307	1.82772	-0.3777	1.03201	1.11978	-0.8079
837	0.29532	1.83547	3.2513	1.81839	-0.3404	1.19116	1.12907	-0.9061
838	0.23376	1.71514	3.22065	1.66582	-0.5411	1.04595	1.18044	-0.9074
839	0.23092	1.79848	3.16771	1.75685	-0.4306	1.06052	0.97031	-0.4707
840	0.24661	1.79687	3.20968	1.77286	-0.3152	1.06417	0.93275	-0.9329
841	0.17913	1.71694	3.16285	1.657	-0.3411	1.07866	0.99877	-0.8096
842	0.2103	1.64612	3.09734	1.64638	-0.3718	1.04536	1.1214	-0.6747
843	0.17579	1.661	3.12308	1.67837	-0.4645	0.92788	1.20679	-0.5743
844	0.20621	1.73464	3.25492	1.7285	-0.3416	0.99101	1.10805	-0.6773
845	0.25603	1.71715	3.29777	1.77343	-0.2001	1.01566	0.91808	-0.9294
846	0.30601	1.84457	3.38519	1.87942	-0.1003	1.08902	1.19342	-0.8468
847	0.20284	1.71738	3.12264	1.80975	-0.1856	0.99453	1.06017	-0.6312
848	0.37622	1.83915	3.29671	1.81195	-0.0164	1.15027	1.29765	-0.5821

849	0.16208	1.69416	3.24644	1.74665	-0.0651	1.05516	1.11629	-0.5994
850	0.1375	1.65352	3.03935	1.56956	-0.4408	0.90873	1.0217	-0.8014
851	0.11493	1.67418	2.97107	1.57146	-0.2094	0.96021	0.97422	-0.7993
852	0.09414	1.64294	3.01907	1.52774	-0.1977	0.93166	1.01054	-0.8861
853	0.06379	1.61613	3.0472	1.66259	-0.3381	0.88607	1.10493	-0.7365
854	0.19181	1.6923	3.09749	1.55774	-0.2782	0.99581	1.09954	-0.8427
855	0.17063	1.8281	3.19079	1.76297	-0.2765	1.03832	1.08755	-0.8287
856	0.30382	1.8588	3.24137	1.81439	-0.1896	1.05846	1.33373	-0.583
857	0.16627	1.70908	3.23981	1.67035	-0.5454	0.94763	1.11772	-0.8546
858	0.23022	1.74841	3.32189	1.85697	-0.3161	1.09427	1.36795	-0.5386
859	0.23952	1.69971	3.16811	1.75271	-0.5009	1.03205	1.1992	-0.6091
860	0.04814	1.51329	3.17883	1.59935	-0.1823	0.98306	1.25858	-0.6466
861	-0.0964	1.50198	3.01377	1.57529	0.18208	0.89612	0.98453	-1.1536
862	0.00981	1.59923	3.13213	1.66703	-0.4277	0.95218	1.09431	-0.9541
863	-0.2799	1.55174	2.84969	1.67082	-0.3017	0.83577	1.12384	-0.9872
864	-0.2587	1.65733	2.93725	1.59735	-0.189	0.89434	1.00301	-0.6888
865	-0.3505	1.58113	2.85868	1.59518	-0.2983	0.80237	1.10783	-0.995
866	-0.2406	1.61641	2.98094	1.62982	-0.1006	0.87382	1.13406	-0.6729
867	-0.1239	1.60958	3.05511	1.55298	-0.0244	0.94458	1.15406	-0.6162
868	0.05753	1.83346	3.20631	1.95912	-0.1024	1.06681	1.23913	-0.7276
869	0.07101	1.83469	3.12368	1.84869	-0.0326	1.06695	1.1843	-0.7401
870	-0.0915	1.64695	2.92979	1.73264	-0.24	0.98222	0.97498	-0.7733
871	0.03668	1.72454	3.05977	1.72556	-0.1278	0.95766	1.13205	-1.0564
872	0.11685	1.81819	3.14133	1.77465	-0.1133	1.04787	1.2777	-0.5488
873	-0.1259	1.59822	2.8828	1.60457	-0.2738	0.80329	0.88237	-0.9814
874	-0.2109	1.55402	2.85533	1.58718	-0.3227	0.80877	1.2148	-0.8404
875	-0.3243	1.53257	2.74604	1.64751	-0.273	0.78117	0.98976	-0.9483
876	-0.2632	1.55818	2.82158	1.57859	-0.0786	0.87837	0.92845	-0.9402
877	-0.1479	1.73416	2.96138	1.74498	0.09182	0.98495	1.3086	-0.8783
878	-0.2708	1.56802	2.91246	1.5745	-0.0473	0.84569	0.96193	-1.1368
879	-0.0957	1.72562	3.01973	1.56416	0.00141	0.97133	1.05007	-0.6639
880	-0.1845	1.63182	2.72561	1.56098	-0.0981	0.86047	0.9509	-0.7301
881	0.19694	1.89832	3.14381	1.88488	-0.1311	1.11191	1.09808	-0.6286
882	-0.085	1.66481	3.0789	1.60153	-0.3162	1.01702	0.96171	-1.0483
883	0.13669	1.61979	3.17296	1.57362	-0.1624	1.02845	0.87849	-0.7258
884	0.01588	1.72076	3.02817	1.73588	-0.0318	0.98871	0.99975	-0.9526
885	-0.0793	1.71028	2.94389	1.58841	0.09644	0.84323	0.79806	-1.0492
886	-0.3268	1.56469	2.7724	1.56275	-0.0987	0.76268	0.67852	-0.9722
887	-0.2256	1.66102	2.97553	1.63446	-0.0863	0.88322	0.91148	-0.8255
888	-0.2019	1.62185	2.88133	1.62736	-0.2475	0.79335	0.82064	-0.8303
889	-0.1538	1.63197	2.9927	1.66022	-0.2466	0.88668	0.98391	-1.0149
890	-0.0742	1.67364	3.05137	1.69098	0.06586	0.94567	1.06469	-0.7732
891	-0.1989	1.67141	2.84865	1.67454	-0.3889	0.8403	1.13351	-0.7595
892	-0.1294	1.68627	2.8412	1.75035	-0.2524	0.72221	0.92345	-0.8272
893	-0.1919	1.66618	2.91103	1.64538	-0.1375	0.83151	1.03022	-0.9407
894	-0.1476	1.6556	2.94626	1.66487	-0.175	0.79269	0.74785	-0.9388

895	-0.0775	1.67931	2.98776	1.73395	-0.1296	0.84027	1.00328	-1.0338
896	-0.2032	1.61339	2.80652	1.88522	-0.3008	0.77953	1.02192	-1.0716
897	-0.1754	1.66328	2.80851	1.68578	-0.1255	0.76746	0.76746	-1.2879
898	-0.0187	1.69845	2.84014	1.80437	-0.1282	0.82561	0.60698	-1.1981
899	-0.0472	1.75379	2.94257	1.73771	-0.0322	0.93515	0.79979	-0.7915
900	-0.1904	1.57663	2.8048	1.52981	-0.2289	0.71949	0.49547	-1.2002
901	-0.0725	1.67301	2.9152	1.67337	-0.0586	0.7424	0.48207	-1.3563
902	-0.0939	1.7013	2.98038	1.62886	0.0201	0.96521	0.78028	-1.1241
903	-0.0759	1.64555	2.82737	1.67786	-0.2023	0.91396	0.77608	-1.0837
904	-0.0952	1.64526	2.75299	1.61309	-0.2223	0.84594	0.67984	-0.641
905	-0.2146	1.5931	2.66951	1.42849	-0.0417	0.88803	0.69023	-0.7348
906	-0.1332	1.72279	2.99374	1.60444	-0.0619	1.15934	0.71474	-0.6102
907	-0.1659	1.65106	2.96443	1.66495	-0.2605	1.06968	0.4789	-0.723
908	-0.3224	1.47688	3.27736	1.43863	-0.3753	1.0876	0.50829	-0.9513
909	-0.0843	1.72302	3.25018	1.67252	-0.1552	1.2824	0.73126	-0.5268
910	-0.1506	1.73962	2.93141	1.78178	-0.2485	1.0388	0.67191	-0.9604
911	-0.0921	1.69672	3.19291	1.66638	-0.1847	1.20179	0.72531	-0.9651
912	-0.1015	1.82975	3.50113	1.77132	0.12393	1.40383	0.90938	-0.6465
913	-0.1498	1.6968	3.15539	1.68947	-0.1982	1.18533	0.72123	-0.9871
914	-0.2165	1.6061	2.82531	1.56202	-0.4222	0.97911	0.60192	-0.9397
915	-0.3421	1.56859	2.76799	1.54633	-0.6731	0.93116	0.70946	-0.9603
916	-0.1049	1.68126	2.78373	1.67103	-0.2786	0.9172	0.89819	-0.6428
917	-0.3756	1.51815	2.66447	1.44977	-0.4659	0.68739	0.60695	-0.9295
918	-0.2859	1.4095	2.72689	1.3648	-0.5788	0.77396	0.56139	-1.0695
919	-0.2584	1.4384	2.78107	1.43752	-0.5311	0.79502	0.61288	-1.0598
920	0.05889	1.55191	2.92756	1.53625	-0.4401	1.00448	0.84367	-0.7038
921	0.05719	1.49342	2.78455	1.47926	-0.353	0.81081	0.46914	-1.1141
922	-0.2743	1.14968	2.49485	1.10137	-0.7419	0.70036	0.65036	-1.6298
923	-0.4031	1.18498	2.4985	1.02422	-0.4925	0.81831	0.8685	-1.1908
924	-0.4276	0.97062	2.2675	0.88583	-0.5074	0.61406	0.58024	-1.4289
925	-0.7119	0.85236	2.12613	0.76574	-0.6847	0.62216	0.44364	-1.5943

1.1.4. SI C2

Table Appendix Table 1.7. Natural log of key indicator element abundance variability against conservative lithophile element Ti in core SI C2 in the Three Rivers Estuarine Complex saltmarshes.

Depth (mm)	Si/Ti	K/Ti	Ca/Ti	Br/Ti	Sr/Ti	Zr/Ti	Ba/Ti
1	-2.368	-0.1254	1.16656	-0.5918	0.01844	-0.5173	-2.7901
2	-2.0871	-0.0697	1.26865	-1.0455	-0.6423	-1.3739	-3.8712
3	-2.0499	-0.0411	1.41661	-1.0401	-0.6252	-1.1214	-2.8714
4	-1.944	-0.0257	1.41471	-1.0041	-0.5776	-1.3671	-3.2655
5	-2.0571	-0.1385	1.30689	-1.0735	-0.6836	-1.2333	-4.6452

6	-2.0504	-0.0504	1.38943	-1.0118	-0.5621	-1.2847	-4.177
7	-1.9516	-0.0829	1.37186	-1.0164	-0.6318	-1.3853	-4.2903
8	-1.9143	-0.0552	1.44033	-0.9581	-0.6637	-1.3047	-2.8874
9	-2.1418	-0.1345	1.26968	-1.1824	-0.6018	-1.0683	-3.0694
10	-1.9528	-0.0108	1.42807	-1.0009	-0.4771	-0.9942	-2.9829
11	-1.8515	-0.093	1.40036	-1.1666	-0.5909	-1.0604	-2.4738
12	-1.9139	-0.0676	1.43326	-1.1452	-0.5786	-1.0584	-2.3752
13	-1.825	-0.0656	1.42267	-1.2826	-0.5894	-0.9618	-2.5283
14	-1.867	-0.0703	1.49123	-1.2467	-0.4831	-1.0186	-2.5403
15	-1.8745	-0.0599	1.49546	-1.2484	-0.5838	-1.0377	-2.5954
16	-1.753	0.04466	1.56408	-1.2284	-0.505	-1.2284	-2.3212
17	-1.7983	-0.0434	1.44401	-1.3142	-0.5835	-1.1901	-2.7688
18	-1.9444	-0.0976	1.37618	-1.406	-0.6421	-1.0276	-3.1967
19	-1.8185	-0.0693	1.4824	-1.3815	-0.5223	-0.9424	-2.6111
20	-1.7579	-0.033	1.59583	-1.3982	-0.4241	-0.9367	-2.6903
21	-1.7624	-0.0648	1.55328	-1.0302	-0.6376	-1.3464	-2.4451
22	-1.7417	-0.0072	1.61408	-1.1832	-0.4999	-1.2757	-2.4187
23	-1.8322	-0.0692	1.54301	-1.1614	-0.5369	-1.1773	-2.7591
24	-1.8107	-0.0946	1.54103	-1.1107	-0.665	-1.2296	-2.6197
25	-1.8079	-0.0441	1.57738	-1.2472	-0.5606	-1.3882	-2.3604
26	-1.7728	-0.0397	1.55642	-1.3201	-0.5535	-1.2862	-2.5235
27	-1.7973	-0.0449	1.48114	-1.3043	-0.5575	-1.1716	-2.471
28	-1.8091	-0.0297	1.61945	-1.1403	-0.4382	-1.0046	-2.5001
29	-2.0376	-0.1622	1.35586	-1.2073	-0.4651	-1.1377	-2.5942
30	-1.8575	0.03697	1.53827	-0.704	-0.2735	-0.7095	-2.0169
31	-2.0138	-0.0526	1.38447	-0.3396	-0.2547	-0.7827	-2.4655
32	-2.1589	-0.1177	1.3361	-0.5552	-0.3643	-0.7866	-2.9254
33	-1.9439	-0.0396	1.41964	-0.6749	-0.2534	-0.84	-2.6402
34	-1.9506	0.00999	1.40411	-0.8656	-0.2404	-1.1178	-2.3861
35	-1.8929	-0.0104	1.40377	-0.9426	-0.3995	-1.1462	-2.6975
36	-1.8631	0.03718	1.37241	-0.9964	-0.4478	-1.1465	-2.6681
37	-2.0166	-0.0659	1.22965	-1.1322	-0.4723	-1.3665	-2.9317
38	-1.8912	0.08007	1.36245	-1.1693	-0.3689	-1.2324	-2.5059
39	-1.9922	-0.0168	1.43618	-1.119	-0.4605	-1.1698	-2.6312
40	-1.7961	0.03979	1.44477	-0.9361	-0.3634	-1.2025	-2.577
41	-1.833	-0.0036	1.4521	-0.9516	-0.3799	-1.2621	-2.6322
42	-1.7921	0.05113	1.53644	-0.8465	-0.3657	-1.5715	-2.3427
43	-2.0637	-0.0878	1.18501	-0.9904	-0.5392	-2.1307	-2.7489
44	-1.9003	0.0046	1.30609	-0.8209	-0.4547	-1.8297	-2.2743
45	-1.9603	-0.0224	1.20981	-0.9889	-0.5003	-2.0871	-2.64
46	-1.9262	0.00738	1.28882	-1.0086	-0.5323	-1.9073	-2.9772
47	-1.8256	0.0565	1.25742	-0.9892	-0.5299	-2.0089	-2.7785
48	-1.9021	0.08995	1.22979	-0.9255	-0.5523	-1.9052	-2.6428
49	-2.0786	0.04942	1.1549	-1.0341	-0.5642	-2.2592	-2.8439
50	-1.9519	0.11502	1.09447	-0.9455	-0.5416	-2.0592	-2.3786
51	-2.0614	0.07583	1.06274	-0.9359	-0.5686	-1.9028	-2.8451

52	-1.9007	0.07822	1.16079	-0.8166	-0.4815	-2.2707	-2.4828
53	-2.0847	0.01184	1.09774	-0.8283	-0.4936	-2.1815	-2.6842
54	-1.9496	0.12203	1.19006	-0.6994	-0.3396	-2.0219	-2.3344
55	-1.9809	0.11057	1.13797	-0.7063	-0.4391	-2.0589	-2.3957
56	-1.9818	0.11017	1.13312	-0.6924	-0.3715	-2.4215	-2.4444
57	-1.9852	0.07993	1.1524	-0.6248	-0.337	-2.1953	-2.5497
58	-2.0077	0.08454	1.12865	-0.685	-0.2995	-2.1694	-2.867
59	-1.9995	0.0317	1.098	-0.7665	-0.468	-2.2534	-2.8014
60	-1.9575	0.0838	1.20753	-0.8205	-0.3418	-2.5847	-2.986
61	-1.9303	0.05376	1.17508	-0.8408	-0.3665	-2.0966	-2.6325
62	-2.0955	-0.0315	1.1816	-0.8688	-0.4047	-2.1429	-2.5649
63	-2.048	0.02976	1.21963	-0.7412	-0.3431	-1.9361	-2.6425
64	-2.0047	0.06421	1.22535	-0.8643	-0.4933	-1.9454	-2.5167
65	-2.0409	0.07323	1.19784	-0.8983	-0.4617	-1.9274	-2.6362
66	-2.0026	0.06311	1.23979	-1.0254	-0.4425	-2.1066	-2.6592
67	-1.9935	0.10151	1.32322	-0.8317	-0.3902	-1.9177	-2.6572
68	-1.9437	0.1257	1.3485	-0.9579	-0.3322	-1.7978	-2.5208
69	-1.803	0.20381	1.43719	-0.9147	-0.2885	-1.9577	-2.2992
70	-1.9417	0.11316	1.37902	-0.9301	-0.3946	-2.0129	-2.5471
71	-2.0045	0.081	1.29989	-1.0112	-0.4775	-1.9498	-3.0494
72	-1.898	0.11312	1.35151	-0.9889	-0.4219	-2.0252	-2.7337
73	-1.9079	0.09382	1.30383	-0.9734	-0.4249	-1.8374	-2.6011
74	-1.882	0.12986	1.37076	-0.9805	-0.3782	-1.7806	-2.4442
75	-1.9846	0.04102	1.33111	-1.0141	-0.3728	-1.8372	-2.5553
76	-1.8783	0.09745	1.48671	-0.863	-0.2135	-2.0626	-2.5894
77	-1.9029	0.06223	1.28891	-1.061	-0.3559	-2.1846	-2.6609
78	-1.9242	0.08411	1.30972	-1.1015	-0.4635	-2.2311	-2.7974
79	-1.8838	0.17796	1.47682	-0.8922	-0.2841	-2.4514	-3.0026
80	-1.9015	0.12531	1.3753	-0.8586	-0.4908	-1.9759	-2.8153
81	-1.8949	0.14058	1.35265	-0.7006	-0.5796	-1.9664	-2.4805
82	-1.8862	0.11905	1.37436	-0.4658	-0.5706	-1.7919	-2.2538
83	-1.9578	0.1033	1.28933	-0.5454	-0.6179	-1.7115	-2.6063
84	-1.8643	0.1193	1.32845	-0.6997	-0.6487	-1.8376	-2.5994
85	-1.9629	0.04251	1.22723	-0.5089	-0.7659	-1.9008	-2.9706
86	-1.9417	0.08439	1.21966	-0.6541	-0.6538	-1.79	-2.5243
87	-1.899	0.11387	1.31069	-0.7247	-0.4448	-1.4707	-2.2357
88	-1.9543	0.08655	1.32169	-0.9591	-0.4088	-1.5256	-2.6394
89	-1.9697	0.05112	1.30126	-0.8219	-0.5263	-1.5562	-2.4526
90	-1.921	0.06061	1.31628	-0.9992	-0.5508	-1.6635	-2.6078
91	-1.9467	0.07762	1.3579	-0.9467	-0.5224	-1.7469	-2.8564
92	-2.0625	-0.0131	1.24804	-1.0274	-0.6862	-2.0333	-3.0053
93	-1.8445	0.06735	1.34008	-0.7667	-0.7122	-1.919	-2.784
94	-1.8645	0.10036	1.28426	-0.8898	-0.6128	-1.7166	-2.4143
95	-2.0147	0.04494	1.22255	-0.9456	-0.7433	-1.6452	-2.6732
96	-1.9883	-0.0203	1.17982	-0.8758	-0.6352	-1.5886	-2.6428
97	-1.9288	0.06829	1.20149	-0.8925	-0.7149	-1.8416	-2.6952

98	-2.0242	-0.0745	1.1004	-1.17	-0.8444	-2.0421	-2.8169
99	-1.8006	0.06478	1.14136	-0.8868	-0.7151	-2.0039	-2.4758
100	-1.9632	0.0396	1.03441	-1.0427	-0.7684	-2.0134	-2.6009
101	-1.9576	-0.0161	1.0695	-0.9075	-0.723	-1.912	-2.6816
102	-1.904	0.02414	1.05534	-0.7894	-0.7802	-1.9547	-2.3713
103	-2.0987	-0.0262	1.06134	-0.7472	-0.6852	-1.9497	-2.5658
104	-1.9457	0.0512	1.06213	-0.8555	-0.7282	-1.8897	-2.6923
105	-1.9973	0.02242	0.99884	-0.7924	-0.7706	-2.0967	-2.531
106	-1.992	0.05231	1.0171	-0.7931	-0.8042	-1.9323	-2.8072
107	-1.8684	0.06854	1.00454	-0.8748	-0.9063	-2.032	-2.7047
108	-1.811	0.09998	1.01442	-0.8932	-0.8595	-1.9114	-2.3347
109	-1.7336	0.13751	0.89989	-0.9702	-0.9005	-2.0015	-2.4601
110	-1.8962	0.03221	0.77525	-0.9987	-1.0126	-2.0142	-2.6491
111	-1.8415	0.06759	0.87525	-0.9176	-0.9616	-2.1426	-2.4011
112	-1.9174	0.0279	0.85024	-0.9822	-0.964	-2.0594	-2.6106
113	-1.9516	0.05234	0.91178	-1.0166	-0.9778	-2.0123	-2.5507
114	-2.0337	0.00707	0.87396	-1.0969	-0.9643	-1.9765	-2.8286
115	-1.9178	0.09131	0.91542	-0.9361	-0.9816	-2.039	-2.4607
116	-1.964	0.03949	0.95977	-0.9276	-0.9323	-1.6995	-2.6779
117	-1.8139	0.043	0.94964	-0.9256	-0.9746	-1.9195	-2.5928
118	-2.0343	0.00206	0.92227	-0.8658	-0.9062	-1.8377	-2.5419
119	-1.9227	0.10329	0.95062	-0.7584	-0.861	-1.7312	-2.2973
120	-1.8825	0.07127	0.96283	-0.7249	-0.8491	-1.6404	-2.6731
121	-1.8366	0.12545	1.10626	-0.638	-0.7668	-1.6605	-2.1792
122	-1.864	0.03763	1.00052	-0.7286	-0.7879	-1.6587	-2.5614
123	-1.8862	0.0344	1.09973	-0.7161	-0.7723	-1.755	-2.4897
124	-1.8667	-0.0378	1.02881	-0.6141	-0.861	-1.9107	-2.8498
125	-1.9832	-0.0108	1.00243	-0.5091	-0.9459	-2.026	-2.7226
126	-1.8779	-0.0212	0.98659	-0.1825	-0.8438	-1.8057	-2.7723
127	-2.0027	0.02486	1.0406	0.06618	-0.7269	-1.8588	-2.7069
128	-2.0778	-0.0215	1.01157	-0.3872	-0.7447	-2.0764	-2.9331
129	-1.823	0.03717	1.13293	-0.5335	-0.5988	-1.8059	-2.6432
130	-1.9169	0.02685	1.22611	-0.5279	-0.6585	-1.9348	-2.6224
131	-1.7999	0.06894	1.15962	-0.1076	-0.6295	-1.9812	-2.6744
132	-1.9483	-0.0158	1.11046	0.0838	-0.8306	-1.9318	-3.1839
133	-1.9348	0.03627	1.32074	-0.2466	-0.4159	-1.743	-2.5327
134	-2.0383	-0.0458	1.18967	-0.2829	-0.6246	-1.715	-3.0163
135	-1.9943	-0.0119	1.0658	-0.2865	-0.7116	-1.7067	-2.4471
136	-2.0829	0.03322	1.08045	-0.0341	-0.6765	-1.6746	-2.3574
137	-1.9742	0.02319	1.06814	-0.0196	-0.7512	-1.7085	-2.0835
138	-1.8941	-0.013	1.0665	0.19478	-0.8873	-2.1201	-2.5735
139	-2.0794	-0.0202	1.034	0.19615	-0.9	-1.846	-2.7223
140	-2.0518	0.02643	0.97463	0.26586	-1.0327	-2.4138	-3.152
141	-1.8938	0.01974	1.07566	-0.1005	-0.8513	-1.9857	-2.953
142	-1.9457	0.02643	1.00068	-0.207	-0.666	-1.7235	-2.5887
143	-1.882	0.02406	1.0452	-0.6826	-0.5814	-1.838	-2.2716

144	-2.0046	0.01461	1.07221	-0.8389	-0.6403	-1.7781	-2.4835
145	-2.0822	0.01697	1.02277	-0.8624	-0.6675	-1.7678	-2.4584
146	-1.9921	0.00372	1.07008	-1.1124	-0.6989	-1.6134	-2.5673
147	-1.9679	0.01912	0.9956	-1.1113	-0.8006	-1.795	-2.5028
148	-1.9166	0.00682	0.96822	-1.1031	-0.8783	-1.88	-2.4589
149	-1.9422	-0.0136	0.99814	-1.1288	-0.8828	-1.9007	-3.0164
150	-1.955	-0.0227	0.9626	-1.003	-0.9303	-1.8844	-2.6986
151	-1.9284	0.02717	1.09019	-0.7685	-0.8411	-1.8465	-2.6731
152	-1.8453	0.07135	1.1358	-0.9925	-0.8167	-1.5956	-2.568
153	-1.8482	0.06234	1.03224	-1.059	-0.857	-1.8502	-2.8713
154	-1.9937	-0.0039	0.96919	-1.1208	-0.815	-2.0955	-2.5864
155	-1.9043	0.02915	0.92582	-1.174	-0.8699	-1.9732	-2.6219
156	-1.9356	0.00992	0.88636	-1.2629	-0.9516	-2.0082	-2.5591
157	-1.9103	0.05279	0.91087	-1.2436	-0.8482	-1.7761	-2.4612
158	-1.8984	0.02333	0.91856	-1.2711	-0.9261	-1.9462	-2.7047
159	-1.9277	0.03957	0.94178	-1.1764	-0.9348	-1.9425	-2.4802
160	-1.8614	0.09603	1.02257	-1.1471	-0.8291	-1.9662	-2.3831
161	-1.8612	0.05904	1.0061	-1.1158	-0.7981	-1.8334	-2.443
162	-1.9385	0.05605	1.00659	-1.0884	-0.8057	-2.1035	-2.4336
163	-1.9308	0.05976	0.96919	-1.1129	-0.8028	-1.7869	-2.3795
164	-1.7508	0.12256	1.00926	-1.0058	-0.8136	-1.7339	-2.4297
165	-1.9606	0.00072	0.90258	-1.1914	-0.9147	-1.9803	-2.8888
166	-1.9092	0.04122	0.96608	-1.13	-0.9093	-1.9467	-2.8958
167	-1.9662	-0.0184	0.94256	-0.9117	-0.8861	-2.1943	-2.9325
168	-1.8902	0.05669	1.00001	-0.7637	-0.716	-1.7674	-2.5526
169	-1.8592	0.02441	0.98036	-0.8045	-0.7654	-2.0477	-2.7408
170	-1.862	0.07639	1.0349	-0.9374	-0.7759	-1.9383	-2.6542
171	-1.8167	0.09835	1.00202	-0.9205	-0.7726	-1.6817	-2.504
172	-1.9039	0.00947	0.93935	-0.8724	-0.9217	-1.9602	-2.8391
173	-1.7884	0.05721	1.02468	-1.0076	-0.857	-2.4183	-2.8195
174	-1.9202	0.02955	1.09447	-1.0614	-0.8433	-2.0525	-2.622
175	-1.9477	0.02623	1.05627	-1.0062	-0.8623	-2.3332	-2.4095
176	-1.8648	0.09251	1.22585	-1.0286	-0.8138	-1.9844	-2.5013
177	-1.9085	0.08311	1.25871	-0.9178	-0.7749	-2.1306	-2.5291
178	-1.96	0.06249	1.19169	-0.8242	-0.7213	-1.9352	-2.8472
179	-2.2858	-0.0865	1.11976	-0.4789	-0.7818	-1.8952	-2.6377
180	-1.9855	0.02675	1.1551	-0.7414	-0.7263	-1.8653	-2.7061
181	-1.9414	0.03545	1.14154	-0.7416	-0.7434	-1.4943	-2.4329
182	-1.9696	0.06823	1.30613	-0.7112	-0.8279	-1.5105	-2.3549
183	-2.068	0.00979	0.96485	-0.8046	-0.9847	-1.7174	-2.5877
184	-2.1886	-0.0608	0.8483	-0.8938	-0.963	-2.217	-2.5041
185	-2.1206	-0.0197	0.8161	-1.0786	-0.907	-2.2821	-2.3515
186	-2.1345	-0.0491	0.84113	-1.1401	-1.0318	-2.0607	-2.7374
187	-2.1319	-0.0106	0.90222	-1.1431	-0.9646	-1.8689	-2.5829
188	-2.0222	-0.003	0.84099	-1.072	-0.9828	-2.0411	-2.6178
189	-2.1159	-0.0235	0.82946	-0.9471	-1.0033	-1.9361	-2.58

190	-2.0766	-0.0145	0.81058	-0.9263	-0.9385	-1.9323	-2.5299
191	-2.0896	-0.0126	0.87382	-0.8989	-0.9703	-1.8753	-2.3241
192	-2.0348	-0.0188	0.83013	-1.1414	-0.9344	-1.9203	-2.7774
193	-2.1072	0.00748	0.83529	-1.1207	-0.9534	-1.7862	-2.8044
194	-1.8938	-0.0063	0.84298	-1.0739	-1.0841	-1.8858	-2.6436
195	-2.0438	-0.0381	0.82485	-1.175	-1.0498	-2.3104	-3.0484
196	-2.0448	0.00693	0.86796	-0.9301	-0.9454	-2.1764	-2.769
197	-1.967	0.07615	0.92837	-0.9033	-0.866	-1.7788	-2.516
198	-2.026	0.02609	0.81549	-0.9735	-0.8649	-1.7885	-2.6807
199	-2.1083	0.00369	0.83956	-1.0176	-0.8862	-1.7099	-2.2578
200	-2.1142	-0.0288	0.80497	-1.0932	-0.9126	-1.909	-2.6649
201	-2.0603	0.03096	0.97419	-1.0228	-0.7256	-1.7331	-2.6108
202	-2.0348	-0.0163	0.8897	-0.9103	-0.7757	-1.7646	-2.9125
203	-2.244	-0.0445	0.86887	-1.0095	-0.8667	-2.0643	-2.7232
204	-2.0624	-0.0334	0.86487	-0.8553	-0.8413	-1.888	-2.7912
205	-1.9799	0.04142	0.99923	-0.8675	-0.6952	-1.7809	-2.7197
206	-2.1317	-0.0155	0.95995	-1.0191	-0.8146	-2.2692	-2.7253
207	-2.0533	0.05606	1.04206	-1.0051	-0.8316	-1.9204	-2.6294
208	-2.0729	-0.0107	0.98171	-1.0268	-0.7953	-1.85	-2.7401
209	-2.085	-0.0371	0.94173	-1.0409	-0.8725	-2.0996	-2.765
210	-2.0788	-0.0229	0.96815	-1.0695	-0.7547	-1.921	-2.375
211	-2.0182	-0.0115	0.96526	-1.1109	-0.8426	-1.8625	-2.5598
212	-1.9536	0.05364	1.00407	-0.9872	-0.7127	-1.9079	-2.4417
213	-2.0631	-0.0085	0.91681	-1.1338	-0.8072	-2.1758	-2.4589
214	-1.9494	-0.0213	0.9333	-1.0814	-0.877	-2.09	-2.7977
215	-1.9313	0.00635	0.94873	-1.0717	-0.8916	-1.9774	-2.6683
216	-2.0225	0.02316	0.99887	-1.0626	-0.9141	-1.9696	-2.3909
217	-2.0317	0.03076	0.98747	-0.9279	-0.9497	-2.0341	-2.4871
218	-1.9342	0.02243	0.90138	-0.538	-1.0718	-2.1921	-2.6102
219	-2.0241	-0.0245	0.81444	-0.384	-1.1397	-2.1979	-2.8004
220	-2.1446	0.00211	0.84037	-0.7527	-0.9197	-1.8303	-2.652
221	-1.9852	0.00936	0.86793	-0.919	-0.7659	-1.7952	-2.5554
222	-2.0793	0.00905	0.85889	-1.0434	-0.9165	-2.113	-2.606
223	-2.0848	-0.0144	0.80856	-1.0256	-1.0248	-2.163	-2.6219
224	-2.0116	0.02759	0.7857	-1.028	-0.9869	-1.9223	-2.4503
225	-2.0352	-0.0167	0.80049	-1.1921	-0.9557	-2.0878	-2.6773
226	-2.0326	0.04733	0.82599	-1.0281	-1.0075	-2.2778	-2.5406
227	-1.8693	0.11153	0.93974	-1.1028	-0.9556	-1.984	-2.2129
228	-1.9965	0.05111	0.83593	-0.9593	-0.867	-2.0028	-2.4969
229	-1.8571	0.10305	0.88159	-0.8016	-0.7753	-2.1116	-2.3057
230	-1.911	0.10482	0.9273	-1.037	-0.9362	-1.9025	-2.6718
231	-1.9438	0.06095	0.76916	-1.1036	-0.9612	-2.1753	-2.702
232	-1.9742	0.05656	0.79978	-1.2698	-1.0093	-2.5075	-2.6654
233	-1.9181	0.03446	0.85682	-1.1841	-1.012	-2.347	-2.6301
234	-2.1037	-0.0046	0.84752	-1.2442	-1.0082	-2.3829	-3.2744
235	-2.0118	-0.0021	0.8918	-1.2325	-0.9859	-2.4232	-2.8611

236	-2.0551	-0.0166	0.81773	-1.2897	-0.9232	-2.2073	-3.0151
237	-2.0699	0.00722	0.84926	-1.194	-0.8702	-2.1365	-2.5514
238	-1.9949	0.06074	0.88675	-1.0893	-0.8939	-2.1536	-2.467
239	-1.9611	0.03568	0.8784	-1.1194	-0.9082	-2.1013	-2.5444
240	-1.9396	0.0205	0.85042	-1.2041	-0.8906	-2.0452	-2.3796
241	-1.912	0.05165	0.93112	-1.1056	-0.8166	-2.3747	-2.42
242	-1.9529	0.05415	0.86476	-1.2187	-0.9107	-2.0404	-2.7549
243	-1.9384	0.06881	0.91306	-1.2016	-0.8232	-2.1541	-2.4742
244	-1.9113	0.02191	0.91051	-1.2961	-0.9404	-2.1928	-2.7174
245	-1.9052	0.05498	0.90118	-1.2478	-0.8621	-2.2928	-2.6989
246	-1.9357	0.0365	0.90005	-1.3474	-0.8644	-2.2972	-2.8184
247	-1.9523	0.00474	0.93324	-1.199	-0.8009	-2.2063	-2.7491
248	-1.9498	0.06643	0.99939	-1.1739	-0.6525	-1.8429	-2.6386
249	-1.8797	0.02502	1.07306	-1.0938	-0.805	-1.9587	-2.3441
250	-1.9848	-0.0389	0.9784	-1.1708	-0.9166	-2.1934	-2.7578
251	-1.9398	0.00385	1.00051	-1.3415	-0.9343	-2.2472	-2.9229
252	-1.8876	0.03263	0.94887	-1.331	-1.0225	-2.2594	-2.7195
253	-1.8771	0.04971	1.03155	-1.2092	-0.994	-2.1364	-2.6501
254	-1.9452	0.03404	0.93146	-1.2451	-1.0343	-2.0585	-2.6413
255	-1.9197	0.02117	0.87398	-1.1431	-0.9562	-2.6708	-2.6816
256	-1.9059	0.04364	0.8816	-1.157	-0.944	-2.1686	-2.4396
257	-1.8999	0.02585	0.82398	-1.1745	-0.8795	-2.0244	-2.7186
258	-1.9413	-0.0036	0.84592	-1.05	-0.9669	-2.097	-2.8246
259	-1.9572	0.01454	0.9303	-1.042	-0.9061	-2.0288	-2.5317
260	-2.0059	0.02735	0.92784	-0.7747	-0.8458	-1.8276	-2.6054
261	-2.0312	-0.0167	0.93011	-0.2429	-0.8859	-1.6408	-2.775
262	-2.0734	0.06194	0.92876	-0.6037	-0.8928	-1.774	-2.6641
263	-2.1358	-0.0027	0.91229	-0.8311	-0.8992	-1.7738	-2.7795
264	-2.1322	-0.0324	0.85841	-0.8472	-0.9757	-1.6645	-3.2017
265	-2.0674	0.03139	0.89746	-0.8575	-0.8424	-1.4921	-2.7004
266	-1.985	0.03804	0.99873	-0.6106	-0.7567	-1.31	-2.5098
267	-2.0681	-0.0702	0.90278	-0.8735	-0.8952	-1.7031	-2.5712
268	-1.9486	0.03696	0.99988	-0.9275	-0.9558	-1.6415	-2.5573
269	-1.9835	0.03774	0.9832	-0.8866	-0.8368	-1.6055	-2.2895
270	-1.9564	0.07164	0.99204	-0.7426	-0.7632	-1.3454	-2.3275
271	-2.0362	-0.0138	0.93093	-0.8053	-0.8539	-1.4196	-2.8588
272	-1.9051	0.06534	0.96562	-0.7635	-0.7498	-1.4089	-2.4172
273	-2.0466	-0.0607	0.93186	-1.038	-0.8636	-1.4511	-2.8893
274	-2.0108	-0.0118	1.01536	-1.0859	-0.7714	-1.4232	-2.8061
275	-1.9149	0.02229	1.03689	-0.959	-0.7456	-1.3544	-2.5534
276	-1.9396	0.03296	1.0677	-0.957	-0.7895	-1.5737	-2.8362
277	-2.0173	-0.0178	1.00029	-1.0421	-0.8392	-1.4917	-3.1704
278	-1.8638	0.0449	1.05335	-1.0581	-0.828	-1.6574	-2.7635
279	-1.829	0.03936	1.04624	-1.0176	-1.063	-1.5486	-2.3574
280	-1.9718	-0.0163	0.96452	-1.14	-0.9931	-1.7362	-2.7434
281	-1.8339	0.05383	1.02574	-1.0149	-1.0015	-1.5626	-2.8557

282	-1.9703	0.0275	0.9859	-0.9919	-0.9965	-1.549	-2.4627
283	-1.9499	0.00578	0.87203	-0.906	-0.9912	-1.5416	-2.4575
284	-1.9546	0.04758	0.89349	-0.7621	-0.9764	-1.5439	-2.7131
285	-2.0796	0.00674	0.83726	-0.8632	-0.9606	-1.763	-2.7127
286	-1.9409	0.01364	0.91679	-0.9171	-0.8658	-1.6029	-2.5388
287	-1.9378	0.03384	0.98441	-0.88	-0.8445	-1.5728	-2.5166
288	-1.9071	0.01326	0.96226	-0.8754	-0.7953	-1.591	-2.5327
289	-2.021	0.01722	1.0052	-0.9026	-0.7737	-1.5624	-2.7204
290	-2.0081	0.06313	1.00611	-1.0233	-0.7269	-1.5521	-2.2702
291	-1.8554	0.00233	0.94036	-1.2061	-0.8438	-1.8838	-2.4808
292	-1.9881	0.04284	1.07139	-0.9458	-0.8734	-1.6254	-2.6054
293	-1.9479	0.04554	1.08896	-0.9913	-0.8994	-1.5302	-2.5719
294	-1.8947	0.03962	1.05642	-1.0461	-0.875	-1.3338	-2.8654
295	-1.9287	-0.0262	0.94936	-1.0822	-0.9301	-1.1309	-2.9422
296	-1.8343	0.07448	1.10975	-1.0155	-0.8424	-1.1013	-2.2548
297	-1.9298	-0.0418	1.0867	-0.9159	-0.9109	-1.2261	-2.1254
298	-1.938	-0.0601	1.05978	-0.9154	-0.8284	-1.4782	-2.8252
299	-1.951	-0.1003	1.03846	-1.0652	-0.9825	-1.683	-2.8607
300	-1.935	0.00588	1.11373	-0.9465	-0.9178	-1.7531	-2.2923
301	-1.9618	0.00835	1.12254	-0.8402	-0.8459	-1.4213	-2.1911
302	-1.9909	-0.0177	1.09789	-0.7823	-0.9012	-1.4095	-2.3761
303	-1.889	0.05384	1.16199	-0.8643	-0.8508	-1.4455	-2.4785
304	-1.8866	-0.0309	1.09386	-0.8105	-0.8519	-1.7979	-2.8374
305	-1.9365	0.00122	1.06375	-0.7124	-0.7871	-1.7001	-2.5099
306	-1.9185	-0.0498	1.03868	-1.0624	-0.8536	-1.6589	-2.6274
307	-1.9892	0.01559	1.08759	-0.8534	-0.7656	-1.6269	-2.5032
308	-2.0321	0.01824	1.07821	-0.9545	-0.8063	-1.7706	-2.6151
309	-2.0746	-0.0164	0.97736	-0.9185	-0.9586	-1.559	-2.5712
310	-2.0333	-0.0849	1.01421	-0.9203	-0.9399	-1.4724	-2.6892
311	-1.9099	0.02909	1.10277	-0.8742	-0.8301	-1.5121	-2.2953
312	-1.9447	0.00367	1.12732	-0.8887	-0.7897	-1.433	-2.4036
313	-1.9181	0.01399	1.03404	-0.9761	-0.8657	-1.2831	-2.6263
314	-1.901	0.05921	1.12371	-0.9052	-0.7437	-1.2625	-2.2855
315	-1.888	0.03514	1.06762	-1	-0.7785	-1.3467	-2.62
316	-1.997	-0.0298	1.06582	-0.7664	-0.7725	-1.2074	-2.9225
317	-2.0886	-0.064	1.06655	-0.3647	-0.6492	-1.4825	-2.6828
318	-2.016	-0.0029	1.07824	-0.5863	-0.7087	-1.3569	-2.7002
319	-2.017	-0.0243	1.16537	-0.6397	-0.7425	-1.4519	-2.4093
320	-1.9537	-0.0179	1.13865	-0.6869	-0.7283	-1.4727	-2.7792
321	-1.9013	0.03532	1.25697	-0.5702	-0.6513	-1.3448	-2.6855
322	-1.915	0.00622	1.16344	-0.5932	-0.8046	-1.3646	-2.8083
323	-1.9502	-0.0035	1.14327	-0.6669	-0.8794	-1.0712	-2.7811
324	-1.9964	-0.0398	1.17564	-0.5834	-0.8589	-1.1352	-2.6614
325	-2.0136	-0.0026	1.13939	-0.5584	-0.8522	-1.0352	-2.4328
326	-2.0903	-0.0584	1.11766	-0.3699	-0.9003	-1.313	-2.7821
327	-1.8818	0.03352	1.18153	-0.3408	-0.8293	-1.12	-2.6202

328	-1.9414	0.02449	1.17405	-0.3531	-0.8495	-1.2135	-2.5191
329	-1.8757	0.083	1.19406	-0.404	-0.745	-1.3314	-2.3819
330	-1.9771	-0.0095	1.11954	-0.4036	-0.8034	-1.4446	-3.2009
331	-1.7825	0.09631	1.24234	0.07949	-0.599	-1.1356	-2.2329
332	-1.9935	0.01425	1.23896	0.08274	-0.8723	-1.33	-2.3958
333	-1.8611	-0.0186	1.30907	-0.2045	-0.8542	-1.359	-2.2868
334	-1.8426	0.03676	1.35017	-0.4622	-0.7552	-1.236	-2.3469
335	-1.9591	0.01181	1.33354	-0.7344	-0.6673	-1.15	-2.4358
336	-1.871	-0.0177	1.24535	-0.6082	-0.6758	-1.1976	-2.6539
337	-2.0212	0.02878	1.28294	-0.616	-0.6261	-0.96	-2.9808
338	-1.8043	0.07929	1.34066	-0.8958	-0.6271	-0.8194	-2.418
339	-1.8677	-0.0755	1.25526	-1.0183	-0.7192	-0.9845	-2.8526
340	-1.8884	-0.0563	1.25858	-0.9962	-0.6937	-0.894	-2.5994
341	-2.0125	-0.185	1.17711	-1.0668	-0.7376	-0.7435	-2.9692
342	-2.0657	-0.1051	1.20771	-0.9545	-0.7544	-0.619	-2.748
343	-2.0203	-0.1038	1.18287	-0.9267	-0.8772	-0.7286	-2.6722
344	-2.131	-0.1013	1.06327	-0.9894	-0.9314	-0.8344	-2.7701
345	-2.0103	-0.0657	1.00937	-1.0505	-0.9442	-0.9047	-2.5277
346	-1.8569	-0.0726	1.03519	-1.2023	-1.0768	-1.1718	-2.5285
347	-1.9199	-0.0572	1.01562	-1.1684	-1.0146	-1.3508	-2.7755
348	-2.0525	-0.0368	0.99151	-1.0376	-0.9514	-1.3508	-2.6771
349	-1.8887	-0.0101	1.06328	-0.8682	-0.7622	-1.4525	-3.0509
350	-1.9641	-0.1048	0.94416	-0.991	-0.7899	-1.191	-3.0639
351	-1.8701	-0.0496	0.98341	-0.8585	-0.7989	-1.1966	-2.8455
352	-2.0244	-0.0897	0.94077	-0.9463	-1.0277	-1.5058	-3.0352
353	-1.7003	0.07368	1.08225	-0.707	-0.8007	-1.2875	-2.5659
354	-1.789	0.04286	1.11771	-0.7636	-0.893	-1.6894	-2.588
355	-1.8745	0.02898	0.96191	-0.7219	-1.1025	-1.5414	-2.6697
356	-1.8477	0.02749	0.7892	-0.7515	-1.1108	-1.8454	-2.7185
357	-2.0093	-0.0913	0.76302	-0.8508	-1.2624	-1.7421	-2.9491
358	-1.7835	0.01465	0.95994	-0.8046	-1.0171	-1.3212	-2.2844
359	-1.8736	-0.0254	1.01664	-0.8937	-0.9092	-1.4164	-2.6875
360	-1.8744	0.06695	1.07267	-0.5473	-0.684	-1.2381	-2.3291
361	-2.2739	-0.1093	1.02334	-0.8199	-0.6863	-1.0311	-2.449
362	-1.9617	-0.0214	1.25475	-0.858	-0.6019	-0.9205	-2.432
363	-2.1159	-0.0136	1.17551	-1.0548	-0.6122	-1.4124	-2.3133
364	-1.8845	-0.0191	1.22798	-1.1016	-0.5792	-1.4806	-2.6972
365	-2.0296	-0.0348	1.32723	-1.066	-0.4725	-1.1826	-2.6411
366	-1.902	-0.0261	1.38491	-0.8575	-0.4158	-1.194	-2.735
367	-1.9196	-0.0054	1.42413	-0.7871	-0.4774	-1.497	-2.5535
368	-1.962	0.03329	1.30052	-0.7435	-0.4577	-1.4221	-2.4185
369	-1.7583	0.10697	1.32018	-0.8214	-0.6107	-1.2756	-2.1125
370	-1.8439	0.07162	1.28043	-1.096	-0.6883	-1.5032	-2.7919
371	-1.8833	0.06476	1.27705	-0.9769	-0.6687	-1.7769	-2.9284
372	-1.7107	0.09246	1.35859	-0.7669	-0.5463	-1.4473	-2.636
373	-1.6641	0.10015	1.28244	-0.8244	-0.5649	-1.6125	-2.5302

374	-1.7843	0.06999	1.32649	-0.9254	-0.5138	-1.6013	-2.6934
375	-1.7428	0.10706	1.37929	-0.9146	-0.4609	-1.4526	-2.4482
376	-1.6759	0.11438	1.34309	-1.0058	-0.5559	-1.6409	-2.3551
377	-1.6573	0.08352	1.33366	-0.8022	-0.461	-1.5379	-2.45
378	-1.7255	0.09929	1.30924	-0.8936	-0.4908	-1.4496	-2.328
379	-1.6662	0.12326	1.30347	-0.6238	-0.4424	-1.6064	-2.4647
380	-1.7548	0.13253	1.29629	-0.8004	-0.5909	-2.4549	-2.3895
381	-1.8296	0.15404	1.30015	-0.783	-0.5589	-1.8296	-2.7392
382	-1.7706	0.08744	1.24148	-1.0149	-0.7964	-2.102	-2.8645
383	-1.7406	0.08272	1.36503	-0.9793	-0.5722	-1.5149	-2.4627
384	-1.7857	0.10744	1.38185	-0.8232	-0.4477	-1.0238	-2.4477
385	-1.9175	0.00169	1.29887	-0.892	-0.5	-1.0674	-3.1607
386	-1.9922	-0.0353	1.27686	-0.8844	-0.4146	-1.1799	-2.6331
387	-1.8173	0.08943	1.32079	-0.9346	-0.4227	-1.3934	-2.5488
388	-1.8835	0.01738	1.33364	-1.0191	-0.531	-1.2173	-2.5678
389	-2.0273	0.00504	1.30641	-1.0028	-0.5829	-1.1206	-2.4448
390	-1.8915	0.06147	1.31487	-0.9605	-0.6454	-0.9981	-2.649
391	-1.8771	0.00654	1.29234	-0.9594	-0.6308	-0.8327	-2.5968
392	-1.9514	-0.0675	1.20524	-1.0078	-0.8016	-1.1317	-2.5233
393	-1.8962	0.06808	1.27123	-0.9766	-0.7454	-0.931	-2.8196
394	-1.8514	0.08161	1.27861	-0.9013	-0.7711	-0.934	-2.7413
395	-1.8844	-0.0226	1.20939	-0.9282	-0.8987	-1.4677	-2.769
396	-1.9146	-0.0267	1.11962	-1.0465	-0.7981	-1.1302	-2.8087
397	-1.9756	0.03829	1.10522	-0.8115	-0.8512	-1.1245	-2.692
398	-2.066	-0.0519	1.15436	-0.8222	-0.7422	-1.2503	-2.4974
399	-1.7687	0.08107	1.25897	-0.7723	-0.7232	-1.0005	-2.4081
400	-1.9663	-0.0217	1.15971	-1.0772	-0.9466	-1.263	-3.0954
401	-2.0193	-0.0444	1.03924	-0.8575	-0.9285	-1.3071	-2.6838
402	-2.1574	-0.1432	1.02883	-0.7657	-0.7977	-1.2171	-2.7412
403	-1.9246	0.01589	1.0992	-0.8158	-0.7675	-1.2844	-2.7881
404	-1.9411	0.01374	1.10903	-0.9005	-0.8446	-1.0904	-2.75
405	-1.9467	0.02111	1.03944	-1.1241	-1.0495	-1.5298	-2.666
406	-1.92	-0.0279	1.06186	-1.236	-1.0437	-1.5278	-2.5046
407	-1.8768	-0.0175	1.05051	-1.0792	-0.9179	-1.4505	-3.1406
408	-1.9208	0.01998	1.07405	-1.0373	-0.8805	-1.3238	-2.7244
409	-2.0831	-0.075	0.96579	-1.127	-0.9344	-1.188	-2.89
410	-2.1021	-0.0831	0.97852	-1.0159	-0.8906	-1.1787	-3.005
411	-2.219	-0.2065	0.92128	-0.9555	-0.8518	-0.831	-3.1608
412	-2.0368	-0.1207	1.0253	-0.9215	-0.6866	-0.9631	-2.5267
413	-1.9758	-0.0513	1.06082	-0.7895	-0.7328	-0.8679	-2.8808
414	-1.9245	-0.0076	1.02542	-0.4938	-0.6266	-0.8521	-2.3669
415	-1.963	-0.0712	1.00315	-1.0198	-0.8241	-0.5012	-2.5445
416	-2.0502	-0.2052	1.0293	-1.1145	-0.9723	-0.4558	-2.7235
417	-2.0786	-0.1217	1.07829	-1.1184	-0.8638	-0.6286	-2.9092
418	-2.056	-0.0815	0.8977	-1.1009	-0.9811	-0.9594	-2.5763
419	-2.0112	-0.0622	0.83258	-0.8894	-0.9731	-0.9302	-3.0398

420	-1.9575	-0.0352	0.89074	-1.0439	-0.994	-0.8457	-2.8896
421	-1.8355	-0.066	1.12678	-1.1367	-0.9243	-0.7031	-2.6673
422	-2.0306	-0.3176	1.02121	-1.5625	-1.0477	-0.8828	-2.9874
423	-2.0873	-0.3224	1.02228	-1.0701	-1.0168	-0.9722	-3.046
424	-2.0112	-0.0581	1.02614	-0.7671	-0.9118	-0.9073	-2.7331
425	-1.8397	-0.0439	0.91641	-0.856	-1.0344	-1.2582	-2.5445
426	-1.893	-0.0352	0.95287	-1.0361	-0.9485	-1.2798	-2.9028
427	-1.9026	-0.0234	0.8843	-0.7599	-0.7884	-0.9622	-2.353
428	-1.8425	-0.0233	0.85056	-0.7087	-0.9273	-1.2267	-2.4421
429	-1.8037	-0.0054	0.82493	-0.9364	-1.1791	-1.4818	-2.4137
430	-1.6786	0.03063	0.75548	-0.9273	-1.2191	-1.6189	-2.7405
431	-1.7865	0.01016	0.65449	-0.6635	-1.0777	-1.2402	-2.9786
432	-1.7857	0.03795	0.62788	-0.5989	-1.0547	-1.214	-3.036
433	-1.8168	0.04081	0.6646	-0.6418	-1.1092	-1.2049	-2.9742
434	-1.7592	0.05945	0.61965	-0.4451	-1.0838	-1.1604	-2.7218
435	-1.7466	0.03406	0.7861	-0.2602	-0.9489	-1.0638	-2.6887
436	-1.7751	0.03062	0.83397	-0.4358	-1.2698	-1.3454	-2.7654
437	-1.7453	0.07391	0.56682	-0.567	-1.4134	-1.4961	-2.5323
438	-1.748	-0.0002	0.57636	-0.3192	-1.0497	-1.1976	-2.7879
439	-2.0823	-0.0974	0.63526	-0.2549	-0.948	-1.0828	-2.8677
440	-2.089	-0.0811	0.53628	-0.4659	-1.2777	-1.3664	-2.3959
441	-2.1311	-0.0597	0.30217	-0.3565	-1.2017	-1.4707	-2.6245
442	-2.203	-0.0927	0.46695	-0.5061	-1.17	-1.2163	-2.5734
443	-2.118	-0.045	0.4151	-0.4889	-1.121	-1.0777	-2.8424
444	-2.1188	-0.0553	0.33334	-0.5087	-1.2488	-1.2552	-2.3973
445	-1.8256	-0.0009	0.53616	-0.343	-0.9175	-1.1481	-2.5636
446	-1.8615	0.02322	0.64925	-0.447	-1.0674	-1.2761	-2.5464
447	-2.0539	-0.0023	0.6858	-0.4051	-1.0483	-1.158	-2.6219
448	-1.8787	-0.0098	0.80889	-0.5954	-1.0962	-1.1874	-2.3015
449	-1.9078	0.01352	0.64415	-0.8146	-1.1174	-1.2675	-2.9452
450	-1.8164	0.02609	0.82121	-1.1734	-0.9989	-1.4113	-2.6226
451	-1.8608	0.03743	0.89317	-0.9626	-0.9472	-1.3746	-2.4702
452	-1.8766	0.04644	0.95865	-1.0191	-0.9029	-1.3893	-2.656
453	-1.7973	0.03142	0.97286	-0.9782	-0.8454	-1.4049	-2.6728
454	-1.8024	0.03319	0.99972	-0.9275	-0.8253	-1.3869	-2.6292
455	-2.007	-0.0275	0.91871	-0.7902	-0.7675	-1.2524	-3.1426
456	-1.7493	0.097	1.04374	-0.7382	-0.652	-1.0959	-2.4761
457	-1.8088	0.05437	0.96952	-1.0137	-0.8526	-1.358	-2.6099
458	-1.7908	0.12998	1.03792	-0.8844	-0.7977	-1.3006	-2.3379
459	-1.8868	0.03613	0.95983	-0.9147	-0.8389	-1.4369	-2.6972
460	-1.8396	0.05518	0.96808	-0.8495	-0.7517	-1.3829	-2.3511
461	-1.9053	0.03111	1.03486	-0.7841	-0.6766	-1.2734	-2.7615
462	-2.36	0.01951	1.17295	-0.2806	0.01548	-0.4216	-1.4455
463	-2.2424	-0.0875	1.13723	-0.584	-0.7483	-1.2287	-2.5995
464	-2.0921	-0.024	1.19262	-0.6511	-0.8893	-1.4752	-3.0131
465	-2.0954	-0.1352	1.46008	-0.7764	-0.9063	-1.7873	-3.5925

466	-2.0501	0.01569	1.62295	-0.7598	-0.5825	-1.41	-3.6895
467	-2.094	-0.0398	1.14662	-1.0599	-0.7332	-1.1633	-2.8581
468	-1.987	-0.0059	1.20587	-0.8938	-0.7056	-1.1953	-3.0749
469	-1.9493	-0.0346	1.04733	-0.9832	-0.8634	-1.508	-3.8827
470	-1.943	0.08642	1.06869	-0.5002	-0.7641	-1.3756	-3.262
471	-1.8659	0.08339	1.06694	-0.6869	-0.6429	-1.3376	-3.1384
472	-1.9445	0.00218	1.01355	-0.9465	-0.9682	-1.5285	-3.4253
473	-1.9938	-0.0095	1.03684	-0.9434	-0.9643	-1.2207	-4.06
474	-1.9306	-0.0029	1.03689	-0.9539	-0.9866	-1.2949	-2.7304
475	-1.9138	-0.0196	0.96462	-1.0804	-0.8992	-1.3523	-3.1222
476	-1.8722	0.00588	0.90947	-0.9207	-0.9535	-1.1996	-3.1386
477	-1.8384	0.02295	0.85846	-1.0642	-0.9628	-0.6284	-2.7315
478	-2.0331	-0.0379	0.7745	-1.1759	-1.1171	-0.7036	-3.1224
479	-1.9063	0.03352	0.62355	-1.1174	-1.0156	-0.8413	-2.7614
480	-1.9635	-0.0152	0.55847	-1.117	-1.1694	-0.9416	-2.2792
481	-2.1455	-0.0814	0.57699	-1.0028	-1.0171	-0.9454	-2.6117
482	-2.2013	-0.1147	0.62235	-0.9642	-1.0676	-0.9625	-2.4769
483	-2.0922	-0.071	0.692	-0.9897	-1.0209	-0.8418	-2.2786
484	-2.0578	0.00232	0.69701	-1.0662	-1.1011	-0.9592	-2.5636
485	-1.9835	-0.0558	0.59558	-1.1854	-1.2208	-1.2003	-2.6
486	-2.0152	-0.0729	0.64979	-1.0549	-1.0689	-0.926	-2.6445
487	-1.8631	0.05307	0.99018	-0.8344	-0.8997	-0.927	-2.6836
488	-1.9696	0.12884	1.16513	-0.9192	-0.7372	-1.1408	-2.6142
489	-1.938	0.06382	0.99356	-0.9831	-0.9545	-1.3365	-2.7895
490	-2.0178	-0.0083	0.88368	-1.0165	-0.8981	-1.1568	-2.8883
491	-1.9792	0.05393	0.94208	-0.9943	-0.9793	-1.1683	-2.8773
492	-1.9271	0.09875	1.0782	-1.0264	-0.8738	-1.2638	-2.5006
493	-1.9881	0.07613	1.16552	-1.0104	-0.7979	-1.5274	-2.4533
494	-2.1368	-0.0345	1.00071	-0.9447	-0.9078	-1.3151	-2.6174
495	-1.8617	0.09101	1.07914	-0.8705	-0.9324	-1.3517	-2.4547
496	-1.9403	-0.002	1.04954	-1.0732	-1.095	-1.497	-2.8687
497	-1.876	0.07542	1.09423	-1.0038	-1.0869	-1.2397	-2.7299
498	-2.0101	-0.0019	1.01635	-1.0978	-1.1289	-1.2458	-2.7632
499	-1.8643	0.02941	0.98593	-1.1657	-1.2081	-1.3198	-2.8948
500	-1.8669	0.06186	1.0844	-1.0036	-1.0603	-1.2982	-3.0923
501	-1.889	0.06608	1.06949	-1.2179	-1.0663	-1.3691	-2.83
502	-1.8995	0.00468	0.96901	-1.0292	-1.0762	-1.3208	-2.368
503	-1.8399	0.01049	0.95417	-0.6101	-1.0532	-1.4623	-2.4839
504	-1.8233	0.05403	0.83881	-0.3208	-1.0935	-1.5819	-2.8712
505	-1.8941	0.01467	0.83837	-0.6952	-1.1946	-1.4834	-2.5951
506	-1.8749	0.02075	0.83711	-0.7998	-1.277	-1.7031	-2.4191
507	-2.0505	0.03445	0.79183	-0.9416	-1.2933	-1.0721	-2.5912
508	-1.7936	0.04809	0.87467	-0.9401	-0.9963	-0.9862	-2.7077
509	-1.8684	0.09319	0.84039	-1.0689	-1.1663	-0.765	-2.4093
510	-1.9125	0.04446	0.86211	-0.9832	-1.0222	-0.8734	-2.4873
511	-1.956	-0.0256	0.75186	-0.6662	-1.1415	-0.8951	-2.824

512	-1.9626	0.00117	0.70728	-0.7979	-1.1416	-1.0855	-2.5211
513	-1.8771	0.03986	0.81277	-1.1004	-1.0532	-1.2603	-2.29
514	-2.0262	0.04824	0.83062	-0.969	-0.9529	-1.381	-2.2827
515	-1.8756	0.03016	0.83094	-0.9563	-1.0628	-1.3292	-2.7148
516	-1.9921	0.04702	0.92654	-0.7828	-0.8772	-1.3762	-2.5254
517	-1.8033	0.14486	0.99181	-0.8664	-0.9116	-1.3853	-2.4904
518	-2.0345	-0.029	0.75583	-1.1463	-1.1449	-1.6352	-2.7463
519	-1.88	-0.004	0.81838	-1.1085	-1.0717	-1.4825	-2.8447
520	-1.8571	0.04339	0.99894	-0.9648	-0.9118	-1.5945	-2.9011
521	-1.9035	0.10668	1.0357	-0.8977	-0.9316	-1.4746	-2.5117
522	-1.9416	0.0377	0.93551	-1.0553	-0.912	-1.6292	-2.8832
523	-1.9921	-0.0361	0.8854	-0.9695	-1.0618	-1.4113	-2.7052
524	-1.9412	0.05301	0.9831	-1.0483	-0.9866	-1.5827	-2.7039
525	-1.9098	0.05743	0.946	-1.0633	-0.9216	-1.3765	-2.8687
526	-1.9333	0.04236	1.0462	-1.1672	-0.9342	-1.4494	-2.3746
527	-1.8226	0.06567	1.00334	-1.0646	-1.0011	-1.3128	-2.3639
528	-1.9115	0.00059	0.85342	-1.0668	-1.0963	-1.5915	-2.5308
529	-1.8103	0.07071	0.87682	-0.8552	-1.0787	-1.5149	-2.4731
530	-1.9931	0.09704	0.89117	-0.8663	-0.8634	-1.5736	-2.4799
531	-1.9596	0.02748	0.92863	-1.0286	-0.9482	-1.6981	-2.9015
532	-1.9402	0.03576	0.88061	-1.0779	-0.9683	-1.6165	-3.313
533	-1.937	0.08716	1.00117	-1.0594	-0.9165	-1.8996	-2.7528
534	-1.948	0.02965	1.01635	-1.3324	-1.0233	-1.4954	-3.0668
535	-1.8843	0.01649	1.02313	-1.2566	-0.9048	-1.2914	-2.3301
536	-1.9767	-0.0147	1.03878	-1.4255	-0.8663	-1.3571	-2.3804
537	-2.0913	0.01926	1.07109	-1.3534	-0.8517	-1.0525	-2.4582
538	-1.9217	0.0447	1.03672	-1.3073	-0.9204	-1.1335	-2.779
539	-1.9113	0.04124	1.02948	-1.3274	-0.8553	-1.2275	-2.6149
540	-2.0584	0.07016	1.04137	-1.3773	-0.8961	-1.3266	-2.4556
541	-1.9256	0.06491	1.13237	-1.2811	-0.8522	-1.3738	-2.3564
542	-1.8591	0.05799	1.14719	-1.4135	-0.8109	-1.6074	-2.6631
543	-1.8458	0.0668	1.10807	-1.3308	-0.7974	-1.5281	-2.798
544	-1.8091	0.07332	1.04621	-1.3299	-0.9137	-1.5373	-2.5819
545	-1.8384	0.04124	1.06916	-1.3004	-0.9581	-1.5755	-2.5469
546	-1.9255	0.10544	1.08096	-1.251	-0.8592	-1.4635	-2.3103
547	-2.0247	0.06955	0.98295	-1.2274	-0.9037	-1.6262	-2.5113
548	-1.9477	0.04419	0.97753	-1.0307	-0.8249	-1.5555	-3.1115
549	-1.9518	0.0686	0.97527	-1.0046	-0.7458	-1.4089	-2.8963
550	-2.0903	-0.0099	0.90502	-1.1452	-0.8686	-1.8711	-2.5996
551	-1.9968	0.01767	0.84659	-1.0071	-0.8354	-1.63	-2.9375
552	-2.03	0.06163	0.88232	-1.0432	-0.8343	-1.6665	-2.6785
553	-1.9815	-0.0321	0.78384	-1.051	-0.8075	-1.5283	-2.6712
554	-2.0292	0.04282	0.84776	-1.0527	-0.8141	-1.5997	-2.5135
555	-1.9236	0.0225	0.83275	-1.0518	-0.7158	-1.3624	-2.6972
556	-1.963	0.0151	0.77731	-1.1339	-0.7933	-1.5897	-2.5906
557	-1.9959	-0.001	0.92035	-1.2189	-0.8685	-1.6767	-2.6599

558	-1.9993	-0.0144	1.01416	-1.1222	-0.7412	-1.3383	-2.4878
559	-2.0958	-0.0105	1.16105	-0.7078	-0.4171	-1.0596	-2.4913
560	-1.7935	0.0263	1.2002	-0.8542	-0.516	-1.3319	-2.4855
561	-1.8888	0.04201	1.11506	-1.1353	-0.6356	-1.5401	-2.8693
562	-1.8417	0.07453	1.27439	-0.9877	-0.6114	-1.5655	-2.5988
563	-1.8884	0.03676	1.28306	-1.0338	-0.6383	-1.5783	-2.542
564	-1.9155	0.09062	1.33008	-1.0049	-0.5679	-1.5418	-2.511
565	-1.834	0.06665	1.23647	-0.9964	-0.6053	-1.6572	-2.9378
566	-2.0265	0.0023	1.28843	-0.7754	-0.5	-1.6688	-3.0359
567	-2.1306	-0.0111	1.15712	-0.9798	-0.6308	-1.742	-3.2369
568	-2.1117	-0.0237	1.19522	-1.0983	-0.6974	-1.5992	-3.1854
569	-2.0181	0.04873	1.21552	-1.1612	-0.6959	-1.5937	-2.8419
570	-1.995	-0.001	1.1651	-1.1645	-0.7466	-1.8218	-3.1954
571	-1.8972	0.06457	1.33771	-1.0376	-0.6097	-1.7335	-2.7627
572	-1.8623	0.11199	1.25013	-1.0461	-0.6658	-1.7219	-2.5451
573	-1.9414	0.03249	1.23727	-1.119	-0.6186	-1.5378	-2.8577
574	-1.8158	0.04414	1.31978	-1.2197	-0.509	-1.6265	-2.7536
575	-1.8804	0.05896	1.34588	-1.3089	-0.5165	-1.6447	-3.0017
576	-1.8911	0.0805	1.33327	-1.3988	-0.538	-1.4692	-2.4863
577	-1.8462	0.04143	1.28401	-1.5076	-0.5693	-1.5174	-2.6004
578	-2.0291	-0.0032	1.36668	-1.2972	-0.4674	-1.5309	-2.7678
579	-1.7295	0.10934	1.50856	-0.9704	-0.3814	-1.2955	-2.3613
580	-1.7552	0.06305	1.60462	-1.2129	-0.4003	-1.2694	-2.7661
581	-1.7593	0.08112	1.56414	-1.2319	-0.3353	-1.1759	-2.7436
582	-1.8802	0.02783	1.55409	-1.2242	-0.4375	-1.2609	-2.5667
583	-1.7539	0.05741	1.61854	-1.1954	-0.3757	-1.2855	-2.6488
584	-1.9263	-0.0487	1.49006	-1.0683	-0.5004	-1.5066	-3.0187
585	-1.7504	0.03141	1.57497	-0.8539	-0.4383	-1.4374	-3.0968
586	-1.9461	0.02732	1.54223	-0.8698	-0.4268	-1.3648	-2.41
587	-1.8739	0.07012	1.5534	-0.9141	-0.369	-1.73	-2.2106
588	-1.9409	0.01077	1.57399	-0.9286	-0.397	-1.6016	-2.5568
589	-1.9135	0.00123	1.54472	-0.9887	-0.3973	-1.4669	-2.5716
590	-1.936	0.03812	1.56889	-1.0865	-0.3999	-1.496	-2.8748
591	-1.7781	0.03035	1.58919	-1.1688	-0.4309	-1.6827	-2.8609
592	-1.8574	0.0881	1.5829	-1.2059	-0.4453	-1.7165	-3.1754
593	-1.7976	0.13753	1.59822	-1.0575	-0.4078	-1.6326	-2.4927
594	-1.8831	0.01514	1.56847	-1.1244	-0.4932	-1.5333	-2.4676
595	-1.9296	0.09295	1.48686	-0.9972	-0.4672	-1.6272	-2.4655
596	-1.7934	0.11529	1.58421	-0.996	-0.348	-1.5527	-2.5462
597	-1.8832	0.13927	1.47816	-1.0946	-0.4255	-1.5535	-2.6133
598	-1.8866	0.09633	1.53928	-1.012	-0.3936	-1.6034	-2.3273
599	-1.8993	0.09848	1.65105	-1.0054	-0.3933	-1.5515	-2.6005
600	-1.9744	0.1104	1.53823	-1.0816	-0.4174	-1.4511	-2.961
601	-1.9497	0.06047	1.5249	-1.2571	-0.5543	-1.6053	-2.5875
602	-1.8804	0.11426	1.57154	-1.2815	-0.4676	-1.3184	-2.5651
603	-1.8539	0.14847	1.59461	-1.276	-0.4188	-1.4652	-2.4727

604	-1.9351	0.07083	1.54686	-1.252	-0.4069	-1.6166	-2.5189
605	-2.0115	0.02669	1.45933	-1.2983	-0.4872	-1.738	-2.9142
606	-1.888	0.07997	1.52371	-1.1944	-0.476	-1.5463	-2.8646
607	-1.945	0.04676	1.48544	-1.1477	-0.5136	-1.7811	-2.636
608	-1.9595	0.0532	1.40031	-1.1637	-0.5765	-1.6754	-2.52
609	-1.8574	0.12289	1.47611	-1.0643	-0.3772	-1.5319	-2.4286
610	-1.8921	0.0412	1.42202	-1.1752	-0.6095	-1.6818	-2.4079
611	-1.9249	0.05261	1.40398	-1.2117	-0.5587	-1.5232	-3.0529
612	-1.829	0.11192	1.38928	-1.1597	-0.5442	-1.7439	-2.6542
613	-1.8026	0.16586	1.47889	-1.1989	-0.5766	-1.8875	-2.7609
614	-1.8254	0.18786	1.50914	-1.3351	-0.5781	-2.1782	-2.8982
615	-1.985	0.09318	1.37346	-1.1913	-0.5143	-2.0093	-2.5406
616	-1.9487	0.15829	1.43448	-1.2022	-0.5166	-1.9073	-2.7208
617	-1.9719	0.11172	1.41958	-1.1762	-0.5251	-2.3558	-2.5537
618	-1.9132	0.10734	1.41833	-1.1649	-0.5251	-1.8559	-2.7898
619	-1.8662	0.11981	1.52437	-1.2351	-0.4879	-1.6901	-2.5528
620	-1.8721	0.06674	1.43155	-1.2316	-0.5401	-1.536	-2.3149
621	-1.8862	0.04117	1.417	-1.1428	-0.4228	-1.7931	-2.4217
622	-1.8461	0.02332	1.43052	-1.2514	-0.5831	-1.7619	-2.5231
623	-1.8942	0.06917	1.49535	-1.1931	-0.5372	-1.6994	-2.4259
624	-1.9884	0.06542	1.39368	-1.1411	-0.496	-1.7678	-2.7622
625	-2.0118	0.12211	1.44342	-1.1537	-0.4154	-1.9766	-2.7284
626	-1.9279	0.1005	1.5156	-1.1879	-0.3604	-1.9631	-2.7305
627	-1.9479	0.08298	1.53318	-1.3365	-0.3904	-2.1418	-2.9402
628	-1.8401	0.14647	1.52938	-1.2642	-0.4072	-2.2256	-2.5218
629	-1.8761	0.20005	1.65707	-1.337	-0.3898	-1.493	-2.4719
630	-1.9897	0.07021	1.46131	-1.2105	-0.4076	-1.9157	-2.8413
631	-2.0314	0.15302	1.59795	-1.2398	-0.363	-2.067	-2.3031
632	-1.8571	0.14737	1.57527	-1.1197	-0.372	-1.6821	-2.5279
633	-1.8721	0.12575	1.53846	-1.0236	-0.3548	-1.9155	-2.2067
634	-1.9148	0.04292	1.40007	-1.1984	-0.4207	-2.0233	-2.4337
635	-2.0464	-0.0198	1.40543	-1.2847	-0.4681	-2.109	-2.7323
636	-1.9324	0.0633	1.40432	-1.1486	-0.3724	-1.8734	-2.5065
637	-1.8897	0.06588	1.40059	-1.1838	-0.4368	-1.9193	-2.4468
638	-1.8623	0.07471	1.39108	-1.2401	-0.4359	-1.6238	-2.5816
639	-1.9842	0.0563	1.40887	-1.2399	-0.4349	-2.0683	-2.6473
640	-1.9956	-0.0029	1.38289	-1.0611	-0.5627	-1.9354	-2.7338
641	-1.8407	0.02249	1.46062	-1.1856	-0.5401	-1.5761	-2.8787
642	-1.8852	-0.011	1.4817	-1.2021	-0.5693	-1.8782	-2.6807
643	-1.7742	0.11368	1.48139	-1.0303	-0.4398	-1.7424	-2.5161
644	-1.8824	0.06387	1.52839	-1.2169	-0.463	-1.6093	-2.8253
645	-1.8088	0.04771	1.53286	-1.2651	-0.459	-1.7575	-2.6936
646	-1.8602	0.08053	1.44273	-1.286	-0.4932	-1.7252	-2.6364
647	-1.7429	0.10083	1.50504	-1.3293	-0.4905	-1.812	-2.6342
648	-1.7829	0.09992	1.46658	-1.2123	-0.4849	-1.6878	-2.3321
649	-1.8488	-0.0048	1.3693	-1.3578	-0.5089	-2.0409	-3.4338

650	-1.9638	-0.0528	1.39736	-1.417	-0.5733	-1.89	-2.9295
651	-1.7563	0.11548	1.5473	-1.1782	-0.4049	-1.9483	-2.6492
652	-1.8015	0.09814	1.4584	-1.308	-0.4786	-1.7735	-2.2995
653	-1.8334	0.04492	1.46576	-1.427	-0.4744	-1.477	-2.5354
654	-1.8256	0.11277	1.58181	-1.3507	-0.4221	-1.8094	-2.6146
655	-1.7993	0.0433	1.41957	-1.496	-0.5184	-1.8169	-2.7863
656	-1.8787	0.03542	1.46741	-1.3321	-0.4328	-1.7524	-2.574
657	-1.8884	0.03637	1.42728	-1.3384	-0.4145	-1.7166	-2.3959
658	-1.8601	0.07669	1.46548	-1.3052	-0.3936	-1.6641	-2.2454
659	-1.8225	0.13774	1.50699	-1.3843	-0.4385	-1.6994	-2.8894
660	-1.7651	0.13068	1.54358	-1.314	-0.4981	-1.8345	-2.4965
661	-1.787	0.14929	1.49958	-1.3788	-0.4875	-1.7689	-2.4268
662	-1.8114	0.11391	1.53214	-1.3302	-0.4752	-1.9712	-2.6142
663	-1.7636	0.18256	1.59161	-1.1909	-0.5082	-1.6819	-2.6387
664	-1.8692	0.04541	1.47981	-1.3509	-0.531	-1.5948	-2.4854
665	-1.9644	0.05895	1.44008	-1.2611	-0.4751	-1.9178	-2.4905
666	-1.8616	0.12567	1.56391	-1.2186	-0.4156	-1.4912	-2.4406
667	-1.8584	0.10841	1.50264	-1.1481	-0.4619	-1.6658	-2.5942
668	-1.8706	0.01575	1.50406	-1.2365	-0.5347	-1.9173	-2.8342
669	-1.841	0.15071	1.55209	-1.16	-0.4622	-1.317	-2.2953
670	-1.7293	0.15074	1.57259	-1.0627	-0.4172	-1.1456	-2.1557
671	-1.8674	0.12625	1.52923	-1.074	-0.5024	-1.764	-2.5075
672	-1.8149	0.1559	1.53434	-1.0875	-0.4399	-1.4196	-2.7128
673	-1.8352	0.15443	1.53568	-1.0496	-0.5229	-1.5209	-2.168
674	-1.8954	0.04789	1.58105	-1.2407	-0.4807	-1.8852	-2.4285
675	-1.9159	0.0188	1.56547	-1.2521	-0.4912	-1.6519	-2.7573
676	-1.9359	-0.0107	1.38537	-1.3196	-0.579	-1.7915	-2.6387
677	-1.8564	0.12923	1.54435	-1.1907	-0.5164	-1.5737	-2.7359
678	-1.7023	0.15333	1.69691	-1.1551	-0.5368	-1.4888	-2.3746
679	-1.8288	0.07103	1.52002	-1.3257	-0.5714	-1.5658	-2.4953
680	-1.8714	0.07837	1.59082	-1.2188	-0.4039	-1.6803	-2.6745
681	-1.865	0.0301	1.58729	-1.2682	-0.4528	-1.7746	-2.441
682	-1.8489	0.10287	1.5148	-1.2338	-0.4373	-1.5426	-2.503
683	-1.8112	0.13661	1.46402	-1.2714	-0.5263	-1.746	-2.73
684	-1.8626	0.09652	1.47178	-1.3231	-0.5107	-1.8363	-2.5998
685	-1.8337	0.12537	1.5027	-1.3244	-0.5018	-1.6719	-2.3221
686	-1.7681	0.13259	1.45116	-1.2948	-0.5164	-1.811	-2.4163
687	-1.9331	0.06506	1.4342	-1.2366	-0.4929	-1.7457	-2.7044
688	-1.7966	0.06847	1.50706	-1.256	-0.5746	-1.666	-2.7105
689	-1.8225	0.1149	1.48529	-1.2717	-0.5294	-1.5971	-2.5879
690	-1.773	0.06224	1.44397	-1.401	-0.6474	-1.7606	-2.7873
691	-1.9259	-0.0017	1.4071	-1.471	-0.6689	-1.7737	-2.983
692	-1.8107	0.06416	1.51675	-1.3089	-0.6911	-1.6435	-2.6929
693	-1.7926	0.05772	1.45509	-1.042	-0.6736	-1.9118	-2.7829
694	-1.7262	0.1128	1.59981	-1.0184	-0.5876	-1.4828	-2.7833
695	-1.9151	0.03383	1.48936	-1.3041	-0.6155	-1.5214	-2.5995

696	-1.8501	0.06761	1.66038	-1.3058	-0.4731	-1.6466	-2.692
697	-1.8287	0.07695	1.56808	-1.2853	-0.552	-1.6459	-2.58
698	-1.7656	0.08992	1.52092	-1.4292	-0.546	-1.5958	-2.7125
699	-1.8549	0.03298	1.47882	-1.4769	-0.575	-1.5357	-2.5303
700	-1.8096	0.12058	1.55332	-1.134	-0.4998	-1.7296	-2.3486
701	-1.8232	0.147	1.60584	-1.2946	-0.4967	-1.5424	-2.5287
702	-1.6081	0.16149	1.62379	-1.3566	-0.4015	-1.6158	-2.3443
703	-1.7333	0.06133	1.26825	-1.4042	-0.6846	-1.9113	-2.6205
704	-1.9009	0.05484	1.13918	-1.5139	-0.8602	-2.1315	-2.8559
705	-1.7905	0.09988	1.28926	-1.236	-0.6836	-1.8696	-2.7082
706	-2.1692	0.00189	1.25481	-1.2391	-0.454	-1.6096	-2.3113
707	-2.1339	-0.0098	1.29347	-1.2678	-0.4818	-1.699	-2.5751
708	-1.9921	0.00798	1.37773	-1.136	-0.4886	-1.3134	-2.3456
709	-1.9292	0.07697	1.41131	-1.2355	-0.5509	-1.5914	-2.4794
710	-1.9072	0.05987	1.28604	-1.2949	-0.6522	-1.6594	-2.6422
711	-1.888	0.03748	1.33924	-1.3792	-0.6357	-2.05	-2.5521
712	-1.828	0.10382	1.39205	-1.2941	-0.5622	-1.5329	-2.8827
713	-1.7831	0.06562	1.3947	-1.3285	-0.5533	-1.9268	-2.5981
714	-1.8252	0.11806	1.45772	-1.3824	-0.4333	-1.6696	-2.6002
715	-1.8786	0.03053	1.41178	-1.3538	-0.4853	-1.6077	-2.6542
716	-1.7649	0.13454	1.48569	-1.0159	-0.4322	-1.5214	-2.536
717	-1.6975	0.19839	1.45903	-1.1855	-0.3933	-1.8341	-2.5701
718	-1.8463	0.11461	1.47252	-1.1371	-0.4022	-1.9609	-2.3853
719	-1.9704	0.05478	1.38565	-1.3397	-0.4316	-1.7461	-2.4383
720	-1.8323	0.11113	1.41538	-1.4036	-0.4555	-2.1821	-2.5285
721	-1.7746	0.15413	1.4076	-1.334	-0.4965	-1.6614	-2.213
722	-1.9287	0.08933	1.37578	-1.4377	-0.6214	-1.761	-2.5625
723	-1.8958	0.09707	1.31571	-1.3861	-0.5019	-2.0919	-3.0132
724	-1.9619	0.07038	1.29339	-1.4184	-0.6037	-1.9253	-2.7338
725	-1.9441	0.025	1.29567	-1.4152	-0.6417	-1.6868	-2.5937
726	-1.8878	0.08851	1.35294	-1.366	-0.5445	-1.594	-3.2394
727	-1.8372	-0.0077	1.35888	-1.4742	-0.6222	-1.5749	-3.1442
728	-1.8863	0.00031	1.39395	-1.5605	-0.6387	-1.2707	-2.8564
729	-1.8059	0.08015	1.6105	-1.4427	-0.4652	-1.5505	-2.5873
730	-1.8602	0.04231	1.52952	-1.4863	-0.4723	-1.5136	-2.5047
731	-1.896	-0.0036	1.44532	-1.4678	-0.5351	-1.5605	-2.6132
732	-1.9328	0.07845	1.44174	-1.4971	-0.497	-1.5432	-2.8298
733	-2.0459	0.03224	1.39004	-1.4274	-0.5704	-1.5648	-2.4854
734	-1.9413	0.10078	1.34274	-1.315	-0.6024	-1.6406	-2.704
735	-1.93	0.09793	1.40237	-1.2944	-0.5668	-1.3809	-2.428
736	-2.02	0.06354	1.39829	-1.2747	-0.566	-1.5715	-2.3818
737	-1.8811	0.08558	1.39637	-1.1822	-0.5174	-1.2594	-2.612
738	-1.9081	0.03602	1.40817	-1.3066	-0.4748	-1.146	-2.7353
739	-1.9249	0	1.36116	-1.4382	-0.5093	-1.2831	-2.8049
740	-1.9198	0.0788	1.43718	-1.4162	-0.4749	-1.4047	-2.6657
741	-1.9193	0.05774	1.50848	-1.3252	-0.483	-1.4329	-2.716

742	-1.8874	0.04776	1.41504	-1.1498	-0.5749	-1.8938	-2.7878
743	-1.8579	0.07944	1.39114	-1.1815	-0.5176	-1.5246	-2.5118
744	-1.8373	0.0655	1.4002	-1.2151	-0.4892	-1.6757	-2.4617
745	-1.9108	0.13437	1.45223	-1.1882	-0.4065	-1.5143	-2.3304
746	-1.9991	0.02293	1.38625	-1.3135	-0.5155	-1.537	-2.5417
747	-1.9951	0.07179	1.35179	-1.3511	-0.5013	-1.5749	-2.6397
748	-1.8862	0.06296	1.39638	-1.3084	-0.5066	-1.5707	-2.9453
749	-1.9406	0.07659	1.31916	-1.3834	-0.5855	-1.6699	-2.4945
750	-1.9965	0.04664	1.31602	-1.3833	-0.5594	-1.7987	-2.7431
751	-1.931	0.05539	1.30716	-1.2697	-0.5574	-1.5271	-2.6338
752	-1.9268	0.06833	1.40638	-1.0721	-0.5595	-1.7259	-2.7721
753	-2.04	0.07371	1.31063	-1.2381	-0.5922	-1.7316	-2.4102
754	-1.9599	0.08228	1.2553	-1.3543	-0.5536	-1.7988	-2.4216
755	-1.9549	0.06848	1.25879	-1.3779	-0.5668	-1.7584	-2.6304
756	-1.9442	0.03592	1.24291	-1.5031	-0.5919	-1.6577	-2.6386
757	-1.8572	0.07049	1.34551	-1.202	-0.4089	-1.5842	-2.4833
758	-1.9394	0.06763	1.19917	-1.3342	-0.5415	-1.7088	-2.8074
759	-1.8429	0.0713	1.18142	-1.2519	-0.4691	-1.7581	-2.6952
760	-1.9222	0.06686	1.21695	-1.2952	-0.5467	-1.7329	-2.4126
761	-1.8301	0.09011	1.34657	-1.2521	-0.4399	-1.6214	-2.3409
762	-1.9854	0.07813	1.29558	-1.3257	-0.4701	-1.69	-2.4548
763	-2.0054	0.0532	1.29998	-1.5026	-0.5333	-1.7989	-2.4984
764	-1.9415	0.03875	1.24415	-1.3665	-0.5328	-1.8005	-2.4732
765	-2.0159	-0.0099	1.26028	-1.516	-0.5527	-1.5046	-2.6866
766	-1.8965	0.081	1.3526	-1.3149	-0.5272	-1.8098	-2.503
767	-1.9532	0.0514	1.32805	-1.2829	-0.4722	-1.692	-2.7709
768	-1.8975	0.05727	1.40074	-1.3946	-0.5355	-1.7388	-2.8662
769	-2.0029	0.02767	1.37034	-1.3291	-0.4863	-1.7773	-2.8259
770	-1.905	0.05717	1.38466	-1.156	-0.503	-1.8534	-2.6458
771	-1.8794	0.02148	1.36477	-1.304	-0.5727	-1.7095	-2.6228
772	-1.9582	-0.0585	1.34681	-1.2575	-0.518	-1.8382	-2.6291
773	-1.9241	-0.0348	1.29914	-1.3329	-0.6141	-1.7711	-2.7054
774	-1.892	-0.0395	1.31522	-1.3527	-0.6679	-1.6572	-2.6213
775	-1.9231	0.10008	1.34622	-1.3236	-0.4863	-1.6023	-2.3475
776	-1.8889	0.09538	1.26047	-1.1903	-0.551	-1.6294	-2.2634
777	-1.9834	0.02105	1.30989	-1.265	-0.5798	-1.8573	-2.6874
778	-1.9362	0.03005	1.2719	-1.3281	-0.5586	-1.5019	-2.623
779	-1.8334	0.08881	1.35379	-1.3404	-0.5907	-1.5999	-2.5027
780	-1.8768	0.05072	1.3424	-1.2152	-0.5286	-1.5529	-2.4303
781	-2.0458	0.03739	1.27995	-1.3344	-0.5683	-2.0031	-2.6027
782	-1.8915	0.09564	1.29419	-1.232	-0.4603	-1.5659	-2.5157
783	-1.9246	0.02213	1.26384	-1.4366	-0.6248	-1.5968	-2.658
784	-1.8164	0.06333	1.3816	-1.4218	-0.4965	-1.5723	-2.376
785	-1.8556	0.02399	1.32064	-1.4061	-0.5301	-1.6093	-2.4786
786	-1.8366	0.0209	1.37445	-1.3743	-0.5348	-1.752	-2.6798
787	-1.8302	0.05797	1.37459	-1.2711	-0.433	-1.8056	-2.7965

788	-1.7981	0.06707	1.41105	-1.2609	-0.4158	-1.6194	-2.6018
789	-1.881	0.02289	1.41355	-1.374	-0.4617	-1.6978	-2.8075
790	-1.9096	-0.0159	1.40631	-1.3942	-0.4712	-1.7155	-2.5417
791	-1.8912	0.04598	1.37069	-1.2799	-0.4225	-1.5887	-2.4662
792	-2.0326	0.06035	1.34024	-1.4089	-0.4726	-1.6579	-3.1217
793	-1.9087	0.03649	1.31741	-1.3672	-0.3986	-1.631	-2.6849
794	-2.0252	0.00548	1.27735	-1.5309	-0.5828	-1.7853	-3.0039
795	-1.9304	0.03719	1.32678	-1.3279	-0.4849	-2.0429	-2.4024
796	-1.9552	0.03353	1.31552	-1.3829	-0.4754	-1.7511	-2.6729
797	-1.9691	0.04857	1.30815	-1.3875	-0.5225	-1.6826	-2.8369
798	-1.9471	0.06488	1.36698	-1.3751	-0.497	-1.7995	-2.6896
799	-1.8044	0.09471	1.40742	-1.3321	-0.514	-1.7691	-2.6777
800	-1.797	0.11744	1.47997	-1.3475	-0.4598	-1.7225	-2.352
801	-1.9234	0.05885	1.3819	-1.3765	-0.5018	-1.495	-2.7016
802	-1.7213	0.13143	1.42249	-1.3279	-0.4688	-1.5204	-2.4552
803	-1.8495	0.08527	1.4894	-1.5167	-0.4999	-1.666	-2.7703
804	-1.9805	0.01553	1.40628	-1.3601	-0.4653	-1.6667	-2.6382
805	-1.9119	0.05941	1.36643	-1.4337	-0.4679	-1.6565	-2.5829
806	-1.9118	0.07114	1.44663	-1.3468	-0.5397	-1.7718	-2.7513
807	-1.995	0.03847	1.37939	-1.3645	-0.5725	-1.8137	-2.5561
808	-1.8716	0.05019	1.29586	-1.324	-0.5231	-1.6148	-2.9496
809	-1.9058	0.06215	1.33778	-1.3066	-0.4305	-1.6841	-2.9276
810	-1.7813	0.11628	1.41025	-1.2482	-0.458	-1.4718	-2.4834
811	-1.9024	0.0869	1.29132	-1.1895	-0.403	-1.4936	-2.4496
812	-2.0696	0.02867	1.26589	-1.3901	-0.5349	-1.9048	-2.5752
813	-1.9794	0.07831	1.34898	-1.3285	-0.5297	-1.7306	-2.444
814	-1.8312	0.09392	1.29709	-1.2686	-0.5676	-1.5739	-2.3528
815	-1.7786	0.07442	1.36022	-1.3583	-0.4447	-1.552	-2.5468
816	-1.8794	0.089	1.42692	-1.2303	-0.4456	-1.61	-2.541
817	-1.9217	0.08658	1.33328	-1.3771	-0.5037	-1.5124	-2.9276
818	-1.9019	0.06072	1.37104	-1.3377	-0.4455	-1.6993	-2.308
819	-1.8156	0.16825	1.41121	-1.3476	-0.4148	-1.5183	-2.2602
820	-1.9151	0.09233	1.28906	-1.3465	-0.4925	-1.6483	-2.3013
821	-1.7818	0.09137	1.38334	-1.1459	-0.4281	-1.2125	-2.2635
822	-2.0124	0.02627	1.2226	-1.333	-0.4919	-1.5114	-2.3341
823	-1.7918	0.06342	1.46078	-1.2293	-0.3947	-0.9157	-2.2471
824	-1.972	-0.0202	1.41707	-1.5223	-0.4838	-1.0919	-2.5129
825	-1.8617	-0.0149	1.56402	-1.5798	-0.4791	-1.4332	-2.8021
826	-1.9712	0.0137	1.37398	-1.3696	-0.3923	-1.1867	-3.0563
827	-2.0232	-0.0221	1.47907	-1.2805	-0.3383	-1.1728	-2.7101
828	-2.0097	-0.0243	1.35289	-1.224	-0.4229	-1.4747	-2.4579
829	-1.8759	0.11015	1.47438	-1.0963	-0.3487	-1.5287	-2.2179
830	-1.8837	0.0409	1.42993	-1.1067	-0.4447	-1.4748	-2.3736
831	-1.9554	0.05255	1.28158	-1.1635	-0.5114	-1.5686	-2.7896
832	-1.8706	0.02684	1.30034	-1.25	-0.4764	-1.5645	-2.3526
833	-1.8838	0.08503	1.40538	-1.2365	-0.4141	-1.4986	-2.5938

834	-1.8726	0.12329	1.36788	-1.149	-0.4494	-1.7087	-2.5285
835	-1.9962	0.02706	1.27509	-0.9942	-0.55	-1.5835	-2.6866
836	-1.8751	0.05868	1.35359	-0.7971	-0.4285	-1.5356	-2.5065
837	-1.8353	0.09062	1.40154	-1.2055	-0.4329	-1.5467	-2.5765
838	-1.8278	0.11376	1.4252	-1.1859	-0.3491	-1.4215	-2.3406
839	-1.8938	0.03637	1.22059	-1.2528	-0.3776	-1.6042	-2.5612
840	-1.857	0.00299	1.33621	-1.2098	-0.4095	-1.6053	-2.8642
841	-1.9938	0.01971	1.42091	-1.1018	-0.4263	-1.5351	-2.5712
842	-1.8243	0.05436	1.3772	-0.9088	-0.3132	-1.6774	-2.9075
843	-1.9804	0.00661	1.42861	-1.108	-0.4232	-1.6625	-2.5218
844	-1.9357	-0.02	1.27611	-0.8675	-0.3944	-1.5895	-2.6331
845	-1.92	0.05117	1.50654	-1.1545	-0.3778	-1.4856	-2.3677
846	-1.7127	0.08828	1.59676	-0.966	-0.2925	-1.3196	-2.3871
847	-1.8657	0.02965	1.42197	-1.1647	-0.3882	-1.2741	-2.554
848	-1.8506	0.07014	1.54506	-1.3418	-0.3795	-1.8227	-2.3363
849	-1.8888	0.03966	1.62653	-1.2257	-0.2692	-1.4133	-2.4559
850	-1.8968	0.01121	1.60379	-1.3	-0.2706	-1.4159	-2.8363
851	-1.8295	0.034	1.68667	-1.4121	-0.1789	-1.2906	-2.646
852	-1.8822	0.1035	1.9499	-1.1651	-0.0514	-1.1865	-2.506
853	-1.6648	0.16318	1.92671	-1.179	-0.0311	-1.1593	-2.4162
854	-1.6333	0.14633	1.97786	-1.3986	-0.0236	-0.9745	-2.7136
855	-1.562	0.21868	2.22568	-1.1085	0.17788	-1.0631	-2.3643
856	-1.6304	0.03893	2.14779	-1.6089	0.18174	-1.2568	-2.2771
857	-1.7676	0.01736	1.87234	-1.4879	0.19393	-1.3088	-2.415
858	-1.6968	0.11126	1.79081	-1.416	-0.005	-1.2554	-2.405
859	-1.8301	0.05798	1.69037	-1.3974	-0.2411	-1.5219	-2.5987
860	-1.7054	0.12205	1.5182	-1.3083	-0.3506	-1.5054	-2.6701
861	-1.5939	0.17936	1.67177	-1.306	-0.328	-1.4587	-2.4939
862	-1.6617	0.15654	1.82164	-1.3895	-0.1478	-1.5628	-2.4064
863	-1.6238	0.14887	2.00218	-1.2001	-0.0027	-1.2303	-2.6478
864	-1.4536	0.20014	2.15894	-1.4143	0.12169	-1.0689	-2.8607
865	-1.2078	0.41002	2.097	-1.3721	0.26256	-1.1391	-1.8815
866	-1.4903	0.14302	2.33498	-1.5993	0.33477	-0.926	-2.5199
867	-1.4159	0.14261	2.13106	-1.6202	0.28968	-0.5833	-2.5491
868	-1.1699	0.42144	2.65142	-1.2424	0.49038	-0.4885	-2.8374
869	-1.3075	0.19569	2.51315	-1.4951	0.40753	-0.6346	-2.7788
870	-1.2759	0.36246	2.55947	-1.2787	0.53399	-0.28	-2.3018
871	-1.5884	0.15151	2.13802	-1.5976	0.32212	-0.659	-2.4316
872	-1.4745	0.26739	2.15925	-1.4058	0.36003	-0.9816	-2.1993
873	-1.5515	0.04066	2.26097	-1.8036	0.37687	-0.8538	-2.4078
874	-1.1127	0.36173	2.36904	-1.5157	0.43102	-0.7389	-2.3137
875	-0.9257	0.53849	2.54647	-1.5493	0.50535	-0.3123	-1.9414
876	-1.3874	0.27937	2.22877	-1.4473	0.47529	-0.5367	-2.1532
877	-1.528	0.24786	2.09986	-1.3353	0.41791	-0.4857	-2.3108
878	-1.1851	0.51028	2.42972	-0.766	0.6209	-0.5138	-1.8344
879	-1.11	0.66067	2.08015	-0.9796	0.53274	-1.0501	-1.7975

880	-0.8903	0.677	2.17402	-1.1512	0.35365	-0.7462	-1.8812
881	-0.6089	0.68061	2.19393	-1.3029	0.32199	-1.3435	-1.6561
882	-0.8334	0.69925	2.08341	-1.0889	0.31511	-1.3427	-1.8435
883	-1.0495	0.50711	1.93449	-1.1603	0.062	-1.1459	-1.8979
884	-1.233	0.52484	2.04154	-1.0458	-0.0593	-1.5195	-2.2127
885	-1.0747	0.59401	2.1456	-0.8592	-0.0182	-1.1301	-2.0364
886	-1.605	0.21449	1.91528	-1.3905	-0.1017	-1.5791	-2.543
887	-1.1973	0.56743	2.06525	-1.0896	0.07044	-1.326	-2.1268
888	-1.0805	0.32065	1.91767	-1.3172	-0.0898	-1.4389	-2.2748
889	-0.9502	0.65946	1.96403	-1.0905	0.17722	-1.6836	-2.1216
890	-1.175	0.58474	2.07898	-1.3498	-0.0463	-1.6284	-2.1814
891	-1.0209	0.63937	1.97248	-1.3266	0.06032	-1.4838	-1.9134
892	-0.9434	0.65582	2.05485	-1.2768	0.05506	-1.5136	-2.0364
893	-0.9003	0.73583	2.26048	-1.5689	0.13467	-1.8078	-1.8483
894	-0.7626	0.80281	2.39152	-0.8831	0.23931	-1.0663	-1.7501
895	-0.8355	0.7168	2.24377	-0.7955	0.22257	-1.219	-1.8247
896	-0.758	0.62117	2.21128	-1.3147	0.4579	-1.3621	-1.882
897	-0.6943	0.80816	2.60715	-1.3581	0.9214	-1.0045	-1.7212
898	-0.5496	0.82557	2.54951	-1.484	0.51736	-0.9024	-2.1039
899	-0.6074	0.89696	2.36779	-1.125	0.46013	-0.3795	-1.8947
900	-1.066	0.5818	2.07443	-1.6224	0.30281	-0.985	-2.0187
901	-1.0607	0.51195	2.13382	-1.3685	0.19917	-1.0833	-3.1658
902	-1.1173	0.42053	2.07196	-1.8259	0.16915	-1.0927	-2.2026
903	-0.9425	0.64851	2.30319	-1.3413	0.33223	-1.4193	-2.1393
904	-0.8947	0.68838	2.38194	-1.4475	0.63908	-0.7994	-1.9504
905	-1.8541	0.18989	1.84559	-1.4253	0.08864	-1.1459	-2.5906
906	-1.6215	0.241	1.92223	-1.456	0.01848	-1.1936	-2.0815
907	-1.8468	0.03989	1.53077	-1.3679	-0.2193	-1.1847	-3.0203
908	-1.8283	0.11532	1.44739	-1.1514	-0.3114	-1.3868	-2.2337
909	-1.8367	0.03906	1.42695	-1.2012	-0.507	-1.3888	-2.5093
910	-1.9276	0.09468	1.30966	-1.2345	-0.4994	-1.3863	-2.3914
911	-1.988	-0.0139	1.34151	-1.0708	-0.4994	-1.6762	-2.6581
912	-1.8791	-0.0652	1.31407	-1.2735	-0.5412	-1.6495	-2.9286
913	-1.935	0.02133	1.33539	-1.2463	-0.2866	-1.181	-2.4092
914	-1.9168	0.05657	1.38537	-0.9391	-0.1393	-0.8888	-2.7157
915	-1.9418	0.02663	1.36632	-0.9405	-0.3528	-1.4471	-2.7471
916	-1.9557	0.03189	1.2914	-1.0816	-0.3972	-1.4107	-2.4887
917	-1.8254	0.08667	1.39152	-1.2049	-0.3642	-1.249	-2.3298
918	-1.8716	0.01187	1.33173	-1.2055	-0.5199	-1.5945	-3.0705
919	-1.9276	0.02191	1.40131	-1.2746	-0.4743	-1.1263	-2.7434
920	-1.9351	0.04525	1.39323	-1.1056	-0.3644	-1.1801	-2.4919
921	-1.8469	0.04527	1.37499	-0.8414	-0.3016	-1.2228	-2.4756
922	-1.9683	-0.0502	1.29925	-0.9538	-0.469	-1.5442	-3.0956
923	-1.9981	0.01223	1.43132	-1.0529	-0.3177	-1.043	-2.6086
924	-1.964	0.01161	1.37291	-1.3501	-0.4418	-1.1561	-2.7898
925	-1.9502	-0.0065	1.37713	-1.3848	-0.4472	-1.1682	-2.482

926	-1.9724	0.01071	1.47611	-1.3758	-0.4172	-1.1023	-2.6605
927	-1.9387	-0.0428	1.41841	-1.3382	-0.499	-1.1335	-2.5985
928	-1.8892	0.00236	1.51458	-1.0161	-0.3935	-0.9823	-2.737
929	-1.9981	-0.059	1.31505	-1.2167	-0.5585	-1.3869	-2.5245
930	-1.948	0.00958	1.38724	-1.1134	-0.4497	-1.1861	-2.6368
931	-2.0155	0.00879	1.4177	-1.1454	-0.3873	-1.1342	-2.4316
932	-2.0118	0.03245	1.44642	-1.0349	-0.3802	-1.1392	-2.5618
933	-1.9912	-0.0969	1.27976	-1.2729	-0.6349	-1.4285	-3.1027
934	-1.8347	-0.0051	1.51627	-1.234	-0.396	-1.1962	-2.2924
935	-1.9996	-0.0651	1.51319	-1.24	-0.3011	-0.9631	-2.7132
936	-1.8385	-0.0306	1.5392	-1.1771	-0.4635	-1.3306	-2.4643
937	-1.9478	-0.055	1.51429	-0.6115	-0.3947	-1.2546	-2.6579
938	-1.8895	0.01049	1.55122	-1.2212	-0.2501	-1.1338	-2.9427
939	-1.9333	-0.0518	1.60821	-1.373	-0.2597	-1.1603	-2.8528
940	-1.9601	0.00722	1.67787	-0.9979	-0.2938	-1.0931	-2.4661
941	-1.925	-0.0046	1.57444	-1.1551	-0.3002	-1.1864	-2.7635
942	-1.8442	-0.0985	1.68266	-1.5192	-0.2885	-1.0876	-2.4912
943	-1.7743	-0.0251	1.61802	-1.4356	-0.2957	-1.2359	-2.6004
944	-1.9294	-0.0522	1.57285	-1.3482	-0.304	-1.0579	-3.1004
945	-1.7223	-0.0185	1.73073	-1.2675	-0.2553	-1.1774	-2.4937
946	-1.7182	-0.0082	1.57294	-1.3786	-0.306	-0.9896	-2.7085
947	-1.6194	0.03247	1.73602	-1.2157	-0.2372	-1.1101	-2.4259
948	-1.7833	-0.0321	1.69471	-1.2318	-0.2108	-1.026	-2.5056
949	-1.7284	0.00175	1.67987	-1.2809	-0.2883	-1.2247	-2.5594
950	-1.716	0.05703	1.75542	-1.2706	-0.1657	-0.962	-2.4179
951	-1.666	0.15663	1.78875	-1.0422	-0.1329	-0.9137	-2.2326
952	-1.7605	0.04572	1.62961	-1.2545	-0.2786	-1.1701	-2.3633
953	-1.7831	0.00259	1.50634	-1.5142	-0.364	-1.1692	-2.8046
954	-1.8227	-0.0396	1.55446	-1.5026	-0.3591	-1.2303	-2.8993
955	-1.6841	-0.0486	1.62025	-1.2749	-0.233	-0.8972	-2.9028
956	-1.6774	0.0743	1.81862	-1.4298	-0.1757	-1.0228	-2.5345
957	-1.7386	0.03705	1.71047	-1.228	-0.1541	-0.9603	-2.3222
958	-1.6678	0.05462	1.65741	-1.4066	-0.21	-1.148	-2.5603
959	-1.7378	0.0094	1.67048	-1.4805	-0.2291	-1.0139	-2.6169
960	-1.6525	0.10809	1.70451	-1.2845	-0.1187	-0.888	-2.6222
961	-1.6552	0.07666	1.64986	-0.953	-0.0586	-0.7902	-2.5686
962	-1.7604	0.05949	1.57776	-0.8952	0.1914	-0.4062	-2.1904

Appendix Table 1.8. Natural log of key indicator element abundance variability against conservative lithophile element Rb in core SI C2 in the Three Rivers Estuarine Complex saltmarshes.

Depth (mm)	Si/Rb	K/Rb	Ca/Rb	Ti/Rb	Br/Rb	Sr/Rb	Zr/Rb	Ba/Rb
1	-1.6001	0.64242	1.93438	0.76783	0.17606	0.78627	0.25057	-2.0223
2	-0.6201	1.3974	2.7357	1.46706	0.4216	0.82479	0.09314	-2.4041
3	-0.598	1.41074	2.86848	1.45187	0.41176	0.82668	0.33043	-1.4195
4	-0.2123	1.706	3.14643	1.73172	0.72762	1.15408	0.36461	-1.5337
5	-0.3957	1.52296	2.9683	1.66141	0.58788	0.97782	0.42808	-2.9838
6	-0.5165	1.48348	2.92333	1.5339	0.52208	0.9718	0.24916	-2.6431
7	-0.315	1.55371	3.00843	1.63657	0.62016	1.00481	0.25122	-2.6537
8	-0.4375	1.42165	2.91716	1.47683	0.51874	0.81314	0.1721	-1.4106
9	-0.5694	1.43791	2.84209	1.57241	0.39	0.97066	0.50414	-1.497
10	-0.4905	1.45152	2.89041	1.46235	0.46149	0.98529	0.46819	-1.5206
11	-0.449	1.30949	2.80286	1.4025	0.23587	0.81159	0.34211	-1.0713
12	-0.3308	1.51556	3.01638	1.58312	0.43794	1.00449	0.52469	-0.792
13	-0.3974	1.36207	2.85036	1.42769	0.14509	0.83824	0.46584	-1.1007
14	-0.378	1.41869	2.98024	1.48901	0.24235	1.00593	0.47037	-1.0513
15	-0.439	1.37562	2.93098	1.43552	0.1871	0.85167	0.39782	-1.1599
16	-0.3425	1.45524	2.97467	1.41058	0.18222	0.90557	0.18222	-0.9106
17	-0.2011	1.55381	3.04123	1.59722	0.28301	1.01367	0.40707	-1.1716
18	-0.2262	1.6206	3.09439	1.71822	0.31224	1.07611	0.69066	-1.4785
19	-0.2016	1.54764	3.09934	1.61694	0.23547	1.09466	0.67451	-0.9942
20	-0.3033	1.42161	3.05043	1.4546	0.05639	1.03048	0.51793	-1.2357
21	-0.1001	1.59753	3.21558	1.6623	0.63214	1.02475	0.31585	-0.7828
22	-0.2268	1.50777	3.12905	1.51497	0.3318	1.01502	0.23925	-0.9037
23	-0.3182	1.44482	3.05706	1.51404	0.35261	0.97715	0.33677	-1.2451
24	-0.3486	1.36742	3.00309	1.46206	0.35135	0.79703	0.23251	-1.1576
25	-0.3749	1.3889	3.01042	1.43304	0.1858	0.87242	0.0448	-0.9274
26	-0.3747	1.35842	2.95451	1.39809	0.07801	0.84455	0.11189	-1.1254
27	-0.3661	1.38629	2.9123	1.43116	0.12688	0.87365	0.25959	-1.0399
28	-0.3128	1.46658	3.11576	1.4963	0.35597	1.05813	0.49169	-1.0038
29	-0.5522	1.32311	2.84121	1.48536	0.27808	1.02021	0.34766	-1.1088
30	-0.5157	1.37872	2.88001	1.34174	0.63771	1.06824	0.63223	-0.6752
31	-0.7742	1.18691	2.624	1.23953	0.89995	0.98485	0.45684	-1.226
32	-0.8322	1.20903	2.66284	1.32674	0.77152	0.96246	0.54017	-1.5987
33	-0.7863	1.11795	2.57722	1.15758	0.48267	0.90422	0.3176	-1.4826
34	-0.6121	1.34848	2.7426	1.33849	0.47293	1.09809	0.22064	-1.0476
35	-0.4923	1.39018	2.8043	1.40053	0.45789	1.00099	0.25438	-1.2969
36	-0.4763	1.42397	2.75921	1.3868	0.39037	0.93897	0.2403	-1.2813
37	-0.6266	1.32417	2.6197	1.39004	0.25783	0.91779	0.0235	-1.5417
38	-0.5738	1.39739	2.67977	1.31732	0.14804	0.94847	0.08493	-1.1886
39	-0.6724	1.30304	2.75604	1.31986	0.2009	0.85932	0.15008	-1.3113
40	-0.3946	1.44122	2.8462	1.40143	0.46536	1.03799	0.19889	-1.1756

41	-0.5464	1.28303	2.73874	1.28663	0.33505	0.9067	0.0245	-1.3456
42	-0.5807	1.26258	2.74788	1.21144	0.36497	0.84577	-0.3601	-1.1313
43	-0.6794	1.29645	2.56929	1.38427	0.39386	0.84507	-0.7464	-1.3646
44	-0.6834	1.22153	2.52302	1.21693	0.396	0.76226	-0.6128	-1.0574
45	-0.6347	1.30312	2.53533	1.32552	0.33664	0.82519	-0.7615	-1.3145
46	-0.6755	1.25806	2.5395	1.25068	0.24205	0.71843	-0.6566	-1.7265
47	-0.5619	1.32019	2.52111	1.26369	0.2745	0.73377	-0.7452	-1.5148
48	-0.5996	1.39237	2.53221	1.30242	0.37692	0.75013	-0.6027	-1.3403
49	-0.7995	1.32853	2.434	1.2791	0.24498	0.71494	-0.9801	-1.5648
50	-0.6826	1.38434	2.36378	1.26931	0.32378	0.72776	-0.7899	-1.1093
51	-0.8099	1.32737	2.31428	1.25154	0.31563	0.68293	-0.6513	-1.5935
52	-0.7206	1.25834	2.34091	1.18012	0.36347	0.69865	-1.0906	-1.3026
53	-0.7947	1.30182	2.38772	1.28998	0.46172	0.79634	-0.8915	-1.3942
54	-0.7095	1.36207	2.4301	1.24004	0.5406	0.90039	-0.7819	-1.0944
55	-0.7069	1.38458	2.41198	1.27401	0.56772	0.83494	-0.7849	-1.1217
56	-0.823	1.26903	2.29198	1.15886	0.46649	0.78738	-1.2627	-1.2856
57	-0.812	1.25313	2.3256	1.1732	0.54842	0.83625	-1.0221	-1.3765
58	-0.8289	1.26337	2.30747	1.17883	0.49387	0.87931	-0.9905	-1.6882
59	-0.7298	1.30132	2.36762	1.26962	0.50315	0.80167	-0.9837	-1.5317
60	-0.5382	1.50313	2.62687	1.41934	0.59881	1.07752	-1.1654	-1.5667
61	-0.8856	1.09846	2.21978	1.0447	0.20392	0.67817	-1.0519	-1.5878
62	-0.8381	1.22589	2.43899	1.25738	0.38863	0.85267	-0.8855	-1.3076
63	-0.8045	1.27328	2.46315	1.24352	0.50236	0.90039	-0.6925	-1.399
64	-0.6682	1.4008	2.56193	1.33659	0.47226	0.84333	-0.6089	-1.1802
65	-0.7279	1.38629	2.5109	1.31306	0.4148	0.85139	-0.6143	-1.3231
66	-0.7464	1.31933	2.49601	1.25622	0.23083	0.81374	-0.8504	-1.403
67	-0.7972	1.29777	2.51948	1.19626	0.36454	0.80603	-0.7215	-1.461
68	-0.6802	1.38926	2.61206	1.26356	0.30563	0.93138	-0.5343	-1.2572
69	-0.7307	1.27614	2.50951	1.07232	0.15763	0.78387	-0.8854	-1.2269
70	-0.6948	1.36007	2.62593	1.24691	0.31682	0.85227	-0.766	-1.3002
71	-0.7182	1.3673	2.58619	1.2863	0.2751	0.80878	-0.6635	-1.7631
72	-0.7095	1.30163	2.54001	1.1885	0.19956	0.76662	-0.8367	-1.5452
73	-0.672	1.32968	2.5397	1.23587	0.26245	0.81093	-0.6015	-1.3652
74	-0.6611	1.35074	2.59164	1.22088	0.2404	0.84272	-0.5598	-1.2233
75	-0.8862	1.13946	2.42955	1.09843	0.08437	0.72563	-0.7387	-1.4569
76	-0.8109	1.16478	2.55403	1.06733	0.20437	0.85384	-0.9953	-1.5221
77	-0.7888	1.17634	2.40302	1.11411	0.05307	0.75823	-1.0705	-1.5467
78	-0.6685	1.33982	2.56544	1.25572	0.15423	0.79217	-0.9754	-1.5417
79	-0.6267	1.43506	2.73391	1.2571	0.36486	0.97299	-1.1943	-1.7455
80	-0.6247	1.40212	2.65211	1.27681	0.41818	0.78605	-0.6991	-1.5385
81	-0.6427	1.39281	2.60488	1.25223	0.55158	0.67267	-0.7142	-1.2283
82	-0.6046	1.40074	2.65605	1.28169	0.81593	0.7111	-0.5102	-0.9722
83	-0.7598	1.30122	2.48725	1.19792	0.65253	0.58007	-0.5136	-1.4084
84	-0.5056	1.478	2.68714	1.35869	0.659	0.70994	-0.4789	-1.2407
85	-0.7167	1.28876	2.47348	1.24625	0.73736	0.48037	-0.6545	-1.7244
86	-0.4268	1.59931	2.73458	1.51492	0.86083	0.86112	-0.275	-1.0094

87	-0.5669	1.44603	2.64285	1.33216	0.60751	0.88738	-0.1385	-0.9036
88	-0.5878	1.45306	2.6882	1.36651	0.40739	0.95768	-0.1591	-1.2729
89	-0.7331	1.28778	2.53791	1.23665	0.41474	0.71034	-0.3195	-1.216
90	-0.6071	1.37449	2.63016	1.31388	0.3147	0.76311	-0.3497	-1.2939
91	-0.6776	1.34669	2.62697	1.26907	0.32241	0.74671	-0.4779	-1.5873
92	-0.5976	1.45177	2.71293	1.46489	0.43753	0.77867	-0.5684	-1.5404
93	-0.4794	1.43244	2.70517	1.36508	0.59836	0.65284	-0.5539	-1.4189
94	-0.576	1.38883	2.57273	1.28847	0.39867	0.67567	-0.4281	-1.1259
95	-0.6996	1.36009	2.5377	1.31515	0.36957	0.57181	-0.3301	-1.3581
96	-0.4972	1.47082	2.67091	1.49109	0.61529	0.85593	-0.0975	-1.1517
97	-0.7	1.29717	2.43037	1.22889	0.33639	0.51399	-0.6128	-1.4663
98	-0.4928	1.457	2.63186	1.53146	0.36149	0.68709	-0.5106	-1.2854
99	-0.6169	1.24849	2.32507	1.18371	0.2969	0.46859	-0.8202	-1.2921
100	-0.6201	1.38266	2.37746	1.34306	0.30036	0.57463	-0.6703	-1.2579
101	-0.5729	1.36871	2.45427	1.38476	0.47724	0.66177	-0.5273	-1.2968
102	-0.5577	1.37052	2.40172	1.34638	0.55695	0.56622	-0.6083	-1.0249
103	-0.9592	1.11326	2.20084	1.1395	0.39232	0.4543	-0.8102	-1.4263
104	-0.5427	1.45428	2.46521	1.40308	0.54762	0.6749	-0.4866	-1.2893
105	-0.6984	1.32133	2.29775	1.29891	0.50652	0.52834	-0.7978	-1.2321
106	-0.7028	1.3415	2.3063	1.28919	0.49607	0.48503	-0.6432	-1.518
107	-0.6236	1.31337	2.24937	1.24483	0.37005	0.33856	-0.7872	-1.4599
108	-0.4471	1.46392	2.37836	1.36394	0.47079	0.50442	-0.5474	-0.9708
109	-0.5604	1.31071	2.07309	1.1732	0.20295	0.27274	-0.8283	-1.2869
110	-0.7136	1.21477	1.95781	1.18256	0.1839	0.16993	-0.8316	-1.4665
111	-0.5498	1.35931	2.16696	1.29171	0.37409	0.33016	-0.8509	-1.1094
112	-0.5576	1.38775	2.2101	1.35985	0.37768	0.3959	-0.6996	-1.2507
113	-0.7455	1.25835	2.11779	1.20601	0.18937	0.22818	-0.8062	-1.3447
114	-0.7892	1.25161	2.11851	1.24454	0.14763	0.28029	-0.7319	-1.5841
115	-0.6018	1.40733	2.23145	1.31603	0.37992	0.33442	-0.723	-1.1447
116	-0.6743	1.32923	2.24951	1.28974	0.36213	0.35741	-0.4098	-1.3881
117	-0.5226	1.33431	2.24095	1.29131	0.36567	0.31667	-0.6282	-1.3015
118	-0.8381	1.19829	2.1185	1.19623	0.33045	0.29004	-0.6415	-1.3457
119	-0.6669	1.35915	2.20647	1.25585	0.49749	0.39488	-0.4753	-1.0415
120	-0.5135	1.44023	2.33178	1.36895	0.64405	0.51986	-0.2715	-1.3042
121	-0.4118	1.55031	2.53111	1.42486	0.78691	0.65804	-0.2356	-0.7543
122	-0.5734	1.32819	2.29108	1.29056	0.56196	0.50264	-0.3681	-1.2709
123	-0.7881	1.13253	2.19786	1.09813	0.38203	0.32587	-0.6569	-1.3916
124	-0.515	1.31383	2.38049	1.35168	0.7376	0.49073	-0.559	-1.4981
125	-0.567	1.40534	2.4186	1.41617	0.90712	0.47024	-0.6098	-1.3064
126	-0.5694	1.28734	2.2951	1.30851	1.12606	0.4647	-0.4972	-1.4638
127	-0.5517	1.47584	2.49158	1.45098	1.51716	0.72409	-0.4079	-1.256
128	-0.6466	1.40965	2.44271	1.43114	1.04392	0.68647	-0.6453	-1.502
129	-0.4536	1.40665	2.5024	1.36948	0.83595	0.7707	-0.4364	-1.2737
130	-0.4877	1.45607	2.65533	1.42922	0.90131	0.77068	-0.5055	-1.1932
131	-0.583	1.28576	2.37644	1.21682	1.10922	0.58733	-0.7644	-1.4575
132	-0.6513	1.28116	2.40744	1.29697	1.38077	0.46633	-0.6348	-1.8869

133	-0.7641	1.20696	2.49143	1.17069	0.92411	0.75475	-0.5723	-1.362
134	-0.7566	1.23591	2.47138	1.2817	0.99884	0.65715	-0.4333	-1.7346
135	-0.8815	1.10093	2.17862	1.11282	0.82628	0.4012	-0.5938	-1.3343
136	-0.9405	1.17559	2.22282	1.14237	1.10823	0.46586	-0.5322	-1.215
137	-0.9774	1.02	2.06495	0.99681	0.97717	0.24557	-0.7116	-1.0867
138	-0.5973	1.28385	2.36335	1.29685	1.49164	0.40952	-0.8232	-1.2767
139	-0.6635	1.39576	2.44994	1.41594	1.61209	0.51595	-0.4301	-1.3064
140	-0.6098	1.46843	2.41663	1.442	1.70786	0.40926	-0.9718	-1.71
141	-0.6389	1.27463	2.33055	1.25489	1.15437	0.40363	-0.7308	-1.6981
142	-0.8351	1.13696	2.11122	1.11053	0.90355	0.4445	-0.613	-1.4782
143	-0.9016	1.00444	2.02558	0.98039	0.29781	0.39895	-0.8576	-1.2913
144	-0.8587	1.16053	2.21813	1.14592	0.30702	0.50561	-0.6321	-1.3376
145	-1.0051	1.09405	2.09986	1.07708	0.21467	0.40959	-0.6907	-1.3813
146	-0.804	1.19179	2.25815	1.18807	0.07562	0.48922	-0.4253	-1.3792
147	-0.7547	1.23226	2.20875	1.21315	0.10188	0.41259	-0.5819	-1.2897
148	-0.578	1.34535	2.30675	1.33853	0.23546	0.46025	-0.5415	-1.1204
149	-0.7493	1.17934	2.19108	1.19294	0.06416	0.31012	-0.7077	-1.8234
150	-0.6294	1.30282	2.28817	1.32557	0.32254	0.39526	-0.5589	-1.373
151	-0.7123	1.24329	2.30631	1.21612	0.44759	0.37498	-0.6303	-1.457
152	-0.7297	1.18698	2.25143	1.11563	0.12314	0.29893	-0.4799	-1.4524
153	-0.6819	1.22864	2.19854	1.1663	0.10732	0.30933	-0.6839	-1.705
154	-0.6638	1.32595	2.29909	1.32989	0.20907	0.51494	-0.7656	-1.2565
155	-0.5579	1.37556	2.27224	1.34642	0.17237	0.47655	-0.6267	-1.2755
156	-0.6464	1.29909	2.17554	1.28917	0.02625	0.33761	-0.719	-1.2699
157	-0.5381	1.42491	2.28299	1.37212	0.1285	0.52391	-0.404	-1.0891
158	-0.5591	1.36266	2.25789	1.33932	0.06825	0.41322	-0.6069	-1.3654
159	-0.5392	1.42801	2.33022	1.38844	0.21199	0.45365	-0.5541	-1.0918
160	-0.4879	1.46954	2.39608	1.37351	0.22645	0.54441	-0.5927	-1.0096
161	-0.4941	1.42617	2.37323	1.36714	0.25138	0.56902	-0.4662	-1.0759
162	-0.6607	1.33387	2.2844	1.27782	0.18937	0.47216	-0.8257	-1.1557
163	-0.7088	1.28177	2.19119	1.222	0.10911	0.41924	-0.5649	-1.1575
164	-0.5672	1.30607	2.19277	1.18351	0.17767	0.3699	-0.5504	-1.2462
165	-0.4562	1.50516	2.40702	1.50444	0.31306	0.58974	-0.4759	-1.3843
166	-0.3761	1.57433	2.49918	1.53311	0.40312	0.62383	-0.4136	-1.3627
167	-0.5154	1.43237	2.39336	1.4508	0.53911	0.56475	-0.7435	-1.4817
168	-0.6286	1.31826	2.26158	1.26157	0.49789	0.54557	-0.5059	-1.291
169	-0.3741	1.50945	2.4654	1.48504	0.68057	0.71969	-0.5627	-1.2558
170	-0.6721	1.26627	2.22477	1.18988	0.2525	0.41401	-0.7484	-1.4643
171	-0.533	1.38199	2.28565	1.28364	0.36313	0.51105	-0.398	-1.2203
172	-0.4941	1.41931	2.34919	1.40984	0.53745	0.48817	-0.5504	-1.4293
173	-0.4103	1.43534	2.40281	1.37813	0.37055	0.52113	-1.0402	-1.4414
174	-0.416	1.53377	2.59869	1.50422	0.44278	0.66095	-0.5483	-1.1178
175	-0.46	1.51393	2.54397	1.48771	0.48153	0.62541	-0.8455	-0.9218
176	-0.5279	1.42943	2.56278	1.33693	0.30831	0.52314	-0.6474	-1.1644
177	-0.5361	1.45549	2.63108	1.37238	0.45458	0.59745	-0.7582	-1.1568
178	-0.8089	1.21368	2.34288	1.15119	0.32702	0.42988	-0.784	-1.696

179	-0.8909	1.30841	2.51471	1.39495	0.91601	0.61319	-0.5002	-1.2427
180	-0.7587	1.25354	2.38189	1.22679	0.48537	0.5005	-0.6385	-1.4793
181	-0.7735	1.20338	2.30947	1.16793	0.42629	0.42453	-0.3264	-1.265
182	-0.7066	1.33121	2.56911	1.26298	0.55175	0.43507	-0.2475	-1.0919
183	-0.5581	1.51964	2.4747	1.50985	0.70526	0.52518	-0.2075	-1.0778
184	-0.8054	1.32235	2.23146	1.38316	0.48936	0.42011	-0.8339	-1.121
185	-0.9423	1.15869	1.99445	1.17835	0.0997	0.27131	-1.1038	-1.1731
186	-0.8363	1.24912	2.13933	1.2982	0.15812	0.26641	-0.7625	-1.4392
187	-0.923	1.19823	2.11106	1.20884	0.0657	0.24424	-0.66	-1.374
188	-0.7245	1.2947	2.13868	1.29768	0.22568	0.31487	-0.7435	-1.3201
189	-0.8394	1.25294	2.1059	1.27643	0.32933	0.27315	-0.6597	-1.3035
190	-0.9179	1.14432	1.96936	1.15877	0.23245	0.2203	-0.7735	-1.3712
191	-0.9103	1.16679	2.05319	1.17937	0.28051	0.20908	-0.6959	-1.1447
192	-0.8396	1.1764	2.02528	1.19515	0.05371	0.26072	-0.7252	-1.5822
193	-0.886	1.22868	2.05649	1.2212	0.10048	0.26784	-0.565	-1.5832
194	-0.4704	1.41708	2.26642	1.42343	0.34952	0.33933	-0.4624	-1.2202
195	-0.6337	1.37193	2.23493	1.41007	0.23507	0.36029	-0.9004	-1.6384
196	-0.7053	1.34646	2.20749	1.33953	0.40948	0.39414	-0.8369	-1.4294
197	-0.5056	1.53753	2.38975	1.46138	0.55809	0.59537	-0.3174	-1.0546
198	-0.6269	1.42514	2.21454	1.39905	0.42554	0.53413	-0.3894	-1.2817
199	-0.7665	1.34552	2.18139	1.34184	0.32419	0.45561	-0.3681	-0.916
200	-0.7615	1.32384	2.15766	1.35268	0.25949	0.44011	-0.5563	-1.3122
201	-0.699	1.39225	2.33548	1.36129	0.3385	0.63568	-0.3718	-1.2495
202	-0.5797	1.43886	2.34486	1.45515	0.54486	0.67948	-0.3094	-1.4573
203	-0.8312	1.3683	2.28172	1.41285	0.40338	0.54612	-0.6515	-1.3104
204	-0.7299	1.29918	2.19742	1.33255	0.47724	0.49122	-0.5554	-1.4586
205	-0.7881	1.23324	2.19105	1.19182	0.32433	0.49663	-0.5891	-1.5278
206	-0.8771	1.23905	2.21452	1.25457	0.23552	0.43994	-1.0146	-1.4708
207	-0.7778	1.33159	2.31759	1.27553	0.27048	0.44393	-0.6449	-1.3539
208	-0.6837	1.37839	2.37084	1.38913	0.36233	0.59386	-0.4608	-1.351
209	-0.8757	1.17222	2.15106	1.20934	0.16841	0.33683	-0.8903	-1.5556
210	-0.9752	1.08065	2.07172	1.10357	0.03405	0.3489	-0.8174	-1.2715
211	-0.7497	1.25701	2.23378	1.26851	0.15758	0.42587	-0.594	-1.2913
212	-0.8399	1.16736	2.1178	1.11372	0.12654	0.40103	-0.7942	-1.328
213	-0.7404	1.31418	2.23949	1.32268	0.18884	0.51543	-0.8531	-1.1363
214	-0.487	1.44102	2.39561	1.46231	0.38088	0.58535	-0.6276	-1.3354
215	-0.5919	1.3458	2.28817	1.33944	0.26779	0.44782	-0.6379	-1.3289
216	-0.7228	1.32286	2.29857	1.2997	0.23714	0.38559	-0.6699	-1.0912
217	-0.7762	1.28621	2.24292	1.25545	0.32757	0.30579	-0.7786	-1.2317
218	-0.567	1.38966	2.26862	1.36724	0.82925	0.29548	-0.8248	-1.243
219	-0.5066	1.49298	2.33196	1.51752	1.13352	0.37784	-0.6804	-1.2829
220	-0.8626	1.28413	2.12239	1.28202	0.52929	0.3623	-0.5483	-1.37
221	-0.8613	1.13327	1.99183	1.1239	0.20487	0.35804	-0.6713	-1.4315
222	-0.9214	1.16695	2.0168	1.1579	0.11451	0.24145	-0.9551	-1.4481
223	-0.9006	1.16983	1.99275	1.18419	0.15858	0.15943	-0.9788	-1.4377
224	-0.751	1.2882	2.0463	1.26061	0.23258	0.27366	-0.6617	-1.1897

225	-0.6931	1.32539	2.14254	1.34205	0.14991	0.3863	-0.7458	-1.3352
226	-0.7002	1.37967	2.15833	1.33234	0.30427	0.32484	-0.9455	-1.2083
227	-0.6046	1.37628	2.20449	1.26475	0.16199	0.30914	-0.7193	-0.9482
228	-0.8554	1.1923	1.97712	1.14119	0.18188	0.27422	-0.8617	-1.3557
229	-0.8306	1.12948	1.90802	1.02643	0.22479	0.25115	-1.0851	-1.2793
230	-0.5816	1.43426	2.25673	1.32944	0.29246	0.39321	-0.573	-1.3423
231	-0.6228	1.38193	2.09014	1.32098	0.21743	0.35973	-0.8544	-1.381
232	-0.5626	1.46815	2.21137	1.41159	0.14181	0.40224	-1.0959	-1.2538
233	-0.6248	1.32785	2.15021	1.29339	0.10925	0.28137	-1.0536	-1.3367
234	-0.6334	1.46565	2.31781	1.47029	0.22605	0.46206	-0.9127	-1.8042
235	-0.5659	1.44379	2.3377	1.4459	0.21338	0.45997	-0.9773	-1.4152
236	-0.6775	1.36099	2.19529	1.37757	0.08783	0.4544	-0.8297	-1.6375
237	-0.8098	1.26734	2.10938	1.26011	0.0661	0.38987	-0.8764	-1.2913
238	-0.6943	1.36131	2.18733	1.30057	0.21125	0.40665	-0.853	-1.1665
239	-0.7083	1.28852	2.13124	1.25284	0.13339	0.34461	-0.8484	-1.2915
240	-0.5204	1.43974	2.26967	1.41924	0.21517	0.52866	-0.626	-0.9604
241	-0.4225	1.5412	2.42066	1.48955	0.38395	0.67294	-0.8852	-0.9304
242	-0.5995	1.40752	2.21813	1.35337	0.13465	0.44271	-0.687	-1.4016
243	-0.5581	1.44906	2.29332	1.38025	0.17869	0.55709	-0.7739	-1.0939
244	-0.5607	1.37257	2.26117	1.35066	0.0546	0.41026	-0.8421	-1.3667
245	-0.6255	1.3347	2.1809	1.27971	0.03188	0.41758	-1.013	-1.4192
246	-0.4353	1.53692	2.40047	1.50042	0.15307	0.63599	-0.7968	-1.318
247	-0.4913	1.46567	2.39416	1.46092	0.26189	0.65999	-0.7454	-1.2882
248	-0.563	1.45318	2.38615	1.38676	0.21284	0.73429	-0.4561	-1.2518
249	-0.5688	1.33591	2.38394	1.31089	0.21705	0.50589	-0.6478	-1.0332
250	-0.4895	1.45639	2.47366	1.49526	0.32448	0.57861	-0.6982	-1.2625
251	-0.6405	1.30309	2.29975	1.29924	-0.0423	0.36498	-0.948	-1.6237
252	-0.6196	1.30073	2.21696	1.26809	-0.0629	0.24555	-0.9913	-1.4514
253	-0.5997	1.32715	2.30899	1.27744	0.06822	0.28346	-0.859	-1.3727
254	-0.5352	1.44409	2.3415	1.41004	0.16498	0.37572	-0.6484	-1.2313
255	-0.6032	1.33766	2.19048	1.3165	0.17338	0.36025	-1.3543	-1.3651
256	-0.5769	1.37257	2.21052	1.32893	0.17191	0.3849	-0.8397	-1.1107
257	-0.4234	1.50237	2.3005	1.47652	0.30199	0.59701	-0.5479	-1.2421
258	-0.5462	1.3915	2.24102	1.3951	0.34513	0.4282	-0.7019	-1.4295
259	-0.6943	1.27743	2.1932	1.26289	0.22091	0.35679	-0.7659	-1.2688
260	-0.6523	1.38091	2.2814	1.35357	0.57891	0.50779	-0.4741	-1.2518
261	-0.6605	1.35405	2.30086	1.37075	1.12784	0.48487	-0.27	-1.4042
262	-0.8022	1.33309	2.19991	1.27115	0.66744	0.37831	-0.5028	-1.393
263	-0.8152	1.3179	2.23291	1.32062	0.48953	0.42143	-0.4532	-1.4589
264	-0.7761	1.3237	2.21448	1.35607	0.50888	0.38034	-0.3084	-1.8456
265	-0.7065	1.39226	2.25834	1.36087	0.50335	0.51851	-0.1313	-1.3395
266	-0.8475	1.17558	2.13627	1.13754	0.5269	0.38081	-0.1724	-1.3723
267	-0.7567	1.24114	2.21413	1.31135	0.43788	0.41611	-0.3918	-1.2598
268	-0.6061	1.37945	2.34237	1.34249	0.41494	0.38667	-0.299	-1.2149
269	-0.642	1.3793	2.32476	1.34156	0.45499	0.50471	-0.264	-0.9479
270	-0.7381	1.29	2.2104	1.21836	0.47572	0.45514	-0.1271	-1.1092

271	-0.6485	1.37391	2.31865	1.38772	0.58238	0.53381	-0.0319	-1.4711
272	-0.6713	1.29911	2.19939	1.23377	0.47032	0.484	-0.1752	-1.1834
273	-0.4028	1.58316	2.57569	1.64384	0.60579	0.78019	0.19276	-1.2455
274	-0.704	1.29507	2.3222	1.30684	0.22098	0.53549	-0.1164	-1.4993
275	-0.5894	1.34779	2.36239	1.3255	0.3665	0.57995	-0.0289	-1.2279
276	-0.5765	1.39607	2.43081	1.36311	0.40612	0.57364	-0.2106	-1.4731
277	-0.6761	1.32339	2.34146	1.34117	0.29911	0.50196	-0.1505	-1.8292
278	-0.4295	1.4792	2.48765	1.4343	0.37622	0.60632	-0.2231	-1.3292
279	-0.5612	1.30714	2.31401	1.26778	0.25013	0.20477	-0.2808	-1.0896
280	-0.5352	1.4204	2.40117	1.43665	0.29666	0.44352	-0.2996	-1.3068
281	-0.4959	1.39183	2.36374	1.338	0.32308	0.33647	-0.2246	-1.5177
282	-0.6457	1.35218	2.31058	1.32468	0.33278	0.32815	-0.2243	-1.138
283	-0.5621	1.39361	2.25985	1.38782	0.48178	0.39666	-0.1537	-1.0697
284	-0.7557	1.24649	2.0924	1.19891	0.43677	0.22247	-0.345	-1.5142
285	-0.6416	1.44476	2.27528	1.43802	0.57481	0.47744	-0.325	-1.2747
286	-0.575	1.37954	2.28269	1.3659	0.44876	0.50013	-0.237	-1.1729
287	-0.7178	1.25387	2.20444	1.22003	0.34002	0.37556	-0.3527	-1.2965
288	-0.7818	1.1386	2.0876	1.12534	0.2499	0.33007	-0.4656	-1.4073
289	-0.8229	1.21526	2.20324	1.19803	0.29546	0.42429	-0.3644	-1.5223
290	-0.867	1.20418	2.14715	1.14104	0.11773	0.4141	-0.4111	-1.1292
291	-0.6724	1.18531	2.12333	1.18297	-0.0231	0.33912	-0.7008	-1.2979
292	-0.5509	1.48012	2.50867	1.43728	0.49145	0.5639	-0.1881	-1.1682
293	-0.7272	1.26622	2.30965	1.22069	0.22937	0.32129	-0.3095	-1.3512
294	-0.5334	1.40093	2.41773	1.36131	0.31523	0.48632	0.02755	-1.5041
295	-0.4703	1.43228	2.40783	1.45846	0.37629	0.52832	0.32756	-1.4837
296	-0.5061	1.40276	2.43802	1.32827	0.31278	0.48588	0.22696	-0.9265
297	-0.691	1.19702	2.32551	1.23881	0.3229	0.32791	0.01271	-0.8866
298	-0.6525	1.22536	2.34528	1.2855	0.37013	0.45711	-0.1927	-1.5397
299	-0.44	1.41065	2.5494	1.51095	0.44579	0.52844	-0.1721	-1.3497
300	-0.6532	1.28763	2.39548	1.28175	0.33521	0.36391	-0.4713	-1.0106
301	-0.7534	1.2167	2.33089	1.20835	0.36813	0.36245	-0.213	-0.9828
302	-0.8067	1.16661	2.28215	1.18426	0.40192	0.2831	-0.2252	-1.1919
303	-0.7044	1.23848	2.34664	1.18464	0.32032	0.33387	-0.2608	-1.2938
304	-0.5051	1.35059	2.47536	1.38151	0.57103	0.52962	-0.4164	-1.4559
305	-0.7028	1.23494	2.29747	1.23372	0.52133	0.44662	-0.4664	-1.2761
306	-0.6028	1.26586	2.35435	1.31566	0.25329	0.46209	-0.3433	-1.3118
307	-0.9263	1.07852	2.15052	1.06293	0.2095	0.29735	-0.564	-1.4403
308	-0.7303	1.3201	2.38007	1.30186	0.34732	0.49556	-0.4687	-1.3133
309	-0.6477	1.4105	2.40427	1.42692	0.50844	0.46835	-0.1321	-1.1442
310	-0.6579	1.29052	2.38961	1.3754	0.45508	0.43545	-0.097	-1.3138
311	-0.7089	1.2301	2.30377	1.201	0.3268	0.37091	-0.3111	-1.0943
312	-0.5788	1.36962	2.49328	1.36595	0.47726	0.57622	-0.067	-1.0376
313	-0.6535	1.27865	2.2987	1.26466	0.28851	0.39897	-0.0185	-1.3616
314	-0.7325	1.2277	2.2922	1.16849	0.26325	0.42476	-0.0941	-1.117
315	-0.5326	1.39048	2.42296	1.35535	0.35531	0.57688	0.00867	-1.2646
316	-0.6226	1.34462	2.4402	1.37437	0.60799	0.60188	0.16695	-1.5482

317	-0.6777	1.34687	2.47744	1.4109	1.04621	0.76174	-0.0717	-1.2719
318	-0.6225	1.3906	2.47176	1.39352	0.80724	0.68483	0.03661	-1.3067
319	-0.7104	1.28228	2.47193	1.30656	0.66681	0.56408	-0.1453	-1.1028
320	-0.5965	1.33926	2.4958	1.35716	0.67023	0.62891	-0.1156	-1.422
321	-0.554	1.38272	2.60437	1.3474	0.77718	0.69606	0.00259	-1.3381
322	-0.4483	1.47293	2.63015	1.46671	0.8735	0.66216	0.1021	-1.3415
323	-0.5902	1.3565	2.50331	1.36004	0.69315	0.48066	0.28888	-1.421
324	-0.6752	1.28137	2.49683	1.32119	0.73778	0.46227	0.18594	-1.3402
325	-0.6964	1.31462	2.45661	1.31722	0.75882	0.46506	0.28201	-1.1156
326	-0.6999	1.33197	2.508	1.39034	1.02041	0.49007	0.07734	-1.3917
327	-0.4868	1.42855	2.57656	1.39503	1.05418	0.56574	0.27507	-1.2252
328	-0.5755	1.39036	2.53993	1.36587	1.01276	0.51634	0.15233	-1.1533
329	-0.635	1.32368	2.43475	1.24068	0.83667	0.49565	-0.0907	-1.1412
330	-0.639	1.32852	2.45758	1.33804	0.93446	0.53465	-0.1066	-1.8628
331	-0.5569	1.3219	2.46793	1.22559	1.30508	0.62664	0.09	-1.0073
332	-0.6262	1.38153	2.60625	1.36729	1.45003	0.49496	0.03729	-1.0285
333	-0.5993	1.24317	2.5708	1.26173	1.0572	0.40756	-0.0973	-1.0251
334	-0.2957	1.5837	2.8971	1.54694	1.0847	0.79172	0.31089	-0.7999
335	-0.7099	1.26102	2.58275	1.2492	0.51482	0.58186	0.0992	-1.1866
336	-0.4296	1.42379	2.68679	1.44144	0.83323	0.76564	0.2438	-1.2125
337	-0.867	1.18303	2.43719	1.15425	0.53822	0.5282	0.19424	-1.8265
338	-0.5725	1.31108	2.57245	1.23179	0.33603	0.60465	0.41243	-1.1863
339	-0.5232	1.26901	2.59977	1.34452	0.32622	0.62529	0.35999	-1.5081
340	-0.4908	1.34132	2.65616	1.39759	0.40137	0.7039	0.50359	-1.2018
341	-0.4319	1.39555	2.75763	1.58052	0.51367	0.84288	0.83707	-1.3887
342	-0.6153	1.34533	2.65818	1.45046	0.49599	0.69609	0.8315	-1.2976
343	-0.5789	1.33767	2.6243	1.44142	0.51471	0.56418	0.71277	-1.2308
344	-0.6027	1.42695	2.59154	1.52826	0.53882	0.59685	0.69385	-1.2419
345	-0.5429	1.40164	2.47669	1.46732	0.41683	0.52312	0.56259	-1.0603
346	-0.3815	1.40279	2.51058	1.47539	0.27304	0.39855	0.30354	-1.0531
347	-0.4058	1.45687	2.52972	1.5141	0.34569	0.49951	0.16328	-1.2614
348	-0.5544	1.46135	2.48964	1.49813	0.46057	0.54669	0.14731	-1.179
349	-0.5296	1.34899	2.42238	1.3591	0.4909	0.59693	-0.0934	-1.6918
350	-0.4833	1.37598	2.4249	1.48074	0.48977	0.69086	0.28977	-1.5832
351	-0.408	1.41243	2.44547	1.46206	0.60351	0.66316	0.26546	-1.3834
352	-0.4493	1.48543	2.51592	1.57516	0.62885	0.54751	0.06933	-1.46
353	-0.2824	1.49152	2.50009	1.41783	0.71079	0.61715	0.13036	-1.1481
354	-0.6248	1.20707	2.28192	1.16421	0.40058	0.27118	-0.5251	-1.4238
355	-0.4587	1.44473	2.37767	1.41576	0.6939	0.31328	-0.1257	-1.2539
356	-0.5162	1.35901	2.12071	1.33151	0.58002	0.22075	-0.5139	-1.387
357	-0.2898	1.62828	2.48261	1.71959	0.86878	0.45714	-0.0225	-1.2295
358	-0.3587	1.43946	2.38475	1.42481	0.62025	0.40771	0.10364	-0.8596
359	-0.2977	1.55045	2.59254	1.5759	0.68223	0.66665	0.15954	-1.1116
360	-0.6199	1.32139	2.32711	1.25444	0.70714	0.57041	0.01631	-1.0746
361	-0.9007	1.26391	2.39654	1.3732	0.55334	0.68693	0.34212	-1.0758
362	-0.5274	1.41289	2.68905	1.4343	0.57629	0.83237	0.51378	-0.9977

363	-0.8046	1.2977	2.4868	1.31129	0.25649	0.69914	-0.1011	-1.002
364	-0.5542	1.31123	2.55829	1.33031	0.22866	0.75111	-0.1503	-1.3669
365	-0.5067	1.48808	2.8501	1.52288	0.45691	1.05037	0.34024	-1.1182
366	-0.6768	1.19909	2.61008	1.22517	0.36763	0.80937	0.03116	-1.5099
367	-0.6861	1.22815	2.65763	1.2335	0.44638	0.75613	-0.2635	-1.32
368	-0.8045	1.19083	2.45806	1.15754	0.41402	0.69986	-0.2645	-1.261
369	-0.6124	1.25285	2.46606	1.14588	0.32447	0.53522	-0.1298	-0.9666
370	-0.5188	1.39674	2.60555	1.32512	0.22909	0.63681	-0.1781	-1.4667
371	-0.5539	1.39416	2.60646	1.32941	0.35252	0.6607	-0.4475	-1.599
372	-0.4236	1.37952	2.64566	1.28707	0.52019	0.74078	-0.1603	-1.3489
373	-0.2356	1.5287	2.71099	1.42854	0.60413	0.86368	-0.184	-1.1017
374	-0.3826	1.47168	2.72818	1.40169	0.47632	0.88788	-0.1996	-1.2917
375	-0.4694	1.38039	2.65262	1.27333	0.35868	0.81247	-0.1793	-1.1749
376	-0.4934	1.29694	2.52565	1.18256	0.17681	0.62663	-0.4583	-1.1726
377	-0.3337	1.40705	2.6572	1.32353	0.5213	0.86255	-0.2144	-1.1265
378	-0.4313	1.3935	2.60345	1.29422	0.40063	0.80337	-0.1554	-1.0337
379	-0.3348	1.45462	2.63483	1.33136	0.7076	0.88897	-0.275	-1.1333
380	-0.3581	1.52929	2.69305	1.39676	0.59638	0.80588	-1.0582	-0.9928
381	-0.5537	1.42991	2.57602	1.27587	0.4929	0.71699	-0.5537	-1.4633
382	-0.3085	1.54961	2.70365	1.46217	0.44731	0.66575	-0.6398	-1.4024
383	-0.4104	1.4129	2.6952	1.33017	0.35084	0.75799	-0.1847	-1.1325
384	-0.4797	1.41341	2.68782	1.30597	0.48272	0.85832	0.28221	-1.1417
385	-0.6639	1.25531	2.55248	1.25361	0.36161	0.75366	0.18616	-1.9071
386	-0.6175	1.3394	2.65159	1.37473	0.49029	0.96012	0.19485	-1.2583
387	-0.5347	1.372	2.60336	1.28257	0.34795	0.85982	-0.1108	-1.2662
388	-0.5093	1.39161	2.70787	1.37423	0.35514	0.8432	0.15691	-1.1936
389	-0.6047	1.42769	2.72907	1.42266	0.41981	0.83973	0.30203	-1.0221
390	-0.6513	1.30169	2.55508	1.24021	0.27967	0.59485	0.24211	-1.4088
391	-0.6727	1.21094	2.49673	1.2044	0.24502	0.57358	0.37169	-1.3924
392	-0.6967	1.18713	2.45987	1.25463	0.24688	0.45307	0.12292	-1.2686
393	-0.5997	1.36465	2.56779	1.29657	0.31993	0.55114	0.36553	-1.5231
394	-0.5756	1.35741	2.55441	1.2758	0.37449	0.50466	0.34185	-1.4655
395	-0.5889	1.27292	2.5049	1.29551	0.36729	0.39685	-0.1722	-1.4735
396	-0.5707	1.31723	2.46352	1.3439	0.2974	0.54576	0.21372	-1.4648
397	-0.6107	1.40323	2.47016	1.36494	0.5534	0.51376	0.24048	-1.3271
398	-0.8449	1.16929	2.3755	1.22114	0.39892	0.47899	-0.0292	-1.2763
399	-0.5242	1.32564	2.50355	1.24457	0.47225	0.52142	0.24409	-1.1635
400	-0.6056	1.33888	2.52032	1.36062	0.28342	0.41403	0.09765	-1.7348
401	-0.6332	1.34174	2.42538	1.38614	0.52859	0.45764	0.079	-1.2976
402	-0.9758	1.03837	2.21043	1.1816	0.41586	0.38394	-0.0355	-1.5596
403	-0.713	1.22751	2.31082	1.21162	0.39579	0.44408	-0.0728	-1.5765
404	-0.6767	1.27806	2.37335	1.26432	0.3638	0.4197	0.1739	-1.4857
405	-0.6872	1.28057	2.2989	1.25946	0.13536	0.20997	-0.2703	-1.4065
406	-0.3348	1.55734	2.64708	1.58522	0.34921	0.54149	0.05737	-0.9194
407	-0.3667	1.49273	2.5607	1.51019	0.43098	0.59231	0.05973	-1.6304
408	-0.5414	1.39945	2.45352	1.37947	0.34218	0.49902	0.05569	-1.3449

409	-0.7965	1.21155	2.25236	1.28657	0.15961	0.35217	0.09857	-1.6035
410	-0.8009	1.21805	2.27972	1.3012	0.28528	0.41056	0.12245	-1.7038
411	-1.0811	0.93145	2.05921	1.13793	0.18242	0.28611	0.30688	-2.0229
412	-0.9403	0.97588	2.12184	1.09654	0.17505	0.40997	0.13346	-1.4301
413	-0.7077	1.21679	2.32888	1.26806	0.4786	0.53526	0.40019	-1.6127
414	-0.9194	0.99748	2.03048	1.00507	0.51124	0.37847	0.15297	-1.3618
415	-0.701	1.1908	2.26518	1.26202	0.24223	0.43792	0.76079	-1.2825
416	-0.5933	1.25174	2.48626	1.45696	0.34242	0.48465	1.00117	-1.2666
417	-0.6709	1.28611	2.48607	1.40778	0.28934	0.54396	0.77919	-1.5014
418	-0.714	1.26044	2.23968	1.34199	0.24112	0.36086	0.38263	-1.2343
419	-0.6104	1.33853	2.23337	1.40078	0.51133	0.42764	0.47056	-1.6391
420	-0.4875	1.43478	2.36073	1.46999	0.42605	0.47601	0.62427	-1.4196
421	-0.5151	1.25433	2.44715	1.32037	0.18364	0.39608	0.61726	-1.3469
422	-0.4464	1.26669	2.60548	1.58427	0.0218	0.53654	0.70146	-1.4031
423	-0.5326	1.23238	2.57706	1.55478	0.48468	0.53798	0.5826	-1.4913
424	-0.718	1.23504	2.3193	1.29316	0.52607	0.38138	0.38588	-1.4399
425	-0.5131	1.28264	2.24295	1.32654	0.47058	0.29217	0.06837	-1.218
426	-0.64	1.21781	2.20591	1.25303	0.21697	0.30449	-0.0267	-1.6498
427	-0.632	1.24713	2.15482	1.27052	0.51058	0.48209	0.30837	-1.0825
428	-0.4748	1.34444	2.2183	1.36774	0.65908	0.44043	0.14099	-1.0744
429	-0.2138	1.5845	2.41481	1.58988	0.65352	0.41083	0.10811	-0.8239
430	-0.2188	1.4905	2.21535	1.45987	0.53261	0.24076	-0.1591	-1.2807
431	-0.4344	1.36222	2.00655	1.35206	0.68856	0.27438	0.11189	-1.6265
432	-0.2869	1.53672	2.12664	1.49876	0.89987	0.44408	0.28474	-1.5373
433	-0.4111	1.44649	2.07028	1.40568	0.76391	0.29644	0.20073	-1.5685
434	-0.3429	1.47578	2.03598	1.41633	0.97124	0.33249	0.25598	-1.3055
435	-0.5927	1.18794	1.93998	1.15388	0.89371	0.20497	0.09006	-1.5349
436	-0.4662	1.33949	2.14284	1.30887	0.87309	0.03911	-0.0366	-1.4565
437	-0.2901	1.52911	2.02202	1.4552	0.88815	0.04185	-0.0409	-1.0771
438	-0.5271	1.2206	1.79718	1.22083	0.90162	0.17113	0.02325	-1.5671
439	-1.1634	0.82143	1.55413	0.91887	0.664	-0.0291	-0.164	-1.9488
440	-0.649	1.35886	1.97628	1.44	0.97413	0.16235	0.07356	-0.9559
441	-0.9814	1.08992	1.45182	1.14965	0.79311	-0.052	-0.321	-1.4748
442	-0.9339	1.1764	1.73607	1.26912	0.76301	0.0991	0.05285	-1.3043
443	-0.9883	1.08471	1.54483	1.12973	0.64085	0.00868	0.05203	-1.7127
444	-0.8558	1.20767	1.59636	1.26301	0.75427	0.01419	0.00777	-1.1343
445	-0.8679	0.95679	1.49386	0.9577	0.61474	0.04016	-0.1904	-1.6059
446	-0.7499	1.13476	1.7608	1.11154	0.66458	0.04418	-0.1645	-1.4349
447	-1.1112	0.94038	1.62844	0.94264	0.53755	-0.1056	-0.2153	-1.6793
448	-0.7421	1.12692	1.94558	1.13668	0.54132	0.0405	-0.0507	-1.1648
449	-0.5777	1.34367	1.97431	1.33016	0.51554	0.2128	0.06267	-1.615
450	-0.5141	1.3284	2.12351	1.30231	0.12895	0.3034	-0.1089	-1.3203
451	-0.8357	1.06253	1.91827	1.0251	0.06249	0.07793	-0.3495	-1.4451
452	-0.7182	1.20485	2.11706	1.15841	0.13928	0.25551	-0.2309	-1.4975
453	-0.5559	1.27282	2.21425	1.24139	0.26322	0.39604	-0.1635	-1.4314
454	-0.5399	1.29568	2.26221	1.26249	0.33502	0.43718	-0.1244	-1.3667

455	-0.8314	1.14807	2.09426	1.17555	0.38536	0.40801	-0.0769	-1.9671
456	-0.5339	1.31234	2.25908	1.21534	0.47712	0.56336	0.11943	-1.2608
457	-0.5613	1.30186	2.21701	1.24749	0.23381	0.39489	-0.1105	-1.3624
458	-0.6683	1.25248	2.16041	1.12249	0.23814	0.32475	-0.1781	-1.2155
459	-0.8039	1.11907	2.04278	1.08295	0.1682	0.24408	-0.3539	-1.6143
460	-0.7518	1.14303	2.05593	1.08785	0.23831	0.33612	-0.295	-1.2633
461	-0.8503	1.08613	2.08989	1.05502	0.27091	0.37842	-0.2184	-1.7064
462	-1.7024	0.67717	1.83061	0.65766	0.37707	0.67314	0.23606	-0.7878
463	-1.0685	1.08644	2.31116	1.17393	0.58993	0.42567	-0.0548	-1.4256
464	-0.6594	1.40871	2.62531	1.43269	0.78164	0.54338	-0.0426	-1.5805
465	-0.5112	1.44898	3.04429	1.58421	0.80784	0.67792	-0.2031	-2.0083
466	-0.5221	1.54377	3.15103	1.52808	0.76824	0.94559	0.11811	-2.1614
467	-0.5824	1.47178	2.65818	1.51156	0.45168	0.77837	0.34831	-1.3466
468	-0.7594	1.22169	2.43351	1.22764	0.33382	0.52206	0.03235	-1.8472
469	-0.4017	1.51302	2.59493	1.5476	0.56444	0.68418	0.03962	-2.3351
470	-0.8178	1.21162	2.1939	1.1252	0.62499	0.36111	-0.2504	-2.1368
471	-0.7731	1.17624	2.15979	1.09285	0.40599	0.44992	-0.2447	-2.0455
472	-0.539	1.40771	2.41907	1.40553	0.45902	0.43731	-0.123	-2.0198
473	-0.5286	1.45566	2.50198	1.46513	0.5217	0.50088	0.24444	-2.5949
474	-0.6385	1.28927	2.32902	1.29213	0.33826	0.30556	-0.0028	-1.4383
475	-0.5601	1.33402	2.31828	1.35365	0.27325	0.45443	0.00138	-1.7686
476	-0.4846	1.39356	2.29715	1.38768	0.46696	0.43421	0.18809	-1.7509
477	-0.5931	1.26822	2.10372	1.24526	0.18106	0.28247	0.6169	-1.4863
478	-0.7288	1.2664	2.07879	1.30429	0.1284	0.18718	0.60069	-1.8181
479	-0.5044	1.43546	2.02548	1.40193	0.28456	0.38635	0.56062	-1.3594
480	-0.6964	1.25193	1.82561	1.26714	0.15018	0.09771	0.32553	-1.0121
481	-0.7765	1.28767	1.94604	1.36905	0.36622	0.35196	0.42365	-1.2426
482	-0.7624	1.32419	2.06121	1.43886	0.47468	0.37129	0.47634	-1.038
483	-0.7448	1.27635	2.03938	1.34738	0.35771	0.32649	0.50554	-0.9312
484	-0.6379	1.42227	2.11696	1.41995	0.35371	0.31882	0.46075	-1.1436
485	-0.5028	1.42485	2.07625	1.48067	0.29527	0.25986	0.2804	-1.1194
486	-0.6533	1.28892	2.01163	1.36184	0.30693	0.29292	0.43581	-1.2826
487	-0.6386	1.27757	2.21467	1.22449	0.39011	0.32481	0.29745	-1.4591
488	-0.7826	1.31579	2.35209	1.18695	0.26774	0.44975	0.04619	-1.4272
489	-0.5348	1.46706	2.3968	1.40324	0.4201	0.44875	0.06676	-1.3863
490	-0.5605	1.44888	2.34089	1.45722	0.44072	0.55909	0.30041	-1.4311
491	-0.6424	1.39079	2.27894	1.33686	0.34256	0.35761	0.16854	-1.5404
492	-0.6237	1.40209	2.38154	1.30334	0.27691	0.42955	0.03956	-1.1973
493	-0.6644	1.39983	2.48922	1.3237	0.31331	0.52577	-0.2037	-1.1296
494	-0.7592	1.34317	2.37833	1.37762	0.4329	0.46984	0.06254	-1.2398
495	-0.4866	1.46619	2.45432	1.37518	0.50465	0.44279	0.02344	-1.0796
496	-0.6142	1.324	2.37558	1.32604	0.25282	0.23103	-0.1709	-1.5426
497	-0.5995	1.35195	2.37076	1.27653	0.2727	0.18963	0.03679	-1.4533
498	-0.7709	1.23724	2.25551	1.23916	0.14134	0.1103	-0.0066	-1.5241
499	-0.6488	1.2449	2.20143	1.2155	0.04984	0.00735	-0.1043	-1.6793
500	-0.5405	1.38827	2.41081	1.32641	0.32282	0.26615	0.0282	-1.7659

501	-0.7255	1.22962	2.23302	1.16354	-0.0543	0.09727	-0.2056	-1.6665
502	-0.6064	1.29773	2.26206	1.29305	0.2639	0.21686	-0.0277	-1.075
503	-0.6672	1.18321	2.12689	1.17272	0.56264	0.11956	-0.2896	-1.3112
504	-0.6448	1.23253	2.01731	1.1785	0.8577	0.08495	-0.4034	-1.6927
505	-0.6092	1.29957	2.12327	1.2849	0.58968	0.09034	-0.1985	-1.3102
506	-0.4821	1.41352	2.22987	1.39277	0.59295	0.11581	-0.3104	-1.0263
507	-0.7801	1.30489	2.06228	1.27044	0.32888	-0.0229	0.19834	-1.3207
508	-0.489	1.35276	2.17934	1.30467	0.36459	0.30836	0.31845	-1.403
509	-0.5341	1.42748	2.17469	1.3343	0.26545	0.16803	0.56932	-1.075
510	-0.6716	1.28542	2.10307	1.24096	0.25771	0.21877	0.36753	-1.2464
511	-0.6755	1.25495	2.03239	1.28052	0.61431	0.13904	0.38542	-1.5435
512	-0.4637	1.50007	2.20618	1.4989	0.70099	0.35735	0.41343	-1.0222
513	-0.5721	1.34484	2.11775	1.30498	0.2046	0.25178	0.04463	-0.985
514	-0.7797	1.29475	2.07714	1.24652	0.2775	0.29365	-0.1345	-1.0361
515	-0.5937	1.31209	2.11287	1.28193	0.3256	0.21916	-0.0473	-1.4329
516	-0.6846	1.35457	2.23409	1.30755	0.52478	0.43039	-0.0687	-1.2179
517	-0.5605	1.38769	2.23464	1.24283	0.3764	0.33127	-0.1425	-1.2475
518	-0.6415	1.36396	2.14881	1.39298	0.24663	0.24806	-0.2422	-1.3533
519	-0.4727	1.4033	2.22566	1.40727	0.29879	0.33555	-0.0753	-1.4374
520	-0.4436	1.45686	2.41241	1.41347	0.44864	0.50164	-0.1811	-1.4876
521	-0.7741	1.23609	2.16511	1.12941	0.23174	0.19784	-0.3451	-1.3823
522	-0.6442	1.33503	2.23285	1.29734	0.24203	0.3853	-0.3318	-1.5859
523	-0.6714	1.28455	2.20609	1.32069	0.3512	0.25893	-0.0906	-1.3845
524	-0.63	1.36418	2.29427	1.31117	0.26286	0.32457	-0.2716	-1.3928
525	-0.6841	1.28318	2.17175	1.22575	0.16241	0.30418	-0.1507	-1.643
526	-0.6792	1.29646	2.3003	1.2541	0.08686	0.31994	-0.1953	-1.1205
527	-0.5822	1.30607	2.24374	1.2404	0.17578	0.23932	-0.0724	-1.1235
528	-0.6494	1.26266	2.11549	1.26207	0.19532	0.16581	-0.3294	-1.2687
529	-0.4668	1.41423	2.22034	1.34352	0.48828	0.26485	-0.1714	-1.1296
530	-0.858	1.23208	2.0262	1.13504	0.26877	0.27168	-0.4386	-1.3448
531	-0.6288	1.35835	2.25949	1.33086	0.30225	0.38264	-0.3673	-1.5707
532	-0.6074	1.3686	2.21345	1.33284	0.25492	0.36452	-0.2837	-1.9801
533	-0.7524	1.27179	2.18581	1.18464	0.12528	0.26811	-0.7149	-1.5682
534	-0.6649	1.31275	2.29945	1.28309	-0.0493	0.25974	-0.2123	-1.7837
535	-0.5382	1.36261	2.36926	1.34612	0.08949	0.44129	0.05477	-0.984
536	-0.7467	1.21534	2.2688	1.23002	-0.1955	0.36371	-0.1271	-1.1503
537	-0.7949	1.31568	2.36751	1.29642	-0.057	0.4447	0.24391	-1.1618
538	-0.547	1.41936	2.41138	1.37466	0.06739	0.45423	0.24112	-1.4043
539	-0.6044	1.3481	2.33634	1.30686	-0.0206	0.45152	0.07935	-1.308
540	-0.715	1.41357	2.38478	1.3434	-0.0339	0.44729	0.01683	-1.1122
541	-0.6792	1.31131	2.37877	1.2464	-0.0347	0.39422	-0.1274	-1.11
542	-0.4296	1.48747	2.57668	1.42948	0.01598	0.61859	-0.1779	-1.2336
543	-0.5505	1.36212	2.40339	1.29532	-0.0355	0.49793	-0.2328	-1.5026
544	-0.4427	1.4397	2.41259	1.36638	0.03647	0.45271	-0.171	-1.2155
545	-0.4786	1.40103	2.42894	1.35978	0.05934	0.40173	-0.2157	-1.1871
546	-0.6611	1.36975	2.34527	1.26431	0.01327	0.40508	-0.1992	-1.046

547	-0.7667	1.32762	2.24101	1.25807	0.03063	0.35438	-0.3682	-1.2533
548	-0.6582	1.33371	2.26705	1.28952	0.25881	0.46459	-0.2659	-1.822
549	-0.6524	1.36805	2.27471	1.29945	0.29489	0.55366	-0.1095	-1.5969
550	-0.6495	1.43095	2.34583	1.44081	0.29565	0.57218	-0.4303	-1.1588
551	-0.7088	1.30566	2.13459	1.28799	0.28088	0.45261	-0.342	-1.6495
552	-0.7852	1.3064	2.12709	1.24477	0.20157	0.41048	-0.4217	-1.4337
553	-0.6926	1.25687	2.07281	1.28897	0.23797	0.48147	-0.2393	-1.3822
554	-0.7508	1.32122	2.12616	1.2784	0.22573	0.46429	-0.3213	-1.2351
555	-0.7447	1.20137	2.01162	1.17887	0.12709	0.46306	-0.1836	-1.5183
556	-0.7341	1.24406	2.00627	1.22896	0.09501	0.4357	-0.3607	-1.3617
557	-0.7643	1.23049	2.15188	1.23153	0.01264	0.36302	-0.4452	-1.4284
558	-0.6303	1.35463	2.38316	1.369	0.2468	0.62778	0.0307	-1.1188
559	-1.011	1.07426	2.24582	1.08477	0.37696	0.66766	0.02515	-1.4065
560	-0.6045	1.2153	2.3892	1.189	0.33482	0.673	-0.143	-1.2965
561	-0.4348	1.49599	2.56904	1.45398	0.31864	0.81837	-0.0861	-1.4153
562	-0.5182	1.39799	2.59785	1.32346	0.33579	0.71203	-0.2421	-1.2754
563	-0.5342	1.39102	2.63732	1.35426	0.32044	0.71598	-0.224	-1.1877
564	-0.5952	1.41097	2.65043	1.32035	0.31544	0.75246	-0.2215	-1.1906
565	-0.477	1.42365	2.59347	1.357	0.3606	0.75172	-0.3002	-1.5808
566	-0.7332	1.29565	2.58178	1.29334	0.51794	0.79335	-0.3755	-1.7426
567	-0.6939	1.42569	2.59386	1.43674	0.45694	0.80595	-0.3053	-1.8001
568	-0.6539	1.43411	2.65301	1.45778	0.35951	0.76039	-0.1414	-1.7276
569	-0.5238	1.54301	2.7098	1.49428	0.33311	0.79833	-0.0995	-1.3477
570	-0.6315	1.36246	2.52859	1.36349	0.19904	0.6169	-0.4583	-1.8319
571	-0.513	1.44875	2.72189	1.38418	0.34662	0.77449	-0.3493	-1.3785
572	-0.4943	1.48005	2.61819	1.36806	0.32196	0.7023	-0.3539	-1.1771
573	-0.4873	1.48661	2.69139	1.45412	0.3351	0.83556	-0.0837	-1.4036
574	-0.4272	1.43274	2.70838	1.3886	0.1689	0.87956	-0.2379	-1.365
575	-0.5657	1.37364	2.66055	1.31467	0.00577	0.79819	-0.33	-1.687
576	-0.4817	1.48998	2.74275	1.40948	0.01065	0.87147	-0.0597	-1.0768
577	-0.3743	1.5133	2.75587	1.47187	-0.0357	0.90253	-0.0455	-1.1285
578	-0.616	1.40993	2.77978	1.41309	0.11586	0.94573	-0.1178	-1.3547
579	-0.5324	1.30643	2.70565	1.19709	0.22668	0.81568	-0.0985	-1.1642
580	-0.2699	1.54836	3.08994	1.48532	0.27246	1.08501	0.2159	-1.2808
581	-0.4216	1.41883	2.90185	1.3377	0.10576	1.00239	0.16185	-1.4059
582	-0.5036	1.40442	2.93069	1.37659	0.15241	0.93906	0.11567	-1.1901
583	-0.4759	1.33543	2.89656	1.27802	0.08258	0.90234	-0.0075	-1.3708
584	-0.5613	1.31642	2.85513	1.36508	0.29679	0.86471	-0.1415	-1.6536
585	-0.4409	1.34087	2.88443	1.30945	0.45552	0.8712	-0.128	-1.7873
586	-0.7183	1.25507	2.76998	1.22775	0.35792	0.80093	-0.1371	-1.1822
587	-0.6613	1.28273	2.76602	1.21262	0.29847	0.84357	-0.5174	-0.998
588	-0.6407	1.31093	2.87414	1.30016	0.37156	0.90313	-0.3015	-1.2566
589	-0.6661	1.24866	2.79215	1.24743	0.25874	0.85008	-0.2195	-1.3242
590	-0.5606	1.41349	2.94426	1.37537	0.28885	0.97547	-0.1206	-1.4994
591	-0.5233	1.28517	2.84401	1.25482	0.08599	0.8239	-0.4279	-1.6061
592	-0.4287	1.51674	3.01155	1.42864	0.22275	0.98334	-0.2879	-1.7468

593	-0.6338	1.30131	2.762	1.16378	0.10632	0.75599	-0.4688	-1.329
594	-0.5524	1.34591	2.89923	1.33076	0.20634	0.83756	-0.2025	-1.1368
595	-0.7146	1.30794	2.70184	1.21499	0.21776	0.74783	-0.4122	-1.2505
596	-0.62	1.28864	2.75756	1.17335	0.17731	0.82539	-0.3794	-1.3729
597	-0.6481	1.37428	2.71318	1.23502	0.14041	0.80952	-0.3185	-1.3783
598	-0.718	1.26491	2.70787	1.16859	0.15656	0.77499	-0.4348	-1.1587
599	-0.6221	1.37566	2.92823	1.27718	0.27176	0.88387	-0.2743	-1.3233
600	-0.7873	1.29749	2.72532	1.18709	0.10547	0.76964	-0.264	-1.7739
601	-0.7142	1.29605	2.76048	1.23558	-0.0216	0.68132	-0.3697	-1.3519
602	-0.6368	1.3579	2.81518	1.24364	-0.0378	0.776	-0.0748	-1.3215
603	-0.6135	1.38883	2.83497	1.24036	-0.0356	0.82159	-0.2248	-1.2324
604	-0.411	1.59495	3.07098	1.52412	0.27212	1.1172	-0.0925	-0.9947
605	-0.7433	1.29493	2.72758	1.26824	-0.03	0.78104	-0.4698	-1.6459
606	-0.7768	1.19122	2.63496	1.11125	-0.0831	0.63524	-0.435	-1.7534
607	-0.6052	1.38659	2.82527	1.33983	0.19217	0.82621	-0.4413	-1.2962
608	-0.7337	1.27901	2.62612	1.22581	0.06216	0.64935	-0.4496	-1.2942
609	-0.7417	1.23858	2.5918	1.11569	0.0514	0.73846	-0.4162	-1.3129
610	-0.5596	1.37364	2.75446	1.33244	0.15725	0.72298	-0.3494	-1.0755
611	-0.7009	1.27659	2.62796	1.22399	0.01224	0.66531	-0.2992	-1.8289
612	-0.5934	1.34747	2.62483	1.23555	0.07582	0.69132	-0.5084	-1.4186
613	-0.5439	1.42458	2.73762	1.25872	0.05987	0.68209	-0.6287	-1.5022
614	-0.5555	1.45774	2.77902	1.26988	-0.0652	0.69181	-0.9083	-1.6283
615	-0.7246	1.35351	2.63378	1.26033	0.06899	0.74599	-0.7489	-1.2803
616	-0.7361	1.37085	2.64704	1.21256	0.01034	0.696	-0.6947	-1.5082
617	-0.7269	1.35672	2.66458	1.245	0.06885	0.71986	-1.1108	-1.3087
618	-0.712	1.30847	2.61946	1.20113	0.03621	0.67598	-0.6548	-1.5887
619	-0.5423	1.44377	2.84833	1.32396	0.08881	0.83606	-0.3662	-1.2289
620	-0.604	1.33482	2.69963	1.26808	0.03649	0.72798	-0.2679	-1.0468
621	-0.7466	1.1808	2.55663	1.13962	-0.0032	0.71678	-0.6535	-1.2821
622	-0.5668	1.30259	2.7098	1.27928	0.02787	0.69623	-0.4826	-1.2438
623	-0.5636	1.39981	2.82598	1.33064	0.13749	0.79339	-0.3687	-1.0952
624	-0.7408	1.31305	2.64131	1.24763	0.10648	0.7516	-0.5201	-1.5146
625	-0.7943	1.33959	2.6609	1.21748	0.06382	0.80206	-0.7591	-1.5109
626	-0.7293	1.29914	2.71423	1.19864	0.0107	0.83827	-0.7644	-1.5319
627	-0.7416	1.28924	2.73944	1.20626	-0.1303	0.81584	-0.9356	-1.7339
628	-0.5519	1.43461	2.81752	1.28814	0.02398	0.88092	-0.9375	-1.2336
629	-0.649	1.42716	2.88417	1.22711	-0.1099	0.83726	-0.2659	-1.2448
630	-0.8279	1.23204	2.62314	1.16183	-0.0487	0.75426	-0.7538	-1.6795
631	-0.8978	1.28661	2.73154	1.13359	-0.1062	0.77057	-0.9334	-1.1695
632	-0.6397	1.36473	2.79264	1.21737	0.09769	0.84534	-0.4648	-1.3105
633	-0.7321	1.26568	2.67839	1.13993	0.11629	0.78517	-0.7756	-1.0668
634	-0.581	1.37676	2.73391	1.33384	0.13544	0.9131	-0.6895	-1.0998
635	-0.827	1.19966	2.62489	1.21946	-0.0652	0.7514	-0.8896	-1.5129
636	-0.7106	1.28511	2.62612	1.2218	0.07317	0.84943	-0.6516	-1.2846
637	-0.6126	1.34299	2.6777	1.27711	0.09332	0.84033	-0.6422	-1.1697
638	-0.6089	1.32817	2.64454	1.25346	0.01334	0.81756	-0.3704	-1.3282

639	-0.6889	1.35167	2.70424	1.29537	0.05545	0.86044	-0.7729	-1.3519
640	-0.5374	1.45524	2.84105	1.45816	0.39707	0.89546	-0.4773	-1.2757
641	-0.2941	1.56912	3.00726	1.54664	0.36101	1.00653	-0.0294	-1.3321
642	-0.3621	1.51211	3.00484	1.52314	0.32099	0.95384	-0.3551	-1.1576
643	-0.5661	1.32183	2.68955	1.20815	0.17781	0.76832	-0.5343	-1.3079
644	-0.627	1.31922	2.78374	1.25535	0.03841	0.79238	-0.3539	-1.5699
645	-0.4574	1.39911	2.88426	1.3514	0.0863	0.89236	-0.4061	-1.3422
646	-0.5766	1.36411	2.72631	1.28358	-0.0024	0.79036	-0.4416	-1.3528
647	-0.3456	1.49809	2.90231	1.39726	0.06797	0.90678	-0.4148	-1.2369
648	-0.5339	1.34885	2.71552	1.24894	0.03663	0.76407	-0.4389	-1.0831
649	-0.4417	1.40234	2.7764	1.40711	0.04935	0.89825	-0.6338	-2.0267
650	-0.5092	1.40171	2.85191	1.45455	0.03752	0.88128	-0.4355	-1.4749
651	-0.4333	1.43845	2.87028	1.32297	0.14475	0.91806	-0.6253	-1.3262
652	-0.3735	1.52617	2.88642	1.42803	0.12002	0.94944	-0.3455	-0.8714
653	-0.5288	1.34948	2.77032	1.30456	-0.1224	0.8302	-0.1725	-1.2308
654	-0.5139	1.42446	2.89351	1.3117	-0.0391	0.88955	-0.4977	-1.3029
655	-0.4511	1.39142	2.76769	1.34812	-0.1479	0.82969	-0.4688	-1.4381
656	-0.6275	1.2867	2.7187	1.25128	-0.0809	0.81845	-0.5011	-1.3228
657	-0.4964	1.42835	2.81926	1.39198	0.05357	0.97747	-0.3246	-1.0039
658	-0.517	1.4198	2.80859	1.34311	0.03793	0.94955	-0.321	-0.9023
659	-0.5752	1.38498	2.75422	1.24723	-0.137	0.80872	-0.4522	-1.6421
660	-0.4269	1.46886	2.88175	1.33818	0.02416	0.8401	-0.4963	-1.1583
661	-0.5494	1.38688	2.73717	1.23759	-0.1413	0.75005	-0.5313	-1.1892
662	-0.4454	1.47994	2.89817	1.36603	0.03588	0.89079	-0.6052	-1.2482
663	-0.5119	1.43435	2.84341	1.2518	0.06088	0.74355	-0.4301	-1.3869
664	-0.3221	1.59244	3.02685	1.54703	0.19615	1.01604	-0.0478	-0.9384
665	-0.7106	1.31274	2.69388	1.2538	-0.0073	0.77872	-0.664	-1.2367
666	-0.6585	1.32878	2.76703	1.20312	-0.0155	0.78753	-0.2881	-1.2375
667	-0.6283	1.33843	2.73267	1.23003	0.08193	0.76811	-0.4358	-1.3642
668	-0.6574	1.22888	2.71719	1.21313	-0.0234	0.67845	-0.7042	-1.6211
669	-0.6839	1.30783	2.70921	1.15712	-0.0029	0.69488	-0.1599	-1.1382
670	-0.6018	1.27824	2.70008	1.1275	0.06484	0.71034	-0.0181	-1.0282
671	-0.6149	1.37874	2.78172	1.25249	0.17847	0.75011	-0.5115	-1.255
672	-0.5543	1.41646	2.7949	1.26056	0.17304	0.8207	-0.159	-1.4523
673	-0.5988	1.3908	2.77204	1.23636	0.18677	0.71347	-0.2846	-0.9317
674	-0.7674	1.17592	2.70907	1.12803	-0.1126	0.64733	-0.7572	-1.3005
675	-0.5397	1.395	2.94167	1.3762	0.1241	0.88498	-0.2757	-1.3811
676	-0.581	1.3442	2.7403	1.35493	0.03534	0.77595	-0.4365	-1.2838
677	-0.7036	1.28206	2.69718	1.15282	-0.0378	0.63641	-0.4209	-1.583
678	-0.5378	1.31784	2.86142	1.16451	0.00945	0.62768	-0.3243	-1.2101
679	-0.5791	1.32082	2.76981	1.24979	-0.0759	0.67842	-0.316	-1.2455
680	-0.7487	1.20106	2.71351	1.12268	-0.0961	0.71877	-0.5576	-1.5518
681	-0.6977	1.19742	2.75462	1.16733	-0.1008	0.71448	-0.6073	-1.2737
682	-0.7151	1.23665	2.64859	1.13379	-0.1	0.69648	-0.4088	-1.3692
683	-0.5244	1.42337	2.75079	1.28677	0.01535	0.76043	-0.4592	-1.4432
684	-0.7038	1.25529	2.63055	1.15877	-0.1643	0.64805	-0.6776	-1.441

685	-0.5766	1.38251	2.75985	1.25715	-0.0672	0.75531	-0.4148	-1.0649
686	-0.5395	1.36118	2.67975	1.22858	-0.0662	0.7122	-0.5824	-1.1878
687	-0.5579	1.44021	2.80936	1.37515	0.13851	0.88226	-0.3705	-1.3293
688	-0.5824	1.28275	2.72133	1.21427	-0.0417	0.6397	-0.4518	-1.4962
689	-0.5029	1.43451	2.8049	1.31961	0.04792	0.79023	-0.2775	-1.2683
690	-0.4643	1.37098	2.75271	1.30874	-0.0923	0.66134	-0.4518	-1.4786
691	-0.5701	1.35421	2.76297	1.35587	-0.1152	0.68699	-0.4178	-1.6271
692	-0.5173	1.35748	2.81007	1.29332	-0.0156	0.60222	-0.3502	-1.3996
693	-0.3419	1.50839	2.90576	1.45067	0.4087	0.77703	-0.4612	-1.3322
694	-0.459	1.38001	2.86703	1.26722	0.24879	0.67966	-0.2156	-1.5161
695	-0.5989	1.34995	2.80548	1.31612	0.01198	0.70065	-0.2052	-1.2833
696	-0.6552	1.26257	2.85533	1.19496	-0.1108	0.72189	-0.4517	-1.4971
697	-0.4667	1.43893	2.93006	1.36198	0.07663	0.80995	-0.2839	-1.218
698	-0.4365	1.41911	2.85011	1.32919	-0.1	0.78322	-0.2666	-1.3833
699	-0.5402	1.3477	2.79354	1.31472	-0.1622	0.73973	-0.221	-1.2156
700	-0.5425	1.38774	2.82048	1.26716	0.13317	0.76732	-0.4624	-1.0815
701	-0.5661	1.4041	2.86293	1.25709	-0.0375	0.76035	-0.2853	-1.2716
702	-0.4273	1.34222	2.80452	1.18073	-0.1758	0.77922	-0.4351	-1.1636
703	-0.4276	1.36698	2.5739	1.30565	-0.0985	0.62107	-0.6057	-1.3148
704	-0.4857	1.47004	2.55439	1.41521	-0.0987	0.55501	-0.7163	-1.4407
705	-0.3909	1.49944	2.68881	1.39955	0.16359	0.716	-0.47	-1.3087
706	-1.1888	0.98234	2.23527	0.98045	-0.2587	0.52644	-0.6292	-1.3309
707	-0.9405	1.18366	2.4869	1.19343	-0.0744	0.71162	-0.5056	-1.3816
708	-0.8236	1.17644	2.54619	1.16846	0.03244	0.67987	-0.1449	-1.1772
709	-0.7205	1.28565	2.61998	1.20868	-0.0268	0.65774	-0.3827	-1.2708
710	-0.6354	1.33175	2.55791	1.27188	-0.0231	0.61964	-0.3876	-1.3703
711	-0.6674	1.25812	2.55988	1.22064	-0.1586	0.58494	-0.8294	-1.3315
712	-0.4075	1.52438	2.81261	1.42056	0.12645	0.85834	-0.1123	-1.4621
713	-0.3162	1.53255	2.86162	1.46693	0.1384	0.91364	-0.4599	-1.1312
714	-0.5518	1.39138	2.73104	1.27332	-0.1091	0.83998	-0.3963	-1.3269
715	-0.4147	1.49438	2.87562	1.46384	0.11006	0.97853	-0.1439	-1.1903
716	-0.6801	1.21939	2.57054	1.08485	0.06893	0.65261	-0.4366	-1.4511
717	-0.4984	1.3975	2.65815	1.19911	0.0136	0.80578	-0.635	-1.371
718	-0.5621	1.39886	2.75677	1.28425	0.14716	0.88203	-0.6766	-1.1011
719	-0.7677	1.25746	2.58832	1.20268	-0.137	0.77107	-0.5434	-1.2356
720	-0.6599	1.28351	2.58776	1.17238	-0.2312	0.71689	-1.0098	-1.3561
721	-0.4738	1.45497	2.70845	1.30084	-0.0331	0.80433	-0.3606	-0.9122
722	-0.6236	1.39446	2.68091	1.30513	-0.1326	0.68369	-0.4559	-1.2573
723	-0.5986	1.39426	2.6129	1.29719	-0.0889	0.79524	-0.7947	-1.716
724	-0.672	1.36028	2.58329	1.2899	-0.1285	0.6862	-0.6354	-1.4439
725	-0.4881	1.48098	2.75165	1.45598	0.04077	0.81425	-0.2308	-1.1377
726	-0.6893	1.287	2.55142	1.19849	-0.1675	0.65397	-0.3956	-2.0409
727	-0.2927	1.53674	2.90334	1.54446	0.07029	0.92228	-0.0305	-1.5997
728	-0.4346	1.45197	2.84562	1.45167	-0.1088	0.81296	0.18102	-1.4047
729	-0.5286	1.35746	2.88781	1.27731	-0.1654	0.81209	-0.2732	-1.31
730	-0.6071	1.29541	2.78262	1.2531	-0.2332	0.7808	-0.2605	-1.2516

731	-0.5033	1.38922	2.83811	1.39279	-0.0751	0.85767	-0.1677	-1.2204
732	-0.6884	1.32286	2.68616	1.24441	-0.2527	0.74746	-0.2988	-1.5854
733	-0.6487	1.42951	2.78731	1.39728	-0.0301	0.82684	-0.1675	-1.0881
734	-0.7546	1.28741	2.52937	1.18663	-0.1284	0.58421	-0.454	-1.5173
735	-0.4559	1.57198	2.87642	1.47405	0.17965	0.90725	0.09316	-0.954
736	-0.7108	1.37271	2.70747	1.30917	0.03449	0.74316	-0.2624	-1.0726
737	-0.5882	1.37846	2.68925	1.29288	0.11067	0.77548	0.03348	-1.3191
738	-0.5155	1.4286	2.80075	1.39258	0.08596	0.91777	0.24661	-1.3427
739	-0.424	1.50095	2.86211	1.50095	0.06273	0.99169	0.21783	-1.304
740	-0.5887	1.40989	2.76827	1.33108	-0.0851	0.85616	-0.0736	-1.3346
741	-0.5857	1.39133	2.84207	1.33359	0.00844	0.85055	-0.0993	-1.3824
742	-0.6222	1.31291	2.68019	1.26515	0.11536	0.69027	-0.6287	-1.5226
743	-0.6307	1.30662	2.61831	1.22718	0.04566	0.70957	-0.2974	-1.2846
744	-0.4828	1.41998	2.75468	1.35448	0.13933	0.86531	-0.3212	-1.1072
745	-0.719	1.32614	2.64401	1.19178	0.00356	0.78532	-0.3225	-1.1386
746	-0.7443	1.27773	2.64105	1.2548	-0.0587	0.73928	-0.2822	-1.2869
747	-0.6183	1.44865	2.72866	1.37687	0.0258	0.87552	-0.198	-1.2629
748	-0.541	1.40819	2.7416	1.34522	0.03687	0.83864	-0.2255	-1.6001
749	-0.5019	1.51528	2.75785	1.43869	0.05533	0.85322	-0.2312	-1.0558
750	-0.7519	1.29121	2.5606	1.24457	-0.1387	0.68513	-0.5541	-1.4986
751	-0.6669	1.31949	2.57126	1.2641	-0.0056	0.70666	-0.263	-1.3697
752	-0.6853	1.30975	2.6478	1.24142	0.16928	0.68193	-0.4845	-1.5306
753	-0.8631	1.2506	2.48752	1.17689	-0.0612	0.58467	-0.5547	-1.2333
754	-0.8113	1.23087	2.40388	1.14858	-0.2057	0.59498	-0.6502	-1.273
755	-0.7061	1.31722	2.50753	1.24874	-0.1292	0.68196	-0.5097	-1.3816
756	-0.7451	1.23504	2.44203	1.19912	-0.304	0.6072	-0.4586	-1.4394
757	-0.8074	1.12031	2.39534	1.04982	-0.1522	0.64091	-0.5343	-1.4335
758	-0.7942	1.21288	2.34442	1.14524	-0.189	0.60377	-0.5636	-1.6622
759	-0.6734	1.2408	2.35093	1.16951	-0.0824	0.70045	-0.5886	-1.5257
760	-0.6606	1.32843	2.47852	1.26157	-0.0336	0.71486	-0.4713	-1.1511
761	-0.5205	1.39966	2.65612	1.30956	0.05741	0.86965	-0.3118	-1.0313
762	-0.7472	1.31627	2.53373	1.23814	-0.0876	0.768	-0.4518	-1.2167
763	-0.6912	1.3674	2.61417	1.3142	-0.1884	0.78086	-0.4847	-1.1842
764	-0.7589	1.22134	2.42675	1.1826	-0.1839	0.64981	-0.6179	-1.2906
765	-0.7248	1.2812	2.55144	1.29115	-0.2248	0.73847	-0.2134	-1.3955
766	-0.782	1.19549	2.46709	1.11449	-0.2004	0.5873	-0.6954	-1.3885
767	-0.7298	1.27485	2.5515	1.22345	-0.0594	0.75129	-0.4685	-1.5475
768	-0.5242	1.43057	2.77404	1.3733	-0.0213	0.8378	-0.3655	-1.4929
769	-0.8597	1.17083	2.51349	1.14316	-0.1859	0.65689	-0.6341	-1.6827
770	-0.7423	1.2199	2.54739	1.16273	0.00674	0.65969	-0.6907	-1.4831
771	-0.6032	1.29768	2.64097	1.2762	-0.0278	0.70355	-0.4333	-1.3466
772	-0.7626	1.13712	2.54241	1.1956	-0.0619	0.67757	-0.6426	-1.4335
773	-0.6537	1.23556	2.56951	1.27036	-0.0625	0.6563	-0.5008	-1.4351
774	-0.6629	1.18958	2.54426	1.22904	-0.1236	0.56113	-0.4282	-1.3922
775	-0.889	1.13418	2.38031	1.0341	-0.2895	0.54783	-0.5682	-1.3134
776	-0.8085	1.17586	2.34095	1.08048	-0.1098	0.52946	-0.5489	-1.1829

777	-0.6171	1.38738	2.67622	1.36634	0.10129	0.78654	-0.491	-1.321
778	-0.6074	1.35886	2.60071	1.32881	0.00069	0.77025	-0.1731	-1.2942
779	-0.5802	1.34194	2.60692	1.25313	-0.0872	0.66248	-0.3468	-1.2496
780	-0.5241	1.40337	2.69505	1.35265	0.13745	0.82403	-0.2002	-1.0777
781	-0.905	1.17815	2.42071	1.14076	-0.1936	0.57246	-0.8623	-1.4619
782	-0.6492	1.33798	2.53653	1.24234	0.01031	0.78203	-0.3236	-1.2734
783	-0.7132	1.23348	2.47519	1.21135	-0.2252	0.58656	-0.3855	-1.4466
784	-0.6592	1.22058	2.53885	1.15725	-0.2645	0.66074	-0.415	-1.2188
785	-0.5355	1.34405	2.64069	1.32005	-0.086	0.79	-0.2892	-1.1586
786	-0.5458	1.31173	2.66529	1.29084	-0.0834	0.75609	-0.4611	-1.3889
787	-0.6691	1.21914	2.53576	1.16117	-0.11	0.72815	-0.6444	-1.6353
788	-0.6502	1.2149	2.55888	1.14783	-0.1131	0.73202	-0.4716	-1.454
789	-0.5859	1.31793	2.70858	1.29504	-0.0789	0.83331	-0.4028	-1.5124
790	-0.73	1.16373	2.58596	1.17964	-0.2146	0.70849	-0.5358	-1.3621
791	-0.7817	1.15549	2.4802	1.10952	-0.1704	0.687	-0.4792	-1.3566
792	-0.9311	1.16181	2.4417	1.10146	-0.3075	0.62882	-0.5564	-2.0203
793	-0.8488	1.09641	2.37733	1.05992	-0.3073	0.66129	-0.5711	-1.625
794	-0.7537	1.27697	2.54884	1.27149	-0.2594	0.68869	-0.5138	-1.7324
795	-0.7757	1.19193	2.48153	1.15475	-0.1731	0.6698	-0.8882	-1.2476
796	-0.785	1.2037	2.48569	1.17017	-0.2127	0.6948	-0.581	-1.5027
797	-0.7189	1.29873	2.55832	1.25017	-0.1373	0.72765	-0.4325	-1.5867
798	-0.7307	1.28136	2.58346	1.21648	-0.1586	0.71952	-0.583	-1.4731
799	-0.6287	1.27032	2.58304	1.17562	-0.1565	0.66165	-0.5934	-1.5021
800	-0.4749	1.43956	2.80209	1.32212	-0.0254	0.86228	-0.4004	-1.0299
801	-0.7314	1.25087	2.57392	1.19201	-0.1845	0.69026	-0.303	-1.5096
802	-0.4504	1.40239	2.69344	1.27095	-0.0569	0.80213	-0.2494	-1.1842
803	-0.6903	1.24443	2.64856	1.15916	-0.3576	0.6593	-0.5069	-1.6111
804	-0.7034	1.29259	2.68334	1.27706	-0.0831	0.81178	-0.3896	-1.3611
805	-0.768	1.20334	2.51035	1.14393	-0.2898	0.67598	-0.5126	-1.439
806	-0.5556	1.42736	2.80285	1.35622	0.00938	0.81653	-0.4156	-1.3951
807	-0.648	1.38549	2.72641	1.34702	-0.0175	0.77447	-0.4667	-1.2091
808	-0.6162	1.30563	2.5513	1.25544	-0.0685	0.73237	-0.3594	-1.6942
809	-0.7458	1.22216	2.49779	1.16001	-0.1466	0.72948	-0.5241	-1.7676
810	-0.6015	1.29611	2.59008	1.17983	-0.0683	0.72179	-0.292	-1.3036
811	-0.746	1.24334	2.44776	1.15644	-0.0331	0.75339	-0.3372	-1.2932
812	-0.8748	1.22353	2.46074	1.19486	-0.1952	0.65998	-0.7099	-1.3804
813	-0.6563	1.40141	2.67207	1.32309	-0.0054	0.79337	-0.4075	-1.1209
814	-0.6673	1.25778	2.46095	1.16386	-0.1047	0.59627	-0.41	-1.1889
815	-0.5529	1.30006	2.58587	1.22565	-0.1327	0.78097	-0.3264	-1.3211
816	-0.7949	1.17342	2.51134	1.08442	-0.1458	0.63886	-0.5256	-1.4566
817	-0.7199	1.28834	2.53504	1.20176	-0.1753	0.69805	-0.3107	-1.7258
818	-0.7351	1.22755	2.53786	1.16682	-0.1708	0.7213	-0.5325	-1.1411
819	-0.6137	1.37008	2.61303	1.20183	-0.1458	0.78702	-0.3165	-1.0584
820	-0.6504	1.35706	2.55378	1.26472	-0.0818	0.77226	-0.3835	-1.0366
821	-0.6851	1.18805	2.48002	1.09668	-0.0492	0.66854	-0.1158	-1.1669
822	-0.9666	1.07211	2.26844	1.04584	-0.2871	0.55392	-0.4655	-1.2883

823	-0.6439	1.21126	2.60861	1.14783	-0.0815	0.75309	0.23216	-1.0993
824	-0.6464	1.30548	2.74274	1.32567	-0.1967	0.84191	0.23376	-1.1872
825	-0.6494	1.19737	2.77634	1.21231	-0.3675	0.73325	-0.2209	-1.5898
826	-0.6192	1.36563	2.72591	1.35193	-0.0177	0.9596	0.16525	-1.7044
827	-0.8451	1.15599	2.6572	1.17814	-0.1024	0.83989	0.00535	-1.532
828	-0.9067	1.07873	2.45591	1.10302	-0.121	0.6801	-0.3717	-1.3548
829	-0.8193	1.16675	2.53099	1.05661	-0.0397	0.70793	-0.4721	-1.1613
830	-0.7281	1.19644	2.58547	1.15554	0.04882	0.71081	-0.3192	-1.218
831	-0.8126	1.19533	2.42436	1.14278	-0.0207	0.63137	-0.4258	-1.6469
832	-0.6877	1.20977	2.48327	1.18293	-0.0671	0.70653	-0.3816	-1.1697
833	-0.8449	1.12396	2.44431	1.03893	-0.1976	0.62486	-0.4597	-1.5548
834	-0.8819	1.114	2.35859	0.99071	-0.1583	0.5413	-0.718	-1.5378
835	-0.7518	1.27146	2.51949	1.2444	0.25023	0.69444	-0.3391	-1.4422
836	-0.7202	1.21361	2.50852	1.15493	0.35779	0.72642	-0.3806	-1.3515
837	-0.5724	1.35352	2.66443	1.26289	0.05738	0.82998	-0.2838	-1.3136
838	-0.6572	1.28432	2.59576	1.17055	-0.0154	0.82144	-0.251	-1.17
839	-0.8242	1.10601	2.29023	1.06964	-0.1831	0.692	-0.5345	-1.4916
840	-0.6237	1.23631	2.56953	1.23332	0.02347	0.82383	-0.372	-1.6308
841	-0.7739	1.23959	2.64078	1.21988	0.11807	0.79353	-0.3152	-1.3513
842	-0.7288	1.14984	2.47268	1.09548	0.18669	0.78229	-0.5819	-1.812
843	-0.6543	1.33276	2.75476	1.32615	0.21814	0.90299	-0.3363	-1.1957
844	-0.7024	1.21333	2.5094	1.23329	0.36582	0.83888	-0.3562	-1.3998
845	-0.7839	1.18723	2.6426	1.13606	-0.0184	0.75828	-0.3495	-1.2316
846	-0.4286	1.37243	2.88091	1.28415	0.31819	0.99164	-0.0354	-1.103
847	-0.6166	1.27869	2.671	1.24903	0.08435	0.8608	-0.0251	-1.3049
848	-0.7454	1.17536	2.65028	1.10522	-0.2365	0.72567	-0.7174	-1.2311
849	-0.7005	1.22797	2.81484	1.18831	-0.0374	0.91909	-0.225	-1.2675
850	-0.7131	1.19493	2.78752	1.18373	-0.1163	0.91315	-0.2322	-1.6526
851	-0.6515	1.21193	2.8646	1.17793	-0.2342	0.99902	-0.1127	-1.468
852	-0.9937	0.99197	2.83836	0.88847	-0.2766	0.83709	-0.298	-1.6175
853	-0.7405	1.08741	2.85094	0.92423	-0.2548	0.89315	-0.2351	-1.4919
854	-0.396	1.3836	3.21513	1.23727	-0.1614	1.21369	0.26275	-1.4763
855	-0.5731	1.20754	3.21454	0.98886	-0.1196	1.16674	-0.0742	-1.3755
856	-0.438	1.23134	3.3402	1.1924	-0.4165	1.37415	-0.0644	-1.0847
857	-0.5688	1.21611	3.07109	1.19875	-0.2891	1.39268	-0.11	-1.2163
858	-0.5318	1.27624	2.95579	1.16498	-0.251	1.15994	-0.0904	-1.24
859	-0.5699	1.31811	2.9505	1.26013	-0.1373	1.01898	-0.2618	-1.3386
860	-0.4723	1.35518	2.75133	1.23313	-0.0752	0.88255	-0.2722	-1.437
861	-0.3301	1.44313	2.93554	1.26377	-0.0422	0.93573	-0.1949	-1.2301
862	-0.511	1.30717	2.97227	1.15063	-0.2388	1.00279	-0.4122	-1.2558
863	-0.4839	1.28882	3.14213	1.13995	-0.0602	1.13728	-0.0904	-1.5079
864	-0.2085	1.44521	3.40401	1.24507	-0.1692	1.36676	0.17615	-1.6156
865	-0.1106	1.50724	3.19422	1.09722	-0.2749	1.35977	-0.0419	-0.7843
866	-0.0933	1.54002	3.73198	1.397	-0.2023	1.73177	0.471	-1.1229
867	-0.1043	1.45416	3.44262	1.31156	-0.3087	1.60123	0.72827	-1.2376
868	-0.1677	1.42367	3.65365	1.00223	-0.2401	1.49261	0.51372	-1.8352

869	-0.203	1.30022	3.61768	1.10453	-0.3906	1.51206	0.46989	-1.6743
870	-0.3188	1.31948	3.51649	0.95702	-0.3217	1.49101	0.67699	-1.3448
871	-0.3417	1.39819	3.3847	1.24668	-0.3509	1.5688	0.58767	-1.1849
872	-0.2067	1.53518	3.42705	1.2678	-0.138	1.62782	0.28617	-0.9315
873	-0.4342	1.15795	3.37827	1.1173	-0.6863	1.49416	0.26349	-1.2905
874	-0.0572	1.41723	3.42454	1.0555	-0.4602	1.48652	0.31663	-1.2582
875	-0.1716	1.29256	3.30054	0.75408	-0.7952	1.25943	0.44177	-1.1874
876	-0.3778	1.28902	3.23842	1.00965	-0.4376	1.48494	0.47294	-1.1435
877	-0.47	1.30586	3.15785	1.05799	-0.2773	1.47591	0.57229	-1.2528
878	-0.8422	0.85325	2.77269	0.34297	-0.423	0.96386	-0.1708	-1.4914
879	-0.5056	1.26507	2.68455	0.6044	-0.3752	1.13714	-0.4457	-1.1931
880	-0.3018	1.26552	2.76254	0.58852	-0.5627	0.94217	-0.1577	-1.2927
881	-0.0146	1.27491	2.78822	0.5943	-0.7086	0.91629	-0.7492	-1.0618
882	-0.2778	1.25483	2.639	0.55558	-0.5333	0.87069	-0.7871	-1.288
883	-0.216	1.34062	2.76801	0.83351	-0.3268	0.89552	-0.3124	-1.0644
884	-0.4824	1.2755	2.79221	0.75067	-0.2952	0.69134	-0.7689	-1.462
885	-0.0988	1.56997	3.12156	0.97596	0.11678	0.95773	-0.1542	-1.0605
886	-0.5602	1.25929	2.96007	1.04479	-0.3457	0.9431	-0.5343	-1.4982
887	-0.4345	1.33014	2.82796	0.76271	-0.3269	0.83314	-0.5633	-1.3641
888	-0.0517	1.34937	2.94639	1.02872	-0.2885	0.93889	-0.4102	-1.2461
889	-0.154	1.45562	2.76019	0.79615	-0.2943	0.97338	-0.8874	-1.3255
890	-0.0486	1.71111	3.20535	1.12637	-0.2234	1.0801	-0.502	-1.055
891	-0.17	1.49027	2.82338	0.8509	-0.4757	0.91122	-0.6329	-1.0625
892	-0.0903	1.5089	2.90793	0.85308	-0.4237	0.90814	-0.6605	-1.1833
893	-0.0253	1.61084	3.13549	0.87501	-0.6939	1.00968	-0.9328	-0.9733
894	-0.1076	1.45776	3.04647	0.65495	-0.2282	0.89426	-0.4114	-1.0951
895	0.06345	1.61573	3.14271	0.89893	0.10339	1.1215	-0.32	-0.9258
896	0.24618	1.62531	3.21543	1.00414	-0.3106	1.46205	-0.3579	-0.8779
897	0.30921	1.81163	3.61062	1.00347	-0.3547	1.92487	-0.001	-0.7177
898	0.30805	1.68327	3.40721	0.8577	-0.6263	1.37505	-0.0447	-1.2462
899	0.16134	1.66574	3.13657	0.76878	-0.3562	1.22891	0.38925	-1.1259
900	-0.164	1.48386	2.97649	0.90206	-0.7204	1.20487	-0.0829	-1.1167
901	-0.0865	1.48612	3.108	0.97417	-0.3944	1.17334	-0.1091	-2.1917
902	-0.02	1.51788	3.16931	1.09736	-0.7286	1.26651	0.00469	-1.1052
903	-0.0647	1.52631	3.18098	0.87779	-0.4635	1.21002	-0.5415	-1.2615
904	-0.1415	1.44152	3.13508	0.75314	-0.6943	1.39222	-0.0462	-1.1973
905	-0.8473	1.19667	2.85238	1.00679	-0.4185	1.09543	-0.1391	-1.5838
906	-0.7165	1.14598	2.82722	0.90499	-0.551	0.92347	-0.2886	-1.1765
907	-0.6361	1.25066	2.74155	1.21078	-0.1571	0.99151	0.02609	-1.8095
908	-0.624	1.3196	2.65168	1.20429	0.05287	0.89289	-0.1825	-1.0295
909	-0.5544	1.32141	2.7093	1.28235	0.08114	0.77532	-0.1064	-1.2269
910	-0.6109	1.41146	2.62644	1.31678	0.08228	0.81738	-0.0695	-1.0746
911	-0.7735	1.20053	2.55594	1.21443	0.14367	0.71508	-0.4617	-1.4437
912	-0.4238	1.3902	2.76944	1.45537	0.18191	0.91414	-0.1941	-1.4732
913	-0.6204	1.33589	2.64995	1.31456	0.06824	1.02796	0.13353	-1.0946
914	-0.977	0.99642	2.32522	0.93985	0.00073	0.80054	0.051	-1.7759

915	-0.807	1.1614	2.50109	1.13477	0.19432	0.78198	-0.3124	-1.6123
916	-0.6573	1.33025	2.58976	1.29837	0.21676	0.90113	-0.1124	-1.1904
917	-0.6334	1.2786	2.58345	1.19193	-0.0129	0.82769	-0.057	-1.1379
918	-0.4719	1.41157	2.73143	1.3997	0.19416	0.87976	-0.1948	-1.6708
919	-0.5903	1.3592	2.73861	1.3373	0.06272	0.86297	0.211	-1.4061
920	-0.5964	1.38395	2.73193	1.33869	0.23309	0.97426	0.15861	-1.1532
921	-0.6003	1.2919	2.62162	1.24663	0.40521	0.94498	0.02384	-1.2289
922	-0.5749	1.34321	2.6927	1.39345	0.43967	0.92443	-0.1508	-1.7021
923	-0.7325	1.2779	2.69698	1.26567	0.21276	0.94793	0.22271	-1.3429
924	-0.6297	1.34593	2.70723	1.33432	-0.0158	0.89255	0.17822	-1.4555
925	-0.4637	1.47999	2.86362	1.48649	0.10173	1.03932	0.31832	-0.9955
926	-0.5339	1.44919	2.91459	1.43848	0.06272	1.02129	0.33615	-1.222
927	-0.4977	1.39824	2.85943	1.44102	0.10284	0.94204	0.30751	-1.1575
928	-0.4832	1.40836	2.92058	1.406	0.38989	1.01248	0.42367	-1.331
929	-0.6901	1.24889	2.62298	1.30793	0.0912	0.74943	-0.079	-1.2166
930	-0.3902	1.56741	2.94507	1.55783	0.44446	1.10818	0.37177	-1.0789
931	-0.5893	1.435	2.84392	1.42621	0.28077	1.03894	0.29206	-1.0054
932	-0.5487	1.4956	2.90957	1.46314	0.42823	1.08295	0.32393	-1.0986
933	-0.3246	1.56963	2.94633	1.66657	0.39367	1.03165	0.23811	-1.4361
934	-0.4881	1.34152	2.86284	1.34657	0.11258	0.95058	0.15035	-0.9458
935	-0.6888	1.24569	2.82395	1.31076	0.07073	1.00962	0.34771	-1.4024
936	-0.4051	1.40281	2.9726	1.4334	0.25631	0.96993	0.10279	-1.0309
937	-0.5897	1.30312	2.8724	1.3581	0.74657	0.96337	0.10349	-1.2998
938	-0.6118	1.28827	2.829	1.27778	0.05654	1.02772	0.14399	-1.6649
939	-0.4261	1.45548	3.11545	1.50725	0.13425	1.2475	0.34691	-1.3455
940	-0.5224	1.44498	3.11563	1.43776	0.43982	1.14399	0.34471	-1.0284
941	-0.5359	1.38453	2.96356	1.38912	0.23397	1.08891	0.20272	-1.3744
942	-0.2808	1.46493	3.24605	1.56339	0.04418	1.27493	0.47583	-0.9278
943	-0.1721	1.57713	3.22022	1.6022	0.16659	1.30652	0.36634	-0.9982
944	-0.2445	1.63271	3.25778	1.68492	0.33674	1.38095	0.62706	-1.4154
945	-0.2617	1.44208	3.19132	1.46059	0.19305	1.20533	0.28316	-1.0331
946	-0.1834	1.52659	3.10776	1.53483	0.15622	1.22887	0.54526	-1.1737
947	-0.1693	1.48255	3.1861	1.45008	0.23442	1.21291	0.33995	-0.9758
948	-0.3641	1.38715	3.11396	1.41925	0.18746	1.2085	0.39325	-1.0863
949	-0.1937	1.53638	3.2145	1.53464	0.25377	1.24632	0.30991	-1.0248
950	-0.3752	1.39786	3.09625	1.34083	0.07024	1.17513	0.37886	-1.0771
951	-0.3406	1.48209	3.11421	1.32546	0.28329	1.19256	0.41179	-0.9072
952	-0.462	1.34422	2.92811	1.2985	0.04402	1.01993	0.12839	-1.0648
953	-0.2057	1.58003	3.08378	1.57744	0.06328	1.21348	0.40825	-1.2271
954	-0.3311	1.452	3.04608	1.49162	-0.011	1.13251	0.2613	-1.4076
955	-0.1733	1.46227	3.13114	1.51089	0.23601	1.27791	0.61374	-1.3919
956	-0.2589	1.49279	3.23711	1.41849	-0.0113	1.24278	0.39569	-1.116
957	-0.3529	1.42279	3.09621	1.38574	0.15774	1.23162	0.42548	-0.9365
958	-0.2459	1.47654	3.07933	1.42192	0.01535	1.21197	0.27397	-1.1384
959	-0.5628	1.18439	2.84547	1.17499	-0.3055	0.94589	0.16107	-1.4419
960	-0.5039	1.25662	2.85304	1.14853	-0.136	1.0298	0.26057	-1.4737

961	-0.4643	1.26755	2.84075	1.19089	0.23789	1.13232	0.40069	-1.3778
962	-0.9409	0.87901	2.39728	0.81952	-0.0757	1.01093	0.41331	-1.3709

1.1.5. SI C3

Appendix Table 1.9. Natural log of key indicator element abundance variability against conservative lithophile element Ti in core SI C3 in the Three Rivers Estuarine Complex saltmarshes.

Depth (mm)	Si/Ti	K/Ti	Ca/Ti	Br/Ti	Sr/Ti	Zr/Ti	Ba/Ti
1	-1.8116	-0.1472	1.61311	-0.9455	-0.2167	-1.191	-2.5403
2	-1.6073	0.03056	1.82718	-0.8652	-0.0485	-0.7523	-2.6295
3	-1.7641	-0.0745	1.79321	-0.9706	-0.2596	-1.0735	-2.9436
4	-1.6029	-0.0211	1.98373	-0.9294	-0.191	-1.3237	-2.9815
5	-1.6829	-0.12	1.85288	-1.3865	-0.2632	-1.5593	-3.839
6	-1.6752	-0.0899	1.75638	-1.195	-0.3561	-1.2804	-3.2846
7	-1.7172	-0.1284	1.64853	-1.1661	-0.3634	-1.4388	-3.7911
8	-1.8676	-0.2174	1.65183	-1.0684	-0.396	-1.365	-3.341
9	-1.8197	-0.1658	1.6714	-0.901	-0.3534	-1.2344	-3.1967
10	-1.811	-0.0861	1.81005	-0.9325	-0.2503	-0.7541	-3.1849
11	-2.0631	-0.2281	1.50033	-1.1563	-0.3996	-1.6572	-3.8892
12	-2.0505	-0.0872	1.66038	-1.1803	-0.3709	-1.2088	-3.7945
13	-2.1584	-0.1074	1.61345	-0.8904	-0.298	-1.3787	-3.6386
14	-2.1232	-0.0351	1.54541	-0.8548	-0.2427	-1.0376	-3.2532
15	-2.0341	-0.0629	1.65791	-1.0856	-0.2953	-1.2795	-3.7015
16	-1.8877	-0.1191	1.54407	-1.0342	-0.5069	-1.3474	-3.7321
17	-1.9632	-0.1161	1.73393	-0.9549	-0.3231	-1.1836	-3.7028
18	-2.185	-0.1337	1.60053	-1.0058	-0.204	-1.2139	-3.3231
19	-2.0061	-0.0879	1.61982	-0.7989	-0.2507	-1.2709	-3.3006
20	-2.1715	-0.15	1.53139	-0.9798	-0.2368	-1.1269	-2.5226
21	-2.0034	-0.1724	1.61647	-1.1274	-0.2874	-1.1296	-2.5703
22	-1.9884	-0.0962	1.52114	-1.13	-0.3673	-1.0089	-2.4358
23	-1.9	-0.0591	1.63541	-0.9523	-0.265	-1.07	-2.6636
24	-1.76	0.03425	1.7318	-1.0263	-0.2636	-0.804	-2.4249
25	-1.9295	-0.1231	1.7545	-1.2246	-0.3234	-0.9033	-2.267
26	-1.6594	0.00259	1.77597	-1.0276	-0.3535	-0.841	-2.3643
27	-2.0218	-0.1456	1.72767	-0.7797	-0.2791	-0.6755	-2.7832
28	-2.1124	-0.1304	1.67425	-0.9314	-0.2243	-0.6862	-2.1591
29	-2.2961	-0.1766	1.39491	-0.9788	-0.4697	-0.6717	-2.3966
30	-2.2136	0.03967	1.52099	-0.857	-0.2846	-0.8899	-2.2265
31	-2.2859	0.11025	1.5874	-0.78	-0.322	-0.8528	-2.1856
32	-1.9391	-0.0065	1.67743	-0.8304	-0.3724	-0.788	-2.1867
33	-1.8071	-0.0261	1.63173	-0.9409	-0.4034	-0.8796	-2.3037
34	-1.8391	-0.0824	1.61782	-1.0843	-0.3554	-0.9165	-2.826

35	-1.7819	-0.0414	1.56001	-1.105	-0.5961	-1.0187	-2.3577
36	-1.639	0.05518	1.67821	-0.9395	-0.4664	-0.8344	-2.2149
37	-1.6856	-0.0333	1.72675	-1.0901	-0.4784	-0.7314	-2.4897
38	-1.7791	-0.0656	1.611	-0.9417	-0.4176	-0.8901	-2.5173
39	-1.9401	-0.2182	1.46271	-0.4518	-0.5388	-0.9407	-2.6972
40	-1.8388	-0.0264	1.68352	-0.9733	-0.3378	-0.9528	-2.5498
41	-1.9751	-0.1134	1.54517	-0.2601	-0.3522	-0.888	-2.5166
42	-1.9312	-0.1075	1.69161	-0.6714	-0.3545	-0.9126	-2.9359
43	-1.8965	-0.1628	1.8324	-1.2165	-0.3776	-0.9323	-2.4985
44	-1.9509	-0.0758	1.62415	-0.8215	-0.3279	-0.6576	-2.263
45	-1.8278	-0.0747	1.73137	-1.0559	-0.2848	-1.0414	-2.3763
46	-1.8128	0	1.65893	-1.0874	-0.2491	-1.0127	-2.6667
47	-1.9645	-0.0638	1.71949	-0.8686	-0.269	-1.1136	-2.1476
48	-2.1873	-0.078	1.63642	-0.9617	-0.3568	-1.0084	-2.2399
49	-2.0009	-0.051	1.70511	-0.9673	-0.3873	-1.1656	-2.3181
50	-1.9303	-0.0705	1.60636	-1.1654	-0.4092	-1.1057	-2.334
51	-1.6731	0.09444	1.7888	-1.0315	-0.2297	-0.9121	-2.2374
52	-1.7249	0.05881	1.77145	-1.0806	-0.3063	-1.0956	-2.1489
53	-1.782	0.0442	1.62632	-0.9991	-0.345	-0.9922	-2.3473
54	-1.8039	0.02745	1.54948	-1.2083	-0.4201	-1.1903	-2.7176
55	-1.7868	0.05336	1.69452	-1.066	-0.3555	-1.0467	-2.2409
56	-1.8904	0.0248	1.75405	-1.1027	-0.3703	-1.1972	-2.4896
57	-1.8163	0.06782	1.71285	-1.1136	-0.2861	-1.3117	-2.3622
58	-1.8354	-0.0384	1.57015	-0.6374	-0.4535	-1.2566	-2.7918
59	-1.9102	0.03519	1.52559	-0.6939	-0.3826	-1.0954	-2.8724
60	-1.8182	0.09163	1.71237	-0.661	-0.3037	-1.1961	-2.2966
61	-1.9378	0.07025	1.60017	-0.4191	-0.312	-1.4765	-2.1959
62	-1.9746	-0.0323	1.49466	-0.7274	-0.5284	-1.568	-2.544
63	-2.0235	-0.0951	1.47978	-1.1535	-0.432	-1.537	-2.9386
64	-1.8909	0.07266	1.67276	-1.117	-0.2922	-1.2262	-2.7515
65	-1.8806	0.04698	1.6423	-1.0613	-0.3141	-1.2722	-2.6316
66	-1.999	-0.0251	1.58137	-1.2153	-0.3785	-1.4281	-2.4882
67	-1.9321	0.01238	1.61249	-1.1264	-0.343	-1.4123	-2.568
68	-1.9504	-0.0764	1.58729	-1.2165	-0.4595	-1.1859	-2.4897
69	-1.8737	-0.0179	1.66142	-1.1376	-0.3429	-1.2078	-2.4691
70	-2.0285	-0.0689	1.72478	-1.2033	-0.2978	-0.9625	-2.7933
71	-1.9478	0.03996	1.74107	-1.2054	-0.278	-0.942	-2.5766
72	-1.9313	0.08085	1.64594	-0.9875	-0.3368	-1.3056	-2.3777
73	-1.7914	-0.0138	1.60152	-0.8008	-0.4179	-1.3992	-2.3915
74	-1.964	0.00927	1.46536	-1.108	-0.4637	-1.4119	-2.0839
75	-1.9539	-0.0155	1.45109	-1.2139	-0.5056	-1.5147	-2.3174
76	-1.9955	-0.027	1.44599	-1.289	-0.5282	-1.606	-2.6057
77	-1.8845	-0.0525	1.5128	-1.2036	-0.511	-1.612	-2.5776
78	-1.9534	-0.0387	1.57492	-1.211	-0.4769	-1.6173	-2.6593
79	-1.9317	-0.0122	1.48875	-1.2665	-0.4507	-1.3322	-2.7956
80	-1.8257	0.04404	1.61783	-1.1273	-0.4469	-1.1595	-2.205

81	-1.9367	-0.0114	1.55474	-0.9662	-0.4895	-1.4376	-2.5744
82	-2.034	-0.0713	1.55791	-1.045	-0.4601	-1.5169	-2.7048
83	-2.1	-0.0499	1.5528	-1.0122	-0.3594	-1.3413	-2.666
84	-2.0645	-0.0743	1.46913	-1.0494	-0.338	-1.1025	-2.2402
85	-2.0424	-0.132	1.52827	-1.0544	-0.3298	-0.9117	-2.6188
86	-1.6994	-0.0155	1.71559	-1.3502	-0.3062	-1.0198	-2.766
87	-1.7821	0.01958	1.72898	-1.1291	-0.1669	-0.9233	-2.4886
88	-2.0457	-0.0653	1.59304	-1.0242	-0.1934	-1.0723	-2.5268
89	-1.8191	0.05662	1.7262	-0.8344	-0.0265	-0.9645	-2.4888
90	-1.9056	-0.0477	1.59298	-1.0058	-0.1916	-0.9432	-2.4534
91	-2.1335	-0.0296	1.62613	-1.1307	-0.1457	-0.8736	-2.3597
92	-2.1078	-0.0914	1.57746	-1.1957	-0.2759	-0.9068	-2.5369
93	-1.9241	-0.004	1.5709	-1.2942	-0.2617	-1.0533	-2.3262
94	-1.894	-0.0207	1.63415	-1.24	-0.254	-1.1798	-2.4806
95	-2.0563	0.02611	1.71478	-1.0913	-0.2182	-1.0481	-2.3255
96	-1.9222	-0.0387	1.67429	-1.1528	-0.3285	-1.1496	-2.3063
97	-2.0473	0.0098	1.57813	-1.2291	-0.3078	-1.3109	-2.4508
98	-2.2042	-0.1477	1.46598	-1.2337	-0.4165	-1.3863	-3.1438
99	-1.9785	0.02581	1.64322	-0.8204	-0.3639	-1.3103	-2.4558
100	-2.0354	-0.02	1.62025	-1.288	-0.3288	-1.393	-2.2814
101	-2.0347	-0.044	1.5183	-1.2685	-0.4636	-1.2436	-2.2797
102	-1.9871	0.00665	1.61111	-1.2085	-0.3767	-1.2816	-2.5638
103	-2.0359	0.01282	1.56788	-1.081	-0.4141	-1.1976	-2.3763
104	-2.1868	0.00286	1.59287	-0.929	-0.279	-1.2607	-2.6042
105	-1.8739	0.09272	1.68062	-0.988	-0.3639	-1.5768	-2.3753
106	-1.9215	-0.0461	1.54869	-1.2658	-0.4343	-1.5156	-2.2804
107	-2.0297	-0.0772	1.48019	-1.2488	-0.4353	-1.4191	-2.5418
108	-1.8825	-0.0301	1.56808	-1.1764	-0.4978	-1.4539	-2.6744
109	-1.866	0.01108	1.52948	-1.2135	-0.4233	-1.3	-2.5981
110	-1.9281	0.07914	1.71139	-1.2066	-0.3085	-1.3475	-2.2699
111	-1.8069	0.07617	1.60446	-0.7765	-0.3387	-1.289	-2.3919
112	-1.9263	0.03981	1.5273	-0.7047	-0.3442	-1.4516	-2.5611
113	-1.8665	-0.0102	1.52867	-0.9794	-0.3197	-1.3466	-2.1852
114	-1.95	0.0119	1.55323	-1.1669	-0.3108	-1.3728	-2.3095
115	-1.7886	0.11723	1.64525	-1.0321	-0.264	-1.0055	-2.0563
116	-1.707	-0.0272	1.47043	-1.1436	-0.3925	-1.3152	-2.5928
117	-1.8227	-0.0612	1.55148	-1.2556	-0.4541	-1.6458	-2.4101
118	-1.6935	0.12074	1.56559	-1.0252	-0.3288	-1.1908	-2.2824
119	-1.8967	0.07713	1.56801	-1.0678	-0.2926	-1.1067	-2.1957
120	-1.8525	-0.0354	1.35034	-1.2879	-0.4138	-1.5163	-2.5632
121	-1.8978	-0.0973	1.4411	-1.3468	-0.4576	-1.4302	-2.9097
122	-1.9262	-0.0157	1.42889	-1.3382	-0.2708	-1.4083	-2.4616
123	-1.9197	-0.0522	1.58236	-1.0126	-0.1676	-1.2246	-2.4292
124	-1.9639	0.01751	1.57067	-1.1098	-0.2578	-1.2151	-2.3554
125	-1.9862	0.04772	1.56824	-1.0237	-0.3189	-1.382	-2.1867
126	-1.8717	0.07018	1.58621	-1.1022	-0.3476	-1.3292	-2.3773

127	-1.8583	0.0661	1.5562	-1.3377	-0.2905	-1.3618	-2.3585
128	-1.9292	0.06035	1.51429	-1.385	-0.3649	-1.469	-2.4166
129	-1.854	0.04303	1.54602	-1.4388	-0.3541	-1.4562	-2.5504
130	-2.1094	-0.1014	1.47573	-1.4273	-0.4436	-1.533	-2.6411
131	-1.9951	0.01776	1.57643	-1.2689	-0.3992	-1.6536	-2.6577
132	-1.9463	0.0437	1.60809	-0.9057	-0.476	-1.5611	-2.534
133	-1.9875	-0.0645	1.37281	-1.1447	-0.5449	-1.5941	-2.2896
134	-1.9583	-0.0187	1.4556	-1.0499	-0.4942	-1.51	-2.5846
135	-1.8218	0.04445	1.51393	-1.2722	-0.4052	-1.7951	-2.4243
136	-2.0362	0.05325	1.54648	-1.0441	-0.3378	-1.4849	-2.7044
137	-2.1745	-0.1034	1.39926	-1.1671	-0.4259	-1.5961	-2.9878
138	-2.0973	-0.041	1.46913	-0.9338	-0.2984	-1.2927	-2.6408
139	-1.947	0.06792	1.62014	-0.7962	-0.2204	-1.2501	-2.3962
140	-1.9305	0.12023	1.65786	-0.9888	-0.181	-1.253	-2.0772
141	-2.0295	-0.0503	1.4513	-1.0717	-0.3912	-1.3617	-3.0965
142	-1.9337	0.01919	1.53693	-1.0149	-0.3503	-1.3797	-2.5575
143	-1.9137	0.08139	1.59207	-0.9051	-0.3089	-1.5977	-2.3419
144	-1.9795	-0.0336	1.43697	-1.0304	-0.347	-1.3785	-2.9046
145	-2.0366	0.01122	1.54769	-0.9763	-0.4002	-1.4387	-2.2125
146	-2.0468	0.00511	1.58897	-0.8461	-0.2287	-1.1444	-2.0213
147	-1.7712	0.04102	1.57951	-1.2041	-0.3893	-1.2727	-2.2157
148	-1.9819	0.03011	1.50223	-1.1818	-0.405	-1.3333	-2.3835
149	-2.0917	0.04564	1.66419	-1.0139	-0.2914	-1.3049	-2.5136
150	-1.8544	0.00348	1.57459	-1.2695	-0.4684	-1.5393	-2.2753
151	-1.9928	0.03443	1.55553	-1.2249	-0.54	-2.1289	-3.2661
152	-2.0864	0.06003	1.65716	-1.0252	-0.3696	-1.5066	-2.3335
153	-2.0044	0.06566	1.6505	-0.982	-0.3477	-1.3553	-2.2624
154	-1.9194	-0.0178	1.47486	-1.1833	-0.4514	-1.4318	-2.2041
155	-1.9156	0.0309	1.57488	-1.0329	-0.2718	-1.5886	-2.2671
156	-2.0295	0.02726	1.54245	-0.9624	-0.3779	-1.631	-2.5696
157	-1.8113	0.1174	1.59245	-0.7362	-0.2711	-1.4945	-2.4456
158	-1.8003	0.0328	1.51526	-0.7374	-0.4406	-1.5948	-3.1924
159	-2.0314	-0.0039	1.43164	-0.9159	-0.2755	-1.201	-2.5816
160	-1.9156	-0.0051	1.48617	-1.0886	-0.4326	-1.6842	-2.4902
161	-1.973	0.03565	1.61272	-1.0351	-0.5854	-2.0073	-2.3733
162	-1.8756	0.03996	1.53753	-1.0656	-0.5332	-1.5986	-2.5508
163	-2.0214	-0.0483	1.53846	-1.1137	-0.5467	-1.8682	-2.6753
164	-2.0376	-0.0448	1.45402	-1.074	-0.5187	-1.573	-2.8432
165	-1.8448	0.01836	1.53055	-0.9715	-0.408	-1.4298	-2.9174
166	-1.8291	0.04521	1.55093	-1.031	-0.3361	-1.4076	-2.475
167	-2.045	0.01408	1.63722	-0.7729	-0.3397	-1.2178	-2.6519
168	-1.8136	0.07638	1.60417	-0.7154	-0.3772	-1.4274	-2.4635
169	-1.8367	0.00018	1.59127	-0.7527	-0.3872	-1.4111	-2.4284
170	-1.9713	0.06631	1.63068	-0.8486	-0.4123	-1.0763	-2.1941
171	-1.846	0.15113	1.64277	-0.8675	-0.2822	-1.1738	-1.9501
172	-1.78	0.04308	1.64217	-1.1156	-0.5358	-1.1062	-2.5103

173	-1.7433	0.0891	1.59525	-1.2728	-0.4872	-1.4226	-2.2542
174	-1.772	0.09057	1.55411	-0.9899	-0.5131	-1.4143	-2.3276
175	-1.7584	0.06208	1.5725	-1.0758	-0.5282	-1.4232	-2.6671
176	-1.7985	0.07863	1.61486	-1.0701	-0.5219	-1.37	-2.5252
177	-1.806	0.0893	1.59323	-1.1513	-0.5132	-1.6471	-2.4608
178	-1.8898	0.08493	1.54113	-1.1532	-0.4381	-1.4774	-2.4339
179	-1.9048	0.04598	1.51058	-1.1132	-0.5035	-1.5075	-2.9346
180	-1.7943	0.12039	1.60151	-0.9988	-0.4095	-1.3782	-2.1489
181	-1.815	0.0647	1.51843	-0.9594	-0.3449	-1.1713	-2.3668
182	-1.8492	0.0198	1.48957	-0.2393	-0.5198	-1.4841	-2.83
183	-1.9045	-0.0451	1.46429	-0.6227	-0.5501	-1.3467	-2.5665
184	-1.8671	0.00765	1.50558	-1.0421	-0.5202	-1.2937	-2.6506
185	-1.9155	-0.0013	1.46673	-1.1748	-0.4988	-1.3876	-2.912
186	-1.8749	0.04986	1.51497	-1.0929	-0.3666	-1.3584	-2.2059
187	-1.9645	0.02535	1.47732	-0.9349	-0.4026	-1.2578	-2.6733
188	-1.931	0.04865	1.55287	-1.0074	-0.2781	-1.3022	-2.4142
189	-1.9953	0.01906	1.48412	-0.6955	-0.0432	-1.1932	-2.3109
190	-1.8196	0.07247	1.56916	-1.0967	0.24085	-1.1867	-2.3962
191	-2.0321	0.11396	1.53402	-0.8005	0.35518	-1.1511	-2.2222
192	-1.8409	0.06065	1.48211	-0.9864	0.33747	-1.3201	-2.2215
193	-1.8441	0.03705	1.50904	-1.1195	0.22966	-1.1714	-2.3921
194	-1.8825	0.06606	1.50668	-1.1109	0.16861	-1.2525	-2.2932
195	-1.8749	0.1003	1.5611	-1.1006	-0.0434	-1.1157	-2.499
196	-1.9174	0.03559	1.49601	-1.0479	-0.2026	-1.3936	-2.38
197	-1.8907	0.00718	1.47931	-0.8562	-0.3313	-1.2972	-2.8391
198	-1.934	0.00222	1.48819	-1.2564	-0.2891	-1.303	-2.5576
199	-1.8982	0.00929	1.5365	-1.0613	-0.2487	-1.0643	-2.2547
200	-1.7811	0.033	1.46642	-1.1867	-0.274	-1.3599	-2.266
201	-1.9472	-0.0382	1.438	-1.2131	-0.3521	-1.3497	-2.1759
202	-1.8959	-0.0103	1.47204	-1.1264	-0.3058	-1.3824	-2.2844
203	-2.0438	0.03415	1.62436	-0.9506	-0.2844	-1.5394	-2.3621
204	-1.8663	0.04662	1.53662	-1.1292	-0.3211	-1.5139	-2.3589
205	-1.9304	0.04002	1.52829	-0.8722	-0.2559	-1.5258	-2.2144
206	-2.0691	-0.0874	1.31191	-1.0654	-0.4059	-1.4196	-2.4374
207	-1.9942	0.03149	1.47345	-0.9401	-0.27	-1.2338	-2.3416
208	-1.832	0.08206	1.59019	-1.0883	-0.2687	-1.1173	-2.1436
209	-1.8592	0.01072	1.49865	-0.9716	-0.3795	-1.3592	-2.6875
210	-1.8193	0.01829	1.54253	-1.1997	-0.3281	-1.0567	-2.3529
211	-1.8467	0.06151	1.56959	-1.1906	-0.3145	-1.1298	-2.1154
212	-1.8948	0.05356	1.53484	-1.0966	-0.2915	-1.2227	-2.3999
213	-1.8565	0.08574	1.55465	-1.1553	-0.3155	-1.0831	-2.3335
214	-2.0224	-0.0165	1.41773	-1.3215	-0.3601	-1.3056	-2.4666
215	-1.847	-0.0006	1.60167	-1.0887	-0.2961	-0.9875	-2.6091
216	-1.8713	-0.0091	1.51025	-1.202	-0.3254	-1.2383	-2.2289
217	-1.9023	0.05039	1.59244	-1.1039	-0.3121	-1.165	-2.3275
218	-1.9048	0.01242	1.56149	-0.9104	-0.278	-1.1826	-2.4384

219	-1.961	0.00645	1.46638	-1.1078	-0.3395	-1.2534	-2.2819
220	-1.8809	0.00791	1.54754	-1.3285	-0.439	-1.3615	-2.5569
221	-1.9053	0.04109	1.55821	-1.2518	-0.4582	-1.495	-2.3791
222	-1.8946	-0.0576	1.46819	-1.2228	-0.4258	-1.5704	-2.4021
223	-1.8866	-0.0254	1.4897	-1.2223	-0.4566	-1.2425	-2.296
224	-1.8974	0.05107	1.57796	-0.9885	-0.31	-1.3394	-2.0734
225	-1.9255	0.03256	1.57689	-1.0319	-0.3618	-1.2975	-2.5422
226	-1.911	0.00961	1.49708	-1.2155	-0.4637	-1.3017	-2.623
227	-1.9612	0.03609	1.4948	-1.1764	-0.4992	-1.0733	-2.5495
228	-1.9492	0.09733	1.58305	-0.7282	-0.4147	-1.4119	-2.3042
229	-1.8254	0.08904	1.56384	-0.936	-0.3354	-1.3541	-2.6424
230	-1.9069	-0.0258	1.33042	-1.3349	-0.5578	-1.5957	-2.4497
231	-1.9731	-0.0657	1.41121	-1.3288	-0.5345	-1.4004	-2.5923
232	-1.8778	-0.0319	1.47677	-0.967	-0.4889	-1.4297	-2.7784
233	-1.9429	-0.0544	1.31556	-1.0645	-0.5547	-1.4407	-2.673
234	-1.8384	0.06017	1.54511	-1.3357	-0.3829	-1.2978	-2.3562
235	-1.9447	0.01629	1.60226	-1.2825	-0.4777	-1.3648	-2.5685
236	-1.8879	-0.001	1.4982	-1.1788	-0.4734	-1.2352	-2.6193
237	-1.7709	0.06026	1.48964	-1.2291	-0.3694	-1.0767	-2.0747
238	-1.8864	0.03907	1.52743	-1.0884	-0.4431	-1.0278	-2.3177
239	-1.9107	-0.0054	1.57297	-1.3242	-0.4418	-1.3962	-2.6319
240	-1.8514	-0.0175	1.55645	-1.1342	-0.5115	-1.2007	-2.4307
241	-1.963	0.03254	1.51882	-1.2221	-0.3985	-1.298	-2.4437
242	-2.1739	0.00259	1.62059	-1.2345	-0.2666	-1.0493	-2.6706
243	-1.9971	-0.0499	1.47981	-1.3023	-0.5355	-1.0338	-2.579
244	-1.9127	-0.0262	1.57132	-1.368	-0.4195	-0.9626	-2.3578
245	-1.9293	-0.0689	1.35889	-1.3639	-0.5256	-1.1812	-2.4143
246	-2.0519	-0.0883	1.29485	-1.3313	-0.6569	-1.3582	-2.6293
247	-2.067	-0.0128	1.45158	-1.0306	-0.4567	-0.8299	-2.4037
248	-2.0471	-0.0671	1.36618	-1.2376	-0.4667	-1.2717	-2.6485
249	-1.9708	0.04947	1.39259	-1.2688	-0.498	-1.2611	-2.5034
250	-1.9997	0.02935	1.44963	-1.0675	-0.4233	-1.2118	-2.3853
251	-1.8923	-0.0258	1.47325	-1.2076	-0.3956	-1.2003	-2.8347
252	-1.8291	0.03705	1.52941	-1.1088	-0.4495	-1.0313	-2.27
253	-1.8492	-0.0176	1.50734	-1.1855	-0.4513	-0.9205	-2.2311
254	-1.9107	-0.0207	1.47083	-0.9033	-0.4928	-0.9697	-2.7988
255	-1.8832	-0.0168	1.48755	-0.9459	-0.392	-1.09	-2.552
256	-2.1483	-0.1339	1.45056	-1.3229	-0.4348	-1.2237	-3.0646
257	-2.0504	-0.1007	1.49066	-1.1412	-0.4275	-0.9911	-2.7989
258	-1.7808	0.05149	1.64068	-1.0124	-0.2837	-1.2977	-2.2408
259	-2.1539	-0.1887	1.43345	-1.0895	-0.4583	-1.2463	-2.3647
260	-2.0742	-0.138	1.51318	-1.0636	-0.3598	-1.2768	-2.5187
261	-1.9936	0.02331	1.53715	-0.8376	-0.2733	-1.2002	-2.227
262	-2.0428	0.00251	1.63553	-0.832	-0.3436	-1.0233	-2.6854
263	-1.9	0.05159	1.68236	-1.0416	-0.2237	-0.6367	-2.1194
264	-1.9216	0.02751	1.59717	-1.1134	-0.3398	-0.8474	-2.4033

265	-1.8227	0.06436	1.71191	-0.9764	-0.3218	-0.7465	-2.4267
266	-1.8	0.05068	1.57346	-0.6879	-0.3305	-0.6127	-2.5347
267	-1.8765	0.01257	1.54368	-1.0701	-0.3488	-0.9198	-2.3259
268	-1.9264	-0.029	1.5058	-1.0572	-0.4451	-0.8776	-2.4805
269	-1.8232	0.0056	1.53747	-1.1573	-0.4291	-0.9546	-2.3797
270	-1.9497	-0.1407	1.35195	-1.239	-0.598	-1.0687	-2.5948
271	-1.8553	-0.0613	1.39576	-1.2791	-0.4627	-1.0027	-2.7045
272	-2.0178	-0.1771	1.35693	-1.3842	-0.6113	-1.0685	-2.5683
273	-2.0015	-0.0199	1.53145	-1.1419	-0.4374	-0.8795	-2.4966
274	-1.9347	-0.0775	1.47756	-1.0757	-0.5157	-1.1592	-2.7309
275	-1.8225	0.05884	1.62979	-1.0734	-0.37	-1.0559	-2.5048
276	-1.8582	-0.0288	1.5012	-1.3417	-0.3555	-0.9718	-2.3767
277	-1.961	-0.1196	1.41531	-1.305	-0.496	-0.7231	-2.4422
278	-1.9751	-0.0665	1.42572	-1.2114	-0.5168	-0.865	-2.8434
279	-1.9908	-0.1367	1.44567	-1.3032	-0.583	-1.0306	-2.7472
280	-1.7726	0.08487	1.57498	-1.1604	-0.3778	-0.9588	-2.1739
281	-1.9146	-0.0237	1.45899	-1.2275	-0.5349	-0.8974	-2.5132
282	-1.9495	-0.0796	1.51429	-1.4657	-0.657	-1.2074	-2.4376
283	-1.9849	-0.1253	1.31136	-1.4378	-0.7589	-1.1769	-2.5555
284	-2.1567	-0.1025	1.35778	-1.2491	-0.7147	-1.206	-3.1864
285	-2.0456	-0.1298	1.24944	-1.3927	-0.7995	-1.1457	-2.4414
286	-2.0764	-0.1763	1.23934	-1.2589	-0.7268	-1.4272	-2.8817
287	-1.8654	0.0993	1.47192	-1.0852	-0.4398	-1.0004	-2.1397
288	-1.9933	-0.0616	1.4017	-1.1168	-0.5154	-0.8592	-2.2563
289	-2.1029	-0.1233	1.26837	-1.2517	-0.7465	-1.0992	-2.7837
290	-1.7993	0.0625	1.40277	-1.0163	-0.5581	-0.9334	-2.3202
291	-1.8479	0.1326	1.46771	-0.9562	-0.4997	-1.2099	-2.2636
292	-1.9067	0.02608	1.43985	-1.0494	-0.4969	-0.9515	-2.4752
293	-1.9238	-0.0286	1.31951	-1.1534	-0.6289	-1.0571	-2.4041
294	-1.8238	0.04044	1.5584	-0.9481	-0.6118	-0.9163	-2.2078
295	-1.7472	0.04485	1.564	-1.0722	-0.4961	-0.935	-2.1584
296	-1.8058	0.0144	1.63984	-1.2108	-0.4611	-0.682	-2.2331
297	-1.7638	0.01104	1.61611	-0.9868	-0.4612	-0.7856	-2.3472
298	-1.8337	-0.0587	1.49475	-1.1424	-0.5827	-0.8439	-2.4006
299	-1.7607	0.02806	1.66688	-1.2917	-0.3734	-0.7547	-2.3495
300	-1.8094	-0.0612	1.48165	-1.4582	-0.4905	-0.8609	-2.3429
301	-1.7873	0.01508	1.55076	-1.2538	-0.4349	-1.0155	-2.137
302	-1.9296	-0.0582	1.50907	-1.1443	-0.4774	-0.6916	-2.285
303	-2.0997	-0.1539	1.35919	-1.239	-0.5331	-0.8517	-2.9219
304	-2.0061	-0.0464	1.4395	-1.0367	-0.4464	-0.8577	-2.2042
305	-1.9747	-0.0188	1.49383	-0.8944	-0.4393	-0.9628	-2.5727
306	-2.1541	-0.13	1.34791	-1.0356	-0.5483	-1.029	-2.4427
307	-1.8635	0.03103	1.42942	-0.7241	-0.452	-0.9982	-2.5995
308	-1.9283	-0.009	1.4515	-0.7654	-0.5484	-1.0385	-2.5161
309	-1.9278	0.05309	1.55368	-0.9019	-0.5818	-1.1706	-2.5745
310	-1.9979	0.01631	1.5056	-0.8321	-0.546	-1.2568	-2.4102

311	-1.9457	-0.0123	1.47632	-1.0071	-0.5877	-1.1941	-2.7386
312	-1.92	0.06796	1.52519	-0.9564	-0.5415	-0.8074	-2.3663
313	-1.9647	0.03504	1.45554	-0.9863	-0.5364	-0.8271	-2.3079
314	-1.8474	0.006	1.55901	-0.6753	-0.5127	-1.0831	-2.5508
315	-1.7619	0.13734	1.68362	-0.5514	-0.328	-0.9868	-2.4377
316	-1.8086	0.0348	1.50821	-0.8903	-0.6013	-0.9507	-2.6681
317	-1.8954	-0.1044	1.36341	-0.9497	-0.7699	-1.2089	-2.4136
318	-1.9017	0.00459	1.45302	-1.0686	-0.6356	-1.086	-2.3039
319	-1.8753	0.01699	1.48847	-1.1625	-0.6204	-1.0277	-2.1149
320	-1.8001	0.04211	1.47009	-1.1059	-0.6719	-1.212	-2.507
321	-1.7957	0.06994	1.52494	-1.1763	-0.6249	-1.0238	-2.4672
322	-1.8175	0.03722	1.54159	-1.0867	-0.5186	-0.7984	-2.5322
323	-2.0934	-0.1177	1.3815	-1.0739	-0.6412	-1.2823	-3.0585
324	-2.0413	-0.0693	1.45734	-1.0819	-0.5407	-0.763	-2.4777
325	-1.8588	0.01683	1.51962	-1.0945	-0.5366	-1.0588	-2.4565
326	-1.8842	0.01563	1.45329	-0.965	-0.6211	-1.3693	-2.6818
327	-1.8569	0.01714	1.55381	-0.905	-0.4219	-1.066	-2.8662
328	-1.9404	-0.0448	1.47726	-0.9301	-0.453	-0.9297	-2.5914
329	-1.7854	-0.0166	1.49192	-0.8865	-0.6346	-1.202	-2.5385
330	-1.5412	0.10268	1.59128	-1.2131	-0.6174	-1.3014	-2.3056
331	-1.7434	0.05697	1.50563	-1.3137	-0.7225	-1.4543	-2.6359
332	-1.7325	0.03997	1.43398	-1.1135	-0.646	-1.1978	-2.6748
333	-1.7495	-0.0298	1.40023	-1.3046	-0.5717	-1.2024	-2.6526
334	-1.8792	-0.0199	1.53131	-1.1543	-0.4262	-1.2019	-2.9538
335	-1.8494	-0.02	1.54369	-1.1878	-0.63	-1.3665	-2.7216
336	-2.1296	-0.1186	1.43372	-1.343	-0.5945	-1.334	-2.6317
337	-2.0161	-0.0684	1.43041	-1.1941	-0.4506	-1.1424	-2.3863
338	-1.8511	0.02496	1.60908	-0.9506	-0.4469	-1.0878	-2.4553
339	-1.9671	-0.0029	1.43217	-0.727	-0.5642	-1.1753	-2.5828
340	-1.8191	0.0218	1.41435	-0.6708	-0.6052	-1.2648	-2.4343
341	-1.8498	0.0782	1.48412	-0.6555	-0.4073	-0.9637	-2.2622
342	-1.8059	0.09758	1.5104	-0.995	-0.4588	-1.1057	-2.215
343	-1.7604	0.0983	1.63502	-0.9936	-0.4386	-1.18	-2.37
344	-1.793	0.04999	1.50089	-1.0931	-0.5836	-1.0516	-2.0592
345	-1.683	0.16022	1.59964	-1.0819	-0.4183	-0.9852	-2.1805
346	-1.7593	0.06602	1.51687	-1.1945	-0.5167	-1.0387	-2.643
347	-1.9684	-0.0238	1.41944	-1.1258	-0.5594	-1.1226	-2.3306
348	-1.7623	0.04802	1.5097	-1.1682	-0.5163	-1.1535	-2.6786
349	-1.7337	0.00983	1.58945	-1.2612	-0.5634	-1.4159	-2.5396
350	-1.7474	0.05626	1.48033	-1.255	-0.5964	-1.1106	-2.8416
351	-1.881	-0.0128	1.41934	-1.2151	-0.629	-1.2316	-2.4187
352	-1.8439	0.09806	1.54301	-1.1914	-0.4353	-1.1747	-2.1813
353	-1.8098	0.04167	1.52302	-1.2011	-0.4575	-1.1527	-2.6701
354	-1.8068	-0.0874	1.515	-1.3092	-0.7472	-1.1136	-2.6389
355	-1.7579	0.03403	1.43128	-1.3848	-0.5818	-1.4954	-2.207
356	-1.7381	0.0822	1.55879	-1.2587	-0.5122	-1.0959	-2.2307

357	-2.0166	-0.0609	1.31185	-1.3978	-0.5795	-1.3379	-2.3051
358	-1.7893	0.06804	1.55293	-1.3098	-0.4666	-1.1613	-2.4399
359	-1.9776	-0.0629	1.36901	-1.4288	-0.5572	-1.0504	-2.6267
360	-1.9805	0.00868	1.51609	-1.4584	-0.4743	-0.9785	-2.339
361	-1.791	0.0359	1.60539	-1.231	-0.3283	-0.8593	-2.1173
362	-1.9479	-0.0354	1.52579	-1.2163	-0.296	-0.7724	-2.4659
363	-1.9828	-0.0205	1.49093	-1.4447	-0.4244	-0.8345	-2.5511
364	-2.0014	-0.0363	1.51566	-1.3333	-0.4281	-0.8753	-2.6003
365	-1.847	-0.0378	1.60327	-1.3666	-0.4087	-0.934	-2.4451
366	-1.7546	0.0523	1.57634	-1.4525	-0.4171	-0.825	-2.2799
367	-1.8208	-0.06	1.53471	-1.165	-0.5065	-0.7002	-2.3636
368	-1.8512	-0.0404	1.56568	-1.3965	-0.5604	-0.7247	-2.2989
369	-1.7492	0.04954	1.68552	-1.3084	-0.5315	-0.512	-2.4955
370	-1.7283	0.00533	1.63008	-1.3171	-0.4734	-0.6112	-2.8597
371	-1.6439	0.11027	1.73242	-1.1493	-0.4964	-0.6004	-2.6227
372	-1.7556	0.11795	1.56469	-1.2305	-0.5678	-0.8849	-2.4104
373	-1.8949	0.02982	1.59543	-1.4423	-0.6444	-1.1678	-2.5745
374	-1.8728	0.00755	1.57501	-1.3281	-0.6727	-1.1283	-2.4086
375	-1.9057	0.03567	1.53322	-1.2249	-0.6375	-1.2343	-2.2346
376	-1.8656	0.10486	1.61387	-1.1515	-0.5515	-0.9534	-2.3955
377	-1.6885	0.04308	1.46212	-1.2982	-0.5724	-0.6983	-2.1625
378	-1.718	0.05261	1.57695	-1.3348	-0.5854	-1.0452	-2.3014
379	-1.8782	-0.0402	1.40354	-1.5045	-0.6386	-0.811	-2.6143
380	-1.8214	0.04917	1.51069	-1.346	-0.594	-0.9754	-2.6148
381	-1.842	0.11127	1.51535	-0.8926	-0.6524	-0.9891	-2.3733
382	-1.8485	0.03577	1.40829	-1.0847	-0.7737	-1.0654	-2.9394
383	-1.9125	-0.016	1.28408	-1.2305	-0.759	-1.1957	-2.3597
384	-1.8982	-0.0002	1.38132	-1.2767	-0.747	-1.1892	-2.608
385	-1.7788	0.04948	1.54753	-1.4269	-0.6785	-0.9471	-2.2093
386	-1.8576	-0.0263	1.42543	-1.4087	-0.7476	-1.1254	-2.7147
387	-1.8974	0.04162	1.56134	-1.3137	-0.5949	-1.0297	-2.3334
388	-1.8056	0.06468	1.49826	-1.3609	-0.6351	-1.0173	-2.2675
389	-1.7673	0.14238	1.58356	-1.2897	-0.5186	-0.9614	-2.5
390	-1.8449	0.05532	1.50127	-1.0407	-0.5324	-0.8831	-2.3376
391	-1.956	-0.036	1.3756	-1.1379	-0.6871	-0.9271	-2.4402
392	-1.891	-0.0499	1.40866	-1.3439	-0.6617	-1.0773	-2.8804
393	-1.8668	-0.0119	1.44369	-1.2007	-0.6095	-1.1826	-2.3995
394	-1.7681	0.03636	1.49648	-1.437	-0.6294	-0.859	-2.6383
395	-1.8509	0.0045	1.57395	-1.2722	-0.607	-0.9562	-2.4029
396	-1.8881	-0.0139	1.5293	-1.38	-0.6483	-0.976	-2.5125
397	-1.8819	-0.0324	1.4517	-1.3909	-0.6911	-1.1573	-2.5486
398	-1.8546	0.0303	1.48554	-1.5034	-0.6788	-0.985	-2.3934
399	-1.866	0.03808	1.50453	-1.3327	-0.6791	-0.9289	-2.4971
400	-1.7709	0.0903	1.55458	-1.3511	-0.6555	-0.7734	-2.3115
401	-1.9393	-0.0587	1.37696	-1.6443	-0.6639	-1.0091	-2.4052
402	-1.7965	0.02688	1.47715	-1.5312	-0.6304	-0.7338	-2.3464

403	-1.8252	0.06831	1.5094	-1.3866	-0.5609	-0.7672	-2.0181
404	-1.8324	0.0547	1.40705	-1.3651	-0.6366	-1.0623	-2.4396
405	-1.8389	0.13188	1.54786	-1.3647	-0.5359	-1.2695	-2.2117
406	-1.7281	0.06963	1.5619	-1.255	-0.7474	-1.4951	-2.4637
407	-1.6797	0.1565	1.54214	-1.2868	-0.7011	-1.1999	-2.3196
408	-1.7857	0.09807	1.47888	-1.5148	-0.7373	-1.3043	-2.4255
409	-1.7435	0.04462	1.58005	-1.594	-0.6846	-1.4074	-2.483
410	-1.7301	0.05881	1.40572	-1.5158	-0.7316	-1.2004	-2.7742
411	-1.814	-0.0152	1.24687	-1.6521	-0.9203	-1.2849	-2.7284
412	-1.6446	0.07771	1.39551	-1.6084	-0.7533	-1.379	-2.3962
413	-1.7924	0.04108	1.28249	-1.6349	-0.7571	-1.2734	-2.4267
414	-1.8244	0.06369	1.36254	-1.614	-0.7036	-1.2208	-2.4522
415	-1.8211	0.03792	1.41796	-1.6034	-0.7627	-1.3682	-2.5286
416	-1.8769	0.01095	1.34974	-1.2904	-0.7992	-1.2412	-2.6528
417	-1.812	0.08479	1.39757	-1.3263	-0.648	-0.9755	-2.1104
418	-1.9616	0.07114	1.42701	-1.3601	-0.5161	-1.302	-2.3704
419	-1.9703	-0.0209	1.29011	-1.2455	-0.5481	-1.0764	-2.7696
420	-1.9534	-0.0134	1.41766	-1.3773	-0.457	-1.2997	-2.6353
421	-1.8174	0.06249	1.48563	-1.2647	-0.4982	-1.3818	-2.3727
422	-1.8608	0.05507	1.6455	-1.4117	-0.5897	-1.2778	-2.5516
423	-1.945	-0.0366	1.45782	-1.3879	-0.6192	-1.1472	-2.3614
424	-1.729	0.08515	1.48825	-1.3365	-0.6225	-0.9236	-2.2924
425	-1.6886	0.18157	1.59255	-1.231	-0.606	-1.2417	-2.3132
426	-1.8435	0.02678	1.56478	-1.1809	-0.6106	-0.994	-2.6348
427	-1.9629	-0.0823	1.33967	-1.3169	-0.6323	-1.4511	-2.5827
428	-1.8425	0.01291	1.56182	-1.3393	-0.6136	-1.1862	-2.6614
429	-1.9092	0.02921	1.54559	-1.4142	-0.5358	-1.33	-2.3111
430	-1.718	0.10856	1.77379	-1.2136	-0.3612	-1.067	-2.775
431	-1.6999	0.12226	1.83131	-1.3286	-0.3375	-0.953	-2.6414
432	-1.7462	0.10326	1.70185	-1.3333	-0.3278	-0.708	-2.3936
433	-1.6275	0.20579	1.72106	-1.3825	-0.3139	-0.5824	-2.287
434	-1.6787	0.09435	1.74509	-1.5418	-0.3448	-0.8314	-2.3028
435	-1.6694	0.03933	1.73833	-1.587	-0.2888	-0.5593	-2.5622
436	-1.8129	0.04791	1.65417	-1.4828	-0.3254	-0.5301	-2.3407
437	-1.6949	0.09312	1.69366	-1.3282	-0.2435	-0.8004	-2.5166
438	-1.617	0.16795	1.81903	-1.3946	-0.2554	-1.098	-2.1848
439	-1.7111	0.09587	1.67164	-1.2058	-0.3037	-1.296	-2.2076
440	-1.6991	0.15478	1.69684	-1.2519	-0.297	-1.5586	-2.49
441	-1.7575	0.04027	1.66883	-1.4238	-0.3712	-1.5029	-2.2185
442	-1.9471	-0.113	1.53138	-1.625	-0.4463	-1.4702	-2.5576
443	-1.738	0.0828	1.64883	-1.562	-0.2854	-1.2749	-2.2772
444	-1.7613	0.11403	1.77059	-1.481	-0.2	-1.3893	-2.1657
445	-1.6418	0.11017	1.84228	-1.6249	-0.2481	-1.2553	-2.2547
446	-1.6389	0.14629	1.90758	-1.4967	-0.2345	-1.4587	-2.2117
447	-1.706	0.0967	1.76476	-1.4371	-0.3379	-1.7193	-2.4017
448	-1.8258	0.03875	1.64302	-1.5257	-0.4182	-1.7984	-2.5865

449	-1.7256	0.13049	1.77616	-1.4483	-0.2517	-1.5843	-2.6232
450	-1.7048	0.11594	1.85487	-1.4049	-0.2795	-1.3846	-2.2494
451	-1.5354	0.13765	1.91829	-1.4663	-0.1164	-1.4234	-2.2034
452	-1.8215	-0.0582	1.71839	-1.6324	-0.3161	-1.4681	-2.3152
453	-1.7013	0.0773	1.82629	-1.5799	-0.188	-1.1679	-2.1735
454	-1.571	0.10956	1.94246	-1.617	-0.1923	-1.0028	-2.3003
455	-1.6303	0.08715	1.8605	-1.7314	-0.2126	-1.2173	-2.275
456	-1.6599	0.10335	1.87285	-1.6117	-0.2699	-1.1748	-2.4934
457	-1.7337	0.06584	1.86929	-1.752	-0.2617	-1.2106	-2.4335
458	-1.7028	0.07545	1.85124	-1.6192	-0.2667	-1.0855	-2.6182
459	-1.6962	0.01239	1.88185	-1.7964	-0.3461	-1.2049	-2.4912
460	-1.6152	0.09376	2.01469	-1.7731	-0.1287	-0.9522	-2.3503
461	-1.5388	0.09649	2.05832	-1.5009	-0.0736	-1.0682	-2.4862
462	-1.6235	-0.025	1.87256	-1.6597	-0.2748	-1.133	-2.4459
463	-2.1689	-0.0655	1.60662	-1.4227	-0.246	-1.0894	-3.2867
464	-2.1745	-0.061	1.62077	-1.5269	0.02332	-0.7363	-2.6791
465	-2.3838	-0.0323	1.46995	-1.3529	-0.0234	-0.8138	-2.8388
466	-2.2344	0.00571	1.52681	-1.3548	-0.1395	-0.8354	-2.7731
467	-1.9954	-0.0546	1.64152	-1.403	-0.2153	-0.9514	-2.8267
468	-2.0911	-0.0504	1.57037	-1.6456	-0.3101	-1.2474	-2.9648
469	-2.143	-0.0956	1.54147	-1.5218	-0.3546	-1.331	-2.8806
470	-1.9479	0.0321	1.66469	-1.2738	-0.2486	-1.0824	-2.2472
471	-1.9967	0.09052	1.68767	-1.3979	-0.2238	-1.0876	-2.6354
472	-1.957	0.07793	1.76801	-1.3276	-0.1837	-0.9604	-2.2867
473	-2.1579	-0.0222	1.57508	-1.1976	-0.3377	-1.0956	-2.3733
474	-1.9915	-0.0622	1.46894	-1.5223	-0.4192	-1.2159	-2.7077
475	-1.8271	0.09462	1.73711	-1.3943	-0.2019	-1.0309	-2.45
476	-1.9016	0.05451	1.75683	-1.3161	-0.2663	-0.9466	-2.707
477	-1.8368	0.08379	1.73598	-1.2547	-0.1833	-0.6891	-2.3917
478	-2.0371	-0.0434	1.70287	-1.5155	-0.2911	-0.7848	-2.9862
479	-1.9713	0.01167	1.69402	-1.4209	-0.3051	-0.8874	-2.6246
480	-1.7494	0.08767	1.77062	-1.3874	-0.205	-0.8224	-2.6074
481	-1.905	0.03264	1.64773	-1.527	-0.3197	-0.7169	-2.7408
482	-1.9485	0.1102	1.67173	-1.5691	-0.1579	-0.6996	-2.1111
483	-1.8992	0.03291	1.66788	-1.4967	-0.3107	-0.8785	-2.5835
484	-2.065	-0.1045	1.63078	-1.8054	-0.4114	-0.8426	-2.3019
485	-2.0145	-0.0548	1.61189	-1.7262	-0.4093	-0.8159	-2.5048
486	-1.9621	-0.0368	1.61447	-1.8437	-0.4304	-0.9005	-2.5026
487	-1.8131	0.05366	1.76254	-1.5646	-0.3201	-0.8144	-2.5297
488	-1.9802	-0.0632	1.60863	-1.5144	-0.317	-0.783	-2.7367
489	-1.9112	-0.025	1.68441	-1.5871	-0.4087	-0.8395	-2.6996
490	-1.8702	0.05103	1.84337	-1.4016	-0.2389	-0.7869	-2.475
491	-1.8707	0.0885	1.90207	-1.4553	-0.1784	-0.6133	-2.5809
492	-2.0898	-0.1016	1.71042	-1.919	-0.382	-0.7857	-2.4847
493	-1.8756	0.04851	1.80757	-1.5351	-0.223	-0.7889	-2.7984
494	-1.9998	-0.0025	1.6937	-1.658	-0.3262	-0.9922	-2.4305

495	-1.791	0.06967	1.79072	-1.0695	-0.1607	-0.9917	-2.5433
496	-2.0503	-0.1447	1.71623	-1.4851	-0.4626	-1.176	-2.8445
497	-1.7923	-0.0078	1.85589	-1.6976	-0.2223	-0.8737	-2.3088
498	-1.8433	0.02847	1.87747	-1.7051	-0.0726	-0.6497	-2.4803
499	-1.688	0.13145	2.03839	-1.7305	-0.0944	-0.5837	-2.3928
500	-1.6935	-0.0292	2.0793	-1.7107	-0.1162	-0.5705	-2.2306
501	-2.1976	-0.2596	1.71393	-2.0593	-0.276	-0.8055	-2.2612
502	-1.8472	0.0985	1.94574	-1.5075	0.03105	-0.5574	-2.7559
503	-1.709	0.11681	1.95758	-1.6889	-0.0501	-0.7794	-2.4396
504	-1.8578	0.05005	1.93196	-1.5811	0.00659	-0.5129	-2.508
505	-1.8862	0.04931	1.9616	-1.6327	-0.1139	-0.596	-2.4234
506	-1.9329	0.03042	1.85587	-1.8196	-0.1941	-0.7897	-2.7876
507	-1.974	-0.0747	1.70803	-2.127	-0.2264	-0.8166	-2.5929
508	-1.8898	-0.0018	1.84233	-1.846	-0.1444	-0.7635	-2.9265
509	-1.8528	0.0545	2.01826	-1.8426	-0.0044	-0.4728	-2.1869
510	-1.9216	0.01359	1.8813	-2.0774	-0.0565	-0.6313	-2.4581
511	-1.6976	0.11752	1.98301	-1.9819	0.07347	-0.4565	-2.0011
512	-1.7623	-0.0486	2.02129	-1.8814	-0.0978	-0.6278	-2.5423
513	-1.8633	-0.1159	1.8635	-2.2008	-0.2393	-0.8128	-2.2779
514	-1.6767	0.16357	2.19502	-1.978	0.10039	-0.5197	-1.9639
515	-1.9014	-0.1704	1.73773	-2.3667	-0.2806	-0.9356	-2.5757
516	-1.7727	0.00333	1.95664	-2.1215	-0.1482	-0.7955	-2.2637
517	-1.8018	-0.0962	2.11647	-2.4443	-0.0795	-0.7358	-2.4398
518	-1.6486	-0.038	2.18321	-1.9452	0.07624	-0.5645	-2.8036
519	-1.4837	0.14845	2.25105	-2.4619	0.07465	-0.5337	-2.4918
520	-1.5912	0.04786	2.36085	-2.0873	0.14295	-0.5003	-2.2203
521	-1.6365	0.01663	2.13637	-2.5935	-0.0167	-0.6077	-2.5501
522	-1.7086	0.02378	2.14393	-1.9114	0.04584	-0.6282	-2.404
523	-1.9542	-0.1097	1.92921	-1.8031	-0.1226	-0.9067	-2.4941
524	-1.6739	0.02103	2.18866	-1.9143	0.02837	-0.6374	-2.3115
525	-1.6386	0.08875	2.02357	-1.8814	0.02773	-0.51	-2.2595
526	-1.699	0.11767	2.15299	-2.018	0.12462	-0.4807	-2.2147
527	-1.7293	-0.0948	2.06018	-1.9683	-0.1226	-0.6297	-2.3876
528	-1.5985	0.13303	2.19487	-1.8203	0.0764	-0.4089	-2.6051
529	-1.9467	-0.1081	1.89826	-1.9445	-0.1944	-0.8909	-2.3705
530	-1.9048	-0.1364	1.97696	-1.7794	-0.1991	-1.1734	-2.4926
531	-1.8285	-0.0378	1.99593	-2.032	-0.1309	-0.8471	-2.7006
532	-1.7485	0.06333	2.06145	-1.7895	-0.0924	-0.6767	-2.6417
533	-1.4911	0.16412	2.19102	-1.2717	0.09901	-0.5236	-2.4033
534	-1.5853	0.12645	2.25656	-1.9105	0.06024	-0.9762	-2.3933
535	-1.5124	0.19406	2.25264	-1.7584	0.0318	-1.1446	-2.2264
536	-1.7203	0.11678	2.00008	-2.0521	-0.125	-0.7644	-2.2508
537	-1.6864	0.06396	1.95624	-2.1204	-0.1385	-1.1115	-2.4732
538	-1.6137	0.09342	2.12639	-1.9007	-0.0707	-0.783	-2.4182
539	-1.8567	-0.0319	1.88099	-1.7891	-0.1647	-0.9043	-2.5661
540	-1.7659	-0.0281	1.76355	-1.7112	-0.2223	-0.9055	-2.9262

541	-1.753	0.06755	2.03592	-1.7169	-0.0552	-1.1346	-2.8622
542	-1.7444	-0.0061	1.80338	-1.7657	-0.0643	-1.0984	-2.6673
543	-1.6616	0.08026	2.12786	-1.7085	-0.0011	-0.7906	-2.7212
544	-1.9155	-0.0661	1.87852	-1.8931	-0.2233	-0.594	-2.6025
545	-1.6767	0.03727	1.81372	-1.7123	-0.1303	-1.0866	-2.7487
546	-1.5766	0.15852	2.00206	-1.9569	-0.0102	-0.6847	-2.7079
547	-1.6689	0.12814	1.98747	-1.9071	-0.0075	-0.952	-2.304
548	-1.7023	0.13319	2.05843	-1.54	0.11365	-0.8857	-2.4017
549	-1.6019	0.1376	2.17561	-1.5317	0.13507	-0.9493	-2.2116
550	-1.8686	0.06317	1.94923	-1.9517	-0.0406	-1.1646	-2.9392
551	-1.8281	0.03462	1.93526	-1.8917	0.01581	-0.9027	-2.2795
552	-1.9256	-0.0933	1.77021	-2.1163	-0.1465	-1.213	-2.6814
553	-1.8967	0.00616	1.89493	-2.006	-0.0746	-0.9645	-2.5965
554	-1.6629	0.16221	2.15308	-1.9447	0.14505	-1.0831	-2.1882
555	-1.9222	-0.0944	1.87219	-2.0952	-0.0503	-1.1491	-2.3928
556	-1.6638	0.14202	2.14215	-1.7695	0.19948	-0.868	-2.3663
557	-1.6879	0.02925	2.11815	-1.986	0.05387	-0.9718	-2.2379
558	-1.7323	0.18783	2.19325	-1.7178	0.17476	-0.8424	-2.5725
559	-1.7909	0.05089	2.06388	-2.0459	0.07738	-0.9872	-2.6917
560	-1.9133	0.03887	2.13295	-1.9466	0.11746	-1.2617	-2.3821
561	-1.8671	-0.0338	2.1073	-1.7882	0.10404	-1.0467	-2.5663
562	-1.6362	0.04166	2.1214	-1.6216	0.2353	-0.9616	-2.4983
563	-1.7043	0.08924	2.17524	-1.9311	0.21145	-1.2749	-2.3041
564	-1.7362	0.10676	2.16141	-1.8342	0.24237	-1.1645	-2.5107
565	-1.7082	0.07729	2.17093	-1.9713	0.21051	-1.0274	-2.6998
566	-1.628	0.06961	2.13824	-1.8589	0.22271	-1.1947	-2.8737
567	-1.5713	0.13791	2.28947	-1.9198	0.23211	-0.9461	-2.7013
568	-1.4883	0.1689	2.54476	-2.3156	0.52462	-0.9604	-2.472
569	-1.6693	-0.0307	2.13195	-1.7957	0.2381	-1.0247	-2.0112
570	-1.3827	0.25757	2.52155	-1.5518	0.50185	-0.6377	-2.0566
571	-1.7126	-0.0222	2.26478	-1.9414	0.22879	-0.7947	-2.2214
572	-1.7623	-0.0796	2.08415	-2.1254	0.16821	-0.8633	-2.6935
573	-1.7062	0.13335	2.27755	-2.0755	0.61498	-1.3658	-2.3412
574	-1.6755	0.16072	2.26731	-1.9515	0.83261	-1.108	-2.5886
575	-1.6621	0.13043	2.40849	-2.0296	0.80852	-1.2678	-2.5428
576	-1.6073	0.12055	2.20436	-1.9108	0.42807	-1.2344	-2.3425
577	-1.5677	0.23559	2.34771	-1.4313	0.3868	-0.5437	-2.2316
578	-1.6365	0.18684	2.28569	-1.6998	0.41379	-0.8542	-2.3702
579	-1.7792	0.08654	2.21186	-1.9931	0.19478	-0.9423	-2.3301
580	-1.6332	0.15294	2.24015	-2.067	0.27999	-1.1774	-1.9621
581	-1.5171	0.15316	2.21817	-2.1005	0.30519	-0.967	-2.181
582	-1.8261	0.02775	2.18288	-1.9157	0.1334	-1.1477	-2.2071
583	-1.6529	0.0808	2.23636	-1.7322	0.21886	-0.9366	-2.3822
584	-1.4341	0.24618	2.26652	-1.8256	0.27023	-1.0558	-2.1229
585	-1.7781	0.01644	1.93379	-2.3352	-0.0102	-1.2692	-2.3335
586	-1.7145	0.02179	2.03831	-2.075	0.04137	-1.0117	-2.3885

587	-1.7406	0.02448	2.08219	-1.8174	0.05662	-0.964	-2.2335
588	-1.5011	0.16087	2.3059	-1.9555	0.27204	-0.9163	-1.9812
589	-1.6337	0.05036	2.14401	-1.8738	0.08616	-1.3351	-2.781
590	-1.6257	0.05186	2.18001	-1.8688	0.06487	-1.0794	-2.5843
591	-1.7257	0.02831	2.03479	-2.259	-0.0428	-0.9163	-2.6503
592	-1.6008	0.16777	2.11745	-1.9243	0.07166	-0.481	-2.4845
593	-1.655	0.1385	2.09527	-1.7595	0.05283	-0.8459	-2.6315
594	-1.8033	-0.0638	1.91661	-1.8957	-0.0231	-1.2829	-2.533
595	-1.8732	0.03473	1.9251	-1.655	-0.0319	-1.3058	-2.5632
596	-1.7397	0.1076	1.82603	-1.4561	-0.0429	-1.242	-2.5042
597	-1.766	0.09565	1.86265	-1.3966	-0.0746	-1.085	-2.203
598	-1.894	-0.0501	1.74494	-1.5603	-0.2325	-1.1831	-2.4846
599	-1.908	-0.074	1.8552	-1.5218	-0.2338	-1.1562	-2.595
600	-1.8043	0.059	2.0445	-1.4399	-0.0329	-1.0156	-2.5267
601	-1.7021	0.15878	2.19947	-1.6124	0.10625	-1.2089	-2.3856
602	-1.7986	0.14698	2.14269	-1.678	0.16843	-1.0998	-2.7105
603	-1.8124	0.13999	2.08767	-1.5448	0.2304	-0.6759	-2.2647
604	-1.8489	-0.0662	2.0079	-1.5243	0.08376	-1.1617	-2.5575
605	-1.5907	0.19765	2.20383	-1.6428	0.26655	-1.0136	-2.3981
606	-1.5554	0.13297	2.35116	-1.5181	0.37161	-0.8858	-2.4123
607	-1.7552	0.06181	2.19303	-1.5182	0.31933	-0.9947	-2.5316
608	-1.8376	0.05149	2.25416	-1.507	0.28979	-1.2996	-2.3844
609	-1.805	0.01155	2.33078	-1.5807	0.14445	-1.1319	-2.9641
610	-1.5502	0.35265	2.45467	-1.4074	0.50087	-1.0859	-2.2096
611	-1.6375	0.23843	2.39068	-1.6349	0.36259	-0.7493	-2.2954
612	-1.4764	0.29942	2.59711	-1.5317	0.49338	-0.7602	-2.0042
613	-1.7708	0.0724	2.31103	-1.9513	0.21502	-1.1038	-2.9279
614	-1.6735	0.18583	2.33939	-1.7014	0.3059	-0.8246	-2.1856
615	-1.5506	0.3003	2.41158	-1.612	0.3407	-0.367	-2.1655
616	-1.762	0.12998	2.0556	-1.5727	0.10998	-0.7872	-2.2829
617	-1.6851	0.11921	2.21572	-1.7663	0.09677	-0.5729	-2.2324
618	-1.6871	-0.0097	2.2008	-1.8876	0.02319	-0.6775	-2.1566
619	-1.4905	0.16108	2.28048	-1.5627	0.14137	-1.0726	-2.1572
620	-1.7146	0.03805	2.10047	-2.0347	0.0596	-1.0607	-2.3942
621	-1.716	0.12135	2.14634	-1.8289	0.17724	-0.8597	-2.4135
622	-1.6814	0.1321	2.1842	-2.137	0.15075	-0.9561	-2.5246
623	-1.6582	0.08264	2.23403	-1.8294	0.1435	-1.3033	-2.5568
624	-1.6545	0.10698	2.31258	-1.8659	0.47113	-1.3233	-2.6163
625	-1.609	0.18965	2.21181	-1.8434	0.22314	-0.9786	-2.4663
626	-1.7662	0.21085	2.37779	-1.8619	0.22359	-0.6981	-1.9646
627	-1.6401	0.18353	2.29282	-1.8168	0.17484	-0.9116	-2.2529
628	-1.8557	-0.0093	2.02699	-1.9461	-0.1052	-0.9493	-2.7298
629	-1.6243	0.13783	2.27323	-1.8131	0.1135	-1.2618	-2.2131
630	-1.4442	0.16075	2.39575	-1.5087	0.34229	-0.8708	-2.0497
631	-1.5764	0.17274	2.44042	-1.306	0.39278	-0.7793	-2.2055
632	-1.5482	0.24372	2.41035	-1.5984	0.40514	-0.7233	-2.162

633	-1.6499	0.03626	2.19379	-1.7426	0.15716	-0.8285	-2.1254
634	-1.7368	0.09638	2.13862	-1.8603	0.11379	-1.2903	-2.7198
635	-1.7443	0.07652	2.12577	-1.8511	0.05674	-1.0594	-2.47
636	-1.7673	0.1242	2.08121	-1.5533	0.13682	-0.7109	-2.4114
637	-1.7736	0.08519	1.93184	-1.6688	0.07286	-1.1917	-2.141
638	-1.7644	-0.0606	2.05486	-1.5464	0.00586	-1.1841	-2.3653
639	-1.066	0.18085	2.51095	-2.2702	0.39538	-1.4728	-2.3185
640	-1.2948	0.06028	2.37941	-2.4287	0.27949	-1.2926	-2.374
641	-1.3204	0.02053	2.30058	-2.5122	0.2389	-1.2648	-2.2752
642	-1.1556	0.12803	2.41401	-2.5035	0.34806	-1.11	-2.4198
643	-1.2645	0.05118	2.24418	-2.5469	0.19622	-1.3738	-2.6116
644	-1.1774	0.20942	2.54061	-2.6762	0.42878	-1.1435	-2.2996
645	-1.1591	0.1379	2.38972	-2.5539	0.32559	-1.0917	-2.4064
646	-1.2682	0.02932	2.3891	-2.5807	0.3008	-1.3732	-2.4711
647	-1.1424	0.19206	2.4694	-2.3657	0.44117	-1.5197	-2.1999
648	-1.0863	0.19988	2.60401	-2.5885	0.50636	-1.6074	-2.8089
649	-1.0544	0.19979	2.52328	-2.4296	0.52264	-1.4098	-2.1723
650	-1.1147	0.19261	2.66122	-2.2447	0.63206	-1.0835	-2.2654
651	-1.0331	0.25075	2.71642	-2.5684	0.55099	-1.3772	-2.2466
652	-0.9501	0.24781	2.8437	-2.0947	0.69792	-1.2223	-2.2831
653	-1.0435	0.12637	2.6073	-2.2064	0.57676	-1.5194	-2.2802
654	-0.7589	0.22966	2.87637	-2.1358	0.59881	-1.4851	-2.4652
655	-0.7878	0.28346	2.74776	-1.9761	0.58038	-1.299	-2.1466
656	-0.9282	0.1342	2.51745	-2.1965	0.46364	-1.2423	-2.2835
657	-1.1257	0.20707	2.64475	-2.1473	0.61894	-1.2033	-2.1735
658	-1.0278	0.21578	2.71949	-2.1209	0.70209	-1.3536	-2.0709
659	-0.8043	0.46745	1.951	-1.5982	-0.2651	-1.381	-2.1249
660	-0.5433	0.5482	2.23908	-1.7852	0.09721	-0.9838	-1.8891
661	-0.7427	0.47084	2.06286	-2.1006	-0.1075	-1.3428	-2.1204
662	-0.8368	0.34751	2.13465	-2.6053	0.09292	-1.1701	-2.0668
663	-0.9078	0.10719	2.37006	-2.3709	0.15183	-1.2111	-2.332
664	-0.6743	0.30728	2.33783	-2.1116	0.2105	-0.9437	-2.1116
665	-0.6169	0.23477	2.25336	-2.2124	0.35272	-1.1452	-1.8834
666	-0.7793	0.13971	2.288	-2.1826	0.24814	-1.1736	-2.2142
667	-0.7941	0.29443	2.32422	-2.2061	0.50115	-1.1802	-2.053
668	-0.6798	0.18519	2.09475	-2.2293	0.23427	-1.0237	-2.3724
669	-0.9178	0.16788	1.89669	-2.216	-0.0253	-1.144	-2.3403
670	-0.8888	0.25552	1.84994	-2.2542	-0.0431	-0.9483	-2.3629
671	-0.9056	0.19963	1.90765	-1.8348	-0.0342	-1.0888	-2.5229
672	-0.8834	0.28015	2.48607	-2.1964	-0.0477	-1.0187	-1.511
673	-1.2222	0.25378	1.9161	-1.8609	-0.3292	-1.0311	-3.1156
674	-1.1154	0.27399	2.17132	-1.96	-0.1656	-1.0149	-2.3325
675	-1.1652	0.16786	2.14882	-2.095	-0.1521	-1.0963	-2.3478
676	-1.2769	0.19258	2.15002	-2.0654	-0.1256	-0.9768	-3.0541
677	-1.1023	0.21885	2.25195	-2.0076	-0.2406	-0.9324	-2.3589
678	-0.9986	0.31107	2.35374	-2.1498	-0.2396	-1.0008	-2.2144

679	-0.9198	0.28359	2.30641	-2.1772	-0.273	-1.0851	-2.2934
680	-1.1823	0.12098	2.31377	-2.262	-0.4286	-1.2093	-2.7425
681	-0.9927	0.15517	2.41449	-2.1545	-0.2287	-1.1554	-2.7154
682	-0.9865	0.0915	2.2425	-2.1926	-0.1005	-1.2145	-2.6062
683	-1.0118	0.09665	2.19943	-2.2074	0.0492	-1.2054	-2.3625
684	-0.7573	0.29983	2.25363	-2.1595	0.27233	-1.118	-2.0315
685	-0.7348	0.36866	2.00567	-2.3389	-0.0466	-1.2055	-2.6852
686	-0.5602	0.13293	1.99086	-2.1089	-0.1017	-1.1152	-2.0415
687	-0.6335	0.08226	2.08697	-2.0727	0.29896	-1.0739	-2.4248
688	-0.8151	0.25175	2.5938	-2.0857	0.5165	-0.948	-1.7484
689	-1.1012	0.06914	2.30164	-2.5694	0.24389	-1.414	-2.0896
690	-0.7211	0.2543	2.58045	-2.2454	0.509	-0.5938	-2.4539
691	-0.7219	0.30204	2.66591	-2.1926	0.53323	-1.0802	-2.3119
692	-0.6783	0.27305	2.43022	-2.2924	0.35895	-1.193	-2.3731
693	-0.7387	0.08954	2.56949	-2.2293	0.36244	-1.2924	-2.2928
694	-0.8978	0.13576	2.20343	-2.2969	0.43223	-1.1383	-2.2129
695	-0.7042	0.30645	2.5535	-2.2993	0.47125	-0.9053	-2.5535
696	-0.8594	0.25001	2.71442	-2.412	0.50323	-1.164	-2.3333
697	-0.6559	0.45777	2.81337	-2.1877	0.61739	-0.983	-1.9541
698	-0.789	0.21512	2.74707	-2.3492	0.50955	-1.1986	-2.158
699	-0.7872	0.29024	2.6995	-2.4589	0.49495	-1.0706	-2.2073
700	-1.1649	0.07433	2.29821	-2.428	0.12675	-1.3494	-2.5104
701	-1.118	0.18876	2.39421	-2.4684	0.23069	-1.4311	-2.5121
702	-1.1055	0.13068	2.40698	-2.3366	0.24298	-1.3799	-2.2762
703	-1.0783	0.24305	2.62984	-2.2948	0.45437	-1.471	-2.6643
704	-1.1116	0.11868	2.49766	-2.5637	0.33517	-1.6088	-2.6422
705	-1.1091	0.1796	2.72208	-2.4791	0.4468	-1.4058	-2.6951
706	-0.735	0.31505	2.84889	-1.9685	0.5375	-1.3942	-2.1099
707	-0.7629	0.36654	2.78206	-2.1104	0.62143	-1.1393	-2.2696
708	-0.9846	0.22199	2.51722	-2.4226	0.32162	-1.2769	-2.2729
709	-0.8357	0.19699	2.6737	-1.9883	0.42781	-1.5295	-2.6874
710	-0.9263	0.16144	2.60333	-2.0968	0.39877	-1.1662	-2.6358
711	-0.7562	0.23455	2.82455	-2.258	0.55584	-1.3478	-2.2864
712	-0.9162	0.17743	2.74728	-2.3584	0.47869	-1.1209	-2.1491
713	-0.8588	0.22467	2.71392	-2.275	0.47365	-0.9834	-2.2554
714	-0.8882	0.13148	2.6284	-2.3316	0.41997	-1.3694	-2.2301
715	-0.7804	0.19755	2.88282	-2.4592	0.67907	-1.001	-1.9256
716	-0.9361	0.06709	2.54691	-2.2937	0.47006	-1.1316	-2.1197
717	-0.8708	0.20767	2.73389	-2.0611	0.56142	-1.1494	-1.924
718	-0.9362	0.13647	2.82486	-2.476	0.58726	-1.293	-2.109
719	-0.8422	0.20841	2.88185	-2.1467	0.55353	-1.2518	-1.8969
720	-1.0418	0.10891	2.68464	-2.3388	0.44195	-1.4712	-2.1854
721	-1.0356	0.13968	2.65791	-2.1312	0.61293	-1.7205	-2.4547
722	-0.9918	0.10222	2.67698	-2.2619	0.42514	-1.702	-2.4996
723	-1.2211	-0.0049	2.54531	-2.0729	0.35854	-1.8097	-2.1303
724	-1.319	-0.0205	2.44365	-2.4358	0.22001	-1.6088	-2.5467

725	-1.0389	0.23689	2.64138	-2.4312	0.42155	-1.498	-2.6339
726	-0.9947	0.09458	2.64758	-1.9789	0.47092	-1.3107	-2.2539
727	-1.0132	0.24369	2.51709	-2.1565	0.46397	-1.326	-2.048
728	-0.7121	0.40855	2.40511	-2.1315	0.36336	-1.3416	-2.0412
729	-0.8804	0.22173	2.04324	-2.1041	-0.1898	-1.6954	-3.0367
730	-0.7188	0.51045	2.2714	-1.8835	-0.0259	-1.4891	-2.0364
731	-1.0318	0.43305	1.99177	-1.7615	-0.2377	-2.1423	-2.3193
732	-0.9939	0.459	2.06049	-1.9514	-0.3565	-1.886	-2.2093
733	-1.5123	0.2572	2.46833	-1.8437	0.51415	-1.4574	-2.3252
734	-1.6379	0.04284	2.21139	-2.1932	0.33262	-1.1705	-2.7216
735	-1.4877	0.20017	2.35733	-1.9198	0.38777	-1.1234	-2.1631
736	-1.5788	0.2025	2.35325	-1.947	0.35935	-1.1799	-2.3004
737	-1.6925	0.0737	2.17543	-1.8857	0.21236	-1.4369	-2.1825
738	-1.6705	0.00237	2.14066	-2.0162	0.12933	-1.5236	-2.4819
739	-1.6703	0.08223	1.99343	-1.8597	0.07255	-1.4629	-2.499
740	-1.5655	0.15133	2.04136	-1.7291	0.1676	-1.397	-2.4195
741	-1.595	0.10278	2.29801	-1.9994	0.15157	-1.4969	-2.656
742	-1.2632	0.22008	2.63506	-2.0212	0.47801	-1.0559	-1.977
743	-1.4183	0.14202	2.56503	-1.9847	0.4027	-1.3529	-2.2873
744	-1.2428	0.29613	2.39661	-1.6024	0.44435	-1.1872	-2.6234
745	-1.1546	0.19576	2.32971	-1.6935	0.51797	-1.0011	-2.2447
746	-1.2433	0.10334	2.34873	-1.6081	0.44344	-1.1862	-2.5379
747	-1.1213	-0.2899	2.39914	-1.6336	0.49529	-0.8514	-2.7263
748	-1.181	-0.3731	2.29759	-1.8194	0.35109	-0.9612	-2.4052
749	-1.2386	-0.4558	2.25222	-2.0516	0.27473	-1.0852	-2.3264
750	-1.2553	-0.1868	2.22197	-2.1985	-0.0067	-1.2644	-2.3057
751	-1.3512	-0.3247	2.15275	-2.3272	-0.2278	-1.2557	-2.3007
752	-1.1614	-0.219	2.29122	-2.1907	-0.1665	-1.1706	-2.1411
753	-1.4209	0.07798	2.10488	-2.5374	-0.3285	-1.2794	-2.0352
754	-1.655	0.04994	1.85354	-2.6614	-0.6263	-1.247	-1.8874
755	-1.7424	0.02884	1.60077	-2.535	-0.7495	-1.5662	-2.0355
756	-1.5569	0.11998	1.56377	-2.8263	-0.697	-1.4621	-1.9358
757	-1.6687	0.114	1.45436	-2.8334	-0.5942	-1.4075	-2.127
758	-1.5533	0.09392	1.34089	-2.646	-0.509	-1.2756	-2.201
759	-1.6078	0.17249	1.25216	-2.6365	-0.5045	-1.5977	-2.2135
760	-1.5453	0.17335	1.4814	-2.8986	-0.4198	-1.4287	-2.0823
761	-1.6986	0.10117	1.47684	-2.5989	-0.506	-1.5757	-2.5581
762	-1.618	0.06224	1.44426	-2.7432	-0.4377	-1.692	-2.2628
763	-1.7292	-0.0432	1.53702	-2.5855	-0.4722	-1.3407	-2.5022
764	-1.6087	0.06902	1.47966	-2.4414	-0.3852	-1.337	-2.6365
765	-1.5686	0.11421	1.71462	-2.3166	-0.361	-1.4287	-2.7126
766	-1.5527	0.0738	1.53841	-2.2896	-0.2782	-1.5095	-2.7691
767	-1.5762	0.00623	1.64147	-2.3973	-0.3122	-1.2673	-2.5182
768	-1.5416	0.1123	1.89607	-2.4238	-0.1244	-1.3087	-2.4124
769	-1.6136	0.058	1.85853	-2.6426	-0.1896	-1.6218	-2.4953
770	-1.5232	0.02543	1.89431	-2.7544	-0.1201	-1.5285	-2.9133

771	-1.3258	0.21511	2.08768	-2.1978	0.02584	-1.2558	-2.1308
772	-1.4207	0.04735	2.01255	-2.7028	-0.047	-1.4811	-2.3851
773	-1.1125	0.18918	2.338	-2.1661	0.18775	-1.2689	-2.5585
774	-0.9138	0.25493	2.5099	-2.4775	0.43849	-1.0141	-2.5667
775	-0.9294	0.26938	2.61709	-2.2719	0.39586	-1.1916	-2.4502
776	-0.922	0.14703	2.72577	-2.1283	0.50881	-0.7252	-2.3504
777	-1.0367	0.10379	2.47008	-2.3603	0.29974	-1.0928	-2.3847
778	-0.8407	0.29639	2.69457	-2.2238	0.42216	-1.1187	-2.1086
779	-0.9103	0.09181	2.48983	-2.4845	0.25202	-1.1956	-2.2614
780	-0.936	0.1527	2.48064	-2.4789	0.33416	-0.7701	-2.7277
781	-0.9847	0.1423	2.4022	-2.4603	0.18398	-0.9206	-2.3617
782	-0.9764	0.15506	2.42667	-2.1944	0.27595	-0.3108	-2.4213
783	-1.031	0.14266	2.43596	-2.6177	0.2261	-0.5961	-2.5463
784	-1.1621	0.0066	2.29235	-2.581	0.04875	-0.6969	-2.5735
785	-1.3398	-0.1217	2.04212	-3.2559	-0.0632	-1.3605	-3.1642
786	-1.4036	-0.1584	2.11416	-2.8561	-0.0453	-1.3203	-3.0066
787	-1.3309	0.03075	2.05382	-2.7609	-0.0975	-1.1301	-2.37
788	-1.4393	-0.089	1.71272	-2.6679	-0.2907	-1.3377	-2.6489
789	-1.2333	0.11134	1.93728	-2.6422	-0.1132	-1.4689	-2.8508
790	-1.2875	0.0583	2.08153	-2.4092	0.0043	-1.7499	-2.6109
791	-1.2155	0.07283	2.25129	-2.3172	0.259	-1.1474	-2.4386
792	-1.2396	0.14165	2.3175	-2.2442	0.30578	-1.1183	-2.5429
793	-1.229	0.11397	2.25417	-2.3138	0.2354	-1.3501	-2.2611
794	-1.2442	0.18096	2.24403	-2.3789	0.21905	-1.3855	-2.2587
795	-1.2359	0.16852	2.2266	-2.4652	0.20732	-1.4197	-2.1137
796	-1.4129	0.10385	2.18538	-2.3292	0.28633	-1.2697	-2.2444
797	-1.3547	0.09268	2.24041	-2.2511	0.24776	-1.3049	-2.1798
798	-1.1316	0.20301	2.39042	-2.0781	0.41086	-1.297	-2.29
799	-1.066	0.18085	2.51095	-2.5241	0.39538	-1.4728	-2.3185
800	-1.2948	0.06028	2.37941	-2.6955	0.27949	-1.2926	-2.374
801	-1.3204	0.02053	2.30058	-2.7769	0.2389	-1.2648	-2.2752
802	-1.1556	0.12803	2.41401	-2.5818	0.34806	-1.11	-2.4198
803	-1.2645	0.05118	2.24418	-2.5469	0.19622	-1.3738	-2.6116
804	-1.1774	0.20942	2.54061	-2.6762	0.42878	-1.1435	-2.2996
805	-1.1591	0.1379	2.38972	-2.5539	0.32559	-1.0917	-2.4064
806	-1.2682	0.02932	2.3891	-2.5807	0.3008	-1.3732	-2.4711
807	-1.1424	0.19206	2.4694	-2.3657	0.44117	-1.5197	-2.1999
808	-1.0863	0.19988	2.60401	-2.5885	0.50636	-1.6074	-2.8089
809	-1.0544	0.19979	2.52328	-2.4296	0.52264	-1.4098	-2.1723
810	-1.1147	0.19261	2.66122	-2.2447	0.63206	-1.0835	-2.2654
811	-1.0331	0.25075	2.71642	-2.4911	0.55099	-1.3772	-2.2466
812	-0.9501	0.24781	2.8437	-2.3521	0.69792	-1.2223	-2.2831
813	-1.0435	0.12637	2.6073	-2.4413	0.57676	-1.5194	-2.2802
814	-0.7589	0.22966	2.87637	-2.1358	0.59881	-1.4851	-2.4652
815	-0.7878	0.28346	2.74776	-1.9761	0.58038	-1.299	-2.1466
816	-0.9282	0.1342	2.51745	-2.1965	0.46364	-1.2423	-2.2835

817	-1.1257	0.20707	2.64475	-2.3906	0.61894	-1.2033	-2.1735
818	-1.0278	0.21578	2.71949	-2.3559	0.70209	-1.3536	-2.0709
819	-0.9751	0.12215	2.80147	-2.5985	0.68718	-1.2644	-2.1264
820	-0.9481	0.15759	2.78953	-2.3974	0.64877	-1.2264	-1.9611
821	-0.8346	0.17471	2.92623	-3.1022	0.75547	-1.3195	-2.0983
822	-0.702	0.36456	3.11806	-2.4743	0.86766	-1.1794	-2.0701
823	-1.0545	0.27087	2.99928	-2.1472	0.74619	-1.2868	-2.5028
824	-1.0927	0.14697	2.86489	-2.7193	0.65411	-1.7478	-2.6959
825	-0.8204	0.18028	3.04621	-2.5574	0.77922	-0.9777	-2.1272
826	-1.1588	0.14167	2.76635	-2.5823	0.64813	-1.244	-2.5531
827	-0.7592	0.28639	3.06965	-2.3285	0.86082	-0.8743	-2.313
828	-0.6358	0.33055	3.21113	-2.4771	0.96396	-1.0743	-2.4091
829	-0.5709	0.49252	3.28935	-2.2038	1.11165	-0.8272	-1.7178
830	-0.8862	0.18878	2.93794	-2.2883	0.74824	-1.0687	-2.0302
831	-0.792	0.3	3.05331	-2.2576	0.81974	-1.0896	-2.0937
832	-0.9213	0.42447	3.00577	-1.9403	0.82945	-1.0397	-2.1986
833	-0.8917	0.35319	3.00113	-2.0694	0.79718	-1.0953	-2.1326
834	-0.7036	0.36153	3.12253	-2.4897	0.65238	-1.2688	-1.8312
835	-0.4765	0.39166	3.14703	-2.4759	0.71465	-1.4753	-2.2171
836	-0.5595	0.39346	3.09535	-2.8084	0.78673	-1.1265	-2.5271
837	-0.5147	0.41879	3.2047	-2.1341	0.83769	-1.064	-2.3773
838	-0.7692	0.1869	2.85377	-2.2086	0.55993	-1.0691	-2.7127
839	-0.6975	0.2824	2.93877	-2.3224	0.82651	-1.0548	-1.9401
840	-0.7842	0.24473	2.89858	-2.5837	0.70357	-1.3656	-2.261
841	-0.8347	0.21302	2.93409	-2.3143	0.72149	-1.2274	-2.0193
842	-0.7808	0.27557	2.90053	-2.2517	0.64491	-1.127	-2.9525
843	-0.7114	0.25731	2.82555	-2.5774	0.81602	-0.842	-2.5128
844	-0.6912	0.19711	2.86386	-2.7559	0.5591	-1.4866	-2.6377
845	-0.671	0.25488	2.8949	-1.9387	0.79677	-0.8655	-2.1726
846	-0.8664	0.20365	2.63984	-2.3121	0.55983	-1.2254	-2.6988
847	-1.0089	0.0731	2.51267	-2.356	0.31371	-1.8436	-2.7462
848	-0.753	0.32396	2.78617	-2.2041	0.70846	-1.0191	-2.1435
849	-0.9725	0.19424	2.68358	-2.3352	0.53187	-1.3335	-2.8357
850	-0.9914	0.23448	2.69131	-2.5778	0.66035	-1.1081	-2.3068
851	-1.1967	0.16345	2.62705	-2.5473	0.53763	-1.4539	-2.8592
852	-1.1637	0.17848	2.66666	-2.4568	0.54255	-1.5284	-2.5107
853	-1.2141	0.16074	2.6864	-2.5126	0.56989	-1.4295	-2.5862
854	-1.2075	0.16017	2.68646	-2.3704	0.56979	-1.3209	-2.3892
855	-1.1772	0.13576	2.71654	-2.5497	0.58924	-1.2308	-2.3208
856	-1.233	0.08451	2.69764	-2.4791	0.55657	-1.2239	-2.3045
857	-1.2507	0.04349	2.68315	-2.517	0.52628	-1.1669	-2.4884
858	-1.1996	0.17287	2.82314	-2.5483	0.68471	-1.4048	-2.1863
859	-1.2286	0.22391	2.7544	-2.3756	0.57576	-1.4199	-2.2911
860	-1.075	0.27507	2.71525	-2.3297	0.63515	-1.0384	-2.1126
861	-1.3389	0.13983	2.55154	-2.3838	0.49321	-1.0599	-2.3972
862	-1.255	0.17449	2.5376	-2.4574	0.39316	-1.1937	-2.0485

863	-1.1954	0.27748	2.62943	-2.4955	0.54084	-1.1178	-2.4176
864	-1.3265	0.162	2.51659	-2.3672	0.44531	-1.408	-2.3725
865	-1.3104	0.20742	2.44153	-2.3616	0.4244	-1.345	-2.456
866	-1.4388	0.0614	2.42265	-2.5911	0.28186	-1.3307	-2.3359
867	-1.5199	0.08391	2.33083	-2.4983	0.30773	-1.1448	-2.3402
868	-1.4977	0.19341	2.28444	-2.6955	0.26497	-1.4613	-2.3137
869	-1.4982	0.14168	2.20909	-2.5021	0.16945	-1.2584	-2.5063
870	-1.3966	0.15098	2.34017	-2.6008	0.26995	-1.4823	-2.0291
871	-1.3643	0.19961	2.28334	-2.773	0.34775	-1.2041	-2.0575
872	-1.3583	0.12399	2.31706	-2.412	0.30508	-1.2821	-2.2478
873	-1.2075	0.18264	2.50432	-2.6092	0.39736	-0.9717	-2.0804
874	-1.1306	0.20549	2.40057	-2.7982	0.45164	-1.2191	-2.3005
875	-1.1815	0.07752	2.46297	-2.8274	0.3708	-1.2397	-2.5427
876	-1.0742	0.17027	2.58209	-2.7063	0.45297	-1.3025	-2.4507
877	-0.8306	0.30557	2.8115	-2.4085	0.54011	-1.539	-2.6592
878	-0.6203	0.43995	3.04473	-2.2094	0.80294	-1.3956	-2.0297
879	-0.6852	0.36342	3.09605	-2.2697	0.86684	-1.4095	-1.9117
880	-0.6723	0.39214	3.23264	-2.2732	0.99866	-1.5651	-1.9714
881	-0.5739	0.27647	3.3012	-2.1747	1.06596	-1.3628	-2.697
882	-0.488	0.43234	3.38596	-2.5592	1.10248	-1.1859	-1.8001
883	-0.8665	0.23748	2.89102	-2.3205	0.74604	-2.1413	-2.6893
884	-0.6286	0.43875	3.14129	-2.2388	0.97002	-1.649	-2.3182
885	-0.8655	0.2983	2.86699	-2.2757	0.87033	-1.1315	-2.117
886	-0.9615	0.25211	2.76263	-2.361	0.69409	-1.3822	-2.5151
887	-0.8	0.27538	2.95641	-2.7729	0.75388	-1.3275	-1.9065
888	-0.6471	0.44127	3.0089	-2.4362	0.60297	-1.5862	-2.0415
889	-0.9549	0.31885	2.87137	-2.4589	1.03349	-1.1475	-2.553
890	-1.2851	0.21615	2.68144	-2.5387	0.53162	-1.8412	-2.599
891	-1.3085	0.2848	2.74164	-2.5806	0.59201	-1.869	-2.6957
892	-1.2988	0.19358	2.50045	-2.8186	0.47187	-1.5107	-2.8332
893	-1.4325	0.18271	2.3804	-2.3561	0.42179	-1.2814	-2.2023
894	-1.5773	0.21799	2.44806	-2.5486	0.59768	-1.2736	-2.0981
895	-1.3643	0.18673	2.48849	-2.4523	0.35936	-1.4087	-2.1236
896	-1.283	0.19815	2.45633	-2.9444	0.33893	-1.3244	-2.4516
897	-1.4016	0.13428	2.42401	-2.6755	0.31576	-1.5467	-2.6914
898	-1.302	0.13537	2.50972	-2.6455	0.39509	-1.4158	-2.2543
899	-1.5063	-0.0601	2.46456	-2.8951	0.30207	-1.2802	-2.5795
900	-1.4265	0.12824	2.51885	-2.3864	0.45213	-1.3602	-2.3018
901	-1.4368	0.00887	2.51843	-2.7743	0.36652	-1.5105	-2.8678
902	-1.1595	0.186	2.55853	-2.5058	0.46458	-1.5457	-2.2957
903	-0.8867	0.29669	3.02337	-2.3841	0.76907	-1.3333	-2.3074
904	-1.05	0.18262	2.87157	-2.5399	0.63072	-1.4195	-2.3931
905	-0.8742	0.28529	2.93126	-2.1677	0.84409	-0.6736	-2.744
906	-1.0656	0.1301	2.82937	-2.5276	0.58342	-1.4433	-2.8287
907	-1.088	0.29659	2.69509	-2.5008	0.54867	-1.3444	-2.3684
908	-1.1664	0.25635	2.70143	-2.6009	0.64313	-0.9878	-2.4642

909	-1.281	0.27758	2.71573	-2.3568	0.60367	-1.0697	-2.3859
910	-1.1592	0.20605	2.70082	-2.3415	0.4478	-1.3803	-2.2437
911	-1.2742	0.10095	2.66747	-2.1944	0.35591	-1.1899	-2.4839
912	-1.1104	0.17455	2.74425	-2.1678	0.44208	-1.3277	-2.6578
913	-1.1151	0.15448	2.59563	-2.4698	0.31608	-1.3232	-2.4051
914	-1.2026	0.18518	2.43702	-2.7879	0.27213	-1.3107	-2.6858
915	-1.0195	0.23466	2.63483	-2.7163	0.40783	-1.4035	-2.3586
916	-1.1061	0.22516	2.51862	-3.2071	0.31651	-1.6518	-2.3989
917	-1.1142	0.23306	2.64609	-2.6053	0.45027	-1.241	-2.1882
918	-1.2074	0.02088	2.344	-2.9374	0.19327	-1.4854	-2.3998
919	-0.9054	0.36695	2.62417	-2.3648	0.51483	-1.2654	-2.156
920	-1.0571	0.20252	2.5062	-2.8711	0.25515	-1.6398	-2.4111
921	-1.1449	0.24813	2.29955	-2.8843	0.34427	-1.4713	-2.3258
922	-1.0704	0.24971	2.3924	-2.5296	0.36052	-1.4217	-2.62
923	-1.1865	0.19106	2.44382	-2.7538	0.31023	-1.3891	-2.3682
924	-1.4379	0.0884	2.0436	-2.7282	0.03334	-1.6898	-2.7484
925	-1.396	0.08795	2.21542	-2.7509	0.07176	-1.7772	-2.6845
926	-1.3944	0.17756	2.11328	-2.8264	0.0629	-1.6715	-2.9577
927	-1.3898	0.11025	2.17596	-2.9346	0.12844	-1.8151	-3.0527
928	-1.1655	0.27721	2.47107	-2.8203	0.28559	-1.5845	-2.8318
929	-1.2222	0.21835	2.45982	-2.9599	0.32551	-1.6587	-2.3257
930	-1.109	0.27761	2.58308	-2.7287	0.40692	-1.625	-2.7287
931	-1.0669	0.29323	2.58922	-2.7002	0.49044	-1.5631	-2.6142
932	-0.9881	0.27908	2.71682	-2.6843	0.5321	-1.6293	-2.7504
933	-0.8619	0.30232	2.78241	-2.7231	0.63845	-1.2431	-2.4703
934	-1.0251	0.10252	2.69622	-2.6976	0.53223	-1.4474	-2.2624
935	-0.9859	0.31051	2.77809	-2.9689	0.58412	-1.3148	-2.2255
936	-1.1266	0.21369	2.79344	-2.8799	0.62989	-1.2352	-2.4217
937	-1.1318	0.24234	2.71284	-2.4978	0.54422	-1.5369	-2.3899
938	-1.2207	0.16352	2.55546	-2.8661	0.49184	-1.5029	-2.2451
939	-1.2276	0.13597	2.90919	-2.8135	0.64672	-1.5714	-2.6782
940	-1.1112	0.22913	2.88925	-2.2836	0.70022	-1.4124	-2.2836
941	-1.2383	0.16877	2.68095	-2.6506	0.67402	-1.4527	-2.5446
942	-1.0629	0.2768	2.90113	-2.2677	0.78981	-1.5415	-2.2701
943	-1.0762	0.36835	2.86403	-0.6634	0.69103	-1.3827	-2.256
944	-1.4645	0.1141	2.3804	-0.7692	0.26441	-1.1072	-2.4274
945	-1.5648	0.18301	2.01837	-1.4978	0.21528	-1.4485	-2.3406
946	-1.4483	0.20232	2.46043	-1.2293	0.3786	-0.895	-2.1103
947	-1.5681	0.09251	2.2716	-1.294	0.24844	-0.9973	-2.1033
948	-1.578	0.17909	2.2564	-0.9884	0.22946	-1.0348	-2.2547
949	-1.7148	0.09642	2.15685	-1.2246	0.13958	-0.9976	-2.1834
950	-1.8418	0.10659	2.1401	-1.2833	0.12175	-1.1	-2.0443
951	-1.7945	0.11605	2.12235	-1.174	0.10707	-1.3934	-2.5058
952	-1.5501	0.1327	2.34627	-1.1724	0.15771	-1.5729	-2.2393
953	-1.6464	0.14991	2.33684	-1.4276	0.11372	-0.7043	-2.1523
954	-1.8954	-0.088	2.27116	-1.6094	-0.0508	-1.1538	-2.362

955	-1.6146	0.0121	2.39706	-1.2747	0.04831	-0.7184	-2.3307
956	-1.4637	0.22127	2.41239	-0.8656	0.1457	-1.4362	-2.4494
957	-1.7679	0.15956	2.33961	-1.3657	-0.0317	-1.2003	-2.8495
958	-1.5449	0.22756	2.20314	-1.3042	0.20939	-1.2787	-2.4422
959	-1.7588	0.00399	2.1655	-1.5207	-0.0434	-1.1196	-2.7973
960	-1.6263	0.14164	2.33166	-1.143	0.08764	-1.4703	-2.702
961	-1.5527	0.21966	2.33735	-1.199	0.02205	-1.3783	-2.396
962	-1.6685	0.16566	2.1545	-1.2666	0.01579	-1.1201	-2.4404
963	-1.4582	0.23666	2.28427	-1.0047	0.05561	-1.1053	-2.456
964	-1.717	0.04936	2.17493	-1.1618	-0.1362	-1.6762	-2.5505
965	-1.6062	0.14816	2.41752	-1.14	0.11451	-1.5047	-2.8531
966	-1.4444	0.15	2.63576	-1.2091	0.44243	-1.4305	-2.0739
967	-1.458	0.06644	2.75516	-1.5841	0.39791	-1.4807	-3.1684
968	-0.8679	0.38301	3.26835	-1.2187	0.9033	-1.4847	-1.5946
969	-1.1747	0.10338	3.02386	-1.8011	0.7301	-1.7536	-2.8222
970	-0.6946	0.50745	3.52522	-2.0295	1.20576	-1.7062	-2.2638
971	-0.5416	0.54377	3.59924	-1.7043	1.22313	-1.0348	-2.2028
972	-1.1881	0.14605	2.92969	-2.1334	0.84974	-1.0909	-3.0142
973	-1.4123	0.24448	2.72932	-2.284	0.66506	-0.9958	-2.2815
974	-1.3893	0.10031	2.70617	-2.2403	0.53355	-1.1626	-2.4369
975	-1.4022	0.16587	2.51255	-2.5	0.48928	-1.3886	-2.526
976	-1.4046	0.00564	2.54865	-2.6876	0.48663	-1.399	-2.765
977	-1.2078	0.21937	2.93007	-2.1408	0.68368	-1.1592	-2.0934
978	-1.2537	0.18383	2.84002	-2.1396	0.68056	-1.0795	-2.1416
979	-1.1523	0.24627	2.80652	-2.0283	0.79103	-1.3165	-2.198
980	-1.1562	0.14453	2.84394	-2.3223	0.7294	-1.2819	-2.1037
981	-0.8498	0.35311	3.25005	-2.4363	0.95515	-0.8269	-2.0511
982	-0.8535	0.33935	3.31431	-2.147	1.07064	-0.7079	-2.0588
983	-0.8634	0.22619	3.16601	-2.3119	0.90322	-0.8347	-2.2969
984	-1.1571	0.06909	2.73249	-2.8228	0.51541	-1.1519	-2.712
985	-1.1214	0.16639	2.84466	-2.3477	0.67962	-0.9224	-1.9847
986	-0.9511	0.18462	2.78634	-2.767	0.491	-0.9763	-2.3363
987	-0.6452	0.13962	2.94001	-1.796	0.68175	-0.74	-2.5264
988	-0.8561	0.03527	2.9314	-2.751	0.64926	-1.2153	-2.6941
989	-0.6358	0.36986	3.1788	-2.243	0.98763	-0.919	-2.3465
990	-0.9502	0.16679	2.84239	-2.4139	0.64197	-1.1813	-2.185
991	-0.9345	0.07896	2.90632	-2.4964	0.63328	-0.5973	-2.6581
992	-0.8099	0.17046	3.0036	-2.219	0.80263	-0.3113	-2.6315
993	-0.8847	0.19905	2.90064	-2.887	0.62972	-0.5766	-2.5262
994	-0.7904	0.21037	2.96542	-2.4664	0.65382	-1.0431	-2.3888
995	-0.694	0.20978	2.96936	-3.0849	0.70255	-0.5693	-2.3322
996	-0.681	0.33695	3.09781	-2.5797	0.80807	-0.9354	-1.8906
997	-0.8875	0.23051	2.79695	-2.5723	0.63554	-0.9772	-2.4423
998	-1.163	0.07621	2.62471	-2.5045	0.32753	-1.0698	-2.4493
999	-1.3497	0.14146	2.40509	-2.3248	0.17521	-1.4596	-3.1487
1000	-1.3814	0.19098	2.26419	-2.5817	0.18704	-1.2689	-3.2862

1001	-1.3559	0.1279	2.30273	-2.6814	0.21338	-1.5322	-2.6721
1002	-1.0851	0.25372	2.61786	-2.4908	0.48306	-1.1057	-2.7414
1003	-1.1319	0.11855	2.6165	-2.4598	0.48861	-1.5368	-2.8405
1004	-0.8116	0.28495	2.94307	-2.3221	0.78432	-1.4756	-2.2824
1005	-0.8423	0.25741	3.07242	-2.4242	0.88069	-1.4702	-2.3054
1006	-0.7819	0.27052	2.94412	-2.4982	0.7408	-0.9582	-2.1507
1007	-0.8452	0.28849	2.88547	-2.7191	0.75665	-1.4712	-2.3352
1008	-0.8686	0.25861	3.08235	-2.4221	0.88566	-1.5433	-2.2224
1009	-0.4324	0.5096	3.66874	-2.2909	1.36436	-1.4516	-2.0405
1010	-0.2076	0.49764	3.90246	-2.4423	1.70305	-0.9325	-1.3812
1011	-0.1418	0.77259	4.16643	-2.394	1.75706	-1.4132	-1.3325
1012	-0.0484	0.69853	4.20524	-1.9439	1.90304	-0.8312	-1.7132
1013	-0.4631	0.34095	3.80132	-2.3131	1.48588	-1.3233	-1.8936
1014	-0.7393	0.3516	3.28532	-2.2402	0.98915	-1.9682	-2.3464
1015	-0.7822	0.21232	3.62734	-2.6185	1.26066	-1.8716	-2.5955
1016	-0.8182	0.27425	3.24013	-2.4795	1.12506	-2.0294	-2.2759
1017	-0.6621	0.36442	3.66115	-2.3212	1.33112	-1.9496	-2.0211
1018	-0.5042	0.44282	3.66762	-1.9219	1.45123	-1.9736	-2.0249
1019	-0.6928	0.33674	3.53972	-1.9448	1.28104	-1.7448	-2.2465
1020	-0.7072	0.3547	3.58905	-2.6056	1.33217	-1.8011	-1.8917
1021	-0.771	0.26952	3.52569	-2.412	1.28336	-1.5848	-1.9983
1022	-0.7655	0.27815	3.58843	-2.3585	1.16568	-2.3023	-2.3152
1023	-0.7825	0.43166	3.78756	-2.2322	1.54065	-1.585	-1.9722
1024	-0.4998	0.47276	3.6935	-2.1093	1.27671	-2.4541	-2.0659
1025	-0.3931	0.40587	3.79458	-2.0961	1.42017	-1.8433	-2.3991
1026	-0.4462	0.47538	3.90711	-1.8682	1.54846	-1.8117	-1.9067
1027	-0.5232	0.43037	3.85896	-1.7537	1.55215	-1.483	-2.2469
1028	-0.7919	0.23328	3.55335	-1.9031	1.41696	-1.5504	-1.9958
1029	-0.6514	0.46921	3.85193	-1.5559	1.53019	-1.7654	-1.6365
1030	-0.705	0.29847	3.8467	-2.0172	1.33668	-1.3668	-2.1134
1031	-0.629	0.19015	3.83996	-1.5716	1.4637	-1.2547	-1.899
1032	-0.6042	0.34676	3.73403	-1.5771	1.46826	-1.5314	-1.903
1033	-0.9373	0.11184	3.6082	-1.4106	1.16033	-1.7622	-2.0688
1034	-0.6829	0.19747	3.46671	-1.1632	1.24982	-1.514	-2.3181
1035	-0.7301	0.10948	3.82441	-1.6459	1.45733	-1.7631	-2.3653
1036	-0.5634	0.43291	3.87998	-1.4411	1.53056	-1.6015	-2.4064
1037	-0.5009	0.38898	3.82222	-1.3087	1.40063	-1.9271	-1.6953
1038	-0.6694	0.11265	4.10668	-1.3345	1.33481	-1.8266	-2.0689
1039	-0.2508	0.50289	4.36349	-1.0774	1.80549	-1.7836	-1.9542
1040	-0.4422	0.42803	4.00676	-1.573	1.38955	-1.7487	-2.2257
1041	-0.9029	-0.1002	3.44384	-2.8045	0.97084	-2.1044	-2.2095
1042	-0.489	0.13283	3.85558	-1.5004	1.50806	-1.1021	-2.2474
1043	-0.2927	0.60212	4.3467	-1.6654	1.81633	-1.5622	-1.5885
1044	-0.5135	0.38562	3.90909	-1.263	1.55514	-1.915	-1.9512
1045	-0.7293	0.33768	3.75343	-1.7674	1.36663	-1.9832	-2.27
1046	-0.8339	0.18159	3.76634	-2.122	1.36555	-1.6947	-2.3518

1047	-0.9028	0.08767	3.66519	-2.3175	1.24392	-2.2273	-2.6505
1048	-0.5032	0.33934	4.02901	-2.3784	1.48781	-1.899	-2.0852
1049	-0.1841	0.54153	4.22134	-1.4879	1.62952	-1.5978	-2.1882
1050	-0.6831	0.02344	4.06612	-1.9803	1.3128	-1.6601	-2.6375
1051	-0.4962	0.48279	3.96336	-1.9004	1.44362	-1.2606	-2.1291
1052	-0.5336	0.51989	3.85879	-1.5914	1.556	-1.4329	-1.5681
1053	-0.559	0.47896	3.73739	-1.5619	1.35605	-1.1803	-1.8502
1054	-0.8828	0.1473	3.5152	-2.1128	0.98725	-1.1486	-2.0773
1055	-0.6631	0.3257	3.67107	-2.0163	1.21165	-1.1887	-2.4565
1056	-0.9977	0.23288	3.20997	-1.9556	0.86965	-1.0772	-2.1533
1057	-1.1438	0.23544	3.05728	-1.5332	0.8616	-1.0887	-2.3535
1058	-1.3841	0.08952	2.88641	-2.3924	0.70761	-1.0564	-2.2528
1059	-1.1461	0.17071	2.90089	-2.0842	0.75205	-1.2128	-2.2779
1060	-0.8723	0.35029	3.03805	-2.2616	0.74405	-1.2535	-2.1808
1061	-0.9104	0.28138	2.84842	-2.1809	0.81701	-1.0487	-2.5851
1062	-1.0563	0.18601	2.98107	-2.8522	0.81368	-1.1956	-2.2793
1063	-1.1953	0.12761	2.879	-2.6307	0.6789	-1.4148	-2.7698
1064	-1.1158	0.23137	2.87085	-2.3773	0.70202	-1.1219	-2.3588
1065	-1.1223	0.29033	2.81482	-2.3613	0.66281	-0.9165	-2.4219
1066	-1.2491	-0.0241	2.55711	-2.3182	0.58891	-1.3941	-2.4789
1067	-1.1188	0.06108	2.81104	-2.929	0.67049	-1.4365	-2.3688
1068	-1.0093	0.06418	2.80426	-2.6441	0.63849	-1.0646	-2.7523
1069	-1.0504	0.05231	2.84119	-2.2763	0.60189	-0.8559	-2.1751
1070	-1.2608	0.13222	2.52064	-2.9046	0.62011	-1.0514	-2.1019
1071	-0.9961	0.22184	3.0255	-2.3464	0.80779	-0.8001	-2.1036
1072	-1.0739	0.24094	2.89255	-2.5898	0.7102	-0.9014	-2.0898
1073	-0.7578	0.28211	3.12441	-3.1385	0.82186	-1.4637	-2.4298
1074	-0.9765	0.17689	2.93678	-2.5373	0.97298	-0.8306	-2.3954
1075	-0.6366	0.37447	3.33116	-1.9842	1.11742	-0.9002	-2.3005
1076	-0.8511	0.11374	3.00459	-2.2092	0.82252	-1.2078	-2.1081
1077	-0.6124	0.4466	3.566	-1.3339	1.24032	-0.8101	-1.7488
1078	-0.7321	0.22717	3.46447	-1.3248	1.20231	-1.0515	-2.1358
1079	-0.3245	0.51645	3.97161	-1.2345	1.41572	-1.4601	-1.6853
1080	-0.1067	0.80782	4.13639	-1.202	1.6771	-0.9503	-1.3102
1081	0.16554	0.62776	4.11359	-1.3877	1.769	-0.5616	-1.5831
1082	-0.3271	0.39758	3.75688	-1.2946	1.33757	-1.2963	-1.9222
1083	-0.3211	0.48931	3.84702	-1.3449	1.29965	-1.6603	-1.8152
1084	0.18169	0.72986	4.243	-1.3342	1.68693	-0.7929	-1.7022
1085	0.29282	0.87552	4.22285	-1.779	1.78313	-1.3484	-1.4557
1086	0.14474	0.6089	4.35976	-1.6498	1.75384	-1.1896	-1.6807
1087	-0.0858	0.73408	4.25038	-2.0042	1.83581	-1.3545	-1.6641
1088	-0.1505	0.50977	3.97064	-1.7003	1.59504	-1.927	-2.1101
1089	-0.2682	0.45363	3.87289	-1.9164	1.3897	-2.3026	-2.0927
1090	-0.2587	0.50193	3.67968	-3.1497	1.43782	-0.7978	-1.6666
1091	-0.6035	0.13751	3.4756	-2.0526	1.07779	-1.3054	-2.4502
1092	-0.176	0.41901	3.73539	-2.298	1.32972	-0.6566	-1.8702

1093	-0.2585	0.4226	3.50085	-2.1923	1.18956	-1.4364	-2.3622
1094	-0.1544	0.69656	4.01527	-1.7417	1.58897	-1.2024	-1.5407
1095	-0.3863	0.5672	4.00694	-1.8598	1.61867	-1.1534	-1.6025
1096	-0.8107	0.20414	3.432	-2.1817	1.05469	-1.5004	-2.2338
1097	-0.5266	0.5659	3.92537	-1.9916	1.54367	-0.9717	-1.9489
1098	-0.6475	0.26939	3.76896	-1.9883	1.35356	-1.1155	-2.0643
1099	-0.6506	0.53807	3.79298	-1.9885	1.49897	-0.1889	-1.5397
1100	-0.8455	0.47299	3.34744	-2.4225	1.11548	-1.1902	-1.9161
1101	-0.9498	0.04085	3.3865	-2.3704	1.01004	-0.901	-1.985
1102	-0.5527	0.33095	3.49474	-1.9311	1.09778	-1.0035	-1.9455
1103	-0.5044	0.78145	3.64025	-1.8598	1.43569	-1.4255	-1.853
1104	-0.7209	0.42378	3.44362	-2.5798	1.0545	-1.7405	-1.8217
1105	-0.3562	0.69356	3.47831	-2.0478	1.13225	-1.4379	-1.7681
1106	-0.5908	0.39554	3.24851	-2.0774	0.76398	-1.6281	-2.1186
1107	-1.0873	0.09233	2.95945	-2.3417	0.60502	-1.1931	-2.4644
1108	-0.8542	0.0503	2.95585	-2.325	0.64365	-0.5211	-2.108
1109	-0.5059	0.46995	3.47732	-1.8221	0.94019	-0.633	-1.7106
1110	-0.7236	0.20715	3.10028	-2.6049	0.67938	-1.1816	-2.2194
1111	-0.5441	0.441	3.12044	-2.3428	0.70334	-0.7317	-1.9903
1112	-1.0717	-0.1146	2.46077	-2.8909	0.14892	-1.1211	-2.3773
1113	-1.0523	0.07721	2.74852	-2.248	0.48062	-0.6776	-2.6678
1114	-0.7284	0.00999	3.00451	-2.2916	0.58559	-0.8287	-1.9233
1115	-0.5991	0.42315	3.17028	-2.1823	0.83669	-0.3892	-1.8742
1116	-0.6305	0.60541	3.31235	-1.8359	1.15113	-0.4478	-1.8394
1117	-0.728	0.24952	3.12256	-2.1283	0.80385	-0.7062	-1.8129
1118	-0.7752	0.14446	2.86897	-2.6851	0.66026	-0.4692	-2.0531
1119	-0.4943	0.26397	3.04563	-2.2073	0.74042	-0.3947	-1.4847
1120	-0.1199	0.49516	3.35351	-2.2886	1.03652	-0.7135	-1.6334
1121	-0.272	0.55326	3.49655	-2.6612	1.11747	-0.7979	-1.5699
1122	-0.414	0.20609	3.54243	-2.6047	0.98578	-0.266	-1.5701
1123	-0.3734	0.47171	3.62185	-3.266	1.15735	-0.5259	-1.8056
1124	-0.6547	0.38946	3.53064	-2.004	1.20547	-0.6962	-1.9732
1125	-1.035	0.15177	3.07891	-2.2306	0.60134	-1.1432	-2.3178
1126	-1.0834	0.06102	3.24337	-1.6704	0.81923	-1.2453	-2.4551
1127	-0.7488	0.25974	3.50259	-2.2267	1.11342	-1.2902	-2.4553
1128	-0.5004	0.36883	3.81889	-2.1382	0.997	-0.8573	-2.1166
1129	-0.6413	0.16857	3.45394	-2.3973	0.68253	-1.2127	-2.458
1130	-0.5294	0.25751	3.44099	-2.2694	0.67396	-0.8019	-2.051
1131	-0.6078	0.32957	3.15325	-2.6494	0.6633	-0.5459	-2.025
1132	-0.7063	0.38402	2.80464	-2.3062	0.55817	-0.3255	-1.6635
1133	-1.1271	0.05409	2.65735	-2.4703	0.24876	-0.4207	-2.2125
1134	-1.2057	0.0059	2.44632	-2.464	0.26592	-0.4595	-2.5459
1135	-1.0756	0.15082	2.56484	-2.1687	0.26754	-0.7938	-2.215
1136	-0.8509	0.2703	2.75693	-2.0615	0.56575	-0.651	-1.8018
1137	-1.0661	0.03377	2.28557	-2.3113	0.13084	-0.769	-2.26
1138	-1.2633	0.1108	2.48418	-2.0529	0.44584	-0.82	-2.2498

1139	-1.4756	0.15184	2.04583	-2.135	0.19513	-0.9232	-2.2313
1140	-1.8134	-0.041	2.0151	-1.999	0.04967	-1.5364	-2.3811
1141	-1.6164	0.14759	2.35706	-1.7832	0.27996	-1.1188	-2.1951
1142	-1.8907	-0.024	2.00411	-1.9707	0.06878	-1.4256	-2.6702
1143	-1.8027	0.01172	2.02791	-2.1808	0.0521	-1.4753	-2.8077
1144	-1.7125	0.12193	2.08179	-1.4818	0.11828	-1.2684	-2.6353
1145	-2.0318	0.00327	2.10332	-1.805	0.15824	-1.5406	-2.6912
1146	-1.7682	0.13026	2.26564	-1.7695	0.25601	-1.0293	-2.2918
1147	-1.7472	0.06066	2.16727	-1.4085	0.26898	-0.775	-2.2831
1148	-1.9547	-0.1028	1.92018	-1.6742	0.09781	-1.3774	-2.3682
1149	-1.6476	0.06209	2.09125	-2.044	0.0788	-1.1272	-2.2726
1150	-1.734	0.0585	1.97632	-2.0173	-0.0101	-1.2127	-2.3386
1151	-1.5821	0.1119	2.18488	-1.9352	0.15214	-0.9711	-2.3942
1152	-1.7899	0.06047	2.05579	-1.8645	0.14606	-1.0125	-2.2391
1153	-1.7703	-0.0433	1.90361	-2.2273	-0.0722	-1.0961	-2.6496
1154	-1.656	-0.0072	2.06307	-2.1193	0.02479	-0.7366	-2.7629
1155	-1.5516	0.03401	2.24	-1.8777	0.19544	-1.004	-2.5812
1156	-1.5308	-0.0203	2.28382	-2.1035	0.14368	-1.099	-2.3473
1157	-1.4328	0.058	2.33944	-1.7528	0.149	-0.8391	-2.5227
1158	-1.4561	0.18208	2.37801	-2.0544	0.34439	-0.7777	-2.3364
1159	-1.606	0.00954	2.16711	-1.8608	0.08714	-0.906	-2.3832
1160	-1.5772	-0.0329	2.08364	-1.8583	0.03652	-1.1492	-2.4892
1161	-1.7014	-0.0308	2.23119	-1.823	0.06788	-0.9467	-2.2559
1162	-1.6278	0.10743	2.30994	-1.7139	0.09898	-1.2775	-2.2611
1163	-1.786	0.03813	2.09675	-1.7816	0.06385	-1.7139	-2.6297
1164	-1.7195	0.13875	2.07877	-1.6738	0.05695	-1.1612	-2.2742
1165	-1.7124	0.14297	2.13194	-1.7983	0.10714	-1.1694	-2.1434
1166	-1.7938	0.12197	2.05892	-1.9305	0.12146	-1.086	-2.3242
1167	-1.8543	0.04176	2.06123	-1.8858	-0.0085	-1.0371	-2.6002
1168	-1.8382	0.126	1.91852	-1.8298	-0.0112	-1.2145	-2.2192
1169	-2.0063	-0.0457	1.91996	-1.8722	-0.0216	-1.5016	-2.4716
1170	-1.9836	0.03225	2.04173	-1.8133	0.04224	-1.2153	-2.4123
1171	-1.8808	0.04896	2.08775	-2.0335	0.11558	-1.0331	-2.3226
1172	-1.8458	-0.0874	1.98142	-1.6862	-0.0099	-1.3627	-2.4203
1173	-1.5663	0.13765	2.50446	-1.9561	0.32508	-0.7082	-2.378
1174	-1.6928	-0.1234	2.25302	-2.1342	0.18232	-0.8148	-2.3283
1175	-1.6429	0.04393	2.40711	-1.6846	0.41617	-0.7349	-2.2081
1176	-1.7945	-0.0469	2.25403	-1.7402	0.31617	-0.7664	-2.6619
1177	-1.8138	0.01456	2.56564	-1.9411	0.38941	-0.8043	-2.3568
1178	-1.7129	-0.0221	2.48392	-2.179	0.41541	-0.8281	-2.4583
1179	-1.5861	0.01897	2.42986	-2.2036	0.39899	-0.6371	-2.5099
1180	-1.236	0.16913	2.56341	-2.1648	0.42892	-0.6363	-2.2279
1181	-1.152	0.12718	2.74232	-2.3573	0.52782	-0.6273	-2.1012
1182	-1.3381	0.24259	2.56305	-2.4477	0.54006	-0.4254	-2.3052
1183	-1.1538	0.17507	2.58803	-2.0722	0.54572	-0.831	-2.0278
1184	-1.3286	0.04302	2.46666	-2.362	0.27905	-0.958	-2.4239

1185	-1.275	0.17152	2.58848	-2.468	0.3834	-0.796	-2.4854
1186	-1.4302	0.10817	2.51924	-2.1372	0.40583	-0.8095	-2.3907
1187	-1.1388	0.15665	2.67701	-1.9199	0.44491	-0.8023	-2.4298
1188	-1.1358	0.13169	2.62258	-1.9105	0.48486	-0.7415	-2.7589
1189	-1.3678	0.09496	2.44715	-2.1414	0.32339	-1.2616	-2.6186
1190	-1.6412	0.014	2.3974	-1.7288	0.41355	-1.0832	-2.2214
1191	-1.6793	0.17163	2.33045	-2.0549	0.36208	-0.9803	-2.2999
1192	-1.6618	0.06749	2.24161	-1.5916	0.20594	-1.0137	-2.1187
1193	-1.7163	-0.045	2.23813	-2.1632	0.16413	-1.1185	-2.1889
1194	-1.5866	0.08187	2.34719	-2.1655	0.32752	-1.0392	-2.6004
1195	-1.3233	0.14288	2.36355	-2.1366	0.19021	-1.3673	-2.3313
1196	-1.2274	0.22249	2.402	-2.4017	0.36476	-0.8884	-2.0349
1197	-1.3505	0.23793	2.42766	-1.9111	0.44347	-1.026	-1.7303
1198	-1.5392	0.09945	2.2799	-2.2011	0.32152	-1.2454	-2.4176
1199	-1.7883	0.11349	2.12856	-1.898	0.19367	-1.2123	-2.1794
1200	-1.6901	0.18052	2.08913	-1.9606	0.16985	-1.234	-2.0438
1201	-1.7565	0.08351	2.01503	-2.0345	0.09421	-1.2848	-2.4142
1202	-1.5032	0.09051	2.07653	-2.1269	0.06476	-1.2348	-2.3993
1203	-1.4764	0.14637	2.12911	-2.0073	0.1217	-1.6261	-2.3263
1204	-1.7195	-0.0028	2.03432	-2.1187	-0.0019	-1.8375	-2.2236
1205	-1.7366	-0.0471	1.90931	-2.0949	-0.0782	-1.3635	-2.4888
1206	-1.662	0.0424	2.02111	-1.9911	0.05046	-1.3441	-2.359
1207	-1.6427	0.08985	2.06202	-2.2795	0.01507	-1.5148	-2.1381
1208	-1.6719	0.09147	2.1532	-2.2137	0.10058	-1.2752	-2.428
1209	-1.4922	0.13063	2.38167	-2.213	0.32345	-1.5282	-2.2619
1210	-1.4889	0.18177	2.30048	-1.8353	0.2875	-1.0838	-2.0117
1211	-1.7634	0.072	2.14612	-1.9676	0.2211	-1.7467	-2.3771
1212	-1.9443	-0.0975	2.15149	-1.9264	0.18637	-1.5519	-2.3387
1213	-1.7237	-0.0077	2.26767	-1.9687	0.12024	-1.4585	-2.5097
1214	-1.8199	0.12148	2.16303	-1.8971	0.2001	-1.2071	-2.5509
1215	-1.8999	0.00767	2.24916	-1.7627	0.19395	-1.3806	-2.6694
1216	-1.6376	0.04799	2.26034	-2.0569	0.07501	-1.5744	-2.4577
1217	-1.6283	0.15169	2.20104	-1.8953	0.28744	-1.1003	-2.0566
1218	-1.8805	0.00783	2.12059	-1.7999	0.21521	-1.2157	-2.2986
1219	-1.6502	0.13212	2.25915	-1.9878	0.26328	-1.2236	-2.1974
1220	-1.7431	0.08604	2.07741	-1.6773	0.16699	-1.3095	-2.3738
1221	-1.8002	0.10147	2.02948	-2.0835	0.1429	-1.4475	-2.2409
1222	-1.6827	0.12399	2.16604	-1.9823	0.18119	-1.3848	-2.4312
1223	-1.4677	0.18561	2.39962	-1.7491	0.37832	-1.0008	-1.8609
1224	-1.8817	-0.0019	1.8048	-2.1686	0.09294	-1.5367	-2.5064
1225	-1.4598	0.1124	2.31033	-2.0167	0.29279	-1.7967	-2.5305
1226	-1.495	0.16974	2.32128	-1.9077	0.39419	-1.8166	-2.3995
1227	-1.4146	0.17577	2.31132	-2.0894	0.29368	-1.2993	-2.279
1228	-1.1598	0.31238	2.51013	-1.7157	0.40503	-1.2809	-2.0556
1229	-1.2052	0.22853	2.28959	-1.8001	0.38162	-1.2697	-2.2151
1230	-1.5191	0.17824	2.29167	-1.7782	0.22578	-2.0075	-3.2239

1231	-1.2337	0.25071	2.22368	-1.7963	0.19914	-1.5313	-2.1616
1232	-1.1511	0.31216	2.49286	-2.152	0.29899	-1.4666	-2.0861
1233	-1.3418	0.24677	2.27579	-1.9836	0.29447	-1.407	-2.1602
1234	-1.356	0.12844	2.2322	-1.9373	0.2369	-1.4336	-2.1793
1235	-1.3904	0.10865	2.24096	-1.8835	0.19927	-1.4435	-2.1867
1236	-1.3927	0.09999	2.27666	-1.7876	0.19544	-1.4134	-2.1656
1237	-1.2219	0.23434	2.21445	-1.3601	0.37047	-1.2239	-2.244
1238	-1.4732	0.07108	2.14777	-2.1312	0.24927	-1.3941	-2.2512
1239	-1.266	0.2364	2.36034	-1.5893	0.30309	-1.0013	-2.0121
1240	-1.5236	0.08255	2.20413	-2.0058	0.21785	-1.3894	-2.299
1241	-1.5586	-0.0757	1.99696	-2.1907	-0.0392	-1.5728	-2.4829
1242	-1.3928	0.11108	2.2247	-1.9144	0.10695	-1.6253	-2.3912
1243	-1.4327	0.1022	2.0667	-1.9952	0.02491	-1.7206	-2.3354
1244	-1.4184	0.19936	2.18161	-1.788	0.21147	-1.6523	-2.2315
1245	-1.6586	0.11132	2.0409	-2.3335	0.14103	-1.3769	-2.2286
1246	-1.6218	0.10336	1.98184	-2.1535	0.05301	-1.3699	-2.4886
1247	-1.6932	0.14718	1.98714	-2.0335	0.10154	-1.7754	-2.2711
1248	-1.6656	0.20638	2.02567	-2.0621	-0.0129	-1.5274	-2.415
1249	-1.775	0.05403	1.90134	-2.0153	-0.0939	-1.7034	-2.3778
1250	-1.7445	0.03809	1.93736	-2.1485	-0.0983	-1.4642	-2.3115
1251	-1.6158	0.07961	2.17728	-2.0308	0.08496	-1.4976	-2.2959
1252	-1.6119	0.13616	2.253	-1.9027	0.1795	-1.5684	-2.2715
1253	-1.6984	0.03899	2.13301	-2.041	0.09792	-1.7058	-2.6778
1254	-1.7763	0.06023	2.18971	-1.8855	-0.0251	-1.5368	-2.5465
1255	-1.6669	0.02715	2.07904	-1.9363	0.08492	-1.347	-2.2799
1256	-1.7787	0.04577	2.0807	-1.7608	0.06146	-1.4421	-2.2676
1257	-1.7111	0.08471	2.02696	-1.723	0.12639	-1.5625	-2.2593
1258	-1.7773	0.07993	1.94959	-1.6396	0.03467	-1.7605	-2.4715
1259	-1.6627	0.04728	2.12532	-2.0025	0.07951	-1.7121	-2.4897
1260	-1.8386	0.06864	2.09075	-2.1035	0.01146	-1.6899	-2.3288
1261	-1.7266	0.09297	2.09752	-1.9472	0.07333	-1.6114	-2.6076
1262	-1.6708	0.13263	2.06276	-1.9697	0.04676	-1.5903	-2.1236
1263	-1.7992	0.04035	1.96069	-2.0264	-0.1121	-1.7153	-2.6596
1264	-1.6063	0.13467	2.02103	-1.932	0.01406	-1.5986	-2.5051
1265	-1.8341	0.03685	1.92262	-2.0789	0.0525	-1.5644	-2.3243
1266	-1.8588	0.15574	2.10394	-1.9384	0.10392	-1.6494	-2.4013
1267	-1.7856	0.08338	2.05746	-1.8161	-0.0205	-1.7263	-2.6713
1268	-1.6496	0.19295	2.09068	-1.7044	0.17287	-1.3232	-2.3639
1269	-1.945	0.0121	1.92017	-1.8764	0.06776	-1.3255	-2.3459
1270	-2.0867	0.06503	2.05772	-1.7619	0.10669	-1.3624	-2.3514
1271	-1.8966	0.03199	2.00788	-1.6551	0.03896	-1.4899	-2.4351
1272	-1.8861	0.06418	1.92499	-1.9498	0.04771	-1.5031	-2.4178
1273	-2.0779	0.09235	2.04434	-1.5739	0.08296	-1.3618	-2.1959
1274	-1.9252	0.04789	2.03284	-1.7601	0.19395	-1.7078	-2.1157
1275	-1.879	0.08223	2.05529	-1.7717	0.08837	-1.6337	-2.3238
1276	-1.969	-0.1338	1.82902	-2.0343	-0.0139	-1.4332	-3.022

1277	-2.0483	-0.1846	1.81138	-1.6906	0.0026	-1.5427	-2.7314
1278	-1.6545	0.10915	2.30429	-2.0503	0.2187	-1.3311	-2.4264
1279	-1.5225	0.11339	2.30973	-1.9206	0.21951	-1.2377	-2.2146
1280	-1.6328	0.07877	2.13326	-1.8497	0.18791	-1.3099	-2.2926
1281	-1.5778	0.13212	2.02198	-2.0439	0.12725	-1.23	-2.4306
1282	-1.4285	0.18014	2.23841	-1.6886	0.30039	-1.3525	-1.9784
1283	-1.5809	0.11437	2.21006	-1.6577	0.35387	-1.2858	-2.4187
1284	-1.584	0.04602	2.1623	-2.0579	0.1018	-1.5515	-2.2694
1285	-1.6408	0.16217	2.2098	-2.0275	0.24926	-1.2258	-2.3893
1286	-1.7213	0.10694	2.32562	-1.5574	0.39242	-1.4996	-2.2894
1287	-2.0212	-0.1403	2.0053	-2.1282	0.06925	-1.524	-2.461
1288	-1.591	0.15853	2.0668	-1.9939	0.13358	-1.2192	-2.3934
1289	-1.4026	0.11492	2.24442	-2.0808	0.29432	-1.4017	-2.2708
1290	-1.496	0.19597	2.33166	-2.0373	0.29634	-1.233	-2.058
1291	-1.4027	0.3449	2.65349	-1.7355	0.41828	-1.135	-1.9103
1292	-1.3391	0.31654	2.51102	-2.0211	0.38807	-0.9697	-2.2685
1293	-1.5753	-0.0495	1.97245	-2.5753	0.1004	-1.6502	-2.5655
1294	-1.5133	0.11289	2.38653	-2.0113	0.43458	-1.1653	-2.455
1295	-1.5635	0.16628	2.65531	-1.825	0.63208	-1.2708	-2.2905
1296	-1.6825	-0.0998	2.09742	-2.1809	0.20652	-1.3294	-2.8924
1297	-1.4311	0.16881	2.20127	-1.7729	0.24451	-1.3543	-2.7728
1298	-1.4218	0.10548	2.33641	-2.0214	0.3521	-1.4028	-2.5982
1299	-1.452	0.19318	2.64464	-1.7866	0.48758	-1.5959	-2.4289
1300	-1.3101	0.23907	2.71418	-1.773	0.50506	-1.4837	-2.6043
1301	-1.5471	0.08683	2.44858	-2.2805	0.35182	-1.2625	-2.3611
1302	-1.5967	0.15818	2.71128	-1.9129	0.49676	-1.2134	-2.2537
1303	-1.6348	0.17743	2.62174	-2.0338	0.5371	-1.2522	-2.5482
1304	-1.3882	0.28605	2.65905	-1.8414	0.63927	-0.8222	-2.1376
1305	-1.6082	0.27826	2.71096	-1.7074	0.63885	-1.2225	-2.4022
1306	-1.5048	0.32975	2.67041	-1.6224	0.60903	-2.1338	-1.8525
1307	-1.5554	0.10155	2.42225	-1.8543	0.40627	-1.6012	-2.4586
1308	-1.2739	0.19422	2.60358	-1.9556	0.47715	-1.1894	-2.4046
1309	-1.3388	0.12381	2.53509	-1.9978	0.40602	-1.5667	-2.2985
1310	-1.4846	0.34237	2.55563	-1.8567	0.49342	-1.2936	-2.0822
1311	-1.3536	0.24848	2.52696	-1.9162	0.4614	-1.535	-2.5951
1312	-1.2881	0.17882	2.54134	-1.9893	0.33495	-1.5477	-2.4697
1313	-1.1004	0.13568	2.46169	-1.8866	0.28066	-1.4279	-2.3475
1314	-1.2204	0.3231	2.53996	-1.7205	0.48798	-1.3682	-2.3756
1315	-1.2206	0.17982	2.45893	-1.7659	0.49963	-1.3169	-2.3192
1316	-1.0498	0.28571	2.57342	-1.8305	0.38423	-1.5348	-2.5169
1317	-1.0436	0.40478	2.57676	-1.6965	0.44656	-1.7596	-2.0703
1318	-1.3281	0.23612	2.34972	-2.0373	0.19677	-1.714	-2.3532
1319	-1.4145	0.19118	2.3601	-2.0779	0.2835	-1.6067	-2.4047
1320	-1.4387	0.19472	2.39377	-2.0002	0.28901	-1.0483	-2.1383
1321	-1.5476	0.21229	2.25354	-1.4035	0.39976	-1.2078	-2.299
1322	-1.579	0.18126	2.4912	-2.0942	0.36981	-1.5312	-2.5382

1323	-1.6906	0.09826	2.46534	-1.664	0.37292	-0.931	-2.6629
1324	-1.5542	0.12621	2.29141	-1.7259	0.2776	-1.4338	-2.5838
1325	-1.4879	0.27653	2.44453	-2.0794	0.20835	-1.1721	-2.3439
1326	-1.5316	0.20972	2.45312	-2.1587	0.33392	-1.3407	-2.4
1327	-1.5406	0.14577	2.41304	-2.0263	0.24615	-1.4955	-2.5248
1328	-1.5362	0.26063	2.49065	-1.9022	0.41212	-1.3097	-2.3589
1329	-1.7782	-0.0132	2.30768	-1.9533	0.1464	-1.6466	-2.3914
1330	-1.5186	0.14443	2.37378	-2.1643	0.24771	-1.361	-2.5997
1331	-1.4779	0.12746	2.2904	-1.6317	0.33585	-1.4869	-2.0903
1332	-1.5192	0.03361	2.25592	-1.6903	0.35984	-1.6758	-2.6
1333	-1.5865	0.19346	2.49758	-2.0863	0.52014	-1.3068	-2.1695
1334	-1.5419	0.1594	2.46834	-1.7666	0.44772	-1.0846	-2.2555
1335	-1.5565	0.20188	2.27951	-1.9619	0.33882	-1.2155	-2.3176
1336	-1.6298	0.20675	2.55431	-1.5731	0.5441	-0.8513	-1.8298
1337	-1.6452	0.07605	2.35727	-1.3354	0.42806	-1.3579	-2.2085
1338	-1.5676	0.23486	2.48009	-1.5958	0.591	-0.8914	-1.965
1339	-1.6544	0.09827	2.33807	-1.6765	0.47732	-1.1143	-2.5343
1340	-1.6626	0.13999	2.17957	-2.4183	0.3173	-0.923	-2.16
1341	-1.3266	0.25745	2.5318	-1.5074	0.49373	-0.8595	-2.221
1342	-1.4026	0.19133	2.45177	-1.5847	0.43763	-1.0917	-2.4461
1343	-1.4299	0.23859	2.44918	-1.5593	0.36244	-1.3084	-2.1733
1344	-1.7234	-0.2783	2.15762	-2.195	-0.1026	-1.5954	-2.3955
1345	-1.6331	0.10159	2.35877	-1.6428	0.36396	-1.5262	-2.2792
1346	-1.6744	0.10557	2.232	-1.7745	0.24558	-1.3944	-2.3216
1347	-1.7325	0.04476	2.26041	-1.7213	0.29875	-1.1539	-2.2068
1348	-1.6511	0.13488	2.41743	-1.613	0.32882	-1.2838	-2.3049
1349	-1.9239	0.05909	2.33819	-1.7818	0.36299	-1.3092	-2.5816
1350	-1.8466	0.10123	2.25944	-1.868	0.30352	-1.0807	-2.6414
1351	-1.7377	-0.0118	2.40156	-1.8596	0.25368	-1.3241	-2.6437
1352	-1.6661	0.02028	2.40503	-1.617	0.31207	-1.3333	-2.4554
1353	-1.4844	0.22044	2.68252	-1.5109	0.58157	-1.0532	-2.4007
1354	-1.4194	0.14206	2.61029	-1.9031	0.48019	-1.2453	-2.4632
1355	-1.3346	0.14926	2.64169	-1.8101	0.44453	-1.224	-2.4249
1356	-1.3852	0.12269	2.57595	-2.0792	0.36557	-1.3958	-2.4971
1357	-1.2893	0.1009	2.81085	-1.9277	0.61437	-0.9425	-2.5037
1358	-1.3085	0.35687	2.72645	-1.4911	0.63522	-1.0357	-1.9565
1359	-1.416	0.12891	2.52849	-1.9501	0.3915	-1.1235	-2.2552
1360	-1.15	0.20962	2.61727	-1.895	0.50532	-1.1576	-2.282
1361	-0.903	0.33508	2.60377	-1.9084	0.41625	-0.9565	-2.5534
1362	-1.0107	0.23523	2.56565	-1.8698	0.41861	-0.9913	-2.2344
1363	-1.1161	0.29508	2.56749	-2.0423	0.70221	-0.6974	-2.5779
1364	-1.1643	0.13396	2.75521	-1.6548	0.80409	-0.9441	-2.4739
1365	-1.0296	0.33531	2.58469	-1.9138	0.34683	-1.071	-2.2697
1366	-0.9243	0.32275	2.78502	-1.9285	0.47784	-0.8307	-2.1091
1367	-0.9139	0.34812	3.30596	-1.7073	0.60935	-0.7453	-2.0238
1368	-1.0847	0.13824	2.85526	-1.8202	0.40246	-1.023	-2.5415

1369	-1.0514	0.21073	2.63973	-1.9303	0.30578	-1.0802	-2.8342
1370	-0.9241	0.2429	2.68105	-1.8933	0.36591	-0.6182	-2.0997
1371	-0.9344	0.25538	2.6576	-1.7741	0.35303	-0.5888	-2.1538
1372	-0.9457	0.23986	2.59437	-1.809	0.31066	-0.5948	-2.1841
1373	-0.8791	0.2722	2.62905	-1.761	0.39417	-0.4809	-2.1144
1374	-0.8882	0.27669	2.57947	-1.7902	0.41284	-0.482	-2.156
1375	-0.854	0.30376	2.60639	-1.7459	0.47755	-0.4206	-2.1217
1376	-0.7968	0.31877	2.65623	-1.7127	0.55812	-0.3036	-2.0389
1377	-0.7146	0.35295	2.65402	-1.7171	0.60754	-0.2548	-2.0108
1378	-0.7611	0.38839	2.69335	-1.6816	0.67302	-0.1894	-1.9875
1379	-0.9087	0.35759	2.77138	-1.5598	0.61404	-0.5413	-1.7112
1380	-0.867	0.26325	2.62975	-1.8617	0.44994	-0.6874	-2.5005
1381	-1.2067	0.26504	2.40534	-1.9971	0.38358	-0.4917	-2.1355
1382	-1.1023	0.23191	2.65281	-1.7671	0.45539	-1.0368	-2.5889
1383	-1.4733	0.18038	2.40176	-1.6118	0.3482	-0.9634	-2.4024
1384	-1.7679	0.02809	2.27253	-2	0.34904	-1.2449	-2.2436
1385	-1.7149	0.05478	2.20343	-1.9107	0.24824	-1.0124	-2.3408
1386	-1.8562	0.07012	2.24831	-1.5311	0.37434	-0.8202	-1.9979
1387	-1.912	0.01809	2.23383	-1.5427	0.35582	-0.8792	-2.2899
1388	-1.6889	0.0979	2.36835	-1.7045	0.39766	-0.9021	-2.0143
1389	-1.3173	0.17421	2.5762	-1.4737	0.48564	-0.8125	-2.0668
1390	-1.5928	0.16399	2.516	-1.845	0.3981	-0.9238	-2.0964
1391	-1.8213	-0.0091	2.51913	-1.5214	0.40137	-0.9949	-2.3163
1392	-1.7105	-0.0027	2.23238	-1.7924	0.21084	-1.1848	-2.8167
1393	-1.659	0.18163	2.44043	-1.4626	0.56805	-0.6829	-1.9884
1394	-1.7455	0.11396	2.15427	-1.6129	0.21223	-1.4239	-2.4639
1395	-1.3715	0.28936	2.43431	-1.8645	0.33984	-1.1167	-2.0985
1396	-1.4678	0.15947	2.38232	-1.8733	0.37652	-0.9184	-2.3554
1397	-1.549	-0.007	2.28497	-1.6704	0.22014	-1.4743	-2.6192
1398	-1.1925	0.17183	2.33261	-2.1077	0.17164	-1.2396	-2.3155
1399	-1.1772	0.35001	2.52173	-1.9786	0.32244	-1.0043	-1.9962
1400	-1.3546	0.10613	2.26463	-1.917	0.24829	-0.7254	-2.3031
1401	-1.4684	0.21418	2.50421	-1.6705	0.38637	-0.8838	-2.2308
1402	-1.635	-0.0124	2.3076	-1.9008	0.1564	-1.4039	-2.2312
1403	-1.5893	0.10726	2.3952	-1.7882	0.3702	-1.1585	-2.5782
1404	-1.3587	0.14477	2.47715	-1.4817	0.37977	-0.7022	-2.4087
1405	-1.4567	0.19394	2.49211	-1.7414	0.44761	-0.9998	-2.3832
1406	-1.3768	0.23915	2.5327	-1.8279	0.45873	-1.2588	-1.9874
1407	-1.5049	0.17029	2.33831	-1.8796	0.36075	-0.8992	-2.2638
1408	-1.2457	0.25706	2.47274	-1.6358	0.48728	-0.7524	-2.0843
1409	-1.0997	0.28207	2.54055	-1.8153	0.38067	-0.9815	-1.7519
1410	-1.3339	0.03482	2.30012	-1.6688	0.31179	-1.2989	-2.2928
1411	-1.185	0.08246	2.40639	-1.6488	0.30334	-1.0319	-2.3355
1412	-1.0525	0.26784	2.54412	-1.6298	0.5172	-0.5057	-2.0489
1413	-1.1837	0.152	2.5488	-1.7119	0.48614	-1.0469	-2.2997
1414	-1.3102	0.13982	2.43679	-1.3896	0.36493	-1.078	-2.0911

1415	-1.0591	0.36275	2.64807	-1.3803	0.56689	-0.5932	-2.3511
1416	-0.8087	0.3684	2.63671	-1.5234	0.5358	-1.0132	-2.2212
1417	-0.9575	0.27529	2.69901	-1.6231	0.44336	-0.9249	-2.2974
1418	-1.0572	0.13602	2.46592	-2.2149	0.17462	-1.092	-2.5841
1419	-1.0368	0.18285	2.48267	-2.0477	0.32	-0.9984	-2.2179
1420	-1.2276	0.14563	2.37479	-1.9351	0.20077	-1.3612	-2.4293
1421	-1.317	0.17935	2.48743	-1.7356	0.44364	-0.7459	-2.9027
1422	-2.0413	-0.2694	2.01924	-2.0252	-0.0599	-1.1724	-2.3986
1423	-1.3218	0.22354	2.4118	-2.2961	0.27468	-0.9025	-2.7053
1424	-1.2474	0.31166	2.54258	-1.6914	0.44403	-0.453	-2.1667
1425	-1.3705	0.08593	2.39787	-1.6874	0.22073	-0.925	-2.1965
1426	-1.7253	0.09992	2.42165	-1.6894	0.4061	-0.7725	-2.8644
1427	-1.7039	0.05006	2.3481	-1.6989	0.28843	-1.1982	-2.7481
1428	-1.7055	0.02014	2.20753	-1.758	0.09721	-0.9191	-2.4755
1429	-1.6459	-0.0085	2.21098	-1.4264	0.22605	-0.8774	-2.183
1430	-1.5077	0.16563	2.37585	-1.6375	0.27762	-0.6557	-2.3598
1431	-1.7157	0.04632	2.2764	-1.752	0.14413	-0.5234	-2.4509
1432	-1.6305	-0.1219	2.19158	-1.9353	0.03051	-0.8165	-2.5306
1433	-1.5905	0.03044	2.26429	-1.5917	0.29897	-0.6634	-2.1302
1434	-1.5567	-0.0057	2.40104	-1.4856	0.27995	-0.5997	-2.3336
1435	-1.793	-0.0697	2.2808	-1.7169	0.208	-0.9136	-2.2094
1436	-1.7724	0.00825	2.07766	-1.6029	0.137	-0.7242	-2.3139
1437	-1.696	0.0806	2.23903	-1.8668	0.20824	-0.7181	-2.4461
1438	-1.7126	-0.0831	2.09626	-1.7662	0.04389	-0.7659	-2.5218
1439	-1.6099	0.06785	2.39508	-1.8507	0.23893	-0.3824	-2.4847
1440	-1.5297	-0.02	2.36388	-1.8483	0.18824	-0.7333	-3.0243
1441	-1.2535	0.23432	2.58772	-1.8213	0.30753	-0.1082	-2.0216
1442	-1.7096	0.10779	2.10802	-1.4126	0.17362	-0.1495	-2.2593
1443	-1.8805	0.04203	2.16829	-1.2732	0.12054	-0.6386	-2.2949
1444	-1.6449	0.09102	2.09093	-1.3993	-0.0394	-0.8074	-2.5069
1445	-1.6219	0.13164	2.13398	-1.3681	0.02961	-0.7892	-2.1663
1446	-1.7186	0.1082	2.09374	-1.5066	0.09838	-0.9841	-1.944
1447	-1.7237	0.07106	2.17015	-1.5543	0.06079	-1.0812	-2.1505
1448	-1.7955	0.09215	1.94724	-1.5761	-0.0258	-1.0832	-2.5048
1449	-1.7728	0.0959	2.06988	-1.4255	0.05038	-1.1376	-2.4347
1450	-1.7475	0.0704	2.17839	-1.2766	0.03358	-0.9416	-2.4169
1451	-1.8203	0.01592	2.10638	-1.4354	-0.0075	-0.9804	-2.8622
1452	-1.7794	0.0874	2.10877	-1.1971	0.13567	-0.8439	-2.1972
1453	-1.54	0.15229	2.30506	-1.1743	0.16364	-1.0758	-2.2796
1454	-1.7257	0.07402	1.94851	-1.4249	-0.1428	-1.1855	-2.528
1455	-1.5801	0.15608	2.17128	-1.2915	0.13859	-0.9444	-2.3026
1456	-1.5468	0.09445	2.33607	-1.4939	0.14228	-0.7724	-2.2566
1457	-1.4322	0.09291	2.27152	-1.4738	0.17038	-0.5513	-2.3085
1458	-1.5509	0.06195	2.21724	-1.4106	0.11339	-0.65	-2.3496
1459	-1.6209	0.05652	2.25984	-1.4301	0.09799	-0.8888	-2.3518
1460	-1.5806	0.11533	2.21192	-1.4058	0.08174	-0.9029	-2.5955

1461	-1.707	0.01407	2.09692	-1.3621	-0.0178	-0.7895	-2.2378
1462	-1.6749	0.09907	2.12088	-1.2099	0.05488	-0.4795	-2.0651
1463	-1.7079	0.00785	2.07954	-1.7163	-0.0205	-0.9042	-2.297
1464	-1.4203	0.25146	2.29188	-1.5328	0.13512	-0.4209	-2.1002
1465	-1.6077	0.0392	2.13984	-1.4888	0.06902	-0.783	-2.4618
1466	-1.658	0.08313	2.15086	-1.4208	0.07928	-0.7206	-2.3617
1467	-1.581	0.04612	2.0496	-1.4876	0.14719	-0.5595	-2.3233
1468	-1.5652	0.12725	2.02186	-1.4546	0.08884	-0.6062	-2.4947
1469	-1.6145	-0.0359	1.97429	-1.1263	0.47909	-0.3599	-2.7425

Appendix Table 1.10. Natural log of key indicator element abundance variability against conservative lithophile element Rb in core SI C3 in the Three Rivers Estuarine Complex saltmarshes.

Depth (mm)	Si/Rb	K/Rb	Ca/Rb	Ti/Rb	Br/Rb	Sr/Rb	Zr/Rb	Ba/Rb
1	-0.005	1.65941	3.41968	1.80657	0.86106	1.58984	0.61559	-0.7338
2	0.32897	1.96687	3.7635	1.93631	1.07111	1.88777	1.18401	-0.6931
3	-0.0542	1.63534	3.50303	1.70983	0.73927	1.45021	0.63637	-1.2337
4	0.05198	1.63376	3.63863	1.6549	0.72545	1.46391	0.33118	-1.3266
5	0.40945	1.97242	3.94528	2.09239	0.70589	1.82923	0.53314	-1.7466
6	0.64306	2.22838	4.07464	2.31826	1.12325	1.96211	1.0379	-0.9664
7	0.37072	1.95952	3.73647	2.08794	0.9218	1.72451	0.6491	-1.7031
8	0.24829	1.89848	3.76773	2.11591	1.04753	1.71991	0.75087	-1.2251
9	0.24734	1.90119	3.73844	2.06703	1.16602	1.71368	0.83261	-1.1297
10	0.18093	1.90583	3.80202	1.99198	1.05952	1.74164	1.23789	-1.1929
11	-0.1257	1.70929	3.43768	1.93735	0.78105	1.53771	0.2802	-1.9519
12	-0.0972	1.86612	3.61369	1.95332	0.77299	1.58243	0.74447	-1.8412
13	-0.5054	1.54561	3.26646	1.65302	0.76257	1.355	0.27435	-1.9856
14	-0.7095	1.37865	2.95915	1.41374	0.55894	1.17109	0.37618	-1.8395
15	-0.3584	1.61278	3.33361	1.6757	0.59008	1.38037	0.39624	-2.0258
16	-0.0248	1.74382	3.407	1.86292	0.82874	1.35605	0.5155	-1.8691
17	-0.0604	1.78667	3.63672	1.90279	0.94791	1.57969	0.71918	-1.8
18	-0.6154	1.43595	3.17017	1.56965	0.56382	1.36563	0.35572	-1.7535
19	-0.3245	1.59372	3.3014	1.68159	0.88264	1.43086	0.41072	-1.619
20	-0.5767	1.44481	3.12618	1.59479	0.61497	1.35801	0.46788	-0.9278
21	-0.2994	1.53169	3.32051	1.70404	0.57664	1.4166	0.57446	-0.8662
22	-0.2953	1.59692	3.21425	1.6931	0.56314	1.32576	0.68422	-0.7427
23	-0.2408	1.60014	3.29462	1.65921	0.70694	1.39424	0.58916	-1.0044
24	-0.2276	1.56664	3.26419	1.53239	0.50608	1.2688	0.72841	-0.8925
25	-0.3995	1.40691	3.28451	1.53002	0.30538	1.20659	0.6267	-0.7369
26	-0.2305	1.4315	3.20488	1.42891	0.40133	1.07538	0.58796	-0.9354
27	-0.6702	1.20601	3.07928	1.35162	0.57189	1.07251	0.67614	-1.4316
28	-0.7756	1.20647	3.01108	1.33683	0.40547	1.11252	0.65066	-0.8223
29	-0.6661	1.4534	3.02491	1.63	0.6512	1.16025	0.95827	-0.7666

30	-0.9332	1.32014	2.80146	1.28047	0.42343	0.99588	0.39057	-0.946
31	-1.1606	1.23555	2.7127	1.1253	0.34534	0.8033	0.27254	-1.0603
32	-0.5021	1.4305	3.11439	1.43695	0.60653	1.06456	0.64895	-0.7497
33	-0.3424	1.43852	3.0964	1.46467	0.52375	1.06124	0.58511	-0.839
34	-0.455	1.30171	3.00195	1.38413	0.29986	1.02869	0.46766	-1.4419
35	-0.1571	1.58339	3.18479	1.62477	0.51981	1.02864	0.60607	-0.7329
36	-0.2768	1.41743	3.04045	1.36225	0.42278	0.89582	0.52787	-0.8527
37	-0.0906	1.56172	3.32179	1.59504	0.50492	1.11667	0.86362	-0.8947
38	-0.2362	1.47743	3.15398	1.54299	0.60127	1.12539	0.65291	-0.9743
39	-0.2345	1.48741	3.16832	1.7056	1.25384	1.16685	0.7649	-0.9916
40	-0.3367	1.47573	3.18569	1.50217	0.52888	1.16433	0.54939	-1.0476
41	-0.5052	1.35653	3.01507	1.46989	1.20974	1.11772	0.58185	-1.0467
42	-0.312	1.51168	3.31083	1.61923	0.94785	1.26469	0.70663	-1.3167
43	-0.4001	1.33352	3.32874	1.49635	0.27984	1.11872	0.56407	-1.0021
44	-0.5775	1.29764	2.99757	1.37342	0.55195	1.04556	0.71584	-0.8896
45	-0.4729	1.28008	3.08619	1.35483	0.29892	1.07002	0.31341	-1.0215
46	-0.358	1.45482	3.11375	1.45482	0.36741	1.20577	0.44212	-1.2119
47	-0.4611	1.4396	3.22288	1.50339	0.63475	1.23438	0.38981	-0.6442
48	-0.7568	1.3525	3.06695	1.43054	0.4688	1.07375	0.42214	-0.8093
49	-0.445	1.50488	3.26097	1.55586	0.58859	1.16861	0.39031	-0.7623
50	-0.3517	1.50816	3.18501	1.57865	0.41325	1.16946	0.47293	-0.7553
51	-0.2828	1.48477	3.17913	1.39033	0.35881	1.16062	0.47824	-0.8471
52	-0.1358	1.64793	3.36056	1.58912	0.50851	1.28281	0.49353	-0.5598
53	-0.2687	1.55754	3.13966	1.51334	0.51427	1.16837	0.52112	-0.834
54	-0.2994	1.53194	3.05397	1.50449	0.29617	1.08443	0.3142	-1.2132
55	-0.3768	1.46331	3.10447	1.40995	0.34396	1.05448	0.36325	-0.8309
56	-0.3931	1.52211	3.25136	1.49731	0.3946	1.12702	0.30007	-0.9923
57	-0.4478	1.43629	3.08132	1.36847	0.25489	1.08235	0.05673	-0.9937
58	-0.3012	1.49579	3.10428	1.53414	0.89671	1.08068	0.27753	-1.2576
59	-0.5491	1.39627	2.88668	1.36108	0.66723	0.97849	0.26566	-1.5114
60	-0.6567	1.25312	2.87386	1.16149	0.50051	0.85775	-0.0346	-1.1351
61	-0.5761	1.43189	2.96182	1.36164	0.94256	1.0496	-0.1149	-0.8342
62	-0.369	1.57326	3.10026	1.6056	0.87821	1.0772	0.03757	-0.9384
63	-0.3959	1.53251	3.10736	1.62758	0.47405	1.19553	0.09061	-1.311
64	-0.4211	1.54253	3.14263	1.46987	0.35282	1.17763	0.24367	-1.2816
65	-0.3865	1.54104	3.13636	1.49406	0.43277	1.17993	0.22181	-1.1376
66	-0.506	1.46786	3.07438	1.49301	0.27772	1.11449	0.06492	-0.9952
67	-0.5593	1.38524	2.98536	1.37286	0.24646	1.02982	-0.0394	-1.1951
68	-0.2617	1.61228	3.27599	1.6887	0.47222	1.22925	0.50279	-0.801
69	-0.4537	1.40212	3.0814	1.41998	0.28241	1.07711	0.21221	-1.0491
70	-0.4974	1.46214	3.25581	1.53103	0.32771	1.23324	0.56853	-1.2623
71	-0.5717	1.41606	3.11718	1.37611	0.17074	1.09811	0.43408	-1.2005
72	-0.6658	1.34634	2.91143	1.26548	0.27796	0.92872	-0.0401	-1.1122
73	-0.3323	1.44534	3.06062	1.4591	0.65832	1.04119	0.05992	-0.9324
74	-0.4741	1.49923	2.95533	1.48997	0.382	1.02625	0.07803	-0.5939
75	-0.4295	1.50885	2.97543	1.52434	0.31045	1.01873	0.00961	-0.7931

76	-0.5323	1.43617	2.90919	1.4632	0.17418	0.935	-0.1428	-1.1425
77	-0.4974	1.33463	2.8999	1.3871	0.1835	0.87611	-0.2249	-1.1905
78	-0.392	1.52278	3.13637	1.56145	0.35045	1.08455	-0.0558	-1.0978
79	-0.415	1.50458	3.00552	1.51677	0.25031	1.06607	0.18459	-1.2788
80	-0.3155	1.5543	3.12809	1.51026	0.38299	1.06337	0.35077	-0.6947
81	-0.4508	1.47447	3.04064	1.48589	0.51966	0.99634	0.04827	-1.0885
82	-0.5193	1.44331	3.07256	1.51465	0.46963	1.05456	-0.0022	-1.1901
83	-0.4708	1.57932	3.18199	1.62919	0.61697	1.26974	0.28789	-1.0369
84	-0.5925	1.39773	2.94113	1.472	0.4226	1.13401	0.36952	-0.7682
85	-0.5474	1.36302	3.02325	1.49499	0.44054	1.16522	0.58325	-1.1238
86	-0.2295	1.45442	3.18555	1.46997	0.11981	1.16377	0.45018	-1.296
87	-0.203	1.5987	3.3081	1.57912	0.45001	1.4122	0.65581	-0.9095
88	-0.4317	1.54876	3.2071	1.61407	0.58987	1.42071	0.54174	-0.9127
89	-0.3288	1.54699	3.21657	1.49037	0.65598	1.46384	0.52585	-0.9984
90	-0.2308	1.6271	3.26774	1.67476	0.66901	1.48316	0.73155	-0.7786
91	-0.6732	1.43071	3.08648	1.46035	0.32968	1.31469	0.58675	-0.8994
92	-0.5711	1.44522	3.11412	1.53666	0.34093	1.26074	0.62989	-1.0002
93	-0.4699	1.45029	3.02517	1.45427	0.16011	1.19257	0.40097	-0.8719
94	-0.5058	1.36745	3.02235	1.38819	0.14821	1.13416	0.20837	-1.0924
95	-0.7632	1.31916	3.00783	1.29305	0.20173	1.07486	0.24491	-1.0325
96	-0.4653	1.41813	3.13113	1.45685	0.304	1.12838	0.30723	-0.8495
97	-0.453	1.60415	3.17247	1.59435	0.36523	1.28659	0.28342	-0.8564
98	-0.5013	1.55525	3.16891	1.70293	0.46924	1.28638	0.31663	-1.4408
99	-0.4986	1.50574	3.12314	1.47992	0.65954	1.11603	0.16965	-0.9759
100	-0.5368	1.4786	3.11886	1.49861	0.21061	1.16977	0.10558	-0.7828
101	-0.3825	1.60818	3.1705	1.6522	0.38367	1.18855	0.40861	-0.6275
102	-0.5048	1.48898	3.09344	1.48232	0.27383	1.10562	0.20074	-1.0814
103	-0.6257	1.42296	2.97803	1.41014	0.3291	0.99604	0.21252	-0.9661
104	-0.7816	1.40801	2.99802	1.40515	0.4762	1.1262	0.14445	-1.1991
105	-0.4954	1.47125	3.05915	1.37853	0.39049	1.0146	-0.1983	-0.9968
106	-0.3657	1.50973	3.10449	1.55581	0.28998	1.1215	0.04019	-0.7246
107	-0.5505	1.40201	2.95941	1.47921	0.23046	1.04386	0.06007	-1.0626
108	-0.3869	1.46549	3.06364	1.49556	0.31912	0.99776	0.0417	-1.1788
109	-0.3882	1.48884	3.00724	1.47776	0.2643	1.05451	0.17775	-1.1203
110	-0.5149	1.49232	3.12457	1.41318	0.20654	1.10469	0.06563	-0.8567
111	-0.3887	1.49444	3.02273	1.41826	0.64181	1.0796	0.12929	-0.9736
112	-0.4778	1.48828	2.97577	1.44847	0.74378	1.10428	-0.0031	-1.1127
113	-0.4378	1.41848	2.95736	1.42869	0.44932	1.10904	0.08206	-0.7565
114	-0.6306	1.33128	2.87261	1.31938	0.15246	1.0086	-0.0534	-0.9901
115	-0.3771	1.52871	3.05673	1.41148	0.37937	1.14745	0.40595	-0.6448
116	-0.1223	1.55753	3.05513	1.5847	0.44111	1.19224	0.26951	-1.0081
117	-0.2602	1.50137	3.11402	1.56254	0.3069	1.10846	-0.0833	-0.8476
118	-0.415	1.39925	2.8441	1.2785	0.25327	0.94969	0.08766	-1.0039
119	-0.5851	1.38873	2.87961	1.3116	0.24379	1.01903	0.2049	-0.8841
120	-0.4648	1.35229	2.738	1.38767	0.09979	0.97386	-0.1286	-1.1756
121	-0.429	1.37144	2.90985	1.46874	0.1219	1.01114	0.03858	-1.4409

122	-0.4997	1.41076	2.85534	1.42645	0.08822	1.15564	0.01813	-1.0351
123	-0.3147	1.55274	3.18732	1.60496	0.59233	1.43734	0.38032	-0.8243
124	-0.534	1.44741	3.00057	1.4299	0.32011	1.17213	0.21482	-0.9255
125	-0.6508	1.38312	2.90363	1.33539	0.31165	1.01647	-0.0466	-0.8513
126	-0.6565	1.28543	2.80146	1.21525	0.11306	0.86763	-0.1139	-1.162
127	-0.4944	1.42999	2.92009	1.36389	0.02617	1.07341	0.00209	-0.9946
128	-0.6	1.3896	2.84354	1.32925	-0.0557	0.96439	-0.1398	-1.0873
129	-0.5221	1.37493	2.87792	1.3319	-0.1069	0.97776	-0.1243	-1.2185
130	-0.5152	1.49281	3.06997	1.59423	0.16694	1.15061	0.06121	-1.0469
131	-0.5812	1.43167	2.99033	1.41391	0.14503	1.01475	-0.2397	-1.2438
132	-0.5942	1.39575	2.96014	1.35205	0.44639	0.87602	-0.2091	-1.182
133	-0.4813	1.44175	2.87902	1.50621	0.36151	0.96131	-0.0879	-0.7833
134	-0.5138	1.42582	2.90013	1.44452	0.39461	0.9503	-0.0655	-1.1401
135	-0.4211	1.44509	2.91456	1.40064	0.12843	0.99544	-0.3944	-1.0237
136	-0.4693	1.62016	3.11339	1.56691	0.52284	1.22912	0.08204	-1.1375
137	-0.6583	1.41278	2.91547	1.51621	0.34913	1.09032	-0.0799	-1.4716
138	-0.7612	1.29504	2.80522	1.33609	0.40226	1.03766	0.04339	-1.3047
139	-0.8153	1.19964	2.75186	1.13172	0.33552	0.91136	-0.1184	-1.2645
140	-0.6091	1.44165	2.97928	1.32142	0.33261	1.14045	0.06843	-0.7558
141	-0.5944	1.38476	2.88635	1.43505	0.36334	1.04385	0.07334	-1.6615
142	-0.5478	1.40509	2.92283	1.3859	0.37097	1.03564	0.00624	-1.1716
143	-0.5941	1.40101	2.91169	1.31962	0.41451	1.01073	-0.2781	-1.0223
144	-0.5771	1.36878	2.83937	1.40239	0.37195	1.05543	0.02386	-1.5022
145	-0.4258	1.622	3.15847	1.61078	0.63447	1.21056	0.17205	-0.6017
146	-0.6669	1.38497	2.96882	1.37986	0.53375	1.15119	0.23546	-0.6414
147	-0.4188	1.39341	2.9319	1.35239	0.1483	0.96307	0.07973	-0.8633
148	-0.4241	1.5879	3.06002	1.55779	0.37595	1.15277	0.22448	-0.8257
149	-0.6005	1.53688	3.15543	1.49123	0.47732	1.19987	0.18632	-1.0223
150	-0.3813	1.47657	3.04768	1.47309	0.20358	1.00466	-0.0662	-0.8022
151	-0.3935	1.63369	3.15479	1.59926	0.37437	1.05922	-0.5296	-1.6668
152	-0.6282	1.51825	3.11537	1.45821	0.43298	1.08862	-0.0484	-0.8753
153	-0.6046	1.46546	3.0503	1.3998	0.41783	1.05209	0.04445	-0.8626
154	-0.3511	1.55051	3.04314	1.56828	0.38497	1.11691	0.13648	-0.6358
155	-0.5076	1.43893	2.98291	1.40802	0.37513	1.13627	-0.1806	-0.8591
156	-0.4479	1.60882	3.12401	1.58157	0.6192	1.20367	-0.0494	-0.988
157	-0.0884	1.84026	3.31532	1.72287	0.98671	1.45172	0.2284	-0.7227
158	-0.27	1.56307	3.04553	1.53027	0.79291	1.08964	-0.0645	-1.6621
159	-0.5253	1.50223	2.93778	1.50614	0.59028	1.23059	0.30512	-1.0754
160	-0.5008	1.40961	2.90092	1.41475	0.32618	0.98215	-0.2695	-1.0755
161	-0.4192	1.58943	3.16649	1.55378	0.51865	0.96837	-0.4536	-0.8195
162	-0.2473	1.66829	3.16586	1.62833	0.56271	1.09514	0.02977	-0.9224
163	-0.4691	1.50398	3.09073	1.55227	0.43856	1.00554	-0.316	-1.1231
164	-0.6556	1.33725	2.83607	1.38205	0.30809	0.86337	-0.1909	-1.4612
165	-0.4673	1.39581	2.908	1.37745	0.40596	0.96943	-0.0523	-1.5399
166	-0.2839	1.59035	3.09608	1.54514	0.51412	1.20908	0.13753	-0.9298
167	-0.5438	1.51529	3.13843	1.50121	0.72835	1.16154	0.28345	-1.1507

168	-0.4135	1.47645	3.00424	1.40007	0.68472	1.02282	-0.0274	-1.0635
169	-0.4463	1.39051	2.9816	1.39033	0.63763	1.00308	-0.0208	-1.038
170	-0.6164	1.42118	2.98554	1.35486	0.50626	0.94252	0.27853	-0.8392
171	-0.6283	1.36885	2.86049	1.21772	0.35023	0.93551	0.04396	-0.7324
172	-0.3297	1.49336	3.09245	1.45028	0.3347	0.91449	0.34404	-1.06
173	-0.1808	1.65163	3.15777	1.56253	0.28977	1.07533	0.13996	-0.6916
174	-0.4254	1.43717	2.90072	1.3466	0.35674	0.83353	-0.0677	-0.981
175	-0.1055	1.71504	3.22546	1.65296	0.57718	1.12479	0.22979	-1.0142
176	-0.294	1.58319	3.11942	1.50456	0.43447	0.98264	0.13453	-1.0207
177	-0.2996	1.59571	3.09964	1.50641	0.35515	0.99317	-0.1407	-0.9544
178	-0.4069	1.56786	3.02406	1.48293	0.3297	1.04484	0.00554	-0.9509
179	-0.2916	1.6592	3.1238	1.61322	0.49998	1.10973	0.10572	-1.3214
180	-0.2999	1.61477	3.09589	1.49438	0.49557	1.08491	0.11621	-0.6546
181	-0.329	1.55078	3.00451	1.48608	0.52668	1.14115	0.31482	-0.8808
182	-0.2625	1.60644	3.07621	1.58664	1.34733	1.06686	0.10252	-1.2434
183	-0.0781	1.7813	3.29073	1.82644	1.20378	1.27632	0.47971	-0.7401
184	-0.3016	1.57316	3.07109	1.56552	0.52337	1.0453	0.27178	-1.0851
185	-0.4036	1.51061	2.97868	1.51195	0.33712	1.01311	0.12432	-1.4
186	-0.5336	1.3912	2.85632	1.34135	0.24842	0.97475	-0.017	-0.8646
187	-0.3365	1.65336	3.10532	1.628	0.69315	1.22536	0.37022	-1.0453
188	-0.3043	1.67537	3.17959	1.62671	0.61934	1.34856	0.32451	-0.7875
189	-0.5621	1.45233	2.91739	1.43327	0.73779	1.39006	0.24002	-0.8776
190	-0.2877	1.60438	3.10107	1.53191	0.43526	1.77276	0.34522	-0.8642
191	-0.4563	1.68982	3.10989	1.57587	0.7754	1.93104	0.4248	-0.6463
192	-0.2247	1.67687	3.09833	1.61623	0.62978	1.95369	0.29616	-0.6053
193	-0.3096	1.57154	3.04353	1.5345	0.41505	1.76416	0.36306	-0.8576
194	-0.3523	1.59621	3.03683	1.53015	0.41925	1.69876	0.27769	-0.7631
195	-0.4214	1.55382	3.01462	1.45352	0.35291	1.41011	0.33781	-1.0454
196	-0.4435	1.50953	2.96995	1.47394	0.42602	1.27132	0.08029	-0.9061
197	-0.3773	1.52052	2.99265	1.51334	0.65712	1.18204	0.21612	-1.3258
198	-0.1052	1.83101	3.31698	1.82879	0.57244	1.53969	0.5258	-0.7288
199	-0.4196	1.48786	3.01507	1.47857	0.41727	1.22987	0.41427	-0.7761
200	-0.2358	1.57829	3.0117	1.54528	0.35859	1.2713	0.18538	-0.7207
201	-0.2989	1.61013	3.08629	1.64829	0.43517	1.29622	0.2986	-0.5276
202	-0.4617	1.42389	2.90627	1.43423	0.3078	1.12838	0.05187	-0.8502
203	-0.6369	1.44105	3.03125	1.4069	0.45632	1.12248	-0.1325	-0.9552
204	-0.4702	1.44281	2.9328	1.39619	0.26703	1.07508	-0.1177	-0.9627
205	-0.5759	1.39452	2.88279	1.3545	0.48231	1.09861	-0.1713	-0.8599
206	-0.7126	1.26911	2.6684	1.35649	0.29111	0.95059	-0.0631	-1.0809
207	-0.6322	1.39347	2.83543	1.36198	0.42184	1.09194	0.12816	-0.9796
208	-0.5875	1.32655	2.83468	1.24449	0.15621	0.97582	0.1272	-0.8991
209	-0.4591	1.41075	2.89869	1.40003	0.42842	1.0205	0.04082	-1.2875
210	-0.3709	1.46674	2.99098	1.44844	0.24876	1.12037	0.39178	-0.9045
211	-0.4897	1.41846	2.92655	1.35695	0.16639	1.04247	0.22716	-0.7585
212	-0.3894	1.55893	3.04021	1.50537	0.40878	1.21387	0.28269	-0.8946
213	-0.4648	1.47749	2.94639	1.39175	0.23647	1.07626	0.3086	-0.9418

214	-0.5287	1.4771	2.91136	1.49363	0.17213	1.13349	0.18801	-0.973
215	-0.4329	1.41353	3.01576	1.41409	0.32538	1.11799	0.4266	-1.195
216	-0.5683	1.2938	2.81317	1.30292	0.10094	0.97757	0.06466	-0.926
217	-0.473	1.47963	3.02168	1.42924	0.32534	1.11718	0.26423	-0.8982
218	-0.5168	1.40039	2.94946	1.38797	0.47754	1.11001	0.20535	-1.0505
219	-0.4863	1.4811	2.94103	1.47465	0.36681	1.13511	0.22121	-0.8072
220	-0.4262	1.46263	3.00226	1.45472	0.12625	1.01571	0.09325	-1.1022
221	-0.4633	1.48306	3.00019	1.44198	0.1902	0.98379	-0.0531	-0.9371
222	-0.4241	1.41291	2.93867	1.47048	0.24768	1.04466	-0.0999	-0.9317
223	-0.3668	1.49447	3.00953	1.51983	0.2975	1.06327	0.27737	-0.7762
224	-0.5909	1.35756	2.88445	1.30649	0.31801	0.99645	-0.0329	-0.7669
225	-0.5133	1.44474	2.98907	1.41218	0.38024	1.05043	0.11468	-1.13
226	-0.2384	1.68221	3.16968	1.6726	0.45706	1.20892	0.3709	-0.9504
227	-0.4686	1.5287	2.98741	1.4926	0.31617	0.99339	0.41931	-1.0569
228	-0.3832	1.66334	3.14905	1.566	0.8378	1.15129	0.15415	-0.7382
229	-0.5025	1.41196	2.88676	1.32292	0.38692	0.98752	-0.0312	-1.3195
230	-0.3725	1.50865	2.86485	1.53444	0.19953	0.97663	-0.0612	-0.9152
231	-0.4113	1.49613	2.97302	1.56181	0.23298	1.02733	0.16139	-1.0305
232	-0.3075	1.5384	3.04706	1.57029	0.60332	1.08144	0.14057	-1.2081
233	-0.4649	1.4236	2.79357	1.47802	0.4135	0.92332	0.03731	-1.195
234	-0.3884	1.51012	2.99506	1.44995	0.11421	1.067	0.15212	-0.9063
235	-0.4134	1.5476	3.13357	1.53131	0.24876	1.05357	0.16651	-1.0372
236	-0.403	1.48398	2.98315	1.48495	0.30614	1.0116	0.24972	-1.1343
237	-0.1756	1.65551	3.08488	1.59524	0.36611	1.2258	0.51851	-0.4794
238	-0.4619	1.46355	2.95191	1.42448	0.3361	0.9814	0.39667	-0.8932
239	-0.4603	1.44503	3.02341	1.45044	0.12627	1.00868	0.05429	-1.1814
240	-0.3812	1.45272	3.02667	1.47022	0.33598	0.9587	0.26953	-0.9605
241	-0.616	1.37959	2.86587	1.34705	0.12493	0.94851	0.04901	-1.0967
242	-0.62	1.55647	3.17448	1.55388	0.31942	1.28726	0.5046	-1.1167
243	-0.3733	1.57388	3.10362	1.62381	0.32152	1.08833	0.59006	-0.9552
244	-0.5031	1.38331	2.98085	1.40953	0.04151	0.99006	0.44698	-0.9483
245	-0.4197	1.44071	2.86853	1.50964	0.14576	0.98401	0.32848	-0.9047
246	-0.534	1.42964	2.81282	1.51797	0.18664	0.8611	0.15975	-1.1114
247	-0.7367	1.31744	2.78183	1.33025	0.29965	0.87358	0.50032	-1.0735
248	-0.5106	1.46945	2.90272	1.53654	0.29892	1.06988	0.26482	-1.112
249	-0.3566	1.66374	3.00686	1.61427	0.3455	1.11628	0.35316	-0.8891
250	-0.5493	1.47975	2.90003	1.4504	0.38289	1.02709	0.23857	-0.9349
251	-0.2021	1.66444	3.1635	1.69025	0.48262	1.29461	0.48993	-1.1445
252	-0.1244	1.7418	3.23416	1.70475	0.59598	1.25527	0.67346	-0.5652
253	0.00729	1.83887	3.36383	1.85649	0.67096	1.40518	0.93595	-0.3746
254	-0.4091	1.48102	2.97251	1.50168	0.59841	1.00886	0.53198	-1.2971
255	-0.2736	1.5928	3.09715	1.6096	0.66372	1.2176	0.51961	-0.9424
256	-0.4638	1.5506	3.13506	1.6845	0.36155	1.24965	0.46084	-1.3801
257	-0.399	1.55071	3.14209	1.65143	0.51021	1.22391	0.66033	-1.1474
258	-0.2151	1.61715	3.20634	1.56566	0.55324	1.28199	0.26792	-0.6752
259	-0.6259	1.33934	2.96149	1.52804	0.43856	1.06978	0.2817	-0.8367

260	-0.4773	1.45887	3.11002	1.59684	0.53324	1.23702	0.32004	-0.9219
261	-0.6931	1.3238	2.83764	1.30049	0.46291	1.02722	0.10025	-0.9265
262	-0.3957	1.64958	3.2826	1.64707	0.81504	1.30343	0.6238	-1.0384
263	-0.2357	1.71586	3.34663	1.66427	0.62272	1.44056	1.0276	-0.4551
264	-0.4905	1.45862	3.02828	1.43111	0.31766	1.09134	0.58375	-0.9722
265	-0.3984	1.48866	3.13621	1.4243	0.44785	1.10252	0.67777	-1.0024
266	-0.1768	1.67386	3.19664	1.62318	0.93526	1.29271	1.01048	-0.9116
267	-0.1919	1.69716	3.22828	1.6846	0.6145	1.33579	0.76475	-0.6413
268	-0.3966	1.50079	3.03563	1.52984	0.47262	1.08478	0.65228	-0.9507
269	-0.2204	1.60842	3.1403	1.60282	0.44551	1.17377	0.6482	-0.7769
270	-0.2602	1.54876	3.04141	1.68946	0.45047	1.09151	0.62079	-0.9053
271	-0.2371	1.55693	3.01394	1.61818	0.33911	1.15551	0.61548	-1.0864
272	-0.3085	1.53231	3.06629	1.70937	0.32517	1.0981	0.64088	-0.8589
273	-0.5037	1.47793	3.02926	1.49781	0.35594	1.06042	0.6183	-0.9987
274	-0.3783	1.47889	3.03392	1.55636	0.48068	1.0407	0.39714	-1.1745
275	-0.3288	1.5526	3.12355	1.49376	0.42035	1.12381	0.43782	-1.011
276	-0.4022	1.4272	2.95722	1.45602	0.11429	1.10056	0.48422	-0.9207
277	-0.4202	1.42124	2.95611	1.5408	0.23579	1.04477	0.81766	-0.9014
278	-0.3411	1.56748	3.05975	1.63403	0.42265	1.11719	0.76905	-1.2094
279	-0.4657	1.38839	2.97076	1.52508	0.22188	0.94213	0.49446	-1.2221
280	-0.3776	1.47988	2.96999	1.39501	0.23466	1.01724	0.4362	-0.7789
281	-0.4142	1.4767	2.95934	1.50035	0.27283	0.96543	0.60295	-1.0129
282	-0.378	1.49192	3.08583	1.57153	0.10579	0.91457	0.36409	-0.8661
283	-0.2292	1.63027	3.06698	1.75562	0.31779	0.99669	0.57875	-0.7999
284	-0.5561	1.49805	2.95837	1.60059	0.35148	0.88585	0.39459	-1.5858
285	-0.5127	1.40309	2.78238	1.53294	0.14027	0.73339	0.38728	-0.9085
286	-0.4588	1.44125	2.85694	1.6176	0.35872	0.89083	0.19041	-1.2641
287	-0.5803	1.38435	2.75696	1.28505	0.19984	0.84528	0.28467	-0.8546
288	-0.4508	1.48091	2.94421	1.54251	0.4257	1.02712	0.6833	-0.7138
289	-0.4507	1.5288	2.92052	1.65215	0.40045	0.90564	0.55293	-1.1316
290	-0.4065	1.45522	2.79548	1.39271	0.37644	0.83465	0.45931	-0.9274
291	-0.5082	1.47229	2.8074	1.33969	0.38345	0.84001	0.12981	-0.9239
292	-0.4877	1.44511	2.85888	1.41904	0.36968	0.92211	0.46757	-1.0561
293	-0.4446	1.45063	2.79872	1.47921	0.32586	0.85034	0.42215	-0.9249
294	-0.4741	1.39015	2.90811	1.34971	0.40159	0.73788	0.43342	-0.8581
295	-0.3185	1.47362	2.99277	1.42877	0.35654	0.93268	0.49374	-0.7296
296	-0.3139	1.50638	3.13182	1.49198	0.28114	1.03088	0.80999	-0.7411
297	-0.1605	1.61437	3.21944	1.60332	0.61656	1.14213	0.81768	-0.7438
298	-0.3104	1.46466	3.01808	1.52333	0.38089	0.94063	0.67944	-0.8772
299	-0.3639	1.42481	3.06364	1.39676	0.10508	1.02339	0.64208	-0.9527
300	-0.1814	1.56676	3.10965	1.628	0.16983	1.13753	0.76715	-0.7149
301	-0.3001	1.50227	3.03796	1.4872	0.23343	1.05226	0.47166	-0.6498
302	-0.2774	1.59396	3.16127	1.6522	0.5079	1.17485	0.96063	-0.6328
303	-0.614	1.33167	2.8448	1.48562	0.24665	0.95252	0.63388	-1.4363
304	-0.7431	1.21652	2.70242	1.26292	0.22621	0.81648	0.40524	-0.9413
305	-0.4891	1.46687	2.97948	1.48565	0.59123	1.04637	0.52285	-1.0871

306	-0.4378	1.58636	3.06424	1.71634	0.68069	1.16806	0.68738	-0.7264
307	-0.2092	1.68531	3.08369	1.65427	0.93019	1.20231	0.6561	-0.9453
308	-0.3982	1.52114	2.98164	1.53014	0.76473	0.98174	0.49167	-0.986
309	-0.3586	1.62227	3.12286	1.56918	0.66725	0.98742	0.39857	-1.0053
310	-0.4924	1.52178	3.01106	1.50546	0.67339	0.95947	0.24863	-0.9047
311	-0.2485	1.68492	3.17359	1.69727	0.69014	1.10955	0.5032	-1.0413
312	-0.5666	1.42133	2.87857	1.35338	0.39695	0.81187	0.54598	-1.013
313	-0.4218	1.57786	2.99836	1.54283	0.55648	1.0064	0.71572	-0.765
314	-0.3242	1.52921	3.08222	1.52321	0.84795	1.01051	0.44012	-1.0276
315	-0.361	1.5383	3.08458	1.40096	0.84957	1.07296	0.41418	-1.0368
316	-0.5872	1.25615	2.72956	1.22135	0.33107	0.62001	0.2706	-1.4467
317	-0.4484	1.34266	2.81046	1.44704	0.49733	0.67714	0.23813	-0.9666
318	-0.5432	1.3631	2.81153	1.35851	0.28992	0.7229	0.27247	-0.9454
319	-0.2671	1.62518	3.09666	1.60819	0.44565	0.98782	0.58053	-0.5067
320	-0.3182	1.52406	2.95204	1.48195	0.37603	0.81008	0.26997	-1.025
321	-0.3426	1.52311	2.97811	1.45317	0.27686	0.82827	0.42941	-1.0141
322	-0.3469	1.50784	3.01221	1.47062	0.38388	0.95197	0.67221	-1.0616
323	-0.3351	1.64056	3.13981	1.75831	0.68438	1.11707	0.47599	-1.3002
324	-0.6143	1.35768	2.88432	1.42698	0.34504	0.88627	0.66399	-1.0507
325	-0.5285	1.34711	2.8499	1.33028	0.23577	0.79363	0.2715	-1.1262
326	-0.3976	1.50216	2.93982	1.48653	0.52155	0.86543	0.1172	-1.1953
327	-0.3888	1.48522	3.02189	1.46808	0.56307	1.04618	0.40207	-1.3981
328	-0.4888	1.40681	2.92887	1.45161	0.52148	0.99864	0.52192	-1.1398
329	-0.3469	1.42185	2.93041	1.43849	0.55198	0.80389	0.23654	-1.1
330	0.10493	1.74883	3.23743	1.64615	0.4331	1.02876	0.34477	-0.6594
331	-0.1396	1.66071	3.10936	1.60373	0.29005	0.88124	0.1494	-1.0322
332	-0.2492	1.52325	2.91726	1.48328	0.36978	0.83727	0.28552	-1.1915
333	-0.1618	1.55788	2.9879	1.58767	0.28308	1.01599	0.38523	-1.065
334	-0.4018	1.45748	3.00866	1.47735	0.32303	1.05116	0.27541	-1.4764
335	-0.2937	1.53563	3.09936	1.55567	0.36789	0.92565	0.18917	-1.1659
336	-0.367	1.64402	3.19634	1.76262	0.41965	1.16815	0.42859	-0.8691
337	-0.4208	1.52678	3.02562	1.59521	0.4011	1.14462	0.45286	-0.7911
338	-0.2963	1.57979	3.1639	1.55483	0.60423	1.10789	0.46699	-0.9005
339	-0.4593	1.50493	2.94001	1.50784	0.78086	0.94365	0.3325	-1.075
340	-0.3338	1.50718	2.89972	1.48537	0.81453	0.88017	0.22057	-0.9489
341	-0.508	1.41993	2.82586	1.34174	0.68624	0.93447	0.37808	-0.9205
342	-0.5022	1.40131	2.81413	1.30373	0.30871	0.84493	0.19805	-0.9113
343	-0.3633	1.49539	3.03211	1.39709	0.40347	0.9585	0.21714	-0.9729
344	-0.4255	1.41743	2.86833	1.36744	0.2743	0.7838	0.31588	-0.6918
345	-0.4865	1.35677	2.79619	1.19654	0.11462	0.77829	0.21131	-0.984
346	-0.2326	1.5928	3.04365	1.52678	0.3323	1.01008	0.48807	-1.1163
347	-0.3345	1.61015	3.05335	1.63391	0.50815	1.07456	0.51136	-0.6967
348	-0.3979	1.41244	2.87412	1.36442	0.19619	0.84809	0.21088	-1.3142
349	-0.0386	1.70498	3.28459	1.69514	0.43393	1.1317	0.27924	-0.8445
350	-0.1465	1.65718	3.08126	1.60092	0.34594	1.00449	0.49033	-1.2407
351	-0.3562	1.51202	2.94418	1.52484	0.30974	0.89587	0.29324	-0.8939

352	-0.4238	1.51817	2.96312	1.42011	0.22872	0.98479	0.24542	-0.7612
353	-0.2137	1.63776	3.11911	1.59609	0.39497	1.13862	0.44341	-1.0741
354	0.10403	1.82337	3.42581	1.91081	0.6016	1.16364	0.79718	-0.7281
355	-0.2897	1.50226	2.89951	1.46822	0.08347	0.88638	-0.0272	-0.7388
356	-0.1691	1.65125	3.12784	1.56905	0.31033	1.05684	0.47313	-0.6617
357	-0.4899	1.46575	2.8385	1.52665	0.12884	0.94713	0.18879	-0.7784
358	-0.2759	1.58147	3.06636	1.51343	0.20367	1.04681	0.35218	-0.9265
359	-0.4503	1.46436	2.89631	1.5273	0.09846	0.9701	0.47687	-1.0994
360	-0.4904	1.49878	3.00619	1.4901	0.03172	1.01577	0.51163	-0.8489
361	-0.3344	1.49246	3.06195	1.45656	0.22557	1.12821	0.59727	-0.6607
362	-0.441	1.47148	3.03272	1.50693	0.29066	1.21093	0.73456	-0.959
363	-0.5389	1.42342	2.93488	1.44395	-0.0008	1.01954	0.60945	-1.1072
364	-0.5212	1.44394	2.9959	1.48023	0.1469	1.05214	0.60495	-1.12
365	-0.4571	1.35208	2.9932	1.38993	0.0233	0.98126	0.45595	-1.0552
366	-0.3626	1.44422	2.96826	1.39192	-0.0606	0.97483	0.56691	-0.888
367	-0.2019	1.55897	3.15364	1.61892	0.45395	1.11238	0.91871	-0.7447
368	-0.3089	1.50186	3.10796	1.54228	0.14581	0.98187	0.81755	-0.7566
369	-0.0767	1.72202	3.358	1.67248	0.36403	1.14095	1.16053	-0.823
370	-0.1031	1.63055	3.25529	1.62522	0.30808	1.15181	1.01398	-1.2345
371	-0.2843	1.4699	3.09204	1.35963	0.21034	0.86322	0.75926	-1.263
372	-0.3161	1.55746	3.0042	1.43951	0.20903	0.87174	0.55465	-0.9709
373	-0.1825	1.74217	3.30777	1.71234	0.27009	1.06799	0.54456	-0.8622
374	-0.407	1.47343	3.04089	1.46588	0.13781	0.7932	0.33754	-0.9428
375	-0.2792	1.6622	3.15975	1.62653	0.40165	0.98904	0.39218	-0.608
376	-0.4468	1.5236	3.03262	1.41875	0.26722	0.86727	0.46536	-0.9767
377	-0.2222	1.50936	2.9284	1.46628	0.16812	0.89389	0.76797	-0.6962
378	-0.2133	1.55729	3.08163	1.50468	0.16985	0.91923	0.45949	-0.7967
379	-0.437	1.40099	2.84475	1.4412	-0.0633	0.80261	0.63023	-1.1731
380	-0.3191	1.55155	3.01307	1.50237	0.15634	0.90836	0.52697	-1.1124
381	-0.4145	1.53881	2.94289	1.42754	0.5349	0.77514	0.43844	-0.9457
382	-0.3164	1.56781	2.94033	1.53204	0.44738	0.75839	0.46669	-1.4074
383	-0.363	1.53358	2.83364	1.54956	0.31904	0.79052	0.35383	-0.8101
384	-0.3864	1.51163	2.89313	1.51181	0.23512	0.76481	0.32261	-1.0962
385	-0.2467	1.58156	3.07961	1.53208	0.1052	0.85359	0.58501	-0.6772
386	-0.3074	1.52389	2.97563	1.55019	0.14147	0.80258	0.4248	-1.1645
387	-0.5966	1.34244	2.86216	1.30082	-0.0129	0.7059	0.27116	-1.0326
388	-0.2711	1.59919	3.03277	1.53451	0.17365	0.89942	0.51718	-0.733
389	-0.2772	1.63253	3.0737	1.49015	0.20046	0.97151	0.52876	-1.0099
390	-0.3674	1.53285	2.9788	1.47753	0.43681	0.94512	0.5944	-0.8601
391	-0.436	1.48388	2.89552	1.51992	0.38197	0.83278	0.59285	-0.9203
392	-0.1774	1.66371	3.12232	1.71365	0.36976	1.05192	0.63639	-1.1668
393	-0.3442	1.51066	2.96625	1.52256	0.32183	0.91302	0.33997	-0.877
394	-0.1979	1.60649	3.06661	1.57013	0.13314	0.94076	0.71117	-1.0681
395	-0.2231	1.63229	3.20175	1.62779	0.35561	1.0208	0.67161	-0.7751
396	-0.4241	1.45009	2.99327	1.46396	0.08398	0.81571	0.48798	-1.0486
397	-0.3209	1.52862	3.01272	1.56101	0.17016	0.86991	0.40372	-0.9876

398	-0.3293	1.55558	3.01082	1.52529	0.02185	0.84646	0.54028	-0.8681
399	-0.4051	1.499	2.96544	1.46092	0.12827	0.78179	0.53203	-1.0362
400	-0.3813	1.47992	2.94421	1.38962	0.03851	0.73415	0.61619	-0.9219
401	-0.4597	1.42097	2.85658	1.47963	-0.1647	0.81575	0.47054	-0.9256
402	-0.2582	1.56517	3.01544	1.53829	0.00711	0.90785	0.80448	-0.8082
403	-0.5413	1.35222	2.79331	1.28391	-0.1027	0.72301	0.51668	-0.7342
404	-0.2298	1.65725	3.0096	1.60254	0.23747	0.9659	0.54028	-0.837
405	-0.4242	1.54657	2.96255	1.4147	0.05003	0.87882	0.1452	-0.797
406	-0.2669	1.53076	3.02303	1.46113	0.20617	0.71378	-0.0339	-1.0025
407	-0.2724	1.56379	2.94943	1.40729	0.12046	0.70623	0.20737	-0.9123
408	-0.3539	1.52984	2.91065	1.43178	-0.083	0.69452	0.1275	-0.9937
409	-0.3309	1.45724	2.99267	1.41262	-0.1814	0.72799	0.00519	-1.0704
410	-0.369	1.41994	2.76684	1.36113	-0.1547	0.62951	0.16068	-1.4131
411	-0.4117	1.38708	2.64916	1.40229	-0.2498	0.48199	0.11744	-1.3261
412	-0.3679	1.35449	2.67228	1.27677	-0.3316	0.52346	-0.1023	-1.1194
413	-0.5245	1.30902	2.55043	1.26794	-0.367	0.51083	-0.0055	-1.1588
414	-0.404	1.48416	2.78301	1.42048	-0.1935	0.71692	0.19971	-1.0317
415	-0.4653	1.39366	2.77371	1.35574	-0.2477	0.59305	-0.0125	-1.1728
416	-0.311	1.57691	2.9157	1.56596	0.27556	0.76674	0.32472	-1.0869
417	-0.3084	1.58846	2.90124	1.50368	0.17735	0.85564	0.52818	-0.6067
418	-0.6441	1.38859	2.74446	1.31745	-0.0427	0.80137	0.01545	-1.053
419	-0.5448	1.40457	2.71562	1.42551	0.18001	0.87741	0.34912	-1.3441
420	-0.4257	1.51436	2.94538	1.52772	0.15041	1.07077	0.22803	-1.1076
421	-0.4372	1.44275	2.86589	1.38026	0.11561	0.88203	-0.0015	-0.9924
422	-0.3112	1.60461	3.19504	1.54954	0.13788	0.95985	0.27178	-1.0021
423	-0.4405	1.4679	2.96229	1.50447	0.11661	0.88532	0.35724	-0.8569
424	-0.3569	1.45723	2.86032	1.37207	0.03558	0.74954	0.44852	-0.9203
425	-0.4355	1.43468	2.84565	1.25311	0.02212	0.64706	0.01142	-1.0601
426	-0.439	1.43121	2.96922	1.40443	0.22357	0.79379	0.41048	-1.2304
427	-0.4222	1.4584	2.88033	1.54066	0.22375	0.9084	0.08953	-1.0421
428	-0.3526	1.50275	3.05166	1.48984	0.15051	0.87628	0.30365	-1.1716
429	-0.4497	1.48869	3.00507	1.45948	0.04528	0.9237	0.12944	-0.8516
430	-0.2874	1.53913	3.20435	1.43056	0.21692	1.06941	0.36352	-1.3444
431	-0.2968	1.52532	3.23438	1.40306	0.07445	1.0656	0.45008	-1.2384
432	-0.3576	1.49189	3.09048	1.38863	0.0553	1.06078	0.68061	-1.005
433	-0.2541	1.57911	3.09438	1.37332	-0.0091	1.05944	0.79094	-0.9136
434	-0.1828	1.59023	3.24097	1.49588	-0.0459	1.15109	0.66451	-0.8069
435	-0.1492	1.55955	3.25855	1.52022	-0.0667	1.23139	0.96095	-1.042
436	-0.3817	1.47912	3.08538	1.43121	-0.0516	1.10577	0.9011	-0.9095
437	-0.3213	1.46675	3.0673	1.37364	0.04539	1.1301	0.57323	-1.1429
438	-0.3028	1.48217	3.13325	1.31422	-0.0804	1.05883	0.2162	-0.8706
439	-0.3707	1.43632	3.01209	1.34045	0.13467	1.03678	0.04445	-0.8672
440	-0.1529	1.70092	3.24299	1.54614	0.29426	1.24911	-0.0124	-0.9439
441	-0.2674	1.53035	3.15891	1.49008	0.0663	1.1189	-0.0128	-0.7284
442	-0.3659	1.46823	3.11259	1.58121	-0.0438	1.13495	0.11097	-0.9764
443	-0.3152	1.50564	3.07167	1.42284	-0.1392	1.13741	0.14791	-0.8543

444	-0.4496	1.42574	3.0823	1.31171	-0.1693	1.11172	-0.0776	-0.854
445	-0.1067	1.64529	3.3774	1.53512	-0.0898	1.28701	0.27979	-0.7196
446	-0.2434	1.54179	3.30309	1.3955	-0.1012	1.161	-0.0632	-0.8162
447	-0.2276	1.57513	3.24319	1.47843	0.0413	1.14054	-0.2409	-0.9232
448	-0.3218	1.54276	3.14702	1.50401	-0.0216	1.08577	-0.2944	-1.0825
449	-0.3732	1.48284	3.12851	1.35235	-0.0959	1.10067	-0.232	-1.2708
450	-0.233	1.58781	3.32673	1.47186	0.06698	1.19238	0.0873	-0.7775
451	-0.251	1.42198	3.20262	1.28433	-0.182	1.16789	-0.1391	-0.9191
452	-0.2971	1.46629	3.24284	1.52445	-0.1079	1.20839	0.0564	-0.7907
453	-0.2437	1.5349	3.28389	1.4576	-0.1223	1.26963	0.28966	-0.7159
454	-0.1166	1.56396	3.39686	1.4544	-0.1626	1.26214	0.4516	-0.8459
455	-0.2141	1.50337	3.27671	1.41622	-0.3152	1.20359	0.19893	-0.8588
456	-0.1738	1.58946	3.35896	1.48612	-0.1256	1.21622	0.3113	-1.0073
457	-0.459	1.34056	3.144	1.27472	-0.4773	1.01302	0.06411	-1.1588
458	-0.0851	1.69316	3.46895	1.61771	-0.0015	1.35102	0.53224	-1.0005
459	-0.1129	1.59567	3.46513	1.58328	-0.2131	1.23719	0.37835	-0.908
460	-0.1985	1.51043	3.43137	1.41667	-0.3565	1.288	0.46443	-0.9337
461	-0.1072	1.52804	3.48987	1.43155	-0.0693	1.35792	0.36335	-1.0547
462	-0.0621	1.53645	3.43399	1.56142	-0.0983	1.2866	0.42842	-0.8845
463	-0.7154	1.38803	3.06013	1.45351	0.03081	1.20756	0.36406	-1.8332
464	-1.0327	1.08086	2.76258	1.14181	-0.385	1.16513	0.40547	-1.5373
465	-1.0244	1.32709	2.82931	1.35936	0.00649	1.33597	0.54557	-1.4794
466	-0.9265	1.31361	2.83472	1.3079	-0.0469	1.16843	0.47254	-1.4652
467	-0.686	1.25482	2.95093	1.30941	-0.0936	1.09409	0.35803	-1.5173
468	-0.6958	1.34493	2.9657	1.39533	-0.2503	1.08524	0.14793	-1.5695
469	-0.4373	1.61009	3.2472	1.70573	0.18394	1.35113	0.37476	-1.1749
470	-0.5866	1.39346	3.02604	1.36136	0.08759	1.11275	0.27893	-0.8858
471	-0.6072	1.48005	3.0772	1.38953	-0.0084	1.16569	0.30192	-1.2458
472	-0.7305	1.30438	2.99447	1.22646	-0.1011	1.04275	0.26606	-1.0602
473	-0.8089	1.32684	2.92412	1.34904	0.15145	1.01138	0.25341	-1.0242
474	-0.4825	1.44677	2.97789	1.50894	-0.0133	1.08974	0.29305	-1.1987
475	-0.4286	1.49311	3.1356	1.39849	0.00415	1.19654	0.3676	-1.0515
476	-0.4473	1.50877	3.21109	1.45426	0.13815	1.18797	0.50765	-1.2528
477	-0.4399	1.48066	3.13285	1.39687	0.14217	1.21356	0.7078	-0.9948
478	-0.5766	1.41712	3.16336	1.46049	-0.055	1.16936	0.6757	-1.5257
479	-0.4926	1.49037	3.17271	1.47869	0.0578	1.17359	0.59133	-1.1459
480	-0.3273	1.50975	3.19271	1.42209	0.03473	1.21705	0.59969	-1.1853
481	-0.2475	1.69013	3.30523	1.6575	0.13052	1.33778	0.94061	-1.0833
482	-0.5968	1.46193	3.02345	1.35173	-0.2174	1.19381	0.65216	-0.7594
483	-0.358	1.57418	3.20915	1.54127	0.04453	1.23058	0.66278	-1.0422
484	-0.4139	1.5466	3.28188	1.6511	-0.1543	1.23969	0.80848	-0.6508
485	-0.2994	1.66024	3.32696	1.71507	-0.0111	1.30579	0.8992	-0.7897
486	-0.2385	1.68682	3.33809	1.72362	-0.1201	1.29324	0.82314	-0.779
487	-0.3137	1.55311	3.26199	1.49945	-0.0652	1.17936	0.68504	-1.0302
488	-0.5709	1.34612	3.01795	1.40933	-0.105	1.09233	0.62629	-1.3274
489	-0.6077	1.27845	2.98791	1.3035	-0.2836	0.89479	0.46403	-1.3961

490	-0.4381	1.48312	3.27546	1.43209	0.03051	1.19315	0.64515	-1.0429
491	-0.4483	1.51088	3.32446	1.42239	-0.0329	1.24394	0.80908	-1.1585
492	-0.5158	1.47239	3.28438	1.57396	-0.345	1.19191	0.78824	-0.9108
493	-0.3808	1.54332	3.30238	1.49481	-0.0403	1.2718	0.70596	-1.3036
494	-0.4266	1.57072	3.26691	1.5732	-0.0848	1.247	0.58102	-0.8573
495	-0.2543	1.60634	3.32739	1.53667	0.46716	1.37601	0.54496	-1.0066
496	-0.2951	1.61046	3.47142	1.75518	0.27007	1.2926	0.57914	-1.0893
497	-0.295	1.48947	3.35313	1.49724	-0.2004	1.27498	0.62356	-0.8115
498	-0.4339	1.43787	3.28688	1.40941	-0.2957	1.33683	0.75976	-1.0709
499	-0.1175	1.70194	3.60889	1.5705	-0.16	1.47608	0.98684	-0.8223
500	-0.0097	1.65461	3.76316	1.68386	-0.0268	1.56766	1.11334	-0.5468
501	-0.5766	1.36141	3.33491	1.62098	-0.4383	1.34496	0.8155	-0.6403
502	-0.3397	1.60595	3.45319	1.50745	0	1.5385	0.95006	-1.2484
503	-0.108	1.7178	3.55856	1.60098	-0.0879	1.55087	0.82162	-0.8386
504	-0.2942	1.61357	3.49548	1.56352	-0.0176	1.57011	1.05064	-0.9445
505	-0.2434	1.69212	3.60442	1.64281	0.01013	1.5289	1.04676	-0.7806
506	-0.1108	1.85251	3.67796	1.82209	0.00249	1.62799	1.03238	-0.9655
507	-0.2193	1.68011	3.46279	1.75476	-0.3723	1.52836	0.93817	-0.8381
508	-0.3332	1.55481	3.39899	1.55666	-0.2893	1.41224	0.79314	-1.3699
509	-0.2351	1.67224	3.636	1.61774	-0.2249	1.61337	1.14497	-0.5692
510	-0.6963	1.2389	3.10661	1.22531	-0.852	1.16876	0.594	-1.2328
511	-0.3152	1.49989	3.36539	1.38237	-0.5995	1.45584	0.92585	-0.6187
512	-0.1907	1.52306	3.59291	1.57161	-0.3098	1.47378	0.94385	-0.9707
513	-0.2658	1.48169	3.46105	1.59756	-0.6032	1.35823	0.78476	-0.6803
514	-0.2507	1.58951	3.62096	1.42594	-0.552	1.52632	0.90627	-0.538
515	-0.0628	1.66812	3.57629	1.83857	-0.5281	1.55798	0.90298	-0.7371
516	-0.2643	1.51173	3.46504	1.5084	-0.6131	1.36025	0.7129	-0.7553
517	-0.102	1.60354	3.81625	1.69978	-0.7446	1.62027	0.96394	-0.74
518	-0.1643	1.44634	3.66751	1.4843	-0.4609	1.56054	0.91985	-1.3193
519	0.15566	1.78783	3.89043	1.63937	-0.8225	1.71402	1.10565	-0.8524
520	-0.0562	1.58292	3.89592	1.53507	-0.5522	1.67802	1.03481	-0.6852
521	-0.1425	1.51062	3.63035	1.49398	-1.0995	1.47728	0.88633	-1.0562
522	-0.1493	1.5831	3.70325	1.55932	-0.3521	1.60516	0.93112	-0.8447
523	-0.3407	1.50378	3.54272	1.6135	-0.1896	1.4909	0.70678	-0.8806
524	-0.0772	1.61776	3.78539	1.59673	-0.3175	1.6251	0.95936	-0.7147
525	-0.1716	1.55567	3.4905	1.46693	-0.4145	1.49466	0.95689	-0.7926
526	-0.3042	1.51246	3.54778	1.39479	-0.6232	1.51941	0.91412	-0.8199
527	-0.0639	1.57065	3.72564	1.66546	-0.3029	1.54282	1.03573	-0.7222
528	-0.05	1.68148	3.74332	1.54845	-0.2719	1.62486	1.13959	-1.0567
529	-0.437	1.40154	3.40793	1.50967	-0.4348	1.31525	0.61876	-0.8608
530	-0.1282	1.64016	3.75356	1.77661	-0.0028	1.57754	0.60323	-0.716
531	0.00102	1.79176	3.82549	1.82956	-0.2025	1.69862	0.98248	-0.871
532	-0.0702	1.7416	3.73972	1.67827	-0.1112	1.58588	1.00161	-0.9634
533	0.07044	1.72569	3.75259	1.56156	0.2899	1.66057	1.03797	-0.8417
534	0.0118	1.72354	3.85366	1.5971	-0.3134	1.65733	0.62086	-0.7962
535	-0.0324	1.67409	3.73267	1.48003	-0.2783	1.51183	0.33543	-0.7464

536	-0.0824	1.75472	3.63802	1.63794	-0.4141	1.51293	0.87357	-0.6128
537	-0.1448	1.6056	3.49788	1.54164	-0.5787	1.4031	0.43014	-0.9316
538	-0.1355	1.5716	3.60457	1.47819	-0.4226	1.40746	0.69516	-0.94
539	-0.2056	1.61921	3.53214	1.65115	-0.1379	1.48649	0.74689	-0.915
540	-0.0851	1.65265	3.44427	1.68072	-0.0305	1.45838	0.77517	-1.2455
541	-0.1837	1.63686	3.60523	1.56931	-0.1476	1.51413	0.43475	-1.2929
542	-0.1883	1.54999	3.35952	1.55614	-0.2096	1.49184	0.4577	-1.1111
543	0.04169	1.78359	3.83119	1.70333	-0.0052	1.7022	0.91275	-1.0179
544	-0.2475	1.60186	3.54645	1.66793	-0.2252	1.4446	1.07395	-0.9345
545	-0.139	1.57492	3.35137	1.53765	-0.1747	1.40738	0.45106	-1.211
546	-0.2067	1.52833	3.37187	1.36981	-0.5871	1.3596	0.68512	-1.3381
547	-0.0929	1.70419	3.56352	1.57605	-0.331	1.56858	0.62409	-0.728
548	-0.2725	1.56291	3.48815	1.42972	-0.1103	1.54337	0.544	-0.972
549	-0.0422	1.69738	3.7354	1.55978	0.02804	1.69486	0.61046	-0.6518
550	-0.298	1.63377	3.51983	1.57061	-0.381	1.53003	0.40601	-1.3686
551	0.17774	2.04051	3.94115	2.00588	0.11417	2.0217	1.10317	-0.2736
552	-0.2208	1.61149	3.47503	1.70483	-0.4115	1.55828	0.49186	-0.9766
553	-0.0782	1.82468	3.71345	1.81852	-0.1875	1.74395	0.85404	-0.778
554	0.05256	1.87771	3.86858	1.7155	-0.2292	1.86056	0.63242	-0.4727
555	-0.1642	1.66353	3.63015	1.75795	-0.3372	1.70768	0.6089	-0.6349
556	-0.1513	1.65445	3.65459	1.51244	-0.257	1.71191	0.64442	-0.8538
557	-0.1325	1.58465	3.67354	1.5554	-0.4306	1.60927	0.58355	-0.6825
558	-0.2687	1.65139	3.65682	1.46356	-0.2543	1.63832	0.62121	-1.1089
559	-0.0583	1.78347	3.79645	1.73258	-0.3133	1.80996	0.74535	-0.9592
560	-0.2974	1.65478	3.74887	1.61592	-0.3307	1.73338	0.35424	-0.7661
561	-0.0732	1.76006	3.90111	1.79381	0.00559	1.89785	0.74716	-0.7724
562	-0.1178	1.56006	3.6398	1.51839	-0.1032	1.7537	0.55681	-0.9799
563	-0.3407	1.45284	3.53884	1.3636	-0.5675	1.57505	0.08869	-0.9405
564	-0.281	1.56199	3.61664	1.45523	-0.3789	1.69759	0.29076	-1.0555
565	-0.0984	1.68711	3.78076	1.60982	-0.3615	1.82033	0.5824	-1.09
566	-0.1013	1.59626	3.66489	1.52665	-0.3323	1.74936	0.33192	-1.3471
567	0.14295	1.8522	4.00376	1.71429	-0.2055	1.9464	0.76824	-0.987
568	0.03973	1.69689	4.07275	1.52799	-0.7876	2.05262	0.56754	-0.944
569	-0.1832	1.4554	3.61804	1.48609	-0.3096	1.72419	0.4614	-0.5251
570	-0.1726	1.46773	3.7317	1.21016	-0.3417	1.712	0.57245	-0.8464
571	-0.2558	1.43467	3.72161	1.45683	-0.4845	1.68561	0.66211	-0.7646
572	-0.118	1.56465	3.72845	1.6443	-0.4811	1.81251	0.78103	-1.0492
573	-0.1604	1.67918	3.82338	1.54583	-0.5296	2.1608	0.18003	-0.7954
574	-0.11	1.7262	3.8328	1.56548	-0.3861	2.3981	0.45747	-1.0231
575	0.13829	1.93087	4.20892	1.80043	-0.2292	2.60895	0.53262	-0.7424
576	-0.0078	1.72002	3.80383	1.59947	-0.3113	2.02753	0.3651	-0.743
577	-0.1561	1.64719	3.75931	1.41161	-0.0197	1.79841	0.86787	-0.82
578	-0.171	1.65232	3.75117	1.46548	-0.2344	1.87926	0.61129	-0.9047
579	-0.1331	1.73268	3.85801	1.64614	-0.3469	1.84092	0.70382	-0.684
580	-0.1293	1.65682	3.74402	1.50387	-0.5631	1.78386	0.3265	-0.4582
581	0.06537	1.73562	3.80064	1.58247	-0.518	1.88766	0.61549	-0.5985

582	-0.1668	1.68707	3.8422	1.65932	-0.2564	1.79271	0.51159	-0.5478
583	-0.0217	1.71206	3.86762	1.63126	-0.1009	1.85012	0.69468	-0.751
584	-0.0541	1.62619	3.64652	1.38	-0.4456	1.65023	0.32421	-0.7429
585	-0.1491	1.64549	3.56284	1.62905	-0.7061	1.61889	0.35989	-0.7045
586	-0.0476	1.68867	3.70519	1.66688	-0.4081	1.70825	0.65515	-0.7216
587	0.06672	1.83178	3.88949	1.8073	-0.0101	1.86393	0.84329	-0.4262
588	-0.1233	1.53864	3.68368	1.37777	-0.5777	1.64981	0.46148	-0.6034
589	-0.0524	1.63166	3.72531	1.5813	-0.2925	1.66747	0.24619	-1.1997
590	0.03711	1.71467	3.84282	1.66281	-0.206	1.72768	0.58337	-0.9215
591	-0.0698	1.68419	3.69067	1.65588	-0.6031	1.61306	0.73959	-0.9945
592	-0.0101	1.75848	3.70817	1.59072	-0.3336	1.66238	1.10976	-0.8938
593	-0.0559	1.73754	3.6943	1.59903	-0.1605	1.65186	0.75315	-1.0324
594	-0.0287	1.71081	3.69126	1.77465	-0.1211	1.75153	0.4918	-0.7584
595	-0.2053	1.70262	3.59299	1.66789	0.01293	1.63597	0.36204	-0.8953
596	-0.007	1.84039	3.55882	1.73279	0.27673	1.68988	0.49082	-0.7714
597	-0.3539	1.50769	3.27469	1.41203	0.01541	1.33741	0.32702	-0.791
598	-0.3183	1.52557	3.32063	1.57569	0.01544	1.34315	0.39254	-0.9089
599	-0.2738	1.56019	3.48937	1.63417	0.11241	1.40039	0.47794	-0.9608
600	-0.2582	1.60514	3.59064	1.54614	0.10627	1.51329	0.53058	-0.9806
601	-0.2294	1.63149	3.67219	1.47272	-0.1397	1.57896	0.26381	-0.9129
602	-0.1784	1.76718	3.76289	1.6202	-0.0578	1.78863	0.52035	-1.0903
603	-0.4618	1.4905	3.43819	1.35052	-0.1943	1.58092	0.67457	-0.9142
604	-0.3827	1.39992	3.47405	1.46615	-0.0582	1.54991	0.30449	-1.0914
605	-0.4011	1.3872	3.39338	1.18955	-0.4532	1.45611	0.17591	-1.2086
606	-0.2623	1.42611	3.6443	1.29313	-0.225	1.66474	0.40736	-1.1191
607	-0.4681	1.3489	3.48012	1.28709	-0.2311	1.60642	0.29243	-1.2445
608	-0.7553	1.13381	3.33648	1.08232	-0.4247	1.37211	-0.2173	-1.3021
609	-0.3987	1.41794	3.73717	1.40639	-0.1743	1.55084	0.27453	-1.5577
610	-0.5315	1.37138	3.4734	1.01873	-0.3886	1.5196	-0.0672	-1.1908
611	-0.4199	1.45605	3.6083	1.21761	-0.4173	1.5802	0.46832	-1.0778
612	-0.2795	1.49639	3.79408	1.19697	-0.3347	1.69035	0.43677	-0.8072
613	-0.3414	1.50188	3.7405	1.42948	-0.5218	1.6445	0.32568	-1.4985
614	-0.4474	1.4119	3.56547	1.22607	-0.4753	1.53197	0.40147	-0.9595
615	-0.3788	1.47214	3.58343	1.17185	-0.4402	1.51255	0.80481	-0.9937
616	-0.3636	1.52835	3.45397	1.39837	-0.1743	1.50835	0.61115	-0.8846
617	-0.4009	1.40344	3.49994	1.28422	-0.4821	1.38099	0.71133	-0.9482
618	-0.1491	1.52832	3.73879	1.538	-0.3496	1.56119	0.86048	-0.6186
619	0.03175	1.68332	3.80272	1.52224	-0.0404	1.66361	0.44964	-0.635
620	-0.1466	1.60607	3.66849	1.56802	-0.4666	1.62762	0.50728	-0.8262
621	-0.2309	1.60653	3.63151	1.48518	-0.3437	1.66241	0.62547	-0.9283
622	-0.1431	1.67042	3.72252	1.53832	-0.5987	1.68906	0.58227	-0.9862
623	-0.1633	1.57756	3.72895	1.49492	-0.3345	1.63843	0.19164	-1.0619
624	-0.048	1.71342	3.91902	1.60644	-0.2595	2.07757	0.28318	-1.0099
625	-0.2879	1.51072	3.53288	1.32106	-0.5223	1.54421	0.34251	-1.1452
626	-0.3687	1.60836	3.7753	1.3975	-0.4644	1.62109	0.69944	-0.5671
627	-0.2359	1.58768	3.69696	1.40414	-0.4127	1.57898	0.49252	-0.8487

628	-0.1121	1.73433	3.77063	1.74364	-0.2024	1.63841	0.79436	-0.9861
629	-0.2183	1.54383	3.67923	1.40599	-0.4071	1.5195	0.14423	-0.8071
630	-0.2326	1.37243	3.60744	1.21168	-0.297	1.55398	0.34091	-0.838
631	-0.3387	1.41044	3.67812	1.2377	-0.0683	1.63048	0.45836	-0.9678
632	-0.2372	1.55471	3.72134	1.31098	-0.2874	1.71612	0.58768	-0.851
633	-0.3202	1.36596	3.52349	1.3297	-0.4129	1.48686	0.50118	-0.7957
634	-0.3038	1.52937	3.5716	1.43298	-0.4273	1.54678	0.14273	-1.2868
635	-0.1325	1.68831	3.73756	1.61179	-0.2394	1.66853	0.55234	-0.8582
636	-0.2999	1.5916	3.54862	1.4674	-0.0859	1.60423	0.75652	-0.944
637	-0.35	1.5087	3.35535	1.42351	-0.2453	1.49638	0.23177	-0.7175
638	-0.0523	1.65151	3.76699	1.71213	0.16572	1.71799	0.52799	-0.6532
639	0.18569	1.43258	3.76267	1.25172	-1.0185	1.6471	-0.2211	-1.0667
640	0.03997	1.39508	3.7142	1.33479	-1.0939	1.61429	0.04223	-1.0392
641	0.08701	1.42798	3.70803	1.40745	-1.1048	1.64634	0.14264	-0.8678
642	0.31972	1.60334	3.88932	1.47531	-1.0282	1.82337	0.36532	-0.9445
643	0.39586	1.7115	3.9045	1.66032	-0.8866	1.85654	0.28649	-0.9513
644	0.23395	1.62077	3.95196	1.41136	-1.2649	1.84014	0.2679	-0.8882
645	0.26702	1.56407	3.81589	1.42617	-1.1277	1.75176	0.33442	-0.9803
646	0.34273	1.64028	4.00007	1.61096	-0.9697	1.91177	0.23775	-0.8601
647	0.35934	1.69383	3.97117	1.50177	-0.8639	1.94294	-0.0179	-0.6981
648	0.46306	1.74924	4.15337	1.54936	-1.0392	2.05572	-0.058	-1.2596
649	0.26447	1.51864	3.84213	1.31885	-1.1108	1.84149	-0.091	-0.8535
650	0.18897	1.49624	3.96486	1.30364	-0.941	1.9357	0.22012	-0.9618
651	0.38363	1.66744	4.13312	1.41669	-1.1517	1.96769	0.03949	-0.8299
652	0.17144	1.36934	3.96523	1.12153	-0.9731	1.81945	-0.1007	-1.1616
653	0.41632	1.58624	4.06716	1.45987	-0.7466	2.03663	-0.0595	-0.8204
654	0.67444	1.66297	4.30969	1.43332	-0.7025	2.03212	-0.0518	-1.0319
655	0.58736	1.6586	4.12289	1.37513	-0.601	1.95552	0.07617	-0.7714
656	0.3987	1.46109	3.84434	1.32689	-0.8696	1.79053	0.08456	-0.9566
657	0.09624	1.42903	3.86671	1.22196	-0.9253	1.8409	0.01866	-0.9516
658	0.38773	1.63131	4.13502	1.41553	-0.7054	2.11762	0.06194	-0.6553
659	0.66622	1.93801	3.42157	1.47056	-0.1276	1.20542	0.08958	-0.6543
660	0.60368	1.69515	3.38602	1.14695	-0.6382	1.24416	0.16317	-0.7421
661	0.64049	1.85402	3.44604	1.38317	-0.7174	1.27565	0.0404	-0.7373
662	0.41949	1.60377	3.39091	1.25626	-1.3491	1.34918	0.08614	-0.8106
663	0.40879	1.42376	3.68663	1.31657	-1.0543	1.4684	0.10551	-1.0154
664	0.3549	1.33651	3.36706	1.02923	-1.0824	1.23973	0.08553	-1.0824
665	0.3812	1.23282	3.2514	0.99805	-1.2144	1.35076	-0.1471	-0.8854
666	0.23069	1.14973	3.29802	1.01002	-1.1726	1.25816	-0.1636	-1.2042
667	0.18833	1.27691	3.3067	0.98248	-1.2236	1.48363	-0.1977	-1.0705
668	0.33602	1.20096	3.11052	1.01577	-1.2135	1.25004	-0.008	-1.3566
669	0.01297	1.09861	2.82742	0.93073	-1.2853	0.90542	-0.2132	-1.4096
670	0.12269	1.26706	2.86148	1.01153	-1.2427	0.96842	0.06322	-1.3514
671	0.14138	1.24656	2.95458	1.04693	-0.7879	1.01277	-0.0419	-1.476
672	0.09877	1.26231	3.46824	0.98216	-1.2142	0.93445	-0.0365	-0.5288
673	-0.229	1.24697	2.90929	0.99319	-0.8677	0.664	-0.0379	-2.1224

674	0.0123	1.40165	3.29898	1.12766	-0.8324	0.96209	0.11276	-1.2049
675	0.01013	1.34318	3.32414	1.17532	-0.9197	1.02318	0.07906	-1.1725
676	-0.1612	1.30824	3.26568	1.11566	-0.9497	0.99004	0.13882	-1.9385
677	0.06675	1.38788	3.42098	1.16904	-0.8386	0.92839	0.23668	-1.1898
678	0.25835	1.56802	3.61069	1.25695	-0.8929	1.01736	0.25615	-0.9574
679	0.21553	1.41895	3.44176	1.13536	-1.0418	0.86236	0.05031	-1.158
680	-0.1073	1.19604	3.38883	1.07505	-1.187	0.64642	-0.1342	-1.6675
681	-0.0648	1.08308	3.3424	0.92791	-1.2265	0.69924	-0.2275	-1.7875
682	-0.041	1.03702	3.18802	0.94552	-1.2471	0.84501	-0.269	-1.6607
683	-0.0621	1.04631	3.14908	0.94965	-1.2577	0.99886	-0.2557	-1.4128
684	0.14546	1.20254	3.15634	0.90271	-1.2568	1.17504	-0.2153	-1.1288
685	0.35993	1.46343	3.10044	1.09477	-1.2442	1.04816	-0.1107	-1.5905
686	0.38826	1.0814	2.93933	0.94848	-1.1604	0.84676	-0.1667	-1.093
687	0.35257	1.06837	3.07307	0.98611	-1.0866	1.28507	-0.0877	-1.4387
688	0.12615	1.19301	3.53506	0.94126	-1.1445	1.45776	-0.0067	-0.8071
689	0.34374	1.51408	3.74658	1.44494	-1.1245	1.68883	0.0309	-0.6447
690	0.3444	1.31985	3.646	1.06555	-1.1799	1.57455	0.47174	-1.3884
691	0.33996	1.36395	3.72781	1.0619	-1.1307	1.59513	-0.0183	-1.25
692	0.38032	1.33169	3.48886	1.05863	-1.2338	1.41758	-0.1344	-1.3144
693	0.26889	1.09715	3.5771	1.00761	-1.2217	1.37005	-0.2848	-1.2852
694	0.12161	1.15517	3.22283	1.01941	-1.2775	1.45164	-0.1189	-1.1935
695	0.35993	1.37059	3.61765	1.06415	-1.2351	1.5354	0.1588	-1.4893
696	0.44466	1.55405	4.01845	1.30403	-1.1079	1.80726	0.14006	-1.0293
697	0.33539	1.44906	3.80466	0.99129	-1.1964	1.60868	0.0083	-0.9628
698	0.50617	1.51025	4.0422	1.29513	-1.0541	1.80469	0.09649	-0.8629
699	0.50895	1.58635	3.9956	1.2961	-1.1628	1.79105	0.22553	-0.9112
700	0.3101	1.54936	3.77325	1.47503	-0.953	1.60178	0.12566	-1.0354
701	0.22298	1.52969	3.73515	1.34094	-1.1275	1.57163	-0.0902	-1.1712
702	0.60218	1.83833	4.11464	1.70766	-0.6289	1.95064	0.32777	-0.5685
703	0.17435	1.4957	3.88249	1.25265	-1.0421	1.70702	-0.2183	-1.4116
704	0.38455	1.6148	3.99378	1.49612	-1.0676	1.83128	-0.1127	-1.1461
705	0.4444	1.73309	4.27557	1.55349	-0.9256	2.00029	0.14768	-1.1416
706	0.6981	1.74819	4.28203	1.43314	-0.5354	1.97065	0.03892	-0.6767
707	0.35215	1.4816	3.89713	1.11507	-0.9954	1.7365	-0.0243	-1.1545
708	0.5515	1.7581	4.05333	1.53611	-0.8865	1.85772	0.25923	-0.7368
709	0.38688	1.41957	3.89628	1.22258	-0.7657	1.65039	-0.3069	-1.4648
710	0.50225	1.59003	4.03192	1.42859	-0.6682	1.82736	0.26236	-1.2072
711	0.45825	1.44898	4.03898	1.21443	-1.0436	1.77027	-0.1334	-1.072
712	0.56259	1.65619	4.22604	1.47876	-0.8796	1.95745	0.35788	-0.6704
713	0.41361	1.49709	3.98634	1.27242	-1.0026	1.74608	0.28904	-0.983
714	0.58936	1.60903	4.10596	1.47755	-0.8541	1.89752	0.10819	-0.7525
715	0.47	1.44799	4.13326	1.25044	-1.2088	1.92951	0.2494	-0.6751
716	0.33822	1.34143	3.82125	1.27434	-1.0194	1.7444	0.14277	-0.8454
717	0.61128	1.68976	4.21598	1.48209	-0.5791	2.04351	0.33265	-0.442
718	0.5106	1.58326	4.27164	1.44679	-1.0292	2.03404	0.15383	-0.6622
719	0.40517	1.45578	4.12922	1.24737	-0.8994	1.8009	-0.0044	-0.6495

720	0.5005	1.65119	4.22692	1.54228	-0.7965	1.98423	0.07107	-0.6431
721	0.17082	1.34606	3.86429	1.20638	-0.9248	1.8193	-0.5141	-1.2483
722	0.70257	1.79659	4.37135	1.69436	-0.5675	2.11951	-0.0076	-0.8053
723	0.40745	1.62364	4.17387	1.62856	-0.4444	1.98711	-0.1811	-0.5017
724	0.21827	1.51685	3.98096	1.53732	-0.8985	1.75732	-0.0715	-1.0094
725	0.4518	1.72761	4.1321	1.49072	-0.9405	1.91227	-0.0073	-1.1432
726	0.37068	1.45994	4.01295	1.36537	-0.6136	1.83628	0.05469	-0.8886
727	0.14796	1.40481	3.67821	1.16112	-0.9953	1.6251	-0.1649	-0.8868
728	0.27688	1.39754	3.39411	0.989	-1.1425	1.35235	-0.3526	-1.0522
729	0.35912	1.4612	3.28272	1.23948	-0.8647	1.04965	-0.456	-1.7972
730	0.36137	1.59059	3.35154	1.08014	-0.8033	1.05424	-0.409	-0.9563
731	0.5879	2.05279	3.61152	1.61974	-0.1417	1.38206	-0.5225	-0.6995
732	0.30914	1.762	3.36349	1.303	-0.6484	0.94651	-0.583	-0.9063
733	-0.2211	1.54841	3.75955	1.29122	-0.5524	1.80537	-0.1662	-1.0339
734	-0.1831	1.49765	3.6662	1.45481	-0.7384	1.78742	0.28431	-1.2668
735	-0.171	1.51682	3.67398	1.31665	-0.6032	1.70443	0.19322	-0.8464
736	-0.2866	1.49466	3.64541	1.29216	-0.6548	1.65151	0.11221	-1.0083
737	-0.1783	1.58792	3.68965	1.51423	-0.3715	1.72659	0.07735	-0.6683
738	0.2093	1.88215	4.02045	1.87979	-0.1364	2.00912	0.35623	-0.6021
739	0.30778	2.06035	3.97155	1.97812	0.1184	2.05067	0.51527	-0.5209
740	0.30959	2.02637	3.9164	1.87504	0.14598	2.04264	0.47801	-0.5444
741	0.43061	2.12842	4.32366	2.02565	0.02627	2.17722	0.52872	-0.6303
742	0.46069	1.94392	4.35891	1.72384	-0.2974	2.20185	0.66792	-0.2531
743	0.33664	1.89701	4.32001	1.75498	-0.2297	2.15768	0.40204	-0.5323
744	0.39289	1.93182	4.0323	1.63569	0.0333	2.08005	0.44846	-0.9877
745	0.36811	1.71848	3.85243	1.52272	-0.1708	2.04069	0.52164	-0.722
746	0.15602	1.50262	3.74802	1.39928	-0.2088	1.84273	0.21307	-1.1386
747	0.62582	1.45718	4.14623	1.74709	0.11351	2.24238	0.89571	-0.9792
748	0.21704	1.02494	3.69565	1.39806	-0.4214	1.74915	0.43691	-1.0071
749	0.5492	1.33201	4.04003	1.78781	-0.2638	2.06254	0.70257	-0.5385
750	0.34696	1.41545	3.82426	1.60229	-0.5962	1.5956	0.33793	-0.7034
751	0.51052	1.53705	4.01449	1.86174	-0.4654	1.63394	0.606	-0.4389
752	0.2508	1.19329	3.70346	1.41224	-0.7785	1.24573	0.24166	-0.7288
753	0.06953	1.56841	3.59531	1.49043	-1.047	1.1619	0.21107	-0.5447
754	0.28768	1.9926	3.7962	1.94266	-0.7187	1.31635	0.69567	0.05526
755	0.33989	2.11112	3.68305	2.08228	-0.4527	1.33279	0.51608	0.04679
756	0.52281	2.19972	3.64351	2.07974	-0.7466	1.38274	0.61767	0.14397
757	0.32704	2.10974	3.4501	1.99574	-0.8376	1.40156	0.58825	-0.1313
758	0.4724	2.11962	3.3666	2.02571	-0.6203	1.51666	0.75007	-0.1753
759	0.11618	1.89647	2.97615	1.72399	-0.9125	1.21952	0.12628	-0.4895
760	0.52159	2.24021	3.54826	2.06686	-0.8317	1.64707	0.63813	-0.0154
761	0.28999	2.0898	3.46548	1.98864	-0.6103	1.48259	0.41298	-0.5694
762	0.27851	1.95874	3.34075	1.89649	-0.8467	1.45884	0.20451	-0.3663
763	-0.1322	1.55381	3.134	1.59698	-0.9885	1.12474	0.25624	-0.9052
764	0.2689	1.94661	3.35725	1.87759	-0.5638	1.49236	0.54055	-0.7589
765	0.29497	1.97783	3.57824	1.86362	-0.453	1.50262	0.43496	-0.849

766	0.40333	2.02986	3.49447	1.95606	-0.3335	1.67783	0.44654	-0.8131
767	0.57185	2.15425	3.78949	2.14802	-0.2493	1.83581	0.88068	-0.3702
768	0.11364	1.76758	3.55135	1.65527	-0.7685	1.53085	0.34654	-0.7571
769	0.19537	1.86702	3.66755	1.80902	-0.8336	1.61944	0.18724	-0.6863
770	0.05809	1.60672	3.47561	1.58129	-1.1731	1.46117	0.05281	-1.332
771	0.18406	1.72497	3.59755	1.50987	-0.6879	1.53571	0.25402	-0.6209
772	0.12476	1.59278	3.55797	1.54542	-1.1574	1.49838	0.06433	-0.8397
773	0.37661	1.67834	3.82716	1.48916	-0.677	1.67691	0.22026	-1.0693
774	0.36889	1.53764	3.79261	1.28271	-1.1948	1.72121	0.26858	-1.284
775	0.4699	1.66864	4.01636	1.39927	-0.8726	1.79512	0.20769	-1.0509
776	0.41727	1.48627	4.06501	1.33925	-0.789	1.84805	0.61407	-1.0111
777	0.40333	1.54381	3.9101	1.44002	-0.9203	1.73976	0.34727	-0.9447
778	0.60775	1.74482	4.14299	1.44843	-0.7753	1.87059	0.32969	-0.6602
779	0.54296	1.5451	3.94311	1.45328	-1.0312	1.70531	0.25767	-0.8081
780	0.59736	1.68604	4.01399	1.53335	-0.9456	1.8675	0.76323	-1.1944
781	0.40918	1.53619	3.79608	1.39389	-1.0664	1.57787	0.47325	-0.9678
782	0.28456	1.41598	3.68759	1.26092	-0.9335	1.53688	0.95013	-1.1603
783	0.46019	1.63383	3.92713	1.49117	-1.1265	1.71726	0.89511	-1.0552
784	0.55389	1.72258	4.00833	1.71598	-0.865	1.76473	1.01904	-0.8575
785	0.61054	1.82855	3.99242	1.9503	-1.3056	1.88707	0.58976	-1.2139
786	0.40058	1.64584	3.91836	1.8042	-1.0519	1.75887	0.48393	-1.2023
787	0.22796	1.58958	3.61265	1.55883	-1.2021	1.46133	0.42869	-0.8112
788	0.26318	1.6135	3.41518	1.70245	-0.9655	1.4118	0.36478	-0.9464
789	0.43198	1.77659	3.60253	1.66525	-0.977	1.55202	0.19639	-1.1855
790	0.53352	1.87934	3.90257	1.82104	-0.5882	1.82534	0.07118	-0.7899
791	0.18169	1.46998	3.64844	1.39715	-0.9201	1.65615	0.24973	-1.0415
792	0.0518	1.43307	3.60893	1.29143	-0.9528	1.59721	0.17314	-1.2515
793	0.06732	1.41026	3.55046	1.29629	-1.0175	1.53169	-0.0538	-0.9648
794	0.09893	1.52412	3.58718	1.34316	-1.0357	1.56221	-0.0423	-0.9155
795	0.18381	1.58822	3.64631	1.4197	-1.0455	1.62702	0	-0.694
796	0.03788	1.55466	3.63618	1.4508	-0.8784	1.73714	0.1811	-0.7936
797	0.08294	1.53032	3.67805	1.43764	-0.8135	1.6854	0.13269	-0.7422
798	0.06054	1.39517	3.58259	1.19216	-0.8859	1.60303	-0.1049	-1.0979
799	0.32444	1.57133	3.90142	1.39047	-1.1336	1.78585	-0.0824	-0.928
800	0.31132	1.66642	3.98555	1.60614	-1.0894	1.88563	0.31358	-0.7679
801	0.2046	1.54557	3.82562	1.52504	-1.2519	1.76394	0.26023	-0.7502
802	0.19501	1.47864	3.76462	1.35061	-1.2312	1.69867	0.24061	-1.0692
803	0.34189	1.65754	3.85053	1.60635	-0.9406	1.80257	0.23252	-1.0053
804	0.26469	1.65152	3.98271	1.4421	-1.2341	1.87088	0.29864	-0.8575
805	0.26618	1.56323	3.81505	1.42533	-1.1285	1.75092	0.33358	-0.9811
806	0.36984	1.66739	4.02717	1.63807	-0.9426	1.93888	0.26485	-0.833
807	0.28333	1.61782	3.89516	1.42576	-0.9399	1.86693	-0.0939	-0.7741
808	0.64247	1.92865	4.33278	1.72877	-0.8598	2.23513	0.12139	-1.0802
809	0.4154	1.66958	3.99307	1.46979	-0.9598	1.99243	0.05996	-0.7026
810	0.29482	1.6021	4.07071	1.40949	-0.8352	2.04155	0.32597	-0.8559
811	0.26955	1.55336	4.01904	1.30262	-1.1885	1.85361	-0.0746	-0.944

812	0.35872	1.55662	4.15251	1.30881	-1.0433	2.00673	0.08655	-0.9743
813	0.41632	1.58624	4.06716	1.45987	-0.9815	2.03663	-0.0595	-0.8204
814	0.60386	1.5924	4.23911	1.36275	-0.773	1.96155	-0.1224	-1.1025
815	0.62673	1.69797	4.16227	1.41451	-0.5616	1.99489	0.11555	-0.732
816	0.69624	1.75863	4.14188	1.62442	-0.5721	2.08807	0.38209	-0.6591
817	0.38507	1.71786	4.15554	1.51079	-0.8798	2.12973	0.30748	-0.6628
818	0.48122	1.72479	4.22851	1.50901	-0.8469	2.21111	0.15542	-0.5618
819	0.4355	1.53279	4.21211	1.41064	-1.1878	2.09782	0.14628	-0.7158
820	0.47215	1.57786	4.2098	1.42027	-0.9771	2.06904	0.19386	-0.5409
821	0.5728	1.58208	4.3336	1.40737	-1.6948	2.16284	0.08784	-0.6909
822	0.53512	1.60164	4.35513	1.23708	-1.2372	2.10474	0.05764	-0.833
823	0.1941	1.51941	4.24783	1.24855	-0.8987	1.99473	-0.0383	-1.2543
824	0.31488	1.55451	4.27243	1.40754	-1.3117	2.06165	-0.3403	-1.2884
825	0.38127	1.38192	4.24786	1.20164	-1.3558	1.98087	0.22392	-0.9255
826	0.32481	1.62532	4.25	1.48365	-1.0986	2.13178	0.23967	-1.0694
827	0.42087	1.46649	4.24975	1.1801	-1.1484	2.04092	0.30585	-1.1329
828	0.52791	1.49423	4.37481	1.16368	-1.3134	2.12763	0.08937	-1.2454
829	0.50221	1.5656	4.36244	1.07308	-1.1307	2.18473	0.24591	-0.6447
830	0.64737	1.72238	4.47154	1.5336	-0.7547	2.28185	0.46492	-0.4966
831	0.4784	1.57035	4.32366	1.27035	-0.9873	2.09009	0.18071	-0.8233
832	0.30278	1.64859	4.22988	1.22411	-0.7162	2.05356	0.18438	-0.9745
833	0.56087	1.80579	4.45373	1.4526	-0.6168	2.24978	0.35734	-0.68
834	0.98273	2.04788	4.80888	1.68636	-0.8033	2.33873	0.41751	-0.1448
835	1.02629	1.89444	4.64981	1.50278	-0.9731	2.21743	0.02752	-0.7143
836	0.61142	1.56441	4.2663	1.17096	-1.6375	1.95769	0.04441	-1.3562
837	0.5716	1.50514	4.29106	1.08635	-1.0477	1.92404	0.02238	-1.2909
838	0.72329	1.67939	4.34626	1.49249	-0.7161	2.05243	0.4234	-1.2202
839	0.78225	1.76219	4.41856	1.47979	-0.8426	2.30631	0.42498	-0.4603
840	0.56256	1.59151	4.24536	1.34678	-1.2369	2.05036	-0.0188	-0.9142
841	0.56283	1.61051	4.33158	1.39749	-0.9168	2.11898	0.1701	-0.6218
842	0.60653	1.66294	4.2879	1.38737	-0.8643	2.03228	0.26037	-1.5652
843	0.6583	1.62697	4.19521	1.36966	-1.2077	2.18567	0.52762	-1.1432
844	0.8015	1.68984	4.35658	1.49273	-1.2632	2.05183	0.0061	-1.145
845	0.55345	1.47931	4.11933	1.22443	-0.7143	2.0212	0.35889	-0.9482
846	0.75638	1.82643	4.26263	1.62278	-0.6894	2.18261	0.39741	-1.0761
847	0.57982	1.66185	4.10142	1.58875	-0.7673	1.90246	-0.2549	-1.1575
848	0.54319	1.62018	4.08239	1.29622	-0.9079	2.00469	0.27712	-0.8473
849	0.65158	1.81833	4.30767	1.62409	-0.7111	2.15595	0.29054	-1.2116
850	0.52898	1.75483	4.21166	1.52034	-1.0575	2.18069	0.41223	-0.7864
851	0.3376	1.69773	4.16134	1.53429	-1.013	2.07192	0.08039	-1.3249
852	0.31088	1.65302	4.14119	1.47453	-0.9823	2.01708	-0.0538	-1.0362
853	0.19675	1.5716	4.09726	1.41086	-1.1017	1.98075	-0.0186	-1.1753
854	0.18682	1.55445	4.08074	1.39428	-0.9762	1.96407	0.07339	-0.995
855	0.29231	1.60528	4.18606	1.46952	-1.0802	2.05876	0.23874	-0.8513
856	0.29911	1.61659	4.22973	1.53208	-0.947	2.08865	0.30821	-0.7724
857	0.29424	1.58838	4.22805	1.5449	-0.9721	2.07118	0.37805	-0.9435

858	0.21598	1.58846	4.23873	1.41559	-1.1327	2.1003	0.01075	-0.7707
859	0.14371	1.59622	4.12671	1.37231	-1.0033	1.94807	-0.0476	-0.9188
860	0.29731	1.64741	4.08759	1.37234	-0.9574	2.00748	0.33393	-0.7403
861	0.18889	1.6676	4.07932	1.52777	-0.856	2.02099	0.46788	-0.8694
862	0.28922	1.71868	4.08178	1.54419	-0.9132	1.93735	0.35048	-0.5043
863	0.27699	1.74983	4.10178	1.47235	-1.0231	2.01318	0.35455	-0.9453
864	-0.0805	1.40798	3.76258	1.24598	-1.1212	1.69129	-0.1621	-1.1265
865	0.11906	1.63684	3.87094	1.42941	-0.9322	1.85381	0.08445	-1.0266
866	0.09634	1.5965	3.95775	1.5351	-1.0561	1.81696	0.20444	-0.8008
867	-0.0562	1.5476	3.79452	1.46369	-1.0346	1.77142	0.31893	-0.8765
868	0.141	1.83209	3.92312	1.63868	-1.0568	1.90365	0.1774	-0.675
869	0.20335	1.84322	3.91063	1.70154	-0.8005	1.871	0.44312	-0.8048
870	0.21526	1.76284	3.95203	1.61186	-0.989	1.88182	0.12955	-0.4172
871	0.26775	1.8317	3.91542	1.63209	-1.1409	1.97984	0.42799	-0.4254
872	0.1161	1.59842	3.79149	1.47443	-0.9376	1.77951	0.19233	-0.7733
873	0.17596	1.56608	3.88776	1.38344	-1.2258	1.7808	0.41178	-0.697
874	0.32258	1.65869	3.85377	1.4532	-1.345	1.90484	0.23412	-0.8473
875	0.39227	1.65129	4.03673	1.57377	-1.2536	1.94457	0.33403	-0.9689
876	0.51988	1.76431	4.17613	1.59404	-1.1122	2.04701	0.29154	-0.8567
877	0.60598	1.74217	4.2481	1.4366	-0.9719	1.97671	-0.1024	-1.2226
878	0.63552	1.69573	4.30051	1.25578	-0.9536	2.05873	-0.1399	-0.7739
879	0.4886	1.53718	4.26982	1.17376	-1.0959	2.04061	-0.2357	-0.7379
880	0.39399	1.45841	4.2989	1.06626	-1.207	2.06492	-0.4989	-0.9051
881	0.57139	1.42174	4.44647	1.14527	-1.0294	2.21123	-0.2175	-1.5518
882	0.4884	1.4087	4.36232	0.97636	-1.5828	2.07884	-0.2095	-0.8238
883	0.45126	1.55519	4.20873	1.31771	-1.0028	2.06375	-0.8236	-1.3715
884	0.40256	1.46993	4.17246	1.03117	-1.2076	2.00119	-0.6178	-1.287
885	0.45939	1.62319	4.19188	1.32489	-0.9508	2.19522	0.19334	-0.7921
886	0.36727	1.58087	4.09138	1.32875	-1.0322	2.02284	-0.0535	-1.1864
887	0.99422	2.06959	4.75061	1.79421	-0.9787	2.54809	0.46673	-0.1123
888	1.22581	2.3142	4.88182	1.87292	-0.5633	2.47589	0.28677	-0.1685
889	0.04368	1.31738	3.8699	0.99853	-1.4604	2.03202	-0.149	-1.5544
890	0.63007	2.13136	4.59665	1.91522	-0.6235	2.44683	0.074	-0.6838
891	0.49986	2.09316	4.55	1.80836	-0.7722	2.40037	-0.0606	-0.8873
892	0.54893	2.04136	4.34823	1.84778	-0.9708	2.31966	0.33706	-0.9854
893	0.30531	1.92056	4.11825	1.73785	-0.6183	2.15964	0.45641	-0.4645
894	0.43645	2.23173	4.4618	2.01375	-0.5349	2.61143	0.74019	-0.0844
895	0.44591	1.99697	4.29873	1.81024	-0.6421	2.1696	0.40149	-0.3134
896	0.74729	2.22843	4.48661	2.03029	-0.9142	2.36922	0.7059	-0.4213
897	0.48928	2.02515	4.31488	1.89087	-0.7846	2.20663	0.34414	-0.8005
898	0.29581	1.73317	4.10752	1.5978	-1.0477	1.9929	0.18201	-0.6565
899	0.21844	1.6646	4.18927	1.72471	-1.1704	2.02677	0.44449	-0.8548
900	0.00679	1.5615	3.95211	1.43326	-0.9531	1.88539	0.07301	-0.8685
901	0.12287	1.56851	4.07806	1.55963	-1.2146	1.92616	0.04913	-1.3082
902	0.32886	1.67437	4.04689	1.48837	-1.0175	1.95295	-0.0574	-0.8073
903	0.42753	1.61094	4.33762	1.31425	-1.0698	2.08332	-0.019	-0.9932

904	0.6135	1.84608	4.53503	1.66345	-0.8764	2.29418	0.24398	-0.7297
905	0.48353	1.64297	4.28895	1.35768	-0.81	2.20177	0.68413	-1.3863
906	0.43231	1.62804	4.3273	1.49794	-1.0296	2.08135	0.0546	-1.3307
907	0.18841	1.57298	3.97149	1.27639	-1.2244	1.82506	-0.068	-1.092
908	0.1719	1.59461	4.0397	1.33827	-1.2627	1.98139	0.35044	-1.1259
909	0.02336	1.58197	4.02013	1.30439	-1.0524	1.90806	0.23471	-1.0815
910	0.61472	1.97994	4.47471	1.77389	-0.5676	2.22168	0.39359	-0.4698
911	0.18061	1.55575	4.12227	1.4548	-0.7396	1.81072	0.26493	-1.0291
912	0.56578	1.85073	4.42043	1.67618	-0.4916	2.11826	0.34844	-0.9816
913	0.4914	1.761	4.20215	1.60652	-0.8633	1.92259	0.2833	-0.7986
914	0.34173	1.72951	3.98135	1.54433	-1.2436	1.81646	0.23365	-1.1414
915	0.27522	1.52943	3.9296	1.29477	-1.4215	1.7026	-0.1087	-1.0638
916	0.42234	1.75359	4.04705	1.52844	-1.6786	1.84495	-0.1234	-0.8705
917	0.27813	1.62539	4.03842	1.39233	-1.2129	1.84259	0.15131	-0.7959
918	0.44228	1.67057	3.99369	1.64969	-1.2877	1.84296	0.1643	-0.7501
919	0.34277	1.61516	3.87238	1.24821	-1.1166	1.76303	-0.0172	-0.9078
920	0.53478	1.79436	4.09804	1.59184	-1.2793	1.84699	-0.048	-0.8192
921	0.52499	1.91807	3.96949	1.66994	-1.2144	2.01421	0.19868	-0.6559
922	0.59201	1.91216	4.05486	1.66245	-0.8672	2.02298	0.24077	-0.9575
923	0.43125	1.80877	4.06153	1.61771	-1.1361	1.92794	0.22861	-0.7505
924	0.51838	2.04465	3.99985	1.95625	-0.772	1.98959	0.26645	-0.7922
925	0.37609	1.86003	3.9875	1.77208	-0.9788	1.84383	-0.0052	-0.9124
926	0.47692	2.04889	3.98461	1.87133	-0.9551	1.93423	0.19983	-1.0863
927	0.35962	1.85969	3.9254	1.74944	-1.1851	1.87788	-0.0656	-1.3033
928	0.40738	1.85011	4.04396	1.57289	-1.2474	1.85848	-0.0116	-1.259
929	0.16789	1.60843	3.8499	1.39008	-1.5698	1.71559	-0.2686	-0.9356
930	0.40547	1.79206	4.09753	1.51445	-1.2143	1.92137	-0.1106	-1.2143
931	0.48241	1.84252	4.13851	1.54929	-1.1509	2.03973	-0.0138	-1.0649
932	0.43218	1.69932	4.13706	1.42023	-1.2641	1.95234	-0.209	-1.3301
933	0.51611	1.68035	4.16044	1.37803	-1.3451	2.01649	0.1349	-1.0922
934	0.40518	1.53278	4.12649	1.43027	-1.2673	1.96249	-0.0171	-0.8321
935	0.35315	1.64957	4.11715	1.33906	-1.6299	1.92318	0.02431	-0.8864
936	0.34689	1.68717	4.26692	1.47348	-1.4064	2.10337	0.23832	-0.9482
937	0.28792	1.66209	4.13259	1.41975	-1.078	1.96397	-0.1172	-0.9702
938	0.72401	2.10818	4.50012	1.94466	-0.9214	2.4365	0.44173	-0.3004
939	0.29592	1.65952	4.43275	1.52356	-1.2899	2.17028	-0.0478	-1.1546
940	0.25193	1.59229	4.25241	1.36315	-0.9205	2.06337	-0.0493	-0.9205
941	0.42989	1.83697	4.34915	1.6682	-0.9824	2.34222	0.21546	-0.8764
942	0.2342	1.57394	4.19827	1.29714	-0.9705	2.08695	-0.2443	-0.973
943	0.12333	1.56791	4.06358	1.19955	0.53615	1.89059	-0.1831	-1.0564
944	-0.1479	1.43066	3.69696	1.31657	0.54738	1.58097	0.20939	-1.1108
945	-0.0164	1.73147	3.56683	1.54846	0.0507	1.76374	0.09993	-0.7921
946	-0.0097	1.64084	3.89894	1.43852	0.20925	1.81712	0.54348	-0.6718
947	0.33733	1.99797	4.17705	1.90546	0.61147	2.1539	0.90811	-0.1978
948	-0.1284	1.62869	3.70601	1.4496	0.46122	1.67907	0.41482	-0.8051
949	-0.069	1.74223	3.80266	1.64581	0.42121	1.78539	0.64824	-0.5376

950	0.00751	1.95591	3.98943	1.84932	0.56606	1.97108	0.74933	-0.195
951	-0.2835	1.62709	3.6334	1.51104	0.33703	1.61811	0.11768	-0.9948
952	-0.0746	1.60816	3.82173	1.47546	0.30303	1.63318	-0.0974	-0.7638
953	-0.1564	1.63989	3.82681	1.48998	0.06236	1.6037	0.78569	-0.6623
954	-0.0999	1.70753	4.06666	1.7955	0.18606	1.74466	0.64175	-0.5665
955	-0.1543	1.47237	3.85732	1.46027	0.18556	1.50858	0.74186	-0.8704
956	-0.1309	1.55413	3.74525	1.33286	0.46725	1.47856	-0.1033	-1.1165
957	-0.3889	1.53854	3.7186	1.37898	0.01323	1.34724	0.17871	-1.4705
958	-0.3215	1.45092	3.4265	1.22336	-0.0808	1.43274	-0.0554	-1.2189
959	-0.1363	1.62647	3.78798	1.62248	0.10178	1.57906	0.50288	-1.1748
960	-0.3322	1.43573	3.62574	1.29409	0.15109	1.38173	-0.1762	-1.4079
961	-0.1252	1.64713	3.76482	1.42747	0.22844	1.44952	0.04921	-0.9685
962	-0.078	1.7561	3.74494	1.59044	0.32381	1.60623	0.47038	-0.85
963	-0.0187	1.67622	3.72384	1.43957	0.43486	1.49517	0.33425	-1.0165
964	-0.0507	1.71565	3.84121	1.66629	0.50448	1.53009	-0.0099	-0.8842
965	-0.2642	1.49022	3.75958	1.34206	0.20209	1.45657	-0.1627	-1.5111
966	-0.3109	1.28357	3.76933	1.13357	-0.0755	1.576	-0.2969	-0.9403
967	-0.1531	1.37128	4.06	1.30484	-0.2792	1.70275	-0.1759	-1.8635
968	0.13235	1.38322	4.26856	1.00022	-0.2184	1.90351	-0.4844	-0.5944
969	0.19491	1.473	4.39349	1.36962	-0.4315	2.09972	-0.384	-1.4526
970	0.28573	1.48779	4.50556	0.98034	-1.0491	2.18611	-0.7259	-1.2835
971	0.04177	1.12714	4.18261	0.58338	-1.1209	1.8065	-0.4514	-1.6194
972	0.12766	1.46183	4.24547	1.31578	-0.8176	2.16552	0.22484	-1.6984
973	-0.002	1.6548	4.13964	1.41032	-0.8736	2.07538	0.41454	-0.8712
974	0.20743	1.69701	4.30287	1.5967	-0.6436	2.13025	0.43405	-0.8402
975	0.12596	1.69408	4.04076	1.52821	-0.9718	2.01749	0.13959	-0.9978
976	0.5956	2.00583	4.54884	2.00019	-0.6874	2.48683	0.60115	-0.7648
977	0.33266	1.75981	4.47051	1.54045	-0.6004	2.22412	0.38125	-0.553
978	0.15791	1.59546	4.25165	1.41163	-0.728	2.09219	0.33213	-0.73
979	0.19374	1.59231	4.15256	1.34603	-0.6822	2.13706	0.02953	-0.852
980	0.09531	1.39608	4.09548	1.25154	-1.0708	1.98094	-0.0304	-0.8522
981	0.53621	1.7391	4.63604	1.38599	-1.0504	2.34114	0.55909	-0.6651
982	0.36076	1.55357	4.52854	1.21422	-0.9328	2.28486	0.50637	-0.8446
983	0.16557	1.25515	4.19497	1.02896	-1.2829	1.93218	0.19425	-1.268
984	0.57522	1.80137	4.46478	1.73228	-1.0905	2.24769	0.58042	-0.9797
985	0.36169	1.64952	4.32779	1.48313	-0.8646	2.16274	0.56073	-0.5016
986	0.81486	1.95061	4.55233	1.76599	-1.001	2.25699	0.78968	-0.5704
987	0.78552	1.57037	4.37076	1.43075	-0.3652	2.11249	0.6907	-1.0957
988	0.64113	1.53254	4.42867	1.49727	-1.2537	2.14653	0.28201	-1.1968
989	0.60585	1.6115	4.42044	1.24164	-1.0013	2.22927	0.32267	-1.1048
990	0.63587	1.75285	4.42845	1.58606	-0.8279	2.22802	0.40476	-0.599
991	0.7044	1.71783	4.54518	1.63886	-0.8575	2.27215	1.04159	-1.0193
992	0.65893	1.63933	4.47247	1.46887	-0.7502	2.2715	1.15753	-1.1626
993	0.70708	1.79082	4.49241	1.59177	-1.2952	2.22149	1.01517	-0.9344
994	1.06985	2.0706	4.82565	1.86023	-0.6061	2.51405	0.8171	-0.5286
995	0.53353	1.43734	4.19692	1.22756	-1.8573	1.9301	0.65831	-1.1047

996	0.82875	1.8467	4.60756	1.50975	-1.07	2.31782	0.57433	-0.3809
997	0.52858	1.64659	4.21303	1.41608	-1.1562	2.05162	0.43887	-1.0263
998	0.38182	1.62102	4.16952	1.54481	-0.9597	1.87233	0.47505	-0.9045
999	0.51978	2.01093	4.27455	1.86946	-0.4553	2.04467	0.40991	-1.2792
1000	0.4861	2.05846	4.13167	1.86748	-0.7143	2.05452	0.59861	-1.4187
1001	0.69189	2.17572	4.35054	2.04781	-0.6336	2.26119	0.51557	-0.6242
1002	0.63963	1.97849	4.34263	1.72477	-0.766	2.20784	0.61904	-1.0166
1003	0.59088	1.84136	4.3393	1.7228	-0.737	2.21141	0.18597	-1.1177
1004	0.39269	1.48925	4.14737	1.2043	-1.1178	1.98862	-0.2713	-1.0781
1005	0.39386	1.49355	4.30856	1.23614	-1.1881	2.11683	-0.234	-1.0692
1006	0.59517	1.64758	4.32118	1.37706	-1.1211	2.11786	0.41891	-0.7737
1007	0.43606	1.56977	4.16675	1.28128	-1.4378	2.03793	-0.1899	-1.0539
1008	0.58911	1.71627	4.54002	1.45766	-0.9644	2.34332	-0.0856	-0.7648
1009	0.47108	1.41311	4.57224	0.90351	-1.3874	2.26787	-0.5481	-1.137
1010	0.73067	1.43591	4.84073	0.93827	-1.5041	2.64132	0.00576	-0.443
1011	0.61178	1.52616	4.92	0.75356	-1.6405	2.51062	-0.6596	-0.5789
1012	0.24717	0.99413	4.50083	0.29559	-1.6483	2.19864	-0.5356	-1.4176
1013	0.49496	1.29898	4.75935	0.95803	-1.3551	2.44391	-0.3653	-0.9356
1014	0.88148	1.97238	4.9061	1.62078	-0.6194	2.60993	-0.3474	-0.7257
1015	0.34916	1.34368	4.7587	1.13136	-1.4871	2.39202	-0.7402	-1.4641
1016	0.52315	1.61562	4.58151	1.34137	-1.1381	2.46643	-0.688	-0.9345
1017	0.93107	1.95763	5.25436	1.59321	-0.728	2.92433	-0.3564	-0.4278
1018	0.79365	1.74066	4.96545	1.29784	-0.624	2.74906	-0.6758	-0.7271
1019	0.61511	1.64462	4.84761	1.30789	-0.6369	2.58892	-0.4369	-0.9386
1020	1.00866	2.07053	5.30488	1.71583	-0.8898	3.048	-0.0853	-0.1759
1021	0.58842	1.62899	4.88516	1.35947	-1.0525	2.64283	-0.2253	-0.6389
1022	1.32591	2.36956	5.67984	2.09141	-0.2671	3.25709	-0.2108	-0.2238
1023	0.68857	1.90276	5.25865	1.4711	-0.7611	3.01175	-0.1139	-0.5011
1024	1.34547	2.31806	5.5388	1.8453	-0.264	3.12201	-0.6088	-0.2206
1025	0.84591	1.64486	5.03358	1.239	-0.8571	2.65916	-0.6043	-1.1601
1026	0.68895	1.61055	5.04229	1.13518	-0.733	2.68364	-0.6765	-0.7716
1027	1.04446	1.99802	5.42661	1.56765	-0.186	3.1198	0.08468	-0.6793
1028	0.46734	1.49249	4.81255	1.2592	-0.6439	2.67616	-0.2912	-0.7366
1029	0.5907	1.71126	5.09398	1.24205	-0.3138	2.77224	-0.5233	-0.3945
1030	0.79706	1.80058	5.34881	1.50211	-0.5151	2.83879	0.13534	-0.6112
1031	0.71117	1.53036	5.18017	1.34021	-0.2314	2.80391	0.0855	-0.5588
1032	0.75608	1.70708	5.09435	1.36032	-0.2168	2.82858	-0.1711	-0.5427
1033	0.71639	1.76558	5.26194	1.65374	0.24315	2.81407	-0.1085	-0.4151
1034	0.22314	1.10354	4.37278	0.90607	-0.2571	2.15589	-0.6079	-1.412
1035	0.46812	1.30772	5.02265	1.19824	-0.4477	2.65557	-0.5649	-1.1671
1036	0.63851	1.63481	5.08188	1.2019	-0.2391	2.73247	-0.3996	-1.2045
1037	1.01716	1.907	5.34024	1.51802	0.20933	2.91865	-0.4091	-0.1773
1038	0.69546	1.47753	5.47156	1.36488	0.03035	2.69969	-0.4617	-0.704
1039	1.09298	1.84671	5.70731	1.34383	0.2664	3.14931	-0.4397	-0.6104
1040	0.96468	1.83491	5.41364	1.40688	-0.1661	2.79643	-0.3418	-0.8189
1041	0.69664	1.4994	5.04343	1.59959	-1.2049	2.57043	-0.5048	-0.6099

1042	0.77555	1.39735	5.1201	1.26453	-0.2359	2.77259	0.16244	-0.9829
1043	0.61604	1.51088	5.25547	0.90877	-0.7566	2.7251	-0.6535	-0.6797
1044	0.73119	1.63034	5.15381	1.24472	-0.0183	2.79985	-0.6703	-0.7064
1045	0.71008	1.77702	5.19277	1.43933	-0.3281	2.80597	-0.5439	-0.8306
1046	0.73131	1.7468	5.33155	1.56521	-0.5568	2.93076	-0.1295	-0.7866
1047	0.76811	1.75855	5.33608	1.67088	-0.6466	2.9148	-0.5564	-0.9796
1048	0.80501	1.64755	5.33722	1.30821	-1.0702	2.79602	-0.5908	-0.777
1049	0.79865	1.52432	5.20413	0.98279	-0.5051	2.61231	-0.615	-1.2054
1050	0.66506	1.37159	5.41428	1.34815	-0.6322	2.66095	-0.3119	-1.2894
1051	0.51469	1.49369	4.97425	1.0109	-0.8895	2.45452	-0.2497	-1.1182
1052	0.71629	1.76978	5.10868	1.24989	-0.3415	2.80589	-0.183	-0.3182
1053	1.08802	2.12602	5.38445	1.64706	0.0852	3.00312	0.46679	-0.2031
1054	0.75869	1.7888	5.1567	1.6415	-0.4713	2.62875	0.49292	-0.4358
1055	0.60148	1.59028	4.93565	1.26458	-0.7518	2.47623	0.07588	-1.1919
1056	0.6102	1.84077	4.81786	1.60789	-0.3477	2.47754	0.53072	-0.5454
1057	0.26206	1.64125	4.46309	1.40581	-0.1274	2.26741	0.31714	-0.9477
1058	0.41546	1.88903	4.68592	1.79951	-0.5929	2.50712	0.74308	-0.4533
1059	0.94563	2.26248	4.99266	2.09177	0.0076	2.84382	0.87896	-0.1861
1060	0.7697	1.99231	4.68007	1.64202	-0.6196	2.38607	0.3885	-0.5388
1061	0.65166	1.84343	4.41047	1.56205	-0.6188	2.37906	0.5133	-1.023
1062	0.35913	1.60144	4.3965	1.41543	-1.4367	2.22911	0.21986	-0.8638
1063	0.23207	1.55496	4.30635	1.42735	-1.2033	2.10625	0.01259	-1.3424
1064	0.24626	1.59347	4.23294	1.36209	-1.0152	2.06411	0.2402	-0.9967
1065	0.17568	1.58835	4.11284	1.29802	-1.0632	1.96084	0.38148	-1.1239
1066	0.42515	1.65011	4.23138	1.67426	-0.6439	2.26317	0.2802	-0.8046
1067	0.65127	1.83112	4.58108	1.77004	-1.159	2.44053	0.33349	-0.5988
1068	0.5046	1.5781	4.31818	1.51392	-1.1302	2.15241	0.44935	-1.2384
1069	0.52934	1.63202	4.4209	1.5797	-0.6966	2.1816	0.72381	-0.5954
1070	0.2242	1.61722	4.00564	1.48501	-1.4196	2.10511	0.43358	-0.6169
1071	0.35186	1.56983	4.3735	1.34799	-0.9984	2.15578	0.54792	-0.7556
1072	0.60081	1.91566	4.56727	1.67472	-0.9151	2.38492	0.77328	-0.415
1073	0.62825	1.66814	4.51043	1.38602	-1.7525	2.20788	-0.0777	-1.0438
1074	0.25089	1.40431	4.16421	1.22743	-1.3099	2.20041	0.39682	-1.1679
1075	0.65336	1.66445	4.62114	1.28998	-0.6942	2.4074	0.38981	-1.0105
1076	0.49313	1.45798	4.34883	1.34424	-0.865	2.16677	0.13645	-0.7638
1077	0.22295	1.28193	4.40133	0.83533	-0.4986	2.07565	0.02522	-0.9135
1078	0.22034	1.17959	4.41689	0.95242	-0.3724	2.15473	-0.0991	-1.1833
1079	0.46434	1.30529	4.76045	0.78884	-0.4457	2.20456	-0.6713	-0.8965
1080	0.7287	1.64318	4.97175	0.83535	-0.3667	2.51245	-0.1149	-0.4748
1081	0.61742	1.07965	4.56548	0.45188	-0.9358	2.22088	-0.1097	-1.1312
1082	0.86696	1.59164	4.95094	1.19406	-0.1006	2.53163	-0.1022	-0.7281
1083	1.11123	1.92167	5.27938	1.43236	0.08749	2.73201	-0.2279	-0.3829
1084	0.88685	1.43502	4.94816	0.70516	-0.6291	2.3921	-0.0877	-0.9971
1085	1.25324	1.83594	5.18327	0.96042	-0.8185	2.74355	-0.3879	-0.4952
1086	1.15878	1.62294	5.37379	1.01404	-0.6358	2.76788	-0.1755	-0.6667
1087	0.85024	1.6701	5.18641	0.93603	-1.0682	2.77184	-0.4184	-0.7281

1088	0.96677	1.62708	5.08796	1.11731	-0.5829	2.71236	-0.8097	-0.9928
1089	1.30661	2.02843	5.44769	1.5748	-0.3416	2.96451	-0.7278	-0.5179
1090	0.87242	1.6331	4.81084	1.13117	-2.0186	2.56898	0.33334	-0.5355
1091	0.85311	1.59416	4.93225	1.45665	-0.596	2.53444	0.15123	-0.9935
1092	1.1711	1.76608	5.08247	1.34707	-0.951	2.6768	0.69052	-0.5231
1093	0.91403	1.59517	4.67342	1.17257	-1.0197	2.36213	-0.2638	-1.1896
1094	0.46936	1.32031	4.63901	0.62374	-1.118	2.21271	-0.5786	-0.9169
1095	0.09389	1.04736	4.4871	0.48016	-1.3796	2.09883	-0.6732	-1.1224
1096	0.42326	1.43815	4.666	1.234	-0.9477	2.28869	-0.2664	-0.9998
1097	0.44983	1.54236	4.90183	0.97647	-1.0152	2.52014	0.00474	-0.9724
1098	0.62872	1.54556	5.04513	1.27617	-0.7121	2.62973	0.16072	-0.7881
1099	0.42422	1.61287	4.86779	1.07481	-0.9137	2.57378	0.88588	-0.4649
1100	0.41419	1.73265	4.60709	1.25965	-1.1629	2.37513	0.06945	-0.6565
1101	0.46138	1.45202	4.79767	1.41117	-0.9592	2.42122	0.51021	-0.5738
1102	0.44962	1.33328	4.49706	1.00232	-0.9288	2.10011	-0.0011	-0.9432
1103	0.55505	1.84086	4.69967	1.05941	-0.8004	2.4951	-0.366	-0.7936
1104	0.83725	1.98192	5.00176	1.55814	-1.0217	2.61264	-0.1823	-0.2635
1105	0.59832	1.64808	4.43283	0.95452	-1.0933	2.08678	-0.4834	-0.8136
1106	0.82624	1.81261	4.66557	1.41707	-0.6604	2.18105	-0.2111	-0.7015
1107	0.26296	1.44258	4.3097	1.35025	-0.9915	1.95527	0.15713	-1.1141
1108	0.55085	1.45537	4.36092	1.40507	-0.92	2.04872	0.88399	-0.703
1109	0.42214	1.39801	4.40538	0.92806	-0.8941	1.86825	0.29506	-0.7826
1110	0.55251	1.48331	4.37643	1.27615	-1.3287	1.95554	0.09454	-0.9433
1111	0.72124	1.7063	4.38574	1.2653	-1.0775	1.96865	0.53364	-0.725
1112	0.81002	1.7671	4.3425	1.88173	-1.0091	2.03065	0.76061	-0.4956
1113	0.22487	1.35441	4.02572	1.2772	-0.9708	1.75782	0.59962	-1.3906
1114	0.55282	1.2912	4.28572	1.28121	-1.0104	1.8668	0.45255	-0.6421
1115	0.6172	1.63943	4.38657	1.21628	-0.966	2.05297	0.82705	-0.658
1116	0.47728	1.71315	4.42008	1.10773	-0.7281	2.25886	0.65996	-0.7317
1117	0.60193	1.57949	4.45253	1.32997	-0.7983	2.13382	0.62373	-0.4829
1118	0.70389	1.62354	4.34805	1.47908	-1.206	2.13934	1.00992	-0.574
1119	0.75131	1.5096	4.29125	1.24562	-0.9617	1.98605	0.85094	-0.2391
1120	0.87342	1.48852	4.34686	0.99335	-1.2952	2.02987	0.27982	-0.6401
1121	0.60971	1.43497	4.37826	0.88171	-1.7795	1.99918	0.08382	-0.6882
1122	0.8151	1.43515	4.77149	1.22906	-1.3756	2.21484	0.96303	-0.3411
1123	0.62382	1.46899	4.61912	0.99727	-2.2687	2.15463	0.47133	-0.8083
1124	0.19796	1.24215	4.38333	0.85269	-1.1513	2.05816	0.15646	-1.1205
1125	0.53027	1.71705	4.6442	1.56529	-0.6653	2.16663	0.42209	-0.7525
1126	0.56988	1.71434	4.89668	1.65332	-0.017	2.47254	0.40802	-0.8018
1127	0.66942	1.67793	4.92079	1.41819	-0.8085	2.53161	0.128	-1.0371
1128	0.88843	1.75771	5.20777	1.38888	-0.7494	2.38587	0.53158	-0.7277
1129	0.7652	1.57506	4.86043	1.40649	-0.9908	2.08902	0.19375	-1.0515
1130	0.89813	1.68508	4.86857	1.42757	-0.8418	2.10153	0.62565	-0.6234
1131	1.01808	1.9554	4.77908	1.62584	-1.0236	2.28914	1.07989	-0.3991
1132	0.6386	1.72894	4.14956	1.34493	-0.9612	1.9031	1.01946	-0.3186
1133	0.72434	1.90556	4.50881	1.85147	-0.6188	2.10023	1.43075	-0.361

1134	0.26365	1.47524	3.91566	1.46934	-0.9947	1.73526	1.00987	-1.0765
1135	0.63944	1.86585	4.27987	1.71503	-0.4537	1.98258	0.92125	-0.5
1136	0.38988	1.51112	3.99776	1.24083	-0.8207	1.80657	0.58982	-0.561
1137	0.39792	1.49779	3.74959	1.46402	-0.8473	1.59486	0.69503	-0.796
1138	0.16526	1.53936	3.91275	1.42856	-0.6244	1.8744	0.60857	-0.8212
1139	0.13498	1.76243	3.65642	1.61059	-0.5244	1.80573	0.68735	-0.6207
1140	0.05081	1.82318	3.87932	1.86422	-0.1347	1.91389	0.32778	-0.5169
1141	0.02923	1.7932	4.00267	1.64561	-0.1376	1.92557	0.52677	-0.5495
1142	-0.2761	1.59061	3.61874	1.61463	-0.356	1.6834	0.18903	-1.0556
1143	-0.3821	1.43238	3.44856	1.42066	-0.7602	1.47276	-0.0546	-1.387
1144	-0.2045	1.62993	3.58979	1.508	0.0262	1.62629	0.23964	-1.1273
1145	-0.6059	1.42926	3.52931	1.42599	-0.379	1.58423	-0.1146	-1.2652
1146	-0.4527	1.44573	3.58112	1.31547	-0.454	1.57148	0.28621	-0.9764
1147	-0.4231	1.3848	3.49141	1.32414	-0.0844	1.59312	0.5491	-0.9589
1148	-0.4949	1.35705	3.38	1.45982	-0.2143	1.55763	0.08242	-0.9084
1149	-0.0545	1.65512	3.68429	1.59304	-0.451	1.67183	0.46582	-0.6795
1150	-0.1579	1.63462	3.55244	1.57612	-0.4412	1.56606	0.36343	-0.7625
1151	-0.217	1.47693	3.54991	1.36503	-0.5702	1.51717	0.39392	-1.0292
1152	-0.2782	1.5721	3.56742	1.51164	-0.3529	1.65769	0.49918	-0.7274
1153	-0.1725	1.5545	3.50144	1.59784	-0.6294	1.5256	0.50169	-1.0518
1154	0.05153	1.70037	3.77061	1.70754	-0.4117	1.73234	0.97092	-1.0553
1155	-0.1811	1.40451	3.6105	1.3705	-0.5072	1.56594	0.36653	-1.2107
1156	0	1.5105	3.81465	1.53083	-0.5727	1.67451	0.43185	-0.8165
1157	-0.0686	1.42212	3.70356	1.36413	-0.3887	1.51313	0.52502	-1.1586
1158	-0.2342	1.40395	3.59989	1.22187	-0.8325	1.56627	0.4442	-1.1145
1159	-0.133	1.48255	3.64013	1.47302	-0.3878	1.56016	0.56705	-0.9102
1160	-0.0539	1.4904	3.60694	1.52331	-0.335	1.55983	0.37408	-0.9659
1161	-0.1432	1.52735	3.78938	1.55819	-0.2648	1.62607	0.61145	-0.6977
1162	-0.0197	1.7155	3.91801	1.60807	-0.1058	1.70705	0.33061	-0.653
1163	-0.1782	1.64594	3.70455	1.6078	-0.1738	1.67165	-0.1061	-1.0219
1164	-0.2192	1.63902	3.57904	1.50027	-0.1735	1.55722	0.33909	-0.7739
1165	-0.2978	1.55759	3.54655	1.41462	-0.3837	1.52176	0.24523	-0.7288
1166	-0.4172	1.49864	3.43559	1.37667	-0.5538	1.49813	0.29068	-0.9476
1167	-0.4578	1.43821	3.45767	1.39645	-0.4894	1.38799	0.35932	-1.2037
1168	-0.3847	1.57953	3.37205	1.45353	-0.3763	1.44231	0.23898	-0.7657
1169	-0.5998	1.36079	3.32644	1.40648	-0.4658	1.38487	-0.0952	-1.0651
1170	-0.6905	1.32544	3.33492	1.29319	-0.5201	1.33543	0.07786	-1.1191
1171	-0.5862	1.34352	3.38231	1.29456	-0.7389	1.41014	0.26144	-1.0281
1172	-0.4318	1.32658	3.39542	1.414	-0.2722	1.40409	0.05129	-1.0063
1173	-0.3111	1.39284	3.75965	1.25519	-0.7009	1.58027	0.54695	-1.1229
1174	-0.3119	1.25746	3.63388	1.38085	-0.7533	1.56317	0.56601	-0.9475
1175	-0.4027	1.28414	3.64731	1.2402	-0.4444	1.65637	0.50535	-0.9679
1176	-0.4055	1.34219	3.64307	1.38904	-0.3511	1.70521	0.62261	-1.2728
1177	-0.3289	1.49944	4.05052	1.48488	-0.4562	1.87429	0.68058	-0.872
1178	-0.2622	1.42857	3.93462	1.4507	-0.7283	1.86611	0.62255	-1.0076
1179	-0.0738	1.53123	3.94212	1.51226	-0.6913	1.91125	0.87516	-0.9976

1180	0.13951	1.54464	3.93892	1.37551	-0.7893	1.80443	0.73917	-0.8524
1181	0.13875	1.41788	4.03303	1.29071	-1.0666	1.81853	0.66341	-0.8105
1182	0.07502	1.65573	3.97619	1.41315	-1.0345	1.9532	0.98774	-0.892
1183	0.07696	1.40588	3.81884	1.23081	-0.8414	1.77653	0.39982	-0.797
1184	0.1924	1.564	3.98764	1.52098	-0.841	1.80003	0.56302	-0.9029
1185	0.11081	1.55732	3.97428	1.38581	-1.0821	1.76921	0.58985	-1.0996
1186	0.34739	1.88573	4.29679	1.77755	-0.3597	2.18339	0.96805	-0.6131
1187	0.29561	1.59106	4.11142	1.43441	-0.4855	1.87932	0.63208	-0.9954
1188	0.25218	1.51967	4.01057	1.38799	-0.5225	1.87285	0.64653	-1.3709
1189	0.19342	1.65618	4.00836	1.56121	-0.5802	1.8846	0.29957	-1.0574
1190	-0.1759	1.4793	3.8627	1.4653	-0.2635	1.87886	0.3821	-0.7561
1191	-0.4155	1.43542	3.59424	1.26379	-0.7911	1.62587	0.28353	-1.0361
1192	-0.0389	1.69039	3.86451	1.62291	0.03129	1.82885	0.60921	-0.4958
1193	0.20332	1.87465	4.15774	1.91961	-0.2436	2.08374	0.80116	-0.2693
1194	0.02893	1.69736	3.96268	1.61549	-0.55	1.94301	0.57625	-0.9849
1195	0.47928	1.94547	4.16615	1.8026	-0.334	1.9928	0.43532	-0.5287
1196	0.12703	1.57691	3.75643	1.35443	-1.0472	1.71919	0.46602	-0.6805
1197	-0.1982	1.39026	3.57998	1.15233	-0.7588	1.5958	0.12629	-0.578
1198	-0.1987	1.43986	3.62031	1.34041	-0.8607	1.66193	0.095	-1.0772
1199	-0.3966	1.50525	3.52032	1.39176	-0.5062	1.58543	0.17947	-0.7876
1200	-0.3442	1.5264	3.43502	1.34589	-0.6147	1.51574	0.1119	-0.698
1201	-0.3458	1.49427	3.42579	1.41075	-0.6237	1.50496	0.12591	-1.0034
1202	0.02972	1.62342	3.60943	1.53291	-0.594	1.59767	0.29814	-0.8664
1203	-0.0289	1.59388	3.57662	1.44751	-0.5598	1.56921	-0.1786	-0.8788
1204	-0.2743	1.44245	3.47955	1.44523	-0.6735	1.44332	-0.3923	-0.7784
1205	-0.2778	1.41168	3.36804	1.45873	-0.6361	1.38048	0.09524	-1.0301
1206	-0.1481	1.55634	3.53506	1.51394	-0.4772	1.5644	0.16987	-0.8451
1207	-0.0833	1.64922	3.62139	1.55937	-0.7202	1.57444	0.04456	-0.5787
1208	-0.2852	1.47817	3.5399	1.3867	-0.827	1.48728	0.11148	-1.0413
1209	-0.0961	1.52673	3.77777	1.3961	-0.8169	1.71955	-0.1321	-0.8658
1210	-0.1888	1.48192	3.60063	1.30015	-0.5352	1.58766	0.21634	-0.7116
1211	-0.5331	1.30231	3.37643	1.23031	-0.7373	1.45141	-0.5164	-1.1468
1212	-0.4275	1.41935	3.6683	1.51681	-0.4096	1.70318	-0.0351	-0.8219
1213	-0.4114	1.30461	3.58002	1.31236	-0.6564	1.4326	-0.1461	-1.1974
1214	-0.5306	1.41078	3.45233	1.2893	-0.6078	1.4894	0.08224	-1.2616
1215	-0.4909	1.41666	3.65815	1.40899	-0.3537	1.60294	0.0284	-1.2604
1216	-0.0661	1.6195	3.83185	1.57151	-0.4854	1.64653	-0.0029	-0.8862
1217	-0.3988	1.38124	3.43059	1.22955	-0.6658	1.51698	0.12921	-0.827
1218	-0.5619	1.32639	3.43915	1.31856	-0.4813	1.53377	0.10284	-0.98
1219	-0.0486	1.73373	3.86076	1.60161	-0.3862	1.86489	0.37805	-0.5958
1220	-0.2498	1.5794	3.57078	1.49337	-0.184	1.66036	0.18384	-0.8804
1221	-0.5328	1.3689	3.29691	1.26743	-0.8161	1.41033	-0.18	-0.9734
1222	-0.4172	1.3895	3.43155	1.26551	-0.7168	1.4467	-0.1193	-1.1657
1223	-0.3574	1.29592	3.50993	1.11031	-0.6388	1.48863	0.10954	-0.7506
1224	-0.3424	1.53746	3.34413	1.53933	-0.6293	1.63227	0.0026	-0.967
1225	-0.2332	1.33901	3.53694	1.22661	-0.7901	1.5194	-0.5701	-1.3038

1226	-0.4196	1.24513	3.39667	1.07539	-0.8323	1.46958	-0.7412	-1.3241
1227	-0.0706	1.51977	3.65532	1.344	-0.7454	1.63768	0.04471	-0.935
1228	0.11366	1.58583	3.78358	1.27345	-0.4422	1.67848	-0.0074	-0.7822
1229	0.01046	1.44418	3.50523	1.21565	-0.5845	1.59727	-0.054	-0.9994
1230	0.13636	1.83371	3.94714	1.65547	-0.1228	1.88125	-0.352	-1.5684
1231	0.16847	1.6529	3.62587	1.40219	-0.3941	1.60133	-0.1292	-0.7594
1232	0.19076	1.65398	3.83468	1.34182	-0.8102	1.64081	-0.1248	-0.7443
1233	-0.1053	1.48329	3.5123	1.23651	-0.7471	1.53099	-0.1705	-0.9236
1234	-0.1557	1.32875	3.4325	1.2003	-0.737	1.4372	-0.2333	-0.979
1235	-0.1009	1.39812	3.53043	1.28947	-0.594	1.48874	-0.154	-0.8972
1236	-0.0862	1.40653	3.5832	1.30654	-0.481	1.50199	-0.1069	-0.8591
1237	-0.1476	1.30867	3.28878	1.07433	-0.2857	1.4448	-0.1496	-1.1697
1238	-0.0846	1.45965	3.53634	1.38857	-0.7427	1.63784	-0.0055	-0.8626
1239	0.15114	1.6535	3.77743	1.4171	-0.1722	1.72019	0.41576	-0.595
1240	-0.3703	1.23583	3.35741	1.15328	-0.8525	1.37113	-0.2362	-1.1457
1241	-0.0391	1.44381	3.51644	1.51948	-0.6712	1.48033	-0.0534	-0.9634
1242	-0.0307	1.47317	3.58678	1.36209	-0.5523	1.46904	-0.2632	-1.0291
1243	-0.0285	1.50639	3.47089	1.40419	-0.591	1.4291	-0.3164	-0.9312
1244	-0.187	1.43076	3.41301	1.2314	-0.5566	1.44287	-0.4209	-1.0001
1245	-0.3098	1.46003	3.38961	1.34871	-0.9848	1.48973	-0.0282	-0.8799
1246	-0.3543	1.37081	3.24929	1.26745	-0.886	1.32047	-0.1024	-1.2212
1247	-0.361	1.4794	3.31936	1.33222	-0.7013	1.43376	-0.4432	-0.9389
1248	-0.0288	1.84312	3.66241	1.63674	-0.4254	1.62382	0.10929	-0.7782
1249	-0.1287	1.70035	3.54765	1.64632	-0.369	1.55238	-0.0571	-0.7314
1250	-0.121	1.66159	3.56086	1.6235	-0.525	1.52515	0.15932	-0.688
1251	-0.1463	1.54914	3.64681	1.46953	-0.5612	1.55449	-0.0281	-0.8263
1252	-0.318	1.43009	3.54693	1.29393	-0.6088	1.47343	-0.2745	-0.9776
1253	-0.2231	1.51425	3.60827	1.47526	-0.5658	1.57318	-0.2306	-1.2026
1254	-0.3833	1.45327	3.58275	1.39304	-0.4925	1.36797	-0.1438	-1.1535
1255	-0.2209	1.47307	3.52496	1.44592	-0.4904	1.53084	0.09889	-0.834
1256	-0.5234	1.3011	3.33604	1.25534	-0.5055	1.3168	-0.1867	-1.0123
1257	-0.364	1.43183	3.37408	1.34712	-0.3758	1.47351	-0.2154	-0.9122
1258	-0.3101	1.5471	3.41676	1.46717	-0.1725	1.50184	-0.2934	-1.0043
1259	0.03032	1.74031	3.81836	1.69303	-0.3094	1.77254	-0.019	-0.7966
1260	-0.4509	1.45634	3.47844	1.38769	-0.7158	1.39915	-0.3022	-0.9411
1261	-0.4017	1.41788	3.42243	1.32491	-0.6223	1.39823	-0.2865	-1.2827
1262	-0.1303	1.67314	3.60327	1.5405	-0.4292	1.58727	-0.0498	-0.5831
1263	-0.3787	1.46085	3.38119	1.4205	-0.6059	1.30843	-0.2948	-1.2391
1264	-0.1328	1.60823	3.49459	1.47356	-0.4585	1.48762	-0.1251	-1.0316
1265	-0.3905	1.48044	3.3662	1.44359	-0.6353	1.49609	-0.1208	-0.8808
1266	-0.4689	1.54564	3.49383	1.38989	-0.5485	1.49382	-0.2595	-1.0114
1267	-0.1775	1.69148	3.66556	1.6081	-0.208	1.58757	-0.1182	-1.0632
1268	-0.3569	1.48569	3.38342	1.29274	-0.4117	1.4656	-0.0305	-1.0712
1269	-0.4963	1.46082	3.36889	1.44872	-0.4277	1.51648	0.12327	-0.8972
1270	-0.8024	1.34936	3.34205	1.28433	-0.4776	1.39102	-0.078	-1.067
1271	-0.5393	1.38927	3.36516	1.35728	-0.2978	1.39624	-0.1326	-1.0778

1272	-0.398	1.55228	3.41309	1.4881	-0.4617	1.53581	-0.015	-0.9296
1273	-0.7705	1.39979	3.35178	1.30744	-0.2664	1.3904	-0.0544	-0.8884
1274	-0.7694	1.20376	3.18871	1.15587	-0.6043	1.34982	-0.552	-0.9599
1275	-0.6769	1.28431	3.25737	1.20207	-0.5696	1.29044	-0.4316	-1.1218
1276	-0.5752	1.26002	3.22282	1.3938	-0.6405	1.3799	-0.0394	-1.6282
1277	-0.5705	1.29318	3.2892	1.47782	-0.2128	1.48042	-0.0649	-1.2536
1278	-0.4356	1.32807	3.52321	1.21892	-0.8314	1.43762	-0.1121	-1.2074
1279	-0.3237	1.31219	3.50852	1.1988	-0.7218	1.41831	-0.0389	-1.0159
1280	-0.2931	1.41845	3.47294	1.33968	-0.51	1.52758	0.02978	-0.9529
1281	-0.2681	1.44175	3.33161	1.30963	-0.7342	1.43689	0.07962	-1.121
1282	0.01078	1.61944	3.67771	1.4393	-0.2493	1.73969	0.08677	-0.5391
1283	-0.3048	1.39046	3.48615	1.27609	-0.3816	1.62996	-0.0097	-1.1426
1284	-0.1622	1.46786	3.58414	1.42184	-0.6361	1.52364	-0.1296	-0.8476
1285	-0.3064	1.49655	3.54418	1.33438	-0.6931	1.58364	0.10856	-1.0549
1286	-0.6272	1.20105	3.41973	1.09411	-0.4633	1.48653	-0.4055	-1.1953
1287	-0.6048	1.27601	3.42166	1.41636	-0.7118	1.48561	-0.1076	-1.0447
1288	-0.1956	1.55387	3.46214	1.39534	-0.5986	1.52893	0.1761	-0.9981
1289	0.09389	1.61139	3.74089	1.49647	-0.5843	1.79078	0.09478	-0.7743
1290	-0.2836	1.40833	3.54402	1.21236	-0.8249	1.5087	-0.0207	-0.8457
1291	-0.207	1.54063	3.84923	1.19574	-0.5398	1.61401	0.06073	-0.7145
1292	-0.071	1.58468	3.77915	1.26813	-0.753	1.6562	0.29847	-1.0004
1293	0.07487	1.60065	3.62264	1.65019	-0.9251	1.75059	0	-0.9153
1294	-0.1282	1.49793	3.77157	1.38504	-0.6262	1.81962	0.21973	-1.0699
1295	-0.5402	1.18962	3.67865	1.02334	-0.8017	1.65541	-0.2475	-1.2672
1296	-0.3093	1.27336	3.47061	1.37319	-0.8077	1.57971	0.04378	-1.5192
1297	0.14919	1.74911	3.78157	1.5803	-0.1926	1.82481	0.22599	-1.1925
1298	-0.1664	1.36093	3.59186	1.25545	-0.7659	1.60755	-0.1473	-1.3427
1299	-0.0719	1.57321	4.02467	1.38004	-0.4066	1.86762	-0.2158	-1.0489
1300	0.01844	1.56762	4.04274	1.32856	-0.4445	1.83362	-0.1552	-1.2758
1301	-0.2359	1.39802	3.75977	1.31119	-0.9693	1.66301	0.04866	-1.0499
1302	-0.1259	1.62897	4.18207	1.47079	-0.4421	1.96755	0.25735	-0.7829
1303	-0.4344	1.37785	3.82216	1.20042	-0.8334	1.73751	-0.0518	-1.3478
1304	0.02902	1.70323	4.07623	1.41718	-0.4242	2.05645	0.59502	-0.7204
1305	-0.4208	1.46563	3.89833	1.18737	-0.52	1.82622	-0.0352	-1.2149
1306	-0.2595	1.57503	3.91569	1.24528	-0.3772	1.85431	-0.8885	-0.6072
1307	-0.2352	1.42173	3.74243	1.32018	-0.5341	1.72645	-0.281	-1.1384
1308	0.17203	1.64013	4.0495	1.44591	-0.5097	1.92306	0.25648	-0.9587
1309	0.02125	1.48385	3.89513	1.36004	-0.6378	1.76607	-0.2067	-0.9385
1310	0.10437	1.93132	4.14459	1.58896	-0.2677	2.08237	0.29538	-0.4933
1311	0.09258	1.6947	3.97317	1.44621	-0.47	1.90761	-0.0888	-1.1489
1312	0.34042	1.80738	4.16989	1.62856	-0.3608	1.9635	0.08083	-0.8412
1313	0.48492	1.72101	4.04701	1.58532	-0.3013	1.86598	0.15742	-0.7621
1314	0.266	1.80953	4.02638	1.48642	-0.2341	1.9744	0.11821	-0.8891
1315	0.13591	1.53628	3.81538	1.35646	-0.4094	1.85609	0.03952	-0.9627
1316	0.2561	1.59163	3.87934	1.30592	-0.5246	1.69014	-0.2289	-1.211
1317	0.13031	1.57865	3.75064	1.17388	-0.5227	1.62044	-0.5857	-0.8965

1318	0.37492	1.93909	4.0527	1.70297	-0.3343	1.89974	-0.011	-0.6502
1319	0.05343	1.65912	3.82804	1.46794	-0.61	1.75144	-0.1387	-0.9368
1320	0.06042	1.69388	3.89293	1.49916	-0.5011	1.78817	0.45085	-0.6391
1321	-0.0575	1.70249	3.74374	1.4902	0.0867	1.88996	0.2824	-0.8088
1322	-0.0935	1.66675	3.9767	1.4855	-0.6087	1.85531	-0.0457	-1.0527
1323	-0.4095	1.37934	3.74642	1.28108	-0.3829	1.65401	0.35004	-1.3818
1324	-0.0926	1.58783	3.75303	1.46162	-0.2643	1.73922	0.02779	-1.1222
1325	-0.0423	1.72217	3.89017	1.44564	-0.6338	1.65399	0.27353	-0.8982
1326	-0.0304	1.71094	3.95434	1.50122	-0.6575	1.83514	0.16054	-0.8988
1327	0.03155	1.71792	3.98519	1.57214	-0.4542	1.81829	0.07662	-0.9526
1328	-0.222	1.57485	3.80486	1.31421	-0.588	1.72633	0.00454	-1.0446
1329	-0.2182	1.54682	3.86766	1.55998	-0.3933	1.70637	-0.0866	-0.8314
1330	-0.0612	1.60182	3.83118	1.45739	-0.7069	1.7051	0.09637	-1.1424
1331	-0.2261	1.37933	3.54227	1.25187	-0.3798	1.58772	-0.2351	-0.8384
1332	-0.1275	1.42533	3.64763	1.39172	-0.2986	1.75156	-0.2841	-1.2083
1333	-0.3981	1.38187	3.68599	1.18841	-0.8979	1.70855	-0.1184	-0.9811
1334	-0.1918	1.50952	3.81846	1.35012	-0.4165	1.79784	0.26549	-0.9054
1335	-0.1531	1.60525	3.68289	1.40337	-0.5586	1.74219	0.18787	-0.9142
1336	-0.5354	1.30116	3.64872	1.09441	-0.4787	1.63851	0.24309	-0.7354
1337	-0.4397	1.28164	3.56286	1.20559	-0.1298	1.63365	-0.1523	-1.0029
1338	-0.4919	1.31053	3.55576	1.07567	-0.5201	1.66668	0.18426	-0.8894
1339	-0.4725	1.28013	3.51993	1.18186	-0.4946	1.65918	0.06754	-1.3524
1340	-0.1763	1.62629	3.66587	1.4863	-0.932	1.80361	0.56331	-0.6736
1341	-0.2479	1.33613	3.61047	1.07868	-0.4288	1.57241	0.21919	-1.1423
1342	-0.1977	1.39624	3.65667	1.2049	-0.3798	1.64253	0.11323	-1.2412
1343	-0.2517	1.41678	3.62737	1.17819	-0.3811	1.54063	-0.1302	-0.9951
1344	-0.0058	1.4393	3.87525	1.71763	-0.4774	1.61501	0.12227	-0.6779
1345	-0.2935	1.44117	3.69835	1.33958	-0.3032	1.70354	-0.1866	-0.9396
1346	-0.2994	1.48056	3.60699	1.37499	-0.3995	1.62057	-0.0195	-0.9466
1347	-0.4237	1.35359	3.56925	1.30883	-0.4124	1.60758	0.15494	-0.8979
1348	-0.1894	1.59652	3.87907	1.46165	-0.1514	1.79047	0.17789	-0.8433
1349	-0.4925	1.49047	3.76958	1.43138	-0.3504	1.79438	0.1222	-1.1502
1350	-0.2698	1.67808	3.83628	1.57685	-0.2911	1.88037	0.49619	-1.0646
1351	-0.3141	1.41192	3.82524	1.42368	-0.4359	1.67736	0.09963	-1.22
1352	-0.033	1.6534	4.03816	1.63313	0.0161	1.9452	0.29978	-0.8222
1353	-0.2436	1.46131	3.92339	1.24087	-0.27	1.82244	0.18766	-1.1598
1354	0.04926	1.61075	4.07899	1.4687	-0.4344	1.94889	0.22336	-0.9945
1355	0.07057	1.55439	4.04682	1.40514	-0.405	1.84967	0.18117	-1.0198
1356	0.16506	1.67294	4.1262	1.55025	-0.529	1.91582	0.15445	-0.9468
1357	0.10189	1.49209	4.20204	1.39118	-0.5365	2.00556	0.44873	-1.1125
1358	-0.1441	1.52123	3.89082	1.16437	-0.3267	1.79958	0.12865	-0.7922
1359	-0.0648	1.48013	3.87972	1.35123	-0.5989	1.74273	0.2277	-0.904
1360	0.25023	1.60987	4.01752	1.40025	-0.4947	1.90557	0.24263	-0.8818
1361	0.3354	1.57344	3.84213	1.23836	-0.67	1.65461	0.28182	-1.315
1362	0.28585	1.53176	3.86218	1.29653	-0.5733	1.71513	0.30527	-0.9379
1363	0.18867	1.59989	3.8723	1.30481	-0.7375	2.00702	0.60745	-1.2731

1364	0.09594	1.39424	4.01549	1.26028	-0.3946	2.06437	0.31619	-1.2137
1365	0.32622	1.69115	3.94053	1.35584	-0.558	1.70267	0.28482	-0.9139
1366	0.38043	1.62746	4.08973	1.30471	-0.6238	1.78255	0.47403	-0.8044
1367	0.21476	1.47676	4.4346	1.12864	-0.5787	1.73799	0.38335	-0.8951
1368	0.23486	1.45781	4.17483	1.31957	-0.5006	1.72203	0.29653	-1.2219
1369	0.30139	1.5635	3.99249	1.35276	-0.5775	1.65854	0.2726	-1.4814
1370	0.39674	1.56372	4.00187	1.32082	-0.5725	1.68673	0.70262	-0.7789
1371	0.31951	1.50925	3.91148	1.25387	-0.5203	1.60691	0.66503	-0.8999
1372	0.31423	1.49979	3.8543	1.25993	-0.5491	1.57059	0.66512	-0.9242
1373	0.28194	1.43323	3.79008	1.16103	-0.6	1.5552	0.68011	-0.9533
1374	0.27037	1.43528	3.73806	1.15859	-0.6316	1.57143	0.67662	-0.9974
1375	0.13459	1.29233	3.59496	0.98857	-0.7573	1.46612	0.56792	-1.1331
1376	0.08026	1.19586	3.53333	0.87709	-0.8356	1.43522	0.57345	-1.1619
1377	0.17849	1.24605	3.54711	0.89309	-0.824	1.50064	0.63833	-1.1177
1378	-0.0512	1.09832	3.40327	0.70992	-0.9717	1.38295	0.52057	-1.2776
1379	0.05276	1.31903	3.73282	0.96144	-0.5983	1.57548	0.42016	-0.7498
1380	0.25504	1.38531	3.7518	1.12205	-0.7397	1.57199	0.43468	-1.3784
1381	0.11778	1.58957	3.72987	1.32453	-0.6725	1.70811	0.83281	-0.8109
1382	0.40038	1.7346	4.15551	1.50269	-0.2644	1.95809	0.46585	-1.0862
1383	-0.185	1.4687	3.69008	1.28832	-0.3235	1.63652	0.32489	-1.1141
1384	-0.2914	1.50457	3.74901	1.47648	-0.5235	1.82552	0.23157	-0.7671
1385	-0.1372	1.63248	3.78114	1.5777	-0.333	1.82594	0.56526	-0.7631
1386	-0.3227	1.60371	3.7819	1.53359	0.00248	1.90793	0.71344	-0.4643
1387	-0.4038	1.5263	3.74205	1.50821	-0.0345	1.86404	0.62899	-0.7817
1388	-0.2494	1.5374	3.80785	1.4395	-0.265	1.83716	0.53736	-0.5748
1389	-0.0543	1.43713	3.83913	1.26293	-0.2107	1.74856	0.45047	-0.8039
1390	-0.3678	1.38897	3.74098	1.22498	-0.6201	1.62308	0.30119	-0.8714
1391	-0.2016	1.61059	4.13884	1.61972	0.09833	2.02108	0.62485	-0.6966
1392	-0.3677	1.34008	3.57518	1.34279	-0.4496	1.55363	0.15797	-1.4739
1393	-0.5274	1.31324	3.57204	1.13161	-0.331	1.69966	0.44874	-0.8568
1394	-0.1542	1.70533	3.74563	1.59137	-0.0216	1.80359	0.16746	-0.8725
1395	-0.0337	1.6271	3.77205	1.33774	-0.5267	1.67758	0.22106	-0.7608
1396	-0.0546	1.5727	3.79556	1.41323	-0.46	1.78975	0.49487	-0.9422
1397	0.00698	1.54899	3.84095	1.55598	-0.1144	1.77612	0.08166	-1.0632
1398	0.32964	1.694	3.85478	1.52217	-0.5856	1.69381	0.2826	-0.7933
1399	0.14277	1.66996	3.84168	1.31995	-0.6586	1.64239	0.31562	-0.6762
1400	0.00373	1.46447	3.62297	1.35834	-0.5587	1.60663	0.63296	-0.9447
1401	-0.2644	1.41815	3.70818	1.20397	-0.4665	1.59034	0.32021	-1.0269
1402	-0.0208	1.60183	3.92179	1.61419	-0.2866	1.77059	0.21028	-0.617
1403	-0.2654	1.43121	3.71915	1.32395	-0.4642	1.69414	0.16542	-1.2542
1404	-0.0628	1.44073	3.77311	1.29596	-0.1857	1.67573	0.5938	-1.1128
1405	-0.1596	1.49103	3.7892	1.29709	-0.4443	1.7447	0.29728	-1.0862
1406	-0.0784	1.53749	3.83104	1.29834	-0.5296	1.75707	0.0395	-0.689
1407	-0.3081	1.36705	3.53506	1.19675	-0.6828	1.55751	0.2976	-1.0671
1408	0.00938	1.51211	3.72779	1.25505	-0.3808	1.74233	0.50269	-0.8292
1409	0.29124	1.67302	3.9315	1.39095	-0.4243	1.77162	0.40948	-0.3609

1410	0.02127	1.39003	3.65533	1.35521	-0.3136	1.667	0.05633	-0.9375
1411	0.05193	1.31938	3.64331	1.23693	-0.4118	1.54026	0.20505	-1.0986
1412	0.0796	1.39993	3.6762	1.13209	-0.4977	1.64929	0.62642	-0.9168
1413	0.2946	1.63028	4.02709	1.47828	-0.2336	1.96442	0.43136	-0.8214
1414	-0.0301	1.41998	3.71695	1.28016	-0.1095	1.64509	0.20218	-0.8109
1415	0.08701	1.50884	3.79415	1.14609	-0.2342	1.71298	0.55289	-1.205
1416	0.16962	1.34675	3.61505	0.97835	-0.5451	1.51415	-0.0349	-1.2429
1417	0.42298	1.65581	4.07953	1.38052	-0.2426	1.82388	0.45564	-0.9169
1418	0.33716	1.53042	3.86032	1.3944	-0.8205	1.56901	0.30241	-1.1897
1419	0.20992	1.4296	3.72942	1.24675	-0.8009	1.56675	0.24837	-0.9711
1420	0.25045	1.62366	3.85282	1.47803	-0.4571	1.67881	0.11681	-0.9513
1421	-0.0925	1.40377	3.71185	1.22442	-0.5112	1.66806	0.47853	-1.6783
1422	-0.2015	1.57041	3.85905	1.83981	-0.1854	1.77989	0.66738	-0.5588
1423	0.30365	1.84901	4.03728	1.62547	-0.6707	1.90015	0.723	-1.0799
1424	0.22733	1.7864	4.01733	1.47474	-0.2167	1.91877	1.02175	-0.6919
1425	-0.0009	1.45548	3.76742	1.36955	-0.3179	1.59028	0.44454	-0.8269
1426	-0.5242	1.30109	3.62282	1.20117	-0.4882	1.60727	0.42866	-1.6632
1427	-0.4659	1.28813	3.58617	1.23807	-0.4608	1.52651	0.03986	-1.5101
1428	-0.1236	1.60211	3.7895	1.58197	-0.176	1.67919	0.66292	-0.8935
1429	0.02163	1.65905	3.87853	1.66755	0.24116	1.8936	0.79013	-0.5154
1430	0.02105	1.69441	3.90463	1.52878	-0.1087	1.8064	0.87304	-0.831
1431	-0.1282	1.6338	3.86388	1.58748	-0.1645	1.7316	1.0641	-0.8634
1432	0.08292	1.59157	3.905	1.71342	-0.2218	1.74393	0.89694	-0.8172
1433	0.03007	1.65105	3.88489	1.62061	0.02888	1.91958	0.9572	-0.5096
1434	-0.0334	1.5175	3.92428	1.52324	0.03762	1.80319	0.92349	-0.8104
1435	-0.2543	1.46907	3.81955	1.53875	-0.1782	1.74675	0.62511	-0.6707
1436	-0.1284	1.65223	3.72164	1.64397	0.04103	1.78098	0.91976	-0.6699
1437	-0.139	1.63755	3.79599	1.55695	-0.3099	1.76519	0.83883	-0.8891
1438	-0.0391	1.59036	3.76975	1.67348	-0.0928	1.71737	0.90759	-0.8483
1439	-0.181	1.49671	3.82394	1.42886	-0.4219	1.66779	1.04642	-1.0558
1440	0.02405	1.53382	3.91765	1.55378	-0.2945	1.74202	0.82051	-1.4706
1441	-0.0167	1.47111	3.82451	1.23679	-0.5845	1.54433	1.12864	-0.7848
1442	-0.2049	1.61247	3.6127	1.50468	0.09205	1.6783	1.35521	-0.7546
1443	-0.151	1.7716	3.89786	1.72957	0.45638	1.85011	1.09094	-0.5654
1444	-0.0261	1.70983	3.70974	1.61881	0.21955	1.57939	0.81143	-0.8881
1445	-0.1738	1.57966	3.582	1.44803	0.07997	1.47763	0.65887	-0.7182
1446	-0.3278	1.49899	3.48454	1.3908	-0.1158	1.48918	0.40673	-0.5532
1447	-0.351	1.44373	3.54281	1.37266	-0.1816	1.43345	0.29151	-0.7779
1448	-0.1193	1.76841	3.6235	1.67627	0.10014	1.65048	0.59303	-0.8285
1449	-0.2554	1.61332	3.5873	1.51742	0.09195	1.5678	0.37987	-0.9173
1450	-0.43	1.38781	3.4958	1.31741	0.04079	1.35099	0.37583	-1.0995
1451	-0.4958	1.34042	3.43089	1.32451	-0.1109	1.31701	0.34412	-1.5377
1452	-0.5823	1.28448	3.30585	1.19708	0	1.33274	0.35319	-1.0001
1453	-0.3975	1.29483	3.4476	1.14254	-0.0318	1.30618	0.06669	-1.137
1454	-0.3787	1.42107	3.29556	1.34706	-0.0779	1.20422	0.16153	-1.1809
1455	-0.5187	1.21755	3.23275	1.06147	-0.23	1.20006	0.11709	-1.2411

1456	-0.5301	1.11118	3.3528	1.01673	-0.4772	1.159	0.24435	-1.2398
1457	-0.2376	1.28745	3.46605	1.19454	-0.2793	1.36492	0.64328	-1.114
1458	-0.2459	1.36696	3.52224	1.30501	-0.1055	1.41839	0.65497	-1.0445
1459	-0.1044	1.57306	3.77638	1.51654	0.08644	1.61453	0.62776	-0.8353
1460	-0.2379	1.45809	3.55468	1.34276	-0.063	1.4245	0.43986	-1.2528
1461	-0.2134	1.50768	3.59053	1.49361	0.1315	1.47585	0.70408	-0.7441
1462	-0.3807	1.39331	3.41511	1.29423	0.0843	1.34911	0.81473	-0.7708
1463	-0.2326	1.48317	3.55486	1.47532	-0.2409	1.45485	0.57115	-0.8217
1464	0.17219	1.84398	3.88441	1.59252	0.05975	1.72765	1.17161	-0.5076
1465	-0.2885	1.35846	3.4591	1.31926	-0.1695	1.38828	0.53627	-1.1425
1466	-0.1052	1.63601	3.70374	1.55288	0.13212	1.63215	0.83225	-0.8088
1467	-0.1772	1.44994	3.45343	1.40382	-0.0838	1.55101	0.84431	-0.9195
1468	-0.3507	1.34173	3.23635	1.21449	-0.2401	1.30333	0.60832	-1.2802
1469	-0.74	0.83863	2.84882	0.87453	-0.2518	1.35363	0.51461	-1.8679

1.2. Particle Size

The following tables exhibit the particle size variability throughout the five cores selected for laboratory analysis.

1.2.1. FS W3

Appendix Table 1.11. Particle size variability in the Core FS W3. The D-Values (D10, D50 and D90) show the cumulative sample mass values for 10%, 50% and 90%.

West 3		Particle Diameter (μm) for Cumulative Mass Intervals			
Elevation (mOD)	Measured Depth (m)	D10	D50	D90	D50 Wentworth (1922) Classification
3.39	0	4.81	37.43	227.24	Coarse silt
3.37	0.02	4.67	35.33	214.89	Coarse silt
3.35	0.04	4.67	31.03	203.81	Coarse silt
3.33	0.06	4.73	35.84	219.49	Coarse silt
3.31	0.08	5.01	37.92	238.74	Coarse silt
3.29	0.1	5.43	45.29	285.21	Coarse silt
3.27	0.12	5.88	42.81	276.12	Coarse silt
3.25	0.14	4.57	30.78	226.20	Coarse silt
3.23	0.16	5.77	33.93	233.07	Coarse silt
3.21	0.18	5.96	47.24	252.64	Coarse silt
3.19	0.2	6.02	48.78	261.21	Coarse silt
3.17	0.22	5.93	46.01	256.49	Coarse silt
3.15	0.24	5.72	42.89	250.40	Coarse silt
3.13	0.26	5.97	53.74	271.66	Coarse silt
3.11	0.28	6.28	56.99	289.31	Coarse silt
3.09	0.3	6.63	62.72	290.72	Coarse silt
3.07	0.32	6.82	61.43	304.71	Coarse silt
3.05	0.34	6.54	60.70	297.64	Coarse silt
3.03	0.36	7.89	69.21	321.41	Very fine sand
3.01	0.38	7.80	73.68	357.91	Very fine sand
2.99	0.4	28.38	271.19	431.90	Medium sand
2.97	0.42	39.72	347.29	530.29	Medium sand
2.95	0.44	35.48	309.46	507.14	Medium sand
2.93	0.46	8.90	82.28	375.00	Very fine sand
2.91	0.48	6.83	62.11	270.09	Coarse silt
2.89	0.5	6.28	55.89	249.28	Coarse silt
2.87	0.52	5.15	43.09	223.71	Coarse silt
2.85	0.54	6.10	29.44	198.62	Medium silt

2.83	0.56	5.67	28.10	181.49	Medium silt
2.81	0.58	5.81	24.78	175.26	Medium silt
2.79	0.6	6.43	21.34	167.90	Medium silt
2.77	0.62	5.78	18.65	147.91	Medium silt
2.75	0.64	4.76	13.71	124.32	Fine silt
2.73	0.66	4.49	8.23	96.30	Fine silt
2.71	0.68	4.20	7.13	89.33	V fine silt
2.69	0.7	3.37	3.96	36.39	V fine silt
2.67	0.72	3.42	4.12	26.71	V fine silt
2.65	0.74	3.11	3.87	23.49	Clay
2.63	0.76	2.84	3.78	20.51	Clay
2.61	0.78	2.35	3.73	20.39	Clay
2.59	0.8	2.14	3.51	19.35	Clay
2.57	0.82	2.06	2.90	16.28	Clay
2.55	0.84	1.97	2.69	14.71	Clay
2.53	0.86	1.99	2.72	15.49	Clay
2.51	0.88	2.01	2.87	19.53	Clay
2.49	0.9	2.17	2.99	23.81	Clay
2.47	0.92	2.53	3.00	28.32	Clay
2.45	0.94	2.10	2.83	24.44	Clay
2.43	0.96	2.84	3.25	41.60	Clay
2.41	0.98	28.88	189.27	447.28	Fine sand
2.39	1	36.03	243.90	507.23	Fine sand
2.37	1.02	39.67	269.18	543.12	Medium sand
2.35	1.04	43.78	302.12	592.18	Medium sand

1.2.2. FS C2

Appendix Table 1.12. Particle size variability in the Core FS C2. The D-Values (D10, D50 and D90) show the cumulative sample mass values for 10%, 50% and 90%.

Central 2		Particle Diameter (μm) for Cumulative Mass Intervals			D50 Wentworth (1922) Classification
Elevation (mOD)	Measured Depth (m)	D10	D50	D90	
3.41	0	3.90	20.99	150.21	Medium silt
3.39	0.02	4.13	26.24	172.79	Medium silt
3.37	0.04	4.32	29.83	189.24	Medium silt
3.35	0.06	4.48	30.89	197.55	Medium silt
3.33	0.08	3.78	24.60	172.09	Medium silt
3.31	0.1	4.23	28.67	182.46	Medium silt

3.29	0.12	4.57	30.10	199.73	Medium silt
3.27	0.14	4.99	33.82	211.22	Coarse silt
3.25	0.16	5.33	35.81	227.24	Coarse silt
3.23	0.18	5.79	43.19	268.34	Coarse silt
3.21	0.2	6.00	49.01	294.71	Coarse silt
3.19	0.22	6.07	51.78	297.45	Coarse silt
3.17	0.24	6.13	53.79	302.73	Coarse silt
3.15	0.26	6.18	43.56	275.39	Coarse silt
3.13	0.28	5.90	38.92	247.90	Coarse silt
3.11	0.3	5.67	37.26	224.18	Coarse silt
3.09	0.32	5.41	36.99	185.35	Coarse silt
3.07	0.34	6.56	46.41	236.17	Coarse silt
3.05	0.36	7.89	59.00	287.32	Coarse silt
3.03	0.38	7.13	64.18	310.26	Very fine sand
3.01	0.4	6.92	62.32	299.32	Coarse silt
2.99	0.42	6.81	57.22	277.23	Coarse silt
2.97	0.44	6.78	52.40	267.89	Coarse silt
2.95	0.46	6.45	49.34	255.66	Coarse silt
2.93	0.48	6.10	46.40	223.46	Coarse silt
2.91	0.5	5.97	43.18	199.45	Coarse silt
2.89	0.52	5.83	37.69	180.29	Coarse silt
2.87	0.54	6.05	40.08	201.33	Coarse silt
2.85	0.56	6.02	42.52	205.71	Coarse silt
2.83	0.58	6.45	49.29	234.49	Coarse silt
2.81	0.6	6.89	54.31	211.31	Coarse silt
2.79	0.62	6.99	52.38	201.84	Coarse silt
2.77	0.64	7.01	50.43	198.33	Coarse silt
2.75	0.66	32.79	280.34	529.29	Medium sand
2.73	0.68	43.89	342.91	632.75	Medium sand
2.71	0.7	45.76	369.12	702.13	Medium sand
2.69	0.72	3.56	4.29	29.11	Veryfine silt
2.67	0.74	2.55	3.88	22.11	Clay
2.65	0.76	2.35	3.60	26.82	Clay
2.63	0.78	2.46	3.85	32.03	Clay

1.2.3. FS E3

Appendix Table 1.13. Particle size variability in the Core FS E3. The D-Values (D10, D50 and D90) show the cumulative sample mass values for 10%, 50% and 90%.

East 3		Particle Diameter (μm) for Cumulative Mass Intervals			
Elevation (mOD)	Measured Depth (m)	D10	D50	D90	D50 Wentworth (1922) Classification
3.43	0	4.90	25.34	175.39	Medium silt
3.41	0.02	5.00	27.44	184.28	Medium silt
3.39	0.04	5.23	28.84	186.09	Medium silt
3.37	0.06	5.31	27.87	189.74	Medium silt
3.35	0.08	5.45	30.67	192.01	Medium silt
3.33	0.1	4.79	28.12	184.39	Medium silt
3.31	0.12	4.83	28.00	167.90	Medium silt
3.29	0.14	5.46	28.88	183.44	Medium silt
3.27	0.16	5.81	26.00	197.43	Medium silt
3.25	0.18	5.97	31.86	208.77	Coarse silt
3.23	0.2	5.35	34.83	221.03	Coarse silt
3.21	0.22	6.14	44.78	241.34	Coarse silt
3.19	0.24	6.32	50.32	277.09	Coarse silt
3.17	0.26	6.86	46.78	251.01	Coarse silt
3.15	0.28	6.65	41.72	229.02	Coarse silt
3.13	0.3	6.89	50.66	232.67	Coarse silt
3.11	0.32	6.81	57.92	248.11	Coarse silt
3.09	0.34	7.56	69.14	272.47	Very fine sand
3.07	0.36	26.41	259.09	413.01	Medium sand
3.05	0.38	37.87	293.87	524.70	Medium sand
3.03	0.4	8.24	73.18	346.11	Very fine sand
3.01	0.42	8.00	64.60	309.56	Very fine sand
2.99	0.44	6.17	58.92	293.21	Coarse silt
2.97	0.46	6.72	57.45	267.44	Coarse silt
2.95	0.48	6.80	56.14	248.20	Coarse silt
2.93	0.5	6.18	50.13	263.67	Coarse silt
2.91	0.52	5.71	45.86	242.40	Coarse silt
2.89	0.54	4.89	36.45	220.55	Coarse silt
2.87	0.56	5.98	30.11	189.70	Medium silt
2.85	0.58	6.00	30.86	195.30	Medium silt
2.83	0.6	5.71	28.21	199.80	Medium silt
2.81	0.62	5.60	27.38	182.33	Medium silt
2.79	0.64	5.90	36.02	183.02	Coarse silt
2.77	0.66	6.00	40.38	205.38	Coarse silt
2.75	0.68	5.87	41.21	167.99	Coarse silt

2.73	0.7	6.45	49.90	192.68	Coarse silt
2.71	0.72	7.90	61.71	288.12	Coarse silt
2.69	0.74	8.04	79.43	292.56	Coarse silt
2.67	0.76	34.04	269.01	495.11	Medium sand
2.65	0.78	38.56	327.29	611.78	Medium sand
2.63	0.8	8.97	84.28	389.00	Coarse silt
2.61	0.82	8.25	75.90	364.74	Coarse silt
2.59	0.84	7.52	57.80	261.31	Coarse silt
2.57	0.86	6.25	54.14	250.01	Coarse silt
2.55	0.88	5.84	47.20	233.95	Coarse silt
2.53	0.9	6.05	49.68	246.46	Coarse silt
2.51	0.92	6.25	48.01	232.03	Coarse silt

1.2.4. SI C2

Appendix Table 1.14. Particle size variability in the Core SI C2. The D-Values (D10, D50 and D90) show the cumulative sample mass values for 10%, 50% and 90%.

Central 2		Particle Diameter (μm) for Cumulative Mass Intervals			D50 Wentworth (1922) Classification
Elevation (mOD)	Measured Depth (m)	D10	D50	D90	
3.41	0	3.80	23.78	188.57	Medium silt
3.39	0.02	3.91	27.65	190.78	Medium silt
3.37	0.04	4.32	29.16	201.11	Medium silt
3.35	0.06	4.20	30.01	206.78	Medium silt
3.33	0.08	4.18	27.10	192.31	Medium silt
3.31	0.1	4.32	30.05	199.74	Medium silt
3.29	0.12	4.57	34.54	222.31	Coarse silt
3.27	0.14	4.88	38.12	245.80	Coarse silt
3.25	0.16	4.10	30.98	179.80	Medium silt
3.23	0.18	5.00	35.02	202.74	Coarse silt
3.21	0.2	4.72	32.23	189.75	Coarse silt

3.19	0.22	5.35	35.17	216.83	Coarse silt
3.17	0.24	5.87	37.22	223.65	Coarse silt
3.15	0.26	5.73	36.98	219.83	Coarse silt
3.13	0.28	5.67	38.45	215.89	Coarse silt
3.11	0.3	6.22	42.74	212.87	Coarse silt
3.09	0.32	6.43	47.87	229.50	Coarse silt
3.07	0.34	6.09	41.90	226.90	Coarse silt
3.05	0.36	6.12	46.81	204.72	Coarse silt
3.03	0.38	6.10	41.87	220.46	Coarse silt
3.01	0.4	6.33	42.19	226.79	Coarse silt
2.99	0.42	5.98	39.76	201.98	Coarse silt
2.97	0.44	5.97	36.81	199.53	Coarse silt
2.95	0.46	6.28	46.90	227.09	Coarse silt
2.93	0.48	6.45	51.33	247.81	Coarse silt
2.91	0.5	6.17	46.87	220.73	Coarse silt
2.89	0.52	6.18	50.45	230.92	Coarse silt
2.87	0.54	4.45	27.95	186.83	Medium silt
2.85	0.56	4.54	30.52	195.79	Medium silt
2.83	0.58	6.46	48.10	221.41	Coarse silt
2.81	0.6	5.01	30.76	192.84	Medium silt
2.79	0.62	7.13	49.90	196.44	Coarse silt
2.77	0.64	6.89	47.60	218.73	Coarse silt
2.75	0.66	7.46	54.51	220.66	Coarse silt
2.73	0.68	7.16	51.93	212.39	Coarse silt
2.71	0.7	6.89	44.88	198.66	Coarse silt
2.69	0.72	7.29	52.75	204.78	Coarse silt
2.67	0.74	7.57	58.62	227.87	Coarse silt
2.65	0.76	6.64	59.29	230.42	Coarse silt
2.63	0.78	7.37	62.66	247.81	Coarse silt
2.61	0.8	7.24	59.79	235.98	Coarse silt
2.59	0.82	7.89	55.12	227.83	Coarse silt
2.57	0.84	8.47	61.89	254.93	Coarse silt
2.55	0.86	9.73	69.51	282.49	Very fine sand
2.51	0.88	26.95	259.78	512.78	Medium sand
2.49	0.9	29.80	267.83	536.72	Medium sand
2.47	0.92	14.02	85.89	379.21	Very fine sand
2.45	0.94	12.00	76.30	334.15	Very fine sand
2.43	0.96	8.18	59.73	235.50	Coarse silt

1.2.5. SI C3

Appendix Table 1.15. Particle size variability in the Core SI C3. The D-Values (D10, D50 and D90) show the cumulative sample mass values for 10%, 50% and 90%.

Central 3		Particle Diameter (μm) for Cumulative Mass Intervals			
Elevation (mOD)	Measured Depth (m)	D10	D50	D90	D50 Wentworth (1922) Classification
3.36	0	4.68	27.39	198.72	Coarse silt
3.34	0.02	4.99	31.89	205.89	Coarse silt
3.32	0.04	5.82	35.81	216.19	Coarse silt
3.3	0.06	5.29	31.89	198.26	Coarse silt
3.28	0.08	5.97	36.79	207.24	Coarse silt
3.26	0.1	6.01	37.89	228.21	Coarse silt
3.24	0.12	5.81	38.50	222.90	Coarse silt
3.22	0.14	5.98	42.89	232.55	Coarse silt
3.2	0.16	5.72	44.91	238.44	Coarse silt
3.18	0.18	6.24	53.10	252.91	Coarse silt
3.16	0.2	6.10	50.30	247.91	Coarse silt
3.14	0.22	5.98	47.91	239.89	Coarse silt
3.12	0.24	5.76	36.15	201.75	Coarse silt
3.1	0.26	5.40	33.79	191.43	Coarse silt
3.08	0.28	5.23	29.38	183.21	Medium silt
3.06	0.3	5.46	32.19	188.89	Coarse silt
3.04	0.32	5.57	33.57	179.79	Coarse silt
3.02	0.34	5.61	35.29	184.90	Coarse silt
3	0.36	6.13	30.87	157.74	Medium silt
2.98	0.38	6.00	34.81	176.88	Coarse silt
2.96	0.4	5.73	32.17	167.98	Coarse silt
2.94	0.42	5.10	30.12	158.90	Medium silt
2.92	0.44	5.33	34.11	197.87	Coarse silt
2.9	0.46	5.75	38.79	213.40	Coarse silt
2.88	0.48	5.11	41.74	222.76	Coarse silt
2.86	0.5	5.56	46.01	232.82	Coarse silt
2.84	0.52	5.95	49.37	249.11	Coarse silt
2.82	0.54	6.11	52.40	258.18	Coarse silt
2.8	0.56	6.18	54.76	239.24	Coarse silt
2.78	0.58	5.78	48.62	224.72	Coarse silt
2.76	0.6	5.89	50.08	228.33	Coarse silt
2.74	0.62	6.46	52.83	207.98	Coarse silt
2.72	0.64	7.20	68.93	267.39	Very fine sand
2.7	0.66	26.59	253.07	510.40	Medium sand
2.68	0.68	31.07	283.17	530.46	Medium sand

2.66	0.7	15.08	78.90	357.91	Very fine sand
2.64	0.72	7.87	62.29	258.92	Coarse silt
2.62	0.74	11.81	57.92	246.01	Coarse silt
2.6	0.76	9.03	48.91	209.73	Coarse silt
2.58	0.78	5.75	41.37	256.81	Coarse silt
2.56	0.8	5.51	38.16	225.26	Coarse silt
2.54	0.82	4.90	35.23	205.62	Coarse silt
2.52	0.84	4.56	33.99	194.59	Coarse silt
2.5	0.86	4.90	38.78	201.55	Coarse silt
2.48	0.88	5.10	45.60	218.76	Coarse silt
2.46	0.9	5.01	44.89	215.49	Coarse silt
2.44	0.92	5.27	48.02	216.00	Coarse silt
2.42	0.94	5.56	52.37	224.87	Coarse silt
2.4	0.96	6.88	59.42	240.27	Coarse silt
2.38	0.98	7.69	62.62	257.72	Coarse silt
2.36	1	13.92	73.89	304.89	Very fine sand
2.34	1.02	15.62	88.39	336.85	Very fine sand
2.32	1.04	32.89	286.24	502.67	Medium sand
2.3	1.06	35.69	344.83	531.48	Medium sand
2.28	1.08	37.89	391.71	578.62	Medium sand
2.26	1.1	39.28	425.67	676.29	Medium sand
2.24	1.12	56.89	491.93	805.78	Medium sand
2.22	1.14	43.81	431.82	701.93	Medium sand
2.2	1.16	19.44	113.85	415.28	Very fine sand
2.18	1.18	16.49	89.39	342.72	Very fine sand
2.16	1.2	14.80	73.17	307.82	Very fine sand
2.14	1.22	13.00	65.28	278.38	Very fine sand
2.12	1.24	10.90	59.86	280.28	Coarse silt
2.1	1.26	10.87	61.03	287.39	Coarse silt
2.08	1.28	11.76	62.88	299.39	Coarse silt
2.06	1.3	10.79	60.24	268.56	Coarse silt
2.04	1.32	9.89	59.87	263.11	Coarse silt
2.02	1.34	9.87	58.57	251.89	Coarse silt
2	1.36	10.00	57.80	256.80	Coarse silt
1.98	1.38	8.49	52.94	248.24	Coarse silt
1.96	1.4	9.49	60.19	242.38	Coarse silt
1.94	1.42	8.96	55.80	237.82	Coarse silt
1.92	1.44	8.83	53.63	224.67	Coarse silt
1.9	1.46	9.64	59.96	247.39	Coarse silt

1.3. Radionuclide Activity

The following tables exhibit the variability in the activity of the radionuclides ¹³⁷Cs and ²¹⁰Pb throughout the cores FS E3 and SI C3 following height correction. The cores were selected following field, geochemical and particle size analyses.

1.3.1. FS E3

Appendix Table 1.16. Height corrected core radionuclide activity in core FS E3 from the Three Rivers Estuarine Complex saltmarshes.

Depth (cm)	Height Corrected (Becquerel/g)					
	Cs-137	±	Pb-210	±	Ln (Pb210 Xs)	Pb-210 Xs
-1	0.0042	0.0003	0.065	0.0045	-2.9067463	-0.0055
-5	0.0042	0.0003	0.052	0.0036	-3.1723547	-0.0064
-9	0.0032	0.0003	0.060	0.0033	-3.0036973	-0.0067
-13	0.0038	0.0003	0.038	0.0027	-3.56805	-0.0073
-17	0.0032	0.0003	0.033	0.0030	-3.7639096	-0.0070
-21	0.0034	0.0003	0.039	0.0036	-3.5246705	-0.0064
-25	0.0034	0.0003	0.034	0.0027	-3.7419971	-0.0073
-29	0.0041	0.0003	0.033	0.0032	-3.7639096	-0.0068
-33	0.0045	0.0003	0.026	0.0030	-4.1288026	-0.0070
-37	0.0049	0.0003	0.029	0.0027	-3.9771761	-0.0073
-41	0.0038	0.0003	0.026	0.0026	-4.1567348	-0.0074
-45	0.0032	0.0003	0.026	0.0031	-4.1288026	-0.0069
-49	0.0027	0.0003	0.030	0.0066	-3.935252	-0.0034
-53	0.0025	0.0003	0.029	0.0032	-3.9510772	-0.0068
-57	0.0025	0.0003	0.031	0.0031	-3.878378	-0.0069
-61	0.0015	0.0003	0.029	0.0030	-3.98077	-0.0070
-65	0.0010	0.0003	0.029	0.0035	-3.9752812	-0.0065
-69	< Det Limit	-	0.028	0.0033	-3.9918388	-0.0067
-73	< Det Limit	-	0.025	0.0030	-4.1745055	-0.0070
-77	< Det Limit	-	0.027	0.0033	-4.0669361	-0.0067
-81	< Det Limit	-	0.024	0.0077	-4.2875483	-0.0023
-85	< Det Limit	-	0.034	0.0091	-3.7360261	-0.0009
-89	< Det Limit	-	0.023	0.0070	-4.3256655	-0.0030
-93	< Det Limit	-	0.022	0.0076	-4.4065569	-0.0024

1.3.2. SI C3

Appendix Table 1.17. Height corrected core radionuclide activity in core SI C3 from the Three Rivers Estuarine Complex saltmarshes.

Depth (cm)	Height Corrected Activity (Becquerel/g)					
	Cs-137	±	Pb-210	±	Ln(Pb210 Xs)	Pb-210 Xs
-1	0.0036	0.0004	0.060	0.0048	-3.001569	0.049709
-5	0.0060	0.0005	0.063	0.0054	-2.936089	0.0530729
-9	0.0041	0.0003	0.081	0.0053	-2.648111	0.0707848
-13	0.0057	0.0004	0.057	0.0049	-3.05021	0.047349
-17	0.0061	0.0004	0.062	0.0050	-2.952768	0.052195
-21	0.0049	0.0003	0.080	0.0048	-2.662337	0.0697849
-25	0.0062	0.0005	0.062	0.0050	-2.956188	0.0520168
-29	0.0050	0.0000	0.053	0.0050	-3.141583	0.0432143
-33	0.0034	0.0003	0.061	0.0049	-2.973763	0.0511106
-37	0.0050	0.0004	0.055	0.0046	-3.111362	0.0445402
-41	0.0052	0.0000	0.048	0.0050	-3.259749	0.038398
-45	0.0048	0.0003	0.060	0.0042	-2.991243	0.050225
-49	0.0048	0.0003	0.037	0.0035	-3.617525	0.0268491
-53	0.0019	0.0007	0.030	0.0050	-3.925516	0.019732
-57	< Det Limit	0.0008	0.037	0.0042	-3.628932	0.0265445
-61	< Det Limit	0.0009	0.024	0.0030	-4.243099	0.014363
-65	< Det Limit	0.0009	0.028	0.0050	-4.002799	0.0182644
-69	< Det Limit	0.0009	0.034	0.0036	-3.736026	0.0238487
-73	< Det Limit	0.0011	0.030	0.0034	-3.925408	0.0197341
-77	< Det Limit	0.0009	0.018	0.0050	-4.791911	0.0082966
-81	< Det Limit	0.0007	0.027	0.0039	-4.092478	0.0166978
-85	< Det Limit	0.0008	0.017	0.0027	-4.953468	0.0070589
-89	< Det Limit	0.0050	0.016	0.0040	-5.044446	0.006445
-93	< Det Limit	0.0007	0.023	0.0028	-4.363841	0.0127294
-97	< Det Limit	0.0006	0.014	0.0021	-5.456108	0.0042701
-101	< Det Limit	0.0007	0.016	0.0026	-5.163271	0.0057229
-105	< Det Limit	0.0008	0.013	0.0000	-5.9049	0.0027261
-109	< Det Limit	0.0007	0.022	0.0029	-4.459018	0.0115737
-113	< Det Limit	0.0009	0.025	0.0030	-4.183574	0.0152439
-117	< Det Limit	0.0008	0.022	0.0027	-4.401161	0.0122631
-121	< Det Limit	0.0011	0.024	0.0026	-4.303047	0.0135273
-125	< Det Limit	0.0007	0.027	0.0030	-4.072953	0.017027
-129	< Det Limit	0.0008	0.027	0.0029	-4.09607	0.0166379
-133	< Det Limit	0.0008	0.015	0.0029	-5.277268	0.0051064
-137	< Det Limit	0.0009	0.023	0.0000	-4.372262	0.0126227
-141	< Det Limit	0.0010	0.032	0.0032	-3.820829	0.0219096
-145	< Det Limit	0.0029	0.031	0.0027	-3.851852	0.0212404

Appendix 2: Archival Database

Appendix Table 2.1. The entire database for all newspaper storm-related reports from Western Britain between 1800 and 2020.

Year	Day Range	Month	Region(s) Impacted	Newspaper Source(s)	Publishing Date(s)	Recorded Fatalities	Summary
1800	1 to 4	1	Cornish Peninsula	Trewman's Exeter Flying Post & Caledonian Mercury	02/01/1800 - 09/01/1800		A vessel "having carried away her rudder in Torbay in a gale of wind" was received at the Plymouth Dock. A strong wind from the SE was noted which interrupted communication throughout the UK.
1800	19	8	Southwest Britain	Trewman's Exeter Flying Post	28/08/1800		God. 0. Damage. A gale from the North was accompanied heavy clouds and thunder at Plymouth as the area was enveloped by a thunderstorm which brought "loud rolling claps of thunder, tremendously terrible, with vivid quick flashes of dreadful lightning". Several pleasure boats were almost destroyed although the occupants "providentially escaped unhurt". Many inhabitants of the quays in Plymouth were up all night due to the sense of fear.
1800	7 to 9	11	Southwest Britain	Hampshire Telegraph in The Morning Post	17/11/1800		God. 0. A gale of wind from the west and south-west produced heavy sea in the Plymouth sound which caused the frigates and naval vessels to ride hard at anchor. A 12-gun man of war made a signal for assistance which was immediately rendered from the frigates who dispatched men to help secure the drifting vessel. It was said she "would have drifted on Mount Batten, had not timely assistance been afforded". The sea continued to

<p>1801 30 to 1</p>	<p>1</p>	<p>British Isles</p>	<p>Trewman's Exeter Flying Post & Caledonian Mercury</p>	<p>08/01/1801</p>	<p>"runmountains high" as the gale oscilated between SSE to NW on the 8th whilst heavy rain also fell. A ship drove her anchors in the Catwater and was forced ashore in Deadman's Bay were she sustained considerable damage and her misenmast was cut to help preserve the vessel. Forutnately the shift of the wind to the NW and the outgoing tide provided shelter and the vessel was not wrecked and it was remarked "hopes are entertained that the shop and cargo may yet be saved" so long as the wind did not shift back into a southerly quatre. It was remarked although several of the men of war drove from their anchor the vessels "providentially rode out the storm". The sea ran mountains high and heavy rain fell.</p> <p>0. A succinct report of Plymouth of a gale of wind from the SW which was accompnied by a deluge of rain. A barge was wrecked under the city of Plymouth but no lives were lost whilst a vessel had also reported to have parted from it's convoy and little was known of it's whereabouts. The gale continued into the new year and a vessel was reported to have carried away all her masts off the Lizard and was consequently taken in tow to Falmouth. Another vessel ran onshore between Exmouth and the bar but it was thought she would get off without any damage. At Glasgow many chimney tops suffered and one of the oldest of trees "containing the Panorama of the burning of the Boyne" was blown down. The annual report concering the vessels in the Sound in 1800 also mentioned of a very heavy gale from the Sewhich struck the coast on the eve of the 8th. During the gale a Prussian galliot had been driven out of the roads and struck upon</p>
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1801	20-21	3	Southwest Britain	Morning Post	24/03/1801	the rocks of Castle point where it remained full of water and the cargo was substantially damaged.
1801	12 to 14	4	Southwest Britain	Morning Post	16/04/1801, 17/04/1801	0. No damage. A ship news report from Plymouth spoke of a violent gale of wind which blew incessantly for two days. As a consequence a frigate got into a situation of distress although she was immediatley rendered assistance and no further damage was sustained. A "whole gale" from the ENE was noted at Brixham Quay and in consequence "a great many of the West India fleet in Torbay drove from and lost their anchors; others drove foul of each other, and did considerable damage". A ship lost it's anchors and drove on shore at Goodrington Sands in Torbay but was recovered. A ship drove ashore near Brixham Pier were she bilged and it was feared she would be wrecked. On the 14th the vessels of the West India fleet who had survived sailed in a gale from the NE with a heavy sea even despite of lost anchors. A ship was also reported wrecked ashore near Berryhead although it's crew had been saved. A little black brig was also in a similar position but it was hoped she could be saved.
1801	2 to 3	11	Southwest Britain	Morning Chronicle	06/11/1801	A tremendous gale was observed at Plymouth with the wind veering from SSW to NNW which produced heavy seas in the bay. An American ship dragged her anchors and went ashore at Catdown and received much damage but was floated off again on the next tide whilst a large tender which went ashore nearby Withy Hedge "very providentially" got on a gravel bank between two outcrops and although the tide broke over her mast heads she sustained only moderate damage and the crew were saved. An armed schooner also had a lucky escape as it

1801	21-25	11	Northwest Britain	Lancaster Gazette	28/11/1801	<p data-bbox="1332 183 2125 311">parted both cables but yet fortunately drifted into the Catwater. The naval ships weather the gale well although a few tenders were lost.</p> <p data-bbox="1332 311 2125 1329">4 During storm off the North-West coast a dismasted brig was driven just north of the Ribble estuary and no crew were found with all being presumed dead. A sloop was also lost near Rhydland with only one man out of the five strong crew surviving. "The wind blew so violent a storm" that a sloop was driven across driven across the dock and capsized an all five men onboard were forced to cling the hull and rigging for two hours. It was remarked they "would have been lost but for the humane and bold exertions of the persons on shore, who instantly manned four boats, and after great hazard and difficulty, and no less than six unsuccessfil attempts, and no less then six unsuccessful attempts, at length succeeded inbringing the people from on board". Every single character who assisted was accredited and it was remarked "the spirit and perseverance of the whole cannot be too much applauded and admired" especially the last boat on the scne who's vessel upset and were "obliged to swim for their lives". Even despite this they returned to the scene in order to continue rendering assistance despite the presence of others on the scene. Eventually a vessel manned by Greenock Captains "whose exertions reflect the highest honour on their characters" brought the distressed five ashore "to the unspeakable satisfaction of a numerous crowd on the pier, who witnessed the extreme danger". On the morning of the 22nd the storm</p>
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1801	29-30	11	Southwest Britain	Morning Post	03/12/1801, 08/12/1801	1	<p>"threw down the chimnery" of a church which did the building considerable damage.</p> <p>A severe gale of wind from the ESE which was accompanied by a heavy sea forced in a convoy who anchored in the Sound. The wind then shifted westward and "blew a hurricane" and drove four of the anchored vessels onto the rocks. Two of the vessels were completely wrecked whilst only a small portion of the cargoes of the other two was considered salvagable. One man perished in an attempt to render assistance and he left a wife and three small children. Great credit was also said to be due to the officers and crew of the naval vessel Uranie as when the anchored fleet had got into a spot of bother the naval vessel had sent over a cutter to render assistance in the form of a spare anchor although the vessel in distress drifted onto the rocks before she could be reached. Two bargemen were also reported to have been drowned when their vessel capsized and they also left large families. One of the bodies was recovered and taken to the workhouse where the jury of an inquest found a verdict of "Accidental Death".</p>
1801	26-27	12	Southwest Britain	Morning Chronicle	30/12/1801	14	<p>A ship news report from Plymouth spoke of a violent gale of wind which blew incessantly for two days from the NW. As a consequence a frigate got into a situation of distress although she was immediatley rendered assistance and no further damage was sustained. However two "very melancholy accidents happened in the gale of wind" as the heavy seas capsized a tender leading to the death of three mariners. A tender of a man of war also upset leading to the 11 deaths of the 14 aboard.</p>

1801	29-30	12	Southwest Britain	Morning Chronicle	02/01/1801		A succinct report from Plymouth of a "violent storm of hail, rain, and a gale of wind at NW" although no damage was done to the naval vessels.
1802	20-21	1	Northwest Britain	Morning Post, Caledonian Mercury & Lancaster Gazette	25/01/1802, 28/01/1802 & 30/01/1802	12	The Northwest coast and the Port of Liverpool were visited "by a most dreadful hurricane... that can be rembered by the oldest inhabitants. A horrid night it was indeed, and the day light opened a scene schocking to behold". Many houses were "quite blown down and demolished" and chinmeys were widely felled throughout the town by the gale force westerly winds. As a result "many lives are lost in the ruins" whilst the "havoc made in the river Mersey surpasses all description". One of these victims lost ashore included a pregnant woman who was crushed to death, whilst a gentleman was also reported crushed to death. The survivial of a gentleman who had remained in bed as his roof collapsed was portrayed as "the most wonderful mark of preservation" as "if by the specialcare of providence". At the height of the tide several vessels foundered with crews perishing in sight of those ashore who could not come to their rescue despite their best attempts. Along the Cheshire shore dead bodies were thrown up by the sea and wreck strewed the shoreline and it was reported "horror has been depicted in every countenance - each person afraid either to go ut in the street for fear of being killed by the falling of brick, slates, ridgings, &c. and equally apprehensive of his life by constant expectation of his house falling down over him". The reporter emphasised that this succint portrayal was "by no means exaggerated". Subsequent reports from Caledonian

1802	31 to 1	2	Northwest Britain	Caledonian Mercury	04/02/1802		<p>Mercury spoke of the wreckage of a sloop from this port which lead to the loss of all but one of the 13 men onboard. All had lashed themselves to the rigging in a desperate attempt to stay alive as the vessel was thrown on her beam ends and the sea washed over her in the sight of many helpless spectators on shore. The observed tide was observed to be "near six feet higher than mentioned in the tide table" and the only positive news was the storm was abating and two vessels did make it in to port havin reefed considerably.</p> <p>One of the most severe storms of the winter was noted at Greenock as gale force winds and heavy showers caused the shipping at the Tail of the Bank drove considerably but no vessels were wrecked.</p>
1802	24-26	2	Southwest Britain	Morning Post	01/03/1802, 02/03/1802	1	<p>A hurricane which originally came from the NNW before shifting NNE "blew with incredible fury". Although the frigates in the Sound rode well several distress shots were fired as anchors dragged and cables snapped yet all the naval vessels were eventually secured with help from ashore. At Brixham Quay the shift and violence of the gale was also experienced and many fishing sloops were driven from their moorings with tow going to pieces on impact with the pier. Another vessel was "providentially carried" to safety by the waves and current which carried her to a place of safety "where no man could have steered her". About 12 vessels were estimated to have been wrecked and hundreds of people were observed picking up oranges from the a wrecked vessel. In this process one woman fell and broke her leg whilst a boy was washed off a rock and drowned. It was remarked "The inhabitants are, as if duty</p>

1802	10 to 11	9	Southwest Britain	Morning Post	14/09/1802, 15/09/1802	1	bound, rendering the distressed every assistance". It was further said "it is a truly awful, melancholy scene" at the shore although the correspondent was "proud to find the men of war have rode well". Most crews were providentially saved with the exception of a little boy was reported to have drowned onboard one of the wrecked vessels as he could no longer hold onto the rigging due to hypothermia and fatigue. A vessel which arrived in Falmouth entered the port with the loss of her main top mast in a gale of wind off the Lizaard and one man washed overboard and drowned whilst another had his arm broken. Likewise three naval vessels from the Carribean overshot the port of Plymouth and arrived at Torbay on the 12th due to the fall of wind.
1802	29.00	9		Morning Post	29/09/1802		A sonnet named "The Storm" emphasising the sublime power and divine control of the storm. The fury and untameable nature of the storm is communicated with the lines "When a tremendous dirge the wild winds sing,/In concert the belching surges' sound;". The belief that storm is result of the fury of God is communicated with the lines "When rous'd, and madd'ning with his might, the flood/Pours on the Naiad's haunt his ire". The poem then seems to elude to the courage of a sailor in the storm "Dauntless enthusiast! 'mid the raving storm;/Pursu'st along the loud resounding shore," before the total control of the allmighty over nature is reinforced with the concluding lines "Or where the forest with his force contends,/Or where, at his command, the torrent's rage descends".

1802	27-28	10	Southwest Britain	Morning Post	01/11/1802	<p>A heavy gale of wind from the South-west was recorded at Plymouth although it did no damage to the shipping despite it's violence as the frigates in the Sound and Cawsand Bay struck their topmasts on it's onset. At Plymouth the wind blew a "dreadful gale" at SSE and several vessels which came into Plymouth did so as they could not beat up the Channel due to the violence of the wind. A Portuguese brig had received substantial damage at sea and had been obliged to throw part of her cargo overboard to prevent her from sinking. At Brxham quay a large shift was noted an intense gale blew but "there was scarcely a vessel but drove or lost an anchor" although the fisherman did have to rescue a drifting Danish vessel in a prearious position. A 28 gun frigate also lost her mizen mast but was soon repaired. Later news reported of the melancholy loss of a sloop off Stoke Point which had been completely wrecked and all four onboard perished. Impromptu lifesaving. Damage. A report from Plymouth from December the 2nd reported of "a very heavy gale at SSE with a most tremendous sea running" which forced many vessels to take shelter in Plymouth. Amongst those vessels were a Dutch and Danish vessel which both sustained considerable damage but remained afloat. The aforementioned Dutch vessel was close to being wrecked but "providetnally her cable held till day-break when the "polperro fisherman pilots, with great resolution, succeeded in getting on board her" and brought her into port witht he assistance of a few trawlers. It was remarked if it was not for "the timely assistance of the Polperro pilot's, she must have gone on shore and all</p>
1802	20-25	11	Southwest Britain	Morning Post	23/11/1802, 26/11/1802, 29/11/1802 & 30/11/1802	
1802	2 to 3	12	Southwest Britain	Morning Post	06/12/1802, 08/12/1802	

1803	9 to 10	1	Southwest Britain	Morning Post	12/01/1803	hands perished". As a consequence they were handsoemly rewarded for their efforts by the Dutch captain. A gun brig with 14 guns drove on the Devil's Point and was very near to being lost.
1803	30-31	1	Southwest Britain	Morning Post	07/02/1803	Damage. Storm Surge. A shipping news report from Plymouth stated that a very hard gale of wind at SSE had produced a very heavy sea which breached over a bridge on Drakes Island. It was remarked: "if the gale continues, it being the top of the spring, the lower part of the town will be overflowed" by a storm surge.
1803	17-18	4	Southwest Britain	Morning Post	21/04/1803	Wrecked. Impromptu lifesaving. A ship news article from Plymouth dated Feb 3 stating that letters from Brixham reported of a schooner from Newfoundland which had run onto the Goodrington sands and was wrecked during a storm. Although the crew and vessel was lost the crew were saved.
1803	6 to 7	11	Southwest Britain	Morning Post	10/11/1803	A severe "hurricane at SW with hail and heavy rains" was noted in the Plymouth and caused the men of war in Cawsand Bay to strike yards in their topmasts for the evening unitl the gale force winds abated and shifted to the NNW.
1803	21-22	11	Southwest Britain	Morning Post &	25/11/1803	Very strong winds from the SSW produced a very heavy sea which "nealry made a breach over the Edystone Light-House. It was remarked "If Bonaparte's thread paper flotilla had been off, they would have upoon the iron coasts of Devon and Cornwall last night with such a gale of wind and heavy sea". Two major naval ships were waiting on deployment following the abatement of the gale.
						Damage. A gale which increased into a hurricane accompanied by thunder and lightning created an "awfully

				Morning Chronicle				grand" scene in Plymouth and several vessels dragged in the Sound and fired guns of distress although most weathered the storm. It was exclaimed "at one period the lightning was so quick and vivid that the whole of Mount Edgecumb appeared as if one fire". Although the naval vessels survived without injury one sloop was wrecked and all hands were saved. The sight of wreck littering the coasts however indicated vessels in the two convoys that sailed on the 21st "met the fury of the gale".
1803	24-27	12	Southwest Britain	Morning Post	29/12/1803 - 03/01/1804	1		Damage. One of the "most tremendous storms at SW that any person here recollects to have witnessed". The damage done by the gale which blew with near unabated fury to the shipping was very great with many vessels being forced ashore although most escaped wreckage and were later got off. However one vessel was completely wrecked off Deadman's head with the vessel and cargo being a total loss although none of the crew were lost. There was a particularly lucky escape with attributed to the "special intervation of Providence" that an ill man in the cabin floated from the vessel and "was saved from the inevitable fate that seemed to await him". A large French vessel recently impounded by the Navy drifted from her anchors and broached on the shore and was completely wrecked although the crew were rescued by people on the rocks, "many of whom were near perishing in the attempt". A later report confirmmed no responsibility for the wreckage of the ship was attached to the prize-master as she was an old ship which had been safely secured. A guard of Colonel Longmead's Battalion were deployed to guard the wreckage from the lurking pirate boats and they

"obliged to fire several rounds of ball cartridges to keep off the water pirate boats, which were skulking in shore to plunder". It was reported the season ran so high that before the vessels wreckage 100 guineas was repeatedly offered to any pilot" to assist the vessel although none dared venture out of port. A British privateer was reported to have sunk and overall it was said the damage done to shipping was so widespread it was impossible to enumerate all the individual cases. An adjutant to the citadel was reported to have been blown down on shore breaking a bone in his arm. The British Navy channel fleet were feared to have experienced major damage and have headed for shelter in Torbay as a result as the extreme violence of the gale made it impossible for them to keep station off Brest. A report from the 26th confirmed this assumption as the three naval vessels entered the port of Plymouth having sustained major damage and it was reasoned they had arrived as the violence of the gale prevented them reaching Torbay. Although the storm surge had inundated oth piers and wrecked many a vessel as of the 26th there were no reports of any lives being lost. However many houses were unroofed with bricks and tiles flying everywhere creating a hazard to those on foot. Despite this the squadron of six vessels were waiting in Cawsand Bay in order to defend against a potential French advance. Later several ships with considerable damage anchored in cawsand bay waiting for the gale to moderate so they could sail into port for repairs. The on the afternoon of the 27th the conditons were described as The gale of winnd still increases;the sky very louring, and

<p>1804 8 to 9</p>	<p>1</p>	<p>Southwest Britain</p>	<p>Morning Post</p>	<p>12/01/1804</p>	<p>5 black in the offing to the Southward". The report dated the 28th told of a vessel which arrived with the loss of all masts after experiencing the gale off the Lizard and in Cawsand Bay there were 10 naval vessels that needed refitting due to storm damages. A brig was also reported to have cut away her masts and flown a flag of distress although she and her crew were saved thanks to the endeavour of a trawler. A report of Plymouth dated the 31st spoke of an incoming 74 gun vessel which has sustained minor damage in the storm and it was also exclaimed "the wind is SSW and at present there is no chance of its shifting to the eastward; there need not, therefore be any apprehensions entertained of the enemy's fleet and transports getting out of Brest, while the wind remains in this quarter" as the British fleet remained ashore on the South coast ports. There were also reports from Brixham quay of the arrival of the Admiral Cornwallis in a much damaged vessel whilst American vessels arriving at port were put under quarantine. One vessel which "was thrown on her beam ends with the violence of the sea" off the Scilly Isles reported one drowned overboard. As the storm abated it was mentioned the supply ships were already preparing to set sail again to attend to the naval vessels seiging the port of Brest.</p> <p>A report of a "dreadful gale of wind at SW" which blew through the night of the 8th and into the 9th resulting in the wreckage of a sloop under the rocks of the Citadel. The wreckage of the vessels and it's crew of ankers of beer were found washed ashore and every soul was</p>
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1804	19-20	1	Southwest Britain	Caledonian Mercury	26/01/1804	4 deemed to have perished. A large 84 gun naval ship could not enter the harbour and several vessels were forced back into port owing to the ferocity of the storm. Damage. A violent gale commenced from the SSW at 8 pm on the 19th and lasted until 4 am on the 19th causing considerable damage amongst shipping in Falmouth. A brig which arrived at the height of the gale around 10 pm was the first casualty of the gale as it struck the rocks of Tresuses Point and sunk. Although the captain was washed overboard the surging sea carried the vessel and the crew onto the rocks who "saved themselves by leaping from the vessel to the rocks". The vessel was a complete wreck although "every endeavour" was being made to save the cargo. Several other vessels were carried onshore and lay high on the rocks and full with water although the majority were likely to be got off and the cargoes were saved. Approximately 100 elm trees were blown down in Arnwick Grove and "scarcely a house has escaped losing part of its roof; a more severe gale never was remembered by the oldest person in this neighbourhood". The conditions also produced a tidal bore which was especially noted as "a remarkable rise of the tide was observed" and it was said "in three minutes the water rose full eight feet, and went and came four times in the same way". As a result the shipwrights had to run and swim for their lives. It was ominously remarked "We are apprehensive of great damage on the coast". These fears were realised in the Plymouth shipping news. A ship named the "The British Tar" had driven from her anchors and sunk with her cargo whilst a lighter was wrecked with
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1804	23-24	2	Northwest Britain	Lancaster Gazette	03/03/1804	the loss of one life. A large Swedish ship had to cut away its masts to hold anchor a French privateer sunk in the Catwater whilst it was remarked "there is scarce a vessel that has not suffered in their hulls, masts, yards & c." Three more died upon a lighter wrecked in Cawsand, two frigates collided doing damage and a gunbrig was also ashore. The tidal bore was also noted as the water in the harbour "rose, in the space of ten minutes, as many feet perpendicular, and then ebbed as suddenly carrying everything before it". Overall it was remarked "the damage done is incalculable, nor is the extent of it yet known".
1804	24-25	3	Northwest Britain	Lancaster Gazette	31/03/1804	Damage. A succinct report of a severe gale at Liverpool in which many drowned pigs were washed ashore along with the wreckage of a Dundalk vessel.
1804	14	4		Lancaster Gazette	14/04/1804	Damage. A vessel drove ashore near a Fort in the Mersey but was expected to get off without damage. However it was "greatly to be feared we shall hear of more damage along this and the adjoining coast, from the violence of the wind". The poem 'The Evening Gale' which seems to imply a parallel between the ever presence and unwavering power of nature and human hope throughout a lifetime. Throughout the poem the final line of each verse refers to the continuing Ev'ning Gale from the first verse in which the start of life is implied with the "The cheerful morning hail;". The poet then refers to the "young hopes when Fortune smil'd,/ And joy the passing hour beguil'd," before the trials, tribulations and monotony of later life are mentioned in the fourth verse "crush'd by Misfortune's

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power,/ And languid counting each long hour,/My sorrows I bewail". The next two verse adopt an all together more depressing tone as the poet "Mourns to the Ev'ning Gale!" and "heave the deep responsive sigh/To the soft Ev'ning Gale" as "e'en from Frienshhp's smile I fly". The 6th and 7th verse appear to relate to the decline at the end of life as the poet asks "Ere comes the Ev'ning Gale?" as if to imply an impnedning death whilst the state of physical decay is implied with the lines "her sails all torn-her anchors lost,/And Jope herself turn pale!", drawing a clear parrallel with a foundering vessel and human demise. The poem concludes as the poet looks to "fair Hope, most welcome guest!/And sit thee down within my breast,/Nor ever hence me fail;" before it is implied hope in the form of the evening gale will be with them until death "and when life's chequer'd course is run,/Breathe o'er my grave, at setting Sun,/Thy scents, O Ev'ning Gale!"

A report from Torbay stating "Notwithstanding the indefatigable Admiral Cornwallis seems determined to return to his station off Brest yet the elements fight against him" as he attempted to blockage the French port during the Napeolonic wars. This was proving a challenge as the wind was blowing "a whole gale" from the SSW which was accompanied with thick rain. As a result the fleet were fighting against the wind to return to Torbay but "being so far to leeward, they cannot work up before the post departs". One ship had made it to port so far whilst the rest were predicted to follow soon.

1804	13-15	11	Southwest Britain	Morning Post	19/11/1804	<p>As it blew a gale from the NE at Torbay the whole fleet of naval ships under the command of Admiral Cornwallis got under weigh and sailed for Brest. The breeze continued to blow hard from the same direction.</p> <p>Damage. Impromptu lifesaving. An exceptionally strong gale blew for a week varying from SE to NE in direction which was described as one of the hardest gales "experienced for many years along this coast". At Brixham the hurricane from the ENE confined all to the pier during the start of the storm. "Their situaiton was at this time dreadful, and nothing but inevitable destruction appeared to await both ship and crew". However the people of the town deployed several vessels and rescued those onboard naval vessels. One vessel lay bilged and it was feared she would go to pieces. Fortunately the naval vessels in Cawsand Bay rode out the gale well thanks to "the exertions of officers and crew" although a vessel sent to assist nearly got into deep trouble. One vessel did touch rocks in the Bay and sustained minor damage although she was soon recovered whilst several vessels who's crew were owed wages in the the port of Plymouth had to bear away and postpone their entry to the port due to the conditions. A report from Torbay dated Dec 22 stated that "The Nemesis frigate thank God, continue to ride it out" whilst another frigate had "in a masterly seaman-like manner" been run in on the sands very close to a reef of rocks in order to give "her yield to the shore". She was purposefully position to enable the "brave Brixham pilots to go off in their boat, and thereby preserved the lives of the whole crew, 114 men, 18 women, and a number of</p>
1804	17-24	12	Western Britain	Morning Chronicle and Morning Post	24/12/1804, 25/12/1804, 26/12/1804 & 27/12/1804	

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young children". It was also remarked "Great praise is due to the inhabitants of Brixham and Paignton, who assembled in thousands". The captain of the beached vessel was "going to reward the brave fellows; and some other gentlemen are going to have a medal engraved for those seven men that ventured off in their boat". These same men "were immediately ordered by our Navy Agent to weigh the Blonde's sheet anchor, and to carry it on board the Nemesis" which continued to fight against the elements in the bay. After the gale moderated slightly they set off to the exposed vessel only to be driven by twice by the elements and for fear another anchor they carried from the shore for the vessel would go through her own bows as it was transported in the rough sea. Although the frigate continued to ride well an old brig was not so fortunate and entirely when to pieces and it was reported: "the poor fisherman have suffered considerably in their craft". A scheduled review and gathering of "150 fine fellows, and hardy fisherman" who constituted the Cawsand Sea fencibles (milita) for the "great gun and pike exercise" was also dismissed by the Rear Admiral as it "blew such a hurricane the men could not stand at the guns". He was much pleased with their appearance however. A convoy from Milford and the west of Cornwall was also "much retarded" by the storm which was "to the great detriment of the trade of this town and dock". News relayed to the Port of Liverpool from Falmouth spoke of a brig which had run ashore in an easterly gale near Pendehnis castle, Falmouth and was currently on the rocks. The majoiryt of her cargo consisting of casks of ale

1805	20	7	Lancaster Gazette	20/07/1805	<p>had been landed and it was thought the rest of the provisions and the vessel itself would be saved.</p> <p>A stanza which was "written during a storm" which begins with the poet exclaiming the grandeur of nature with the lines "WHAT sable clouds obscure the skies! How swift the forked lightning flies, And awes the great and gay!". A clear parallel between the fury of the storm and the trials and tribulations of human life is made with the lines "Ah me! this elemental strife/Presents a type of human life" as a comparison between the changing nature of the storm is made with the changing human emotions: "So sorrow, poverty, remorse,/ Alternate speed their fated course,". The poet continues to portray the ominous and looming nature of the storm before stating such conditions "Shall pass - their fury cease; - /The pelting shower, forbear to pour,/ No lightning flash, nor thunder roar,/ And all be joy and peace". This appears to be the poet drawing a parallel between the abating of the storm and the end of a tumultuous period and beginning of one of good fortune in life. Despite the favourable change in conditions and circumstance the poet hints at a lingering issue with the lines "But ah! the secret ills I prove,/No breeze, no sunshine can remove, ... Griefer's dreary path, are hid in gloom,/ And give me to despair". The poem takes an all together more sinister turn as the character being portrayed speaks of being "Wrong'd and opprest, forlorn, in pain,/ Her fiends possess my possess my madd'ning brain," before even seeming to suggest suicide: "She whispers to my totur'd soul,/There comfort in the grave'." The poem concludes with a direct reference to</p>
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1805	6 to 7	9	Southwest Britain	Morning Post	13/09/1805	2	<p>the divine and appears to imply that God, friendship and love make life worth living: "Almighty God! at whose command/ The storm terrific rules the land, / On me thy influence shed! / Let friendship bear her lenient balm, / Let love gigantic woe disarm, / Or lay me with the dead".</p> <p>Damage. A storm of wind, lightning and hail was experienced at Plymouth causing several men of war to drive from their anchors. One naval ship was "firing guns of distress all night, and making signals for a best bower cable and anchor, which was put onboard". Although "a dreadful squall came on, and split all her sails to ribbons" the vessel ran before the gale preventing it's wreckage and the potential loss of lives. A "tremendous sea" caused a tender for a naval vessel to break adrift from the ship and although "the three boat-keepers had nothing to trust to but their rudders and thwarts ... they providentially got, amidst a dreadful sea, into the Pier Head". Several vessels "humanely put off to their assistance", one of which was a yawl which was upset the captain and one other drowned. A report from Plymouth that an 84 gun vessel could not enter Plymouth harbour due to the ferocity of a gale which caused her to bring up mooring in the bay. Likewise Admiral Lord Gardner was still "detained by the tempestuous weather in Hamoaze" in a 36 gun ship. A Plymouth Ship News reported described how a 84 gun vessel was "inveloped in such a dark thunder storm, as to be obliged after weighing to bring to aain" as the wind blew a "perfect hurricane" for three hours.</p>
1805	22-23	9	Southwest Britain	Morning Chronicle	26/09/1805		
1805	10	9	Southwest Britain	Morning Chronicle	16/10/1805		

1805	30	11	Southwest Britain	Morning Chronicle	03/12/1805		Damage. A fresh gale of wind caused damaged to several naval vessels leaving Plymouth but the convoy continued as the wind moderated.
1805	22-23	12	Southwest Britain	Morning Post	26/12/1805		Damage. A gale of wind produced storm surge condition in Plymouth as the sea overflowed the boundary wall of the marshes in Mill Bay which became "a complete sea". Several large naval vessels were blown off station in the bay but came to no harm. Three French prisoners who when in port having been imprisoned after the Battle of Trafalgar escaped from a prison ship in a small boat which capsized in the gale leading to two deaths whilst the survivor was "taken onboard almost dead with fright".
1805	25-26	12	Southwest Britain	Morning Chronicle	30/12/1805		A "tremendous gale of wind at SW as forced all the frigates in the Sound to strike yards and top-masts"although the men of war in Cawsand Bay road well.
1806	14-15	1	Southwest Britain	Morning Chronicle	18/01/1806	2	Damage. A report from Plymouth exclaimed "The thunder and lightning last night was indeed horrific. And a vessel coming from across the Atlantic endure "a tempestuous passage" with all three top masts being split and tow men killed. Another naval vessel with a aristocrat onboard was obliged to put back "owing to the heavy gale and violent thunder and lightning". A tremendous storm "that was ever remembered by the oldest inhabitant; in fact about twenty minutes it was a mere hurricane" from the WSW was also reported at Torbay. There were also vivid flashes oflightning, chimnes were damaged and other property damage was sustained. The wind then veered W and continued to blow "a whole gale" although the Channel Fleet were reported to have entered the port safely.

1806	8	2		Lancaster Gazette	08/02/1806		A poem 'The Winter's Night' which begins by the portraying the storm in a sinister and semi-human manner: "The thick'ning shades of night appear;/Hoarse breathes the wint'ry storm afar;/ ... The din of elemental war". The power of the storm and grandeur of nature is then emphasised with the lines "Fierce on my roof the rattling hail/Its glassy flood tremendous pours;/The tempest bellows in the vale;Aloud the bending forests roars". However a sense of human resilience to the tremendous force of nature is conjured with the lines: "A smile, dear girl, from thee alone,/Imparts calm sunshine to my soul". Although the poet speaks of their relative insignificance of life they reflect on their favourable situation at the time of the storm: "Yet thousands, in the dreadful hour,/Would give all these to fare like me". The focus is then specifically placed on the strife of mariners in this hour during the storm as they reflect on: "What numbers, on the troubled deep,/Remote from friends, from kindred dear," before the torment of their love ones back on land is referred to with the lines: "For wives belov'd, despairing weep,/ For children drop the bitter tear!". On the contrary the poet refers to the beauty of the simplicity of life inside during the storm with their family as they "sit around the cheerful fire" in "scenes of mutual bliss,". The poem concludes by highlighting the simple joys of life and a fear of resilience as the character "nor dread the wind that round us blows" before drifting off to sleep "to pleasing dreams, or soft repose".
1806	9 to 10	3	Northwest Britain	Lancaster Gazette	15/03/1806	5	Damage. A report of the inconvenience to shipping around the North-West coast spoke of several vessels which had

1806	11	7	Northwest Britain	Lancaster Gazette	02/08/1806	<p>been driven ashore in Liverpool Bay, and although many had been substantially damaged losing masts, rigging, keels and bowsprits the majority were got off and taken into port. One of the vessels went down off West Hoyle with all her crew but nothing was known of their whereabouts and it was believed all were lost. Rum from the a vessel from St. Vincent were also found in the Mersey and it was unfortunately believed she was also lost.</p> <p>Damage. During a tremendous thunderstorm on the morning of the 11th July lightning struck property in Ulverston arousing considerable alarm and damaging the chimney and roof structure as well as many metal features of the house. Following the widespread damage caused by the dissipation of the electric current throughout the building it was said "this is a remarkable instance of the various directions into which the electric matter may be divided, when a great body of it strikes a building where there are no conducting substances to carry it into the earth sufficiently deep to prevent its return". Consequently the following advice was offered: "And as the course of electric matter was principally along the walls, it affords some confirmation to the general opinion of electricians, that the middle of a room is the safest place during a thunderstorm".</p>
1806	20-22	11	Southwest Britain	Morning Chronicle	25/11/1806	<p>Damage. A naval vessel which bore up for Torbay on the 20th due to a heavy gale from the SW although the vessel was due to leave shortly as the wind was veering to the NNW.</p>

1806	25-26	11	Southwest Britain	Morning Post & Caledonian Mercury	29/11/1806 & 06/12/1806	Damage. A succinct report of a "tremendous gale of wind, at SSW, with a hevy sea in the Sound". A Lloyd's report also came in from Milford Haven of the six vessels which had sustained major damage with the crews being forced to cut rigging to stay afloat. Although several were driven ashore and one vessel was presumed wrecked no lives were reporteed lost.
1806	5 to 6	12	Southwest Britain	Mornign Post	09/12/1806	Damage. A report from Plymouth of a terrible gale of wind from the SW although litte damage was done to shipping in the Sound.
1806	26-27	12	Southwest Britain	Caledonian Mercury	29/01/1807	Damage. Storm Surge. A vessel in search of a military convoy "experienced such terrible weather, and such dreadful storms, that after beating about several days, and not having any intelligence of the Expedition" decided to turn back into Plymouth and arrived on the 27th with her dead lights stove in. A later report labelled 'Sound Intelligence' reported that a hevy gale from the the Northwest with rain and sleet on the 25th and the gale continued on the night of the 26th. The report stated "the water was as high as the bridge, which has done considrable damage to the lower batteries" although fortunately no damage was done to shipping in the Roads.
1807	20-22	1	Southwest Britain	Trewman's Exeter Flying Post	29/01/1807	A report noting a "dreadful gale of wind at WNW" although fortunately no damage was done to shipping on the catwater, or in the Sound or at hamoaze. The gale continued into the 22nd creating a heavy sea in the Sound that infringed navigation.
1807	8 to 10	2	Southwest Britain	Morning Chronicle	13/02/1807	Damage. A 74 gun Naval vessel experienced a dreadful gale of wind whilst bearing up for Torbay and "in a heavy squall she was almost laid on her beam ends" and

1807	6 to 7	9	Northwest Britain	Morning Post	11/09/1807	3	<p>received considerable damage to the extent she came into Torbay "quite disabled". It was subsequently thought she would head to Portsmouth to refit as the Docks at Torbay were nearing full capacity.</p> <p>Damage. A letter from Holyhead dated the 7th "describing the tremendous gale which blew on the preceding day" which mentioned seven vessels had been wrecked and two ships were dismasted whilst soldiers and cattle were reported drowned on one vessel.</p>
1807	3 to 4	11	Western Britain	Trewman's Exeter Flying Post & Morning Post	10/11/1807 & 12/11/1807		<p>Damage. An account of a severe storm from the SW on the West of Britain which caused great damage and destruction to shipping. A Portuguese ship was driven upon the rocks near Portreath. Despite the efforts of the captain of another vessel who set off to rescue the distressed crew in a tender the "violence of the surf upset his boat, when three of the brave fellows were drowend, and himself and the two others were driven onshore sneseless but happilly recovered". The crew of the Portuguese vessel were saved however and "Lord De Dunstanville and Colonel John Lemon arrived onshore in time to prevent the cargo becoming a prey to the populace". A military company was assembled and assisted in landing and guarding the cargo. One of the deceased rescuers was reported to have left a widow. A letter from Ayr reported of a sunken brig in a Hurricane near Black Rock and the nearby beach was covered with wreck and cargo as well as a few corgs. Consequently a military party was "stationed on the coast, to prevent depredations, and collect the wreck. A guard is to be on the shore all night". In Plymouth "a tremendous hurricane</p>

1807	10 to 11	11	Western Britain	Lancaster Gazette	14/11/1807 & 16/11/1807	<p>at SW with a dreadful hollow sea in the Sound" was reported although it was remarked it was fortunate a large convoy estimated to be worth £50,000 had made it into the port safely.</p> <p>Damage. A vessel also put into Lochryan in Northern Ireland after experiencing a very heavy gale in the Irish Sea. A Maltese vessel was driven onshore near Beaumaris in a "tremendous storm". Although the crew were saved the vessel was in danger of going to pieces. A brig from Whitehaven to the West Indies was also ashore in the same location.</p>
1807	12	12		Morning Chronicle	12/12/1807	<p>Damage. A song entitled "The pilot who has not Weathered the Storm" which concerns the responsibilities and failings of a Pilot during a storm. The song begins by seeking the scene and describing "the loud whirlwind, once hushed in the deep,/And the clouds with dark tempests the sky does deform;". Before the focus is turned onto the failings on the Pilot with the lines "shall the Pilot go to sleep?/No - Perish the Pilot that failed in the storm". The background to his failings are explained in the subsequent lines "When, thro weakness and age, he came more withdrawn". The song writer then seems to imply the pilot who is seemingly portrayed to represent Great Britain in early the Napoleonic wars failed to do his duty due to a lack of financial incentive and underlying greed: "For his heart is corrupted by interest and fear,/ By power he polluted, and tainted by gold,". The moral failings of the man are also reinforced by the lines "Whose example with honour no man can behold?". The writer then appears to draw a very clear parallel with what is</p>

1807 7 to 8	12	Southwest Britain	Morning Post	23/12/1807	<p>likely to be the Napoleonic wars which were raging at the time and Britain's limited involvement at the time by stating "When terror and doubts thro' the universe reign;d;/ And nations appall'd, kept their standards close furl'd; The honour and faith of his country he stain'd; By a vigour which scamped our disgrace to the world". The writer then implies that a lack of involvement or action will contribute to "his welcome decline" and that to take action was an act of wisdom not stupidity: For evils, that Wisdom, not Folly could brave-". The final verse finishes by once more drawing on the storm parallel and suggests war is the righteous course of action and that peace is not a viable solution "Oh! see the rude whirlwinds and storms fresh arise,/Thy vigour all dawning of Peace must deform;/The contempt of the good and complaints of the wise/Shall fall on the Pilot that fails in the storm".</p> <p>23 Damage. Letters received at Plymouth told of the "the melancholy effects of the severe storm" at Bideford in which five vessels were wrecked on the bar with the total loss of all crews. Onboard one brig was an aristocrat and reverend who was lost along with his wife and three children. His portfolio and beautiful drawing of several places he had visited were washed ashore but no dead bodies were recovered. Two transport vessels with crew and 20 troops and a brig with copper was lost between Padstow and St Ives with no accounts of any survivors. It was reported "Bideford is quite a scene of distress. - Several widows, orphans, and distressed mothers, are there bewailing the melancholy loss of their dearest relatives".</p>
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1807 27-28	12	Southwest Britain	Morning Post, Morning Chronicle & Trewman's Exeter Flying Post	02- 14/01/1808	99 Damage. A series of report concerning a heavy gale which most prominently resulted in the loss of HMS the Anson in Mount's Bay which had great consequences throughout the Navy. The incident occurred in a violetn storm from the W to SW when the vessel's distingued captain Lydiard mistook the Land's End for the Lizard. The captain knew the vessel was in peril as soon as breakers were noted off the bow and despite the best attempts to release anchors although all attempts to hold the ship failed. The ship was subsequently washed upon a ridge near Loepool and waves broke over the ship's mast and wrecked the ship with the few survivors escaipa by floating on the mass to shore. It was remarked "never did the sea run more tremendously high" and that the captain "seemed to have lost the use of his faculties, with he horror of the scene" before being washed overboard. The first lieutenant also perished along with an estimated 98 crew. A Methodist preacher lead 'some brave hearts' through the surf and to the wreck in the surf and saved two women below although two children perished. When the vessel went to pieces a few men who had been kept prisoner in the depths of the vessel emerged and one of those was saved. It was remarked she was an old vessel which "accounts for her beating to pieves so soon on a sandy bottom". A court marshall was later held in Hamoaze with the Hon Rear-Admiral Bertie overseeing the proceedings. After a recital of the causes of the wreck the surviving crew and officers who were "unanimously acquitted" of any wrongdoing except the master of the vessel Mr H Stuart who "the court were of opinion did not
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1808	13-14	1	Southwest Britain	Morning Chronicle & Calendonian Mercury	18/01/1808	<p>fulfil the duties of his station, and therefore adjudged him to be admonished, and he was admonished accordingly". Other reports told of naval vessels which had put back into Plymouth due to the damages they had recieved in the gale and a vessel which was initially reported to have been lost off Land's End was said "confidentally to have arrived at Liverpool". A brig was also reported plump ashore on the rocks under the Hoe were she lay dry. A strong gale from the NW was noted on the Southwest coast which forced a vessel back into Plymouth having got as far as Barney Pool. The NW Channel Fleet had to return to Torbay where it blew "the most tremendous storm" and it was reported "Some of the men of war are driving". Damage. A vessel bound to Liverpool from Dublin ran ashore near Red Noses and although the passengers which numbered more than 200 were got off it was "feared that several who were not able to keep up with their companions are lost" as they had to walk a "considerable distance through the snow, before they could reach the nearest houses". A vessel was reported in dock in Liverpool with loss of anchors and cables. As it blew a gale of wind at ENE very few arrivals were expected from the westward at Plymouth. It was exclaimed in the Plymouth Ship News that "it has blow such a gale of wind for three days past, there has not been any arrivals from the westward".</p> <p>5 Damage. A sloop was reported to have sunk off Langness Point, Isle of Man. She appeared to have been water logged from the shore although "it was impossible to render her any assistance". A cutter picked up a capsized</p>
1808	3 to 4	2	Southwest Britain	Lancaster Gazette	20/02/1808	
1808	24	2	Southwest Britain	Morning Chronicle	27/02/1808	
1808	10 to 12	3	Southwest Britain	Morning Post	15/03/1808	
1808	24-27	3	Irish Sea	Lancaster Gazette	09/03/1808	

1808	4 to 5	4	Southwest Britain	Morning Chronicle	09/04/1808	1	<p>vessel off Peel and towed her in. The vessel was identified as a Whitehaven boat and it was stated "there is every reason to conclude, that she had overset, and that all on board perished!" which included 5 people in total. Of the most prestigious passenger who was a notable manager of an ironmongers it was said that the "ultimate fate will be deeply regretted by all who knew him".</p> <p>The ship news from Plymouth told of a wrecked vessel in Whitsand Bay and although the majority of the crew were rescued by locals one man unfortunately perished.</p>
1808	15	7	Southwest Britain	Morning Chronicle	23/07/1808		<p>Damage. A storm which "exceeded in awful phenomena any one remembered for many years past" struck the West of England. The thunder was remarked "to roll is one continuous roar for upwards of an hour and a half" whilst "the flashes of lightning followed each other in the most rapid and uninterrupted succession". However the "the most tremendous circumstance attending this elemental tumult was the destructive hail shower". In areas where the storm was most severe the hail stones were measured from three to nine inches in circumference and "appeared like fragments of one vast plate of ice". The tempest was said to have arisen in the Southwest before moving Southwest and then finally dying in the north-east and the strong breeze which accompanied it was "peculiarly hollow and mournful in its sound". In the vicinity of Bristol the storm was particularly violent and one gentleman had 600 panes of glass broken, crops destroyed and his loss was estimated at £170 (£15,100). Orchards were also stripped of their fruit and trees strewn roads.</p>

1808	8 to 9	10	Northwest England	Lancaster Gazette	15/10/1808	4	<p>Damage. A severe storm hit the Northwest of England causing many vessels on the Mersey to drag their cables and several ship wrecks. A naval vessel was rescued and towed up the Sloyne after going adrift whilst six vessels were beached but all were eventually got off and towed in George's Dock with little damage. Several vessels fared less well however and three were completely wrecked although all the crews had been saved. The crew of a vessel lost off North Meols were not so fortunate however as all perished when she was wrecked and another vessel lost on the Spit of Hoyle resulted in three fatalities whilst the remainder of the even strong crew floated to shore on the wreckage and were saved. A brig was later towed into Hoylake by a fishing boat with no one onboard except "one dead body lashed to the rigging". A Swedish brig was also washed up on the high water mark and all her hands had perished. Several more vessels were reported washed ashore or having sustained considerable damage in the Mersey as well as a brig at Whitehaven although no more lives were reported.</p>
1808	26-29	10	Southwest Britain	Trewman's Exeter Flying Post	03/11/1808		<p>Damage. God. The port news from Plymouth reported a gale from the SW and that vessels from the Bay of Biscay had the "Most tempestuous passage". A heavy sea rolled in the Sound. Many vessels had issues holding anchor and one vessel sunk as she was forced "plump ashore on the rocks, near Rusty Anchor, under the West Hoe. Although she sunk "providentially the officers and crew were all saved". Two houses were unroofed near New Town and walls were blown down in that vicinity".</p>

1808	18-19	11	Southwest Britain	Morning Chronicle & Calendonian Mercury	22/11/1808 & 26/11/1808	7	Damage. A report in the lloyd's marine list read "Much damage was done among shipping in Stonehouse Pool yesterday, during a very violent gale of wind at WNW". Several of the ships in Plymouth broke adrift and many gorunded. A pleasure vessel unfortunately upset in the Sound and seven met a watery grave.
1804	5	6		Lancaster Gazetter	26/11/1808		A poem entitled "The Storm" written on the 5th June 1804 printed in the Lancaster Gazette. The poem mainly concerns the experience and anguish of a sailor aboard a vessel foundering in a storm. The focus focus is firstly placed on the fear and futility of the sailor who faces "the rude contention of the wind" and hears the "hoarse rearing waves" in this "frail-built bark". The impending sense of death and the isolation of the crew is communicated by the lnes "one thin plant/The barrier twixt eternity and us.-/To look around, and see no human face,/Save the devoted few, who share our fate-". The storm is portrayal much like a predator as the poet describes "circling waves" which leave the crew isolated and alone: "While the far-stretch'd horizon closing round,/Seems to exclude all commerce from mankind." The poet then refers to the contrast of the storm with flat calm conditions "When the still'd sea scarce heaves one languid wave;/The sails inactive hang - the idle dog-vane/Droops listless o'er the sleepy vessel's side-". The poet then refers to other adverse sailing conditions in the form of "The tedious teizing too of adverse winds," and how such make the sailor "Dispirited and sad!". However, the poet increases the tempo of by starkly contrasting such conditions: "But what are these/To that dread hour,

when from the furious North/The unimprison'd winds
come bursting forth,/And tear the foaming deep?". The
poem then describes the frantic actions of the crew
onboard the ship which are to of no avail as "The strong
mast yields/Like a bent twig that decks the school-boy's
hand". The grandeur of the "vivid lightning" is depicted as
the masted is felled. The sailor has a sudden moment of
realisation of his impending fate as the ship begins to
founder: But who can paint/The terror that appalls the
shudd'ring soul,/When the tried pump proclaims a leak is
sprung!". On the hearing of this a sense of futility is felt by
all as "Hope dies in every breast - the seaman's
heart,/That still has bid defiance to Despair,/Now sinks
within him". All rationality now evaporates as the sailor
becomes gripped by the fear of his impending death as
"Instinct only guides./For Reason flies its seat! - Now fear
awakes,/And holds his empire in the wretch's mind" as
death is once more portrayed in a personified form, much
like a hunter or predator which "stalks his round, and on
the mountain waves,/Poises his threat'ning dart alof in
air;/Or, in the deep'ning valley, bends his bow-". The
scene of universal destitution around the boat is depicted
as the sailor "with a father's heart/feels for his drooping
crew - his soul alone". However the sailor "Disdains to
yield to fear" realising "the fate of all/Hangs on his firmer
mind". The sailor remarkably grows in courage and begins
to give commands and inspire confidence as "his full-ton'd
voice,/Thro' the uplifted trumped, cheerly sounds,/ and
banishes dismay". Consequently, he eradicates the fears
of the crew crying "Courage" and "Despair alone is

1808	25-26	11	Southwest Britain	Morning Post	01/12/1808	4	death!" before reassuring the sailors that the vessel will brave the storm. Ultimately his belief in power of their confidence and the protection of God overrides the fear and fury and the storm as it is exclaimed "Be it our comfort too, God is o'er all, Nor can the winds, or waves, or awful death,/Without his fiat, hurt a single hair!". Report of "shocking gales of wind" at Torbay resulting in the loss of a trawler and itt's "four poor industrious hands" near the Skerries.
1809	7 to 9	1	Southwest Britain	Calendonian Mercury	21/01/1809		Damage. A vessel put into it's home port of Penzance with great damage and leaking having departed Falmouth in a gale under a convoy of the warship HMS Alert on the 8th. A Malta bound vessel was also noted flying a signal of distress.
1809	26-30	1	Southwest Britain	Trewman's Exeter Flying Post	01/02/1809 & 09/02/1809	3	A hurricane struck Plymouth of the "most terrific violence" and A troop transport vessel was driven onto the rocks by Plymouth Haw but all "poor souls" were saved. Several other vessels were driven onshore near high water but no lives were lost. Another vessel was lost in Whitsand Bay which lead to the loss of cargo and 6 lives. At Torbay a vessel named The Royal George parted anchors and drifted to sea lthough all other ships in the harbour "rode tolerably well". It was noted a cavalry division had disembarked before the storm had commenced. Later a contest gun boat came into Plymouth with a captured French vessel having expereinced the fury of a gale. It was said "the poor fellows on board her were forced to get down below, and to belay the rudder". The only victual they could access for 48 hours were no more than a few biscuits.

1809	2 to 3	2	Southwest Britain	Trewman's Exeter Flying Post	09/02/1809	Reports of a gale and rain from the Southwest which caused a vessel to "cut and run from Torbay" for the port of Plymouth which several other battleships. Hail, thunder and lightning were also noted at Plymouth.
1809	7 to 8	2	Southwest Britain	Trewman's Exeter Flying Post	16/02/1809	A gale from the ESE led to a warship overshooting Plymouth and instead being driven to Falmouth.
1809	18-19	9	Northwest England	Calendonian Mercury	21/10/1809	Damage. A report in the Lloyd's marine list of a severe storm at Liverpool. Several vessels bound to the Clyde were driven onshore in the Mersey but were got off and put into the Old Dock Basin with considerable damage. Overall 11 vessels were reported ashore, mostly with loss of anchor and cables although no lives were reported lost. The Norwegian vessel, Kentish was also considerably damaged near the Isle of Man, losing most of her sails so was consequently forced to put back to Liverpool.
1809	10 to 13	10	Southwest Britain	Morning Chronicle	17/10/1809	Damage. A violent gale of wind did considerable damage to a vessel leaving Plymouth which sprung all her masts and was by consequence forced to return to port. There was also another collision between vessels which led to one vessel running ashore but she was consequently got off.
1810	13-15	1	Southwest Britain	Morning Chronicle	17/01/1810 & 18/01/1810	Damage. In Torbay a gale continued with "unabated fury and I am very apprehensive that is the wind does not veer farther to the northward that one-half the fleet now in the Bay will drive on shore". Brixham pilots onboard a distressed vessel were reported to have saved her by running her onshore. Many vessels were "cutting and running" into the port and the number of brigs driven on the shore was said to present "a melancholy site". The

1810	25	2	Northwest England	Lancaster Gazetter	03/03/1810	<p>correspondent was apprehensive about whether many of the vessels would survive given the conditions. A sloop of war, The Alert, had also discovered an abandoned vessel off the Scilly which was in a total state of ruin and she fired several shot at her to sink the vessel. The correpondent concluded "It blows heavy and much sea".</p> <p>Damage. The ship news from Liverpool report of a violent gale during which several vessels in the Mersey sustained damage and one vessel inbound with wheat from Waterford "struck violently against the Pier, as to cause her to sink in about 15 minutes in the basin" whilst running for the Queen's Dock.</p>
1810	24-25	3	Celtic Sea	Morning Post	28/03/1810	<p>At Plymouth dock yard it was reported it had blown a gale from the East and South-east during night of the 24th which continued into the 25th. As a result a convey of cutters had to return to Torbay.</p>
1810	30	6		Lancaster Gazetter	30/06/1810	<p>A poem entitled "The Sea Beach - Midnight" which begins by portraying the scne on the coast during the storm and highlights the grandeur and of the elements : "When the rude surges strike the sounding shore,/And scatter on the beach, their starry foam; When midnight tempests wake old Ocean's roar". The looming threatening nature of the storm is communication with the lines "And hear the rolling thunder's awful voice -/These may impose on happy minds dismay,". However the poet highlights the appreciation of the sublime power of nature with the following line "But care-worn souls amid such scenes rejoice" before conveying a form of human resilience to the storm "And the rough roar my sighs indignant mock;/ I</p>

joy to see dark clouds the skies deform,/And smile at Nature's deep convulsive shock-". The scene "'neath the sea-worn rock" of "fluttering forms of shipwreck'd seamen" is depicted and related to a "lost, screaming sea-bird seeks the flock". The poet succinctly communicates the dual feeling of joy and dread of the elements with the two lines "the roar that tears my burthen'd soul/Bids it rejoice amid such scenes to dwell". However the attention is then switched to the tangible fear of death as the "new-born horro presses on my ear-/Th' imploring minute-gun sounds from afar,/And wakes for others woes the anxious fear-". The feeling of impending death on the coast is then conveyed as the "mournful rolls along the madd'ning waves ... warns the dear-struck sailor to his grave". The tempo of the poem then suddenly increases as the graphic scene of a shipwrecked sailors struggle for life is conveyed: "And now I hear the mingled cry of death - / What screams of terror pierce my anguish'd breat!/ My life seems gone - horror suspends my breath,/ And my whole soul's by sympathy opprest -". As the vessel drives ashore despite their vain efforts the sailors turn to their last resort in the form of their tender: "One hope is left-they ply eager oar,.And to the boat commit their doubtful lives-". The poem implies the humanity of the almighty as "Heav'n smiles - the storm recedes - they reach the land" and they are lead to "Briton's firendly door". The final verse depicts the sailors on shore celebrating their escape: "And in the cheering bowl their sorrows drown," before the poet thanks God for their safe return and forgets his

1810	1	7	Southwest Britain	Morning Post	04/07/1810	own troubles "I praise the Pow'r who gave the transport birth,/And as their griefs subside, forget my own!". A "violent thunderstorm today, accompanied with vivid flashes of lightning and heavy rain" was reported at Torbay.
1810	27 to 2	8	Celtic Sea	Morning Post	16/07/1810	Damage. A schooner was obliged to put back into Plymouth in a leaky state having encountered a heavy gale of wind on the morning of the 2nd whilst twenty leagues south of Plymouth. She was aground going into Stonehouse Pool and was considerably damaged although she was later got off. A brig from Guernsey also put in in a leaky state having encountered a heavy gale of wind of the 27th at 44 N and 12.30 W. Since this time it was reported "the crew have been constantly employed at the pumps, and were several times near foundering; she also sprung her main-mast in gale".
1810	13-16	11	Celtic Sea	Morning Chronicle	17/10/1810	Damage. A heavy rain storm hit Exeter with rain falling without intermission for 24 hours. Waters rose so rapidly that all low grounds were presently deluged" and the flood was "three inches higher on the Exeter Quay than ever known before". As a consequences three vessels were carried upon the quay, walls were thrown down and several out-houses totally destroyed. The Monmouthshire regiment of militia "were obliged to trade through the water up to their necks". Travellers from Plymouth to Exeter by coach were severely impeded by the flood waters. In one incident two coach horses were drowned with the coachmen up to his chin in water whilst the passengers were forced on top of a hedge. Six passengers sought refuge in a nearby house where they

1810 20-27	12	Celtic Sea	Trewman's Exeter Flying Post	03/01/1811	<p>2 were treated hospitably and given "an asylum for the night" however a "stout black man, taking a different course, remained under an high hedge nine or ten hours". At Dawlish the "beautiful canal" and it's bridges was servely damaged with one gentlemen sustaining damages estimated at £10000 (£790,000). At Budleigh Salte the flood descended on the town with such violence two "handsome houses, near the beach" were swept into the sea as the "force of the water was so prodigious as to make a channel of about 60 feet wide and 12 deep". The ship news from Plymouth descibed how a gale from the ESE had driven a Portuguese man of war from her anchorage and she recieved damage but fortunately she didn nto go ashore. One of his majesty's schonners went ashore in Mill Bay but it was expected she would be got off on the following tide.</p> <p>The ship news from Plymotuh reported that a 44 gunboat the Medusa had put back to Plymouth due to "contrary winds". A another vesse lthe Harpooner encountered a violent gale on the 20th which caused her to part company with the two ships she was with and she was forced to put back. Another vessel coming from lisbon which came into porton the 31 stated she had encountered "nothing ut gales of wind at SW". The gale "was so violent, that she carried away her fore-yard, all her beams,spars, and boats, and will go up the harbour to refit". She brought no news of the Napoleonic conflict on the Iberian peninsula. A 44 gun ship from Lisbon nearly went ashore in the sound on the 24th but with "her best ower holding,she rode outthe gale very well" and was</p>
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1811 30-31	1	Irish Sea	Lancaster Gazetter	09/02/1811 & 16/02/1811	21 perfectly safe at the time of reporting. Off Falmouth a vessel put in to port having been ran foul by a man of war on the night of the 23rd. She had lost her bowsprit and two men overboard. Impromptu severity. The vessel the Lady Dunbar was wreced off Donaghadee in "a perfect storm, at east". As a result the vessel and it's wreck now presented "a most melancholy and affecting sight, as eleven bodies, ten men and one woman,lay drowned, and entangled with the rocks" and it was reported "only one man has escaped the unrelenting tempestuous wind and waves". The sole survivor said a certain crew member was "active, brave, and persevering, through the whole night's storm, and never seemed to be fatigued or disheartened amidst all the storm and danger". There reports of the gallant actions of "four brave fellows belonging to Donaghadee" who had saved the sole survivor who was near-senseless on the deck by passing a rope round him and hauling him to shore. A brig was also lost near Ballywater and all the crew perished as a dead body was washed ashore afterwards. Later reports mentioned that some of the dead bodies of the Lady Dunbar had been "decently interred by the inhabitants of Donaghadee" whilst others were recognised by friends and carried away in cars to Bangor. Another vessel was wrecked near Killough with all 22 on board perishing, although the crew of another vessel wrecked in Dundrum bay were more forutnate as all were saved. Three more also perished on a sloop bound from Glasgow to Belfast which was wrecked on Scarnachan-point near the Gobbins. However the
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1811

2

3

Lancaster
Gazetter

02/03/1811

remaining 7 onboard were saved that to the "humane exertions of the people on shore" and it was said the effort "deserves to be recorded in the most honourable terms". However one of the gallant rescuers, described as "a yeoman" was "so overcome with excessive fatigue , in his benevolent exertions to save the people and property, that on his way home, after night, he became so exhausted, that he perished among the snow". The man was "greatly respected by the gentleman in whose service he was employed, and was also much esteemed by the commanding officer of the corps". However it was also remarked "what adds to the calamity, he has left a wife and five helpless children". Another vessel was wrecked off Island Magee and although the vessel was so close to the Gobbins the cry of the distressed sailors could be heard from the shore and rescuers immediately responded to the cry on embarking off the bow of the vessel the ship suddenly split in two before a lifeline could be thrown and all souls perished. After weathering the storm "his Majesty's revenue cutter, Defence identified a wreck off the Creek of Cambyr in Anglesea. The vessel was said to be well built and from Dublin and it was believed 10 had perished in total.

A poem entitled "The Wreck-Pirate!" concerning the devious ways of wreckers on the British coast and their immoral nature. The poem begins by firstly referring to the lack of humanity of the wrecks "Is there a heart, enshrin'd in human form,/That feels no pity for a Seaman's woes!" The poem talks of the "miscreants" that "sad experiences shews" are "lost to all that's good"

1811 12 to 13

5

Western
Scotland

Calendonian
Mercury

18/05/1811

before referring to the wreckers eagerly anticipating the foundering of a vessel in a storm: "Who, when the furious wint'ry tempest blows,/Watch, with a tyger-eye, the raging flood!". The poet then refers to the greed of the wreckers who attempt to tempt the vessel into dangerous rocks in order to condemn it: "Eager for plunder, as the brute for blood-/Miscreants who, in the horrors of the night,/(More savage than the prowler of the wood)/Raise on the rocky beach the treach'rous light!". The poem mentions how the wreckers attempt to deceive the near-overwhelmed mariner with the lines: "To cheat the Mariner's bewilder'd sight,/As tossing o'er the tide his vessel reels" before he turns his attempt to the evil delight of devilish wrecks who "when the lure succeeds, the full delight/Of hellish mischeif each dark villain feels". The poet concludes by going further to emphasise the looters' willingness to add to their evil convictions by potentially murdering the crew by finishing: "On rapine bent - on murder too, if need,/To give a deeper dye to the nefarious deed!".

A severe storm of thunder and lightning were experienced across Dumfries which was said to be one of the most tremendous storms ever rememebered due ot "the constant and unremitting flashes of lightning" whilst hail and large chunks of ice fell from the sky. At Newabbey village the inhabitants were greatly alarmed as the lightning struck buildings knocking individuals to the floor and starting fires which did much damage to property making one house uninhabitable. Several individuals were reported to have been"stupified and pained for a

considerable time" although all were on the road to recovery. Those struck by lightning suffered from "a total loss of sensation in the parts where the electric fluid had struck with the most violence; the skin was pale, and unconscious of impression. This was sooner or later followed by acute pain". The correspondent then exhibited evidence of an understanding of lightning and conduction stating "It appeared evident that, in this thunder storm, the clouds were positively, and the earth negatively, electrified" whilst they also noted "This wonderful agent of nature (the electric fluid) had, in an instant, heated the bedrocks to a white heat, as the brass curtain rings were melted upon them". Subsequent hail showers were said to have done great damage to glass in the district. In Glasgow large hailstones measuring 4 1/2 to 5 inch in circumference in the extreme were observed as well as peals of thunder and flashes of forked lightning. Around the district several houses were struck and materially damaged whilst a woman was struck senseless and several livestock perished. A chapel house was set on fire which was said to be remarkable given "its low situation, it might have been predicted that it would be one of the last habitations in the parish which would have been visited with a calamity of this nature" although it was later revealed a iron boiler in tow of three horses had been passing by the building at the time which was deemed to "have attracted the lightning". In the Clyde Ironworks a man was thrown to the ground, several houses were damaged in Newart hill and a property burnt to the

1811	5 to 6	9	Southwest Britain	Royal Cornwall Gazette	14/09/1811	ground in Cambusnethan. Two people also lost their lives in Moffat and Dalserf. Damage. A report entitled the Plymouth Journal that a Spanish ship had to put back to port due to the damage she sustained in a gale of wind in the Celtic Sea which carried away her "main-top-gallant" masts.
1811	15	8	Lancashire	Lancaster Gazetter & Liverpool Paper	25/09/1811 & 12/10/1811	Damage. An agricultural report for the historical county of Lancashire for the month of August sating that very fine weather had continued throughout the month until the afternoon of the 20th "when we had a violent storm of thunder, lightning and heavy rain". The storm was reported to have lasted nearly two hours in the Liverpool district and the "lightning in faint flashes was almost incessant; and the explosions in the air never ceased for twenty minutes to break into each other; thereby maintaining a constant roar that seemed to traverse the hemisphere".
1811	12 to 13	10	Merseyside	Liverpool Mercury	25/10/1811	Most severe storm of the year with strong SWerly winds noted in a meterological diary with readings taken from a Liverpool Observatory.
1811	25	10.3	Merseyside	Liverpool Mercury	01/11/1811	Short storm centric poem concerning the Liverpool and it's natural beauty of the river Mersey is noted "Old Mersey rolls his wave serne".
1811	1	11	Western Coast	Liverpool Mercury	01/11/1811	Poem written after a tour of North-Wales and the North-West of England. The poet makes a reference to "O Cambria" adien to thy storm-beaten rocks", To thy deep retir'd vales, and thy floods". Caernarvon is also referreed to the "the Quen of the flood" with the "Castle proud rising from CONway;s blue wave".

1812	22	2		Lancaster Gazetter	22/02/1812		A poem drawing parrallels between the storm and Britain's imperial situation entitled "Hold to the laws, and stand fast by the throne". In particular the poem exclaims "While the wrecks of proud empires lie scatte'd around,/And the tempest, still raging, drives dark o'er the plain,/ Unshaken the bulkwarks of Britain are found,/And undaunted her sons on the land and the main".
1812	3	3	South-west Britain	Liverpool Mercury	06/03/1812		A "dreadful thunderstom" struck the ship "Salvador del Mundo" in Casand Bay, Plymouth doing great damage and injuring several men whilst 9 men were stupidfied on another vessel.
1812	12	6	Merseyside	Liverpool Mercury	12/06/1812	3	Report of 3 boys who were killed by lightening during a thunder storm. One escpaed in a "most providental manner". The dead were burnt in a in a "dreadful manner".
1813	16	7	Merseyside	Liverpool Mercury	16/07/1813		Very violent storm in Kirkdale. No mention of specific social or economic effects. However the hailstones were "unusually large and descneded with great violence".
1814	8 to 9	11	Merseyside	Liverpool Mercury	18/11/1814		Violent hail storms and brisk winds caused a bessel to snap it's mast. Another vessel was onshore near Hoylake.
1814	16-17	12	Western Coast	Liverpool Mercury	23/12/1814		Described as most severe storm since 1802. Extensive damage to shipping and property along the west coast, although the incident did not occur at the same time as high tide. Many "bricks and chimneys precipitated into the streets" and the low tide was said to have mitigated damaged. Many of hte Duke's flats were sunk and one narrow escape occurred with a family fleeing the scene just before catastphe. The chief magisrate was concerned with the loose slates and flags on houses which could pose potential dangers to pedestrians.

1815	11	1	Merseyside	Liverpool Mercury	10/02/1815	Considerable storm from the NW noted in Meterological Report.
1815	29 to 30	3	Somerset	Liverpool Mercury	07/04/1815	Severe storm thunder and hail caused substantial damage to church and tower at Minehead. A "heavy hail storm fell at Minehead, accompanied by a most vivid flash of lightning, and immediately followed by a most tremendous clap of thunder". The church was completely destroyed by the lightning which caused a great shock.
1815	13	11	Merseyside	Liverpool Mercury	24/11/1815	A violent wind storm at noon with evening squalls fo wind, rian and hail.
1816	1 to 10	6	Merseyside	Liverpool Mercury	12/07/1816	A succession of thunderstorms during the first 10 days and 22nd of June with n major impacts.
1816	17 to 18	7	Merseyside	Liverpool Mercury	26/07/1816	Severe thunder storm accompanied by a torrential downpour. No mention of economic losses although the event was described as terrific in nature and "was uncommonly grand and to many persons, no doubt terrific in the extreme". The lightning was oincessant and "of a lalac hue" and the "thunder was protracted to a most unusual length, whilst the rain descended in the most copious torrents". It was said had the morning of the 18th commenced in such a way "the greatest fright and confusion would probably have ensued; as the popular mind was prepared to expect on that day noless a catastrophe than the annihilatio of our globe, according to the prediction of the foregin philospoher. Some persons were so convinced of this occurring they had "made up their minds to betake themselves to the Floating Bath, preferring the chance of being gradually stewed or boiled afloat, to the certainty of being instantaneously roasted ashore".

1816	15 to 16	8	Cumberland	Liverpool Mercury	06/09/1816		Severe storm of thunder, lightening, rain and wind which destroyed property, agricultural land and lead to significant flooding in the county of Cumberland. The storms caused havoc in all areas of the neighbourhood and bridges were broken by the storm water flows.
1816	10	9	Irish Sea	Liverpool Mercury	13/10/1816	7	Ship heading from Liverpool to Dublin wrecked during severe storm with 7 fatalities. The sloop Augustus was also wrecked.
1816	25	10	Merseyside	Liverpool Mercury	18/10/1816		Debating socety question concerning the priorities when saving lives at sea. Specifically the question was "In a storm at Sea, if a man had with him a Parent, Wife, and Child, and could only save one of them, which would he save?"
1816	6	11.7	Merseyside	Liverpool Mercury	06/12/1816		News of a violent storm in the Irish Sea during which the crew and the captain prevented passengers throwing a nobleman's horse aboard due to his popularity.
1816	5, 14, 30 [24, 26, 28	12	Merseyside	Liverpool Mercury	10/01/1817		Wind storms from the E - SE and W reported in Liverpool.
1817	6	3	Merseyside	Liverpool Mercury	07/03/1817		Of the most violent storms ever experienced in the port of Liverpool caused significant disruption to shipping and damaged many houses. "Providentially" no fatalities were recorded despite roof and structural collapses. This was the summit of adverse weather conditions within a long period of tempestuous waternly winds which had been severely impacted shipping.
1817	20 to 4	7	Lancashire	Liverpool Mercury	04/07/1817		A temptous period of two weeks which featured the most severe storm in living memory in St Helens. As a response to this period the Mercury calls for readers (intelligent

1817	24	10	Merseyside	Liverpool Mercury	24/10/1817		persons) to begin recording meteorological observations at a local level. Original poem describing the ferocity of a storm as the "night-horn in the tempest's yell". Frequent references were made to war with the phrase "Scarce echo'd n the rampart wall" aimed at portraying the lack of warning as the storm "Stole silent through that Pace-square". A sense of fear was depicted by the concluding phrase "Wild rain, and wirlwind's doubled roar".
1818	4 to 8	3	National	Liverpool Mercury	13/03/1818		Accounts of a national storm that caused fatalities and substantial damage to infrastructure and properties, although the weather in Liverpool was comparatively moderate. In Devon and Cornwall trees were blown down and blocked roads causing much delay of mails and carriages.
1818	20	3	Irish Sea	Liverpool Mercury	20/03/1818		Account of an Irish Sea storm in which a sail ship was considerably damaged due to a fire caused by a lightning strike but yet was able to weather the storm. No fatalities although injuries were sustained by the crew.
1818	7	7	River Lavern	Liverpool Mercury	24/07/1818		High winds and lightning damaged reverends house and caused severe injuries shattering fragments of the structure and windows. One girl was "mercifully spared by the invisible, but potecting hand of Providence".
1819	27	7	British NW	Kendal Chronicle	06/08/1818	2	Thunderstorm, high winds and rain were responsible for two fatalities and the destruction of six bridges and multiple properties.
1819	8	8	Western Britain	Liverpool Mercury	13/08/1818		Violent storms felt throughout Britain resulting in flash flooding which caused damaged to property due to the effects of floodwater and sediment deposition. Lightning was also responsible for minor damage to property and the death of livestock.

1819	23	10		Liverpool Mercury	23/10/1818	An article concerning the "Superioity of steam-vessels in rough weather". Objections regarding the unseaworthiness of port steam tugs were "found in error". An engineer who had set out to prove the superiority to underwriters and merchants had observed in 1815 that "during a passage of 1500 miles, the steam-boat made upwards of three knots and a half over the sea, directly against the wind". More recent evidence from a steam packet passenger wh stated during a "tempestuous night and high running seas, all the vessels in the channel were scudding under reefed topsails". Although all passengers were sick they "did not ship a single sea" and all stayed on deck. An extract from the Belfast Chronicle also noted the value for merchants as steam vessels could make "a certain passage witout the necessity of waiting for a fair wind" exhibiting the "advantage such vessels have over all others".
1819	4	9	Irish Sea	Liverpool Mercury	17/09/1819	A severe north-westerly gale drove eight commercial vessels in total onshore. A lifeboat, which was deployed to save the crew of the two boats driven onshore outside the harbour due to their highly perilius position, was also eventually forced onshore. However, no lives were lost due to the extradionary acts of courage and humanity of the seamen.
1820	24	7	Cheshire	Chester Guardian	28/07/1820	One of the most severe storms in living memory with very high winds, rain and thunder. Severe flooding ensued turning the high streets into torrents which damaged dwellings and businesses alike. Much of the harvest was ruined due to inundation and the deposition of vast quantities of silt and sand on agricultural land. Hail stones

<p>1820 10 to 14</p>	<p>8</p>	<p>Bristol Channel</p>	<p>Bristol Mercury</p>	<p>14/08/1820</p>	<p>weighing a pound were noted in the vale of Clwyd with the heaviest rain "we have ever witnessed". An article of the Bristol Seaman Friend Society concerning the religious instruction of captains. The chairman of the meeting stated that a seaman without religious instruction was like "a person rescued from a watery grave refusing to throw a rope for the assistance of a suffering companion". It was stated that religion onboard ships in the Napoleonic wars had shown "poor seaman could be brought to feel the power of divine grace. A reverend also told of a boy so bad he was expelled from Sunday school had been revolutionised following a shipwreck in Honduras. He was said to have been insensible and washed ashore onto rocks and in a "deplorable situation". He had then remembered a time in Sunday school and prayed to "God to protect him, and his prayers were not made in vain". He subsequently converted and subsequently "departed this life in a happy state in a foreign country". In Bristol 10 captains had come forward to the reverend speaker asking for divine instruction. The lack of religious instruction was also stated to be particularly bad as "sailors might be made the means of diffusing the word of God in foreign parts". It was stated sailors had been particularly neglected compared to other working class roles and "On the quays of Bristol many were busy on the part of Satan to ruin them, but few to counteract this influence". Another instance of a shipwrecked captain "imploring the assistance of the Divine Being" before saving life of a shipwrecked crew in Memel was noted. When he was thanked by authorities</p>
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1821	27	3.3	Merseyside	Liverpool Mercury	30/03/1821		for this act e replied "Do not thank us: thank God". A storm of hail, rain and wind damaged properties in localities around the Bristol channel. was also noted. Several vessels were driven ashore and livestock was killed by lightning.
1821	2	5	Lancashire	Liverpool Mercury	04/05/1821	2	A question concerning who a man would save in a storm at sea out of a parent, a wife or a child ends with the panel concluding that the wife would be saved. A severe storm of hail, thunder and lightning accompanied by strong winds of a strength never before witnessed in some localities. Hailstones "of an incredible size" some 3 inches in circumference fell throughout the North-west. Substantial damage was done to residential and commerical property due to a combination once in a generation flooding and hail whilst 2 fatalities were recorded.
1821	8	6	Devonshire	Liverpool Mercury	08/06/1821		After recent storms which damaged orchards in Devon the price of a hogshead of cider has gone up 10 shillings from £3 to £3 10s
1821	11	9	Irish Sea	Liverpool Mercury	14/09/1821		A tempest caused considerabel disruption to shipping in the Irish Sea. Several steam ships were partially inundated whilst cargo was lost or damaged beyond repair. The valiance of the captain and crew on board the Belfast steam-packet was praised by passengers. A vessel named "The Four Sons" was wrecked near Stranrear but all were saved.
1821	30-31	11	Merseyside and Irish Sea	Liverpool Mercury	07/12/1821	11	A storm with the strongest gales in many years caused destruction on a level never previously observed. In certain areas of Liverpool nearly every house incurred some form of damaged and several fatalities were

						recorded. One woman escaped "providentially" from a destroyed room. Several ships were driven onshore in the Mersey and there was considerable damage to shipping in the docks. In the Isle of man, where the storm was described as resembling 'a West India hurricane' a vessel was wrecked off Peel and its 9 crew were killed. A boatman was also drowned in the storm surge along with a farmer who was attending to his property. The agricultural produce of the island was largely destroyed. Damages done by the storm were latter attributed to the poor attendance at music events at Lime-street. The windmill at Garston caught fire and was totally destroyed creating a tremendous noise and fire which no one could approach. The widespread damage caused a great rise in the demand for slates.
1822	12	3	Liverpool Bay	Liverpool Mercury	15/03/1822	3 One vessel wrecked off Dawpool resulting in 3 fatalities who perished in the "merciless waves".
1822	1	11	Dumfries	Caledonian Mercury	22/11/1822	30 Cargo ship originally lost in fog in the Irish sea is aided into the firth of Solway before impending storm. A vessel was wrecked off Southport with every one of the 24 souls perishing. 400 bales of cotton were washed up at Southport. Another vessel was wrecked off the Sea Dyke near the river Lune and all 16 were lost and there was "no prospect of any of the cargo being saved".
1822	30	11	Merseyside	Liverpool Mercury	06/12/1822	1 Gale caused the damage and destruction in the shipyards as well as widespread damage of residential property which resulted in one fatality. Four cows were also killed by lightning in Cumberland.
1822	5 to 6	12	Merseyside	Liverpool Mercury	13/12/1822	6 Very strong gale and tremendous storm caused widespread destruction of residential and commercial

1823	23	2	Merseyside and Lancashire	Liverpool Mercury	28/02/1823	<p>property and transport by horse or foot was near impossible. The streets of Liverpool were totally deserted. Slates and building materials littered the roads and horses were blown off course. As of publishing 6 people were known to have lost their lives and many families were pulled from the rubble of destroyed homes. May a "heart-rending" account was heard. 14 Ships in total were damaged, either being forced onshore, demasted or sinking for alternative reasons. Much destitution and hardship was sustained by tenants, many of whom were out of work and poor and it was exclaimed the only saying "it is an ill wind that blows nobody good" was true. There were accounts of families being "deprived of their only surviving natural protector". Vegetation around Liverpool was widely damaged and "the leaves & c. also, when applied to the tongue tasted salt: which we conjecture to have been caused by the foam or saline mist of the sea". In certain instances houses were destroyed and servants hurt but "providentially the family were absent". Many a great and lucky escape were also noted. Coaches to and from Carlisle and elsewhere were widely delayed. "Great exertions" were also made by a gentleman to free his children from the rubble of a house but they were to no avail.</p> <p>A strong gale which did largely minor damage to residential property in Liverpool, although 4 new-built houses were blown down in Bolton. Several families did not sleep due to the fear lingering from the previous storm choosing to shelter in detached out-houses away</p>
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1823	3	3	Merseyside	Liverpool Mercury	14/03/1823	1	<p>from chimneys. No fatalities were recorded and no damage to shipping was noted.</p> <p>A 'tremendous storm' caused a fire originating for a cotton drying kiln to become out of hand resulting in a fatality. This sparked a question from a reader concerning whether "a dangerous operation as the kiln-drying of cotton be permitted to be carried on in the very centre of the town". Such was the danger posed to the workers and surrounding neighbourhood particularly in the event of a storm it was exclaimed it must "at least be under some regulations or restrictions". A steam packet was forced to lie to for two days such is the fury of the gale.</p>
1823	1	9		Bristol Mercury	01/09/1823		<p>The weather section in the Bristol Mercury which featured an interesting table entitled "Weather likely to follow during the Quarter" which had been constructed by Sir W. Herschell concerning the "philosophical considerations of the attractions of Sun and moon, as affecting our climate. The table featured specifically the weather at each time of the day at the "time of the new or full moon or of entering the first or last quarter". The table had been created with many years experience and was found to be "tolerably correct based off recent observations". Although the paper did not "pretend to vouch for the accuracy of this table" they stated "we believe that there exists materials for a tolerably systematic prediction of the weayjer, in the long continued observations made by our eminent astronomers and natural philosphers". The value of accurate weatehr bservations in the process of prediction were noted and it was stated it was "difficult to conceive that none of these observations have a bearing on the</p>

1823 2 to 3

12

Irish Sea

Liverpool
Mercury

05/12/1823

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causes which produce changes in the weater" as "The variations of the atmosphere ... seem to succeed each other by chance: but there is no such thing as chance" with variations depending on certain law which perhaps "may be connected toger by one great common principle. Torricelli's barometer and its impact on our knowledge of the atmosphere was noted and now "variations of the atmosphere may be regarded as a sort of tides in the air". It was further remarked "modern philosphy has given us many means unknown to the ancients of observing these phenomena with accuracy; we have the barmeter, the thermometer, the electrometer, the storm-glass; we know much more of the condensation and expansion of vapours" before the reporter talked of modern scientific explantions of condensation,rainbows, comets and the Aurora Borealis. With such much progress it was stated it "was no unreasonale to expect that meterlogical science may be successfully cultivated, expecially with the aid of astronomy".

Very violent storm of similar ferocity to the event a year previous with wind veering from the SE to SW. Considerable damage was sustained by residential property although it was noted that the precautions taken after the event the year before substantially reduced the degree of destruction which resulted in one fatality, although the desperate situation of many families was noted. Shipping across the Irish Sea was severely affected with 3 large vessels considerably damaged and/or blown ashore.

1823	10	12	Liverpool Bay and Lancashire	Liverpool Mercury	12/12/1823	2	A total of 10 boats were driven onshore or wrecked, with the vessels Ellison and Union being completely destroyed and later plundered onshore by 'urchins' who could only be warded off with firearms. 2 men aboard the ellison perished whilst the crew was marooned on the wreck until low water. Many individuals sustained injuries both in shipping incidences and as a result of the destruction of residences and chimney related incidenes throughout the historic county of Lancashire. Following this event Mr Thornley suggested a change in Liverpool's chimney construction by stating that cement be used as oppose to mortar when setting the bricks in order to better secure the chinmeys in a storm. He believed this would be particularly effective in reducing injuries and damages resulting from falling chinmeys which were particulaly hazardous in Liverpool as the the quality of brick masonry was 'the worst in the kingdom'.
1823	12	12	Lancashire	Liverpool Mercury	19/12/1823	1	A strong gale forced a brig onshore off Blackpool at high tide during a storm surge that made it impossible to aid the mariners leading to the death of the ship mate who had perished of "cold, hunger and fatigue". The people of Blackpol treated them "with every attention". A man was also swept from a roof by strong winds and "taken up in a state nearly lifeless" causing great distress to is family and required to turn to charity to survive. The paper asked for donations.
1823	11	12	South-west Wales	Bristol Mercury	22/12/1823	1	A ketch was diven ashore by strong SW winds at Freshwater West and totally wrecked with the loss of 1 life in the breakers as the lifeline snapped. The wind shifted to the NW and blew with increasing violence

1824	11	4	Liverpool	Liverpool Mercury	16/04/1824		although the vessels in Miflord Haven were little distrubed. On the 11th a violent and sudden thunnderstorm came to Liverpool with thunder and lightning. The hailstones were uncommonly large with many sky light windows being damaged. Snow fall followed the day after.
1824	13	8		Liverpool Mercury	13/08/1824		A poem named the wind which speaks of the wind as "a language, I would I could learn". The tranquility and "low sweet song" of the wind which carries "the tall ship sleeps on its heaving breast" was first addressed before the poet started to paint the wind in a more ominous sense. The wind "comes like a wizard, and mutters its spell" before it "pauses to gather its fearfil breath,/ And lifts up its voice like the angel of death". The wind was porttrayed to beckon the "uncouth creatures that dwell in the deep" which "shore in the tumult their joy and delight,/ And when the moon rises, the ship is no more". The fierce storm was described in a milittaristic sense as "slewing the ship... "like the dark dream tat flies from the light of day!". In all the wind is portrayed in a devious and calm manner and the contrast in it's nature made most apparent. Unusually cold climate throughout the week with a violent storm of hail accompanied by thunder and lightening on the specific date.
1824	26	9	Liverpool and North Wales	Liverpool Mercury	01/10/1824		A pilot drowned at Minehead when his boat was upset in a tremendous gale was declared found drowned by an inquest.
1824	6	10	Bristol Channel	Bristol Mercury	11/10/1824		A 'near hurricane' storm in manner with wind from the west caused carnage on the northern shore of the Mersey resulting in severe damage to >10 vessels in the estuary
1824	26	10	Liverpool Bay	Liverpool Mercury	29/10/1824	12	

1824	13 to 14	11	Liverpool Bay	Liverpool Mercury	19/11/1824	7	and Liverpool Bay whilst far more boats were damaged within the docks. At least 12 were known to have perished although more were feared as a gig and it's hands were reported missing. No reports of onshore damages. It was noted that had it occurred during the night "many mre distressing accidents" would have been recorded.
1824	23 to 24	11	Merseyside	Liverpool Courier	26/11/1824	3	A violent gale from the north-west accompanied by heavy rain and showers. No major reported incidences onshore but unquantified damage along the coast. A vessel was lost between Milford and Amlwch with 7 lost and never heard of again. Note that the weather of the last fortnight has been dominated by violent gales and storms.
1825	14-15	1	South-West	Bristol Mercury	24/01/1825		Lowest barometer readings ever seen as pressure fell below 28 indicating a great depression. Strong winds proceeded to blow from the west. It was odly stated that in a warm climat this would signal an approaching earth. A sloop was lost on the Lavan sands at Penmaenmawr and the crew of 3 died.
1825	25	3		Liverpool Mercury	25/03/1825		A "complete hurricane" from the South-west blew at Milford. A vessel parted cables and ran up to Neyland for shelter A vessel drifted onto rocks and had to discharge her cargo to get off on the next tide. An unmanned vessel went to pieces on the shore. Windows were damaged by objects blown into a public house. Not since 19th October 1812 had Milford experienced any storm so severe.
							An address from Mrs Henry Rolls to the audience at the first anniversary of the preservation of life from shipwreck during their 1st annivesary. She emphatically began "'Tis Night;s most awful hour, her solemn noon!/ Veil'd is each guiding star; the o'erclouded moon/Just gives at times a

sudden dubious light/ That heightens all the terrors of the night". She goes on to emotionally describe the storm "High heave the billows with tremendous roar,/ Then burst in foam upon the craggy shore;". She then turned her attention to the vessel in distress "'Reft of each anchor, shattered every sail,/ The vessel dives before the raging gale;". After the destruction of the boat she turns her attention to the futility of the sailor as the "frantic cry resounds along the shore,". The sailors themselves live and remains "brave" despite his pitiful position he exclaims "I am on land, and human aid is near!" which "soothes ever and, and conquers every fear." She then moves onto the sinister nature of the approaching wreckers as she poses the questions "Are there in human hearts such passions fell,/ Can such dark thoughts in human bosoms dwell" before the sailor is thrown overboard by those who are only "In form alone allied to human race! / Or some dark Pagans, who have never known/ God's awful name, or bow'd before his throne?" The wreckers were described as "savages" and charity was noted elsewhere in the British empire where wealth was not aplenty. She exclaimed "Blush, Britain! blush" for these sinful actions and asked "where are thy feeling hearts, thy powerful laws,/ To plead or shield thy guardian sailors' cause". The prominence of sailors in the British empire was noted as they were "supporters of thy proudest regin" and the "nations tremble at thy name?" The target audience was made clear as the plea was aimed at "enlighten'd sons of British sires" who were encouraged to be philanthropic and through such

1825	6	5	Lancashire	Liverpool Mercury	20/05/1825		<p>engagement they pursued a "noble strife,. The prize yet seek, not less than human life!". She stated every nation should join together to prevent such loss of life at sea as "in each sufferer, hail a brother man!". Such aid and charity was stated to provide a "power, which led thee 'midst the storm," and it was a clear recognition of "stern danger in its direst form! It was importantly stated such danger was "Not the wrath of heaven which bade thee know/ And share such scenes of agonising wo: / No! - 'twas His hand, whom winds and waves obey, / Which drew forth to show the appointed way; / To bid Philanthropy's bright flame expand, / And pour new glories o'er thy native land!".</p> <p>Severe thunderstorm, lightening and rain experienced throughout Lancashire including the coastal towns of Preston and Lytham. The hail was "considerably larger than marbles" and covered the ground. Only one individual was injured as she was blinded temporarily via a lightning strike impact. Several residences were damaged and trees split by lightning. One house endured a chimney strike sending soot and ash into the dining room and destroying furniture and a portrait of an aristocrat.</p>
1825	20	9	North-east Wales	Liverpool Mercury	23/09/1825		<p>Tremendous storm of thunder, lightening in north-east wales, no mention of damages although the weather was spectacular.</p>
1825	7	10	Merseyside	Liverpool Mercury	14/10/1825	5	<p>Violent gale from the NW which resulted in the fatalities of 5 mariners described as "melancholy accident". Winds were accompanied by a heavy fall of rain 4 large vessels were damaged, several small vessels were driven onshore. Another large vessel sailing to New York had to come</p>

1825	21	10	Merseyside	Liverpool Mercury	21/10/1825	<p>anchor in the Bight of Hoyle but the anchor later slipped and it returned to the Prince's Dock. One man fortunately recovered due to the humane attentions of Mrs Boodie at Mockbeggar hall. Mrs Boodie was widely praised for her humanity and contrasted with the plundering wreckers. In a letter to the editor it was said her philanthropy was an example of "the interosition of Providence" by readers who was part of the shipwrecked crew and had been attended to by her servants on her command. A subscription was to made by the paper for the wrecked men.</p> <p>Poem entitled 'Wreckers' concerning those who deliberately attempted to wreck and plunder ships and their immorality. The poet describes them intially as "impatient bloodhounds" with "savage office". The wreckers murder the shipwrecked crew who have survived the "horror of the main" even though the crew "Implored their mercy, but implored in vain". It was stated socieity must "drain compassion's melting tear" as the "kindred miseries oft beheld too near,". The "kindred wretches" were said to cast ruin on the country before the poem concluded by stating sailos were the "bravest sons" and guardians of the kingdom. A subsriber wrote that the "present season of the year the above lines of the melancholy Falconer are appropriate to your columns". A second poem followed concerning the very same topic of wreckers. The poem starts with a great contrast "Most Christain Isle! Land of the brave and free! / One horrid stain clings to thy rocky shore, ... Louder, ye wreckers! than loud ocean's roar". The scene was firstly depicted of</p>
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1825	28 to 11 (starts in October)	11	Irish Sea	Liverpool Mercury	11/11/1825	<p>a sailor in a storm as the poet exclaims "Round Britain's coast mid darkness rush the storm/ As firece monster foam'd the wintry wave,". The seaman are said to pray to god as they desperately try to save the ship thinking of their love ones as they progress towards a light "gleaming from the rocks so grim and drear, / Human hyenas flickering torches mov'd". The vessel "strikes" and "parts" and the wreckers move in "before the dead are cold" to rob "Rapine and discord,-plunder, lust of gold, / Pervade by turns the eager demon mob". The poet then exclaims "Just Heaven! thy laws, benevolent and kind, / (E'en to the savage of the leafy wild)" highlighting the injustice and immorality of the entire situation and stresses the rude man must be taght to "be no more y avarice beguiled". A direct reference is made to the humanity of Mrs Boddie "lady of the ancient hall, / The shipweck'd seaman cheer'd with oil and wine;". This was ultimately regarded as the "samaritain design" which shown "thr' gloom, the tempest, and night's sable pall".</p> <p>Accounts of a great number of nautical fatalities on the Irish Sea although the overall number is not quantified. The journalist indicates they will pursue the disasters no further unless they be 'suspected of the superstition that these disasters are ominous of the wickedness of the times' a view they indicate 'they shall be slow to entertain' as amoungs the lost souls so many "bright spirits have been extinguished".</p> <p>Much damage was done to shipping on the Clyde and some Liverpool vessels drove ashore "notwithstanding the utmost precaution being observed".</p>
1825	18-19	11	Western Scotland	Liverpool Mercury	25/11/1825	

1825	21	12	Cheshire	Liverpool Mercury	23/12/1825	A violent storm of thunder, lightning and high winds made transport by coach difficult and damaged property. Horses were pelted to a standstill by hail and coachmen found it hard to keep on their seat in Cheshire.
1826	6	2	Northwest England	Liverpool Mercury	10/02/1826	A gale of wind from the Southwest set in at Liverpool causing considerable alarm as fears of the previous gales of 1822 and 1823 arose. Injury was not done and there were no major losses apart from one or two signalling posts.
1826	19-23	2	Northwest England	Liverpool Mercury	24/02/1826	On the eve of the 19th and morning of the 20th a great gale was experienced from the WSE with an American brig driven ashore near the mouth of the Dee Estuary. They took to their lifeboat and the boat was destroyed with the cargo washed along the shore. Fortunately they received "every humane attention from the inmates of the Grange Farm" and recovered. The pilot "who behaved nobly" was praised. All the vessels which arrived last week had suffered severely from the westerly gales and the harbour of Holyhead was crowded with shipping due to the continuing adverse weather.
1826	25	3	Northwest England	Liverpool Mercury	03/03/1826	In Whitehaven a terrific storm of thunder and lightning accompanied by heavy showers of hailstones came to the town. Many measured 2 1/2 inches in diameter and a good deal of damage was done to windows of the neighbourhood.
1826	1	9		Liverpool Mercury	01/09/1826	An extract entitled the "phenomena of thunder-storms" concerning how gusts could be explained by a diagram and apparatus called an "Air Thermometer" which shows the effect of electricity and lightning in displacing air". The apparatus was explained and how it supposedly simulate gusts in a thunderstorm detailed.

1826	6 to 7	9	Southwest Britain	Bristol Mercury	18/09/1826		A dreadful storm swept over Somerset and the navigation of the coast of Burham was made very difficult indeed. It was stated the "fury of the storm rendered powerless the exertion of uman skill" and one vessel was totally lost with all onboard estimated at 6 lives. Another boat was a complete wreck but all were saved. The latter vessel deliberately scuttled itself and was likely to be saved. In one Uphill orchard 16 trees were torn down and "evidence of the power of the tempest lie about ine very direction". Houses were unroofed and trees lay prostrate to prevent an "awful exhibition of the influence of the tempest".
1826	24-25	9	Northwest Britain	Liverpool Mercury	29/09/1826		Inquests were held into the deaths of two bodies of the masters of two boats which foundered near the 'floating light' in the mouth of the Mersey and were drowned. The verdict was official "Accidental Death".
1826	8 to 9	10	North Wales	Bristol Mercury	23/10/1826		During a great gale from te SW a schooner was wrecked on the skerries it the crew being forced to take to the boats and made it to the sfaety of the Great Skerry lighthouse unhurt. After the accident a Mr Gray and the crew secured some f the sails and stores.
1826	31 to 1	11	Northwest Britain	Liverpool Mercury	10/11/1826	3	A schooner was caught in an Irish Sea gale that "Increasing to something like a hurricane" with a heavy rolling sea. Rain "literally fell in torrents" with the "darkness of the night added not a little to the fears of the passengers". Te nly option was to head for the Dee but before they got far the warning cry "breakers a-head" was given with all onboard huddling together as the boat struck a rock. The vessel was completely wrecked and as it was tossed upon the rocky Cumbrian shore "hope at this moments had

1826	24-25	11	Western Scotland	Liverpool Mercury	01/12/1826	17	<p>almost fled; a watery grave appeared to be the inevitable lot of all". However the vessel came close enough to the shore that the master and more active passengers could clamber onto the rocks and to shore "as fast as their fears and the pitchy darkness of the night permitted them". Thei escape was described as "most providential" as the storm "raged with unabated fury" and the frail bark was dashed to pieces. Two farm houses provided refuge and comfort although three were missing and presumed drowned whilst "Property has been lost to a large amount".</p> <p>A vessel in the Irish Sea was forced ashore on the Scottish coast at Little Ross on a dark night during a gale despite the best efforts of the master to hold to and drift past the coast in heavy showers of the sleet and snow. The gale became increasingly strong and the vessel went to pieces on the rock. When a mate went to rescue a woman the vessel went to rescue a woman the vessel broke up and both "were pecipitated to a watery grave". The mate left a widow and seven children whilst the woman was a mother of numerous children. The loss was ascribed by "all nautical men, to the want to a becon on the Little Ross" as this was one of numerous incidences at the location. With thanks to the lights of the moon the remaining crew escaped over the rocks and identified another vessel. This nearby vessel and it's crew were "roused by the cries of the shivering survivors" and took all onboard and "treated them with the greatets possible kindness". They were later conveyed to Kirkcudbright and it was stated they had no knowledge of the coast and if</p>
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1826	2 to 3	12	Northwest Britain	Liverpool Mercury	08/12/1826	<p>they had have known of the neabry Maksman's Lake they would have been guided by a light into a good anchorage and would have found "no difficulty in weathering the gale". A vessel named the Marquis of Wellington was also lost in Holyhead Bay with 15 perishing with the ship. Every effort was applied to save their property but the coast was strewn with wreck and most property lost. A vessel was also forced ashore in Pwllheli Bay during the gale. The weather in Holyhead was reported as being "extremely boisterous" with the wind blowing hard from the west. Two vessels were driven onshore at the Red Roses whilst another went ashore at Hoylake and the Hoylake lifeboat deployed to their assistance. Steam boats also deployed. It was understood one of the foundered boats had been beatign about for three days waiting for a pilot.</p> <p>A poem named "The Pilot That Weathered The Storm" written clearly considering the recent shipwrecks in the Northwest and situation concerning pilot pay in Liverpool. The poem begings by talking of an oceangoing vessels coming from India "Returning to Britannia's isle" with "elate crew" aboard. The ship calls for the "pilot's guide" just before "A storm arose, and from the skies / he lightnings flash'd, the thunder roar'd, / Before the gale the vessel flies". The precarious situation of entering the Mersey is clearly noted as the vessel lies between the Cheshire shore and "on the larboard bow lay Bottle Bay". There is a "narrow passage to explore / No hand on board could tell the way". The vessel is depicted to "larbour'd hard" in the sea with the crew "ready haste the canvas</p>
1826	15	12		Liverpool Mercury	15/12/1826	

<p>1827 9 to 14</p>	<p>1</p>	<p>Northwest Britain</p>	<p>Liverpool Mercury</p>	<p>19/01/1827</p>	<p>furl; / The billows, foaming to the cloud, / High o'er the creaking vessel curl". The ominous nature of the storm is depicted as "Around the ship the seas, the skies, / Seem headlong tumbling to and fro," before he switches onto the strife of the sailors remarking " "What's to be done?" the captain cries," / "Behold the breakers right a-head!" / "The ship must strike," the mate replies;". The crew cry out "Is there no help?" before ""HELP AT HAND!" the darkness rings; It was the Pilot's welcome shout, / AStern his trusty vessel swings". The captain jums aboard and it is remarked "He timely caught the vacant helm" and "fronts the waves that fierce o'erwhelm". The pilot aids the ship "with steady art" and "he singly with the tempest strives" as the gale expires and the "the turning tide restores the day" as the ship "rides to port from Bootle Bay". The poet then exclaims "Long live the King! - as long too, live / The Pilot bold; for he can save / The British shipping, and can give / Us wings to waft us o'er the wave". The poet then finally turns to the poignant point of "who would grudge the Pilot;s pay? / Or scrimp him of his wonted hire?". The fianl poetical point elludes to the importance of the pilot's roel in Britain's nautical commerce as the poet concludes "Without him Britain falls away, / For British commerce must expire".</p> <p>An extract from the Dumfires Courier regarding severe thunderstorms in Scotland with reports of lightning strikes affecting people, damaging trees and property. Snow also fell and floods ensued with Dumfires inundated and embankments carried away nad valuable land destroyed. The six vessels at the quay "were fairly cast upon dry land,</p>
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1827	20-26	1	Northwest Britain	Liverpool Mercury	02/02/1827	<p>beyond the level of the highest spring tides". Many streets in lower-lying areas of Glasgow were inundated driving many poor people from their homes but the magistrates and police provided emergency food and drink and "by every possible means alleviated their distress". At Whitehaven several vessels entering the harbour were "thrown upon the beach, one being totally wrecked but the crew saved. The compassion of the crowd in saving the men was noted and they saved the crew via means of a lifeline from the shore all lifted "through the foaming waves, and over a wall". Another sloop, of Carnarvon, was also wrecked off Mostyn and it was feared all aboard perished as there was no account of them having been seen leaving the craft in a small boat by a captain of another vessel that rode out the gale.</p> <p>A "fine ship" named Leonora was driven onshore on the rocks near Troon Pier and completely wrecked. Over 40 hands had worked on "erecting bulkheads fore and aft" before the vessel was caught by a strong SW gale. A vessel from Newfoundland was also driven ashore near Beaumaris and "is gone to pieces". Another vessel which had previously been raised was also driven from her moorings at Llanelly and completely wrecked.</p>
1827	13	3	Southwest Britain	Liverpool Mercury	19/03/1827	<p>A thunderstorm in Bristol resulted in a valuable cart horse being struck by lightning and it later died.</p>
1827	24-25	4	Northwest Britain	Liverpool Mercury	27/04/1827	<p>The spring of 1827 was described as "Not unseasonable" with thick snow falling over the town before a gale from the NW which brought "intense cold" to the town was felt on the proceeding day.</p>

1827	30-31	7	Southwest Britain	Bristol Mercury	06/08/1827	A "tremendous thunderstorm, accompanied with torrents of rain, and the most vivid lightning ever witnessed in this city" came to Bristol. During 2 hours peals of thunder and flashes of lightning "were almost incessant; it was literally the "war of elements"." Several houses were damaged and people started as their properties were struck with the lightning being attracted to curtain rails as curtains caught fire. A man burnt his arms and hands whilst trying to smooth it to prevent the fire's spread. Several arge trees were hit near Marshfield and sheep killed. In Tauton and Bridgewater the "storm was pecuuliarly awful" and a horse was killed and trees struck. More horses were injured in a Taunton stable and one horse was completely "insensible to the whip" the next day and "could not be made to stir". A tree was also struck otoutside Bristol and it;s impact were "Most extraordinary with the tree shredding of bark "of six to eight inches" width for 200 feet. It was stated there was no doubt the house near it would have been much injured "had not the tree served as a conductor". A smuggling boat was also captured near Dartmouth as the boat. It contained 65 kegs of brandy which were all detained and handed into customs. It was remarked had it not been for the "the light ocassioned by the vivid flashes of lightning" they would have escaped from the view of the coastguard officers.
1827	10 to 12	10	North Wales	Liverpool Mercury	19/10/1827	A vessel was driven onto the rocks to leeward of Holyhead and was likely to "become a total wreck" although the crew and most of their cattle was saved.
1827	30 to 1	12	Western Britain	Liverpool Mercury &	07/12/1827 - 10/12/1827	It was reported the weather had been "extremely tempestuous" with severe gales and huge waves in the

				Bristol Mercury		Mersey meant 2 vessels had to return back to Bristol with damage. The rain accompanied violent gales from the westard forcing several vessels back into port with one requiring a pilot to navigate back to port safely. Two vessels were wrecked off Southport but the 2 crew were fortunately saved. A vessel also came into Swansea and found 27 livestock worth £400 all dead due to inundations suffered in the storm.
1827	9 to 10	12	Irish Sea	Bristol Mercury	17/12/1827	Two Milford Steam Packets sustained damage in Irish Sea gales and were forced back by the heavy seas and unrelenting fales. It was stated these new steam packets from Milford "continue to ply regularly, in depsite of wind and weather, and arrive at their destination almost as certain as a mail coach".
1827	19-27	12	Northwest Britain	Liverpool Mercury	28/12/1827 - 18/01/1828	A vessel was seen flying signals of distress at the entrance of the Formby channel and another vessel fell in with her the sea running "tremendously high" he dare not attempt to approach the other vessel. The vessel was eventually driven upon the sore and the "crew clung to the rigging all night" but were eventually saved and the boat broke up but most of her cargo was to be saved. There was also an article entitled "Encroachments of the sea - mutations on the Wirral peninsula" as over the last "50 years, the sea has made grea encorachments on the coast, from Leasowe Castle to the mouth of the River Dee". It was stated that "there is a tradiation" that the Mersey was once "forest and pasture land". Whether this was true the correspondent did not know but there was however clear evidence of the "rapid encroachments of the tide" in the form of storm surges. On the 19th "a gale of wind forced

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the tide to rise four or five feet above its expected height: the water broke over the Leasowes, and inundated the common for nearly half a mile beyond its ordinary boundary". The Leasowe Lighthouse was surrounded with watery and old men stated that the lighthouse was nearly "half a mile farther out on the beach than the present one" but sea encroachments had made it necessarily to erect another lighthouse further inshore. This older charatcer stated "in a short time, the sea will break through the Leasowes, be the case, the navigation of the Mersey will be destroyed; and we would press upon the Corporation and the landholders of Cheshire, the necessity of taking some steps to stop its further ingress, before it becomes impracticable". At Ayr a on the 26th vessel was met with heavy gales form th SSW and hoisted signals of distress but no attention was paid to her by passing boats despite oobvious signs of incapacity and the signal but she came to rest at anchor in the aby of Ayr. An article entitled "Safety Ships, Steam-boats" which began with the telling line "There never was any suggestion for the improvement of science of morals, which had not, at first to encounter opposition or ridicule". The correspondent then brought examples of the gas light or the Liverpool Floating Bath which were initially condemned but proved to be worthy ideas. It was firstly stated that a false pretense was that a vessel fitted with copper scuttling tubes would also be destroyed should it go adrift like standard timber vessels but this was not the case. It was stated vessels were usually abandoned at the first sign of a leak however if they were

"fitted up with such buoyant apparatus" the crew would remain onboard and heighten the chance of recovering her. It was stated many vessels were currently dashed to pieces and accidents were frequent enough to "entitle any plan for their prevention to our serious consideration". Although the correspondent had little experience of storms at sea they had experience of seeing vessels washed up intact which they supposedly would not have happened if the crew had remained due to the fact they did not believe the boat was going to go to pieces. Such was the prevalence the correspondent stated "half the shipwrecks which have taken place might have been avoided, by the adoption of the means we have been recommending". The correspondent gave examples such as the sinking of the Peican in 1793 and Royal George later which all may have been prevented, according to the correspondent, if they had such copper tube "buoyant apparatus" aboard as none of those vessels were "much injured in the hulls". The buoyant principle was stated to be most useful in steamboats which were now "almost innumerable, and are daily increasing in number". Not wishing to "excite any unnecessary panic" it was stated that a steamboat was likely to sink "Owing to the immense weight of the machinery" and it was stated something must be done to overcome this buoyancy problem. Referring to an extract from an engineer it was stated the use of scuttles to allow and regulate the flow of water in and out of a vessel would be particularly useful in the event of the prevention of sinking a fire. Such devices were present on a line-of-battle ship where "in case of

<p>1828 3 to 8</p>	<p>1</p>	<p>Southwest Britain</p>	<p>Bristol Mercury</p>	<p>14/01/1828</p>	<p>fire, might be hauled close to the wind, under a heavy press of sail, and her lee-ports and scuttles opened purposely to permit her to fill, and thus overpower the flames". Once she was partially sunk to a certain point the scuttles could be closed and "every danger averted". As, according to reports, "nearly two British ships are lost (by wreck, fire and foundering) every day in the year" it was proposed an additional expense of only "5%" could make this chance of foundering "be almost made to disappear entirely". It was stated such scuttles security could be applied to any vessel and only the "Most bigotted adherence to old things, however defective, could prevent its immediate and universal adoption".</p> <p>Shipwreck news alluding to the wreck of the sloop liver with 125 pigs off the Angle rocks at the South entrance of Milford Haven where she went to pieces. The crew were "most miraculously preserved" by "creeping over the bowsprit to the rocks; whence, by great exertion, they ascended the cliff sufficiently high to prevent them being washed off into the sea". They became visible at daylight and a boy belonging to the vessel scaled the 200 ft cliffs at "immense risk" to render assistance. Cart ropes were then provided and the sufferers were hauled up the precipice "with the exception of some cuts and bruises against the different projections in their passage". 18 pigs and some equipment was recovered and all was "sold for the benefit of those concerned". A brig was also forced onto rocks NW Tenby Pier by endeavouring to enter the harbour during the surge but was not significantly damaged. Another schoor was driven up WSW of Tenby and was</p>
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1828 12 to 13	1	Southwest Britain	Western Times	19/01/1828	<p>2 thought would become a complete wreck but both crews were saved by remaining onboard until the ebb.</p> <p>In Teignmouth a storm "raged with great fury" with "Blue forked lightning" playing on the waters most vividly and "the roar of the thunder was lost in the louder roar of the storm". Buildings shook to a degree all families left their beds and many were convinced roofs would collapse. Chimneys were blown down and several houses unroofed. It was remarked spring tides would have occasioned much more damage. At Shaldon a small dwelling house was nearly completed was blown down along with trees felled and the cliff eroded to a significant extent. The house destruction took a man and his wife and 2 children from "comparative comfort to great distress". Little damage was sustained ashore at Dartmouth. At Plymouth and Devonport the effects were "tremendous" destroying much property despite the short duration with few losses of life. It was stated but had it been for the new Sound breakwater barrier "the loss of shipping would have been much more extensive". The <i>Jesse Lawson</i> parted cables and drove against an Indian Trader doing much damage to her foremast which was carried away. A Portuguese barque also dragged anchor and ran foul of a transport ripping up her stern and causing them both to part cables. Another vessel was dismasted by the drifting vessels and one drifted ashore becoming a complete wreck. The crews were saved as the mast came down on rocks and with aid from the shore by a man who used a spar as a bridge. The master had to swim to shore and was much bruised against the rocks but</p>
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was eventually saved whilst a woman endured great agony followed by relief as her child was lost but then heroically saved by a sailor from a watery grave. Several other transport vessels, the Harbour master's yacht and a brig all went ashore. Various other vessels with goods from afar went ashore on the shores of the Catwater and two men attempting to plunder the cargo of one vessel were drowned. Ashore the destruction of property was great with many chimneys being felled in Plymouth and all villages around. A minaret of a chapel was blown down and fell through the roof and the roof of the citadel barracks was much damaged as well as that of the Government Workhouse where 1 woman was injured and cost of repair was estimated at £100. Two hundred trees were levelled on the estate of J.Harris at Radford. Overall it was remarked "In short every tree and every house, exposed to the tempest, has suffered more or less". On the " February the Western Times made the observation that "it was ever considered that the changes of the moon operated in causing changes in the weather" and tides. However since "the memorable storm of 1824 all the gales in this part of the country ... have taken place about the neap of tides, or quarter of the moon". Although a rise above the predicted neap was noted the storm occurred at "the dead of neap" The subsequent rise of the tide combined with "extraordinary pressure of land floods, greater than ever before known, pouring down the rivers and harbours, directly against a violent wind, caused in an open roadstead, such an agitated surface, that few vessels could withstand it". By compiling accounts it was

1828	16	1		Western Times	16/02/1828	<p>presumed the height of the hurricane was supposed to have been at 3 am when the water was 13 feet above the low water mark and they were "happy to add, that no impression whatsoever" had been made on the breakwater, the storm being its first real trial.</p> <p>A poem named "light that darkens all the gale" concerning a "stirring" description of a storm. The thunderstorm was called "the eloquence of heaven" which was a "sublime idea, worthy the muse of Milton". The poem started "when every cloud is from its slumber driven - / Who hath not paused beneath its hollow groan, / And felt an Omnipresence round him thrown?". The leaves were depicted to "shiver with expectant fears" whilst the waters were seen to be "curling with a fellow dread" almost as if nature was paranoid of the coming power of the storm. As the storm cascaded down "wizard shapes" were seen in the sky to mark "the coming of the thunder storm". The poet wishes to be "alone on some still height / Were heaven's black curtains hang before the sight, / And watch the swollen clouds their bosoms clash,". The elements are depicted almost to be at war as the poet remarks "While fleet and far the lightning daggers flash - / Like rocks in battle on the ocean's bed". The looming power and magnitude of the storm is depicted by the phrase "caverns of the sky" and the "furnace-flames, that in their wombs repose," as "fiery arrows fall and rise" portraying the lightning to be almost like a weapon from the heavens. The poet concludes by depicting the storm as a "dizzy chase along the rattling skies!" before going on to ask "How stirs the spirit while the thunders roll /</p>
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1828	13-14	2	Southwest Britain	Bristol Mercury	18/02/1828		<p>And some vast presence rocks from pole to pole!" as if to imply the all powerful presence of God.</p> <p>A gale resulted in a shipwreck off Bristol with one mistaking a light on the shore for the pier. The crew were obliged to take to the rigging with the sea running very high "where they remained for two hours, with the sea breaking over them". No assistance could be afforded until the tide ebbed when they were relieved but the vessel was wrecked.</p>
1828	17-18	2	Southwest Britain	Liverpool Mercuy	29/02/1828		<p>During a violent gale from the WNW to NW a schooner was driven ashore on the rocks near Godrevy and all onboard perished. The wreck came ashore at Hayle after and the vessel was uninsured and the sole property of the master who left a widow and large family unprovided for. None of the 4 dead had been found.</p>
1828	25	3	Celtic Sea	Western Times	29/03/1828	4	<p>The account of a "gentleman who providentially escaped" the vessel Venus which was incapacitated and then overwhelmed by a storm on the eastern Irish coast. After initially attempting to pump out the flood water which seeped in the captain, mate and stewards along with a collection of sailors were said to have abandoned the vessel in a lifeboat leaving four sailors and the passengers to their fate. As the boat rapidly sunk the nine remaining climbed the rigging of the main mast and the valiant but in vain efforts of a certain "Mr Williams of Ross" were told as "in such a perilous situation, he humanely endeavoured, at great personal risk, to preserve the life of a young woman. He held her up until she died from excessive fright, fatigue and the continued dashing of the water". His attempts to save a young relative were also in vain as</p>

1829	24-25	7	North-west England	Liverpool Mercury	31/07/1829		<p>the boy was "drowned by the waves so repeatedly washing over him", whilst two sailors met a similar fate. The waterguard (coastguard) boat which was deployed after the captain and his crew reached the shore did however save said Mr Williams and the four remaining others.</p> <p>A brief account of a storm in an account of market trade at the Liverpool Corn Exchange in which it was stated "The weather, since our last, with the exception of a heavy storm on Friday night, has been favourable for the coming crops and has tended to depress the market for both wheat and oats."</p>
1829	21	8	Irish Sea	Dublin Evening Post and the Liverpool Mercury	20/08/1829	5	<p>A very strong gale blowing from the north-east whipped up a sea that totally wrecked caused a schooner bound for Liverpool in Dublin Bay and 5 of the 18 onboard were reported to have perished. This rescue was only made possible thanks to the intrepid efforts of Captain Brett of the St. George steam-packet who's quick reponse and deployment of his lifeboats saved 13 lives. A Whitehaven brig was also discovered in a cove embayed between the rocks and a pier and it was only the prompt actions of the harbour-master and galantary of the 12 sailors belonging to the water-guard who "with imminent peril, and at the risk of having the boat dashed to pieces between the vessel and the rocks" managed to save all those onboard the vessel before it swiftly went to pieces almost immediately as the lifeboat left the scene. Dead bodies of the 5 drowned sailors aboard the schooner were later washed onto the shore "and presented a most distressign spectacle". It was reported the vessels had only become</p>

1829	19-21	10	North-west England	Carlisle Journal in the Western Times	24/10/1829		<p>distressed due to their inability to navigate into the the safety of the harbour where a great number (67) of vessels rode out the storm.</p> <p>An account from Carlisle told of a great tempest which brought with it torrential rain that lead to widespread flooding in the valleys of the Caldew and Eden inundating low-lying agricultural lands for miles leading to the considerable loss of livestock whilst "a great number of homes were flooded to the depth of a yard and upwards". An agricultural report for the month of August in which it is stated frequent and succesive storms of rain and wind have "ocassioned the harvest to be perplexing; farmers having looked back to former years with alarm, and have been induced to house their corn in indifferent condition rather than run the risk of exposing it to wet, and on other ocassions, spoiling, or most materailly injuring it". In particular, damp wheat resulting from the frequent rains was proposed to be a potential problem.</p>
1830		8	South-west England	Western Times	11/09/1830		
1831	16-17	8	Western Britain	Liverpool Mercury & Bristol Mercury	19/08/1831 & 23/08/1831	38	<p>Liverpool was visited by a tremendous thuderstorm storm which brought falls of rain so tremendous tgey said to "have considerably exceeded the memorable one of 1789, when the wards of the Infirmary were fitted up for the reception of the poor, whowere driven in despair from their wretched habitations". The beginnings of the "elemental war" were signalled with thickening clouds and the distant roll of thunder in the morning before thunder broke over Liverpool in the early hours of the 17th, appearing "to shake it to its very foundation" as the "floodgates of heaven appeared soon afterwards to be opened". Torrential rain fell continuously for several hours</p>

completely inundation the lower part of the city to a depth of 4 feet in places. Evry cellar was said to be flooded and the damage was both catastrophic and widespread. Carts were requisitioned to transport business owners, customers and residents to safety which was "to the great benefit of the oweners, as several hundreds were glad to avaiill themselves of such accomodation". Pumping engines were soon installed around the city to clear flooded property and cellars which were in some cases flooded to a depth of 8 feet. Despite the widespread damage to property no lives were reported to have been lost. A final extract told of a shop owner who had been recording flood depths on his street for 20 years and assured the correspondent that the flood waters were 18 inches deeper than ever previously recorded. The storm also brought with it strong NNW gales which forced an already leaky and decrepit passenger steamer onto a sand bank by Puffin Island during low water. Chaos then ensued as passengers panicked as their "apprehensions now gave place to despair" shreiking and creating a most unsavoury of scenes aboard as the beached vessel lurched over on it's starboard side. It was said the old steamer's alarm bell was head ringing in Beaumaris but "as there was no light hoisted on the mast of the steamer, those who heard the signal were of course ignorant from when it proceeded". Several individuals were washed overboard as waves broke over the decks and "certain death seemed now to present itself to all on board" as couples prepared to die in each others arms and "the females in particular,

1831	5 to 6	10	Northwest Britain	Liverpool Mercury & Western Times	21/10/1831 - 22/10/1831	3	<p>uttered the most piercing cries". 15-20 people attempted to escape in an open lifeboat but lost their lives as the lifeboat was swamped and sunk. The vessel then split in two and nine passengers managed to grab onto the floating timber wreck and signal to the lifeboat ashore which was promptly deployed and carried them to safety after several hours exposed to the elements in the early hours of the morning. Most unfortunately the other passengers were not so fortunate and 38 bodies had been found 5 days after the sinking. A coroner's inquest which was "expected to be of considerable length" commenced on the 22nd.</p> <p>A "melancholy accident" occurred when two youths set out in a storm off Menai despite every advice from seaman of experience not to. When making a tack halfway across the bay a sudden squall came on and the boat filled and went down with the young men going to a watery grave as their fathers looked on helplessly. Despite a search no bodies were found and the "fine young men are deeply imbedded in the sands". Nothing was found but ones' hat. Another fatality occurred near Warrington when the violent storm felled a tree which struck a young gentleman passing on an adjacent road and caused his severe injuries which he later died from. The death caused a "great sensation in the neighbourhood" and it was first thought he had been murdered before subsequent investigation made it clear the storm was the cause of death.</p>
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1831	6 to 7	11	Northwest Britain	Liverpool Mercury & Western Times	11/11/1831	A vessel for the port of Liverpool was wrecked on West Hoyle in a gale and all the crew were supposed to have perished.
1831	10 to 12	12	Southwest Britain	Western Times	17/12/1831	A tremendous gale from the S and SW was noted. No damage was done to Plymouth shipping although it was thought shipping in the Celtic Sea and English Channel had suffered most dearly.
1832	24	3	Northwest Britain	Liverpool Mercury	30/03/1832	A stormy day was noted in the meteorological diary with winds from the North and the weather was described as a "severe gale during the night, with hail and snow".
1832	2 to 3	5	Northwest Britain	Liverpool Mercury	04/05/1832	"A rather sudden gale of wind" came from the north with heavy rain and a vessel drifted and was purposefully run ashore by the crew to stop the vessel being very much damaged on rocks.
1832	13-14	5	Northwest Britain	Liverpool Mercury	18/05/1832	A meteorological diary detailed a heavy thunderstorm on the 14th with heavy showers, hail and rain on the 13th.
1832	12	6	Northwest Britain	Liverpool Mercury	15/06/1832	Liverpool was visited by a severe thunderstorm which brought "torrents of rain, and occasionally heavy showers of hail-stones, some of them of large size". Many low-lying parts of the town were flooded in some places to a depth of 2-3 feet. The sopkeepers had such drequent warnings so could protext most of their property however the poor inhabiting the cellars were "as usual, sufferers both in health and property". During the storm their were incidents of lightning impact and mortally injured a child and a servant. One had been sheltering under a tree carrying a scyth when it was stuck by lightning instantly killing im whilst another character was so severely injured he was thought unlikely to recover. Advice was given that

1832	24	6	Northwest Britain	Liverpool Mercury	29/06/1832	<p>one should never shelter under a tree in a thunderstorms as it was "one of the most dangerous places that can be selected".</p> <p>A new steampacket out of Glasgow performed perfectly in a gale of wind and a large sea coming out of the port with no issues and was stated to be the "fastest sailing steamer out of the port".</p>
1832	14	7	Southwest Britain	Bristol Mercury	14/07/1832	<p>A poem "written while entering the Bristol Channel during a heavy gale". The poem begins in an emphatic manner describing the threatening nature of the storm "Wide ocean's wave is rolling high, / And Havoc rears her arm; / And hark! Along the lowering sky / The eagle of the storm / Speeds his rough flight; - on pinions strong / Swift comes the rushing blast". The boat is described to struggle as the "stubborn mast" bends as a fight with the elements is depicted. The vessels drove on "bounding forth" over the waves. The waves were exclaimed to break over "the ducking bow" as the rain poured down on a somewhat ominous "hissing tide" with the vessel driven "a-lee" as the waves foam and perilously seep over the bending side. However the "ruffling surface of the deep" gave a "strange delight to me". The waves were described to come with a "fierce ambitious strife" and possess an aggressive "warrior's crest". The waves were portrayed to retire under the boat as the sailor pondered "How many a seaman, bold and brave, / Rots in his last, long sleep;". The vessel was also seen to pay homage to the fallen as it "breathes, as down the vessel dives, / A sigh for all that fell;" and the storm and sea is described as "their murderer" and the voice of the waves seemed to urge</p>

1832	25	8	Southwest Britain	Bristol Mercury	01/09/1832		<p>"Their tomb to chant a clamorous dirge". The mariner was praised and hailed and stated to "enrich thy native land". The memory of the sailor was stated to live on despite their rough nature they was be "belov'd and pitied by the good". The ship is depicted to arrive in the Avon with the storm abating but a "distant roar" is heard as the storm blows away as it "cases yet our course behind, / As hungering for its prey" before the poet concludes by focusing on the sailors relief to be ashore "Hail, native shores! and welcome home"!</p> <p>A thunder storm visited Bath which was described as being terrific featuring torrential rain and hail. At Dunkerton, three houses were stripped of their roofs by "the violence of the storm" and a large tree was shivered near Radstock by lightning.</p>
1832	13-14	9	Northwest Britain	Liverpool Mercury	21/09/1832	11	<p>A "tremendous gale of wind" came ot the port of Liverpool and several vessels on the west side of the docks were driven from their moorings. A scene of "great confusion arose" and the damage to vessels was very considerable. A Russian vessel was wrecked off Hoylake in a heavy gale. There were 12 onboard and all perished with the exception of 1 who was found "clinging to part of the rigging" and rescued by a boat that put off from the shore. Four of the bodies were found and an inquest was held by a coroner who gave the verdict "Found drowned".</p>
1832	5	10	Northwest Britain	Liverpool Mercury	12/10/1832	1	<p>A "fatal tornado" visited The Wirral and Liverpool. The clouds were noted to be very low, nearly "touching the trees" before torrents of rain descended. The wind from the South-west suddenly increased in vilence and "branches, as thick as a man's thigh" were pulled from the</p>

1832	8	10	Northwest Britain	Liverpool Mercury	12/10/1832	34	<p>trees and carried hundreds of yards with smaller trees uprooted and walls blown over. A poor man who had taken shelter close to the wall was killed while two other men were carried by the breeze but escaped uninjured. The storm was believed to have been very localised.</p> <p>A tremendous hurricane visited Liverpool from the Northwest causing much destruction to property and great loss of life. The morning was calm before a sudden fall of the barometer which made many Captains refuse to go to sea "Notwithstanding the wish of their owners to that effect". One stated he would rather "see them dead before he went to sea with such a sky" and "the result has unfortunately justified his predictions". The storm then sudden came on with a tremendous gale, blowing from the north-west during the night with the "ravages" of the storm becoming more apparent over the night. Fragments of wrecks lay all along the beach and Mersey shore from the low to high water mark in such "numbers as to leave it no longer doubtful that the tempest had been tremendous in operation, and more than ordinarily calamitous in its consequences". Hundreds of spectators and wreckers were seen on the shore. In one vessel which foundered in deep water having been overcome off Burbo Bank 3 had perished. The distance goods had been carried up the beach was seen as proof of the strength of the gale. One captian put out on his maiden voyage despite the best meteorological advice with all aboard presumed to have perished. There were 31 confirmed fatalities in the form of recovered bodies but this number in truth was thought to be higher.</p>
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1832	12	10	South Wales	Bristol Mercury	20/10/1832	<p>Fishguard was visited by a most terrific hail storm "accompanied with unusual thunder and lightning". The size of the hail stones and their "solidity" were like those some "inhabitants had never before witnessed" being 2 1/3 inchs in circumfrence and as transparent at ice although little to no damage ensued from its effects.</p> <p>A strong gale from the SSW with rain was recorded at Falmouth. A "tremendous gale from the NW to N" was recorded on the 7th causing minimal damage in Falmouth but great fears were entertained for shipping and coastal communities on the North Cornish coast.</p> <p>A passage from Count Peccio's observation on England which spoke of the observation of the Sabbath onboard English vessels. He stated their "religion is a comfort as well as a terror to their minds" continuing that it was only his prayers that gave an Englishman the connection with the "supreme being". It was stated in a storm "he performs his duty, displays all the firmness of his mind, and all the strength of his body, struggles against death to the very last moment". However the count seemed to suggest it God was not called on in moments of peril with the emphasis on human action as it was only at the very last moment "when he has tried in vain all the means his mind can suggest, and all his bodily strength, that he resigns himself to his fate, raises his eyes to heaven, and awaits with reverence the will of Providence".</p> <p>A troop ship cutter got into trouble off Dart Point and fortunately managed to limp into Darmouth in "extreme difficulty".</p>
1832	31 to 7	10	Southwest Britain	Western Times	10/11/1832	
1832	17	11	Southwest Britain	Western Times	17/11/1832	
1832	17	11	Southwest Britain	Western Times	24/11/1832	

1832	29-30	11	Southwest Britain	Bristol Mercury	15/12/1832	<p>The parish of Bleadon in Somerset was visited by an "awful thunder storm" accompanied by a "hurly hurly" of "thunder, lightning, hail and rain". It was referred to as a "tempests we sometimes hear of between the tropics" as very strong winds accompanied "pelting hail, the fierce and vivid lightning" along with "peals of thunder" giving the impression "the energies of the tempests were concentrated in this little village". The church tower was badly damaged and it was "subsequently ascertained that the electric fluid had been attracted by the south-west pinnacle" which was thrown to the ground. The shock of impact was so heavy the church buildings "trembled as if by an earthquake" and every person nearby was thrown to the floor. Two people were directly hit with one knocked unconscious.</p>
1832	17-18	12	Northwest Britain	Liverpool Mercury	21/12/1832	<p>A vessel was driven onshore in Bootle Bay but was later got off in a perilous state.</p>
1832	29	12	Southwest Britain	Western Times	29/12/1832	<p>A poem named Sea Rover which began by depicting a vessel beautifully sailing through the waves springing "swift as the eagle in her course so true, / She looks a giant bird, on snowy wind". A jovial sense is depicted as the sailors "hurrah - hurrah - thou rover's home". The vessel "gaily bounds" over the mountainous main and the welcome home is depicted as the "the united roar / Of joyous hearts, all unrestrained by fear" and the sailor praises his boat "Hurrah - my bark - hurrah-". The sailor exclaims "Give me the rover's life, so wild and free: / The tempest, and the battle rage to dare, / The shout of welcome o'er the foaming sea,". The sailor concludes by mentioning the "thrills with delight, that we alone may</p>

1833	18-22	2	Celtic Sea and South-west England	Western Times	02/03/1833	<p data-bbox="1344 191 2083 263">share" before referring to his love for his "brave and loyal crew" and his love for the sea.</p> <p data-bbox="1344 271 2105 1356">41 The papers around the west coast of Britain reported that a hurricane had passed over the land and sea with appalling consequences. In Exeter it was said to have caused £10,000 worth of damage. Numerous shipping casualties too frequent to number were reported from around the Cornish and Devonshire coasts and there was "a melancholy loss of life and shipping in the Channel". The gale was reported to have been particularly destructive at Swansea where at least 7 vessels were have reported to have been sunk and only the lives of the crew aboard the one of the vessels were saved. In Milford Haven a brig ran ashore in Sandy Haven Bay and 6 of the 18 crew perished. Great praise was said to be due to a Mr William Field "who dashed under the breakers, and swam to the brig, and succeeded in bringing nine of the crew on shore alive" whilst part of the goods were saved in a damaged state. It was also stated "not one of the many spectators would venture to the wreck but Mr Field who had two or three narrow escapes for his life in his perilous exertions". In Freshwater West Bay a coal-laden schooner was completely wrecked and four of the five crew drowned. A further vessel was wrecked in St. Davids Bay with only 3 of 7 crew surviving whilst two vessels were lost off Fishguard although all crew was saved. Two vessels were also driven on the Saunton Sands near Barnstaple although it was thought they would be got off after the cessation of the storm with crew and cargo largely intact. In the town itself "scarcely a house in the</p>
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town but what has been more or less injured, many of them roofed". Trees were unrooted, livestock killed and two men died on board one of the numerous barges which sunk on the river Taw. At Bovey Tracey 300 apple trees were destroyed. The trees "would have produced nearly two hundred hogsheads (60,000 litres) of cider, so that the effects of this storm will materially interfere with the quantity of this article produced next year, and create heavy loss to those who have much ground employed in the produce of this beverage". Further north a vessel was lost on the north bank of the Mersey with only 2 crew saved whilst another vessel was driven onshore near the Dublin lighthouse. "The greatest fears were entertained" for the City of Waterford steamer which was seen in great distress 30 miles west of Lundy although the sea ran so high no assistance could be rendered. "Country people" were stated to have been plundering the cargo of a vessel washed ashore between Boscastle and Bude, three drowned bodies were found and two more vessels were washed up. Elsewhere on the North Devon coast three stern name boards of different vessels, presumably in pieces were picked up. An account from Lloyd's of London stated that already 100 sail boats had been wrecked, "several of them are of considerable value, but the great proportion of the number are coasting vessels". The "nature of the risk" surrounding one of the valuable vessels, the steam-boat Erin from London, was so great 80 guineas was offered for anyone who assisted her safe return.

1833 26-27	2 SW England	North Devon Journal 28/02/1833	6 A strong gale from the SW which veered to the NW over a 15 hour period was said to have caused great damage both on sea and ashore. Throughout Devon and Cornwall plantations and forests were descimated surpassing the damge experienced during the also devastating storm of 1807. Throught the Cornish peninsula roads were said to be strewn with trees "so that the coaches have been much obstructed in their progress". In Lady Duckworth's ground at weir over 100 trees were said to have been felled whilst the estates of the Duke of Northumberland, Mr Terrell and Lord Clifford were said to have been widely destroyed. Orchards also suffered as it was said at least 50 appletrees had been torn up in the village of Brampford Speke where it was said "in short, nothing can exceed the devastation done within so small a campus". Damage was sustained to properties throughout the region and two sisters had a narrow escape when a chinmey fell through the roof of their Swiss cottage but fortunately only resulted in minor injury. A girl was also blown into a stream near Trew's Waier but was "providentially saved from a watery grave by a man who happened to passing at the time". A hellier who was blown from the roof of a public house who was taken to hospital "almost senseless" was later found to have sustained no broken bones and was recovering from the effect of the fright and bruises". In Cornwall it was said 1000s of pounds worth of damage had been sustained with £1,000 of damage been sustained in Launceston alone, although no lives were reported to have been lost. The most notable damage was sustained by "the 'withces' tower belonging to the old
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castle in Launceston, and which had braved the storms of centuries, gave way just before day-light on Wednesday morning and came down with a deafening crash". Among notable areas to sustain damage were the town hall and guild hall, prison, church, Mayoralty-romm and inn along with approximately half of the houses. Several other instances involving the falling of slates and tiles were also said to have occurred although none had resulted in major damage. At sea it was said the "the extent of he injury cannot be estimated, every arrival bringing additional accounts of devastation". The captain about the steamer the William the Fourth exclaimed he had never seen such a gale as the storm blew out part of the bulwarks and the decks were swept as the steamer made slow progress up the channel. The steamer The Herlad which left Hayle for Bristol also progressed through the storm despite public anxiety as it carried Mr Halse, Member fo St. Ives, "with the intent to proceed by Bristol to London, in order to attend his duty in Parliament". Elsewhere, the view of the captain of the William the Fourth was said to be largely universally withheld as it was said "some of our oldest seamen represent the sea, in the Channel, during Wednesday last, as most terrifically agitated so much so, that from Falmouth to Plymouth, it was one body of beautifully white surf". Throughout the area it was reported by that 3 brigs had been damaged whilst the brig Erin Gale of Liverpool which had been travelling to Savannah with salt had gone entirely to pieces on teh Plymouth breakwater although the crew had managed to get ashore as the tide fell and were later

rescued with difficulty by "His Majesty's ships Spartiate and Rover" who themselves had to be towed to safety by a trawler. It was said they were eventually "safely landed at the Pier, to the great joy of a great number of spectators which was manifested on their landing by three hearty cheers". Elsewhere it was said a 700 tonne 'free-trade' had been driven ashore and "nearly all pilot boats belonging to different islands had also been wrecked". A Spanish schooner bound for Bristol was also driven ashore in Deadman's Bay, Carter. Although the crew were saved the large proportion of the cargo of nuts which was strewn over the beach "became an easy prize to the rabble who crowded around the spot in immense numbers, intent on securing whatever came in their way". However it was said "too much praise cannot be given to Major Crofton, of the 22nd Regt, for the alacrity with which a detachment of his corps was placed at the disposal of the agent of the Conception, but notwithstanding their most strenuous exertions, assisted by the police and revenue officers, it was impossible to prevent great quantities of nuts being carried away, so that the portion of the cargo saved for the benefit of the concerned is but inconsiderable". It was also said a Russian barque from Odessa was driven onto rocks by Catdown although she was got off without damage thanks to the "persevering intrepidity of her captian". Fears were also enterained for an irish steamer heading from London to Dublin which had not been heard of for several days until she arrived in Falmouth without sustaining "any injury worth mentioning". A schooner from Newport,

1833	2	Celtic Sea and South-west England	Bristol Mercury	06/04/1833		laden with coals, was said to be less fortunately as it was driven ashore in a cove to the west of Portreath which resulted in a serious leg break and the loss of one life (no mention of any socio-economic insurance). More melancholy tales, came from Padstow where it was said the entire crew of a 60 ton vessel had perished which a similar fate was said to have befel a sloop heading to cork, after after a sloop searching for the sloop discovered several drowned bodies in the vicinity of the wreck. It was said "twopoor men" were also drowned after their boat was overwhelmed by large waves propogating up the river with the evening tide. However it was said two vessels who ran for Padstow harbour in when with the "wind blowing a heavy gale at NNW with a tremendous seas" were saved from wreckage due to "prompt assistance rendered by the boats and capstans belonging to the Padstow Harbour Association". On the shores of St. Martin's Island, Scilly a Navy brigantine was said to have parted anchors and been driven ashore and flooded although hopes were enterained she could be hauled off the rocks without considerable damage on the next high tide.
1833 28-29	11	Irish Sea	Liverpool Mercury, The Chester Courant &	06/12/1833	9	A poem directly composed about the loss of the steamboat Erin during the storm previous stressing the grief the lost cause and the ultimate futility of man in comparison to the power of God and nature. A violent hurricane wrought much destruction on the the west coast of Britain, with particularly notable damage being sustained on the Mersey although it was noted the number of incidents would have been far higher if "had

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Wales
Chronicle in
the Liverpool
Mercury &
The Bristol
Mercury

not a great and sudden fall of the barometer, the almost infallible precursor of a storm, induced many masters of vessels, who were about to put to sea before the storm came on, to remain in dock". Given the direct of wind and orientation of the Mersey it is unsurprising the storm brought storm surge conditions as the "the tide rose at least six feet above the height marked on the table, 18 feet" causing widespread inundation of the piers and considerable damage in the docks. Considerable damage was sustained in the docks with one vessel being lifted onto and subsequently beached on the dock. Indeed the volume of material being carried off was such it "gave the river the appearance of being covered with wreck" leading to alarming reports of shipping disaster to quickly spread around the town. All vessels who had ventured out put back and all sea transport over the Mersey was halted. Considerable damage was done to property throughout the town to the extent it was exclaimed "it would be endless, however, to enumerate all the instances of damage". The major fatality concerned the wreck of a pilot boat and the loss of 9 of its 22 strong crew. A reader's letter subsequently published in the Mercury on the 20th spoke of the valiance of a Mr Summer, the village surgeon who was "lauded for his intrepidity, his humanity, and noble exertions", however he himself had to be rescued by the lifeboat. It was said that initially "everyone was condemning the lifeboat, was blaming the sluggishness, the backwardness, and cowardice of the crew, that they should hesitate to put to sea, when a brave man, by his single efforts, gained the wreck", but "lo

and behold we now learn that he was put onboard the pilot-boat by this very lifeboat, which all have condemned, and in no very measured terms". Thus this letters gives a vivid insight into the perceived and actual rescue operation. Two other villagers were praised for their heroic actions as they each saved one man and the reader asked the question "Why were the names of these men Formby and Kershaw, withheld from the public? Was it because they were "humble individuals" of a lower class, as Mr Formby informs us? Or is not merit to rewarded whether it is found?" It was said that the public had subsequently complained about the exaggerated statements and that "they were importuned to subscribe and reward the exertions of one, while others had an equal right to remuneration, if real merit be the test". It was said it was hoped the rewards had not all yet been given to Mr Summers had they would be shared between all who had risked their lives to saved the distressed. The subscriber finished by offering his praise to Formby and Kershaw and below the letter he asked the question "do you think the pilots would care by whom they were saved?". Considerable inundation was also said to have occurred on the banks of the Ribble flooding a cottage to a depth of five feet and rendering the key road to Liverpool impassible. Property damage was widespread throughout Lancashire. The Ditton marsh was also inundated by Runcorn. An extract from the Chester Courant also indicated storm surge conditions had been observed on the Dee with banks and building being washed down whilst agricultural losses on the lowlying lands

1833	31	12	North-west England	Liverpool Mercury	03/01/1834	<p>surrounding Parkgate were most tremendous. The North Wales Chronicle also reported of a loss of one brig off Carnarvon although all crew were saved despite the initial obsitency of the captain to use the lifeboat. The lifeboat could not however render assitance to another brig which went to pieces with the loss of all those onboard along with two others, whilst "a number of vessels" were observed washed ashore. Vessels were also washed ashore in Beaumaris, Pwlheli, Milford Haven, Lundy, Swansea, Padstow and Penzance with a great many lives lost although the intrepida actions lifeboat crews throughout the region greatly reduced the number of fatalities.</p> <p>Another gale from the north-west "supposed only to have been equalled in fury by the memorable hurricane of January 21, 1802" struck Merseyside and great damage was sustained in both in the city of Liverpool and in the docks. Although destruction was widespread and it was difficult to walk the streets, "providentially, no material injury has been done to life or limb". Slates blew off rooves whilst chimney falls were a freequent ocurence. This include the chimney of the a chemical works that was 140ft in height which completely destroyed a workshop and and an adjoining soapery. Precautions were susbequently taken to stabilise the remaining structure. The scene in the docks was said to be worse than that experienced on the 28th Novemeber as the storm surge was greater in height (despite only being predicted to reach a height of 17 feet and 5 inches) as the river rose 6ft in height sweeping the piers and doing considerable</p>
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1834

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Western
Times

25/01/1834

damage to vessels in the docks, two of which sunk after doing considerable damage to piers and jetties. Cellars in the low-lying areas of the city were flooded with seawater and streets were flooded up to a depth of 2-3 feet. However, it was said that one of the vessels the Vale of Clwyd was sunk purposefully "in order to prevent her being dashed to peices ahainst he pier, and that she has since been got up and taken into dock". This was after "a considerable quantity" of her cargo was unloaded and saved "principally through the exertions of spectators, had had thronged to the pierhead to witness the magnificent scene which the river presented". Praise was also given to Mr John Keet and "several military officers, belonging to the 28th regiment, we believe, who kept their station manfully, and aided in passing the goods, though thoroughly drenched by the waves and spray". Three vessels broke from their moorings and drifted into a creek and a small coastal vessel was sunk after she run down by a barge in canning dock but was quickly raised. Overall it was said "the scene was one of terrific grandeur and sublimity" as "the Mersey lashed into fury, the whole surface of the river foaming like a boiling cauldron". Elsewhere a vessel which was beached on Hoyle bank 6 days previous was destroyed and a sloop sank off Ormshead with the loss of all crew. A poem written drawing a parrallel between love, the trials of life and a storm empahsing the authors lover is the "Star of my hope!-my beacon light! As on I drive through life's rough sea, The gale is howling, but aright I steer whilst guided thus by thee".

1834	18-19	7	North-west England	Liverpool Mercury	25/07/1834	"One of the most tremendous thunder storms we remember to have witnessed for many" years struck Liverpool and Merseyside and the rain was said to pour down in torrents. However the improved sewerage and drainage systems were said to have drastically reduce damage resulting from flash flooding when compared to previous storms of similar nature. Indeed whilst a selection of cellars were inundated "a inhabitants ... who have hitherto been inundated whenever a heavy fall of rain occurred about tide time, escaped almost scot-free". Damage reported to crops and agriculture was likewise minimal.
1835	1	7	North-west England	Liverpool Mercury	03/07/1835	A vessel was reported to have been driven onto a sandbank by strong north-westerly breezes in the mouth of the Ribble. Fortunately all crew and passengers were saved after 5 hours in the rigging along with the majority of the cargo which was valued at £25,000. The correspondent understood "that great praise is due to the fishermen of Lytham, for their exertions in saving the passengers and the captain and men".
1835		7		Lancaster Gazetter in the Liverpool Mercury	11/07/1835	A poem drawing the parallels between storms and friendship.
1835	31 to 1	10	South-west England	Western Times	07/11/1835	The value of the Falmouth lighthouse was praised as it was stated a steam vessel from Dublin was solely dependent on its presence which allowed it to run into the safety of the harbour. Without the light it was said it would have had to wait the night out to enter with potentially dire consequences.

1836		6		Western Times	25/06/1836		A song concerning the strife and anxiety a sailor's wife feels caring for her sleeping infant whilst his father is out to sea and ultimately deemed to be at the mercy of god.
1836	10 to 13	10	Celtic Sea & South-west England	Western Times and the Plymouth Journal	15/10/1836	12	A severe gale wrought great damage upon shipping and communities as the wind "blew nearly a hurricane from the south-west". A vessel was wrecked off Torbay with the loss of 11 of 12 hands and £30,000 worth of Cargo as she was driven from her moorings and driven north-eastwards onto rocks. The captain was ill ashore and neither the ship nor cargo were insured. Moderate-minor damage to property was incurred throughout the south-west whilst an unmanned vessel broke from it's moorings in Teignmouth and was destroyed. In Topsham it was stated "one of the most tremendous storms that has occurred since the November gale of 1824" was felt and the storm was such it "occasioned the tide to flow with such rapidity, that it was at his usual height two hours before high water; when it arrived to its greatest height it was at least three to four feet higher than its usual course". The storm surge resulted in the inundation of the surrounding streets and houses, the destruction of boats and the death of one man on the river Exe. At Sidmouth it was reported "our great sea wall has this morning recieved the most violent assault from the watery element it ever was attacked with since its erection" but was said to have held firm. Experienced seafarers said the gale was equal to that of a previous gale that had dessimated the town before the sea wall was constructed indiciating its value as no damage of noted was incurred by property as the storm surge waves "successively recieved such a shock at our

1836	28-29	11	Nationwide	Bristol Mercury	03/12/1836	2	<p>great Protector of property, as to turn their lion like fury into the mildness of the lamb". Where the seawall ended a road had been washed away to the extent were by it was impassable and overall it was "considered the sea wall has more than saved its expense in building only in this single gale". Storm surge conditions were also observed at Barnstaple completely inundating the coastal marshes as well as offices and storage warehouses in the quay causing considerable damage, whilst three men had close escapes from the surging floodwater with two having to be lifted from their stricken barge onto a bridge above. The storm surge likewise caused considerable destruction in Plymouth inundating the wharfs and completely flooding the houses as the "wind veered round to all points of the compass" bringing with it heavy rain. The damage to goods was also extensive as they were either rendered unfit for sale or destroyed altogether. Buildings were also said to have been destroyed on a widespread scale by the force of the wind alone and much fear was entertained for shipping as minute guns of distress had been heard fired in the sound although it was not known if assistance had been rendered.</p> <p>A violent storm which affected the entire country was said to have brought torrents of rain "seldom before witnessed" to the city of Bristol and the surrounding areas. As a consequence "the lower parts of the city, and in particular the low-lands bordering on the from, in the neighbourhood of Baptist hills, speedily became inundated, and the inhabitants of several of the cottages thus</p>
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1837	5		Western Times	20/05/1837	<p>situated were, for a time, placed in circumstances of considerable peril." Reference to water being released from a reservoir of sorts was made and was said that such action averted "considerable mischief and inconvenience". After the rain subsided violent squalls from the west and south west were said to have raged for two hours "in a manner almost unprecedented in this quarter of the globe". The Bristol market was said to have been destroyed, the roof of the Horticultural showroom was lifted off and chimneys and roofs were damaged on a widespread scale. Several individuals were injured by falling slates whilst innumerable trees were blown down and livestock lost in the rural districts of the south-west and Wales. Losses on both sides of the Bristol Channel were said to be particularly severe as this was where "the storm raged with the utmost fury, and with destructive consequences", whilst two men were drowned as their small vessel capsized whilst communicating from their ship to the shore.</p> <p>A poem emphasising how the peril produced by storms is what defines a sailor's existence and shapes their very character.</p>
1838 14-16	2	Southern Ireland	The Cork Reporter in the Liverpool Mercury	23/02/1838	<p>An immensely powerful gale from the SE stronger than any "within the memory of the oldest inhabitant" hit the southern coast of Ireland causing great destruction both onshore and at sea. It was said that the sea in the harbour was so heavy that "it is impossible for a boat to put off" thus it was near impossible to render assistance to several vessels who drove ashore whilst firing distress signals as pilot boats were swamped. Although, larger, ocean-going</p>

1838	20	3	Irish Sea and North-west England	Liverpool Mercury	23/03/1838	<p>revenue ships rode out the gale, at Cove, six vessels were said to be ashore or have sunk whilst two were said to have collided. Two vessels were said to be have been lost near Ballycroneen and whilst the crew was saved from one nothing was known about another who's cargo of livestock had been washed ashore. Outside Crosshaven a brig was also lost and nothing had been seen of her cargo ro crew.</p> <p>Two large vessels were stated two have collided in a gale in the Irish Sea resulting in both vessels being considerably disabled and a passenger breaking both his legs. The south-westerly gale which veered westard drove 3 vessels ashore in Liverpool Bay, completely wrecking 2. It was siad "it is fortunate that on Tuesday the tide happened to range low - about 11 feet. Had the same gale occurred with a 21 feet tide, the effects upon the river would have been tremendously magnified". Had the tide been higher "the water would have been blown at least four or five feet higher than the calculated level, and vessels, as has been the case before, might have been mounted clean over the pier". As it was the venal equinox the gale was considered to be "quite in character with the season".</p>
1838	18-20	6	Western Britain	Liverpool Mercury & The Western Times	22/06/1838 & 23/06/1838	<p>3 "An abundance of rain" was said to have fallen over Liverpool and the North-west. During the intense thunder storms "rain fell more like a number of sheets of water than the ordinary fall of even the heaviest rains. It was just such a deluge as we hear of in tropical regions during the rainy season". The low-lying areas of Liverpool "were for some time under water" and when the sewers carried away the excess water some time later cellars remained</p>

1838 27-28

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South-west
Britain

Bristol
Mercury, The
Wiltshire
Independent
& The Exeter
Herald

03/11/1838

flooded and were difficult to clear. The water ran through the town like a torrent with such a force it tore up paving stones. Coals were said to have been washed down streets and the high winds and rain also did much damage to crops in the surrounding rural areas. The road running through the low-lying smithdown area was inundated to knee depth for a quatere of a mile whilst a small brook "resembled more a mountain torrent than the placid meandering streamlet, which is its usual appearance". In the Preston area the lowlands about Rufford were inundated for miles and two persons were most unfortunately killed by lightning. In Cheshire the potato crops were stated to have been considerably damaged. The stormy conditions were said to have been most severe during the evening and afternoon of each day. An inquest also confirmed a that a young man, believed to be 18 or 19 in age, who was found dead, washed ashore on the Sidmouth coast, was part of the crew of a schooner which had been carried ashore by the strong south-westerly winds. Despite every attempt to render assistance the the berieved was washed overboard and carried off by the undercurrent. It was said it was near impossible to identify him such was the extent of multilation he had endured.

A terrific gale of near-hurricane force struck the south-west doing considerable damage to property throughout the region. In Bath chimney stacks were blown down although the the damage was said to be minor when compared to other areas in the region due to the fact "the houses of the city are for the most part of a very

1838	28-30	11	The British Isles	Western Times, Liverpool	01/12/1838 & 07/12/1838	7	<p>substantial character". In the neighbourhood of Frome hundreds of trees were torn up, livestock killed and several houses were partially unroofed. Eighty trees were also blown on Miss Dickinson's estate at Queen Charlton. An inhabitant of Taunton had a very near escape as a chimney fell through his roof and it was said "their escape was most providential", although they did sustain a damage of £300. The Wiltshire independent also confirmed that deforestation and injury to livestock was also widely sustained across that county. At Devizes the storm was said to be one of the strongest in memory as the wind from the west veering to the north-west caused much damage to dwellings and agriculture although claimed no lives. Similar incidences were noted in Trowbridge and the roof of the Hilperton church was blown off as the people in the parish were sleeping and so did not attach wagon ropes to the church roof and anchor it to the surrounding tombstones as they had done during a previous storms. Most depressing tidings came from Clovelly where the coastal fishing fleet had been dissipated with the loss of 11 vessels and 21 men. "The distress among the wives, children and relatives, of the unfortunate sufferers is beyond description ... the appearance of Clovelly presents a scene of the most melancholy and heart-rending description". Many boats in Teignmouth harbour had been sunk and widespread damage to crops and property was said to have been sustained in Holsworthy.</p> <p>The weather was described as having been "unprecedented in boisterousness and violence". Gales came from the north, east and south-east which were</p>
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Mercury,
Northern
Whig & The
Cork
Reporter

"accompanied with deluging showers, thunder and lightning, hail storms, and all the usual indications of the most tempestuous seasons". One of the thunderstorms to break over the city on the 28th was reported to be "equal in intensity to any that we had ever before witnessed, and the storm continued with unmitigated fury throughout the night". Although the storm subsided somewhat over the 29th-30th the less-frequent showers and gusts of wind remained of a high magnitude. Flooding was widespread and the Exe was several above its usual level and livestock perished on a wide scale as the floodwaters inundated low-lying agricultural areas. A schooner worth £50 broke from an inland quay and was washed over two weirs leading to its complete destruction and loss of 26 tons of coal. Another schooner also broke free and was also left stuck on the weir. Such an incident on the river had not been observed since November 1807 when a schooner stuck on the weir was eventually completely wrecked. In the centre of Exeter a boat was observed plying the streets, all business was suspended and destruction to property was abundant. On higher ground shops were closed due to the very strong winds whilst flooding was the primary issue in the lower-lying areas. Of particular note was the loss of a large quantity of valuable timber which was purposefully placed out of the reach of the floodwaters only to be destroyed by the strong winds. There was also a minor infestation of rats as the vermin were flushed out of their burrows and attempted to move to higher ground. Storm surge conditions were noted at Dawlish as the gardens and houses of the coastal property

were inundated. However "the sea wall afforded all the benefit anticipated from it, and averted much damage that would otherwise have ensued". At Teignmouth the wind was noted to have suddenly shifted to the S and SW "where it blew a tremendous hurricane" this had the effect of producing a considerable quantity of spray and the East Teignmouth church yard and other coastal properties to a depth of 2 feet in some cases, whilst all travel around the village was halted. A crowd of spectators gathered "to witness the power of the contending elements" although they were obliged to hastily retreat from the impending waves leading to many becoming rather wet. It was unusually remarked that the damage done to property would be good business for the glaziers and slaters of the district. The "old and weather beaten mariners" of the town had secured their vessels so little damage was incurred in the harbour as all the vessels remained wind-bound. In Plymouth the large wind shift from the ESE to SW was noted which caught a vessel off guard which was blown onto the rocks. She was saved however due to the rapid deployment of two (non-official) rescue boats and return only without her rudder. Several more boats were onto the rocks but were saved thanks to the efforts of the numerous people assembled onshore. Quite unfortunately a young man of only 19 was washed off the rocks by the swell and met a watery grave. Another fatality was noted on a French vessel which struck the rocks as the mate drowned whilst attempting to swim to the shore with a lifeline. The other 4 onboard were saved thanks to the intrepid actions of a nearby

vessel who saved the crew from the rigging onto which they were clinging. The distressed French sailors were then well cared for by 'several kind-hearted individuals' at a nearby inn whilst "the noble fellows achieved this daring and humane act, were repeatedly cheered during their labour by hundreds of persons assembled on the shore, and we doubt not they will be handsomely rewarded for their almost unparalleled bravery". At Ottery St. Mary the rivver Otter was higher than had ever been known, trade was suspended as the river burst it's bank as the water came to waist height. The fact that the main bridge in the town was impassable caused the correspondent to pose the question whether legal proceedings should be commenced against those responsible for it. It was stressed "it is a serious subject and ought not to be trifled with, endangering and obstructing the mail is a matter of considerable importance, and when we find a substantial bridge can be built there for a sum of £150, it cannot but excite surprise that the magistracy do not order it to be done to ensure the safety of her Majesty's subjects passing that way". The river Dart also burst it's banks as water rose to such a great height that the lower part of the town as well as the surrounding plains and warland were completely inundated. Several sheep had died and a large quantity of timber was seen floating down the river although no significant damage was noted. A ship carrying wheat and groceries was wrecked between Burton and Abbotsbury with the loss of all hands bar one. Two vessels were also wrecked by Penzance as they were caught offguard by the sudden windshift and increase in

windstrength and could not enter the port due to the low tide, although the crews had near-miraculous escapes. In Falmouth nearly 200 vessels sought refuge in the harbour and "the force of the wind has caused the tides unusually high" doing considerable damage to the cellars and quays along the shore. It was remarked that it was fortunate it was not spring tides as "the oldest inhabitant never before saw such tremendous waves in the inner harbour" and thus terrible destruction would have ensued if the tide had been higher. It was also noted that this storm happened to coincide with the 135 year anniversary of the great storm of 1703 in which over 800 homes were completely destroyed, c.8000 people were listed as dead or missing and over £2,000,000 (£486,936,295) worth of damage was done in London alone. Clear profiteering had also ensued afterwards as the price of tiles rose from 21 shillings (£234) before the storm to £6 (£1,460) immediately after. In Liverpool the the "mercurial column of the barometer had seldom or never within our collection stood as low as on the 28th and 29th, on the latter of which days the mercury subsided to 28.1" and it was said the mercury elsewhere had fallen to a level lower than this. This was affirmed using a an article concerning Meterology from Brewster's Encyclopedia in which "the greatest depression of the barometer that has been observed in this county for many years took place on the 5th March 1818, with a SW wind ... during the morning of the 5th the barometer stood at 27.970, correspondening to 28.155 at the level of the sea". The storm did not have extreme consequences of Liverpool which most likely

indicates the town was at the centre of depression, and indeed it was remarked that the consequences would be felt elsewhere, although the correspondent somewhat oddly makes the link between a drop of the barometer in Liverpool and the great earthquake in Lisbon of 1755. However the correspondent did note the widespread destruction that had been experienced elsewhere throughout the kingdom. A correspondent of the Belfast Northern Whig reported "the old and new light-houses are swept away. Not a stone of the new house is to be seen" in Ardglass where a storm surge of 3 feet was noted and a large ship was observed ashore at Dundrum. Newry was also reported to have been "nearly inundated with the highest tide ever remembered" as the canal system and gates were completely overwhelmed. Likewise in Cork the wind shift from the SW was noted as one of the most memorable storms in living memory damaged houses at high elevations and tore up trees on a wide scale. A steamer bound for Waterford was lost when she was overcome by the high winds and seas and wrecked on the Tower of Hook. "So total has been the destruction, that we are told not a plank of the timber work remains". Three of her twenty-three man crew were said to have perished and all cargo was lost. Two more lives were lost aboard a vessel although eighteen were saved thanks to the effort of a "fine Newfoundland dog" who swam ashore with a lifeline. The Cambrian noted the storm surge conditions at Swansea were such that the tide rose to 23 feet 2 inches which was "7 feet 2 inches about its proper level. The barometer fell to 28, which is a very

<p>1839 6 to 7</p>	<p>1 The British Isles Liverpool Mercury, The Northern Whig, Unspecified Dublin papers, Bristol Mercury and the Western Times</p>	<p>extradoniary occurrence in this part of the country". The report concluded that the the number of fatalities throughout the United Kingdom were too numerous to report all of them and also critiqued certain meterological readings from other papers that an atmospheric pressure 29 inhg was noted as this was not an indicator of stormy weather.</p> <p>43 A severely violent storm caused destruction throughout the country as considerable damage to property and loss of life was sustained. Although a strom wind blew on the 6th and "the glass fell considerably, many vessels, commanded by experienced captains, when to sea, and there was nothing to inidicate the frightful storm that followed". The wind then shifted from the south-east to south-west and "a perrfect hurricane ensued". Damage in Liverpool was so universal and widespread the correspondent stated "we never rmeember a night of more universal or well-founded alarm". After a sleepless night for thousands the town woke to see the "evidence of the elemental war which had raged during the night" and there was not or a street nor scarecly a house that had not recieved some form of damage. The loss of life both at sea and on land was most frightful as "there is scarcely a part of the town in which some fatal accident did not occur". There were several accounts of where chimney falls had lead to deaths although one man had a lucky escape from the ruins which was referred to as "a miraculous interposition of Providence". As would be expected several casualties were admitted to the hospital from the docks with serious injueries. A cotton mill was</p>
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extensively damaged with the loss of considerable quantities of cotton which blew around the vicinity giving a false appearance of frost. More than 15 vessels ran ashore in Bottle Bay with many becoming complete wrecks. One of the most notable of these was the packet ship Pennsylvania, which was wrecked on the West Hoyle bank with the loss of 39 crew and passengers as well as an unspecified valuable cargo. Only one man survived who was "so fortunate as to possess a life preserver" and thus escaped from the wreck unharmed. Another transatlantic ship, The Lockwards, ran aground on the north Hoyle bank and was expected to go to pieces whilst a vessel which had sailed the great distance from Bombay was also wrecked after "the lifeboat, after several ineffectual attempts to reach her, was towed close to her by a steamer". Thirty-five of the crew were saved whilst 28 left the wreck on the raft and were yet to be heard from. They subsequently perished. Several more significant vessels were also wrecked on the sand bars of Liverpool Bay and, rather ominously, "dead bodies continue to be washed up the tide along the coast". A reward of £1,000 was offered to any steam-tug who could tow a perilously placed ocean-going steamer away from the quay, although "the gale was, however, so strong, that none of even the powerful steam-tugs of the port accepted of the proffer. A group of 8 riggers who, most likely in search of a financial reward, unessecarily went to the periloiously placed steamer on a small craft capsized en-route leading to three deaths "in the view of numerous distressed spectators, who could afford them no assistance in the

moment of need". It was later reported that a man died as he fell from the boom of a sloop which had ran into the quay in St. George's dock. A coroner's inquest into his death was subsequently conducted. A considerably more detailed report on the inquest was held into the death of 28 people who had died on board the transatlantic packet ship The Lockwoods. An account from a survivor stated that the captian had ordered that the sails be reefed although the lack of navigation lights in the area meant the "vessel was all abroad in their calculations" coupled with an injury to the 2nd mate were two key factors that lead to the vessels demise. The loss of both anchors exacerabated an already perious situation which lead the capatain and sigificant crew members to leave the boat in a pilot boat to render the assistance of a powerful steam tug, which also carried a lifeboat at her stern. Despite several lifelines snapping 35 were rescued from the Lockwoods and it was stated the crew of the steam tug "rendered all the assistance they could render; they put their own boat in jeopardy, and their lives also". Neither the captain nor crew asked for any rewards for their endeavours. However an account from the 1st mate to the inquest panel satetd he believed more would have been saved if the steam-tug had reamineded longer, although as the Lockwards was on a bank he stressed a small boat would have been required to save the passengers suggesting "had the lifeboat remained with the steam tug I think all hands may have been saved". He also further accused the Hoylake lifeboat men of "not allowing any half-dead people on board" during the final

evacuation from the wreck, although two individuals in a severe condition were taken off. A representative of the steam tug company naturally supported the former witness who stated that the low water would have rendered the situation highly dangerous for the tug stressing "if she had damaged or lost one of her paddles she would have been useless". He also affirmed the tug crew had been most hospitable towards their distressed guests. A later report from the master of No 1. pilot boat stated that the Steam Tug company initially did not accept an offer of £20-£30 (£2050-£3050) to take their pilot boats out to the distressed vessels and it was only after sometime the Victoria was sourced. He also accused the lifeboat captain of cowardice stating "the men in it complained that the steamer would tow them under" and this complaint persisted even when the steamer slowed somewhat. Despite the fact "several of the branch pilots, on hearing this, volunteered to man the boat" and the lifeboat crew and his captain were asked to come aboard the tug to be replaced, the lifeboat captain replied he would not change crew afloat and immediately let go of the tow rope setting sail for Liverpool. Overall the pilot of No.1 concluded that "if they had had the lifeboat they could have saved many more both from the Lockwards and Pennsylvania" which were wrecked in the shallow waters unreachably in the craft they had at their disposal. Other witnesses described the most awful scenes of watching dead men drown and removing their corpses from the shore. On the southern bank of the Mersey at Woodside one life was lost as a chimney fell on top of a

servent sleeping in an attic whilst destruction to commercial and residential property was widespread, including the loss of a new church which was nearing completion before it was completely levelled and the expense of repair was estimated to be >£200 (£20,500). In Preston damage was also widespread and "the streets presented a most dreadful appearance and one fatality was recorded. A large factory was also destroyed and trains were unable to traverse over the Ribble bridge in its unfinished state. Throughout the Dublin area the storm was terrific in nature claiming 8 lives, destroying property, levelling forested avenues and causing countless injuries. A fire broke out in a Church and subsequently destroyed 6 nearby houses despite "the military and police co-operating in the great object of subduing the conflagration with much zeal". Two artillerymen were severely injured when trying to subdue the fire in one house and there was said to be no hope of their recovery. Some of the worst storm conditions were noted in the North of Ireland where the storm was noted to increase in magnitude as it shifted SW producing "a scene of utter desolation we were never before called to witness" as barely a roof was left unscathed. In the area two deaths were recorded and a large weaving factory which had been re-roofed just days earlier was "prostrated to the ground". In Stranford Lough at least 6 vessels were driven ashore and several sailors were lost despite tremendous rescue efforts which saved many aboard sinking or perilously placed vessels. In the south-west of Scotland by the mouth of the Urr "the most dreadful hurricane ever

1839		2		Liverpool Mercury	01/02/1839		witnessed by the oldest inhabitants" ensued with much damage to houses and agriculture. At Douglas, Isle of Man, 6-7ft of water were observed on the strand at low-tide when it is usually dry. Poem named "The King of the Southern Sea" which emphasises the power of nature and the futlity of man as well as man's exploitation of nature.
1839	20-21	6	South-West England	Western Times and Bristol Mercury	22/06/1839 & 29/06/1839	1	A thunder storm of a "severity that exceeded any former visitation - even as far back as the memory of the oldest inhabitant exteneded" passed over the South-west of England bringing with it large hailstones and deluging showers of rain which "followed each other so unremittingly, that the streets had the appearance of rivers". The sewers of the city of Exeter were completely overwhelmed and the cellars of many properties flooded. Floods of aheight of 4-5ft were noted within the town and it was noted "it was very fortunate the water of the river had been drawn off for the purpose of repairing Trew's Weir, so that, though the floods came down violenetly during the night and morning, no mischeif was done". However it said crop growth was "not sufficiently advanced" to substantially suffer from the flooding. The intensity of the storm caused great anxiety to prevail over the district and prompted men "to start calling for their wives, and wives fearful for their husbands - sweethearts anxious for their distant lovers" although no lives were lost or substantial damage down. The thunder storm was said to sweep across from the SE to NW and an unforutnate fatality was recorded at Wells as a young boy

1840	19-21	1	North-west England	Liverpool Mercury	24/01/1840	<p>was electrocuted as he took shelter under and oak tree whilst livestock was also killed.</p> <p>A succession of heavy gales caused great alarm among the populous of Merseyside although "providentially, no damage was done to life or limb, and very little to property". The tide rose above its predicted level to 19ft as the tide was the highest of the month and the association commonly noted by seamen between the incoming tide and an gale severity was noted as the tempest "abated with the reflux of the sea". The correspondent challenged the opinion the storm of the January previous was stronger due to the extensive damage caused by stressing "it must be borne in mind, however, that the houses, &c., which were damaged on that occasion, have undergone thorough repairs, and that these repairs have been effected with the direct view of resisting the force of another tempest". There were no reports of any serious damage to shipping on the Mersey, although a barge did break loose and drifted down the the Liverpool shoreline only to be safely moored in Waterloo Dock with plentiful assistance from the shore. Likewise four men in a swamped rowing boat were also brought to safety. Two other vessels drifted ashore but were not substantially damaged and all crew were saved. Perhaps learning from the storm the year previous, a steamer was sent out to assess the state of the lightships although the seas ran so high she could not reach either although she reported "that they were all secure and would without doubt be enabled to ride out the gale". Two lives were unfortunately lost when the crew of a small boat put out to rescue an</p>
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1840	5	2	Bristol Channel	Western Times	08/02/1840	<p>overboard pilot lost a crew member themselves. The violence and the presence of mind of those on board another pilot boat who attempted to save the man in the swamped rescue craft was noted.</p> <p>A strong gale from the NW wind-bound all vessels including powerful steam-driven packet ships at Ilfracombe. Another large vessel of 150 tons burthen which had just been launched was driven from her moorings against a bridge and was reported to now be lying on her beam ends with two masts across the bridge. Part of the rigging had to be cut away to allow traffic to pass and it was estimated £200 (£20,500) worth of damage had been done to the bridge.</p>
1840	29	9	Irish Sea	Liverpool Mercury	02/10/1840	<p>A account from an Irish Sea steamer, noted a severe gale was blowing at the Isle of Man as it left for Liverpool and consequently many a passenger "immediately betook themselves to their berths, in silent preparation for all the pleasures and amusements of seasickness". The tide meeting against the wind was said to generate a "temendous swell" that made "the stomachs of the devotees of pleasure began to give up their contents". The state of the sea was such some began to act in a hysterical manner and resorted to "audible prayer" and another man was "keeping his spirits up by pouring brandy down" whilst musicians on the deck also played tunes of reassurance. A large barque bound for New-South Wales was observed flying a flag of distress "and Captain Quayle, with that humanity which has ever distinguished the noble commanders of Manx packets, immediately lay to for her". The barque had lost all of her</p>

1840	21	11	Bristol Channel	Western Times	28/11/1840	<p>sails and was without a pilot only a few miles from the banks and but for the intervention of the Manx packet a serious incident could have occurred. Despite this selfishness and anxiety was shown by the passengers who "had evinced a great desire for their own safety, showed, by their expressions and looks, that they were regardless of other". However most were delighted that the Manx packet was able to come to the assistance of the distressed barque as it "in all probability preserved life and property in the other to a considerable extent".</p> <p>A tremendous gale was observed the Bristol Channel which created conditions where by the sea was so rough it was impossible for the Ilfracombe pilots to put off and render assistance to a distressed vessel who was attempting to weather the storm with improvised temporary sails after the masts, bowsprits and rigging had been substantially damaged off Lundy by the very strong westerly winds. It was feared if "she got among the breakers she would go down with all hands", although she managed to avoid this heading to the roadstead where the "intrepid pilots, at the most imminent risk of their lives, went off to her ... and took her to shore safely".</p> <p>Once the crew were safely ashore the captains of the vessels inside the harbour "nobly came forward" to render assistance to the pilots and collectively the damaged vessel and its valuable cargo of copper sheets were brought into the harbour. "Too much praise cannot be given to the pilots for their heroic conduct in saving the lives as well as the property" which was "valued at twelve</p>
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1841	21-23	8	North-west England	Liverpool Mercury	27/08/1841	<p>thousand pounds, therefore we hope the salvors will be liberally rewarded".</p> <p>A heavy thunder storm bringing caused great damage over the north-west as lightning struck property and trees whilst torrents of rain resulted in flash flooding. Lightning only broke over Liverpool twice and "each time the immediate roll of thunder "in explosion vast" raising its tremendous "voice" amid the silence of the morning, indicated the proximity of danger". All around the air "as surcharged with electrical matter" and the clap of thunder " made the earth tremble". The steeples of two churches were seriously damaged and the damage sustained at St. Michael's, described as one of the most handsome in Liverpool, was illustrated in the paper and was described as a "thunder-splintered pinnacle" in need of considerable repair. Although no loss of life had occurred there was a prevailing feeling of sorrow that such a magnificent church had been so badly damaged and crowds of people came to view the spire of St. Michael's in its sorry state and police had to be deployed to preserve order.</p>
1841	16-17	10	North-west England	Manchester Courier and Lancashire General Advertiser	23/10/1841	<p>A violent tempest was said to have swept over Runcorn doing great damage and proving a harrowing experience for many who still remembered the disastrous storm of January 1839 and who consequently were "kept, awake, in fear and trembling, throughout the last". Although little damage was sustained inland considerable damage was sustained by shipping in the docks as the storm took hold during high tide. However it was noted that "happily the storm arose so much before tide time, that no vessels ventured out of the Mersey and Irwell docks, or the loss</p>

1842	1 to 2	2	The British Isles	Western Times	05/02/1842	29	and damage would, almost doubtless, have been severe and extensive". A storm which was described as a hurricane swept over the entire kingdom doing particularly severe damage in the Bristol Channel were a strong WNW gale shipping up a "tremendous sea" which nearly overwhelmed a cutter approximately 30 miles west of Lundy Island. The vessel was completely incapacitated and lay on her beam end causing the ballast to shift and the 6 crew on deck to be swept overboard and 2 of which to drown, whilst a further 6 were injured. The vessel which contained a mate of the Queen and Francis Peel, the nephew of primeminister Sir Robert Peel was then righted and towed into bristol harbour by a steamer. A coronor's inquest returned the verdict of "Accidental death". The NNW gales also wrought havoc upon a barque in the Celtic Sea upon which 5 lives were lost and substantial damage to the rigging and structure was sustained. As a result the vessel had to make port at Bristol. Damage and destruction was also widespread throughout Ireland as "a number of houses were stripped of their slating, and two lives endangered" in Dublin whilst a sprie was removed from atop of a Waterford church. In Limerick two lives were lost ashore an a brig and schooner were both sunk and dismasted. Another ship was wrecked near Wexford with the loss of 3 lives and two more vessels were wrocked wrecked at Pwllheli. A further 9 lives were lost offshore near Londonderry and 10 were lost near Dungloe.
1842	22-24	10	The British Isles	Bristol Mercury	29/10/1842	21	A dreadful storm which raged over the course of 3 days and brought immensley strong W to NW winds caused

1842

12

Western
Times

03/12/1842

immense loss of life and destruction of property. At Dungeness 3 vessels were wrecked, with the crew of one fishing boat being washed ashore alive. However the two brigs which were also driven onshore in the vicinity and completely destroyed. The crew of one perished soon after their craft was destroyed and they were swept overboard whilst the coast-guard retrieved several men from the rigging of the other brig but they "were in a dreadful state of exhaustion, and were all but dead". The combined loss of craft and cargo was estimated at £2,000 (£227,860). Ten more men also perished at Ilfracombe in the Bristol Channel where their brig was swept upon and wrecked on the cliffs of Bideford bay with a loss of ship and cargo valued at £1200 (£136,716). On the north bank of the channel several vessels were reported ashore and expected to become a wreck by Porthcawl whilst a brig laden with copper ore foundered in St. Ives Bay and "all onboard met a watery grave". The same fate was also met by those onboard a Cardiff vessel who sank in the centre of the Bristol Channel and at Bideford "the loss of life was dreadful in the extreme" as numerous more vessels were lost.

A poem entitled "The Stranger's Grave" concerning the woe and heartache felt by the family of a sailor drowned at sea in a storm and buried in an unmarked grave. The poem clearly indicates the sailor's fate "wash'd by the storm on yonder pebbly shore", the misery of his family "haply for him some wide may weep alone" and their desperation that he may return one day "a place stands vacant, which he ne'er will fill". The poem must be seen as

<p>1843 12 to 14</p>	<p>1 The British Isles Liverpool Mercury</p> <p>20/01/1843, 28/01/1843</p>	<p>21 a clear response to the widespread uncertainty and woe falling the near innumerable fatalities that occurred during the westerly tempest of the 22nd to 24th October.</p> <p>"Ever since the awful hurricane of 1839, the month of January has been associated in the minds of the public with many painful recollections, and we regret that the disasters of that month, in the present year, will add another gloomy chapter to the sad history of melancholy events already on record". Although the damage in Liverpool was not to the extent of those incurred between the 6th and 7th of January 1839, damage to property was widespread, many serious casualties were recorded and multiple lives lost. However it was said the sudden fall of the barometer to 28.92 mm/hg on the 12th gave warning to the inhabitants and sailors who made what preparations they could. The fall of the mercury was said to be so sudden that it was "supposed some accident had occurred to the glass; but we soon ascertained that the barometers in the town had fallen in the same proportion" and "Mr Abraham, of Lord-street, who is a good authority on the subject, stated that he had not witnessed such a change in the barometer for the last thirty years". There was a significant public reaction to this fall in pressure as merchants and brokers returned home, the captains of many vessels ready to depart decided to stay in port and "underwriters declined insuring vessels until the impending storm had blown over". It was stated these measures and restrictions resulting from the pressure change ultimately reduced casualties. The wind gradually increased from the south-west bringing with it heavy</p>
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showers of hail before it suddenly shifted to the north-west from which point it began "to blow with fearful violence". The wind then became so strong it shook buildings to their foundations, and despite the fact the storm occurred at low tide the river was "one sheet of foam, the waves running as high as if it had been a full tide in calm weather". Despite the fact the storms of recent years had made owners pay more attention to house maintenance many families were still kept up all night and the streets presented a scene of ruin the following day with chimney pots and tiles littering nearly every street. Throughout the city walls were blown down, both residential and commercial property damage whilst trees were felled on a wide scale. In one house two lives were lost when a chimney fell through three floors into the cellar crushing the unfortunate occupants whilst one life was lost in Birkenhead when a gable of a new house in Wellington-terrace fell and killed an occupant. The villages of Bootle and Waterloo suffered little during the storm and this was attributed "to the firm manner in which the houses are built and the lowness of the chimneys". On the river storm surge conditions swamped many anchored craft and inundated various pierheads, although casualties and damage were said to have been greatly reduced due to the prior preparation and the presence of police along the sea front to render assistance. A coal barge broke from its anchor and began dashing against the pier putting in danger its two crew members who were thrown overboard from the shore and then cared for in a public house before the barge sank. A vessel also sank in

the Sloyne off Tranmere, small craft throughout the estuary recieved minor damage and the landing slip at Georg'es pier was partially eroded b the sea. The ferry steamers were obliged to keep to the northern bank to avoid the destruction of the NW hurricane as any vessel on the Wirral side would have most likely been wrecked. A schooner sprung a leak in the Formby channel and promptly sank off Crosby Point leading to the death of 4 crew although the captain was saved after the mail-packet from Dublin lowered it's lifeboat and recovered the man from the wreck. He was brought to a recieving house where he was attended to and a collection was made for him aboard the steamer. The saved captain was later acclaimed to "begs to return his sincere thanks to the captain of the steamer Princess, from Dublin, for his kind and humane conduct in sending a boat to the wreck, by which means he saved his life". A schooner Vernon, of Glasgow sank off Great Burbo as the crew became disorientated due to the thick spin-drift, sleet, rain and haze brought by the storm. Three men including the mate and captain were washed overboard and drowned, however partially thanks to the strong well and motivation provided by a crew member named Thompson, 6 were saved by the lifeboat and on rescue it was exclaimed they were "benumbed by the cold and exposure, as to be nearly powerless; and when Thompson was taken from the rigging, he was holding on to one of the rattlign by nearly his teeth!". The men were subsequently taken to a public house, two being so exhausted they had to be carried and one in a state of

delirium. A surgeon also attended to the men who were all in a good state once rested although they did have substantial injured to their hands. An American ship also went ashore on the Jordan flats and the captain ordered her rigging to be cut away to preserve her. A steamtug brought a lifeboat to the vessel and all crew were promptly rescued and brought ashore where they recovered. The ship was subsequently brought into St. George's dock full of water the previous day creating a spectacle which many came down to the shore to view. It was also reported it was probable the crew of a Schnooner wrecked off West Holye had perished. The wreck of two flats was also observed off Hilbre Island. Nine more aboard a distressed vessel were reported saved off Southport by the lifeboat. The magnitude and full force of the gale was also felt at Holyhead, Douglas and throughout the Irish Sea, whilst numerous vessels put back to port having sustained substantial damage. It was detailed three steamers carrying livestock had experienced considerable losses aboard. In Cork the city was said to have suffered severely and the "ravages of the storm on the whole line of coast, both in the west and south of Ireland, are said to have been very great". However a new iron steam-ship which sailed from Glasgow "proved her qualitieis as a sea-boat" as she sailed from Glasgow to Greenock at the time when the hurricane was most severe without sustaining any damage. In Castletown in the Isle of Man damage was sustained to housing but no lives were lost although two vessels were wrecked at Peel after they were driven from their

anchorage and hit exposed banks at low water. All crew were saved however one sustained considerable injuries. At Devonport, Plymouth no life was lost but eight vessels were driven ashore. It was said that an indication of the ferocity of the storm was that "the remains of the unfortunate brig Mayflower, wrecked outside the breakwater a fortnight since, were caught up by a tremendous sea, and carried over the great width of the solid masonry to the north or inner side". At Bristol the storm destroyed the ornate gothic window of St. Nicholas' Church and the tower was torn out. A factory roof caved in causing many of the women working there to go "into hysterics, but providentially none were injured" although £600 worth of damage was sustained. Most of the vessels lying in the Kingroad were driven ashore but did not receive much damage. A transatlantic vessel bound for the West Indies was driven from her anchorage down the channel and a Irish paddle steamer was much damaged as she came into port having encountered the full fury of the storm in the Irish Sea and lost upwards of 200 pigs onboard. At Barmouth a brig was wrecked on the bar and the surf produced made it impossible for a number of rescue vessels render her assistance. Consequently only one man survived as two were swept overboard and two were found having lashed themselves to the rigging as a desperate attempt to preserve themselves. Another vessel two vessels were wrecked along the bar although the efforts of the Barmouth lifeboats were partially rewarded as the master of one vessel and all but one avoided a "watery grave" on the

other. At Aberdovey three vessels were lost and all hands perished. At Mildford Haven "the hurricane was attended with a heavy fall of snow, thunder and lightning" and a brig was lost with all crew by the Head cliffs. A subsequent column stated that a vessel had been wrecked on the sands at Cruckington Haven near Boscastle and all 12 had perished whilst the crew of another vessel wrecked nearby were saved due to the humane actions of nearby fisherman. Near Parkgate on the Dee a vessel was lost with all three aboard along whilst another four lives were lost aboard another wrecked vessel in the same area. Two bodies were also washed up close to another new wreck by the West Hoyle bank. Two more perished aboard a coasting lighter driven ashore at Lytham. Citing a Lloyd's telegram this subsequent report also highlighted that 'wreckers' had been widely plundering wrecked vessels for their cargo stating "On Sunday all our opposite sects were merged into wreckers, and never was a more busy day of rest for man and beast. The shore thronged with wretches hardened as the rocks that surrounded them, wholly intent on plunder." Wreckers were reported to have attacked revenue officers and the Coast Guard but were beaten off and their "nine ringleaders secured". Lloyd's also noted that a Liverpool vessel value at £20,000 had been lost upon the Tauton Sands along with another vessel from Southampton, however all crew were rescued, some of which were found to be so drunk they could not function. A group of 23 men were set out to guard the valuable contents which washed ashore and the coast guard had to fire upon desperate wreckers in order

1843	12	7	North-west England	Liverpool Mercury	14/07/1843	1	to deter them from their devious acts and "several of the principal offender have been apprehended and committed for trial".
1843	28	7		Liverpool Mercury	28/07/1843		Violent thunderstorms were experienced across the north-west of England causing considerably damage and death of a small child in west Derby due to lightening exposure. The wooden Formby lifeboat was strick and shattered to peieces and a vessel lying off the isle of Barrow had it's mast split nearly in two. However the majority of the damage was sustained inland.
1843	17-18	10	Western Britain	Bristol Mercury	21/10/1843		A poem entitled "The Corsair" which depicts a storm in both a human and divine manner which "frowns upon the main ... in form e'en more commanding, in look more god-like now". The poem concludes making the clear link between a storm and a privateer vessel with total power and the ability to take lives with the line "acceptance, on the lee" whilst the ensuing destruction and fatalities are implied with the lines "but, where you sea-bird's screaming, a wreck is on the shore".
							A tremendous gale resulted in a brig being wrecked off Appledore in North Devon. The crew tok to the rigging and a lifeboat came to render assistance but had to return before they rescued the crew as two of oars broke rendering the vessel near unmanagable whilst "darkness preventted their attempting it again". However the crew were saved the morning after. Several other vessels were reported foundering or ashore on the North Devon coast and it was "feared that the losses will be very great". Indeed, at Padstow the NNW gale wrecked three boats off the coast of Padstow whilst two vessels were reported to

1843	27-28	10	Western Britain	Liverpool Mercury	03/11/1843	<p>have foundered in Bideford with the loss of all hands. A schooner filled with lead also dragged anchors and sunk in Bovisand Bay but all were saved and there was hope of recovering some of the crew. Only one incident was reported off the gower as a vessel was driven ashore and there was no reports of damage in Falmouth which is most likely owing to the direction of the wind. A severe gale of wind did considerable damage throughout the west coast of Britain, particularly in the port of Liverpool where shipping was adversely affected. The gale was anticipated as it was noted that the mercury had fallen to 29 in/hg. This preceeded the development of a strong gale from the south-east which veered round to westard between 1 am to 4 am on the morning of the 27th. As the barometer fell yet lower to 28.60 and the wind increased many chinmey tops and slates fell from rooves and the "river was very much agitated throughout the day, and passengers by steamers from the Cheshire side expereinced much difficulty in maintaining their equilibrium". A fire was said to have broken out on a ship retreating from the Mersey to the safety of the docks whilst two other vessels parted anchor and "were obliged to run into the river". Three vessels were forced ashore with little damage however lives were lost upon a big and schooner which sunk off Formby and the Great Ormshead. The lifeboat and steamtug were noted to have saved the crew of a distressed steam boat in the mouth of the Mersey although the vessel later went to pieces. Further south on the north coast of the Llyn peninsula nine more vessels were driven ashore although no lives were lost.</p>
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1844	16-17	3	Irish Sea	Bristol Mercury	23/03/1844	58	<p>Another vessel carrying a particularly valuable cargo of mahogany was wrecked on the Formby sands and agents from Lloyd's who inspected the wreckage claimed one man had been crushed by falling spars whilst the other 12 had sustained considerable injuries. The abundance of grain washed up principally near Formby was taken as an indicator the Lady Bentinch had been wrecked along with the loss of all her crew. The strength of the wind was said to have been considerable enough that another vessel was driven so high up the beach near Formby point she was left in only 3 feet of water so that the crew could wade ashore.</p> <p>A violent storm caused many a calamity on the eastern coast of Ireland, leading to the deaths of 9 men in Belfast Lough and the cessation of all Irish coastal railway services as the storm surge conditions breached sea walls and undermined the coastal line. The shipping was very much disturbed in Torbay and an Irish vessel went to pieces on the Broad sands with the loss of all 10 aboard. A total of greater than 20 lives were lost aboard one barque and one steampacket which were wrecked in the Irish Sea. The barque Georgina was wrecked on a "dangerous shoal" off Wexford. The lifeboats were manned but subsequently capsized leading to the death of 12 of the 14 aboard who "perished in the breakers". The barque and its contents were said to have been worth c.£30,000 (£3,840,000) although it was mostly insured. The steam packet the Caroline which was outbound to Africa with a general cargo and crew of 29 was overwhelmed by the gale on the Welsh coast as it shifted WNW, causing the ship to drift</p>
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1844

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Bristol
Mercury

23/03/1844

from her anchor in Cardigan Bay. The captain and certain "unfortunate fellows" were said to have abandoned ship and attempted to swim to the Studwell island but were "soon swept off by the waves and perished". The remainder of the crew saved themselves by in the lifeboat although they were "in a most dreadful state of exhaustion" after their endeavours. It was remarked the financial loss would be great although the vessel was partially insured by a Lloyd's syndicate. A subscribers letter in the Bristol Mercury concerning the state of the charitable organisation named the "Shipwrecked Fishermen and Mariners' Benevolent Society" to "the worthy citizens of Bristol". The subscriber began by praising the late Capt. Stuart of the Royal Navy for his "exertions and endeavours" during the formation of the Bristol branch of the society and his key role as secretary. However the writer then stated of the "surprise, indeed, I will say with great regret, that I have observed the perfect unconcern with which the merchants of Bristol have treated this institution since its formation". The writer went on to state of their other charitable donations in the town and considered the floated idea that it "was perhaps the smallness of the annual subscription (2s 6d only) which makes them indifferent about it". He stated that the fundamental purpose of such donation would allow more sailors to "come forward and enrol themselves as members of the institution" as such donations would mean that "those poor fellows can more readily become annual subscribers at half-a-crown than at a larger sum". The writer also

<p>1844 1 to 3</p>	<p>9 Irish Sea</p> <p>Liverpool Mercury</p> <p>08/11/1844</p>	<p>4 suggested merchants should both subscribe and give annual donations. The writer then switched his attention to praising the ladies of the town "who are always foremost when acts of charity are to be accomplished" before suggesting they should "use their persuasive powers with their fathers, husbands, brother-and may I add another class of "the lords of creation" in order to "aid this benevolent and praiseworthy institution". The writer concluded that the society had assisted 7970 people since it's formation in February 1839 "consisting of widows, orphans, aged parents, shipwrecked persons, destitute fisherman and their families" before offering a final plea for donations to the "worthy fellow citizens" of Bristol.</p> <p>A dreadful gale from the south-east was said to have "considerably retarded" the Irish Sea steamers, whilst the critical Formby lightship was driven from her moorings by the strong winds causing many vessels to have to wait in Liverpool Bay before they could safely navigate the channel. Shipping also struggled to leave Irish ports leading to widespread delays in ferry and cargo traffic. Despite the strong winds and periods of torrential rain little damage was sustained. The author showed a degree of scientific understanding by correctly attributing the "mill pond conditions" on the Mersey to be a result of the offshore wind blowing with the tide which was attributed to have reduced the height of waves and the height of the water observed at the quays. One vessels went ashore in Bootle-bay but was recovered at the flood of tide having recieved little damage whilst one vessel sank in Holyhead</p>
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1844	10 to 11	11	North-west England	Liverpool Mercury	15/11/1844	<p>harbour. However the "effects of the gale on the Irish coast have been disastorous".The Kingston light ship slipped from her moorings and sustained considerable damage on the harbours North Wall and she was immediately replaced due to the vital importance for navigation. Four men drowned when a 300 vessel ran ashore near Whitehaven whilst two other vessels were wrecked near clogher and Anagassen with the loss of all hands. However the crew of a 700 ton from Quebec to Belfast vessel were more fortunate having been rescued after they were violently driven ashore at Skerries. Evidence of destruction and wreckage was widespread throughout the eastern Irish coast and considerable destruction was occurred in Kingstown harbour has one West Indian vessel sank and a fire broke out on another. A notable landmark simply named "the big tree" was blown down on a house in Dublin, whilst the storm surge conditions destroyed a sea wall protecting property at Dalkey, County Dulin. The propagation of storm surge waves up the River Liffey sunk many flat barges and a great many more were damaged as they were driven into the embanking walls. The captain of the Isle of Man steam-packet recieved widespread praise for his handling of the vesssel during the crossing from Dublin to the island as he diverted the craft to the leeside of the island to avoid over exposure to the prevailing winds and a potential disaster.</p> <p>A heavy gale from the north west gave the river Mersey "a very animated appearance; the water rose several feet higher than indicated by the table and the water dashed</p>
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1845	25-26	1	Liverpool Mercury	31/01/1845	13	<p>over the pierheads". Several vessels were driven ashore in Bootle bay without sustaining much damage. A collision occurred in the Victoria Channel in the Mersey in which a brig sunk after colliding with a distressed ship that was being assisted back into port by the pilot. However the hands had a narrow escape and the vessel was insured.</p> <p>A strong north-westerly gale did considerable damage to shipping in the Irish Sea. Most notably this included the loss of a fine barque of 315 tons burthen who which was bound for Calcuta but driven upon the West Hoyle bank. The crew however, escaped in their lifeboats and they were subsequently taken aboard by the crew of the Hoylake lifeboat who guided them through the breakers. The shipwrecked seamen were said to have been well-cared for at the village inn where the serious injuries of the crew were addressed. Another vessel was driven ashore near Formby point and several vessels put back having sustained considerable damage. A day later on the 26th a vessel sunk in the Sloyne and another sank whilst following in a pilot boat and striking a sand bar leading to one fatality and two severe injuries. Damage was widespread amongst shipping in the docks. The high winds persisted for two further days bringing with them snow and it was remarked "it was quite a novelty to see the town of Liverpool so completely enveloped in a sheet of snow". Further reports from the Mona's Herald stated that losses around the coasts of the Isle of Man had been great as the strong W-NNW winds had wrecked several vessels which had moored in the exposed roadstead of Ramsey Bay. After a collision several lives were lost in the</p>
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1845	6	7	South-west England	Liverpool Mercury	12/07/1845	<p>surf as crews attempted to run ashore through the surf only to find a watery grave. Another vessel was wrecked on the north of the islands near Jurby head although the lives of the crew were saved by the intrepid actions of those onshore who deployed a lifeboat and came to the aid of the exhausted crew whilst also managing to save the cargo. The crew of a large vessel were less fortunate as the ship became unmanagable and was dashed against the rocky shoreline of the northern shore of the island. All crew drowned and the vessel was "dashed in a thousand pieces". The surging waves were said to be so hazardous it was impossible to recover the numerous dead bodies spread along the area of the coast which made for a most distressing site.</p> <p>Bristol and the surrounding parish was visited "with a very heavy thunder storm, the rain descending in sheets". Widespread damage was done to crops as the instense storm moved over the areas from the south-west. It was stated "nothing like it has happened since the memorable night preceeding the death of George IV" as if to imply a link between severe storms and death.</p>
1845	22-26	12	National	Bristol Mercury	27/12/1845	<p>"Fearful gales from the NW and NE ... ocassioned the most distressing casualties off all parts of the coast; and since the destructive storm that happened in the early part of 1839, a similar visitation has not been experienced". Over 30 vessels were reported to have been lost along with their cargos with 40 lives having been lost upon one vessel alone in Cardigan bay. Just north of Cardigan a "shocking site was witnessed" as the crew of vessel which had sunk on a sand bar lashed themselves to the mast for a 10 hour</p>

1846 3 to 5

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Western Britain

Liverpool
Mercury &
Bristol
Mercury

10/07/1846 -
11/07/1846

period before the lifeboat could eventually reach them and when eventually brought ashore they were in a terrible state of suffering. Multiple wrecks were reported along the Cardigan Bay coast and many a man drowned or recieved horrific injuries. A barque worth £20,000 (£2,560,000) was "shivered to atoms" in front of a crowd of 2,000 who had been attracted to the scene by the firing of her distress signal guns, whilst several vessels which put into Welsh ports had sustained losses to vessel or crew. A vessel was also totally lost near St. David's Head after sustained catastrophic damage to the sails and rigging and becoming unmanagable. After a wait of 18 hours on exposed rocks with only a wild rabbit to eat the three crew members were luckily saved from a "state of thraldom" by a passing vessel and were fortunately returned to shore without injury although the cargo of slate worth £70 (£9,000) was lost.

An intense summer thunder storm visited Liverpool and the North-west on the 3rd and 4th before later visiting Bristol and the South-west on the 5th. In Liverpool the temperature "was oppressively sultry" in the build up before the storm broke brining with it torrents of rain as well as thunder and lightening which was described as being "most remarkable for their frequency and also for their brilliancy". In the north-west of England there were scattered incidents of buildings being damaged and several people plus a horse had "miraculous" escapes having been struck momentarily "insensible" but quickly recovered without harm. Identical conditions proceeded a thunderstorm in the south-west of England on the 5th

1846	31 to 3	8	National	Liverpool Mercury, Western Times & Bristol Mercury	07/08/1846 - 08/08/1846	3	<p>before "the storm burst forth with terrific fury". There were occasional incidences of livestock deaths and several large trees were destroyed and one death was recorded when "the electric fluid" struck a building occupied by a Sunday school. Two other boys were said to be in a "precarious state". Elsewhere in the south-west no serious damage was recorded although many were intimidated by the thunder which was "as loud and startling as a discharge of artillery".</p> <p>Very violent storms of rain accompanied by "terrific thunder and lightning" deluged several settlements across the kingdom causing extensive flooding which resulted in loss of life and widespread destruction of agricultural land and property. In Truro a life was lost as the sudden burst of the storm "threw the townspeople into the greatest dismay" and lightning bolt struck a man dead as he approached his cottage window whilst several buildings sustained considerable damage in the area along with the corn crop near Taunton. In Exeter the violence of the storm was said to be exceptional and many riverside properties were inundated and destroyed as a result of the flash flooding. In the vicinity of Aberayron in Cardiganshire, the heavy thunder clouds that had "burdened the lurid atmosphere" for 2-3 days previously unleashed torrents of driving rain which caused widespread flooding in the region. A Talsarn the "river rose like a vast wall, and dashing onward in its headlong fury, swept away twenty-five houses in the village". It was remarked "the consternation of the inhabitants at this fearful destruction of their property may be better</p>
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imagined than described". However "not only property became the prey of the remorseless destroyer, even life did not escape" as a certain Dr Rodgers who was described as "a gentleman of property, and highly respected in the neighbourhood" was drowned along with his servant as the vast flood swept across the highway on which they were travelling. In the small village of Talsarn the damage to property was estimated at £1000 (£122,500) whilst crops were destroyed on a widescale along with four bridges that straddled the Ayron. Further North similarly widespread destruction was noted in the valleys of the Petteril, Calden and Eden which were all observed to be far above the high water mark and the floodwaters drowned livestock and ruined crops on an impressive scale. Several riverside properties were also inundated. In Liverpool the thunderstorm was preceded by a sand storm and the correspondent went to great length to explain why this had occurred by offering a scientific justification. "Professor Espy's theory was fully verified. The upward current carried the hot air to a height which the sand could not reach, but the vast volumes of water the air contained soon arrived at the dew point, and there becoming chilled into vapour, while beneath there was a partial vacuum left by rising wind and falling dust, it quickly descended into a tremendous shower which deluged the streets". Despite many of the inhabitants of the town being in a "state of the greatest consternation" no people were severely injured although several were knocked down as the lightning struck in close vicinity and were all said to be recovering from the

1846	18-19	10	South-west Britain	Western Times	24/10/1846	<p>shock. It was said that between the 1st - 3rd over 5 inches of rain fell in water which meant that the rainfall in Liverpool had been a quarter of the overall annual rainfall observed in London (20 inches).</p> <p>A strong gale from the south-east and high tides created storm surge conditions on the south-west coast leading to the inundation and destruction of one part of the South Devon railway line near Dawlish. However, the correspondent explained that the fact that exposed parts of the line had been engineered with a breakwater in front of a secondary railway embankment had largely reduced damage. The correspondent explained "the effect of the breakwater is more protective in its secondary result than its direct agency in breaking the first shock of waves; for the tide striking it on the face, and flowing round it at each end, the waters meet in two opposing forces behind, and the sand carried in by them is deposited ... by these means, at certain points, accumulation of beach, of a highly conservative character in such cases has been created". He then went on to show an understanding of geomorphology by comparing this process to the depositional process in the mouth of a delta before stating it was the dual ability of the breakwater to encourage deposition as well as direct wave dissipation that had reduced damage to only localised areas. The removal of this deposited sand at Teignmouth had caused great concern to the extent the railway company had employed teams of masons to reinforce and cement the foundations of the sea wall. The undermining of the railway was reported by another, more sensationalist</p>
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1846	28-29	10	Western Britain	Bristol Mercury	31/10/1846	<p data-bbox="1332 199 2105 542">correspondent to have caused great distress amongst passengers and rail traffic was stopped for two days at Dawlish forcing travellers to revert to traditional carriages. It was noted the veering of the wind to a south-westerly direction enabled repair work to be quickly enacted as the wind shift resulted in the absence of storm surge conditions. Damage was also done in the mouth of the Exe near Starcross where a large heavy coal-lighter broke adrift damaging the harbour walls.</p> <p data-bbox="1332 550 2105 1366">33 A report from Lloyd's of London detailed the extensive losses which had occurred during a two day tempest which were described as "truly frightening". A schooner and brig had been driven from their cables in Cardigan bay and become complete wrecks leading to at least 9 deaths on the two vessels. Another account told of a vessel which was wrecked off Bangor (Wales) although the crew miraculously survived after 8 hours in the rigging thanks to the "eleven heroic fellows who manned the lifeboat". Countless disasters were reported north and south of Aberystwyth and the beaches of Cardigan were strewn with pieces of wreck, although all onboard were saved from a large vessel that was forced ashore in close vicinity to the town whilst the cargo was largely saved. Several more men perished aboard a vessel wrecked at the mouth of the Dovey whilst the local lifeboat had not returned after attempting to render assistance to a barque beached on a sand bank. A later reported state only one man and a small portion of the cargo were recovered. Disasters were likewise frequent along the Northern coast of Cornwall and 8 lives as well as a valuable crew were lost upon a</p>
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1846	19-20	11	Western Britain	Liverpool Mercury, Bristol Mercury & the Western Times	27/11/1846 - 28/11/1846	10	<p>Brigantine which was wrecked off Padstow. Likewise all hands aboard a 500 ton barque were presumed to have been lost as it was wrecked off St. David's Head, Haverfordwest. A similar disaster also occurred in St. Bride's bay, Swansea, Bideford, Exemouth and Cardigan. The gale force N Westerly winds also resulted in the loss of five vessels in Limerick. A large ship of 1,000 tons was observed off Fishguard dismasted and flying a signal of distress and was lost the morning after. Several more small vessels were wrecked in southern Cardigan bay although lives were saved on many thanks to the courageous efforts of the lifeboat crews.</p> <p>The west of Britain was visited by a terrific storm from the east which was accompanied by the unfortunate loss of life and property. In Liverpool the Mercury was acknowledged to have fallen "considerably" before a strong gale from the SE ensued creating moderate storm surge conditions although the appearance of the Mersey was "highly picturesque" and hundreds "thronged to the pierheads to watch the ferry steamers struggling with the immense waves occasioned by the meeting of the rising tide and the wind". The ferry boats were greatly impeded in their crossing and the passengers aboard were greatly alarmed by the quantity of water shipped by the crafts. The ferries encountered much difficulty and sustained moderate damage when docking at St. George's pier although no serious loss was incurred. A steam tug was less fortunate as it sank near Runcorn although all crew were saved and she was later raised the day after having sustained comparatively little damage. There were multiple</p>
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incidents of collisions in the Liverpool docks and a flat snak off Hilbre but all were saved due to the actions of the Hoylake lifeboat. Two fatalities were unfortunately sustained off the Mersey lightship but the rest were saved by the Magazines, Wallasey lifeboat and the vessel left at anchor. Damage to buildings was widespread throughout Merseyside and losses included the destruction of a haberdashers premises, near-total damage to a windmill as wellas the loss of 200 tons of coal into the river Mersey. An embankment was also eroded away at the Woodside slipway whilst the esplanade at Rock Ferry sustained considerable damage. Rain fell despite the rising of the mercury on the 20th as the storm abated in Liverpool. The South Devon railway once more recieved substantial damage as the South-easterly winds and high spring tides produced storm surge conditions which drove a vessel into the sea wall protecting the railway and the vessel miraculously ended up with her bowsprit pointing across the line. "The breaks were put on by the driver, but it was impossible to stop the train, which came with such force against the bowsprit as to break it: with this exception the tran arrived safely at the next station". The breaching of the sea wall by the strom surge and subsequent inundation of the line at Langston resulted in the cesation of the service until the damage done could be assessed. As a result it was stated "It is not likely the working of the line will be resumed for some days. In the meantime every vehicle is put in requisition, and the company are conveying passengers between Teignmouth and Exeter att railway fares, an expensive game for them and a very

1847	8	7	North-west England and Northern Devon	Carlisle Journal and Bristol Mercury	13/07/1847 & 17/07/1847	<p>inconvenient one for the public". The storm surge conditons resulted in inundation to above knee height at Starcross and it was said the depth of the water was such it was "sufficient to wash away the back of the rail embankment in three places, leaving gaps in the line between the station house and the viaduct" which no doubt caused more concern for the railway company. At Penzance a "tremendous gale" from SSE to SSW resulted in the lost of three men aboard a vessel and two more seamen met watery graves on a sandbar near Teignmouth. Lives were lost onboard two vessels wrecked near Llanelly althoguh all hands were saved by the lifeboat onboard another vessel wrecked near Padstow. Palm oil cargo from a wrecked vessel was also reported washed ashore near Ilfracombe. Around the port of Milford haven the strong S to SSW winds drove several vessels onshore although only one vessel was completely wrecked as seven were later got off the surrounding shores having sustained considerable damage. In Tenby many vessels sustained considerable damage and one had to cut it's mast away to avoid being wrecked on a shoal but no lives were reported lost.</p> <p>A period of fine weather which had resulted in "vegetation of all kinds progressing with such remarkable rapidity" was interrupted by an intense storm of thunder, lightening and rain. The storm was of an "aggravated form" and the "electric fire was most vivid, and the peals of thunder perfectly terrific". Although intense rainfall ensued it was remarked that the grain crops largely escaped injury as they progressed passed the stage of</p>
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1847	11 to 12	10	South-west England	Liverpool Mercury	19/10/1847	8	<p>germination. A localised thunderstorm was also reported in Camelford in the North of Devon. It was remarked "so terrific a storm and flood has not been known at Camelford since the year 1797". Although no lives were lost the the whole course of the Camel valley was "a scene of devastation" and many only narrowly escaped with their lives which included a certain gentleman who spent nine hours up a tree waiting for the floodwaters to subside. The five hour deluge carried away everything in its path including floodgates, crops and bridges whilst houses were inundated to a depth of three to four feet although no serious structural damage was reported. The flash flood was so extreme the water rose to a height five feet above the high water mark of seasonal floods and the subsequent erosion resulted in the creation of a channel double the size of the previous channel. Tracks of high quality agricultural land was ruined and livestock were noted floating past at the mouth of the river at Wadebridge where "nothing equal to this flood had ever before been witnessed". It was also noted that it was fortunate the tide was out at the time of peak discharge or "the consequences would have been far more serious". Overall it was stated "very considerable" losses had been incurred due to the destruction of several key bridges and the widespread loss of agricultural assests throughout the North of Devon.</p> <p>A large three-masted Russian ship was wrecked off the lizard after she was overcome by gale force winds from the south-west and was "dashed to atoms" on the rocks between Mallion and Gunwalloe. Initially two men aboard</p>
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1847 6 to 7

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Western Britain

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Mercury

14/12/1847

the vessel were fortuitously washed into an alcove form which they scrambled to safety and were subsequently "hospitably sheltered" in a nearby house. The property owners went down to the site of the wreck to search for more survivors although "nothing, however, could be discerned of the vessel or any person belonging to her; the howling of the storm and the lashing of the sea against the broken rocks at the basement of the cliffs, stifling all cries, if any were raised". However at daybreak "three poor creatures were observed clinging to a small rock, the sea breaking over them most terrifically". A line was then thrown to them with the initial intention of supplying them "with some brandy and other stimulants, it being too perceptible that they were almost in the last stage of exhaustion". The three men were subsequently drawn up although the remaining 8 men were not located and presumed dead.

A large ocean-going vessels named the Frankfield encountered gale force northerly winds in the Irish Sea which were accompanied by sleet, rain and a "tremendous sea". The vessel was subsequently wrecked as the captain misjudged the bearing due to the fact he confused navigational lights and sails tore due to the exceptionally strong winds. This rendered the vessel unmanagable and it was subsequently driven onto the rocks in Cemaes Bay in the North of Anglesey. The "poor old captain cried out 'Run forward, my lads, and try to save yourselves; her bowsprit is on the rocks' as a result of this 8 men survived but many were injured but the captain "could not be persuaded to save himself, but

1848	26	3	Irish Sea	Isle of Man Times & Liverpool Mercury	03/03/1848	1	<p>simply said, 'Never mind me, save yourselves'. He was lost". Overall 21 men were lost in the melancholy incident".</p> <p>A storm bringing storm winds from the SE which veered to the SW wrecked three vessels off the east coast of the Isle of Man. Despite being under the management of a pilot a brigantine struck a submerged rock and the crew were forced to take to a boat that was sent out for relief. This boat, manned by several pilots was itself overcome in the surf leading to one death although all others including the crew of the distressed vessel and the lifeboat reached the shore in an exhausted condition. Two other vessels were also reported to have been wrecked near the Point of Ayr the South of the Isle of Man although no lives were reported lost. Another vessel was wrecked in Castletown in the South of the Isle of Man however "the people on shore seeing the danger she was in, got the lifeboat ready and manned by a crew of brave fellows, faced the boiling surf, and succeeded in taking the crew off the vessel" which was later pronounced to be a total wreck.</p>
1848	18-21	8	Irish Sea	Liverpool Mercury	22/08/1848 - 25/08/1848	1	<p>A three-day period of very high winds and rain resulted in considerable damage and destruction as trees were torn down and crops destroyed across the North-west of England where the rivers were described as being "much swollen". In the Isle of Man the very strong south and south-easterly breezes wrought destruction amongst the fishing fleet which had proceeded to the Calf of Man. Overall five boats were wrecked with the loss of one life whilst wives were said to have fled to the nearest port in desperate search of news of the welfare of their husbands</p>

1849	8 to 10	1	Irish Sea	Liverpool Mercury	12/01/1849 - 16/01/1849	26	<p>out at sea. However the vast majority of the fleet numbering several hundred rode out the storm well and crowds of relieved relatives were assembled on the Castletown pier to welcome their arrival on the 20th. In Runcorn the storm also resulted in the destruction of a church spire, 70ft in height. Three people who were on the scaffolding surrounding the spire at the time were injured whilst £150 of damage was sustained as masonry fell into the church, destroying pews and the external supporting structure sustained considerable damage. A severe storm of rain also visited Liverpool as the strong SSE winds veered to the north and west. The violent gusts resulted in the desertion of the streets and widespread minor damage to roofs. The onshore winds meant the river "presented a very animated appearance and at the tide time the water washed over the pierhead" almost resulting in the loss of an insecure landing stage, although a hand aboard a schooner attempting to dock was washed overboard and drowned. All traffic between the Isle of Man and Liverpool was halted as the packet steamer had to return back without mail or passengers having "encountered a heavy sea and dirty weather" off Douglas head before eventually being forced to return.</p> <p>Severe gales produced a great deal of damage on the north-west coast of England. Very high tides produced storm surge conditions as the pierheads in the Mersey were inundated "to a great extent" and a temporary embankment was destroyed at the new dock in Birkenhead, whilst the Seacombe sea wall was completely inundated. A transatlantic steamer struck Burbo bank and</p>
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1849	7	10	Isle of Man	Mona's Herald	12/10/1849	reached the port of Liverpool with 13ft of water in her hold, whilst another vessel with a storm-related fatality onboard sank off New Brighton under tow. A collision also occurred between two vessels on the Mersey whilst a schooner with a cargo was driven ashore in Llandudno although the crew were fortunately saved due to the act of the local lifeboat. Damage to shipping was widespread in Liverpool Bay and several vessels hoisted flags of distress on approaching the entrance to the Mersey due to the fear of navigating the estuary under such treacherous conditions. At Waterloo near Bottle a portion of shipwreck was washed ashore, the name plate and the cargo of brandy confirmed the theory it was of a French vessel that regularly traded between Bordeaux and Liverpool. The capsizing of two vessels and the loss of all hands off the Hoyle bank was also reported to the Dock Committee. A barque was also lost off Clonakilty in Southern Ireland claiming the lives of 19 crew and passengers.
1849	30	11	Isle of Man	Liverpool Mercury	07/12/1849	A heavy gale from the NE forced a distressed schooner onto the rocks on the entrance to Ramsey harbour in the Isle of Man. All four men were rescued with the assistance of a certain Mr Thomas Kaighen who helped ferry the men ashore. The cargo of salt was partially saved and the vessel was "very much shook" and still onshore. During a heavy gale a vessel ran against the north pier in Ramsey harbour doing substantial damage to the stern although she managed to sail into port unaided without sustaining further damage.

1850 5 to 6	2	Irish Sea	Liverpool Mercury	08/02/1850 The wind blew "a whole gale from the NW" and "the declining state of the barometer gave early indication of the impending storm" at Liverpool on the 5th. Damage and destruction to property in Liverpool was widespread as slates from rooves, windows were broken whilst hundreds of chimneys were also blown down along with walls causing great alarm amongst the residents. Storm surge conditions ensued as the waters of the Mersey "were truly 'lashed to storm' and with tremendous force they dashed over the pierheads and landing stages" whilst the spray drenched anyone in close proximity to the docks. As a result the Mersey ferry services largely ceased "to the great disappointment and annoyance of those who lived on the other side of the river" who were now unable to get home in the late afternoon. Many accidents occurred on the river but none were attended with loss of life, although a man almost met his end when he fell in whilst trying to board a steamer at Woodside but he was saved thanks to the exertions of those who saw him fall. The new landing stage was greatly tested as the captain of a steamer reported to the dock comitte that "the heavy sea had caused the stage to work so much that the seams were slightly opened, and the framework at the north end became detached". Two vessels sunk as they were damaged by multiple collisions with the seawalls although all were saved thank to the "active exertions of boatmen". A hulk was beached off the "Devil's Bank" and several large ships dragged their anchors. The magazines lifeboat was also deployed to rescue those onboard a sinking vessel flying a distress flag. Another two lifeboats
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were towed out to the scene of a screw steamer stranded on Great Burbo although all were saved and it was said a crew of 50 men would be able to move the weight distribution of the ship's cargo in order get her off at the next high tide without much damage. A large 797-ton new transatlantic ship was also wrecked after striking three different banks around the navigable channel although all crew and passengers escaped on the ships lifeboats and were subsequently picked up by a steam tug. The cargo was completely lost although she was partially insured. The valiant captain of the steamer "who so humanely exerted himself" later complained that he was refused the assistance of a lifeboat service as two lifeboats went to the aid of the screw steamer leaving him alone to rescue the distressed from the 797-ton vessel. The Manx steam-packet "Captain Quayle" again recieved high praise for his excellent seamanship which allowed him to navigate the treacherous seas off the Isle of Man and land at Douglas without issue. Elsewhere in the Isle of Man a sloop was driven onshore and wrecked in Ramsey bay although all were saved. A windmill was destroyed after it caught fire as "the wind got hold of the sails and forced round the machinery with such immense force, that the frection set the mill on fire". The north west light ship was also set adrifted forcing Lieutenant Lord, the marine surveyor to head out into the estuary and restablish her positon after it was decided the sea was too rough to tow the replacement out. The lighthship had rode so roughly that the master of the light ship had to relieved of his duty due to the serious head injury he had sustained and he in a

precarious state. Another ship put back to Liverpool having encountered very strong WSW winds shifting NW which produced unnavigable seas off the Llyn peninsula which forced her to return. A Belfast steamer also sustained significant damage whilst the Dublin steamer took nearly twice the usual time of 10 and a half to complete her journey. This was true of the Glasgow steamers which also took twice the usual time to complete their journeys. A statement made in the Times that a steamer with a cargo valued at £100,000 (£13,600,000) had gone ashore on the North bank was vehemently denied as in truth "the captain had very prudently kept in dock, and awaited the subsiding of the gale". It was remarked that the new works of the dock surveyor Mr Jesse Hartley were clearly very substantial in nature due to the fact only "very trifling damage resulted to the dock gates, notwithstanding the great violence of the gale". On the Cheshire side of the Mersey the "ravages of the gale seemed to be more general" and the storm surge did considerable damage to the Birkenhead dock works, destroyed a landing stage and incapacitated a ferry. The cost of the damage and the loss of traffic could not be calculated. The tide was said to have risen "several feet above the indication in the Almanac, - being pent up by the strong northerly gale and it did not seem to recede for two hours". This quantitative tidal information and the fact the "stage carried away had stood the 'tide and the breeze,' with slight occasional damage, since the year 1836" was stated to indicate the extreme violence of the storm. The same conditions were experienced at the

1850	23-24	3	Irish Sea	Liverpool Mercury	26/03/1850	1	<p>Seacombe and the Egremont ferry whilst significant storm surge erosion of storm wall in the latter locality resulted in its partial destruction. The strong winds also resulted in widespread damage to property on the Wirral peninsula although fortunately no lives were lost.</p> <p>A severe gale from the NE was said to have caused much disruption to shipping and fatalities of many cattle aboard an Irish Sea steamer. Over of the 150 or so livestock died during the crossing due to exposure to the elements and many were "much mutilated". It was said the kindness of those passengers with cabins saved the poorer passengers on deck from the extreme conditions although a poor young Irish boy was found lying dead alongside another boy who almost perished of presumed hypothermia. Livestock was also lost upon another steamer. Likewise the soem of the 420 deck passengers onboard another steamer were descibed to be "in the most deplorable condition" as they had been exposed to the strong gale and near freeezing temperatures as the "spray washed over the unfortunate creatures, and their cattle companion on deck ... the condition of these poor wretches attracted general attention". The master of the Clarence Dock "observed particularly two women and six children who were in a shocking condition. Three of the children were orphans, the other three were fatherkess, and on their way to Manchester to their relatives. They were clothed in rags, which were completely saturated with salt water." The masters wife was said to have showed humanity by supplying them with food and dry clothes. Another family with two women and four</p>
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1850	15	7	South-west England	Bristol Mercury	20/07/1850	<p>children were in a similar state and one of the children "six years old, appeared to be dying from cold and exposure on deck; but having been supplied with warm food in the hut of the plice-officer, it recovered." A charitable collection was also made for this desheveled family.</p> <p>A fearful storm of lightning, thunder, hail and rain broke over Bristol and the surrounding neighbourhood. "The flashes of the electric fluid followed each other with amazing rapidity and startling vividness, while the instantaneous crash which succeeded, testified to the alarming propinquity of the storm. During all the time the heat was oppressive the atmosphere close, stifling and sulphurous, and the dun clouds spread out over the whole expanse their dark funeral pull". In Bristol a house in the neighbourhood of the Dings was struck severely injuring one woman and a nearby stable was nearly destroyed whilst the horses inside were much injured. A man was also struck blind by lightning. Damage was also done by lightening strikes in the port as masts and gunwales were split by lightning. Property damage was widespread as the shutters of a shop were "shattered to atoms", chinneys struck and certain houses sustained considerable structural damage as the electricity was conducted down the chimneys. Two men were taken to the hospital dreadfully injured. After they had been sheltering under an elm "the lightning had passed down between them, shrivelling up their clothes and scorching hier persons" whilst their dog was killed. At Bath, rain fell in torrents, accomnaied with lightning and very heavy</p>
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1850	21-22	9	North-west England	Liverpool Mercury	24/09/1850	1	<p>peals of thunder. Hailstones were also noted at Combe. At the house of Captain McDougall lightning struck the chinmey, causing it to fall through the roof and the burning soot set the property alight, and a servant sustained injuries in the neck and arm. Injuries were also sustained by a man and woman exposed riding a cart near Clevedon and the storm was said to have raged with great violence throughout the area. A farmer was killed when he fell from his wagon after attempting to calm his horses which had "took fright at the thunder and lightning".</p> <p>A storm arose in the Mersey channel "which was marked by most extraordinary characteristics of violence, and was perhaps, unprecedented in the suddenness with which it burst over the waters". Many small boats and gigs were said to have suffered greatly being caught offguard by the sudden onslaught of the storm. The winds suddenly veered from a near perfect calm from the NE to a gale from the WNW and the change in conditions was described to "have taken place as unexpectedly as a flash of lightning or clap of thunder". The wind was so strong and the sea so heavy the small craft "were tossed about like so many shells upon the waves" and tow of the gigs were completely overpowered and capsized "and that much life was not sacrificed is only owing to those efforts of humanity which are occasionally called forth, and which, in fact, constitute a trait in the character of British seamen, and are, with rare exceptions exercised in every case of danger and distress where a fellow-creature calls on them for aid". A Captain of steamer "determined, at all hazards" to go to the assistance of a distressed gig. "The</p>
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sea was raging tremendously at the time, beating over the paddle-box and the funnel, and the waves were of such magnitude and strength that even the powerful steamer seemed in the greatest of peril". Despite the fact that the gig, The John was a mile distant and "it was only occasionally that she could be seen, in consequence of the foam by which she was surrounded". Despite capsizing in the surf and the fact the three men were clinging to the keel and underside of the boat for dear life another vessel was seen to sail past the distressed men without "beyond looking over the bulwarks at the men who were struggling for their lives". Consequently it was said an inquiry would be identify the vessel, which was well equipped for lifesaving, and it's captain. Two of the three men aboard the distressed vessel were saved via throwing the lifebuoy to the exhausted men and hauling them up, however, Gordon, the last let go his grip of the keel out of sheer exhaustion and met a watery grave, it was said emphatically "another moment might of saved him". The men were reported to have initially given themselves up for lost but when the screw-steamer neared them they "had some hope, and called out to one another to keep their hearts". After the immesnely disheartening instance of being ignored by the screw-steamer it was said the later deceased "at once gave wave to despair, and called upon God to protect his wife and family". The other two crew members wh were saved were stated to have soon "sufficiently reocvered to express their gratitude to Captain Bell and his crew, who had so nobly rescued them from death". The correspondent made a point of nothing

"their thanks were conveyed in rough and ready manner, but they were none the less sincere". The boat was lost however. Another story of heroism told of a crew of a small gig which had let go the tow of a much larger vessel in order to save the lives of those on the other boat which had capsized whilst also on tow. Despite "a trying moment or two for the men of the other vessel ... they boldly resolved to run the hazard, and they immediately let go from the larger vessel and launched themselves forth to the assistance of those who called for help. The storm was now at its height, and the waves every moment threatened them with a watery grave." It was stated it was obvious to the crew of the rescue vessel it "was obvious that, if the utmost exertions were not used, they would be entirely lost. However eventually all the crew of the capsized vessel were eventually rescued thanks to an "extraordinary effort and unexampled bravery". Although a crew member had stripped to a state of near nakedness in an effort to swim for his life "the precaution proved unnecessary" and all arrived safely in the Prince's basin. It was said it was feared that more vessels may have been lost and that the deceased man, Gordon was "very steady and deserving, and he had left a wife and family of young children to deplore his loss. The poor woman, who is near her confinement, is in the greatest of distress". A charitable subscription had subsequently been set up to provide relief for the widow and her children, as well as "the brave men to whom those saved are indebted for their deliverance".

<p>1850 6 to 7</p> <p>10</p>	<p>Western Britain</p> <p>Liverpool Mercury and Bristol Mercury</p> <p>08/10/1850, 11/10/1850 & 18/10/1850</p>	<p>24</p> <p>A strong north-westerly gale accompanied by intervals of heavy rain was observed on the 6th before a raging storm of great violence ensued. "As the tide rose the river became much agitated" which resulted in navigation becoming difficult and delayed ferry services across the river Mersey. At high tide the storm surge height was such "the sea broke with great violence over the pierheads, and even the large landing stage was very sensibly affected by the motion of the water". Many collisions occurred between small vessels in the dock basins but the damage was said to be "only of trifling character". Several casualties occurred on the river which included an incident where a man fell from George's Pier into the river but he was recovered "by the promptitude of one of the hands belonging to the landing-stage, and sustained no material injury from his immersion". A boy also fell into the water after attempting to jump onboard one of the Woodside ferries but he was fortunately rescued. In the Mersey estuary 3 vessels were driven ashore although only one was in imminent danger and the crews and vessels were subsequently rescued by a steam tug. A sloop ran ashore and was found abandoned on the Welsh and the crew was saved. In Holyhead the crew of a wrecked schooner were saved thanks to the intrepid actions of a lifeboat. A large 690 ton vessel was also lost in Liverpool Bay after encountering a very strong westerly gale just off the Calf of Man. A first hand account from one of the vessel's survivors stated after sustaining substantial damage to the rigging the ship began "careering and labouring tremendously; the decks were buried in water" and the</p>
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masts were eventually blown away as the ship developed a heel that rendered the bilge pumps useless. Despite an early successful attempt to cut the mizen mast away which righted the ship the mast fell through the stern causing substantial structural damage. Despite the gallant efforts of the Liverpool pilot boat captains to tow the vessel the gale-force winds from the WNW meant she was drifting fast towards the banks and "to the great mortification" of those onboard the lifeboat and steamer sent to rescue them "abandoned us to our fate". Those attempting to escape in the ships longboat were "jammed to pieces" by the forcing of the waves throwing them onto the hull of the ship as the longboat was overcome by the mountainous seas and capsized. This was the most distressing sight as "The dreadful death-cries reached my ears above the howling of the storm". Those remaining lashed themselves to the remaining stump of the mizen mast and awaited their fate and entry into the afterlife "We then addressed ourselves to the Almighty to receive our souls; as for asking to escape I never thought of it; I envied those that went first, and thought it folly for me to prolong my life for half an hour longer; but I spent in hearty prayer to God to receive my spirit, together with my shipmates". The conditions experienced were truly dire as "every sea seemed to threaten death ... the night was dark and gloomy, illumined by the foam of the sea breaking with awful grandeur over the ship". The scene was said to have lasted for 4 hours until "when it pleased the Almighty to spare us, the tide ebbed, and a faint hope gleamed in our bosoms". Following the abatement of the

storm the steamer arrived with the lifeboat and the 12 survivors of the 35 original crew members were taken good care of although one of the original survivors later passed away due to exhaustion and the injuries he had sustained. It was said the carpenter Archibald Cowarth had "maintained the most determined courage and perseverance" and should be highly praised for his motivation which was implied to have preserved the will of many. The survivors had "lost their all however" with just mere garments in their possession although the survivor showed the men maintained strong hearts and a sense of humour stating "although the comedy far surpassed the tragedy". Despite the conditions the Isle of Man steak ferry "proved herself to be one of the finest crafts afloat, as she steamed against the gale in gallant style, and reached Douglas in eleven and a half hours". Another act of gallantry was performed by the captain of the British and North American Royal Mail steamship as she encountered the a dismayed vessel off the coast of Waterford and immediately took her tow, guiding her to the safety of Waterford harbour. A fatalitiy was also noted in the docks after a hawser snapped and a sailor sustained a critical head injury. A schooner was also wrecked off Crosby point and 2 men were lost thanks to the gallantry of a local man, a native of Waterloo who approached the vessel from the shore after the Magazines lifeboat and tug had again given up on the sailors of the wrecked vessel. The conduct of the saviour was stated to "deserve all priase; his companions congratulated him in terms most cheering, and the bystanders, who had witnessed his

1850	18-21	11	Western Britain	Liverpool Mercury	26/11/1850	10	<p>extraordinary and successful efforts, immediately set on foot a subscription as their acknowledgement of his daring and humane conduct". The storm surge also did considerably to embankments of the new docks in Liverpool. A summary of a subsequent dock committee meeting later highlighted that the conduct of the lifeboat crew was under scrutiny and that "communication from the Pilots' Committee to the effect that the life-boat might, with little difficulty, have been brought near the wreck, and all onboard the Providence could have been saved". A letter suggesting the a beacon should be placed on Puffin Islands to highlight it's danger to shipping was also discussed. It was stated decisions would be reached regarding both issues by the superior Marine committee.</p> <p>A "fearful gale from the SW" drove a large immigrant 'coffin' ship onto the rocks of the dangerous bay of Kilkee. The strong winds and high tides produced a storm surge skew driving the vessels onto a rocky ledge in compartive safety, however the cpatain threw out the anchor causing the ship to heel round and be driven "with great impetnosity against the rocks, and soon became a total wreck". From the shore the appearance of the catastrophe was "indescribably agonising and dreadful. The shrieks of the passengers could be heard over the terrific roar of he sea, and of the winds, which continued to blow with resistless fury". 96 people lost their lives. Every effort to save those aboard was made although after a day of calculation it was ascertained that 96 people lost their lives which was stated to be "sufficient to appal the stoutest heart". The inhabitants of Kilkee were "very</p>
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zealous on the occasion; every one did what lay in their power to relieve those who were saved". "Wave after wave, however, washed ashore the bodies of the dead, and augmented the horrors and agony of the scene" Every huse in Kilkee was converted into an hospital; all the available resources of the village were put in immediate requisition". As soon as the new reached Limerick "effective steps were at once taken to provide for the requirements of the sufferers". After a few hours more than £80 (£10,900) was collected and the harbour commissioners gave £16 (£2,170). Fears were entertained for the other vessels on the west coast of Ireland of which little had been heard whilst there was news of a number of vessels ashore but with no confirmed fatalities although grave fears were entertained for the safety of the crews. Indeed a lloyd's telegram later stated "every port seems to have had its fatal casualty", before stating that in at least four seperate incidences near Seafield, Tralee, Ballina and Dingle vessels had been wrecked with the loss of all hands. It was almost certain all had perished on two vessels which were observed to founder whilst rounding Cape Clear. The very strong NW wind had also wrecked a vessel on Hoyle bank and "cries of the ill-fated crew were heard from the shore, but the tempestuous state of the surf entirely prevented the life-boat being put off to their aid". It was thought the entire crew, numbering 8-10 men had perished amongst the breakers. Substantial damage and loss was sustained on the Cornish coast as one man was crushed by falling debris onboard a steamer heading from Liverpool to

1851 2 to 3	1	North-west England	Carlisle Journal	04/01/1851	<p>Gibraltar. Two vessels were wrecked between Tenby and Saundersfoot whilst four were wrecked near Portmadoc along with an several other vessels off Milford Haven. The city of Carlisle was completey inundated in water and it was said "since the year 1822 the waters of the Eden, the Cladew, and the Petteril have not risne to such a heihgt, and we question whether at that memorable period the waters were higher, though unquestionably the storm was much freater, and the damage done to property very much more". The very strong winds were accompanied rain which "poured down in perfect torrents" causing the rivers of Cumberland to rise to an unusual height and many of the villages were completely submerged. However the loss of livestock was less than was expected desite the fact orders to move sheep from the low-lying floodplain due to the anticipated flooding had not been heeded. Thanks to the intrepid efforts of two men who resuced 70 of the 76 marooned sheep by boat. The fact one of the men involved in the rescue operation was largely naked caused "considerable merriment amongst the onlookers". 17 more sheep were also saved by boat and it was stated overall few animals were lost. Many rural dwellings were inundated throughout the county although no lives were reported lost despite the fact thousands of acres of lands were flooded and the vale of Etterby resembled "one braod, expansive, and placid lake, or rather resembled sme model bay for the anchorage of an extensive navy". An incidcence of oppurtunism was noted as a spectator with a horse near Petteril bridge offered to ransport those on</p>
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1851	12 to 15	1	Irish Sea	Liverpool Mercury	24/01/1851	<p>foot for a penny as the waters were high enough to make walking the route unwise. The floods were said to have caused "quite a sensation" in Carlisle as "crowds of people were seen at all hours of the day" observing the spectacle of the flood.</p> <p>On the 12th a very strong southerly gale wrecked a schooner near Craggleto Castle in Argyshire as the vessel was rendered unmanageable in the heavy seas and driven north into the onto "the rocky and precipitous shores of which have long been the dread of mariners in stormy weather". Fortunately the four men aboard managed to scramble to the safety up the rocky shoreface and the local people of the area acted in a "highly commendable manner" by saving valuable parts of the vessel from destruction at the cliff face. It was also stated that many other vessels "entered Garlieston harbour in safety, the anchorage of which, from the improvements introduced of late years was let lately by public auction to Mr Alexander Blyth for £125 (£17,600)". The continuing heavy gales from the SSW forced the crew of a Preston vessel were forced to abandon their craft by the Saltees off Waterford on the 15th despite taking all the necessary storm precautions. However the captain and another member of the crew were crushed and killed by his own lifeboat in the surf as they attempted to venture ashore to safety. The vessel, which was uninsured, was presumed to be lost. A strong wind from the SSE which veered to WSW caused considerable injury to some of smaller class of shipping and several lives in the Liverpool Bay. Several steamers had to return to port after encountering un navigable sea</p>
1851	24	8	North-west England and Wales	Liverpool Mercury	26/08/1851	

1851 5 to 6

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North-west
England and
Wales

Liverpool
Mercury

07/10/1851

near the Mersey light in the outer estuary and "the ferry boats experienced not a little difficulty in crossing the river from the swell that prevailed". A sloop that was initially rescued in Liverpool bay by a dreadnought steam tug but suddenly went down on tow off Taylor's bank with the loss of all 6 onboard. Soon after a sloop sunk near the river wall at Bootle "englushing, it is reported, four men and a female in a watery grave". In the late evening the wind veered WNW and a body of female of approximately 45 years of age was washed up. It was supposed she formerly belong to the wrecked sloop.

A violent gale from the NW and WNW which was accompanied with heavy showers of rain and fog made navigation difficult in the Mersey estuary. As a result a "fine American barque ... from City Point, Virginia, was driven on Taylor's Bank by the violence of the gale and is likely to become a complete wreck" although the crew were fortunately saved. However her cargo of "tobacco, said to be the finest and largest imported into Liverpool during the last twenty years" was lost. It was said she had come to such ruin after her anchors let slip off Taylor's bank. The Liverpool and Magazines lifeboats were deployed but were unable to go alongside due to the heavy sea running. However the crew were safely lowered down the jib boom and saved. A later statement by the captain of the vessel once again suggested the master of the Formby lifeboat had prioritised self-preservation as he had refused to stay by the vessel and therefore forced the crew of the barque to traverse down the jib boom. "At the earnest request of the captain, the Liverpool lifeboat ...

1852 8 to 11

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United Kingdom

The North British Journal, The Scotsman, Carlisle Journal, Liverpool Mercury

13/01/1852

and pilot onboard remained alongside the vessel until all hopes of saving her were at an end". The vessel lost was described as being "very fine" and only a year old and the was only partially insured. However great praise was said to be due to the master of the Liverpool and Magazines lifeboats "for the gallant conduct displayed by them in remaining alongside the unfortunate vessel, which they did for upwards of an hour after the other lifeboats had departed". This praise was echoed by the captain of the distressed vessel who had his own section in the paper. A Glasgow steamer, The Princess Royal, was also rendered unmanageable by the heavy seas approximately 35 miles off the Isle of Man and the captain, chief mate and steersman sustained severe wounds. However a first officer of another ship who was a passenger on the vessel and the second mate relinquished control of the vessel and safely guided her into Liverpool. The passengers, who numbered nearly 200, expressed their acknowledgments to those who had acted to ensure the safe navigation of the vessel. The weather in the Clyde was described to be "of the most rude and violent description" as strong winds were accompanied by heavy snowfalls which transformed many streets into rivers of "ice-cold water and mud". The heavy winds were so strong that they compelled even the coastal steamers had to remain in port although the Belfast mailboats reached Ireland with "astonishing rapidity" despite the fact that they "encountered gales as severe as they could have met with on the Atlantic". All of the fishing fleet were confined to Whitehaven and very few vessels were said to be able "to make harbour".

1852	21-25	1	United Kingdom	Liverpool Mercury	27/01/1852	<p>Casualties to vessels were reported but they were "happily, unattended with any loss of life" despite the fact the sea ran "mountains high". The Isle of Man the steamer the Princess Royal from Liverpool progressed as far as the Point of Ayr before she was "compelled to put about and run for Douglas harbour" due to the tremendously high seas. Two vessels, a schooner and smack were forced ashore but no major damage or loss of life was sustained. A Belfast steamer, The Blenheim, sought shelter in the lee of Douglas head, whilst another was much delayed due to the treacherous conditions. The same steamer found it "impossible that she could leave the harbour" due to mountainous seas and her sailing was thus postponed. Very strong winds from the SW and SSW caused much disturbance to shipping around the shores of the British Isles. At Piel Island near Fleetwood several vessels were foundering ashore with the crew breaking over the vessels and helpless crew. However as soon as they were seen "a race ensued between the steamers as to which should be first to render assistance, which reflects the highest credit on both crews". The plan was to recover the damaged vessel at the next high tide and all crew survived despite their exhausted state. They "expressed themselves highly obliged to Captain Thomas and his crew for the promptness and skill shown in getting them away from their dangerous place of refuge". Another vessel was reported ashore in nearby Walney Island. A barque was also reported to be in a perilous situation going up the Sound at the Calf of Man as it had flown signals of distressed but could not be rendered assistance and the</p>
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crew were therefore forced to run before the wind in their lifeboat to the safety of Port Erin where they were attended to in Mr Clugstone's hotel. Despite the best efforts of the crew the steamer the King Orry subsequently reported she had become a total wreck by the 25th. An American ship was also lost on the Waterford coast and after an investigation lasting several days which called no multiple witnesses it was concluded "that it was to be regretted that greater exertions were not made use of, in accordance with the usual custom in boarding the vessel; and as it appeared that the pilot boats were not in an efficient state, the officers were to blame in not reporting their circumstances". A schooner with a cargo of copper ore encountered heavy weather off Point Lynas and had most of her rigging carried away and an attempt to rescue her by a steam boat failed after her tow rope snapped although she was later safely rescued by the a dreadnought steam-tug. A major casualty was recorded in the stomr of the steamer Leeds from the City of Dublin Steam-packet Company. The vessel had approximately 80 people as well asover 150 cattle onboard and was reported to have first sprang a considerable leak in the engine room. Water soon engulfed most the ship putting out the fires rendering the steam engines useless and despite attempts to lighten the load by throwing the cattle off the deck as well as hoisting the sails the signal of distress was soon flown and shots fired. Fortunately however they were sighted by an American ship and all passengers and crew were transferred safely between the two vessels although most of their possessions were lost.

1852	28-30	9	United Kingdom	Liverpool Mercury	05/10/1852	5	<p>The Captain of the distressed steamer was said to have shown "great consternation" by allowing all passengers to shelter in the cabin whilst the vessel foundered although the vessel was condemned and was reported totally lost. A merchant vessel sustained considerable damage as the WNW winds at Plymouth which were described as blowing "almost a hurricane" drove the Belgian craft onto the rocks in the Plymouth Sound. As soon as the news of her situation was seen the port-admiral Sir John Ommanny sent a steam-tug to assist in getting her off but in a very much injured state.</p> <p>The Kingstown harbour lighthouse which had stood for 12 years was ruined and several craft were damaged by gale force north-eastern winds. A brig was completely wrecked on the great South Wall of Portbeg Lighthouse and 'not a soul was saved to tell the narrative of the calamity ... four dead bodies of sailors were found some distance up the river Liffey" whilst a boy with the vessel also drowned. A subsequent coroners inquest identified the deceased and the coastguard deposed what tragedy he thought of the incident "a verdict was found that the deceased had been shipwrecked at the lighthouse and drowned". Another crew were fortunately saved after their vessel was stranded in Dublin Bay. Only one vessel, a Glasgow steamer proceeded to sea and the vessel sustained heavy losses as the majority of the cattle onboard drowned as waves swept the deck whilst her portside, state cabin and foremast sustained considerable damage.</p>
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1852	10 to 13	11	Irish Sea Eastern Ireland	Liverpool Mercury and Western Times	16/11/1852 - 20/11/1852	6	The weather on the east coast of Ireland was reported to be "exceedingly severe here for several days" as high winds and heavy rain continued without intermission. The rain "came down in perfect torrents" on the eve of the 10th flooding much of the low-lying neighbourhoods of Durham and the River Tolka was much swollen and the surrounding agricultural land was inundated. A "very wild sea" resulted in waves breaking furiously over the railway wall from Williamstown to the Blackrock as the storm surge inundated the line. Inundation of the coastal railway to a height of 2ft at Kingstown was observed were the force of the storm "was severely felt". The line in many places was torn up by the force of the surge and labourers were constantly employed laying new line where it had been previously torn up and keeping the rails clear of "sand and stones cast upon them by the violence of the waves, which in some cases made a clean breach over the wall". In the Liffey the storm surge conditons caused several small vessels to break from their moorings and sustain considerable damage on the sea wall causing several to sink. The surge was so high on the banks of the Liffey "the sea dashed over the wall, and strucks against the doors and windows of man of the houses. The night was pitch dark, and pen cannot describe the dreariness and desolation of the scene. Many of the occupants of the houses remained up till the reacherous and uncertain sea had begun to reced from the shore". The best efforts of the dwellings occupants were made to protect and prevent their houses from inundation. "The sea had it all its own way, and swept the road like a park of artillery,
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throwing up weeds, sticks and shells. The watery volume was irrepressible; nothing could withstand it". It was noted that it was not until 2 hours after high tide that anyone could leave their homes. A steamer lying at north-quay broke loss and collided with other moored vessels causing confusion "beyond all description" and many vessels sustained considerable damage with 4 smacks sinking. However no lives were lost "owing to the vigilance and untiring exertions of the police on duty". Three vessels were ashore at Bray Head and it was feared heavy casualties had been sustained at sea. A shipwreck was also noted at Clogher-head Drogheda when a coal-laden Schooner struck a reef of rocks when the sea was running tremendously high. The coastguard fired several rocket propelled lifelines using the Denett's life rocket apparatus but all was in vain. However the Captain of the coastguard then decided to brave the sea in a lifeboat and saved all four men aboard the schooner before the lifeboat was pulled to shore. The vessel subsequently became a complete wreck and the "gallant conduct is deserving of all praise". The crew of a 3 masted barque were less fortunate as all human effort to save the "noble vessel" failed and the "worst anticipations which had been formed of the fate of the ship and gallant crew have been unfortunately too fully realised" as she struck the rocks off Clogher-head and all crew, had had last been sighted stripped naked on the deck in an attempt to swim, perished with the exception of the captain and the cabin boy. The police and coastguard had subsequently been deployed to protect the cargo and a Lloyd's agent was also

in attendance. The two survivors had "been treated with considerate kindness by some of the neighbouring gentry". A vessel driven on the sands in Balbriggan was completely destroyed however all were saved thanks to the exertions of the nearby schooner Mountaineer who's captain and crew sailed to the distressed vessel in a yawl by "dashing through the surf and succeeded, after immense exertion, and at the imminet peril of their lives, in securing a hawser to the wreck". The entire crew subsequently reached the shore by tranversing along the hawser to the shore. "The conduct of the master and crew of the Mountaineer is deserving of the highest praise. It was reported the coastguard intended to scuttle the distressed vessel to prevent her being wrecked upon the shore before she was evenetually floated once more. At Rush 2 deep sea trawlers were lost and the "cries and wailings of the bereaved families of the poor fellows embarked in the missing vessels were truly heartrending". As the wind abated the continued rainfall was reported to have totally stopped the sowing of wheat and winter oats and "little can be done in the shape of farming business for some weeks to come". Strom surge conditons produced by the heavy gale from the ESE inundated the GWR coastal railway line southern coast of England and the water was such a height it was reported to have "nearly extinguish the engine fire and ocassioning considerable delay". Several carriages were thrown off the line near Langstone Cliff and the passengers remained detained on the train due to the high level of the seawater which surrounded the train. The resident engineer was

1852 24-27	12	United Kingdom	Liverpool Mercury and Western Times	31/12/1852, 01/01/1853	6	<p>quickly of the scene however and "did his best to solace the passengers, by liberally administering to their creature comforts in the shape of a plentiful supply of sandwiches, brandy and water, and cigars". This was said to have occurred due to a considerable breach of the railway embankment which had resulted in considerable flooding of the line although no harm to human life was done other than an occasional drenching. Wrecks were numerous at Dawlish whilst the streets of Teignmouth were inundated to a height that all traffic completely stopped as boats floated down the streets. A fatality was recorded when a fishing vessel was wrecked. In the village of Kingsteignton roads were inundated to a depth of 4 feet and all the surrounding marshes were completely inundated. Storm surge conditions were also noted at Torquay where waves broke at the doors of the shops of the seafront and the meadows were inundated. Much debris was left by the storm surge as seaweed, sand and stones littered the low-lying streets</p> <p>"The hurricane which burst forth on Christmas night has not been equalled in point of severity, and for extent of havoc since that which occasioned so much destruction to life and property in 1839". Around the coasts of the UK over 100 lives were thought to have been lost at sea along with "several fine ships (some of which were emigrant vessels)". The velocity and power of the storm from the south-west "far exceeded anything which had been experienced on our shores of late years". Accounts from the Welsh coast told of a "perfect hurricane from WNW" and storm surge conditions were observed at</p>
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Aberystwyth as the sea ran tremendously high covering the embankment and causing much damage to the pier. In Morecambe Bay a schooner was driven ashore leading to the deaths of all of those aboard and the force of the surging waves did great damage to the breakwater and the lighthouse was washed away. In Plymouth little damage was sustained as the fleet lying in the sound were well prepared leading to only one of approximately 50 boats being driven ashore. The crew were saved by another vessel in the vicinity but the vessel was a wreck. Considerable damage was done to a pier and a wall was completely destroyed. There was news of a complete loss of a vessel in Wembury Bay but all crew were saved. In Chester there was widespread damage to property and trees were torn down by the hurricane as chimneys fell in large numbers. It was reported to be almost impossible to walk and "the Dee at high water when the tide ran unusually deep, was lashed into a miniature resemblance of its more excited neighbour the Mersey". It was said to be "a providential circumstance" that no one had sustained serious injury due to the extent of the damage to roofs and chimneys. Similar conditions were experienced in Bristol where torrential rainfall and very high winds caused much damage to elevated property. Damage to windows and roofs were widespread whilst trees were also blown down across the area whilst the barricading surrounding the GWR engine house was blown down along with that adjoining a major bridge. At Swansea some of the houses "appeared to the inmates as though shaken to the foundation". The storm surge was of

such a height it broke into the workyard of the dokc company but the sluice had been opened to allow water to flow to the river so no serious damage was sustained. Two ancient elm trees which had "withstood the storm of ages" were also torn up. Tenders belonging to vessels in the bay were also lost as they were carried out by the tide. Railway delays also ensued and the tramroads "suffered through the violence of the sea, consequent upon the high winds". A Carnarvon the storm surge caused the tide to rise to a height it breached the quay wall and great alarm was caused as many feared for the safety of the shipping as boats were driven from their moorings and others sunk in situ. In the Vale of Clywd the torrential rains produced scenes which "had scarcely been witnessed before by the oldest inhabitants" with valleys inundated for miles resembling a vast lake or a mighty river. In Merythyr great losses were sustained and the rain "came down with unabated fury" leading to widespread inundation which paralysed all road travel. Very high winds and heavy rain resulted in damage in Glasgow although that experienced was said to be minor compared to that experienced in other cities throughout the kingdom. the Clyde was "swollen to an immense height, the lighter craft at the Broomielaw being elevated from their moorings and great difficulty was experienced in averting their coming into collision with the beams of the quay". The tide was "driven up its course with great velocity by a boisterous west wind, the harbour was completely flooded from the central bridge downwards along the whole of the north quay" as water rose 3ft over the

parapet of the the quay and itnot the sheds. However the rise of water was slow enough that the majority of precious goods were moved before the quay was inundated resulted in only inconsiderable losses. It was stated it "was exteremly fortunate" channel wideing and channelisation had occurred at Kelvinhaugh and Govan "for if the tide has rushed throguh the old narrow channel we would doubtless have had to record more casualties". A Belfast steamer was reported driven ashore in Barassie Bay near Troon whilst a brig was driven ashore near West Kilbride. In Dunbarton the flood rose of high a boat was used to ply the streets. The report from Greenock stated the highest tide had been recorded for many years and a "considerable quantity" of property had been damaged. It was stated "The strong south-west wind which prevailed in the morning, combined with the swollen state of the river from the recent rains, was no doubt the cause of the spring tide being unusally high". The warehouses and property on the quay were completely flooded although the promptitude of the workers saved many hogsheads of sugar from injury. The water reached a depth of "about three feet above th level of the quay" forcing goods to be removed in boats and the horses worked in a depth up to their girths. Flooding to this height caused considerable damage to the low-lying dwellings and "much inconvienece and loss to their occupants". The Victoria Harbour was filled to the brim which was stated to be a depth of 32 ft although as the tide receeded it fell by 4-5 ft in an hour which was "a most fortunate circumstance, as after that time the wind freshened and veered round to its original

point, and contending with the tide, caused waves of large size to dash over the piers". The tide was described as "almost unprecedented" in height throughout the Clyde. Much damage was done to agricultural property in the grounds of the Duchess Dowager of Argyll. The mailtrain from London to Glasgow was also blown off the rails near Preston but no individuals sustained great injury. Telegraphic wires were also "thrown down by the violence of the gale". In Dumfries the roof of St. Michael's church "which hitherto has withstood the storms of a century without much injury, was rendered nearly as bald as the head of its patron saint" whilst damage to properties was widespread. The River Nith raged in full flood and inundated "the greater portion of the White-sands and again inundating the lower portion of Friars' Vennel". At midday "the waters were dammed back by the tidal flow of the Solway" which caused them to rise to 18 inches of the highest ever recorded water mark. On the 27th the wind veered from SW to W and continued to blow with very considerable force bringing heavy rain before the conditions abated. It was hoped the waters of the Nith would soon subside but it was said "the rapid rise of the barometer since the forenoon indicates, we fear, anything but the approach of favourable weather". The Annan was also reported to have overflowed its usual boundaries and the tide "urged by the fury of the wind" was particularly high in the mouth of the river. A sloop was partially disabled whilst coming up the Solway having her bulwarks carried away but managed to navigate to the new quay with little damage. A boy aboard the sloop was

considerably injured during the storm but he quickly transported to the infirmary and later reported to be in a favourable state. In Dublin the storm resulted in widespread destruction as the intense violence of the storm shook even well built houses to their foundations and much damage was sustained in the grounds of Trinity college and several buildings sustained considerable damage. Chimney stacks fell through roofs in the city doing considerable damage to houses doing £100s worth of damage to individual properties. Two women sustained that were presumed as fatal injuries to the spine and head in a similar chimney fall incident whilst the National School of education also sustained considerable damage. An incident also occurred on the railway when 2 wagons were blown from the sidings onto the mainline where they collided with a train doing much damage to the wagons and carriages. The vice-regal lodge which was the property of the Lord Lieutenant of Ireland was also damaged as a chimney fell into the dressing room of his excellency and 32 trees were prostrated in the private grounds. In Kingstown 48 chimneys were recorded to have blown down and 235 houses sustained some form of notable damage. Whilst it was noted the south-westerly gale "had not such a command over the harbour as an easterly wind usually exercises over it" a schooner was sunk at a pier and two other vessels broke free and collided with her. Three lives were lost in Miltown as a large tree fell on a cottage, destroying the building and burying the "hapless inmates". The villagers rushed to the scene and pulled out 4 survivors from the ruin and a

coroners inquest confirmed the above detail of events. Destruction to roofs and domestic property was widespread in Belfast and a young man sustained considerable injuries when bricks from a chimney fell upon him. The roof of the Belfast Distillery was blown off and several other roofs in the area were "completely denuded". Watermen claimed they had not felt such an intense gale in their time although little damage was sustained amongst the 300-400 vessels in port. At Kinnegar the storm surge eroded away the railway embankment tearing up rails and halting traffic. Three unmanned schooners were also driven landward and left high and dry on the embankment by the storm surge. It was said torrents of water had flowed through the embankments which were now "very seriously injured, and considerable expense will have to be incurred in their repairs". It was reported "the inhabitants of Tomb-street, accustomed to an inundation every moon, and who have become almost amphibious in consequence, on this occasion saw their locality transformed into a canal, with rafts plying up and down, throughout its entire length". The poorer classes who feed pigs only saved the livestock with considerable exertions by carrying them upstairs. Many shops on the high street were closed as the floodwaters stood several inches above the kerb. In Limerick the "unprecedented hurricane" from the SSW veered NW exposing the quays and the vessels in port but the storm surge remained below four feet of the top of the key wall. The force of the gale was such that shipping broke away from the quay wall tearing away masonry and

wrecking the groundwork and many vessels collectively valued at approximately £4000 (£512,000) were completely destroyed. Elsewhere the roof of the railway terminus was carried away and a club house roof sustained considerable damage. A newly erected chimney shaft built to a height of 160ft at a flax factory was also blown down with losses estimated at £500 (£64,000). The gateway at the potato markets at merchants quay were blown down and all produce swept off although only one life was lost. Five large merchant vessels were reported ashore in the region and "thirty sail of turf boats" were cast ashore over the banks of the river Shannon although all crews were saved. In Clontraf substantial damage was sustained by residential properties and a church whilst the extreme force of the wind blew the shingle up onto the coastal road and against the windows of many houses. Several houses with thatched roofs were completely stripped and a house was completely destroyed at Ballybough bridge when a tree fell upon it. Storm surge conditions were noted as the sea topped the sea wall inundating the roads and the grounds of the neighbourhood. Along the North coast no lives were lost through shipwreck as the gale was offshore and it was said many lives "which otherwise could have scarcely escaped" were saved due to the fact the fleet of fishing boats had been hauled ashore for Christmas. Along the Boyne at Drogheda several railway stations were destroyed but the line itself was not injured so losses to the railway company had been comparatively small. It was said "No small amount of mischief has occurred at the

1853	25-26	2	United Kingdom	Liverpool Mercury and Bristol Mercury	01/03/1853, 04/03/1853 & 08/03/1853	12	<p>Boyne viaduct" as whilst the "noble piers and masonwork of thei magnificent structure do not seem to have suffered in the least" the Wellington cranes were destroyed and some heavy pieces of ironwork were blown off the road although it was said the 800 labourers would soon be able to solve this issue under the direction of the eningeere. Two collierer steamers suffered significant damage when they broke from their moorings loosing spars and being dismasted. At Skerries two windmills were shattered and various other damage was sustained by property. At Malahide nearly ever property in the village sustained some form of damage and a large number of trees in Lord Talbot De Malahide's demesne were blown down. In Parstonstown similarly widespread damage to property and trees was noted and it was said the a great deal of damage was done to the crops. In Roscrea a man was reported to have been blown into a limekiln and only narrowly escaped death thanks to the saving actions of those in his immediate vicinity.</p> <p>A strong gale from the SW veered to the NNW from which it blew a near hurricane and caused considerable damage to shipping on the Mersey. With the exception of the fall of a few slates and chimney pots few incidents occurred ashore. "As the wind blew directly up the river, the waters of the Mersey were unusually agitated, and dashed over the pierhead and landstages. The tide, as indicated by the almanack, was 19 1/2 feet high". It was exclaimed "Never did the Mersey present a grandeur appearance ... the great landing-stage had the most severe trial ever encountered by it, but nobly withstood the storm".The</p>
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results from sourced from the Osler's anemometer at the Liverpool Observatory highlighted the windspeed had reached a maximum hourly mean of 60 mph between 11-12 when the greatest gusts of 33 pounds per square foot were noted. The wind remained at a constant 58 pm until 14:00 before reaching 31 mph by 21:00. These readings were compared with the storms of the 08-11/01/1852 and 24-27/12/1852 where the windspeed was 62 mph and 71 mph over an hour period the gust strength was 29 pounds per sq ft and 42 pounds per sq ft respectively. The reporter then compared the storms stating: "It will be seen from the above results that the two gales on the 25th and 27th December were by far the heaviest, and that the gale of Saturday last was more violent than the gale on the 29th January of 1852, as regards the force of the wind at one particular instant; but the wind on January 29th 1852, blew with a more steady pressure, and therefore the horizontal motion of the air for the whole hour was greater than it was on Saturday last". During the gale the a flat drifted down the Mersey at Prince's pier despite the best attempts of those on the pier to throw a hawser as the vessel and it's crew were swamped with seawater. The flat subsequently collided with a departing steamer which was rendered immobile once the flat collided and severely damaged the paddles. Although the steamer was hauled back into the George's dock basin only two of individuals on the astray flat were rescued by the steamer. The rigging then fell from the flat dragging one man under as he was "buried in the surf" and promptly drowned although the final man aboard was

vessel was thrown a life preserver from the shore and was subsequently saved. Despite the fact the sea state considerably limited the passage of ferries across the Mersey and forced them to land at Monks Ferry rather than Woodside all crossed safely and it was exclaimed "too much praise cannot be bestowed upon the captains and crews of these steamers, for the creditable manner in which they conducted themselves during the whole of the storm". Two more men drowned near high tide after being washed off a flat at Rock Ferry but reports were limited. Although the wind dropped after high tide the sea state on the Mersey still remained treacherous to the extent that the Woodside ferry boats could not approach the landing stage. The City of Manchester vessel began to drag her anchors at the turn of the tide and was beached ashore at Rock Ferry although no material damage was done. A barque also capsized whilst under tow and 11 of the 20 onboard perished. Several parties were attributing blame to each other for the disaster and the lack of provision of aid to the distressed men although a subsequent coroners investigation was to be conducted to officially determine the responsible parties. The survivors well treated at the hospital. One of the men was said to have £16 (£2000) on his person whilst "screams of the unfortunate men clinging to the vessel were distinctly heard" by those onshore who were unable to render them assistance. An American ship was also lost on the river when she drifted upriver with both anchors down and then parted chain coming into contact with the ship Atlas, badly damaging her stern. Despite the best efforts of

the pilot the vessel slipped her other chain and ended up on the Devil's bank. Although all aboard were carried safe to shore the captain offer to pay salvors 15% of the value of all cargo the vessel and her cargo were largely wrecked. The vessel itself was valued at £10,000 (£1,280,000) and insured in London whilst the cargo was partly insured in Britian, Canada and the United States and worth between £30,000-£40,000 (£3,840,000 - £5,120,000). It was said "it must be a satisfaction to the underwriters to know that during the whole of the awful gale on Saturday he was onboard the ship, co-operating with the pilot to save her, if it had been in human power to do so". A man also had his arm crushed whilst attempting to adjust fenders between steamers. At Chester the tide rose higher than the oldest inhabitant could remember flooding the elevated racecourse and surrounding streets. A woman was struck down by falling woodwork and a minor incident occurred on the River Dee. "The time of high water, according to Holden's tide-table, was set down at about forty minutes past one, but the wind was so violent, that the maximum height was attained at least hald an hour before that time, and the velocity and rise of the tidal wave were so great, that before reaching Chester it had done considerable mischief". The tidal bore eroded away several parts of the embankment of the Chester and Holyhead Railway and spray from the surge covered the passing railway traffic. However every precaution was taken to ensure the line and embnakment was quickly repaired and rail traffic remained safe. At Saltney near the bend in the River the shipping was driven upon the beach

and the adjoining canal works were damaged. Much of brackish flood water then froze on the flooded race course as well as around the Roodee area and in the meadows further upstream. At the port of Mostyn the disaster on sea and alnd exceeded those sustained even in the memorable storm of January 6 1839. The magnitude of the storm sureg ws such a vessel was driven driven over the danks at Greenfield and the crew "providentially" avoided a watery grave. A schooner also sank and although it was thought all crew had been lost the crew managed to climb up the mast and were exposed to "a most cutting north wind during five hours" before they were saved from the shore despite the dangerous ebbing tide. The crew were suffering from hypohthermia and eventually were carried ashore with the lure of rum in an almost insensible sate where they were treated with great humanity and given proper remedies after which they began to recover. It was remarked "had there been a lifeboat in the neighbourhood, they might easily have been rescued before the ship went down". The harbour at Flint was at the mouth of the River Dee was "the scene of a fearful inundation, causing great alarm to the inhabitants and a vast amount of damage to property". An embankment protecting factories, shipbuilding yards and the surrounding houses broke and "in consequence an immense body of water rushed with irresistible force into the iron works". The furance was filled with steam water, high walls were knocked over, houses inundated and the managers office inundated to a height of several feet. An alkali works was also washed away, three vessels were

sunk and several more sustained considerable damage as they broke free and were dashed to pieces upon a pier. Two hands aboard a Carnarvon vessel were left in "the most imminent peril for some hours, until the tide receded, as there was no lifeboat to take their assistance". The crew were rescued in a hypothermic state although the vessel was a complete wreck. An embankment enclosing a considerable area of marshland owned by Lord Vivian was "wholly destroyed" and additionally damage was done to crops. The Times reported it was calculated that it would cost £1000 (£128,000) to restore the embankment. Another vessel was wrecked near Ulverstone as it was overwhelmed by the vessel and "hurled on the coast near the north end of Walney Island. The fearful sea that bore over the ill-fated vessel entirely destroyed all chance of the unfortunate creatures reaching the shore". "The later advices from the Scotch coast speak of the weather still continuing to be very inclement and numerous casualties occurring". A subsequent advert from the Henry Wood and Co. company of Liverpool printed on the 8 March in the Liverpool Mercury which was noted as "Important to shipowners" reported how a large American packet ship with only one anchor down which was "of Trotman's patent" had not dragged despite the fact the anchor was 20 cwt lighter than "a common anchor would have been required by Lloyd's". All vessels with this type of anchor down had "rode out the storm in perfect safety", whilst others with heavier conventional anchors had dragged and, in some instances, become wrecks. It was also stated

1853	26-27	7	South-west Britian	Liverpool Mercury	30/08/1853 & 03/09/1853	5	<p>that such anchors "were prounced by the report of the committee appointed by the admiralty, of navy officers and shipowners of Great Britain, to be the best anchor now in use, and fully 40 per cent superior to the admiralty and other anchors tested at these trials". Messrs. Wood was also noted to have "obtained the prize medal for the best chain ables at the great exhibition of all nations, held in London, 1851". A featured extract from the London Herald within the advert stated that such new anchor designs from aboard would now be further tested by the admiralty anchor committee.</p> <p>A severe storm struck the south and south-west of England leading two fataliites in a fishing vessel in a fishing vessel near Teignmouth. The storm was described as "more like an earthquake than anything else" at Teignmouth as the tempest of strong winds and rain caused houses to shake with great violence as immense trees were blown down. Aterrific thunderstorm of lightning and hail also passed over Bristrol causing great destruction of property and considerable injury. A men broke both his legs as a tree fell upon him and the "utmost damage" was done to crops and trees which had been widely damaged in the surrounding area of Somerset as the gale from the SSW progressed up the Bristol Channel. At Exeter the rain was "so heavy it penetrated the roofs of many houses, and obliged inhabitants to get out of their beds" and three lives were reported lost off the nearby village of Budleigh Salterton. It was estimated £150 (£19,200) of damage had been sustained after an orchard belonging to Mr Boon was</p>
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1853 25-26

9

North and
Western Britain

Liverpool
Mercury

27/09/1853 -
30/09/1853

uprooted whilst trees provding 20 hoghsheads (4800 l) of cider were also lost in a different orchard. The devastation in Knole-park, the seat of Colonel Master "was lamentable ... the splendid horse-chesnut avenue, for which this fine park was cobrated, is a complete wreck". Road were rendered impassable for hours across the south-west and it was said it was fortunate more lives were not lost although livestock including a valuable Ox were killed on the estate of Mr T Daniel at Henbury by falling trees and lightening, whilst it "was rumoured that a cottage has been completely swept away near Fishponds". It was remarked that that shipping damage was only slight as the storm from the SSW had "not swept the channel" although slight damage was sustained at Kingsroad as well as in Falmouth, Teignmouth and Plymouth but "on the whole, it has proved one of the most destructive storms we have had to record for a very long period".

The north-west of England and Wales was visited by very strong gale which veered from the West to NNW over a two day periods. A meterological observation table form the Liverpool observatory exhibited how the wind speed had reached a maximum average of 65 mph at 7.45 pm on the 25th which coincided with the maximal gust strength of 34 pounds per square ft. The wind was consistently equal to or stronger than 39 mph in the 24 hour period between midday on 25th and 26th. The hourly velcoity of 52.75 mph was "an amount exceeding by ten miles the average hourly velocity of any other 24 hour consecutive hours since the erection of the anemometer in 1851". In comparison to other recorded

events it was noted that the gusts were stronger during the storms of 25th and 27th 1852. As a result there was widespread destruction with chimney pots and slates widely littering the streets of Liverpool and the outskirts of the city. A man suffered serious head injuries when he was hit by a fallen weathercock whilst two others received serious wounds. It was said the owner of the premises the weathercock was associated with was "very attentive to the sufferings by this unfortunate accident". Scaffolding was blown down on several properties under construction and the timeball was almost blown down had it not been for efforts made to secure it whilst a new asylum was also damaged. It was exclaimed "The great landing-stage was, as usual the centre of attraction, and throughout the day thousands of both sexes repaired thither to admire the most favourable point of view the grandeur of the scene upon the river". A large ship bound to Australia nearly ended up ashore as an anchor slipped causing much panic aboard although she was then brought back under control although much of her sails and rigging was badly damaged. However the Ferry boats continued to run and "many hardy youths crossed and recrossed the river from mere bravado, whilst not a few residents on each side were afraid to leave the shore". A storm surge skew was noted as "The tide rose unusually high. According to the table it was to flow a little before five o'clock, but it was after six o'clock before the water began to ebb". The Mersey was described as looking most picturesque as the "water boiled and foamed" and spray covered the shores and there was inundation of the great piers whilst the

landing stage rose and fell but impressively withstood the storm with little damage. In the Stanley dock a coal flat sunk and a woman and two children narrowly escaped. Despite the best assistance of pilot a barge was wrecked in the Mersey as her anchors dragged and she drifted towards Huskisson dock. Although five steam tugs and a lifeboat were in the vicinity they could render no assistance due to "the tremendous sea which was running" as the vessels could not make headway whilst towing the distressed barge. Although none of the crew received serious injuries the vessel suffered major damage and was only insured "to a small amount". An emigrant ship which chiefly carried Irish peasants was also damaged in dock forcing the emigrants to wait ashore. It was said that "the scene yesterday along the pier was altogether a very melancholy one, the poor creatures congregating in groups to bewail their detention, many of them with children in their arms". The newly formed White Star Line's packet ship Neva also dragged anchors of the Magazines and was damaged as she collided with a pier and great carnage ensued onboard as panic set in leading to the drowning of 2-3 emigrants while several sustaining severe injuries and received little attention. A large vessel of 1300 tons displacement also sustained major damage to its topmasts inside the Huskisson dock whilst a sloop sunk. Several other incidences of collisions with piers and dock walls were reported inside the docks with several near losses of human life including the rescue of an intoxicated seaman from drowning. In Chester the Chester Paper reported there was no great damage as

1853	17-19	12	Western Britain	Liverpool Mercury and the Western Times	23/12/1853 & 24/12/1853	6 only a few roofs had been damage and several trees blown down. Much damage to the fruit trees and gardens was noted in Holywell and Denbighshire as a whole. Fatalities were believed to have occurred at sea in Cardigan Bay. Considerable damage was also noted on the Isle of Man as the wind "did great mischief in several parts of the island, stripping houses and corn stakcs, blowing down and breaking branches fro many trees which had resisted the storms of previous winters". No vessels sailed from Douglas as the dock gates were kept shut due to the storm surge conditions and several vessels were blown out to sea in Ramsey Bay. The entirety of the northwest coast of England experienced the full force of the storm and a vessel was driven ashore in Morecambe although the crew narrowly escaped in their lifeboat. Substantial damage was also done in Belfast including minor damage in the harbour "where gusts regularly distrub shipping". The steam-dredge also broke loose with one man aboard who "in a state of most amusing alarm, raised a long pole, with a white cloth, as a flag of distress, which instantly procured him harm". The Blenheim steamtug which "bore the brunt of the gale in the passage from Liverpool" was seen to have "proved her admirable qualities as a sea boat by an excellent run in the very teeth of the tempest". A heavy gale had numerous detrimental impacts on the eastern and southern shores of Ireland including the wreckage of large vessels. All ships were held in Dublin port and more than 60 tons of dead fowl intended to "form a portion of John Bull's Christmas cheer" remained in port. Several vessels were reported sunk around Cork
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but their crews were thankfully saved. The lifeboat was also deployed at Holyhead but the mail steamer did eventually managed to proceed to Kingstown although she was much delayed. A dead body was ashore near Howth in the North of Ireland which was believed to have belonged to the Queen Victoria steamer which sunk off the Baily Light. However it was reported that the corpse had been strangely buried "without having the usual inquest required by law held upon the remains". The Sutton coastguard was in a state of constant awareness and observed a vessel flying a union jack with her cross facing downwards which was a "well known signal of distress" before putting out to the vessel. With great exertions the coastguard managed to reach her "and by the exercise of good seamanship and knowledge of the coast managed to bring her safely into Howth harbour". The fisherman all had to rapidly cease actions with many boring up in the nearest creek but thankfully all escaped unharmed. Men were observed clinging to the rigging of a wreck at Drogheda but thankfully they were relieved after a quick despatch to Dublin for aid which resulted in the deployment of the life boat of the Drogheda Railway. A vessel was also observed wrecked on the sands near Drogheda but despite the best exertions of the coastguard she could not be reached and several of the men clinging to the rigging passed away. Several more still remained at the time of writing and it was reported "strenuous exertions" were underway to save them. A barque washed ashore on the sands was also wrecked and only one man was left alive after the majority of the crew

perished at sea and a boy died of hypothermia and exhaustion soon after being brought ashore. It was also impossible for the coastguard to attend to a distressed vessel just outside Balbriggan harbour as there was no lifeboat in the vicinity despite the fact they were close enough their "shouts for assistance could be heard from the beach". Although a request was sent to Dublin to have a lifeboat sent down they had to endure two nights without any attempted rescue. When the lifeboat eventually arrived the conditions were such the crew had to abandon their first attempt. Despite being driven back at first the gallant crew launched again and "though the sea threatened to overwhelm them, they held to their purpose for upward of an hour" until they once more had to return as they "could not make way against so heavy a sea". The crew nevertheless tried again launching in the twilight of the morning and miraculously managed to avoid the breakers and locate the wreck saving the master and two of the crew. The men had been without food for 3 days and night and had been exposed to the wind for near two days whilst it was also disclosed the master had experienced the trauma of his son dying in his arms. The vessel was written off and only a single shroud held up the only remaining mast. It was exclaimed that "too much praise cannot be given to Mr Harry A Hamilton and the crew for their intrepidity and perseverance, which have been rewarded by the preservation of the lives of three fellow creatures". Both the rescuers and rescued were hospitably attended to following the incident. Near Ballycotton certain members of the coastguard and a pilot had

"narrowly escaped being sacrificed to their humanity" and had shown "great daring" as they rescued a stricken Portuguese vessel that had grounded in the breakers. After evacuating the exhausted crew the pilot and coastguard members had satyed onboard the vessel in an attempt to prevent her being run high ashore and save the cargo spending the night in "a fearful position" as they were driven to the rigging for safety as "the sea swept her decks clean". Despite their best efforts and voluntary exposure to such peril the boat was carried high ashore and "little will remain to provide adequate compensation for those who acted so nobly and endured such peril during that dreadful night". A police constable was also nobly commended for rescuing the life of a young boy who fell into the water as the Portuguese crew were landed ashore. Those who volunteered to stay aboard the vessel during the night were only saved due to the formaiton of a human chain through the waves. In Cork storm surge conditions prevented both the running of the railway and river steamers and the steerts were strewn with debris of slates and tiles from the roofs of the city. An indicator of the violence was that a railway carriage had been blown several hundred yards with just the force of the wind proppelling it. The osuth-easterly gale also wreaked havoc on the south-west coast and the region of Exeter and several shipwrecks were reported. The heavy rain caused flooding on the Crediton railway and a bridge was also damaged along with the track. On returning the train was delibrately halted due to the increasingly treachour conditions although the line upon which it ran

subsided caused two carriages to topple over to within a foot of the embankment. The passengers "were in consternation ... in the midst of a raging sea, roaring and rattling, and shaking the carriages as if the ground was giving way under them". No alarm signals could be made as the fires were out and the surrounding roads were too waterlogged for local assistance to be rendered. Thankfully the rain later subsided and a surgeon risked his life to attend to the passengers. All were then shown hospitality at the nearest station and several were conveyed by omnibus and carriages to Exeter approximately twelve hours after they had started their journey. It was predicted it would be many weeks before the line could reopen to traffic as entire embankments 7ft high had been washed away leaving the rails simply hanging. In Crediton "the waters rushed with tremendous force down the neighbouring hills, and filled the valleys" doing great damage to the surrounding property. Large bodies of sand had been deposited on the banks of the Exe undermining structures along its course. A horse-drawn wagon convey was completely stopped by the rushing waters and the leader of the convey was so petrified he attempted to flee the scene but was drowned with the loss of £30 (£3,800) worth of horses. In Northtawton a "providential escape" occurring on the 19 after a local officer of inland revenue somewhat brazenly forced his horse to ford a river which had swollen to a depth of near 10ft. Thousands of pounds worth of property was destroyed by the heavy rain and strong winds at Newton Abbot as the rush of water was "so sudden no

one had time to prepare against inundation". Agricultural land was ravaged at the raging flood carried away trees, destroyed crops, felled walls and drowned livestock. Such damage also included the destruction of a flood defence wall recently constructed by a Mr Vicary after the previous flood leading to the destruction of his leather tan pits. The foreman of the tannery had his property inundated and the furniture was swept away. The losses incurred by Mr Vicary were said to be in the region of hundreds of pounds (tens of thousands £20-60). In the town of Newton Abbot itself the main high street was under 3ft of water and all the shops and their cellar were completely flooded with individual shops and businesses near-unanimously incurring losses of £100s of pounds as their stock and property was devastated. It was exclaimed "the town presents a very desolate appearance, and Christmas will bring but little cheer for many". Many houses were also flooded in Totnes as floods several inches deep covered streets and penetrated homes and businesses. Bridges were washed away and the surrounding agricultural lands were inundated to great depths. The correspondent was "glad to say that no serious damage was done". In Torquay the cellars in a certain street were inundated "owing to the inefficiency of the sewerage" despite the fact the sewer was opened "to relieve the flooding, when an immense body of water flowed through the street rendering it perfectly impassable". Much damage was done to a grocer where no less than £100 (£10,000) of damage was sustained and

1854	20	1	Western Britain	Liverpool Mercury	24/01/1854	<p>many houses in the course of erection also experienced much damage.</p> <p>A storm of "very unusual occurrence" visited the port of Liverpool and the west coast of Britain. A constant breeze from the SSE suddenly shifted to the WSW and the gust pressure increased from 2- 22 lbs per square foot in a matter of minutes. The intense squall lasting only a few minutes was accompanied by heavy rain and a decrease of temperate in 5 degs fahrenheit in the shade. Several ships broke from their moorings and a vessel was thrown on her beam ends off the Ormshead. Minor damage was also noted ashore. At Preston the clouds from which the gusts descended were noted "to be at a very low altitude making it excessively dark". Flashes of lightning and peals of thunder were succeeded by "one of the heaiest hailstorms we remember to have seen" which lasted for half an hour. A boy was temporally blinded when he was struck by lighening and several others sustained minor injuries and one house which was struck sustained moderate damage At Blackpool the violent storm "ploughed up the sea from the south to the north, gradually approaching the land, as if the clouds above and the water below were about to form a waterspout, but before it appraoched the shore it burst away with a loud rumbling noise". A prolonged period of storm was said to have been anticiapted by many but the weather soon returned to a pleasant state. Two individuals tending to "the wires" on the coastal railway were thrown to the ground by the force of the lightning but thankfully neither was killed. A Belfast court case in Belfast was also</p>
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1854	17-18	2	Western British Isles	Liverpool Mercury	21/02/1854 - 24/02/1854	11	<p>disrupted when one of the windows was blown in causing "no small consternation" and travel was disrupted in Limerick due to the ferocity of the storm.</p> <p>A very severe storm bringing with it snow and very strong gales from the NW to WNW caused great damage in throughout the North-west of Britain and the North of Ireland. In Liverpool a windspeed above 40 mph was observed for a 31 hour period whilst a maximal wind speed of 56 mph and means gusts of 30.5 lbs per sq ft were observed at 3-4 am on the morning of the 18th. Ocassional periods of winds at 70 mph and gusts of 15 lbs per sq ft were also stated to have been noted. It was also noted that more injury was generally done to the shipping in Liverpool by storms from the NNW despite the fact storms from the W and SW tended to be more violent in nature. The strong winds forced the cross-river steamers to stop running for periods and a few vessels got ashore but most sustained no serious injuries. Two brigs did collided in the channel however sustaining serious damage. A flat also sunk in George's dock basin although the crew were saved "with some difficulty". A Sicilian brig also parted with her hawser whilst being towed in by a steam tug and ran foul of the landing stage sustaining slight injuries. A screw steamer also had to limp into dock taking on considerable water after a collision with a schooner off seacombe Ferry and both vessels sustained considerable damage. A "miraculous escape" occurred upon a schooner which collided with another vessel as a boy was left alone aboard a vessel after he failed to abandone the vessel before the rigging gave way and was</p>
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unable to receive help from his fellow crew mates. The schooner was swept down the Mersey by the ferocious storm and capsized however the young boy clung on to the inverted hull "notwithstanding that the waves swept completely over him, and he was in danger at any moment of being engulfed in the deep". He was however saved by another passing vessel before the uninsured craft was driven onto New Brighton beach and became a complete wreck. The cargo of the boat consisting of flour, rum and other goods were washed ashore and several "depredators" tried to steal the cargo although many were arrested by the police and placed in custody and then sent before the magistrates "who committed them to gaol for a short period". Along the Cheshire coast there were also instances of individuals consuming vast quantities of liquor which was washed ashore to the extent they "rendered themselves insensible and for some time they were in considerable danger". The police were reported to have done all that was possible to ensure the majority of the cargo washed ashore was safely contained however. Another ship which was badly damaged in a collision off Great Burbo bank set off distress signals and was subsequently towed into port whilst an American ship was run aground off Taylor's bank and was rescued in a sinking state. She was then purposefully ran ashore on Devil's Bank to prevent her sinking in the river. The most melancholy disaster occurred when the barque Cherokee ran ashore on East Hoyle Bank. On receipt of this incident the steam tugs set out with the lifeboat in tow to render assistance although only

one was not a simple river boatman. However the lifeboat itself was capsized in the breaking waves on the flats and all but one of the crew of 11 drowned. As a result the families of the man were "left without the means of subsistence, and the case is, therefore, one deserving of the sympathy of the benevolent". A councillor had donated £2.10s in aid of the widows and and orphans of the lifeboat crew, one of which had left six children and another 5. It was said the "boat was constructed on the ordinary principle of life boats, and was considered well adapted for the service in which she was employed; her capabilities had been frequently put to the test in cases of great peril". The Hoylake lifeboat subsequetely recured the crew of the originally distressed vessel which remained ashore and became full of water. Cargo belonging to a wrecked vessel on Burbo bank was washed ashore at New Brighton and it was thought all onboard had perished. Several other collisions and beachings in the Mersey which resulted in moderate and minor damage were also noted. The crew of the Liverpool lifeboat were said to have "exerted themselves in the most praiseworthy and courageous manner on several occasions". One vessel which had sought shelter in Holyhead harbour parted anchor and wrecked. A flat was abandoned at Hilbre Island and a brig put into Beaumaris having sustained significant damaged. The storm in the Mersey abated on the afternoon of the 18th as the wind shifted North and a period of rain set in. On the Glasgow and south-western railway the storm was such a train had to come to a complete stop after leaving Dumfries. In

1854 16-18

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Western United
Kingdom

Liverpool
Mercury

20/10/1854

Greenock two of HMS had to turn back and a steamer lost many cattle as they were thrown overboard to preserve the ship and see arrived in port 6 hour late. A lucky escape occurred on another steamer as the chief mate was nearly washed overboard. A vessel which put into Llanelly from Newry lost one sailor who was washed overboard and all attempts to save him failed. In Portrush the heavy snow and strong winds were said to be equal to the fury of the memorable storm of 1839. Many vessels sustained considerable injures and it was said "so fearful was the commotion in the Atlantic waters that no pilot could venture out with the remotest chance of success". In Coleraine several fires were noted by the fire insurance offices in the town although no fire engine was at hand to extinguish them resulting in considerable damage to property. A combination of great maritime skill and providence was stated to have saved a vessel travelling from Innishowen to Londonderry although the cabins were flooded and livestock perished resulting in the loss of the entire proprty of some of those onboard. A strong wind from the east matured into a full gale causing damage to the roofs of many properties whilst several walls and numerous trees were blown down in large numbers strewing roads throughout the east of Ireland. Vessels dragged from their anchors in Kingston harbour and one sloop sunk and several broke from their anchors in the River Liffey causing minor to moderate damage. A brig was also wrecked in Ramsey bay off the east of the Isle of Man as she parted anchors and was dashed upon the rocky the rocky cliffs near St. Maughold's

1854 27-28

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Western United
Kingdom

Liverpool
Mercury

03/11/1854

Well. The crew "clung to the ship with great tenacity" before the captain scrambled ashore and informed a collection of mine workers of the state of the crew. Assistance was speedily procured and all were taken to safety ashore although the second mate did break his leg in the process of disembarking. The "Lloyd's agent at the port has taken charge of the wreck" and although the vessel was in a terrible state it was thought the majority of the cargo would be saved. Another schooner was observed ashore on a beach and was "likely to sustain much damage" due to the violent surf. The landing stage of the Ramsey Steam-packet Company was "smashed to pieces" by the violence of the storm and fragments strewn across the beach. It had been "put up by the company in May last, at considerable expense, and was considered as strong as the forts of Cronstadt".

A storm brining heavy rain and very strong winds sudden set in on the evening of the 27 causing hundreds of vessels to run for cover in Strangford Lough whilst Carrickfergus roads were occupied by "a large number of refugees" with one vessel running aground but sustaining little injury. A brig was not so fortunate and driven ashore near Carrick and "sustained so great injuries that the tide is flowing in and out of her". A Dutch vessel which was discharging at Larne key was driven from her moorings and was rapidly sinking. The storm was said to have "produced a derangement in the moveent of the steamers plying to and from this port which has been unequalled since the snow stomrs of the last winter". In Greenock a strong southernly gale became a "perfect hurricane"

1854 27-29	11	North-west England and Wales	Liverpool Mercury	01/12/1854	<p>2 making it impossible for steamers to dock. Several vessels broke from their moorings in the harbour and multiple vessels were forced to put back into port or could not venture out to sea at all. Several vessels at sea sustained considerable damage due to the force of the elements alone whilst two collisions between vessels were also noted. Storm surge conditions were noted in Loch Fyne and a large number of fishing boats were damaged or carried adrift. The sea was observed to break over the pier and lighthouse at Ardrishaig and several more fishing boats were wrecked and their contents scattered ashore. A brig bound to Constantinople was observed in Loch Fyne in a terrible state by the principal customs officer. The compass had been broken the cabin filled with water as well as the captain washed overboard but then saved. Several of the crew suffered major injuries. The vessel went ashore but was later got off by a gang of men and the "obliging customs officer was unremitting in his endeavours to get assistance, for which those on board were very grateful". The fisherman also aided in the transfer of another distressed foreign vessel to safe anchorage. Several more vessels were reported washed up along the Clyde and herbydies. The storm gradually died off on the afternoon of the 28th and all traces of it were gone by Sunday evening.</p> <p>A strong gale visited Liverpool and the North West of England bringing with it heavy showers of rain and sleet. The gale arrived at Liverpool on the 28th and was from the north-west and increased in strength on the 29th as "the wind blew in sudden and fitful gusts". At high tide the</p>
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<p>1855 22-27</p>	<p>12 Western United Kingdom Liverpool Mercury</p> <p>29/12/1855</p>	<p>16 "noble river presented an appearance of terrific grandeur, the waves furiously lashing the piers, and the vessels being tossed about by the force of the elements". The rivers Irwell and Mersey were also reported to be considerably swollen as a result of the heavy rains. Several incidents occurred amongst the Mersey shipping and in one case two lives were lost upon one vessel. Throughout the Liverpool Bay there were reports of schooners and steamers abandoned on the coast with the majority of crews being saved by lifeboats, pilots and nearby craft. Immigrant beds and a number of empty chests were observed to have washed ashore at Waterloo which were supposed to belong to a wrecked steamship. The fatalities occurred on the Liverpool and Isle of Man clipper steamer. Despite making excellent progress "rising and falling with the heavy seas-her excellent behaviour ... exciting the admiration of several nautical men who were passengers on board". However a tremendous wave struck the ship with a blow so heavy that the mate and a crew member were pitched overboard and quickly were "at once engulfed in the tremendous sea which was running". One of the deceased left a wife and 6 children whilst the other left a wife and 3 children. The Ellan Vannin returned to port injured but it was said she had behaved admirably in the storm. The strong winds from the west resulted in the steamers Irish Sea steamers going to and from Belfast being considerably delayed.</p> <p>A tempestuous period of gales veering from the SE to S resulted in several tragedies along the Irish coast as strong winds and high tides produced storm surge conditions. A</p>
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schooner wrecked on the Saltee Island off Ireland's south-east coast was completely destroyed and although the majority of the crew were able to approach the shore on a piece of floating wreck one man was crushed by a spar and drowned. They were saved thanks to the endeavour of the coastguards, fisherman and peasants "who showed the most active sympathy with the sufferers". Two vessels from Guernsey were also wrecked off Wexford harbour and it was presumed all had perished. Two more vessels were presumed at sea due as the vessels were missing. The quays of Wexford were inundated by the extracionarily high tide and spray flung in the area. Ashore building roofs were damaged whilst trees and walls were felled. A large English ship was initially observed in distress but navigated the Saltees with great skill however a later telegram from Lloyd's highlighted no ship had been able to render her assistance and she sunk with no sign of the crew. Wreck of another vessel was also observed ashore. A vessel was wrecked off Queenstown although the crew were saved thanks to the humanity of a nearby vessel who showed the shipwrecked crew much compassion which lead the shipwrecked captain to declare "no words he could command would express his feelings of gratitude and thanfulness towards Captain Clarke. The shipwrecked were then conveyed to the Queenstown Sailors' Home which was described as comfortable and had everything necessary in supply for them. A French brig was wrecked off Portmadoc with the loss of four lives as it was driven onto the sands and its lifeboat subsequently capsized. The remaining lives were

<p>1856 13-14</p>	<p>2 Northern Britain and Western Wales</p> <p>The North British Daily Mail in the Liverpool Mercury</p> <p>16/02/1856</p>	<p>8 saved by the exertions of one man Mr John Roberts of Harlech and the captain, who had remained behind, was taken off the brig by the Portmadoc lifeboat. Wreckage of a sloop from Glasgow to Runcorn which had previously put into two ports due to damage sustained during it's voyage was found on the shores of the Isle of Man. It was feared the lives of the for crew aboard had been lost. A vessel sailing from Bideford to Tenby foundered near St. Catherine's Island but the exertions of the lifeboat who endured a "hard pull through the heavy breakers" saved the lives of 3 of the 4 aboard. The Tenby lifeboat crew were then called out again and "manully persevered, notwithstanding that each successive sea broke over them". Their endavours saved the lives of the 5 crew aboard the distressed French vessel who were subsequently taken to a nearby farmhouse to recover.</p> <p>The nation of Scotland and the far North of England were devastated by a Great Storm which was accompanied by heavy rain. In Glasgow the storm was stated to be "one of the most powerful and destructive hurricanes on records" and the streets were deserted but for a few stragglers. Chimney pots and slates fell in all directions and the "uproar caused by the excited element resembled nothing we can percieve but that of an Indian jungle infested by wild beats" and "the inmates were kept in constant alarm lest the windows should be bodily forced in". The river Clyde "rolled like a very sea and the SSW gale was so intense as to force back the water in the harbour over the quay walls" creating storm surge conditions. Goods from the port and property was strewn around the</p>
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neighbourhood and workmen were employed to clean the mess with the most valuable goods sent to the police. A Professor of astronomy at the University of Glasgow stated the hurricane was the most violent observed for a great many years. Although the anemometer had been disturbed so that "an exact force cannot be given. I have reason to suppose, however, that at its extreme it must have exceeded a pressure of 40 pounds on the square foot". The Tenant's brewers sustained substantial damage as the falling ruins destroyed a "large iron holder, which contained nearly £1000 worth of that liquid". It was said it was fortunate the night shift workers were taking their 2 am meal as a many could of lost their lives. as it was only one was slightly injured. However another man did have his legs broken when the roof of his house collapsed on him. A woman was killed in bed when a chimney fell through the roof and her daughter beside her seriously hurt, several other injuries were reported around the city including one man who had been "dreadfully burned" and broken his arm when a chimney had fallen upon him when attending to a furnace. Another man was presumed to have drowned after falling into the River Clyde whilst intoxicated. The number of premises of businesses of all sizes which had been damaged was near uncountable. In Hamilton the glass dome of the Palace Mausoleum was broken and it was estimated it would cost £200-£300 to repair. In Govan a young woman was killed as chimney fell on her in a neighbour's house she had sought refuge in. The property done to damage in the parish at Govan was estimated at not less than £60,000 (£6,500,000). In Patrick

the roof of a former cholera hospital which had since become a Catholic School was completely torn off and blown 50 yards from the building. An order for more than 500 panes of glass had already been submitted. In Milngavie a three story wooden drying shed was reported to be a complete wreck along with another shed in similar condition. Scarcely a house or property in the neighbourhood went uncathed. In Lanark nearly 150 trees were blown down, the waterworks were severely damaged and the temporary Roman Catholic chapel was completely destroyed. It was reported that "the oldest person in Lanark has no recollection of such a hurricane. Agricultural land in the Neilston high lands was greatly damaged with much loss to agriculture as the farmers had to gather what remained of their crop. The printworks were badly damaged which the bowling green also sustained damage. A family had a narrow escape as a chimney fell through their roof but they were fortunately only trapped and none sustained injury. The crops in Paisley were badly damaged and a nursery destroyed and a printworks was in ruin. Nearly all factories associated with the textiles industry sustained significant damage. At Blackwood and Gordon's shipbuilding yard a small screw-steamer was blown out of the river and into a field where it lay beached. "Wallace's Oak, which has stood for centuries as a land mark at Elderslie, and a memorial of the 'great patriot hero, ill-requited chief' was uprooted by the gale". The tree was said to have been in a state of decay and was one of the largest in the country. Its fall "removes one of the most ancient memorials of the great

Sir William Wallace" as it was located a short distance from the mansion house in which he was born. It was exclaimed "a link between the past and the present has thus been swept away from the gaze of mankind". At Greenock the storm was described as the most furious in 9 years with the tide rising to "an almost unprecedented height, completely submerging some of the wharfs, floating off quantities of material, filling many of the shops and places of business in proximity to the harbours- in some cases to the extent of several feet" and doing immense damage. The storm surge conditions also caused a large steamer to break free out of the East India Harbour doing much damage in the process and ending up beached. It was said the height of the storm surge would make it difficult to recover her. Several vessels broke free in the harbour doing immense damage to craft and a vessel which was in the shipbuilding yards for repair floated off and was substantially damaged. At Helensburgh the corpse of a woman and child belonging to a vessel which was ashore were unfortunately discovered. Two corpses of drowned men were also found at Row and their vessel was found wrecked nearby. The wharf and pier of the Wemyss Bay was reported to have been destroyed by the storm surge. Several lighter barges were reported to have been driven ashore throughout the Clyde estuary. Three more died of sea when a raft of barges heading up the Clyde was broken up and the three bodies were picked up from a meadow. Six to seven vessels which sought refuge in Holy Loch were driven ashore and sustained substantial damage. All

public baths were reported to have suffered and the quay was damaged at Largs. At Gourock the the damage to property resulting from the storm and the surge was very extensive and at Helensburgh the damage was estimated to be as great as £100,000 (£10,900,000). On the Great Western Railway it was observed that large swathes of land were underwater and it was evident much damage had been done to agriculture. The barometer had been observed to fall to 27 in/hg. Overall it was stated in the Glasgow shipyards "the wreck and ruin here are so complete, so utter, that the actual appearances can only be realised by a personal inspection on the spot" as high storage warehouses 60ft in height had been completely levelled and so many ships substantially damaged. The total losses of the property of one shipbuilding firm alone were estimated to be between £18,000 to £20,000 (£2,000,000 - £2,200,000) and the premises were uninsured. Trees were leveled "in very direction". In Dumbarton it was exclaimed "a portion of this town was under water, and the tide rose so high as to throw several craft on the quays". Efforts to remove the larger craft from the quay before the tide fell and they became completely removed were successful however, although one new ship which was driven so far upshore she was going to have to be dug out. The storm surge conditions created by the very strong SSW gale were also observed in Ardrossan where a 140 feet of new sea level defence was undermined and torn down whilst many of the vessels in port sustained considerable damage. The Carlisle journal reported widespread damage to property

throughout the town and there were accounts of close shaves with falling debris but no serious injury was sustained. At Rockcliffe "the tide has never been known to rise so high since the memorable storm on the 7th of January 1839. Shoreside property was flooded to a depth of several feet and the villagers entertained great fear for their children who they deemed to be in great peril. The main embankment was partially destroyed along with another embankment near the marsh as the tidal surge propagated up the Solway. Livestock was also reported to have drowned. The extent of the surge was such that the tide rose to a height of 27 feet at Port Carlisle "being about 9 feet above the height given in Holden's tide table". Although shipping damage was only minor one man was unfortunately lost overboard. The damage on the Port Carlisle railway was "only trifling" which was stated to be "chiefly attributed to the erection of the bank which was constructed at Kirkland after last flood". Nevertheless the water lay 18 inches deep for 3 miles and 20 yards of rail had been carried away along with one of the approaches near Easton bridge slightly damaged. At Silloth the gale only damaged a jetty. At Annan the SSW gale was severely felt. A coal barge levelled a quay was to the ground and sustained serious damage herself, a brig also damaged a house of the quay and a vessel was driven high up the Annan marshes. A vessel was also left at the high water point at Torduff Point but did not sustain serious damage. Her captain said "he never saw such a storm in the Solway in his life". To the west of Pwllheli a large American ship was driven ashore at Hell's Mouth in a

<p>1856 7 to 8</p>	<p>7 Irish Sea and Western Britain Liverpool Mercury</p>	<p>12/07/1856</p> <p>1 heavy WSW gale. All were saved at low water with the exception of two black men who tried to flee in the ships life boat at high water and subsequently drowned. Another Brazilian vessel went ashore on the Gimlet Rock but subsequently drifted onto the beach with the crew safe and the vessel intact. At St. Govan's Head, to the westward of Carmarthen Bay a large American ship of 2000 tons was completely lost and between 30-40 of the crew drowned. She was laden with a cotton cargo worth £30,000 (£3,300,000). Only three survivors remained. A captain of a Belfast - Glasgow steamer was immediately conveyed to Hospital on returning to Glasgow after he fell from the bridge to the deck of his vessel, fracturing his femur. It was said all the possible attention and care had been given to him and he was now in a stable state. A strong gale resulted in the disabling of a steamer just off the Isle of Man coast although she was fortunately rescued by another vessel nearby who towed her into the Mersey. A clergyman onboard "spoke in the highest terms of the conduct of Captain Higginson under the trying circumstances in which he was placed, and of his great kindness and consideration for the passengers under his care". It was stated the Isle of Man Company "have again been very fortunate" although the passengers who desired it had their money returned and the cargo was transferred to another vessel. On the Pembrokeshire coast the formidable weather resulted in two vessels being driven ashore near Abermaur and it was feared one seaman had perished. One vessel was driven ashore near Fishguard and two became complete wrecks as they</p>
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1856	5 to 9	12	Irish Sea and Western Britain	Liverpool Mercury	10/12/1856	3	<p>were driven on the rocks in St. Bride's Bay whilst a schooner was also lost with its master at Holyhead. A large ship with 320 emigrants onboard bound to America went ashore near Amlwch although all onboard and their luggage was saved.</p> <p>A severe gale from the south-west structure the west coast of Britain and Ireland. A great loss occurred off the Irish coast near Dungarvon where three men lost their lives and a ship and cargo with an estimated value of £100,000. Most Irish Sea ferries were windbound although the shipping in the mouth of the River Liffey was well prepared so sustained little damage. Flashes of lightning accompanied by loud claps of thunder were noted. The heavy sea forced a Cork steamer bound for Milford to put into Dublin with 190 dead livestock aboard, some of which were used as fuel to keep the steam up. In Swansea a "complete hurricane" from the WSW caused two vessels full of copper ore to part chain and they were washed ashore. In Bowling Bay in the Clyde the "flooded state of the river" caused a vessel to become stranded high above the normal tidal level and it was said the cargo would have to be discharged before she were got off. An American ship was wrecked a mile north of Whitehaven harbour. It transpired she had previously put into Westport, Ireland in a sinking state and several crew had been arrested due to the fact they did not want to go to sea again. However the sea was so heavy the tug committed to tow her across to Liverpool could only act as a pilot as the hawsers broke. Driven by the SSW gale up to Whitehaven the vessel attempted to make port at</p>
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Whitehaven however the captain, expecting another tow in port, ordered his men to set sails and the vessel "immediately began to drift onto the rocks at Reduess Point, on which she struck shortly afterwards". The lifeboat and a steamtug of the port were immediately despatched and "after several ineffectual attempts to get alongside, in one of which one of her compartments was stove in, succeeded in getting twelve men off the wreck". The captain and eight others refused to be rescued as the lifeboat would not rescue the luggage however "as the tide had begun to ebb it was considered probable that the vessel might hold together till the water had so far receded as to enable the remainder of the men to land in safety". This was proven to be correct and the remaining 9 came ashore with their luggage at low water although the ship had broken into two and was an unsalvagable wreck. A British and North American Royal Mail steamship returned to Liverpool "in a disabled state, havin encountered a severe gale in St. George's Channel. When about 50 miles to the west fo Cape Clear she had been "struck by a tremendous sea, the gale raging at the time with terrific violence". As a result the decks had been swept and considerably alarm was created onboard, especially amoungst the passengers. The bulwarks were carried away, as well as three lifeboats and a large proportion of the accomodation and living spaces onboard. One man sustained serious injuries fracturing both femurs although the majority of the other reported injuries were no more than moderate in nature. The captain was described to have "maintained the utmost

1856	15	12		Bristol Mercury	13/12/1856		coolness and self-possession during the trying scene" and put the vessel about before returning to port. Those seriously injured were quickly conveyed to hospital. On hearing of the return the authorities immediately readied another ocean-going steamer and all mail and passengers were conveyed onto the vessel which was due to set sail the day following. A document released by a collective group of passengers "whilst returning their grateful thanks to Almighty Providence for their safe deliverance from the fearful storm" was also highly complimentary of the Captain's actions. A joint report from a naval surveyors and underwriter highlighted the exact damages done to the ship which were numerous in nature and would take a great time and expense to repair. A poem entitled 'The Late Tempests' emotionally and emphatically depicted the storms which had recently occurred throughout the UK. A clear collection between the almighty, the elements and fate is expressed throughout as the poet explains exclaiming "So resolutely rage the winds of heaven! Dark ministers they seem, to whom is given//The mandate of the Mighty one, to heap//Destruction on our dwellings-yea, to sweep...Is from pure reverence of th' Akmighty Power!". A sense of human vulnerability and the wrath of god is expressed throughout.
1856	11 to 12	12	Irish Sea and Western Britain	Liverpool Mercury and Carnarvon Herald	15/12/1856	2	The correspondent began by exclaiming "the terrific gale of Thursday night and following morning prepared the underwriters for another catalogue of disasters along the coast. Unhappily, their forebodings were truly verified" as the advices from many ports told of woe, destruction and

loss of life. The gales of the 11th and 12th were the end of a succession of gales from the SSW which had wreaked widespread havoc unknown for many years and it was feared many vessels had gone down with all hands. In St. George's Channel several large ships were "driven back with fearful impetuosity" as the seas broke over them doing break damage to machinery and forcing them to retreat to the Plymouth sounds, Falmouth and Penzance to see to serious damage. At least two vessels had lost a man overboard who had met a watery grave. Wrecks and cargo of several vessels littered the beaches around the sound and all onboard one were presumed drowned. Likewise the wreckage of a boat washed ashore eastward of the Scillies was presumed to indicate a fatality. Lifeboat crews were indicated to have acted valiantly and have saved many lives although many brought ashore did not survive long after. Four vessels were ashore near Whitehaven and off the Cumberland many were expected to become a complete wreck and those insured were under the observation of the Lloyd's agent at Whitehaven. A 600 ton ship put into Whitehaven in a sinking state and the crew had suffered greatly and were so fatigued by the incessant labour needed to keep her afloat 12 fresh hands had to be brought aboard to sail her into port. The reaction between the raw sugar aboard and seawater was reported to have made many sick and some were temporarily blind. Several cats the captain had brought aboard to protect the sugar cargo from vermin had died in the hold as a result of the gas produced from the reaction. The ship itself was still intact although 2 feet of water

1857

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Bristol
Mercury

03/01/1857

covered the hold. In the River Conway a "Great Flood" occurred as a deluge of rain fell in the valley after the fall of snow. This caused the tributaries to swell to a near unprecedented and the excessive flow of water into the Conway caused the main river flood the surrounding streets of Conway to an extent the riverside roads of the town were impassible and many churches, businesses and homes were flooded by "rushing streams of turbid water" to a height of three feet. Many foundations were undermined and a mill dam wall collapsed momentarily increasing the volume of water in the vicinity. The extent of damage and loss was incalculable and the thick veneer of silt that lay in properties was predicted to take weeks to clear and the houses would take many months to dry out. At the height of the flood the extent of the flood was such the whole of the Vale of Conway had been said to have represented once great lake.

A poem entitled: "Down on the Shore" depicts the joy and woes of life on the coast and the influence of the weather. The 1st verse of the poem begins in a cheerful and uplifting manner: "Where the salt smell cheers the land;/ Where the tide moves bright under boundless light/ And the surge on the glittering strand". The 2nd verse is a marked contrast as it begins: "Down on the shore, on the stormy shore/beset by a growling sea/whose mad waves leap on the rocky steep/like wolves up a traveller's tree". The poem then continues with a direct reference to the perils of those at sea and the scene of a shipwreck is described: "Where the tall ship rolls on the hidden shoals/And scatters her planks on the beach". The focus

1857	14	5	North-west England	Liverpool Mercury	15/05/1857	<p>then switches to onshore and the destitution of a sailor's wife who is presumed to have lost her husband in the storm: "Where slate and straw through the village spin/ ... With a sailor's wide sitting sad within/Harkening the wind and water's roar/Till at last her tears begin".</p> <p>A thunderstorm "of the great violence and considerable duration" visited Merseyside. Before the event began the weather was described as being "excessively close , accompanied by that oppressiveness which usually indicates the presence of electric fluid in the atmopshere".The storm borught with it thunder, lightening, south-westerly winds and heavy rains which flooded public roads and paths. Following a short abatement the lightening became more vivid and the thunder "rolled in loud and continuous peals" whilst the rain continued to fall. The only incidient occurred on a steamer which was discharging at the Nelson Dock which struck by "electric fluid" doing considerable damage to the iron gunwale but "providentially no one sustained any injury beyond a severe shock recieved by an Inspector and a few others". No serious damage resulting from flooding was noted.</p>
1857	31	5	North-west England	Liverpool Mercury	03/07/1857	<p>Another thunderstrom struck the North-west which was accompanied by rain, thunder and lightning. The loss was near univerally caused by lightning strikes. The superintendan of the Crown-street railway station was struck by lightning whilst carrying an umbrella and sustained severe bruising in the fall. Adriver of a coach was struck by lightning and rendered near senseless being deprived of his eyesight, the use of his limbs and</p>

<p>1857 13-14</p>	<p>8</p>	<p>Western Britain</p>	<p>Liverpool Mercury</p>	<p>17/08/1857</p>	<p>1</p> <p>speechless. He was conveyed to a hospital and fortunately recovered much to the relief of his wife and children. A large residence sustained severe injury in Algburth but fortunately neither servants nor the occupants were injured. A wedding ring was also drop during a wedding ceremony although after encouragment from the bride the ceremony was safely completed. In Preston, the "thunder peals seemed to shake the houses to their very foundations" although only one house sustained severe damage and a sewer also burst. At Chester the rain fell in torrents and the vivid lightning doing only moderate damage to a roof.</p> <p>A sequele of thunderstorms and heavy rains lasting over two days were highly destruction throughout the west of England. At Newport the thunderstrom was accompanied by strong gusts of wind from various directions and heavy rain. Many streets in the lower parts of the town were flooded and the Usk overflowed it's banks. Drainage systems and sewers were often choked which exacerabted the flooding in many places. This lead to the flooding on many groundfloors and cellars. The flooding was exacerabated due to the overflowing cellars creating conditions "most injurious to the health of the inhabitants, unless nergetic measures be instantly taken to remedy the evil". The lightning was described as a "species of electricity called chaic lightning" and the lightning "resembled in several instances the sharp rattle of a fusilade close to the ear" whilst "long peals of artillery rolled away into the distance and made the scene truly awful". A working men fell dead at the door of a house</p>
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1857	7 to 9	10	United Kingdom	Liverpool Mercury and Bristol Mercury	12/10/1857	4	<p>when he was struck in the aptly named "Bolt-street" and it was said the brave fellow was in the action of going to fetch his wife during the storm "knowing her to be nervous and frightened during a thunder storm". In Cardiff terrific thunder and lightning was also observed and the cellars in the lower part of the town were flooded as a result of the heavy rain. Many streets were impassable and "assumed the appearance of a Dutch street with a canal running in the centre". Several houses in the town and the surrounding villages were severely damaged and a servant girl was badly scorched although no fatalities were recorded. In Liverpool only slight indications of the storm were observed although the heavy rain in the surrounding Lancashire and Cheshire countryside was feared to have seriously damaged the crops.</p> <p>A severe storm the coasts of the UK bringing with it heavy winds , lightning and peals of thunder. In Dublin three boys aboard a small boat in the Liffey almost perished but they were saved and all vessels were very tightly secured. No steamers left port due to the state of the Irish Sea which ran mountains high. The Great Western docks at Plymouth sustained considerable damage. A fatal loss also occurred in Carmarthen Bay when a French vessel drove from her anchorage near Hooper Land and foundered taking all hands with her.</p> <p>Liverpool and Lancashire was visited by a severe gale of wind which came in sudden gusts predominately from the north-west. The violence was such that it created alarm amongst soe of the residents in exposed areas of the town</p>
1858	5 to 6	3	North-west England	Liverpool Mercury	08/03/1858		

1858	8	3	Isle of Man	Mona Herald in Liverpool Mercury	11/03/1858	1	and the winds serious interfered with navigation. One vessel drifted upon the Pluckington bank but was later got off with little damage whilst a french vessel came into contact with Seacombe slip but "by the skilful management of the pilot" she was got off and docked with only minimal damage. An isle of Man steamer sustained much damage but managed to maneourve into port whilst a sloop of Castletown, Isle of Man ran ashore at Rhyl and the crew saved themselves in their lifeboat with great difficulty. Snow and sleet then fell and it was reported cold sharp winds from the north and north-west had been prevalent.
1858	9 to 11	4	Irish Sea	Liverpool Mercury	12/04/1858	9	A smack was driven out of Ramsey Bay and in making for Douglas harbour got ashore on St. Mary's Rock as the master could not steer her as he was "benumbed with the cold" in the extremely severe river. The vessel become a total wreck but the crew were saved thanks to the nedeabours of man named Joesph Hogg who went to the assistance of the crew in a boat. The captain however died soon after reaching hospital and in the following inquest into his death the jury returned a verdict of "died of starvation from cold". Lloyd's insurance market received several terribel accounts of loses that occurred during a "fearful gale which has swept the Irish Channel". A vessel foundered off the Dundalk lighthouse and it was feared that the entire crew as well as the master of the tug that was sent to assistthem had perished. Another vessel was lost off Cooley Point with all of her crew and several bodies had washed ashore whilst another fatal wreck happened at

1858	5	South-West England	Liverpool Mercury	04/05/1858	<p>Kiltred when a Mersey bound vessel was driven across the Irish Sea by the easterly winds. A boat containing Newry pilots also capsized with all onboard perishing. In Dundrum bay near Belfast 2 vessels were reported to be in distress at sea and another was ashore near Waterford. Two more individuals perished on a vessel driven ashore at Wicklow Head but all others succeeded in getting ashore.</p> <p>The coxswain of the Natioanl Lifeboat Institution at Budehaven published an account of the tidings of a Liverpool ship that was wrecked during a strong WNW gale off Budehaven. The coxswain wrote of the initial sighting of the vessel in distress before a decision was made to reach the ship by sure as opposed to sea due to the rate the vessel was drifting to shore. Once an assessment was made of where the vessel would drift ashore and a party proceeded in findings the secluded wreck amongst the ragged coastal cliffs. An account was given of the of the use of the lifesaving rocket line and warp although the inability of the crew to understand the contraption resulted in a delay in the rescue operation. The crew who were making signals of distress by burning torches therefore were on the boat at high tide when the sea rose causing great destruction as the vessel was wrecked as it surged against the 300ft high cliffs which was "a time of most intense anxiety". Due to the surging tide which moved the vessel the rescue team changed position in relation to the floating wreckage and managed to svae the all 16 crew and the pilot in "a most providential manner" despite the fact the crew had been</p>
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1858	12	6	Western Britain	Liverpool Mercury & Western Times	14/06/1858 & 19/06/1858	4	<p>clinging to rocks "with the sea breaking heavily over them, without one ray of hope, and an overhanging cliff of immense height above them". A thrilling account of the cliff rescue was told as well as the perilous total reliance on the durability of one rope which held firm and enabled all to be rescued. The coxswain "in justice to the inhabitants" said that "they one and all did their best for rescue of the crew, and stood by to the last rendering what aid they could". The vessel which was wrecked was of 1000 tons burthen and had been bound for Liverpool from the Gold coast and was reported to have previously been in a distressed state and left to her fate by a steamer who could no longer tow the vessel due to the conditions at sea.</p> <p>A severe thunderstorm was observed In Merseyside and the South-West of England. In Liverpool "vivid flashes of lightning broke forth from the heavens, accompanied with loud and long-continued peals of thunder". Intervals of heavy showers also fell deluging the streets in the lower parts of the town which flet the full violence of the storm. A chapel roof was badly damaged and the communion table set alight whilst at Seaforth the chimney and windows of a house were badly damaged by another lightning strike. A roof was struck at a farm, set alight and reduced to ashes amounting to a loss of £100 but it was fortunately insured by the Royal Insurance Company. Several trees were also set alight in rural neighbourhoods. A Welsh mariner was also struck on the dock of his vessel and rendered temporarily blind but soon recovered in hospital. Telegraph transmission was also delayed as the</p>
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1858 24-25

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North-west
England

Liverpool
Mercury

31/07/1858

wires were struck near Bebington and a house sustained some damage to it's roof in the area. Heavy rain fell late into the evening across Merseyside and Cheshire. The storm was also felt in Western Scotalnd and raged for 22 hours in the island of Arran with "rain falling as from a waterspout". A woman in Wallacetown was struck whilst attending to a curtain and one side of her body was left scorched and completely paralysed. Livestock was killed in rurual Ayrshire whilst several telegraph poles were struck. The village of Dunure was inundated and fields of crops entirely destroyed. near Portpatricks a boy and a girl drowned whilst playing near a brook which had been greatly swollen by the storm. In the Isle of man the thunderstorm struck the mizen mast of a lugger entering Peel harbour. The electric pulse ran down the rigging and killed the helmsman whilst several individuals aboard were partially stupified. Livestock exposed in the fields was killed and a young man 21 years of age was killed whilst sleeping and his brother badly hurt. The thunderstom was also felt on the Cornish peninsula as at Barnstaple several livestock were killed by lightning strikes and the several telegraph poles split, whilst the storm "presented a grand spectacle for several hours" at Teignmouth. Throughout Cornwall and Devon there were numerous more reports of livestock fatalities and several instances of property damage caused by lightning. A tremendous gale from the north-west hit the North-west coast and blew with little intermission throughout the night on the 14th and into the following morning. Several casualties were reported amoungst the shipping

with a schooner sinking near the North Spit although the crew were saved by a lifeboat. Another vessel was adrift off Tranmere whilst a boat was reported missing off West Hoyle. in Liverpool trees were felled in exposed areas whilst several buildings were damaged. The underwriters office reported that two men had been washed overboard from a Whitehaven vessel whilst the Isle of Man steamer The Mona's Queen had reported several vessels wrecked. The lifeboat crew of the Hoylake performed a gallant rescue of a schooner which was wrecked off Hoyle bank as the lifeboat men "rowed for two hours with all their strength, until their hands blistered and bled; but still they kept at it, against the storm and strong current, fearing every moment lest the mast should fall and the poor men be lost". After four hours and the aid of a tug the men of the wrecked schooner were rescued and it was said much praise was due to the captain of the tug and the lifeboat crew. A 56 ton schooner was also wrecked off the Southport coast but it's crew were fortunately rescued by the Southport lifeboat. The three seamen were subsequently treated hospitably. The rescue of the three took "the number to 200 saved by Captain Rockliffe and the crew of the SOuthport lifeboat since its establishment on this coast". The rescue distressed vessel attracted much attention and the Lytham lifeboat was also on the scene although it arrived some 5 minutes after the rescue. The "veteran Rockliffe marched up the beach with the three sailors whom he had rescued, the vistor's who were assembled in large numbers on the Promenade and near the Victoria Hotel

1858	17	9	Liverpool Mercury	17/09/1858	<p>greeted them with hearty cheers". It was remarked the "female portion" of the crowd were particularly congratulatory at the "providential deliverance of the crew". A schooner was also washed up at Lytham and was supposed to have gone down with all hands. Off the Isle of Man a smack ran ashore in Peel Bay whilst the master of a vessel drowned whilst attempting to escape in the ships tender before it was released from the vessel. Fortunately the two others were saved by a Peel fisherman. Another schooner put in to Ramsey having cut away the mainmast in the Irish Sea. The three crew of a flat from Whitehaven also perished in the Irish Sea. Three lives were lost when a yacht was overwhelmed and capsized off Donaghadee.</p> <p>The poem "The Shipwreck" begins by exclaiming the joy of life at sea and emphasizing the beauty of the ocean and the sailing craft: "A ship is bounding o'er the sea,/ Gaily to to her goal/The favouring gale/Fills her snow white sail;". The lighthearted spirits aboard are highlighted "Light is every heart on board-/Light and merry every word/No care is there;/For the wind blows fair". A sudden change in tone is experienced as the peril grows as the storm sets in and the vessel is destroyed in the storm "But hark!-the winds rise-/...And the blast/Strikes the mast-/And the torn sails fluttering fly-And dark, and darker, and darker grows the sky." The suffering and the destitution of the those aboard is expressed "And the cry of wild despair-/And the dying sinner's prayer/For mercy-and the moan-/And the sinking wretches groan". The sea is depicted in a human form as the "Ocean's grim monsters" are stated to</p>
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1859

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Liverpool
Mercury

28/01/1859

"devour" the dead. The poem then takes a sudden change in emphasis expressing "But what of that?-is not the sea/The Briton's home?-why should not be/Ocean his resting-place at last/What fitter tomb than ocean for the brave?-/What fitter for a British seaman's grave?" almost implying it is natural for a sailor to die at sea before the poem finishes by expressing the fury of the storm "As it dashes enraged on the echoing shore."

A song "Storm at Sea" starts by emphasising the dramatic grandeur of nature as the "Dun storm-cloud veil the azure sky"/The winds blows fierce, the waves run high" before comparing the power of the storm:"The thunder has a voice of doom" compared to the feebleness of man "Our little vessel, like a deer/When wounded, plunges on in fear!". The fear and uncertainty of those onboard is stressed in the chorus: "O thou who canst not lay thy head/Upon a soft or certain bed,/But wanderest in scorn and ban" before the song takes a distinctly religious turn "Sleep, holy Christ! with tranquil breat;/Sleep on, great Brother! sleep and rest". The 'disciples' then issue a plea to god to save those in peril at sea: "O Master, hearest thou the flood?/...Arise, and bring salvation nigh!" before the "winds, rebuked, fled to their caves,/ And all the wild insurgent waves/Grew placid like a sea of glass! Then did the stormy blackness pass". The song finishes by address all travellers in peril:"O Brother, travelling through the waste/And well nigh foundering in the blast;/Ye pilgrims of eternity,/In perils of the land or sea/Or the more dangerous commotion/Than wilderness or swelling ocean-". The orchestrater then exclaims it is only God who can

1859	27-28	3	North Wales	Liverpool Mercury	03/05/1859	<p>heed their calls and ultimately save their lives:"Cry, all, to him of Palestine,/ The Man-God, human and divine,/ For he alone has power to save/From sin, from anguish from the grave".</p> <p>Very strong gales from the east caused great destruction at Holyhead, namely the roof of the RNLI was stripped off and deposited on the beach. Five wrecks occurred in Holyhead harbour and the packet ferry From Kingston took 9 1/2 hours, the longest on record. Three more vessels sunk in hte new harbour and several more sustained considerable damage in the old harbour.</p>
1859	22	10	North-west England	Liverpool Mercury	24/10/1859	<p>The region of Merseywise was visited by "one of the severest storms of thunder and hail that have occurred for some years". The day before the storm the "themometer fell considerably" as the weather turned cold. The day after hail and sleet fell in the morning with the wind from the south-west. Around noon a heavy hailstorm precipitated down along with alternate showers of rain and sleet which was accompanied by a "piercing wind" before lightning "shot forth in broad and vivid flashes, followed b loud and continuous peals of thunder,s everal of which were so terrific as to create alarm in the minds of many inhabitants". The lightning "illumated the country for miles around" but no accidents. There was a heavy fall of snow fell over Cheshire, Lancashire and Merseyside and the temperatures were 9 degs below the mean for the same day for the last 13 years. This was said to have compensated for the very high temperatures at the start of the week rendering the temperature as a whole "about</p>

1859	25-26	10	United Kingdom	Liverpool Mercury, Bristol Mercury and Western Times	27/10/1859, 28/10/1859 & 29/10/1859	469	<p>an average" although there was an 'enorous' difference of 26.4 degs F.</p> <p>One of the greatest storms in history struck the western coast of the United Kingdom causing catastrophic damage and destruction and most notably resulted in the wreck of the Royal Charter. Overall 133 ships were sunk and 90 sustained considerable damage with the death toll on land and at sea estimated to be approximately 800. In Liverpool the gales from the NNW brought with them the strongest gusts ever recorded at the observatory as a pressure of 21lbs per sq foot as the wind graudally backed to a westerly direction. The tide at flood "presented a scene sledom witnessed, the sea running so high as to render navigation during three or four hours of the day exceedingly difficult". The spring tide which was predicted to reach a height of 18 feet and two inches rose to a height of two - three feet more than that stated. The storm surge washed over the baths near George's Pier and the coastal roads in Liverpool were breached and even large ocean-going vessels were confined to the Mersey as the decks of the ferry vessels crossing the Mersey were swept whilst landing as the rolling landing stages became near impossible for periods. Many vessels came into port having sustained considerable damage to the vessel and with damaged cargo or dead livestock. The Seacombe river wall sustained a considerable amount of damage due to the storm surge as "a considerable lenght of the coping had been torn up by the water, and many of the large blocks of stone carried to a great distance". The captain of a flat and his son died when a Runcorn flat capsized and it</p>
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was impossible to render them any assistance due to the state of the sea. The gale also did considerable damage to roofing in the town of Liverpool although no fatalities were mentioned. At Plymouth a very high tide and storm surge was noted and all vessels had to run into the sound and the tunpike roads in Liverpool when the surge inundated the roads and destroyed the granite coping whilst the Teignmouth sea walls were greatly damaged. Several breaches occurred on the western railway lines which was undermined for long stretches. In Swansea all trains were delayed as the platforms were covered by the surging sea and all the gaslights were blown out by the storm. A sloop was reported to have sunk off the Mumbles and it was said it was doubtless many other incidents had happened during the evening. A brig also sunk off Douglas Head but the crew were saved and a schooner was reported sunk off the Calf of Man and it was not known whether the hands were safe. The telegraph messages to Lloyd's in Liverpool were awash with messages of lost vessels from throughout the UK and Europe and numerous fatalities were reported. In Bristol it was reported that the temperature before the storm had been as low as 22 degs F which was the lowest on record during the month of October which was "somewhat remarkable" given the high temperatures of the month before. The barometer had fallen to 28 1/2 in/hg which was noted to be the sign of a coming storm. When the storm struck the wind suddenly veered and blew from the south-west and the high tide "occasioned great damage". As well as noting the damages on the South Devon

Railway breaches were also reported on the North Devon line. The storm surge raised water levels to "twelve to thirteen feet above the ordinary level of spring tides" and "huge masses of granite were flung like pebbles across the line to the base of the cliff". It was estimated that £2000-£3000 (£250,000 - £380,000) worth of damage had been done to the line which would not resume traffic for weeks. At Totnes the "tide rose to a prodigious height, and the Seven Stars Hotel was so completely inundated that the inmates had to leave by boat". A detailed account of the fate of the Royal Charter was given and it was stated in total 494 people were onboard and of those only 39 were saved. It was estimated that between £500,000 - £800,000 (£63,300,000 - £101,300,000) worth of valuables was onboard and one man alone had £10,000 (£1,270,000) worth of gold about his possession. The vessel had been forced ashore near Point Lynas in Red Wharf Bay as the pilot had not been able to aid the ship and the anchors had been unable to hold the vessel. Although anxiety was at first low amongst the passengers the ship was thrown broadside and great panick ensued and a Clergyman began offering up prayer but "his exhortations were interrupted by the violent thumping of the vessel on the rocks and the heavy seas which came dashing into the cabin". The scene in the saloon was "of the most heartrending description: children and parents, husbands and wives, were clinging to each other in affectionate embrace". Despite the reassurance of the crews the ship was swung onto the rocks and split in two amidships and many were drowned as the ship broke up and bodies

were flung helplessly onto the rocks. All the officers drowned or were killed aboard and the few who saved themselves scrambled ashore along a hawser and many of those left alive sustained severe injuries. Three days later there was "scarcely a vestige of the Royal Charter remaining". The bullion chest was also destroyed and gold bullion, 250 sovregins and notes were picked up among the rocks. Many of the recovered bodies were lined up in a nearby church and many were "frightfully mutilated". All survivors were treated with compassion by those ashore and "two ladies made themselves conspicuous by their attention to the sufferers". The lifeboats on the ships had been ready to launch but the circumstances of the ship being on the rocks prevented their deployment. The ship had been built in Chester in 1833 and was originally a sailing vessel converted into a screw steamer and was registered as 2749 tons and worth approximately £80,000 (£10,130,000). The gold bullion was also mostly covered by insurance. It was said the latest accounts stated "that a more complete annihilation of a ship was never seen than has been effected by this storm". Marines and coastguardsmen were in the area ready to protect the valuable cargo. The news from Cardiff was of widespread destruction and loss at sea. Several small inshore vessels and sunk along with a pilot boat. Despite the gallantry of two men who ventured out from the pier head to a wrecked brigantine no men were found in the rigging and it was assumed they had been condemned to the sea. Five vessels were observed floating past keel upwards and several bodies were washed up along the shore to the

extent the coroner was constantly engaged in holding inquests into their deaths. The storm surge was 15 inches than the predicted high water spring tide and therefore the lock gates and pavillion was breached. Houses were unroofed and trees lay unrooted for miles around and the the neighbourhood was said to be "unmistakeable evidence of the devastating effects of the gale". In Western_Super-Mare the high spring tide and exceedindly strong onshore winds from the west carried spray hundreds of feet in the air and completely destroyed the coastal property of a doctor doing damage estimated at £150 (£19,000). The water was driven inland "with an impetuosity which could only be compared to the rushing down of a torrent from a mountain eminence" and the Calremont Hotel and its officers completely inundated. The newly erected sea wall was washed away and large coping stones driven across the road whilst a few roofs were torn off by the wind alone. This damage of the storm surge was trifling compared to the scenes at Knightstone where "about thirty different craft" were hauled up near the landing place "when the maddened waves roared in and drove them one by one from their moorings" largely destroying the whole fleet. The storm surge also washed down a wall 150ft long and destroyed a trow from Gloucester although the crew survived by taking refuge at the top of the mast. It was noted that the majority of the vessels belonging to "poor fishermen, who, especially at this season when their only profitable time of the year may be expected to commence, must sorely feel their loss". Only one vessel was insured and a plea was made

to readers for assistance. In Watchet more than 7 vessels were completely wrecked ashore and the storm surge made a complete breach over the quay and several carriages belong to the West Somerset Mineral Company were carried into the sea. The quay wall in Minehead suffered severe damage due to the storm surge, several vessels were wrecked and crew left without a vessel. Trees strewed the roads making travel impossible. Numerous vessels were also wrecked in Burnham-on-sea with more crew having to take to the rigging to avoid drowning. In Highbridge a chimney fell through the roof of a hotel and an individual was "providentially" saved by a "beam running across immediately under where the chimney fell and over the bed" sparing the life of it's occupant who nevertheless sustained serious injuries. Two more fatalities were noted at Ilfracombe where many more vessels were wrecked on the rocks and the Mont sands. Ten men also drowned at St. Ives when a vessel was wrecked on Hayle bar whilst two more were noted wrecked. A vessel was also lost at Bideford but the crew were fortunately saved. The RNLI lifeboat at Rhyl was in constant action saving dozens of men although many more ships were wrecked in the dead of night and their unfortunate crews perished before it was possible to render them any assistance. The new chemical works at Flint were destroyed and all works "razed to the ground; and men had to throw themselves into the river and save their lives by floating on pieces of wood". The Western Times' review of the event pronounced it the most "memorable and destructive gale" since November 1824

1859	1 to 2	11	United Kingdom	Liverpool Mercury, Bristol Mercury	03/11/1859 & 05/11/1859	5	<p>and stated "the devastations and life losses of which are still a topic of mournful recollection with all the elders of the long shore-men and sea-faring people". References to Brunel's mocking defiance of a mariner who had criticised the location of the line so close to the sea saying the line would be regularly inundated once in ten years were made as all railway traffic was now suspended for weeks and £2000-£3000 worth of damage had been done.</p> <p>Another exceptionally severe storm hit the UK doing terrific damage across the nation. In Bristol the barometer fell rapidly as the easterly gales accompanied by heavy rain hit the channel. The "lightning was fearfully vivid, the thunder boomed and crashed with awful solemnity, and the rain was at times intermixed with hailstones". Valuable livestock were killed and trees were blown down in rural areas whilst roofs were stripped, windows smashed and chimney pots removed. Although casualties were far less than those on the east coast and particularly the Thames which was said to have resembled "an inland sea" the port of Bristol suffered a major casualties when the barque Batanga belonging to an African trading merchant was wrecked. Several vessels also lost anchors, sails and sustained considerable damages. The 200 ton barque which was laden with "the miscellaneous merchandise which is usually comprised in an African venture". The vessel had come into difficulty after the wind had veered from east to south before suddenly blowing a full gale from the west and the waves broke her bulwarks. She was then wrecked on the Hook Sands off Clevedon whilst trying to return to Bristol.</p>
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Although the vessel "providentially" fell to leeward saving it from destruction and the men from certain death the crew were left marooned on the isolated sands and "nothing but death seemed to stare them in the face" as they could not communicate with the passing steamers causing the men to engage "in united prayer, seeking help from that quarter from which alone it could be afforded them". Although the men were rescued a day later "why the poor creatures should have been left so long so they were on the sand appears to us, we confess, altogether inexplicable" as telegrams had been sent by the vessel's owner as soon as they were reported wrecked. On the approach of a steamer the benumbed men who had attempted to make a raft and were now drinking the ship's ale supplies "threw themselves on their knees and joined the captain in praying earnestly for deliverance from their great peril" but the vessel sailed on by leaving them to the mercy of the element once more. The captain "saw the danger of the course" of building a raft and logically persuaded the sailors not to attempt an escape. A small steamer captained by a former mariner who was tired of his "do nothing shore life" saved the men following his previous rescue of a large ship from the Manacle Rocks with 400 people onboard who were largely military officers from which he had received between £500-£600 (£63,000-£76,000) as an award for his salvage. On return the Captain and a few volunteers went to the shipwrecked men's aid on the dangerous sandbank and the benumbed men were hauled into the vessel and given great care and attention. The survivors were near

1859	11	North Wales	Bristol Mercury	05/11/1859 hysterical with joy and they they were reunited with their wives and friends at the Bathurst Basin although all their possession had perished. When asked if he had been given any award one of the rescuers stated "Lord, no sir; I wouldn't have asked any reward for the world: I couldn't ask them for anything at such a time, exhausted as they were; but I'd a' given twenty pounds to save 'em". The tug was later charter by the owner of Batanga to salvage all possible from the sandbank for the benefit of the underwriter and the correspondence stated the captain should be accorded "a high meed of praise". In Milford a schooner was totally wreck and it's crew drowned whilst two ships were dismasted. A vessel was reported to have come into port at Swansea having sustained severe damage at sea. In Newport the thunder was reported to equal any in the hottest months and a large wooden building erected to accomodate 2000 people was destroyed. A poem specifically focussed on the loss of the Royal Charter. The poem begins depicting the storm as human stating "the winds awoke the other day,/And from their couches leaping/Cried out, 'We'll have a tragic play,/And set the world a weeping.' " The storm is portrayed like the devil emerging "from his lair" and whispers "Come thou, and bring the thunder" and the spatial extent of the destruction around "Old England's Isle both east and west as well as south and north" is noted. The personified winds and storm are described to "smote the ocean in their wrath" and identify the Royal Charter "Somme goodly ship returning-/Some goodly ship with souls well
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1859	4 to 5	12	North-west England & Irish Sea	Liverpool Mercury	08/11/1859	4	<p>stored,/Souls by the hundred numbered;/A ship with precious gold on board,". The elements were then portrayed to "lashed the sea to madness" to bring "ruin, death and sadness" to the shore with "hellish spite/And vengeful malice burning.". The "unequal wardare waging" against the ship and the storm is mentioned before the destruction of the ship is described before "Then appeared a horrid sight,/A sight the soul bewildering,/A host of creatures deadly white-/Men, women and their children.". The great extent and smoothness of her journey from Australia and the fact the Royal Charter had been wrecked so close to home is portrayed in the final verse before the poet concludes by personally condemning the elements for their foul deeds: "O cruel winds, your play is done,/Your tragedy is ended,/WHich many a sad and sorrowing one/Wih bitter tears attended".</p> <p>In Carlisle from winds from the south-west blew down a chapel under constrction in Carlise and a crew was washed ashore near Allonby and it was supposed her crew had drowned whilst the body of one man was found "entagled in the rigging very much mutilated". Other pieces of wreck were also found washed up between Maryport and Allonby. Two vessels were driven ashore by their captains to avoid being driven up the Firth of Clyde whilst waiting for a steam tug that never came outside Maryport, one of which sustained serious damage. It was reported that a standard rate was applied for entering the harbour "irrespective of a charge for towage when such is rendered" and the Steam Tug Company had three good boats in working order in the harbour "but whether they</p>
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1860	21-24	1	United Kingdom	Liverpool Mercury	24-27/01/1860	8	<p>should be allowed to lie idly in the harbour when their assistance is most needed is a question for the shipowners themselves to settle".</p> <p>A very severe gale with exceptionally strong winds veering from WSW to WNW did great damage throughout western Britain with the anemometer registering a constant wind strength force of 20 lbs per square ft and a maximum force of 28 lbs per square foot in the gusts in Liverpool. A schooner laden with slates collided by a flat causing the schooner to sink although the her crew were injured. A steamer was also blown from her moorings on the Cheshire side of the river, whilst a flat sank in Queen's dock and the man and boy aboard were saved by the lifeline thrown to them from the dockgateman. The Macedonia from Liverpool to Alexandria also came into port with damaged sails. A captain of a schooner passed away when his schooner was driven onto one of the banks outside the Mersey. In the city the streets were littered with slates, bricks and chimney pots and substantial damage was incurred by a few shops. Elsewhere a vessel was wrecked at St. Bees, Cumbria and in Carnarvon the a severely disabled vessel from Prussia was stranded on the sand bar. A vessel sustained substantial damage at Fleetwood. In Milford a vessel sunk and was washed ashore near Hubberston Pill, whilst another vessel from Bombay put in with damage. An oceangoing vessel from Whampoa, Singapore put into Plymouth having encountered a heavy gale and tremendous seas in the Celtic Sea. She had sustained considerable damage, 2 men were washed overboard and her captain died of</p>
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1860 27-28	2	United Kingdom	Liverpool Mercury &	29/02/1860, 01/03/1860	36	<p>dysentery. The Fleetwood lifeboat of the RNLI was despatched to attend to a schooner shipwrecked on the Fleetwood coast, however the rescue was hampered by the huge sea and strong tides flowing at 5-6 mph. Although one man got aboard the lifeboat two injured individuals did not have the strength to pull themselves into the lifeboat and a huge wave then engulfed the wrecked vessel, claiming the two lives. The lifeboat was once more in action the following morning as a vessel was observed on the Shell Wharf Flats, six miles west of Fleetwood and were successful in rescuing the shipwrecked mariners from the mast. The crew were said to be rewarded by the RNLI. Two other vessels also sank but the crews saved themselves. In Barmouth a large ship was on shore on the west end of St. Patrick's Causeway and the Pwllheli lifeboat attended to her. Another vessel was wrecked near Clay Head on the Isle of Man and only one man survived as the captain and another crew member were thrown into the sea by the violence of the waves and drowned. The survivor was "much bruised and in a very exhausted state" and made his way to the nearest farmhouse where "he was very kindly treated, being supplied with dry clothers and good nourishment" and recovered from his minor injuries. In the Isle of Man more than 180m of shed roof was torn off the gable of a house on the Woodbourne estate. A smack also sustained much damage when she was blown ashore off Douglas harbour whilst a schooner ashore recieved little damage. A very heavy gale visited the British Isles with very strong winds from the north-west causing destruction and loss of</p>
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Bristol &
Mercury 03/03/1860

life. Storm surge conditions were observed in Liverpool "as the tide rose the sea was lashed into fury by the violence over the landing stages and the river walls". It became impossible to land at even the largest stages and several vessels had to be brought by steam tugs after slipping anchor. The most serious damage to business occurred due to the disruption of telegraph communication as lines were broken and poles blown down thus preventing news from parliament in London reaching Dublin, Glasgow and Edinburgh. At Glasgow a chimney fell through the roof of a dwelling burring a man and a boy in the ruins who sustained serious injuries. The gale also caused all sea traffic from Greenock to stop whilst trees and fences were blown down over wide areas. Several buildings were struck by lightening. The westerly winds were the strongest experienced for many years as the maximum gust strength recorded by Lloyds was 30lbs to foot which was higher than recorded during the Royal Charter storm. The most casualty of the storm was that of the ship Nimrod who was driven ashore near St, David's Head on the coast of Pembrokeshire and all onboard perished. Due to the position of the vessel and high seas those ashore could only look on as they heard the "heart rendering" cries of the unfortunate victims of the shipwreck which included soldiers, women and children. The vessel was a 600 ton vessel built in 1853 and had £50,000 (£6,125,000) worth of valuables on board. Issues arise as it emerged the steamer of Paris had communicated with the Nimrod in the Irish Sea but had not offered any assistance. It emerged that the Nimrod's

1860 26-28	5	United Kingdom	Liverpool Mercury	29/05/1860 & 30/05/1860	<p>commandered had offered £100 for the performance of assistance but due to the violence of the gale the captain of the City of Paris had "declined to make any agreement, preferring to bring a large salvage claim against the owners". The correspondent did noted "we hope for the honour of humanity that it will be clearly established, upon further inquiry, that the fatal disaster which ensued is not to be attributed to either parsimony on the one hand or base extortion on the other". It was noted it was curious how the City of Paris had not recieved any passengers although the Nimrod had been making good progress after their encounter. An extract from the Cork Herald stated that many of the crew aboard had been native to Cork and "this melancholy event leaves many a dwelling desolate, and many aged mothers, bereaved widows, and helpless orphans to lament its dreadful results". An official inquiry was to be held by the Board of Trade under the Merchant Shipping Act and the Cork Steam Navigation Company had arrived at the scene of the wreck in an attempt to retrieve the dead and salvage what was left of the ship was was valued at £17,000 (£2,000,000). Captain Lyall, the commander of the Nimrod was well known in Liverpool and throughout NW Europe as one of the ablest seasman and was highly experienced in the trade</p> <p>A great storm from the NNE hit the United Kingdom doing considerable damage to the shipping in Liverpool Bay. Heavy rain and hail was accompanied by violent gusts reaching 59 miles per hour at the observatory. Several vessels broke free and sustained considerable damage as</p>
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1861 9 to 10	2	Irish Sea	Liverpool Mercury	11/02/1861, 12/02/1861 & 13/02/1861	<p>they collided with the landing stages and other vessels although no lives were lost in Liverpool. Several large vessels also ran into the dock wall by the observatory sustaining moderate to minor damage. Two of the Mersey ferries broke lose from their mooring and sustained damage and a bridge in Tranmere was damage when a vessel undergoing repairs broke free and ran into it. In the exposed areas of Liverpool houses sustained considerable damage as "chimney pots strewed th streets, gates were blown down" although no one was injured. In more rural areas large trees were torn out of the ground and blown down. It was said that despite the fact the Fruit trees in this neighbourhood gave eivdence of a most luxuriant crop" on both the Lancashire and Cheshire side of the Mersey the "trees have suffered severely, and that the yield of fruit is likely to be seriously affected by the hurricane". At Plymouth the westerly wind did damage to a screw steam-frigate which parted chain and collided with a passenger ship. An account from the Glasgow Herald told of the near capsize of a vessel from Glasgow to Hunter's troon. Although all escaaed unscathed the correspondent remarked "This show the danager of sailboats even in professional hands, and it is a good time to warn our adventurous young Glasgoweians". HMS Harpy a lug boat capsized in the Clyde and two of the crew were lost.</p> <p>29 A tremendous gale visited the British coasts causing substanital damage and desruption as "no fewer than 135 losssees were reported at Lloyd's which has never been equalled" and it was thought losses were yet greater as</p>
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the total did not encompass the large number of small craft which had been lost. Although the casualties the gale from the north-east, which was noted as being unusual in Liverpool did cause disruption in the town and port although the damage was slight as the port "enjoyed a comparative immunity from the destructive element". Nevertheless a force of wind of 20 lbs to the square foot was experienced which was reported to be "a pressure from the north-east scarcely ever experienced at this port" although this paled in comparison to the 35 lbs per square foot exerted in a north-westerly direction. It was reported the meteorological department of the Board of Trade had issued a telegram to all seaports in the kingdom warning of the "severe gale that might be expected" beforehand and this served to reduce casualties. Nevertheless several casualties occurred outside the Mersey although none were fatal in nature. Off the east coast of Ireland the storm "raged most furiously" and 10 vessels were wrecked off Kingstown with 15 lives been lost in one instance where 14 men were swept off a pier by a large storm surge wave whilst trying to render assistance to a vessel in distress. Several Irish Sea vessels returned to Kingstown and Dublin in a state of near ruin and many more at anchor were destroyed against the quay walls. In Dublin snow, sleet and rain accompanied a rapid drop in temperature doing great damage to buildings and vegetation but fortunately no lives were lost ashore. An iron ship from Glasgow to Calcutta went ashore in Stranford lough and was in a "very dangerous position" but all crew were saved. Off Wicklow a wreck was

reported and those aboard were saved were gallant boatmen from the shore as a anxious crowd bearing "death-stricken faces" looked on. After many attempts and the courageous efforts of one man named Lacy all 5 were brought ashore in an exhausted state "through the interpositoin of an ever-rulling Providence". Two other vessels were destroyed on the coast and attended with loss of life although the crew of a fishing vessel which was also destroyed was providentially saved". The losses at Howth were also reported to be numerous with several vessels being wrecked with the loss of nine lives. At Skerries a ship, the Elizabeth of Drogheda was sunk with all on board, although the crews of two more wrecked vessels were rescued by lifeboat. All hands were also lost on a vessel which went ashore on Briggs Rocks. The Penmon lifeboat near Beaumaris was also deployed to heed the assistance of the a vessel on a sand bank outside Beaumaris and the 13 men in the rigging were saved. It was stated "any other boat than a lifeboat owuld have been swamped on the ocassion, as five succesive seas nearly filled her, but she immediately emptied herself of them". At Rhyl the lifeboat was also deployed and five men onboard a shipwrecked schooner were rescued. Following the event Admiral Fitzroy wrote in The Times to state that all major ports had been warned but this message had not been communicated far and wide. The specific warning message read "Caution: Gale threatening form south-west and then northward. Show signal drum". A detailed explanation of how to interpret the simple storm drum and cones were then given and it was stated

1861	18 to 20	2	Western Britain	Liverpool Mercury & Western Times	26/02/1861 & 02/03/1861	9	<p>such signals would be shown in an easily-viewable elevated position and "in consequence of a telegram from London". It was stated "these cautionary of warning signals advert to winds during part of the next following two or three days; and therefore due vigilance should prevail from the beginning of such time until the weather is again thoroughly settled". Other "organisations were stated to allow the relaying of such signals once the "coastguard had prepared arangements for repeating these signals along the coast to certain distances". The locaiton were it was shown was instructed to be "a conspicuous place ... near the telegraph station". A simple explanation of what barometric change to expect during northernly and southerly gales was given before Fitzroy concluded "the influence of either is shown by instruments some hours, if not days, before actual alteration is visible to ordinary notice".</p> <p>A gale transformed into a perfect hurricane doing much damage throughout western and southern Britain. In Liverpool strong gales from the west and south-west were felt with certain gusts exerting a pressue of 23 lbs per sq foot. Many vessels also dragged anchor in the river and docks doing damage to the South landing stage and sustaining moderate injuries themselves although none were sunk. A Captain who had been at sea for 30 years said he had never expereinced anything like the weather of the recent. A vessel off Bardsey Island was very much damaged loosing most of her sails and put into Liverpool most damaged. A vessel was driven upon the Batton rocks off Plymouth and 3 more vessels were wrecked. Seven</p>
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perished when a Plymouth vessel laden with coals drove ashore at Penzance including 5 of the crew and two who had gone to the shore to render assistance. A large tree was blown down on a man who sustained "severe if not fatal injuries". A fatal accident also occurred in Falmouth when an ignorant captain and a young boy took to sea in a small vessel which soon capsized and both drowned. Several vessels were also driven ashore and a poor girl was blown to the ground with such violence she died shortly afterwards. At Bristol the storm registered a wind pressure of between 20 lb to 25 lbs on the square foot and the electric wires on the railways were blown down. The damage done in Bristol was reported to be "very considerable" but no loss of life was attained. In Holyhead a vessel was observed dismasted in a heavy gale from the SSW leading to lifeboat deployment. Although the master would not leave his vessel his pleas for a steam tug were answered and the vessel was brought into harbour. The RNLI lifeboat was again deployed to a large anchored outside the Scarweather Sands which was flying a flag of distress. Although the lifeboat's assistance was not required it was later aided into port by a steam tug. Off the Scilly Isles it was reported a ship was lost after it sprang a leak and took on 15 inches of water in an hour and overwhelmed the pumps. The crew of the vessel was saved by a nearby vessel before she was set alight in order to minimise the damage caused by her wreck. The officers lost most of their belongings although the ship and cargo was insured for £20,000 (£2,400,000). Off Milford the mainmast of a ship was blown down and its fall killed the

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Isle of Man

Liverpool
Mercury

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captain and mate. A vessel was abandoned in the Celtic Sea off the Tuskar lights in a sinking state. A Bremen vessel fortunately came to its rescue finding an exhausted crew in the ships lifeboats. The distressed crew spoke "highly of the kindness shown to them by the officers and crew" of the foregin vessel. In St. Leonard's outside of Exeter a huge elem tree fell upon St. Leonard's School huse making "a purty racked of it" and many trees were also blown down in the neighbourhood. Several chimney stacks were also felled in the neighbourhood and the roof of Cullompton church was torn off sustained damage estimated at £60 (£7,200).

A fearful gale from the south-west did much damage to the herring fleet off the Isle of Man. Although many saw the signs of a storm appraoching the low tide meant the majority could not enter the harbour and approximately 300 small fishing vessels and three steam-packets were left exposed in the harbour. According to the correspondents calculation that each vessel was worth about £250 that meant £75,000 (£9,000,000) worth of assests and approximately 2100 men, " a great proportion of whom are married, with large families dependent upon them" were exposed to the gale for a period of time. However even with the rising tide the harbour soon filled up leaving 100 exposed to the storm winds all night. Consequentley many returned having sustained severe damage but fortunately no lives were lost. It was said "providence is certainly kinder to the fisherman than the 'powers that be' for had the wind gone round to the north or north-west the loss of life and property would have

1861	21-24	9	British Isles	Liverpool Mercury	24/09/1861	<p>been fearful to contemplate. As the size of the harbour "which is freely admitted by all to be too small" was stated to be the main cause of the exposure and severe damage sustained by the vessels it was exclaimed that "surely it is high time for the Commissioners of Harbours, or those whom it may concern, to take immediate action in reference to the erection of a breakwater, or harbour of refuge, wherein those hardy, enterprising and weather-beaten sons of the ocean might take refuge when overtaken by the storm and tempest".</p> <p>A violent gale from the WNW struck the British Isles doing great damage although this was primarily concentrated in London. Great anxiety prevailed at Lloyd's as it was "feared the next post will bring a long list of shipping disasters from the north and west coasts". A storm surge was noted in Liverpool as the tide rose "above its usual height, inundating wharves and low lying premises". Dams were currently being "constructed to prevent its recurrence".</p>
1861	21-24	9	British Isles	Liverpool Mercury	28/09/1861	<p>An instruction regarding the storm-warning signals which were issued "by the Marine Department of the Board of Trade through Rear Admiral Fitzroy". It was said they were attracting " a good deal of attention among seafaring people" and were deployed in several locations during the recent September storm to highlight the incoming storm and has resulted in many vessels being kept in safely in port during the storm. The information contained in the report of the storm between the 9-10/02/1861 was repeated although Rear Admiral Robert Fitzroy added "the coast guard may repeat the warning as</p>

<p>1861 2 to 3</p>	<p>11 British Isles Liverpool Mercury</p>	<p>05/11/1861</p> <p>3 far as means allow" and it was explicitly stated that "only the greater and more general disturbances of the atmosphere are to be made known by this method (warning signals) not merely local, or sudden changes, however violent or dangerous, which are not felt at a certain distance and do not therefore affect other localities". Instead such changes were said to be "indicated to observers at these places by their own instruments, by signs of the weather, and by consideration of the weather reports for a few previous days". The observed conditions that could indicate an increase in wind including "much inequality of atmospheric pressure or temperature, great depression or elevation of the barometer, sudden or rapid alternations, great falls of rain or snow" were noted although the spatial scale of variability was stressed. Fitzroy finished by stating "speaking generally, there is far less occasion to give warning of southerly storms by signal than of northerly, because those from the southward are preceded by notable signs in the atmosphere, by a falling barometer, and by a temperature higher than usual at the season" whilst "dangerous storms from the polar quarter (NW to NE) are sometimes sudden, and usually are preceded by a rising barometer, which often misleads unformed persons".</p> <p>Great gales from the east hit the coasts of the British Isles doing great damage throughout. In the Irish Sea "nothing but sleet, rain and strong wind from the North" was experienced by a Kingstown - Holyhead steamer which was considerably delayed and had issued docking at a</p>
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1861	10 to 11	11	Irish Sea, North-West England Wales	Liverpool Mercury	13/11/1861	<p>temporary pier in the high seas and strong winds. The issue the ship had in docking was said to show "how essentially necessary it is for a breakwater to be laid to the north of this pier, as a protection to shipping lying at it, if ever they lie at the north side". On the Fleetwood coast the coastguard identified a vessel stranded on the North wharf of the Wyre Estuary. The chief boatman in charge of coastguard response and the RNLI lifeboat was rapidly deployed in a matter of minutes but the "heavy sea and high tide" made it impossible to manually launch the lifeboat and a steamtug instead had to be called. Unfortunately it took an hour to prepare the steam vessel due to the slow process of coal ignition and by the time the steam tug had towed the lifeboat to the place the vessel was spotted the masts were underwater and none of the crew were in sight. Therefore after a few minutes of searching "the lifeboat was obliged to return with the melancholy news that the poor fellows had been drowned" and it was also said it would have been very hazardous to rescue the crew even if they had been identified on the bank. It was assumed three men were on her and the ven "cast a gloom over the inhabitants of Fleetwood".</p> <p>A gale from the south-west once again caused great mischief in the Irish Sea and on the North-west coasts of England and Wales. A schooner bound to Liverpool from Newport became unmangeable and snak off Rhyl. As the vessel's lifeboat had been washed away long before the crew were forced to suffer in the rigging as the sea broke over them during the "fearfully cold night". It was</p>
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1861	14 - 15	11	United Kingdom	Liverpool Mercury	16/11/1861		<p>exclaimed that the crew had clung on to the rigging "with the utmost determination and 'love of life' as one of the poor fellos not inappropriately termed it". Fortunately they were saved in the early hours of the 11th by the Port of Ayr lifeboat which wuickly rescued the distressed. A vessel from Alexandria was at first rescued by a steam tug having gone adrift in a distressed state in Liverpool Bay, however when the hawser broke off Lytham her captain refused to be towed once more. The next day she was nowhere to be seen and presumed wrecked. A birg was totally wrecked on Barnard's Wharf and another sank on the North Wharf but both crews were saved. The report was followed with a storm warning that read "Expected Gale. The following telegram was recieved at this port yesterday from Admiral Fitzroy:- "Hoist cone, point up." Probable gale from the northward.</p> <p>The fearful gale which had previous been predicted was felt across the country and the anemometer at lloyd's highlighted it exceeded the violence of the previous gale whilst the "meterological department of the Board of Trade showed that the range of the gale extended from Portsmouth to Aberdeen". The storm swept the northern parts of the UK and NW Europe but the NE winds meant that all losses were primarily confined to the east coast.</p>
1862	16 - 19	1	Irish Sea and South-West Britain	Liverpool Mercury	22/01/1862	12	<p>Strong gales from the east resulted in considerable destruction and loss around the Irish and English Irish Sea coasts and on the Cornish peninsula. A vesel was wrecked off Lytham during the gale of wind which unusually coincided with thick fog and left the vessel in their lifeboat only to be subsequently picked up by the Lytham lifeboat</p>

who's crew helped them recover their vessel as the tide rose. A detailed account of all the vessels and crews the Lytham lifeboat had saved over "the past few years" was given perhaps as a means to heighten public awareness of their endeavours. In Dundalk a schooner was driven onto the bar by the SE gale and the RNLI lifeboat was immediately launched and proceeded to the vessel before the crew jumped onboard and got her off the bank before she was piloted safely into port. It was said "in the absence of the valable services of the National Institution's lifeboat, the probability is that by the next morning a fearful scene would have been witnessed on these dangerous banks". In tyrella a small vessel was observed onshore in Dundrum bay and it emerged 3 of her 4 crew had been washed overboard and drowned. The only survivor was the captain who was found lashed to the mast who was rescued by the Tyrella lifeboat of the National Lifeboat Institution. The liefboat was stated to have "behaved admirably" whilst another unadapted "four-oared shoreboat" had attempted to reach the vessel and been capsized only to be fortunately rescued by a vessel belonging to the Marquis of Downshire. Off Youghal a vessel was competely wrecked at Cloycastle although the coastguard did manage to save 4 of the 7 men aboard whilst the other unfortuantely drowned. In the Plymouth Sound strong NE winds and violent squalls caused a small sailing vessel ferrying Royal Marines and Naval sailors form their vessel to the shore to capsize on the west of Drake's Island. As result six of the eleven men

1862	24-25	1	Irish Sea and Western Britain	Liverpool Mercury	28/01/1862	38	drowned in the "deadly cold" waters despite the quick deployment of a lifeboat from a nearby vessel. Very strong westerly gales once more caused carnage and devastation in the Irish Sea. Correspondence from Dublin told of fact major navigational buoys had set adrift whilst the Connyveg liightship had also been driven from it's moorings. Shipping agents in Kingstown were highly anxious due to the disappearance of a large vessel and a powerful steamtug, neither of which had not been heard of for 3 days. A captain of another vessel who had been fifty years at sea stated "it was one of the hardets gales that he ever was in" and believed he had potentially spotted the missing vessel in question. Two ocean-going vessels put into Waterford having been suffered damage by storm and six vessels had been lost off southern Ireland with all lives being lost on three on those vessels. A steamer was also wrecked at Rhoscolyn near Holyhead and all fourteen hands aboard were lost. Off Galway the brigantine Charles Souchay put in with substantail damage. Another vessel was wrecked in Cardigan Bay which had previously been spotted flying signals of distress. As a result the RNLI instantly deployed a twelve man lifeboat but by the time they got to the scene they found seven out of the eight crew had taken to their own lifeboat which had immediately capsized and drowned them all. The one man who remained onboard was safely brought to shore by the RNLI. In a letter from Milford Haven it was stated that many fatal casualties had occurred on the coast and around six hundred vessels had flocked to the haven to escape the storm. However "three
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unfortunate vessels, however, in striving to reach it sank in the very sight of the haven, and no human aid could be given to them. The sea ran mountains high, and overwhelmed them in a moment". A later report from a brig, The Angelo, at Kingstown who witnessed several vessels who had been accompanying her in her voyage founder off Land's End and in the Bristol Channel. The scene was described as "most heartrending, and their shrieks for help, we understand, were heard amid the tempest" although the conditions meant there was no possibility of saving any of their crews. She also witnessed an Austrian barque being wrecked on the Cornish coast upon which all perished except a small child making her witness to five wrecks with near total loss of all crews since her journey from Falmouth. The vessel was fortunate to make Milford on the flood tide as the sea became much heavier on the ebb due to the westerly winds and as a consequence many of the vessels which failed to make Milford Haven before the ebb were lost at sea. The Angelo reported "many vessels were cutting away their masts in the harbour and foundering" along with several narrow escapes and sightings of drifting wrecked vessels who were presumed to have gone down "bodily with all onboard". A pilot onboard who had been at sea for 40 years stated "he had not encountered a more severe gale" and that the vessel was the "best seaboat he was ever on board of" before implying he would otherwise have drowned on another vessel of different design. A review of the loss of the steamer off Dalkey Island in the previous storm between the 24-25th

1862		2	Liverpool Mercury	14/02/1862	<p>Jan 1862 concluded that the steamer "was lost by great neglect and by the default of her master" as "all the neighbouring lights are deposed to have been visible" although the master had already lost his certificate of service in the wreck.</p> <p>An expanded more detailed explanation of storm-warning signals including a guide for interpretation night signals. Succinct diagrams of the 5 major visual storm signals including cones and drums were firstly provided and a caption given to each. The night singals to replicate the five warnings in the absence of light would be "three or four lights of a uniform colour are arranged in triangle or square. It was further stated that on recieving a telegram from London the appropriate signal would be shown "till dusk of that day only, unless otherwise specially directed". It was stressed that the signals were primarily "cautionary signals avert to winds during some part of the next nights and two or three days; therefore due vigilance should prevail until the weather is again settled, without deferring departures or any operations unnecessarily". It was emphasised that "further notice could be given by local interests and authorities as London can only warn principal outports" before a disclaimer that the warnings only related to the "greater atmospheric disturbances" and not localised storms was issued. Two succint related tables of the changes in barometric pressure and temperature and their respective relation to impending southern and northerly winds was also given.</p>
1862	31	7	Liverpool Mercury	01/08/1862	<p>An account of a meeting of the RNLI chaired by Sir Edward Perrott, Baronet and vice president in which financial</p>

awards to the crews of various lifeboats from around the British Isles were announced. A reward of £6 10 shillings (£860) was bestowed upon the crew of the Fleetwood lifeboat for "assiting, in conjunction with a steam-tug, to save a sloop". It was also noted "this valuable lifeboat had previously been instrumental, under the most perilous circumstances, in saving twenty-seven shipwrecked persons". A reward of £12 (£1500) was granted to the Penmon lifeboat in Anglesey for assisting a disabled smack and taking her in tow into Llandudno Bay. Other actions of this lifeboat were also commended. The committee also voted that £6 10 shillings be donated to the crew of the RNLI lifeboat at Soutport for their attempts to rescue a brig off South Shields despite the fact it had been wrecked and it's crew had already been removed from the vessel although the crew were taken to Lytham by the lifeboat. The Arklow lifeboat also recieved the same award for heeding the calls of a distressed ship off a sand bank although it had already been rescued by a steam-tug when it got half way. The Arklow crew were also awarded £9 (£1100) "in appreciation of their gallant conduct in putting off in a salmon coble, during a gale of wind, and rescuing at great risk of life the crew of four men of the schooner Thankful, of Sunderland, which was totally wrecked" as they had showed great humanity and courage in their endeavours to save the crew. It was subsequenetely reported that the design plans of two lifeboats had been forwarded to Portugal to the Amiral Sir George Sartotius on behalf of the Portuguese government. The RNLI had lifeboat s ready to send to five

1862	18-24	10	British Isles	Liverpool Mercury & Bristol Mercury	21- 25/10/1862	<p data-bbox="1332 199 2123 853">ports on the east coast fo Ireland and "Lord Calthorpe had sent to the society £100 (£12,250) in aid of the cost of the Blakeney lifeboat house, and Miss Brightwell had paid the cost of the boat". A marine insurance company from Abo in Finland had sent the institution £50 (£6100) "in appreciation of the important services its liefebots were often rendering to shipwrecked crews of all nations". amodel of the self-righting lifeboat of the society was presented to the president of the instituion the Duke of Northumberland "as a permanent memoral of the important services rendered to the cause of humanity by his grace, to whose enlightened and liberal philanthropy is to be ascribed the origin of the self-rgihting lifeboat now succesfully used on the coasts of the United Kingdom, and on those of many other parts of the world". Following the awarding and donation of over £1000 (£125,000) the proceedings came to a close.</p> <p data-bbox="1332 861 2123 1369">36 Severe gales ravaged the British Isles causing a tremendous number of casualties and damage both at sea and on land. There was a large shift to the west before the gales set in with the "wind blowing in sudden and fitful gusts" with the wind pressure reachign 20 - 27 lbs to the square foot and average wind speed was 55 miles per hour whilst the barometric pressure was 28.60 inches making it the heaviest gale since the Royal Charter gale of October 26 1859. A collision between two ships on the Mersey ocurred near Southport when a vessel was washed upon Horse Bank. Although the Southport lifeboat named the Jessie Knwles and the Lytham lifeboat quickly deployed it was a full three hours until they could reach</p>
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the distressed vessel due to the "tremendous power" of the squall. The lifeboats successful rescue 16 of the 20 onboard but four lives were lost with two being washed overboard and two others perished trying to escape in the vessel's lifeboat small boat after a steamer had been forced to leave the vessel due to the roughness of the weather. It was said "All praise was due to the crew of the two lifeboats for the noble manner in which they worked" and the vessel was completely wrecked. Two large transatlantic ships broke from their anchors with one having to be towed off the shore, whilst the Prince of Wales steamer sighted a sunken vessel near the Crosby lightship. It was remarked "were it not that the tides were low, the shipping in the river and docks must have suffered much" on the 21st in Liverpool. Ashore slates and chimneys fell widely throughout Liverpool and on the Wirral side of the Mersey. In Falmouth the sea was remarked to have "rose to a greater height than has been known for many years and swept entirely over the lower portions of the quay". The storm surge conditions were described as "the water appeared to come in as if from the rush of large river, accompanied with a great deal of foam and ebullition, as if a very large shoal of fish had been bobbing up in the water". At Gunwalloe, Cornwall a vessel was embayed and driven ashore but all crew disembarked without injury. "A most melancholy accident incurred in Falmouth harbour, by which two young men lost their lives aboard a freshwater supply vessel which was overwhelmed by a heavy sea and the two sons of the vessel owners sank before they could be reached by a

nearby coastal punt. A naval vessel saw spotted a sinking vessel with two men in the water but were only able to rescue one before the other sank. He whole sunk was treated by the ship's surgeon and reported to be "in a very weak and almost insensible state". On the 22nd it was reported that a Liverpool ship, the Bencoolen, bound for Bombay had foundered off Bude with the lost only 28 of the 33 man strong crew although the vessel was insured. It was later reported that "much praise is due to Sir T. D. Acland, Bart., and W. Maskell, Esq., for their kindness to survivors, who reached the shore on spars" a portion of the cargo was also washed up. An inquiry was later held into the loss of the Bencoolen as required by the Merchant Shipping act when the "depositions of the survivors were taken on oath". According to the survivors the ship's captain lost his sense of orientation causing him to mistake Bude for Milford and the mate had been lost after being washed off trying to secure lifesaving apparatus fired from the shore to the vessel although the vessel had been broken up before the crew could clamber across the lines to shore. The lifeboat had not been able to approach the vessel due to the sea. The captain was ascertained to be drunk at the time of the incident and at many other times during the voyage whilst another witness stated that the vessel had been sinking and the rigging had not been set up properly before the voyage. The information was later forwarded to the Marine Department of the Board of Trade. An independent eye-witness wrote that surely some public inquiry should be held into the matter as "if two or three lives are lost by

accident on a railway, a Government official proceeds to inquire into the cause of the accident, while in the case of this shipwreck a valuable vessel has been lost and 30 lives sacrificed almost unnoticed". He also stated the lifeboat was "manned with a very inefficient crew, who hardly made any attempt to reach the vessel" and "it is almost certain that all these lives would have been saved had Government allowed a greater number of rocket-lines, so as to admit of the rockets being fired in quick succession, or had there been a sufficient number of Coastguard men at the station to form the nucleus of an effective lifeboat crew". Distressed flares were fired by the Formby light boat although the lifeboat boat tugs and steamers could not find the distressed vessel. A schooner was also lost off the Scilly Isles but fortunately all crew were saved whilst a collision was reported in the Penarth Roads. A vessel named the Black Eagles also foundered off the Calf of Man and all perished except the captain and the master as the crew took to a small vessel which subsequently capsized, although the masters was retrieved from the vessel by a schooner. It was emphatically stated "Seldom has it been our lot to furnish a larger list of casualties at sea than have been caused by the late gales. When the reports have all been received they will exhibit an enormous loss of shipping". Indeed the Bristol Mercury reported that "upwards of 100 wrecks and casualties were posted on the loss-book at Lloyd's" and "scarcely any portion of the coast seems to have escaped the fury of the storm". On the 27th the Mercury publish that 182

1862		12		Bristol Mercury	06/12/1862		wrecks had been officially reported over the week so the total number of wrecks for the years equalled 1461. A jovial poem concerned with life at sea which portrays the storm in an emphatic manner without conjuring a sense of fear. The poem conveys a sense of resilience to the storm as the vessel sails "o'er the billows' crest of foam. O'er the ocean's pathless wilds we'll roam; And a jovial time we'll keep". Although the fury of the storm is portrayed "The lightnings flash, the thunders crash, The rugged old rocks the wild waves lash; And the deep is raging now" the sense of resolution is maintained as "never a thought of dread" is entertained and the storm song continues until "all the great earth rejoice".
1862	18-21	12	Western Britain	Liverpool Mercury	22- 25/12/1862	6	A heavy gale from the west lasting nearly four days in length struck the western coast with gusts exerting a pressure of greater than 28 lbs to the square foot at the Liverpool Observatory. Despite this severity it was noted that on the whole very few casualties had occurred amongst the seamen although many vessels had issues approaching Liverpool and one hand was washed overboard as a large vessel was hit by a large waves which also injured the officers onboard. A large American ship was also driven from her anchors against a quay wall and was only retrieved by several powerful steamtugs in the vicinity. Another vessel was also run aground on Pluckington bank by the high winds but was pulled off with the assistance of steam tugs. Throughout the west of Britain telegraph wires were blown down, trains delayed and buildings in construction were demolished. A Portuguese Brigantine sank off Holyhead and the account

1863	18-21	1	British Isles	Liverpool Mercury	21- 28/01/1863	22	<p>of the only survivor of the four-strong crew gave a first hand account of the destruction of the vessel and his battle to survive stating "I found my feet and legs benumbed and would not bear me" before he covered himself in sand to survive and was then treated with great hospitality by a local gamekeeper. A screw steamer which was previously feared for sent a telegram to the Underwriters' room from Merville stating that "the wind increased to a gale and shifted to NW about midnight; it continued to blow until this morning at daylight, with very heavy squalls" and hence the steamer had reduced its speed to 3 mph hence the significant delay and concern of its whereabouts. Likewise the steamer Heron from Liverpool to the Clyde was reported having put into Belfast short of coals. In Porthcawl the strong NW gales forced a vessel eastward of the dangerous Scarweather Sands and she was sighted on the morning of the 20th with her "mainmast gone and signals of distress flying". The RNLI's Porthcawl lifeboat was rapidly launched "through a heavy surf and despatched to the rescue, and nobly did she and her crew behave, returning in the course of two hours with the whole crew, consisting of captain and eight men, with one passenger". However another brigantine was not so fortunate as she instantly was "swallowed up on those fatal sands with all her crew". It was noted that the cost of the Porthcawl lifeboat was presented to the RNLI by a lady (M.A.C.S).</p> <p>One of the most fearful gales ever witnessed hit the west coast of Britain resulting in tremendous destruction. In Liverpool it was said that the gale was "more severe and</p>
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of longer duration than any that have preceded it". The gales originally began from the WSW and a wind speed pressure of 30 lbs per sq foot was noted before ashift to the WNW. This created a scene on the Mersey of "a most exciting description" as the tide "rolled up" both banks of the Mersey with tremendous force. The high tide time was 11.48 am and although the almanack predicted it would reach 19 feet 2 inches "in consequences of the gale it rose to the eheight of 23 feet, filling with water many of the cellars and underground stores near the docks, and doing considerable damage". The storm surge washed over the pierheads "with terrific grandeur" and several smaller vessels were washed with owners having considerable difficulty in preventing them being considerable damage as was the case in one or two instances. Travel across the river was much impeded but the Woodside steamers still ran due to the "pressure of the passengers" and much difficulty was experienced around highwater when attempting to land the vessels. Many a passenger was drenched on getting to shore. Some hailed cabs onto the landing stages through the floodwater whilst others "whenever a wave receded, made a gallant dash towards the shore, apparently determined not to be detained by the fear of getting their feet or clothes wet". It was said in spite of police advice many still attempted to cross between the land and stage through the floodwaters with many being knocked over to the "great merriment" of the crowd. The storm surge eroded many of the coping stones near George's Pierhead and the surrounding baths whilst a portion of the

earthwork was washed away. The Morpeth lock was also breached but little damage was done. A fatality occurred near Seacombe when a "labouring man" was blown into the Mersey by a strong gust of wind and immediately drowned his body not being recovered whilst another died when he washed overboard off a screw steamer. At Seacombe the force of the storm surge destroyed 200 feet of the old river wall and the landing stage at New Brighton was also substantially damaged. Goods in the quays and on the piers of Liverpool were also damaged whilst the tide penetrated cellars and the lower floors of warehouses doing considerable damage. Many vessels in the port were windbound whilst a large vessel was noted aground on Burbo bank which prompted the dispatch of a powerful steam tug which rescued all thirty onboard. All rescued expressed their gratitude toward their rescuers aboard the steam tug whilst the lifeboats also performed gallant services. The crew of a vessel wrecked ashore at Holyhead were saved and it was thought a large proportion of the cargo could be recovered. The storm surge was so high and the force of the wind and waves was so great on the Dee that the doors of the lifeboat house in Hilbre Island were burst open and the lifeboat was washed out to Holylake. The embankment at Leasowe was also overcome and destroyed in many places by the storm surge and the lower land in the neighbourhood was widely submerged as a consequence. A gentleman also had a narrow escape at Limesteet station as the wind blew through glass pane and he narrowly avoided the falling fragments. Much interest was

aroused in the exchange newsroom when a telegram was received that announced a "Sir Edward Cust and family are adrift on the Bell Buoy. Sir Edward has hoisted the white feather as a signal of distress. The Point of Ayr lifeboat has gone to their assistance". In Southport the neighbourhood was reported to have suffered greatly from the gale as a "perfect hurricane has raged". As a result of the strong WNW winds of the 19-20 the winds had "forced the tide at high water to a greater height than it has been known to attain for more than 20 years". As a result of the power of the storm surge the sea slope facing the promenade had been torn up, the sea fence had been blown down in places and great damage was done to sea front buildings. A rifle range store and facilities was considerably damaged and the lifeboat house doors were also severely injured. In Blackpool it was reported that "such a storm has not been experienced for years" and the new pier had been destroyed and collapsed into the sea below. Likewise the river Ribble was observed to overflow its banks for miles with agricultural land being widely inundated as many individuals narrowly escaped with their lives. Preston itself was flooded as low-lying ground floor properties were filled with three to four feet of water, whilst water in a throughfare was observed to be nearly five feet deep so that neither carriages or pedestrians could pass. The wind also did considerable damage to property as slates and chimney stacks fell. In Portcrawl a Captain Buchan wrote of a sad wreck of a vessel near Tuskar rock in the dead of night. With all possible haste the RNLI lifeboat deployed in the dead of

night and with difficulty identified a burning tar barrel to signal its state of distress. However as the lifeboat approached the vessel by realising from an anchored position to windward the distressed vessel was witnessed to have sunk with no signs of the crew. Although the lifeboat "shipped several very heavy seas ... she behaved nobly, giving every confidence to the crew, to whom great praise is due for risking their lives in the attempt to succour their fellow creatures". It was noted in the "Magnetic Telegraph" section that "Admiral Fitzroy warned the various outports of approaching dangerous winds on Saturday, again on Sunday, and also on Monday". Laster news from the Mersey published on the 22nd spoke of the death of two men who had been part of a crew of a gig which had been overwhelmed in the storm. Fortunately for the survivors another vessel was close by at the time and made haste to the rescue of two of the distressed men although the other two sunk before assistance could be rendered. Two drowned when a US steamer was wrecked on Jordan Bank. A barque also went ashore near Lytham but the crew saved themselves in their own lifeboat. The actions of a new steamer built by "Messrs. Laird, of Birkenhead" which was reported to have not only outpaced all other steamers set on rescuing a transatlantic ship, but to have also towed the ship into the safety of port with comparative ease. The "immense embankment at Leasowe" was reported to have been damaged to a greater or lesser extent right along its 3000 yard length and 100 feet thickness. As a result the dock engineer dispatched 400-500 labourers to repair the

damage but the continuing gale prevented such repairs being undertaken for a day. However the repairs were swiftly repaired the day after and the flooding land drained into a culvert in Birkenhead. Overall it was estimated £1000 had been done to the three ferry stages on the Wirral and many of the houses on the Wallasey shore were flooded. In the outskirts of Liverpool slates and chimneys fell from roofs but no damage of a "very serious character" occurred although sea fences and low lying land was damaged. From the 09:00 on the 19th to 12:00 on the 20th the Observatory registered winds of 50 mph. Although greater windspeeds had been recorded during the gales of 1852 and 1854 "such a velocity has seldom if ever been maintained for so long a time period". The anemometer recorded a pressure of 36 lbs per square foot and the highest wind velocity recorded was 50 mph. This was compared to the Royal Charter Storm of October 1859 when the maximum velocity was 57 mph and maximum pressure 28 lbs. A storm surge was noted on the Dee as the low-lying towns of Flint, Abergele and Bagillt on the Welsh side of the River were broken up and the sections of the railway line eroded away causing traffic to stop for several hours. Further news from the Ribble estuary spoke of widespread inundation of the lowlands in the neighbourhoods of Crossens and Banks and it was said that "farmers will be great sufferers from the loss of potatoes and other produce". A large three-masted ship was sighted drifting toward Lytham although the crew were saved by the local lifeboat. The Lytham lifeboat was so badly damaged by the storm it could no longer exhibit

it's light. The Southport lifeboat the Jessie Knowles "fought bravely through the tremendously heavy sea" to find a deserted vessel without a crew who had departed on their own lifeboats although nothing was known of them and she was expected to become a total wreck. At Chester "The River Dee has risen with astonishing rapidity, in consequence of the severe gales and heavy fall of rain which have recently visited the city". As a result the low lying neighbourhoods were completely flooded and streets were rendered completely impassable as the race course and surrounding meadows was completely flooded. It was stated the "flood has not been equalled in Chester for many years". In the vicinity of Barnstale the flood produced by the storm surge flooded the low roads and marshes as the River Taw burst it's banks flooding houses to a knee-depth. It was reported that was "18 years since such a storm was known to have occurred here". In Dublin and Kingstown the inbound Irish Sea ferries reported mountainous seas and gale force winds and several vessels sank in the harbour. A transatlantic vessel was reported to have foundered off Queenstown and the only survivor was the Captain. Four poor migrant passengers died onboard a ferry from Sligo to Liverpool which had to put into Belfast. Great anguish prevailed when two children were killed when they were thrown from their parents arms by a large wave sweeping the deck and tossed into the forecandle. The helmsman also broke his legs when the bridgehouse fell and two women were missing, presumed washed overboard. In Bristol the Bristol Mercury reported that those travelling the roads in

the neighbourhood found travel near impossible. In Bedminster several tannary buildings were damaged by falling chimney stacks. The roof of an Inn was also blown off and several other commercial properties recieved considerable damage. The tide was observed to rise to a height "six feet higher than the height indicated in Bunt;s Tide-tabel, and higher than the highest tide known for the last seventeen years" causing the Rivers Avon, Pill and Cumberland to overflow their banks and cinundate considerable areas. As a result several houses hundreds of yards from the river had their cellars flooded to a depth of two to three feet. St. Philip's marsh on the Avon and the surrounding agricultural land was inundated to a "very great depth" but livestock losses were low as the larbourers acted quickly in response to the flood although one labourer wsa reported to have had a fit in the process and had to be rescued himself. The owner of a Rope producing firm reported that his works was flooded to a height of five feet and "everything in the warhouses and workshops, besides workmen's tools, was completely damaged". He also entertained fears that the foundations would give way. At Portishead substantial damage was sustained at a coastal property next to the Baths as a great portion of the building was blown down by the violence of the wind. A considerable portion of the sea wall at Clevedon was also "swept away by the force of the extraordinary high tide, the pressure of which was much increased by the terrific wind which prevailed". At Pill, near the mouth of the Avon the gale from the SW was attributed to be the cause of the "extraordinary rise of the

tide, in fact, only some ten inches less than the great overflow of the year 1858". As a result St. Geroge's Warth and Portbury Marsh was entirely inundated whilst the road from Pill to Bristol was obstructed by large pieces of timber floating across the carriageway. At Newport a shift in the wind to the ENE in the locality was noted to have "opposed the high spring of Wednesday morning, than increased it; though it was sufficiently high to cover the marshes and fields adjacent to the river" although damage was still sustained by sugar held in shoreside warehouses. In Cardiff the storm surge was such the locks of the outer gates of the dock gave way and a shipbuilding yard was inundated leading to substantial damage whilst a large vessel was carried away during the night. Part of the sea bank erected by the trustees of Lord Bute near the river Taff was eroded away and water inundated a park whilst livestock belonging to the poor were carried away and drowned by the tide. The Taff also flooded and substantially damaged a considerable wall under construction. The Cardiff Gas Company was also under water and the Penarth road was rendered impassable. A flock of 86 sheep were also drowned along with several more on the moors at S. Mellons. A vessel was also wrecked off St. Athan's although the entire crew and their valuable possessions were also saved thanks to the courageous efforts of the local farmers and labourers who "heroically dragged the 13 men through the roaring breakers" despite the fact the men had originally refused assistance. Later news published on the 26th reported that both the Chester - Holyhead and Conway -Ilandudno

railways were considerably damaged by the storm surge resulting in substantial economic loss and considerable delays to traffic. There was also a detailed report of the loss of the transatlantic vessel Pamela Flood which had been overwhelmed by heavy gales from the NNW to such an extent the crew cut the masts away in order to right the boat. Despite the fact the pumps were working at maximum capacity the vessel was soon overwhelmed and capsized. Only the master survived when he was washed up just south of Caernarfon and he estimated the ship had been worth £5000 (£630,000) and the cargo £6000 (£760,000) and it was noted the ship had been insured to a sum of \$12,000. The men were saved by the local shoreside population who gallantly "rushed into the boiling surf as soon as he thought the man was near enough for them to carry him to the shore" as the men "cheerfully risked their lives for the sake of a fellow creature". It was said "every attention that kindness could suggest was promptly rendered to the sufferer" and that the captain considered his escape "a little short of miraculous". It was said that the majority of the crew had perished when the ship sank although 2 crew and the pilot had persisted by floating on the cargo and wreckage before succumbing to the sea. Regarding the Captain's survival it was exclaimed: "How Captain Anderson retained his strength is a marvel, as he had had nothing to eat since the morning of the 19th. No doubt he owes his preservation in part to his presence of mind, for he took the precaution to maintain some degree of animal heat by exercising his hands and feet, holding on occasionally y

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British Isles

Bristol
Mercury

24/01/1863

one hand, whilst he beat the other, stamping his feet on his limited foothold". The captain has also obtained a quilt which he had used to keep warm and also acted as a sail. The captain spoke "in high terms of the kindness he recieved, for which he has expressed his grateful acknowledgements". Although he was in a delicate state it was reported he was in "judicious medical treatment, slowly recovering". The wreck and cargo was reported washed ashore near Ty Mawr, Clynnog. On the 26th the barometer was noted to continue to fall in Liverpool and the wind remained gale force from the west although little damage was done to shipping in the Liverpool docks. It was later reported that a barque had foundered at Langness Point, Isle of Man on the 23rd with the loss of 7 lives with only one boy aboard being spared. Fears for the London - Liverpool steamship the East Anglian were quelled when she came into dock after a week-long voyage throughout which no news of her safety had been communicated. By the 27th the barometer started to rise once more and the wind speed decreased causing minor inconievnce amongst the shipping. Reports of the impacts at Banks told of "an embankment which the country people call a 'sea cop:' this was washed down, and then the sea began its reckless course". Entire fields of crops had been destroyed, two houses demolished and a great many more rendered uninhabitable. The salt water had also damaged the wheat and fields which were being prepared for the potatoe crop.

A appeal to the Editor and subscribers of the Bristol Mercury from the Honorary Agent for Bristol belonging to

<p>1863 6 to 7 9</p>	<p>Liverpool Mercury 08/09/1863</p>	<p>2 the Shipwrecked Mariners' Society who sought to emphatically capture the readers attention in order to attract donations. The agent exclaimed "We shall hear of some terrible work amongst the shipping... gale succeeds gale, and the howling wind as it sweeps by proclaims its power with a voice of thunder". As a result it was said many shipwrecked seamen would be "cast on our shores, and that many poor fellows will find a watery grave, leaving wives, children, parents in deep distress, is, als! too certain". The agent then issued an earnest appeal "to whose whose hearts are capable of feeling for the sorrows and the anguish of others in behalf of that society whose special work it is ... to provide poor shipwrecked men with food and clothing, and to forward them to their homes free of expense, and also to afford relief to the families. The agent then also disclosed the minutes of the most recent meeting to highlight the society had aided 2918 shipwrecked men and 614 widows and orphans of mariners over the previous 3 months emphasising "that part of the shipwrecked men were foreigners of various nations". Overall £3739 had been paid out at £500 of stock had so far been raised in an attempt to deal with the trauma of the gales of December. The rewards recieved by the gallant lifeboat crews were also disclosed. The agent finished by appealing for any amount of contriutions which could go towards raising funds for the society.</p> <p>A strong storm and heavy showers of rain caused much mischief in the Irish Sea and in the North-west coast of England. The crops of the surrounding neighbourhood</p>
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1863	29 to 2	11	Irish Sea and Wester Britain	Liverpool Mercury	30/10/1863 - 03/11/1863
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were substantially damaged and it was feared farmers would sustain considerable losses. An Isle of Man steamer ran into heavy seas whipped up by the strong westerly winds which did the vessel damage and swept a woman into the water who was presumed drowned although it was seen by no passengers or the crew. The vessel was due to run the next day regardless. At Preston another life was lost when the the strong south-westerly gales dislodged some masonry in a mill which lead to a man been crushed to death by a falling chimney. ANother man was seriously injured having been blown from the roof of a building and widespread damage to roofing was noted. A telegram received on the 28/10 from Admiral Fitzroy was was first sign of an impending gales that "might be expected from different quarters successively". This "prognostication proved to be correct" a strong gale was felt in Liverpool and the departures of many vessels were delayed. In the Isle of Man the wind was initially from the South before it veered to the SW and blew a terrific gale causing vessels to seek shelter behind the Great Orme. True to the prediction two other vessels also reported the wind veering from the SE to WSE and increasing in force. By midnight of the 28th the wind had veered to the WNW and the gale was beginnign to abate as the mercury rose. A windmill was also blown down in Preston when the storm was at it's height as the sails were ripped off and fell upon the mill house crushing the building and the machinery inside. One of the sails also hit a school window in St. ignatius-square although only one school girl was injured and it was remarked that it "is marvellous

that many lives were not lost" when the population density of the district was considered. The torrential rain in the district of Preston also resulted in flooding in the valley of up to 6 feet in certain places. A simple diagram and explanation of the storm drum was repeated at the foot of the article. A valuable transatlantic vessel was also driven ashore in Morecambe Bay but little injured, whilst another was wrecked off Lytham with both crews being saved. A fishing smack foundered with her crew off Lambay near Dublin and a Norwegian barque was driven ashore near the North Bull but would be removed at high tide whilst a woman had her arm broken as she was knocked down by the force of the wind whilst walking in the city. At Dumbarton the scaffolding around a new church under construction was blown down and fell through the roofs of nearby buildings although no one was seriously injured. A later report on the 3/11 stated that the statistical data highlighted how "preeminently severe" the gale had been. The strength of the gale of 19 lbs per sq foot in Liverpool was contrasted with the Royal Charter storm (28 lbs per sq foot), 36 lbs per sq foot in Jan 1863 and 43 lbs in Jan 1853. The predominant direction was confirmed as SW although the wind had shifted to the N on the 2nd which caused a heavy sea in the River Mersey. A Captain's report of the Storm in the Irish Sea during his journey to Liverpool highlighted at the height of the "hurricane" the barometer reached a low of 28.83 in/hg and he had felt compelled to take depth lead readings every 15 minutes such was his fear of running aground. He had also been compelled to give a fishing smack "£10

1863	1 to 4	12	British Isles	Liverpool Mercury & Bristol Mercury	04/12/1863 - 07/12/1863	2	<p>to take a message to Liverpool for assistance" in getting into port.</p> <p>Another telergam warning from the Admiral Fitzroy was received at all ports on the 1st warning of an impending storm was once more proved to be correct as the barometer sudden fell on the 2nd to a pressure of 28.85 before a gale from the WNW developed. During the course of Thursday morning a maximal recorded wind pressure of 48 lb per sq ft was measured at 08.30 and the maximal presure remained above 28 lb per sq ft until 15.30. An employee of the Liverpool observatory remarked that the continuous pressure was remarkable as although 42 lbs of wind pressure had been registers on the 25th December 1852 and 43 lbs had been registered on the 26th of January the pressure was exerted over a matter of only a few hours whilst the gale of the 2nd was continuous for 7 hours. The pressure was also greater than that reigstered during the Royal Charter storm when 28 lbs of pressure and 57 mph of wind was recorded. Therefore, according to the wind pressure readings the "gale of yesterday was the most violent experienced in this town for many years" although the velocity in mph was not recorded as the anemometer had been damaged by the stormwhich had not occurred since the erection of the anemometer in 1850. As a result "the Mersey was converted by the storm into a miniature sea" as spray lashed the quaysides and ceased nearly all traffic in the channel. Although the ferry boats tossed and pitch the new boat was remarked to have "behaved admirably" although two were thrown from her decks and she was</p>
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damaged coming into land creating a feeling of anxiety amongst her passengers. Such was the commotion that "Lieutenant Murray Parks, the marine surveyor of the dock board was present during the afternoon directing the operations of the men" whose actions were commended. Fortunately nearly all vessels remained in port although many in the river and in Liverpool Bay suffered considerable damage when they broke from their anchors and ran ashore. It was said that the rapid transpiring of the storm was a major reason why many flats were sunk as there was not time to move them to a safe location. Two steamers collided when the new steamer the Albanian broke adrift before it grounded on Pluckington Bank. Fortunately she was got off by three steam tugs before high water so she was not destroyed against the sea wall. Another ocean-going vessel drifted onto a landing stage but was thankfully secured. Several more collisions were noted in the river and although no fatalities were reported several vessels were badly damaged as a result, the worst of which being the ship John Bunyan which was run into by an amock screw steamer losing her mast before she ploughed into the dock wall "stoving in her stern and quarter". The tugs were frequently at work saving adrift vessels which had been driven ashore although a French brig did sink when she was driven into the Waterloo Pierhead. A lifeboat was deployed to the Prince's landing stage to rescue a distressed vessel and the 6 female passengers and a child were taken off although the vessel remained aground. The Holylake lifeboat was also deployed to rescue the crew of

a aground schooner and succeeded in the mission. Another schooner was ashore near Rhyl and its crew had not been heard of. A tug also collided with the vessel the Iona, carrying her funnel away and she later ended up ashore near. A Reuter's telegram told of a Liverpool vessel bound from China to London which had been driven ashore at the Scilly Isles along with 6 other vessels although the crew were fortunately saved thanks to the use of the lifesaving rocket apparatus. In the outskirts of Liverpool walls were blown down and slates and chimneys fell from roofs although in certain cases "measures were immediately adopted to protect the public" by fencing off dangerous areas. Although many narrow escapes were had as trees fell onto roads and chimneys crashed through roofs throughout the North-west no fatalities were recorded on shore although a boy was in a critical condition in hospital after fracturing his skull after being blown down by a gust of wind. A man also was blown from a wall and fractured both legs whilst others received more minor impact injuries. The police were also on hand to ensure dislodged fragments and perilous objects were removed where possible. The mercantile community were considerably inconvenienced by the destruction of telegraph wires ceasing communication with London and other trading areas and it was said "business men had a practical lesson of the value of the telegraph". IN Birkenhead it was reported "nearly every street gave evidence of the effects of the gale, slates, bricks and chimney-tops being strewn in every direction". Roofs were stripped off houses as well as on the new glass

Woodside landing stage which was smashed to pieces. In Chester a Catholic Chapel was blown down at an estimate loss of £2000 (£250,000) and a 50 foot long roof of the Roodee Shipyard was completely torn off. At Soutport the hurricane was observed to be of a greater intensity than any noted for many years and was accompanied by rain and hail although most of the damage caused to property was a result of the galeforce winds which blew down chimneys and dislodged slates causing widespread economic losses. The lifeboat was also deployed to rescue two vessels in distress near Trunk Hill bank. The storm surge was noted to have contributed to the flooding in the Ribble which was "forced up the channel with great fury, and in many places it ran inland for a mile or two" near Preston and the surrounding areas. Gales from the W and NW were felt throughout the West of England with the exposed regions of Cornwall being the most affected. Near Saltash the railway line was blocked when a telegraph wire fell across it and at Plymouth squalls accompanied by rain did much damage in the Devonport Dockyard where the roof of a building slip was blown off and vessels drifted from their moorings causing moderate damage. Several casualties were noted in the Falmouth harbour as the sudden gale struck causing one vessel under repairs whilst afloat to sink despite the best efforts of the shipwrights who were nearly washed away as the spray came over the breakwater. Another vessel was thrown upon the rocks by St. Anthony's Lighthouse although all crew were saved whilst a Maltese barque and two other vessels were driven ashore. There were reports of

collisions between drifting boats in the harbour whilst the fall of chimneys and slates in the town was such that "many of the tradesmen were afraid to open their shops through the fearful gales". A gunboat Hind went out to render assistance to a distressed vessel and reported she was beached on the rocks and her rigging had been cut away to prevent further damage. In the Bristol channel two vessels went down, one of which with all hands whilst on the other only one individual was not saved as the majority of the hands escaped in their boat. In Bristol "the storm had been foretold by that noted meteorologist, Admiral Fitzroy, who had caused the drum signal to be hoisted" before a gale from the WNW set in. Chimneys, slabs and slates were torn off roofs and walls and flung by the wind leading to the death of a horse and several fortunate escapes although a labourer had both legs broken by a falling tree in Abbot's Leigh. In Clevedon a disabled vessel was thankfully guided by her crew onto the sandy beach whilst a vessel was sighted in the channel with her mainmast gone and one sail disabled. Thunder and lightning were also noted on the morning of the 3rd. A vessel was wrecked upon the Welsh Hook sand and a shipwrecked mariner drifted in on the wreckage and was treated with great compassion before he then was reunited with his crew who had escaped in a small boat on their way back to Bristol. A vessel was also sighted underwater with no signs of the crew whilst a trading vessel was washed onto the sands although the crew and captain were all saved and returned to Bristol 3 hours after they ran ashore. In Weston-Super-Mare a coal vessel

in distress caused great interest and anxiety amongst the residents although she happily found refuge in the protected mouth of the Uphill River. When the gale increased to a near hurricane on the 3rd several disasters occurred including the total wreck of the sloop Gleaner on the Brean sands whilst another found refuge in the mouth of the Uphill having being very disabled. Two men drowned off Watchet whilst out cod fishing as they were overcome by the sudden coming of the storm. The marine barometer constructed by Negretti and Zambra's highlighted the mercury had fallen to 28.80 mm/hg which was far lower than the 32 mm/hg which was the usual indicator of fine weather. It was said "it was remarkable that before leaving the shore, one of the fisherman was told that rough weather was to be feared, but he replied that it would only be rain". At Newport a man was drowned in the River usk when his vessel capsized and he sunk instantly and three other hobbler who went down the channel in search of work were feared lost. Gardens and ornaments on buildings in some buildings had suffered along with the roofs of residential and commercial property. In Swansea the gale caused the barque the Dukr of Northumberland to break adrift and travel towards Neath. The vessel when struck a sandbank and the lifeboat was immediately dispatched to render her crew assistance. Despite the fact she lay in an "most exposed and dangerous position... faint hopes are entertained of her being got off". In Neath two vessels were considerably damaged and one of which had to rendered assistance. A smack was wrecked off Porthcrawl

and damage was noted to a vessel in Llanelly. In Ilfracombe foam spray was noted to have been carried high into the air by the storm and a pilot boat of Bristol came in with substantial damage. In Bideford many trees were blown down and properties damaged, telegraph posts were broken and two men escaped a near death. In Barnstaple the gale "occasioned the greatest consternation" and it was noted "The wind kept veering about from, as Admiral Fitzroy stated, "opposite quarters". In Appledore and Fowey many vessels put in having received substantial damage and in Hayle a brigantine was driven ashore leading to two deaths via drowning whilst a schooner also grounded. In Carnarvon a life was also lost when a mail driver was blown from off his coach and killed instantly as he was run over by his carriage leaving a wife and three children. Later reports published on the 7th told of the loss of three Liverpool Pilots who were all onboard one schooner which perished in the storm on the way into Liverpool having been assisting other vessels on their outbound journeys beforehand. A Liverpool vessel was also reported to have been lost in the strong NW gale with six of the crew. A Norwegian brig had initially come to the rescue of the vessel but could only take eight of the crew, the captain's wife and child. Whilst sailing away the distressed ship was observed to go down and all onboard perished. It was said calls of distress were heard just before the vessel sank but assistance could not be rendered. "Captain Bradfield, the honorary secretary of the Shipwrecked Mariners' Society, will forward men to their homes" and the men were left

destitute with no possessions whilst the captain's wife and child were to be taken care of at Falmouth. Several over vessels were reported to have put into Falmouth with damage. A young woman who had escaped her family with a barque captain before being forced to return to Liverpool, however she fled back to the captain only to become a victim of the storm as her body "whose description answered to that of the lady in question, was found on the beach at Holyhead: and there is too much reason to fear that she has been drowned also" as the barque she was believed to have been on was wrecked. A schooner was also sighted by the coastguard by the White Rocks off Portrush, Northern Ireland in a distressed state. despite the fact the coastguard and the crew of a fishing yawl came out in the storm to offer assistance the captain would not leave "stating as his reason that he had another person's property in his charge, and he would remain by the ship till the last, lest he might be charged with cowardice". The vessel swiftly became a wreck and the coastguard attempt to run to shore only to be capsized leading to one death. The fishing yawl also capsized on it's attempted escape "In view of a crow of people, all anxious if it was in their power to save them" although 4 more were rescued thanks to the efforts of those ashore who threw lifelines and pulled the men out of the waves. A father and son were also swept into the "seething tide" and it was said "no hand but that of a merciful Providence could have saved them". The ship's boat also sank during an attempted escape leading to another meeting a watery grave whilst one man swam to shore. Although the final

<p>1864 12 to 13</p>	<p>2</p>	<p>Irish Sea and Wester Britain</p>	<p>Liverpool Mercury</p>	<p>15/02/1864</p>	<p>21</p> <p>man aboard, who had seen all of his companions leave "some of them to their last account" at first "offered up a short prayer and trusted himself to the treacherous waves". The survivors were very much injured and immediately conveyed to their homes and a doctor was sent to care for each of them. Two of the men had left widows and children and the "lamentable occurrence has cast a gloom over the inhabitants of Portrush". The gallantry of the Hoylake Lifeboat recieved a specific mention in a letter by "A friend of the Shipwrecked Mariners" which had rescued the schooner George of Liverpool which sank in the Dee channel. The crew, who were imminent danger of their lives were rescued from the rigging before being taken to the Ship Inn in Hoylake where they were treated most hospitably and an agent of the SHiprecked Mariners' Society then dealt with the situation. Another man was rescued from West Hoyle Bank although two men and one boy drowned. He was also taken to the Inn and attended to by a minister and surgeon and was said to be progressing as well as could be expected.</p> <p>A strong gale from the South-west was once more predicted by Admiral Fitzroy who's storm warning telegram "Hoist Drum this day and again tomorrow" was depicted in diagramatic form and as explained to signify "Dangerous winds may be expected from nearly opposite quarters successively". It was noted that these warnings had significantly reduced the number of vessels that had proceeded to sea. Serious accidents were reported off the skerries when a severe gale from the SW to WSW hit a</p>
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Liverpool vessel causing five men to fall from the riggings, one of which was completely disbaled. A chapel under construction which could seat 1200 people was damaged as the gable and end wall fell although no one was injured. The masonry also fell onto nearby property doing considerable damage to outhouses and "instant measures were taken to prevent the two remaining walls from falling" as the buildings were propped up with timber. The surveyor estimated between £300 - £400 (£38,500 - £51,000) of damage had been done to the structure. The Holyhead lifeboat was sent out to assist a drifted Portuguese schooner which had parted chains and was then run onto a nearby beach. The lifeboat also assisted in another distressed vessel which landed on the sandy beach sustaining little damage. Another telegram told of a ship ashore in Carnarvon Bay and after discharging it's cargo is was expected she would be got off although she currently had 8 feet of water in her hold and lay in an exposed position. A schooner was sighted off Lytham labouring heavily and flying a distress flag as she drifted towards Horse Bank a few miles from Lytham. The new lifeboat and crew was towed out to the vessel but could scarcely make anny progress under oar due to the high sea running whilstthe vessel was overwhelmed with huge waves. After three hours of futile struggle against the elements the vessel was reached but she had gone down and nothing could be seen of the crew. After a day of waiting for their emergence on the shore they were presumed drowned.

1864	20	5	British Isles	Liverpool Mercury	24/05/1864	<p>Violent thunderstorms were felt throughout Britain and in the North-west several houses were struck by "the electric fluid" causing chimneys to shatter and great consternation. Heavy rain also fell and it was remarked "the lightning was exceedingly vivid, and occasionally the thunder broke over the town with a force and suddenness resembling powerful discharges of artillery. A ship's mast was also struck and shattered although little other damage was reported in the docks. The temperature was noted to have fallen rapidly from 73 degs to 61 degs F. A woman was also killed in Cheshire when she was struck by scorching lightning walking on the outskirts of Birkenhead. The poem 'Hymn to the Sea' written by the Dean of Canterbury focussing on both the life-giving and perilous nature of the ocean referring to the sea in human sense as "a married matron long ago,/ With nations at her side; her milk doth flow" but yet stresses the grandeur of the ocean "but thee no husband dares to tame; Thy wild will is thine own". After further emphasises the sublime beauty of nature the "tempest-cloud that blurs the sky" is described as "holding rough dalliance with the fitful blast, Whose stiff breath, whistling shrill, Pierces with deadly chill" which leaves "the wet crew feebly clinging to their shattered mast" as man is portrayed as feeble and helpless in comparison. The dean further emphasises the fury of the storm as the "Thine onward-leaping billows plunge and roar" as the grim reaper of death described as "cloaked figures, dim and grey" watch "for some struck vessel in the boiling tide". The poem concludes emotionally depicting the death of a sailor who is</p>
1864	9	8		Liverpool Mercury	09/08/1864	

1864	20-23	10	British Isles	Liverpool Mercury	21/10/1864- 23/10/1864	<p>overwhelmed by the storm "his arm is feeble, and his eye is dim; He tells old tales again, He wearies of long pain: Thou art as a the first; thou journeyedst not with him".</p> <p>Following a warning telegram from Admiral Fitzroy on the 18th a severe gale hit the United Kingdom. True to the warning the gale came from different quates as it initially came from the west sinking a brig off the Albert Dock. A vessel was also washed ashore at Donegal whilst the Southort lifeboat was deployed when a small schooner was noted in distress and all aboard were saved having been clinging on to the rigging for their lives. Two steamers collided off the Isle of Man with one being so seriously injured she had to return to port. In Glasgow it was reported that "an almost continuous, drenching rain fell throughout the day, accompanied by violent gusts of wind" which resulted in the streets of the city being strewn with fallen chimney pots. A young woman was severely wounded by one of these falling chimney pots but did not lose her life. Steamers were said to have been hit by waves that washed over their funnels and as the tide rose the "sea was lashed over the quays and sheds in a very violent manner" and many vessel anchored off Greenock were driven close to the shore. The River Clyde "presented a very agigated appearance" and the storm surge conditions saw waves lashing over the banks and quays whilst several ships collided with the quay walls and other vessels sustaining considerable damage whilst others could not land at Greenock. Although a lull on the 22nd caused several to think "the heart of the storm was broken" the wind in creased once more to such an extent</p>
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1864	17-19	11	Western Britain	Liverpool Mercury	21/11/1864	19	<p>the steam tugs could not render any assistance to distressed and overwhelmed vessels in the estuary. As a result three men from one vessel had to abandon their vessel in their small boat and "The Steamboat Quay and West Quay were crowded with spectators, who witnessed the attempt of the men with breathless anxiety". Fortunately the vessel was driven safely into a dock and the men were saved creating "a feeling of intense satisfaction" especially as their vessel was witnessed to sink soon after they had departed. Another vessel sank inside the harbour whilst two vessels was driven ashore in Gourack Bay where "the scene was terribly grand". "Several shipmasters described the weather at sea as being dreadfully bad" although despite the widespread damaged throughout Western Scotland no loss of life was reported.</p> <p>Strong winds from the west caused heavy seas in which one vessel was wrecked with the loss of 3 lives as despite the best efforts of the Steamer the Mona Queen those onboard were retarded by the oil skin jacket they wore so they could not swim to the lifebuoys deployed by the Captain who made his best efforts to save those in peril. The sinking of a brig off Lytham was sadly attended with losses of life despite the best of the Marshside lifeboat who only managed to save one of the 14 passengers onboard. It is interesting to note the man is solely referred to as "a negro" and remains anonymous. The vessel 205 tonnes and was owned by the Anglo-African Company and built in 1859. Many on the vessel were gravely ill at the time of it's sinking and the Captain had died on the</p>
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1864	26-28	11	British Isles	Liverpool Mercury	26/11/1864, 01/12/1864	<p>journey. A brig of approximately 200-300 tons was also lost off Campeltown despite the great endeavours of the local lifeboat. The vessel foundered in 16-18 fathoms of water about 500 yards from the shore and nothing was seen of the crew who were all presumed to have perished. The Chief Officer of the coastguard reported that the Newquay lifeboat was "instrumental this morning, during a terrific gale of wind, in rescuing the crew of five men of the Heroine, of Milford, which was driven on shore. The service was described as "most gallant" and the lifeboat behaved very well on the occasion. A later report published on the 01/12 spoke of a missing oyster dredging vessel in Wigtown Bay which was believed to have been overwhelmed by the high seas resulting in 3 fatalities.</p> <p>A storm forecast sent by Admiral Fitzroy which warned "Dangerous winds may be expected from nearly opposite quarters successively" and instructed the storm drum should be hoisted. Although the vast majority of the damage was concentrated on the east coast a schooner named Content was wrecked off Lytham. The vessel was beached at high tide and the crew and captain disembarked and sought help from the lifeboat to get her off but all attempts failed despite the exertions. The vessel then subsequently floated off into the main Ribble Channel before sinking and over £1000 of cargo was loss alone although it was fully insured. The vessel was expected to become a total wreck.</p>
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1865	13-14	1	Western Britain	Liverpool Mercury & Western Times	16/01/1865 - 21/01/1865	44	<p>Very strong winds from the SW and SSW which were once more forecast by Fitzroy struck the Western coast of Britain doing substantial damage and destruction. In Liverpool the "furious gale" prevented all but two vessels from leaving the port and one of which was unfortunately lost. The barometer "was lower than it had been, with one exception, for 20 years" as it stood at 28.35 in/hg whilst the record low was 28.19 in/hg recorded on the 6th December 1847. The heaviest pressure exerted was 26 lbs on the sq foot. The steamship Leloa foundered near the North-west lightship and of the supposed 40 onboard only 12 were saved and aboard the lightship itself whilst the instance was reported to have "created considerable sensation" at the Exchange and Underwriters' Rooms. The Liverpool lifeboat was then dispatched with the view to rescuing those currently stranded on the lightship but "was struck upon the port bow by a heavy cross sea, and immediately capsized, the whole of the crew being thrown into the water" and of the 11 strong crew only 4 were saved. It was stated "It is much to be regretted that the crew of the lifeboat had been guilty of an infraction of a rule of the dock dock service, which requires them to wear their lifebelts when on duty". It was remarked that "had they been thus equipped the probability is the whole of the crew might have been saved". Those awaiting the arrival of the sunken steamship grew anxious on the shore and many a sad tidings was exchanged following the return of the crew of the towing steamers and Leila on their return to shore. The Leila was considered a fine new seaworthy vessel of 1100 tons and her wreckage and</p>
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lifeboats were washed up on the nearby shores in the hours and days following the terrible incident. In the south-west similar conditions were noted with rain and hail accompanying strong winds which gradually veered from the SW to N. At Bideford the storm was accompanied by hail and peals of thunder and several houses were damaged along with one wreck. Likewise at Exmouth the scene was much the same, a lighter was sunk at her mooring and another barge was "dashed against the railway embankment". Another vessel broke free of her moorings and went out to sea with no crew aboard with another in distress was rescued but was very much damaged. At Dawlish many roofs were damaged and trees uprooted. At Ashburton "the wind blew with violence, the houses being shaken, and missiles flying in the air, to the danger of the inhabitants" and property and trees were damaged. Serious losses to the shipping occurred at Plymouth where the schooner Christianan broke from her moorings and drove into a coal hulk before sinking although all aboard were saved. Several boats sunk at Devonport and 3 seaman proceeding to the MHS Indus on a small boat were capsized and drowned. Throughout the villages of Cornwall many roofs were severely damaged and many trees were blown down. At Haule a vessel carrying salt was wrecked and all hands aboard drowned whilst a big of about 170 tons was dashed to pieces off Land's End. A woman died on her return from the Falmouth market as she bow into the water and then drowned. In Bristol the "weatherwise folks" began to "look for squalls" on the 13th which

quickly materialised and trees were torn up and "a great deal of mischief wrought in many localities". In the elevated spot of Clifton many chimneys fell and entire stone walls were blown down and throughout Bristol trees were ripped up whilst commercial and residential property sustained considerable damage with few individuals sustaining minor injuries and considerable financial losses were sustained in the region of £20 - £40 (£2560 - 5000). A Clevedon the "perfect hurricane, being accompanied by heavy showers at intervals" caused substantial damage to properties and gas lamps in the coastal areas were blown out. Wreckage of a Gloucester sloop were washed ashore although the crew and captain had been previously saved by another vessel and the cargo was insured at Lloyd's. The Captain and the owner were in a state of much distress. Another sloop washed ashore but fortunately ended up on the mud off Old Church-hill and its crew had been saved. In Cardiff the strong winds did much damage to property but no serious injury to life or limb was heard of. One small vessel was crushed by a large ship at the pierhead and swarms of rats were seen leaving the large ship before they swiftly drowned. Off Swansea two vessels lying at the Mumbles anchorage were driven ashore and a Mason was killed by a falling chimney ashore whilst 3 others sustained injuries. The inquest into the death returned a verdict of "Accidental Death". In Appledore near Bideford the storm surge swept onto the bar and wreckage of a vessel including the nameplate was found on the Northern sands. Off Bude a Spanish brig was lost despite the fact a

"strict and vigilant look-out was kept for any unfortunate disabled vessel that might be in sight throughout the gale, her destruction being inevitable if she did". "It was the opinion of all the 'old salts' here, that no vessel under canvass could live in the bay". Two men had died after being washed overboard from the stricken Spanish vessel and a rescue line was thrown to those remaining shipwrecked crew who either climbed the rope to shore or were rescued hauled ashore in a rescue cradle. The Spanish captain was at first reluctant to relieve believing the coastguard to be "Cornish Wreckers" although the "the crown and anchor on the dress of the chief officer of the coast-guard persuaded him that there were present men to help and protect, and not to rob". All the remaining crew appeared "more dead than alive" and were completely drenched. The correspondent subsequently ascertained "The spirit of the Cornish wreckers has widely altered of late, and whatever they might have been addicted to in olden times, what I have seen in a few years has persuaded me to believe that kindness to the shipwrecked mariner is the predominant feeling at the present day. Those poor shivering souls were quickly clothed by the men on the beach who stripped themselves of their own clothes to put on the Spaniards". All were carried to a wagon before being transported to a farmhouse where much attention was paid to them by their host whilst a doctor attended to the injured. The ship however was completely destroyed and carried away by the next tide.

1865 29-30	1	Irish Sea	Liverpool Mercury	31/01/1865 - 09/02/1865	<p>A great storm in Irish Sea lead to the notable destruction of "two splendid vessels" as well as the Douglas breakwater. In Liverpool Bay the East India clipper Assaye was wrecked haven been driven by the storm up St. George's channel untill she struck at Galley Head on the South of Ireland where she became a complete wreck and the nature of the coast meant there was next to no chance of recovering her although several of the crew were saved. The clipper was 1599 tons and "built in Bombay, of teak, in 1856 and classed A1" but was fully insured. The Lady Hobart bound from Liverpool to Bermuda with a cargo of coals was also lost on the South of Ireland. Another vessel was noted to have sunk in St. George's channel and the conditions were such no assistance could be rendered to her. Another rescue was performed by a pilot boat on the Mersey. A Conway vessel in a disabled state also foundered off Point Lynas and the conditons were such nearby vessels could not rendered her any assistance. In Douglas the high tide and strong gale from the SSE proceeded to create "immense waves which came rolling beat with terrific fury on the breakwater now being erected in Douglas Bay". The sea demolished a large proportion of the seawall and flowed over the promenade into seafront property doing create damage. True to many an 'old salt's' prediction the breakwater in the process of contruction which was valued at £52,800 at completion was eroded, undermined and carried away doing an esitmated £20,000 worth of damage as despite showing initial resilience the "breakwater began to succumb to the titanic force of the</p>
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immense waves which unceasingly beat against it. One by one the ponderous frames were beaten from their fastenings, and in a short itme the bay was literally covered with floating timber" and the seawall in ruins, it's remain literring the nearby beaches. A schooner was also forced into the seawall as the sea "was running mountains high, was sweeping right over her". Fortunately men ashore spotted the vessel in peril and after many fruitless attempts a rope was thrown to the distressed seamen who were "one by one dragged through the boiling surf and up the side of the quay". It was remarked "Such destruction of property was never seen in Douglas before, and the question asked by every one here is, Who is to bear the expense - who is to take the blame for this greta waste of public money caused by the adoption of a plan for the breaktwater which is only suitable for smooth and shallow water, and not for an open bay where the sea exerts such gigantic force as it does at Douglas?" The quantiaty of timber floating around the bay was such that steamers were delayed from departing from the port due to fear of collision. On the 9th of February it was remarked that the breakwater designed by "Mr Abernethy, the celebrated London engineer" was know almost in complete ruin and a meeting meeting of the "united branches of the Manx Legislature, called the Tynwald Court, held at Castle Rushen" was called to discuss it's condition. As a result of the damage caused by the storm the breakwater was to be shortened from it's originally intended lenght of 1100 feet and "Mr Hawkshaw, the celebrated engineer engaged in

<p>1865 22-24</p>	<p>5 British Isles</p> <p>Liverpool Mercury</p> <p>24-26/05/1865</p>	<p>superintending the Holyhead breakwater works, was requested to inspect the structure". Mr Hawkshaw recommended that the breakwater should now not extend past 700 feet and a fetty be built from the end of the pier to allow passengers to embark at all times of tide. The court took these recommendations into consideration and approved the design modifications stressing "these measures being carried speedily into effect". The Lieutenant Governor remarked that although "Mr Abernethy's plan of a wooden breakwater had entirely failed" as he came to the island after the plans had been adopted "he did not feel himself at liberty to interfere in the mode of construction" and that now the plan had failed "it was now his duty to represent to the proper quarters the injury that had occurred, and to recommend that a more permanent work - one of stone - should be formed, a work that would be beneficial not only to the town of Douglas but to the island at large". The fact the Lieutenant Governor had already entered into negotiations regarding how to reclaim the money was met with applause.</p> <p>A succession of violent thunderstorms burst over the British Isles doing great damage on the cities of the west of England. In Preston the storm was accompanied by thunder, lightning, hail and rain with the water coming up to the box of the steam engines. Lightning struck many properties and a house was set on fire leading to the deployment of the water engines to extinguish the inferno. Mills and factories were damaged leading to the cessation of work and damage to machinery. A peasant</p>
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1865	30	6	North-west England	Liverpool Mercury	31/05/1865 - 02/06/1865	<p>was unfortunately killed as he was struck by the lightning in a surrounding village. Several tradesmen reported the torrential rains had destroyed valuable goods worth around £100 (£12,800) and £50 (£6,400) in two instances whilst several inmates were forced to abandon lower lying dwellings as furniture floated in the streets. A railway embankment was also eroded away by the floodwater and the line was blocked with deposited sand and torn up sleepers. The hail stones which fell were described as being "fully an inch in diameter ... more like short icicles than ordinary hailstones". In Scotland the storm intense storm only lasting for 1/2 an hour did much damage and claimed the life of one woman when she was killed on the spot on the village green by lightning just outside Glasgow. A family were also scorched when the chimney can on the top of their house was hit and the electricity was conducted into the kitchen where they were situated. A workman in the western district of Glasgow was knocked to the floor by lightning but "the injuries he sustained were trifling".</p> <p>A complete gale hit the North-west of England registering a maximum pressure of 31 lbs per sq foot at the observatory in Liverpool although the average pressure for the early morning of the 30th was 25 lbs per square foot which was comparable to the recent storm on the 19th of February in which the pressure was 29 lbs to the sq foot. In Liverpool scaffolding was blown down whilst several signboards, chimney pots and slates were blown down and strewn the streets. The crops on the outskirts of the town were feared to have been much damaged. A</p>
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1865	24-25	10	British Isles	Liverpool Mercury	26/10/1865		<p>chapel under construction was much damaged and the estimated cost of the damage was around £1000 (£130,000). It was also exclaimed "it is a matter of surprise that little or no disaster to the shipping has resulted therefrom" the only damage being occasioned to a schooner that was guided in by the crew of a pilot boat from the Bell buoy as the crew of the boat abandoned insisted the vessel was sinking despite the fact it sailed into port with little issue. Telegraph wires relaying information between Holyhead and the Mersey Docks and Harbour had been badly damaged.</p> <p>The Meteorological Department once more were correct in issuing a warning of a heavy westerly gale on the morning of the 24th as a strong gale materialised in the evening and carried on until the 25th. As the telegraph lines were down between Liverpool and Holyhead there was limited information regarding casualties in the Irish sea. It was known however that the steamer Syrian had struck the ground on the bar in the Queen's Channel and had to be removed by steamtug United Kingdom before she again grounded on Burbo Bank. Three more tugs eventually got her off and she was returned to port with little damage.</p>
1865	22-25	11	British Isles	Liverpool Mercury & Bristol Mercury	23/11/1865 - 27/11/1865	21	<p>A violent storm of great destructive capacity from the west struck the British Isles causing great damage and destruction. The wind varied from SSW to WNW in direction and the accompanying storm brought heavy rain and the occasional flash of lightning causing many vessels in the Mersey to remain at anchor. An emigrant ship was forced ashore at Plymouth having dragged her anchors</p>

but all her 435 passengers were landed safely and although several more vessels drove anchor no lives were lost which was partially attributed to the fact it was low water at the height of the storm. The port lifeboat was also influential in rescuing the crew of many a wrecked and/or damaged vessel. On the 23rd the Meteorological Office sent another storm warning signal stating that the port authority must "Hoist drum with south cone under" as it was expected "dangerous winds may be expected, probably at first from the southward". In the south-west the gale was "generally described as having been unexampled for its fury" and it produced a great storm surge sweeping over the passage pier of the Bristol and South Wales Union Railway. In Bristol itself the storm surge was described as follows "the morning tide was forced to an altitude of fully seven feet above the anticipated and proper level, and was retarded in its outflow for a very considerable period". It was noted had it been spring tides "a damaging flood would have been experienced". In and around the city of Bristol itself trees were blown down over wide areas and many properties lost slates whilst chimneys and broken glass strewn the streets whilst several new houses in course of erection were completely destroyed. At Avonmouth the pontoons connected with the landing pier of the Port and Pier Railway was damaged and an iron bridge supporting pontoons was destroyed whilst the Avonmouth Hotel lost three chimneys. The storm surge inundated the warehouses near the store and a barge was lost whilst another was wrecked. The receding tide was observed to

hve produced breaking waves and a high degree of turbulence seldom observed so close to shore. Several boats drifted from their mooring off Lundy and had to run to safety whilst one man was washed from his skiff and drowned leaving an ill wife and four children. Further upstream at New passage the piers of the shoreside railway were eroded, undermined and to a large extent demolished by the storm surge as the waves inundated the goods sheds. Vessels moored against the seawall were badly damaged whilst an uninsured vessel in service of the British and Irish Magnetic Telegraph Company sank although the three crew members survived having being carried 13 miles upstream in a small lifeboat. At Swansea five vessels were forced ashore and the sea tore away and undermined the South Wales Railway running between Swansea and Milford. At Cardiff the sea rose over the entrance to the docks and completely flooding them whilst the spray was noted as being 20-30 feet high. Brunel's great Eastern was forced to put down additional anchors in the Bristol Channel and several residents in Bristol had lucky escapes as their houses were destroyed by the wind as chimneys fell and slates flew. The Severn suspension bridge was noted to have withstood the storm well but "the chains on the land side oscillated at one time as much as 18 inches". A barque from Sierra Leone to Liverpool with palm oil was driven ashore near Southport and totally wrecked with the loss of her cargo and all hands. At Clevedon several trees were unrooted and houses partially unroofed as the sea dashed over the esplanade. At Western-Super-Mare nearly all of the boats

belonging to fisherman were damaged and some were completely wrecked. A coal sloop was driven from her moorings against the wall of the Knighstone pier doing much damage whilst several over vessels were also washed ashore and sustained considerable damage. A very large pane of the glass on Mr Geoch's library was blown through its panel falling on one of his assistants who was much injured. Many other properties sustained damage to their roofs. At Highbridge the storm surge burst over the river banks and inundated the high street and many houses along the Somerset Central Railway suffered dearly. As soon as the tide abated a team of workmen were charged with repairing the breach in the river bank. At Burnham a trawl from Cardiff laden with "Spanish grass" was stranded in the river mouth and several boats were smashed to pieces. Likewise at Wotton-Under-Edge many houses sustained considerable damage and trees were blown down on a widespread scale. At Newport the storm surge endangered many of the small coastal vessels and pilot boats, some of which were carried into the nearby coastal fields. In the Cardiff docks three vessels were driven ashore and one was wrecked whilst many lowlying lands were flooded with widespread damage to houses. At Carmarthen "the flood was immense, buildings were much damaged, a brig blown on shore, and the railway traffic impeded by a breach of the sea". Several vessels were blown onshore at Swansea and thousands of tons of embankment of the Mumbles railway was eroded away by the surging sea. By the 25th the gales in Liverpool had abated to 17 lbs per

square foot and only two vessels got into distress on the Mersey, both of which were later saved without any serious damage or loss of life. An impetuous charge was made against the Blackpool lifeboat crew after the wrecking of the brig Favourite and the loss of 9 lives, although a subsequent inquest found that the lifeboat crew had exerted themselves to their full capacity and this charge was in fact unfounded. The inquest found the lifeboat had tried for 2 and half hours to rescue the foundering vessel and the lifeboat had only returned once it had been substantially damaged and it's crew were at the point of exhaustion having been inundated with water several times. Dead bodies were subsequently found washed upon the shore by the police and the lifeboat men after calls of distress were heard from the vessel. The jury then levelled a charge at the Liverpool Mercury stating "the crew of the lifeboat were called great cowards, but the evidence showed that they were anything but cowards. They were brave to the very soul, and he felt proud that such men belonged to Blackpool". The correspondent of the Mercury then responding saying the Mercury "after intimating what opinions were prevailing in Blackpool as to the conduct of the lifeboat crew, gave the statement of a member of the lifeboat committee, which was highly in favour of the men". The Coroner summed up the evidence deciding the "lifeboat crew did not appear to be at all to blame in the matter; and although it might be questionable as to whether the vessel was seaworthy, it was quite clear that the captain must have thought so or else he would never have

1865	29-31	12	British Isles	Liverpool Mercury	01/01/1865 - 06/01/1865	15	<p>ventured to sea with her". Consequently a verdict of "accidental death" was returned. Three more vessels were unfortunately reported wrecked off the Cornish coast with the loss of 21 lives in total.</p> <p>A very severe gale from the SSW struck the British Isles reistering a force of 24 lbs per square foot in Liverpool bringing with it heavy rain. Near Queenstown a ship went ashore off Ballycronin Bay and 14 lives were reported lost despite the best efforts of steamtugs, the lifeboat and naval men. Two other collisions between vessels occurred leading to major damage being sustained by all involved. In Dublin the storm was anticipated by the "drum signals" and was described as "more like what we read of having taken place at the tropics than what we were in the habit of regarding as a storm". There was widespread damage to property, people in the streets were knocked over and the majority of the inhabitants lay awake in fear. All the vessels in Dublin harbour were secured and great relief was ocassioned following the late arrival of the Irish Sea ferries. In the Isle of Man the storm was described as "one of the most violent storms ever experienced" and so powerful was the wind that many houses in Douglas were unroofed, the streets strewn with slates although no injuries were reported. In Glasgow the storm "ocassioned more or less damage in almost every quarter of the city, but we have not heard of any loss of life" although a few minor injuries were susained. A pilot boat was damaged by loose sheets of iron roofing and in the River Clyde a storm surge occurred as the river overtopped the banks and covered adjacent raodways although no properties</p>
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were inundated. The Wemyss Bay Railway was considerably damaged by the storm surge however with a great portion of the earth and masonry embankment being eroded and washed away along with 40 goods wagons which had been on the line when the storm ensued. The pier connected the line to the terminal was also destroyed and the shore was littered with wreckage. Chinmenys stacks fell in several localities doing great damage and the streets were littered with debris from roofs. Several vessels in the Clyde drifted from their moorings but all were secured and there only one report of a collision. One vessel was wrecked off the south of Arran and could not be rendered assistance due to the sea state however all aboard were saved, whilst another went ashore off Mull and steamtugs were sent to her rescue. Many vessels were towed into the Clyde or limped in having sustained considerable damage whilst there were numerous reports of wrecks from throughout the western coast of Scotland. There were also accounts of a missing hebridian steamer whilst many vessels put back to port damaged. There were also two shipwrecks on the Island of Tiree which were "the first which have occurred since the erection of the Skeyyyvore lighthouse, twelve miles to the SW of the island, in 1843". Despite the signal of distress the storm surge conditions were such that the ship's lifeboat could not be launched although the crew escaped safely the vessel was left marooned. A large three masted ship was also lost off Ballycotton, Ireland although the sea state significantly delayed any rendering of assistance. Despite the best efforts of the coastguard to

throw a lifeline to the distressed vessel the precarious position of the vessel on the rocks meant no assistance could be granted and the rescuers were forced to observe a 'harrowing scene' as the men aboard were drowned and crushed against the rocks. A barque was seen lighting a tar barrel to signal distress off Balywater but before the coastguard could fire the lifesaving rocket apparatus the vessel was completely inundated and visibility was lost in the the squall, it was presumed she went down in deep water with all crew. Several vessels were reported having put into western British ports during their journey in a state of considerable damage and the ship Zimi put into into Plymouth reporting the loss of one man overboard. More lives were lost on the vessel the Senhouse which was wrecked off the Isle of Man whilst another wreck was reported. The Rev T. Bybyan Robinson reported that there had been a grave accident off the Lizard in Cornwall after the lifeboat had been overwhelmed by a huge wave breaking over oar but one which resulted in the death of three men. It was remarked two of three may have been saved had the rocket apparatus arrived earlier but it arrived too late and the men tragically died in front of their fellow surviving lifeboat crew. Two of the three left wives and children and the reverend said he should "be very glad to receive contributions of the benevolent towards the future support of the poor widows and orphans". A new lifeboat was to be sent to the Lizard in a the space of two days as it was said the RNLI always had boats ready "to meet such emergencies which, happily, are of very rare occurrence". It was also reported that over

1866	5 to 8	1	Western Britain	Liverpool Mercury & Western Times	09/01/1866 - 12/01/1866	7	<p>the last three years the lifeboats of the British Isles had been manned by upwards of 18,000 and only 6 lives had been lost, including those reported in this instance. A summary of events published on the 6 reported that in Holyhead there were 100 vessels taking refuge in the inner harbour and 60 more larger vessels at anchor in the roads, a vessel from St. Nazaire also limped in having had her rigging and steering gear greatly damaged in the heavy WSW gales. It was also feared a large vessel in distress off Anglesey would become a total wreck and Lloyd's agents had been sent to recover the vessel.</p> <p>A great storm bringing gales from the SSE struck the north west of Britian causing much damage in the coastal towns and a wind pressure of 26-29 lbs per sq foot was continuously recorded with maximum pressures reaching up to 31 lbs. In Liverpool only minor damage to property and shipping was recorded although a man had a narrow escape after a chinmey fell in a cotton processing factory. The gale created a minor storm surge in the Mersey of a height of 2 1/2 feet above the indicated height in the tidal atlas which was "remarkable, seeing that it was a low or neap tide of 13 feet 5 inches". Little damage was noted to shipping and only 2 vessels had to be assisted. However latter reports told of major disaster further north and the towns of Lancaster and Blackpool had been particularly badly affected. However it was said damage done by inundation was limited due to the high tide and had it been springs damages of £2000 (£240,000) would have ensued. Nevertheless the embankment at Southshore was partially eroded away. Many vessels put back into the</p>
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Mersey in a damaged state and vessels had to proceed in a line behind a pilot boat, it being too windy for pilots to board this was "considered a most important service, and reflects great credit on the crew of the pilot boat". One life was lost in Liverpool bay as he was washed overboard from a vessels which had sailed from West Africa despite all efforts being made to save him. Three lives were lost when another vessel, The Singapore drove upon the Formby banks and the three men perished whilst trying to reach the shore as they were drowned in the breaking waves as the lifeboat could reach the men in the breakers despite their best efforts. The Glasgow Herald also reported that storms of the "most disastorous character" had been experienced off the west coast of Scotalnd and many vessels could not leave port or had to put back for shelter, considerably delaying many voyages. The vessel of a brigatine were rescued by a steamer after the vessel foundered off Colonsay with the men of the stricken vessel having to be dragged through the surf by the crew of another stricken vessel already ashore they had "Lost all their effects and suffered great hardships". Another ship stranded on Colonsay was in the process of being towed to Greenock before the vessel aiding her was forced to let her go due to the conditions. The valuable ship was subsequently found and brought back to port and the crew forwarded to their homes by the Shpwrecked Mariners' Society. Another damaged vessel being towed by a steamer were driven ashore by the "violent hurricane ... accompanied by blinding showers of snow and hail" which drove the steamer into a shoreside

1866	10 to 18	1	South-West Britain	Liverpool Mercury	15/01/1866- 19/01/1866	100	<p>field and the ship high upon the beach. Assistance was sent and it was believed that their marooned positions high up on the shore meant no further damage could befall them. Two vessels were reported stranded on Jura, one wrecked the other safe on a beach. A vessel from Newport to the Cape of Good Hope was totally wrecked on Barry Island leading to the loss of 9 lives with only three being saved.</p> <p>A great storm struck the South-west of Britian doing immense damage and leading to the loss of 100 lives. The South Devon Railway line was completely blocked between Plymouth and Newton and the telegraphic communication was much disrupted in the south-west. The strong gales were accompanied by heavy seas and substantial snowfall and some 17 vessels were noted ashore. The most serious case was that of the sloop Sarah (Chapple) Goole which was smashed against the government pier at Portland and completely wrecked although all aboard survived. Off Falmouth harbour there were several collisons and one barque and a steam tug sank at anchor. The Penzance lifeboat "with a stout-hearted crew" rescued 13 men hanging from their shrouds whilst a large new ship was on Hayle bar and another vessel was also wrecked. In Torbay of the 60 boats at anchor 11 went ashore and five became total wrecks with crews having to be rescued by lines and baskets whilst numerous other vessels were reported wrecked in the Brixham area. Many an anxious crowd "looked on with bated breath" but fortunately several vessels made miraculous escapes with the help of those</p>
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ashore and in other vessels. It was said "The Brixham fishwives did a noble act. In the height of the gale, when the cries of drowning men were mingled with the howling of the wind, they brought out their mattresses and bedding, and made a fire on the quay to indicate to the shipwrecked sailors the entrance to the harbour". The "most frantic excitement prevailed throughout the town, and many noble efforts were put forth to save life and property". The coastguard men were also fully engaged in throwing ropes to wrecked sailors within reach of shipwrecked sailors and a captain and his two sons volunteered to swim to ships in cork jacket to take lifelines to the sailors "to the cheers of the assembled crowd" and the crews subsequently got to shore although "many a widow could be seen weeping at her untimely loss". The insurance companies at Brixham and Teighmouth made heavy losses and although it was impossible to calculate all losses at the time of publication it was estimated the losses were near £250,000 (£30,000,000). In the Mersey a packet-ship ran onto Pluckington bank and fouled a vessel doing great damage. There were several other collisions and the vessels involved were escorted to docks in a sorry state. A Southport trawling crew came to the rescue of the crews of two foundering vessels who were in exhausted states. A schooner was also wrecked off Taylor's bank and rescued by the Formby lifeboat and the crew and schooner were saved. Later reports told of the delay in telegraphic messages and the flooding on the lines which had retarded rail travel between London and the west of England. In the South-west it was said worse

weather had not been experienced since 1824. Nineteen lives were lost off Lundy when a Clipper was overwhelmed by the winds and sea in the Bristol Channel. In the south-west it was said the many peasants and townspeople who had escaped with little damage "will long have reason to be thankful for the arrest of the destroyer - and will recollect the flood of 1866 to the last moment of their existence". A meeting was held in St. Thomas' parish by the Rector to consider the how to relieve the sufferers. An official inquiry was held into the conduct of the Teignmouth lifeboat due the fact "the excitement consequent on the storm was aggravated by a feeling that the necessary promptitude was not displayed at Teignmouth in despatching the lifeboat". The lieutenant coastguard had been "charged, in the popular judgment, with having been unequal to the great emergency" and this charge was reviewed by the lifeboat committee. The issue arose regarding how the lifeboat was despatched from Teignmouth to Torbay as the mariners had suggested "that water was the best passage-by water they would get soonest the scene of destruction" whilst the lieutenant had differed saying the boat was "not go safely over the bar, and he therefore maintained that it must be sent by land" or his men, many of which were lifeboat crew, would not go in her. Much time was lost during this contention although it was eventually despatched over land and the issue had been subsequently referred to the parent society in London who subsequently sent an inspector to investigate. The issue arose when a telegram was received from the secretary of the Shipwrecked

Fishermen's Society to send the boat to Torbay as quickly as possible. The lieutenant had quickly proceeded to the lifeboat house and after much arguing between the lieutenant and coxswain it was been despatched by land some 1 hour 34 minutes after receiving the telegram. The lieutenant had threatened to withdraw his crew should it have been sent my sea and only allowed a portion of them to go, the other spaces being filled by "volunteers unaccustomed to lifeboat service". The parent lifeboat society "censured the Teignmouth people" stating their disapproval of it's tardy dispatch. It was reported that a steamer had been ready to tow the boat over the bar and competent spare crews had been offered whilst the lieutenant had been threatened with "a good thrashing" by the fisherwoman of the town. It later emerged that some of the crew had refused to go stating "I am not going out to be killed" and the vessel had not been deployed in Torbay until 13.40. The inspector on hearing these statements told the committee that "Torquay or Brixham would soon have a life-boat he hoped with a suitable crew. The crew on the present occasion, the coastguard exxcepted, had not done what they should have. No blame was to be attributed to Captain Burney individually or any of the committee; with him the matter lay whether he dare weaken his force. Ath most, if it could be so pute, it was an error in judgement". The committee then decided "on due inquiry, that the disaster happened efore it was possible to have rescued them, whether the boat had proceeded by land or water. No blame was attributable as was supposed to Captain, Burney, who

withheld his men from going beyond the limit of their appointed duty. Nevertheless they must record their conviction that the crew, the two coxwains and one or two of the men excepted, did not show a readiness to volunteer their services on an occasion when it might have been expected of them". In the future to avoid confusion and confrontation only one appointed member of the committee would have jurisdiction over the response to emergency, especially when concerning the lifeboat. The committee also decided that the distinction of 1st and 2nd crews be abolished and that "all able-bodied boatmen in the port be invited to enrol themselves as a crew for the lifeboat, and that the committee at the next meeting select a certain number as engaged for all emergencies". An appeal for the shipwrecked mariners' fund was also made by the Chaplain to the Torbay Mission to Seamen. The letter began with the chaplain explaining "I am anxious that people should know what funds are required in our present distress" before very abruptly stating "we want money". The chaplain stated the three reasons why contributions were desperately required. The first was for "the payment of food and clothing already supplied". The second reason was that the society had already issued rail passes for nearly 150 sailors around the UK and had to provide for the widows and orphans of the deceased". There was also the third reason to provide specifically for the widows of four of "our own fisherman" who were members of the Mission School. It was exclaimed that the hope was to "enable us to give them a pound or two a

1866		2	North-west England	Liverpool Mercury	07/02/1866	<p>year for each child until it attain a certain age". The chaplain was happy to receive general contributions or Apply them in any way that the donor may direct". The Western Times published on the 16th also disclosed a history of major storm surges in the area from 1823 onwards described the height above the key the water had reached in Exeter.</p> <p>A gale warning from the Meteorological Office stating "hoist south cone" which implied gales from the south were to be expected.</p>
1866	3 to 6	2	British Isles	Liverpool Mercury	08/02/1866	<p>A storm hit the British Isles doing the most notable damage off Land's End where an Austrian vessel was wrecked but the six sailors made a daring escape. Several people were "violently knocked down by the lightning, but no lives were lost" whilst an MP's castle residence was badly damaged as lightning set curtains alight and the masonry, brass handles and wires were badly damaged.</p> <p>Very strong winds hit the British Isles which did great damage from the Mersey to...</p>
1866	23-26	3	British Isles	Liverpool Mercury & Western Times	24/03/1866 - 30/03/1866	
1866	27	6	South-West Britain	Bristol Mercury	30/06/1866	<p>A terrific thunderstorm bringing thunder and lightning as well as showers of hail and rain fell over the City of Bristol and the surrounding areas. The lightning was described as "intensely vivid, and the thunder boomed and crashed in a manner which caused, in the minds of timid persons, no small amount of alarm". The channels designed to drain roads "in some of the lower districts proved unequal to the carrying off of the floods of water which descended from the hills, so that locomotion in some parts of the city</p>

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was rendered for a time exceedingly unpleasant and difficult". The crops were much damaged in the rural areas and one man was for a while rendered senseless having fallen from his horse after been struck by lightning. A chimney stack fell after being struck and ignited a small fire at one commercial property and a fine oak tree was "literally split in twain by the lightning". Several agricultural labourers had a narrow escape having been previously sheltering under the oak in question but moved cover just in time to see the tree "shivered to pieces by its fiery enemy". Several lightning strikes also hit telegraph lines and made transmission of telegraphs impossible due to the sudden impulses which were sporadically sent down the lines. As a result the "bells of the instruments in the various police-stations were constantly ringing" confusing police officers who anticipated messages which never came.

Following the death of Admiral Fitzroy in May of 1865 the Board of Trade had felt it necessary that the entire system of "weather telegraphy" was reviewed so it was "long associated with his name". The Meteorological Department of the Board of Trade was organised in 1855 "in accordance with suggestions from the Royal Society whose advice had been requested in the previous year by the Government". As it had "Long been recognised that that it would be desirable to collect and digest, upon a uniform plan, the observations made at sea by navigators of various maritime nations, and the recent labours of Captain Maury had thrown a new light on the subject". The Royal Society subsequently suggest "that such

phenomena as ocean currents, magnetic variations, the fluctuations of temperature in the atmosphere and in the sea, the limits of trade winds and monsoons, might be investigated with advantage. on a much larger scale". As opposed to relying on private contributors whose information was of questionable accuracy "it was proposed to map out all the accessible parts of the ocean, to provide accurate instruments for the use of officers in the navy and merchant services". By doing this a "firm statistical basis ... would be laid for the science of meteorology and the art of navigation". Although the process of gathering of meteorological and hydrological information at first was highly efficient and the results were "mostly, if not entirely, of good quality" it was reported Admiral Fitzroy was not content with simple information gathering for the benefit of future hydrographers but instead he "became impatient to utilise the knowledge already acquired" and of February 1861 the department's primary concern was to provide "Storm Warnings" and "Daily Forecasts". Following the death of Fitzroy the Royal Society recommended that the practice of recording "meteorological observations at sea discontinued by Admiral Fitzroy, should be resumed" and "Weather Telegraphy", was condemned. It was said the Royal Society "hardly admits of dispute, especially as a few thousand a year will cover the whole expense of procuring statistics which may not only prove of inestimable value to science, but add greatly to the security of life and property at sea". The fundamental difference between the two was that "forecasts directly

founded on telegraphic intelligence and those deduced from supposed laws of weather; and, secondly, between occasional predictions of storms and regular daily predictions of the weather to be expected within the next 24 or 48 hours. The reporter gave an example supporting the technique of "Weather Telegraphy" stating seafarers on the North Sea highly appreciated telegraphic information relayed from Hamburg and took such news with great caution. However the meteorological committee in charge of the current direction of progress argued such readings attained from other ports "are not sufficiently correct to be of any value". After the comparison of facts recorded by the meteorological department and the wreck department it was argued the conclusions storm telegraphy warnings gave "were oftener wrong than right as to direction of wind, though somewhat more trustworthy as to force of wind". Specifically, according to the meteorological department, the weather telegraphs had been 75% right regarding force alone and 36% correct regarding direction. However the wreck department statistics stated that there had been more incorrect warnings regarding force with 78% readings being incorrect. It was noted however that readings derived from "telegraphy" had improved over time in terms of accuracy. The daily forecasts derived from weather measurements were regarded as "more than useless" and it was stated "there is no sound basis on which they are founded" as the committee concluded "there is not only no correspondence, but no determinate relation of any kind" between the weather observations and the storm

1866	10 to 11	11	Western British Isles and Irish Sea	Liverpool Mercury	12/11/1866	25	<p>warnings issued by this method as "disagreement is the rule, agreement the exception". The reporter then stated "with such evidence before us we cannot but concur in the view of the committee, that official prophecies of weather should be abandoned". The correspondent then exclaimed "nothing but a considerable degree of probability can justify their being issued by the authority of a public department, whereas, to judge by the result, the oracles of the weather office, like delusive visions of the night, must proceed from the ivory gates of dreamland". The correspondents lament continued stating that real knowledge had been confused with "illfounded pretences" and it was not the duties of a state department "to publish formal opinions every morning which science does not warrant and which experience generally confutes". However it was said that "to doubt that a science of weather is possible, would be to doubt that atmospheric disturbances are governed by fixed laws - a heresy which the committee are careful to disclaim". In order to progress towards the stage of accurate weather forecasting the committee recommended that weather was to be accurately recorded at more distant stations at an official level.</p> <p>Strong gales from the S and SSE accompanied by heavy rain caused destruction in the Irish Sea and on the surrounding coasts as the barometer fell to a level of 29.45 in/hg. The wind shifted NW blowing a strong gale into the morning of the 11th leading to the loss of one schooner and a sloop. Nothing was known of the fate of the schooner's crew and it was presumed they had</p>
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1866	6 to 7	12	Irish Sea	Liverpool Mercury	08/12/1866	<p>perished, whilst the three fellows aboard the sloop were observed clinging to the mast which unfortunately fell before the lifeboat reached them and they were "swept into eternity". A steamer was also lost off Wexford leading to the loss of 25 lives and the wrecking of the vessel. The wind was said to moderate on the 11th and the barometer rose.</p> <p>A severe gale was felt in the Irish sea and on the west coast of Britain registering a maximum 25 lbs per sq foot at Liverpool as the breeze veered from the south to NW. It was remarked it was fortunate the Mersey was comparatively free of shipping and those at anchor held safely, although two vessels in the docks causing minor damage. Several vessels put in to Liverpool with minor damages, one vessel was driven ashore at Whitehaven and another grounded off Pluckington Bank and powerful steamtug were subsequently sent to get her off. Another vessel went ashore near Carlingford. Much anxiety was felt for the large fleet of vessels which left the Mersey on the 11th up to the closing of the underwriters' rooms" on the evening of the 7th nothing further had been recorded. The annual summary of the contributions of the National Lifeboat Institution to saving lives at sea. Overall it was stated the institution had saved 876 lives and 15 vessels from shipwrecks throughout the UK. It had also deployed its boats 122 times in response to distress calls when it was not required. This meant that since its formation was documented as 15856 and for these services 82 gold medals, 767 silver medals and £23,280 (£2,750,000) in cash had been given as rewards. The wider benefit of the</p>
1866	25	12		Liverpool Mercury & The Times	25/12/1866	

1867 5 to 8	1	British Isles	Liverpool Mercury & Western Times	08/01/1867 - 11/01/1867	38	<p>lifeboat institution to the poor men in damage was stressed as well as the benefit to their country as well as "wives and children, who would otherwise be widows and orphans". An extract from the Times was then quoted stating that against the elements at sea men of the institution were "inspired by a sense of duty" and their actions "raises even men of ordinary mould to the moral level of heroes and martyrs". They continued "could a history be written of all the services rendered by the lifeboats of the National Lifeboat Institution, it would contain more golden deeds than Plutaroh and his successors ever culled from the annals of war". Since it's formation the institution ha also expended £29,667 (£3,500,000) on 172 lifeboats as well as £160,400 (£19,500,000) on lifeboat stations. The article finished by concluded "contributions for the institution will be thankfully recieved by all London and country bankers" and by the secretaries of the institution.</p> <p>A great gale from the SE accompanied by snow and heavy squalls swept over the United Kingdom resulting in the largest number of daily losses ever recorded at Underwriters' Rooms as vessels were shipwrecked throughout the coasts of the British Isles. The greatest of these losses was the ship James Crosfield, an East India Clipper which was wrecked near Langness Point off the Isle of Man and "not a single soul escaped to the shore" and no bodies were found. The vessel was insured and was valued at £20,000 (£2,250,000) and held £80,000 (£9,000,000) worth of cargo, a portion of which was saved. The crew of a fine schooner would have suffered a</p>
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similar fate had it not been for the heroic exertions of two men ashore who succeeded in scrambling down a rockface before subsequently passing a lifeline and then transferring the stricken men to shore. Despite the woe there was also news of the endeavours of a small 25 foot boat who braved the entire storm and its three crew were the subject of much interest in Douglas. A Spanish vessel also came into port at Liverpool with the entire crew of a vessel which had foundered in the Irish Sea. A Spanish vessel was also blown ashore near Larne but was fortunately rescued at flood tide whilst an iron ship was less fortunate and was wrecked off Wexford. An overwhelmed vessel and its exhausted crew was fallen in with by a steamtug and thankfully all were saved and brought into the safety of Birkenhead Dock. The schooner Emily Constance ran into Douglas harbour and collided with the Douglas bridge in the darkness doing it moderate damage. The Douglas breakwater was once more completely demolished and there was "scarcely anything standing now except a portion of the stone work at the land end". Off the Isle of Man six vessels were lost and the storm was "one of the most severe ever felt on the Island". Off Cork a steamer foundered although all were rescued by a Dutch schooner having been in a precarious position in their lifeboats for some four hours. In Holyhead it was remarked "ever since the 2nd and 3rd January, 1855, this port has not seen such a serious disarrangement and detention of the mail and passenger service". The snow and hail which fell on the surrounding Carnarvon countryside rendered the roads quite

impassable whilst the Chester and Hoylhead railway line was in places covered with snow to a depth of 10 to 15 feet. As a consequence the mails were delayed for more than 24 hours and it was only thanks to the work of a railway engineer and 400 navies that the line was eventually cleared. In the South-west of England Devonshire a brigantine was lost along with 6 of 7 lives aboard. But what made the scene particularly "deplorable is that the vessel belonged to this port, and the poor fellows were drowned in sight of their own wives and families". Although the lifeboat was launched at the first sign of distress it was 45 minutes before she could make headway and she could not reach the ill-fated vessel. There were once more reports of "complaints of the delay of the life boat and of ill-management" but the correspondent thought it best to reserve judgement until both sides of the story had been heard. Specifically it was thought the vessel should have been drawn and deployed to leeward of the vessel but it was stated "in all cases the lifeboat crew should have the benefit of the doubt" as in past instances the paper had "often to record acts of heroic daring by these crews, and never any instance of deliberate neglect of duty or lubberly cowardice". Later reports spoke of a lack of planning on behalf of the lifeboat however and a 45 minute delay in its deployment. It was exclaimed by the Western Times correspondent "Whatever of romantic daring might belong to the sailor of tradition, the chivalry (if the word will be allowed) of his modern successor is considerably mitigated, and it is even hinted that the promise of a five

pound note if he succeeds will never his arm quite as much as the hope of saving a fellow creature's life". It was also reported that whilst ordinary long-shore men "may plead considerations of his own danger, the claims of his wife and family, or mother, or sweetheart, as reasons for not risking his precious life too freely, the coastguard man should be made to feel that it is a part of his duty for which the country keeps him in pay, as much a part of his duty as chasing a smuggling lugger or seizing contraband goods". The correspondent also voiced his opinion that any neglect on behalf of the coastguard's attempt to save lives should be "dealt with sharply". However, it was said that the Naval reserve men "nobly redeemed the sailor's honour by the way they ventured out in an ordinary boat, and saved the only survivor of the seven". Likewise it was said the extraordinary efforts of the Penzance lifeboat were "a grand example of what can be done by these boats when in the hands of men who know their duty and have the courage to do it". Inland the Valley of the Exe had been flooded and great apprehension was felt by the shareholders in the South Devon line as in south-east gales. It was remarked "a south east gale and a spring tide coming together are some day to do execution on the line which will stop the dividends for years". Whilst "Neptune hath occasionally made his mark on the line by biting a mile or so out of its defences; ut he hath never thus far stopped the traffic for above a few hours" and the recently improved defences had proved their worth as the line had sustained minimal damage during the recent gale. At Dawlish it was reported that many huses had been

partially unroofed but no material damage had been done by the storm surge. At Teignmouth no damage was sustained but "much anxiety was felt for the safety of the lifeboat house and the sea wall". At Torquay the new harbour works were much damaged with hundreds of tons of sediment deposited for widening the strand being eroded away whilst two fishing boats were also damaged. At Plymouth as vessel docked with the crew of another vessel which had become unmanagable in Mounts Bay whilst a vessel was much damaged on the shore in the bay and several more were wrecked. A trawler also capsized at Loe leading to the loss of 6 lives and a house in the course of erection was blown down. At Penzance a schooner was driven ashore and two more considerably damaged. The lifeboat was also instrumental in saving crew aboard two distressed vessel shortly before they went to pieces. The lifeboat saved the lives of those aboard two more vessels taking the total number of lives saved by one lifeboat crew to 17 in one day. The storm surge had also done great damage to a pier and had somewhat damaged the sea wall. In Falmouth the several vessels went ashore and were much injured with one life being lost as a cook was washed overboard from a Swedish vessel. A telegram from Glasgow reported of the wreck of a vessel and the loss of 40 lives when it went ashore on the west of Cantyre when the vessel was overcome in thick sleet and strong winds. A combination of engine failure and indecisiveness from the captain led to a policy of abandoning ship. However despite having ample numbers of lifeboats, great difficulty was

1867	26	1		Bristol Mercury	26/01/1867	<p>experienced in lower the ships lifeboats and as a result only one lifeboat was deployed saving three men including the captain who had to suffer 12 hours of drifting before being rescued by the sons of a farming tenant who "with praiseworthy courage set out in the teeth of a heavy gale" to rescue the three drifting men. The three had "suffered so dearly from want and exposure, that on being assisted to land they were found unable to walk" and were subsequently kindly attended to in a farm house ashore. The vessel was said to have been completely lost at sea and was also reported to have been under investigation due to previous disasters involving the same boat.</p> <p>A poem entitled the Fisherman's Daughter which concerns the fears and sorrow of a daughter who's father passes away at sea in a storm. The anxiety of the daughter sitting on the cliff is depicted as the storm rises as "The stormy night is coming,/Freshens the rising gale;/ Still she peereth through the gloaming/For her faather's little sail". The sorrow and desitution of the child is depcited as she sits on the cliff facing the storm "Through the midnight dark and dreary ... All sorrowing and weary/Watched the poor sobbing child". The poem concludes revealing the fate of her harbour and expresses the helplessness of her situation "Let the black tempest gather -/Go, amiden, to thy bed; Thou shalt never see thy father/Till the sea gives up its dead".</p>
1867	5 to 7	2	Western British Isles	Liverpool Mercury and	08/01/1867 & 09/01/1867	5 <p>A fresh gale from the WNW blowing on the 5th increased to a gale at Liverpool on the 6h and 7th and brought with it hail and rain showers. The barometer was observed to</p>

Bristol
Mercury

fall rapidly which indicated the severe gale which came from the south as the wind backed. The fears that many casualties would be reported were realised with three vessels having to return to the Mersey, whilst a large ship bound for New York was completely dismasted and had to be towed into back into the port of Liverpool. News from Cornwall told of the unfortunate occurrence of the loss of five lifeboat crew in Padstow who had deployed to save those aboard a vessel stranded on Doom Bar. The account of a local reverend stated her oars had been quickly broken in the mountainous waves and thus the boat was soon forced to drive before the waves and was soon capsized. As a result 5 drowned and only seven were saved whilst one life was lost on the vessel stranded on the bar, with all others saved. It was said the boat was a gift to the National Lifeboat Institution from the city of Bristol only had previously "performed one of the noblest services a lifeboat could achieve, during a fearful midnight storm, in saving the crew of 17 men of the barque Juliet, of Greenock, who, in absence of the boat, must inevitably have perished". It was said the "gallant Mr Sea, the chief officer of the coastguard" who perished in this instance had contributed to saving over 55 lives previously. Likewise the other four men lost "never shrank from their dangerous duties" and consequently "in conjunction with the National Lifeboat Institution, the public at large will come forward liberally to support the families of the unfortunate men who have thus perished in the performance of the noblest as well as the most perilous duties". It was also remarked that fact that only 18 lives

1867	25-30	3	Western British Isles	Liverpool Mercury and Bristol Mercury	30/03/1867 - 01/04/1867	27	<p>had been lost of an estimated 6000 lifeboat men nationwide over 14 years that "it must be a source of congratulation to everyone that so small a percentage has been sacrificed compared with the noble service done in that period, and the large number of brave men engaged at so much hazard in the work". It was said the NLI had voted for £210 (£23,700) to be given as relief supporting the bereaved families. The lifeboat had been named Albert Edward with special permission of the Prince of Wales and it had been pronounced the best in service in 1864 and it was now "much to be regretted that the institution has been so deprived of its services".</p> <p>During a severe gale a steamer was wreck off Cornwall when she suddnely encountered a great storm leading to the loss of 3 lives and many a head of cattle. The sea "rose to a great heart" and swept over the vessel doing great damage and disabling the boat with it's "irresiptable force". As the boat reeled the passengers were in a situation was descirbed as "one of the most horrible that can be percieved" as they remained inside the cabin in the perfect darkness with the water rising around their waists. Despite the situation and loss it was remarked "the greatest praise is due to the officers and men for their admirable conduct in the most trying situation, and it is to be hoped that the services of the captain and amte will recieve some recognition from the company to which the boat belongs". An inquest held by the deputy coroner retruned the verdict of the deceased were "Accidentally killed onboard the Bride steamer during a heavy storm". Another tragedy occured on the Conrish coast were 24</p>
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<p>1867 10 to 11</p>	<p>4 North-west Britain</p> <p>Liverpool Mercury</p> <p>12/04/1867</p>	<p>3 people ddiored as a vessel was wrecked and completely destroyed by Mullion. Two of the bodies had been washed up and were described as being in "a shocking spectacle from having been much bruised upon the rocks". Only one survivor, a greek seaman with a broken arm miraculously made it to shore having floated on the vessels bowsprit. He sstated that there had been 25 people onboard including six woman, one of which had recently given birth. The ship had been spotted throughout the day before "labouring and making strenuous exertions to beat to windward to clear this fatal bay; but it came to blow with thick weather from the south ... and she was a doomed ship before morning". A later report from Falmouth Bay declared the ship was owned by the Dutch East India Company although no more bodies were found. A vessel was also went ashore near Ballyhalbert, Northern Ireland and became a total wreck. Many dead cattle and wreckage was noted in the Bristol Channel indicated the likelohood of a higher death toll.</p> <p>A "formidable list of disasters" arose as a result of heavy gales from the NW. Three vessels were found off the Crosby Lightship in shallow water with the rescue tug having to abandone one which was likely to become a total wreck. The Lytham lifeboat was deployed to aid two vessels ashore off Lytham whilst a vessel bound for Bermuda had to put back having collided with a vessel and recieveed conserdable damage 15 miles NNW of the lightship. The Formby lifeboat and tugs was deployed to another vessel which unforunately went ashore before</p>
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1867 13-15

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Western Britain

Liverpool
Mercury

19/04/1867

she reached her and it was thought that three hands may have lost their lives. The tugs of the port were very much occupied rescuing vessels which were in precariously shallow water and many vessels were towed into safety. A tug had also been damaged when the 1013 American ship the H L Routh in tow parted from her hawser and was herself driven ashore along with two other vessels in the Southport and Lytham area.. The reserve lifeboat in Liverpool was also severely damaged when she got foul of the moorings of the Prince's Landing-stage. Another vessel was discharging her cargo from Brazil after running ashore off Crosby Point. The Blackpool, Southport and the Lytham lifeboats were also reported to have worked well in tandem throwing lifelines to save the crew of one vessel whilst 14 crew belonging to the vessel of which was soon wrecked after their rescue and it was said: "great credit is due to the Blackpool crew for the prompt and heroic manner in which they performed their hazardous duties".

A heavy gale from the NW was felt at Cardiff and Milford. A vessel reported many vessels had been washed ashore on the North-west coast of England whilst many were marooned on sand bank. The Southport pier had also sustained considerable damage when a wrecked vessel became jammed between the pillars of the jetty and the force of the tide rushing out combined with the powerful waves resulted in great damage to the structure and 20-30 yards of the pier. Two men attempting to support the pier were thrown into the sea but were "happily they were not seriously injured".

1867 2 to 3	9	South-west Britain	Western Times	06/09/1867	<p>A great storm of high winds, lightning, thunder and torrential rain hit the south-west of England doing much damage to the region. Between the afternoon of the 2nd and morning of the 3rd the barometer dropped from 30.034 in/hg to 29.926 in/hg and the temperature dropped from 101 degs F to 68 degs F in exposed areas. A vivid flashes of lightning began just before midnight and such flashes "increased in rapid succession till between two and three o'clock, when the boom of distant thunder began to be heard". Hail and rain then fell in torrents and "the lightning, emitted apparently from all quarters of the sky, lit up the heavens with incessant flashes. It was more like a tropical storm than any we usually get in this region" of Exeter in which many gardens had been severely damaged. In Teignouth the "lightning assumed a brilliancy as itnese as that of the sun on a bright May day ... the heavens appared blaze". The torrential rains flooded house and the streets as the severs were unable to carry away the quantity of water whilst a large quantity of sediment carried by the train was deposited in the streets. Although not too much damage was done in a certain street the flood waters rose eighteen icnhes and certain areas "resembled a second ocean". In Newton Abbot the choked greatings caused minor flooding and the correspondent remarked "when the rain came, and oh! such rain - a perfect deluge!". In Torquay the choked drains resulted in flooding which greatly damaged trademen's goods in lower lying streets whilst the ground floor was flooded at the Royal Hotel and several houses were flooded to two-three feet of water. Similr damage</p>
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was noted in Dartmouth were it was claimed a hailstone found weighing nearly a pound was discovered and as a result of the hail many windows and greenhouses were damaged. A house in the surrounding area of Dartmouth was severely damaged by flood waters which came the hills which brought into the house "several tons of earth and mud, on top of which water accumulated to the height of five feet". A great scene of distress was noted in Brixham where "Woman screamed and shouted from their windows for help, as the water was in their lower rooms three or four feet deep, and many rushed out in their night dresses with children in their arms, up to their middle in water". Although the floods were of a short duration great damage was done to the streets and highways whilst "Many a poor family has suffered in damage to furniture". In Kingsbridge the "storm was raging in majestic grandeur ... the lightning was one continuous blaze, and the thunder almost without intermission". After 03:00 "the war of the elements ceased" and many in the town were left with broken windows and greenhouses whilst several homes were flooded "but no accident of a serious character occurred". In Exmouth "rain deluged the lower part of the town, and flooded several streets, owing to the inadequate sewage accommodation, and several houses were flooded with rain-water. In some houses the water rose 18 inches" and the damage to property in one house alone exceeded £20 (£2,250). At Budleigh Salterton "many people were aroused from their slumbers by the vivid lightning flashes; several thought their houses were on fire. Weak and

1867	11	9	Liverpool Mercury	11/09/1867	<p>nervous people instantly dressed themselves, and, shivering with fright, anxiously awaited the dawn". Several houses were flooded by the rainwater and it was stated "the oldest inhabitants do not remember such vivid and continuous lightning". In Sidmouth the identical remark was made and although the floodwaters did little damage to property as "The Sid, swollen by the rapid downfall forced its way through the single ebach about 7 am and soon exhausted itself".</p> <p>A report of the "sectional meetings of the British Association" which concerned Colonel Sykes' paper on "Strom Warnings, their Importance and Practicability". The paper began with a "detailed history of the progress of meterological discovery down to the period of the late Admiral Fitzroy's appointment to the head to the Meterological Department of the Board of Trade". The paper stated that in three years between 1862-65 "Admiral Fitzroy gave 405 warnings, 306 of which were right, representing, it was quite safe to infer, a saving from shipwreck of 305 ships and nobody knew how many lives". Predictions regarding the direction of the wind were 38% correct. It was said "such results were surely a sufficient justification for the continuance of the storm warnings; but upon the death of Admiral Fitzroy, a committee of the Royal Society, appointed by Governmennt, had declined to continue them, on the grounds the admiral had promulgated them on empirical data. He had no hesitation in saying that this was pedantic affection of science - literally, the coxcombrly of science" which was followed laughter and appaulse. The scientific</p>
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committe had instead proposed "a continuance of the system of warnings, to establish eight oservatories for the purpose of making records which 15 years hence they expected would furnish such data as would enable them to promulgate storm warnings philosophicallys and not empirically". In response it was stated that "it would occur to most persons that if meterologists had not been able in 50 years to ascertain all the normal conditions which would enable them to place meteorology upon a scientific basis, very little advantage could be derived from these observations. After referring to the opinions in favour of storm-signals by many eminent men in this country and on the countinent, and demonstrating the practicality of the system, Colonel Sykes concluding by stating his opinion that this was not a question of science". He stated there was no science in it "Storm signalling was really practicable; it had been proved so". He then stated it was up to the meteorological department to "rest its actions on individual convictions and continue the suspension of the signals, or listen to the claims of humanity and the just claims of the public interest" which was met with applause. In response a Mr. J. P. Gassiot, F.R.S, assured the memebers that there was "no intention ... to suspend storm signals for 15 years, but, on the contrary, there was a desire to carry them out in a proper and useful manner". Instead they had the opinion that "no observations were worht recording which were not self recording" (i.e. not weather telegraphs) and "they proposed to communicate facts of a precise kind, from which the mariner might make his own deductions" instead of being responsible for

hoisted storm signals as was practised by Fitzroy. Several men of prominence supported the motion of Colonel Sykes stating their favour of restarting storm warning signals. The Duke of Buccleuch stating "he had much pleasure in seconding the motion ... he did no intend to enter upon the scientific part of the question, nor to consider whether the Royal Society was the proper quarter from which these storm warnings should emanate. All that we went upon was the practical benefit which would result from some such signals being resumed. He did not want any body of men to undertake the duty of being weather-prophets; but he wanted to have that information given to mariners which would enable them to judge what was likely to be the condition of the weather at any stated period". Two other men Sir John Ogilvy and the president of the Dundee Chamber of commerce both supported the Duke's idea to take the issue of restarting storm signalling up with the government. A Dr Balfour Stewart, secretary of the meteorological committee, stated that there was "some misapprehension about the amount of valuable information which the committee were really giving, or intended to give". He stated "the committee would be prepared to establish telegraph stations all over the country, more particularly in the west and south-west of Ireland" whilst there would also be an observatory at Valentia with a "proper officer to keep an outlook on the weather and telegraph to the central office in London when a storm was found to be approaching. As soon as the board in London found that an approaching storm was

<p>1867 26-27</p>	<p>10</p>	<p>Western Britain</p>	<p>Liverpool Mercury</p>	<p>29/10/1867</p>	<p>4</p> <p>an actual fact, they would be ready to telegraph the announcement to the outports without loss of time". Therefore to him it was clear the same system carried out by Fitzroy would still be occur and just issued in a slightly different manner. Two others also spoke up in favour of reissuing storm signals with Admiral Sir E. Belcher stating "even birds, fishes reptiles, he said, gave warning of gales; and a man of intellect, assisted by the barometer and the electric telegraph, could have no difficulty in affording to mariners most valuable information". A Rev. Mr. Pritchard gave a balanced appraisal of the state of affairs stating "the truth in this matter lay between two extremes. Possibly too much was attempted to be done by Addmiral Fitzroy; but, on the other hand, it seemed that the admirable committee of scientific men were influenced by the natural coyness of science in a case where coyness was not at all applicable". One other memeber stated he would strong object to a simple system "hich merely intimated where a strom was raging, and did not tell where it might be expected to reach to. It was for that reason he had coupled Admiral Fitzroy's name with the resolution". Following further discussion it was agreed "That this section apply to the council to make a communication to her Majesty's Government urging them to institute arrangements causing the storm signals to be continued".</p> <p>Strong gales from the west backing the south-west caused much destruction to shipping in the Irish Sea with several vessels reported to have foundered. A vessel was driven onto the rocks in Holhead Bay becoming a complete</p>
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wreck whilst several vessels put into port with damage. A vessel was also lost near Milford Haven. The ship the Earl of Chester for Madras from Liverpool was also lost near Holyhead with all onboard and the fate of the few vessels in her company was not known. Several bodies were washed up ashore and the station master at Tycoes was "glad to offer any assistance to friends and relatives of the deceased who may come down to this lamentable spot". A peasant from a nearby village witnessed sailors in the rigging as the sea washed over the deck before the mainmast gave way and all were seen plunging into the deep. There were also attempts to launch their lifeboat which evidently failed. The shore was also strewn with wreckage and sailors' belongings and the dead bodies had been conveyed to a national schoolroom at Llanfalog "where they await identification and inquest". Owing to the other shipwreck in the area there was "but a small number of coastguards to watch the property" although the few at the scene "did their part ably and manly during a long day and stormy night with great success, judging from the quantity of property saved". The correspondent also remarked "he was struck with the polite care and feeling attention paid by Mr R Roberts, churchwarden of Llanfaelog, to the dead". Three vessels went ashore on the Isle of Man whilst one steamer ran into the pierhead. Another foundered on St. Mary's Rocks and "in order to attract the attention of the people on shore to their dangerous position, the crew, five in number, brought their beds on deck and set fire to them". Consequently she was spotted and a boat from the harbour rescued the

1867	30 to 5	12	British Isles	Liverpool Mercury & Western Times	02/12/1867 - 12/12/1867	20	<p>men with great difficulty although it was feared the vessel herself would become a complete wreck. Substantial damage was done to the shipping in Dublin but the gale was "happily unattended with any loss of life". The vessel HMS Royal George broke free of her anchor lines and was swept upon a pier and then rocks in Kingstown harbour. After issuing multiple calls of distressed the regional coastguard rapidly deployed a party of coastguards to render her assistance and lift her off the rocks. Subsequently other coastguard men were sent for before "a second gun was fired, for all liberty men to come to the rescue at once". Together with the aid of a Royal Mail steamship she was cleared off the rocks without substantial damage. However the "greatest anxiety prevailed as to the result of the unusual mishaps" and the warship incident reminded the people of Kingstown of "that ill-fated day on which the gallant Boyd lost his life" and "very many persons came down and remained near the pier to await the result of the attempts to bring the good ship to her moorings". A court of inquiry was "of course" to be set up to "determine the origin of the occurrence, and whether any blame attaches to any of the officers".</p> <p>A great storm struck the British Isles which did great damage at sea whilst loss of life was also occasioned. The first evidence of the storm was the rapid fall of the barometer followed by the occurrence of heavy rain and strong gust which gradually became a gale which brought showers of sleet. The Liverpool Mercury uniquely for the period posted two sections specifically concerning the</p>
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meterology of the storm. At Bidston hills the heaviest wind pressure recorded was 37 lbs to the sq foot and at no period during the morning of the 1st did the NNW wind did not exert a force less than 30 lbs per sq foot. The telegrams from the Underwriters' Room from the Board of trade stated the storm was felt across the entirety of the west coast the British Isles and had been of very high magnitude: "Valentia: Barometer 29.36; wind NNE, force 9. Yarmouth: Barometer 29.36; wind NW, force 10. ... Yarmouth reports tremendous gales with snow and hail; Holyhead whole gale from north; Milford, NNW gale". It was also noted the temperature fell so rapidly on the 1st: "so rapidly that the showers of rain which were deluging the surface of the earth were turned into hail and sleet, and a very severe frost set in". A telegram received from the observatory stated "the change of weather within the last 48 hours has been remarkable, torrents of rain being succeeded by heavy gales, snow, and frost ... a very heavy sea prevails today on the western and northern coasts". Whilst it was said greater wind velocities had been experienced in the spring of 1867 it was exclaimed "seldom that the pressure has been so great for such a continuous period as within the past two days. When the pressure of wind reaches to 25 lbs or 30 lbs on the square foot it is what is denominated 'a heavy gale.' On Sunday, considerably above 30 lbs was registered". It was then stated "Some idea of the character of the storm may be gathered by comparing it with previous gales which have been remembered in consequence of some more than usually appalling disaster... for instance, the storm in

which the Royal Charter was lost. In that gale, the pressure of the wind was only 28 lbs to the square foot". The reporter then showed a clear evidence of an understanding of the multi-causal factors which contribute towards storm loss: "The strength of the wind, however, is not always the cause of the greatest disasters". Ashore on Sunday it grew so dark that gas lights had to be lit inside churches and the wind tore off shutters in Bold Street Liverpool and "committed the usual amount of havoc among insecure chimney pots, hoardings, & c". A woman sustained serious head injuries when bricks fell upon her, several walls and telegraph were blown down. In St. George's channel the captain of a schooner was lost when his vessel was overwhelmed by a the strong SSW wind although the two crew survived by clinging onto spars and were rescued by a nearby steamtug who's crew made a heroic but delicate effort to save the two struggling men and it was remarked "too much praise cannot be awarded to Captain Evans and his crew for the manner in which they effected the rescue, which was attended with much risk". Four lives were lost at Cemaes Bay where a brig was wrecked and various small coasters were noted wrecked and strewn along the Liverpool Bay shoreline and in the Mersey itself. The crew of a Mersey smack had a lucky escape but fortunately managed to get ashore much like a woman and her four children who were trapped on an inundated flat but assistance was fortunately rendered and all escaped unharmed. There were various collisions in the Mersey although few resulted in serious damage. One of the

ferries sunk after colliding with the Seacombe slip and another sustained considerable damage after a collision with a tug boat. Eight lives were lost when a barque was wrecked off Abergele and the wreck and its cargo of coal was carefully guarded by a police inspector and his recruits. In Llandudno Bay a flat was sighted in great danger and although every attempt was made it was found impossible to launch the Orme's Head lifeboat, the water level being too low and the waves too high to prevent launching in deep water. However its crew alternatively deployed the Pilot boat and saved the two men aboard the flat. It was remarked the lifeboat crew "are worthy of the highest commendation for their intrepid conduct... as but for this timely aid there is every probability that the men would have been lost". Another vessel was driven ashore near Gogarth but all got ashore safely whilst the coastguard were deployed to save those aboard a vessel ashore at Penmaenmawr. Although the crew were saved by means of lifelines thrown from the the captain's wife was struck by a heavy sea as she was being lowered off the boat and unfortunately drowned. A woman in Llandudno was knocked down by the wind and broke both her leg and arm whilst great fear prevailed amongst the congregation at one of the chapels who left out of fright before the service ended. The Liverpool Mercury Holyhead Correspondent remarked "not since the 3rd of December, 1863, four years to this very day, when 13 vessels were stranded and 43 lives lost, has Holyhead seen such a distressing sight". Two vessels were wrecked in Holyhead including a French vessel a new iron

ship, the Lydia Williams, of 1175 tons register although no lives were lost on these vessels. As the Lydia Williams was forced ashore the cries of those on board were said to be "loud and heartrending in the extreme" as much distress enveloped aboard. However the cries and the danger signals "brought together a large number of brave and sturdy volunteers" who were quickly deployed under the command of "The Queen's harbour master, Admiral Schomberg, and Captain Jones" who had "such energy and speed as brought forth a loud cheer from the spectators". The lifeboat was deployed at the "dead of night" towards the vessel and with the "greatest humanity and good conduct" all lives aboard the ship were saved and "comfortably lodged at once under the hospitable roof of Mr Smith of the Marine Hotel, and Mr Owens, of the Castle". One of the lost cargo consisted of a particularly rare bull valued at £300 (£34,000) which was a present from the Emperor of the French to the Queen of the Sandwich Islands. The lifeboat crew were also instrumental in saving those aboard the wrecked French brig whilst workmen saved three lives aboard a vessel which was helpless on the breakwater although one boy drowned and another was so "benumbed with cold that in spite of the efficient medical attendance, promptly rendered by Dr Price, Holyhead, death ensued". A barque in a very disabled condition was noted off Bolt Head but was able to make slow progress into the haven of the Plymouth Sound. In Belfast great destruction of property was noted with slates and chimneys being thrown from roofs and strewn streets. Unfinished buildings were

destroyed with one alone incurring losses between £700-£800 (£79,000-£90,000). On the Belfast coasta smack was wrecked with the loss of one man. Off Wicklow the lifeboat was deployed but it was found it was just a lighter drifting freely. Off St. Ives a French coal vessel went ashore with the lifeboat being dispatched to assist. They managed to save one of men whilst the one got to shore in the ship's lifeboat and six remaining men drowned despite multiple attempts of the lifeboat to approach the brig. It was reported "there seems to have been some lull or hesitation on the part of the lifeboat crew" as they were slow to deploy and after a few minutes the "undertow was so strong that it was not possible to get to the brig". The one man who came ashore on the ship's lifeboat was stated to be "all but dead, but there were strong hopes of his recovery. Another French vessel was wrecked at Bideford and although the crew fortunately got to safety via wading through the surf on to the rocks "several of them were dreadfully cut and bruised". They were found by a "reciever of wrecks" who found them "wet to the skin and in a very exhausted state" and rendered them hospitality. Another French boat was driven ashore near Bideford and was completely wrecked. It was supposed all of her crew had perished. In Devon and Cornwall the storm raged with great violence. At Brixham a herring boat struck against the breakwater seriously damaged although her crew managed to escape by climbing onto the breakwater itself and were rescued and taken to an Inn "where every attention was paid them" and they were visited by a lady who had "made

herself so conspicuous in the last disastrous gale in the bay, and she supplied them with dry clothing, fed them, and found them suitable lodgings". It was remarked "It is to be hoped that this disaster will teach the lifeboat committee a lesson, and cause this, at present useless, gift to be placed in a situation where she may be made available in case of distress". At Appledore an American barque dragged anchors and grounded and several vessels broke from their moorings and were wrecked. At Looe the great exertions and promptness of the lifeboat and coastguard allowed a distressed vessel to be safely got off the rocks although 50 tons of her cargo had to be thrown overboard. The lifeboat was also deployed once more on the 2nd but due to a favourable windshift to the north the vessel in distress was saved. On the 4th the gale strengthened once more and the sea at Holyhead "rolled into the harbour with terrific violence" and an American ship was ashore near the Menai bridge and was thought to have become a complete wreck whilst another was ashore off Liverpool with seven to eight feet of water in her hold and taken to safety by a steamtug. A new crew was despatched to remove her from the shore and this crew was then removed by the national lifeboat. The Chevalier of Irine was reported to have lost two men overboard as the storm waves swept the deck and she arrived at Ardrossan in a much damaged state. As a result of the kingdom-wide reach and magnitude of the storm it was explicitly stated "The lossbook at Lloyd's shows a long list of losses and casualties from all round the coast". As a result "it is believed, that the small advance of

1867	21	12	Liverpool Mercury	21/12/1867	<p>premiums recently adopted will require to be considerably enhanced to bring the business of marine insurance into a safe position".</p> <p>An announcement of from the Board of trade declaring the "renewal of the system of storm-signals" from T. H. Farrenof the Board of Trade itself. The letter firstly proclaimed that the Board of Trade "have been informed by the meterological committee appointed by the Royal Society that that committee are no prepared to issue, free of cost, to ports or fishing stations which are accessible by telegraph, notices of serious atmospherical disturbance on the coasts or in the vicinity of the British Islands". The information was to be forwarded as soon as news of an atmospherical disturbance reached the Meterological Office and the ports the news was sent would be determined by the Board of Trade. There was to be a renewal of the use of Admiral Fitzroy's storm drum warning signals and the drum was to remain hoisted 36 hours after reciept of the message unless the meterological committee thought it should be held up longer. It was stated all ports and fishing stations had the ability to apply to recieve this information from the Meterological Officer via telegraph. It was expected that the ports themselves would finance their own drums however "where it is made to appear to the Board of Trade that no staff and drum are provided, and that the place is too poor to bear the espense then the cost will be defrayed by the Meterological Office". The responsibility of hoisting the drums was placed on the local authorities regardless of who financed the warning signals. It was also</p>
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1868	12 to 13	1	Western British Isles	Liverpool Mercury	14/01/1868	21	<p>made explicatally clear the Meterological Office would only pay for the "transmission of the notices of atmospherical disturbances".</p> <p>Several disasters to shipping were reported in the Irish Sea as strong gales caused destruction on both the British and Irish coasts. A vessel was eventually wrecked on the rocks outside Queenstown harbour although thankfully all crew, passengers and cargo worth £60,000 (£6,750,000) were saved and landed ashore. Thankfully she was "extra classed at Lloyd's" and fully insured and the valuable cargo was protect by a party of marines along with the constabulary and coastguard. Interestingly the nearby Lord Fermoy attended at an early hour and "after seeing everythign safely arranged, took all the first-class passengers to his mansion at Trabolgan, where now they remain in safety and comfort". A "large vessel" was supposed to have been lost off the entrance of the Ribble and much in the way of wreckage was seen floating in the entrance of the estuary. A vessel was also wrecked off Tramore Bay, County waterford and it was supposed all ten aboard had been lost. Likewise at Ballymoney it was reported that 11 had perished after a barque was wreckage and a proportion of cargo had retrieved.</p> <p>A violent storm bringing from winds from the west which veered southerly produced "a tremendous sea" in Liverpool Bay. Aboard a ship a great wave washed a seaman of the foredeck and an alarm was instantly rased. It was some time before the tug in assistance found the unfrotunate man although he was sighted "struggling in the angry waves" and after placing the tug in a windward</p>
1868	18	1	Irish Sea	Liverpool Mercury	20/01/1868 - 21/01/1868		

position to act as shelter for the man the tug crew ultimately saved the man who was in a very exhausted state. Whilst the vessel was in tow back to Liverpool yet another seaman fell overboard and the tug captain once more and promptly saved the man. It was said "Much credit is due to Captain Griffiths and his crew for their prompt services in rescuing the two men" and that "Captain Griffiths has already received the notice of the Board of Trade for his gallantry" for a previous rescue in St. Bride's Bay whilst he had also "been presented with the silver medal and other rewards by the Liverpool Shipwreck and Humane Society for saving life on several occasions". Considerable damage was also occasioned to the iron pier at Southport which was under the process of construction and the roadway was carried away leaving a gap of several yards in the pier. In the Isle of Man the westerly gales caused much anxiety to prevail amongst the Douglas population regarding the fate of the Peel breakwater which was "built of wood, and which has recently shown signs of weakness". Owing to the fury of the wind the Liverpool - Douglas steamer took 9 hours to complete a 5 hour passage and she collided with the Douglas harbour pierhead doing damage to one of her spars. However "thanks to the precautions taken by the engineer" the new landing pier in Douglas "escaped with very trifling damage". A disabled schooner was also noted demasted off Castletown and the lifeboat was at once launched. It was said "the greatest expedition was used, and many persons from Castletown proceeded with the boat" which soon got to the schooner and conveyed

1868	21-22	1	South-west Great Britain	Liverpool Mercury	25/01/1868	7	<p>the 5 crew to safety ashore, whilst the vessel was safely brought into port the day after and would undergo minor repairs. A telegram reported another vessel was also wrecked near Wexford and all the crew were reported saved.</p> <p>A storm of great violence struck the south coast producing a storm surge so high that the waves dashed over the Plymouth breakwater and "waves of unusual volume entered the Sound" although the 40-50 vessels riding at anchor weather the storm without doing any material damage to vessels. On the North of Cornwall a gale of great severity wrecked a crew at Doonbar and the crew lost all they possessed. Three men aboard a foundering schooner were also saved off Trebetherick Point with thanks to the rapid deployment of the rocket apparatus by the coastguard although two died as one was washed overboard and one did not wait for the lifesaving basket to come to him and tried to climb ashore by the warp alone and perished in the attempt. Five men aboard a smack were wrecked off Mullion at perished as the vessel broke up in just 10 minutes. A Prussian barque with coal from Cardiff to Barcelona was totally wrecked with "heavy loss of life". Despite the quick deployment of the lifeboat the vessel broke up at such a rapid rate assistance could not be rendered. Two en got to shore alive however, one through swimming whilst the "latter was washed ashore insensible".</p>
1868	24-25	1	Western British Isles	Liverpool Mercury	27/01/1868 - 29/01/1868	54	<p>A great storm with winds initially from the south veering WNW struck the western coast of the British lives doing great damage and resulting the loss of many lives. Many</p>

vessels returned back to Liverpool in a much damaged state and there were reports of many casualties to shipping and the majority of the vessels were aided tugs. Four lives were unfortunately lost on West Hoyle Bank although the remaining 11 were rescued by the Point of Ayr lifeboat. Several more lives were lost on a vessel on a bar just north of Barmouth although 4 lives were saved. At Holyhead rain fell in torrents and the wind "Increased to a perfect hurricane" damaging several rural abodes. The storm surge washed over the great Holyhead harbour walls which stood firm despite the inundation. The NW gales were said to have made it difficult for large vessels to reach the harbour. A large new iron barque of 450 tons was broken amidships and "the huge breakers were completing the work of destruction". Another vessel was also driven onto the rocks near Bryn-y-bar rocks and the coastguard could not make headway through the breakers to the distressed vessel. A lifeline was then thrown from the vessel and secured to a rock ashore and by means of this all got to shore safely despite the fact the coastguard had to rush into the sea to retrieve a boy who was drowning. An eye witness present stated the coastguard's "conduct was most noble and praiseworthy". The coastguard were fully exerted on this occasion with all officers and men being deployed to assist the 3 wrecks in within a space of 3 miles of each other in Cwerran Bay. There were also reports of numerous wrecks on the Gower coast and it was "feared that about 30 lives were lost". "The night being fine the masters of the vessels wished to take advantage of it, having long been storm-

bound; but there was a terrific ground sea, and at the bar, near the mouth of the bay, it ran mountains high". Such conditions did not prevent the vessels from venturing out as their masters, presumably without storm warnings thought they would soon be in smooth water". However the wind was of an insufficient space to take them over the bar and they consequently "grounded on the sands, and were literally knocked to pieces by the force of the waves". Of the 19 vessels which left the port only five returned "the remainder having, it is feared, become total wrecks". As a result it was estimated 30 lives have been lost although an exact figure could not be ascertained due to the "scene of the disaster being a wild and remote coast" and it was thus difficult to obtain full particulars. A telegram from Stranraer also told of a schooner which was totally wrecked off North Cairn. Nearby five lives were lost when a brigantine tried to enter Portpatrick's harbour but was wrecked on the nearby Cocksma Craig Rock leading to the death of all aboard despite the best efforts of those ashore who threw a lifeline to the men although they were washed overboard before they could be pulled to shore. At the Isle of Man three vessels were drawn to shore and all crew were saved with the exception of the captain of a three-masted schooner who was lost whilst attempting to get to shore. The crews of two small vessels wrecked nearby were also saved. In Greencastle the heavy gales drove 4 vessels ashore, all hands were saved and at least one of the vessels was reported to have been got off since. In Glasgow "the wind swept the streets in sifting, eddying gusts, rendering

1868	31 to 2	2	British Isles	Liverpool Mercury & Bristol Mercury	03/02/1868 - 13/02/1868	2	walking a matter of extreme difficulty, and bringing down chimney-pots about the ears of unwary travellers". Two lives were lost when a woman was crushed in her house by a falling chimney and a falling gable derpived another poor woman of her life in Gallowgate. On the north bank of the Clyde the villages had suffered very severely with as "Roads bordering on the river have been swept away for miles and a number of the piers have been greatly damaged, while others are wholly swept away". Captain's on the Clyde reported of much wreckage adrift and several vessels had to be aided into ports by nearby vessels. The crew of a vessel numbering 22 men were saved in St. George's channel by that of another vessel captained by Greig and they "spoke in the highest terms of gratitude of Captain Greig's kindness to them". On the 28th it was reported that yet another vessel, the brig Colonist, had been lost off the Isle of Man near Langness with all hands aboard. In Belfast Loch were were multiple shipping casulaties with a vessel being wahed up and abandoned by her crew although she was later recovered. The same fate befell that of a schooner which was also rendered assistance by a steamtug. A ship in the Lough was completely dismasted whilst the crew of a schooner were forced to cut away her masts to prevent her from stranding. A great storm struck the British Isles leading to a loss of life and severe destruction on land although it was stated that by in the large the storm "appears in the most singular manner to have been fortunately unaccompanied by those disasters so prevalent amongst shipping during
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boisterous weather". It was hypthosised that "one reason for this exemption from shipwrecks and other casualties, and certianly the most likely, is the fact that within the last few days very few vessels have left the Mersey, and those which sailed from the port have in ordinary course probably reached a point beyond the influence of local meterological changes". It was said on the 3rd that it was call for congratulation that "the disasters to shipping already known are almost nil". However as far as the city of Liverpool was concerned it was "one most severe storms which have occurred for several years" and the storm "continued with less or more intensity for nearly 24 hours". It was said the "premonitory indications were of an unmistakable character" as the barometer fell reapidly and clouds collected "in dark and ominous masses" and it was apparent to all a storm was coming. Soon after the wind came from the west, first in sharp gust before increasing to "a regular gale" which reached its at noon on the 31st and veered round to the WNW as heavy showers of rain fell. Throughout Liverpool and the surrounding neighbourhoods chinmeys were blown down, walls weree thrown down and windows smashed "much to the consternation of residents, "many of whom narrowly escaped injury to life". The barometer dropped by 6 10ths of an inch in accordance with the change in conditions. Unfortunately many dwellings and commerical buildings were damaged and life was lost through injuries inflicted by the falling materials". "So great was the force of the gusts that several persons were carried off their feet and vehicle moved from their position". A storm surge was

noted "as tending to show the influence of the gale, it may be stated that on Saturday the tide in the Mersy rose several feet above the computed average". Little rain fell however which was one of the reasons why it hypothesised the damage had been minor. Several men were injured when a chimney fell through a ceiling with one man sustaining scalp wounds. A mother and infants were also struck as they walked down a street and both were seriously hurt. A coal dealer was struck on the head by a falling chimney and sustained a serious injury which he later died from in hospital. Several properties were unroofed and a wall 11 foot high was blown down as chimney pots and tiles strewed the streets, with a youth being severely injured as he was struck in the head in the dark streets as the lamps were extinguished in great number as the wind shattered the glass and damaged the framework. It was noted that the WSW direction of the gale meant the swell on the river was reduced compared to "storms of much less violence when the wind has been from the NW". However significant spray was still noted washing over ferry boats, landing stages and pierheads which attracted large crowds of people to the riverside. Although several ships dragged anchor there was "numerous tugboats in readiness to render assistance", whilst the ferry boats were reported to be substantially delayed. There was only one serious casualty when the schooner got aground on West Hoyle Bank and the Point of Ayr lifeboat fortunately managed to save the lives of those onboard with great difficulty. A Captain J M Cawkitt of the Wreck Association, Underwriters' Rooms who was

an eye-witness on the scene noted of "the bravery displayed by the crew of the Point of Ayr lifeboat going off from thence during the height of the gale to the schooner Mary and Grace ... we could not but admire the real pluck of these men in the lifeboat, and were pleased to find their efforts were crowned with success by saving the master and crew". Pilot boats found it very difficult, if not impossible to board vessels and most cross channel steamers came into port having sustained some form of damage with several being unable to land their passengers on the 1. Similar considerable havoc was produced by the storm in Birkenhead but no personal injury was reported. In Neston and Parkgate the storm was noted to have raged with particularly great fury and it was dangerous for one to walk outside due to the danger of flying slates and bricks. The maximal strength of the SW gale measured at the Liverpool Observatory from was measured at 51 lbs per sq foot at 11.30 pm on the 31st before moderating to pressures between 30 lbs and 40lbs on the 1st. The anemometer read 87 miles per hour on the morning of the 1st whilst the velocity was recorded as reaching 100 to 120 miles per hour around midday. Pressures of 50 lbs to 70lbs were recorded in this period. The barometer read 28.98 in/hg and it was remarked "no gale of wind having any comparison to this in violence has ever been registered at Liverpool Observatory". A continued pressure of 35 lbs per square foot was noted until the morning of the 2nd. The gale in Chester likewise did substantial damage to property although no serious injury was sustained. In Dublin the "fearful gale" rendered

1868	18-23	2	Western British Isles	Liverpool Mercury & Western Times	20/02/1868 - 25/02/1868	<p>it "dangerous to walk the streets" and serious injury was inflicting on one person when a chinmey stack fell through their roofs and a body was carried in an almost lifeless state from the house to hospital. A subsequent coroner's inques into the death of a man who was kncocked down by the date of the Canada dock when it was "loosed from its position by the gale then prevailing" and later died in hospital from multiple wounds concluded "accidental death" with "the jury expressing their opinion that the fastenings of the gate were not sufficiently strong".</p> <p>A ferocious storm from the west caused significant loss of life and substantial damage throughout the west of Britian. In Holyhead a schooner was lost with all hands. The Holyhead lightkeepers raised the alarm of the vessel in distress by firing rockets which alerted the chief officer of the coatguard who passed word to the lifeboat and the head contractor of the harbour works "asking his permission for the use of a locomotive to expedite the carrying of the lifesaving apparatus to the end of the breakwater". Although there was a rapid communication of lifesaving appartus to the point in need the schooner unfortunately went down within 15 minutes and all lives were lost. A San Francisco vessel also foundered on the rocks but it remained to be seen whether she could be got off or not. Several vessels were wrecked off the Cornish coast and the St. Ives lifeboat was deployed to the rescue. In the attempted rescue of a schooner three men were initially washed overboard "when a great billow struck her" although all aboard the schooner were saved before it was wrecked. Three gigs also went out to render</p>
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assistance with the lifeboat but one was upset leading to the loss of one life. Off Hartland "the sea was hurled in enormous masses against our beetling cliffs". "Many were on the look-out for unfortunate ships exposed to this fearful tempest, though, alas, little or no aid could be rendered to those in danger". A brig was dashed o pieces with all eight of her crew meeting a watery grave whilst the terms about the loss of another ship were uncertain. At Brixham much damage was done to the fishing smacks but no lives were lost. On the Mersey the barque Melbourne from Savannah came into collision with a government ship with both vessels sustaining considerable damage whilst several more vessels also sustained damage and had to be rendered assistance with the lifeboat being deployed but fortunately their services were not needed. A "marine surveyor" was also on hand to evaluate if lifeboats need be sent out. St. Geroge's landing stage was badly damaged, whilst several flats were sunk. In the city of Liverpool no serious accident took place although many a slate and a chimney pot fell whilst many walls were blown down. The situation of was much the same at Birkenhead and much sand was deposiited by the lashing waves and high seas on the Egremont Ferry slip which served to delay communication. The data from the Liverpool Observatory at Bidston exhibited from 5 to noon on the 22nd there "frequent pressures from WSW of from 10 lbs to 15 lbs on the square foot". The barometer fell bradually from 29.97 in/hg at 13.00 to 29.68 in/hg at 06.00 on the 22nd. The meterological data was also tabulated. The Holyhead

1868	19	5	North-west England	Liverpool Mercury	22/05/1868	<p>breakwater and lighthouse was also considerably damaged as "machinery, cranes and other apparatus" on the breakwater were damaged as the connecting railway line was damaged and the lights of the lighthouse were extinguished. It was stated "Nothing short of backing the breakwater will suffice to withstand the force of the sea". At Greenock loss of life and significant damaged was also reported with the most notable loss being the life of a man who was blown into Plymouth Harbour and although "his cry was heard, but nothing but his cap was got". There were several collisions in the harbour including a collisions in the harbour in which much damage was sustained but no lives were lost. Later reports published on the 25th told of the a vessel which on the 22nd had it's foremast, sails and gear carried away off Bell buoy in the Mersey. In the Isle of Man the SW gale hugely delayed the Mersey ferrys and had much difficulty in landing her passengers and much anxiety was experienced in Douglas after the breakage of a submarine telegraph pole prevented the delay of transmission between Liverpool and the Isle. Only one vessel dared leave the harbour to rescue a dismasted lugger in Douglas harbour. As soon as the captain heard of the vessel in distress "he at once ordered sail up, and proceeded on his noble errand" and he returned with not only the crew but the vessel herself. A terrific thunderstorm hit the town of Liverpool after a day which had seen of oppressive heat and clodu gathering over the city. At 20:00 there were repeated flashes of lightning and thunder and "peal after peal succeeded each other rapidly". The clap of thunder at 9</p>
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1868	15	8	North-west Britain	Liverpool Mercury	18/08/1868		<p>was so loud it "startled the whole community". The lightning observed was described as "'sheet lightning,' and not attended with the danger which often ensues from 'forked lightning' no great harm seems to have been done". A gentleman observer was also said to have counted 300 flashes in an hour period. The thunder was also accompanied heavy rainfall and "the consequence being, as it was then high tide, that the sewers became choked, and many dwellings in the lower portions of the town were flooded with backwater". In some cellars water of a depth of 3 feet 6 inches was noted although little damage was done to public or personal property. At the height of the storm "the streets of the town resembled small rivulets, and in some cases where the sewers were choked the throughfares becomes impassable from the quantity of rain water which flooded the footways".</p> <p>Lightning struck close to a ship on the Mersey although no damage was sustained by the ship and her crew.</p> <p>At Ayr, in south-west Scotland a nurse was struck whilst carrying an infant and was thrown to the floor and her right arm much injured. However the infant escaped unscathed despite being thrown a fair distance whilst another of the servants was struck in the foot. The two women who sustained injuries were being attended to and were said to be rapidly recovering.</p>
1868	22-23	8	Western British Isles	Liverpool Mercury	25/08/1868, 31/08/1868 & 10/09/1868	25	<p>A great storm struck the British Isles doing great damage to the shipping on the west coast whilst the loss of life was occasioned as "many vessels foundered, carrying their crews to a watery grave". There was much uncertainty ashore which "occasioned a suspense of the most painful</p>

nature" as interested parties waited for news of missing vessels. The most notable incident was the foundering of the vessel the Tara which was wrecked in the Mersey leading to the loss of 23 men and boys whilst it remained doubtful whether the Captain would survive his injuries. Many of the men were married and had left "widows and families to deplore their loss". A vessel was reported ashore off Leasowe Lighthouse but all crew were saved whilst the crew of a vessel had a very close escape as they were fortunately rescued from their stricken vessel by another vessel. Six schooners and a large ship were also reported to have foundered off the Formby Lightship. An insured yacht worth £460 (£52,400) was also destroyed and another saved thanks to the valiant efforts of nearby boatmen. A flat was also ashore at Llandudno and a large amount of wreckage was reported floating in the channel. The strong north westerly winds severely delayed ferry movements in the Irish Sea with the Greenock and Isle of Man steamers being severely delayed. It was stated "the seaworthiness of the boats of the Isle of Man Steam-packet Company was never subjected to a severer test, and never more thoroughly did the boats justify the confidence which the public entertain in them. The passengers speak in high terms of the cool self-possession and ability of the captains for the several boats under the trying circumstances in which they were placed". There were reports of several other incidents although it was not known how many lives had been lost. The Point of Ayr lifeboat retrieved a box containing for a vessel presumed wrecked. The assistant marine surveyor proceeded into

the channel to assess and identify some of the more notable wreckage. Two young men from New Brighton in a river gig unfortunately perished when they were capsized by a sudden gust and the survivor was eventually rescued in a deshelved condition by a flat sailor. Three other sailors in an open boat sailing from Whitehaven to Ramsey had a 'miraculous' escape after they were caught in the storm and nearly ran down by the Isle of Man steamer but were fortunately blown back to Liverpool where they arrived safely. A pilot boat was reported to have been run down off Kingstown. Due to the excessive winds "the sea outside was one sheet of foam" making visibility very poor "and vessels came tumbling into the harbour with loss of spars and sails". The storm flag was hoisted by the harbour commissioner as "a warning to vessels in harbour to take all precautionary measures for holding safely at moorings". Several boats dragged anchor and one sunk whilst the pilot cutter was blown into the channel in the course of a steamer and was promptly sunk although all men were either saved by the steamer or escaped in the pilot cutter's tender. One of Her Majesty's cutters was also severely damaged. A schooner was lost off Cultra after hitting a wreck and all crew escaped in their lifeboat. In Douglas the storm was reported as being "almost unparalleled for its violence" as it swept the island. Before the storm on the 21st the "glass went down with a rush" before heavy gales became to prevail. As a result the steamers found it impossible to get passengers on board and several had to be left as the sea was so high that several had to be left behind, the conditions making it

impossible to board. The lifeboat was launched in Douglas to render aid to a foundering schooner, although the fatality occurred amongst the spectators with one lady standing on a perilous ledge being washed into the sea by the storm surge waves. A return wave washed her back up and "with the desperation of death" she clung onto an iron bar supporting the steps. She was fortunately rescued by two boatmen whose bravery was noted and conveyed to the Imperial Hotel in a state of insensibility. It was reported "the crowd on the pier was so delighted with the bravery of young Elliott that a subscription was at once started, and about £3 (£340) raised for him on the spot". Later reports told that the ship The Queen of Beauty had been towed in by tugs and beached at New Brighton whilst 4 bodies had been found in the River Mersey and taken for subsequent examination. On the 9th of September an inquest was held on the bodies of two of the crew lost from The Tara, the most prominent ship that was lost. In attendance was a barrister of the steam-tug which towed the Tara out of port. The inquest began with the captain of the Tara stating that the vessel had first been towed out by the steam tug and with a pilot onboard and "there was no indication of bad weather beyond the lowness of the barometer". It was said the ship was in good condition although "the greater part of the crew were actually worse for drink when we left the Wellington Dock" and only 6 men of the 21 crew were "able to do their duty satisfactorily". The pilot had left the boat outside Bell Buoy and the captain had not objected to his departure.

As the storm increased in violence the towing hawser broke and the captain had hoisted the sails although "the crew at this time were for the most part still incapable of duty from the effects of drink" and this meant it took twice as long to hoist the sails. It had taken an hour to get the canvas set and despite the captain asking the tug driver to hold him to windward until there was sufficient depth to get over the bar, according to the captain the tug driver had steamed off and simply saying "it's no use". The captain did admit however that the tug had asked him if he wanted the ship to go back but he had ordered the vessel to go forward. As soon as the hawser broke the captain had hoisted the "jack" as a signal of distress but continued to refer to the condition of the crew stating "if the crew had all been efficient when the hawser gave way I am almost certain I could have saved their lives, but it would not have enabled me to get the ship clear of danger". The captain thought all had drowned when the ship parted midships on the sands and he himself was picked up from amongst the wreck by a passing steamer in the early morning. He stated "I had no rockets on board and I had to use what signals of distress I could. I made touches of paraffin" and he also claimed to have tried to beach the ship on the Formby sands with the "view of saving life". He also claimed he had made orders to drop anchors but none had been and the reason he had not dropped anchors earlier because he was entertaining the idea that another steamer may have come to the rescue. The statements were then cross examined and then a jurymen stated he thought the captain of the tug could

have hung by the vessel without any danger to his vessel. A coroner then stated that he felt that "she was in all respects fully equipped for sea" when she left port. A juryman stated that the officer from the Sailors' Home saw the crew before they embarked and would have rejected unfit men but because he run the "risk of being found fault with by the owners, because it would delay the ship going out. I speak generally". A witness then stated he thought the sailors were "quite capable of working her under ordinary circumstances". The witness then offered a somewhat vague statement about where the steamtug should have left the vessel saying "If the wind had kept in the same quarter it was before the hawser broke I should have taken the steamer to Holyhead. I should not have taken it further than the north-west lightship or the Ormshead if the wind had continued the same as it was when we left the dock". The pilot said he agreed with the capitan the low barometer may only indicate rain and said "the crew seemed in a very nice state". After the coroner exclaimed "oh, nice sate!" the witness stated "Well, they may have been a little in drink, but it was not worth mentioning. They were in a far better state than a great many of the crews that usually go to sea". The engineer of the tug said the tug captain had signalled to tell the captain of the Tara to go back to Liverpool but he didn't think he got any reply. He also stated that the Tara had also set her sail before the hawser broke. The tug then sailed off for 1/2 an hour to get the hawser aboard and then proceeded to speak to hope to the captain of the Tara before concluding there

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Irish Sea

Liverpool
Mercury

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were "Not in a position to render the Tara the slightest assistance" due to the heavy seas. He claimed the tug had stayed by the Tara but lost her in the treacherous conditions of the night and did not know it had been wrecked. When asked if it would have been possible to take a hawser from the Tara the witness replied "It would have been just as possible for us to have attempted to pull down the moon" as the engine was working at maximum capacity just to render motion and the crew of the tug were "dead beaten". The view of another pilot was taken aboard and when cross-examined it was decided it "would have been quite impossible for the Constitution or any other steamer to get hold of the Tara". After an hour of summing up due to the fact the coronor thought it was "a matter of very great interest to the owners of ships - and more especially to underwriters and to the public generally - to consider if anything could be done to promote a better habit of life amongst seamen to whose care so many valuable lives and so much valuable property were so frequently entrusted". After deliberation the jury concluded a verdict of "Found drowned" attaching no plan to anyone. Instead he suggested "that it would be very desirbale for all ships to remain in the river at least one tide, so that the men going on board in a state of intoxication might have an opportunity of recovering". The coroner said he thought this would be considered by all interested party and that "no ship should be permitted to go to sea with incompetent hands on board". Reports from the South of Ireland reported of a storm of "almost unprecedented fury" and that many

1868	5 to 6	12	Western British Isles	Liverpool Mercury	08/12/1868	10	<p>apprehensions were felt for the vessels at sea. A ship was also almost completely wrecked off the Waterford bar and tugs had been sent to assist her. A barque from Constantinople was totally wrecked in Tramore Bay after her two rope broke and she was driven towards to the strand. Although the tug reestablished a connection the tow rope broke again before leaving her after deciding the situation was useless. The Tom Egan lifeboat was then launched "amidst the acclamations of the hundreds who had by this time gathered on the beach" although after three attempts it was decided it was out of the question to rendered assistance and the lifeboat returned to shore. This caused "great excitement" ashore as the crew were left to cling to the deck. Fortunately, however the lifeboat managed to launch again at lower water and succeeded in rescuing all 16 crew. Several casks of palm oil were also reported ashore at Wexford from the wreck of The Inanda from Africa to Liverpool. An African mail steamer was also reported wrecked on the bar of the Bonny river but the crew reached the shore with difficulty.</p> <p>A fearful gale struck the south and west of the British Isles doing great damage as maximal pressures of between 27 lbs - 30 lbs on the square foot were recorded at observatories around the kingdom. The vessel North Briton was wrecked off Long-Rock in North Devon and seven of her crew were drowned when attempting to reach the shore in their own boat. The lifeboat which was deployed to rescue the men was upset with the brave coxswain being disabled and one man from the lifeboat crew being washed from the boat to shore. Fortunately he</p>
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had "happily been kept afloat by his cork lifebelt" although both men were described as being "still very ill" as a result of their calmaties. The lifeboat fortunately got to the vessel on the 2nd attempt and rescued 8 men but in doing so one of the lifeboat crew had his ribs broken. The vessel soon went to pieces. A collector of customs at Campbeltown reported that in "the very thick weather" and SSE gale a barque had dragged anchors miles NE of the town and was about to go on the rocks, whilst the crew "could not land in the heavy sea then running, and that they were in danger of losing their lives". Fortunately the lifeboat was deployed and proceeded to the spot rescuing the crew of 15 men from the ship and placing them aboard a tug which safely returned the crew and the lifeboat to Campbeltown. A Quebec ship was reported ashore near Barmouth and was likely to become a wreck whilst some of her crew had been lost. The ship had been forced ashore on the south side of Portmadoc Bar in a strong SW gale and with a heavy sea running. As soon as she was spotted in peril the RNLI lifeboat was launched and a tug deployed to tow her to the spot with the wind having shifted round to the South. The lifeboat crew were reported to have exercised a great care and managed to get 18 people aboard their craft despite the "deal of surf alongside". However "three poor fellows were drowned while attempting to get ashore during the night in their own boat". As soon as they got into the boat and the waves were of such a force "the rope dragged the stern clean out of her, and though lifebuoys were thrown to the men they sank". The lifeboat was reported to have

1868	10	12	Western Europe	Western Times	11/12/1868		<p>"behaved admirably" being "very stiff under her cargo of 18 besides her crew, and she has been housed in as good order as when she was launched".</p> <p>The lifeboat institution at Exeter received a storm warning telegram from the Meteorological Department of the Board of Trade. This was in the form of a Fitzroy storm signal in which weather information from ports to windward had been relayed and read: "Gale has extended down east coast to Yarmouth and freshened at Valencia. Hoist Drum".</p>
1868	23	12	Western Europe	Western Times	24/12/1868		<p>A storm warning telegram from the Meteorological Department read "No gale blowing except West in the Bay of Biscay, but pressure so low there is great danger. Hoist drum".</p>
1868	26-29	12	British Isles	Liverpool Mercury	29/12/1868 - 02/12/1869	10	<p>As predicted by the previous storm signal telegram a great gale struck the British Isles causing much damage to property and distress to shipping. The roofs and structure of several incompletd houses were damaged but fortunately the damilies were away from away and thus no injury resulted to anyone. At Aberwystwyth the lifeboat proved invaluable once again coming to the rescue of a smack which had run aground and the cires of the distress sailors could be heard ashore which were described as "pitiale in the extreme". The lifeboat succeed in rescuing all the crew after a "hard struggle with the fearful breakers" and the men were brought ashore "amid the hearty cheers of some hundreds of spectators" although the vessel was completely lost. The correspondent noted great praise was due to the lifeboat crew for "their strenuous exertions in assisting to get the</p>

boat launched, which was done with a will and at risk of great personal injury". All were delighted with the conduct fo the lifeboat themselves. It was said the lifeboat had been payed for by the sister in law of the Lord Chancellor who had "always been a warm friend of the Nationale Lifeboat Institution and a liberal contributor to its funds". Despite the success at Abersyswyth there was a report of one death and considerable damage to a vessel which came into Dartmouth. The "fury of the elements" did damage to waterside property on the banks of the Mersey and walls were blown down. A vessel was noted on her beams off Runcorn although no casualties were reported, whilst a collision between a pilot boat and the steam China resulted in the destruction of a pilot boat and a loss of two lives. One man left a widow and family. In birkenhead destruction to the roof of a potrait gallery occurred when a chinmey pot fell through the roof. In Ireland the reports stated "since the memorable hurricane of 1839 we have not had so stiff a gale". The gale "was most remarkable fo the suddenness with which it at intervals swept over the city, as well as for great violence and force. At times it was allbut irresistible". People could barely walk and many were laid prostrate by the force of the storm. Although substantial damage was sustained by property ther were no accounts of personal injury. Water in the canals "was raised to an altitude of several feet, and swept along like a mimic cyclone" whilst trees which had "wiithstood many a stiff breeze were bent and swayed like saplings". Thank to the storm warnings from the Department of Trade the storm drum was raised on

consecutive days so very few vessels ventured out and although some were damaged none were wrecked and no lives were reported lost in the vicinity. The sea was said to be "one sheet of foam, and the spray ran like a racehorse over the waters". Two vessels parted anchor and were forced onto a reef off Plymouth. The crews were all saved whilst one vessel was towed off and the cargo was expected to be saved from the other. A vessel also capsized off Ellesmere Port and two men made a fortunate escape by cutting the tow rope when their vessel capsized in tow. They then went to rescue the captain's daughter before all parties were transferred onto a lifeboat in tow of a tug. The owners of the capsized vessels went out of their way to stress that "not one of the crew was saved by the lifeboat". At Holyhead the strong gales from the NW and W brought 150 ships into the harbour whilst around 50 foreign-going ships took refuge in the roadstead whilst in considerable danger. Trains on Anglesey were also substantially delayed being unable to progress against the fearsome winds. Although a good deal of damage was done in Holyhead, the gale was not attended with any loss of life. In Wales a fine vessel 20 feet long came ashore at Portiullet whilst the meadows near Exeter were submerged following torrential rain and the strong winds gave them "the appearance of the sea when moderately 'Fresh' ". On the North Devon coast 6 lives were lost as the WNW gales and "fearful gusts" drove two large barques ashore in Bideford Bay. Although the coastguard fired rockets to one of the vessels and the basket pulley system was set up, one man was knocked

out of the suspended basket by the waves and drowned. Two lifeboats were deployed to save the Austrian barque and 9 crew were brought off in an exhausted state. On their second attempt at a rescue the lifeboat became disabled and capsized although the crew were saved. Fortunately those men were saved however three men in the barque died plus two more later perished in the rigging whilst three remained as the second lifeboat could not render assistance due to the strong headwind. There was an unfortunate lifeboat accident at Ballywater when one of the crew lost their life when on a training exercise when the boat capsized under full canvas. Although the three remaining onboard did rescue the life of all others the chief coxswain perished. The paper also included a section entitled "Weather Prognostications" in which "The Daily News points out the signs which seem to indicate an approaching change of the weather". The current conditions were reviewed with the meteorological correspondent stating "we still have a mild moisture-laden air, heavy showers, and fierce falls of wind" whilst the instance of gales occurring mainly in the night was noted. The changing meteorological conditions were deemed as "sufficient to indicate that the long-continued wet and storm will before long be replaced by weather of a different type". A "more than usually persistent term of cold" was predicted as the north-easterly winds were predicted to blow with unusual persistence. Following this an oscillating period of SW and NE winds were predicted with "successive spells resembling each other as respects

1868	British Isles	Liverpool Mercury	31/12/1868	<p>length much as the successive swings of a pendulum would do".</p> <p>A section concerning historical storms was published in the Liverpool Mercury which was focussed on "records of storms fully as severe as any which have been experienced in recent times". "In 944, for example, there was a storm which raged over the whole of England, and unroofed or destroyed upwards of 1500 houses in London alone". The correspondent also wrote of the 1091 storm which came from the south-west "like those which have raged during the past few weeks". It was said "when the full fury of the storm was experienced, people believed that the last day had come" with 500 houses being destroyed in London. There was also mention of the great hurricanes of Spetmeber 3 1658 and November 26-27 1703 "the former is that which blew on the night of Cromwell's death. An account written following the former storm told of unroofed houses and trees torn from their roots and exclaimed "it was indeed a night which prophesied a woful time to England, but to Cromwell it proved a night of happiness. It ushered in for him, far more surely than at Worcester or Dunbar, his fortunate day". The storm of 1703 "has always been remembered as the great storm, and probably surpassed in intensity all the storms which have ever visited the country". In all "the floods occasioned by it 8000 persons lost their lives; twelve men-of-war, with 1800 men on board, were lost in sight of land; London sustained a damage of £2,000,000, and 17,00 trees were uprooted in Kent alone". The Bishop of Bath and Wells was also reported call which the</p>
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1869	13	1	Western British Isles	Western Times	15/01/1869		<p>designed and builder of the Eddystone lighthouse perished when the storm destroyed it "so completely that no vestige of it was ever afterwards seen".</p> <p>A storm warning from the Meteorological Department to the lifeboat institution in Exeter which read "Pressure falling fast in Ireland, and south-east gale there. Drum hoisted".</p>
1869	30-31	1	British Isles	Liverpool Mercury, Western Times & Bristol Mercury	02/02/1869 - 06/02/1869	11	<p>The British Isles was visited a severe storm which was accompanied by "remarkably high tides" which inundated low-lying land and caused great damage. Near Borth the sea was reported to have washed away large lengths of the Cambrian railway along the coast of Cardigan bay. In Beaumaris the heavy gale from the south drove a flat onto a quay wall and one of the crew perished whilst trying to jump to safety. His drowned body was later washed up. On the Welsh coast a considerable portion of the coast railway line around the Dovey estuary was washed away so a considerable portion of the mails for towns in the area had to be conveyed by road which was slow due to flooding in places "nearly up to the heads of the horses". Vast expanses of water extended over the coastal lowlands and farmers near the Dovey were "compelled to leave their farms, the river having broken its banks in many places". In St. Cadfan and Towyn much damage was done to properties but no lives were reported lost. The Isle of Man also suffered greatly with many properties along the coast sustaining significant damage due to the high tides. "Under the influence of the heavy gale coming up the channel the tide rose several feet higher than it otherwise would have done, sweeping down walls,</p>

clearing out yards, and destroying everything that offered obstruction to its career". At Ramsey the tide rushed over the quay and into the market place and flooded all the houses in the shoreside streets. In one of the hotels the dinners were "cooked in a kitchen in which there was nearly two feet of water". One of the Castletown periods was also substantially damaged which was predicted to cost hundreds to repair. The greatest damage was sustained in Douglas where the marketplace was completely flooded, destroying goods and the sea flowed into cellars. All houses by the shore sustained some damage and the damage to the road and the promenade was estimated to cost £500 (£60,000) to repair, with several hundred yards of wall and most of the road being completely destroyed. The new landing stage had suffered very little damage however. At Whitehaven and along the Cumbrian coast, the tide "which at this time of year is at its highest point" did considerable damage to lowlying property. As a result "a great number of poor people had to leave their dwellings, and a large portion of their scanty furniture has been swept away". A great portion of the coastal railway was entirely washed away stopping all traffic on the Furness and Carlisle railways. Many tradesmen in Whitehaven had their cellars and warehouses flooded losing hundreds of pounds worth of property including sugar and wine. It was reported to be the highest flooded in Whitehaven since 1842 whilst at Workington and Harrington tradesmen and residents had suffered comparable damage to dwellings, property and goods. In Devon and Cornwall the storm surge was such that it was

reported "the tide rose higher than has been known for 30 years". In Plymouth and Falmouth it was exclaimed "the tides have risen higher than ever before known", as all the lower level streets were flooded and immense damage was done. Boats were being used in many streets and two fatalities were recorded with many more near misses. The railway near Dawlish had once again been washed away and all traffic stopped as the line had been destroyed "where it runs across the sands at the foot of the lofty red sandstone cliffs ... as it was during the Royal Charter gale". All traffic between Exeter and Plymouth was stopped. The Electric and International Telegraph line which followed the South Devon railway line was washed away when "a wave of extradonary size washed over the line, and in its retreat carried with it more than a hundred yards of the outer wall and the telegraph wires" whilst subsequent waves undermined the line. The waves then eroded the embankment in which a contractor was intending to build villas and all travel was ceased as the line was washed away. As a result the passengers and their luggage had to be conveyed to Exeter to board a special train to Plymouth and a number of 'packers' were conveyed to the scene of the disaster in order to make a temporary path for the passengers. One of these packers unfortunately lost his life when an undermined wall weighing several tons fell on him crushing him to death. Even though "the most strenuous efforts were instantly made" to rescue the poor man "on taking him out life was found to be quite extinct". Work was then reduced as it was believed the next tide was undo all efforts and in

spite of the death it was remarked "Priase is due tot he railway officials for the energtic manner in which they worked, so that the trians might be delayed as little as possible". Several fisherman;s boats were also substantially damaged as they were driven ashore to the cliffs and then a large volume of eroded earth was depoisted on them. The second tide on the evening of the 31st also carried off 40-50 yards of the granite coping outer wall at Dawlish whilstit also eroded the earth from base of the cliff serving to undermine it. A large body of men were employed with the task fo taking away the debris and repair the seawall and embankment. The wall was being built to height of 14 ft in places and it was expected that "if the weather proves favourable, the line may again be in order in a week or ten days". The Exe bight oyster fishery company was reported to have suffered severely as the sea washed over the warren and "the oyster beds were entirely covered with sand". Two lighteres were flooded at Starcross whilst at Topsham a man was drowned while endeavouring to moor his boat. The sea washed over the Strand and flooded house making roads impassable as much destruction to nature and property was ocassioned in the neighbourhood.. Several other men sustained light injuries. Shipping in Plymouth Sound was safe although multiple collisions occurred in Falmouth harbour with a French brig sinking although all crew were saved. A schooner and all hands were lost off Start point whilst a brig went ashore at Penzance with three hands drowned. A barque also foundered but all hands were saved. Two hundred yards

of viaduct was also washed away and telegraph poles and lines were destroyed on a large scale. On land two houses were blown down at Chacewater Cornwall whilst the tower of St. Josey church had been brought down and crushed the roof of the church, organ and bells. Trees and chinmenys were destroyed across the region whilst several cattle were drowned and 400 feet of sea wall in Exeter washed away. Despite these colossal damages it was noted "happily the loss of human life is small". In Scotland the abnormally high tides and storm surge conditions coupled with heavy rain on the 29th also caused major disturbances. In Greenock the water rose above the old quays flooding several houses to a depth of 2 feet. A schooner also went ashore and steamers scheduled to land at Wemyss Bay had to run up to Greenock to land passengers. In Dumfries a large portion of the embankment of the river Nith near Rosehall farm was swept away flooding the holm land as the tide surged up the river elevating waters to a highest level noted in years. At Kingholm houses were flooded and spray from the water was noted dashing upon the upper windows of a two-story house as inmates were trapped in their homes by the 3 feet water whilst the contents of a wool store were badly damaged. On the Irish coast at Dublin the tide "rose higher than it was ever known to have risen since 1839" as timber drifted about on top of the quays. Much damage was done as the tide broke into the cellar and underground stores of property in low-lying districts throughout the coast and "the Dodder became a formidable river, and numerous fields in its vicinity were

quite under water". Houses in the neighbourhood of the Royal Canal basin were also flooded to a wide extent and many riverside roads were impassable until the ebb set in. In Kingstown HM ship Royal George had to keep up steam to prevent drifting from her anchors although the shipping largely weather the storm without injury due to the southerly direction of the gale. It was stated "had the wind been from the northward and eastward many of the crafts would have come to grief". At Bray the high tide "made great havoc" with the whole of the esplanada being inundated whilst the harbour pilling was destroyed for a great distance. The sea made a clean sweep over the baths and the roads were flooded by the storm surge to the extent they were impassable on foot. The greater part of Cork was also flooded with the water in the main streets being 3-4 ft deep. Breaches were made in the Queenstown to Cork railway line and park of Youghal station was destroyed as the sea overturned wagons. A row of new houses on the beach were also gutted and part of Queenstown was submerged. The baroque Lady Londesborough was also wrecked off the Irish coast on the 31st but all crew were saved. At Blackpool the "tide was swollen to a most extraordinary height" and waves "dashed with great fury on the beach" and immense destruction to property was occasioned with damage estimates being placed in the thousands. At South Shore the lower portion of the new promenade was "torn up by the violence of the waters" with great damage being done along the coast. Foundations of houses were also undermined leaving the structures in a perilous position

and it was feared a substantial time would be needed to repair property. Serious damage was also sustained on the Welsh coast with the Queen's Hotel in Aberswyth being rendered a total wreck as the windows were smashed in by the rain, the ground floor flooded and chimneys fell through the roof. The building for the new Welsh university was greatly damaged and a portion of the Aberwysyth pier was washed away. At Borth just down the coast three cottages were washed away with the inmates having just time to escape with their lives. The town was underwater and the Welsh Coast railway was greatly damaged on the shores of Cardigan Bay with substantial erosion occurring on the coast and a bridge being washed away. Two gentlemen who went out duck shooting on the sands near Aberdovey were supposedly carried away and drowned but only one body was found in a "shockingly mutilated" condition. The rivers Dovey, Vernien and Severn were all reported to have flooded the surrounding lowlands to a depth of several feet. There was also damage to shipping at Aberdovey and portmadoc where "such a high tide has not been known in this part for upwards of 45 years". A Wexford the storm surge flooded all the houses along the quays and an embankment protecting a key arterial route and agricultural land was swept away. A life of a fisherman was also lost when he attempted to escape his foundering vessel by the quay wall. Two wrecks were reported near Kilmore and Hooyland, although it was said the height of the storm surge saved the lives of the crews as it carried them to high ground. One vessel was reported to be a

complete wreck however and practically nothing was spared by the elements. Destruction of property was also great at Youghal where a railway station was nearly completely swept away and a large portion of the platform "was torn up bodily and dashed to fragments" whilst waggons were picked up and deposited off the rails. The storm severely damaged a row of new houses completely gutting them and carrying away furniture forcing the inmates to run for their lives causing an estimated cost of £700-£800 (£84,000-£96,000) whilst telegraph poles were also greatly damaged. In Queenstown the extremely strong winds and tides also wrought havoc as Columbine quay was completely submerged and vessels damaged as the strand was torn up and a cliff undermined. The damage to the coastal railway was such all traffic was stopped and the damage to property overall was tremendous. In Cork the rising floodwaters brought about an infestation of rats which were "forced out of their usual haunts in the sewers, and rushed in hordes over the quay walls" settling in trees and houses. In Waterford a large part of the town was under water and "great quantities of sugar, flour, and molasses, and such like article, were completely destroyed in the shops" along with vast quantities of other goods. The flooding was such that "boats were busily employed all night sailing from street to street, and from court to court, affording succour to the distressed, who had to take refuge in the upper stories of their low houses" and one child was unfortunately drowned in his bed. As a result of this the "most aristocratic part of the city resembled in

some respects Venice with its gondolas" as it was "utterly impossible for horses to travel, for in some places the streets were covered to a depth of six feet". As a secondary result of the flooding the gasworks were completely submerged so that the town was in "Cimmerian darkness at night". Another fatality was recorded when a drunk man drowned in his sleep inside his flooded home whilst 55 pigs were killed when the floodwaters inundated the pigstore. The Cathedral was also flooded to a depth of two feet and the waters filled the kitchens of the gentry "to the ceilings with muddy abomination of the sewers". The police "exerted themselves nobly" and saved many individuals from walls and windows. The lifeboat house was in ruins and a new row of terraces were "very much injured by the waves". Near Tramore the waves swept away an embankment protecting property where workmen were living and "in the efforts one family were making to save their lives by escaping out of the house, the father, who was carrying an infant eighteen months old in his arms, was knocked down several times, and the child was washed away from him and drowned". The body was later found and it was reported "the screams of the mother were heartrending when she saw her child driven away by the waves, and she had to be forcibly detained from rushing after it to certain death". In Belfast all traffic in the lower part of the town was suspended and the audience of two church services were "imprisoned" by the rising floodwaters made movement difficult and several people were conveyed out in boat and high cars. The inundation did

<p>1869 6 to 8</p>	<p>2 Western Wales Liverpool Mercury</p>	<p>09/02/1869</p> <p>damage to the works of the Central Railway Company and the waters were so high ferry passengers could step straight from the ferry onto the quay. Subsequently a meeting was "convened to take steps to alleviate the distress occasioned to the poor by the inundations". In Bristol the high tide and the SSW and SW gales accompanied by heavy rain. At the Cumberland Basin the high tide "should have stood at 32ft. 1in.: but this was increased to about 35ft. 4in. or 35ft. 6 in". For the reference the "highest normal tide will be 33ft. 2in.". All of the lands bordering the river Pill were flooded covering miles of agricultural and residential land. Locks were flooded at Hotwells and Rownham-ferry. The storm surge flooded the field around St. Philip's marsh and the land and the works around the area were flooded to a depth of several feet. At the Totterdown locks there was one continuous sheet of water covering the fields, roads and workyards until the bounds of the Great Western Railway embankment. The factories "appeared to rise from the water itself, and became unapproachable except by boats" whilst several houses were in a similar state of inundation. Flooding was also noted in the lower parts of Bristol and around Pill.</p> <p>The west coast of Wales was visited with a heavy gale of wind which resulted in serious consequences. Chiefly the Welsh Coast Railway once more sustained considerable damage and traffic was once more greatly delayed. Great damage was also done to property in Dolgelly and Mawddach where floodwaters higher than anything noted for the previous 10 years were noted. Near the Dovey the</p>
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1869	12 to 14	2	British Isles	Liverpool Mercury	15/02/1869 - 16/02/1869	12	<p>highway was completely cut off as waters rose to a level of 12-14 feet. whilst the Severn and Vernien had "also broken out and have done much mischief". Damage to shipping in the harbours of Portmadoc, Aberdovey and Barmouth was also noted.</p> <p>A very heavy gale struck the British Isles occasioning great loss throughout the West of Britain. A 105 ton vessel was wrecked off Crosby Spit and abandoned by her crew on the morning of the 14th. The master reported he could not attract the attention of a Pilot despite his best light signalling and was therefore forced to abandon ship in a small punt as the vessel foundered. A schooner was lost along with four lives off the Pladda Rocks on Arran whilst a barque foundered off Falmouth although all her crew were saved and were returned to Falmouth. Rather unfortunately 8 people perished in Glasgow when at the height of the storm an 80 ft high chimney connected with a paper mill was blown down on top of a row of terraced houses. The weight of the falling debris was such the roofs caved in and the houses nearly completely destroyed. The eight dead bodies were quickly removed from the rubbish whilst another individual was sent to the infirmary with serious but not critical injuries.</p> <p>It was remarked "Seldom has such a continuous gale visited this portion of the island as that which has prevailed for some days past" as variable winds "rising to a hurricane from the WNW, then sinking to a light air from the south, and anon suddenly veering round to the north and blowing a full gale" wrought havoc amongst the communities. The very high tides and strong winds</p>
1869	27 to 2	3	North-west Britain	Liverpool Mercury	03/03/1869		

partially washed away Leasowe embankment causing the surrounding lowlands it was built to protect to be inundated which included the grounds of the Leasowe Hotel and Leasowe Castle. The tide in the Mersey was noted at 28 feet and 25 feet 6 inches as the "wind licked up the spray, which was sent in blinding clouds over the stages and pierheads". Such conditions brought spectators to the banks of the Mersey who were drawn in by the "scene of unusual excitement" which hampered vessel's departure and progress as they fought the elements rolled at anchor in the Mersey. The telegram from the Liverpool Observatory at Bidston on March 2 read "wind gradually changed yesterday afternoon from NW to SSE; at eight pm it shifted back again to WSE... Greatest pressure 50 lbs. on the sphygmometer at 10.10pm". The barometer was recorded at 29.08 in/hg at 6.00 am on the morning of the 2nd. A barque broke loose in the Mersey and caused great damage to the Waterloo dock wall causing the crew to abandon the vessel. Although a steam tug was employed to retain the drifting barque a confusing scene arose and she ended up being carried onto Prince's Pier and did great damage to the pier and the vessel itself. The mate in charge of the pier fearing further damage would be done to the pier which had already sustained a broken mooring chain "succeeded in getting a number of boatmen, at great risk to their limbs and lives, to volunteer to pass a tow-rope from the tug Universe round the mainmast of the barque". This was done with great difficulty and the barque was towed into George's Basin and subsequently safely moored. "It is the

<p>1869 19-21</p>	<p>3</p>	<p>South-West Britain</p>	<p>Liverpool Mercury</p>	<p>23/03/1869 - 24/03/1869</p>	<p>opinion of some who witnessed the occurrence that the vessel was saved from becoming a complete wreck by the prompt obedience of the captains of the steam-tugs United States and Universe". The disabled ship became a spectator for passers by. Several other vessels moored in the river dragged anchor and collided although all comotion was promptly attended to by the steamtugs. At Blackpool it was reported the storm had left "nothing but wreck and ruin" and "thousands of tons of shingle have been washed away" leaving the coastline and it's defence in a dismal state. It was said "if the new promenade had not been formed there can be no doubt that the whole of the houses in front of South Shre would have been either seriously undermined or swept away". On the Lancashire coast a dismasted brig was noted and the assistance of the commerical Travellers lifeboat were required although the vessel was abandoned and later became a complete wreck. Off Holyhead a very severe gale from the NNW forced 250 ships of varying sizes to take shelter.</p> <p>9 A great storm caused tremendous damage on the South-west coast as roofs were blown off houses at Exeter and a long list of maritime casualties were reported. At Dawlish the sea was "one mass of foam, portions of which were blown over the town". Many houses had their roofs lifted off and one lady narrowly escaped with her life as large stack of chinmeys fell through her roof and one man was almost killed by a falling tree. Fallen trees were stated to strew the roads although the direction of the winds saved the seawall under construction from total destruction. In Dartmouth similar destruction was wrought to the natural</p>
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and human landscape. The roof of a Linhay was blown down although only 1 of the 9 cattle underneath it perished. It was said great sympathy was felt for the tenant "whose family at the moment were in by no means the best of health. This sad affair unhappily added not a little to their sufferings. It is to be hoped that this sympathy among his neighbours, who much respect the family, may be carried somewhat further". At Brixham it was reported a French smack had been destroyed on the harbour entrance but the crew were fortunately saved thanks to the gallantry of a local craft. The Coastguard men had been "very active in rendering what assistance was possible" to distressed boats in the harbour and the lifeboat was launched by direction of the secretary with "landsmen taking the place of the regular crew" in order to hasten deployment to the multiple vessels which foundered and no lives were reported lost. The correspondent remarked "We cannot speak too highly of the services rendered on the occasion by Miss Browse, agent of the Shipwrecked Mariners' Society, Mr Wilson, chief officer of the coastguard". At Bideford a coach driver sustained severe injuries after being blown from his horse and a boy was cut in a dreadful manner having been hit with slates blown from a roof. The bargemen suffered greatly as their barges were swamped and two men drowned. Fear was also entertained for a steamer which could not approach the quay. At Morthoe an Italian barque was in distress and marooned on the coast. The sea was so heavy "that none but the gallant lifeboat would venture out". The crew assisted of "a

dozen daring fellows who were accompanied by Mr G N Maule, barrister-at-law". It was only after five hours of hard labour did the lifeboat reach the vessel and rescue her crew and the lifeboat was then taken back to Ilfracombe. Their return was "warmly cheered" and "The distressed Italian mariners found comfortable quarters at the Pier Hotel, Commander Williams, R., hon. agent to the Shipwrecked Fishermen and Mariners' Society paying them very kind attention". The mariners were supplied with clothing gratuitously by several inhabitants and the vessel was later towed un having sustained little damage. At Appledore a vessel entered the harbour in a distress sate and was given assistance by the customs officers. In the river a few lighters were sunk with lives only being saved thanks to the heroic actions of a pilot. No casualties were reported at Plymouth although a child was crushed to death by a falling chimney and at Saltash many houses were much damaged. At Boscatle a schooner was lost along with its four hands whilst at Padstow several vessels were lost and the damage to shipping was very great. A vessel with all hands was lost of St. Agnes as a distressed vessel was overwhelmed by large waves breaking on the beach. The coastguardsmen were on the beach and fired three lifesaving rockets however they missed the vessel and the men and the vessel was which turned broadside into the waves and all aboard drowned with all men pershing within a few yards of the beach. A similar melancholy incidences occured at Portreath and whilst several more lives were lost in St. Ives Bay were "gallant lifeboat services were rendered". The coatgaurd reported

1869	14	4	North-west Britain	Liverpool Mercury	17/04/1869	1	<p>they could "hear the crew calling" and went to fetch the rocket lifesaving apparatus but on return she was found to have been engulfed. Aboard the vessels the father was heard to say to his son "Good-bye, son" and "hardly had the son answered 'Good-bye, father,' when the two and a sailor were almost instantly washed over board and drowned". Two sailors aboard the vessel were washed up high onto a rock by a large wave and managed to scramble to the safety of a nearby farmhouse.</p> <p>A great thunderstorm swept over the north-west of Britain doing great damage to property and occasioning loss of life. In the Isle of Man a the thunderstorm's approach was signalled by rumbling in the distance before "crash after crash followed each other with terrific violence. This lasted about half an hour, and caused great alarm on account of its propinquity." It was followed by tremendous rain "the drops of which were fully the size of shilling pieces". In Lytham a man was struck dead by lightning whilst working in a garden and a little girl was struck blind and although she recovered sight in one eye it was feared she would be permanently blind in the other. A succinct weather report, the first of which to be published in the Western Mail mentioning gales. The direction was from the east in Falmouth and Queenstown. The article "The proverbial fickleness of the English climate has been strikingly illustrated in the state of the weather during the past few days" before the correspondent described how the "warmth and brilliancy of midsummer" had been replaced as "the weather assumed the severity and violence of March". A "fresh</p>
1869	12	5	British Isles	Western Mail	15/05/1869		
1869	15-16	6	North-west Britain	Liverpool Mercury	16/06/1869		

1869	11 to 13	9	British Isles	Liverpool Mercury, Western Mail, Western Times & Bristol Mercury	13/09/1869 - 18/09/1869	22	<p>and intensely cold gale, accompanied with heavy showers of rain" blew from the WNW bringing "fitful" and "extremely dangerous" gusts. The sea ran high in the Mersey causing a schooner to run athwart of the George's Landing Stage doing great damage to herself. A schooner was also observed to have collided with a steamer lying at anchor but only slight damage was sustained. Wreckage was also noted floating in the channel. The wind veered in the night and great fear was entertained for the ships in the Mersey but all held fast. There was a narrow escape from drowning when an elderly man fell into the river although the man was rescued thanks to the prompt actions of a constable who threw him a life-buoy and he was promptly saved and returned back to the Wirral "not much worse for him immersion".</p> <p>"After a long period of comparative tranquillity" a great gale struck the British Isles. The first reports of the gale from Liverpool spoke of NW gales which caused much havoc to steamers in the Irish sea creating waves described by captains as "mountainous in size". Ashore in Merseyside there was only reports of minor damage when a nine foot wall near the Docks was blown down. The most notable initial loss of the storm was that of the steamer Golden Fleece which was already in a sinking state before the storm hit so she promptly sank off Cardiff in fog. The vessel was 2091 tons and built for East India trade and originally valued at £80,000 in 1854 (£9,600,000). The Western Times told of notable damages to natural and human property across the South-west of England describing the storm as "an ill wind, however,</p>
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which blows nobody good". Four crew belonging to a schooner perished at Bideford and an Italian barque laden with coals was totally wrecked near Clovelly. At Plymouth only minor damage was done including the fall of a chimney through the roof of a house and child had to be rescued from the rubble by the police. At Millbay against the outer walls of the Great Western Docks several small pleasure boats and yachts were dashed against the wall and sunk. At Falmouth and Penzance little damage was occasioned to the shipping in harbour but several houses were damaged and many trees laid prostrate. Off the coast of the peninsula it is feared that many vessels had been wrecked and lives lost however. One such incident occurred when a ship was driven onto the rocky coast between Bude and Hartland after the pilot had left and 7 men lost their lives as the tremendous sea raged and swept over the boat. The 15 others were saved however by the rocket apparatus and the help of the coastguard. According to a Lloyd's telegram the number of vessels lost in the gales numbered 120 and several hundred had sustained damaged throughout the British Isles. The gale was reported to have been especially severe throughout the Bristol Channel to the extent many vessels struggled to make headway against the tempest. The meteorological report of the 14th in Western Mail sated "The westerly gale blew with great force along our southern and south-western coasts ... The sea is calm in the north-east, but runs moderately high elsewhere. All coasts were warned yester day". In Walton Bay it was stated "probably within the recollection the oldest person

living in the district the terrific violence of the gale has never been exceeded in its disastrous effects on the Somersetshire coast". For miles the coast was reported to be strewn with wreckage and sailors belongings. Several barque driven from their moorings in the Penarth Roads were driven onto the mud by Portishead and two more were driven high up onto the rocks and the sailors of both vessels were busily engaged in removing all the valuable possessions from the stricken craft. The barque Caravan was also lost along with the £3000 (£360,000) of phosphate cargo aboard. Spectators on the shore secured a warp by means all the crew but one reached the shore safely but one unfortunate man fell into the sea and was overwhelmed. The men ashore were "in a pitiable plight" and "they received the utmost kindness from the gentry and others in the neighbourhood". A list of generous gentlemen was recited and it was stated the sailors had been received at their houses and "after being made as comfortable as good food, rest, and clothing could make them, they left for Bristol in the evening. Names of several farmers who also assisted were also disclosed and it was said the captain "felt his loss intensely, and he was heard to say that everything of value on board was lost". In Cardiff the storm did very little damage to the docks or roads as a result of its NW direction. As a result only minor damage to shipping was reported. The torrential rain flooded the streets turning them into "a miserable state of mud and water". It was said the quantity of rain which had fallen lately was "no doubt partly the cause of the recent very high tides". In Newport many vessels had

come to grief despite the fact "the weather prophets had predicted the effects of the equinoctial winds, and many recieved warning on Saturday and Sunday to keep within port". However it was remarked "this had, doubtless, the effect of preventing many casualties". A vessel was driven onto the sands on the spit but was fortunately saved by a steamer, although she had recieved considerable damage and was in a sinking state. In Padstow several barques escaped foundering by running ashore. A smack was also badly damaged having lost her rudder on Doom bar and was thrown upon the rocks although the crew of two men were taken off safely by a pilot boat. The coastguard was also deployed to Trevoze Head where a demasted ship was drifting ashore and the men were eventually taken off with rocket apparatus in Fox Cove. Two vessels put into Padstow badly damaged and another vessel went ashore on the Doombar with the crew being taken off by the Albert Edward lifeboat. At Weston-Super-Mare considerable damage was done to property and several vessels in the boat. Once vessel was going to pieces on the shore at Knightstone and a large vessel was believed to have been wrecked off the Holmes as the funnels of a steam ship were noted partially submerged in the channel. The bay was full of wreck some of which was stated to have clearly belonged to a "vessel of first-class build". In Cork and Queestown the storm raged and in the port of the former several yachts collided and were severely damaged whilst a schooner drove ashore but fortunatly no lives were lost. The ship Mary E. Campbell was reported abandoned on the 13th 40 miles west of

Lundy Island. She has "experienced the full fury of the recent gales and became disabled , rendering her manageable and leaky". After abandoning the vessel part of the crew were picked up by a schooner and seven were still missing and feared lost. A steamer was completely wrecked on Arklow bank and the crew were saved by a lifeboat. A flat was also lost off New Brighton and although the three aboard were rescued from a watery grave by a shriming boat's who's crew had to braely wade up to their armpits in the water to carry the distressed crew from the flat to their boat. The distressed had been in a state of peril for 28 hours and although there was a lifeboat at lifeboat at New Brighton it was not deployed. Two men were washed off a vessel in the Celtic sea near Waterford and perished in an incident in which the vessel was also badly damaged. The Connigbery light vessel was also washed ashore and stranded off Blackrock, Southern Ireland and was in the processof being replaced by commissioners. In Bristol an agent to a ship-builder who couldn't recruit a captain to take a steamtug out took the vessel out himself. It was said "there were few seamen in Bristol who would gave ventured out with her in such a gale". Despite the best efforts of his friends, other seamen and his employer to dissuade him he ventured out to honour a promise. The vessel was soon overpowered by the storm and the agent then decided to swim to shore despite the protests of his men aboard the steamer. He was quickly overwhelmed and his body had not been recovered. The steamer was washed ashore near Hallen and all others lived. The agent left a wife and seven or

eight children to lament his untimely loss. At Winterbourne near Bristol the gale was so violent the leaves "on the weather side are all blackened and withered as if from severe frost or intense heat, while on the lee side no injury is perceptible". The leaves tasted strongly in brine and windows were coated with salt in some places such was the height of the storm surge. The was accounted for "by supposing the hurricane to have been a sirocco wind, which in its course across the channel must have taken up and carried inland considerable quantities of sea water". This occurred because the gale veered from the WSW to the NNW between the 11 and 12 exposing the northern coastline of the Cornish peninsula which resulted in the destruction of many properties in the elevated neighbourhoods as roofs were ripped off, chimney pots were overthrown and trees denuded of their branches. Gardens and crops sustained widespread damage and one tree fell onto a house near the centre of Bristol doing great damage. A train had a narrow escape from a falling tree on the Portishead railway and the telrgraph wires were destroyed over a wide area. A cook was almost killed when a tree fell through the roof of the cooking house in the gael, New Cut. Great damage was alsodown to the steam saw mills in the era and a partially erected dwelling was blown down. Many valuable trees were blown down and the agricultural pastures suffered great damage and a boy was killed when a large limb fell through a farm roof and killed a boy. In Newton Bushel another boy was killed by a falling chimney. The sight at Avonmouth was "one of

<p>1869 18-21</p>	<p>9 British Isles</p> <p>Liverpool Mercury</p> <p>21/09/1869, 22/09/1869 & 23/09/1869</p>	<p>novel description" as more than a dozen ships lay beached on the mudflats were there was more than 50 sail ships at anchor in the mouth. There were also reports of two ships colliding on the mudflats with both sustaining considerable damage. One vessel was reported sunk although no lives were lost and a part of her cargo was recovered. A summary piece reported that the loss book at Lloyd's disclosed a catalogue of wrecks and casualties resulting from the Equinoctial gales and it was stated "The loss of human life has not been so serious as was apprehended. The vessels wrecked were mostly colliers and coasters. These, no doubt, were mostly insured at the clubs. The losses on the underwriters were not extensive. Much destruction of property has occurred on land. One feature of the storm has been sudden variations in the barometer, although in the North readings have been lower than in the South".</p> <p>A great gale struck the west coast of Britain causing a notable disturbance. In Scotland "the wind blew from the south-west and was accompanied with a perfect deluge of rain" and the river at the Tail of the Bank was described to be "white with spindrift". Several boats had to put back into Glasgow with considerable damage whilst one vessel lost a man overboard as the sea ran "mountains high". One vessel was also burned off Dunoon with the crew saved after the cargo of lime which caught fire had been partially discharged. The men were rescued by means of a rope passed onto the shore although the partially insured vessel was completely burned. Along the coast many pleasure boats and yachts had been driven from their</p>
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1869	15-19	10	British Isles	Liverpool Mercury & Western Mail	19/10/1869 & 20/10/1869	3	<p>moorings and destroyed. Ashore in East Hamilton and Rue several telegraphic wires were blown down and a few slates and chimneys fell greatly inconveniencing people coming back from church. The schooner Prudence was totally wrecked whilst trying to make port at Burnham and her crew were saved by the Chletenham lifeboat. The report from the Liverpool Observatory at Bidston stated that on the 20th September "the wind was greatest from five to eight pm, between which hours there were frequent pressures of from 35 to 45 pounds on the square foot, and upwards of 200 miles of air passed over the Observatory. During the above-named three hours the direction of the wind was W by S. The lowest reading of the barometer was 29.22 at 5 1/2 pm".</p> <p>A severe storm from the east occasioned much damage and loss of life throughout Britain although losses on the western coast were relatively minor in relation to those elsewhere. A Carnarvon ship drove ashore near Portinllaen in North Wales whilst another vessel also went ashore at the Bwlch Briden although all crews were rescued. The first instance the Cotton Sheppard lifeboat proceeded to the heavy sea to rescue the stricken men and whilst this was occurring three men of the lifeboat station proceeded in a shore gig to save the two men on the other distressed vessel. The wreck of another vessel was also found strewn along the coast near Beaumaris. The vessel had encountered a heavy easterly gale "opposite the spot where the Royal Charter was lost - Dalas Rocks - where she was driven ashore, and is a total wreck". One boy came ashore on a plank and the rest</p>
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1869	2 to 6	11	North-west Britain	Liverpool Mercury & Western Mail	04/11/1869 & 06/11/1869	<p>were assumed dead. The vessel was a well known trader. The schooner Elephant was wrecked by Taylor's Bank in the Mersey and two crew took to the rigging whilst the mast another man was holding onto unfortunately collapsed and drowned. The New Brighton lifeboat was towed out to the scene and managed to rescue the remaining men in the rig. It was remarked much praise was due to the master of the tug due to the "masterly manner in which he laid the lifeboat on to the wreck". Another schooner was reported lost on Burbo bank. In Scotland a fishing boat manned by three brothers was lost off Campbeltown and the worst was feared for the three men. Part of the reason for the containment of loss was due to the fact ample warning was given by the Meterological Department of the heavy rain and continuous rain. This warning enabled captains of vessels "to seek shelter when it was rendered necessary". A great storm visited the west coast of Britain causing considerable anxiety to prevail for the safety of several hundred fishing boats who had put out to fish for herring at the Tail of the bank as several had not returned. Although various rumours circulated there was no news of loss of life although two oats were missing and two had been seen keel up. On the afternoon of the 2nd the Meterological Office telegraphed the Glasgow port authorities the storm drum as the strong winds from the north-west and south-west continued. The onshore gales combined with high tides caused significant issues in Liverpool Bay. A brig in ballast between Waterloo and Crosby but was fortunately got off by a tug and the</p>
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Liverpool lifeboat rendered valuable assistance. There was also a collision between one of her majesty's gunboats and a ship with minor damage being sustained by the latter. A screw steamer also sustained damage and a vessel was picked up from the Formby shore. At Blackpool the storm surge conditions were such that the "the tidal water rose to a greater height and with more violence than the oldest inhabitant can remember". The tide swept over the promenade doing substantial erosive damage and flooding several properties to a depth of 2ft to 3ft. in spite of fact many inhabitants tried to dam the flood waters by closing the door and cealing the gaps with clay. The water swept over the seawalls and into two hotels with great fury and swept away part of the Blackpool and Lytham Railway. As a result all traffic was stopped and passengers had to make other travel arrangements. The two newly erected piers withstood the storm well however it was stated had the wind been from the south-west as opposed to the north-west they would have suffered greatly. "The scene presented at South Shore on Thursday was one of devastation" as long lengths of walls were washed down and large stones and blocks of granite littered the coast whilst the foundations of houses were undermined. Many people evacuated their houses due to apprehensions of a second storm surge at high tide. Despite the work of 20 horses and carts as well as 70 men all work to repair the breaches in the seawall and by the railway but all their work was washed away by the next tide. The damages to the seawall were stated to cost between £200 and £250 (£24,000 - £30,000) to replace whilst the railway

embankment damage was yet to be calculated. Overall "South Shore throughout its whole length presents a most deplorable aspect, and the inhabitants are in a very distressed sate of mind" and the outside of their properties were much damaged although their attempts to keep water out of their houses had largely been successful. A schooner was driven ashore near Ayr and it was feared she would become a total wreck whilst another went to pieces on the Carrick coast. The captain remarked where the ship was washed up was rather fortunate as had they washed up 100 yards further south "no chance could have remained of saving the lives of the crew" as much difficulty was experienced in getting ashore in the ship's tender. Another vessel was totally wrecked near Llandudno and the crew were thought to have been saved. Two lives were lost off Tenby when a smack carrying granite for the fort at Pembroke Dock was overwhelmed and sank. It emerged that the ship's mate had previously refused to go on her due to her leaking state and a boy had gone in place. It was stated "The loss of the cargo will greatly retard the completion of the fort". Two steamers collided in the Bristol Channel which caused one to sink although the quick reactions of the Captain to beach her on the mid ensured that all 20 passengers and the crew could be safely landed although between 70-80 sheep were lost and other goods were much damaged. It was stated the Captain of the foundering vessel was not to blame for the collision and there would be an inquiry into the matter.

1869	29	12	Welsh Coast	Western Mail	03/01/1870		A two vesseles were wrecked on the Carnarvon bar on the Welsh coast. On one vessle all hands (estimated 9-12) were lost.
1870	7 to 8	1	National	Western Mail	10/01/1870	1	Severe gales from the WSW and rain resulted in sigificant damage in western coastal areas due to marine inundation and the shear force of the wind and rain. Throughout the towns of the welsh coast significant damage was noted to residences and it was unsafe to go outside for fear of falling chinmeys and loose slates. Several new builds being completely destroyed. Shipping was also severely hampered by the 'perfect hurricane' and the most notable case involved a French brig which was wrecked off Swansea and pilot from Tenby drowned in the incident. The hospitality and compassion of the local residents towards the surviving seamen was noted.
1870	14	1	Cardigan Bay	Western Mail	20/01/1870		A vessel was wrecked due to storm conditions and strong SW winds in Cardigan Bay although her crew were saved due to the intrepid and courageous efforts of the Barmouth and Abersoch lifeboats.
1870	12 to 14	10	Irish Sea & Bristol Channel	Western Mail	12/10/1870 - 15/10/1870	6	A very strong gale with winds veering from the SSE to SSW accompanied with heavy showers and hail swept over the Bristol channel area. In Cardiff streets were deserted, travel was difficult and shops shutters were blown down two pubs were badly damaged. Shipping movements were completely halted in the Newport, Bristol and Cardiff docks which were largely deserted expect for pilots. A barque was driven into a jetty and was close to sinking, two steamers recieved considerable damage with members of both crews sustaining severe injuries. Three ships had to be aided into Cardiff after their anchor

1870	22-23	11	South Wales	Western Mail	23/11/1870
1871	9	3	Swansea Bay	Western Mail	11/03/1871

snapped in the channel. Another small 3 man vessel sank in the Bristol channel although the men were rescued by a Cardiff pilot boat. Two ships were stranded on the sands, a large vessel was also driven onto the mud whilst an Austrain vessel was demasted. In the Cardiff area one sailor lost his life after falling whilst trying the reef the top sails and two more men were washed overboard near Lundy Island. Several other vessles were driven ashore on the spit in the Newport Ronds. 10 vessels and their cargo were damaged or driven ashore in the Swansea area alone and 1 vessel sank with it's captain perishing along with 2 other men who were washed overboard on one of the distressed vessels. Very high seas were observed around Tenby and preparations were made by the coastguard in case of emergency but lifeboats were not required. At Aberdare damage was done to the machinery of a the Aberdare Iron Company were damaged along with residences. At Aberystwith there was a considerable storm surge occurred and cart-loads of sand and gravel were deposited along the parade to mitigate it's effects. At Aberayron a strong WNW wind caused a 2 vessels to run ashore although all crew safely waded ashore. Another vessle was rescued by the lifeboat crew at St. Davids.

Basic account of a severe storm of wind, rain and hail accompanied by thunder and lightening. A ship at sea off Penarth slipped anchor and ran ashore.

Strong SSW gales caused a barque on tow from Swansea to Cardiff to be wrecked leading to the loss of all 7 hands.

1871	13	8	South Wales	Western Mail	13/08/1871		A highly severe storm of thunder, lightning and rain swept over South Wales. A brisk wind sprang up which threatened to 'tear up trees from their roots' whilst windows were broken by hailstones. No serious injuries were recorded but windows were broken by hail whilst chimney falls caused considerable damage to properties throughout the region. Strong winds and hail broke glass in Newport, whilst in Pontypool the storm reached a level of ferocity never before witnessed. The storm was also attributed to the cause of a fire in a house Pontypridd whilst a chapel and a mast of a yacht was damaged in Llanelli.
1871	21-22	8	South Wales and the Bristol Channel	Western Mail	28/08/1871	3	A storm and heavy seas led to the destruction of a yacht and 3 of the 4 men aboard drowned.
1872	10	1	South Wales	Western Mail	02/10/1871		A severe storm of strong winds and heavy rain led to the loss of a captain's life at sea whilst there was also severe flooding in the vale of the Severn which resulted in flooding of agriculture land and transport was made difficult. Crop were also pre-emptively harvested whilst livestock had to be rescued and it was feared many could imminently lose their lives.
1872	19-20	1	South Wales	Western Mail	21/12/1871		One of the strongest gales for several years to hit the south Wales coast caused significant flooding. The gales were from the NW-SW and described as hurricane force whilst rain fell in torrents causing the River Tuff to rise rapidly although no flooding of property or disturbance to people was noted. In Cardiff and Swansea damage was done to shipping in the docks and a schooner was wrecked whilst attempting to enter Swansea. Damage was

1872	17-18	12	Irish and Celtic Sea	Western Mail	23/12/1871	44	done to the clock face in Neath whilst slates fell from roofs across the region. Hurricane force winds from the south-west severely disrupted shipping on the west coast of Britain and lead to the destruction of the ship the Delaware and 44 of her 46 crew perish along with £250,000 worth of cargo.
1873	18-19	1	South Wales and the Bristol Channel	Western Mail	20/01/1873		A two day period of near-continuous gales and torrential rain saw very strong wind from the SW (veering NW) resulted in high seas that destroyed two ships (no fatalities). A following report mentioned a collision occurred in the Bristol channel and a Brig became stranded off Swansea, whilst exceptionally low pressure (28-29 bars) was noted at Pembroke dock. Commerce and marine transportation was considerably hampered as over 600 boats had to remain in the dock for the period. In the Cardiff east dock alone 140 of the 200 boats with the dock were delayed by the unavigable high seas.
1873	15-16	12	West coast of Scotland and northern Irish Sea	Western Mail	17/12/1873		A severe storm and gales caused destruction across the west coast of Scotland. Communication structures were destroyed leading to a halt in communication between Glasgow and London. A steamer was driven ashore and damaged whilst their was considerable damage to roofing making venturing outdoors in the city dangerous. A boy was killed when he was knocked over by a large gate as he fractured his skull on impact with the floor.
1874	10	1	Celtic Sea	Western Mail	10/01/1874	1	The Java, a schooner heading from Portugal, encountered a severe storm which ruined the storm sails and a large part of the rigging. The master was swept overboard and could not be saved.

1874	24	6	South Wales	Western Mail	26/04/1874		A severe storm brought hail, thunder and lightning to Neath which damaged fragile vegetation.
1874	20-21	10	National	Western Mail	22/04/1874		A storm of high intensity created heavy seas across the west coast of Britain which persisted for a day even after the storm abated. Shipping was disrupted both in the Bristol channel and off the North Wales coast and lifeboats were required to aid shipping in both locations.
1874	28-29	11	National	Western Mail	30/11/1874	4	A violent storm of wind, accompanied by rain and squalls. Throughout the two day period the wind veered from SSE to NW as it increased in strength. The event was described as a full force hurricane and the captain stated it was one of the severest storm experienced in the channel for many years as 'the sea ran mountains' due to the ebbing tide and the SW-NWN wind which was experienced at the height of the storm on the eve of the 28th. Several ships in Swansea and Cardiff drifted from their anchors and considerable damage was done to three vessels in the Bristol Channel and Penarth Rhodes. Considerable damage to a church in Cardiff was noted and travel outdoors was difficult. Elsewhere it was reported that fatalities occurred in Cornwall where the RNLI was deployed in several locations, in one case just saving the lives of the seaman whose vessel was driven onto a sand bar.
1874	8 to 9	12	National	Western Mail	11/12/1874		A low pressure system passed over the area generating a severe gale of hurricane force from the SW accompanied by heavy rain. Across the SW of Britain considerable disruption to shipping was noted as vessels were blown off course, anchors slipped and/or had to seek refuge in sheltered bays or inlets although no fatalities were

1874	11	12	National	Western Mail	12/12/1874		reported in the Bristol channel or on the Welsh coast although mariners in Cornwall were not so fortunate. Strong westerly winds, rain and low pressure forced many ships who had set out in the brief window of moderate weather to put back. A fierce gale from the SE at Milford Haven also forced many ships to seek refuge inside the haven.
1874	28	12		Western Mail	24/12/1874		An extra from a short novel 'Death in Life' by Carl Morganwg which depicts and describes a storm as a 'war of air and water' generated by 'madly howling storm god' who 'dares the world to mortal combat'.
1875	6 to 7	1	Bristol Channel	Western Mail	08/01/1875		Having met heavy seas to westward in the mouth of the Bristol channel an Austrian vessel was had to put back to Newport.
1875	24-26	1	South and West Wales	Western Mail	27/01/1875	3	A great tempest caused severe disruption throughout Wales and a storm surge, driven by strong WSW winds occurred at Tenby which severely restricted access to the town whilst the marsh and the cottages to it's rear it were also flooded causing great distress to more than twenty families who were originally told their homes were not at risk of flooding. The sea was reported to be one mass of foam at Ferryside and the heavy rain and hurricane force winds caused considerable damage to properties in Milford Haven and Haverforwest, where the water rose to the height of the quay. On the coast there was utter carnage and reports indicate at least 6 vessels were wrecked whilst countless more withstood considerable damage and had to put into port. Three fatalities were reported in Pembroke although countless more were feared to have lost their lives.

1875	22-23	5	North-west Wales	Western Mail	25/05/1875	The individuals aboard Llanfairfechan pleasure boat who were feared to have perished after their vessel was overcome by a storm were safely returned to the mainland by a rescue party having been marooned on the uninhabited Puffin Island
1876		8	South Wales	Western Mail	14/09/1876	Meteorological report for the month of August detailing accounts of several violent thunderstorms and heavy rainfall. Most notable the author described the month's weather as 'not unworthy of its imperial and August namesake. It was for the most part hot, fine and brilliant; but the heat of the sun was tempered in some places by violent local thunderstorms'.
1876	20-21	12	National	Western Mail	22/12/1876	Account of a national storm that resulted in loss of 16 lives on a vessel in the North Sea as well as widespread damage to property and communications throughout Great Britain. On the west coast portions of the Great Western Railway were flooded although the trains could still run on coastal lines but they did have to slow when travelling through inundated stretches of line.
1876	27-28	12	South Wales	Western Mail	29/12/1876	Extensive fluvial flooding was experienced throughout South Wales due to the occurrence of a severe storm that brought with it heavy rain. The rivers Taff, Lougher, Gwilly and Rhymney all burst their banks leading to the inundation of the Great Western Railway to a depth of 15 inches at Whitland, the flooding of main arterial roads in Caerphilly. The vale of Towy was 'inundated for miles around' and some properties were flooded in Pontardulais although no injuries or deaths were reported. In Cardiff it is noted that there was initial concern the high river flows and high tide at 4pm would lead to significant inundation

1877	31/12 to 5/1	1	Western Europe	Western Mail	2-5/1/1877	<p>at the coast, however the flood abated before the tide was at its highest and therefore no damage was sustained.</p> <p>Heavy rain and gale force winds resulting in widespread flooding and destruction throughout the kingdom and on the west coast of mainland Europe. On the west coast high tides resulted in storm surge waves breaking over coastal roads in Aberystwyth. The Severn also burst its banks and many square miles of land was flooded with untold damage to property. On the Mersey a ship broke from her moorings near high water and was driven onshore at Rock Ferry although no fatalities were noted. At the Mumbles a high tide and SEerly gales drove three oyster smacks ashore. Significant inundation was experienced in the forest of Dean on several occasions throughout this period although, miraculously no loss of life was sustained despite the fact several damiles were 'imprisoned in their bedrooms', several mines were flooded and work had to be suspended on the Severn Bridge Railway. In Carmarthen the heavy rains caused the Tywi to overflow the marshes and several houses on the quay were inundated. In Somerset the storm tides and heavy rain resulted in two thirds of Langport was flooded and the main street was rendered impassable with inhabitants obliged to live upstairs whilst also business was suspended and crops ruined. Nearly the whole borough of Wicklow, east Ireland was submerged as waves pounded against houses and the railway was breached leading to substantial damage to property and</p>
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1877 29 - 30	1	South Wales	Western Mail	31/01/1877	14 communications. The inhabitants of several coastal villages left their homes in boats. A perfect gale from the SE combined with high tide resulted in a storm surge in Cardiff which resulted in tidal waters washing over the pierhead and the loss of a portion of the road leading down to the low water pier. Several vessels also parted anchor although no major damage occurred although shipping was largely paralysed. Elsewhere in the city coastal roads were inundated to a depth of approximately 3 feet and cellars of some coastal properties were flooded. It is specifically mentioned that although the tide was high at 32 feet and 9 inches the gale, which was unlike any in recent years, was responsible for the widespread inundation. Elsewhere several chimneys were blown down in Roath and other slight damage to property was sustained. In Port Talbot a strong westerly breeze and high tide resulted in the docks becoming 'overflown' and the storm surge also resulted in the flooding of a row of houses so that the water 'nearly reached the beds' and all inhabitants were evacuated by boats and taken to the Port Talbot Inn to shelter. In Aberystwyth the 'terrific hurricane' and storm surge resulted in water overtopping and partial destruction of the sea wall which was partially destroyed and the consequent widespread inundation and the flooding of the basement of Victorian houses. The seawall road was also partially washed away whilst several houses along the seafront sustained significant damage whilst the pier was lost. Labourers were promptly went to construct a barrier to protect the foundation of the houses as there were
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fears they may give way. At Tonybwllch, the sea embankment was broken down for a hundred yards resulting in the flooding of meadows, field and gardens whilst ten pigs were drowned at St. Trefechan. At the time of writing the damage could not be estimated and it was remarked that 'no such storm has ever been known here within the memory of man'. At Briton Ferry the heavy gale resulted in a captain losing control of his steamship which collided with and did significant damage to the west pier although the vessel itself sustained minor damage. There was also partial inundation of the lower part of the town, although it was noted the inhabitants were used to such flooding. In Cardigan a strong north-westerly breeze produced a storm surge which inundated the houses bordering the Strand and Mwdan rivers which sustained substantial structural damage. In Carmarthen heavy rain and storm surge conditions resulted in widespread inundated for miles in the Vale of Towy although no major damage to property occurred. South of Cowbridge part of the sails of a windmill were blown away. In Haverfordwest many rooves were stripped of their slates whilst the storm surge resulted in inundation of the lower portion of the town. In Llanelli many rooves were damaged and the Burry tin-plate works sustained major damage as two 30ft high chimneys were blown down resulting in £30 worth of damage and 3 men sustaining injured. At Pembroke dock and Neyland the highest tide in more than 10 years was experienced and several boats parted anchors and were smashed on the beach whilst shipping debris was found throughout

freshwater bay. A wooden bridge crossing the stream at church lake was also lost. At Penarth a 'furious gale of wind, accompanied by rain and hail' produced once of the most severe storms experienced during the last 15 years. In the town several rooves and chinmeys stacks were damaged although the shipping in the dock rode out the gale very well and no serious damage was reported. Signals of distress were observed from an Italian vessel in the roadstead which had parted anchor and the lifeboat crew and a steam tug successfully prevented her drifting into the sand-bank towards which she was heading. At Tenby several rooves were damaged and the top of an old wooden windmill was blown straight off. There were fears for several vessels in the Caldy Roads although at the time of writing no losses had been reported. Shipping also faired were at the Mumbles. The damage sustained to the pier also prevented the arrival of the first train from the bristol via the new passage crossing and the inundation of the area surrounding the new passage hotels which marooned passengers who had to complete their journey via ferry. It was noted that the new passage pier had no sustained such violent weather before, however the structure withstood the storm well despite the fact that issues regarding construction materials were raised during its construction and the contractor was financially ruined by the venture. A steamer which ran ashore in Clougher Bay near Dublin sank on tow outside Copeland leading to the loss of 11 lives. At Swansea the heaviest gale and highest tide since 22nd November 1865 caused significant destruction in the docks and the Italian barque Peruna put

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in with th master dead and two crew dead. The south dock embankment was considerably damaged but the newly conctructed pier extnsion sustained only minor damage despite being inundated for long periods around high water. A report from the Meterological Offic in London noted ' the changes in the weather over the United Kingdom continue to be most sudden and extensive'. Pressure was very unsteady over the kingdom and during the night of the 29th a 'deep barometrial disturbance' passed over the north of Ireland and England. Serious gales blew on all coasts and inland causing widespread destruction of property and distrubance of shipping whilst dozens of people have been seriously injured and several fatalities were sustained throughout the UK. However the Meterological office later noted that during the final days of the storm the weather system 'proved to be less serious than first anticipated'.

A summary of a report by the Treasury Committee which recommended that ocean meterology should be transferred to the Hyrdographical department of the Admiralty due to their high quality facilities for collecting observations and meterological interpretation abilities. It was suggested meterological work should be extended, whilst £4500 annually should be expended on meterological observation and interpretation, meterological telegraphs should be sent on Sundays. The report finally concludes the issuing of storm warnings is of real value.

1877	1	South Wales	Western Mail	20/02/1877	<p>Meterological report for the month of January detailing the effects of storms which especially emphasises the influence of storm surges 'The wet weather caused a continuance of the floods which have been so conspicuous a feature in the landscape for some time past; as if the genius of the storm were not content with the destructive activity of the air and the clouds, the sea joined in the fray, and in the form of tides did a vast amount of damage'. The waves roared and the wind kept their shrill revels in concert.' The affect of the storms on national agriculture is also highlighted whilst the author also notes that the sanitation standards were generally high considering the weather, although a measles epidemic occurred. There is also an astronomical explanation concerning why high tides occur and the author even goes further to explain why storm surges occur detailing how the wind direction is also key in producing storm surge conditions. Moreover the author explains how the wind direction largely served to 'neutralise the astronomical factors' of high tide on the west welsh coast and was a primary reason why the storm surge conditions experienced in the area were comparably insignificant compared to the conditions experienced on the south and east coasts.</p>
1877 19-20	2	National	Western Mail	21/02/1877	<p>A low pressure system passing over the north of England which caused barometers to drop with 'unusual rapidity' led to the issuing of weather warnings for the west, south and east coasts before a terrific gale ensued. Whilst no serious damage was reported in Cardiff, in Aberystwyth a church roof was partially stripped off, whilst a wall</p>

1877	3	National	New York Herald in the Western Mail	12/03/1877	surrounding a Catholic church gave way. Scores of windows were smashed in the coastal terraces whilst chimney stacks fell and high buildings and trees along the west Wales coast were destroyed. Damage to residential and comemrical property in Newport was also experienced. Despite the fact the storm was anticipated there was also carnage on the Mersey were an incredible intense storm was experienced that resulted in widespread destruction of shipping in the river as ships collided into one another and ran a ground. Most gravely several lives were lost as a vessel was washed up on a bar in the mouth of the estuary.
1877	3	Western Europe	New York Herald in the Western Mail	17/03/1877	The prediction of a storm in the Western Mail Shipping Intelligence section which details information received by the New York Herald office in London that a dangerous storm is crossing the Atlantic and due to arrive in England in approximately two days.
Pre-1730	4	Cardiff	Western Mail	02/04/1877	Another 'storm prophecy' from the New York Herald suggesting that a easterly moving tempest will strike the British and French coasts in approximately a weeks time and last for up to four days.
1877	4	North of England	New York Herald in the Western Mail	02/04/1877	A reference to the destruction of a tower which formed part of Cardiff cathedral in a severe storm just before 1730
					A storm warning featured in the Shipping Intelligence section which features a prediction from America via a telegram received by the New York Herald in London that a storm will strike the North British coast in approximately a days time. It is predicted it will bring with it rain and gales from the south-west to north-west.

1877	4	4	North of England	Western Mail	05/04/1877	A brief account of the predicted severe storms which were said to have done considerable damage to trees and property throughout the North of England. The south of England, namely London and Brighton appear to have been visited by thunderstorms which brought with them torrential rain and hail.
1877		3	South Wales	Western Mail	12/04/1877	The Cardiff Rural Sanitary Authorities report for March which suggested that the increase in mortality from 12 in 1000 to 17 in 1000 in rural areas compared to February was a direct result of the storms that had affected the region. A report by Mr T. Waring subsequently recommends a storm water reservoir should be constructed in Llandaff in order to prevent the Cardiff sewage system becoming overwhelmed and he predicts this would cost approximately £1000 to implement. He also recommended filtration of the sewage water should take place to reduce pollution of the River Taff and a separate storm storage reservoir should be built in the filtration area to prevent it becoming overwhelmed following periods of heavy rain. Overall Waring predicted this new filtration and storm water storage reservoir by the taff would cost £1430.
1877	16-17	5	South Wales	Western Mail	18/05/1877	A brief qualitative account of a storm of heavy rain and strong winds which was noted as being unusually strong for the time of year. Leaves were strewn across the churchyard, flags were 'torn to ribbons' and a flagstaff was also carried away by the violent winds at another church in Pill.
1877	27-28	5	Irish Sea and Bristol Channel	Western Mail	29/05/1877	A report of a strong south-easterly gale which veered to the west which was accompanied by torrents of rain.

1877	4 to 5	6	South and West Wales	Western Mail	06/06/1877	<p>Whilst there was no report of loss of lan, shipping suffered in the Irish as a brigantine was wrecked off Castletown, Isle of Man and all her crew were loss. Two other vessels were forced ashore on the Irish Sea ocast although no lives were lost due to the effective response of the lifeboat crews. However the captain of a brigantine, driven ashore on a sandbank near SOutthport refused to leave his ship, which is stressed will likely become a total wreck.</p> <p>Several brief accounts of the impacts of strong gales on shipping in South and West Wales. A collison between two schooners occurred in Milford Haven resulting in substantial damage to both vessels, whilst another schooner the Shelah of Dublin lost sails in the gale. The fishing fleet of Tenby also sustained substantial damage and the event was described by the fishermen as the most severe they have experienced for years.</p>
1877	27-29	8	South Wales	Western Mail	28/08/1877	<p>Advert for the production 'The Prayer in the Storm' and 'The sea of ice' at the Theatre Royal, Cardiff.</p>
1877	27-29	8	South Wales	Western Mail	29/08/1877	<p>Torrential rainfall and strong winds hit the south of Wales which prevented travel, paralysed business and lead to widespread destruction of residential and commerical property throughout the region. The account focusses primarily on the impact of fluvial flooding as intensew rainfall turned the Taff, Rhodda, Llyni, Ognore and Rumney rivers into raging torrents, all which burst their banks. It was stated that most of Glamorgan spent the night of the 27th 'struggling for life with the treacherous mass of boiling waves'. The floods at Bridgend were of a magnitude not experienced by even the very oldest of</p>

inhabitants and immense damage was sustained by property throughout the town which was initially predicted to cost £50,000. It was stated 'so sudden was the calamity that it was hardly possible to realise the extent of the mischief that occurred', whilst following the rapid rise and fall of a flood a thick veneer of mud coated the town. Five bridges were washed away on the Llyni to Ogmore railway and a large section of a railway embankment subsided near Portcrawl halting rail traffic. It is noted that far more damage was sustained than initially detailed in the account and the flood as a whole was so quick it was 'as if a reservoir had burst over the town'. On the great western railway, the services ran through a depth of water 3ft in depth in some places and passengers on the train noted flooding over many miles of meadows and drowned agricultural land. At Llantrissant station the floods rose to the level of the platform and nearby villagers had to be rescued by boats from rapidly rising flood waters which were said to be 1ft higher than any previously experienced. The human resilience to the event is also noted however as the author details how a picnic party somewhat humorously carried on with their trip whilst a man with a wooden leg on a donkey amongst others provided entertainment for a large public crowd in the town of Pontypridd who made light of the events and served to raise spirits. Near Neath there was further irreversible destruction of bridges and agricultural property whilst the village of Aberdylais was completely submerged. It was noted that 'the damage was most distressing, falling as it does on the humbler classes, who

inhabit cottages by the river and canal side', whilst it was said the vast extent of the damage made it impossible to predict the financial cost. Throughout the entire area at towns such as Gilfachgoch, Llandaff Maesteg and Pentre further damage was sustained to bridges, agricultural property, roads and railways whilst even the oldest residents had likewise not seen a flood so violent. In Aberavon, the premises of several inns were flooded and the quick response of the town council was heralded as being key to avoiding a loss of life. It was noted that 'a discrepancy exists as to the time when a similar flood took place' as although two or three floods with similar consequence had occurred over the previous 50 years, 'the circumstances were now confused in the memory of those who lived at the time and those who were able to remember them'. Indeed it was noted that the river had previously been much shallower than at the time of reporting and thus 'such a volume of water as flowed on Tuesday morning was not required to flood the town'. Following the event a certain Mr T.W. Jenkins suggested that a subscription list should be opened to aid those who had suffered any losses during the flood which was estimated to have amounted to around £500 worth of damage. At the mouth of the Taff in Cardiff, it was estimated that the water level rose from eight to ten feet and to sixteen feet at some point, which was a level higher than that observed for many years. However no material damage to property was sustained in the town and no lives were reported to have been lost throughout the region despite the historically immense devastation.

1877	27-29	8	South Wales	Western Mail	29/08/1877	<p>A letter to the editor of the Western Mail from J.P.Jones a minister from Bridgend detailing the dreadful affects of the storm and devastating flooding. In the short letter he exclaims 'the scenes we have had to witness will never be forgotten' and that many of the the town's 'brave tradesmen have been seen in the fac of this calamity to weep like children' and how the 'flood of waters means floods of tears from hundreds'. He goes further to quote a tradesman who exclaimed 'there, in a few hours I have lost the labour of 20 years'. The author then highlights how the leading figures in the area have pledged to assist in the relief effort, but also stresses the need for a swift response plan to be drawn up. Jones' stresses this quick response and immiediate relief effort will would greatly lift the morale of the community by exclaiming 'bright futures made dark as night will have that light to shine upon them that will make their faces beam once more with the hope and joy'.</p>
1877	27-29	8	South Wales	Western Mail	01/09/1877	<p>A guest contributors account of the human response and clean up operation following the Bridgend. The 'overwhelming sorrow and commiseration' that grips the inhabitants of the town, which is described as an 'utter wreck and ruin', is conveyed with a collection of personal examples. He mentions the unfortunate situation of Mr Behs who's 'beautifully furnished shop' was destroyed by the six feet high flood waters and his most valuable jewellery was lost as he was forced to 'swim for very life'. However the author states it is 'impossible to describe half the destitution, half the loss, half of the heart burnings of a wretched people overcome with a</p>

1877	11	9	South Wales	Western Mail	12/09/1877
1877		10	Western Europe	New York Herald in the	05/10/1877

tribulation unparalleled in its extent and result. The contributor also details what occurred in the flood response meeting attended by 13 magistrates and 200 professional men, and the author sarcastically exclaims 'a magnificent sum of £15' in initial relief finance was collected. However before an official subscription fund was started, it was suggested that a period of two weeks should be dedicated to accurately assessing loss throughout the neighbourhood. The author is highly critical of this decision to wait a fortnight suggesting 'the principal object of the meeting was to do everything and anything but start a fund' despite the fact he claims '£30,000 would not cover the loss in the two alone' let alone adjoining neighbourhoods'. The author goes on to state the subject of distribution was made 'formidable and difficult' and an emphasis was placed on the duty of landlords to provide for their tenants and 'the immorality of drunken wreckers on the Newbridge fields' was also portrayed in a humorous vein, making it abundantly clear that these high ranking members of society had no desire to financially contribute to a relief fund. The author somewhat angrily concludes that 'In a fortnight's time the whole thing will be forgotten, and must make room for some other and more recent agony, which appears to be renewed with unusual frequency right now'.

A brief account of a storm in the Forest of Dean which resulted in the suspension of work at several collieries. News of a slowly approaching 'cyclone storm' in a New York Herald telegram from the United States. Very violent

				Western Mail			winds, lightning and heavy rains are forecast and the storm is described as progressing in a westernly direction in a line ten degrees north and parallel to a line drawn from Bermuda through Azores to the Bay of Biscay.
1877	9	10	Western Europe	New York Herald in the Western Mail	09/10/1877		An update regarding the cyclonic storm progressing in a westerly direction across the Atlantic. Very dangerous easterly-north-easterly gales are predicted to strike the west coast of Europe in a day's time and vessels about to leave British and French ports are advised to take warning.
1877	14-16	10	Western Britain	Western Mail	16/10/1877		A detailed account of a cyclone which caused extensive destruction throughout western Britain leading to the loss of lives, property and many a marine catastrophe. The main reporter expressed that 'seldom has a fiercer gale wreaked vengeance among the homesteads of the agricultural districts of South Wales and the West of England, or played with more fearful fury with the shipping of the Welsh ports'. At the time of writing of the first article the storm was still 'revelling in unrestrained wrath'. Rooves had been torn off churches, theatres and residential property alike, whilst 10,000 apple trees were uprooted in the orchards of Herefordshire, whilst postal and telegraph communications had been delayed. In Cardiff it said although 'the weather was boisterous and the wind cold and high on Sunday night, there was nothing (one assumes this is a superficially assessment) to indicate that a storm of intense severity was about bursting with sudden fury over this town and neighbourhood'. It is said that the 'sudden fury of the wind and the force of the accompanying heavy and almost

incessant downpours of hail made the storm more frightful, and when later in the afternoon and evening thunder and lightning were added, the effect was certainly more disquieting and disastrous. However it was stated that from a monetary point of view the damage sustained to property was not serious. Alternatively, the storm wreaked great havoc on the Penarth roads and the docks as there were multiple collisions between vessels and two pilot boats were overcome leading to the loss of life on both vessels. In Penarth a roof was blown off and there were several chimney falls although no fatalities were recorded despite the gale being described as one of the most violent experienced in the last 18 years. In Swansea four ships were driven ashore after very strong SW winds caused them to part with their anchors although no lives were lost both on the coast and in the town despite damage largely to the roofs of property. In Neath a portable theatre was 'literally blown to atoms'. A subscription list was subsequently started in behalf of the company, whilst the Neath Amateur Dramatic Society also 'kindly consented to give an entertainment at the town-hall in aid of the sufferers'. Inhabitants of cottages on the grounds of the Penrhietwyn estate escaped almost certain death as a huge elm fell just short of their residences and it was noted that the lodges were 'covered with dry salt, evidently deposited by the gale'. In the Forest of Dean, the lack of anticipation of a gale of such immense ferocity was also expressed despite the observed rapid fall of barometric pressure. Indeed it was said 'the moon rose with freshness and beauty, and only those

initiated in the mysteries of 'pointed horns' could a sudden change in the elements been foreknown'. The hurricane force winds were initially described as coming from the south-west although they veered north-west throughout the night there sweeping across SW-NE orientated valleys. Despite the ferocity no loss of life occurred although a few lucky escapes occurred as chimneys fell through roofs. The damage to crops, particularly orchards was also emphasised whilst major roads were blocked with fallen trees. In 'one of the most severe hurricanes which have ever visited Bristol' several houses were completely destroyed and a church and the parapet of Redcliff Church was blown away leaving 'scarcely a street in the city or suburbs that did not show evidence of the force of the gale'. A barque in Bristol harbour broke from her mooring and was driven against Bristol bridge with such force that she sustained significant damage and a portion of the footpath was torn up, whilst 'her bowsprit remained in the carriage way for a considerable time'. £50 of damage was sustained at the general hospital and trees were uprooted throughout the city. In Newport, Monmouth and Llanelli several houses sustained major damage to their roofs whilst the south-westerly gales destroyed the new goods shed at Tenby station as many vessels sought shelter in the Caldy roadstead. However a vessel offshore near Cowbridge was not so lucky and was driven ashore with the consequences unknown at the time of writing of the first article. In Liverpool Bay a vessel worth in the region of £12,000 was sighted stranded on the Middle Mouse sandbank near

1877	17-27	10	Western Britain	New York Herald in the Western Mail	16/10/1877	<p>Amlwch but the actions of an intrepid lifeboat crew ensured no lives were lost. Moreover, the squalls from the west were said to have completely prevented any shipping from leaving the Mersey for foreign ports for the entirety of Monday.</p> <p>A storm warning suggesting a 'sucession of depressions, probably four, attended by heavy winds and rain will reach British coasts over the next 10 days. A turbulant period is predicted with fine weather alternating with the disturbances.</p>
1877	27	10	Western Britain	New York Herald in the Western Mail	25/10/1877	<p>Warning of a coming storm in the Shipping Intelligence section sourced from a telegram sent to the offices of the New York Herald in London. The telegram forecasts 'heavy gales from the south-east to north-west will prevail' and strike the British coast in two days time. The danger to vessels bound to American ports north of latitude 35 is emphasised.</p>
1877	29-30	10	Western Britain	Western Mail	31/10/1877	<p>An account of a heavy gale from the south-west with significant fluctuations in wind strength that passed over Cardiff but the wind was not as consistently as strong as the storm of the 14th-16th. The impact of the multiple storm forecasts and the dilligent observation of the weather system is hoped to have reduced casualties to shipping to a level 'far less than would otherwise be the case'. The intense heavy rainfall brought by the storm is said to have resulted in flooding at close proximity to the Taf and Ely rivers although 'a comparatively small amount of damage occurred around Cardiff' and by the 30th the rivers had 'fallen to nearly their normal condition'. However, upstream of Cardiff there was instances of</p>

1877	11	National	Western Mail	02/11/1877		<p>flooding of some riverside residences leaving many houses by the river and the canal near Blackweir and in Grangetown 'in a very sad plight' with the 'principal injury being the alarm and inconvenience occasioned'. The complaints of the residents of Grangetown are also noted as they felt 'nothing has been done to keep the waters of the Ely from overflowing the district, and it is urged that something should now at least be attempted whereby to remedy such a state of things'. In Llandaff the sudden rise of the Taff paralysed production at the Iron works, a quarry was flooded whilst farmers 'were obliged to wade waist deep in the water to save their pigs'. The flooding at Llandaff bridge also prevented the postman from reaching the letterbox so no letters could reach the nearby Cardiff. An announcement from the Board of Trade with the Shipping Intelligence section stating the accuracy of all issued storm warnings for the year 1876 was 83.9%, which was higher than any previous year.</p>
1877 10 to 11	11	Western Britain	Western Mail	12/11/1877, 13/11/1877 and 16/11/1877	8	<p>Heavy relentless rainfall was accompanied by gusts of strong winds in Cardiff as the temperature plummeted. The wind was described as becoming 'very boisterous, although of a fitful nature and 'the rain fell with deluge force'. The rapid rise of the Taff and Ely rivers was also noted and large tracks of low-lying land was submerged although there was no mention of the human consequences. In Swansea however, the continuous heavy rainfall and heavy winds were noted to have flooded streets whilst some buildings in 'more exposed situations suffered damage from the severity of the hurricane'. In Neath similar damage was sustained to exposed</p>

properties whilst two men 'attempting to rescue a pig from a sty, were washing into a depth of 12ft of water', although despite being able to swim 'they clung to a wall and were saved in a most miraculous manner'. At Tenby minor damage was sustained to the roofs of several homes whilst a large fleet of vessels took shelter in the Caldy Roadstead, however one vessel broke adrift on the morning of the 12th and was driven ashore on the Pembrey sands near Burry Port, leading to the loss of four hands although eight were saved. Near Carmarthen flooding occurred as the River Towy burst its banks although the damage was limited to the partial destruction of the tinworks near Carmarthen, whilst 'a large quantity' of timber was swept away. The death of a young man whose vessel was shipwrecked on the Carmarthen coast reached his parents in Abertillery on the 12th was the cause of much sorrow and 'the sad end of a so promising a young man was the chief topic of conversation' in the village. In Cardigan 'the incessant downpour of rain causing the lower parts of the town to be entirely inundated'. However, despite several areas of the town 'presenting a river-like appearance' little serious damage was done, 'with the exception of the natural results of inhabited houses being flooded'. At Liverpool the storm, which brought violent winds from the south-south-west, was reported to have been responsible of the loss of three lives, significant injuries and all the deck load on a vessel travelling from Saguenay, Canada. Despite such consequences the main reporter is keen to point out how the so-called 'weather prophets would seem to be

1877	10	South Wales	Western Mail	12/11/1877	<p>attaining a pitch of perfection in their predictions of the exact time when storms are to pass over from one side of the world to the other which is really marvellous.' The reporter goes on to credit the weather prediction system and communication service as being largely responsible for reducing loss and damage to property, seeming to praise the meteorologists as almost demi-gods.</p> <p>A semi-quantitative meteorological report for the month of October. It is said an Indian summer was experienced in South Wales during the beginning of the month although these conditions did not influence the the north of England and Scotland to the same extent. following this however, it was stated 'storm and rain prevailed, that hurried on the natural changes at a great rate' and strong winds from the west 'ultimately bared the branches of the trees at an earlier period than usual'. Maximums and minimums for pressure are given whilst the heavy rainfall was measured at 5.85 inches, which is equal to 590 tons, or upwards of 2,440 hogsheads to an acre, with rain falling on 17 days, with the highest rate of rainfall falling on the 29th of October which produced conditions that even exceeded the great flood in August by nine inches and was the highest on record'. A dispute with regards to the measurement of rainfall at Bridgend on the 27th and 28th of August is also raised 'as no such fall has ever been known to occur anywhere in the British Isles' and the author supposes the daily rainfall level presented at the meeting in Bridgend is in fact the monthly total, although he is open to a scientific critique of the data.</p>
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1877	21-22	11	Western Europe	Western Mail and New York Herald	23/11/1877	<p>News of a strong gale and heavy winds across of Western Britian. However the storm was largely expected as 'south-westerly winds, and north-westerly, probably blowing a gale, with cooler, sqially weater'. Despite reports of 'boisterous weather' and 'a perfect hurricane' little damage was sustained throughout South Wales with only one incident of aa chimney fall near Newton, Cardiff being reported without any 'injury to life or limb'. However in the Atlantic the storm overwhelmed a brigs heading to Greenock from Miramichi, Canada, which had to abandoned although the crew were fortunately saved by an Italian Barque heading for Cardiff. The overwhelming appreciation of the crew of the stricken vessels to their rescuers was also expressed. The section concludes with another warning from New York via the New York Herald that another storm will strike the west coast of Europe on the 25th with south-westerly and north-westerly gales and wind being 'probably severest on the northern section of the British islands'.</p>
1877	10	12	Western Europe	New York Herald in the Western Mail	10/12/1877	<p>News from New York within the Shipping intelligence section that a severe storm with 'strong gales from the south-west to north-west, bringing with them low temperature, heavy rain and snow in the northern districts'. It is specifically stressed that vessels leaving ports on the east coast of the United States should be warned.</p>
1877	15-19th	12	Western Europe	New York Herald in the Western Mail	15/12/1877	<p>News of a New York Herald telegram predicting storm conditions and south-easterly to north-easterly gales on British and French coasts with 'rains in the south, and snow in the north'.</p>

1877	31	12	South Wales	Western Mail	01/01/1878	<p>Reports of a storm which resulted in a ship running ashore off Breaksea point. It is said it is feared how she will get off the shore.</p>
1878	15	8	South Wales	The Western Mail	17/08/1878	<p>A severe thunderstorm caused substantial rainfall across South Wales leading to significant flooding and damage to property. In Cardiff the tenants of houses in the low-lying coastal location Temperance town were hit hardest as high tides and torrential rainfall meant 2-3 feet of water from overflowing drains flowed into their basements, whilst the roof of the town surveyor's offices was greatly damaged. It is stated that a large number of shipchandlers and publicans have lost property valued at several hundred pounds due to the incursion of water into their cellars. Overall it is stated "there is hardly a street in the town which has not been made to suffer by the recent deluge". In Newport several low-lying houses were flooded along with the kitchens and cellars of a grand hotel. A landslip also occurred at Caerleon, blocking traffic for sometime. Many brooks in the forest of Dean broke their banks rendering many highways impassable, whilst livestock outdoors could scarcely stand. Following the event, the heavy seas produced by the storm caused significant issues for a Schooner near Milford Haven. As the wind abated the schooner, now becalmed, was uncontrollably swept the the tide onto the rocks of a small island named Skokam. She subsequently sank, leading to complete loss of the boat and all her cargo, although all crew members escaped without injury.</p>
1878	9 to 10	9	South Wales	The Western Mail	11/09/1878	<p>A deep depression passing over the western coast of Britain produced strong southerly and south-westerly</p>

1878 9 to 10

11

South Wales

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11/11/1878

gales. Consequently very high seas were observed in the channel and the Bay of Biscay whilst the sea was also rough in the south-west and consequently the admiralty issued warning signals to mariners on all coasts. The river taff was said to be "much swollen, in consequence of the heavy rains which fell over the district". Whilst the river Rumney also ran high. Although no material damage was done, a considerably quantity of rain water inconvenienced pedestrians in the centre of Cardiff. In Tenby the high tide and strong gales, caused "nearly every boat to part from her moorings". "A good deal of damage" was said to be done and one boat sank at her moorings. A telegram recieved from Dublin also stated the Irish cross shannel steamers had rough passages on Thursday although no damage was done. On the contrary, there was news that a French vessle was wrecked off St. Agnes, Scily Isles and the four men who had been saved required medical attention which was given to them by a doctor on board the St. Agnes lifeboat. The continuation fo the gale prevented the mail boat making her passage from Penzance.

Heavy storms raged over Cardiff throughout the 9th and 10th which caused the local river - Taff, Ely and Rumney to become "considerably swollen". However, forutnatley for the inhabitants of Temperance-twon, the low tide prevented storm surge flooding in the Taff and therefore the properties were not flooded once more. The Sophia Gardens were again damaged, and despite abating rainfall, the incoming tide ensured river levels remained high on Sunday evening. The strong onshore breeze also

reeked havoc in Swansea, driving two vessels from their mooring and onto the shore, although the damage to the vessels was reported to be slight. In Bridgend "rain fell in torrents, and the wind howled in a terrific way" which caused great alarm to the inhabitants of the town. The river was said to rise and cover 80ft of concrete work that faces the new embankment on the River Ogmore, whilst on the opposite side of river, flooding ensued, submerging apartments of the house near bridges, whilst agricultural land and highways were inundated near Newbridge and Ewenny as "trees were carried away by the powerful force of the water". The contributor does however mention how recent improvements in the river were severely tested and "save at a vulnerable point opposite the engine house the work proved a safeguard to town". Indeed the contributor goes to the extent of acknowledging the vital importance of the fluvial engineering stating "But for the earthworks thrown up, the deepening of the river, it would be our painful duty to record another inundation of the town of Bridgend". It is also suggested that the damage done to the bank will "we hope, be soon repaired and strengthened with concrete". It is subsequently suggested that a difference in opinion between engineers and 'experienced people' as to where the improvements should be carried out. However, until such protective measures are enforced it is suggested the townsfolk will still remain anxious, due to the fear of flood. Elsewhere Roman Catholic schools in the course of erection were blown down in Aberkenfig whilst showers and heavy gusts of

wind continued throughout the night of the 10th. At Neath the heavy rains of Saturday night and Sunday morning caused considerable damage in Neath as the Wern brook flooded a considerably greater area than usual, spilling over agricultural land and flooding houses and cellars in the neighbourhood. At Aberdylais it was once more suggested that the recent deepening of the river averted catastrophic flooding. The floods overwhelmed the sewers in Melyn, preventing traffic flow and a boy was killed in Worn Brook as he "appeared to turn giddy and fell into the stream". At Briton Ferry several neighbourhoods were flooded, presenting a "pitiable site" and the gas works were also affected. In Llandilo the near gale force winds and accompanying torrents of rain made the Vale of Towey, from Llandovery to Carmarthen appear as if it were "a huge lake". Despite efforts to erect dams of clay in Llandoveyr, the turbulent flood waters still found their way into several houses and shops with the remnant mud doing considerable damage. Fields on the banks of the river were inundated to a depth of 3-4ft although only a few ricks of hay and a "quantity of bark" was damaged. It was noted that "it is somewhat of a coincidence that 26 years today (5th November 1852) that a similar flood occurred in the neighbourhood. The torrential rain caused a Mill pond embankment to collapse leading to considerable flooding of private property in Methyr although the Taff did not burst its banks despite rising several feet. In the Aberdare valley flood water covered the Great Western railway but was not sufficiently high enough to prevent rail travel. A

1879	3	8	South Wales and Gloucestershire	The Western Mail	05/08/1879
1879	16-17	8	North Wales and Cheshire	The Western Mail	21/08/1879

special commendation is given to Mr Jenkins, the surveyor of the local board, "the care and forethought" which resulted in the efficient operation of the drains of the district and thus no damage was done by surface water. Several homes were flooded as the canal flooded and the extent of the water, whilst three horses were drowned as the flood waters were too high to provide assistance to the animals. Part of the Taff Vale Railway was washed away in the flood on Sunday which delayed communications, although the damage to the line was said to be difficult to estimate. In the Rhymney valley the gale and staged downpours hampered transport whilst the river Rumney threatened to burst its banks in Caerphilly. In Resolven many square miles of agricultural lands and pastures were flooded to a several feet causing great concern for the local agricultural communities who had to exert considerable effort to save their livestock from the advancing flood waters.

A storm of "terrible character" was said to have passed through the Gloucestershire Vale and Forest of Dean. The tempest however, was said to have largely spared the harvest, as it was mainly pasture that was flooded to "a couple of feet in depth, or nearly to the top of the hedges" whilst the arable land largely escaped injury. Nevertheless the burden the flood had put on agriculturalist during the hay harvest was stressed. A storm "which raged throughout North Wales with terrible violence" for two days caused considerable damage and disruption throughout North Wales and Cheshire. The countryside of north-wales was said to be

<p>1879 26-27</p>	<p>8 South Wales</p> <p>The Western Mail</p> <p>28/08/1879</p>	<p>1 flooded for miles around with "the damage done to agriculture estimated to be thousands of pounds". The Bryndulas Bridge in Dnebigshire was swept away by the ferocity of flow and this was shortly followed by another bridge, downstream in Abergale. A shingle and stone embankment right across the natural course of the River Dulas was said to have considerably obstructed water flow and caused a considerable volume of water to accumulation right underneath a viaduct spanning the Dulas valley. Despite the efforts of several men to remove the shingle embankment to prevent the accumulation of water in order to save several houses from inundation and the structural integrity of the viaduct, their efforts were to of no avail "water pouring down the mountain sides with tummultious violence" swept away a large stone house. Soon following the safe passage of a luggage train the stone viaduct itself colloapsed into the roaring torrent. It was estimated that the viaduct would cost between £15,000-£20,000 to replace and travel from Ireland, Chester and London was severely disrupted. The hotel at Abergale, the last town before the viaduct was overwhelmed with stranded passengers who were said to be marooned for several days and railway officials suggested it would be at least two months before a replacement service would be operating whiout a break at Llandulas.</p> <p>A gale and excessive rainfall cuased a great deal of damage throughout the entirety of South Wales. The relentless rainfall was said to "convert Cardiff into a swamp" and it was said no tradesman was able to do</p>
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business. Streets were said to have become streams whilst the river Taff was so exceptional violent it drew crowds of thousands of persons who gazed over Cardiff bridge who "looked on in wonderment, confessing that they had seldom, if ever, seen it in such a perturbed state before". The author notes it was extremely fortunate that the flood defence bulwark had been recently elevated protected the Castle grounds, as "had it been otherwise, the grounds and perhaps the castle itself would have been most disastrously flooded" as the water rose above the height of the old wall. Low lying agricultural lands were inundated to great depth and the strong winds made the river appear "very expansive and rough, a veritable sea in miniature". It was said "in the town it was gravely asked what had become of the crops". Dead livestock was also seen floating in similarly turbulent Ely and Rumney rivers although several valiant efforts led to the preservation of the lives of a harras of horses and herds of cattle. Whilst trains were late on the Taff Vale Railway due to inundation of the track and a landslip in the Rhondda valley, the head officials made took all possible measures to ensure delays were minimised. In Merthyr it was said no serious ill effects had been felt, which was said to be due to the considerable falls in the River Tadd, which rapidly carry off immense volumes of water leaving the upper part of the town free from flooding. Extensive inundation was noted on considerable tracts of land in the lower parts of the Merthyr valley. Many streams and river broke their banks in the Aberdare valley leading to expansive inundation which lead to many crops being rendered completely

ruined. The residents of Pontypridd were said to have seldom witnessed a storm of rain. The Taff was said to have burst its banks flooding the streets and the inundation of the surrounding fields and the river in flood was said to be an extraordinary site from the Rhondda bridge. The Taff was so high it was said to have engulfed the Rhondda River, flowing over agricultural land and causing immense damage to gardens and fruit trees. Flood waters up to 4-5ft in height ruined property and business appeared to be entirely suspended. The water was said to have caused the Rhondda bridge to quiver on its foundation and a serious accident occurred on the Rhondda branch of the Taff Vale Railway, although the immense landslide did not lead to the loss of life. However serious injuries were sustained when another mass flow descended towards men clearing the covered road and railway. Cottages by the inundated road were inundated to a depth of 4ft and it is said terrible damage was sustained. In the Rhondda valley the trains were said to have to pass through water of a depth reaching the bed of their carriages and scores of houses, largely belonging to railway employees, were inundated to a depth of 3-4ft, imprisoning cottagers in their bedrooms. Flooding on the Great Western Railway near Mountain Ash was also noted, although this did not significantly affect rail traffic. The mining and refinement industry was considerably affected with floods putting all the fires out at the tin works at Melyn. Moreover, all 'mineral traffic' was suspended on the Taff Vale Railway and the majority of roads were rendered largely impassable. In the

neighbourhood on Pentyrch the forge "presented a bad appearance" and it was feared that damage had been done to the plant. Residents of houses near the river banks were forced to evacuate and find shelter whilst sustained damage was done to crops and livestock was lost in the floodwaters. The strong southerly winds and heavy downpours were also said to have caused a 3-5ft of inundation in the neighbourhoods of Melyncrythan, Pentyrch, Llandaff, Belinog, Caerphilly and Llancaiach and the Rhymney valley hindering all communications as well as causing significant damage to properties and agricultural assets. The flood also coincided with the 2nd anniversary of the historic floods that devastated the neighbourhood of Bridgend, and flood waters "reached within a foot of the height attained in 1877". It was again said that the engineering and dredging measures taken following the previous event resulted in only partial inundation of the town. However, the hay harvest was ruined beyond recovery, a selection of commercial properties were flooded to a depth of 1-2ft and a fatality did most unfortunately occur as a man was carried away by the strong current. In the Llynvi valley flooding resulted in inundation to a depth of 4ft in Maesteg. The terrific storm caused the Avon to rise to a unprecedented height and the railway bridge was washed away by the current along with the six trucks of stones, which were (somewhat bizarrely) placed on it in hopes of preventing the casualty. Destruction of the Llynvi and Ogmore Railway, resulted in the cessation of all rail journeys whilst two individuals in the break van had a fortunate escape

1879 30 to 1

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01/01/1880

when the brake van came into collision with the train as it was unable to stop on the wet tracks. The district of Aberdylais was said to be "like an immense lake" as canals and rivers flooded inundating nearby property to a depth of 3ft, and properties in the town of Neath suffered a similar fate. Livestock and crops were lost on immense scales, devastating the agricultural district of Resolven as cattle was washed away and the silt veneer destroyed the remnants of any corn harvest. In Swansea hurricane force winds blew three vessels ashore, although no severe human or material damage was sustained and it was stated it was likley all the vesseles would be got off during the next high tide. In Llanelly inundation of "many of the poorer class of houses" was specifically emphasised whilst a horiticultural show had to be abandoned at Tenby whilst the persistently strong winds forced many vessles to anchor in the Tenby and Caldys Roads.

Strong squalls from the west-north-west accompanied by sporadic hail showers drove pilot cutters from their moorings, whilst iron mooring ringes were torn from their masonary. Despite this little damage was sustained by property or vessels although shipping was severely inferred with as "extradordinary precautions had in many instances to be adopted". It was also believed that many disasters had ocurred at sea. in Chepstow rail carriages were overturned by the strong winds, causing considerable delay, whilst a man was struck by lightening in the Forest of Dean but didn't sustain injury. In Liverpool the severe gale created conditions that only enabled one vessel, the ocean going mail steamer to New York, to

1880 3 to 4

10

Bristol Channel

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leave port. A telegram from Holyhead stated that a French barque was wrecked off the skerries, leading to the lost of 7 of her 11 strong crew. Considerable damage to property was sustained in the Irish coastal town of Waterford and cross channel steamers were much delayed. Subsequent reports on the 1st of January spoke of fears of floods of the Taff and Ely, whilst an increase in wind following a slight lull forced many vessels to return to the Penarth Roads, and continental shipping to Bilbao was not possible. Flooding of the River Cynon near Aberdare caused considerable loss to landholders whilst "the extraordinary degree of violence" of the wind in the Bristol channel lead to the partial suspension of the Severn shipping trade as the incoming tide enhanced inundation of the Dean lowlands. 'Central News' telegraphs from Wexford reported of the loss of a tug which was blown onto rocks 45 miles from the Saltees, all but one of her crew were said to be lost. Communications from the Wexford coast guard stated a steamer also sank by Naltee island and nothing was known of her crew, whilst a new ship, bound for Singapore was largely destroyed, and had to limp back to the Clyde once again, all be it with no human losses. A schooner was also said to have sank in the OSund of Mull and a brigantine was wrecked of the Island of Eigg with considerable loss of life.

A strong easterly gale caused significant disruption to shipping movements and two pilot cutters were damaged as they broke from their Penarth moorings in the Bristol Channel. The lifeboat was launched after signals of distress were issued from a vessel in the Penarth roads,

1880	10 to 13	10	Western Europe	The New York Herald in the Western Mail	09/10/1880		although the lifeboat was driven ashore only to be relaunched by a collection of gallant men who waded into the water to assist the floundering craft. Another vessel was wrecked on the breakwater at Penarth and only the courageous actions of the dock gateman, who threw himself into the surf to save the floundering captain prevented loss of life. Following this tumultuous evenign the wind moderated and began to veer south-west. A storm warning, predicting a storm will preceed the depression due to pass over the British Isles. South veering north-west gales and several days of unsettled weather is predicted in the Bay of Biscay.
1880	26-28	10	Western Europe	The Western Mail	28/10/1880, 29/10/1880, 30/10/1880	3	Strong easterly winds brought about a storm surge which resulted in the inundation and destruction of the Wicklow-Dublin railway and roads were flooded throughout County Wicklow. A trawler was wrecked as it broke free from her moorings in the harbour, and dashed against the pier, whilst another vessel was wrecked near Balkey. There was a most unfortunate sight at Bray when the bodies of a man, woman and child were washed ashore and it is feared that other casualties will be reported. The streets of Cardiff "were at times rendered exceedingly uncomfortable by the steady downpour", although the author notes that good drainage prevented serious flooding and the Taff did not burst it's banks. Heavy rain and snow was said to be responsible for the delay of the mid-day Irish mail ferry express from Dublin-Holyhead and heavy rain swamped the gas mains at Wenlock plunging the whole town into darkness. A vessel

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was also reported to have capsized at the Swansea docks, with her mast damaging the rooves of property ashore whilst the captain broke his leg in the incident. The violence of the storm on a national level was expressed by the report published on the 29th in which it was stated "from all parts of the country reports recieved by telegraph show that the damage done has been of enormous extent". It was said "shipping had suffered considerably; a large number of wrecks are reported and in several instances whole crews have perished with their ships". Indeed this was the case, as on the comparitvely sheltered west coast alone four vessles were driven ashore and two sustained near crippling levels of damage. The worst of the west coast catastrophes ocurred the Clyde however, as two vessels were driven onshore, one off course and two ships, due to arrive in the port of Glasgow from New York had yet to be seen at Greenock. It was said, however that "owing to the diffculty of telegraphic communications only meagre acconts of the ravages of the gale have arrived" and thus further tales of destruction and potentially worse were feared. Throughout Ireland, Scotland and the north of England all telgraphic communication was said to to have been interupted as strong winds blew down communication lines. Flooding is Monmouthshire was such that boats were said to be plying on the roads as the waters continued to rise. Heavy snow and very strong easterly winds reaked havoc throughout the kingdom, suspending business almost entirely and many an unfortunate incident occurred at

sea. In Cardiff "the wind howled with awe inspiring fierceness, the strongest houses appeared literally to shake under the terrific blast ... The shipping in the docks was swayed to and fro, telling, as it were of the sanger which poor 'Jack at sea' must inevitably have experienced". The bitterly cold, unrelenting conditions were assumed by the author to "have not only caused great damage, but resulted in a serious loss of life" and it was estimated £2,000,000 of damage had been done. Train travel, both national and local, was said to be seriously delayed by snow drifts on the line and "a special" train was despatched to London to, one presumes, clear the line. The scene in the Bristol Channel was "such as even the oldest mariner has seldom witnessed, indeed a coast guardsman who had been twenty-two years in the service, remarked "This is the worst day I have ever had, and I have seen some queer ones: icicles as big as my fist have been hanging to my beard". The sea was described as "a turbulent expanse of white foam" and the full force of the hurricane was felt on the Head and in the Penarth Roads where vessels were "tossed to and fro". A staff of willing workers on the look-out for ships were soon called into action at daybreak as several small craft ran aground and the brigantine Restless ran ashore close to the lifeboat station. The assistance was provided with the use "rocket apparatus" supplied by the board of trade which succeeded in saving six of the crew. The workings of this "simple but effective" apparatus was described in detail by the correspondent who states "Three rockets, with ropes attached, are fired,

and when communication with the distressed vessel is thus effected the endless line is dragged off by those on board. As soon as this line has been secured, the 'britches' buoy is fastened to the hawser (a thick rope for towing) and he is hauled ashore". The crew of two barques were also saved by the coastguard before they were driven onto the beach, whilst the combined efforts of three functioning vessels in the roads saved 32 lives from other distressed vessels in the channel. Overall more than 20 vessels were driven ashore in the Penarth roads alone and it was said some of pilot vessels were only partially insured. The Western Mail shipping report stated "Never since the wreck of the Royal Charter (1859) has the Bristol Channel been visited with so severe an easterly gale", this view was shared by the masses of shipwrecked sailors of all differing nationalities who "were unaimous in characterising the storm as one of exceptional violence". The "gallant and humanic" work of the coastal volunteers was also praised, who, "in the face of a piercing easterly wind and blinding shower of snow worked with laudable cheerfulness and energy for several consecutive hours, and in one or two instances rushed into the water at personal risk to pull seamen ashore". Their courageous endeavours was suggested to be a primary reason why no known fatalities had been sustained. In Swansea several windows were blown in and chimneys felled by the raging blizzard, and not a single boat was able to enter the port. Transport in the town itself was largely retarded and a rogue vessel which broke from its chain and collided with two vessels, caused considerable damage in Swansea

harbour. The Tenby lifeboat was launched followed a signal of distress in the Caldy roadstead, although the crew had already deployed their lifeboat and sought safety on Caldey Island. Further up the channel reports from Bristol stated rail and road communications had been considerably delayed by snow 4ft to 6ft deep in the country whilst the bitterly cold temperatures caused the Severn to partially freeze at Newnham. Thousands of tons of ice which accumulated on the banks and flowed down the river largely suspended shipping traffic. Once again it was said conditions of such "severity had not been rembered for a number of years". By the 18th a guest reporter 'Ballochmyle' exclaimed "the oldest and most experienced of those brave men who go down to the sea in ships were heard to say never had such a howling storm visited Caridiff". News of a large ship running ashore near Penarth inspried some, including the reader, to visit the site of the incident to view the Storm "in all its demonaic glory". The guest report continued to emphasis the sheer power of the storm, stating "the wind blew, as if it would 'blow its last' as Burns says. The reporter went onto give a detailed personal account of the storm, descibe the perils of his party exclaiming "it [the wind] whirled round, and caught us, literally all round, up and down, whistling, howling, abaft, forward, port and starboard, piling up the snow around our limbs, blowing it about our heads, and in a frantic sort of way making the night hideous". He went onto elaborate "the wind, as we progressed due east, did not calm. It concentrated. It met us straight, and rushed upon us, in a frozen kind of serial sheet, keen, clear and

biting. Even the comfort of fraternal conversation was denied". A Penarth Ferry had been sunk although the two ferrymen "gallantly saved their lives after a desperate struggle". On the morning of the 19th the Bristol Channel was depicted as a "boundless and tameless ocean" which "seemed to pitch and toss far out at sea frail barques; it clipped around the rock-bound shore, with that furious, howling sound of oceanic revolory which even imagination cannot grasp. The sailors aboard vessels in the channel were all said to have "gallant hearts" whilst in the docks "were jammed in innumerable vessels from evry quarter of the globe, all 'tight and right' and safe from the fury of the gale. The harbour master was said to have seen the large ship that was subsequently wrecked in trouble but "so severe was the gale that neither a tugboat nor even the lifeboat could go out to her assistance". The ship in question was said to have collided with an ocean-going barque bound for Bombay and dismasted her, and the experienced mariner interviewed were said to be of the opinion nothing could have been done to prevent the catastrophe. The forthcoming carnage was said to have been anticipated by a certain captain who order the crew of his schooner to 'clear the decks' and subsequently they "cut down every mast and bit of rigging". Subequentely , "when the storm was at it's wildest, the gallant captain, was seen safely on deck smoking his pipe, and philosophically, but doubtless sympathetically, surveying the havoc around him - and it was havoc". It was said many barques and brigs were beached "with the roaring sea lashing over them and breaking them up remorsely",

1881	7 to 8	2	West coast of Britain	The Western Mail	09/02/1881	<p>which made for a distressing site. All the seafarers the correspondent met were said to have one "mournful tale-'rarely has such a sight been seen at Penarth".</p> <p>Strong southerly breezes, which gradually veered to the north west caused considerable damage to shipping in the Cardiff docks as several ships broke from their moorings and collided with other vessels which suffered considerable damage. Two vessels were said to have ran ashore in the Penarth roads whilst there were several major collisions between, barques and schooners which parted from their anchor cables. In Caldy Roadstead fierce south-westerly breeze caused a ketch to part anchor and the tide caused her to "dive across the bay in the direction of the Pendine Sands". Unfortunately, a three-masted vessel foundered off Clovelly, Devon and the lifeboat could not save the lives of the crew as the vessel was completely wrecked. The quick deployment of the lifeboat enabled all crew to be saved however, and a tug assisted the lifeboat in returning ashore through the heavy seas. In Newport and the Forest of Dean the tempestuous weather was said to have blown tiles off roofs and uprooted trees, although no casualties were recorded. A subsequent forecast for day of print predicted "north-westerly winds and gales: cloud, some showers" for the North-west of England to South Wales.</p> <p>A storm was said to rage throughout South Wales and the wider Kingdom, with the gale accompanied by sleet and hail. At Swansea a high tide produced storm surge conditions which lead to the destruction of 40 ft high wall which formed part of the embankment supporting the</p>
1881	3 to 7	3	National	The Western Mail	05/03/1881, 07/03/1881 & 08/03/1881	

Oystermouth Railway. It was stated "Labourers were at once employed to repair the damage and prevent any further mischief". A incident of similar nature occurred at Mumbles where waves made a large breach in the wall opposite a chapel, flooding the road with sea water. The onshore gale was also responsible for a large breach in the back of Tenby pier-head as it was destroyed by the immense force of the waves at high water. The waves carved a 16 square foot breach in the pier-head and water rushed into the aperture causing significant erosion as "scores of tons of stones, rubbish and clays were washed out, and it at times appeared imminent that the whole structure would collapse". Once the gale had abated a meeting of the quay committee was held "on the spot" on the immediate day following in which immediate steps concerning the repair and restoration of the breach and pier was discussed. It was ordered that the replacement of the pier-head lamp and the severely damaged sea wall beneath the high-street be seen to at once. A "good deal of damage" was said to have been done in several parts of the town and it was said that the gale was one of the most destructive felt for several years. On the western Irish coast a brigantine was wrecked and five lost their lives. Similar catastrophes occurred on the Wexford coast where three vessels were wrecked and whilst all the crew upon the French lugger Pinson were saved, five men were lost on the Brigantine, Morning Light which was completely wrecked and three men were lost from the French schooner Philomene. A "large ship, the Castlemaine, of Liverpool" was said to have struck the

1881	16-18	3	Western Europe	The New York Herald in the Western Mail	16/03/1881	<p>rocks off Ballywalter although all crew were saved thanks to the intrepid actions of the lifeboat in treacherous conditions. Two more vessels were said to have ran ashore near Ballyhalbert and one steamer was ashore in the southern entrance to the Firth of Clyde. A tremendous numbers of disasters and unfortunate loss of life was also said to have occurred on the norther, southern adn eastern coasts, whilst the heavy snow had significantly hindered rail traffic, and in the north heavy snow had lead to rail services coming to a complete standstill.</p> <p>A succinct forecast warning that a dangerous storm is crossing the Atlatic and will arrive on the British, Fench and Norwegian coasts between the 16th-18th of March. It is said that south-eastery gales will first hit before backing to north-westerly with rain and sleet "another closely following". The reader is told the Atlatic is very storm north of 40 degrees.</p>
1881	23-25	8	National	The Western Mail	26/08/1881 & 27/08/1881	<p>Heavy rain in South Wales lead to the destruciton of 20 yards of the temporary bridge over the taff and an attempt was made by several workmen to intercept valuable timber which had been carried by the flood water. The flood in the Taff and Rhondda was said to be the largest seen in several years and dead livestock was noted in the river. High winds in Kirky Stephen were said to lift a tent in which a flower show was occurring leading to the destruction of many a flower. he heavy rain fallen at Bristol was said to have done "incalculable damage to crops. Great excitment was manifested on the Bristol Corn Exchange in consequence, prices advancing greatly". The excessive rainfall was said to have made "harvest</p>

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prospects even more gloomy than previously" whilst "in the country a feeling of almost consternation" was said to prevail amongst the agricultural classes". The price of wheat in Belfast was said to have increased by 7s and 6d and flour 10s per sack due to the inundation of expansive tracts of land in County Tyrone. The torrential rains in the north-west Furness Railway between Ulverston and Barrow has been washed away and all train travel was consequently suspended. Strong winds from the west which coincided with rapidly dropping atmospheric pressure were said to accompany such incessant rain and at Blackpool and Lytham the sea was said to "exceedingly rough". A gale from the south-west was likewise felt in Beaumaris where two yachts were washed ashore. Stormy conditions were also noted in the Rhymney Valley and the continual downpour for the entirety of the 25th resulted in extensive flooding.

A storm of "unusual violence" raged throughout the whole of South Wales and the kingdom as a whole. At Swansea preparations for the Royal visits were scuppered as "the wind played sad havoc" with marquees and displays which were destroyed. A violent gale, accompanied by "fitful showers of rain, swept Cardiff causing widespread damage to property as tiles were blown off roofs and chimneys toppled. Trees were said to have suffered particularly, as many "both large and small were violently hurled to the ground", which served to impede canal and road traffic. Many came within a "haribreath" of injury in the docks, although a sailmaker broke his arm after impact with a falling brick. Although

the damage was said to be less than that sustained in the infamous February storm of this year, many docks parted from their moorings in the docks and caused considerable damage to one another. The pilot cutters suffered particularly unpleasant experiences in the westward gale with 2 pilot boats losing anchor and chain whilst 2 more considerable damage to their rigging. Numerous vessels were said to have been in serious distress in the Bristol Channel with several sail vessels being rendered completely windbound and helpless. Despite the exertion of many of the Cardiff tugboats several disasters occurred including a Swedish Barque, which, whilst helplessly out of control, dismasted several smaller vessels at anchor outside the Penarth Dock. However, the destruction was not solely limited to sail boats as the screw steamer pilot of Cardiff went ashore at the mouth of the Ogmere, due to the sudden increase in wind and a shift in the direction of the breeze from north-east to west, it was said there was no hope she will be got off. In Swansea strong north-westerly gales and torrents of rain destroyed a marquee erected for a ball in which the prince and princess of Wales were scheduled to attend. In Swansea Bay the high tide and strong winds produced storm surge conditions which carried a dredger onto the beach, whilst two other vessels were also driven ashore. £1000 of damage was said to have been done at the Swansea Complex Copper Ore Company, whilst the 'perfect tornado' felled many trees and the chimney pots, slates and tiles fell "in plentiful showers, and one or two persons were hurt by them". Similar scenes were witnessed near

Burry port were a steamer was stranded although the crew were rescued due to the quick deployment of the lifeboat which was subsequetely towed back to shore by a steamboat. It was said sveral small vessels parted with their cables of Milford Haven, although little damage as sustained. A "galant rescue" of a man abaord a coal hulk was said to be performed by a contractor of the Milford Dock company. Several over vessels were not so fotunate however and sustained considerable damage and a fishing vessel was said to be totally wrecked on Milford beach. The westerly gusts prevented any entrance to the docks at Newport, whilst "much difficulty was experienced in keeping the shipping in anything like order". Although, at the time of writing the weather had said to have moderated the anxiety of the seamen "were still looking out for squalls" was noted. The sea was also said to 2have ran very high, and lashed over the terrace with great furry" in Aberswyth. Along the sea front "there was a perfect rivulet of spray, and as the foam was carried about by the wind it fell like flakes of snow". Roofs were blown off, falling slates rendered travel dangerous and sevrsl shops were forcedd to shut. Similar scenes ocurred in Monmouth were "it was almost impossible for a pedestrian to stand" and in the forest of Dean a small boy lost his life after his head was trapped between a post and a door blown shit by the sheer force of the wind. High tide on the Mersey was said to be "terribly grand" and a collision occurred between two steamers on the river, although fortunately all crew were saved. The large glass front of the Philharmonic hall was blown in, a portion of

1881	21-22	11	National	The Western Mail	23/11/1881
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the St Margaret's new club house was damaged and a man injured, whilst the railway express between Liverpool and Manchester was delayed. A colliery warning was issued for mine managers in South Wales following the passing of the depression as the risk in atmospheric pressure was said to "have the effect of a sudden check upon the escape of gas". Managers were therefore advised "to guard against accumulation."

Reports of a great storm were said to come from every part of the kingdom, although it was in Scotland and Ireland where the south-westerly gale was at its most severe. At Greenock on the firth of Clyde, the windows of a hospital were blown in and a large ship weighing over 1,000 tons was driven ashore and expected to become a total wreck. The cemetery at Greenock had also sustained significant damage whilst the roof of the Caledonian Station in Glasgow had been blown off and three individuals were injured by a falling chimney in the docks. The gale raged with great fury in St George's channel, the steamboat service between Holyhead and Dublin was delayed, the Holyhead-Dublin mail boat had her hurricane deck carried away in the mid-channel and a steamer went ashore in Douglas Bay, Isle of Man. The lifeboat was launched and rescued four people. The roof of the railway terminal at Limerick was lifted off and the railway partially blocked and at Kilrush it was said "such a storm had not been remembered since 1839" as several ships dragged their anchors and went ashore. Likewise great damage was done at Lurgan where the most severe storm for 33 years was experienced. On the north-west of

1882	29	4	Western and Southern Britain	The Western Mail	01/05/1882	1	<p>England "several shipping casualties were reported" and the Llandudno lifeboat had to be launched to rescue the crew of a smack which went ashore. At Blackpool the storm surge destroyed a portion of the sea defences and promenade and the streets were subsequently inundated by the high seas. A dispatch from Oban stated the esplanade in the town was a complete wreck and a sloop had been entirely destroyed at the North Pier. "Fears were entertained for the safety of the fishermen". In Dublin the tempest wreaked havoc, blowing down trees and chimney pots, one of which killed the an individual and severely injured her husband as it fell through their roof. The harbours at Kingstown was overcrowded with vessels, driven in by the gale.</p> <p>A severe storm was said to have swept over the west of Great Britain causing considerable damage to property on sea and land. In Kinsale, Ireland the fishing fleet suffered extensive damage with £10,000 worth of fishing gear being destroyed. As a result of this it was feared "the mackerel and herring fishery on the south coast with prove a failure this year". The strong gale from the west to north-west and accompanied by heavy squalls and rain caused several vessels to break adrift in the Cardiff docks and a collision between vessels under the west-pier was said to have resulted in damage to two of the pilot boats. The roof of a church was also carried away. Damage was also sustained by shipping in the Penarth dock, a French lugger was driven ashore at Burry Port and her captain was said to have sustained a severe head injury. The Swansea oyster fleet encountered a</p>
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1882	23 to 2	10	British Isles	The Western Mail	25/10/1882 - 03/11/1882	1	<p>violent gale out in the Bristol channel. A combination of the gale and a strong tide flowing against them meant the fleets progress was severely delayed, several boats were damaged, whilst the two driven ashore required assistance from the lifeboat. Fortunatley no lives were lost however despite the fact "the fishermen said they were never out in such severe weather before". The strong south-westerly winds were said to caused a pleasure sailing vessel considerable distress although the eight boys on boat were rescued by a shore gig. A schooner sustained considerable damage on the rocks of Caldly island and the heavy rain was said to have flooded the marsh whilst "a good feal of damage was occasioned" elsewhere in the area. There was a melachonly tale from Parkgate, where a fishing boy was driven out in an unmanageable boat and was later found starved to death by a party of fishermen who had gone in search for him.</p> <p>A prolonged tempestuous period began with strong south westerly winds and torrential rain cause significant disruption throughout British Isles. The most notable impact of the storm was the destruction of a railway bridge in the Dorchester area, as it's buttresses were swept away by the tremendous rush of water which flooded the line. A carriage fell through although no fatal incidents occurred. The destruction of two other bridges and extensive landslips halted traffic for the entire day. The River From was also said to have burst it's banks, flooding hundreds of acres of land and inundating many houses in Frome. This also caused the Avon to swell and consequentely c.3000 houses were partially inundated at</p>
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Bristol where it was said "during the present generation no such disastrous flood has occurred". Water rose to a height of seven to eight feet and consequently the water reached the second storey of some houses resulting in two fatal accidents and the widespread destruction of possessions and property. Two houses, undermined by the floods, fell in Bristol although the residents had left shortly before in rafts and boats. A boy who was in charge of a bakers cart was swept away while endeavouring to cross the River Avon and was presumed dead whilst a girl was also reported missing. The extent of the damage done was truly immense and "public relief was spoken of" whilst medical officers stated many domestic properties were unfit for human habitation. The report of a meeting of the Bristol Sanitary appearing in the Western Mail on the 3rd Nov condemned 74 houses which had been flooded as unfit for human residency. Moreover,, "it was agreed that steps should be taken for summoning the owners of the flooded property before the magistrates, with a view to shutting up the houses", although it was stated no compensation would be paid by the authority to the owners. However it was said some members expressed the belief that "the authority should obtain powers to prevent people building houses in flooded areas". The flood waters likewise caused severe issues in Bath where all the lower part of the town was under water. The problem of inundation was exacerbated "owing to the sewers being unable to carry off the water poured into them" resulting in the death of one woman, the destruction of three bridges and major traffic delays in the

neighbourhood. The floods in the city were said to be the most disastrous since 1823, In West Somerset all the low-lying lands in the valleys of the Brue, Parrett, Tone and Carey were submerged by the rising flood waters which reached such a level all passenger trains on the Minehead branch of the Great Western Railway ceased to run. In South Wales excessive rain fall was said to have resulted in widespread inundation of agricultural land and the disruption of road traffic, especially in areas close to the Rumney and Ely rivers. The rain resulted in a landslide on an embankment of the Bristol-Cardiff railway line which consequently meant many passengers had to return to Cardiff. A 400 tonne vessel grounded on Port Talbot Bar and "Lloyd's agents from Swansea proceeded to the vessel for the purpose of taking steps to get her off next tide". In Monmouth "bitterly cold" conditions were experienced as snow fell with the rain and during the height of the gale a local postman narrowly escaped being killed by the falling of a chimney stack. Similar conditions were experienced in Newport where large areas of land were inundated and the mayor's residence was said to have been substantially damaged by the high flood waters. Residential and commercial property was also said to have been flooded throughout the Forest of Dean district and the destruction in the forest itself was "greater than in any previously remembered visitation". It was said thousands of pounds would not cover the damage to the Crown woodlands where many oaks were uprooted and Sir James Campbell, Bart., the crown surveyor of Dean Forest stated "no such destructive

<p>1882 4 to 5</p>	<p>11 British Isles</p> <p>The Western Mail</p> <p>06/11/1882</p>	<p>1 effects have arisen during his appointment to the Forest". Damage to telegraph wires was said to have disrupted communications throughout western Britain. An advert for "Whight's coal tar soap" beneath the weekly meteorological report was cleared tailored for the needs of those who had just experienced the effects of the severe rain. The advert stressed the need for sanitation due to the occurrence of "pestilential fogs and vapours" following excessive summer rainfall which created conditions where "infectious diseases are at no time more prevalent". A report subsequently published indicated the heavy gales from the west continued to blow into November and caused a large vessel being wrecked outside the harbour of Milford Haven and a substantial coal hulk broke free from her moorings although no damage was reported. Elsewhere, the tide was said to have reached 4 ft 8 in above the high water mark on the Thames. On the 2nd of November it was stated a smack was seen flying signals of distress in Cardigan Bay in north-north-westerly gales. After coastguard officers recognised she was of imminent danger of being wrecked and completely helpless, "rolling heavily in a mountainous sea" the Penrhyn Castle lifeboat was launched and its crew saved, although "nothing could be done to the vessel and it was left to the mercy of the waves". The "self denying heroism" of the crew as they "plied the boat to the rescue over the surging deep" was commended.</p> <p>A terrific storm which prevailed throughout the kingdom was said to be so violent "many chapels and churches remained closed". A steam boat was stranded close to</p>
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1882	8 to 9	11	Western Britain	The Western Mail	10/11/1882		<p>Lytham lighthouse whilst an Austrian barque was lost with all hands at Linney head, Pembrokeshire. The gale, which "raged with almost unabated violence" caused chaos in the Bristol channel as a sailor died after falling from the rigging of a French barque was subsequently swept onto the 'East mud' and later assisted off the flats. Two men were said to have been swept away and drowned off the Scilly Isles in the Celtic Sea and a Cardiff pilot cutter lost her mainboom in the Bristol Channel. Four vessels, which had previously left Cardiff, were said to have run back to the Penarth roads for shelter. Consequetely there was a large windbound fleet in the roads, although no further casualties were reported. A portion of the temporary footbrdige over the River Towy at Llandovery was also swept away.</p> <p>Thunder storms did considerable damage throughout the west of Britain, with lightening doing considerable damage to property throughout South Wales, whilst torrents of rain caused notable but non-severe flooding of many roads. A "terrible storm" ocurred over the city of Chester as raid poured down in torrents. The Dee was greatly flooded all along its course and the barometer rose rapidly as the depression passed over the region.</p>
1883	27-28	1	South Wales	The Western Mail and Central News	29/01/1883	43	<p>A strong gale which raged across South Wales over 2 days bringing with it rain and hail caused considerable distress to a Prussian barque which had gone ashore by the Mumbles Lighthouse. Six lifeboat men drowned in an attempt to save the crew, all of whom were saved. Those who did survive were said to have sustained horrific injuires from being thrown onto the rocks and many were</p>

not expected to recover. It was said 2,000-3,000 people came to the Mumbles from Swansea to the wreck of the barque and much sorrow was felt throughout the town and an inquest was to be opened on the day the article was published. A steam yacht sank in the east dock. In Port Eynon Bay a French steamer sunk and 17 men were said to have perished due to the slowed communication, between the town and the vessel in distress, which it was said to be too rough to launch the lifeboat and the all four rocket propelled rescue lines fell just short of the ship. As a result of this the men clinging to the mast became exhausted and fell off the mast and presumably drowned. However, the recovery of the articles on board the ship which included between £9,000-£10,000 worth of Iron ore and the fact the vessel was insured was considered "the most fortunate circumstance in connection with this sad affair". Near Porthcrawl a 2,000 tonne steamer and her 20-strong crew also fell victim to the storm as she was wrecked on the Tuskar Rock. Despite the gallant efforts of the highly competent lifeboat crew, the sea outside the breakwater was too rough for the boat to render assistance and the attempt to save the crew with rocket propelled apparatus also failed. Following the disaster "complaints were made that the tug-boat was kept in the dock instead of the basin at Porthcrawl, as it was believed if she could have been got out sooner" she would have been able to offer assistance to the lifeboat and "the lives of the crew could have been saved". A schooner was also found capsized in the Penarth roods as it is supposed that the gale resulted in her balance shifting and she

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consequently capsized. A collision occurred between two Austrain vessels in the same area and one vessel was said to have had to return to the docks for repair and to discharge her cargo. Trees and houses were reported to have been blown down along the Lancashire coast and a barque went ashore a few miles from Southport and "the coast was strewn with wreckage and cargoes" of wrecked vessels. Heavy rains were also said to have caused considerable inundations in Central and Western Ireland. Large areas of arable land were under several feet of water and the bog lands were also flooded and consequently "a great scarcity of fuel exists owing to the inability to dry the turf". Ploughing and sowing were largely suspended and the loss to numerous small farmers in the low-lying districts was "feared to lead to further distress". Flooding was also frequent in Monmouthshire and trees were uprooted and roofs destroyed in Monmouth and Cardiff.

Three vessels were lost with all hands on the west side of Lundy Islands in a south-westerly gale and the sea state was such that the stricken vessels had not been attended to a day after. The brigantine, Lovebird, went ashore on the Isle of Man and despite the rapid deployment of a lifeboat and rocket brigade, the crew left the left aboard their own boat before any communication could be established. They immediately capsized and the crew of six were all drowned. In South Wales heavy snow was said to have resulted in the level of the River Dee rising to "enormously high" levels and great floods were also recorded at Bangor. By noon of the 3rd the vessel veered

1883 9 to 10	2	National	The Western Mail and The Press Association	12/02/1883	<p>8 to a west-north-west direction, bringing with it violent squalls of hail and rain. During the height of the gale the schooner Storm Nymph was driven ashore near the Padstow pier and one man died as he jumped into the sea to fetch a spar but was "immediately sucked under by the terrific seas". The remainder of the crew were successfully rescued with the rocket apparatus. Another fatality was recorded during a terrific gale in the Bristol Channel as a sailor attempted to furl a sail before being blown off and drowned. In Monmouthshire the heavy rain caused the Rivers Monnow and Trothy to suddenly rise, flooding hundreds of acres of land and making transport near impossible for pedestrians. In the town the basements of several houses were flooded. In Youghal, County Cork, storm surge conditions flooded the goods section of the railway station, fishing boat capsized, it's occupants having a narrow escape and a Captain was severely injured by falling bricks whilst walking through the coastal town.</p> <p>A gale "of great severity" raged over the west of the Great Britain bringing with it heavy rain which caused "exceptional" floods. The Avon was said to have flooded in Bath and a considerable amount of property was swept away and families were entrapped within their homes. For the first time the presence of the low pressure system associated with the storm was depicted in graphical format with the reading under 29.80 inHg indicating storm conditions and a the rise in pressure on the 11th coincided with the end of the storm conditions. The strong southerly to westerly gales wreaked havoc in the Penarth roads</p>
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causing "serious injury to shipping". The hazardous conditions caused a steamer was said to have run amock colliding with a sailing barque and schooner, both of which were badly damaged and had to return to port although the steamer escaped without major injury. There were reported collisions between no fewer than seven other vessels, the cause of themajority being due to dragging anchors which did not hold in the mountainous seas. On vessel ran onto the mud but was not suggested to be severely damaged. In the account of the coroners inquest concerning the deaths of several French sailors aboard a French steamer in Port Eynon Bay, the jury stated the deaths were accidental and no one was held directly accountable for their deaths. A following report from the press association highlighted the spatial scale of devastation caused by the storm as the Irish Sea mail steamers were said to have been much delayed, whilst in Youghal, County Cork, a high tide combined with the very strong onshore breeze produced a storm surge which rendered the coastal road impassable at high water and inundated houses near the beach. In Waterford old houses were said to have been blown down and the surrounding country flooded for miles, whilst a large ship went ashore east fo Kinsale Harbour on Monday although the crew were saved. In Swansea 100ft of the East Pier Extension Works were swept away including hheavy machinery at an estimated cost of £2,000 . The storm washed ashore 3 more dead bodies from the lifeboat disaster which previously ocurred between the 27th and 28th. The strong south-south-westerly breeze resulted in

<p>1883 2 to 3</p>	<p>10 Celtic and Irish Seas as well as wider Europe</p> <p>The Western Mail and The Press Association</p> <p>03/09/1883 - 05/09/1884</p>	<p>23 collisions between four boats and a pilot cutter was completely wrecked. Overall one death was reported in the Irish Sea which occurred when a barque's carpenter was swept overboard by the high seas. In the forest of Dean "the high tides of the Severn, together with the floods" flooded 1,000s of acres of land and floods in the lower districts had "not been remembered so high for a period of thirty years". At Port Eynon it was likewise said "a more violent gale had not visited the Gower coast since the year 1869" although the vessels moored in the port were said to have had a narrow escape despite being somewhat damaged by the high seas and strong breeze.</p> <p>"From all parts of the Southern and Western coasts came reports of serious gales, causing great damage, and in some instances loss of life". The "fearful south-west gale" was said to have raged incessantly for 30 hours and "waves were running mountains high". Twelve were said to have died as a barque was wrecked, despite an experienced pilot's assistance, off Penzance. Throughout the region warning signals to mariners were flown by the coastguard and the lifeboats were put out to aid the numerous vessels in distress, although the treacherous conditions and high seas made assistance difficult and even impossible in some instances. In Swansea, a Turkish barque, whose crew had previously attracted so much attention in the town was suspected to have gone down with all hands. Besides from the grounding of the schooner laden with coal from Newport in Wexford bay, it was feared that an ocean steamer 'Amerique' had foundered in the Celtic Sea as there was no news of the</p>
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vessels following the 1st September. In South Wales "rain fell heavily and almost continuously" and "the wind nearly blew a hurricane". There was minor damage in the docks and town of Cardiff. In Swansea four vessels were blown ashore but were not considered to be in danger, although the powerful storm surge severely damaged 50 yards of a new defensive embankment and the damage done was estimated at £2,000. By the 4th five bodies from the wrecked barque were washed up in Penzance and theft of valuable properties of those drowned and attempting to assist in clearing the shore was noted. It was also said an unspecified "lamentable mistake occurred" suggesting the catastrophe could perhaps have been avoided. Indeed, the account of the inquest published on the 5th found the rocket propelled apparatus "was not fired from the most advantageous spot" and the chief officer of the coastguard, who did not know the coast, confiscated the device from an experienced local mariner (who was also a juror) and had it fired from the beach instead, which wasted 30 minutes and was not successful. However "the really serious charge made is that concerning the lifeboat" which was said to have not been adequately maintained and there was no explanation as to why the boat remained in Penzance for an hour following the communication of the distress call. The non-regular lifeboat crew were also said to have been supplied with drink while waiting and "became much the worse for liquor". Consequently "there is much discussion locally as to the lifeboat arrangements, and an inquiry is reported to be contemplated". In the Penarth roads three vessels

1884	26 - 27	1	National	The Western Mail	28/01/1884 - 29/01/1884	70	<p>were said to have been in distress but they managed to navigate back to the safety of the Penarth Roads without assistance. An ocean going steamer, the Ajax, bound for China from Liverpool "encountered the full force of the gale" in the Irish Sea and her captain unfortunately perished as her wheelhouse was washed away as gargantuan waves swamped the boat. The tempest engulfed such a large area reports of its destruction came from as far as Naples and Rome where it was said to have been particularly destructive. The final note was sourced from a Captain Dulling of a screw steamer who noted that wreckage in the Celtic Sea seven miles northwest of St. Anne's Head had now become a danger to navigation due to its position on the course of steamers bound for the Bristol Channel.</p> <p>A storm which developed into a "perfect hurricane of wind, rain and sleet" caused significant destruction and loss of life throughout Great Britain. In Llandudno the roof of a recently constructed pier pavilion was entirely destroyed and the damage was valued at £4,000. A church in Beaumaris also sustained considerable damage as a portion of the roof was blown in and the parapet collapsed. In Kinsale the station lost its roof and the roof of house was said to have been carried 20 yards by the ferocious winds. However "by far the greatest damage had been caused on the sea" and there was said to be "a long catalogue" of casualties to shipping, wrecks and the sad loss of life all around the west coast of the British Isles. In Cardiff the crew of a sinking vessel were saved with thanks to the gallant actions of a steamtug master.</p>
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The "hurricane squalls" were said to have driven a "light" steamer across the bows of a moored barque causing considerable damage to both vessels and the barque was subsequenetely ordered into dock at Cardiff for substantial repairs. Another vessel was driven on the mud flats after her anchors dragged although was said to be likely got off once the weather moderated, whilst another eight vessels sustained some form of damage. The Penarth lifeboat was deployed after two boats drifted onto the sandbanks and the roofs of several houses were damaged by falling chimneys, toppled by the strong winds. In Swansea, lightening and light snow also accompied the strong winds and the premises of bicycle depot, which were being repaired were considerbaly damaged. In the neighbourhood of Merthyr, Aberdare and Llandilo similar damage was said to have ocurred to the extent that in Carmarthen street, Llandilo "tiles of houses were flying about like autumn leaves" and the marketplace was said to be "in indescribable confusion, the stalls and their contents being blown about in all directions". In Tenby the west-south-westerly gales made a "terrific" scene in the bay and those vessels anchored in the roadstead were said to be making heavy weather. During the height of storm a signal of distress was hoisted aboard a smack in the bay although it was found impossible to launch from the South Beach so the lifeboat was insteand transported to the harbour where she was then launched. The vessel in distress, which was carrying coal from Saundersfoot to Milford, was reached safely and no casualties were reported. In Cardigan, the torrential rain which

accompanied the violent gale caused considerable flooding in the lower streets of the town and many roofs were damaged by the violent winds, although no casualties were reported. "Several passing ships in Cardigan bay were also tossed about in imminent peril" but thankfully no casualties were reported. In the rural neighbourhood of Llangeler the River Teifi was said to have burst it's banks and flooded the country for miles around and several roofs were unthatched although no serious damage was reported. Most unfortunately the reports recieved on the 28th did not reveal the true extent of the damage and distress the tempest had caused as it was subsequently reported that 50 lives had been lost aboard two vessels in Liverpool bay. The lifeboat was deployed but "could not get within a mile of the wrecks, but could see the men in the rigging clinging for life". There were accounts of a collision in both the Penarth and Barry roads whilst an ocean ship had nearly everything moveable swept off her deck in the severe storm. A Cardiff screw steamship and her four hands were said to have been lost near Avonmouth and nothing had been seen of her crew or wreck. In the north of Ireland a barque was also have said to have been wrecked on the Antrim coast after being blown out of her anchorage to sea, and it was said those onshore did not regarding the flashing of a light or the ringing of a bell as a sign she was in danger, as no distress flag was flown. All 15 on board were said to have perished. The land between Newtownwards in the north-east of ireland and Belfast was said to be completely submerged and several people

1884	23	9	County Donegal	The Western Mail and The Press Association	24/09/1884	50	<p>were injured and one killed as a chimney fell through the roof of a bakery in County Armagh. On the Isle of Man the barometer at the Ramsey custom house registered 27.9 inhg, "the lowest recorded in the recollection of the harbour master" whilst the breakwater at the west facing Port Erin was completely destroyed at the cost of £70,000. On the west coast of Britain falling trees and telegraph poles severely disrupted train travel, whilst a tree fell against a train on the Carlisle-Glasgow line, shattering the windows in the carriage and injuring many passengers.</p> <p>A severe storm from the west off the north coast of Ireland lead to the loss of 50 men aboard a 465 ton gunboat, the screw steamer the Wasp. The area in which the catastrophe occurred was described as "very dangerous for navigators in stormy weather" due to the "bold headlands and precipitous cliffs" which defined coastline. It was said members of the admiralty and board of trade were to travel to the area in order to conduct an inquest into the sinking of the vessel.</p>
1884	5 to 7	12	Irish Sea	The Western Mail, The Press Association and Central News	08/12/1884		<p>A heavy squall from the south-west was reported to have completely destroyed a 1,135 tonnes, and 265 ft three masted steamer at Holyhead on the 7th of December. The vessel in question was a new ship built in Glasgow in 1883 and insured by Lloyd's. All 20 hands on board were presumed to have been lost as, despite rapid deployment, the lifeboat was unable to be towed to the scene of the incident in time. On the return of the lifeboat it was hypothesised that the vessel must have took on considerable water, which, combined with the weight of the engines at the stern, caused the boat to sink stern-</p>

1885	3 to 4	10	Bristol Channel	The Western Mail	05/10/1885		<p>first at a rapid rate. In Swansea a small punt designed for crossing the River Tawe capsized after 16 workmen boarded the boat in rough conditions against the boatman's permission. It was said "it was fortunate the accident occurred this early, as all were able to scabble out on the bank and escape with a wetting, thus turning what might have been a serious affair into a rather ludicrous one. It was noted an accident of the same kind had occurred some years ago and resulted in loss of life. Although the south-westerly gale "raged with considerable violence" at Swansea on the 5th and 6th no serious damage or casualties were reported. Continous rain in the county of Carmarthenshire was said to have resulted in inundation throughout the county and the River Tywi was said to be in full flood, "much swollen, and all the fields along it's banks were inundated".</p> <p>A severe storm raged in the Bristol Channel for two days, causing considerable damage and injury, although thankfully no loss of life was reported. The main reported damage was caused by two Elm trees which were felled by the strong winds and severely damage a church premises. All injuries to humans in the vicinity were said to be minor and there was no news of the gales' impact upon shipping.</p>
1885	27 - 29	11	Western Britain	The Western Mail	30/11/1885	1	<p>A great tempest brought strong south-westerly gales and torrential rain to western and southern Wales. On the coast the one reported incident involved the Royal Mail's steamship Para which narrowly escaped destruction in Whitesand Bay, Pembrokeshire, when visibility suddenly increased and it was seen the ship was heading directly</p>

for the shore which was a short distance away. Thankfully the engines were immediately reversed and the vessel and her 150 passengers were placed out of danger. The majority of the damage however, was said to have resulted from the tremendous downpours of rain in the valleys of South Wales. The Taff and Rhondda rivers were said to be in full flood and inundated parts of Pontypridd, flooding commercial and residential properties. It was suggested efforts by a land owner to prevent the Taff from inundating his land during a flood by planting willows in order to reclaim what was once a flood plain had exacerbated the inundation. The correspondent displays knowledge of fluvial erosion and flood management stating the willows planted in the "so-called reclaimed bed... completely lock the soil, which would otherwise be gradually worked away by the water". The impact of this was then expressed: "during almost each flood of unusual dimensions tradesmen lose more goods than the value of the willows referred to, for the reclaimed land is almost useless for any other purpose than to grow them". It was said "the authorities seem powerless to deal with the matter". Inundation to other agricultural land in the area was said to be widespread and two farmers lost 80 sheep in total. In Maesycwmwr the road networks were said to be inundated and an embankment protecting the GWR was collapsed due to the force of the water. One man was discovered lying in a flooded road, in an intoxicated state and later was pronounced dead. In the towns of Ystrad Mynach, Fleur-de-lis, Llancaiach and Caerphilly roads were flooded with

1886	13	1	National	The Western Mail	14/01/1886	<p>"seeting and surging" flood waters, whilst pasture and agricultural land was submerged for countless miles, taking the appearance of a colossal lake. In Troedyrhiw the road networks were impassable by foot and a landslip blocked a stretch of a branch of the Great Western Railway delaying traffic for several hours and causing much excitement amongst the passengers.</p> <p>A violent storm was said to have done a considerable amount of damage throughout the kingdom. On the wets coast the north-westerly gales resulted in a White Star Liner Germanie breaking from her anchor and becoming stranded on the silt flats near Wallasey. Three men were washed off the bow of a steamer whilst crossing the Mersey bar but were saved and returned to hospital. In Newport the "severe squall ... was felt with great force" and in the docks barque collided with a dredger which almost sank and later required substantial repairs. Other incidences of minor collisions were also reported although no serious damage was received. In the neighbourhoods of Neath, Merthyr and Caerphilly the "severe hurricane" damaged several roofs whilst the winds destroyed a school Pontypridd, although no major injuries were reported.</p>
1886	4	9	South Wales	The Western Mail	07/09/1886	<p>A tremendous storm and wind and rain resulted in a tremendous landslide in the valleys surrounding the town of Swansea. This tremendous rush of water and sediment from the valley sides leading to deposits of sediment 6ft deep being deposited in hillside residential areas and a mixture of coarse silt, gravel and larger stones was said to have reached "up to the mantelpiece" in certain houses.</p>

There were many instances of close escapes as the landslide rapidly poured into properties and it was said "there is no doubt had it not been for the assistance of several courageous men some lives would have been lost". Further up the valley side there some gave personal accounts of the torrential rain which transformed the hillside into a series of torrents which brought "no less than 30 tons" of sediment down the valley leading to a 12 ft bank of sediment being deposited on the back of residential premises. It was said a similar catastrophe had occurred 50 years ago had lead to the loss of life and there was no doubt if this storm had occurred during the night it is likely that similar losses would have occurred. Following the event it was said members of the town council amongst other onlookers visited the scene to inspect the disaster and "were utterly astounded" by the extent of the damage done. Those affected were said to be in a "pitiabile condition" and an army officer was designated the task of finding temporary lodgings for all affected during a public relief meeting held by the Mayor. Although the Mayor "believed something must be done to prevent a recurrence of disasters of this kind, the question now to be considered was how best to relieve the sufferers". It was mutually agreed amongst those in attendance that the relief effort must be divided into two parts of immediate and long-term relief and urgency of immediately distributing the charitable donation of £70 to those in need was stressed by a certain member. The article from the guest contributor was followed by a short letter from the local vicar T.W. Williams who offered a

1886	15-19	10	South and West Britain	The Western Mail	16/10/1886 - 18/10/1886	27	<p>plea to the readers of the Western Mail exclaiming "no one can relaise the destruction of porperty and the distress which has followed except those who live in the neighbourhood", whilst he concluded "the committee confidently trust that they are not appealing in vain to the generosity of the public".</p> <p>The first passage on the Western Mail front cover stated a tempest swept across the south and west Britain doing tremdous damage as severe gales wrought havoc on the seas and destroyed many a property ashore whilst the severe rain resulted in tremendous flooding. In a similar fashion the opening paragraph Western Mail front cover on the 18th stressed how the "on the Welsh coast was where the force of the gale seems to have been principally felt" whilst it was also stated that the devastation and loss of life was in "the opinion of persons cometent to judge" of a "severity and direness of effect that had not been expereinced for 25 years". In the Swansea, usually storm resistant tugs were said to have been "dragged incessantly" by the gale force south-westerly winds despite having 45 fathoms of chain out and steaming against the tide. The sea "ran tremendously high all day" and storm surge conditons prevailed as seafront neighbourhoods and roads were inundated and large quantities of debris were deposited on the roads as "a record of it's visit". The mumbles lighthouse keeper was said to have drowned after being washed off the rocks in Langland bay by the tremendously high waves whilst a young man escaped a similar fate in the same vicinity. A barque laden with coal was said to have broken</p>
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free of moorings and the crew were unable to get ashore as it grounded near the time of low water, leaving them "completely at the mercy of the tremendous seas ... which gradually broke up the vessel". As there was no rocket propelled rescue apparatus nearby the men were forced to ascend the rigging although they could not be reached by the lifeboat despite their gallant efforts on two attempts as the wind was so strong that the tug towing her came close to capsizing. The tug and boat were said to run "before the wind like racehorses, the lifeboat being at times being submerged, and at times lifted almost on to the tug's deck" as the sea ran "mountains high". As a result of such near catastrophes and an ability to sight the barque in distress the rescue mission had to be abandoned and the returning crew exclaimed it was the roughest sea they had experienced within their memory. However, thanks to the intuition of those aboard the shipwrecked vessel the crew who clung to the rigging were able to get ashore by allowing an oil can with a rope attached to float to the shore where it was then secured and the men consequently hauled themselves along the rope to safety where they were taken care of by a local agent of the "Shipwrecked Mariners' Society". Most unfortunately a Swansea pilot aboard the vessel was latter washed up ashore after he was said to have descended the rigging and been swept off the deck by the colossal waves". A carpenter was also said to have fallen from the rigging and drowned. Following the event it was said the captain did all he could to save to vessel and the anchorage chosen would have been perfectly safe "in

anything except a terrific storm". The Earl of Dunraven visited the crew and gave the money "for their pressing needs" whilst "he also stated that if he could render any help or offer any hospitality to them it should be theirs" and they were said to have "gladly accepted his lordship's kind offer". Sunday dinner was also given to the sailors by the Countess of Dunraven and the hospitality and kindness was widely appreciated by all. A large 4 masted, ocean-going, iron-hulled ship the Teviotdale, which was only 4 years old was unfortunately not so lucky as a telegram from Ferryside confirmed she had been wrecked on the Cefn Sidan Sands at the mouth of the Tywi estuary in Carmarthen Bay with the loss of 17 hands. Another account stated that the gale from the south-west was so fierce the vessel lost her canvas and the shipping rolled in the sea disturbing her ballast, "rendering her almost helpless". Despite an attempt to run for the Penarth Roads, a combination of disorientation fog and the hurricane force winds meant the crew "speedily found themselves on the much dreaded Cefn Sidan Sands" and the "vessel took ground at St. Ishmael's". The vessel's lifeboat was deployed but "it was afterwards proved, it would have been much better had it's occupants remained on the vessel" as the boat got broadside to the surf, and was not seen again by those on board within only "two of her nineteen occupants managing to scramble up the beach, but the remainder were all drowned". Later however it was said the "Ferryside lifeboat, a splendid craft, one of the best and largest belonging to the Royal Institution, was got out" and "after a great deal of

difficulty, the ten survivors were brought ashore". A subsequent inquest held in Pembrey by a deputy coroner found no clear wrongdoing on anyone's part and concluded "Death from exhaustion, caused by exposure and long immersion, the result of shipwreck". Following the incident the ship was said to have gradually drifted to the shore and, much to the distress of the remaining survivors, the people of Ferryside stole quantities of the cargo of coal as well as sailor's personal belongings. In the Newport Roads at the mouth of the River Usk a collision between a Norwegian and Austrian brig led to the former being completely dismasted, and her starboard quarter cut clean away, whilst on the Austrian vessel a crew member was killed as the foremast fell on him and the port side bulwarks were completely destroyed. An subsequent inquest held by a coroner on the 19th where the only witness was the captain of the Austrian brig concluded the sailor "was accidentally killed" and the vessel was adequately prepared and had been an unfortunate victim of circumstance. There was also a relatively bizarre story concerning how 8 of the 31 men aboard a vessel had refused to assist during the storm, claiming the vessel was undermanned. These men were subsequently arrested and taken to the magistrate where their story did not suffice as the vessel was known to have sailed perfectly well with only 28 men aboard. A 3rd vessel was said to have been lost with all her hands, it was presumed she was Nancy of Cork, Ireland. Two vessels were also blown from their anchorages in the Penarth roads although they fortunately landed on mud and therefore

sustained only light damage. A captain of a large (1,187 ton) vessel was said to have given the upmost of praise to a Cardiff pilot, without whom his vessel, cargo and crew would have all been lost. There was also praised for a barque captain who left the Cardiff roads at the same time as the ill-fated Teviotdale but showed immense "skill, coolness and bravery" to navigate the vessel and her crew back to the safety of the roads unharmed. Two other vessels sustained considerable damage in the Penarth roads losing thier bulwarks, sails and, in one instance the bridge. Consequetely the vessels had to return to the docks for major repair work. The mast of a Christian mission ship also fell through the church roof of which it was associated. A smack was said to have parted her moorings in Saudersfoot harbour and consequetely been carried out to sea to later founder near Monkstone Point. Elsewhere 4 were saved from a boat helplessly drifting in St Bride's Bay when a rocket propelled safety line was deployed from the shore near Druidston. The floods at Pontyclown rose to a level not seen for many years and consequetley "a strong feeling prevailed in the district that the present bridge should be removed, and a more modern on substituted for it. If this were done the traffic would not be interfered with by floods as it is at present". The wind was said to have considerable damage to property at Milford Haven and another ship was wrecked in St Bride's Bay although it's crew were saved via the use of rocket apparatus. A steamer was said said to have put in with it's decks and rigging considerably damaged. In Aberystwyth another storm surge was

recorded as houses on the parade were inundated as waves easily breached the seawalls and large quantities of sand were deposited on the seafront. The rain was so heavy in the town that every river were observed to be in full flood which a five span bridge being carried away in the town itself. In Abersyswyth itself 1.5 of the town was flooded to a depth of at least 4 feet and two hundred houses were flooded. Railways throughout Wales were submerged and the River Dee also overflowed it's bank submergeing many dwelling-houses in it's lowlying flood plain. At Ilfracombe the storm surge did did great damage to recently constructed baths near the beach and waves were said to have "washed over the Capstanparade parade, which, with the meadow and promenade, was flooded". In Bristol destruction of property and the felling of trees was widespread and there were instances of personal injury but fortunately no fatalities were recorded. At Weston-super-Mare all the vegetation was said to have been destroyed by the tremendous amount of salt spray whilst the surging waves caused considerable damage to the pier. A vessel was said to have parted with her tow on the way from Limerick to Liverpool and the gales drove her on to the Skelligs Rocks where she was wrecked with the loss of all hands. In County Kildare, Ireland large tracts of land were submerged to a great detah and the harvest was said to be largely ruined. Likewise the acres of turnips and potatoes at the foot of Mourne mountain were said to be under 3-4ft of water. A mill was flooded at Newry causing all occupants to have to evacuate and the Edward-street Railway station was

1886	15-19	10	North-Western Europe	New York Herald in The Western Mail	18/10/1886		surrounded by 4ft of water. The tremendous rain caused a mill dam to burst and the subsequent torrent carried with in huge bolders and submerged the roads below. A telegram from the New York Herald warned "a storm of greta severity is now central near Anticosti, and will probably advance in an east-north-easterly track, causing gales on the west and northern coasts of Europe.
1886	15-19	10	Western Britain	The Western Mail	19/10/1886 - 20/10/1886 - 01/11/1886	20	The first paragrpah on the front page of the Western Mail once more emphasised "most gloomy forebodings" and enormous damage produced by a tempest which had ravished the west coast of Britain and had been the cause of many a shipping disaster. The "grave charges made against perons on the Welsh coast" who were said to have stolen from wrecked ships and dead mariner as well as "in other ways victimised unfrotunate seamen" also made headline news, especially as it was reported "in one case the dead bodies of shipwrecked sailors were exhibited at the charge of threepence each". A vessel was said to have been wrecked off St Brides Major, Vale of Glamorgan after being overcome by the strong westerly winds with the lost of 20 sailors, some of whom's bodies were washed ashore in an almost unreconisable state they had been so badly damage. It was said the "obloquy thrown on the crew of the lifeboat at Porthcawl, but apparently without any justice" as coastguardsmen stated it was "simply impossible for any steam-tug or boat to go ut on Friday afternoon". Indeed the storm was so strong it carried away the lighthouse at the end of the breakwater where the lifeboat would have been launched. Many who had come to St Bride's Major to see the wreck and pay their

respects to the dead sailors at the Greyhound Inn but "were greatly disgusted to find a man at the door collecting threepence from each of the persons who entered. The reporter rightly exclaimed "there is something so revolting in making an exhibition; particularly on a Sunday, of the bodies of men who met such a terrible death". The reporter stated steps should be at once taken to prevent this happening again and named and shamed the man in question, Mr Jenkin Powell, who was "well known for the various peculiar schemes which he has tried to put money in his pocket". A report published on the 20th suggested it was "probable that proceedings will be taken against Powell for obtaining money on false pretences" his excuse the money was going towards burying uninterred bodies being widely regarded with utmost suspicion. A heated inquest into the lifeboat response ended indecisively with the inquest being adjourned until the 22nd after a heated debate regarding whether it was possible to launch a lifeboat in the conditions which lead to a discussion on the feasibility of Porthcawl as a lifeboat station and questions as to why the coastguard in the area did not possess a rocket propelled life saving apparatus. Further up the Bristol Channel a vessel capsized in the Newport roads after heavy seas displaced her cargo of salt capsized leading to the loss of eight lives. A Cardiff screw steamer came to the rescue of a barque in distress in the Penarth roads although not before two mariners were washed overboard and drowned. Nevertheless great praise was said to be due to the Captain of the screw steamer who

rescued the crew under difficult circumstances. Several other vessels were substantially disabled and damaged in the Penarth roads whilst a large barque was wrecked off the north Cornish coast near Tintagel and all aboard were drowned. Further up the coast six vessels were wrecked in Bideford Bay, with three of the vessels equalling or exceeding 1,000 tons. A week later wreckage of the vessel was found with the marking of the "S.S. Britannia of Glasgow, although after referring to Lloyd's Register of Shipping and consultation with the Anchor Line of Glasgow it was found the only registered vessel was had only recently left Port Said, in Egypt and thus the mystery of the owner of the vessel remained unsolved. An inquest was also held into the death of In Aberwysyth the torrential rain which accompanied the storm resulted in flooding of the River Rheidol which flooded and undermined the ballast on the Cambrian railway line, halting all rail traffic and it was said that it was lucky no trains were running at the time as the results could have been rather serious. Elsewhere bridges over the Rheidol had been swept away "and thus communication with the southern portion of Cardiganshire had been stopped". The rivers Lerry and Mawddach also flooded the surrounding area, further hindering rail travel. However the quick deployment of workmen meant the "mischief was rectified" within two days and rail travel from Aberwysyth was now possible. Throughout North Wales flooding also occurred in the valleys of the Ystwyth, Dowy and Teifi with flood waters of 6-7 feet in depth leading to death of numerous horses and livestock. In

<p>1886 15-19</p> <p>10</p>	<p>South Wales</p> <p>St James' Gazette in</p> <p>20/10/1886</p>	<p>Cardignshire alone it was said "several hundred houses are swamped, and three bridges have been swept away". In the North of Wales and on the English border the River Dee also flooded the surrounding lowland where several dwellings were flooded. Two men and three women were also rescued from a small craft in Colwyn Bay which became unmanageable as the seas became extrodianrily rough by five courageous sailors. It was said little gratitude was shown by the rescued party who "'rewarded' the brave rescuers with half-a-crown, or just sixpence each". Throughout the nation there were multiple stories of the gallant actions of lifeboats who had put themselves in great peril in order to rescue distressed craft and there actions were said to have been hihgly commended by the rescued mariners". A "large quantity of wreckage was washed ashore on the County Clare coast and many vessels, including a large steamship had to put back in to port as they were "unable to meet the heavy sea". Passeangers on the Dublin to Holyhead steam ferry were said to have alighted "in a pitiable conditions" and "they described the passage as one of unprecedented severity for all onboard" as "the tough little boat was pitched and tossed about like a cork". Many passengers were drenched from their experience which they described as "unprecedented", whilst it was said "such a sea had not been encountered in the Irish Channel for many years".</p> <p>An article from the St James gazette strongly condemned the actions of the neighbourhood of Nash Point who were said to have been particularly inhospitable towards sailors</p>
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				the Western Mail					
1886	15-19	10	South Wales	The Sheffield Daily Telegraph in the Western Mail	20/10/1886				<p>from the wrecked Ben-y-gloe and to have stolen from their ship. The correspondent used this example to commend the Welsh as a whole sarcastically remarking about the actions of "the hospitable Celts" from "gallant little Wales" who were said to have "taken a decided step in the direction" of the "good old custom of deliberate wrecking". He then continued to suggest inhabitants "shamelessly rifle the bodies of a crew" and "refused to furnish them with food until payment was guaranteed". Such supposed actions were then starkly contrasted with the generosity of the Lord Dunraven who was described as "the alien representative of feudal despotism in the district" and this was said to "prove how far behind his neighbours he is in civilisation".</p> <p>An article sourced from the Sheffield gazette exclaimed how "long years have elapsed since so fearful a destruction of life and property occurred on the coast of Wales". The correspondent then began setting the tone for the article to communicate the primary message concerning the morals of the inhabitants of the Welsh coast "questioners of the ways of providence sometimes point to the havoc made and the anguish created, and to the peaceful hearths darkened by tempests so mighty that great four masted ships like the Teviotdale ... are driven before time as mockingly as toy ships. Such sceptics are answered that scenes of death and woe call out the finer and nobler qualities of human nature - developing patience, courage, magnanimity - opening up deep wellsprings of sympathy, and affording opportunities for a splendid heroism". He then began to make his main point</p>

1886	15-19	10	South Wales	The Western Mail	20/10/1886
1886	15-19	10	South Wales	The Western Mail	20/10/1886

contrasting behaviours of the coastal dwellers and that of Lord Dunraven by asking rhetorical question concerning the chivalry and "elevating and morally ennobling" behaviour shown by both parties. The contrast then made could not have been more stark "Lord Dunraven sent money, provisions, clothing and an offer of the hospitality of his castle" whilst the "sons of of sweetness and light at Nash point busied themselves at the same time in robbing the dead - no, we beg pardon, in freeing or liberating the drowned sailors from all such worldly encumbrances as watches, purses, or loose money." This heavily critical sarcasm then evolved into a rather ferocious attack on the people of Nash Point who were somewhat fittingly described as "dead hands", whilst the immense sorrow of the sailors most unfortunate of endings "upon the white manes of the breakers" in Nash Point was finally expressed.

A letter from a landlord, Mr Bartholomew Jenkins, who had previously been lamented for his lack of hospitality towards a the shipwrecked crew of the Ben-y-gloe in the St Jame's Gazette, was featured in the Western Mail. In the passage he explained that such claims of disregard for the shipwrecked sailors were completely false before describing in depth the charitable aid the men recieved which included free and plentiful sustenance and comfortable lodgings

A letter from a reader who went by the name Rheidiol again reinforced the general disgust at the behaviour of some of the residents of St Ishmael and Ferryside who stole from the wrecked Teviotdale. However the writer

<p>1886 8 to 10</p>	<p>12</p>	<p>National</p>	<p>The Western Mail & Liverpool Mercury</p>	<p>09/12/1886, 11/12/1886</p> <p>29</p> <p>mounted a very broad attack attacking the Welsh people as a whole he portrays as uncivilised and immoral from the very beginning of his letter "We are often told that Wales has been Evangelised by Dissenters; but I am afraid that we halooed before we are out of the wood". He goes onto state "we ought to send missionaries instead of sending them to foreign countries. Men are vile nearer home than South Africa". He goes onto proclaim that the the inhabitants of the Welsh coast have always been wreckers and gave an uncited example of a past tale of a congregation leaving a Carmarthenshire chapel to scour a recently wrecked boat on the Cefn Sidan Sands and how false lights had previously been used to lure ships onto a dangerous coastal outcrop. The writer then gave an example of how a French vessel containing Napeoleon's niece had been wrecked in November 1825 near the Cefn Sldan Sands after been tempted onto the rocks by false lighting. He continued his harsh unsupported condemnaiton of the Welsh coastal communities stating "it was said the wreckers cut off her ears to have her earrings and her fingers for the sake of her rings. The conduct of the men who stripped the dead bodies are not a white better". He finally finished by exclaiming the Welsh wreckers were "a disgrace to their country, to humanity and to civilisation".</p> <p>The first paragraph on the Western Mail front page exclaimed a "most terrific" storm had raged throughout the British Isles resulting in very serious shipping disasters and "great loss of life". A pressure chart also published on the front page of the Western Mail also showed the rapid</p>
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1886	26-29	12	National	The Western Mail and the Press Association	28/12/1886 - 30/12/1886	1	<p>fall in pressure of approximately 1.3 mmHg in 12 hours from a base level of 29.3 mmHg, well below the 'storm threshold' of 29.8 mmHg. The meteorological office predicted north-westerly gales and showers would prevail in Cardiff/Penarth throughout the 9th and the conditions would gradually moderate throughout the day. 27 of the St. Annes and Southports lifeboats tragically died in an attempt to save the crew of the German barque, the Mexico all of whom were eventually saved by the Lytham lifeboat. Two more died aboard a vessel wrecked on the Margam Sands, Port Talbot and an inquest was held into their deaths. The hospitality of the local people was much commended.</p> <p>A severe snowstorm was said to have hit South Wales as well as the Midlands and Southern England. In the rural districts of Southern Wales roads were rendered "almost impassable" and the "raging winds" were said to have formed snowdrifts 10-12 ft high. The Press Association reported that contact with many parts of the United Kingdom was still impossible on the 29th due to the widespread destruction of the telegraph network and Bristol was said to have gone for twenty-four hours without telegraph communication. It was said the cost of restoring the service would be "enormous". In all instances rail travel was considerably delayed and in some areas such as the rural districts of Merthyr and Dowlais it was completely paralysed. In the Penarth road the "blinding gale" caused shipping considerable difficulties to shipping. A brig was towed onto the soft muds for her own safety, whilst there was also a report that a</p>
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Norwegian barque was run into by a small steamer and as a result the barque sustained considerable damage. The main story involved a passenger steamer, which was caught in a fierce snow squall and driven onto the pier-head. During and for some time after the collision "considerable excitement prevailed on board the steamer and among those of the pier-head", however the steamer did eventually dock safely. It was said but for the "strong construction of the vessel and her water-tight bulkheads the consequences would have been very serious". An analogy was made by a correspondent from the Pall Mall Gazette who made use of the snowstorm to "point a moral upon the situation of England in case of a European war". In the passage the correspondent exclaimed "For just as the whole of our social arrangements, our cities, our telegraphs, our railways, are organised on the assumption that it will never snow, our Empire is organised on the assumption that it will never be at war. And whenever war breaks out it will find us as unprepared to deal with it as this snowstorm: only the case will be worse". He went on to elaborate on his point that at the moment in time Britain was not prepared to defend even the most vital points in our system of communication" and her natural assets, stressing the need for fortification and the increase in a military presence in areas central to the socio-economic operation of the empire. The correspondent concluded "that is the moral of the snowstorm; and if it leads all England to take it to heart at the crisis, its inconvenience and discomfort will have been a cheap price to pay". Interesting enough

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an article published on the 30th declared that England had mobilised the two branches of her armed forces "so that hereafter there will always be a portion of the Army ready to take the field at a moment's notice". At the bottom of the page there was a selection of adverts for cleaning products and medicine claiming to cure and reduce the effects of illnesses commonly associated with cold weather. Throughout the kingdom there were numerous tales of destruction and a storm surge occurred at Portsmouth although there was little news of similar disaster on the west coast although a large ocean-going steam of the Clan Line did find herself on a sandbank in the Firth of Clyde. The only highly unfortunate affect resulting from the storm was the death of a miner who drowned following his descent into a mine in which the draining machinery was broken and he sadly met his end in the high flood waters resulting from snow melt. A meteorological office report stated that falling pressure had been observed over the British Isles and a new depression appeared off Northern Scotland on the 28th which brought with it strong westerly winds. Seas were stated to be rough in the extreme west and south-west whilst the northerly depression was forecast to move eastwards bringing more moderate conditions to most of the British Isles.

Severe weather was reported throughout the kingdom as tremendous thunderstorms brought with them copious amounts of rain which caused widespread flooding. At Cardiff a storm of "tropical violence" followed a day of oppressive heat and there was said to be "an electrical

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display of a character such is seldom witnessed in this district". Following this the "storm burst over the town with sirocco-like violence" and the reporter exclaimed "It was as if the flood-gates of heaven had been opened, so overwhelming were the torrents of rain and hail which descended". The wind was said to have suddenly increased "catching the hissing, seeting torrent, swept it along the roads forming here and there miniature lakes". Drainage was said to be generally insufficient to carry off the huge volume of water, significantly hindering transport and several cellars and shops were flooded. Although the storm broke only an hour before high tide the damage in the docks was said to be "practically nil". Trees were widely uprooted and significantly damaged although there were no reports of falling trees doing damage to property or endangering human life. "An old sailor, who had weathered many storms, both at home and abroad" stated to the correspondent that "he did not remember a storm which broke so suddenly or one of such intensity considering its brief duration". There were also reports of the storm in the areas of Pontypridd, Ebbw vale and Merthyr although no damage was reported. Following the storm accounts there was an advert for Wrights Coal Tar Soap which was said to be the best "preventive against fevers, measles and other infectious diseases". A strong westerly gale was said to have prevailed across the north of the kingdom for the whole of the 16th causing considerable damage both on land and at sea. In Glasgow a Crimean veteran and the supposed "tallest

<p>1890 26-27</p>	<p>1 British Isles Western Mail</p>	<p>28/01/1890</p> <p>2 man in Glasgow" was killed instantly as he was blown off a ledge whilst taking down a sign. A chimney stack was also blown down and crushed a man in a Glasgow warehouse and several others were injured. There were other reports of minor injuries and close escapes caused by flying slates, falling chimneys and, in some cases, destroyed roofs in the city. £200 worth of timber was also demolished as metal railing fell from an elevated height into a Glasgow wood yard. In Ardrossan the dams protecting a new steamboat quay in course of erection gave way leading to considerable damage but all workmen escaped injury. Several vessels dragged their anchors off Greenock and "navigation was attended with great damage" in the Firth of Clyde as a whole and incoming vessels reported "terrific weather" at sea and some required substantial assistance to navigate safely to shore. In the Irish Sea three vessels were wrecked on the Down and Antrim coast, whilst five vessels broke from their mooring in Belfast Lough and were expected to become complete wrecks. and a Norwegian Brig was wrecked in Holyhead Bay.</p> <p>A storm raging over two days was said to have wrought havoc on the southern and western British coasts as many vessels were severely damaged and their progress considerably hampered by the inclement weather. 30 men were said to have been drowned as when the westerly winds forced ashore in the Netherlands whilst a cargo ship in the Atlantic lost 300 cattle when the decks and cabins were flooded as the vessel remained hove-to for three days in north-westerly winds generated by the</p>
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1890 7 to 8	11	British Isles	Western Mail & Bristol Mercury	08/11/1890	3 cyclone. There were also individual fatalities on the Needles and in Conway bay, whilst it was rumoured a Neath steamer had been lost in the Atlantic. A great gale was said to have raged over most the Great Britain and Ireland during great damage to shipping, damaging communications lines and property. However, it was said the loss of life was not considerable when the ferocity of the storm was considered. The state of the Irish Sea made crossing difficult and in some cases impossible. In Somersetshire the gale was reported as "the most severe that had been experienced for years", whilst damage to property and a ship grounding was reported at Ilfracombe. The situation was much the same on the north coast of Cornwall as a ship went ashore at Bude. Although the crew were saved due to the quick and correct deployment of the rocket life-saving apparatus, a man who attempted to swim to the crew's rescue was drowned as he was overcome by the breakers. At Llandudno an extraordinary scene was witnessed due to the lack of preparation and organisation on the part of the lifeboat crew. After a distress flare was fired from a vessel the crew of the lifeboat refused to put out stating the coxswain was not fit to steer the boat. "After an hour's quarrelling the chairman of the lifeboat committee order to coxswain off to sea to complete a successful rescue attempt. However on recovery a labourer was run over and killed by the boat. Elsewhere a schooner ran ashore off the Giant's Causeway in Antrim and none of the crew had been seen whilst the postal authorities also notified the public there would be a delay in communications
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affecting most of their arterial routes. The direction of the north-westerly winds was said to have saved the shipping in the Bristol channel from great damage, and "had the direction of the storm been a few more points to the southward, it is more than probable that several wrecks would have occurred. Desspite this the sea was said to be rather rough indeed causing many a vessel to shelter in the Penarth and Barry roads. The lifeboat was depliyed in an effort to assist a large ship which had broken anchor in the roads, althoug two tugs recovered her before the lifeboat was required. The terrific storm was said to have damaged housing in Milford Haven as "heavy showers of rain raged during the whole night". A extended account of the death of Viscount Cantelupe was also feated who was reported drowned after strong winds from the south-west which then veered north causing his 64 ton yacht to break anchor and strike rocks although the lives of the crew were saved due to the swift deployment of the life-saving rocket apparatus. It was noted that it took a good time for any assistance to be rendered as "the sea ran so high, the wind was blowing with such terrific force and the night was so dark that to launch a lifeboat at that moment would been reckless folly". It was said the lord had died whilst climbing the rigging with his men as the yacht began to fill ip "Lord Cantelupe went first but just as his lordship had reached the top step and was stooping down with a buoy on the arm which clasped the rigging and the other hand extended to help the next man, a tremendous sea struck the little cradt and the unfortunate young nobleman, who at that moment was cheerfully

1891 8 to 13	3	British Isles	Western Mail	10-17/03/1891, 11 March 1954	200 <p>encouraging his men, was swept headlong into the boiling surf and was never seen again. The efforts and great skill and determination of the coastguard was praised after they rescued every man just before the craft was completely wrecked. It was remarked all would have most probably been rescued had it been daylight. The death of his gallant lordship was said to have "aroused the greatest of sympathy" and a search for the body was said to commence once the tempestuous weather had died down.</p> <p>200. Major damage. The series of 5 articles on this major storm event suitably began by referring to the proverb "if March comes in like a lamb it will go out like a lion". Indeed, a "keen" easterly breeze which began to blow on the 8th increased in strength over the the 24hr and by the 9th "half a gale" was said to be blowing from ENE whilst there was also snow fall. By the evening it was said that two feet of snow had fallen over the Cardiff and great anxiety was anturally felt for the vessels in the unprotected Penarth Roads given the ENE direction of the wind and the fact the ferocity of the "blinding snowstorm" was such it was said similar conditons had not been equalled "in violience" since 1881. Fortunately very few were out to sea so only one vessel was driven ashore and undamaged to the extent the captain and crew refused to be rescued, preferring to wait for high tide to float once more. In the streets of Cardiff 200 men were deployed to keep the main roads open as the snow felt relentlessly leaving several families snow-bound. By the 10th it damage was reported predominately across the south of</p>
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the British Isles and in Port Talbot melancholy news of the deaths of two youths were reported dead following a chimney fall. The railway, postal and telegraphic services were considerably hampered throughout Wales and much of Southern England as well as on the continent. At Pembroke dock a snow storm of the severity not experienced since 1854-5 was experienced as the weather became intensely cold due to the biting easterly winds whilst snow blocked roads and led to a three hour rail delay as a train was held up by a snowdrift blocking the line at Manobier. The situation was much the same in Haverfordwest, Tenby and Milford Haven where 5-6ft of snow fell, whilst travel in the valleys of south Wales became near impossible and hundreds of livestock were said to have perished with grave consequences for the agricultural communities. Loss of life in maritime incidents were unsurprisingly concentrated on the exposed east coast and deaths from exposure/hypothermia were widespread. On the Thursday the 12th it was reported a schooner ran ashore off Hayle Bar and another vessel was wrecked off Scilly leading to the death of the mate. An account of the perilous escape of four sailors from their wrecked schooner in St. Ives Bay was given as they were said to have "climbed up the steep rocky heights for a distance of over 300ft ... the ascent was made with the utmost difficulty, several of the men slipping backwards and nearly losing their life on the sharp crags". After this it was said the men had found shelter and subsequently been well cared for at a farm before going onto Hayle where they were taken care of "by the hon. agent of the

Shipwrecked Mariners Society" before being returned to Newport, highlighting the social insurance schemes in place. There was also an account of a tremendously sad tale in County Mayo where two coastguardsmen were returned to their station with their children in their small patrol boat which capsized in the rough seas and they subsequently perished in an attempt to save their children. By the 13th the storm was abating across most of the UK although there was still disruption to rail travel in the west of England, whilst mail had to be delivered on horseback and by foot to the regional sorting centre in Plymouth from the engulfed rural areas of Cornwall. It was initially stated 14 vessels and 60 lives were said to have been lost around the coasts of Devon and Cornwall, although much anxiety had arisen following the disappearance of a floundering American liner off Plymouth and injuries and one death were also reported in the Cardiff docks. However this death toll was later raised to 70 and crews putting into dock at ports in the Bristol Channel indicate it was highly likely the toll was to rise given the extent of distress and destruction witnessed. The good deeds of a Norwegian barque who saved two sailors out of three from a sinking vessel were applauded, whilst the Shipwrecked Mariners Society granted the two sailors free rail warrants to ensure their safe return home. Acts of humanity were also apparent elsewhere as it was said £700 had so far been donated to a relief fund for the widows and orphans of the coastguardsmen of Sandal lifeboat at Ecclestone-on-sea in Lancashire with the RNLI contributing £500 of the total

<p>1891 25-26</p>	<p>8</p>	<p>Western British Isles</p>	<p>Western Mail</p>	<p>27/08/1891</p>	<p>1 reported on the 17th. Overall, at sea the iron steamer Marana was wrecked off Start Point with the loss of 24 lives whilst a crew of 22 onboard a rigged ship went down 2 miles from Start Point. A vessel was also wrecked at Penare Point where 19 of the 40 crew drowned or froze to death in the rigging. A report from 11 March 1954 stated "it was almost the same tiem of year, sixty-three years ago, when the Great Blizzard afflicted the West of England". "Powedery blizzard-snow began to circulate, and before long an unbridled hurricane raged across the West". All business ground to a halt as 200 perished in the Artic conditions and it was stated the winds at time resmebled "the frantic yells and fiendish laughter of millions of liberated maniacs".</p> <p>A tempest raged over Cardiff bringing with it torrents of rain. In the British Channel area there was little in the way of shipping casulaties as only one collision was noted and the devastation and destruction largely resulted from fluvial flooding inland in the valleys of South of Wales as the town districts of the Morrision, Llandilo, Neath and Llandoverly were all flooded. This resulted in the widespread loss of livestock and the flooding of residential property which in some cases incurred irreparable damage. In contrast there were several instances of distress on the coast of North Wales and the North West of England as a steamer was blown ashore near Deganway, a yacht was sunk in the Conway and another had a close shave at Llandudno but was fortunately saved by the heorics of the Llandudno lifeboat. The crew of a Norwegian schooner were also saved by the liefeboat and</p>
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1891	21	9	Western and Northern British Isles	Western Mail and the Press Association	22/09/1891	<p>another vessel after running ashore near Southport, although it was said the vessel was likely to become a complete wreck. The areas of Cheshire and North Wales were reported to have experienced the "heaviest storm and gale for some years" with the rivers Severn, Dee, Clwyd, CONway and all their surrounding tributaries breaking their banks. A gardner was said to have drowned as he foolishly attempted to cross the Dee and thousands of acre of crops were ruined along whilst rural "dwelling-houses" were also considerably damaged by the flood. The situation was much the same in Cumberland as grain crops were damaged on a grand scale, whilst "great anxiety is felt for the safety of the pits, as it is feared if the river [Eden] should break into some of them all the others would become flooded and about 1000 persons would be thrown idle". In Dublin two men were said to have died having taken to sea in a small boat at the height of the storm.</p> <p>A fierece gale swept over the north and west British Isles and storm surge conditions were reported at Blackpool as the "the promenade was swept, houses were flooded and considerable damage done" whilst a fierce storm was said to rage in the Mersey. A three-masted iron-built schooner of London was driven ashore in Cardigan bay during her maiden damage although the crew were saved by the rocket-propelled apparatus and pulled to shore. Their immediate needs were taken care of by an agent of the Shipwrecked Mariners' Society, although the vessel was bredicted to become a total wreck.. Flooding was said to have wrought havoc in the valleys of South Wales, and the</p>
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1891	13-16	10	British Isles	Western Mail, Liverpool Mercury, Bristol Mercury and Western Times	14/10/1891	1	<p>Gala valley was said to have transformed into a "large unbroken lake, making in some places the ordinary channel undiscernible" for a distance of over 60 miles. Two bridges were carried away halting rail and road transport in the region and "incalculable damage" was done to crops.</p> <p>A great storm struck the west coast of Britain causing untold damage to property and loss of life. In Liverpool the gale veered from South-east to South-west and the strong winds were accompanied by driving rain although the seas were not so high as to impede the Mersey ferries. One man drowned on a tender leaving a vessel. The New Brighton lifeboat was called out to aid two shrimpers. Although the captain of the escorting tug sustained great injury, the lifeboat and the men in the shrimpers were subsequently brought to safety. In Southport a large amount of glass in properties was reported to have been destroyed. Several mussel fishermen had a narrow escape in Morecambe Bay which was watched by hundreds of spectators. All attempts to rescue a steamer stranded in Morecambe Bay proved fruitless and it was thought she'd be completely wrecked with a loss of £13,000. Several boats were sent out but did not find the men who later walked back across the flats to their safety. Much damage to property was done in Preston and several individuals sustained major injuries although none were thought to be life threatening. At Blackpool the heavy sea broke over the promenade although in anticipation of the storm many of the fishermen had removed their vessels from the shore. The Royal Gardens sustained serious damage</p>
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whilst at Lytham the fishing community and lifeboat was on the look out for foundering craft. Many small vessels were washed ashore but none were thought to have been manned whilst Lytham pier was substantially damaged. The barometer was seen to fall below 28.00 in/hg in Rhyl and houses substantially damaged. Unfortunately one small girl was seriously injured when thrown on a wall by strong gust of wind. The Rhyl pier also sustained great damage and "in the open country trees were uprooted". Several vessels dragged anchor in the harbour and the lifeboat was required. In the Menai Straits the high seas caused a ferry. The Royal Navy reservists were also deployed in mountainous seas in their cork jackets and saved the men of distressed small vessels whilst the quay thronged with spectators, amongst whom were the panic stricken wives and relatives of the poor fellows". Fears were entertained for the a final boat that was not found and concern for their children and families noted. Off Holyhead a vessel was wrecked and the whereabouts of the crew unknown. The crew of another vessel were also saved. Many of the vales in Carnarvonshire were flooded and large swathes of agricultural land submerged. The storm also did damage in Cardiff forcing a vessel onto the Cardiff Flats and other vessels were reported ashore. Felled telegraph poles delayed communications whilst trees were widely uprooted. In the Isle of Man it was stated the wind strength had not been matched for 4 years and "huge seas swept clean over the lighthouse on the end of the breakwater". In Douglas the seas broke over the sea wall

and the dashing waves produced spray which went up to 100ft in height whilst a schooner were wrecked. All men were rescued by a crowd ashore with two making use of 'lifebelts'. The crew of a schooner were also rescued by two lifeboats. Trees were blown across the line halting a train although the passengers removed the obstruction. In South Wales the felling of telegraph poles delayed communications and the "newspaper offices were almost besieged". Pedestrians found it hard to make headway against the wind and several houses were severely damaged. The vessels in Cardiff had telegraphic warning of the storm and "great anxiety was felt for the shipping ... these fears were fully justified". Two vessels were forced ashore with the rough sea preventing rescue from shore. A schooner came to the assistance of the distressed seaman lower a small boat even though from the shore the attempt appeared "foolhardy ... especially as the tide was now at the full, and the sunken vessel must be left high and dry on the beach in a few hours". Nevertheless the men in the small rescue boat rescued the crew which was appalled ashore. Several other vessels ran ashore in the area and there were other attempts at rescue although only one vessel was sunk. A "perfect hurricane" was also observed in Swansea Bay although no fatalities were recorded there were numerous escapes. There was also great flooding on the 15th in Swansea as the downpour led to flood water entering houses as the Tawe overflowed submerging low-lying districts. Ashore communication was much delayed due to felled telegraph poles and it was hard to walk whilst chimneys also fell

throughout the town. Off Tenby several trawlers experienced difficulty but made the harbour and rain fell in torrents. The Bristol Mercury on the 15th also issued an article which began "The Meteorological Department is, as a general rule, bold in prophesying. Its predictions may not always be accurate; indeed its critics have made out a case for taking them in a reverse sense". The article then continued that "the weather prophets were constrained to admit that concerning yesterday 'no detailed forecasts were possible'. They were, so to speak, completely at sea, or rather in a gale, as to what was to happen". However despite this underlying criticism the correspondent stated the "astonishing variety and change was precisely of the kind that could not have been foreseen". The gale was described to have caused enormous damage over the whole country and at sea whilst its resurgence during the 14 was completely unexpected. A gallant rescue was also performed at Torquay the lifeboat had to be deployed to rescue a vessel in "deplorable condition" but it returned after advice from the coastguard the vessel was making port. She was subsequently deployed to rescue another vessel however which she did. The lifeboat of the latest pattern "behaved splendidly" and the vessel was rescued. There was also a rescue when several men waiting to get into a yacht were washed into the sea and only rescued by a superintendent from a bathing cove who dived in after them. In West Somerset the low-lying lands were largely submerged and great damage was done to agriculture around the Southwest. Orchards were widely damaged and the areas around the Exe and Clyst were inundated.

1891 18-20

10

British Isles

Bristol
Mercury,
Liverpool
Mercury,

20/10/1891 -
21/10/1891

Five boats sank off Exmouth and "old watermen state that if the gale had come during the spring tides instead of yesterday in the neap tides, damage to the extent of hundreds of pounds would have been wrought off Exmouth alone". The South Wesyern Railway was also blocked by a tree but service was quickly reopened. On the 17th the gale struck again with a renewed fury delaying most sea traffic in the Mersey and when a gig capsized on tow one man drowned despite all gallant attempts at rescue. At Swansea the rain gauge at the dock registered an incredible 59.3 in such was the torrent of rain and one further shipping casulaty was recorded. A house under construction was also demolished by the gale in llanelly. In Milford Haven a perfect hurrican and heavy showers of rain was noted and the house and treess of the neighbourhood suffered significant. This included the churhc of St. Ishmael's which was damaged by a felled elm tree. The whole meadows of the Cleddau Valley were completely flooded. The Holyhead breakwater was covered by waves for the most part of the storm and the harbour full with weather-bound vessels. I Ramsey teh stor surge was such that streets and a number of houses near the sea front were flooded and the promendade impassble for three hours as "blinding rain and hail" fell and "a tremendous sea prevailed in the harbour". Another gale struck the British Isles doing immense damage across the kingdom with very strong winds and torrential rain. Swansea and Cardiff were deluged although the Taff only just overtopped it's banks despite fear of widespread flooding due to the high tide. The

Western
Mail

Queenstown lifeboat broke from it's mooring and was destroyed whilst one man was severely injured in the attempt to save her. Several vessels were forced into the port with substantial damage and crews were exhausted. A storm surge was noted in Newport as the marshes were inundated and low-lying coastal properties flooded. In the valley of the Usk heavy rain on already saturated ground caused widespred flooding over hundreds of acres and arterial routes were flooded to a depth of 18 to 20 inches deep. A vessel was driven ashore off Londonderry but no fatalities were recorded and she was later got off. In West Somerset the river Parrett burst the embankment and "deeply submerged thousands of acres of valuable grass land". An "immense stretch of water" stretched from Chedzoy to Langport and many cottagers had been forced to move their possessions to evade the advancing floodwaters. An Irish Sea Royal Mail steamer was disabled by the south-westerly gales but was subsequently able to proceed arriving late to Holyhead where 200 vessels were windbound with many having sustained great damage. An Embankment was washed away near Arnside on the Fruness railway preventing all traffic. In Liverpool the conditoins were "exhilirating" as heavy rain fell and strong winds lew. The unusually high storm surge tide caused the tide to reach a height of 20-21 feet and a collision occurred on the river resulting in substantial damage to the vessels. Great damage was done by the storm surge at Douglas which washed over the promenade and flooded the streets resulting in the depositon of hundreds of tons of sand and stones on the streets. The sewage system was

overwhelmed resulting in flooding to cellars and houses on a widescale. Tramlines were eroded away and telegraph wires blown down severely hampering communication. Ramsey was flooded for the second time in a week and houses were severely damaged by the waves on the promenade. Great anxiety was felt amongst many of the residents and telegraphic communication was interrupted. In Blackpool the high tides combined with the heavy rains did great damage as the "action of the water ... completely undermined what little remains of the once favoured Lower Walk". It was remarked "it is evident that unless precautionary measures be taken the whole of the walk will be utterly demolished during the winter". Substantial erosion to the cliffs to the north of the town was noted to have occurred exacerbating an ongoing process as "during the last few years the cliffs have been gradually crumbling away. Tons upon tons of marl have been dislodged by the action of the wind, the waves and the rain". Despite the erosion during this storm it was remarked a long concrete wall at the foot of the cliff had substantially reduced erosion. In Maryport the lower section of the town was inundated by the surge with some houses flooded to a depth of 4 feet and great damage being done to the shipbuilding yard. In Preston the Ribble overflowed its banks and flooded the marshes whilst damage was done to the embankment wall. An Amry base was also badly damaged in Tremadoc. In Carnarvon there was a large landslip with the Seiont river having undermined a cliff which subsequently fell into the river causing a diversion. Rhyl was also visited by very

1891	10 to 14	11	British Isles	Bristol Mercury, Liverpool Mercury, Western Mail	12/11/1891 - 14/11/1891	11	<p>high tides reaching 21 ft 18 in which flowed round the newly erected pavilion and flooded its cellars. In bangor several lakes burst their banks and flooded slate quarries throwing 100 men out of employment.</p> <p>A great storm which in many places rose to the force of a hurricane resulting in the loss of many lives and the destruction of many vessels. Communication was widely retarded throughout Britian and between the kingdom and the continent. In Cardiff the "gale of almost unprecedented violence" claimed the lives of 3 men as they attempted to rescue a distressed mariner. Several ships also broke from their moorings doing damage in the docks whilst considerable damage was done to the roofs of houses, and a hpadding fell striking a workman on the head doing him con siderable injury. The strong winds and rain also caused serious damage to property at Penarth and although no fatalities were reported one individual sustained a minor injury. A vessel also put into dock in a much distressed condition. One life was lost as a small tender capsized in Barry however although the other man was saved thanks to quick relief from the shore. Another tender which had headed out to a schooner in the Barry Roads was missing whilst several vessels sustained damage during collisions with each other and the dock. Following the drowning a subscription was proposed for the fatherless families by a local Reverend who felt sympathy for the families of the "three gallant and unfortunate dockers who were drowned during the storm". It was proposed to take up the issue with the Barry dockmaster or "any gentleman of influence in the</p>
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district". And the reverend suggested "I have no doubt a generous response would be made on the part of the public". A subsequent letter stated that in response to the reverends request a "noble hearted inhabitant of the Docks" would be donating 21s to the widows and orphans of the three poor fellows who were drowned " two of them losing their lives in trying to save the third". This individual was "quite ready to take a book and do my humble best to collect as much as ever I can". He disclosed the name of generous doner before finishing "Bravery in saving or trying to save life is always recognised by Englishmen". An eye-witness contributor stated than any suggestion the first man could have been saved was incorrect. He said "I think everybody who witnessed the occurrence will agree with me that it would have been utter madness (as the sequel shows) for any of these cockleshells to have attempted a rescue. Everything that could be done was done". The witness in defence of himself said "I do not wish to say that we did the very best that could be done; but we did our best. No man could be expected to do more". The Newport Pilot finished continued "Unforutnatley, we failed; and nobody can be more sorry than we are for this. I think, under the circumstances, Mr Wordsworth might have withheld his comments till he was sure of the facts". Another contributor stated "It is always injudicious, to say the least of it, for landsmen to question the conduct of seafaring men. It is still more injudicious for one who was not an actual eye-witness to do this". The surveyor from the Board of Trade said he would "take my oath" on the fact

there was nothing could do and that he was well qualified to state this as "an expert on boating" and the "slur" cast upon the Barry boatmen was undeserved. He did "cordially agree" with the need to start up a subscriptions and he was already in consultation with dockmaster about the matter. It was again expressed "we trust the public generally will liberally help the families and dependents whom all three have left behind them". Although "the launching of the punt ... was as reckless a piece of heroism as I ever witnessed" such "splendid bravery" was "certainly deserving of public recognition". The Teignmouth lifeboat rescued a vessel and the barometer was observed to have fallen as low as 28.25 on the North Devon coast and the floods carried away large numbers of sheep and cattle on low lying agricultural lands. A schooner was forced ashore on the Scilly isles although her crew were saved by the St. Mary's lifeboat. A number of small boats in Penzance harbour were also sunk. Somersetshire once more recieved heavy floods excaerbated by heavy rain. "The Drainage Commissioners" have agreed to join other public bodies in a request to the Lord Mayor of London to open a relief fund for the sufferers by the floods". At Bristol several vessels at the mouth of the Avon were forced from their moorign and went ashore. A "shocking accident occurred" when a 50 foot stack fell through the roof of a sawmill killing one and seriously injuring 2 others. In liverpool the storm ensued from the NW relpacing a "heavy and close" atmosphere. As a result "the streets were almost cleared of pedestrians" and walking became very difficult. A heavy

downfall of rain. River traffic was considerably interrupted by the SSW winds whilst most vessels opted to stay in port. In Birkenhead the winds caused minor casualties in the form of blown down chimney pots. In Rhyl people could hardly keep their feet and the "sea ran exceedingly high, and the glass was at the lowest possible point". At Holyhead a mounted messenger indicated a vessel was ashore at Rhosneiger and the lifesaving apparatus was brought to the location. All aboard were rescued by a tug before however and a Lloyd's agent went to inspect the operation. The vessel however went to pieces and a wife of a coastguard man treated the crew who were in a deplorable condition and later taken to the Sailors' Home refuge. Further north at Gargstang a heavy rainstorm lasted for ten consecutive hours and the Wyre overflowed its banks in many places doing great damage to agriculture. Roads were inundated and a house was flooded to such a level it was deemed uninhabitable. In Douglas several vessels were in distress however despite the rapid deployment of the coastguard with the rocket apparatus their services were not required as all vessels got to their berths safely. The lifeboat crew at Blackpool who had recently "severed their connection with the National Lifeboat Institution" performed a rescue via one of crew's yachts due to the moderate concern. In the Mersey a pilot was run down by a steamer although the crew were rescued by a vessel which heard the cry of the men and found them "clinging to the mast of a sunken pilot-boat". A "total wreck" occurred off Formby resulting in the loss of seven lives as the lifeboats could not approach the

vessel sinking in the dangerous waters. Despite signals of distress none ashore nor afloat could approach the vessel. It was said that a steamer could have rescued the men by deploying their boat and the fact the Formby lifeboat was disbanded several years previously was also mentioned. However it was remarked by the "nautical men gathered on shore " such a lifeboat would have been "no sooner launched than swamped". Despite the best hopes that all survivors would be able to hold on till the morning all survivors perished during the night. The Southport lifeboat returned to port with loud cheers and "the crew embraced the two survivors of the 1886 disaster". During it's patrol the lifeboat "behaved splendidly, and, if possible, had inspired the crew with greater confidence in her capacities". At Falmouth several vessels arrived considerably damaged whilst one officer had broken his leg. A vesse; was reported asore in the ristol Channel but was soon got off, three coasting vessels also went adrift at Avonmouth. Seven vessels were reported ashore at Burnham-on-Sea and although the lifeboat was despatched to rescue 3 of the crew in the rigging of one boat but they could not be reached. They later escaped unharmed once the waters receded. The strenth of the wind was such it "forced the tide up the river Parrett four and five feet above the reistererd height, the banks in several places being overflowed". A large portion fo the railway platform was also damaged. The river Parreth embankment "yielded to the enormous combined pressures of wind, rain, and tide" causing expansive flooding throughout the valley and doing great damage to

1891	28-29	11	Western Wales	Liverpool Mercury	30/11/1891	4	<p>agriculture and emergency work was swiftly undertaken to repair the breaches by teams employed by the drainage commissioner. Nevertheless the streets of Langport were submerged and cattle had to be swiftly located to new pastures. A vessel bound to Liverpool was wrecked in Maceherry Bay near Kinsale and despite the use of the rocket propelled lifesaving apparatus by the coastguard only four were saved whilst 7 drowned. A vessel was also wrecked off the Isle of Man although the crew saved themselves by their boat. Much anxiety was left for the Fleetwood fishing fleet but all returned to shore safely. A Liverpool tugboat captain was commended for his bravery when he rescued the crew of a schooner flying signals of distress in a Northwesterly gale just South of Holyhead.</p> <p>A terrific gale from the South-west swept over the Welsh coasts which was accompanied by heavy rains which fell at Carnarvon, A schooner was totally wrecked whilst trying to cross Carnarvon bar but the crew were saved. Another schooner which had recently departed from the port had not been heard of and was feared lost on the south coast.</p>
1890		11	North-west Britain	Liverpool Mercury	04/12/1891		<p>In response to the loss of seven lives during the storm of the 11-14th November on the Formby coast the deputy-coroner of South-west Lancashire wrote to the Mersey Docks Board stating that he believed the lifeboat formerly stationed at Formby should be brought back into service. Likewise a letter from the RNLI was received stating their intentions to place a lifeboat at Formby providing the board had no objections to this action. After "the subject was thoroughly discussed; and it was resolved to</p>

recommend that telephonic communication be established" the board raised "no objection to the institution placing and maintaining a lifeboat at Formby", however the board itself would instead ensure a lifeboat was at Formby. A certain Mr Crow argued that as the board owned no property there they could not possibly object although the reason why no lifeboat was placed there by the board itself was because it was "answered when the committee, after full investigation, determined that the boat was undesirable there, and that owing to the communication between the lifeboat service of Liverpool and that station a boat could be taken from the stage as easily as from the Formby station, if indeed, a boat could be launched at certain times from there at all". In previous instances it was remarked it had been impossible to launch the Formby boat hence why the station had been disbanded. "That however was a matter of opinion" which explained why the Lifeboat Society changed their mind with regards to the establishment of a boat there. Whilst the board still stood by their original decision they admitted a mistake as no rapid communication had been set up between Formby and the Liverpool lifeboat. Consequently in one instance "a man had to be sent three miles in order to communicate". The committee had now come to unanimous conclusion to establish telephone communication between the stations so a boat could be quickly launched at Liverpool therefore justifying their decision not to establish a separate lifeboat at Formby despite the fact one of the members thought the board ought to have their own lifeboat at

Formby and he eluded to the 2 many weeks of anxious thought and consideration" the board had devoted to the question of the Formby lifeboat in the past. However it was mentioned that during past consultations in 1888 the RNLi had "declined to express any opinions on the matter" and it was now clear they had changed their mind. The RNLi's lack of reaction after the abolishment of the boat by board vote was also noted and therefore they "acquiesced in the removal of the boat". The incidents since the boat's removal were subsequently detailed using the former lifeboat master's evidence which included one wreckage in November 1890 which resulted in 4 casualties and the recent wreckage of the vessel the Hawarden Castle which resulted in the loss of 7 lives. However those giving evidence for the reinstatement of the vessel were "Not going to maintain, or pretend, that it was an absolute certainty that if there had been a lifeboat at Formby she could have saved the lives of both those crews ... but what was a matter of certainty, and of history, was that the lifeboat was not there in time, at all events, and that these unhappy men went to their deaths without, apparently, any effort being able to be made on the part of the lifeboat people to rescue them". It was noted that Formby was 8-9 miles from the Liverpool landing stage and the marine surveyor stated that there was only 5-6 hours on each tide in which a lifeboat could be launched from this position with the assistance of a tug. Moreover the emergence of Taylor's Bank at low tide also meant that the lifeboat would have to travel some 6-8miles further if they wished to reach Formby. Moreover

the emergence of that bank would also provide shelter for a Formby lifeboat easing deployment. The history of the Formby station also found that during the last 50 years 180 lives had been saved by the Formby vessel. Therefore it was said with "great pleasure and great regret" that a lifeboat would now be established at Formby. The regret resulting from the fact "so many old members of the board and committee should have brought forward the recommendation" so lives of sailors would have spared. After some argument and response in which it was said the decision to close the lifeboat was based around the available information in 1888 it was decided the committee would decline the RNLI's invite and instead place a boat there themselves as an experiment. It was stated "if the board had not got the men who were fit and proper" to man the lifeboat "let them get them, and let them get the matter into their own hands, as they were morally and legally bound". Although no response could be given with regards to a question posed by Mr Parker, a long-standing board member, regarding launch time due to the variability in conditions it was retorted that the boat had saved over 3 lives a years in the previous 50 years (1838-1888) however "if only three lives were saved in 50 years, then that the board should keep a boat there". Especially as they had plenty of funds "for getting a light and efficient boat there". Mr Glynn also was also said if the responsibility was passed to the RNLI "he did not think the boat would be as well managed as if the board managed it". He then went onto exacerbate the point stating "if the board did not put a boat there, the

next thing would be the giving up of their lights and buoys, then their pilot service, and then asking the Government to take over the docks" and "the lifeboat suggestion would be the thin end of the wedge in the grandest system of dock management... in the world." The MP present also noted that the committee "had a duty to perform, not only towards those whose lives might be placed in danger by reason of a shipping casualty, but to those men who formed the crew of the lifeboat when launched" which was met with a "hear, hear". However a certain Mr Crow said "this very point had been very carefully considered by the committee" and this was precisely one of the reasons why the lifeboat had been removed from Formby. He further stated that there would have been a great possibility the Formby lifeboat would have encountered severe casualties in the last gale and he believed "on one occasion almost the whole of the crew of the Formby boat was lost". The Chairman of the meeting then stated "they must recollect that the institution which they must assume studied the nature of the coast before they made the offer ... to establish a boat". He stated "with their experience they must be satisfied that they considered that a boat would be desirable there and that the crew would not be exposed to unnecessary danger". He further reinforced the point that there would be tidal times when the Liverpool boat could not reach Formby which was itself sheltered. It was said the disagreement about the positioning and control of the lifeboat was a sign of "healthy public opinion" and it was the duty of any dissatisfied committee member to

<p>1891 6 to 8</p>	<p>12</p>	<p>British Isles</p>	<p>Liverpool, Mercury, Western Mail and Bristol Mercury</p>	<p>08/12/1891 - 09/12/1891</p>	<p>make their opinions known to all others. He was keen to point out that "while there was a legal obligation to establish lifeboats, there was no indication as to where they should be placed. They had to exercise their discretion, and they had done it". Mr Gladstone pointed out that the cost of the boats to the board was only £200 a year and "he thought that no man in his senses would allow it to weight with him". With regards to Mr Glynn's argument that allowing the RNLI to take over the lifeboats would be "the thin end of the wedge" it was retorted that it would in fact be advantageous if the RNLI took over their management because at present the board "were unable to give that attention to the matter which was deserved". After a vote the ammendment to place a Mersey Dock Board lifeboat at Formby was approved 12 to 8.</p> <p>A gale from the south-west struck South Wales bringing with it heavy hailstorms and a downpour of rain. A collision occurred in Barry dock as a result and although much inconvienece was caused no serious injuries were reported. There were floods in the Rhmneuy valley and much of the lowlying agricultural land was inundated. However a later report told of the foundering of a all aboard a vessel off Sully with all hands drowned. A body was later washed ashore on Sully island and it supposed to be one of the drowned mariners. A man in a ketch was also washed overboard in the Bristol Channel and drowned. vessel was ashore near Bangor,NI and a vessel went ashore on Burbo bank flying signals of distress. Two lifeboats were dispatched from New Brighton and</p>
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1891 9 to 11	12	British Isles	Liverpool, Mercury, Western	11/12/1891 - 12/12/1891	<p>Liverpool and after 26 hours "owing to a heavy sea and darkness, a crew of 26 were rescued". A later report in the Liverpool Mercury would of the the "saving of valuable lives under circumstances of great danger and heroic gallantry". The strong northerly gales experienced at Liverpool had done great damage to the lifeboat itself yet the crew stated the boat "behaved admirably, and that they are very proud of her". It was further remarked "this must be very satisfactory to her designer, Mr Charles H. Beloe, the hon. secretary of the institution in Liverpool". Overall this meant a grand total of 312 lives had now been saved by the RNLI's New Brighton boat since its establishment in 1863. The Hoylake lifeboat was also deployed to Spencer Spit with many of the rescuers coming straight from their annual dinner at the Stanley Hotel. Although the vessel was found abandoned, being the vessel mentioned above it was remarked that great praise was nevertheless due to the Hoylake crew. It was feared the Hannah Landles would become a complete wreck however as it could not be towed off. The vessel was later reported to have been "Lost in the quicksands". Sheep were drowned in the valley of the Eden in the Carlisle area as the river overflowed its banks owing to the torrential rain. A vessel was forced ashore in Treynon Bay and totally wrecked with the loss of one life. Many of those who escaped sustained severe injuries however.</p> <p>Another severe storm struck the West of England causing much damage and disruption amongst the shipping and also on land. A full-rigged ship was driven ashore off the</p>
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Mail and
Bristol
Mercury

Sully Island. 15 evacuated the vessel in the lifeboat which unfortunately stove in however all were rescued by the tug in assistance. Meanwhile the remaining 16 on the vessel were rescued by the Penarth lifeboat although all of the crew had "lost the whole of their effects". The gallantry of the lifeboat was much praised by a barque was wrecked on the sands at Britonferry with the loss of all 12 hands. At Blackpool the violent gale resulted in "huge accumulations of sand" on the promenade and this storm surge driven sand covered the walks and gardens of coastal property. However buildings in the course of construction had been "wisely protected in anticipation of the storm" and thus contractors sustained little damage. Around Lytham wreckage was washed up on the banks of the Ribble and agricultural land was inundated in lowlying areas. At Southport a chimney stack fell through a roof seriously injuring a lady in bed. At Bristol Joint Station an old goods shed was unroofed and telegraph wires were destroyed covering the line. As a result messages had to be hurriedly conveyed by foot to prevent the dispatch of a train. The removal of telegraph wires caused further widespread disruption of communication throughout the UK although the lines were quickly repaired. The telephone wires withstood the storm well to the extent only 30-35 subscribers were cut off from communication in Bristol. A large steamship was also reported ashore on the Cardiff sands and a vessel broke free from the Barry roads. The Bidston Observatory noted a "maximum hurricane velocity of 85 miles an hour or an indicated pressure per square foot of 65 lbs". Although the storm

was anticipated "a storm of such unusual violence was wholly unexpected". The "great gusts" from the WNW caused much alarm in the port of Liverpool and the No 2 lifeboat was deployed and made little headway due to the conditions and the fact she was insufficiently manned. Despite the sight of distress signals the lifeboat, now under tow, could not find any vessel seeking help and after "some hours were spent in this fruitless search, and with energy wholly expended, and suffering terribly from the cold wind and the almost incessant fall of rain and hail" the crew were landed back at the stage. The heavier more seaworthy No. 1 lifeboat was subsequently deployed to go out but only 5 men including a coxswain who had been in action in the storm earlier that week were willing to go out. As the boat could only safely go out with 14 men "it was impossible to render any assistance". However no vessel in need of assistance was observed and the "absence of all trace of wreckage" was seen as an indicator that no vessel had foundered. "The scene on the Prince's Landing-stage for a couple of hours after midnight was one full of terrific grandeur. The waves were running at a great height, and their crests were white with foam". "The sky for the most part was consistently black, but when there was a slight rift in the clouds the cold, white gleam of the moon became visible, only to render the otherwise prevailing gloom the more severe". Admst the scene the calls for lifeboat assistance were made and "the utter helplessness of everyone under the circumstances, the hoarse steam whistles. and the unanswered signals for help, served t aggravate the distress". Ashore many

narrow escapes were reported in houses around Lancashire and Chester as chimneys fell through roofs and winds were blown in and walls down whilst several major non-fatal injuries were reported. All ferry traffic across the River was suspended such was the severity of the storm and a barque escaped being blown ashore due to the quick reactions of a tug. At West Kirby and Hoylake great damage was sustained and the storm surge inundated the low lying land in the area doing great damage to the crops. Around Southport and Formby it was noted that there was a clear "deficiency of signalling for lifeboats" and currently nothing was being done to improve the situation. Indeed a vessel ashore on Taylor's bank burnt Tar barrels and fired blue lights into the sky but the only response they got came from the Crosby Lightship. Such was the lack of response the crew gave themselves up for lost although the new "splendid" steel boat held together and was eventually beached high and dry off Formby. The fact the Southport lifeboat station had absolutely no electric communication was mainly reasoned as to why it took 11 hours from the sighting of the first distress signal until the lifeboats dispatch which ultimately wasn't required due to the receding of the tide and position of the Eifel Tower on a sandbank. Such was the delay the mayor had been able to accompany the boat on its way out. At Blackpool much damage to property was noted as windows were destroyed on a wide scale and houses were unroofed. The agricultural land was flooded all along the railway from Preston to Blackpool and great damage had been done to crops and the St.

1891

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Liverpool
Mercury

12/12/1891

Anne's golf links. The sand blown the dunes covered a train on the South shore causing it great difficulty. At Preston great damage was done to residential and commercial property. The anemometer registered 230 miles of winds making it the 4th windiest day registered that year the highest being 271.6 miles. On the Manx coast much damage was sustained at Port Erin and three men serving as lighthouse keepers at the Chicken Rock Lighthouse could not be relieved after three weeks of weather imprisonment. A body was found at Aberavon of an unfortunate seaman. An inquest was held by a county coroner at Briton Ferry on the body of a dead sailor found on the Baglan Sands 300 yards below the high-water mark. It was stated that the vessel the sailor belonged to had spoken to the pilots on the fatal day of the 9th and "had made no signals for the pilot". After being told to lay anchor by the another boat, the chain of the ship broke. The assisting vessel soon lost contact with the damned Lenore. From then on after no signal of distress was seen by the lifeboat at Mumbles or any vessel however it was said the captain of the assisting vessel should have reported the dangerous situation of the Lenore and it's 12 crew as he was duty bound. However there was to be "no Board of Trade inquiry, as it was a foreign vessel". However as there was no definitive proof the bodies belonged to the vessel as none had yet been found at Briton Ferry, were it was supposed to be wrecked, the coroner simply concluded "found drowned". A report of the meeting of the RNLi held at the Adelphi Hotel in London during which silver medals and financial

1891	12 to 14	12	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	14/12/1891 - 15/12/1891	<p>rewards were presented to lifeboats of various coxswains who had shown gallantry over the past year. Certificates and financial rewards were also given out totalling some £743 (£95,000) as well as pecuniary grants to the crews of shore-boats. Various charitable and personal donations to the charity from individuals and collective funds ranging from £4600 (590,000) to £250 (£32,000) were announced whilst repairs and improvements to the organisations lifeboats were stated before the proceedings terminated. A severe storm struck the west and south of the British Isles again causing great loss at sea and on land. At Newport the storm was preceded by a rapid fall of the barometer before a gale from the west set in. The rains and conditions were described as "one of the most inclement". A shoop under construction was blown down at Newport with ten inside being being injured despite the fact the build had taken measures to support the structure. However, although the fact the building still remained in danger was recognised before anything could be done "a violent gust of wind swept along the thoroughfare ... howling and whistling like the rush of express trains". Several of those inside sustained major and moderate injuries but none were fatal. They were fortunate that "many willing neighbours turned out to render assistance" whilst the police were quickly on the scene to remove those trapped from the debris. The "utmost commiseration is expressed for those who have sustained personaland monetary injury". On the 15th it was announced a subscription fund had been opened which had been headed by a donation from the mayor of</p>
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£10 (£1280) and the total as of reporting stood at £60 (£7680). It was also said all those in hospital after sustaining injuries "are also in a fair way to complete restoration". The Severn rose "to an alarming height" flooding many thousands of acres in its middle and lower course with the current carrying off "a great deal of property, including many head of cattle". At Llanley the damage was particularly severe with many buildings being unroofed and in one case "the collapse of a chimney stack is likely to end fatally" as a broker was injured by falling bricks which fell through his roof. The storm surge did much damage to the the South Wales Works and a 120ft high chimney fell causing much destruction. "At the lowest computation £1,000 (£130,000) will be insufficient to repair the damage done" as scarcely a property was left undamaged. This figure was later increased to between £10,000 - £12,000 (£1,300,000 - 1,560,000) and it was said many families "were compelled to abandon their houses". Several men were noted to be in a critical condition. In Cardiff many trees and chimney pots were felled although no serious damage was occasioned to human life. The situation was much the case in Swansea and was also observed to have "almost amounted to a blizzard". The gale also forced a great number of vessels to seek shelter at Holyhead. The Banterer, a Royal Navy gunboat which had been missing following her departure from Queenstown to Plymouth encountered "terrific weather" in the Irish Sea and later arrived in Appledore having previously failed to enter St. Ives. The crew was reported to have "suffered considerably from the heavy seas"

although the vessel was little damage. At Milford a "terrible gale" from the NW was experienced with houses unroofed, trees uprooted and hay ricks bwon down. Tere was a narrow escape at St. Ishmael when a man was almost crushed to death by a falling tree and the vicarage suffered greatly. Damage was allso widely reported at Barry and Burry Port although no shipping disasters were reported. A vbrigatine sunk in the Mersey after a collision with a steamer by the Clemence Dock although all managed to clamber upon the vessel they had hit without loss of life. The terrific gale was experienced at Tenby as many coastal houses had their glass in the windows blown in. The sea in Carmarthen Bay was described as being "very high" and several vessels sheltered at Caldy Island. A steamer from Bristol to Tenby was yet to be heard of and thought possibly it could have been lost in Carmarthen Bay. At Westward Ho! a considerable amount of wreckage was found believed to have been from more than two vessels which foundered in Bideford Bay. STeamers in the Irish Sea endured "a terrible passage". Overall 50 cattle were killed and great anxiety ensued amongst the passengers. The lifeboat was deployed in the Menai Straits following signals of distress from Dutchman's Bank although beore it could render assistance to schooner in danger was towed off y another vessel. Two other lifeboats also responded to the call although their services were also deemed unessecary. A Cardigan vesselbound to Cork was long overdue and therefore "grave anxiety was felt for the safety of the vessel and crew".

1891	12	British Isles	Bristol Mercury	04/01/1892	<p>A review of the weather and meteorological observation made throughout 1891 and between this year and 1867 featured in the Bristol Mercury in which specific attention was paid to the storms which had occurred throughout the year. It was remarked "the first three months of the year were phenomenal in their dryness; the three summer months were equally remarkable for their wetness; whilst the last three months of the year were most pronounced in their extremes of storms, rain and fog". It was remarked thanks to the data provided from the Bidston Observatory data comparisons were possible. "Since the Observatory at Bidston commenced operations in 1867 " it was remarked there had been 148 storms over the Mersey estuary area between the 4th April 1867 to the 16th December 1891 which were defined as instances in which "wind velocities exceeding 50 miles an hour" were observed giving an average of 6 per annum. However the storms "have been no means evenly distributed" and the records "bear out the impression created by the earlier storm history, that violent weather moves in more or less distinct cycles". In 1867 there were 9 storms whilst 16 were records in the first four months of 1868 which included "some of the heaviest on record" which included the storms of the 31st of Jan - 2nd February in which a velocity of 87 mph and pressure of 70 lbs per square foot was noted for a period of 30 hours. The number of storms in each year were documented included mention of the 1871 storm of the 9th March in which a pressure of 90 lbs on the square foot was obtained. However it was noted "the fury of the elements seem to have been exhausted"</p>
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as there were no storms with a velocity of over 50 mph until the 18th of November 1875 after which "commenced a tremendous renewal of energy, for over a space of 14 months" in which 18 storms were registered. The year 1877 was also noted as "another stormy period" as 12 storms were noted. The period between May 1881 to the 29th January 1883 were noted as being frequently stormy with 25 storms being observed in 21 months. whilst 1884 and 1885 were storm free in the area. It was noted 1890 and 1891 have been storm free until December of the latter when 3 storms were observed at Bidston. It was said that "those who have observed the remarkable breezy times we had in October and November last, will probably be surprised to learn that there was nothing in those months entitled to rank in this list". However it was noted "that remarkably lively times, and occasionally disastrous ones, maybe caused by disturbances which do not reach the limited named". For example the recent storm of 11th December 1891 was "the second most severe in the record, in point of velocity, being 85 miles to the hour; but the pressure has been equalled and exceeded on several occasions". When the records of storms from earlier period were observed the storm of December 1823 was noted as being "the most violent, as far as the then comparisons permitted, since 1560". However the existence of reliable data regarding that "great disturbance" was questioned. The periods of 1821 to 1824 and 1829 to 1836 were also noted as being the most stormy periods up to the commencement of the Bidston records. It was

1892	7	1	North-west Britain	Liverpool Mercury	08/01/1892	<p>stated that whilst the barometer was a could indicator of "bad weather" it was the "rapid fall" in pressure that really indicated the onset of a storm and "anything lke monthly or yearly averages of the barometer, however, give absolutely no guide". Nevertheless it was stated that since 1867 only in three seperate months had the average been below 29.50. Indeed it was further noted that the "excessively stormy four months of 1868 showed an average reading of 29..957" which was little different to the 25 year average of 29.912. Therefore it was remarked "that the barometrical averages over any sustained period do not necessarily bear any close relation to the general character of the weather". After temperature statistics it was noted the average rainfall for 1891 was "nothing abnormal though its distribution was unfortunate". The annualrainfall of 31 inches was similar to the 25 year average of 29.235 inches and contrasted to 45.6 inches and 23.7 inches which were the max and min readings recorded in 1873 and 1872 respectively.</p> <p>A heavy snow storm hit Liverpool and the north-west of Britain with snow covering ground to a depth of 1 inch or more for a short amount of time. The strong wind from the north was "bitterly cold" until a sudden change in drection was noted at 8 am and the nsow melted making travel in the "wet slush" slow and labarious. By 10 am the wind veered round to the NNW and snow began falling once more until the late evening. Off the Max coast the "blinding showers of snow" driven by a gale from the ENE caused a schooner to drag her anchors in Douglas harbour and head towards the rocks. Consequetely the two</p>
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<p>1892 1 to 5</p>	<p>2</p>	<p>Western Britain</p>	<p>Liverpool Mercury</p>	<p>02/02/1892 - 06/02/1892</p>	<p>lifeboats were launched and the "rocket brigade" proceeded to their position with the life saving apparatus within 10 minutes of the distress gun being fired from the vessel. All the crew were taken off by one of the lifeboats and the vessel was brought into the harbour with no damage to property or harm done to life. A great storm rose up on the north-west coast of Britain causing notable damage. At Blackpool the "swept the promenade almost from one end to the other" and the wind "blew like a hurricane". The storm surge resulting from the high tide caused further damage to the coastal lower walk and undermined another coastal footpath. At Soutport the new shoreside works were considerably damaged as the greatest storm surge for several years swamped the promenade. At Preston the banks of the Ribble were breached and the water flooded the surrounding area. Several men working at a sewer cutting had a narrow escape. The arterial routes were underwater and houses and agricultural land was inundated on a wide scale. Fortunately the waters did not breach the quay walls so little damage was done in the town itself however a fleet of boats near the Ribble Sawmills were badly damaged. The storm surge was such a man was "triumphantly sailed home for dinner" along a flooded coastal road in St. Anne's by fishermen. In Ramsey the New Brighton lifeboat which was on a voyage from Liverpool to Lowestoft, "where experiments are to be made with the view of seeing if tubular lifeboats of her class are suitable at Lowesoft" was forced to put in and visited by a number of Manx spectators. An "exciting</p>
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rescue of a flat's crew" was also carried out off Great Orme's Head as a boat was deployed by a local man after the Llandudno lifeboat was thrown onto it's side when it's launching trolley collapsed. A steamer was also forced ashore at Holyhead by the rocks at Port-Felus after dragging anchors. After signals of distress were seen the coastguard at once indicated the lifeboat to be launched and the lifesaving apparatus went by land to the site of distress. All crew, 38 in number were landed by the lifeboat and the captain of the stricken vessel gave "great credit to the crew of the lifeboat for the splendid manner in which they handled the boat in taking the men from the ship". The crew were all lodged by a Lloyd's agent at Holyhead until arrangements could be made for their safe journey home whilst it was hoped the vessel could be got off. Thunder and snow was also noted in Chester and the vividness of the lightning was noted. The storm surge also damaged the Piel branch of the Furness Railway washing away a large quantity of ballast and shifting the rails but delaying traffic for 5-6 hours. Around Rhyl acres of land were submerged in the Vale of Clwyd and "exceedingly high tides" were noted as "waves running mountains high dashed clean over the end of the pier". At Rhuddlan the river Clywd rose rapidly until it "overflowed its banks and spread to the base of the castle walls". The Rhyl lifeboat was also requested by a steamer who sounded loud distress signals to the extent most of the inhabitants were alerted of the situation and flocked to the pier to see the vessel. The Rhyl lifeboat was launched just 15 minutes after the first signal with it's full crew of 13 and the

1892	10 to 11	3	Western Britain	Liverpool Mercury	10/03/1892 - 11/03/1892	4	<p>"gallant crew" reached the vessel "after an hour's hard pulling". Due to the darkness which set in the only knowledge of the rescue was communicated by green rockets being sent up to acknowledge the lifeboat was at the steamer although several hours ensued without any sign of either vessel. Following a second green rocket was sent up 2 miles away from Rhyl the coastguard answered and hundreds hurried in the direction of the rocket. After a long journey in the face of winds which blew "almost a hurricane" the lifeboat returned to shore stating the vessel had been anchored securely and two of the lifeboat crew remained onboard to safeguard the steamer and its crew of 6 who were in good condition.</p> <p>"A heavy gale from the north-north-west prevailed off the port of Liverpool" causing considerable damage to shipping. The "exceedingly cold" weather was characterised by falling snow and very strong wind. A small steamer struck on Taylor's bank and began to sink although a small boat was launched to render assistance. Information of the disaster reached the Prince's launching stage 3 hours later and the lifeboat was despatched in tow of a tug. The lifeboat had to rescue the crew of the formerly launched vessel but could not render assistance to the steamer and its unfortunate crew which were presumed lost. A steamer registered in Liverpool was also wrecked in a storm of sleet and snow on the North Cornish coast on the 11th. The vessel was sighted off Bude after parting cables and drifting on rocks in Widemouth Bay. The lifeboat and rocket apparatus proceeded to the nearest point but the sea state was such the lifeboat could</p>
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1892 18-19	7	North-west Britain	Liverpool Mercury	20-23/07/1867	<p>not be launched and neither could the ship's boat land. However fortunately all the crew were rescued by the apparatus with the Captain being "greeted with cheers from hundreds of people who had gathered on the cliff" when he finally arrived ashore although the vessel was expected to become a total wreck. Snow once more fell heavily in Liverpool to the extent several inches had accumulated by the evening. Consequently road, tram and rail traffic was much delayed. However "the liberal use of salt on the streets, however, enabled the traffic to be resumed by ten o'clock". A thunderstorm occurred before noon before a rapid thaw set in which was followed by "a bitterly cold wind" which made travel by foot unpleasant. Around Rhyl the snowfall made travel in the Vale of Clwyd very difficult which were further hampered by the continued fall of snow which fell across the region. In Ramsey the wind shifted to the WNW before snow fall commenced covering the mountains with snow and in the town were it was "several inches deep". The wind shifted to the NE and blew a fresh gale producing a heavy sea which caused many large stemaers to seek shelter in the bay. It was remarked "the weather was excpetionally severe for the time of year".</p> <p>7 A great tempest hit the North-west coast of Britain causing much "excitement" and great loss was also noted throughout the area. In Douglas Bay a schooner sank with the wind blowing a moderate gale from the north-west. It was said "she went into stays, and then, without the slightest warning and to thee astonishment of beholders, disappeared in the depths of the sea". Despite the quick</p>
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deployment of a lifeboat and several steamers nothing was seen of the crew amongst the floating wreckage and it was presumed all the crew had perished. A Manx steamer also encountered heavy seas and endured a perilous voyage. Although the steamer fractured its starboard paddle, temporarily disabling it for a while whilst repairs were carried out, she was subsequently able to progress homeward to Liverpool though "huge waves from time to time dashed over the counter and swept the decks" and the vessel almost collided with another vessel in distress ashore. In Liverpool it was remarked "The weather of yesterday was more reminiscent of December than July" and the NNW created conditions which were "always particularly enlivening on the river". Although there were no major accidents "the greatest disorder" was observed on the Seacombe stage and the ferry services were postponed as the moored vessels rolled about in a manner which was "decidedly discouraging to the squeamish traveller" but only slight damage was done to the stage and the vessels. The few vessels that did ply the river struggled with the elements and against the tide creating quite a spectacle. The Formby lifeboat was deployed to assist the three-masted schooner ashore although she was gotten off by a tug and the assistance was not needed. The wind strength was such that "walking was not a pleasure to be indulged in to excess" as the driving rain battered travellers. Minor damage was noted to property and an old woman broke her leg. It was noted that "since the beginning of the month Old Sol has been in little evidence". A shipwreck

was noted at Whitehaven and although the crew were saved by lifeboat the vessel sank in a dangerous position. In Blackpool the weather was "of a particularly stormy nature" and it was remarked "to many of the visitors the experience was evidently a novel one, and there were large crowds on the promenade, wrapped up in shawls and cloaks, enjoying the battle against the elements". There was a disaster as the Liverpool lifeboat capsized and 3 of it's crew were drowned whilst attempting to rescue a vessel in distress on the Cheshire shore. An inquest was held upon one of the bodies of a seaman and a charitable subscription was opened for the relatives of the seaman by the Mayor, at the Junior Reform Club and by the city merchants. It was said by some of the crew of the New Brighton Lifeboat that the capsized Liverpool Lifeboat was within hailing distance although the former proceeded straight to the vessel in distress. However it was retorted that "owing to the fury of the gale and the darkness of the night no one in the New Brighton boat could see the Liverpool boat or hear the cries for assistance". However it was said the "greatest credit is due" to the New Brighton lifeboatmen for saving 30 lives and that they "very much regret that they were quite unaware of the distress of the Liverpool lifeboat crew". The Liverpool Salvage Association reported that the vessel originally in distress had sustained moderate damage but retained its structural integrity and the water in the hold would be pumped out at the next low tide. The details regarding the loss of the lifeboat was examined at the Dock Board meeting. The superintendent of the Liverpool lifeboats

revealed the No. 2 boat had been used as she was "the handiest" and the No. 1 boat was "not liked so well because she is heavy pulling, but there is no prejudice against her about capsizing". However it was noted the No. 2 boat had previously performed well in heavy weather. The superintendent went through the deployment process and towing of the lifeboats. The confusion and the anxiety when she was not spotted by any vessel in the vicinity that arose as the night progressed was documented. The superintendent stated that "the crew of No. 2 were all good, experienced men, and perfectly sober. I do not see that any blame attaches to anybody. I think it was just one ugly sea hit the boat and turned her over". =6 men of the Liverpool lifeboat eventually returned to their landing stage via train and were given all they wanted in the way of refreshments. One of the lifeboat crew also stated that they were unfortunate and that he "could find no fault with the handling of the boat". The chairman of the board thought it best not to discuss the matter until the coroner's jury had given their decision. A matron of a hospital said that one of the deceased had been admitted to hospital in Hoylake and was found to be "quite delirious" but died within half an hour of admission. A member of the dockboard, the superintendent, the crew and the captain also retold their version of events. It was said that it was not known if all the men could swim but they all had lifebelts on and clung to the boat. The assisting tug was acquitted of blame as it could not have been any nearer to the lifeboat and was also rendering assistance to another

distressed vessel nearby. Due to the mutual agreement of all parties the jury did not ask many questions but one of the jurymen remarked that in the future it was necessary to make provisions so that "immediate medical attendance could be obtained instead of having to wait a long time for a doctor or depend on the kindness of the ladies at the Cottage Home". The coroner then stated that "there could be no doubt that the two men lost their lives through an accident and that they (the jury) were not in a position to hold anybody responsible or to blame in the matter". Although all were satisfied the foreman said he "wished to ask the gentlemen present connected with the Dock Board how it was they had no self-righting lifeboats in their service". The coroner was very clear that the verdict of "accidental death" still stood and that members "ished to add a rider they could do so in their own terms". In response to the questions from the jury the superintendent of the lifeboats from the dockboard stated "the men in this boat were exceedingly thanful it did not right itself on this occasion, as, had it done so, they would all have gone to the bottom". The reason why the number 2 boat was taken out as opposed to the number 1 was because the former was lighter and the men prefered this boat. It was also said "it was out of the question to think of having medical aid established at every spot round hese coasts at which a vessel might go ashore". Overall the conclusion of "Accidental death" was returned although the jury added a rider "suggesting that a recieving house be provide at Hoylake or such arrangements made that in cases where men were

<p>1892 25-26</p>	<p>8</p>	<p>Western Britain</p>	<p>Liverpool Mercury & Bristol Mercury</p>	<p>26/08/1891 - 27/08/1891</p>	<p>exhausted by exposure as were those in this instance, immediate medical assistance might be obtained". Further particulars spoke of the heroic actions of a boatman whose limbs several sailors had clung onto whilst the lifeboat drifted to shore. Fortunately the boat was quickly blown ashore as he risked having his arm torn off. The funeral of the 3 deceased was arranged by the "Liverpool Watermen's Sailing Club and the procession was to go close to the lifeboat station and to be led by the band of the training ship "indefatigable".</p> <p>Western Britain experienced a great gale and floods during which loss of life was sadly occasioned. At Preston only slight damage was occasioned by the high winds and heavy rains "due to the precautions that were taken along the river and at the quay wall" with only one vessel breaking free of her moorings before she was secured by a steam tug. Several low lying agricultural areas were inundated and slight damage was done to vegetation in the towns surrounding parks. At Fleetwood however serious damage was occasioned to the New Market which was estimated at £5000 (£640,000) although no one was injured. In Lytham the wind did minor damage and the storm surge conditions resulted in the deposition of sand and wreckage of a small fleet of boats which had been forced upon the pier on the shore. Much of the fruit crop in the area was ruined. The Blackpool South Shore was flooded to a great depth and the bathing vans were much damaged. A gale of great fury was also felt in Furness and the torrential rains flooded the surrounding agricultural areas. Several bridges were destroyed in Sedbergh and</p>
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Kirkby by raging torrents. Three shipping casualties were noted on the northern Welsh coast although no life was lost in any case. A terrific gale blew over Llandudno and several sailing craft were prevented from going to the Beaumaris regatta "through stress of the weather". A distress flair was launched and the lifeboat readied but it was not required. A Norwegian schooner was wrecked off Southport as she went aground on Spencer's Bank. The lifeboat crew were summoned and the boat deployed although a steamer in the bay reached it first and rescued the 6 aboard. In Dublin two soldiers and civilian left a pub in the harbour in a small boat which subsequently capsized and all three were drowned. In Swansea large parts of the town were flooded and many workmen were unable to leave their homes. A schooner dragged her anchor and damaged the landing stage at Bangor and the low-lying fields in the Vale of Clwyd were flooded for miles around and trees uprooted in all directions. Agricultural damage was great and the "considerable loss to the farmers" was noted. However no damage was occasioned to the new Rhyl pavilion and "no damage resulting to this magnificent structure". Damage to marque at the Hawarden Flower Show was noted. A severe storm raged throughout Cardiff causing much inconvenience on shore. A collision between a Cardiff steamer and French schooner occurred off Lundy with the schooner sustaining great damage and the captain breaking his leg. At Llandudno the Conway valley was flooded and whilst crops were badly damaged the cattle were saved. A "gentleman

1892	31 to 1	9	North-west Britain	Liverpool Mercury	03/09/1892	<p>gardner" was unfortunately drowned in the Dee whilst a man also drowned in the Mawddach Estuary. Rain storms and strong winds were felt in the Ribble estuary and across the North-west. The Ribble was "greatly swollen, and would have been far beyond its natural bounds but for the new diversion and the other improvements made during the last five years". In the Fylde the heavy rains damaged the grain and it was "expected disease will break out in potatoes" should any further rain continue and the lowlying lands around the district remain inundated. The Wyre overflowed its banks plunging a road under 5 feet of water. There was also great flooding noted on the banks of the River Lune in northern Lancashire. A hailstorm was experienced at Southport which was followed by a thunderstorm which passed over the region.</p>
1892		10		Liverpool Mercury	09/09/1892	<p>A report of an RNLI meeting held in the Adelphi Hotel, London. An award was granted to a 14 year old for his gallantry in saving three people during the storm of the 19th of July. A lifeboat's crew were also thanked for their efforts in saving lives of a steamer and overall rewards totalling £226 (£29,000) were granted to the crews of lifeboats throughout the kingdom. A total of £3574 (£460,000) was given to the 303 lifeboat establishments and the notable sources of that money were disclosed. It was also reported "that HRH the Prince of Wales inspected the steam lifeboat Duke of Northumberland, belonging to the institution, at Cowes" and he had been "greatly pleased with the boat". The Emperor of Germany had also been for a "short run" on the lifeboat. After</p>

<p>1892 8 to 10 10</p>	<p>Western Britain Liverpool Mercury & Western Mail</p> <p>11/10/1891</p>	<p>notification of a new boat at St. Anne's and the improval of the Aberdovey lifeboat which were followed by the reports of the district inspectors the proceedings terminated.</p> <p>A great gale hit the western coast causing many a distrubance and "enormous damage to farm produce". The gale was particularly felt on the Manchester ship Canal as the storm surge swept over the under construction embankment seperating the canal from the Mersey. The flooding of the excovated trench was predicted to halt work for several days. The surge also swept away the ballast under the temporary roads at Runcorn and this subsequenetely required replacing. It was noted "none of the completed works in the estuary suffered any damage". However there was a clear advantage of the storm surge as "large new dredger Bollin, which has lately been constructed in the cutting at Millbank, was enabled to steam her way over the dama at the end of the cutting, which had been partly lowered for the purpose". It was therefore now on the river and "able to commence work immediatly". A Norwegian barque was wrecked at Blackpool and she was now marroned so high it was "absolutely oompossib;e to expect that any tide however high, will float her off". The vessel had done some damage to the pier and the captain had said he had run towards the vessel as he saw it as the "only chance of safety for himself and his crew". However it was remarked he could have purposefully beached the vessel on a sandbank but he had not "the requisitelocal knowledge". The pier intself had withstained damage from the collision</p>
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with the vessel and the supports, shops and seating were badly damaged. It was noted "Though the pier is insured against fire, it is not protected against storms" hence the loss would have to be absorbed by the pier company and thus the tenants who owned property on the structure. Old lifeboat crew members remarked the "salvation of the crew of the Sirene as nothing short of miraculous" given its perilous encounter with the pier. Reports from North Wales spoke of widespread flooding in the plains of all major rivers and "all crops are completely ruined, and there is a deplorable and disastrous outlook". A new road to the Colwyn Bay subway had subsided due to the erosion of the river by the flooding and much effort was forecast to repair it. The sea at Rhyl "was the heaviest seen for many years" and a long coastal way was undermined and eroded exposing the newly constructed asphalt promenade to the waves which did great damage. The Flintshire council was predicted to have to spend hundreds to repair the damage to roads throughout the region. At Southport no clear damage to the concrete embankment and lining of the Marine Lakes was identified though some damage was done to small fishing boats and a notable amount of sand was deposited in the Marine lake as the storm surge waves breached the embankment. Indeed "the general opinion seemed to be that instead of lamenting the total damage there was room for rejoicing at its limitation, considering the force of the wind and water directed against recent works which have not yet been strengthened to the full measure in contemplation". It was remarked that a "new principle of

1892 26-28	10	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	26/10/1892 - 28/10/1892	<p>bolting will probably be adopted" when reconstructing the new gallery in order to stand the force of subsequent storm surges. At Fleetwood 100 yards of the new promenade were destroyed along with portions of the sea wall which were under construction. The damage was estimated at "several thousand pounds". Much agricultural produce in the form of crops and livestock was observed floating down the Wyre which was seen as evidence of the agricultural devastation. A vessescorting 8-9 vessels flying the "Follow me" signal at the masthead was noted in the Mersey according to the "Liverpool Journal of Commerce" with the weather being too rough to allow a pilot to board any vessel. At Peel on the Isel of Man the high tides "swept the Shore-road and Marine promenade from end to end". The road and old sea wall was eroded away and several inhabitants were forced to evacuated their homes. Large gangs of workmen were at work the following day attempting to repair the damage to the promenade.</p> <p>A strong gale and storm hit the UK delaying cross channel steamers in the Irish Sea and the Holyhead lifeboat was delployed to aid a schooner in distress and all the crew and the vessel were rescued. There was also account of two Irish Sea steamers colliding although both sustained only minor damage although all steamers were "repeatedly swept from stem to stern" such were the sea conditions. A New York bound vessel from Liverpool signalled she would not call at Queenstown due to the nature of the sea. A vessel went ashore near Amlwich on the Harry Furlong sands and was predicted to become a</p>
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1892

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Liverpool
Mercury &
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11/11/1892

complete wreck. A vessel was also wrecked in the Bristol Channel between Lundy and the submerged wreckage caused damage to another vessel which had to be towed back. AT Porthcawl two vessels collided in the harbour and was moderately damaged. During a SSE gale a schooner sustained substantial damage sailing into Holhead harbour leaving her stranded inside the breakwater and eventually she ran ashore. She was successfully floated on the high tide but sustained considerable damaged. A steamer also ran ashore and began to leak badly in Church Bay and was subsequently beached inside the Old Harbour, Holyhead due to the rate at which she was sinking. A French vessel was wrecked on St. Govans head and it's crew "by direcion of the consulateauthorities were subsequently taken to the Sailors' Home". The crew had spent "a fearful night aboard" but happily succeeded in getting to shore and scrambled up the rocks to safety before been taken by the French Consul at Milford to Cardiff in an exhausted but stable condition.

The events of an RNLI meeting was recorded which detailed the recent gallantry of several lifeboat coxswains and rewards totalling £812 (£104,000) which were granted to crews across several lifeboat instituions for crews over the month of October. "The steam lifeboat Duke of Northumblerand now stationed at Holyhead, was taken out four times on service in a strong N. gale and a heavy sea on the 27th, saved the crew of four men from the vessel wrecked near Carnarvon" before it rendered assistance to another sinking vessel with great triumph.

<p>1892</p> <p>11</p>	<p>Bristol Mercury</p> <p>21/11/1892</p>	<p>Payments amounting to £6500 (£830,000) were ordered to be made to the 303 lifeboats of the institution and the most generous donors were listed. The reports of the districts inspectors were then read before the proceedings closed.</p> <p>A report of a paper read by Captain H. Toynhee, the former mariner superintendent of the Meteorological Society was documented. In the paper he "explained how a careful observer in any part of the British islands who would regularly write down four-hourly readings of the barometer, and four-hourly observations of the direction and force of wind, with records of the motion of cirrus clouds whenever visible, might generally form a very good judgement of coming wind and weather, and also most usefully supplement for his locality the forecasts issued by the Meteorological Office". He stated "the method could be applied to any part of the world, and was almost as useful to the farmer as to the seamen". It was noted how conditions of barometric pressure could change their position quickly and given the "general disposition of barometric pressure in the northern part of the Atlantic, we had the reason why the Atlantic storms generally moved along an easterly track, and often diverged to the north-eastward as they approached our islands". It was noted the storms had the tendency to move round the south and east side of a area of low pressure which had "it centre somewhere in the southward of Iceland". However the variation of the barometric pressure was said to have more variance over Western Europe and subsequently storm tracks were more varied. The importance of the low</p>
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<p>1892 4 to 6</p>	<p>11</p>	<p>North-west Britain</p>	<p>Liverpool Mercury & Western Mail</p>	<p>06/12/1892</p>	<p>1 pressure and thus the storm track was emphasised and related to the accuracy of forecasts. Therefore the Captain explained why the Met Office had been receiving observations from throughout the UK and Western Europe at 8 am, 2 pm and 6 pm to show the "general disposition of barometric pressure over Western Europe" and thus better predict the progression of a storm track. The importance of the 6 pm observation and the reason for it's publishing the following day was explained as through using these observations a weather observer could predict the likely track a storm would follow and where it would progress. He stated these observations were important as it would allow an observer to confirm the success or failure of the Met Office forecasts and prove why they had failed and what weather would likely be expected in the coming hours.</p> <p>1 Winds of considerable force accompanied by heavy snow showers were felt in North-west Britain giving the area a "thoroughly wintry aspect". Snow fell at intervals as the streets of Liverpool turned to slush which slowed traffic and a gale from the NNW started to blow in the evening of the 4th creating heavy seas conditions on the Mersey. However unfortunately on the morning of the 6th "a terrible scene was being enacted amongst the treacherous billows at the Mersey's mouth". The waves which "thundered ceaselessly upon the Burbo Bank- the scene of so many lamentable disasters" destroyed a Norwegian barque and claimed the lives of all it's crew. The Formby, Hoyake and New Brighton lifeboats all went to her assistance but "Not a vestige of human life could be</p>
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found". However, despite the lack of success the gallantry of the lifeboats was still noted. An interview with a crew member of the Hoylake boat revealed he had been out "for 13 hours at a stretch without bite or sup. During all the voyages I have made I never had any refreshments, unless we got them from the vessel we had gone out to help. I think there ought to be provisions on board every lifeboat, if only to succour any one we might pick up". The man said that whilst a short trip of "three to four hours" did not justify any food an extended search in the winter required provisions to enable to crew to function effectively. It was noted "the National lifeboats always carry a box of biscuits, hermetically sealed, in the locker, together with a bottle of whisky" whilst in contrast the Dock Board lifeboats had nothing. As a result he suggested that the Dock Board ought to consider providing "reasonable refreshment on every lifeboat that goes out on errands of mercy. There is nothing on board this boat except an empty keg. Not even a drink of cold water, and cold water is the only poor stuff for reviving an exhausted man". At Southport similar conditions were experienced whilst on the Isle of Man the snow melt "mantled" the ground to the depth of a foot. Although the railways were kept clear due to efficient management the high land roads were blocked with drifts. Livestock and horses were brought in "with the utmost rapidity" although it was feared "many sheep are buried in the mountain drifts, and search parties are busy all over the hills". An extensive search was carried out for one of "the most prominent merchants of Douglas" who had been

1893	2	Liverpool Mercury	11/03/1893	<p>msiing since the snowstorm of the 4th. Although "Douglas Bay was dragged and divers were employed to search around the Victoria Pier" no vestige wasfound of him. In Chester "blinding storms" of snow ocaasionally alternating with heavy hailstorms were observed and it was remarked "in the country the snow is a foot deep". The snowstorms over North Wales suspended work at many of the quarries and "several thousand workmen were thrown out of employment". Trains were also deplayed and telegraphic communications interrupted whilst the farmers had sustained serious losses to upland sheep. Snow was also observed in South Wales and in elevated areas on the Cornish peninsula were it caused much disruption. The Irish mail ferry was an hour late arriving at Holyhead owing to the blizzard.</p> <p>A report of an RNLi meeting detailing the accomplishments and donations of the society. A captain of a vessel was award the institutions silver medal for aiding a crew "crippeld by rheumatism" from the rigging and then safelyinto a lifeboat. The awards to particularly gallant individuals were announced which totalled £329 (£42,000) were disclosed before £4400 (£560,000) was given to the 304 stations of the institution and the names of particular generous donors were disclosed before it was announced the Prince of Wales would preside at the next meeting and proceedings were subsequently terminated.</p> <p>Details form the meeting of the Liverpool Shipwreck and Humane Society were disclosed which included the awards "for courage and humanity in saving life". Silver</p>
1893	2	Liverpool Mercury	18/03/1893	

<p>1893 9 to 10</p>	<p>8</p>	<p>North-west Britain</p>	<p>Liverpool Mercury</p>	<p>11/08/1893</p> <p>medals and vote of thanks were awarded to several gentlemen who had saved life at sea and for one gentleman who had saved the lives of two boys who had fallen through ice in Wavertree pond. 30 shillings were awarded to individuals who had performed or assisted others who saved lives in the Liverpool Docks and Mersey whilst 15s was awarded to a man who saved a woman who had fallen into a canal lock and was "in imminent danger of being drowned".</p> <p>A severe thunderstorm struck the North-west of Britain which occasioned loss of life as a Welsh poet was struck by lightning at Holyhead and killed. In Liverpool "there appeared signs in the sky of an impending storm" which was quickly followed "by a heavy fall of rain accompanied by successive flashes of lightning and rolling peals of thunder". At Preston "Blinding lightning and deafening thunder were followed by a hailstorm, many stones being the size of walnuts". The rain was so heavy one could not see across a street and a lightning bolt hit a sign which was consequently carried away by the ensuing gale. Cellars were flooded and "many persons literally washed out of their houses" as the sewers burst flooding the surrounding streets. In Lytham the choked sewers led to flooding over the surrounding land and a large flag staff on the Catholic church was shattered to pieces and the tower "badly shaken". At Blackpool the "peals of thunder were deafening" and flagstaff at the Royal Palace Grounds was split by lightning. The new electric works were struck many times but no harm came to any man and only minor damage was sustained. In Ramsey "several days of</p>
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1893	30 to 1	10	South Wales	Western Mail	06/10/1893	5	<p>oppressive heat ... culminated on Wednesday night in a thunderstorm of tropical severity. Rain fell in torrents" and the thunder peals were "appalling". The lightning "was at times unusually prolonged" and the way it illuminated the sea created a spectacle which many came to view.</p> <p>A treacherous squall was observed in Carmarthen Bay forcing many vessels into shelter in the Clady Roads. "Great fears were entertained for local traders" and one steamer was missing having been previously spotted in a disabled state drifting down the channel and was thought to have been lost off Llanelly. The captain was said to have set off "in spite of the storm that was raging, the sea running mountains high" before all control was lost and "she was tossed about like a feather". The storm was such the pilot cutter could not reach the vessel and was forced to keep a remote look out for survivors. It was believed she had sank with no signs of the crew. News brought sadness to the town of Llanelly where many had hoped it was just "an idle rumour". It was identified as the St. George from Bristol by the funnel markings.</p>
1893	14	10	British Isles	Western Mail	14/10/1893		<p>A poet made an appeal for donations to the public to mark the 3rd ever Lifeboat Saturday. The poem began by beginning the appeal to the locals of Cardiff: "Good folk of Cardiff lend a kindly ear / As this, our pageant passes brightly by". The importance was stated as the poet said he wished "To plead a cause that second stands to none; The Lifeboat! thrills not every throbbing heart". It was implied only the "callous, care less take his stand apart" from aiding the "hardy race" of sailors who "Go forth to</p>

1893	16-20	11	British Isles	Liverpool, Mercury, Western Mail and Bristol Mercury	20/11/1893 - 24/11/1893	22	<p>conflict;/ many a doughty deed". The humanity and strife of the sailor was emphasised with the line: "Is theirs - the furious elements they face/ To win their dear ones bread" as the "ild storm raves". The plight of the sailors was further exacerbated with the lines "In rath around them: plunging through the gloom" as the sea was portrayed in a somewhat demonic and lifethreatening manner as "their vessel ploughs the cruel, greedy waves,/ Each moment threatening to become their tomb".</p> <p>A gale of immense force occasioned many a disaster on sea and on land which including many "thrilling incidents" and a "terrible loss of life" was occasioned. Through the United Kingdom immense damage was done and whilst the majority of the damage was concentrated on the east coast the the full force of the gale was experienced in the Forest of Dean as rain was followed by snow which almost entirely suspended traffic and work. At Waterford immense damage was done and many were injured by falling slates as one man was blown from a boat and drowned. The captain of a schooner and his nine crew were blown ashore in County Donegal and only two of the crew survived whilst a barque was forced ashore in Moville Bay. At Newry considerable damage was done and many houses were damaged in Belfast and shipping was majorly disrupted in the Lough. At Whitehaven great damage was done to property and approximately 12 were taken to the infirmary having been injured by falling chimneys and other portions of damaged houses. A steamer broke down off St. Ives and was carried against Gurnard's Head where the vessel was wrecked and 21</p>
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lives were lost with only one survivor. The fatalities occurred when the captain decided to abandon ship and order the men into the boats. Both lifeboats capsized with the chief officer being the only survivor. One small boat was wrecked although all hands were saved. On return from it's rescue mission the lifeboat had a lucky escape as it narrowly avoiding capsizing. Seven men drowned from one vessel on the north coast of Cornwallas three steamers were driven ashore and "so badly knocked about that not a vestige of one of them remains". Two survivors were "miraculously found alive at Hawkes Point" however. Forutnately the coastguards did succeed in resucing over 40 lives by use of the rocket apparatus. Hundreds lined the shore and cheered as the last man from was brought ashore from the two other vessels. "The shipwrecked men were taken good care of by the villagers, but the lfe of Henry Jones was despaired of". It was noted "most of the men lost were married men with families" and great anxiety was felt for the progress of a Penzance steamer which was two days overdue. Two captains of the wrecked vessels gave their sotry with one procaliming "I do not see how anything, or anyone, could live in the heavy sea" and that as "the timbers of the vessel began to smash, and every man was on the look-out to save his own life". He remarked "There was no possible chance for most of the poor fellows" and he was surprised any of his crew had survived. The captain of a vessel wrecked off St. Ives spoke of the lack of assistance from the shore and his consequente attempts to aid the other vessel in distress which subsequently resulted in

his own wrecking. He stated "had it not been for answering the signal of the Cintra I believe I should have been able to save myself". The other vessel wrecked was steaming at full speed before being driven "in the teeth of the gale". As a result of her disabled state the captain decided to run her ashore on Porthminster Beach and the crew of 16 were all landed with aid of the rocket apparatus. A Holyhead telegram indicated "a whole gale blowing from the North" had driven 6 vessels ashore with 4 likely to become total wrecks. A further 6 were observed flying flags of distress and the lifeboats were currently out rendering aid as much anxiety was felt in port. A later telegram revealed two of these vessels had subsequently foundered off the South Stack. The harbour was described as "a scene of wild confusion" and was crowded with shipping sheltering from the gale. A Clyde steamer was ashore off the Great Orme's Head and it was believed she would be got off the sandy shore. Despite the fact the lifeboat could not reach her all were safe. A "remarkable spectacle" of the waves at the entrance to the Menai Straits breaking clean over the Penmon Lighthouse, which stands some 60 ft above the level of the sea at high tide" was witnessed. The lifeboat and tug were observed bringing in a distressed Spanish steamer. In Bristol the barometer fell to 28.80 in/hg and there was a strong gale from the N - NNW whilst heavy snow fell. There were reports of damage all over the town and two fatalities occurred between Filton and Patchway. A large hoarding fell in Bristol although any disaster was averted by the preemptive actions of a constable. The windows of some

shops were blown in and railway infrastructure was damaged. A lamplighter was unfortunately injured when he was engaged in lighting a lamp before his ladder was blown from beneath him. The fatality occurred when a 27 year old was blown into the Cumberland Basin and drowned. The body was removed to the mortuary to await an inquest. A railway porter was killed in what was presumed to be a horrific incident with a special train from Milford. It was "conjectured that owing to the noise of the gale and blinding effect of the blizzard the unfortunate man either did not see or hear the special coming, or that he was suddenly blown against it by the force of the wind". It was said that the storm had "reached almost the fury of a cyclone" and there had been "almost unparalleled disorganisation of the telegraph system throughout the country". It was remarked Cardiff had fared better than most places in the UK as although trees had been uprooted and many telegraph wires cut down there "were few instances of anything like serious damage" with one of the few instances being the loss of the roof of a football stadium. News from Swansea spoke of minor accidents in the town and the dismembering of trees and property in exposed areas. Four men who were rescued from a capsized vessel in the Swansea roads and afterwards the saved captain "shook hands warmly before parting" with the saviour French captain and "declared his intention of representing the Frenchman's conduct to the authorities as it deserved". One man arrived at the Sailors' Home in Swansea and retold his desperate struggle in a ship's punt and the

gallant work of a farmer who spotted him and the subsequent actions of the Port Eyrone lifeboat. A subscription was subsequently raised for him at the ship inn where he "was comfortably provided for and sent on to Swansea". An American liner was also greatly damaged by the storm off Milford and was now lying at anchor outside "Gresham Island". Considerable excitement prevailed in the town of Pembroke and two fishing trawlers rendered what assistance they could. A crew were rescued at Tenby by the lifeboat which was quickly launched near the pier-head. "Such was the force of the fall that the boat filled once, but quickly emptied herself and heaved splendidly". All were safely brought ashore with no injuries being sustained. A gallant rescue was also performed at Fishguard where the lifeboat was deployed in treacherous conditions and saved 6 sailors from a distressed sailors despite having sustained considerable damage to the lifeboat itself and having damaged the primary lifeboat in the launching process. The crew of a Norwegian barque wrecked off Fishguard were saved by rocket propelled apparatus used by the coastguard as it was found impossible to get another crew together. "Hundreds of people on the rocks were watching her, and almost afraid to look at her" and in the process of the drifting a little boy was washed overboard and drowned. At first the apparatus didn't work well with the first man over having a somewhat rough ride to shore but a different rope was then used and all crew were landed including the captain and the captain's daughter. "The people cheered again and again, and as each one was landed the people cheered.

1893	7 to 13	12	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	09/12/1893 - 16/12/1893	10	<p>Lodgings were soon found, and plenty of dry clothes were given to the poor survivors" numberng 113. Later reports published in the Bristol Mercury on the 22nd spoke of how all vessels that arrived in Port "bore testimony to the terrible fury of the gale". There wasalso repoort of a Dublin steamer with cattle which was thrown on it's beams end near Port Lynas with great damage being done to the vessel which thankfully stayed afloat although "many of the cattle were killed and maimed".</p> <p>A terrific gale once more prevailed through Great Britain and Ireland doing great damage throughout. At Holyhead the coastguards saw flares and distress signals but despite deployment of the life laving apparatus no traces of the vessel could be found. Liverpool was visited by a heavy rainstorm and thunder and lightning. In Connemara the storm caused great destruction and torre down railway bridges and uprooted treees whilst telegraph lines were much destroyed. The storm surge did great dmaage at Ayr and the Norwegian steamer went ashore and broke the "stout oak groins protecting the sea wall and the "after much difficulty the crew were rescued". Dublin was visited by "a veritable hurricane" and near Helensbrugh the storm surge washed over the railway at Cardross and interupted the train service. A steamer collided with the Gourock pier and she was forced to remain at port whilst several other steamers had to retreat back to Glasgow. In the Avon's mouth a barge ran over a local pilot boat during the evening and ebb tide leading to the pilot boat sinking at once. "The seven occupnts of the boat were thrown into the water and five managed to save</p>
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themselves, but the two others were drowned". One of them was married and left several children and this news of death "caused quite a sensation" in Pill as the deceased were much respected. Three vessels collided at Barry whilst in the docks although the damage done was trivial. A Russian crew who were shipwrecked on the 8th were taken to the Sailors' Home in Cardiff having been overwhelmed in the Atlantic and the vessel was completely lost. A vessel was wrecked on Grassholm Island with the loss of one life whilst the captain was left unconscious on the island. The 5 men who survived had all been badly bruised and left starving on the island with the captain saying nothing apart from craving for water. They were fortunately saved by the passing trawler Birda who hauled the men to shore via casting out a buoy and dragging the men to shore. The captain however, being helpless, had to be left on shore. The shipwrecked crew declared the crew of the Birda "treated them like gentlemen" and after hearing the captain was still on the island the Birda steamed straight for Milford. The trawler returned towing the Angle lifeboat but seas prevented all attempts to get ashore. The intention was to try again the previous day although it was "feared, if they can land, the captain will have succumbed to hunger and exposure". On the return the captain was found dead and he was subsequently brought ashore. A pontoon was adrift at Cardiff and a party of wreckmen had been employed in order to secure the structure and enact new permanent repairs to the moorings. The Cunard liner Aurania had encountered huge seas which "almost enveloped her, and

five seamen were knocked down and narrowly escaped being washed overboard" with one man sustaining abroken leg. A vessel was wrecked on the Ulverston Sands and twobodies had been washed ashore, however the captain and mate were still missing. A steamer was ashore in the entrance to the Cardiff channel whilst vessels sank at the Mumbles having drifted from their moorings and "grave fears" were entertained for a vessel in Swansea Bay. The violent gale from the south-west caused much mischief at Torquay causing a yacht to capsize with the loss of one life. Passengers of cross channel ferries had "a terrible experience". There were "scenes on the Manx coast" as a terrific storm raged at Ramsey which resulted in the foundering of 2 Norwegian brigs in Ramsey Bay. Fortunately the lifeboat crew and rocket brigade was deployed and each part saved the crews of the two vessels. Another vessel from Fleetwood was forced ashore although the crew got ashore at low tide. ANother vessel which ran shore at Cranstal was completely wrecked but the crew of 8 were saved by people on the beach. The lifeboat was driven ashore on Bride Beach and several of the crew sustained severe injuries. It was remarked that "so heavy was the sea it came over the Battery Pier at Douglas in green masses although the storm surge wasn't reported to have done much damage ashore. At Devonport a boat which was commuting towards a troopship capsized and four sailors and the man in charge of the vessel drowned. The gale did considerable damage over Plymouth doing considerable damage to shipping and property ashore. A train on the South-Western and

1893	23-24	12	Irish Sea	Liverpool Mercury, Western Mail and Bristol Mercury	26/12/1893 - 03/01/1894	<p>Somerset and Dorset railway was brought to a standstill by the gale. The postal telegraph authorities gave "notice ... of very considerable delay to Bristol and Exeter and all offices south and west of those points". A deep embankment between Flint and Bagult which protected the London to Holhead railway line was greatly damaged by the storm surge and the railway company had deployed large gangs of workers with the view to strengthening the structure. A heavy downfall of rain caused floods in the Rhondda valley and much damage had been done to gardens.</p> <p>Another great gale caused much distress around the coast of Britain but fortunately no loss of life was reported. One of her majesty's warships had to put back to Queenstown after experiencing a terrible gale in the Celtic Sea as the vessel was "In the gravest danger, being almost unmanageable, and at the mercy of the seas which broke over her". Hundreds of tons of water got in the 'tween decks and one of the boats was destroyed whilst a seaman was washed overboard and drowned. One other man was rescued by a heroic act. It was remarked "The Resolution is a first-class battleship, and this was her first voyage". She had rolled 40 degrees each way but was now safely moored at Queenstown. A boy who was the sole survivor of a vessel that foundered in the Atlantic and was rescued by the Cunard steamer Cephalonia was taken to the Sailors' Home in Liverpool. Many lives had been lost off Cape Cod as the vessel had run into a cyclone.</p> <p>A great fall of snow and strong winds were experienced throughout the kingdom. In South Wales "bitterly severe</p>
1894	3 to 4	1	British Isles	Western Mail	05/01/1894	

1893	12	Liverpool Mercury	12/01/1894	<p>weather was experienced" and a irece easterly gale blew over the region. The temperature was such there was skating on flooded land around Porthcawl and Newport. A report of another meeting of the RNLI during which medals and monetary awards were given out to those who had gallantly saved lives throughout the UK. One such instance included when the institution recognised the work of a Mr J M Cruickshank and "honorary and pecuniary rewards" were given to several others "for wading into the suf with a line and saving the crew of the brig Gmer, of Svelig, which stranded near the Point of Ayre, Isle of Man, in a whole gale from the SE and a very heavy sea on the 10th December". Overall £987 (£130,000) was granted to the crews of lifeboats throughout the UK for their services rendered over December. A further £1650 (£215,000) was awarded to the 303 lifeboat stations and the most generous donors were noted. The Criccieth lifeboat had just been returned to it's station after being fitted with improvements and reports were read from the district and deputy chief inspectors of lifeboats throughout the UK before the proceedings terminated.</p> <p>A report of a meeting of the Liverpool Shipwreck and Humane Society at the Underwriters' Committee Room. Several awards for "courage and humanity in saving human life" were awarded. Thanks were given to captains who's seamanship and gallantry saved lives in the Atantic and Irish Sea. £3 (£390) was voted to be given to a boat's crew who effected a dring rescue in the Irish sea whilst 30 shillings (£190) were taken to a man who jumped into the</p>
1893	12	Liverpool Mercury	26/01/1894	

1894	27 to 2	2	Western Britain	Liverpool Mercury, Western Mail and Bristol Mercury	29/01/1894 - 03/02/1894	4	<p>river near the Prince's Stage in order to rescue a man who had fallen overboard. Likewise awards were given for non-storm related incidences including rescue from fire. Overall 57 small awards totalling £10 16s (£1400) were paid out to those who had performed humane acts. Financial relief was also given to the 12 crew of the barque Monmouthshire who suffered greatly and were given £1 each (£130).</p> <p>The first page of the Liverpool Mercury read "There was a heavy gale off the port on Saturday, and the schooner Maria Lamb went on shore at Taylor's Bank, near Formy, and became a wreck". Fortunately the crew were rescued by the quick deployment of the Liverpool lifeboat which was at once launched as soon as the Formby and Crosby Lightships quickly relayed the news of distress. The New Brighton steam lifeboat was also launched later due to the fact they were not provided with "proper means - telegraphic or telephonic - of communication with other stations within reasonable and serviceable distances" as they had to rely on the information from the coastguard who was on "occasional watch" and missed the first signals of distress. Nevertheless the crew was mustered in 22 minutes and the boat underway facing heavy seas and a gale from the SW. Although "by this time the Liverpool boat had passed New Brighton, and when the steam lifeboat started was fully a mile and a half to two miles ahead". However as the former lifeboat was under tow it was obliged to steer a course about a mile longer so she could subsequently be dropped down on her whilst the "new Brighton boat steamed direct for her, right over</p>
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the bank in a heavy surf, and in a depth of from six to eight feet of water". As a consequence the steam lifeboat arrived there before and all 6 crew aboard the beached ship were rescued with much difficulty although the captain did sustain injury. The captain and crew of the wrecked vessel had "lost all their effects" and were well catered for at the Sailors' Home. Afterwards they spoke "In the highest terms of praise of the steam lifeboat's abilities, both as a seaboat, and her lifesaving qualities". Although the steam lifeboat the Duke of Northumberland, had been at New Brighton for several months it was the first occasion "in which her abilities were practically tested, and they have proved eminently satisfactory". A man was unfortunately drowned in the river as he was swept into the dock by the force of the wind and drowned. A man was seriously injured when a restraining rope snapped in a lock in the Manchester Ship canal and another ship sustained damage when she was driven into the Latchford Locks by the force of the wind. A flat was also sunk in the Mersey with the crew having a narrow escape thanks to a man throwing a lifeline from the shore. Accidents to shipping also occurred across the South of Wales as a steamer collided with a dock wall in Barry and sustained serious damage when a tug tow rope snapped. The dock and adjoining lighthouse also sustained moderate damage. A Cardiff steamer also sustained damage as it was driven by the wind onto a tug and when drove her across the lock and grounded but luckily only sustained moderate damage due to the intuition of the dockmaster. A Cardiff steamer also collided with a pier at Swansea and

began to sink before she was purposefully beached on the mud opposite Pockett's Wharf. She was subsequently patched up at low tide by the East Dock Engineering Company and successfully floated. There was also news of a wrecked schooner at Padstow with all 4 lives being lost despite the best attempts of the ship's dog to save the master. A brig was also lost off Boscastle with all 7 crew except the captain being drowned. It was noted the place she was wrecked, Crackenden Haven, was "almost an inaccessible spot on the North Cornish coast, and receives the full force of the Atlantic". It was said the crew had been exhausted by working the pumps for two days and the captain had attempted to beach her but been unable to avoid the rocks. At Ramsey on the Isle of Man, an Austrian barque was noted in great peril and was forced to cast out 3 anchors and cut her main mast to stop her drifting onto the Bahama Bank. The lifeboat was launched following the captain's request for assistance but thankfully the vessel held fast and all onboard were in good shape. A telegraph from Galway noted that a steamer from Glasgow had not arrived and it was feared she had gone down with all hands, 15 in number. This fear was supported by the fact a vessel had been noted drifting past the island of Arran bottom up and at "the extreme point of Galway Bay the sea is covered with floating timber". In Liverpool the fall brought a drenching downpour of rain followed by snow and sleet whilst "at the landing-stage the atmosphere was particularly bleak" although no serious accidents were recorded. A ship sunk near Thorn Island, Milford Haven although the crew of 33

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were thankfully saved by the lifeboat but the ship was left sinking and with her forecastle on fire. A vessel was also ashore off Barmouth and four lifeboats had been deployed although the vessel sustained little damage. A steamer grounded off Penarth although the latter was largely undamaged. Several vessels were missing or overdue and much anxiety was feared for their safety. Later discoveries of wreckage near the Scilly Isles all but confirmed the foundering of one Liverpool vessel however. The last effects of the gale on the 2nd included moderate damage done to a vessel entering Barry Dock and wreckage was widely washed up in Porthcawl and throughout the Welsh coast although it was hoped the steamer wrecked off Milford could be salvage should the wind not veer to the south-west in which case "the vessel is doomed". The captain had arranged for the salvage of the cargo at a rate of 1/3 rd of the value although the vessel value at £10,000 (£1,300,000) was insured in Glasgow as it was remarked "The Glasgow underwriters are the principal sufferers".

Great gales from the south and heavy rains hit the British Isles resulting in considerable destruction at sea and damage on land. In the Bristol Channel "a fearful hurricane has raged for many hours" and most marine traffic had been interfered with as a consequence. A large fleet of sailing ships were forced into the Barry and Penarth Roads but no serious casualties were reported whilst no vessels left or entered Cardiff. A tugboat was missing after a journey from Preston to Swansea but it was hoped she had gone into Cardiff. On the Manchester Ship canal two

1894	1	Bristol Mercury	10/02/1894	<p>barges were torn free of their moorings and blown onto a weir at an Old quay whilst a steamer grounded when attempting to enter Ayr Harbour. Minor damage to vessels was also noted on the River Mersey.</p> <p>A meeting of the RNLI was reported and the awards and donations given specific crew members and lifeboats were noted. Specifically the committee recognised the endeavours of the Angle lifeboat who risked their lives to save the 33 people on the vessel wrecked on Thorn Island off Milford Haven. It was said that the honoary secretary of the Angle lifeboat along with 2 crew memebers "landed, taking with them a rope, crawled along the edge of the cliff, the path at some parts being scarcely a foot wide and the night pitch dark, until they arrived over the spot where the ship-wrecked people were, then lowered the rope, and hauled them up one by one". After much ferrying of people all were taken to the lifeboat and saved. As a reward the silver medal of the institution was awarded to the lifeboat crew. The efforts of one man for 18 years of dedicated service were rewarded as well as the efforts of two men from the Portishead crew for their intrepid actions during 1893. For the month awards amounting to £1126 (£150,000) were granted and payments of £4020 (£525,000) were made to the institutions lifeboat establishments.</p>
1894	12	Liverpool Mercury	10/02/1894	<p>A report of the annual meeting of the Liverpool and New Brighton branch of the RNLI held at the Livepool town hall featured in the Liverpool Mercury. It was noted that "the position of the branch was substantially better financially than in previous years. The amount recivied in</p>

subscriptions in 1893 had gone up by £1 and 1s (£140) compared to 1892 whilst other receipts from 1893 included a donation of £264 17s (£34,500) from the Liverpool Cyclists' Club and £146 3 s (£19,100) from Everton Football Club following a charity exhibition match. Combined with a will gift of £250 and other contributions this left the incomings for 1893 at £598 (£78,300) as opposed to £149 13s (£19,400) in 1892 when no special charitable efforts had been made. The key intention of this influx in funding was to provide a steam lifeboat for the Mersey and ensure it was free of expense to the parent institution. However insufficient funds had been raised for this purpose so the committee recommended the funds be used for the maintenance of the vessel already at New Brighton. The committee also "regretted that the receipts from the church and chapel collections during 1893 had fallen very much below their expectations". The efforts of ladies' auxiliary committees were also noted as they had raised £20 6s (£2670). The amount remitted to the parent committee was £1000 (£131,000) which was to be subsequently sent. Over the year 1893 which was remarked to have been "an exceptionally fine year, the lifeboats of the institution had been called out 314 times, and had saved 427 lives". It was remarked "it was a matter of satisfaction" that the New Brighton steam lifeboat Duke of Northumberland had only been required once. This was said to bear "witness to the safety of the port and to the careful navigation of those frequenting it". It was remarked the steamboat had nevertheless proved herself to be an

efficient boat and it was remarked it would be "useful to have such a boat stationed permanently in the Mersey". It was hoped the necessary funds to provide this elite lifesaving vessel would be found. The resignations and appointments were announced and it was hoped that Bootle would also form a branch committee so that the four towns of the port might be properly represented. The Lord Mayor proposed the adoption of the report and balance sheet in order to highlight how the funding had influence the performance of the lifeboat crews. He also reinforced the value of the Duke of Northumberland and stated he had "No doubt that the characteristic generosity of Liverpool people would be given to that cause". An Admiral Gough also supported the steam lifeboat cause stating "the steam lifeboat could proceed to a rescue in a far shorter time than could a boat that had to wait until a tug got up steam to take her out". The proposition to raise funds for a new steam lifeboat was carried unaimously. The crew of the Duke of Northumberland were highly praised for their "gallant services during the rescue of the crew from the Maria Lamb wrecked on Formby beach. It was stated that more steam lifeboats around the coast should be ready for potential emergencies and that the RNLI and the Mersey Docks and Harbour Board should come to a "friendly arrangement .. with a view view to simplifying their life-saving arrangements". The qualities of a steam lifeboat and the need to have one in Liverpool was further supported and linked to the fund raising efforts. Those in the community who advocated the cause of the lifeboats were also praised and whilst the clergy

1894	11 to 13	2	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	12/02/1894 - 16/02/1894	<p>were somewhat criticised for their falling funding it was suggested a "Lifeboat Sunday" may be introduced to enhance support from congregations and this proposition was carried and the Lord Mayor subsequently terminated the proceedings.</p> <p>A great gale was severely felt throughout the country and it was remarked it was "one of the most severe known in Liverpool and neighbourhood for a long time". The wind shifted but generally blew from the west and "its violence naturally alarmed wayfarers, and not without cause". Slates and brickbats were blown about in all directions in different parts of the city and whilst no serious injuries were sustained damage to property was recorded as windows were blown out, chimneys fell and walls were blown down. Communication was also considerably hampered as telephone and telegraph wires were blown down. However the ferry traffic was not impeded owing to the direction of the gale. A waitress was also struck by falling glass but thankfully only received minor injuries. Several vessels had to seek shelter immediately after leaving the safety of the Mersey. Passengers by incoming boats "give accounts of the terrible weather experienced, particularly on the voyage from Ireland" whilst a smack drifted onto the Cheshire coast with its crew in an exhausted state. A schooner ashore off Seaforth created "exciting scenes" as she dragged anchors and went ashore being driven against the North Wall stern first. Although the schooner was in great peril and there was no one in the vicinity to help the crew fortunately were able to jump from the rigging onto the wall and make their way to the</p>
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North-wall lighthouse. All men were treated hospitalably by those at the lighthouse and dock gates. The crew later removed their belongings and the vessel was subsequently removed creating a spectacle watched by thousands and had sustained major but not crippling damage. A Liverpool barque ran aground being towed into Maryport. Having embarked a week previously with a cargo of steel rails for Peru she was driven back past Maryport where she rode at anchor until she began to drag and required assistance from a Maryport tug. Experienced sailors watching her enter the harbour in tow "were astounded to see that an attempt was to be made to tow her in" and she subsequently struck the bottom and the crew had to be taken to safety whilst it was believed the vessel would become a total wreck where she lay blocking the entrance to the port. The vessel was later further damaged when being brought into port on refloating but did make it into dock. There were scenes at Blackpool as the strong south-westerly winds brought "the sea in mountainous waves on to the Promenade and the storm surge washed away hundreds of tons of shingle from the north shore and a large piece of wreckage was discerned from the Promenade". Several people were injured in violent falls. At Southport a wall at a gasworks was blown down and two men were taken to the infirmary in rather serious conditions. Sand drifts onto the Southport railway line also delayed traffic. A steamer was also ashore at St. Annes although it was remarked it was "miraculous" the captain had steered his vessel into a place of relatively safety although her position high above

the high water mark was said to have raised doubts about her refloating. Traffic was also disrupted on the Manchester ship canal and the lightship was driven ashore off Morecambe. Although the position of the men aboard was "most perilous, heavy waves washing completely over the vessel, which was entirely at the mercy of the wind and sea". Fortunately the crew reached the shore having narrowly avoided the rocks of Heysham Point where had she struck "not a soul could have been saved". The crew later reached the sandy shore of Morecambe with the crew "extremely thankful for their providential escape" but the vessel was severely damaged. At Boscastle a young fellow was killed when a tree fell on him whilst out walking with friends. At Dumbarton several chimneys fell through the roofs of houses and in three cases children and an invalid were trapped. A Norwegian barque was driven ashore at Helensburgh and several "small coasting craft wet ashore between Gourock and Largs". In North Wales it was remarked "the storm has been unequalled in duration and force for over 40 years, and even exceeded that when the Royal Charter was lost off Moelfre". A terrible accident occurred when the roof of stable collapsed killing two cattle and maiming two others. In the Vale of Clywd many houses were unroofed and an enormous number of trees were blown down to render any passage impassable in certain districts. In Rhyl pedestrians were "blown clean off their feet" and chimney pots and slates fell in all directions. At Swansea and around the Cornish coast the remains of a lifeboat were picked up which was thought to have been a

1894 15-16

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Liverpool
Mercury

16/02/1894

Liverpool lifeboat which had recently began a journey from Liverpool for San Francisco. Off Barry roads the crew of one vessel were rescued by another vessel in the vicinity and the crew of a vessel wrecked in Penarth Roads and although the crew escaped they suffered all night on a beach in very cold weather but they were aided by men working at a local lime kiln. A vessel sunk off Milford but all were saved and a ketch went ashore near Porthkerry. At Newport a steamship broke adrift and was seriously damaged in the Alexandria dock whilst another small steamer collided with the jetty entrance and did considerable damage to itself and the structure. The storm disrupted travel in the Irish Sea and consequently the inhabitants of Inistrahull Island were said to have been in dire need of food and the Lighthouse was signalling for assistance. A lifeboat was to be sent to their assistance. By the 13th liners were reported to have returned to Liverpool and the sea remained rough outside the bar to the extent that a vessel was seen signalling for help off Formby. In response the Liverpool lifeboat and the New Brighton Steam Lifeboat were despatched but the crew of the ship were previously saved by a dredger before a lifeboat could reach it but it was thought the ship was doomed to be wrecked. At Chester only minor damage was sustained by property and debris was found in some streets.

A meeting of the Liverpool Shipwreck and Humane Society was documented including the provision of awards for saving life by members of the community in the region. A silver medal was given to a captain of a steamer to a

1894	23	2	North-west Britain	Liverpool Mercury	24/02/1894	<p>captain of a steamer William S. Seacombe having travelled to the west of Ireland to save the crew of a vessel who suffered "great privation they had almost abandoned hope" until the steamer came into site and rescued them. A silver medal was also given to the mate of the vessel who undertook "work of great danger" when hauling the men aboard. Other awards were given for the valiance of the captain and chief officer of a steamship which saved the lives of the crew of a distress vessel in the Atlantic. Several other silver medals and awards ranging between £2 and £1 were given out to various other crews who enacted rescues at sea. The heroics of a porter who jumped into the Huskisson Branch Dock to rescue his father were also rewarded along with those who assisted although the man unfortunately drowned. However 3 men who enacted two other similar acts were also rewarded. Relief was also granted to the several sufferers from shipwreck which included £1 to three seamen from the Maria Lamb and £1 for the 13 of a steamship which foundering in the Mersey. An appeal was launched "In consequence of increasing demands on the funds of the society, and the loss of members". The treasurer felt it was his duty to appeal to "shipowners, merchants, and other friends who have not yet joined the society" and welcomed any new subscriptions.</p> <p>A gale of great force arose in Liverpool Bay and the violence of the gusts was such they caused the coastguard to keep "special watch". A vessel was caught in said gale and forced ashore on Taylor's Bank, Corsby and as a consequence both the New Brighton steam lifeboat and</p>
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1894

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Liverpool
Mercury

02/03/1894

the Liverpool rowed lifeboat with tug were deployed. The Liverpool Dock Manned lifeboat encountered numerous issues findings an available tug and even when the tug arrived "a full crew, however, had not assembled, but eventually the lifeboat was fully manned by taking in a stage hand, who agreed to assist". However by the time it was got out it was found the crew of the vessel had already taken to their boat and had met the New Brighton steamlifeboat which had taken them to the safety of the shore. The New Brighton lifeboat had been deployed as rapidly and a large crowd was much relieved to see it land with the 5 seamen in an exhausted condition. Various observers noted the inefficiency of the Liverpool lifeboat and it was "generally conceded that some change is needed so far as the style of lifeboat at the Landing-stage and its manning are concerned". Alternatively the New Brighton lifeboat had once again proved it's value and one observer went as far to say "Of what use is the Liverpool lifeboat?" It was noted if the crew of the wrecked vessel had solely depended on the Liverpool lifeboat "their position might have been very hazardous". Another report from the Liverpool Shipwreck and Humane Society detailed that a gold medal and vote of thanks had been awarded to the Captain of a steamship who was a lieutenant in the Royal Navy Reserves for his efforts in resucing a the crew of a barque in distress in the Atlantic Ocean. This was one of many rescues the Captain had conducted over the past 14 years saving 56 lives and having twice jumped overboard himself. A silver medal and a binocular telescope was given to the second officer

1894

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Bristol
Mercury

23/04/1894

whls the five seaman who affected the rescue with the officer were granted £1 (£130) each. £1 was also given to a seaman who jumped into the Victoria Dock to save the life of a man and 10s (£65) was given to another man who jumped into the Prince's Dock with the view fo savign life. 36 small awards amounting to £3 7shillings (£440) were also given out. Relief in the form of £1 wort of clothing and supplies was given to the two crew of a wrecked schooner who lost everythign during their wrecking on the 15th. Whilst the 5 men who "barely escaped with their lives" having been wrecked on Taylor's bank on the 23rd were also awarded £1.

The annual meeting of the RNLI was documented which was held in London with the Duke of Westminster presiding. It was stated the work of the institution had been "actively and earnestly carried on during the past year, and every effort had been made by the committee - in the face of very adverse circumstances brought about by the general badness of the time, agricultural distress and trade disputes - to maintain and even increase the efficiency of the service". The construction of the 2nd steam lifeboat was announced and although funded entirely by proceeds from the City of Glasgow during "lifeboat Sunday" it was to be sent to Harwich. It was said she would "possess many material improvements on the old boat, suggested by experience". The results of a series of trials of variouspulling lifeboats were documents and thecommittee was satisfied the trials "Not only tended to increase the confidence of the lifeboat crews in their boats, but had been productive of much valuable

information which could not have been obtained in any other way" and therefore the costs were justified. One new station was founded at Formby and 17 others were supplied with new boats with the precise classes being determined by the individual coxswains creating "a species of local option much appreciated by the men". Several other improvements had been made to other boats and the institution possessed 303 lifeboats at the end of the year. It was said the RNLI were prepared to man a lifeboat anywhere on the coast however it was "Imperative, however, that there should be a sufficient number of men, fisherman or others, accustomed to the management of boats at sea, to man the lifeboat". The weather record for 1893 was stated as "remarkably fine, mild, and quiet during the greater part of the year, only broken by occasional bad weather to remind the lifeboat men that they must be ever on alert". The most memorable gale of the year was stated to be the insistent gale of mid November. It was exclaimed "its ravages were not confined to any particular part of the coast, but devastated generally north, south, east and west". During the storm the "lifeboats were launched no less than 82 times, and saved 208 lives and seven vessels. Considering the perils and risks incurred by the lifeboat men it is remarkable that only three lost their lives throughout the year out of the many thousands who manned the lifeboats in that period". Throughout the year the boats had been launched 314 times on service and 1053 times for drill. The coxswains and crew had "generally conducted themselves in an exemplary and

satisfactory manner, and recieved every encouragement from the committee to be prompt and efficient in discharging their important duties". Overall 427 lives had been saved by lifeboats and 27 vessels saved from destruction by lifeboats. Rewards had also been granted to shoreboats who saved 170 lives taking the lifesaving total for the year to 597. Overall £9408 (£1,230,000) had been given out to the men in reward which included "grants to the relatives of men lost on duty and compensation for injuries recived in the service had been approved along with 25 silver medals and several other silver nautical devices as well as certificates. This meant since it's founding the RNLI had given out 98 gold medals, 1120 silver medals, 231 binoculars, 15 telescopes, 6 aneroid barometers and 1447 votes of thanks inscribed on vellum and framed. £139,632 (£18285372) had been given out in grants and 37,854 lives saved from shipwreck. The total expenditure for the past year had been £83,035 (£10,800,000). It was also noted that "under the provisions of the Removal of Wrecks Act 1877 Ammendment Act, 1889" which had been promoted and secured by the RNLI "a considerable number of wrecks, dangerous to the lieboat crews in the discharge of their life saving work, were removed by the Trinity House and other authorities during the year". The importance of the "system of electrical communicaion on the coats for life-saving purposes" hich had been commenced by the government in 1892 was noted and thanks was given to the press of the country for supporting the continued imporvement of communication to the most dangerous

parts of the coast. Plans to connect lighthouse and lifeboats to telephone and telegraphic networks were also noted and it was also stated that a Royal Commission was investigating potential improvements. The death of a RN captain who had been the Chief Inspector of Lifeboats was noted considering his dedication to the cause and the importance of "Lifeboat Saturday" and the support of the Prince of Wales who supported the beginning of the movement in Manchester and Salford in 1891 despite the general depression was also highlighted. Its progression in spite of the depression was said to be remarkable and it was exclaimed "No better scheme could possibly have been devised for nationalising the lifeboat service than this, and the committee gratefully tender their thanks to those earnest workers in every class of society who have endeavoured with great success to advance this movement". Current and future developments for lifeboat Saturday were noted. A plea to the nation for their "earnest support" was also made as the committee said they felt it "would be a discredit to this the greatest maritime country in the world were the Lifeboat Service to lack efficiency for want of funds, and they therefore, confidentially call on every class of the community, all being equally dependent on our sea-going population to rally round the institution". The Duke of Westminster moved that the report of the year be moved and circulated and he said he "was sorry" that the institution had had to dip into their capital to the extent of £26,000 this year. An Earl associated with the Navy said they took "the deepest interest in the Lifeboat Institution, and he believed the

1894

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Liverpool
Mercury

12/05/1894

coastgaurds gave great assistance to its work by giving notice of ships in distress, by helping to man the boats and in other ways". The Lord Chancellor (Lord Herschell) proclaimed that all at the meeting fully appreciated the importance of the great work of the RNLI and had "every confidence in its management, desires to express its admiration of the gallantry of the lifeboat coxswains and crws and of the important help given to the cause by the local hon. secretaries, treasurers committees, and the press". The ned to urge to public to give generously through the Lifeboat Saturday movement was also noted. The Earl of Morley seconded this motion before proceedings terminated with the Lord Mayor offering use of the city facilities for further use by the RNLI and a vote of thanks for the Duke of Westiminster for presiding. A report from the Liverpool Shipwreck and Humane Society detailing the gallanatry of seafearers and coastal residents for their vital roles in saving lives. A silver medal was awarded for the heroics of a captain who saved the lives of the crew of a distressed vessel in a storm in the mid Atlantic. His second officer also recieved a silver medal and a binocular telescope for saving the lives of the 28 men. £24 (£3150) was given to the crew of 24 for their services. A vote of thanks was given to another captain who rescued the crew of a vessel carrying dynamite which had susbequently blown up after ctahing fire. £2 (£260) was given to a coalman who had jumped into the Mersey to save the life of a woman who had tried to commit suicide by jumping off a Mersey ferry whilst 30s (£195) were given to a William Gregson who jumped from the

1894	17	9	Bristol Mercury	17/09/1894	<p>Prince's Landing stage to save the life of another man attempting to drown himself.</p> <p>An extract detailing how all sermons at local parishes throughout the Southwest expressed the importance of the lifeboat ahead of "Lifeboat Saturday" making reference to the lifeboat work and "describing it as a splendid specimen of the herosim of which the nation was justy proud". At the city church Psalm Ovil 23, 21 was chosen due to the reference of "God's goodness as manifested in man's innocence and mercy under the burden of guilt, the preacher contrasted navigation as it ws in the the Pasmist's time with that of the present day. At that time very few were dound to face the perils of the deep - the very expression of 'going down' as to descent to some abyas being remarkable". The fact that sea trade and faring was done as a matter of nessecity due to its perils mae "nations like the Phoeniciaus, Tyre and Sidons" depdentt on other nations. However it was remarked now all has changed with "the most inland village of our land" depending on the foregin supplies. It was said this dependency was what made us all so reliant and indebted to the sailors of the world and it was remarked "no one will do his duty as a citizen who habitually forgets the necessities and the dangers of those who go down to the sea in ships". Likewise at St. Stephens church the "growth of the lifeboat system during the last hundred years" and made specific reference to the fact it had saved over 40,00 lives throughout the kingdom. The dependence on generosity for this "noble work" was stressed and the rector "deplored that in these days the British public</p>
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1894	24 - 26	10	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	25/10/1894 - 27/10/1894	8	<p>seemed to have lost the idea of giving on principle" hence why Lifeboat Saturday had come to fruition and events were needed to entice donation. The dauntless nature of the lifeboat crews was referred to and their motto "DO and dare" referenced. Another reverend alluded to the fact "ships are often wrecked on our cruel coast, and imperilled sailors thank God if they are near a lifeboat station, for they know that at the peril of their lives strong men with brave hearts are struggling long and sturdily to bring the lifeboat to their rescue". The gallantry of the crews in their efforts saving both British and foreign lives was mentioned and their achievements stated. The perilous reference to "go down to the sea in ships" was made along with a reiteration of the personal connections many shared with those at sea who society was ultimately dependent on. In other sermons it was noted that such generosity was an example of the "beautiful idea of the work of the Church of Christ". The plea for donations was reissued far and wide with a moral Christian message relating the work of the lifeboatmen to the charitable and humane actions of God and Jesus Christ running throughout.</p> <p>The Liverpool Mercury article of the 25th commenced "Yesterday the weather in the Liverpool was somewhat boisterous, and rain fell heavily during the morning". Near hurricane conditions were noted off the Southport and Formby coasts although as of the 25th no signals of distress were witnessed. In the Merseyside district there was damage to property including fallen chimneys, flying slates and blown in windows although nothing major. On</p>
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the North Wales coast a violent SE gale caused many vessels to head for Holyhead and the Irish Mails were much delayed. In Carnaronshire a gale from the NW raged along the coasts and it was difficult to pedestrian to make headway in Llandudno. A vessel was thought to have been wrecked on the Gower coast with the loss of all 7 hands. An inquiry into the exact fate of the vessel was being conducted by the coastguard authorities before official confirmation was given. The lifeboats stood at the ready for employment but were not summoned. At Barry a vessel collided with the pier and several other vessels entered the roads in a damaged state. At St. Anne's a number of vessels were driven from their moorings whilst unmanned and significant damage was done to the structure and the vessels. The Fleetwood lifeboat went out to assistance and retrieved a man overboard from the water but he was dead by the time they reached him. Great damage to chimney stacks was noted in Preston and many had lucky escapes from death. The A large four masted vessel was said to have capsized on two from Bristol in the Severn. A vessel also ran ashore off Provoze Head, Cornwall and went to pieces the following day with all crew safe. Another vessel was driven ashore in Rhossilly Bay as her tug aid disappeared to Llanelly and did not return. She was left "lying on the rocks, badly holed foremost and bowsprit gone, and is a total wreck" although the captain, wife, child and 17 men were all saved in their own boat and safely lodged in the coastguard's house. However "the men's effects and part of the gear have been saved". The "Ramsay Bay Regatta

1894	12 to 15	11	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	14/11/1894 - 16/11/1894	<p>Committee ... resolved to open a public subscription list to cover the loss sustained by the owners and crews fo three vessels lost in the storm". A death by drowning was recorded on the Dee near Connah's Quay when a fisherman fell in the river and was overwhelmed by the storm surge coming up the Dee and was overwhelmed despite being an experienced fisherman and strong swimmer. At Rhyl "the gale continued to blow with unabated vigor" and the "moutain torrents are swollen into floods" with rivers overflowing their banks and several deaths from exposure were reported. Off the Mersey a heavy sea was experienced and many coasting vessels were delayed reaching Liverpool and whilst two moderate casualties were reported to ships no serious casualties were reported. In the Bristol cchannel two fishing smacks sunk but were not manned and "owing to sudden and terrific squalls, the movement of tonnage at Cardiff, Penarth, and Barry Docks was seriously impeded". A Brazilian boat was forced into Swansea in a damaged state and a headless man washed ashore on the Gower. Due to the shifting of cargo during a voyage a doctor ws required onboard a steamship anchored in the Sully Sounds as 3 men were injured whilst one man fell overboard.</p> <p>"Serious floods occurred yesterday throuhgout the West of England" the opening line of the Bristol Mercury of the 13th Nov read. Rivers on the Cornish peninsula were said to havd reached "the highest level known for many years". As a result "considerable inconvenience" was caused in the lower parts of Bristol with many house</p>
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flooded to a dept of several feet. Two young men in a cart got out of their depth when trying to ford a brook and both were thought to have been drowned but they were later reported to have been hospitably recieved at a local farmouse. Railway traffic had been considerably interrupted throughout the Southwest due to the inundated with the River Avon flooding to the extent it "returned to its natural course" and flooded the Great Western Railway having overwhelmed and overflowed the engineering in the channel. In St. Ives all schools were closed and business wsa brought to a standstill. At first the water in the streets was thought to be just heavy rain how soon roads "became a river of water, and such was the rush that large boulders and other debris" were brought down the street and houses flooded to such an extent that people were evacuated by boat. In the surrounding district fears were entertained for the immense loss of property and infrastructure. This was the same in the streets surrounding the high land near Plymouth where the Sewers were overwhelmed and bridges near Newlyn were carried away by the raging torrents. As the rain fell the "wind increased in violence and was bitterly cold" creating much hardhsip among those who had to evacuate their premises. At Bath the flooding was worse than anticipated and the flood was such that "the water was only fourteen inches below that of the flood of 1882, the highest on record". The mainstreets were completely inundated and businesses and residential property gutted. The whole of valley was flooded to the extent boats were required for transport.

"The meadow and garden ground on the eastern side of the city was a lake, and Grosvenor Suspension bridge was nearly out of sight". The Mayor subsequently "authorised the administration of temporary relief, pending the raising of a relief fund, and some of the flooded-out residents of the Dolemeads were provided with immediate relief." A terrible storm from WNW blew off the port of Holyhead and all arriving from Ireland described the channel crossing as awful and a lifeboat and a tug was out assisting a barque in distress. On the 15th the Bristol Mercury began with the line "Water, water, everywhere" and it was stated "Day after day, the floods have descended, until a huge part of the West of England at least, is under water". The flooding in Bristol was not said to be a result of the flooding of the "well behaved" From as water had been carried away by relief culverts. It was said the authorities had a responsibility to ensure that defects were "to be made good, and blunders to be rectified". It was said "hardly within living memory have there been floods like these ... there are stories of lost lives, as well as stories of lost homesteads. We doubt whether a storm like that which we are deploring has been equalled within the memory of the present generation". Much pity was felt for the poor citizens of Bath who's town had been completely inundated. A man most unfortunately lost his life when servicing a buoy off Portmadoc in a punt and was overwhelmed as the wind picked up and he was found drowned washed ashore at Borth Farm. A steamer bound from Calcutta to London put into Falmouth having sustained serious damage whilst

one of the crew was washed aboard and another seriously injured. A steamer also drifted into the port on her beams ends also have lost a man overboard. Lytham and Blackpool also "received the full force of the gale" and the storm surge at Fairhaven breached coastal defences. The coast was "strewn with new timber, and fears are expressed that some vessel has gone down in the estuary, which abounds with treacherous sandbanks". The storm surge and high tides also "wrought havoc on the Marine Parade in the course of construction across the Southport Sands". Impact injuries were seen for nearly a quarter of a mile down the parade. It was noted that the damage was largely sustained to the asphalt path as opposed to the reinforced concrete defence which faced the sea. Therefore it was stated "the actual injury has occurred through the sea water forcing its way to find an escape". The gentlemen of influence and hundreds of residents visited the ensuing scene and inspected the damages in order to confirm what repairs needed to be inacted. The borough surveyor estimated that all good be repaired within 10 days providing the weather permitted. An improvement committee was also to preside over whether "a sufficient depth of concrete has been allowed for" given the strain which caused the collapse and damage in order to assess any long term construction changes. Various estimates placed the damage at between £400-£1000 (£52000 - £130000). In Cardiff on the 14th strong southwesterly winds were experienced and rain fell in torrents causing the River Taff to rise in height which was further augmented by the incoming tide although the low-

lying ground was not flooded. Traffic on the Taff Vale Railway was stopped by the floods with much disruption being experienced by merchants, whilst the GWR also experienced such delays. The Manchester - Milford line was also deluged and the railway traffic was much delayed. The Towy "overflowed its bank, giving the valley in the neighbourhood of Carmarthen the appearance of a vast lake". Tin plate work had to be stopped as they were inundated by the rain whilst the River Tawe overflowed flooding the marshland of the Swansea Valley. Several farmhouses were filled with water and their occupants were obliged to seek refuge elsewhere. The floods were particularly bad in Carmarthenshire as the "mountain torrents are carrying all before them" and many were forced to evacuate. Carmarthen key was inundated and many farmers attending the Carmarthen fair had to walk long distances to take trains home owing to the state of the roads. It was remarked "the whole country from Pontardulais to Gowerton and Llanelly is under water" as houses were flooded to 2 feet depths. Collieries were stopped near Aberdare as the mountain railway was undermined and swept away by the floods by the Lletty Skenkin Colliery. The floods in the Forest of Deean were highly destructive as streets were inundated and houses flooded, there was a serious landslide on the Great Western Railway. A vessel was also wrecked in Swansea Bay although the crew escaped in their boat and it was thought the cargo would be saved. In the Penarth Roads a collision was reported with one vessel sustaining major damage, one vessel arrived in port having sustained

serious damage to her rigging having nearly capsized in a sudden squall. Much anxiety was felt at Newport for a vessel which was several days overdue. The flooding was a subject which received "considerable attention at the meeting of the Bristol Sanitary Authority" meeting. The flooding of the Boiling Wells stream was reviewed and it was noted that a culvert had been flooded to a depth of 5ft. Water "15 inches deep, with a velocity of eight miles an hour" had also flooded down a main road into the From and Botany Bay whilst other water was diverted into the main sewer which, being already overwhelmed began to discharge into the streets and flooded several basements. The lag time between the From flood and the overland was described and it was said had it not been "for the stone stile at Botany Bay the whole of that neighbourhood would have been submerged". On the 13th the floods subsided 5 ft and a large body of workmen rendered "what help was possible to the inhabitants of the flooded dwellings in the way of cleaning up the mud and debris for sanitary reasons". Subsequent heavy rain on the 14th caused the Boiling Wells to overflow once more although most of this overland flow was absorbed by the run off gullies. The reduced lag time was again noted as "the land was so saturated that a heavy shower made itself felt in a very short time". Overall 71 houses had been flooded by the Boiling Wells stream but a further 65 had suffered from the "same stream overcharging the main sewer" and four more were flooded by the overflowing of the Hook's Mills stream. Several other streams had flooded the surrounding neighbourhood and

flooded the basements of properties to a depth of 8-10ft and considerable damage was done to property after the culvert collapsed. It was noted "Nothing can be done to prevent a recurrence of these casualties until the reconstruction of this culvert is undertaken by a public body armed with powers to deal with the matter in a comprehensive manner". Much debris was brought into the 78 properties along with with flood water. Subsequent to this it was said that a surveyor would determine the exact relation of the basement with the sewer in order to determine the risk of future flooding. A building already in poor conditon was reported to have collapsed doing damage to the road and surrounding property and a gang of workmen were swiftly sent to reassure the property and divert he overflow channel. The town clerk stated "immediate steps should be taken to prevent any recurrence of this calamity" as the houses affected were all recently built and thus this had not been experienced before. This created the issue of diverting the flow from the two main brooks as it was stated "unless they could devise some scheme of moving the flood water from them, it would be impossible to prevent the catastrophe occurring again". AN engineer present stated that a diversionary culvert should be made "taping these streams before they got into the city, and taking the water by a more direct way into the Froom, and securing a better fall than at present". In order to do this it was said an act of parliament or provisional order would be required although it was stated "under the circumstances

1894	21 to 23	12	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	24/12/1894 - 28/12/1894	24	<p>the owners would not stand in the way of such a great improvement".</p> <p>A terrific storm hit the west coast causing "incalculable" damage a resulting in the loss of many lives on sea and on land. The gale in Liverpool was "almost hurricane strength, so that in many places the presence of people out of doors was attended with the utmost danger". Telegraphic information told of disasters throughout all of the Kingdom although there was much interuption to communication due to the mass felling of telegraphic wires. In Liverpool the gale was "seriously felt" with "many unfortunate craft being lostor dismasted after vainly but bravely fighting the fury of the elements". The south-westrly hurricane and heavy squall of rain hurled debris which littered every route and hospitals were nearly overwhelmed without the number of casualties. A man was killed when he was thrown off a tramcar and under a lorry by the wind whilst several more were blown off the Docks and sustained. The tide was augement by the wind creating a storm surge and comaaprison to the Gale of October 1890 were made. Ferries were delayed across the Mersey but some continued "much to the advantage of business men going to the city" who would have otherwise had to board a train through the Mersey tunnel which many did. Even thealrgest liners struggled againsteh gale and had to either take shelter on the Wirral side or be restrained by tugs. A schooner went ashore off Crosby but was got off again and disaster ocurred off Hoylake and the New Brighton steam lifeboat rescued the crew fo schooner off Waterloo. It was remarked "never</p>
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have the calls upon our Mersey lifeboat been so heavy" as the service and in the face of the gale the "resources of the lifeboat were manifestly inadequate" although the recent disabling of the Hoyle lifeboat no doubt added to this stress of the situation. They were summoned on 3 consecutive occasions whilst the rowed Dock Board lifeboat was only deployed once only to find the crew of a vessel wrecked off Formby were already ashore. This was seen as only further augmenting the cause for two steam lifeboats in the Mersey. This added to the plethora of vessels sunk in the Mersey which included the witnessing of "a shocking scene". Three men and a boy were trying to signal for assistance to those at the quay but before any assistance could be rendered the vessel was struck by "an exceptionally high wave" and capsized before "members of the crew were seen to struggle in the troubled waters for a short time, but it was quickly seen that they were unable to battle with the waves". They were then dashed into the dock wall with terrible force before they drowned to the horror of onlookers. Another man fell from a flat but was rescued and taken to hospital in a critical state. The crew of another capsized schooner had not been heard of. A man who fell from a rigging had to be lifted into a lifeboat in a fragile state and the unfortunate men "had a most deplorable story to tell the large number of people who visited the barque" following a disastrous trip from Preston. At the hospitals "the surgeons ... were busily engaged throughout the day". Southport also experienced "One of the sharpest cyclones locally known in recent years and the fact the full force of the gale struck

during an ebb tide was noted as being key to the reduced damage on the new promenade and pier. It was almost needless to say "every street in Southport and Birkdale presents some evidence of the tearing action of the wind" although injuries were limited to people falling down in the streets. A barque foundered off the Southport coasts as efforts to deploy the sailing lifeboat its rig snapped almost immediately as soon as canvas was set although fortunately the boat was washed safely high and dry. After another boat in distress was identified and much delay the launching of a second lifeboat was enacted and eventually several stricken sailors were brought ashore after 16 hours starving and battling the storm. It was feared a barque had sunk in the mouth of the Ribble with the loss of all hands with a pilot unable to render assistance. Two girls were admitted with their skulls fractured whilst a man was also admitted with a severe head wound to the extent that "the brain laid bare" and he unfortunately later died and the greatest sympathy was felt for his family. There were notable other moderate to minor accidents which filled hospital beds throughout the storm. An immense amount of damage was done to property in and around the vicinity of Birkenhead with traffic being severely retarded and many pedestrians blown down. The promenade at Edremont was at times completely submerged such was the height of the storm surge as waves dashed up against properties on the sea front doing damage although the majority of the damage was occasioned by the gale itself. At Hoyle there was minor damage on land and a fleet of small boats

was destroyed in the Hoyle Lake. The lifeboat was launched with difficulty in an attempt to aid a vessel in distress in the Formby channel however the force of the storm was so great it was found it was impossible to make headway and the lifeboat was beached by the Leasowe Lighthouse with much damage being done to the vessel. Information from the Dock Board stated that the Observatory at Bidston had recorded a pressure of 69 pressure on the square foot and a maximum velocity of 87 mph. A Postoffice official also relayed the information stating that "a scheme is about to be submitted to the Treasury for providing inter-communication in the neighbourhood of Liverpool, under which messages may be sent to and from Formby lifeboat house and between Hoylake and New Brighton". There was to be a day and night telegraphic service so any evidence of distress could be communicated to and between lifeboat stations. At Lytham and St. Annes there was a sudden and rapid fall of the barometer on the 21st which gave short warning of the storm. Much damage was done to sea front hotel by the storm surge and gale and several small craft were blown down the estuary and damaged. The storm surge defence hking was in many places penetrated and telegraph and telephone wires were destroyed in many places whilst large accumulations of wind blown sand stopped all railway travel. The Lytham lifeboats were also deployed to aid struggling vessels at the mouth of the estuary. The situation was much the same in Fleetwood as the gale was branded "the most severe that has occurred for over 40 years" and one house was completely

destroyed but fortunately the inhabitants escaped without injury. The wives of the fisherman who were all out at sea in small craft at the time were in the greatest distress whilst great anxiety was also felt for a steamer until it later arrived in the harbour. It was remarked it was the "record rough voyage since the cross-channel service between Fleetwood and Belfast commence 50 years previously. It was remarked had "it not been for the grand discipline displayed there would have been a great panic onboard and a seaman also broke his leg and several other sailors were injured. It was noted as soon as the storm's onset was noted great preparations were taken to ensure no damage occurred in the Manchester Ship Canal. The Blackpool lifeboat also rendered a valiant rescue service when two vessels were wrecked a short distance away from the town and 22 lives were valiantly saved. 5 had been saved from one vessel by the lifeboatmen going out on horseback and two had been drowned. The other rescue involved the boat being pulled down miles of country lanes before the "vigorous men pulled out to the barque, over which every wave was washing, and whose position was most perilous" and fortunately saved all 17 aboard. The gale blew in windows on the seafront and some houses had been wholly unroofed. One new house was completely razed to the ground with a loss of at least £500 (£650,000). At Preston a mill was partially destroyed and as "the operatives were at work, the consternation was general, and the weavers ran from the looms shrieking in wild confusion" and unfortunately a man who lived with his blind father was crushed to death by a

falling beam and four others injured. Another both was killed when an iron gate fell upon him and a girl had her leg broken. At Sandhills three tramcars were blown over a man killed whilst a wife of a well-known gentleman was buried in debris as her roof and house collapsed. Eight seamen were also drowned at Holyhead although the lifeboat were successful in rescuing the crew of another stricken vessel. A vessel was damaged during a collision in the Bristol channel and the Porthcawl lifeboat was deployed on practice and a man sustained severe injuries. There were many windbound vessels in the Barry Roads. Off the Isle of Lewis the fishing fleet had been decimated with the loss of 20 sailors with many being related to each other "nine were married, and leave widows and about 30 children, while the unmarried men leave many relatives dependent upon them". A Norwegian brig also went ashore near Norse Island and five of the crew were drowned. A vessel was wrecked at the mouth of the Chester Dee and it was thought it was certain that all 18 perished and any efforts to launch the nearby Rhyl and Point of Ayr lifeboats were unable to launch owing to the strength of the gale. It was also near certain the crew of another boat which had foundered near Prestatyn almost certainly perished. A body of 3 men was retrieved near Southport and it was thought they were members of the crew of a fishing smack which foundered in the bay. News from Port Logan in Wigtownshire revealed that a large steamship had been wrecked in the area upon a highly inaccessible rocky coast. Due to this there were no witnesses although it

1894	28-29	12	British Isles	Liverpool Mercury & Western Mail	29/12/1894 - 02/01/1895	32	<p>hypothesised that an explosion had occurred onboard as "it is difficult to believe that any other force could have chopped up the people on board into such small pieces". However it was said even if it had been observed "absolutely nothing could have been done to save life" as the lifeboat "could not have lived near the wreck, while the rocket apparatus could not have been conveyed to that point of the coast in time to be of service". Wreckage and human remains strewn the coast and little had been done to remove wreckage and many bodies were missing or in pieces with human remains being found high above the shoreline. Further investigations undertaken by the coastguard and Cardiff authorities revealed the identity of one affluent gentleman and the Cardiff crew and captain, none of whom survived the incident.</p> <p>A strong south-easterly gale of great fury blew in the Irish Sea and Western Britain causing much distress to shipping. A vessel was noted off Holyhead flying distress signals although she was rendered assistance by two Holyhead lifeboats who safely brought her ashore. However in launching a lifeboat man was run over and was now in a critical condition. Great anxiety was felt for shipping on the Welsh coast and it was "feared that unless the wind abates many of the vessels will drag their anchors and go ashore". It was also feared a barque already ashore would go to pieces if the winds remained at their current strength. At Rhyl the rapid fall of the barometer was noted and "a terrible hurricane was blowing. Rain poured in torrents". A shift in the wind direction to NNW was noted in Liverpool and although the</p>
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New Brighton lifeboat men were in readiness they were not required and damage ashore was minor in nature. There were reports of loss of life on the Welsh coast when a vessel, as predicted, was wrecked at Holyhead and 26 drowned as the ship was obliterated and "heartrending scenes" were described. Despite the very best efforts of the coastguards who succeeded in fixing a lifeline they were forced to watch as men were drowned and overwhelmed by waves of tremendous force and the desperate "men's cries were drowned by the crash of falling spars, which killed many of them". The lifeboat's efforts were also futile as they could not make way against the fury of the storm. "Deep dismay" was felt on the arrival of the news at the sailors homeport of Londonderry and much distress was felt by the wives who had previously been told their husbands were safe. A subsequent investigation by the coroner's jury returned the verdict "Found drowned" in the case of the 12 bodies washed ashore but added "a strong rider for the improvement of the rocket and signalling appliances, it being shown that serious delay occurred in sending the rocket to the distress vessel". In the Bristol Channel a vessel went ashore and two collided as snow fell over Cardiff and South Wales. The Penarth lifeboat was put out in order to render assistance to a vessel in distress in Barry Roads however the severity of the storm and the distances involved meant it was 5 hours before the lifeboat arrived and the vessel in distress was no longer to be seen and therefore the lifeboat was obliged to return. The coastguard did however render assistance to a vessel

1894	21 to 23	12	North-west Britain	Liverpool Mercury	29/12/1894
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which had broken her back and succeeded in getting crew and belongings to shore. The crew were conveyed to the Shipwrecked Mariners' Society and safely guided home. Great excitement was felt at Troon as the lifeboat rescued the crew of a distressed vessel only to subsequently capsize. However all were rescued with the exception of one young man. 6 were drowned in the Irish sea when a brigantine capsized and a vessel was also wrecked off County Down although all were rescued. A body was picked up off Hoylake. Great fears were also entertained for 15 seamen who had been on a vessel in tow in Liverpool bay before the tow rope broke off Llandudno. Wreckage with the vessels identification on had been since picked up and there was no news of their survival. A barque arrived in Liverpool with another ship's crew having performed a gallant rescue at sea. A Newport trader of 1200 tons was also lost which was attributed to the fact "she carried a large quantity of iron and copper ore in the hold, and the presence of the metal caused a deflection of the compass" which carried her off her course and onto a dangerous reef where she was subsequently lost although the crew survived. A public meeting was held in West Kirby to discuss what should be done in order to raise funds and support for the relief of the families of the Hoylake fisherman recently lost in the gale of the 21st to the 23rd. Nine lives had been lost with 4 leaving widows and dependent families including 9 orphans under the age of 14. The Chairman of the meeting remarked it would be "Long before they forgot the great storm of last Saturday, which had brought

desolation and want far and wide". The sadness of so many of the same family being lost was remarked on and it was reported 4 were still missing. It was remarked that the chairman could "conceive of nothing more pathetic than these men leaving their home full of health and strength, and being brought back ... battered and drowned". The suffering of the bereaved was noted to require "comfort of a higher kind than their sympathy could bestow". And whilst the suffering of the bereaved could never be fully compensated it was remarked "that to the bitter sorrow of bereavement should not be added the cares of actual want and the necessity of a future total unprovided for" which was met with a "hear, hear". He trusted that enough money would be raised to provide a fixed income for the dependent and so that each widow could support their dependent until they were old enough to work themselves. The explicit intention to aid the sufferers before replacing lost assets was noted whilst the good character of all of those lost was also reinforced. The committee exclaimed "they wanted to make the Christmas message of peace and goodwill to men practically felt by stretching out a hand to their neighbours at Hoylake, to help them to deal with the distress that had arisen in their midst". A reverend detailed the qualities of the men lost and also noted that many other fishing families had suffered terribly losing all they had in the world during the storm. It was said "there was never a time when the fisherman had been so badly off as this year" and thus it was all the more reason to aid their cause. It was also remarked by the MP Cumming Macdonald that these

1894	31	12	North-west Britain	Liverpool Mercury	31/12/1894	<p>fisherman had been handicapped by the law of the land in which the Board of Trade interpreted the rule to limit fishing within certain areas and had consequently led to their over exposure and death. Overall it was resolved to raise a fund in aid of the widows and orphans and in total £825 16 s (£28,400) was initially raised for them in Hoylake and West Kirby. Funerals of the 5 whose bodies had been recovered were to be held on the 29th. A meeting was held in which important reforms to the Liverpool Lifeboat service were discussed which included a summary of the meeting of the "Royal Commission on electrical communication between lightships, lighthouses and the shore. A letter from the General Postoffice in london dated 26/10/1894 was read out in which it was enclosed "there will be a day and night service at the New Brighton Postoffice and at the office of the Wallasey Ferries Board, on the Landing-stage. Generally speaking the look-out and lifeboat stations of both sides of the Mersey will be able to communicate with each other".It was remarked that these improvements in communication had still not been carried out and therefore it was recommended that the Postoffice be notified "serious attention" should be drawn to the "defective state of the telegraphic communication in the aby" which was essential for the lifesaving services. The annual report was then considered which considered enacting the following reforms: "(!) Two steam lifeboats to be kept in the port at such stations as may be determined; (2) communication between the lightships and shore ... (3) that the rule requiring the local</p>
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1895	12 to 14	1	British Isles	Bristol Mercury	14/01/1895 - 15/01/1895	<p>committee to consult the London committee before spending money on telephonic, telegraphic, or other improvements should be abolished, and that at least two-thirds of the sum collected and subscribed locally should be at the absolute disposal of the local committee". Point 4 concerned basing lifesaving apparatus by the North wall Lighthouse and point 5 included improved telegraphic communication across the north-west coast and that the chief inspector should be based in Liverpool not Ireland. It was also noted that during the storm of the 21st-23rd 5 out of the 6 lifeboats in the bay had been deployed and overall the lifeboat crews in the bay had done splendidly having saved 111 lives according to official figures.</p> <p>A terrific snowstorm hit the UK producing "terrific weather at sea" and resulting in considerable damage to property throughout the kingdom. In West Cornwall the gale interrupted traffic communication and the storm surge seriously damaged the sea wall in Penzance and inundate houses. The NewIn fishing fleet also suffered severely with many boats being lost. In SOuth Devon it was reported snow "fell incessantly for seven hours" and the full force of the gale was felt in Swansea and district. In North Wales railway traffic was delayed and many hundreds of sheep perished in the hills of North Wales as the mountain roads were blocked. Several vessels were driven ashore in Beaumaris and the Irish Sea steamers were much delayed having encountered a terrible snowstorm suring their passage. A vessel bound from Clyde to Waterford was also missingand great uneasiness</p>
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1895	17	12	Liverpool Mercury	18/01/1895	2	<p>prevailed and although the Cunard Liner Luciania arrived 3 hours after she was scheduled the first mate had broken his leg and was subsequently escorted to hospital. Snow fell on the Pembrokeshire coast and across many districts in Northern Ireland causing great disruption to traffic. Upwards of 12 vessels were compelled to seek shelter in Queenstown harbour as "mountainous seas" ran in the bay with several vessels reporting damage to cargo whilst the harbour was strewn with wreckage. The temperature was such that ponds froze at Cardiff attracting many skaters and sliders onto the ice however in the evening the ice gave way and many fell in with one man drowning. In Bristol the snow fall caused severe disruptions and the rapid thaw made it's clearance all the more difficult with the Sanitary authority employing 55 men to clear the abundance of snow. One man was reported to have broken his leg and the tramcars were kept running thanks to the "promptitude of the inspectors and foreman" who salted the rails and deployed snow plows with great effect. An Italian barque was wrecked off Strangeford however the screws were saved whilst much damage was done to vessels in Kilkeel harbour as the storm surge eroded away 5 yards of the sea embankment. A man was also found dead in Merthyr having been overwhelmed by a snow drift and subsequently died of exposure.</p> <p>A report for the meeting of the Liverpool Shipwreck and Humane Society detailing the acts of gallantry in the area of the recent month. The society's silver medal was awarded to a coastguardsman and seaman who for saving</p>
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the lives of the crew of a vessel driven onto the breakwater around Holyhead harbour on the 22nd. Their acts of intelligence and humanity were detailed and overall they saved 11 of the 13 lives aboard. It was also stated "it is officially reported that the great gale of the 22nd ultimo blew with greater force than had ever been previously recorded in the British Isles". A silver medal was also awarded to a man who jumped overboard from an Atlantic steamer to save a crewman and although he succeeded in his efforts at first the men were thrown a lifebuoy the man who he was attempting to aid slipped through and died. Nevertheless the gallantry was rewarded. Several more medals were awarded for humanity on shore including the rescue of a boy who had fallen through ice in a pond and someone who had jumped into the Mersey to save a child who had fallen in and was being swept away by the ebb tide. A silver 'In Memoriam' medallion was awarded to "the parents of Geoffrey Edward Jones, eleven years, who drowned in a pond at Seacombe while going to assist two companions who had fallen into the water through ice breaking" and it was noted one of his companions had been saved. Several more awards for lifesaving heroics were declared with several being rewarded by awards of up to £1 (£130). Relief to sufferers from shipwreck was also declared which included £30 (£3900) to the families of the Hoylake fisherman who had drowned in the gale of the 22nd and £1 in clothing and supplies to the members of shipwrecked crew of various vessels who had been wrecked in the Irish Sea and lost all they possessed.

1895	19-25	1	British Isles	Bristol Mercury & Western Mail	22/01/1895 - 26/01/1895	12	<p>Very heavy rains resulted in serious flooding throughout England and Wales. Specifically great floods were noted in the valleys of the Clwyd, Elwy and Conway in North Wales with thousands of acres being submerged and "scores of houses" being flooded. Livestock had suffered considerably and many remote rural dwellings were isolated. Flooding at St. Ives and Bath was noted as riverside properties was inundated and one man was found drowned in the latter city. There was significant inundated around Cardiff with leckwith Common and a paper mill being flooded as the ely overflowed it's bank. At Porthcawl the strong NE wind caused substantial damage to shipping which broke loose and colided int the harbour. A fishing boat also capsized with the loss of two men and a captain was lost over board on a vessel in Holyhead and the vessel was now in the hadns of the Norwegian Consul. A steamer in the Irish Sea reported "a tidal wave struck the vessel, carrying away her sails and other fixtures, and sweeping overboard 169 head of cattle and 162 sheep". In CHeshire the Prince and Princess Adlophus of Teck were overtaken by a sudden snowstorm and injury was narrowly avoided as a horse slipped during an attempt to reach the Cheshire hunt which was later postponed. A Lloyd's agent telegraphed that a steamer had been totally lost off Portreath and only 8 of the 19 hands washed ashore were saved. The coastguard had seen the vessel in distress and brought rockets to the shore attempts to reach the vessel with the rescue line were fruitless and those who were saved were only saved due to people wading out into the sea to rescue them in a</p>
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<p>1895 6 to 8</p>	<p>2 British Isles</p> <p>Western Mail</p> <p>08/02/1895 - 09/02/1895</p>	<p>rather perilous situation. Fortunately several doctors had been able to render assistance almost immediately to the survivors. The lifeboat crew at nearby Hayle found it impossible to launch despite their best efforts and "hundreds of people lined the beach in a blinding snow storm, looking out for other bodies". It was remarked "it was a pathetic sight at noon yesterday to see the men who had stayed on the wreck dropping from the rigging, the lifeboat being only 300 yards away, but powerless to help them". Although there was minor criticism of the life saving efforts it was generally agreed that the lifeboat and coastguard did all they could and "risked their lives in the endeavour to save the unfortunate men". The rescued men were being looked after at fisherman's homes and the dead bodies were laid out ready for inspection by the coroner. It was noted people flocked from nearby settlements "in the hope of being able to render assistance" whilst others gallantly sent provisions to those in need. On the 25th the north-westerly gale of much violence accompanied by a great snowstorm continued to cause disruption on the Irish sea routes and the masts of a large vessel were seen just above the water's surface off South Stack on Anglesey. A lifeboat was deployed at Barrow to rescue a vessel which had dragged its anchor and all cross-Channel passengers reported a "terrible experience".</p> <p>11 Strong winds continued to batter the British coast causing many delays to international shipping and also resulting in the wreck of a steamer off the Isle of Man. Lifeboat and lifesaving rockets were deployed to the scene and the</p>
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1895	28	2	Liverpool Mercury	01/03/1895	<p>crew were safely brought ashore and regained full consciousness after medical attention ashore. Off Wigtownshire a submerged wreck of a brigantine was uncovered but little was known of it's origin or crew. A vessel was wrecked off the Antrim coast with one drowned and two badly injured whilst 25 steamers remained in a sheltered position off Corsewall Point with the weather being "phenomenally severe". A large vessel was wrecked off Douglas and although the lifeboat was put out only the broken vessel was remained and "the shore was strewn with allkinds of wreckage" and 2 of the 10 dead bodies were picked up. There was a collision in the Bristol channel and vessels arrived at ports having sustained considerable damage.</p> <p>A meeting of the Liverpool Shipwrecked and Humane Society began with the awarding of silver medals for acts of morality at sea on and land. As was standard the specific heroics were detailed before the lesser contributions were awarded fiscally. As per usual the officers of the saviour vessels received medals whilst the seamen receive £1. Votes of thanks of the society were given for assistance in efforts. A tugboat crew received a purely monetary award for a steam tug crew who rescued a man overboard in the Mersey with one of the crew jumping in to assist the drowning man. 30s (£195) was rewarded to a man who jumped into the Mersey to rescue a man who committed suicide and was unfortunately successful.</p>
1895	13	2	Liverpool Mercury	14/03/1895	<p>A reconvening of the Liverpool Shipwreck and Humane Society occurred with awards given all for humanity in</p>

1895	23-24	3	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	26/03/1895	21	<p>saving life at sea in the Atlantic off the American coast. As was standard officers received silver medals and the crew received fiscal awards of £1 each along with the society's vote of thanks.</p> <p>A violent gale struck the south-west sweeping the Bristol channel and causing much distress to vessels in the channel. A vessel in distress of Burnham was immediately responded to by the lifeboat who fired off a rocket signal, however as darkness set in sight of her was lost and the morning after all that remained to be seen was her topmast. The captain and mate both left a widow with family. Another vessel was "struck by a tremendous sea on her broadside" and began to sink, the men escaped in their own boat and although they capsized they were close enough to the shore for soldiers of a nearby garrison to save them. The Barmouth lifeboat landed 19 crew of a distressed vessel off St.Patrick's Causeway. In Bristol minor damage was done to property as chimneys fell, roofs sustained damage and a roof was blown off a sports stadium. A very melancholy event occurred when 3 children went out for a walk and were crushed by a falling poplar tree although the tenant who occupied the land was not the owner who were trustees. The inquest found the tree had been rotten and the testimonies of witnesses were given. The Coroner "remarked the occurrence was a most terrible calamity" and he was in agreement with the jury that the remaining poplar trees should be attended to. The jury eventually returned a verdict "That deceased was killed by the fall of a poplar tree in Fishponds road during a severe gale". The father of</p>
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1895	30	5	North-west Britain	Liverpool Mercury	31/05/1895	<p>the deceased had to attend another inquest due to the fact his other child died shortly after whilst trying to render assistance which was exclaimed to be "Most distressing". The great Western Railway was blocked by the fall of a huge elm and sixty-three trees were uprooted at Aldenham Park and a Grammar School was damaged. In Chester "something in the nature of a cyclone was experienced" and the barometer dropped rapidly and damage to property was widespread with streets strewn with slates and debris. Many Poplar trees were also blown down and an "unprecedented" number of chimney stacks fell with one or two properties being completely destroyed. Damage to the Barry chapel was substantial and the gale caused great postal delays throughout the kingdom. Many damaged vessels were reported in Cardiff with several having to go into dry dock to enact repairs. A Newport-laden vessel was also dismasted and the crew safely landed at St. Davids. A vessel also went ashore on the island of Iona and four men were picked up by another vessel from the ship's punt with 18 presumed dead.</p> <p>A great thunderstorm passed over the Merseyside district which encompassed a shower of rain followed by hailstones as well as "exceedingly vivid flashes of lightning and loud peals of thunder". A county councillors house was set on fire as lightning shattered the roof and a fused a gas pipe below. There was damage to the electricity supply in North Wales meaning many gas lights had to be lit to illuminate the streets.</p>
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1895	26-27	6	British Isles	Liverpool Mercury & Bristol Mercury	27/06/1895 - 29/06/1895	Vivid thunderstorms burst forth over the entire UK causing great excitement and in certain cases notable destruction. In Liverpool in the early part of the afternoon the temperature rose to over 100 degrees in the sun before there was a "change in the atmospheric surroundings, when several copious showers occurred, accompanied by heavy thunder and flashes of lightning" although no damage was reported. The violent storm was also felt over Birkenhead and continued for 1/2 an hour and lightning did minor damage to a few properties. Thunderstorms struck the North-west of Britain after a morning in which the "atmosphere was close and oppressive, giving every indication of an approaching storm" which eventually broke in the early afternoon. Heavy rains flooded the main streets and "torrents furiously rush, sweeping away all kinds of debris" down steep streets. The showers were so copious the sewers became choke resulting in the accumulation of large bodies of water in low-lying districts. As a result many cellars and warehouses were flooded and a great deal of damage was thought to have been done to goods and property. "Defective sewerage caused great inconvenience" to households in the outskirts of the city who were filing complaints. The sky was said to have become so dark at 4.30 due to the density of the rain clouds that gas had to be lighted in many places of business. The "terrific peals of thunder rang out accompanied by intensely vivid flashes of forked lightning, and a hailstorm" which caused mild panic as people rushed for cover. A man had a "really marvellous escape"
1895	1	7	North-west Britain	Liverpool Mercury	02/07/1895	

1895	27	7	Bristol Mercury	27/07/1895	<p>when a telephone wire was struck and it then fell igniting a bakers but thankfully the damage was limited. The storm was noted to finish very rapidly and no accidents were reported to the police.</p> <p>An article concerned with the progression of the Bristol Floods Committee since the distarous floods of November of the previous year. It was said since the floods the "inhabitants in the neighbourhood of Picton street and other flooded parts have been waiting anxiously for some move ot be made". It was noted an engineer and the sanitary council had submitted a report on the drainage design but whilst the reports had been approved no action was yet to be taken. As a result a culvert still remained open and the stench was said to be unbearable in the summer. The engineer's report was referred to as a means to insitigate action as he had stated "I have no doubt that the utterly inadequate size of the arch at the back of the houses in Albany road added to other contractiosn lower down the steam and the tortuous course of the whole prevented the flood water from escaping, which, accumulating in the upper part, burs the arch" and resulted in major flooding. As independent house owners had changed the arch embankment height and width according to their concerns along the wall it was "desirable to design a relief culver on quite independent lines" and thus relieving the flow in the stream which primarily surved as a boundary between property. The storm water was to be directly diverted into the Fromm via a culvert running from the hills to the river for a total cost of £21,000 (£2,800,000). The flooding of</p>
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1895	28	7	Western Mail	29/07/1895	<p>another stream in the district named "the Boiling Wells" was said to be due to an insufficient culvert volume under a railway and the creation of a new culvert and diversions 1112 yards in length and 6ft 6 in in diameter which would cost £25,000 (£3,300,000).</p> <p>A report of the 2nd ever 'Lifeboat Saturday' at Cardiff for which "the inhabitants of the town turned out in their thousands" to see the procession and "show their sympathy with the noble cause by liberally responding to the appeals made for assistance b the small arm of collectors". In 1893 £300 had been collected and it was remarked far more would have been donated this time. It was decided that the funds would be donated towards "the establishment of a fund for superannuating lifeboat men injured on, or getting too old for, active service, and for granting small pensions to the widows and children of men who may ahve met their death in their gllant attempts to save life at sea". It was remarked that a number of lifeboat men lose their lives throughout the year and no fund had existed for pensions or allowanves for the husband and fatherless dependents. The achievements of the RNLI on a kingdomwide basis were noted including that it maintianed 308 lifeboats and 17000 men were engaged in service. In 1892 there were 4000 vessels who required assistance and 1056 lives were saved by the crew and 1000 seaman lose their lives annually. It was remarked to "maintain the service efficiently £100,000 (£13,200,000) per annumis required, but the income last year was only £67,000 (£8,900,000). The Penarth lifeboat which was last in active serive in</p>
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1895	30	8	North-west Britain	Liverpool Mercury	30/08/1895	<p>December 1891 was paraded through the town and her last venture in which the lives of 15 seaman were saved was detailed and the saved men themselves were on procession. After a colourful procession involving other emergency services and seaman was hel including a demonstration of how diving equipment worked whilst the Cardiff Model Yacht Club also on display along with memebers of the dock board flying flags of all nations. Several fanfares also paraded and the Union Jack flag was often seen waving in the breeze. The lifeboat was also launched and rockets were also launched to show how distress was signalled. Althoguh the appearance of two men in the water caused a commotion among spectators this was all part of the program and the lifeboat perfomed a mock-rescue with many prominent gentlemen onboard. Some of the collectors were dressed up in blackface which caused a stir and was reported to have gone down well. An illuminated fete was held in the Sophia Gardens with music from a military regiment and overall it was remarked "the demonstration and fete must be pronounced to be gratifying successes".</p> <p>A report of a meeting of the Liverpool Shipwreck and Humane Society which detailed awards for gallantry given out by the society for acts of humanity in seas across the gloe. Silver medals were presented for officers whilst seaman received £1 (£138) each, A gold medal was awarded fro a captain who saved the crew of the SS Oxenhohne near in the River Plate rescuing the lives of 42 men in treacherous conditions using the ship's schooner. Rarely a carpenter was also awarded a silver medal for</p>
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1895	21	9		Western Mail	21/09/1895	<p>swimming to shore with a rescue line when his vessel was wreacked near Newfoundland. Several monetary awards were given to normal characters in the Cheshire and Merseyside district fro jumping into the Mersey and nearby canals to save lives. Overall the small awards for assisting to save life amounted to £14 11s (£1900). A poem entitled "When My Ship Comes In" which eludes to the constant peril of vessels at sea and the effect of dread and worry on concerned parties ashore. The immensity and power of the elements are communicated with the lines "Where the winds dance and spin/ Beyond the reach of my eager hailing" before the fury and peril of the storm is communicated with the lines "Over the breakers' din;/ Out where the dark storm-clouds are lifting". The poem is told from the perscpective of an anxious party onshore who exclaims "Oh, I have watched till my eyes were aching,/ Day after weary day/ Oh, I Have hoped till my heart was breaking/ Whole the long nights ebbed away" which really illustrates the overwhelming sense of fear and sorrow. In the next verse the poet conversely shows a sense of positivity exclaiming "Surely the port she'll win;/ Never my faith in my ship has faltered,/I know she is coming in". Though they acknowledge sublime nature and peril with the lines the "mad rush of wld waves foaming,/ Trhough the white crest of billows combing" the poet ascerts the vessels is still coming in. This sense of positivity becomes more exurberent and perhaps shows signs of thoughts turned delirious by peril as the vessel is now portrayed in a magnifent manner "Breasting the tides where the gulls</p>
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<p>1895 1 to 7</p>	<p>10</p>	<p>Western Britain</p>	<p>Liverpool Mercury, Western Mail and Bristol Mercury</p>	<p>03/10/1895 - 08/10/1895</p>	<p>11 flying,/Swiftly she's coming in" as she defies the hazards of the deep and brings what is presumed to be the lover of the poet "precious the love she will bring to bless me" who also is implied to bring wealth "proud puple of kings she will dress me". The poem continues on this exurberent trajectory during the final verse as the scene of the vessel arriving is depicted and the poet explictally refers to the scene of arrival as if desperately trying to convince the reader the ship will return "At masthead and peak her colours streaming,/Proudly she's sailing in;" with "Love, hope, and joy on her decks are cheering" as a fanfare plays. The final line "When my ship comes in." stresses this event is in the imagination of the poet and perhaps elludes to the fact that they cling onto a romantic dream when in fact there is little chance of their lover and vessel ever returning.</p> <p>A terrible gale hit the Western coast with it's suddeness causing great calamity in the Bristol Channel and Liverpool Bay with strong winds from the NW wreacking havoc on coastal communities. The onset was such many craft "found themelves at the mercy of the ind and waves" before shelter could be found and thus many were damaged. The most prominent disasters occurred of Ilfracombe when a vessel was noted in distress. Two men rowed out and took off the cpatain and owner but the vessel itself was carried onto rocks and the rescue craft was found stove in and both the rescueres and rescued were drowned. A subsequent account from another boat man told how he had secured his vessel after being told to do so by the rescuers and then gone tothe jetty to assist</p>
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the effort before the rescuers were lost as he haplessly called out into the howling wind. Despite help from the coastguard nothing more was ever seen of the men alive. A subsequent inquest on the captain's body was held by the coroner of the district. It was said that the lifeboat crew member who had found him dead had known him for "the last 25 years, and at once recognised him". It was the first voyage he had made on that vessel and it had come into distress in Stolford Bay. The lifeboat found the vessel at anchor with no one onboard and it was presumed they were all washed overboard by the heavy sea. It was understood "The aggregate of the three men on board the Hereford was 210 years, averaging 70 years each" and the verdict "Accidentally drowned" was returned. A large steamer also went down with only one man surviving the wreckage although he himself was "washed in by the tide and jammed between two rocks, from which perilous position the coastguard gallantly tried to rescue him". He died after 3 hours of their assistance despite medical attention which included the administering of "brandy and restoratives to the man" by a doctor. He revealed he was the captain of a vessel which foundered off Ball Point and five had perished with him and he left a widow and 10 children. A lifeboat later retrieved the body and those rendering assistance. Another inquest into the death of the Captain of the Lanisley heard that on hearing the terrific condition of the captain a policeman had procured a cab and a doctor and drove to the spot before descending the cliffs with the doctor and a coastguard officer. The doctor had

proclaimed "it was impossible to get him alive up the cliffs" and thus the doctor returned by rope and set out for "stimulatns, medicine and dry clothing". As the tide was still coming in "the man was lifted another fifteen feet from whence he was lifted into the lifeboat at 4.30". It was said "everything was done for the man under the circumstances. It was impossible to get him up the cliffs". It was noted rugs had not been taken down at first as it was believed he could have been got up and the the rescuers had taken off their clothing in an attempt to insulate the man's body. The great risk all took in going down the cliffs was noted and the "tide cut off their retreat, and they had to take the man up rock after rock, and then were stopped". It was also stated that the deceased would have certainly died if he had been hauled up so the lifeboat was the only viable means of rescuing him. The doctor also remarked of the danger the men were in and that the man had been only semi-conscious and every man did his best for the deceased. The deceased's brother statement contradicted that of the rescuers stating: "It seems that when found, so far from being in a condition of insensibility, Captain Beckerleg entered into a conversation". Indeed it was stated at the time of his rescue "he was certainly not dead or dying, and his brohter believes that had assistance been forthcoming then with a supply of suitable food, drink, and dry clothing, the captain of the Lanisley wouldhave had a good chance of life". It was also noted that the doctor caused great delay being slow to descend the cliffs. It was also strongly exclaimed "although he had probably

not tasted food for something like twenty-four hours, they were unable to give him anything to eat, they had no change of dry clothing with them, nor had they any means of protecting the man, who had been for nine hours immersed in the sea from the pitiless beating of the rain and hail, which poured down". It was also noted the lifeboat had been called only some four hours after he had been discovered. It was finally concluded "When the lifeboat at last came round Captain Beckerleg's chance of life must have practically gone". An inquest of another captain drowned when his vessel foundered off Trevoise head was concluded as "accidentally drowned" as although the rocket apparatus had been set to work the schooner was too far out to reach and there was no way of reaching land without swimming and all died from exhaustion on the journey. Another captain reported "he saw in the distance a great sea like a wall, a mile in length, coming towards him" such was the sudden onset of the gale. Both the Clovelly and Lynmouth lifeboats were deployed and the coast was strewn with wreckage such was the extent of the disaster. A punt was later found floating in the sea all alone on the 7th and it was feared the occupants of its parent vessel may have all perished. In Liverpool the gale was severely felt as several chimney pots and roof slates littered thoroughfares and there was a "fairly frequent pour" and there was news of small vessels in distress outside the bar. A lifeboat rescue was enacted at Hoylake off the mouth of the Dee as distress signal was noted in the Rock Channel and the lifeboat immediately launched by horse which had to travel 2

miles owing to the bathymetry and state of the tide. Fortunately the schooner in distress was reached and the 2 crew taken off before it went to pieces. The New Brightham lifeboat was also deployed to aid small coasting vessels but none required assistance in the end. The Southport sailing lifeboat enacted a "gallant rescue" which was the first she had performed from a wreck. Their efforts saved the lives of a barque helplessly drifting towards the treacherous Horse Bank and the lifeboat continuously "filled again and again, each time emptying quickly, and in every way behaving admirably" as the men rowed to the vessel with all haste. The rescuers and rescued were all "temporarily refreshed at the pier bar, and then piloted by Messrs Duddell and Rockliff, cheered on the way by a crowd, to Holden's Restaurant, ... an old fashioned house which has lodged shipwrecked mariners for at least a quarter of a century". They were hospitably cared for with a breakfast and pipes and the hosts turned out their wardrobes for clothing for the distressed. The captain disclosed the ship was Russian and although he had known the Lancashire coast well he had been looking for a pilot and was lost in the dense haze which caused him to come into danger "he could not express himself too highly respecting the conduct of the Southport lifeboatmen" as "their promptitude and skill had saved the eight lives, and every kindness had been shown both on sea and land". Two fishermen were also proposed drowned on the banks of the Ribble and two vessels had grounded off Formby but worked themselves free. Off Blackpool and Fleetwood the fishing boat fleet was

severely disturbed with one sinking and all 4 drowning whilst another collided with a steamer and the men were subsequently saved by that vessel. Two more bodies were washed ashore and great anxiety prevailed for the safety of many more. Bodies of the fisherman were subsequently washed up at St Annes with many being married men with family. A yacht escaped however and this was attributed to its design. The Southport crew also deployed to save the crew of a vessel. The rocket apparatus was successfully used to save the crew of a vessel ashore on the North Conrish coast and another vessel was in distress and could not be reached by rocket apparatus or lifeboat. Several more vessels were wrecked with several men missing and the worst fears were entertained for them. There was another sad loss of life in Bridgewater Bay as although the lifeboat was deployed. A Norweigna Brig was wrecked off Clovelly however all were saved thanks to the promptitude of the lifeboat and "hearty cheers were raised for the crew and those saved". A craft off Aberystwyth had a narrow escape but fortunately the lifeboat was rapidly deployed to the vessel and escorted the men back to shore and safety. Another fatality occurred off Spikes Mill when a crew jumped overboard from a distressed vessel in order to reach the shore with one drowning. At Rhyl a vessel was lost after striking a sandbank and although the lifeboat was deployed nothing was seen of it. The two lost left a widow and eight children. Barry pilots described the gale as "wicked" due to its rapid onset and the damage it did. Rumours still circulated as to the fate of many vessels. At

1895	30	10	Liverpool Mercury	01/11/1895	<p>Clevedon the waves broke with great force on the sea wall and the front was rendered impassable. A vessel was smashed into splinters on the "The Black Rocks" of Pembrokeshire however the men had fortunately escaped in their boat. A dismasted vessel was also found dismasted off Holyhead and it was presumed all aboard had drowned. By the 7th the tail end of the storm was still being felt as many vessels sheltered in the lee of Mumbles head with one sustaining minor injury.</p> <p>A report detailing the awards present by the Liverpool Shipwreck and Humane Society for recent actions when saving life at sea and on land. Silver medals and vote of thanks were awarded to two captains for saving lives in the Atlantic whilst a "silver general medal and 10s" was awarded to a coachman for "having, at considerable risk, stopped a runaway horse and brougham" at a junction. £2 (£270) was also given to a 8 individuals who proceeded in a fishing boat and punt to rescue two men from a wrecked flat after failed attempts by the lifeboat due to the shallowness of the water. Several financial awards of around £1 were awarded to various men for jumping in the Mersey to save lives and various small awards totalling £5 were given out (£660).</p>
1895	4	11	Bristol Mercury	04/11/1895	<p>A section of "wind superstitions" which discussed the association between the divine, folklore and the winds in different cultures. It was remarked that "it is not surprising that so many superstitions are associated with the 'winds of heaven'. There is always something peculiarly awe-inspiring in an unseen force". The mystery for the "resistless gale" was remarked to be as "mysterious as</p>

destructive". It was said there was small wonder how classic civilisation "erected a temple 'to the Winds' and that every creed and mythology has its traditions and superstitions regarding the wind". How such traditions had remained despite the birth of Christianity was noted as "Satan was considered as especially 'Prince of the powers' of the air' and evil angels were once said to be condemned to remain in this element. The association that philosophers and "wise doctors" made between the devil and wicked spirits such as witches and the wind were made clear. Sailors' superstitions were also touched upon including how sailors would "buy 'favourable winds' from ancient beldsmen, who presented the confiding mariners with knotted strings" and a gale would follow the loosening of one of these knots. It was also noted that several individuals in the 17th century confessed to being witches who "designedly raised the tempest" which drove back the bride of James I from the Danish shores as a witch could practice "Whistling for a wind". A specific reference to a 17th century witch at Minehead was made as she would constantly wreak havoc on her own descendants by procuring a tempest to wreck their vessels when they took to sea. The Native American belief in Aeolus, a god of the air and the lingering classic traditions in Greek Islands were also noted. The faint evidence of lingering belief in Chirstendom were also shown by the inscription "dissipo ventos" on a church bell whilst the 1801 work "magic" gave directions how to "invoke the spirits of the air" and that on different days different mystical figures controlling the four winds came

into being. A Highland superstition regarding the direction of the wind on New Year's Eve was also detailed "If New Year's Eve night wind blow south;/It betokeneth warm and growth;/If west, much milk and fish in the sea;/If north, much cold and storms there will be;/If east, the trees will bear much fruit;/ If north-east, flee it man and brute". The inhabitants of the Cyclades also had a similar superstitions reagrding the wind on their feast day. Depsite the progression it was said "all the resources of modern science fail to rule the powers of the wind; we can but predict the arrival of the hurricane whose ravages we are powerless to control". It was noted that whilst many other natural resources had been "chained and bridled" wind was still "as wild,as irresistible, as mysterious, as at the time of its first exention". The fatc modern science couldonly "hoist a warning cone" was mentioned and it was said "wind is supposed to have an influence on the weather" but this was still somewhat debated by West Country folklore in which the directions of the wind brought generalised weather which was very much against modern scientific knowledge. However the fact "wind can certainly affect our comfort as well as work us actual harm" was noted as the "brave north-easter" blew away disease but brought many others. However it was noted the "sweet south wind" of the summer came "laden with the breadth of flowers, or 'sweet scented with the hay'". Indeed it was remarked that "surely ancient superstition which ascribed to the the influence of malific spirits the tempest and the gale might magine these 'favouring airs' sent by kindlier beings" and "beneficent

1895	6	11		Liverpool Mercury	07/11/1895		spirits" which ancient magicians believed could invoke the "powers of the air" who ruled destructive winds. A strong westerly breeze caused considerable inconvenience on the Lancashire coast with the high tide and strong winds producing a surge which made the promenade impassable during high water. A barque in distress was noted although she was rendered assistance by a tugboat who towed her to safety towards Fleetwood. Traffic in the Ship canal "has not been interfered with in the slightest" and the only accident involved the sinking of a coal barque which was overladen with coal and thus was overwhelmed quickly.
1895	10 to 11	11	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	12/11/1895 - 13/12/1895	15	A tremendous tempest caused disaster on sea and on land with the most melancholy incidence occurring off Milford with the loss of 14 lives. The vessel Highland Home had foundered off Pembroke as a tow rope between the vessel and the accompanying tug snapped and it was lost in the great sea off Freshwater West. Signals of distress were seen outside Pembroke but the vessel disappeared and only the wreckage was washed ashore despite the deployment of the coastguard. The captain had his wife and two children onboard whilst 3 others were married men with dependents. The news created much distress and commotion in Fleetwood where most of the crew were from and consequently business in the town was at a standstill. Serious effects were also felt in Ramsey Bay where two vessels dragged anchors and as a consequence the lifeboat had to be launched and fortunately saved the crews of those unmanageable vessels. On the shore at Douglas considerable damage occurred with the storm

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surge damaging the baths and a section of the Douglas railway, damage occurred to roofs and multiple windows were blown in and trees blown down. The lifeboat at Ramsey also undertook 3 succesful rescue missions. Floods were also widespread in North Wales as the hurricane blew and the Rivers Dee, Conway and Clywd overflowed their banks and a great number of livestock were drowned causing much woe to agricultural types. The lifeboat service was also required in Anglesey and brought a vessel and her four crew to safety. A vessel escorted into Holyhead had lost one man overboard and one was severely injured to the extent "his life is despaired of". In the Bristol Channel a vessel was driven ashore on the Cariff sands and a Norwegian barque needed to be towed off the East mud after dragging her anchors. A tug put into Queenstown reporting one man of Skye had been killed onboard by a sudden jerk of the hawser. Serious damage occurred in the vales of SOuth Wales as the town of Tredgar was completely inundated to an average depth of 1ft and 9 inchescausing great damage whilst the town was plunged into darkness by teh flooding of the gasworks. The majority of those affected were poor and "their few articles of clothign and their food were totally destroyed and, and much sympathy is felt for them". A mailcart was completely destroyed at Bargavenny and a bridge on the River taff swept away at Merthyr whilst all traffic was suspended on the Rhymney valley railway as it was torn up by the overflowing river. An intense storm caused more damage off the South-west coast with an American steamer being greatly damaged in

1895	23-26	11	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	25/11/1895 - 28/11/1895	5	<p>Swansea Harbour by the strong northerly winds. She had come into collision with the dock entrance and subsequently grounded producing a large rent in her side which was patched up at low tide and she was refloated at the next high tide with the intention of getting her into dry dock. The steamer Herbert capsized near the Skerries with the crew fortunately being able to make the shore in their boat. Ilfracombe was crowded with over 50 vessels who sought shelter from the gales blowing the mouth of the Bristol Channel.</p> <p>A great storm once more hit the Isles causing considerable loss and affecting great damage throughout the kingdom. In the Bristol Channel the Penarth lifeboat was deployed before the vessel in distress was removed by a tugboat. Two more vessels also went ashore off Cardiff and their crews were safely landed after. An "exciting incident occurred at Mmbles when three oyster dredgers had a narrow escape with one man having only just being rescued in an unconscious state and later rendered assistance ashore before he recovered. A large fleet remained at anchor in the lee of Lundy all windbound and tugs were called to render assistance to a steamer in distress. Three trawles sunk off Torbay with the cost of thousands of lives but thankfully no lives. A vessel was damaged after coming into collision with the Barry Pier and a ketch sunk in Ely Harbour but all were landed safely whilst a schooner adrift in the Penarth was safely secured. A Russian barque was wrecked off the Lizard but all of the crew were saved whilst a Norwegian barque drifted on to the Manacle Rocks on the south of Cornwall and was</p>
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1895	30	11	South-west Britian	Bristol Mercury	30/11/1895	<p>totally wrecked "six of the Norwegian crew made for the shore in a boat, but touchin the boulders it cpassed, and five of the occupants were drowned, these being the steward, caprenter, and three sailors". Those remaining onboard survived thanks to the "brilliant and prompt efforts of the Coverack rocket brigade and coastguard staff". The one rescued seaman remained in a prearious condition. A vessel foundered just off Milford pier having sprang a leak however all the sailors escaped in their punt and were now sheltered int the Sailors' Home. A Swansea vessel sank outside Port Ellen but the crew were landed in their boats.</p> <p>A section on the flood improvements carried out as a response to the severe flooding in November of 1894. It was said the formerly flooded distric would be delighted to hear that the committee "had decided to recommend the Council to carry out both of these schemes in their entirety, and thus for once and all do away with the mischief arising from owner of property abutting on the Cutler's Mills brook". These properties had shaped the river bank as they had pleased and now it was decided that the enigeers proposed schemes would be put in place to provide "an adequate relief culver on quite independent lines" in order to divert floodwater from the surrounding hills straight into the From. The costs and anture of Mr Yabbicom's project were once more stated which chiefly concerned the construction of a new culvert 1330 yards in length and 9 ft wide with a total altitude fall of 47 1/2 ft. A tunnel under the railway embankments was also to be built and the discharge would eventually flow</p>
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1895	4 to 8	12	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	06/12/1895 - 09/12/1895	1	<p>into the river at Botany Bay. This brought the overall proposed cost of the project to £46,000 (£6,100,000).</p> <p>A very severe gale prevailed on the British coast doing substantial damaged all over the kingdom. In Liverpool the terrific gale from WNWN was accompanied by heavy rain which made it difficult to venture out in the streets. It was reamrked "although described officially as a moderate gale, the squalls, which were of frequent occurrence, were very violent, and in some of the worst of them the wind blew for several minutes with the force of a hurricane". The "river had a most animated appearance" and the south storm cone was hoisted which was "indicative of heavy depression outside". A young woman recieved sevre injuries when struck walking the streets by falling timber. The chief disaster occurred when a pilot boat was accidentally run over by a larger steamer it was trying to assist. In desperation the crew of 16 got intot he punt and drifted away. The two men abaord the steamer then boarded Pilot Number 1 and signalled for assisance and with the help of other vessels shletering off Point Lynas they conducted a search for the 16 missing men. Forutnaely an incoming steamer found the drifting 16 in their punt and rescued them. One of the men later exclaimed "When the Cambroman struck our boat it looked as through she was going to crush us right into the water" before he described the last-minute escape. The man described their night at sea and the fading belief in a chance of rescue stating "but when daylight came, and no assistance was at hand, we began to think that all was over with us" especially as the puntsoars were badly</p>
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damaged. The debate about the risk of being swamped whilst approaching another vessel was noted but thankfully the transfer of men onto the rescuer vessel was without injury even though the punt capsized in the process. There was widespread news of consternation amongst the pilot's relatives during the search but there was much relief when news of their safety was heard and it was remarked "indeed, their escape from a watery grave may be regarded as almost miraculous". All men went home at once to reassure their "wives and families prostrated by grief" on return to the port of Liverpool. This incident catalysed a well known debate about "steam versus sailing pilot boats" as it was stated "the pilot boat service of the Mersey is not an institution of yesterday". The argument for sail pilot boats ran along the lines "for half a century and upwards the splendid seaworthiness of four Mersey pilot schooners has been in evidence; and there are many who, when the idea of applying steam in this pilot service is mooted, shrug their shoulders and point to the many, many years of immunity from accident which the pilotage service in sailing boats has enjoyed". Against this it was said that whilst the boats were well equipped and skilfully handled "circumstances must occasionally arise under which a sailing vessel is put to an enormous disadvantage in comparison with a vessel propelled by screw or paddle". Indeed it was said that the accident was clear evidence of this danger. The logistical issues of having vessels of very different sizes and windages and how this could cause accident was explained. In support of the steam vessel it was remarked

"there is no case in which a Mersey tug has come to grief through getting under the quarter of another vessel, however heavy the sea or boisterous the weather". The advantage of steam to enable the pilot boats to carry out their tasks regardless of the wind or tide was also noted whilst the recent incident was shown to clear prove contrary to the old argment of their "tradional immunity from catastrophe". It was noted that "strenuous objections, it will be remembered, were raised to the introduction of steam intot he lifeboat service" and now even the "most obdurate critics have had to admit that the steam lifeboat possesses advantages far supeior tot he ebst-manoeurved sialing lifeboats afloat". Overall it was remarked that the Mersey Docks and Harbour Board should turn their attention towards steam lifeboats as whilst "the initial cost might perhaps be large, but in the long run it is obvious that such a change would prove economical". Overall it was stated fewer steam boats would be needed to do the task, they would be more seaworthy and they could approach vessels in weather with impunity "which no sailing vessel, however well managed, could possibly aspire to". An interview with the pilots told of the panic arising as the side otheir deck was completely destroyed by the steamer and of the perils of being in the small boat out in the mountainous sea. Their desperate struggle for survival as the boat filled was noted along with the waining hope of survival before their miraculous rescue by the vessel from Manilla. Minor damage was noted at New Brighton and Birkenhead however their were no casulaties in the Mersey so the

New Brighton lifeboat was not called into action. "A man in Blackpool was also severely injured by a falling object and much damage was done at the foreshore by the storm surge which tore up the asphalt promenade and tore up timber supporting beams. Several sheep were drowned by the tide at Lytham. A lifeboat rescue was affected in Carnarvon bay with 5 persons rescued from a distressed schooner in a heavy sea. A lightship also went adrift into the entrance of the River Dee but no serious damage came of her or harm to her crew. A part of a building erected for the Cardiff Exhibition of 1896 was blown down and damage was very considerable. Houses in Roat suffered "pretty severely" and roads were strewn with tiles and glass blown out. Many vessels were also windbound at Porthcawl. A Dutch barque was driven up the channel by the winds and all traffic was paralysed going out of Cardiff and Bristol and several distress lights were seen in the channel. A sailor unfortunately perished when "a heavy sea struck the vessel, and deceased, by the concussion, was thrown with great violence against the steam winch" receiving frightful injuries which he died from aboard and an inquest on the body was to be subsequently held. Damage was also significant at Newport both on shore as many properties were damaged and several vessels were damaged with one sinking off Barry. A Newport cutter was also wrecked and the crew were saved. The pilot himself later wrote to the editor of the Western Mail stating he wished to publicly thank Mr Wilson, of Cold Knap Farm, and the coastguardsmen of that station for their kindness to me

and my crew after coming ashore from the wreck of my cutter". Their humanity and material assistance was much praised. A Newport pilot was also injured when a hawser snapped whilst towing in a schooner and struck his leg thus fracturing his leg and causing a "bad wound". A Holyhead ferry was much delayed by mountainous seas in the Irish Channel. A vessel was also stranded further up the Mersey on a sandbank but was later got off with much effort from several tugs. The sand also resulted in considerable aeolian deposition of sand at New Brighton and the sand drift was so great local trains were delayed and a number of men had to be employed to clear the lines. This same problem caused by windblown sand occurred near St. Anne's and so great was the accumulation traffic had to be rerouted. A vessel was also blown out to sea from Glenarm harbour but the crew fortunately got to shore. A man also met his end when he was blown over a cliff at Larne. Ilfracombe was full of sheltering vessels and whilst the Woolacombe were ordered out to practise there was not a sufficient number of men to man the boat. Subsequently the Ilfracombe crew were called although "spectators were surprised at the time wasted" as it took nearly 2 hours to launch the vessel. They were of the opinion there ought to be a crew at Woolacombe but it was remarked "during twenty years the boat has only been to two wrecks of a minor character". A Cardiff pilot was driven ashore and was likely to become a total wreck but the crew were saved. In The Clyde steamers reported a heavy sea running and many had to put back owing to the weather. There was a

1895	12 to 15	12	British Isles	Liverpool	14/12/1895	3	<p>great fall of snow and hail with bitterly cold weather over Greenock and the coast of the Clyde and one woman was found dead having died from exposure on her walk home. "A hurricane raged over Liverpool" which caused great inconvenience on land as pedestrians could barely make progress against the winds. Damage was done to the telephonic and telegraphic systems as several wires were pulled down and roofs were pulled off in many instances. It was remarked the "full evidence of its severity being shown by the appearance in the Mersey yesterday of a 'Mother Carey's chicken,' the storm petrel, which near leaves the open sea, its native element, unless driven inland by extremely rough weather". Many captains were deterred from departing in the NW headwind and thus the river was full of craft as ferry traffic was interrupted. Two vessels were in collision and various other minor boating accidents occurred with no severe damage or injury thanks to the prompt assistance of tugs. A flat capsized off tranmere but the occupants escaped in their punt. A dredger belonging to the Preston Harbour Trustees was in grave danger of being broken up against the harbour wall but was fortunately rescued due to the prompt assistance of a tug. The heavy gales forced many vessels to seek shelter in the Menai Straits but no damage was received. A man unfortunately drowned off Piel near Barrow when his sailing pilot boat capsized. The fierce storm on the Manx coast compelled many vessels to seek shelter in their ports but no damage was reported. A trow vessel was wrecked in Walton Bay near Clevedon as she was stripped of her sails and then struck a rock. The crew</p>
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1895	19	12	Liverpool Mercury	20/12/1895	<p data-bbox="1332 199 2094 391">were "observed battling with the waves, but during a blinding storm of rain and hail she suddenly disappeared, and the fate of her occupants has since been shrouded in mystery". The vessel had broken in two and it was feared that the crew had unfortunately perished.</p> <p data-bbox="1332 391 2125 1366">4 A report of the actions of Liverpool Shipwreck and Humane Society chaired by Admiral Gough in the Underwriters' Committee Room in Liverpool. Silver medals for "courage and humanity in saving life" were awarded to a wharfinger who had dived into the Wellington Dock on the 7th to rescue a man between the wharf and a ship. It was remarked they were a long time in being hauled up due to the gale and darkness and at "great risk of being crushed to death". It was noted the man had twice been rewarded for saving life on previous occasions. Monetary awards were given to another seaman for jumping into a dock to save life and to the crew of a steam vessel that saved 5 men from a distressed steam vessel in the Crosby channel when the vessel was sinking and 4 of crew had already drowned. A vote of thanks was also given to the captain of the Manilla vessel for having rescued the 16 pilots adrift in the small punt off north Wales during the 7th. Monetary awards were also given to 3 men for having stopped a runaway horse. Whilst a minor award was given to one other man for a dock drowning rescue. Relief to "Sufferers from Shipwreck" was given to the 5 crew of the sinking steam vessel in the Crosby channel which amounted to £1 (£130) each in clothing and provisions and this was also awarded to the crew of the Flat that sank off Tranmere on the 14th.</p>
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1895	21-29	12	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	24/12/1895 - 29/12/1895	<p>A great gale from the south-east did great damage across the UK leading to loss of life. On the Manx coast mountainous seas were observed and several steamers arrived with much damage and many more remained windbound. The weather was such vessels could not land at Douglas and thus was compelled to go to Peel where a special train had to be put on to convey the passengers back across the island. The Captain was swept from the bridge and sustained a minor injury in the process. The Angle lifeboat was again active off Milford as it was deployed to the rescue of a schooner from which it securely towed back into bay and rescued the 5 men. The Holyhead telegraphs told of a great gale which caused considerable delays to incoming steamers. In Liverpool a strong easterly blew which was accompanied by heavy downpours of sleet and snow. The weather outside the bar was very bad indeed and as a consequence much anxiety was felt for mariners still at sea especially as so many vessels were considerably behind schedule. There were many tales of perilous journeys in the Celtic and Irish Seas with even ocean-going liners being forced to hove to and shelter in the face of the easterly winds. An exciting scene was noted off the Mull of Galloway and the lifeboat was deployed to aid the well-known Swansea barque Castle which was in a perilous position of Pwlldu Bay off the Gower coast. However a steam tug set off before reaching the vessel in the nick of time before it was wrecked. It was found the captain had previously died of fever and had been buried at sea.</p>
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1895	12	British Isles	Bristol Mercury	01/01/1896	<p>A summary of lifeboat services during the year of 1895 which was noted as "remarkable for the lack of stormy weather furing the greater part of the year, but at the same time was marked by a few gales of great force and unusual strength towards the begininnging and close of the year, resulting in considerable destruciton of life and property". The gale of the year was reported to have been on the 2nd and 3rd October when 27 lifeboats had been launched and were "instrumental in saving 54 lives". Throughout the year RNLI lifeboats had been 421 times on service saving 519 lives. Given the number of crew who had deployed to danger it was said it was remarkable only 1 had lost his life and evem then it was not he would not have been sacrificed if "the gallant fellow in his eagerness and anxiety to save the lives of others" had taken the correct precautions for this own safety. However it was noted that the Kingstown lifeboat had recently capsized leading to the deaths of 15 "gallant men". The details of every vessel and life saved were disclosed before the saviour of material assets was also ntoed. Rewards were also granted by the Institution for the saving of 176 lives by means of shore boats. This meant the society had administered 695 rewards n 1895 and 39340 since it's foundation in 1924. However the "cost of maintaining the Institution's fleet of 303 lifeboats in thorough efficiency is increasingly heavy" and the amount recieved in subscriptions was said to be insufficient to meet the current needs. Therefore it was remarked "further help is therefore greatly needed" and a plea for annual subscriptions was issued.</p>
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1895	12	British Isles	Liverpool Mercury	02/01/1896	A summary of the weather of 1895 which was described to be "singularly rich in meteorological interest". The sharp frost and frequent snow showers of January were mentioned along with the prolonged fall of temperature in February. The minimum temperatures at various inland locations throughout the month of February were noted. March brought weather that was "perceptibly milder, the most important feature in the month being the south-westerly gale of unusual violence which swept over the midland and eastern counties on the 24th". The high variability of the weather in May was noted as well as the unsettled summer months which frequently brought thunderstorms and heavy rains in July and August. Very high temperatures on the 6-7th of September were noted which would "have helped to make the fortune of many an English summer". Sharp frosts and snow showers were frequent in the October with "the contrast between the conditions then prevailing and those experienced just one month earlier being one of the sharpest ever observed in these islands". November was "marked by frequent storms of wind and rain, the southwesterly gales of the 5th to 6th, the 10th to 11th, and the 15th to 16th being very severe". One of the most important meteorological events was the gale of the 21st December which "lasted in some places uninterruptedly for four or five days. The actual force of the wind was not excessive but the prolongation of the storm resulted in a very high sea, especially on the east coasts of Ireland and Scotland". Meetings were held by the RNLI over several days in London to discuss the state and actions of the institution
1895	12		Bristol Mercury	11/01/1896	

1896	15-16	1	North-west Britain	Liverpool Mercury	17/01/1896	<p>with several prominent naval officers and aristocrats being present to observe the state of the society. It was first confirmed that £2200 (£300,000) was to be granted in support of widows and dependnets of 15 men who had unhappily perished whilst manning an Irish lifeboat. A gold medal was awarded to the master of the Irish Lights Commissioners' ss Tearaght, a binocular glass given to his son and £2 (£270) given to each of the 8 crew for saving the life of 20 from an ifflated vessel on the 26th December off the Irish coast. Thanks of the institution and medals were given to various other lifeboats for their attempts at assistance off Ireland. Overall £1292 (£170,000) was given to crews of lifeboats around the UK over the past month of December. The achievements of various vessels from throughout the Uk were listed before it wsa announced £11,668 (£1550000) was to be paid to the 303 establishments of the institution and the main donors were listed along with the contribtuion of "Lifeboat Saturday" and "Lifeboat Sunday" collections. It was finally announced two new lifeboats were to be sent ot the Fenit and Point of Ayr stations before proceedings closed after the reports of the Chief Inspector of Lifeboats, Deputy Chief Inspector and Regional Inspectors were read.</p> <p>A brief period of stormy weather was observed in the North-west. A flat was overwhelmed and sunk off Garston and drifted onto the Eastham bank. Despite efforts to get her off she was driven further ashore as the flood tide came in and "the flat quickly filled with water and sank, and the cpatain, George Holden, his father, and a crew of</p>
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two men took to the rigging". After a prolonged period of some hours in this position "their sad plight was seen" by a steamer which rendered assistance to the men and brought them ashore with the older man being exhausted but the rest were "None the worse for their wetting and buffeting". In Liverpool the "seas rushing into the Mersey being exceedingly strong" however very little disturbance to craft was noted. Traffic on the Ship Canal was brought to a standstill due to the high winds. Several schooners were in danger in the Dee where the "sea rose fully 4ft beyond its indicated height". The schooners broke their towing hawser in the storm with the assisting tug helpless to assist them and thus they were blown on a large bank. As there were no lifesaving facilities within reach, the closest being the Point of Ayr, no assistance could be given to the schooners in their perilous position however the tide was fortunately receding and the vessels were left stranded high and dry with no major damage or injury to the crew. Several fishing vessels ran into the Dee for safety and although many had narrow escapes all reached shelter safely.

The monthly meeting of the RNLI was held again in London to discuss the business of the institution over the month of January. The meeting began with the committee expressing "deep regret at the lamented death of his Royal Highness Prince Henry Maurice of Battenberg, K.G," who was the Patron of the Isle of Wight Branch and extended its sympathy to Queen Victoria and his wife Princess Beatrice. Awards and thanks were once more given to the members of the institution who had valiantly saved life

<p>1896 15-16</p>	<p>3</p>	<p>North-west Britain</p>	<p>Liverpool Mercury</p>	<p>17/03/1896</p> <p>throughout the UK which included the donation of a binocular glass to the Captain of a Liverpool tug Kinght of the Cross for rescuing the crew of a barque off Stornoway. Rewards amounting to £461 (£61800) were given to crews of the institution and the seperate achievements of all were reach out. Rewards were alo given to shore crews and payments ammounting to £4400 (£590,000) were ordered to be made to the 303 lifeboat establishments. The main donors were listed including the contributions of various "Lifeboat Sunday" collections. New lifeboats were to be sent to Ayr and Formby and the reports from the various ranks of inspectors were read before proceedings terminated.</p> <p>It was remarked "The weather prevalent in Liverpool and the district at the present time is thoroughly characteristic of the month of March". Wind of "a very severe character" was noted and a "perfect hurricane" blew from the west which was well felt particularly in the elelvated areas of the city where chimney pots and slates fell although no injuries were reported. So powerful was the wind that the tide attanined a height of 21ft which was a full 4ft above the precited height exhibiting a large surge which many came to teh shore of the Mersey to watch. On the Welsh coast a diaster occurred when a vessel was overwhelmed bythe huge waves and it was found impossible to tow the vessel by a local tug and was eventually conveyed to the Mersey were the large amount of damage was relaised. A German vessel ws noted flyng signalsof distress of Great orme's head and several tugs left the Mersey to render her assistance</p>
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1896 11 to 13	4	British Isles	Liverpool Mercury	14/04/1896	<p>although the pilot reached her first and ensured all was secure. On the ship canal the influence of the storm surge was well noted as the river reached a height of 4ft 2 inches above the predicted height of 13ft 10 in and consequently no vessel could leave the canal which was brimming with water to the extent locks were overflowing but fortunately the locks withstood this buffeting. The highest tide for several years was noted at Blackpool as the promenade was inundated and the South Beach was rendered impassable as the low-lying districts were flooded. "Further damage of a serious nature was wrought on the North Shore works. The concrete wall was totally destroyed where the backing had not been put in. Huge sections of 50 tons weight were bodily removed several yards". It was noted the contractor had repeatedly suffered from storm surge damage. At Rhyl the storm surge did great damage to the marine drive and rain fell in torrents on the surrounding mountains and rivers overflowed their banks inundating the countryside. In Anglesey and Carnarvonshire the full force of the gale was felt and although "some doubt existed whether the eisteddfod pavilion at Llandudno would weather the gale, but not a timber was even twisted" and no casualties were reported as most harbours remained crammed full of vessels.</p> <p>A strong gale again caused considerable nuisance off the North-west coast with a new shipping vessel from Southport encountering severe weather during her inaugural passage from Arnside to the port. She was compelled to put into Morecambe owing to the severity of</p>
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1896	8	5	South-west Britian	Bristol Mercury	09/05/1896	<p>the wearther and was later spotted in difficulty off the Blackpool Pier before she becam unmanageable and struck a sandbank. Thanfully the lifeboat went to the assistance of the crew and landed them all safely and the lfieboat men later floated the vessel and took her to St. Annes. The Llandudno lifebaot was also busy at work in Colwyn Bay having observed a vessel in distress. Although the first lifeboat could not launch asshe "got embedded in the sands" another boat was subsequently sent and launched and the two vessels reached the vessel together. The men on the vessel were saved and brought ashroe in front of hundreds of spectators and an individual "provided a conveyance to take the exhausted crew to the hotel, but they first alighted at hs own residence for refreshment". Off the Manx coast severe vessels had a torrid time beign "biffeted about in the channel" with one vessel having to be escorted into the ahrbour at Douglas in a disabled state.</p> <p>A report of the latest reports and proposals concerning the flood prevention schemes at Bristol following the terrible flooding in the winter of 1894 in the ctachment of the River Froom. The meeting started witht eh affirmation that the committtee were happy to accept the flooding of 1894 in Picton street as according to the enigeers reportwas "attributable to the inadequate size of the archved portion of Culters Mills brook at the back of the houses in Shaftesbury avenue and ALbany road ... the tortuous course of the brook preventing the flood waters from escaping freely, so that the accumulation of water occasioned thereby burst the arch at several points". They</p>
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also agreed with the engineer's proposals to remedy this issue by the construction of a relief culvert with the purposes of "carrying the great body of storm waters which flows from the hills of Horfield, Redland, and Cotham directly into the river Froom, leaving the existing course of the brook to receive the altered surface water which now flows into it". The culvert was to direct water to convergence near a railway bridge and the culvert was to be 7 feet high and 6 feet 6 inches wide. The engineer recommended that the existing culvert should be deepened and an invert inserted and the culvert should run for a length of 1330 yards with a total fall of 47 1/2 feet. The "Back Ditch" was also to be deepened by one foot and inverted for a length of 200 feet. The overall purpose of these works will "provide for the escape of the storm waters by a direct instead of a zigzag course, of less length and far better gradient than the present course of the brook, and involve but little permanent interference with private property or boundaries to property". The engineer estimated that the total cost which included compensation and the purchase of private property, the re-rooting of gas and water and the engineering works themselves would reach £21,000 (£280,000). As a result of this the Council could not carry out this work without "further Parliamentary powers being obtained". The committee were also satisfied that the proposed engineering developments would also reduce flood risk in Mina Road by diverting flood water away from the Boiling Wells Stream. It was also proposed another relief culvert was to be constructed taking water

away from the bottleneck under the South Wales union Railway and straight into Botany Bay, this culvert being a length of 1112 yards with a total fall of 19ft and 9 in. In addition to these changes it was also necessary to construct a small catchwater reservoir at the northern end of the culvert in order to control the waters to be discharged by it and it was said "such a reservoir could be so constructed upon the sumpy ground adjacent to the present course of the stream". On a legal front it was stated "it would be desirable in order to deal effectually with the flooding occasions by the boiling Wells streams to acquire with a view to extinguishing any water rights connected therewith the disused mill" however this was deemed unnecessary due to its vacant state. A mill stream was to be filled up and a drainage pipe installed in order to better regulate the fluvial flow and therefore prevent the flooding which had caused trouble in several low lying streets in the past. The total cost of all of these amendments including compensation was estimated to be £25,000 (£3,350,000). The report of a Docks Engineer concerning methods that might be adopted "to deal with flood water in the Floating Harbour at times of high tides, and to prevent flooding of the city by the River From". The key recommendation was the establishment of a pumping station at the Old Junction Lock in the Cumberland Basin "fitted with centrifugal pumps capable of discharging into the tidal river five million cubic feet an hour. the total cost of this installation would be £28,000 although it was pointed out that very little labour would be required to operate this storm surge inundation

device. The report pointed out that dealing with five million cubic feet an hour assuming a maximum discharge of nine million cubic feet into the Floating Harbour by the River From would therefore leave 4 million cubic feet to be dealt with in the way of storage even at times of high tides. It was stated there was "no necessity for a reservoir" even if the River From was discharging its maximal amount of 12 million cubic feet per hour (the maximal contingency discharge estimated by the engineer at full flood). This was stated even though the engineer proposed that another reservoir be constructed by constructing a masonry dam across the From which would divert water into a basin with the total area of 51 acres as at full flood the River was 3 million cubic feet per hour over maximal capacity of 9 million cubic feet. This would cost £45,000 (£600,000). However the committee were of the opinion that the works undertaken in November in 1891 which involved increasing the capacity of the From rendered such work unnecessary. The engineer's report also stated that the River From's channel might be so modified so that its capacity could be increased to 10 million cubic feet an hour which would cost £16,000 (£2,150,000) extra in addition to the already proposed work. When the maintenance of the proposed pumping station was included the Docks Engineer's estimate of £51,000 (£6,800,000) would be required to make these improvements but this cost omitted the construction of another culvert to join two weirs. Overall the committee stated a project of this magnitude and cost would require them to apply to Parliament for powers to make any

1896	19-20	5	British Isles	Liverpool Mercury	21/05/1896	10	channel and catchment ammendments and recruit further funds for the considerable proposed projects. Severe gales hit the UK for a short period resulting in damage and the loss of lives on the Wigtonshire coast ner Port Patrick when a Norwegian vessel foundered and it was feared 10 lives had been lost. Cross channel steamers encountered much difficulty and avessel sank off Bideford and the crew of three had a narrow escaping and drifted in the Bristol Channel for hours. Ferry traffic in the Irish Sea was much disturbed by the gales from the NW. In Liverpool a sudden change in the weather occurred and their were heavy downpours of rain which accompanied the gales. The ferry boats were much interrupted and many vessels were windbound with few progressing out to sea. A collision in the Sloyne resulted in damage being done to one vessel but this was inconsiderable.
1896	9	7	North-west Britain	Liverpool Mercury	10/07/1896		There was heavy rain as well as thunder and lightning throughout the North-west of Britain which caused "much consternation" amongst the inhabitants and visitors of Blackpool. Two men were thrown to the ground by the force of the lightning when it struck a property and did moderate damage to the roofing and windows. Over Rhyl and North Wales as "rain fell in blinding sheets without the slightest cessation" and the streets of the town flooded as drains became choked and water rose to the height of two feet flooding property. "The cellars f several hotels were flooded with five feet of swirling water, and business operations were at a standstill". The encampment of Creewe Engineers was inundated and ahd to be drained by "digging trenches round the tents" and

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10/09/1896

most men had to be billeted at an empty hospital. The streets of Abergele were likewise flooded with "water rushing through the fronts of the houses and coming out at the back, the occupants fruitlessly endeavouring to stem the torrent with brooms". A number of houses were also flooded at St. Asaph. At Southport the storm was also incessant for 3 hours with several major streets being flooded which was remarked as being "a feature of former years". Many individuals recieved a soaking which was provided "much amusement" for those under the verandah. It was noted that such flooding was a surprise as "the storm outlets, constructed some ten years ago, have since usually disposed of surface water so as to prevent flooding". However it was acknowledged that "the state of the tide and the rapidity of the rainfall" did hinder their effectiveness and the rate of rainfall was particularly excessive. The West Lancashire Railway also became flooded with the water at one point reaching the axels of carriages and fog signals were used as warnings although no interuption of traffic occurred. Heavy rainfall around the Bristol area "occasioned some alarm in districts which have in recent times suffered from flooding" especially considering the recent rain which meant the ground was saturated. The suddenness of the te storm "brought a sharp rebuke to city men who had ignored meterological warnings" as the storms cleared the streets and the streets were lined with rivulets which becae water channels that descended down the larger streets. However all traces of the storm dissappeared rapidly after the storms cessation. Despite initial anxiety

<p>1896 24-27</p>	<p>9</p>	<p>Western Britain</p>	<p>Liverpool Mercury</p>	<p>26/09/1894 - 28/09/1896</p>	<p>4 of the public mind due to past events however "happily the mischief was not so bad as the earliest rumours indicated" and there were only minor incidences of inundation in these neighbourhoods although a few houses were inudated. Overall most residents escaped the misdemeours of the flood and although the drains were full "the relief works constructed some time ago were wsufficient to dispose of the increased volume of water, and no cases of homes being flooded are reported". Gales blew over the UK for a week causing many incidents on sea dn land. In Liverpool much difficulty was experinedced in crossing the Mersey and "extreme care" was required when docking although "it is satisfactory to note that no serious mishap has befallen any Liverpool shipping". It was noted that the storm exposure meant that only steamers had been able to ply their trade whilst sail vessels remained windbound. In the Isle of man the gale from he south-west produced a tremendous sea and erractic movements of the barometer were notedalthough no damage ws recorded. A vessel went ashore at Gunard's Head near St Ives having broken it's hawser on tow and all hands were saved by the St. Ives rocket apparatus. A telegram from Lundy stated a vessel had lost both lifeboats and was heading back to port. The Tenby lifeboat was deployed in repsonse to distress signals from two small vessels and brought four men ashore to safety. Another vessels drove ashore on Porthdinllach Beach in Carnarvonshire although the crew of a man and a boy were saved and brought to shore. A vessel also drove ashore at Porthdinllach and two men</p>
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<p>1896 6 to 8 10</p>	<p>British Isles</p> <p>Liverpool Mercury & Bristol Mercury</p> <p>08/10/1896 - 09/10/1896</p>	<p>were saved by the lifeboat crew. Vessels put into Holyhead having sustained much damage with one vessel delivery 2 men straight to hospital due to their moderate injuries sustained.</p> <p>A great gale struck the British Isles causing much havoc around the shores and distress to vessels. A helpless drifting vessel whose tow rope had snapped in a strong WSW 50 miles off Lundy Island was assisted by a Cardiff pilot. The crew of three transferred over to the pilot boat when it was obvious she was going ashore although the Captain remained on her till the last and was "compelled to jump overboard to save his life" and was consequently picked up by the pilot's punt. The men were transferred to the Shipwrecked Mariners Society at Ilfracombe. "Having lost everything they were provided with meals and clothes". High praise was offered to the rescuing pilot captain. An incessant fall of rain over 48 hours resulted in inundation in the Welsh valleys and as a result thousands of acres were underwater and agricultural types were compelled to remove their cattle to the high lands. It also was remarked to have had "an unprecedented effect on the game market" with the prices of basic staples rocketing. A schooner was reported off the North Stack, Holyhead and although she was being looked after by two tugs she suddenly capsized and sank with all hands but one and the lifeboat was too late to render assistance. A schooner also ran ashore off Great Orme's Head and although the lifeboat was summoned it "could not get through the immense breakers" although all were saved by grappling to shore along a line. Llandudno was flooded</p>
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by the storm surge with waves going a quarter of a mile inshore and several houses surrounded by water a depth of 3 feet. A Milford Haven telegram stated a large ship had gone down on Skomer Island and was a total wreck with all hands perishing. The docks and district of Llanelly were inundated and "the greatest distress" was caused as flood waters forced people to take shelter in their upper rooms. Relief parties came in boats to evacuate those in a predicament. Railway traffic was completely paralysed on the GWR as a 1/4 mile of rail had subsided. An infectious disease hospital erected on the marsh was destroyed and hundreds of livestock drowned. The Tenby lifeboat returned to port with the crews of four vessels sheltering the roadstead. Immense damage was done to Tenby Harbour and a 200 feet breach was made in the pier which was estimated at £2000 (£270,000). The lifeboat staging itself was badly damaged and Saundersfoot village was partially underwater. The Tenby lifeboat later landed a crew of another vessels making the total number of lives saved 18 in one day. At Swansea the sea eroded away tons of earth from the foreshore and material in the docks was washed out to sea. A railway bridge was also completely submerged stopping all traffic. At Aberystwyth £1000 (£130,000) was done to the sea wall and many of the coastal properties badly damaged. At Towyn a mile and a half of the Cambrian rail embankment was eroded away by the sea and the sea wall completely destroyed with boats smashed to matchwood and hundreds of sheep on the low lying coastal plains drowned. The damage to the railway in that area was estimated to be £20,000

(£2,700,000). Damage was also done to the coastal railway at Barmouth and Rhyl and damage was done to a large sea wall currently under construction and the incoming sea washed "immense blocks of granite, weighing from 15 cwt to two tons" over the embankment. A large crane was also damaged and water poured through the gaps in the embankment in some cases leaving the rails suspended in mid air as the construction premises were largely destroyed. Men from throughout North Wales had been recruited to construct emergency storm defences and the damage was estimated at thousands of pounds. Very high tides were noted in the Bristol Channel and on the Avon as the water rose "three or four above the mark that would be reached under normal conditions". The damage done was totally unanticipated as the river rose to a higher level than it had done "since the tidal wave of 1883, and overflowing its banks in many parts, inundated hundreds of acres of land and flooded a large number of houses". Three great surge events occurred due to the influence of the hard westerly winds. However it was noted the areas which usually suffered greatly "for once escaped" which was attributed to be due to better hydrological management in the area and only in one street did a gutter overflow and it flooded these houses doing a great deal of damage. At Pill a "striking" scene was observed as "waves rolled over many acres of the grass land" and the "mouth of the Avon seemed broad enough to afford anchorage for a fleet" which was a stark contrast to the "dirty stream" it usually was at low water. Fortunately farmers in the region were

wary of the forecast winds and high tide and it's potential combined effects so removed their livestock to higher ground which was a wise decision seeing as some of the land was flooded to a depth of several feet. Inhabitants at Shirehampton had to barricade doors as the floodwaters ran several hundred yards inland up to a railway station. Unfortunately the a large number of houses on the marine parade were inundated in the lower lying Pill as roads were rendered impassable as they were inundated up to 2-3 feet. When the tide ebbed "it left a thick deposit of slimy mud in addition to making the houses damp and unhealthy" and this situation was only worsened by the repetitive flooding which affected an estimated 50 properties. In Bedminster it was remarked "the gale of wind blowing up the Channel conducted in a great measure to the rise, whilst the extraordinary amount of fresh water which poured down the river Avon and the little streams which run into it, coupled with the high tide, caused the water to rise to a height which has not been known since the memorable tidal wave which swept up the Severn and Avon and caused such havoc some years ago". Lock gates were inundated and bridges covered so great was the tide. Property was flooded, walls undermined and paving ripped up. St. Philip's Marsh and Arno's Vale were also widely inundated with all the land around the Great Western main line being "converted into a veritable lake" and causeways were submerged and 60-70 houses inundated. The damage was so extensive that an Emergency Relief Committee had been formed on the 8th to assess the dire needs of the inhabitants. The initiator of

the fund, a local reverend, wrote to the Mercury stating "The distress amongst the people living in St. Philip's Marsh has in very many instances been suddenly and seriously increased by the floods". He spoke of the damage and exclaimed the scene was "pitiable in the extreme" before it was mentioned fuel and provisions were being supplied to the affected. The vicar stated he would be very grateful for any assistance in the provision of such provisions. It was noted that at least this time no fatalities had occurred as the storm surge of 1883 had resulted in at least 50 deaths at St. Phillip's marsh alone. The Avonmouth railway was considerably damaged and inundated to the extent trains could not run to the port for prolonged periods and travellers much delayed. At Wester Super-Mare 70 bathing machines destroyed but no damage was done to property owing to the new sea wall which had been constructed. Ferry traffic on the Mersey was greatly delayed and traffic on the Manchester Ship Canal suspended. "Violent outbursts of wind and rain have raged over the city" and "boisterous rain squalls" fell making all travel in the city streets rather difficult. The height of the tide was evident by the fact the floating bridge of the landing stage was level with the pierhead and ferries still ran but were considerably retarded by the sea state and high winds. On the Cheshire side of the Estuary the full force of the gale and shops on the promenade were flooded by the storm surge which overflowed the banks at many places throughout the estuary doing damage to the coastal defence and roads. A lifeboat rescue was affected at Ramsey where "the sea ran

the height of the houses on the promenade" and destroyed much of the coastal infrastructure and completely wrecked several houses and shops with owners making desperate attempts to save goods. The Ramsey lifeboat saved 13 men off a distressed vessel and made it back into port with difficulty. The exhausted men and their rescuers were greeted by great crowds and the "crew seemed greatly delighted" by such a warm welcome. In Douglas the promenade was damaged and a ketch was driven upon the Scarlett rocks at Castletown with the crew just saving themselves. Notable events also occurred at Blackpool where tremendous waves and the tidal overflow did great damage to the coastal thoroughfares and properties with the promenade being greatly damaged and householders imprisoned. A sea wall burst at Lytham on the Ribble and the "water flowed like a tidal wave upon the Ribble Steam Laundry" with the women in there being saved from drowning with the greatest of difficulty. A vessel was wrecked on the coast but all crew were fortunately saved by a nearby fishing smack. The shipbuilding works were greatly damaged and the hulking was carried away near Fairhaven and the golf clubhouse damaged. Traffic was also stopped on the Furness railway as "the high tide swept over the embankment, washing hundreds of tons of ballast away" and all railway traffic was severely delayed. Such a happening also occurred in West Cumberland and Whitehaven with the towns being much flooded by the deluge of heavy rain and the road took on the appearance of a great river in high flood with much sediment being deposited as sewers

1896	5,6,8	9		Bristol Mercury	10/10/1896	<p>were overwhelmed. In combination with this the storm sureg flooded the low lying coastal areas and sea walls were greatly damaged severly retarding all communication. at Carnarvon the meeting of the Seiont River at full flood and the tidalsurge on teh Menai Straits caused the slate quays to become completely submerged. The UnionIronworks suspended all works and water traffic was cosniderably delayed.</p> <p>A meeting of the RNLI was reported with the heorics of it's crews and donations to the society being the main source of discussion. The thanks of the institution inscribed on vellum and framed were awarded to a captain for a lifesaving rescue in a shoreboat off Hoylake in a strong NW gale and his crew of 5 were granted £1 10s (£200) for their efforts. Rewards amounting to £684 (£92,000) were granted to the crews of the lifeboats over the past month and all the endeavours of the nations lifeboats were noted. Payments amounting to £3587 (£481,000) were made on the 298 lifeboat establishments and the main donors noted. After reports fromt he isnpectors the proceedings terminated.</p>
1896		12	British Isles	Liverpool Mercury	01/01/1897	<p>A summary of the lifeboat services in 1896 commenced with the line "the last three years have been somewha remarkable for the absence of any long continuance of stormy weather, and the year 1896, taking it altogether, proved to be one of the finest and quietest years expereinced during the last decade". It was reamrked that whilst whole weeks passed withoutthe launching of a single lifeboat their services were required in the closing and starting months of the year. When required however</p>

"there was no timid hanging back, and many a shipwrecked mariner was gallantly rescued by them". The heaviest gale of the year of the 25th September resulted in 25 boats launched and 24 lives saved plus the landing of 8 other people from a precarious position. During the 2nd heaviest gale of the 8th October 17 lifeboats were launched and 24 lives saved with 39 rescued from a dangerous position. It was remarked an enormous amount of damage had been done on the west coast to the lifeboat houses and slipways during both gales and the high tide produced by the storm surge "was alleged to have been the highest, in many places, on record". Only one lifeboatman lost his life on service during the year and the death was not said to be the fault of the lifeboat. The exact contribution of all active lifeboats was detailed along with the number of fishing vessels aided in various locations. In all 312 fishermen's lives were saved and 20 vessels were rescued from a "total or partial loss". Altogether the boats were launched 341 times and crews assembled on 49 other times. Rewards were granted for the saving of 149 lives by the means of shoreboats which took the total number of lives saved to 461 in 1896 and 39815 since 1824. It was noted the cost of maintaining the fleet of 298 lifeboats "in through efficiency is increasingly heavy" and the current income was insufficient to meet the current demand for resources. Therefore further financial help was greatly needed and it was stated: "annual subscriptions and donation will be gladly received by the secretary".

1897	8 to 9	1	North-west Britain	Liverpool Mercury	11/01/1897		A fierce gale from the east and snowstorm hit the North-west causing notable delays to shipping in the Irish Sea as heavy seas repeatedly swept over the vessels and many vessels sought the refuge of Holyhead harbour including two foregin men-of-war. Of the Manx coast the gales were "accompanied by blinding showers of sleet" and the sea of the east of the Island was "abnormally rough".
1896	2 to 4	3	British Isles	Western Mail	04/03/1897 - 06/03/1897	31	A great gale bringing with it torrential rain broke over the UK causing damage and destruction on the land and was particularly severe in the Bristol and Irish Channels. In Cardiff snow and rain fell and several trees were blown down and windows smashed in. A punt was blown out to sea with four men who were fortunately rescued by schooner and although "they were literally drenched to the skin, and were suffering from intense cold" they were otherwise uninjured. A church under construction was damaged at Penarth with it's pinnacles blown down. A chimney fell through a roof which collapsed on the children of a man and they were seriously injured and were attending to. This occurred in other locations although no one was injured. A cutter capsized in the docks and several of the men had narrow escapes. A Brixham trawler was also ran down but the crew were rescued by the vessel which damaged them. A Swansea vessel put into Cardiff having had it's decks swept and being badly damaged by mountainous seas and the strong gale in the Bristol Channel. During the "blizzard" a vessel ran ashore on a slag bank and although the crew were saved the vessel was wrecked as assistance could not be rendered in the heavy snowstorm. A steamer also landed

with 3 lost overboard. Particularly great damage was done at Barry with houses unroofed and other property stripped bare by the ferocious winds although the docks sustained little damage. The lifeboat crew had attempted to render assistance but found a tug had already been deployed so thus returned. At Llanelly the new steelworks suffered greatly and the work of the last three months was completely undone by the NW gale despite the best attempts of workmen to apply guy ropes to secure the building. However due to the inevitability of collapse as the hurricane set in the men had time to retreat to a great distance. "Altogether about 250 tons of material fell down, and it is feared that a great part of this is now useless" with huge cast iron columns being felled and destroyed. It was remarked the "opening of the steelworks will now have to be indefinitely postponed, whilst the loss to the contractors must be very serious". The "fearful gale" caused much damage at Porthcawl with slates falling and windows being smashed in. A ketch came ashore although the crew were "gallantly rescued" by way of the coastguard using the rocket propelled lifesaving apparatus. It was remarked "the rescue was a plucky one, and great praise is due to all concerned" which included the actions of a police officer. The shipwrecked men were in a "sorry plight" and they were escorted to shelter by the Shipwrecked Mariners' Society agent. The lifeboat also had a torrid time as they were out for 5 hours and "every man was drenched to the skin and numbed with the cold", two men were washed overboard but saved by other vessels and by means of a lifeline. A

later interview with the captain disclosed his trials and tribulations and that it was "Not insured for a penny". The storm was severely felt throughout Pembrokeshire and Cardiganshire with many properties being unroofed and substantially damaged but no lives were reported lost. Great damage was done on the Manchester to Milford Railway with many telegraph wires being blown over it and halting communication and traffic especially on the stretch that runs "along the bleak Caron Bog". A distressed vessel was fortunately rendered assistance by the coastguard and lifeboat in a strong WNW gale. An accident was also reported at Newport when a woman was blown over by the gale and received a nasty wound to her right eye whilst a tugboat was driven into shallows and lost its propeller. Eight men were also injured on a four-masted ship in the Channel although none were said to be life-threatening. Three vessels were also driven ashore on the Somerset coast and the Burnham lifeboat put out to assist a large foreign vessel on the tail of the Gore Sands. An unfortunately fatal accident occurred at Bridwater when a chimney fell through the roof of the Somerset Trading Company and killed a man. At Ilfracombe four boats were in distress and consequently two lifeboats from Appledore and Brauton were delayed along with the Croyde rocket apparatus. Thankfully the lifeboats succeeded in rescuing all in distress. Two men were however unfortunately gravely injured when trying to secure another vessel a drift and one family had a narrow escape as they left a room just before a chimney fell. As a result a Liverpool ship which

1897	17	3	South Wales	Western Mail	18/03/1897
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experienced torrid condition off the Scilly when "a tidal wave swept clean over" the vessel causing some considerable destruction and a man was unfortunately lost overboard. A "terrible shipping disaster" occurred off the Newquay headland when a large ocean-bound steamer foundered. She had flown flags of distress before the lifeboat was promptly dispatched with "commendable promptitude" however the lifeboat faced "a terrible battle with the waves" and due to the danger of being wrecked had to abandon her rescue mission and all ashore were helpless to render any aid and the vessel foundered with the loss of 25 lives. Distress lights were also seen from a Newquay vessel which was also unreachably by lifeboat owing to the ferocity of the waves and she too foundered taking with her the lives of her 3 crew. Two vessels had to put back to Newport having been severely damaged in the gales in the Bristol Channel. A vessel was reported off Fishguard although no one was aboard at the time. A German vessel arrived off Falmouth reporting that four of her boats had been lost and two men washed aboard. A severe thunderstorm struck the South of Wales and it was remarked "it came on with much suddenness, and subsided almost as abruptly". However whilst it raged it was "remarkably violent and the flashes of lightning phenomenally vivid" whilst heavy rain also fell and a squall was felt. At Neath the circus marquee was blown down however no one was injured. At Newport the south-westerly increased to a "almost hurricane force" and damage was done to property at Cardiff it drove a

1897	26-27	3	South-west Britian	Western Mail	29/03/1897	<p>German barque against a swing bridge in the Cardiff Docks doing the bridge much damage.</p> <p>As a result of a severe gale in the Bristol Channel no vessel left the Cardiff Docks for two days and one collision occurred in the Penarth Roads but no serious damage was done. A vessel was wrecked at Porthcawl but it was later brought into dock and a ship also went adrift in Swansea dock doing herself and another vessel in the Dock damage.</p>
1897	15-16	6	British Isles	Western Mail & Liverpool Mercury	17/06/1897	<p>A violent gale struck the British Isles with "piercingly sharp winds" hitting the western coast and causing much disruption throughout. The full force of the storm was felt by a schooner which was wrecked on Hoylebank but thankfully the crew were saved by the New Brighton steam lifeboat. Great scenes were noted at Blackpool as windows were blown in on a wide scale and Nelson's old flagship the Foudroyant which had been anchored off the port as part of a future exhibition, foundered in shallow water and received considerable damage as she capsized and subsequently wrecked. It was noted she had been on active service in from 1798 to 1812 and the present owner had paid £5000 (£650,000) to bring her back to England from Germany. She had attracted widespread attention wherever she went. The lifeboat fortunately rescued the crew of 28 men and boys who were later taken to the Wellington Hotel without injured. This was the 3rd lifesaving operation the vessel had carried out and she was remarked to have "behaved herself admirably throughout". A lifeboat rescue was also enacted at Fleetwood saving 18 lives from three vessels whilst a</p>

steamtug saved 3 lives from another vessel. This gallant rescue work was watched by thousands from the shore. Damage was also noted at Morecambe where the storm surge conditions brought waves dashing over the promenade which was impassable and several small vessels were smashed into matchwood as rain fell heavily. "The gale raged in the Solway" doing a great deal of damage as Whitehaven "presented a remarkable sight, the waves washing over the piers, and the surf completely hiding them from view at times". A schooner in distress was spotted and before long the vessel was capsized and the crew left clinging to the rigging however the rocket brigade quickly "established communication with the vessel, and her crew of three men were brought ashore in the breeches buoy" although the vessel was completely wrecked. The gale was also severely felt along the North Wales coast and a vessel was blown ashore off Rhyl and "a regular sandstorm raged" off the Promenade. Around Glasgow heavy rains resulted in evere flooding in the suburbs and railways were completely blocked. Many livestock in Ayrshire were varried out to sea and drowned by the torrents. At Norbreck a schooner was driven ashore by the fierce westerly gale and although the "men gave up all hopes of surviving" they were fortunately rescued by three men who waded out at great personal risk and rescued the crew by means of ropes. Off the Manx coast a "tremendous sea was noed" especially off Peell and many vessels ran to Port Erin habroure whilst smaller craft dragged anchors and went ashore. The lifeboat was deployed to assist a fishing nobbie in distress and all four

1897	28	6	North-west Britain	Liverpool Mercury	30/06/1897	<p>aboard were subsequently landed. A rescue was also effected by a chemist in Kinrade and the rocket brigade also rescued 14 fisherman. The Ramsey lifeboat also rescued the crews of two vessels in distress. The Man fishing fleet suffered great damage as the "gale sprung up with such suddenness and violence that the boats were compelled to leave the nets and run for shelter" and thus the damage was predicted to be thousands of pounds. Much damage was done to buildings in exposed positions. A disaster occurred off Belfast where several vessels were driven ashore and foundered and one ship was lost with all hands off Blackhead as she was noted by other vessels to suddenly disappear and vanish beneath the waves without trace of the crew. The crew of a large barque in danger were taken off by the Bangor lifeboat and a 3 fine yachts foundered. An exciting rescue was also enacted off Aberystwyth when the Aberdovey lifeboat rescued a vessel off a bar and a vessel was in distress of Lundy but it was fortunately rendered assistance by a tug before any damage occurred.</p> <p>A great thunderstorm struck the North-west with torrential rain doing considerable damage to crops around Liverpool and choking cellars. Railway traffic was also delayed due to a great rush of water over a railway line. Several houses had their lower floors inundated to the extent furniture was floating and many basements acquired several feet of floodwater however no considerable damage to property or loss of life was reported.</p>
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1897	5 to 6	8	North-west Britain	Liverpool Mercury	06/08/1897 - 07/08/1897	<p>"For several weeks past the heat in Liverpool has been extremely intense, the glass on some days registering 100 degrees in the sun. Yesterday, however, a sudden change occurred" as a great thunderstorm bringing with it great volumes of rain to the North-west. The noises of the thunder "resembled the roar of artillery" and vivid lashes of forked lightning and hail were noted causing pedestrians to flee to shelter in terror and horses to behave erratically. Many streets were flooded and many cellars were filled with water as drains became choked whilst telegraphic wires were badly damaged. A fatality occurred in the docks when men attending to the steel hull of a vessel were struck with 3 revieing sevre shocks and one dying from the conveyance of current on impact. Another man on a cart was struck and returned home whilst St. George's Hall was also struck causing an electric chandelier to become illuminated which caused great excitement amongst guests. In Southport and Ormskirk "copious rain fell" and lightning damaged the Portland Hotel and killed livestock. Likewise at Preston a horse pulling a cart was struck by lightning and killed.</p> <p>A fierce gale raged throughout the UK doing great damage. In Liverpool the wind was accompanied by the fall of large hailstones which "converted thoroughfares into a very disagreeable state" and hundreds of chimney pots and slates littered the streets. A crane was felled and several had lucky escapes but thankfully all escaped injury in Liverpool. The full force of the gale was felt and the majority of vessels remained windbound and some small craft and yachts sunk at their moorings. On the New</p>
1897	28 - 30	11	British Isles	Liverpool Mercury	29/11/1897 - 03/12/1897	

Brighton railway lines "the oscillation of the carriages when approaching the Dock Station caused a good deal of anxiety" and traffic was much delayed. Similar conditions were felt in Birkenhead and many glass lamps were blown out by the wind "necessitating the constant vigilance of the lamplighters" whilst the Woodside boat experienced heavy seas but nevertheless continued their journeys. The New Brighton Lifeboat was also deployed in response to a foundering Norwegian vessel and all were taken to safety but the vessel was wrecked. At West Kirby the "string of stakes which has been put into the beach at West Kirby to mark the course which the new promenade is to take" were nearly all washed away and the workers huts were all but destroyed. Fishing boats were badly damaged at Parkgate as "grand waves, lashed into white lines of foam by the wind, and overtopping the quays, swept over the Parade" and many fishermen were seen hurrying to save their vessels. A fisherman had a lucky escape as he missed his boat whilst jumping from the wall and several suffered major property losses. A schooner was also ashore on the banks of the Dee on Holywell Bank but the crew were fortunately rescued by the Hilbre Island lifeboat and the crew were landed at Heswall. Moreton and Meols were also flooded by the heavy rain and houses built on highland appeared to be on an island around expansive lakes. Rail passengers were considerably inconvenienced when leaving Moreton station. It was remarked flooding of this nature had not been experienced for more than 30 years. A wreck was also observed off Formby and although the crew mustering signals were set off they

were not heard or acknowledged by the Formby lifeboat crew during the gales and rains which fell. Consequently the lifeboat was very late to deploy and the ship was high and dry by the time the lifeboat arrived, the tide having receded. An interview with the captain further ascertained that one crew had drowned being swept overboard and no one on board had slept for 4 days of drifting in the Irish Sea. At Southport there was some damage to the West Lancashire Yacht Club but little other damage was noted. The Fleetwood lifeboat rescued 19 hands on a stricken vessel which broke from her anchorage which was thought to become "a total wreck on Pilling Sands" and all "suffered terribly from the long exposure". A Nova Scotia vessel also ran ashore off Fleetwood and remained in a dangerous position but its crew were saved. At Holyhead the harbour was full of shipping taking refuge and a vessel in danger of going onto the rocks had to be rescued by the lifeboat and tugs with all 16 crew being safely brought to shore without major injury. The storm surge also washed away 300 yards of embankment owned by the Marsh trustees. The storm of hail and rain also resulted in great flooding at RHyl whilst the sand blew large sand drifts across the promenade and into houses. Numerous trees were also felled and windows blown in. In Carnarvon the gale occasioned considerable damage to property. It was remarked "many miles of lowland present the appearance of freshwater lakes" and damage to agriculture had been considerable. The Ramsey lifeboat was also active as the wind "blew with hurricane force" on the Manx coast after

a schooner displayed a distress flare and she was promptly rendered assistance by the lifeboat. The lifeboat was once again busy at Ramsey with the crew responding to signals of distress in the bay and saving the lives of one dog and five men whose schooner was in peril and later became a total wreck. The crew were landed "exhausted amid a shower of rain, wind, thunder, and lightning". The fishing "fraternity at Peel" were said to have sustained great damage with many of their boats being destroyed. It was remarked it would take hundreds of pounds to cover the fishermen's loss. The sea wall had been badly damaged and it was estimated it would cost at least £2000 (£260,000) to repair the promenade and sea wall. At Blackpool the already wrecked Foudroyant was completely broken up by the storm surge as the "bulwarks and bows were soon wrenched off, and after a final heave everything that was above water, with the exception of the poop, was dashed to pieces". This added to the dismay of the new owner, a Birkenhead gentleman "whose intention was not to break the vessel up, but to make her one of the town's side-shows". "Thousands thronged the north promenades during the afternoon, and the wind was so strong that many were thrown down and injured". The storm surge had done significant damage along the north promenades. In the Flyde district the Ribble, Wyre and Brock were all swollen by rain and flooded "great tracts of the surrounding country". As a result several roads were inundated and the Ribble flowed against the houses in the lower lying districts of Preston. All traffic on the ship canal came to a standstill and therefore only

1897	6	12	Liverpool Mercury	07/12/1897	<p>one vessel reached Manchester. A vessel was wrecked off Portreath in a strong NW gale and it was feared a vessel and all 12 hands had been lost. Although the "coastguards kept a sharp look-out" they saw no signs of distress and bodies were discovered the next day. A schooner was also ashore off Gurnards Head although all men were saved by means of the rocket saving apparatus. A collision also occurred in the Bristol Channel and one vessel was lost but the crew, after many hours floating helplessly in their punt, were picked up and taken to Algiers.</p> <p>The second ever meeting of the RNLI Liverpool ladies' auxiliary was documented with the primary focus being placed on the great satisfaction the group had sustained when they had heard that the "Parliamentary Select Committee was to inquire into the charges and complaints made from time to time in the papers against the general and financial management of the Lifeboat Institution" had been found to "absolutely unfounded, and had been withdrawn by the author". Thanks were given to all present and it was said that overall £489 7s (£64,000) had been received in donations and subscriptions during the year which was slightly down on £530 1 (£69,000) in 1896. However a cheque was handed to them by a representative of the local RNLI branch who "in acknowledging the contribution he spoke of the great need there was at the present time for increased support". Officers of the committee were then appointed. The lady Mayoress pointed out "the great advantage which an efficient lifeboat service was to a port like Liverpool, and expressing hope that all the ladies would</p>
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1897	12	British Isles	Bristol Mercury	01/01/1898 be present at the interesting function at the Town Hall on Wednesday, when the gift of the new steam lifeboat, named The Lueen, would be formally handed over to the local branch of the society by Lord Charles Beresford". The annual review of the lifeboat services of the RNLI for 1897 began "although the past year cannot be said to have been so remarkably free from continued stormy weather as its predecessor, it was by no means a tempestuous one". Indeed it was remarked no great gale could be considered as "out of the common" and lifeboat launches were "evenly distributed throughout the year". The heaviest gales were noted to have occurred on the 2nd and 3rd March and the 28th and 29th of November. In the March storm 19 lifeboats had been launched and 38 lives were saved and 10 rescued from a perilous position whilst in November 29 lifeboats were launched and 108 lives saved around the UK. The month of June was noted to have been the most demanding June in the organisations history as the lifeboats had been launched 31 times and 85 lives saved. Overall 534 lives were saved along with valuable property and 30 vessels. The great assistance given to fishing boats in returning to harbour was also noted as these escorts did not show in the statistics. Rewards were also granted for the saving of 125 lives by shore boats and other means bring the total number of lives saved which the society granted requests for the 659 in 1897 and 40474 since 1823. It was exclaimed "The cost of maintaining the institution's fleet of 295 lifeboats in thorough efficiency is increasingly heavy, and the amount received in annual subscriptions
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<p>1898 1 to 2</p>	<p>2</p>	<p>British Isles</p>	<p>Bristol Mercury</p>	<p>03/02/1898 - 04/02/1898</p>	<p>and accurign from assured income is insufficient for the purpose". Therefore a plea for financial help was once again issued.</p> <p>A "terrible storm" bringing with it a severe gale raged throughout and did considerable damage, with the most notable event being the burning of the Little Crosby Lighthouse". The force of the wind was such it blew the lighthouse glass out and caused the lamps to explode which in turn set fire to the woodwork and the burning oil ran down several floors igniting them each in turn.</p> <p>Despite the best efforts of a policeman to search the adjoining house no signs of life could be seen and the wind soon demolished the now hollow lighthouse. After the had dwindled the "fireman came upon some calcined bones" which were removed and it was presumed that 3 had died along with the dog. Thousands ventured north out of Liverpool the day after to witness the destruction and Dock Board officials had to prevent them from going too close and "the ladies broke down at the sight of the remains". An inquest was to held the following Saturday and a considerable amount of human remains and property was removed. Off Greenock terrible gale blew and a number of yachts were sunk in Gourock Bay and a building used as a contractor's quarter was blown down in Paisley with one woman being seriously injured. At Helensborough roofs were striped and street lamps wrecked and the full force of the gale was felt by steamers in the Irish Sea that "were swept from stem to stern". A vessel outbound from the Dee lost a young seaman overboard and her crew constantly thought she was about</p>
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1898	21-22	2	South-west Britain	Bristol Mercury	23/02/1898 - 26/02/1898	<p>to founder. A ketch went ashore eastward of Neath bar having parted from her hawser and the Mumbles lifeboat "Wolverhampton" proceeded to rescue the crew with great difficulty although the vessel was condemned as a wreck. The RNLI lifeboat put off from Campbeltown to rescue the crew of four from their disabled fishing boat in an operation that lasted 18 hours.</p> <p>Severe gales and snowstorms were reported in the South-west with snow falling for 40 hours in certain places around Exeter. The Great Western train was delayed at Bridgewater due to snow on the line and a snow plough had to be fitted. There was also a collision in which a train ran into another from behind damaging carriages and injuring horses and two passengers, the reason for this was supposed to be that the signals had been disabled by the snow. Telegraphic communication was severely disrupted across the whole district causing much disruption.</p>
1898	1 to 2	11	British Isles	Bristol Mercury & Western Mail	03/11/1898	<p>A great fall of rain and severe gales struck the British Isles with several areas being widely inundated. In Glasgow there was widespread inundation as properties in low-lying districts were inundated with great loss to their occupiers but none drowned. In Dumfrireshire the River Annan "overflowed to such an extent that acres of country were submerged to a depth of several feet" and a bridge being Maffat and Beattock was undermined leaving the rails suspended in the air just minutes after a train had crossed. A strong south-westerly drove a schooner on to bank in the Mersey where it capsized but all were rescued by the Point of Ayr lifeboat. The force of the gale was such</p>

1898	22-24	11	British Isles	Bristol Mercury & Western Mail	24/11/1898 - 26/11/1898	<p>in the Isle of Man that the inhabitants were "afraid to venture in the streets". In South Wales the valleys were widely inundated by the torrential rain and many livestock were carried away by the overflowing Taff. Properties were widely flooded and produce damaged as the rivers burst their banks and brooks ran down roads and steets of the market towns and a tramcar was observed in a foot of water. A landslip also occurred in the Rhondda with "a huge mass of debris" estimated to be about 50 tons covering a road and making it impassable.</p> <p>A great snowstorm and gale struck the UK causing much consternation throughout the kingdom. A workmen's train form Lytham to Blackppol was halted for 5 hours due to accumulation of snow and a party of moruner's who were scheduled to attend a Lord's funeral were detained and thus couldn't attend. It was reamrked "fleetwood was unapproachable ... by any means" with the railways blocked and trains "embedded in snow" and the roads and trams were likewise unable tomove. On the Isle of Man the RNLI at Ramsey were called out 3 times during the morning of the 22nd and succeeded in rescuing 14 men as they "encountered terrific seas" and the vessel recieved moderate damage. A Norwegian barque put into Plymouth Sound statng that they had encountered terrific weather in the Celtic Sea and on sailor fell from the rigging and recieved fatal injuries. There was much anxiety that the River Avon was on the brink of flooded due to the fact "over two inches of rain had fallen during the 48 hours". The river had been progressively rising since the 22nd with a surface water rise of 3 feet from the levels on</p>
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<p>1898 28 to 2</p>	<p>1 British Isles Bristol Mercury</p>	<p>the 21st according to the new gagauges fixed by the "river Pollution and Floods Prevenetion Committee". The newly installed telegraph warning system from "persons at different points of the watershed" had indiciated a great ris ein the upper course and a suveyor predicted a further rise of four feet which would mean "the flooding of cellars and many low-lying apartments". Due to this the chief constable had been communicated with and warnings had subsequently been issued to various low-lying apartments. Flooding had already begun at Chippenham and the river was much swollen in general. Flooding was also noted over low-lyin areas in West Somerset with some roads several feet under water which much delayed travel.</p> <p>4 A great gale from the east hit the British Isles and although the effects were most severely felt on the East coast signalsof distress were noted in Carmarthen Bay and the Burryport lifeboat consequentely deployed but deposite the fact "the crew rowed manfully in heavy seas for several hours" they returned having seen no trace of the vessel and it was feared she had foundered in deep water. The river Usk overflowed its banks near Avergavenny and considerably interrupted traffic whilst the intplate works was stopped at Abercarn. At Portishead the "furious gale" stripped the roofs off two houses. In Helensburgh the storm surge inundated the houses on the sa front and made them impassable whilst at Campbeltown a schooner drove ashore but her crew were fortunately rescued by the lifeboat. The Ramsey lifeboat was also launched two times and saved the crews of three</p>
	<p>30/12/1898 - 03/01/1899</p>	

1899 12 to 17

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British Isles

Bristol
Mercury &
Western
Mail

13/01/1899 -
18/01/1899

vessels in distress. Two schooners foundered off the Antrim coast but their signals of distress were responded to by the Carrickfergus lifeboat that rescued all of them. At Plymouth many vessels but into the Sound in a damaged state whilst this was also the case in Falmouth where a vessel came in having sustained a fatality as a wave washed along the deck of a schooner and broke the neck of a young sailor. At Blackpool it was remarked the weather "during the holidays has been very much unpropitious" as the town was visited by a terrific hurricane which injured many as it blew them off their feet. A large amount of sand was deposited inland and it was "swept in blinding clouds" over the south shore delaying the railway service as it accumulated. In Holyhead a "fearful north-westerly gale" raged and several vessels were noted in precarious positions and the steam lifeboat rendered assistance to many vessels amounting to 15 men rescued overall. Several vessels ran ashore along the coast and a large steamer was observed drifting in the channel.

"The terrific force of the wind and the fierceness with which it blew the rain" made it difficult for pedestrians to make progress against the violent westerly gales which blew and caused much consternation. In Bristol many narrow escapes from falling chimneys pots and slates were had and several properties were damaged. Communication via telephone and telegraph was delayed due to the felling of the poles which caused much interruption in the Corn Trade. An "extraordinary tide" was created by the winds in the Cumberland Basin with

the incoming tide reaching a height of 36ft some 2ft 9in above the predicted high tide of 33ft 3in on the morning of the 12th whilst a storm surge of 2ft 6 in was noted in the morning. As a result the shoreside quays were covered, delaying traffic and "scarcely an vessels came up the river" although no casualties were reported. Ashore many roofs were substantially damaged and trees were widely uprooted in rural areas whilst much damage was done to glass and livestock was also killed. Two men had a very narrow escape at Bath having nearly been struck by the iron beams once supporting a roof whilst another escape was had near St. Paul's Church. Weston-Super-Mare felt the full force of the W to WNW gales and heavy downpours although it was remarked that with the spring tide at it's height it was a "great wonder is that such a violent storm has left but such small evidence". However the roads on the front were impassable being flooded with by the surge and those out spectating were suitably drenched. At knightstone the force of the waves demolished the engine house in connection with the baths and many small vessels sank at their moorings and one was driven ashore. Moderate damage to property was noted elsewhere and a house under construction had it's roof blown off but destruction was otherwise minimal. At Exmouth a trawler was driven on to the Porte sands and was totally wrecked. At Ilfarcomebe the houses on the quay and promenade had to be barricaded in order to keep the sea out which "encroached violently" with many windows being broken by the waves. Three men were also seriously injured when scaffolding at Mount Gould blew

down and were removed to hospital for treatment. At Exeter much damage was done to property and a church clock was destroyed and a girl was injured by a falling chimney. The tide was also exceptionally high on the North Wales coast breaking high onto the shore whilst in "the Conway estuary, it presented a glorious sight of multitudes of tumbling billows sparkling in the sun". The London and North-Western Railway was also submerged and "low-lying littoral was extensively flooded". A furious storm also raged on the Blackpool coast with the storm surge waves flowing in "great billows over the promenade" doing much damage to the asphalt and damaging the supports for the new overhead tram cables. The roof of the Blackpool tower was also damaged and several women were blown down in the streets. Very serious damage was done to the North Shore cliffs and the Glynn estate. A boatman on the Neath canal also fell in and drowned however overall it was remarked "the number of fatal accidents, considering the force of the wind, is small, a fact partly owing, perhaps, to the announcement made in the press a few days ago that a storm was travelling across the Atlantic which would eventually spend itself on the British coast". A similar canal accident occurred at Llandaff but the man was fortunately saved by two gallant youths. It was said it was a "miraculous escape from death, and the bravery of the young Fry and Day deserves ever praise". At Newport moderate damage was done to property. Several minor accidents occurred in the Cardiff docks and the Penarth lifeboat was deployed to assist a vessel in distress but the

conditions were such it could not reach it however the vessel got to Cardiff in safety. A sailor was also blown from the yard of a ship onto a quay and was "fearfully injured". A steamer ran ashore and Llanelly "was the scene of an exciting event" as a gig was carrying employees of the Harbour Commissioners was driven onshore on the Gower coast. One of the hands on a Cardiff vessel had a narrow escape from being washed overboard. At Pembroke Dockyard the roof was blown off the Government saw-mills and the dome of the No. 1 building slip was carried away whilst the steam ferry between Pembroke Dock and New Milford was suspended. A cutter was wrecked off Port Talbot resulting in the death of two Newport pilots on the pier despite the best efforts of the harbour master. A crane also fell into the channel which caused much consternation. The Porthcawl lighthouse was partially destroyed and the lifeboat launching facilities also suffered greatly as the staging of the breakwater was broken "into matchwood" whilst the light and glass of the lighthouse was completely destroyed. The storm surge removed "boulders, weighing tons" from the shore and a coastal road was broken up. At Llanelly a portion of the roof of a new enamelling work was carried away and a man sustained serious injuries when struck on the head by a falling roof of a rivetting shop. A steamer was also ashore off Porthreath and although the lifeboat and the coastguard both offered assistance the crew refused any assistance and all walked ashore at low water. At Aberystwyth the heavy seas did great damage to the jetties and the promenade was inundated. The "most

remarkable fatality as yet known occurred in North Wales, At Penmaenmawr, where a London and North-Western Railway goods train fell over an undermined embankment into the sea, both the driver and stoker being drowned". The storm waves had repeatedly been driven into the embankment with terrific force although despite the observations of attendants all appeared to be structurally sound. However it was remarked the "unusually high tide must have exerted a terrible pressure on the whole sea wall, and with disastrous and fatal effect". The erosion left a " yawning chasm" under the lines and the train constantly careered off although the tow breakmen saved themselves. Fortunately news was conveyed to Bangor quickly enough to prevent further traffic running along the line and all passengers, mails and goods had to be transferred by carriage and consequently the roads were swarming with many a vehicle. The scene of the disaster was rather spectacular with the waves dashing over the engine and several of the wagons were dashed to pieces. Large gangs and cranes had been set to work repairing the damage and embankment as well as removing wreckage. Although the line was thought to be blocked until the 16th at the earliest. A later inquest revealed the "two men killed did not meet their frightful death without warning" although "the warning was pathetically late and futile, though given with almost superhuman promptitude, under the awful and unerring conditions of time and place" as two watchmen had attempted to forewarn the oncoming train despite being "almost paralysed" with fear when they realised the

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British Isles

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24/01/1899

"express goods train was coming at 35 miles an hour through the tempest towards them". Both men ran either way but whilst one was successful in stopping the express the signal was seen to late by the goods train which slammed on the brakes "but all in vain for the yawning gulf was too imminent, and in a moment the catastrophe was consummated". The watchmen were said to have behaved "nobly". The inquest into the railway accident affirmed the above and return a verdict of "Accidental Death" with the recommendation of the installment of a signal box operating 24 hours and the construction of "a more substantial sea wall". At Rhyl the sea wall was also swept and many rivers flooded which was "disastrous for the formers, whose stock is swept away by the floods". Large trees fell in the country blocking traffic. A wreck was noted in Carmarthen Bay as a vessel was spotted floating upside down seven miles south-west of Caldy Island on the Pembrokeshire coast. Another disaster occurred off Lundy Island when a vessel foundered and the crew took to a raft with 2 of the 4 men aboard being washed off. The value of lifebelts was also mentioned. A severe storm caused much trouble throughout and particularly in the Bristol Channel where the Portcawl lifeboat was launched in response to four distress signals from a vessel on the sands. "The waves were mountainous, and the men were quickly deluged" as they ventured to the Nash sands and one huge wave threw the boat over with two men being washed out the boat. The coxswain remarked "The boat righted itself in ten seconds ... but it appeared a long time" and whilst the

others were retained by their lifelines they were drenched. Their search of the sandbank was fruitless and when returning ashore they encountered steering difficulties and "the exhausted men in the Speedwell pulled for life" and hundreds ran to the beach in an effort to save them with ropes but they fortunately returned to harbour exhausted but alive. A Spanish steamer was also noted floating towards a dangerous sandbank but she was towed into the Penarth Roads by her rescuers. A vessel from Genoa put back into the Roath docks after a mate was thrown down by a large wave off Lundy and had one of his legs broken. The Port Eynon lifeboat was also deployed to assist a steamer in distress off the Gower but she was picked up by two tugs and towed into Swansea. At Llandilo there were "exciting scenes" as the heavy downpour turned the "river Towy into a raging flood" which destroyed a temporary wooden bridge used to access a new railway bridge and the surrounding construction site. The loss was said to amount to hundreds of pounds and "the new work will be greatly retarded". A number of sheep were also washed into the Towy but men "waded into the flood waist high" in order to enact a rescue. There were also terrible floods in Carmarthen as the Towy rose to a very high level to the extent that the "old seven-arched town bridge was covered to such a height that at one time the apex of neither of the arches could be seen". The valley of the Towy was "one sheet of water, streaked and dotted here and there with high hedges and isolated trees and sheds". The Towyside quay was inundated and the

occupants of certain houses were up to their waist in water as they endeavoured to remove belongings to the upper rooms as boats plied the streets and "were the means of rendering assistance to the people". The railway was also flooded to a great depth which delayed all railway travel which was "the unavoidable cause of very great inconvenience and distress to a large number of people" who had visited the town on market day. The boathouse of the grammar school was completely wrecked but fortunately the boats were saved and over 10 feet of water was noted in certain depressions in the Pensarn road. At Bangor a policeman performed his rounds in a coracle and amongst the floating debris and dead livestock he discovered the body of a man floating whilst several rescues via boat were enacted and a boy also drowned when he fell into the river at Festiniog. Many livestock were unfortunately drowned however in the Conway Valley which was inundated "for the greater part of its length and presents the appearance of a great lake". The Festiniog railway had been partially washed away caused much disruption to traffic and travel and gangs of platelayers were deployed to repair the spots where it had been undermined. Land was also submerged for miles in the Swansea Valley with the floods causing great inconvenience to travellers and mine workmen as roads were flooded to a depth of several feet as the Tawe flooded its banks. Near Whitland on the Pembroke and Tenby railway a train made its journey through three feet of water and the post-office and adjoining houses were inundated causing much inconvenience. A cliff in Torquay

<p>1899 11 to 14</p>	<p>2 British Isles Bristol Mercury & Western Mail</p> <p>13/02/1899 - 16/02/1899</p>	<p>fell into the Royal-terrace Gardens having been undermined and weakened by the rains. A severe gale raged over the kingdom producing some "unusual scenes" along the South Wales coast. The high spring tides were further excaerbated by the high winds and miles of lowland was inundated and the Great Western Railway traffic was much impeded. The Sophisa Gardens in Crdiff were also flooded, a park was submeregnd and livestock drowned. It was remarked "the effects of the pressure were felt for a considerbale distance up the River Taff, for the waters of the river were swollen to such an unusual extent that the banks were overflowed". Several house holdershad their premises flooded with water 1 to 2 feet deep gathering in cellars. A 50 ft portion of the sea wall by the Windsor-esplanade was eroded away by the force of the surge and 20 houses were flooded as 4ft to 5 ft of water cover the sea front. A nearby Sanatorium ractically became an island. It was noted that the sea wall that had given way was not immediatly repair which according to an interview with an engineer was due to the fact it belonging to the Bute and not the corporation. It was noted the wall had been strenghtened after a previous inundation but that specific part had not been fortified. The eningeer further stated he had previous reported "in order to render the inhabitants of houses in the vicinity safe from floods, a breakwater shouldbe erected some 40 or 50 yards away from the wall". If this were done he noted "the waves would be broken, and the wall would effectually withstand any pressure withut it being heightened or</p>
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strengthened more than it was at present". A Penarth subway was also flooded and old residents remarked the tide was "the highest for a period of over twenty years". A sad event occurred in the Alexandra dock when a labourer drowned when trying to rescue his pigs" whilst another man drowned in the Taff having fallen in to the raging torrent which overwhelmed him. In Newport the surge caused widespread inundation of lowlands as the Usk burst its banks and very serious losses were occasioned at the chemical works and ironworks which temporarily put 400 men out of employment. A man who went to the rescue for his fowls stated "he found himself standing in 3ft 4in of water" and his brick walls "went down like a pack of cards with the force of the inrush of water". The marshes were completely inundated with low lying houses flooded. A trow was also swept from her mooring upstream of the River Usk and collided with a bridge of the Great Western Railway and sustained major damage. A large portion of the Old Neath Castle was damaged as the Neath was also in full flood and the storm surge inundated the lower courses. Llanelli also suffered from inundations as the surge penetrated the sea wall and inundated miles of fields and railways which many negative consequences for rail travel. Families were also forced to reside in their upper rooms as many homes were flooded. The esplanade at Porthcawl was also much damaged by the tremendous seas and surge whilst thousands of tons of sand was removed. A river embankment was also broken at Kidwelly with the surrounding lands being flooded as a consequence. The

surge was also noted at Briton Ferry where it flooded a large number of cottages and filled the pits of the steelworks.. The flood was remarked to be "the highest for the last fifty years" and inundation was also noted at Burry Port. In Llandudno the torrential rain produced great floods which submerged the land in the valley of the Conway was widely inundated. Two vessels were also reported to have put into St. Ives with damage. In hotwells the tide registered 38ft 6 in on the morning of the 13th as opposed to the predicted 36 ft and the Cumberland basin was flooded. The floods were also significant at St. Philip's marsh where it did some damage to houses. Repetitive floods caused much distress to families and waters in living rooms reached 4ft 7 in. Houses never flooded for 40 years were inundated to a depth of 1 1/2 feet whilst travel was only possible on horseback. Damages were estimated to be in the thousands and 200 families were affected however "several gentlemen have promised contributions to the relief fund which will be started, and one gentleman yesterday sent 40 loaves of bread for distribution". It was remarked "a pleasant feature is the cheerful spirit with which the sufferers contemplate the disaster". The relief fund was started by a Reverend of St. Silas church and the Mayor donated £10 whilst £20 was quickly raised. It was specifically noted "this committee is representative of all the religious denominations working in the Marsh". Fuel and provisions had already been distributed and it was noted that the distress and damage had been underestimated with the homes of the poor in a terrible

<p>1899 7 to 10</p>	<p>2</p>	<p>British Isles</p>	<p>Liverpool Mercury and Western Times</p>	<p>13/03/1899</p>	<p>state. There was a terrible stench and it was believed that some of the water in homes had come from overflowing sewers. Several landslip were noted in the Bath neighbourhood which were attributed the saturation of the ground and undermining of flood flows which lead to the closure of footpaths in some instances. In the Celtic Sea there was news of a vessel thrown on it's beam ends and having to put back to Barry whilst other vessels were towed into Penzance, Plymouth and Waterford. Majestic of the White Star line reported "strong west-north-west gales, with high seas" throughout the pasage over the Atlantic. An inquest was carried out on the wreck of vessel washed up in Netham, Bristol and the verdict "accidental death" was returned. A German Liner put into Plymouth Sound "flying signals to the effect that she was not under control" having damaged her steering gear in the Celtic Sea and Atlantic. She was forutnately assisted into harbour by a Plymouth tug. It was said permission to dock her at Devonport would require the permit of the Admiralty. Much anxiety was felt for two major liners the SS Pavonia and Bulgaria by underwriters and family members alike but both eventually retruned to port in Liverpool.</p> <p>A meeting of the RNLI held at the Adelphi in London was attended by many gentlemen of prominence in the navy and aristocrats. Awards in the form of medals, vullum and financial payouts amounting to £642 were given to members of the lifeboat crews although all of those mentioned were on the south or east coasts. Overall £4141 was ordered to be made to the 295 lifeboat</p>
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<p>1899 7 to 8</p>	<p>4</p>	<p>British Isles</p>	<p>Bristol Mercury</p>	<p>08/04/1899 - 10/04/1899</p>	<p>5 establishments and the most prominent donors were mentioned include the £50 annual subscription from "her Most Gracious Majesty the Queen". Details of the next meeting of the governors of the institution were disclosed and it was announced "a new steam lifeboat has recently been placed at Padstow (Cornwall) and a new lifeboat has been sent to the Rhoscolyn (Anglesea) station". Reports were read by the inspectors before proceeding terminated.</p> <p>A great gale raged throughout Britain and occasioned a disaster at Ilfracombe where a vessel went ashore on the rocks and was totally wrecked. Although the coastguard were on the scene ready with the lifesaving rocket apparatus only one survived and two died in transit. There was also reports of another vessel lost off Bude with the loss of one life. Two more hands perished on the wrecked brigantine Gazelle of Boulogne which was wrecked off Boscastle. A Lloyd's Penzance agent telegraphed that a steamer was seen to founder 11 miles north-east of the Seven Stones reefs off Penzance. Three men plus the captain and mate were washed overboard off Godrevy by heavy sea which carried away the wheelhouse and all drowned. Seeing their distress a trawler later rendered aid and lent 3 hands in order to get the damaged vessel into Mount's Bay. It was remarked 4 of the 5 who perished left wives and families. A small fleet of boats were swept from Newlyn and the one man who was aboard one of the craft was fortunately saved and brought ashore however many were wrecked off the Lizard. A ferry boat running between Falmouth and Flushing also capsized with one</p>
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1899

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Liverpool
Mercury

22/05/1899

being drowned whilst the others were fortunately saved by boats from the shore and latter attended to. One man "declined to be rescued himself until he saw that the ferrymen were saved". A steam trawler landed several shipwrecked men at Milford having found them aboard a vessel which "was found tossing about at the mercy of the waves off the Longships". The shipwrecked men were taken care of by the agent of the SHipwrecked Mariners and Fishermen's Society. In a latter interview the experienced captain noted they had been caught in a severe SW gale off St. Ives and remarked "the wind caused the sea to literally boil" making it impossible to put the vessel about with safety. The vessel had been slowly sinking due to a worsening leak and a crew member had broken both of his legs when kncocked down by a breaking hatch. He told of the deployment of the ship's lifeboat and it's capsize and although it was right the sinking of the vessel left 9 floating in a near-full vessel and thus they suffered "great privations, drifting about helplessly in such terrible seas". Of the rescuing captian the saved captain remakred "whose kindness I cannot speak too highly". One man died from exhaustion after boarding the vessel although the rescue it's self was described as a "brave and smart piece of work". Another one of the lifeboats was picked up with a dead man inside and several others were missing and presumed to have perished. An article focused on forecasting the weather appeared in the Liverpool Mercury which was originally from the "Science Siftings" journal. It was remakred "Atmospheric phenomena in all ages have ... been a source of great

1899 18-20	6	North-west Britain	Liverpool Mercury	21/06/1899 - 22/06/1899	<p data-bbox="1332 191 2105 1244">speculation, not only to the scientific mind, but to those of lowly pretences". It was remarked despite the "accumulated observations of ages" that prediction was still far from perfect. However it was noted "Coming events - in a weather sense - always cast their shadows before them" and it was the interpretation of these shadows that made a "weather prophet". The natural instincts of animals and plants alike in their reaction to forthcoming weather was noted to "furnish the most numerous data by which the common people of the world foretell the coming weather, and it is remarkable how true are their predictions". The strategies of the "unlettered" to utilise astronomical observations were also mentioned among with old wives tales about the specific traits of individual animals and it was noted how all of these traits "have for ages been 'sure signs' of atmospheric disturbances and rain". The strategies and proverbs of ancient mariners were also touched upon and it was stated "they very seldom fail in their predictions, even where they have no modern instruments" The ability of sailors to forecast the oncoming weather by observing cloud formations was referred to such as the appearance of a halo round the sun or moon denoting rain in the summer and snow or sleet in the winter. The specific ability of chickweed to predict the weather was noted as well as the prophetic ability of fowl, vovls and ants.</p> <p data-bbox="1332 1244 2105 1372">1 After several weeks of fine summer-like weather Liverpool and the North-west was visited by a severe thunderstorm and accompanying deluge which also brought with it</p>
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1899	1	7	North-west Britain	Liverpool Mercury	03/07/1899	<p>"vivid flashes of lightning and loud peals of thunder". A labourer was also killed when he was struck by lightning in a Formby garden whilst another employer was struck down and rendered unconscious but later recovered. In the inquest the recovered worker stated he "felt a shock as if he had been struck with something on the forehead, and he was rendered unconscious for a few seconds. When he recovered he saw Rimmer lying on his back". The deceased had a clear discolouring on his face and neck and smoke came from his trousers, whilst hair on his face had been singed. The jury returned the verdict the deceased had been "killed by lightning" and the metallic gardening equipment nearby was remarked to have attracted the "electric fluid". The unfortunate man left a wife and four children and the deceased "was the sole support" the widow had. The foreman of the jury suggested that a subscription should be raised for the poor woman and by the end of the inquest £3 (£500) was raised and a plea would be made to the community. It was remarked the deceased was known as "a hard-working and respectable man". The severity of the storm also caused inconvenience for troops at Altcar who were on parade for their annual inspection which had to be postponed. Over North Wales the "sky was almost black and the mountains were quite hidden under clouds of misty vapour" and terrific peals of thunder were noted in a "very oppressive" atmosphere. In many parts of the country roads were flooded by the deluge. Another intense thunderstorm broke over the North-West which was accompanied by a deluge which resulted in</p>
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1899	1 to 3	10	British Isles	Liverpool Mercury	02/10/1899 - 04/10/1899	<p>flooding in North Wales whilst whilst the electric block system on the Festiniog railway was deranged and thus the mail train was much delayed. The storm "played sad havoc with farmers' stock" and a great number of cattle were killed.</p> <p>A storm and gale hit the North-west which compelled a steamer to return to Liverpool after meeting heavy seas due to the "terrific head wind" which rendered all efforts to progress as futile. The streets of Liverpool were practically deserted and at Blackpool the sea washed over the promenade and it was difficult to walk with on eor two people being blown over which a reverend being severely injured. In Chester several trees fell in the Grovesnor estate but no one was injured.</p>
1899	3 to 4	11	Western Britain	Bristol Mercury	04/11/1899	<p>A strong gale from the south-west resulted in several casualties both at land and on sea. In Plymouth the storm was described as "terrific" and a small vessel broke ashore and became a total wreck although the crew of 6 were rescued by the rocket apparatus. The Chilian warship General Eaquedone dragged her anchors but was rendered assistance and many of the mian communication lines were blown down. The gale was noted as being excpetionally severe in the Isle of Man and several carriages of a train were blown over between Douglas and Ramsey but no one was seriously hurt. The Ramsey lifeboat was also deployed and rescued 5 men aboard a struggling barque. Considerable damage was done in the Portmadoc area were a train was blown off the line and a signal box was wrenched from it;s foundations. In Bristol the gale was also felt were it blew</p>

1899	31	11		Liverpool Mercury	01/12/1899		<p>tiles off roofs and a window was blown out which caused great consternation and a skylight was blown off. Telegraphic communication with the North was "almost entirely interrupted".</p> <p>The Liverpool Shipwreck and Humane Society met to announce awards for various heroic acts when saving human life at sea over the past month. Silver medals were given to officers and financial awards to seamen for their bravery in saving life in the North American Atlantic and Indian Oceans whilst £1 (£130) was given to a dock gateman for rescuing the life of someone who had fallen into the Canning Basin. Another man was awarded the same amount for jumping into a canal and rescuing a woman who was trying to commit suicide, whilst several other men received the same amount for their efforts in local docks and canals. A police officer and another man were also thanked for stopping runaway horses and 15 small awards totalling £4 3s (£525) were also given out.</p>
1899	27-29	12	British Isles	Liverpool Mercury	30/12/1899		<p>A severe storm hit the UK which resulted in several casualties on the West Coast including one vessel which was driven on the rocks in Mounts Bay. Although the lifeboat was deployed tugs pulled the vessel clear off and all were saved with the vessel intact. It was also reported that a vessel which became unmanageable in the Irish Sea had gone ashore at Howth and was feared to be a total loss with the sails in ribbons and the "deck was swept by seas". The crew spent hours in the rigging but were eventually saved.</p>
1900	6 to 7	1	South-west Britain	Western Mail	08/01/1900	1	<p>A strong southerly gale was noted in the Bristol Channel and it provoked many vessels to seek shelter whilst</p>

1900	12 to 15	2	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	15/02/1900 - 24/02/1900	0	<p>several casualties were recorded. Among those was a derelict dandy which was found ashore on the sands at Breaksea. At much personal risk the crew of the tug secured her and removed her from the perilous position although it was feared her crew had been drowned. Several vessels put back and entered Cardiff in a damaged condition. A vessel was also wrecked off Nash Point and the 3 crew abandoned the sinking vessel in a punt which capsized just off the shore. Whilst 2 men swam to shore the attempts to find the craft's boy "were fruitless" and he was presumed drowned.</p> <p>A great snowstorm struck the British Isles doing moderate damage and causing a great deal of inconvenience. In South Wales many collieries and industrial works were forced to close and at Cardiff many men were employed clearing the streets in order to allow tram and road services to continue running. It was described as a "good old-fashioned winter" and 4 inches of snow was not uncommon in Cardiff and all horse drawn transport. Many patrons of the grand theatre were "weatherbound" and there were consequently a large number of absentees. Mails were delayed travelling to Newport due to the deep snow that fell in the rural areas and traffic on the North Western Railway was also greatly delayed as tow trains came off the line. The relief parties worked with "remarkable promptitude" however to clear delays whilst small branchlines were completely blocked up. The Irish Mail boats were also very much delayed owing to the bad weather. The storm once again proved "that Bristol has not yet disposed of the problem of floods" as he heavy</p>
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rainfall and accumulation of thawing snow "combined to impose a severe tax on water channels and sewers". The Mina road district was once again flooded and the flood-weary residents were now said to "calculate on the prospect of a flood whenever they have an exceptionally severe downpour of rain" recalling the floods of 1894, 1889 and 1882. Consequently they were not surprised, despite improvements to find great flooding in the area and down the road. Many of the brooks were "discharging a turbulent stream" and smaller channels burst their banks and flooded nearby meadows serving to produce a great flow down Mina road for a time of 2-3 hours. Householders moved belongings and rapidly recoated upstairs as 2 1/2ft to 4ft of water flowed down the road affecting 100 houses. Although the flood did not force entrance into the houses silt traces were left on doors and the road and pathways had to be cleared of silt before any travel could occur. In Broadmead it was specifically noted that the "culverts and other improvements" had drastically reduced flooding in a once perilous location as only one cellar was flooded and a pumping engine was sent for to clear the property. Cellars at the Polcie courts were flooded at high tide with little damage to property. Residents in Picton street also made preparations in the flood however the constructed channels served to divert the water and no issues were caused. A "considerable part of rural West Somerset" was also covered with water and many roads were impassable with floods 3-4ft in height. In the Isle of Man the force of the wind was such that it lifted the sliding roof off the Palace Opera house and

1900	10 to 11	4	South-west Britain	Western Mail and Bristol Mercury	14/04/1900	3	<p>caused it considerable damae. The lowlands were flooded by the thawing snow and rain and the sea washed "celan over the breakwater piers and promenades" with the the storm surge flooding raods. Two landslip also occured on the North-western Railway during the severe gale and rain at Whitehaven which destroyed the lines and just as a gang had been deployed a second destroyed the confronting sea wall which seriously delayed passengers who had to walk between relaying trains. A Helensburgh telegram stated the West Higland telegram was completely blocked and a train become embedded in a snowdrift at glen Douglas and left the metals whilst the Helensburgh-Glasgow train was blocked by fallen telegraph poles. The torrential rain and thaw of snow throughout caused considerable floods in the catchments of thte River Weaver, Dee, Conway and Severn with much agricultural land being completely inundated and quarries closed. "Unprecedeted floods" in Devonshire also destroyed part of the Ashburton and Kingsbridge Railway and did great damage to private property and many livestock perished. The River Dart floods were the most severe with hundreds of acres being flooded and 100s of sheep and other livestock being drowned. At sea on the west coast a large barquentine was in distress off Renby and rocket apparatus and lifeboat were both deployed and a rescue enacted.</p> <p>A severe gale on the South-west coast ocaSSIONED a disaster at Padstow. During the night of the 10th a fishing smack parted cabel and went ashore. Although the lifeboat was put out it capsized in the boiling surf and the</p>
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1900	12	7	South-west Britain	Western Mail	13/07/1900	0	steam lifeboat also subsequently met the same fate. Of those onboard the fishing smack 5 were saved and 3 drowned whilst eight crew of the steam lifeboat all lost their lives. The only positive news was that the crew of the conventional lifeboat and the 5 of the smack were all saved thanks to the "plucky and skilful management" of the coxswain and assistance from the rocket brigade ashore. Three of the steam lifeboat crew were saved in an exhausted condition. One body still remained missing.
1900	27	7	South-west Britain	Western Mail	28/07/1900	2	A great thunderstorm struck South Wales following several days of oppressive heat and high pressure (barometer over 30 in/hg). The thunderstorm ensued after a rapid drop in the barometer with the sky assuming a "most ominous appearance". A fresh wind sprang up and lightning and thunder ensued along with heavy rain. A severe thunderstorm broke over the South and West of Britain. A private was killed in a tent struck by lightning on the Salisbury plain and left three children and his widow. Five men were injured along with several other men from the 3rd Gloucester Regiment in a different tent. A Cardiff postman was also struck whilst on his bicycle although he recovered sufficiently to walk away after. A boy was also killed at Devizes on a farm along with the horse he was riding taking the overall death toll to 2.
1900	3 to 7	8	British Isles	Liverpool Mercury, Western Mail and Bristol Mercury	04/08/1900 - 08/08/1900	1	Terrific thunderstorms proceeded by a great gale struck the British Isles causing much destruction and excitement and occasioning considerable loss. In Liverpool on the 3rd "brilliant flashes of lightning and heavy peals of thunder" were accompanied by torrential rain and a stiff rain. It much reduced business and the rains flooded cellars into

he lowlying parts of the city. Several places were inundated to such an extent the pump from the firestation was needed to extract the vast quantity of water. One other result of the storm was that the cricket match between Liverpool and District against the West Indians was abandoned. Many of the public "showed a marked indispositon to avail themselves of the electric tramcars, fearing, presumably, that there might be a dangerous diversion of the current". It was however stated "Their fears, hwoever, were groundless" as the chief of the tram department noted that neither accident or interuption occurred due to lightning strikes although the flooding of the rails did delay travel. Flooding occurred in the Old Haymarket as the waters created a deep lake in the hollowed out thoroughfare making it impossible for people to cross the street. Overall 30 calls were made to the police for assistance as many houses and businesses were flooded whilst rail services were also delayed. The inhabitatns of Birkenhead and Wirral also suffered in common with flooding whilst many chimney pots androof slates were blown down and littered the streets. In Southport the strong NNW wind did damage to the trees of the neighbourhood and some walls were also blown down. Many steamers did not ply due to the roughness of the sea and there were few visitors providing revenue to small businesses. At Morecombe the waves were driven with force agains the coastal defences and many small vessels were badly damaged. Thousands of people gathered on the pier to watch a pleasure bat in danger but she escaped. The North Wales coast was also a scene

of great danger and destruction with several vessels being washed ashore near Abergele and several large sailing boats were swept onto the promenade with rowing boats being smashed up. Crop damage was great as "fields of golden corn were beaten flat by the torrential rain" whilst orchards were devastated by the high winds. The Anglesey Carnarvonshire ferry services were suspended and heavy rain fell. The lifeboat was also deployed in Cardigan Bay to rescue an ailing punt which capsized before it could be reached and although the occupants "had to struggle for their lives" in the water willing hands saved the party from the shore. The lifeboat at Fishguard also enacted rescues in a strong NE gale with the crew deploying within 20 minutes of the first signal of distress. In all 9 were rescued from 2 vessels. All steamboat excursions to Ilfracombe were cut short as captains turned back due to the mountainous seas. Ashore in South Wales shop windows were blown out in Llanelly and a large shed was blown down at Barry blocking the railway line for some time. Several soldiers who were part of the "Severn Division Submarine Miners" in a military camp at Barry had "unpleasant experiences" having been forced back to shore and then being left with a camp destroyed by the wind. As a result the men had to resort to shelter provided by locals whilst officers found refuge in a signal station. Communication by telephone and telegraph was much interrupted. A brig off Barry was "entirely dismantled" but two local tugs proceeded to secure her and she safely anchored. Crops were badly damaged in the Newport district and the new electric

trams were suspended at Swansea owing to the wind destroying the cables. Off Porthcawl a 3000 ton steamer was in great difficulty whilst all excursions were terminated. The Holyhead lifeboat was also launched to assist a struggling vessel. Rumours circulating in Cardiff that many vessels had foundered on the Welsh coast caused considerable anxiety for relatives although these were later found to be untrue. The full fury was felt at Llandudno and "the pleasure of numerous trippers was completely spoiled" as the wind blew a near hurricane and the rain descended in torrents. Several of the main streets were flooded and boarding establishments also suffered. A sinking vessel was noted in the bay with men desperately clinging to the rigging and two brave men effected the rescue in a small boat. The three men rescued were near exhausted and had been at the mercy of the waves for several hours. They were subsequently taken to a local restaurant and subsequently reported their loss to the Shipwrecked Fishermen and Mariners' Society. There were hopes the cargo of coal could be recovered and the vessel salvaged. Five men were rescued from drowning in Wlaney Channel, Barrow after capsizing due to bad sailing skills, however they were nobly saved by the ferrymen who just enacted the rescue in time. A Liverpool steamer was also ashore off Llanddulas but no reports of loss were noted. A boy was recovered of a captain who capsized in the Mawddach Estuary during the storm and raging flood. A landslide occurred and the village of Tanymaes narrowly escaped destruction.

1900	22	8	North-west Britain	Liverpool Mercury	23/08/1900	0	Another thunderstorm and rain fell over the North-west but little damage of a serious nature was reported in Liverpool and much of the mild commotion was centred in inland Cheshire. One fatality occurred at Lytham when he was struck by lightning when attending to a stable. In the Ribble there was a great downpour and many individuals "were treated to the magnificent spectacle of a waterspout". In the Menai Straits "the rain descended as from a reservoir" and the rain formed "a column" along the straits producing quite a spectacle.
1900	30	8	North-west Britain	Liverpool Mercury	31/08/1900	0	During a meeting of the Liverpool Shipwreck and Humane Society several awards were made for "courage and humanity in saving life" which included awards for an eleven year-old who jumped into the river at Guinea Gap to rescue a schoolmate who was drowning. A vote of thanks and 20 shillings for a fisherman who rescued three occupants of a sailing who were overtaken by a gale on the 6th and were in danger of drowning in Horse Channel. Several other 20 shillings awards were paid for acts of gallantry primarily involving rescues from docks and canals and 21 extra small awards amounting to £6 6s were also paid out for gallant acts.
1900	6 to 7	11	South-west Britain	Western Mail	08/11/1900	4	A considerable gale caused much distress and disruption at sea with many vessels reporting trying experiences in St. George's Channel. In the Bristol Channel off St. David's Head a vessel shipping considerable seas and a mate was drowned as he was lost overboard. The Clovelly lifeboat carried out commendable work saving the crew of a distressed barque whilst a Swansea bound barque was also ashore just south of Bude although her 11-strong

1900	20-21	12	Western Britain	Liverpool Mercury & Western Mail	21/12/1900 - 22/12/1900	0	<p>crew were saved with help of the rocket apparatus. vessels were also noted in distress in Cardigan Bay and rockets were immediately fired to summon the crew of the St. Dogmells lifeboat who deployed quickly into the perfect hurricane. After certain issues with getting the lifeboat to hold station the crew of the distressed vessel were rescued and brought ashore. A Cardigan smack was also lost but all were saved by the local lifeboat. A baroque was also wrecked in the Mersey with the loss of 3 riggers and a pilot.</p> <p>A large liner of the White Star Line SS Cufic signalled she was in distress off the Skerries and the steam lifeboat at Holyhead proceeded to her with two two who secured her with difficulty and all 48 crew were brought to safety. The same lifeboat later rescued five men stranded on Penrhyn Point. Steamers reported terrific weather in the Irish Channel with many being considerably delayed. Damage was noted at Blackpool where the new pier was carried away and all work destroyed at the estimated cost of £4000-5000. The St. Anne's lifeboat rescued a fishing trawler drifting down the Ribble and another drifted up the Cleveley's coast but came to no material harm. A tug was also ashore on a Ribble bank and although the lifeboat went out once more the rising tide enabled it to float. It was also deployed to a four-masted ship although it was found no one was aboard the vessel. It was later found that all 32 had safely been rescued by a tug but had been able to save precious little. An agent from the Salvage Association later arrived and took charge of the vessel and an attempt was being made to refloat the</p>
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vessel which was largely uninjured. A Manx schooner was also noted in distress off the Fylde coast in the "terrific south-westerly" although she was rescued with difficulty by a tug. The sails were torn to shreds and "the crew had a terrible experience, expecting any moment to be driven ashore". The gale was also felt with force in the Furness district and several vessels were thus compelled to shelter in Barrow Harbour, as many vessels remained windbound. The Whitehaven lifeboat came to the assistance of a large ship which was observed burning blue lights of distress. The lifeboat reached the distressed ship having had the towing hawser snap twice on her deployment and the six of her crew were brought ashore whilst the vessel held at anchor. A smack had a great experience in which two men were washed overboard but got back in, the vessel was then damaged against the pier. Off the Isle of Man near the Point of Ayre the lightship keeper noted distress signals and the Ramsey lifeboat was deployed however no trace of a vessel could be found and thus great anxiety was felt. Several vessels were assisted into Ramsey having sustained considerable damage whilst one vessel was cast adrift by its supporting steamer due to the danger of towing in the high seas and this vessel was thought to be one who had displayed signs of distress previously. The harbourers of the Isle of Man were quite crowded with vessels who had put in for shelter whilst considerable damage to crops and property on the isle was noted. In the Mersey a great swell was noted and ferries and outward bound vessels were much interrupted. Little damage occurred on land in Liverpool with the exception of

<p>1900 27-29</p>	<p>12</p>	<p>Western Britain</p>	<p>Western Mail</p>	<p>29/12/1900</p>	<p>49 a few chimney pots being blown down. On evessel whilst attempting to dock sustained cosnideable damage whilst attemptng to enter a dock and a flat was driven ashore off Otterspool. In Birkenhead many telephone poles were levelled along with large trees in Rock Park whilst a few walls were laid flat but no injuries were sustained. The telegraphic lines were damage to the extent all communication to Scotland, the North of England and Ireland was completely disrupted.</p> <p>A tremendous gale struck the West coast of Britain doing terrific damage and ocassioning considerable commotion mainly at sea. The most serious of the many disasters occurred off Holyhead near the South Stack were a vessel went down with the estimated loss of 35-40 lives with only one man succeeding in reaching the rocks, although he was terribly injured. The ship made "a gallant sturggle agains the terrific storm but to no avail" as seas swept the foundering vessel from stem to stern hurling all the onboard into the furious sea. A further 9 perished off Bude when a barquefoundered. A British barque was driven ashore at Lavernock and a vessel foundered at Trevine, North Pembrokeshire and much bravery was observed by the rescuers onshore who saved 4 of the 7 crew. The villagers seeing the vessel foundering ran to the creek were the vessel was heading an dlined the shore and tried to guide the captain to the nearest point of safety using a flag but it was to no avail so instead they stood on every vatnage point with ropes in their veery best attempts to render assistance. It was noted that it had been 25 years since a shipwreck at Trevine and</p>
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although the life-saving apparatus was sent for from St. David's it arrived too late. "Another fine story of heroism" was recorded at Aberystwith where the lifeboat put out to render assistance to 3 onboard a fishing smack "when the storm was raging wildest". It was noted that three of the lifeboat men were washed overboard and it was exclaimed it was "nothing short of a miracle that in such a sea and in the inky darkness of the night they were rescued by their comrades". A vessel was also "dashed to pieces" against the Milford Haven pier-head but the men scrambled up the girders to their safety and all throughout the Welsh coast great damage was done. The captain of the wrecked vessel remarked "never before have I encountered such a gale" having been at sea for 40 years. The crew were in a sorry state when the reporter met them and soaking wet. It was noted they were not members of the Shipwrecked Mariners' Society so could therefore expect no help from the local agent in returning home. However the reporter personally took them to the Deep Sea Fishermen's Institute where they were given food and drink whilst telegrams were despatched on their behalf to their interested parties. It was also noted that the local agent of the Shipwrecked Mariners' Society refunded the money the reporter had advanced to pay for their care at their board and care at the Seamen's Institute and also paid for their journey home despite their lack of membership. Several other vessels were noted to have dragged anchors and to be in a precarious position but none came into great trouble. In Ilfracombe the full force of the gale was felt and extensive damage

was done to various parts of the town. In a Somerset harbour the storm played great havoc as several vessels were destroyed as they broke loose. It was remarked "considering the severity of the storm the immunity from loss of life on land is remarkable" and whilst roofs had been lifted off and chimneys and tiles blown down there were no reported fatalities. A vessel also went ashore at Lavernock but all were rescued by a tug. One man was washed under the tug 3 times but he was eventually saved, although the man in question was conveyed to the hospital ship by the tug. The coastguards later attended the scene of the ship but their shots went over the vessel. Visibility was down to 50 yards on the water and the site of the wreck made an "impressively grand" scene as the 5 tugs attempted to render assistance in the raging storm and a large number of spectators gathered at the shore to witness the spectacle. The captain retold the story of the ship's foundering including the breaking of the anchors in the storm and the fact he gave orders to wear lifebelts although a davit broke tossing 5 men into the water who were retrieved by lines. The vessel was later removed at high tide and towed into Penarth Dock in a sorry state. The Penarth lifeboat was deployed when a vessel was reported on the rocks near Clevedon and successfully managed to rescue the distressed crew. At Barry damage to shipping was slight and there were a few instances of damage ashore, although travel remained dangerous due to the falling slates and train journeys were much delayed. There was also minor damage in the Cardiff docks, one steamer drifted onto a sandbank from her moorings and

steam tugs had to escort several vessels to the safety of shore. In Cardiff "chimneys were blown down in all directions and considerable damage was done to residential properties. The barometer was observed to fall by 1 inch/hg to 28.7 in the early hours of the Thursday. Terrible anxiety was felt and the "howling of the wind did much to terrorise those to whom storms of such a severe character have been unusual. Many thought to find half their homes blown away by the time Friday morning dawned" but little damage was sustained in reality. In Newport the storm did "a good deal minor damage" and the felling of many telegraph wires prevented communication for the most part. Two steamers collided doing great damage in the dock and a Norwegian barque was seen in a disabled state in the mouth of the River Usk with her mainmast broken and seas breaking over her. At Swansea the storm "raged with terrific force" but the only serious instance was the felling of a 50ft high stack connected with a factory but the machinery was largely uninjured and no person was around at the time. The Mumbles lifeboat was also deployed out and took the crews off three small vessels which perilously rode at anchor and were in considerable peril. A steam-pilot cutter proved most useful rescuing the crew of a dragging sail pilot and taking her in tow as well as rescuing a drifting fishing smack. At the Tenby and County Club a chimney-stack fell doing major damage whilst several trees strewn the roads and a few houses were stripped of their slates. The mail train on the Pembroke Dock Railway had to put back in order to recruit another engine

1901	19	1	South-west Britain	The Guardian &	20/01/1901	0	<p>in face of the conditions. At Ferryside a guard's van and a truck were blown off the line near the railway station and a quantity of wreckage was picked up on the beach. At Ilfracombe the "streets presented an extraordinary appearance" with debris flying about in all directions and telegraph and telephone wires were down in all directions with waves of great height breaking over the parade and into the Ropery meadow. In Bristol the fall was very severe and much damage was done to shipping with one sunk off Avonmouth but fortunately the crew were saved. A steamer was reported ashore near Chepstow as she was forced by strong wind and tide onto the rocks but was helped off in a damaged and sinking state by two tugs. A vessel was ashore near Aberavon and although the crew were safely aboard the vessel there was little hope she'd be removed as she was so high on the shore. At Porthcawl considerable damage was done to property and waves which were mountainous in nature completely swept over the lighthouse and pier. The storm surge was such the waves breached the sea wall "long before full tide" and crowds gathered to witness the spectacular sight. A vessel was also reported ashore at Port Talbot and was left high and dry as the tide receded. The Milford Mail steamer was also much delayed and fears were at first felt for her safety. A training ship in the Irish Sea was also damaged and although all hands prepared for the emergency it was estimated that damages over £600 (£75,000) were sustained.</p> <p>A great gale was noted at Plymouth with the wind varying from SSW to WNW with a great sea running. During it's</p>
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			The Observer			height a collision occurred between two vessels with one being seriously damaged and was beached with the aid of two tugs
1901	27-28	1	Western Britain	The Guardian & The Observer	29/01/1901	0 A dismasted schooner was noted driving through Cardigan Bay before "a fierce wind". Although a lifeboat was launched none of the crew were aboard and she was later beached.
1901	26-27	3	British Isles	The Guardian & The Observer	01/04/1901	2 2. Major damage. Official gallantry. Severe weather struck the UK which were accompanied by gales, snowfall and loss of life. In the Flyde district heavy and persistent snowstorms were experienced causing much delay to train and tram services whilst telegraph poles fell in many places severing communication. The St. Annes Golf Links was completely underwater. A fishing smack was driven ashore off Wyre point and the blinding snowstorm caused great distress to mariners although none experienced great loss. A vessel was also ashore in Morecambe Bay after dragging anchor and went ashore near Ulverston but was thought would be got off after. A large ship was also assisted ashore by a tug. Farming losses were also extensive in Furness with the snow being so thick many sheep were overwhelmed and farmers suffered great loss. The subsequent melting and thawing of the snow resulted in considerable inundation through and the flooding of iron mines. A fully rigged ship also went ashore in Carmarthen Bay when a heavy sea was running and the vessel was wrecked at the mouth of the 3 rivers estuary on the Cefn Sidan sands. Two men drowned although the ferryside lifeboat rescued the other 15 and the captain who had sustained considerable injuries.

1901	5 to 6	10	North-west Britain	The Guardian & The Observer	07/10/1901	0	Stormy weather was reported throughout the country although the gales were most strongly felt at Blackpool were the winds "shattered summer-houses, overturned chimney-ots, snapped flagstuffs, and tore up trees". There were frequent "drenching showers" and the steamboat service was suspended. At the Glasgow Exhibition a large telegraph board "used for announcing the results of the America Cup race" was blown down and one man was injured and sent to hospital.
1901	10 to 12	11	British Isles	The Guardian & The Observer	14/11/1901	0	A tremendous storm from the east struck the UK and although the damage was primarily occasioned on the east coast much consternation was felt in the Irish Sea as steamers from Holyhead to Kingstown were greatly delayed. An Isle of Man steamer occasioned a rescue off Douglas and the lifeboat, without knowledge of this subsequently deployed to find an empty vessel drifting. A Russian barque was also rescued off Fleetwood by a tug who observed her ashore on a sandbank. The lifeboat was again not needed.
1901	10 to 12	11	British Isles	The Guardian & The Observer	18/11/1901	0	Following the previous gale a letter from ES Adeane, Admiral and "Chairman of Committee, the Shipwrecked Fisherman and Mariners' Royal Benevolent Society" wrote a letter to the editor of the Guardian. The letter noted the "harrowing accounts of the loss of life and suffering by the severe gales on the coast" which had been recorded and remind the readers "on each occasion of shipwrecked persons being brought ashore by lifeboats or otherwise, our local honorary agents (numbering 1,000) are instructed to bestow on them every requisite attention and comfort" with charge. The humanitarian work of the society in

<p>1902 1 to 2</p>	<p>2 British Isles</p> <p>The Guardian & The Observer</p> <p>02/02/1902 - 04/02/1902</p>	<p>3 connected beared relations and transporting sailors homes was also mentioned although it was said "Our operations are by no means confined within these limits". As a result of the considerable expenditure of this humane work the society was continually in need of donations and thus a plea for contributions was issued by the Admiral.</p> <p>3. Great gales and rough seas caused havoc throughout Britain although damage and loss was mostly felt on the English East coast. A schooner was run into by a French brig and sank in Mullion roads although all were saved by the vessel they collided with and were landed at Newlyn. Several vessels were sheltering in Holyhead harbour with many reporting rough passages. The Scilly correspondent telegraphed that a barque went down off the the Lewis Rocks with all hands. "the lifeboat had been out to the scene, but without avail". One of the lifeboat crew when interviewwed stated "The wind was blowing hard from the east" and despite communication with the shore they only could come close enough to the vessel to see the crew being washed off before they were quickly drowned and carried out to sea. The weather was such the lifeboat had been called out three times. Two of the St. Martin's botamen wereinjured in their attempts to render assistance whilst climbing over the rocks in order to desperately render assistance. Only two bodies had been recovered and a third was seen floating in St. Martin;s Bay. Two Workington fisherman who had gone out to sea on the 1st in a small open boat were still yet to</p>
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1902 3 to 4	9	Western Britain	The Guardian & The Observer	04/09/1902 - 05/02/1902	2	<p>be heard of and the only hope were they had been picked up or reached the Isle of Man.</p> <p>2. A great storm and high tides brought storm surge conditions to Western Britain with many great losses being sustained. Several casualties to shipping were recorded in the Mersey and a man drowned as he was washed out of a vessel belonging to the Dock Board trying to effect a rescue. The rest "kept their presence of mind" and were rescued by the Formby lifeboat which quickly deployed. The men were given hospital treatment and the vessel was rescued by two dredgers. Very high seas were noted at Blackpool which created a great spectacle for tourists as the storm surge swamped the promenade and jetties, whilst many stalls were upset. A rescue occurred in Morecambe Bay as a steamer saved a helpless vessel in distress and guided her to Glasson Dock. The south storm cone was hoisted at Morecambe and great crowds came to see "huge waves dashing over the sea walls" and great damage was done to a gangway and pier. A sad accident occurred between Morecambe and Heysham when two boys playing in a boat 200 yards from the shore got into difficulty. Despite their best efforts to row the boats into shore a large wave broke over the boat and upturned the boat. Although a local man swam out and secured the boat with one boy, in an exhausted state, still in it the other was nowhere to be seen and was presumed drowned. He was the son of a local oil merchant. The Fleetwood fishing fleet experienced extensive damage with two boats having to be rendered assistance. All pleasure steamers had to postpone their cruises and put</p>
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1902	15 to 17	10	North-west Britain	The Guardian & The Observer	18/09/1902	1	<p>into Fleetwood. The Furness line was also inundated by the storm surge and the Haverigg highway was completely underwater as the tide surged up the Duddon estuary "with great force, covering all the low-lying land" and waves dashed against a coastal station. Although the water reached the floor of some of the carriages traffic did not stop. At Barrow several small craft broke from their moorings and were wrecked whilst telegraph and telephone wires were blown down and windows smashed. A large number of sheep on the Kirkby marsh had a narrow escape from drowning. A beck also flooded causing widespread inundation between the railway and a stately hall. The embankment on the Keny estuary gave way and as a result large parts of the estate of Meathop Park were flooded with the loss of hundreds of livestock. "The water was so deep that it could not get away with the tide"> A steamer was also ashore at Maryport but no lives were lost. The Peel herring fleet was also in danger but no serious casualties were sustained. The storm surge was so great at Kirkbride that the village was flooded to the extent many houses had their fires extinguished as the sea water penetrated homes. The highway between Bowness-on-Solway and Port Carlisle was also damaged by the storm surge and the railway flooded. The damage to the cereal crops and the orchards also suffered greatly.</p> <p>1. Four wrecks in three days were noted off Liverpool with two schooners going ashore on the evening of the 15th whilst a Houston liner also went ashore at Crosby. However all three vessels were thought to be only damaged in a minor capacity and would later be got off. A</p>
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1902	18	11		The Guardian & The Observer	19/11/1902	<p data-bbox="1332 183 2110 343">0 Russian barque also later went ashore on Crosby Beach but the crew were thankfully saved by the Hoylake lifeboat. It had however lost on of it's crew overboard in Liverpool Bay.</p> <p data-bbox="1332 343 2110 1327">A report of the "remarkable tests" of a New Norwegian life-saving budy in a tests it's trial in a heavy sea off the east coast. The tests were attended by the Dover harbour master, second coxswain of the lifeboat and "a number of seafaring representatives". It was remarked the "tests which this novel life-saving apparatus subsequently passed through were remarkably conclusice, the craft riding easily through seas through which a ship;s boat could never have lived". Ballast, four men and provisions were added to simulate the craft carrying it's full load. The budy was described as a "globe, which can be hermetically sealed, having air pumping arrangements inside, is 8ft in diameter". A funnel was provided for ventilation purposes. The little craft "rode over the waves like a cork, and remained remarkably steady". The waves striking her never broke and never went over the top of her funnel. One captain was so impressed he wanted to board the craft in the storm and high seas but was denied permission. Following the completion of the tests the officials went inside the craft via the hatch. It was remarked "it hardly seemed possible to conceive that there were human beings inside the little crad, which reminded one of a large buoy". The budy was then sailed in by a captain much the the amusement of those onshore to conclude a succesful trial.</p>
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1902	16-17	12	Irish Sea	The Guardian & The Observer	17/12/1902	5	5. A great gale from the south-west and torrential rainfall wrought havoc in the Irish Sea. The morning ferries from Holyhead to Dublin experienced the full force of the gale off the South Stack making their way through a "tremendous sea". A trawler off the Rockabill Lighthouse picked up a small boat with one occupant who was the only surviving crew of the steamship Marley. The first-hand account from the sailors outlined that he had been the first one in the lifeboat whilst being lowered on the davits before it was struck by a huge wave. "Luckily the boat alighted on its keel, and McGlue managed to hold on to the thwarts to save himself from being washed overboard". He was unable to get back to the steamer which foundered soon after along with the remainder of the 5 crew. The boat drifted all night "at the mercy of the waves" before he was fortunately identified and picked up by the trawler. The shipping firm Tedcastle and McCormack noted "no hope was entertained by the firm of the safety of the Marley". It was said she was "one of the best ships in the Company's fleet" and was specially built for the Liverpool-Belfast route. The south-westerly also produced a storm surge off the Isle of Man as the spring tide was augmented in height covering the surfaces of the promenades and interrupting coastal tramways. Rainfall was consistently heavy throughout the period.
1902	27-28	12	North-west Britain	The Guardian & The Observer	29/12/1902 - 30/12/1902	1	1. A great gale from the west and heavy snowfall was experienced off Holyhead and the North-west coast which caused much consternation. Several large ships were towed into the Holyhead harbour and the steam lifeboat brought ashore the screw of the four-masted ship Lord

<p>1903 26-27</p>	<p>1 South-west Britain</p> <p>The Guardian & The Observer</p> <p>27/01/1903 - 28/01/1903</p>	<p>Shaftesbury which had become unmanagable off Cormel Point and was heading ashore. A man was also blown into the Canning Dock and although he was removed and subsequently taken to hospital he was later found dead. A rigger who tried to save him was also in hospital with hypothermia. In the North-west of Scotland a steamer went ashore on Lochbroom but the crew were saved. The "Blackpool and the Fylde coast expereinced the full force of a winter's gale" and many residents flocked to the cliffs to witness and steamer struggling though the heavy seas which was "just discernible through the sea spray". Much anxiety was entertained due to the mountainous waves and the difficulty of navigating the point at Rossall. She however made the port of Fleetwood safely. At Southport a fierce hailstorm swept over the town and "many persons attempting to reach the promenade were blown back". Large iron seats adn other heavy objects were "blown about like so many cockle-shells". The sea along the Birkdale and Ainsdale coast was "a spectacle of wild grandeur, mountianous white-crested waves appearing as far as the eye could reach".</p> <p>2. A severe gale in the Irish Channel caused many steamers to have "trying experiences" and the Holyhead harbour was a crowded place of refuge. Off the Pembrokeshire coast a steamer was wrecked near to St. David's Head as she struck rocks the the south of Ramsey Island. However such was the thickness of the weather the signals of distress were not noticed until the 27th when the lifeboat was deployed. Due to the "heavy ground swell" the captain and chief engineer were</p>
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1903	23 to 2	2	Western Britain	The Guardian & The Observer	24/02/1903 - 09/03/1903	9	<p>washed away and the third engineer succumbed to exposure. 14 of the 23 abandoned the vessel in its tender boat but it was thought that vessel had probably foundered. However this turned out not to be the case and 14 men aboard the tender were picked off by the Tuskar Rocks by a steamer. The lifeboat brought back the 6 remaining survivors from the wrecked vessel and the dead body of the engineer. Overall 2 had died and 21 had been saved. A German vessel was driven ashore off Abberffraw on the Anglesey coast and became a total wreck but all 18 aboard were rescued. Two lives were unfortunately lost at Plymouth when a fishing boat was swamped and subsequently wrecked just outside the harbour. A portion of the wreckage was retrieved by the coastguards "having been cast up by the gale".</p> <p>9. A great gale caused widespread destruction from Penzance to the Solway and resulted in many casualties both on land. During a gale on the Lancashire coast a barque from Florida to Fleetwood lost its anchors in the Lune deeps although a Fleetwood pilot was on board to beach the vessel at Heysham. The Fleetwood lifeboat "after heroic seamanship took off nine men with six others landing at Heysham with the pilot in a small boat. Lloyds Stornoway agent telegraphed of that a vessel had put in in a disabled state with one lost overboard. Three boats had been smashed and the vessel had flooded somewhat. The gale compelled 20 steamers to seek refuge in Ramsey Bay "in consequence of the fierce south-westerly" which had been raging off the Manx coast. A meteorologist from the Formby observatory noted that</p>
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"only since the great storm of December 22, 1894) has the strength of the wind even slightly exceeded the force attained in during yesterday (27th) morning". During the strongest gust the wind was measured at slightly over 90 mph. Despite the violence fatal and serious accidents were surprisingly few although a disaster occurred on the Furness Railway owing to the "partial breakdow of telegraph and telephone systems" as wires and piles covered the line. This caused the train to slow down and come to a complete standstill right in the middle of a viaduct in an exposed position. It was subsequently overturned by the force of the wind and the windows of most carriages smashed which caused the majority of the 39 recorded injuries as glass cut the passengers. When the passengers got outside the wind was so strong they had "to crawl along on hands and kness until on the Ulverstone side of the vaiduct" which was in comparative shelter. Two were seriously injured and three people were missing and it was remarked "the only explanation fo their absence, it is thought, must be found in the fact that as they scambled out of the compartment in which they were riding they were caught by the hurricane and hurled over the bridge into the raging water beneath". Some individuals were taken into nearby farmhouses were they recieved every attention. A subsequent inquiry held on the 4th by Major Druitt of the Board of Trade was held. Evidence was provided by signalmen and by the two fireman who said all appeared fine on the approach to the viaduct. Informationw as also provided by the harbour master at Barrow who stated gusts of nearly 120 mph had

been recorded. The locomotive superintendent stated he thought the brake can had been blown over first and the rest of the train had followed. The telegraphic superintendent stated that the wires were intact but the falling of the wires along the lines had "partly knocked up the vacuum brake plug and stopped the train". The evidence of the guards was given in absentia as they were too ill to attend. All injured were remarked to be doing well apart from Mrs Goad who had suffered severe spinal injuries. A steamer also went ashore on Barlocco Isle and the Whitnorn lifeboat went to the rescue which it could not enact due to the heavy seas. The men were afterwards taken off in a large rowing boat and it was found that out of the crew of 94 had drowned although only 2 bodies had been recovered. A wreck was also reported on The Cumberland coast and the men climbed the rigging in desperation. Although the Maryport lifeboat was despatched considerable delay occurred "owing, it is alleged, to some of the crew refusing to go, and volunteers having to be called for". All on the shipwrecked vessel were eventually saved however. In North Wales "the gale raged with great fury during Thursday night and early yesterday morning" and considerable damage was done to the promenades and sea defence works whilst property suffered widely from the effects of wind and floods. The Menai bridge received considerable damage as two of the suspension cables broke resulting in the bridge swinging free without the suspension trains. On seeing this the bridgekeeper suspended all traffic so all transport by foot and horse was

stopped. As the telegraph communication lines had been severed the keeper had to pass on foot to inform the contractor at Bangor. Swaying stopped and the bridge was repaired quickly after. A church in Holyhead was completely demolished and another church room was blown down in Colwyn Bay. Flooding was interrupted along the Cambrian and North-Western lines and in Cardigan Bay a steamer was driven ashore near Abersoch. Another vessel in a sinking state was attended to by the Abersoch lifeboat who found the vessel in a sinking condition with the crew of 4 lashed to the rigging who were all saved with difficulty. Three lives were lost at Carlisle as a chimney pot fell on a woman, a platelayer on the railway was run over by a train which "he did not hear owing to the roar of the wind" whilst another died through exhaustion when battling the storm on his way to work. At Morecambe a storm surge did great damage to the pier and the windows and roofs of shoreside properties were badly damaged. Damage to the pier was estimated at £2000 (£250,000) Travel by any means along the exposed seafront was impossible and many were forced to take backroutes to their place of business. Many houses were also flooded by the storm surge. It was noted that many large boulders in the sea had been loosened and moved such was the force of the wind and waves. The arrival of the Dublin boat at the old pier "afforded a magnificent spectacle" which attracted a great crowd. Several of the livestock which were cargo had been so badly injured they were slaughtered on arrival. The scene was much the same in Blackpool where the local folk stated

"there had been nothing like it for a very long time". It was remarked however that the storm had provided some renewed excitement in the town which was usually dead outside the holiday season. Damage to property was widespread and many endured a sleepless night. The "high tide at eleven came rushing over the Promenade and into the nearer steets" whilst the town was "sheeted in foam". People who "tried to 'see the storm; were often bowled over like ninepins and left spluttering in a couple of feet of salt waver". The storm however left the town "specklessly clean" and "everything shone pleasant and bright in the afternoon sun" following it's abatement and inhabitants "talked abou the wonders of the morning" whilst workmen came out to repair the damage. The damage was estiamtedat several thousand pounds. At Liverpool the storm was remarked to have been of the magnitude of the "famous storm of December 1901". The telegraph system was completely disabled and no mesages could be sent out or to Liverpool for a short period. It was remarked "Upon the occasion of storms the first thought of Liverpool people is as to the river and its shipping, and during the morning the Landing STafe was visited by some thousands of people desirous of witnessing the magnitificent spectacle offered at high water". A large sailing ship was wrecked having dragged it's anchor and gone ashore despite the best attempts of two tugs. The seas made a clelan sweep of her and the crew of 24 had to take tot he rigging but "after severalhours of exposure and suffering, they were happily rescued by the New Brighton lifeboat". A schooner from

Bristol also became a casualty as she drifted onto the Landing Stage but two seaman "at great personal risk, succeeded in getting on board the vessel and passing ropes to the stage, to which she was moored". The crew had left her however and no evidence of them was to be seen, the vessel was badly damaged. In Liverpool the city itself great damage was caused to the shops in a "great middle-class shopping centre" and several shop windows were blown in around the town and policemen were widely observed chasing hats and bonnets. Chimney pots, slates and hoardings "were brought down wholesale" whilst trees were blown down in the suburbs and walls felled. Numerous cases of injury were reported but none were fatal. In Southport the effects of the gale were "felt in full force" with many of the fisherman's punts being swamped and booths in the fair-ground and by the lake were flooded. The tide came over the lake and inundated the lower Promenade. Many properties suffered greatly whilst one wooden structure was completely blown down. A fatal accident was occasioned at Preston when the roof of a house fell in and crushed a woman in bed. There were numerous cases of falling chimney stacks and damaged property but no more accidents to life or limb. In Whitehaven the Lifesaving rocket brigade were assembled to assist a vessel in distress between Nethertown and Braystones. However a fatality occurred when a boy in a crowd following the brigade to their train was knocked over by moving waggons and killed on the spot. After the melancholy incident the crew left for their spot of concern but although the vessel went ashore her

crew of 11 scrambled to safety on the rocks although the master had been washed overboard and drowned. At St. Bees the wind demolished the railway station and did damaged to a church amongst over buildings in the district. Amongst some of the vessels to have suffered was the HMS Resolution which experienced a "the full blast of the hurricane" when sailing from Holyhead to Plymouth with seas washing over her and she lost steerage. The vessel hoisted the signal "Not under control" and was brought into Plymouth where she was detained for considerable time for repairs. The divers ascertained the rudder had been completely lost and it was remarked the "opinion is unanimous among both officers and men that the battleships had a wonderful escape from disaster". HMS Collingwood also shipped terrific seas and rolled tremendously in the Celtic Sea and her coal bunkers were flooded to the extent men were swept away when they tried to gather more coal. HMS Camperdown also suffered severely encountering "terrific" weather off the Lizard. However she "rode the gale splendidly, and emerged with trifling damage". HMS Benbow also experienced the full force of the gale and although she was late she arrived in Plymouth from Glasgow in safety. The Lloyd's agent in Penzance stated that a vessel showing signs of distress struck the Brisson rocks and appeared to sink immediately. New Zealand marked casks came ashore and the five crew had perished. The body of a Norwegian sailor washed up near Penzance and some people living near St Michael's Mount stated they saw a small vessel in distress off the coast just

1903	27	8	North-west Britain	The Guardian & The Observer	28/08/1903	0	before she foundered. It was exclaimed "The Bishop of Sodor and Man asks us to state that damage to the extent of £2,00 was done in the recent gale to the beautiful church at Peel". Donations had been promised by local resident although it was thought the required sum could not be raised locally hence the "Bishops appeals for liberal help from England".
1903	8 to 11	9	British Isles	The Guardian & The Observer	10/09/1903 - 17/09/1903	0	Great "storm mishap" was occasioned at Blackpool as strong winds played havoc with at the Read's Swimming Baths and brought a large stone coping on top of a tobacconist's shop which was completely destroyed. The son of the owner and an assistant had narrow escapes. Approximately £250 (£31,000) of damage had been done and it was stated that the wife of the shop owner had repeatedly complained about the state of the shop masonry.
							Great rains and a storm of considerable magnitude caused great flooding in the River Irwell and consequently the sluices of the Manchester Ship Canal had to be opened in order to prevent flooding along it's banks. Many vessels due to leave had to remain moored. The Ribble was greatly swollen as 1 1/3 in of rain fell in it's ctachment around Preston. The waters rose to the level of it's banks and the river presented a "fine sight". Several riverside inn lost scores of boats sustaining losses of over £50 (£6,200) non of which was covered by insurance. Large tracts of land above the tidal mark were flooded flooding an engine house and mills. On the Devonshire coast the gales caused havoc uplifting a marque near Bistol and a message from Appledore reamrked "heavy seas are breaking in the

harbour and the mail and newspaper boats experienced heavy and dangerous passages". 50 vessels ramined windbound and immense trees were uprooted and roofs damaged. At Ilfracombe great damage was done to property and the glass ceiling of an opera house was smashed causing great consternation amongst the female performers below. At Weston-super-Mare the gale and heavy seas caused "whole devastation on the sea front" with half of the causeway leading to the part of the pavilion and baths being washed away. In South Wales telephone and telegrpah wires were blown down over large areas and much damage was done to trees and crops. At the Cardiff Horse Show the ceiling of a grand stand was blown away and several chimneys fell throughout the city. At Newport part of the coping of a building fell and struck two men who were both seriouslyinjured. The train from New Milford was stopped as the railway had been undermined by the storm surge. On the Isle of Man the fierce storm from the east caused a heavy sea to run and blinding rain fell. A steamer landed it's captain who was unconscious. A steamer Duke of Edinburgh was driving ashore near Holyhead. The Dee was also in high flood and many hundreds of acres of meadows and agricultural land flooded ruining the harvest. In Llandudno the baromoeter was noted to have fallen an inch in eight hours and the River Conway overflowed it;s banks flooding thousands of acres and runing the corn crop. The crewe of an Irish vessel were have supposed to have been lost in the Celtic Sea when their vessel foundered and the "shipping office there

1903	6 to 7	10	North-west Britain	The Guardian & The Observer	08/10/1903	2	(Dublin) was besieged by anxious inquirers". The ladies of the Scilly also enacted a rescue of a man in peril off Tresco Island as they came from Tresco Abbey with a large boat and ropes. They then attached the ropes to the boat and launched the craft "in the boiling surf with one of the men onboard". Once the vessel they had cast reached the stricken man who was in a perilous conditon in his own vessel the woman, a boy and a man hauled hte boat to shore "with two men's lives in their hands. They succeeded in beaching the boat, and the poor fellow was carefully tended". It was remarked this was the 2nd time the two ladies had been "instrumental in saving life".
1903	14-15	10	Northern Britain	The Guardian &	16/10/1903	0	2. A severe gale brought with it heavy rain and snow in the Norht of England and Scotland which caused many rivers to in the Solway district. AT Preston "remarkable scenes" were noted as the Ribble overflowed its banks and flooded a main road to Liverpool and boats were seen plying the passage. "The Regatta Inn was flooded to the depth of several feet, and the occupants had to leave the ground floor and seek refuge upstairs". The neighbourhood of the docks was flooded by the surge but little damage was reported in Liverpool itself. A flat with a cargo of chemicals capsized in the Mersey with the two aboard drowning. The Formby lightship was blown from it;s moorings and drifted 1/2 a mile with the tide. Several buidlings in Formby were unroofed.The Nre Brighton, Hoylake and Formby lifeboats were all out and had "trying expereinces" but no lives were lost. Lancashire was visited by heavy rain, hail and thunderstorms which at times were so loud "actors in the

				The Observer			theatres were in several instances inaudible". At Blackpool a judge had to adjourn court for a short time as it was "quite impossible for the witnesses or the counsel to make themselves heard". A house was also struck by lightning with the roof being split and the chimney pots dashed to ground. The wind strength was such several large steamers were compelled to take refuge in Ramsey Bay and the fishing fleet could not put out to sea. Between Wigton and the Solway Firth hundreds of acres were under water due to the combination of fluvial and tidal flooding. It was noted that the "Cumberland County Council were asked some time ago to attend to the cleansing of the course of the river Wampool. but in the absence of compulsory powers the authority was helpless" and thus this inaction was believed to have exacerbated the immense flooding. Consequently a "movement is now being set on foot to obtain the necessary powers".
1903	24	10	South-west Britain	The Guardian & The Observer	25/10/1903	1	1. Extremely stormy weather was experienced at Plymouth and the high winds and rain damage to small craft. A pilot was killed whilst boarding an Italian brigantine when the punt he was transferring from capsized and he was drowned. Another pilot had a narrow escape and a ship was ashore at Batten.
1903	27-29	10	North-west Britain	The Guardian & The Observer	30/10/1903	0	A fierce gale and heavy snow and rain swept across North Wales with the rainfall measuring 5 inches in some places. A serious landslide occurred on the narrow-gauge railway just south of Carnarvon and completely blocked the line ceasing all traffic.

1903	27-29	11	South-west Britain	The Guardian & The Observer	30/11/1903	0	A great storm was noted off the South coast and the Liverpool steamer Gascony landed the crew fo a Fleetwood schooner at Fishguard after the vessel was at the verge of foundering off the Smalls. A destroyer of the Royal Navy returned to port having sustained great damage. The Brixham lifeboat was launched to assist a three-masted brig which was abandoned and the men landed safely at Brixham.
1903	2 to 3	12	Western Britain	The Guardian & The Observer	04/12/1903	0	A great storm swept over the Western coast with winds from the SW and heavy rain causing much consternation to the cross channel ferries from Holyhead to the Irish ports lathough traffic continued to flow with difficulty. A large number of smaller vessel ran into safety of the Holyhead harbour whilst Ramsey was also crowed. A vessel was wrecked in the Bristol Channel when a vessel went ashore off Swansea harbour and the Mumbles lifeboat assisted by a pilot cutter rescue the crew.
1903	21-22	12	Isle of Man	The Guardian & The Observer	23/12/1903	0	A Ramsey correspondent told of heavy gales from the SW which had been unrelenting for 24 hours. The mariners of Ramsey had however received a telegram talking of "a deep distrubance in the Atlantic" which served as a storm warning for mariners. Many craft of all nations took refuge in the harbour. One vessel had been stranded on the coast according to Lloyd's and whilst two seamen saved themselves in a boat the fate of the rest was unknown.
1904	13-15	1	Western Britain	The Guardian & The Observer	15/01/1904	0	A strong gale accompanied by rain blew over the Isle of Man forcing many vessels into habour at Ramsey and Douglas. A steamer was forced to retreat home to Lamlash due to the fury of the gale but later made the

1904	12 to 13	2	North-west Britain and North Wales	The Guardian & The Observer	13/02/1904 - 15/02/1904	0	<p>journey to Douglas. A strong gale from the west raged at Southport as blinding rain fell and heavy iron seats were uprooted and blown into a seafront road. Great fears were entertained for the fishing boats moored in the Channel.</p> <p>Another considerable gale from the SW hit forcing 20 large steamers to take refuge at Ramsey as the gale raged on the Manx coast. The rain, thunder, lightning and "terrible gale of wind" was also experienced on the Welsh coast and much damage was done to property at Carnarvon. A steamer in Carnarvon Bay dragged and was blown on to the beach by Eifl mountain and another vessel went ashore off Moelfre Bay although no lives were lost. Great relief followed great anxiety after the Llandudno lifeboat finally returned to the bay after assisting a schooner off Great Orme's Head. A number of local seafarers waited on the promenade overnight and rendered assistance to the lifeboatmen on their return. The schooner they found had in fact been derelict with her screw being taken onboard a small cargo steamer. Two of the lifeboat crew were deployed to sail the vessel in and the lifeboat shone green lights to indicate to those on shore all was well. However it was impossible to reach the anchorage and thus the schooner was beached on shore between Rhyl and Abergele. The lifeboat then beat back to Llandudno "in the teeth of a furious storm, and displayed such excellent sailing qualities and such stability as to win the entire confidence of the men". Such quality was explained by her new design with a drop keel, self-righting mechanism and tanks for water ballast. The vessel</p>
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1904	3	8	North-west Britain and North Wales	The Guardian & The Observer	08/08/1904	0	<p>was now said to no longer pose danger for other craft and the lifeboat crew would receive salvage allowance if she survived her "sojourn on such an exposed beach".</p> <p>"A summer gale, as violent as it was sudden, swept the west coast". It sprang up during the morning and raged until the evening with a maximum velocity of 61 mph and 45 mph being recorded at Southport and on the Welsh coast. This made "a grand spectacle" at Blackpool with the great waves crashing against the promenade much to the amusement of holidaymakers. At Southport the occurrence of the storm at low tide caused a minor sandstorm which was carried towards Birkdale and landed in the marine lake. Alternatively there was driving rain at Morecambe and the storm produced "a magnificent sea" which caused difficulties to vessels but no issues came about. It was Lifeboat Saturday at Douglas and the conditions created a great spectacle in which the lifeboat could really prove its seaworthiness. Several vessels sought shelter in the harbour. A sandstorm was also noted in North Wales which did damage to the orchards and made things difficult for military units encamped at Conway. Many tents were blown down and buried and those still standing were ordered to be struck. A Colonel was forced against rocks at Penmaenbach and received major injuries as he was knocked unconscious by the blow. A yawl was in danger at Point Lynas and she hoisted flags of distress to which the Penmon lifeboat responded to and deployed. Only the owner was taken off whilst the crew and captain stayed before she was safely towed into Beaumaris.</p>
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1904 11 to 12	9	Isle of Man	The Guardian & The Observer	13/09/1904	0 "An autumn-gale of exceptional force was experienced at Douglas with the wind blowing from the ESE which brought a heavy sea delaying steamers due for England. Great waves "crested with foam, struck the breakwater and the promenades, breaking over them sometimes, or rising in columns of spray to a height of a hundred feet or more". The storm surge submerged roadways and tram traffic was also stopped. Seats on the promenade were washed away and great quantities of sand and gravel were washed onto the promenade although little damage was done to property. A steamer signalled that her steering gear had become deranged but owing to the fury of the storm the Mona steamer sent out to assist could not render assistance. Another steamer was obliged to wait before coming along the pier due to the size of the waves and the danger they posed. The "tremendous seas at Ramsey, and the bay resembled a boiling cauldron" as large waves dashed over the promenade and spray was sent over the highest houses. Streets and houses were also flooded but without substantial loss. A yachting party were taken ashore by the Douglas lifeboat when the damage boat was forced to drastically alter course to avoid collision with a vessel coming out of the harbour and thus fell to leeward of a pierhead and became in great danger of running ashore being unable to tack in the strong winds. Signals for assistance were made and the lifeboat launched and a "large crowd raised a hearty cheer when the green light shown by the lifeboat announced that the rescue had been effected".
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1904 7 to 9	11	British Isles	The Guardian & The Observer	09/11/1904 - 10/11/1904	2 2. A strong gale produced very rough seas on the Welsh coast as "high tides occurred with a very rough sea considerable strain was put upon the sea defence works between Abergele and Foryd" but no damage was done. Great waves dashed against the stone-pitched slope and spray rose into the air and water drained in the gutters creating a create spectacle in the Clwyd estuary. Breaking waves completely overtopped the Rhuddlan Marsh Trustees' embankment but very few breaches were made on the whole. At Colwyn Bay waves made parts of the promenade impassable and large quantities of sand and shingle were deposited. Workers had great difficulty keeping the floodwaters out of a trench in which a new sewer was being laid. It was noted that the new wall tide withstand the elements although when the tide fell it rapped a large amount of water creating a lake on the promenade. Thanks to the recent defensive improvements by the London and North-Western Railway on their "preliminary scheme of defence at Holywell" where the Dee had previously breached there was however no inundation during this event. The works were inspected by engineers who had designed the defence which took the form of a bank of rough stone which extended across a gap which the sea had made with its face "having a natural slope down to the bottom of the river channel". Overall the stone bank shut water out of the surrounding fields and prevented inundation of the line over the grass-covered marsh by the production of stone flank defences. The future issue of subsidence was noted however it was said the addition of stone "presents
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no engineering difficulty or risk". The lifeboats were called out in the Mersey as both the Hoylake and New Brighton boats deployed to a distress signal off Spencers Bank were a flat had gone aground although the crew had already been removed by a passing vessel. At Fleetwood the gale was severe but no major casualties were recorded. Unfortunatley a Preston man was blown from a crane and died due to brain damage sustained on impact. A Runcorn fishing boat was reported missing and was feared lost. The Riblle overflowed it's banks as the strong north-westerly creating "remarkable scenes" at Preston and several key roads were under several feet of water as houses were flooded flooded and residents could not reach their homes for several hours. At Blackpool damage was also sustained among numerous stalls on the front althogu the surge and the related flooding of Spen Dyke created a "magnificent spectacle". People in the Lune Valley were forced to wade to church as the course of the Lune became barely distignuishable as "an independent current" in a sea of flooded land. It was remarked "Here was nature doign her best to present herself in the most admired disorder". The flooding arouse due to "the swollen burns at one end and an excpeitonally high sea tide at the other" and therefore "the lune was compelled to seek freedome beyond its own banks". Many livestorck were lost and the "farmers are blamed for not having foreseen the rising of the river". Many absentees were noted at Claughton church and "the Blishop suggested that this periodical flooding of thevaleey had somehting to do witht he number of small chruches in this district, one

1904	21-22	11	North-west Britain	The Guardian & The Observer	22/11/1904	0	central church would frequently be inaccessible". Those who did attended had to weather "battering rain" on their way home from church. A great sotrm of snow and wind from the NNW was noted in North Wales and the uplands of North Wales were "covered with a white mantle". The wind backed and went ot the SW and a pilot boat was upset off Holyhead although all managed to cling to the floating wreckage and were subsequently rescued. Very low temperatures from 17 degs F at Wick and 32 at Bath were noted as heavy and sporadic snow showers. Such snow showers were noted to have assisted in extinguishing a fire in Liverpool and the "unusual spectacle was witnessed of huge flames shoorting fiercely ipwards into clouds of large drifting snowflakes". The Moelfre RNLI lifeboat deployed and saved a crew of 4 on a stricken vessel which was bound from Garston to Youghal.
1905	28 to 8	1	British Isles	The Guardian & The Observer	31/12/1904 - 10/01/1905	0	A fierce gale came to the Uk and although it's effects were most severely felt on the East coast a strong south-westerly blew with "extraordinary force" in the Irish Sea. The full force was felt in Cumberland were the sea and storm surge did much damage and a train had to stop whilst near the Duddon estuary where all the telegraph poles had been blown down.
1905	15 to 16	1	British Isles	The Guardian & The Observer	16/01/1905 - 18/01/1905	6	6. A strong gale caused issues to shipping on the Welsh coast as a a ketch was driven ashore near the Fryars Roads, Beaumaris although the vessel and crew came to no harm. Another vessel was driven up high on the rocks near the Penomn lifebaot slip and was predicted to go to pieces should another surge head her way. A vessel also

sunk in Kirkcudbright Bay although the crew were saved. A vessel put into Falmouth with serious damage and the Lloyd's Lizard agent told of a large steamer which hoisted the 'uncontrollable' signal off the lizard whilst drifting in the storm and she had not been found by a rescue tug due to the poor visibility resulting from driving rain. Loss of life was most unfortunately occasioned at Ramsey when a steam tug experienced a burst boiler in Ramsey Bay and became uncontrollable and to make things worse her anchor did not hold. The rocket brigade tried to establish communication but all failed and the "position of the crew became perilous". The Ramsey lifeboat was taken a mile overland in a blizzard and launched amid loud cheers but she could not get near the tug in the forthing seas. The crew then resorted to saving themselves with one drifting off in the boat whilst several swam to shore, some with the aid of lifebuoys. Sadly 6 of the 11 perished in the waves as they were overcome in the turbulent sea. The other 5 who survived were doing well and their own surprise at escape was conveyed by the captain who had said: "We may as well be drowned in the sea as here". A Douglas telegram stated a furious SE gale had been felt in the bay and "bitter frost" prevailed in the country. Fears were entertained for the safety of the breakwaters such was the force of the gale as it had yielded many times in the past and was most exposed in this direction. The mail steamer was unable to leave. Peel Bay was full of sheltering vessels and a distressed schooner was driven out of the Bay. The train service was interrupted by snow drifts and telegraphic communication

1905	18-20	2	British Isles	The Guardian & The Observer	22/01/1905	0	<p>was cut. In Wales a block occurred on the line near Aberystwyth where a true "blizzard" was felt. Fallen telegraph poles blocked the railway line and the wind was so severe labourers had great difficulty clearing the poles. After much time spent clearing it was found the express train could not move as the clamp brakes on the carriages had frozen solid to the wheels. Every brake block had to be forced or thawed before the train could get moving again much later. A owner of a small holding died from exposure whilst battling the blizzard. AT Liverpool the tramway service became very disorganised and much salt was spread which formed a liquid mush which was cleared by gangs of city folk. Two boys were drowned when they tried to rescue a friend who had fallen into a pit pool near Chester.</p> <p>"A strong current, starting somewhere near the Arctic Circle, swept the whole of the United Kingdom" with gales battering the western coast of the British Isles and creating mountainous seas in the Irish Sea and St. George's Channel. Hail and sleet squalls were common but precipitation overall was limited except in the Highlands of Scotland and the Lake District. A schooner was forced ashore at Old Colwyn Bay as the wind rose and the rising tide carried her against the seawall at the foot of a railway station but she sustained only trifling damage thanks to the action of her crew. Rough weather prevailed on the North Wales coast throughout the three days and the "sea was a magnificent sight" and much erosion occurred on the beach opposite St. George's Crescent which exposed the base of concrete coastal structures.</p>
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1905	25-26	2	North-west Britain	The Guardian & The Observer	27/02/1905 - 28/02/1905	1	1. A very deep depression off the North of Scotland created strong gales on the North-west coast which were most severely felt in North Wales where a disaster occurred to a Holyhead boat in which one man was lost overboard after the vessel was swept overboard by incessant waves which swamped the distressed vessel. The major disaster was sustained by the assisting vessel however and "The sad boating disaster to the Gwladys is causing much local distress" as the small coastal punt was lost to sea. This caused particular distress to the coxswain of the local steam lifeboat whose son was in the vessel and he was unable to render assistance. He maintained he "heard above the howling of the elements an agonising cry from his son for help" and it was said he had tried to persuade the crew from launching. On Sunday "sympathetic references were made in the various pulpits" and it was stated that "the men were in the path of duty and had died in trying to perform a heroic deed". The Portmadoc ketch Idea was run ashore on the Llyn Promontory named "Hell's Mouth" and all survived.
1905	11 to 15	3	British Isles	The Guardian & The Observer	12/03/1905 - 16/03/1905	1	1. A Scilly correspondent of the Guardian telegraphed a sad boating accident had occurred when a man attempted to cross from Tresco to St. Mary's in sailing boat which capsized. Although a boat was despatched to his aid he sank and drowned just as the boat came to him. He left a widow and 5 children. The worst disaster of the storm was occasioned to the barque Kyhber off the village of Porthgwarra, Land's End which foundered with the loss of 26 lives. It was noted "the cyclonic depression which produced the gale was of quite exceptional intensity" with

the barometer at Malin Head reading 27.92 inhg. As the pressure contours indicated the centre of the low was some miles west of that point it was estimated the lowest pressure was around 27.80 inhg which would have been the lowest reading since 6 January 1887 when 27.33 inhg was registered at Ochteryre, Perthshire. The later was believed to be the "lowest properly authenticated reading ever recorded". Nearly all the trained Met Office observers indicated a wind force of 10-11 on the Beaufort scale. It was noted "it is quite within the bounds of probability that its violence will be proved to have been as great in the south-west and west as the terrible storm of December 21 and 22 1894" and similar to the storm of 29 December 1879. In Cornwall the first news of the disaster was received by the coastguard at 6:30 on the morning of the 15th who immediately summoned the lifeboat crew and went to the scene with the lifesaving apparatus only to find it was too late and the vessel had struck rocks and been wrecked. The vessel had lost all her sails in the hurricane force west-south-westerly and became unmanageable and began burning blue lights to signal its state of distress. No assistance was given by a small steamer in the vicinity despite the firing of rockets. Although the anchors initially held they soon gave way and the ship went ashore with the men falling from the rigging and the masts fell. Three men were miraculously washed up by the sea with two having to crawl on a ladder from a partially submerged rock to the cliff as "the sea roared underneath". The men were taken to Penzance after under the care of a Lloyd's agent. On the Welsh

coast considerable damage was sustained by shipping. One lucky escape included a steamer being driven into the Burryport harbour, which thanks to the quick actions of the coastguard was grabbed by the hawsers and saved from certain destruction on a boundary wall. A Norwegian barque was also washed ashore near Burryport and the lifeboat was launched towards the Cefn Sidan sands in Carmarthen Bay which was described as "one of the most treacherous spots on the Welsh coast". Owing to the breakers it was impossible to get within a mile of the stricken vessel and thus the Burryport lifeboat were compelled to return. The Ferryside lifeboat then came to the rescue but also had to abandon after a failed attempt on the treacherous sands. The crew were however all safe aboard but refused to leave the vessel. The Burryport lifeboat later succeeded in rescuing all 12 and whilst the Ferryside boat capsized it did right itself again with no loss of life. A crew also made a daring escape from a wreck in small boats and their vessel promised to become a total wreck. A lifeboat rescue was also enacted by the steam lifeboat in Holyhead having seen signs of distress they responded and subsequently saved 5 men from a barquentine. A steam tug also rescued the crew of a drifting vessel. The Tenby lifeboat also rescued the crew of 3 from a schooner in the roadstead after much effort. Many schooners were also damaged in Portmadoc after they broke adrift and collided with each other with several hundred pounds of damage being done. A vessel was also driven ashore at Abersoch with the crew reaching land safely after "a

<p>1905 19-20</p>	<p>8 British Isles</p> <p>The Guardian & The Observer</p> <p>21/08/1905</p>	<p>0 terrible experience". The gale blew so severely that the storm surge inundated the Portmadoc embankment delaying all trains. At Douglas the heavy seas frequently swept the promenade and a steamer had to leave the pier to prevent being "dashed against the concrete wall" and was unable to return for several hours. Damage was done to a church and the Seamen's Bethel at Douglas whilst property at Port St. Mary also suffered greatly. The lifeboat was also called out to a schooner which onto the rocks as well as a lugger. Many vessels ran to Ramsey Bay and the coastguard and lifeboat services were called to Maughold Head to assist a labouring trawler in distress. "What meteorologists describe as cyclonic disturbances from the Atlantic" continued to pass over the UK and a great storm was felt in the northern areas of the kingdom. The Lancashire coast bore the full force of the gale with several individuals being blown to the ground and damage was done to the tram wires. The waves dashed with great force against the new sea wall at Blackpool "High being concave, lends itself to magnificent wave effects, as the water is lifted high into the air - 50ft or 60ft, - and then the wind carries it right across the parade in heavy showers". Such the the sight and spectacle large visitors came to visit and there was "overly eighty special trains" for people venturing out to witness the spectacle. At Morecombe much debris was found driven against the sea wall and the high tide of 24ft later came rushing in backed with the "stiff south-west breeze" causing another spectacle at the sea front". People also flocked to Fleetwood to witness</p>
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1905	29-31	12	South-west Britain	The Guardian & The Observer	01/01/1906	3	the spectacle and the powerful Isle of Man steamers had little issue on their journeys. 3. A heavy south-easterly caused problems to shipping in the Irish Sea with even Cunard liners daring not to venture into Irish harbours due to the ferocity of the gale. A large barge foundered in the harbour whilst a large liner was forced to enter port in order to disembark her mail of 900 sacks. In the confusion and fury of the storm a vessel was run down in Plymouth Sound although the crew saved themselves by climbing on board the steamer that wrecked them. A wreck was also noted off Cornwall near Fowey harbour with three drowned and only the captain being saved.
1906	06-Jan	1	Southern Britain	The Guardian & The Observer	07/01/1906	0	A heavy gale accompanied by torrential rain and snow fell over the South of the UK with the gales doing a great deal of damage in Bristol where many properties were damaged and chimney stacks felled. A woman was sadly crushed to death by falling chimney which was felled by the wind and fell straight through the roof and crushed her. A large barge sunk off Avonmouth but no fatalities were reported and many properties on the South Wales coast received considerable damage. Many windows were blown in at Cardiff and trees uprooted in the suburban areas and in Llandaff two houses had their fronts blown out and a roof collapsed on a property although all escaped.
1906	18-24	1	British Isles	The Guardian & The Observer	19/01/1906 - 25/01/1906	12	12. Extremely rough weather prevailed over England and Ireland yesterday which was "due to the swift passage of a small depression of the true cyclone type which came in from the Atlantic with almost no warning". The centre of the depression traversed in an easterly direction over the

Irish Sea producing a gale which was seriously felt in the Irish Sea and Bristol Channel were the wind was at first westerly and then shifted north-west to north. Falls of rain were accompanied by dropping temperatures and also occasional showers of sleet and hail. A schooner was sunk in the Mersey as she dragged her anchors over Burbo Bank although the crew of four were rescued by a tender belonging to the Mersey Dock Board before the schooner sank. Two fishermen unfortunately perished off St. Anne's as their boat sank as they were caught off guard by the rapidly approaching storm. According to an eye-witness "the fishermen were seen clinging to the rigging and doing their utmost to attract attention from the shore, but suddenly a huge wave covered them and they were not seen again". The lifeboat was deployed but the incoming tide and great wind they found it impossible to reach the boat in time. Both the deceased were also members of the lifeboat crew. A body of a fisherman was later found on the banks of the Ribble at Lytham and the chairman of the St Annes RNLI branch started a subscription on behalf of the bereaved widows and as of the 22nd £80 (£10,000) had been raised. A disastrous collision in the Mersey resulted in the sinking of a river tug and the loss of her 10 crew as she was run over by an incoming liner. As soon as this occurred great commotion occurred on the liner with boats immediately being lowered and flaring signals fired to attract the attention of those in the water who were also thrown lifebuoys although no man ever surfaced. Three tugs then went to search the river but found nothing. The crew of the liner stated they were not aware

1906	2 to 3	2	Western Britain	The Guardian & The Observer	03/02/1906	0	<p>fo the incident until it was too late and it was all order. It ws also remarked this was the 2nd time in recent history a liner had sunk a tug leading to a fatality. A subsequent report said that on the 24th "the mercury in Lancashire stood nearly an inch higher than in the Shetlands. The south-westerly air current, which was rushing across our more northern districts to fill the partial vacuum, accordingly blew with the strength of a gale over Ireland, the Irish Sea, Scotaldn, the north of England". Such winds proved hazardous at in the Irish Sea were a schooner was sunk off the Calf of Man duirng a dark morning when it collided with a steamer although thankfully all men on the schooner were got onboard the steamer safely.</p> <p>"A large drop in barometric pressure over Central Europe combined with "a large and deep cyclonic disturbance over Scandinavia, combined with a steady or slightly rising barometer over the Bay of Biscay" served to produce a strong north-westerly wind which was much felt on the north-west coast and "the nature of a blizzard" in Scotland. The resultant product of this was a rather rough sea at Blackpool but due to the lowness of the tide at the height of the gale there was no storm surge washed the promenades and little damage was done. Drenching rain and inense cold was felt at the height of the hurricane which made walking difficult at times as waves rolled inshore with "tremendous force". The wind was recorded to average 50 mph.</p>
1906	25-26	8	British Isles	The Guardian &	27/08/1905	0	<p>A strong south-westerly wind sometimes at gale force were experienced throughout the country doing much damage to the tents and temporary structures at</p>

				The Observer			Blackpool were the Ashton-under-Lyne volunteers suffered from many a collapsed tent. A "serious mishap" occurred in Blackpool were two visitors were sturck with a falling iron drain gutter seriously injuring two but they were later attedned to by a surgeon who patched them up and enable them to return to their their lodgings. At Aberystwyth the gale was "almost hurricane force" and the westerly shift in the breeze and many vessels riding at anchor were swamped by the mountainous waves that washed over them. The lifeboat was launched with the mayor onboard. In order to render assistance to the men onboard such overwhlemed crafts and safely beach those vessels in trouble. It was remarked the rough weather presented a "splendid opportunity for testing the qualities of the new lifeboat" which rode the water easily and the crew expressed their delight. In Cheshire it was reported the crops had been widely damaged and "hundreds of acres of unreaped cerals have been laid flat" whilst the fruit crops also suffered serious damage.
1906	15-19	11	British Isles	The Guardian & The Observer	17/11/1906 - 20/11/1906	1	1. A series of two cyclonic disturbances which moved eastwards over the north of England caused great winds which were felt in full force on the North-west coast as heavy rain also fell. Passages in the Irish Sea were incredible rough and rain well across most of Britain. A Hoylake lifeboatman was unforutnately lost when the lifeboat deployed to rescue a crew of a smack which had gone ashore at Dove Point. The sea was very heavy and the coxswain stated that it was one fo the worst seas he'd ever seen. In the heavy seas equipment was broken and one man was washed overboard and completely lost. The

crew were forced to progress onto the smack and rescue the crew who were in the rigging. The men however declined assistance as the vessel was structurally integral and there was a greater risk in coming down from the rigging than remaining. The body of the dead man was washed up near Moreton and it said he was married and this had been his first trip in the lifeboat. He was later laid to rest "amidst many signs of sympathy with the widowed mother. The coffin, shoulder-borne, was preceded by a guard of the honour of uniformed lifeboatmen". It was noted that many stood bareheaded by the grave "despite the western gale, the biting cold, and the torrential rain". The lifeboat was also deployed at Llandudno having failed to find the boat it had gone in search of. Four men were however rescued by Colwyn Bay boatman having had spent a night in a small boat they were exhausted and in complete darkness their oil lamp having run out of fuel. The Fleetwood lifeboat was also out and enacted a rescue of a stranded steam trawler on the Pilling Sands. Although the trawlermen initially refused assistance with low tide coming and were initially safe the attempts of two tugs to remove the vessel on the next high tide left 32 men in a vulnerable position as the vessel once more began to be "buffeted by the rising waves". Signals of distress were then shown and the lifeboat was again launched and carefully manoeuvred into position near the vessel and all men aboard were safely taken off. It was feared the trawler would be a total wreck. At Blackpool the high tide augmented by the wind formed a storm surge which dashed across the promenade and roads preventing the

1906	5 to 6	12	Western Britain	The Guardian & The Observer	06/12/1906	0	<p>movement of all coastal traffic. The waves "dashed violently against the upright seawall, and masses of spray were thrown high into the air and carried by the wind across the tram and carriage ways". It was noted temporary repairs to the hulking coastal defence prevented further damage. Hail also fell in large volumes. Three dredgers in the Ribble were forced to seek shelter. At Fishguard harbour a great gale was experienced and a labourer was almost washed away by the storm surge on the quay but saved himself by seizing the railway metals. A severe gale was felt on the Western coasts as a large depression based on a north-easterly trajectory over the British Isles. Force 11 winds were recorded in some exposed coastal locations and the barometric gradient was "remarkably steep" with a 0.7 inHg pressure difference between the north of Scotland and North-west England. The storm was such even the great White Star liner Baltic was detained at Liverpool owing to the severity of the gale and state of the sea. The Manx steamer's also had a hard passage with many taking double their usual time and one vessel had its steering house badly damaged. At Machrihanish near Campeltown a wireless telegraphy tower 450ft in height was completely blown down and destroyed but no harm came to the works below or any individuals.</p>
1906	13-14	12	Western Britain	The Guardian & The Observer	15/12/1906	0	<p>"A brisk rise of the barometer to the west and south-west of the British Isles" and an equally sharp fall over the north-west of Europe caused a renewal of gales along the western coasts of Britain with strong winds coming from the NW. The Arctic air was dry and cold and the</p>

1907	28-30	1	British Isles	The Guardian & The Observer	30/01/1907 - 31/01/1907	0	<p>"thermometer scarcely rose above freezing point" across much of the British Isles. There were no reports of any major human losses although traffic was widely impeded by high volumes of snow fall on roads.</p> <p>The severe weather returned to the British Isles in the form of a great gale from the North-west which was most harshly felt on the Flyde coasts were a series of blizzards rendered travel rather difficult indeed and walking was "out of the question". The storm was also accompanied by vivid flashes of lightning and thunder and wind of a velocity of 56 mph was noted. The sea was constantly rough throughout and gale raged on the coast for two nights. A preston church was struck by lightning and caught fire due to a gas leak. The St. Annes lifeboat was also damaged after dragging anchor and colliding with the pier jetty which also recieved considerable damage.</p>
1907	19-21	2	British Isles	The Guardian & The Observer	21/02/1907 - 22/02/1907	0	<p>Storms struck the west coast of the British Isles bringing with them thunder, lightning, heavy rain and winds in excess of 60 mph in the gusts. The meteorological correspondent of the Guardian sated the centre of the depression responsible from the storm was off the SW of Norway on the 20th and pressures as low as 27.65 inhg had been registered at Skudesnaes. This was one of lowest pressures recorded in the area. These contrasted with higher pressures of 28.32 inhg at Aberdeen and 29.32 inhg in Paris which produced a great gradient which was responsible for the very strong winds from the west. It was noted that it was fortunate the gale had struck the west coast at a time of neap tides as "serious damage would have been wrought by the exceptionally high</p>

<p>1907 16-19</p>	<p>3</p>	<p>Western Britain</p>	<p>The Guardian & The Observer</p>	<p>18/03/1907 - 20/03/1907</p>	<p>1</p> <p>water". Passing snow squalls were very common throughout but were interspersed with intervals of sunshine. "Wild scenes" were noted on the Fylde coast where the windspeed was recorded to have reached 68 mph. Despite of the neap tides enormous seas dashed against the Promenade although the sea wall and hulking stood the buffeting "remarkably well". Although greatest anxiety was felt for the defences of the North Shore were the base of the hulking had been eroded away in previous storms all hulking stood firm despite the repairs being only temporary. At Morecambe the seas swept the front and vessels were torn off their moorings and the lifeboat went out in order to try and save several although many sank. The ferries had rough passages. Some of the Lvierpool liners were unable to leave the docks and thus their passages to international destinations were delayed. The Mersey ferries were also much delayed. A three-masted schooner got into difficulties on sandbanks in the mouth of the Ribble and no fewer than 5 vessels including three lifeboats went to her rescue. There was great excitment along all of the Fylde coast and thousands came to watch the launchings of the different rescue craft and their work. Eventurally the schooner was taken in tow by one of tugs to the safety of Liverpool.</p> <p>1. Widespread damage was wrought by a fierce gale on the North-west coast which was particularly noticeable on the Lancashire coast and inland in that region. The New Brighton landing-stage also received substantial damage to the extent it had to be removed for repairs. A woman drowned when her canoe capsized in the swollen Lune at</p>
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Kirkby Lonsdale. A subsequent coroner's inquest found the canoe had capsized when caught at right angles to the bank and the woman's brother had hold of her until they were forced apart by strong current. Despite all the efforts of the brother and other sister she was drawn down by the current and succumbed. The "Coroner said that if any satisfaction could be got out of such a thing, it would be some satisfaction to Mr Lees to know that he had done all he could to rescue his sister". He had lead search parties with lanterns down to the river after but all was in vain. The jury returned a verdict of "accidental death" and expressed their sympathy with the family and the brother stated he felt himself responsible for her death as he "said he did not think he ought to have come out so soon". At Morecambe property was widely damaged and the shift of the wind from south-west to north-west resulted in widespread inundation and "the streets off the Promenade ran like rivers" with basements flooded and furniture and provisions completely destroyed. Windows were blown out by the wind and "Great blocks of asphalt and concrete slabs were torn up and tossed into the gardens like matchwood". The pier also suffered great damage and portions of it were torn away. A wall enclosing the garden of a grand hotel also succumbed and "huge boulders were thrown on to the old harbour". The local fisherman suffered greatly and in many cases their boats were "smashed to atoms". A children's charity venue was also destroyed with furniture witnessed floating in the surrounding fields. Some damage was done to Heysham harbour and a great casam

appeared in the South Pier due to the actions of the waves". Several landslides occurred in the vicinity of the proposed new dock and in one case a railway was left hanging where the foundations had been undermined by the sea. Steamer's from Ireland had difficulty in berthing. Local farmers suffered terribly on the Lune and many lost a large proportion of their livestock as the Lune flooded. A local fisherman remarked he'd "NEver seen anything like it ... since the big gale in '52". At the tail end of the storm on the 18th "the sun "shone brightly out on the desolation, and the storm was ebbing away in the gusts of strong wind that still came fitfully in from the sea". Several showers occurred producing a rainbow and the destruction wrought along the whole sea-front was highly visible as debris and deposited sediment lined the promenade. The iron railing has been twisted "Like so much wire" and the pier "stands out of the sea like a skeleton island, severed from the rest of the structure". Miles of low-lying land around the Lune which flooded gave the appearance of a huge lake. It was noted it was the first time in 50 years that the "sea has broken in and mingled with the Lune" with the tide causing flooding a few miles above the town of Morecambe. It was remarked in many cases there had not been time for farmers to reach their livestock as they had woken to their lands under several feet of water. It was remarked the "aggregate losses in stock, seeds, and crops must amount to many thousands of pounds". Country lanes had been "turned into clear streams" and the "country is a curious sight" as "great sheets of water rippled by the wind, with

bits of high land standing out of the tufts of black trees". The tide was estimated at 19ft in height and hundreds of pounds worth of damage was done in the town. It was remarked "West End residents are having a rather trying time" and occupants were largely living on the upper floors. The fire engine was busy at work pumping sea water out of wrecked homes. The railway line was strewn with debris and loose sleepers to the extent trains were much delayed as the train drivers had to continually slow down to remove obstructions from the rail. One row of cottages on the banks of the Lune were completely isolated and the townspeople had to reach them via boats to give them provisions and some were rescued. It was remarked "most of these unfortunates are working people, and they have suffered losses they can ill afford". A Preston Boy was also reported missing after he had been playing on a tram bridge which spanned the river Ribble and subsequently been blown in. His parents were "prepared for the worst". A great liner was also reported to have struck the rocks near Bolt Tail, Devon although happily no lives were lost. The Jebba which carried 190 passengers and crew was so close under the cliffs that "the coastguardsmen could throw lines aboard, and along these all were drawn to safety". It was exclaimed "despite the sudden shock in the darkness and the wildness of the night, excellent discipline and order prevailed ... and there was nothing like panic". It was hypothesised that the "strange combination of dense fog with a violent gale". It was noted that all the best efforts to illuminate the Lizard had been recently made in October 1903 with the

1907	13-Jan	4	North-west Britain	The Guardian & The Observer	15/04/1907	0	installation of "an electric flashlight of half a million candle power" which was visible in clear weather for 40-50 miles. The vessel was regarded as a total wreck.
1907	06-Jan	5	North Wales	The Guardian & The Observer	07/05/1907	0	A great north-easterly gale was severely felt on the North Wales coast and in the Irish Sea and "there was a sudden reversion to winter conditions" as an "almost impenetrable mist covered the sea" making navigation difficult throughout. As such the Irish Mail ferries were greatly delayed and a steamship struck upon the Platters Rocks in the Clyde but later got off after four hours.
1907	29-Jan	6	British Isles	The Guardian & The Observer	30/06/1907	0	A gale broke with "great suddenness" over the Irish sea with very strong winds coming from the NE. At Holyhead a large number of vessels were compelled to run for shelter with one vessel receiving substantial damage off the Skerries. The gale quickly subsided following this brief tempestuous period.
1907	15-16	8	North-west Britain	The Guardian & The Observer	17/08/1907	2	Thunder and lightning storms broke out throughout the kingdom and one golfer was killed by a direct strike on the Lethamhill course near Glasgow whilst one was injured. In Cardiff two fires were started by the storm but no serious casualties occurred. 2. A strong northerly wind arose in the Clyde which caused much distress to fishing boats which were out by the Gantock Rocks and could not make the safety of shore. After attracting assistance of nearby steamers assistance was rendered as many of the party were in grave danger of being run down by the deep-sea steamers. Despite widespread efforts from the maritime community it was widely reported that 2 and probably 3 lives had been lost having been run down by a steamer. A

1907	10 to 11	10	North-west Britain	The Guardian & The Observer	12/10/1907	0	companion of one of the men lost told a "graphic story" in which they had rowed into the path of a incoming steamer without seeing it and their vessel had been completely destroyed. Fortunately another vessel picked up the remaining survivor of the party of three whilst one of the bodies of the two girls in tow were found. Despite the best efforts of motor launches three boats still remained missing. "Distressing scenes were witnessed throughout the night, people walking about the esplanade looking for the return of their relatives".
1907	15 to 20	10	British Isles	The Guardian & The Observer	17/10/1907 - 21/10/1907	0	A succinct yet severe gale arose in the Irish Sea which forced many gunboats to seek shelter. A Glasgow steamer had her engines "deranged" and many cross channel steamers had a very rough passage. A cyclone with a centre over the North of Brittany brough heavy rain to the British Isles which was particulary noticebale in Scotland were 2.45 inches of rain fell in 24 hours in Glasgow. The swelling Clyde burst it's banks and flooded Dalarnock Station. Although two powerful electric pumps usually conveyed the water away "on this occassion the Clyde came down in high flood, damming back the water in the sewers, which necessitated the removal of the pumps to prevent their becoming submerged and damaged". As a result the flood waters inundated the railway station to a level 21/2 ft higher than the platform. Two steam engines were thus requisitioned from the Fire Brigade which were kept working throughout the drain the station which were also aided by the electric pumps once the water levels decreased to a level they could be installed. The hills of Dumfriesshre and

1907	12 to 13	11	North-west Britain	The Guardian & The Observer	14/11/1907	2	<p>the mountains fo Carnarvonshire were covered by "a white mantle" and hundreds of acres of land was underwater in the Solway district around Cumberland and South-west Scotland. A ketch named Lady of the Isles parted from her moorings in Saundersfoot Harbour and was driven upon the beach by the "terrific seas" the lifesaving apparsatus was summoned was Tenby and all were rescued bar one who was overwhelmed with exhaustion. Fortunately a coastgardsman ventured down to the vessel and traversed the surf to rescue the man. A house was wrecked by lightniing at Newport but no casualties occurred. The liner recently wrecked off the Lizard was towed from Belfast to Southampton from the Harland and Wolff works with her new bow through the Irish Sea at the height of the storm but came to no harm. The Liverpool Salvage Association's pumps "capable of dealing with 60 tons of water per minte" were onboard in case of emergency.</p> <p>2. The full force of a severe gale which raged in the Irish Sea was felt on the North-west coast with a mean wind velocity of 55 2/3 mph being registered at 4 am on the 13th at Barrow. The gusts were estimated to clock around 80 mph with a 73 mph gust being registered at Liverpool were the windspeed was lesser. A body of a sailor was washed up at Blundellsands and wreckcage of a vessel named Countess of Devon was also identified. The man had a letter indicating he was the master of such a vessel. It was supposed he had struck Burbo bank and foundered. It was the third vessel the owner had lost in 5 years. It was thought "the disaster hapened with such suddennes that</p>
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1907	24-26	11	North-west Britain	The Guardian & The Observer	25/11/1907 - 27/11/1907	0	<p>the crew of seven hands had no time either to show a signal of distress or to launch a boat" and consequently all 2 were drowned. Both the drowned master and mate were married men with children. Another schooner went ashore near Waterloo beach and the crew were rescued but their vessel still remained in a perilous position. Morecambe "suffered considerably from the violence of the gale" and there was a severe hailstorm which suspended traffic for a period of several hours. Much damage was done to windows and several small coastal fishing boats were destroyed by the sea. A small steamer being used to repair the previously damaged pier was also sunk.</p> <p>A Fierce gale" raged in the Irish Sea which swept the Manx coast and forced many vessels to seek shelter in Ramsey Bay. The Barmouth lifeboat was also deployed to the assistance of a Pwllheli fishing boat which was badly damaged and lifeboat directed into a position of safety which much care and attention. The main incident resulting from the gale was its exacerbation of a fire at the Queen's Palace Ballroom at Rhyl. The north-westerly gale "baffled the fireman;s efforts and was the cause of the destruction of the property being so great". In all four fireman were injured, one boy broke his leg and £70,000 (£8.6m) of damage was done. Great consternation arose amongst residents and "crowds flocked to the seafront, and the gale that was blowing fanned the flames, while smoke poured forth from every part of the building". The wind sentt the falmes into the heart of the building "the flames breaking forth as from a furnace". All residents</p>
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1907	13-14	12	British Isles	The Guardian & The Observer	15/12/1907 - 16/12/1907	17	<p>ont he leeward side of the Palace took out their property after realising it was in danger whilst a motor car was hauled away from the flames by a large number of men. The flames also weakened the structure of a nearby church which lost it's tower which fell and almost injured several men in the vicinity. Incandescent material was also blown into shops and started one small fire which was extinguished.</p> <p>17. A great storm caused havoc through the coasts of Britain with several major issues occuring on the coasts. A "great sailing ship" was wrecked off Scilly with the loss of 17 lives with only two survivors being found in a much injured state having been thrown against the rocky coastal shore. The great liner Mauretania was also forced onto a mud bank in the Mersey having been driven when side on to the strong wind when swinging round with the tide and she was thus carried on to a soft mudbank near Egremont as her anchors slipped. The continuing gale made "the position of those on the liner and the tugs ... most unpleasant". The Cunard COmpany sent divers down to examine the hull with the view of reassuring the passengers that no damage was done. She was later sent on her way to North America and it was "expected that given fine weather the Mauretania will put up new records for the westward run". A meterological corrrespondent noted that the storm was due to "a cyclone of altogteher abnormal size and intensity".</p>
1907	28-29	12	North-west Britain	The Guardian &	30/12/1907	0	<p>A severe gale was noted in the Irish Sea and off the Welsh coast. The Holyhead breakwater was "deluged with waves from end to end" being obscured by spray which rose to a</p>

1908	7 to 11	1	British Isles	The Observer	09/01/1908	1	height of 100ft for most it's length. The harbour was crowded with vessels taking refuge and the cross channel steamers had rough passages and "passengers suffered severely from the bitter cold of the easterly gale". Several vessels which departed on the 29th were compelled to return and seek shelter once more and it was thought great damage had been done to shipping.
				The Guardian & The Observer	- 13/01/1908		1. Another gale coming variable directions hit the isles causing wrecks on the Cornish coast and much difficulty was encountered by vessels in the Irish Sea. A three-masted schooner was wrecked off St. Ives after receiving chronic damage off Trevoze Head and thus she ran onto a beach with another schooner wrecked the evening before. All were safely taken off through heavy breaking seas by the St.Ives lifeboat however. A crew was also saved off Padstow by a steam lifeboat after a Portuguese ship was seen in distress off the port. One boy was drowned but 20 lives were saved by another vessel and the lifeboat, th elatter of which sustained damage. In the Irish Sea the norterly gale caused great difficulty to steamers who encountered terrible weather and a number of vessels were sheltering at Holyhead and one or two steamers dragged when sheltering off Salt Island but were able to save themselves. The Ramsey and Fleetwood fishing boats were substantially damaged with many having "their canvas blown to shreds, masts and gear were carried away" and some 20 boats were in great danger. The crews however behaved gallantly and all got to shore in safety.

1908 22-23	2 British Isles	<p>The Guardian & The Observer</p> <p>23/02/1908 - 29/02/1908</p> <p>2 2. A storm of great violence raged throughout the British Isles causing near-untold destruction throughout resulting in the widespread destruction of property and loss on land and on sea. Hail and showers fell leading to the postponement of many a sporting fixtures whilst trees and telegraph wires were felled throughout the country causing issues for communication. It was remarked the damage was similar to that of the storm of 1703 in some parts of the country. The Force 11 force recorded in many parts of the north was defined as "nearly as strong as it is possible to imagine it to be even in the worst tropical hurricane. The Holyhead steamboat behaved valiantly rescuing the crew of the steamer Harold which was imboible and in danger of being driven ashore between the North and South Stacks. The Duke of Northumberland was out for 7 hours in total rendering assistance to vessel and "the heroism of the crew saved many lives". The lifeboat "Put out in the teeth of the gale" to aid the vessels with the aid of tug boats and local pilots who all took risks in efforts to valiantly save lives. The lifeboat "was swept end to end" and crowds watched her performing her duties with "much anxiety" with the boat disappearing from sight such was the size of the waves. It was remarked "it was a fearful test of her power to live in a terrible sea" as the lifeboat just reached the distressed steamer before she went upon the sheer cliffs. The crew persevered for two hours as they were carried away by waves but eventually a rope was thrown tothem from the vessel and they arranged a pulley system to convey the crew through the tops of the waves to the lifeboat. All 9</p>
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men aboard were saved and it was later said by the captain that they had been ignored by another vessel who had sailed past despite the fact they were clearly in distress. Another vessel had attempted to render assistance but had to abandon due to the danger of being obliterated by the waves carrying it onto the steamer and doing both great damage. The officers of the accused steamer stated that any attempt to render assistance "Ould have hopelessly failed, and perhaps imperilled many other lives" hence why they ignored the Harold. The Llandudno lifeboat also put off to render assistance to a two-masted ketch which was bound for Carnarvon and was drifting perilously toward the shore of the Great Orme. However the vessel could not be found despite an intense search. One of the crew had departed without oilskins and was thrown against the gunwale in the huge sea and rendered unconscious. He was later attended to by a medical professional. The Ketch however got to safety of the Conway estuary with the tide being high enough for it to pass over a bar. It went aground within 50ft of the Deganwy promenade but sustained little damage. A vessel also foundered. A three-masted schooner sunk off the Liverpool Docks capsizing in a heavy squall and was underwater within a matter of minutes. The crew's fate was a mystery and the river police had no evidence of the rescue of any man and the Sailors' Home and harbour authority was without evidence. It was noted that were the vessel sank the "currents are extremely strong, and the most powerful swimmer would be unable to keep himself afloat for long". Steamers bound to the

<p>1908 5 to 6</p>	<p>3 British Isles</p> <p>The Guardian & The Observer</p> <p>07/04/1908</p>	<p>4 Isle of Man were compelled to put back owing to the sea state. Lytham fishing boats were lost as 8 eight were swamped, 2 carried out to be sea and 2 were smashed against the pier but all were fortunately unmanned. At Barrow a vessel went ashore at Piel but was safe. Morecambe sea wall recieved much damage as 40ft of sea wall was torn away leaving a gaping chasm in the promenade. This damaged the electric wires and as a reslt the frontfell into darkness. An elderly man who was in charge of the level crossing at Whitehaven was unable to hold the gates against the wind and was run over by the oncoming engine. A 54 year-old man was also blown into a dock in Workington and although he was rescued it was found he had drowned even thugh "artificial respiration was tried without success". In Glasgow six people were injured by a falling roof.</p> <p>4. A violent gale raged throughout St. George's Channel and the Irish Sea as the barometric chart depicted "a deep cyclone over the St. george's Cheannel's, to which position it had traveelled very quickly during the night from the Atlantic". The decrease of pressure was very rapid in Wales and the north-west of England "the barometer falling about 0.75in, between 6pm and 8am with the barometric low being registered at 29.0 inHg. It was noted "such a deep cyclone generally causes gales of more or less violence" and thus it was unsurprising that strogn gales from the east were experienced. Many vessels came into difficulty on the Irish coast with wrecked vessels and fatalities being recorded and lifeboats were widely deployed. At Newquay the samll No. 5 lifeboat was</p>
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1908	31-Jan	3	North-West Britain	The Guardian & The Observer	01/04/1908	0	launched for practise in the storm and she capsized twice with the loss of one man despite a heroix attempt from the inspector of lifeboats to rescue him which almost resulted in his own demise. A vessel was also wrecked off Padstow and the steam lifeboat was unable to assist being in harbour for coaling. Despite the fact a line was thrown to those on the wreck the men jumped overboard with three being drowned and only one was saved.
1908	17-19	6	British Isles	The Guardian & The Observer	19/07/1908 - 20/07/1908	0	"There was a fine tide at Mroecambe" as the sea driven by a strong north-westerly wind created a "magnificent spectacle in the bay". The waves did great damage to the roadway and completely halted all traffic. A considerable creach was made in the sea wall once more. A mishap occurred to teh St. Annes lifeboat when the crew had great difficulty in launching, it taking two hours launch and one man was nearly drowned. A steamer sunk in the Bristol Channel and although the crew escaped in boats to Avonmouth they had suffered "severely from exposure".
1908	25 to 1	8	British Isles	The Guardian & The Observer	26/08/1908 - 02/09/1908	20	Heavy gaes and torrential downpours hit the British Isles in a torrential summer storm. On the west coast the most prominent issue concerned the rescue of a youth drifting in an open boat who had drifted for two days and was rescued by a steam barge onboard which he recovered. Serious damage was also done to crops in Somerset where corn and wheat was laid flat over large areas having an impact increasing wheat prices.
							20. A great storm hit the British Isles ocassioning incident throughout the kingdom. In the Irish Sea the Isle of Man steamer Mona Queen received considerable damage during her passage from Douglas to Fleetwood as her

paddle was much damaged and thus it was decided as too risky to enter Fleetwood. The fastest vessel in the Manx service was also damaged when she was run into by an inbound steamer while lying in the Sloyne and had to be taken into dock. In Carlisle the Horticultural Society's show was widely disrupted as the maruquees were wrecked by the high winds and "rain spoilt the attendance". The loss to the society was estimated at £300 (£37,000) and this was particularly serious as there were no reserve funds. The reason for this storm was attributed to a "slight anti-cyclone in the far south-west" and rainfall was generally from "100 to 200 per cent, above the normal for a week in August". The storm proceeded a "brisk fall of the barometer along the Atlantic seaboard of Ireland" which extended across the island at a rapid rate "causing a cyclonic circulation of the wind" which attained the strength of a gale at places" producing a southerly gale in the south and a north-westerly in the north. As a result great damage to crops was predicted and subsequently occurred. In the Bristol Channel there was much damage and at Ilfracombe the storm surge swept the parade and penetrated far inland and the local steamboat service was suspended. Trees were blown down and lamps out whilst windows were also blown in. At Porthcawl the winds veered to the NNW and were accompanied by lightning and "tremendous showers" whilst great damage was also experienced. Waves 50-60ft high came over the breakwater "forming one of the grandest sights ever witnessed on this part of the coast, where no such gale has been experienced since October

15, 1877" according to the correspondent. The Royal Navy's Atlantic fleet experienced the full force of the gale in the Irish Sea but sustained little damage. The Tenby lifeboat landed at Swansea the crew of the Helswick lightship which had broken from her anchors and been totally wrecked. The crew were in an exhausted state. Adding to the shipping casualties was a barque which was wrecked on the Margam Sands in the Bristol Channel. "the seas cut the vessel completely in two and the crew could be seen from the shore climbing to the rigging and lashing themselves to the bulwarks". The mainmast upon which 20 sailors clung eventually yielded to a "terrific breaker" and the men were precipitated into the surf with only one man left remaining on the rigging. The coastguard arrived with the Port Talbot life-saving apparatus and rescued the 2 remaining men onboard who left the ship with the encouragement of those ashore. Those ashore kept a keen watch for survivors and 6 men managed to make the swim ashore whilst 6 more were washed up drowned on the Kenfig sands. Men who were alive were well attended to at the Morfa cottages. 14 still remained missing so it was presumed 20 had died. The Mumbles lifeboat set out from Swansea however the sea were so high they could not reach the wreck whilst a man gallantly swam out to the wreck only to find "the tide was running like a mill race" and was carried 200 yards down the coast but survived. Many other smacks and small craft were driven ashore in the Bristol channel but all crews were reported to have survived. One three-masted ship

1908	8 to 9	9	British Isles	The Guardian & The Observer	10/09/1908	4	<p>was wrecked off Barry but all crew escaped in their own boats.</p> <p>4. Heavy rains and gale were experienced over Scotland and they produced mountainous waves which saw a several vessels wrecked off the North-west coast of Scotland. Over two days the centre of the depression moved from Northern Ireland to Edinburgh before migrating eastwards across the Irish Sea. At Barnstaple a schooner capsized and turned turtle and the wreckage strewn the shore near Croyde, North Devon. A body was washed ashore and was believed to be that of the skipper. The vessel was all but wrecked and although the small punt was missing it was thought all 4 had perished.</p>
1908	21-23	11	British Isles	The Guardian & The Observer	23/11/1908	0	<p>It was remarked "After an unusually long immunity from serious and widespread gales" the British Isles was visited by a deep anti-cyclone which brought strong, yet mild south-westerly winds of of great violence to the west coast. A strong gale and high seas were reported throughout as the cyclone progressed slowly westward as 0.5 inches of rain was widely reported throughout. The Holyhead lifeboat had a long struggle against the gale as they were summoned to a vessel in peril in Holyhead Bay whilst the lifesaving apparatus was also summoned as it was feared the vessel would run ashore. Although the lifeboat reached the vessel in distress "amid raging seas" it was forced to beat about for hours as it could not land due to the wave conditions at the shore. Hundreds of spectators from the shore watched a steamer be driven back by the vessel. The lifeboat was also spotted burning distress signals at one point but "by splendid seamanship,</p>

1908	10 to 13	12	British Isles	The Guardian & The Observer	11/12/1908 - 14/12/1908	0	<p>hwoever, the lifeboat eventually reached Penrhos sands" and burnt a blue flare to show all had reached shore in safety. The Mersey Ferries were also suspended at New Brighton owing to the severity of the gale and several vessels in the channel sought shelter from the heavy seas running in Liverpool Bay. Several windows were blown in and many narrow escapes from falling chimneys were reported.</p> <p>"A heavy storm swept the south and south-west coasts" and it was remarked the passage of the depression must have been very rapid as the "barometer showed practically no indication of its approach". The barometer in the Irish Sea sunk to 28.9 inHg as the cyclone progressed eastwards over the sea and Lancashire. The coasts of Wales and south-west England received the full force of the gale which raged with "exceptional violence" and a Beaufort Force of 11 was registered in the Scilly Isles. The chief officer and 11 crew of a distressed barque were landed at Falmouth whilst 9 remained aboarded in the Celtic Sea. She was aided to by tugs and the Padstow lifeboat and eventually towed into Cardiff.</p>
1908	28 - 29	12	British Isles	The Guardian & The Observer	29/12/1908 - 30/12/1908	0	<p>A great blizzard hit the British Isles and was severely felt in the west and north of the kingdom despite the worst of the snow being in the north-east. Many communities in the North-west, West Wales and Scotland were completely snowbound and the tramway services of Cardiff, Bristol and Liverpool were much delayed as cars had to be dug out of drifts whilst railways also suffered. The meteorological correspondent wrote the "direction of the wind in most regions was between south-east and</p>

1909 9 to 18	1	British Isles	The Guardian & The Observer	11/01/1909 - 19/01/1909	3	<p>south. The disturbance which, in conjunction with the Scandinavian anticyclone, provoked the rough weather, was what is known as a "V-shaped" system". Based on "a moderate estimate an average depth of about four inches fell over Great Britain" it was estimated this amounted to 1,611,781,870 tons. It was remarked that it was not just inland were the majority of the snow fell and the temperate plummeted as the the coasts of Lancashire were "only a trifle less cold than the Midlands" and five degrees of frost prevailed at Southport for the entirety of the 29th. The Irish Mail train was only 15 minutes late at Dumfries but could proceeded no further than Castle Douglas, the line being completely blocked. At Blackpool and the Fylde the storm was remarked as being the worst in 11 years and the strong SE wind blew the storm into large banks. Nearly all tram traffic was suspended and trains heading inland had to be dug out. The Belfast steamer was much delayed having to cross to Fleetwood in "the teeth of the blizaard". A train also had to be dug out near Llandudno as it was blocked by a snowdrift on the line by the West Shore Golf Links. The rear part of the train and passengers had to be taken back and diverted to another line whilst the line and initial locomotive was cleared after several hours of hard labour by a large work party in the snow.</p> <p>3. A great gale which was first felt in the North Sea caused havoc throughout and the lifeboats of the west coast at Moelfre and Fishguard were deployed on rescue missions. At Molefre the coxswain of the lifeboat said he had experienced nothing "approcahing it in dangerous fury</p>
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except the great gale of November, 1891". A vessel which had put into the bay and was windbound showed a signal of distress and the lifeboat was promptly manned and it was remarked there was so much eagerness they could have manned 3 lifeboats if they had them. The lifeboat herself was "severely buffeted, and at times she disappeared from the sight" of those ashore causing anxiety to arise but she eventually reached the brigantine and the men onboard slowly descended into the lifeboat after masterful manoeuvring from the coxswain. Despite effecting one successful rescue the lifeboat then had to attend to another vessel in distress having to traverse dangerous breakers before effecting another rescue. The Moelfre lifeboat also effected a 3rd rescue in the darkness as a steamer grounded and was in danger of being wrecked in the shallow coast. The lifeboat was rowed over a mile and effected another vessel of a captain, 16 men and one stowaway. The day following on the 11th all men were returned to their vessels and all passed safely on to their destinations. It was remarked "The people at Moelfre are loud in their praise of the manner in which the lifeboat was handled" and remarked that one of the captain's had exclaimed "he had never seen a boat so finely handled in all his life". A Fishguard the crew of a Carnarvon vessel were rescued by the lifeboat after it dragged anchors and was in danger on going ashore. Three men and a boy were rescued with difficulty and the lifeboat was damaged in the surf having to hoist sails to reach land again. It was remarked the surge was considerable as "the waves dashed 10ft high over the

massive breakwater which is in course of construction". A later meteorological report remarked the gales "have spent their greatest force over the Irish Sea" and the cyclonic system "has been remarkable for its depth". In the north of Scotland a barometric low of 28.4 inHg was recorded. At Blackpool wind velocities of 63 mph were reached and a constant speed of over 50 mph was recorded as the wind veered from WSW to NW. It was feared a vessel had been shipwrecked off Holyhead after signals of distress were seen and the following lifeboat search, carried out for 5 hours was fruitless. The lifeboatmen returned to the station exhausted and "convinced that the vessel had foundered and the crew perished". A further meteorological observation stated the cyclone produced "a true south-west current" which brought the temperature up to 50 degrees Fahrenheit in most parts of the UK as the pressure fell to 28.1 inHg in the north of Scotland whilst the pressure in the South of England was 2 inHg higher which thus was the cause of the strong winds. At Mumbles two Royal Garrison Artillerymen stationed at Mumbles fort who had set off in a small boat during the night of the 15th had not since been heard of and were presumed drowned. Heavy rain brought ensuing flooding to the Cumberland district as the River Eden burst its banks and flooded a new sports ground near Carlisle and "the holmes presented the appearance of a vast lake". A ship's mate was also drowned at Blackpool when he was carried away by huge waves whilst standing on the steps leading up to the promenade from the beach and

1909	10-Jan	2	British Isles	The Guardian & The Observer	11/02/1909	0	his body was later washed up at Fleetwood. He was noted to have been an exceptional swimmer. Following a depression which travelled southwards over the North Sea and Eastern England gales from the north-west and north ensued along the western coasts which were accompanied by rain, sleet and snow. No damage was reported however as temperatures fell to 35 to 40 degrees fahrenheit.
1909	14-23	10	British Isles	The Guardian & The Observer	16/04/1909 -23/04/1909	0	A storm and heavy rain hit the British Isles from the South-west which caused significant flooding in South Wales where the rivers rose to become "raging torrents" which were especially serious in the Rhondda and Aberdare valleys and the rivers flowing into the Taff. Flood levels were the highest noted in 25 years. Fields, roads and houses were widely flooded with water up to depths of 3 ft and the tramways were suspended. Travel to the court had to be made via boat. Many collieries were flooded and schools were also underwater. Occupants were driven to the upper floors of their homes and had to be conveyed out using ladders and sheltered in houses. A riverside wall was lost down and as a consequence a road became part of a raging torrent. At Aberavon there was 2-3ft of water on the railway line and railway traffic on the South Wales Mineral and Port Talbot Railways had to be stopped. A bridge was also swept away and the sea wall at Porthcawl which had only recently been repaired "at great cost" sustained yet more serious damage. Near Port Talbot a sudden flood nearly swept away 24 cottages of which 4 collapsed under the immense force of the water but all inhabitants escaped. The meteorological

1909	26-29	10	British Isles	The Guardian & The Observer	28/10/1909 - 30/10/1909	3	<p>correspondent noted the disturbance had produced gales from France to Scandinavia and it was said "seldom even in storm October that a single cyclone covers such a vast area" as it was estimated the cyclone extended for 2000 nautical miles in breadth. Lows of 28.4 inHg were noted in the Faroes. The royal Navy's Atlantic Fleet were also kept windbond in Belfast as the storm raged throughout the Irish Sea. A steamer also arrived from Ayr with her stokehold flooded and other vessels were more than a day overdue. A navigation buoy in the Ribble also broke adrift in teh gale and "driven by the high running sea, struck against and broke one of the iron columns" that supported the Lytham Pier which recieved moderate damage. At "the height of the hurricane" a cab was also overturned at Llandudno and whilst neither horse or driver was seriously hurt the cab was ruined. At Blackpool a spectacular event was observed in the form of the pioneering aviator Hubert Latham flying his plane in a gale which the anemometer indicated was a minimum of 28 miles an hour whilst gusts were as strong as 45 mph. It was remakred "Noone has ever before attempted to rise from the ground in such a storm, and no one, not even Latham himself, who earned for himself at the Chalous camp the name of Stormy Petrel, has ever pilotted his Antoinette throughout such a perilous voyage as he deliberately embarked on" on the 22nd.</p> <p>3. A strong gale which originally caused the majority of it's disturbance on the east and southern coasts was also felt off Anglesey were a ketch was in danger of being driven ashore. The Penmon lifeboat was consequently deployed</p>
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<p>1909 2 to 3</p>	<p>12</p>	<p>Western Britain</p>	<p>The Guardian & The Observer</p>	<p>04/12/1909 - 08/12/1909</p>	<p>40</p> <p>and the lifeboatmen succeeded in making contact with those aboard and appealed to them to leave the ketch. However, owing to the sea state they would not make the attempt and the lifeboat waited for 3 hours with the conveyance cradle ready to convey the men until the cables parted and the ketch's anchor dragged. Despite their laborious efforts the ketch was "swept away into the darkness" and the lifeboat crew saw her drift into Red Wharf Bay which was very close to the scene of the wreck of the Royal Charter some 50 years earlier. Despite the best efforts of the lifeboat crew to rendered assistance to the distressed men they were driven from the ketch onto the beach and could no long render assistance in the "face of as furious a gale as ever beat on the North Wales coast". There was cosnequently little doubt that the ketch had gone to pieces and all 3 aboard had drowned. Such fears were confirmed when a dead body of one man was washed up near the wreck. The Abersoch lifebat was also deployed in a "tremendous sea" in response to distress signals from a ketch in Pwllheli Bay. Fortunately, after much exertion the ketch reached the vessel and the seven men aboard who were taken into Abersoch and landed by means of a cradle. A steamship was also driven ashore on the beach of Abersoch and was completely wrecked.</p> <p>40. A great storm resulted in devastating consequences on the West coast of Britain and in the Irish Sea as a "record cyclone" struck the Isles producing "extraordinary variations in barometric pressure" as the system moved rapidly. Barometric lows as low as 27.33 inHg were</p>
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recorded and 27.38 inHg at Belfast producing "weather of the true cyclonic type". One of the greatest incidents was the sinking of a steamer in the Bristol Channel and it was feared all 4 had drowned as several bodies were washed ashore at Westward Ho! The vessel had been in the Clovelly Roads before she was struck by a heavy sea and foundered. Two other vessels were also reported ashore at Clovelly. One man was found to later have telegraphed his daughter but no news of any others was noted. In the Irish Sea the destruction was great and a Navy torpedo was forced ashore on Barrow Sands but later got off. The captains of the Belfast steamers stated they had experienced nothing like it for 1/4 of a century as they encountered mountainous seas as well as blinding sleet and snow squalls. Huge waves smashed part of the upper bridge of one vessels, destroying the communication equipment and the captain sustained minor injuries. Many vessels took shelter in Ramsey Bay to escape the gale. The barque under tow from Birkenhead to Whitehaven broke it's hawser and went ashore at Biggar Bank near Walney Island. The lifeboat was than dispatched from Piel but could not get near the vessel although the two men aboard were reported safe. The Aleppo, a liner being broken up at Ward's shipbreaking yard was also swept from it's moorings and in Preston and carried a mile down the river before runnign aground. The flooding in the Dee valley was considerable and the "river rose with alarming rapidity" flooding the Welsh valleys and surrounding flood plains. The floods removed the telegraph and telephone poles making such

communication with Chester impossible. On the North Devon coast immense damage was done to houses in Ilfracombe with many chimney stacks being blown down, glass in an arcade shattered and trees uprooted. The gale likewise wrought havoc and destruction in Cardiff and the rivers in the valleys of South Wales once again flooded surrounding land to a depth of 2 feet and prevented rail and road travel. Perhaps the greatest disaster of all however was the disappearance of the Isle of Man steamer the Ellan Vannin and all her passengers and crew totalling 36. Divers on the scene of the wreck had uncovered evidence which only increased the mystery surrounding the evidence. The divers "found that the vessel is entirely cut in two and the two parts completely separated and lying part". It was stated "it would appear to be beyond doubt that there was a collision and that the Ellan Vannin was run into by a vessel". The vessel had been stove in on the port side and the decks completely removed. The investigation noted that it was "clear that an attempt was made to lower a boat" and the boat was missing along with every single body. It was thought they had been dispersed by the currents and were soon to be washed ashore on the coast of the coast of the channel. It was hypothesised by the collision could not have occurred within the vicinity of the Mersey Bar because it would have been observed by the nearby lightships who so no such incident. It was thought the captain had tried to run before the northerly wind back to the Mersey with all on deck. Therefore it was supposed no one had met the "their fate in that terrible fashion" by being trapped below

1910 9 to 11

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as the vessel sank. It was remarked that the fact she had been navigated inside the Liverpool was a "tribute to the skill with which she was navigated" but "every effort would seem to have been unavailing" as the vessel broke in two and sank. Two theories were proposed with regards to the vessel which collided with the Ellan Vannin. The first was that she had also "foundered with all hands without leaving a trace behind" whilst the other was she was not greatly damaged but passed with such speed she was unable to render assistance and lost the vessel in the raging sea. The first seemed most tnable given no report of a collision had been recieved at any port or signal station. It was also noted that wreckage that did not belong to the Ellan Vannin had been discovered near the spot in which she was wrecked. Operations were to be commenced on the 8th in order to ascertain whether another vessel was at the bottom of the channel. Later investigation stated that the cabin hadn't yet been penetrated by the divers and thus there could still be trapped passengers below. A telegram from Ramsey said that 20 woman had been made widows and 70 children sadly orphaned with the loss of 17 Manx mail bags. There was said to be no possibility of raising the steamer and the Dock Board discounted he alterative of blowing her up. A violent gale was produced by the progression of a great anticyclonic system over the contient and the coming of a very large cyclonic system over Iceland which generated very strong winds from the SW. As a result very high seas were produced and the barometer sank as low as 28.6 inHg in Shetland and 27.9 inHg in the Faeroes a strong

1910	16-21	2	British Isles	The Guardian & The Observer	18/02/1910 - 22/02/1901	9 pressure gradient was induced across the North of Britain. As the pressure difference was so great a gale of "remarkable severity on the most of the northern coasts" and high seas were also produced. A schooner was also in danger off the Isle of Man and the Ramsey lifeboat was deployed in a strong SW gale as the vessel dragged and deployed flares. The lifeboat rescued all onboard and another trawler collided with the schooner whilst trying to render assistance. Many vessels crossing the Irish Sea were sheltering in Ramsey Bay from the gale. 9. A great south-westerly gale set in during the evening of the 16th doing great damage over the United Kingdom. The meteorological correspondent noted that the wind had been most strongly felt on the coasts and had risen to the force of gale producing "rough or high sea off almost all the coasts". The cyclonic centre lay off the north-west of the islands and the temperature rose by 14 - 15 degrees F between the 17th and 18th. Squalls and showers were widespread and most places and the barometric gradient was strongest over the North of England and the Irish Sea. Near the cyclonic centre the barometer fell as low as 28.3 inHg. Throughout Lancashire and Merseyside there was significant loss and destruction as a girl was killed by a falling stone in Liverpool and a man killed by a falling branch in Alderly park. A great sandstorm was produced as the unconsolidated sands on the Lytham dunes was whipped up by the wind and caused the Lytham shipbuilding works to close down as sand was blown into the machinery whilst the "streets are strewn with evidences of the gale's violence". The storm produced a
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"sea spectacle" at Blackpool and the Met office hoisted their south cone as the "deep depression was approaching from Iceland". On the 17th gusts of 50 mph were noted and the maximal gust strength reached 76 mph in the afternoon as an average of 52 mph was noted. Many signboards were blown down and plate-glass windows blown in with several people sustaining minor injuries. "The seas breaking on the promenade presented a magnificent spectacle". The sun shone "brilliantly over huge waves, which rushed landward terrific power, chasing each other and breaking in many-hued sprays" as "foaming water" poured across the promenade. The gale was also severely felt on the North Wales coast where the Llandudno lifeboat was called out to a distressed vessel 10 miles NW of the Great Orme. However the crew saw nothing in the terrible gale and remarked "the boat behaved splendidly, though seas frequently swept over her". The wind also "raised immense clouds of sand on the Conway Morfa" and did considerable damage including damaging a military storage shed and scattering the targets all over the Morfa range. In the Clyde a steamer was blown ashore and remained stuck fast with little hope of being got off. A cook on the famous liner the Mauretania was severely scolded when the vessel lurched in heavy seas in the Irish Sea and he later died from his scolds in a Liverpool hospital. A West Indies Direct Line steamer was also windbound in Torbay and difficulty was experienced in conveying the mails to shore. A vessel was noted in grave peril in Tenby but later disappeared from view leading to speculation that she had been driven

1910	7 to 8	6	British Isles	The Guardian & The Observer	09/06/1910	<p>ashore and wrecked by the "furious south-westerly gale" as "tremendous seas were breaking against the cliffs". A farmer reported he had seen the vessel flying flags of distress thrown against the rocks and founder. The Tenby lifeboat was sent out to explore the coast but did not find any wreckage whilst the coastguard's search revealed 4 bodies washed up at Lydstep. The Appledore to Instow ferryboat was also swamped and three lives lost with two drowning on the spot and one man later dying ashore from his exposure. The accident was witnessed by a crowd onshore who were powerless to help and it was also noted that this was the first recorded accident of the Appledore ferry in which life had been lost. It was noted that the onshore winds had created a "most disturbed state" and had thus lead to the capsizing. It was noted the ferrymen themselves had previously saved the lives of the crew of two barges which sank off Appledore. One of the men left a wife and 9 children whilst the other a wife and of children.</p> <p>Much of the British Isles was visited by severe thunderstorms and lightning which of "remarkably vivid character" whilst in certain places heavy rain fell and minor. In the west the only major incident occurred near Pwllheli where a farmer and his team of horses were struck by lightning with 2 horses being killed and the farmer slightly injured. There were also reports of other livestock being killed in rural districts.</p>
1910	26-27	8	Western Britain	The Guardian & -	27/08/1910 30/08/1910	7 <p>A fierce storm struck the west of the British Isles which was severely felt off the coast of the Isle of Man. The south-westerly gale and huge seas wrecked a small vessel</p>

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at Spaldwich although of the 6 foru managed to swim to safety but 2 were unfortunately drowned in front of a helpless crowd who saw the "tragedy" unfold. The vessel had been frantically maneourving out of perilbefore being swmaped by a huge wave and thrown upon the cliffs. One of the survivors had a severe head wound. Despite their best efforts and the "piteous cries" for help from the distressed mariners depsite there were mere yards from the shore. Despite the use of ropes and the lifeboat deployment the dangerous place in which the doomed sailors were washed made it impossible to render assistance. Although he drifted towards a safer location he later drowned beaneath the waves before he reached a point a which help could be rendered. The drowned boy was never seen and both bodies were recovered later. A later inquest returned the verfict of "Found drowned" but added a "rider stating that they considered the coxswain might have made greater eforts to reach the drowning men in the corks, and that the lifeboat should never be launched without proper equipment". An open boat had somewhat of an adevnture as it was out in the storm for 16 hours and it was initially feared it had been wrecked. The Peel lifeboat went out to search for the vessel along with fishing boats who scoured the coast looking for the vessel in question. However she was eventually found by the lifeboat in the mid-channel and although the crew had had a terrible experience all were alive. All releif of their rescue was somewhat neutralised by the news of the 2 deaths elswehre. A steamer bound for Douglas from Heysham was also windbound for 4 hours and took twice

as long to do her usual 3 hour voyage due to the wind and sea state. Four different Isle of Man lifeboats were deployed and it was said 7 had died on the island alone during the storm. Two lives were sadly lost during a regatta at the Royal Dart Yacht Club. The twelve-metre class race was suddenly disrupted as one of the yacht was caught by a sudden gust and dismasted. "Three of the crew who were on the weather rail were pitched overboard, and two were drowned". All racing was expectedly abandoned and their vessel towed into Dartmouth. The torrential rain on the Scottish border was "placing farmers in a serious position" as much as he crop was damaged over Annadale. The crops were already over-ripe and it was stated if the storm didn't abate "farmers all over the South of Scotland will suffer heavy loss". A Mersey dredger also capsized resulting in the loss of two lives as the "wind blew with hurricane force" down the estuary. The captain stated the men had very little warning of the impending hurricane as the vessel was thrown on the dock wall but the majority of the men managed to survive by clinging to the overturned vessel. The New Brighton lifeboat was immediately put out and succeeded in rescuing 5 men. A torpedo boat was driven ashore in Campbeltown Loch which was the base of vessels undertaking military exercises in the Firth of Clyde. The vessel was later refloated however and the damage temporarily repaired. A destroyer was also driven ashore in Gare Loch but it was hoped she would later be got off with minimal damage. The passengers of an Irish Sea express steamship had a terrifying experience with the

1910	14-15	10	South-west Britain	The Guardian & The Observer	17/10/1910	2	<p>vessel receiving substantial damage and the seas flooded the saloon. However only the superstructure was damaged and she set sail after reaching Kingstown with minimal delay. There was another tragedy at Saltcoats near Greenock when a 17 year-old drowned whilst bathing in the Firth of Clyde and a reverend as also taken ill and fortunatley rescued in an unconscious condition. A young German lady was also rescued when drawn by the backwash but this was only after two failed rescue attempts by the bathing attendant and 5 shoremen in a galley who themselves capsized. Although a 3rd boat was deployed that to capsized leaving a man whohad jumped in o save the woman and the german woman herself to swim to shore whilst the others were all rescued by the 4th vessel. The "spectators warmly cheered the rescuers however and over £6 (£723) was given to them on the spot for "their plucky conduct".</p> <p>2. A great sea was produced by a severe storm on the South-west coast and in Mount's Bay who men unfortuantley drowned when their vessel capsized whilst communiting to their steamer anchored two miles from the shore. One of the vessel's tenders had become upset when caught by a huge sea and although rescue vessels were quickly dispatched by the vesses nearby only 3 of the 5 aboard could be saved. The Penzance lifeboat also set off but was too late. The men each left and wife and two and three children respectively. One of the survivros said they had been in the water for 10 minutes and "the sea came quite unexpectedly or we should have been all right".</p>
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1910	31 to 2	11	British Isles	The Guardian & The Observer	02/11/1910 - 03/11/1910	"The first winter storm" set in on the 31st and continued with "unabated fury along the Western and Southern coasts" for 3 days. The stiff winds were accompanied by frequent cold showers and hail. The cyclonic system was "unusually extensive and deep" and the centre of the depression lay off the south of Norway where the pressure was measured at 29.3 inHg. In the gale on the Welsh coast a vessel got into trouble off Holyhead and displayed distress signals which the Holyhead steam boat responded to. It was found that the schooner Elizabeth Hyam had dragged anchors and was in danger of going ashore onto dangerous rocks. Thankfully the crew were taken off and all 3 were without injury. Several hours later the lifeboat was out once more to assist another schooner in distress and three more men were saved by the gallant crew. A Plymouth ketch foundered off Clovelly and the local lifeboat and the lifeboat set out to rescue the three men successfully. In Liverpool a rather loud thunder clap was heard and a vessel went ashore by Waterloo with all being rescued by the coastguard and the boat spared being wrecked. The meteorological correspondent noted that the progression of the depression resulted in the wind backing from south-west to north-west over the course of the storm but the gale still persisted until the evening of the 2nd as the temperature fell rapidly as the wind shifted and strong gusts still remained consistent. A period of strong winds developed into a full gale which was severely felt on the South and Western coasts of Britain. Such weather was the produce of the arrival of "depressions, which have been very numerous and often
1910	16-17	12	British Isles	The Guardian & The Observer	17/12/1910 - 20/12/1910	

1911	21-24	2	British Isles	The Guardian & The Observer	24/02/1911 - 25/02/1911	1	<p>of unusual intensity" from the Atlantic. The gales were accompanied by mild temperatures falling no lower than 45 degs F at night which was similar to the average temperature in the afternoon. In the South-west coast at Ilfracombe a woman was lifted off her feet by the strong winds and sustained a severe wound to the head. The whole of the lower portion of the town of Ilfracombe had been isolated by the overflowing seas with stores, stables and offices on the quay being washed away whilst the sea wall was swept away in parts and segments of the parade was damage. In South Wales terrible flooding was indured in the valleys and scores of livestock were drowned as inhabitants were compelled to take shelter in their upper rooms. Houses also collapsed due ot the force of the water and sveral peopple sustained slight injures. Hardly anyone could attend the Usk Christmas market as the roads leading to the town had been washed away.</p> <p>1. A strong westerly gale which blew for 4 days causing much mischief. A derelict French warship was blown upon the Scilly Isles after it had been abandoned in the Atlantic 3 weeks earlier. Not realising the situation of the vessel " signals were fired from the Bishop Lighthouse and two lifeboats put out in a blinding rainstorm and a heavy sea to search the western roads". It was said she could present "a grave menace to navigation". A Ramsey correspondent telegraphed that the storm in the Irish Sea was terrific and "the wrost since the night the Ellan Vannin foundered". Ramsey Bay was consequentely crowded with shipping and the "bay itself was a mass of seething foam". A meterological correspondent noted</p>
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1911	19-Jan	4	British Isles	The Guardian & The Observer	20/04/1911	<p>"the arrival fo the centre of another deep cyclonic disturbance from the Atlantic caused a continuation of the gales". The barometer fell as low as 28.4 inHg in the Hebrides whilst the barometer in Lancashire was a full 2 inches higher creating the steep gradient that produced the winds. Heavy rain fell with the mild SW winds. In Swansea an insurance agent who failed to hear an approaching train "owing to the sound of the gale" was run over and killed. On the Mersey a steam tug rescued a party of 11 in the training ship Conway and 15 cadets who had attempted a rescue themselves. A Canadian liner Empress of Ireland was unable to leave dock owing to the severity of the storm.</p> <p>Strong winds produced heavy seas and fierce winds on the Western coast which were a consequence of the "very deep depression" however, despite this there was very little rain throughout the UK. Despite the fact the barometer fell to 28.7 inHg which was described as being "an unusual figure for the middle of April and is not common even in the winter". In the height of a SW storm a chimney pot of Faarkerly Hospital was blown off and fell through the roof causing a fire although the "alarm was at once raised, and the thirteen patients in the ward were transferred to another part of the hospital". The roof later fell in on fireman who were endangered by "a rain of molten lead which poured from the roof and by showers of slates brought down by the wind" but aprt from superficial injuries all escaped without accident. At Southport a great "dust and sand storm" was experienced as "dense clouds of dust swept over the town". Visibility</p>
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1911	31-Jan	9	British Isles	The Guardian & The Observer	01/10/1911	<p>was very poor and gathered in heaps in front of properties and "every gust of wind caused great inconvenience and pain to pedestrians and drivers of vehicles" with tram drivers being given goggles to aid with the issue. Many houses and public properties were covered in sand which seeped in to property. A sailing yacht on the marine lake was blown over and the occupant had to be rescued by two men in a rowing boat. A storm from the east came to Britain and covered the Annandale district with snow. At Fishguard a transatlantic steamer was prevented from calling at Fishguard owing to the fury of the gale. Another liner instead diverted to the more sheltered Milford Haven.</p> <p>A great gale which "was fierce even for October" swept over the North-west of Britain occasioning several disasters on the coast. Twelve men went missing when their boat sank off Oban and a dredger whilst on the South Wales coast a steamer was driven ashore at Aberavon but all 24 of it's crew were rescued. A vessel also was lost off Tenby and the fate of its crew was unknown. The meteorological correspondent noted the "barometrical changes over these islands have been extremely rapid" as the cyclone produced a gale from the south-west with "extremely fierce" squalls. The fierceness of the gale was noted to be reduced compared to many of those experienced over the past 15 years. The storm system was noted to be "very extensive, covering many thousands of square miles" as it progressed in a gradual easterly direction. Postal delays to Ireland, Scotland and the North and West of England resulted.</p>
1911	29-30	10	British Isles	The Guardian & The Observer	31/10/1911	

1911	4 to 5	11	Western Britain	The Guardian & The Observer	06/11/1911 - 17/11/1911	1	<p>1. A strong westerly gale occasioned a great deal of loss on the Lancashire coast, with Blackpool in particular suffering from the effects of a storm surge as huge waves broke all along the promenade at high tide creating a magnificent spectacle. A vessel showed signals of distress off St. Annes and the St Annes lifeboat "after a hard battle safely brought the crew to land about midnight". The Lytham lifeboat had also been deployed and the Blackpool lifeboat was ready but not needed. In Lancashire and Merseyside there was widespread damage to roofs, windows and trees whilst a girl and an elderly woman were killed by falling chimneys. The telegraph and telephone services suffered serious interruption due to the widespread felling of poles and wires throughout the UK which led to many large areas and cities being completely cut off. A youth was killed whilst fishing from rocks at Porthcurno Cove, Cornwall and a friend who tried to rescue him was thrown back onto the rocks. A cattleboat also arrived at Bristol from Cork with a 43 degree list having been considerably damaged by the storm in the Bristol Channel and over 300 cattle were taken out dead.</p> <p>Strong winds from the east struck the UK and whilst the majority of the mischief was on the south and east coasts a gentleman had a struggle against the elements crossing the Clyde from Glasgow to Dunoon. The boat eventually reached the safety of Castle Rocks, Dunoon but it attracted a huge crowd and caused much anxiety among many, particularly his wife. There were many inquiries after the man who remarked to his land lady "Ah! you</p>
1911	22-24	12	British Isles	The Guardian & The Observer	23/12/1911 - 27/12/1911		

1912	6 to 8	1	British Isles	The Guardian & The Observer	07/01/1912 - 09/01/1912	<p>nearly lost your wee lodger" when he returned. In his interview he noted "at times the front part of the boat was thrown into the air... Again and again the waves dashed over our heads". He remarked "I reached home drenched to the skin, and found my wife in hysterics" but she stated "I did not think you would be drowned, for I was praying for you all the time". He finished "All's well that ends well". Blackpool also nedured a significant storm surge which swept local fishing boats on the promenade and did minor damage as was shown in the first spatially relevant storm photograph to feature in the research. "Squally weather, according to the Meterological office" accompanied with sleet and snow visitied predoiminately the north of the nation. Snow fell heabily over North Wales and delayed railways traffic whilst communication lines were felled.</p> <p>A steamer was noted in distress in a storm off Plymouth. "A fierce gale was blowing with heavy seas" and the warships in the harbour turned their search lights on to illuminate the steamer in the dark which was eventually aided by the lifeboat. There was also a call for aid another vessel. The Newquay lifeboat was also out to rescue the crew of four on a schooner which ran ashore and was wrecked on the Newquay rocks. The crew were however "hauled up the cliff, a hundred, feet high, by the rocket brigade". During the rescue a woman fell over the cliffs and died. The Padstow steam lifeboat was called out after signals fo distress were noted but she returned having been unable to find such a vessel. However a trawler later</p>
1912	4 to 5	3	South-west Britain	The Guardian & The Observer	05/03/1912 - 06/03/1912	

1912 7 to 8	4	British Isles	The Guardian & The Observer	09/04/1912 arrived with 11 men from a steamer which had been caught in the tempest and in an unavigable condition. It was exclaimed that the bank holiday weekend had been "marred" by a storm which was particularly severely felt at Blackpool where the 20,000 excursionists were much affected by the storm and the resorts were deserted. The meteorological correspondent wrote that "a very deep cyclonic disturbance" had travelled across the North of Scotland and brought "High sea to all parts of the coast" produced by winds which veered from SW to N. There was very little rain and the temperature rarely got above 60 degrees as the strong squalls came in from the NW. In Glasgow and child was killed and others were injured when a chimney fell through the roof and into a house. Several people were also "hurled off their feet" as debris widely blew around. Two yachtsmen had a great adventure at Southport when they were forced aground on the Horsebank and remained there for 12 hours. The men who were experienced cruisers had to wait for the tide to rise to get free however "meanwhile the wind had risen to almost hurricane force" and conditions were so dangerous that they anchored their craft which "rode out of gale splendidly" although the drainage pumps did have to be used several times. Eventually the "predicament of the yachtsmen was observed" by a fisherman and his three sons who rescued the men with great difficulty. The vessel was later washed ashore with little damage from the West Lancashire Yacht Club and they were "none the worse for their experience".
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1912	31 to 1	8	North-West Britain	The Guardian & The Observer	01/08/1912		A gale sprang up on the North Wales coast over Llandudno and anxiety was felt for the passengers of two steamers anchored in the bay as the "wind drove at a great rate directly on the shore from the north-west and the sea became very rough" as rain fell in torrents. One of the captains who had come ashore was compelled to return to his vessel however his pump was swamped in the heavy sea and thus the captain asked the lifeboat to be brought out which was promptly done. Rockets were sent up to assemble the crew which was promptly launched and the captain taken back to his steamer. Much excitement was raised ashore during the night as the steamers resisted the storm with their lights on and the lifeboat stood by ready to render assistance which wasn't needed.
1912	25-27	11	British Isles	The Guardian & The Observer	27/11/1912	2	2. Another severe storm swept over the British Isles but fortunately it was thought the storm was "unusually free from loss of life among seaman" although much damage had been inland. At Barrow the storm felled a huge crane which killed two men and injured several others. At Rhyl there was "serious serious of coast" and railway men had been sent to patrol the seawall for the protection trains as the railway line was in danger of being undermined. The meteorological correspondent noted that the barometer had sunk rapidly over the Southern Hebrides to 28.1 inHg and elsewhere on the mainland much higher barometric readings indicated that a strong pressure gradient and thus high windspeed would be produced. The direction of the gale veered from westerly

1912	14-15	12	Firth of Cylda and Cardiff	The Guardian & The Observer	15/12/1912 - 16/12/1912		to northerly and the temperture fell to an extent snow was noted in the north. Strong winds from the west were particularly severely felt on the West coast of Scotland where a ketch named Puis IX foundered near Helensburgh after being run down but her crew were picked up. Two schooners were also driven out to sea and retrieved by tugs. A medicine chest and wreckage of a Liverpool seamer was picked up on the Scilly Isles leading to great anxiety she had foundered. A horse that was frightened by the wind bolted across the docks and drowned in the basin.
1913	7 to 9	2	Mersey and Lancashire	The Guardian & The Observer	09/02/1913 - 10/02/1913	7	7. A storm which brought winds of consdierable enough violence to do major damage to property came to the North of Britain. The major casulaty was the the loss of a Mersey hopper with the loss of 11 of the 12 crew. The vessel had been engaged in the construction of the new Gladstone dock and had stopped work following the ensuing of the storm. Although the men had been "sufficiently aware of the gravity of their position to fasten on their lifebelts" the vessel suddenly was overcome and lost in the dark. Only her masts were visible above water the next morning. The only survivor of 3 had been immersed for 1 1/2 hours and have drifted for 2 miles into a dock were he had attracted the attention of a dockgateman and been pulled from the water "exhausted and scarcely conscious". The man viewed his escape as miraculous and he attributed the lifebelt as the only reason for his survival. He had been fortunate of the flood tide and had been "determined not to give in, and after a time he even grew accustomed to his suffering. He

<p>1913 8 to 9</p>	<p>5 North-west Scotland, The Mersey</p> <p>The Guardian & The Observer</p>	<p>09/05/1913 - 10/05/1913</p> <p>thought he was little the worse for his experience". The man did not speak of the hopper however and it was said no fears had been entertained of it's safety inspite of the storm. No signals of distress were observed adn New Brighton lifeboat went out to report on the disaster and could not find any of the missing bodies. A collision occurred in the Mersey between a schooner and a flat which then sank but her crew were saved whilst two other vessels also dragged anchors but came to no harm. The high winds also blew open the gates of a graving dock at Glasgow and drowned three men inside whilst a fourth was "whirled roudn the dock by the torrent, and eventually cast up on the bank unconscious". At Preston storm surge conditions resulted in flooding of the Ribble to the extent that the main road to Liverpool was impassable for hours. Waves also dashed long the Morecambe promednade which was battered by north-westerlywinds and destroyed a Pay Box and flooded the cellars of houses. A pleasure yacht was also wrecked whilst the electric train service between Morecambe and Heysahm was interuptted as the wires were felled.The Fleetwood trawler Crown returned from fishing reporting she had lost 2 men overboard whilst the captain was severely injured and died when returning to port. All were married men and left families.</p> <p>A severe gale was felt on the North-west coast of Scotland and England which resulted in a passenger steamer being driven onto the rocks on the Isle of Arran although all passengers and crew were eventually saved with difficulty. A second vessel ran ashore in the Sound of Mull</p>
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<p>1913 29 to 30</p>	<p>5</p>	<p>Conway, Mersey</p>	<p>The Guardian & The Observer</p>	<p>31/05/1913</p>	<p>and foundered suddenly although all 18 just escaped. The storm was also felt in the Mersey where a caisson was transported out to sea and a rowing club boathouse was ruined by the surge. The damage was estimated at £1,000 (£118,000). Crops damage was very great across all of Scotland and many lambs were drowned as rivers burst their banks. Photographs published in the Guardian on the 10th also showed the wreck of a four-masted barque Queen Margaret off the Lizard which was smashed to pieces whilst locals searched the wreckage for survivors. A schooner and ketch were also photographed "at the mercy of the storm off the Mumbles" and the Mumbles lifeboat was out to render assistance. A storm of thunder, rain and wind hit the British Isle and a "brisk gale" was noted on the West coast which "made wild work" in many locations. In the Irish Sea the strong westerly gale set in and two yachts capsized off Rock Ferry whilst racing although all 8 yachtsmen were rescued by cadets from the training ship Conway with "great expedition". The weather was so rough the midnight race from Liverpool to the Isle of Man had to be postponed. A military camp was swept by the gale in Conway and 20 men were injured as tents were felled with several in a "precarious state". A passenger train had a narrow escape when a tree was blown across the tunnel although a shepherd fortunately communicated this danger and stopped the trains. The meteorological correspondent noted that hot weather continued over Britain "in spite of the heavy thunderstorm with its drenching rain" and stated "perhaps, however, the southerly wind current</p>
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1913	9 to 10	6	North Wales and Cumbria	The Guardian & The Observer	11/06/1813	aided the thermometer in its rapid upward march rather than retarded it". A "June Gale" accompanied by heavy rains caused much disturbance in North Wales and the North-West as downpours fell for 12 hours at time which caused considerable inconvenience in flood plains and low-lying coastal districts. The River Dovey overflowed and blocked all traffic on the nearby roads and railways. Swollen torrents in Cumbria rendered transportation difficult and agricultural land was flooded with limited loss.
1913	27-28	10	South Wales, Mersey and Morecambe Bay	The Guardian & The Observer	29/10/1913	A "hurricane" caused "extraordinary havoc" in Western Britain and particularly in South Wales. The storm was caused by "an offshoot of a depression in the Atlantic" and it was thought to have travelled from the Bristol Channel in a NE direction. Most of the force was expended on the Taff Vale in a relatively narrow region and two men were carried off their feet by the "tornado" resulting in 2 deaths. Many houses were unroofed and thousands of pounds of damage done. Trees were widely uprooted throughout the Taff Valley and "napped like saplings" whilst lightning struck a church roof and the falling debris injured two girls as the vestry was "entirely demolished". In Widnes over £2000 (£240,000) worth of damage was done to large factory buildings with roofs lifted off and a canal bridge destroyed. Several other chemical and industrial works were badly damaged and most of the 50 employees were put out of work. In one instance the effects of the wind were "almost whimsical" as a roof was taken off a house "without doing to slightest damage to the bedroom". Works relating to a new airship

1914	7 to 9	2	Plymouth, South Wales and Holyhead	The Guardian & The Observer	09/02/1914 - 12/02/1914	4	statement on Walney Island for the Admiralty were also majorly damaged as the gable end of a hanger was blown down caused much disturbance and £150 (£14,000) worth of damage 4. "The Irish Sea was swept by a terrific south-westerly gale" forcing "an unusually large" number of steamers to seek refuge at Holyhead were "the sea rose in huge waves, the spray completely obscuring the breakwater" whilst the lighthouse was frequently hidden from view. Four seamen were missing as a punt had embarked for the shore but nothing was heard of her following her departure and the alst man to see the occupants alive stated "My belief is that the boat must have been carried away by the galeand dashed against the breakwater. If this is what happened there is no doubt that the boat would have sunk rapidly, taking with it the four men". The missing boat was reported to the authoritties but all attempts to find it proved futile. The White Star liner Olympic was prevented from landing at Plymouth owing to the stormy weather as she attempted to land over 2 hours without success. Despite a fearful storm in the Atlantic throughout the voyage with one wave breaking several portholes it was said "the Olympic weathered the storm magnificently". A steamer was also blown ashore on Sully Island and the lifeboat and Penarth lifesaving apparatus was called out but were not required.
1914	14-15	2	Barmouth, Penzance, Morecambe	The Guardian & The Observer	16/02/1914	2	2. A strong storm from the South-West was felt particularly at Barmouth in North Wales were a great deal of damage was done to the marine promenade as "over two hundred feet of the sea wall was washed away" and

1914 19-22

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Plymouth,
Mersey, South
Wales

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23/02/1914

the roadway behind was much damaged. The tide was the highest noted for 20 years. The storm surge washed away the embankment and ballast under the Cambrian railway halting all traffic. The foundation of the line at Penmaenpool built on unconsolidated marsh ground was particularly badly damaged. Several houses were also flooded causing much inconvenience for the residents. The residents at Dolgelly had a "night of terror" which was caused by abnormal rainfall which caused the rivers Wnion and Arran to overflow their banks and the surrounding fields were widely inundated. Using their previous local knowledge and experience the residents spent a night evacuating their valuables from the rising floodwaters. Two bodies were recovered at Land's End which were presumed to be the bodies of the crew of a vessel which had foundered off the coast. Wreckage was washed ashore of the SS Mobassa at Penzance which was registered at Lloyd's as a vessel of over 4,000 tons displacement. The bodies were completely nude and had been "battered about in the heavy seas". At Morecambe "exceptionally stormy weather was experienced" and a storm surge produced a tide of "nineteen feet" in height which flooded the promenade and the surrounding streets and properties.

A severe storm followed a rapid drop of the barometer over the South-east and whilst storm damage was largely confined to the East and Irish coasts a vessel was noted in major difficulty off Lundy after she had to be let go by another vessel which originally had her in tow but the hawser had twice broken. Heavy seas washed over both

1914 14 - 16

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Conrwall,
Lancashire, Mid
Wales, South
Wales

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vessels. A German schooner was wrecked off Plymouth and her crew were rescued by a lifeboat after the vessel dragged her anchors and was driven ashore on Drake's Island. A schooner was also noted adrift in the Mersey and became a danger to navigation. She was carried away by the Ebb tide and powerful easterly winds as she got foul of her moorings at New ferry. She was chased by a tug which attracted a large crowd and eventually caught. Another small vessel was also carried from its moorings but was swiftly caught. A Lloyd's message from Coll, Oban stated that a steamer had become stranded off the island after being driven before the easterly gale and was now taking on water after a rock had pierced the ship's hull. A fire had broken out but the ship's crew had fortunately been landed safely. There were also reports of great storms in South Wales with "heavy thunder, vivid lightning, and hail". "Low-lying districts were flooded and telephone wires were broken down in all directions". It was impossible to reach parts of Neath and Swansea by telephone for long periods.

5. A disastrous storm swept across the UK leading to the wreck of a Swedish vessel off Cornwall and the loss of 5 lives as the vessel was overwhelmed on rocks on Land's End. 6 men however jumped for their lives and were plucked from the sea by the rocket brigade and a "petty officer of the coastguards showed great gallantry in rushing into the breakers to meet men". A photograph of the wreck in smithereens appeared in the Guardian showing the complete destruction of the vessel. A subsequent inquest which drew on evidence from the

survivors concluded that during the gale the cargo had shifted and this had caused the vessel to list considerably and come into distress. Despite the firing distress signals and heading for a sandy shore control was lost and men were washed into the sea. The jury returned a verdict of "accidental death, and expressed their admiration of the gallantry" of the coastguard. The meteorological correspondent noted that the gale was "more general over the southern and south-western parts of the kingdom" and in certain places the squall velocity exceeded 70 mph. The rains had been exceptionally heavy and had been above the normal frequency. At Southport a storm surge was noted as the waves washed over the marine drive and traffic was suspended. The marine lake was flooded and damage was done to a bathing pool. Two children were in distress due to the rising floodwaters but were fortunately rescued by two ladies. Two men were also marooned but not endangered. Thousands of people lined the sea front to view the storm surge spectacle at Blackpool which "provided a magnificent spectacle. At Maryport coastal public paths were washed away along with hundreds of tons of earth which was undermined. So much earth was eroded from a golf links that the sea appeared red in colour and the storm surge submerged all low-lying land in the Ellen estuary creating a great salt water lake. A Barry pilot was unfortunately drowned near Ilfracombe in the Bristol Channel when endeavouring to board a Norwegian vessel in a punt. Two barques also ran ashore off Barry and Lavernock with both being dismasted and the Barry lifeboat was called out to assist one but the

<p>1914 14-15</p>	<p>4 Hebredies</p> <p>The Guardian & The Observer</p>	<p>17/04/1914</p> <p>vessel held. Several other vessels were driven up the Bristol Channel but found shelter in the Barry and Penarth Roads. Floods were also widespread throughout the Ribble Estuary as the river burst it's banks and waters submerged the surrounding agricultural land causing farmers to drive their horses through knee deep water whilst ram services were also impeded. The Mersey also burst it's banks at Widnes flooding the marshes and acres of valuable grazing land whilst canals in the district were also flooded. The Runcorn docks were flooded and the river was almost up to the height of small bridges in the area. At Ilfracombe roofs were damaged and trees blown down as huge seas swept the promenade and several houses were flooded as several houses on the harbour wall were flooded. A roof was partially blown off a school near Pwllheli causing much anxiety amongst pupils and great financial loss. At Aberystwyth the very high tide coinciding with the gale "drove the sea far beyond its usual limits" as large waves borke over the promenade and seas washed up to the houses flooding basements whilst tons of sediment was deposits on the roadway. A wall six feet in height was blown over near Wallasey but fortunately no one was injured.</p> <p>Following the loss of a Fleetwood trawler off Stornaway the question "Should such carry rockets?" was posed at an inquiry. A witness survivor noted it was the first time the captain had been in cahрге of a vessel and that "trawlers were not compelled to carry rockets, but burned flares as distress signals". An inspector from the Board of Trade that the board had frequently recommended that trawlers</p>
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1914	9 to 10	5	Mersey	The Guardian & The Observer	11/05/1914	<p>should carry rockets and asked "Don't you carry things unless you are compelled?" The survivor noted that it was hard to keep rockets in good condition on trawlers. Another member of the board of trade elluded to the fact the reason rockets were not carried was because trawlers were not made to and also commented on the ineffectiveness of flares. It was also noted that the vessel was in the vicinity of a lighthouse at the time and could have been spottted did she have rockets. The findings were reported to the Board of Trade.</p> <p>A "disastrous night" was experienced by yacht owners on the Mersey as four yachts were either sunk, swept away or badly damaged by a raging storm in the estuary. It was remarked "only a small portion of the losses are covered by insurance, much sympathy being extended to the owners, more particularly the misfortunes occurred on teh eve of the season's start". However there was still a good turn out the following day on the 9th with races being held in a gale from the NNW.</p>
1914	25-26	7	Mersey, Lancashire	The Guardian & The Observer	26/07/1914 - 27/07/1914	<p>A "gale of remarkable violence for July" prevailed throughout the North-West of Britain and the waves on the Mersey were remarked to be particularly turbulent which lead to the suspension of many ferry services whilst outbound vessel fought against the mountainous waves. Throughout Cheshire and the Wirral thousands of acres of crops were damaged and in some cases "utterly ruined" whilst fruit was blown off trees in many orchards. A Fleetwood steamer was driven on a sandbank in the Wyre Estuary but fortunately harbour tug rescued all passengers as the vessel's peril was easily recognisable</p>

1914 2 to 5

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Mersey,
Cumrbia,
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from the shore. They were subsequently sent to Fleetwood and proceeded on their respective journeys via train. The vessel was eventually rescued from her position at high tide and towed into the harbour. Many passengers bound to the Isle of Man were much delayed by the storm disrupting ferry travel. A French ketch was overwhelmed and subsequently abandoned off Trevoise Head having sprung a leak and the crew of 8 were left exposed in the gale for 12 hours in an open boat before they landed at Padstow where the coastguard rendered assistance. Their vessel still remained in the channel and was identified by Lloyd's as a danger to navigation. The meteorological correspondent wrote that the cause of the storm was a "practically stationary" depression which sat just to the north of Shetland whilst the pressure remained high in the Atlantic causing a steep gradient in pressure and thus the winds. These unusual conditions for the time of year produced the brisk NW winds. It was stated that the eastward progression of the depression would reduce the gradient and allow a gradual rise in temperature from the previous "spring like" figures that had been recorded.

2. A severe storm occasioned much desruption and destruction throughout the UK but particularly on the North-west coast as a life was lost in Glasgow as a woman was killed and 20 families rendered homeless when a roof of a city tenement collapsed. A wall was also pulled down near an engineering works burying an woman. In North Wales damage was done to an army camp on the Conway Morfa as huts were lifted from their foundations and overturned. In the Menai a steamer collided with a

pier in the SSW gale and did tremendous damaged estimated at £44,000 (£5,200,000) although the vessel did make it back to her moorings with serious damage. There was also heavy rain which induced flooding in the Conway Valley and the Gyffin Valley was also much inundated. A lookout tower was also blown down in Conway. Traffic was halted over the Menai suspension Bridge owing to the damage done by the storm. The Dee, Clywd, Wye and Severn were all reported to have burst their banks whilst three lifeboats responded to urgent wireless calls from a vessel in peril in the Mersey estuary. However the sea was so "furious" they could not reach the vessel although one lifeboatman had to be rescued himself "with the utmost difficulty" and the vessel was expected to be floated on the next high tide. The lifeboat of New Brighton sustained great damage but still functioned properly in the huge seas. Reports from Cumberalnd told of the considerable flooding in the rivers of the district which included the Eden and the Irwell whilst the strong winds had blown down many telephone and telegraph wires and wrecked bill-posting stations. Thousands of slates and chimney-pots had been hurled from houses. At Carlisle a man was blown of the new post office buidling and killed. A Glasgow steamer also foundered near the Lizard and although three were saved. The crew of the rescuing steamer had seen a oil strewn sea and sounds of "Ship ahoy!" before they sighted three men amongst the wreckage which was strewn everywhere and one of the rescued stated his vessel the Waterloo had gone down in 10 minutes and all the lifeboats had been smashed. The

1915	13-14	2	Cornwall, Irish Sea, North Wales	The Guardian & The Observer	15/02/1915	1	<p>full force of the gale was felt by the National Reserves at the Marconi Wireless station in Carnarvon and it was reported "some of the men are down with pneumonia as the result of exposure and the flooding of their shelters". Masses of anchoring wire connecting the huge masts to the ground were thrown by the force of the wind into "strange entanglements" and the service of the vital station was interrupted.</p> <p>1. A grave storm struck the UK from the east and although most of the loss was occasioned on the North Sea coast a sailing ship was also driven ashore at Kilgorra near Falmouth. The lifeboat put out but failed to undertake a rescue due to the heavy sea running and the rocket apparatus was manned by the coastguards and soldiers in training to save all hands but one. Overall 27 were saved and it was noted an army officer and his family had also been in attendance. One man had independently swam ashore. The captain's daughter who was aged 7 was delighted to find her "little cat had been brought ashore as well". The rescuers were in a shabby state and "received every kindness from the inhabitants of St. Anthony" and it was believed the vessel would be totally wrecked. The NE hurricane forced a schooner ashore in Douglas Bay but the lifeboat put out and saved all 4. It was noted "many people mistook the sound of the signals summoning the lifeboat for German guns". Snow and heavy rain were felt across much of North Wales along with the gale force winds.</p>
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1915	12 to 14	11	Pembrokeshire, North Wales	The Guardian & The Observer	14/11/1915 - 15/11/1915	3	3. A great gale from the NW struck the British Isles causing great loss on the Western coasts with the most serious news coming from Fisguard where several vessels were forced on to rocks under cliffs and "totally wrecked". In one case it was believed all 3 crew had been lost but Lloyd's later reported all had been saved. Two steamer was also driven ashore on the Goodwick sands and it was unlikely they would be floated until the next spring tides. The Fisguard lifeboat was summoned to Abermawr to render assistance to a three-masted barque whilst a Great Western steamer was damaged when she collided with the quay wall. Many vessels were 12 hours late to depart owing to the fury of the storm. Mail steamers across the Irish Sea also had to return to Holyhead which delayed the mails and left hundreds of passengers waiting onboard. Snow fell heavily across North Wales causing difficulty for farmers and rivers also swelled.
1915	23-27	12	Porthmadog, Newport, Mullion	The Guardian & The Observer	27/12/1915 - 29/12/1915		A violent gale swept over the UK causing distress on the Welsh coast at Portmadog where several houses had their roofs badly damaged and a church also suffered from the effects of the gale. The River Glasfryn also overflowed its banks submerging hundreds of acres of land around Portmadog. Substantial damage was done at Merthyr with the streets being strewn with debris and at Abertillery windows were blown in a houses "stripped of their roofs". Thousands of acres of land between Newport and the Severn Tunnel were submerged. A vessel off Mullion Cornwall also disappeared from view in the gale and it was feared she had foundered.

1916	1 to 2	1	Mersey, Blackpool and South Wales	The Guardian & The Observer	02/01/1916 - 04/01/1916	1	<p>1. "The new year comes in like a lion" was the opening headline of the Guardian on the 2nd January as "extraordinary scenes were witnessed at Liverpool" as a 5,000 ton steamer was driven into the landing stages of the Wirral ferries but fortunately the ferries themselves were skillfully manoeuvred away from the dangerous vessel. At the Bon Marche in Birkenhead windows were blown in and clothes scattered around the street whilst the Liverpool Cathedral also received minor damage. A number of sheds were blown down at the Bebington military show ground and 14 soldiers had to be treated at hospital. Overall 60 soldiers were buried and one man killed as the large corrugated iron roof fell upon the invalided man who dined together. The day after it was reported the man had died was so badly wounded he was unrecognisable whilst 2 others remained critically injured and the depot made for a "pitiable scene". One of those critically injured later died and an inquest was to be held into the event. Flooding was reported in various locations in South Wales but no severe effects were detailed. In North Wales two small steamers were "almost hidden in spray and spume" as they rode out the storm off North Wales and several shops had their windows blown out in Llandudno. Near Dollgellau heavy flooding of the Mawddach was reported to have inundated "dwelling houses in the low-lying lands, and cattle, sheep, and pigs have been carried away". The Beaumaris ferry service was also suspended for the day whilst many large trees were felled by the force of the wind in the region, some damaging buildings and blocking roads. Off the Mumbles</p>
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1916	15-16	2	Lancashire, North Wales	The Guardian & The Observer	17/02/1916	<p>the Port Eynon lifeboat were out for 20 hours "in a futile attempt to render assistance to a steamer in distress". The men were exhausted on their return and "had suffered terrible privations" with three men succumbing to hypothermia. At Blackpool there was great damage at the convalescent camp for wounded soldiers and walls 16ft in high had been blown down. The work, for which the public had contributed £2,000 was setback 6 weeks and a house was also blown down and a garage wrecked to the north of the town. The gales had been a resulted of a deep depressrion to the north of the British Isles progressing gradually eastwards.</p> <p>Gales swept the North of the UK doing tragic work at Blackpool where an elderly woman was swept into a pit by the great gale and died. Many large glass panes were stripped off a railway station and the promenade "presented a magnificent storm spectacle" as waves broke over it from end to end. So great were the waves in the Irish Sea that steamers were forced to but back to the Isle of Man. The Cambrian Railway line at Barmouth was blcooked by the accumulation of sand on the rails which had been swept by gales form the nearby dunes and consequently a large gang was set to work to clear the line.</p> <p>Serious damage was occassioned by a great storm of wind and rain in Wales as the Dee, Wye, Conway and Severn all burst their banks and flooding hundreds of acres of agricultural land sweeping away livestock and inundating low-lying proeprty. Heavy seas were noted on the coast and the storm surge up the Mawddach estuary as the</p>
1916	14-15	10	North Wales and Lancashire	The Guardian & The Observer	16/01/1916	

1916	29-30	10	Irish Sea, Swansea	The Guardian & The Observer	31/10/1916 - 06/11/1916	103	<p>river overflowed and flooded the railway line and blocking traffic. Motors had to be used to convey stranded passengers. In the Bangor area telephone communication was interrupted between the mainland and Anglesey whilst the ferry was also interrupted. Trees were widely felled by the strong winds across the region. In West Lancashire the Douglas and Ellel rivers flooded hundreds of acres of arable land to a considerable depth and it was "feared that the potato crop... will have been seriously damaged". A large area in the Mawdesley district to the south of the Ribble was inundated and many cattle had to swim for their lives in some of the greatest floods known for many years. On Lord Lathom's estate the main waterway draining the lands burst and the flooding resulted in agricultural damage estimated at several thousands of pounds. Farmers deployed on rafts to rescue their cattle which remained marooned on small islands.</p> <p>103. A violent gale raged in the Irish Sea causing havoc amongst shipping which results in the loss of many lives. This included the loss of a vessel driven onto Splough Rock off Ireland and quickly broke up in the heavy sea and no sign was seen of the 10 crew or their bodies. A woman and a pilot was also left in the riggin of a vessel for 18 hours when her vessel went ashore near Swansea and 3 drowned whilst the raft got ashore. A Norwegian steamer arrived at Glasgow from Swansea in a "battered condition" having lost one man overboard and in need of major repairs. However the greatest loss in the gale from the South-west was that of 93 lives which were lost when two ships collided in the gale off the Irish coast and only 1</p>
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man survived the tragic incident. The correspondent noted "the fear and horror of impending death in the cold blackness and wild fury of the night, the things done by men and women, sailors and soldiers and civilians, to save each other and themselves, and their struggle with the sea, and the fatal battering in the surf on a rock-bound shore (if life remained so long), have all to be imagined". The only survivor "knows little more than the bare fact of his wonderful escape" as no one was there at the scene of the incident. The incident happened in a near hurricane and the shallow seas of the Irish coast which "raised a heavy sea" which made the vessels unmanageable before they collided and rapidly sank. The initial inquiry conducted at the time of publishing noted that whilst the Connemara steamer had been designed with sealed compartments to withstand flooding the other vessel, the Retriever, had struck her in the engine room which was the one compartment which could not take on water without the vessel sinking. It was thought the flooding of this area where the radio equipment was explained the lack of an SOS to shore. An experienced seaman who interviewed about the disaster stated the vessel would have sunk "in a matter of seconds rather than of minutes" and the conditions were such there would have been no hope of deploying the ship's lifeboat. The faint evidence from the one remaining seaman supported this hypothesis of a midships strike and he also stated both boilers had exploded. The Greenore channel was in consequence blocked by the wrecks and all sailings to the town had consequently been suspended. The crew of the

<p>1916 17-20</p>	<p>11 Irish Sea</p> <p>The Guardian & The Observer</p> <p>20/11/1916 - 21/11/1916</p>	<p>Connemara were reported to all hail from Holyhead whilst several of the Tara's crew were also from the region which caused great disturbance in the town. The King and Queen also sent their sympathy and a telegram stated that "The King and Queen are much distressed to hear of the diaster... Their Majesties deeply symphise with the relatives of those who have been drowned, and anxiously await further information in the hope that the number of survivors may be greater than was at first anicipiated". A Sir Guy Granet also arranged for this message to be forwarded to all the relative of the lost and he also expressed the sympathy of the company to all the bereaved. The beach was strewn with carcasses of cattle although a few got ashore alive. Of the 93 who perished only 69 had so far been recovered from the coast of Carlingford Lough where they were strewn. Many were unrecognisable and the majority were still unidentified. As at holyhead there were "very distressing scenes at Greenore yesterday, when men and women arrived at the Company's offices to inquire for relatives ... No hope could be held out, and some of the relatives broke down completely". A woman with her four children was in great distress and "her grief was pitiable to see". A storm caused havoc on the coasts although it's fury was largely concentrated on the east coast. Nevertheless the "hurricane" conditions in the Irish Sea were such they compelled a Holyhead-Greenore to turn back to Holyhead as the captain percieved it too dangerous to continue in the easterly gale. Approximately 200 vessels crowded into Holyhead harbour in an attempt to seek refuge from the</p>
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1917	7 to 8	1	Mersey, North Wales	The Guardian & The Observer	09/01/1917	<p>storm. Several steamers also retreated to Irish ports such as the danger of the gale and many were badly damaged and some had been in danger of foundering such was the damage.</p> <p>A gale and heavy snow was experienced throughout the North-West and vessels on the Mersey particularly felt the effects of the storm as "Ferry traffic was conducted with considerable difficulty, the boats being subjected to much tossing and pitching". A large Russian barque was also driven against the promenade between Seacombe and Egremont but was successfully assisted by several tugs and towed to a place of safety. The effects of the gale were also felt on the Welsh coast and the pier at Rhos-on-Sea in Colwyn Bay was badly damaged and much of the structure was seen drifting with the tide throughout the Bay.</p>
1917	27-28	8	South Wales, North Wales, Cheshire	The Guardian & The Observer	29/08/1917 - 29/08/1917	<p>An August gale swept the country doing great damage to crops and causing flooding in Wales and the west of England. In the West of England much damage was done to crops by the deluge which was "unprecedentedly heavy" causing a "serious" situation in the Avon Valley. Likewise floods and snow in Wales caused the Towy to flood miles of meadow lands and block roads in Carmarthenshire. In Cardiff 8 inches of rain was registered through the month and "crops which promised a record yield are almost ruining" with the wart disease on potatoes spreading throughout the county. The Board of Agriculture said the primary reason for this was that herbicide spraying had commenced too late. In Cheshire the rains destroyed what was considered to be a very promising harvest. A later report from the Food</p>

1917	23-24	11	North-west Scotland, North-west England	The Guardian & The Observer	26/11/1917	<p>Production department stated hat the telegraphic reports from the Department's Commissioners indicate agricultural losses caused by the gale had been over estimated. Nevertheless news still continued to arrive from North Devon and Somerset regarding the serious damage caused by the gales and rains. It was noted that much damage was caused by the saturation of overripe grain which had not been harvested due to the shortage of labour enduced by subscription for the war effort. It was reported the loss to fruit growers was greater in comparison.</p> <p>A great storm bringing high winds from the west and heavy showers of rain, sleet and hail hit the north-west of Britain causing many a sleepless night as the wind screamed in the telegraph wires and trees, some of which were felled. Slates, bricks and chimneys fell from houses but no serious damage was reported in England but the Preston open market had to be abandoned as stalls were blown down in all directions. The gravest news came from Loch Indail on the Isle of Islay were three men drowned when their vessel was overturned in the heavy sea and all drowned despite the quick response of nearby assistance.</p>
1919	11 to 19	3	North-West England North Wales	The Guardian & The Observer	13/03/1919	<p>A great storm of snow and high winds came to the North-West of Britain causing substantial flooding in the many valleys in Cheshire and North Wales. Considerable damge was done near Barmouth, Festiniog and across Denbighshire and Flintshire as many telegraph and telephone poles were blown down as snow eight inches deep suspended work in the quarries. It was stated "Llanfrothen Marsh has assumed hte appearance of a lake</p>

1919 8 to 13

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many miles in extent, and roads were impassable" as the Dwyrdd River overflowed its banks drowning scores of sheep. A foot of snow fell in Lancashire and the melt water caused the Rivers Alt and Douglas to overflow their banks drowning several thousand acres of land. Motor tractor ploughs were held up and a foot of snow fell in 24 hours. In Chester there was also flooding of the Dee's tributaries and main roads were submerged with the local authorities being compelled to assemble a gangway for pedestrians. The Dee was also in flood and roads in its flood plane were largely impassable. The continuation of the floods over a week "created a serious position for agriculturists".

A report of the first post-war Whitsuntide holiday at Blackpool which saw the return of thousands of holiday makers and tourists. Several gales interrupted the flying which was a key attraction for many on the Pleasure Beach. On a management front it was noted "the great task of carrying the promenade northwards has already received a fillip by the recent inclusion of Bispham and Norbreck within the borough boundaries". It was noted "for a couple of years before the war something was done in the way of protecting the crumbling cliffs opposite the Gynn Inn by building a seawall". The outer wall had now been carried forward to protect further areas of coast and allow these areas to "escape further reduction by the ravages of the next winter's storms and tides". A promenade was to be constructed once the area was stabilised and erosion mitigated. In the Irish Sea two lawyers "met with an exciting adventure, and had a

1919	04-Jan	9	North Wales North-West England	The Guardian & The Observer	06/09/1919	<p>narrow escaped from drowning" when trying to circumnavigate the Isle of Man when they encountered a "whole gale from the south-west" in their 32ft craft and she quickly filled with heavy seas. The occupants were exhausted by trying to bale her and eventually ran the vessel on a sandy shore had had to swim through a rough sea to land Thankfully both gentleman survived the ordeal only a little worse fro wear.</p> <p>"Captain Lloyd, an airman who served in France for three years, had an excitign experience on Thursday when attempting to fly from Blackpool to Barmouth". The pilot and his navigator were caughter in a storm over North Wales with "rain and a heavy mist" makingin obersation impossible". When the mist cleared they found themselves flying out to sea and thus the pilot decided to abort the landing at Barmouth and head for the more assured safety of Rhyl.</p>
1919	18 - 24	9	North Wales	The Guardian & The Observer	19/09/1919 - 25/09/1919	<p>During a sailing-boat race in a storm off the North Wales coast a sailor was washed overboard from a racing yacht in the heavy seas and drowned despite "vain endeavours" of other boats to rescue the unfortunate man. However he was eventual saved by another competitor who threw their lifebuoy and pulled the man ashore in a very exhausted condition. As a result of the stormy weather all festivities connected with the visit of the vessels of the Second Battle Squadron were abandoned on the 21st with the ships taking shelter in Pwllheli Bay. The officers and troops were eventual able to come ashore and begin the festivities on the 23rd. The Vice-Admiral Sir Arthur C. Leveson stated the sea "sometimes helped them and at</p>

1919	1 to 2	12	Cornwall, North Wales, Celtic Sea	The Guardian & The Observer	02/12/1919 - 03/12/1919	1	<p>other times hindered them" but it was "the heritage of our race". The weather however worsened on the 24th and was so bad visitors to the vessel could not be conveyed back to shore and thus had to remain on the vessel all night. Heavy snow fell throughout North Wales and the mountains were snow-capped for the first time since the previous winter. Such was the spectacle airplances made flying trips to Cader Idris from Barmouth. The temperature plummeted and rain and ahil covered the lowlands.</p> <p>1. A disaster occurred in a gale in the Celtic Sea as three motor launches from Queenstown to Devonport foundered in a terrific gale and huge seas. Thankfully all crews were rescued from a sinking boat, a vessel on fire and another sinking vessel was aided by the Longships lifeboats. All but one of the vessels sustained major damage. The vessels which had engines of 300 hp and could obtain a speed of 25 kts had all been Canadian built and initially used for observing German submarine patrols. The meterological charts showed a rapid development of a secondary depression over Devonshire which progressed south-east across the country and fine weather proceeded. The Rivers, Wye and Severn as well as the smaller rivers in North Wales were all in flood following heavy rains and melting snow which inundated many acres of pasture. One three-year-old boy playing near a mill pond in Barmouth was overwhelmed by the sudden flood and unforutnately drowned.</p>
1919	27 - 31	12	Cornwall, Pembroke	The Guardian &	01/01/1920	6	<p>6. A great gale from the south-west force a 3,500 ton steamer ashore just North of Lan'ds End after an "exciting</p>

1920 5 to 11	1	Bristol Channel, North Wales, South-West England	The Observer The Guardian & The Observer	06/01/1920 - 14/01/1920	<p>battle with the elements" after her engines gave out and heavy seas which swept the vessel. "huge breakers threw her high on to the beach" in Perranwell Cove. Wireless messages brought out the coastguard who with the rocket apparatus saved all 27 although there was little prospect for the vessel being refloated. A vessel also capsized on the night of the 27th in Pembroke Dock in which 6 naval men lost their lives. An inquest found that the vessel had capsized "owing to the quarrelsome nature of one of the victims" according to the one survivor. The dockyard police stated all had been very sober and the coroner found all had died from exposure.</p> <p>A tremendous gale swept the west of Europe causing considerable havoc at sea and on land with two vessels being driven ashore in the Bristol Channel. Across the UK many telegraph and telephone wires were blown down and many places completely cut off. A distress message was received by the Lloyd's Fishguard station sent via wireless telegraph stating that a steamer was disabled off Strumble Head and another steamer standing by but requested the aid of tugs. The Beaumaris lifeboat deployed to take the crew off a drifting vessel on the Anglesey coast on the 10th and her crew were later conveyed to Llandudno. The Llandudno lifeboat then deployed with the men and returned them to their vessel off the Great Orme but "barely had the lifeboat left for home when, the weather having grown, the crew showed a signal of distress" and the men were taken back off their vessel and landed at Llandudno. One of the crew had his hand crushed when coming alongside the vessel and was</p>
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1920	26-29	1	North Wales, Irish Sea	The Guardian & The Observer	28/01/1920 - 30/01/1920	<p>aken to the infirmary. The lifeboat shortly afterwards deployed to another vessel in a spot of bother in Llandudno Bay and the crew were taken off. Four men landed in their lifeboat at Barmouth having escaped from the vessel Rio Negro which was reported adrift in Cardigan Bay. The vessel was completely disabled with a crew of 44 remaining aboard and although assistance was initially forthcoming from another steamer the conditions were such the hawser parted and further assistance was impossible. The men who had run to shore to seek help had "suffered greatly from exposure, and at times the boat was nearly swamped"> The Barmouth lifeboat was later launched to assist the steamer.</p> <p>"A hurricane wind" swept over the Irish Sea and caused much havoc in North Wales as steamers across the Irish Sea were delayed and train services much retarded. Many roofs were damaged and windows blown in in the towns of Conway and Bangor whilst the Anglesey ferry service was completely postponed. Railway and road travel was also much delayed in Cheshire and the North-west as telegraph poles fell and blocked roads and lines. The meteorological office stated that the storm was caused by a deep depression to the west of Ireland which moved in an easterly and north-easterly direction inducing the gales and rain over the Isles for a period of 1-2 days.</p>
1920	6 to 11	3	Cylde, Cornwall, Celtic Sea	The Guardian & The Observer	08/03/1920 -13/03/1920	<p>2. The headline of the Guardian read "Winter After Spring" as a great storm from the west blew from the Atlantic resulting in one oceanic liner becoming completely disabled in the Celtic Sea. Thankfully wireless distress messages were transmitted from the steamer and a vessel</p>

1920	27-Jan	4	Dawlish	The Guardian & The Observer	28/04/1920	2	<p>in her vicinity coupled with tugs from Cardiff proceeded to her assistance. A vessel in distress was also noted burning distress signals 6 miles off Trevoze Head and the Padstow lifeboat deployed to her rescue but "no response was obtained to signals". For five hours "the lifeboatmen were battling with the heavy seas in an attempt to board the ship" and eventually managed to do so before the steamer was towed into Padstow Harbour where she sank. No one was onboard and the vessel's lifeboat was missing. A Queenstown telegram later read her crew had been picked up by an American liner and all were safe. The strong winds were also responsible for a tragedy in the Clyde as a two ton hammer fell into a boiler house at Dunglass Castle and two men died of their injuries with 3 more being admitted to hospital. The Meteorological Office reported that the gale was a consequence of a deep depression off Iceland and the coast of Norway. The depression brought showers of rain, sleet, hail and snow across Britain and the winds were "mainly north or north-west in the northern districts, and westerly in the south during the morning and afternoon, becoming northerly or north-westerly everywhere in the evening" on the 7th as the temperature fell.</p> <p>2. During a gale two men drowned when their sailing dinghy capsized off Dawlish. "Members of the coastguard who witnessed the incident at once put out to try to rescue the men" but only found one man still alive clinging to the upturned boat. The body of one man had been washed ashore and the other was still missing.</p>
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1920	3 to 4	10	Devon, Cornwall	The Guardian & The Observer	05/10/1920	3	<p>3. A storm struck the south-west coast as strong winds were felt in the western English Channel and three people unfortunately lost their lives when a small sailing yacht capsized on a visit to the town. For two of the unfortunate it was "supposed that during the height of the gale they became alarmed and determined to land in a small dinghy belonging to the yacht" and their bodies were later found washed on the shore near the Princess Pier. The third victim was a young postman named Tuckerman who was killed by the storm surge as the waves broke over the sea wall and dashed him against railings killing him instantly. Intrepid rescues were also made from a vessel driven onto the Plymouth breakwater and 19 aboard were rescued by government tugs who were promptly on the scene although one man was missing and presumed drowned. The local lifeboat was also on scene to rescue two men and a stowaway. The captain stated he had lowered the lifeboat but as soon as the small boat left the shelter of the breakwater "the whole twenty of us were pitched into a mountainous sea". The captain remarked although he had given all the crew lifebelts he "suddenly realised the black stowaway ... could not swim, so I got to him and put him on my shoulders". After a severe struggle the captain reached the lifeboat which skillfully threw a line and he and the boy were hauled to safety.</p> <p>A tremendous gale swept the British Isles causing much distress amongst shipping on the West coast and the Aberystwyth lifeboat was called out to a distressed cruiser floating freely in Cardigan Bay but only one man was</p>
1920	14-19	11	Aberystwyth, Morecambe Bay, Hebrides,	The Guardian & The Observer	17/11/1920 - 21/11/1920		

			South-West Scotland				found on board the rest having already been taken off by the Newquay lifeboat. Such were the conditions off the west of Scotland the officials in charge of the "temperance poll at the Island of Arran could not be landed" and thus another date was fixed. More seriously a Danish Ship was lost in the sound of Harris as it was completely destroyed off the uninhabited island of Harmentray in the "bleak sound". Six of the eight Danes were drowned and the two survivors "were exposed for two days without food or shelter", however a fishing boat "driven up the sound by the storm saw the signals of distress and at great peril rescued the two men". In Morecambe Bay a lightship dragged her anchors and drifted 9 miles towards Walney Island.
1920	1 to 4	12	Penzance, Carnarvon Bay	The Guardian & The Observer	03/12/1920 - 20/12/1920	10	10. A great tempest wrought pure havoc on the Western coast of Britain leading to great loss but also tremendous acts of gallantry. A vessel was shipwrecked off Penzance and went aground under the cliff in a highly perilous position, however an apprentice "pluckily swam through the raging sea with a life-line, and was hauled ashore in an exhausted condition by three Mousehole fisherman". However the life-line hawser was retained and 20 men made the hazardous journey to land despite some near casualties. The rocket apparatus of the coastguard later arrived and the crew were landed in a breeches buoy and all 45 were saved although the vessel was seriously damaged. Further north in the Mersey ocean-going liners were suspended from travelling and Manx steamers driven back to Liverpool. Windows were blown in in many parts of the city and "pedestrians had to dodge a vertiable

deluge of chimney-pots and slates". One man was injured in Walton when a wall was blown down whilst a man was blown from a ladder and seriously injured. 1,100 ex-service men and their families could not board the White Star liner Zeelandic bound for Australia whilst the 400 single men embarked mid-river by a tender. A vessel bound for Liverpool got into difficulty in Carnarvon Bay and the crew of eight were obliged to get into their lifeboats boats, one of which was swamped and three men were missing. The other five reached shore near Dinas Dingle and were catered for in a neighbouring farm. At Blackpool tramway wires were blown down and winds of 60 mph was noted as chimney stacks and roof slates widely fell. Seats on the promenade were uprooted and the storm surge broke over the promenade which considerably interfered with traffic. At Morecambe the full force of the gale was felt and a smack was beached although the crew were unhurt. At St. Annes the lifeboat was deployed to aid a steamer rooted on the sandbank. However the tide fortunately was rising and the vessel was got off before it proceeded up the ribble to Preston. In Exeter the city was "damaged by a whirlwind" although no fatalities or serious injuries were noted. At Rhoscolyn there was a lifeboat disaster as the lifeboat lost 5 of her crew in a desperate effort to render assistance to a vessel in Carnarvon which also lost 4 of her crew although 4 survived. It was remarked "The story of the North Wales disaster describes gallantry worthy of the best traditions of the Lifeboat Institution". The lifeboat had tried 5 times to establish a lifeline and had lost 5 men in the process.

One of the lifeboatmen who survived, Edward Owen stated he had been a member of the crew for 20 years and never seen anything like it and it was beyond his belief they managed to even make it out in the teeth of the gale. It was remarked at the last attempt to establish a line "we succeeded, but no sooner had we commenced to haul in the line than the warp snapped". After all efforts they abandoned the rescue but following their departure the vessel "shipped a tremendous sea which swept two members of the crew, Owen Jones and Evan Hughes, overboard. We did all we could to rescue them, but we failed, and we decided to leave the steamer and to make for Llanddwyn Lighthouse". The vessel then turned turtle in the heavy seas and the sails were carried away and the lifeboatman exclaimed "We had to make a desperate fight for our lives" before the lifeboat eventually righted itself. Three more of the crew were lost and "it was simply terrible. Those of us who remained expected to share the same fate at any moment". It was remarked the helmsman had lost two sons and carried on attempting to save lives despite a broken leg. One of the men drowned was not a regular member of the crew and the bodies of the 5 were recovered from the shore throughout the district the day after. On the 20th it was reported that the RNLI had awarded several orders of merit to those connected with the rescue work and pensions had been granted to the widows of the two married men of the Rhoscolyn lifeboat. Special grants were made to the survivors and awards were granted to the pilots at Llanddyn who rendered valuable assistance when the

1920 20-21

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boat was beached. A large three-masted vessel was observed in danger off Rhyl and the lifeboat there was deployed and communicated with the vessel by Morse code. The heavy sea carried the ship onshore and the lifeboat grounded in shallow water but no crew were majorly hurt. Several other small vessels were driven ashore on the South Wales coast without major incident to human life. A rescue was also effected from the Needles off Fishguard when a vessel was dashed upon the rocks on the morning of the morning of the 4th. The Fishguard motor lifeboat which had stood by all night took off all seven members although the second mate of the vessel drowned. The rocket crew also rescued two others from the shore. The RNLi also awarded gold, silver and bronze medals of the institution to the coxswain, second coxswain and crew respectively. A steamer ran ashore in Lochryan, Wigtownshire and was beached high on the shore and not far from the breakwater. "Exciting rescue scenes were witnessed" as a vessel attempting a rescue also grounded. The rocket apparatus was brought out but the men of both vessels waded ashore without assistance. The Guardian meteorological correspondent noted that the period had "been remarkable for the frequency with which deep depressions have developed, usually off the South-west of Ireland, and caused a gale or strong winds over the British Isles". The intense fall in pressure induced the gradient which caused the great gales which produced windspeed of up to 70 mph at Liverpool. A violent gale swept up the Irish Channel and South-west and forced nearly 30 steamers to run into Ramsey Bay for

1921	18-22	1	British Isles	The Observer				shelter. They road heavily in the bay at at night thee collection of mast lights "presented the spectacle of an illuminated village seawards".
				The Guardian & The Observer	19/01/1921 - 23/10/192	1		1. Very strong winds in some cases reaching a velocity of 70 mph and torrential rain enveloped the British Isles and resulted in an unfortunate fatality in Pembrokeshire where a falling tree struck a schoolboy in Pembrokeshire. The Manx light buoy was also damaged off Ramsey after supposedly being run into by an out of control vessel and many vessels had to run into the bay for shelter. On the Cambrian line a landslide occurred due to the heavy rain which blocked the line as an engine struck many tons of earth and stone and was derailed fortunately without injury and gangs of workman quickly cleared the line. In it's middle course the Mersey was reported to "have overbrimmed its banks with unusual force and to be fairly widespread now over the meadows" which also impeded traffic. The Beaumaris lifeboat was also called out to assist a vessel off Penmon, Anglesey which had struck a bank and all 4 of the crew were rescued although the vessel was likely to become a total wreck. The Guardian's meteorological correspondent noted that severe gales generally between SW and NW had been noted throughout the British Isles with wind gust velocity reaching 60 - 70 mph. However it was remarked "unlike some of its recent predecessors, the storm was not one of the type which develops suddenly and moves rapidly across the country" and instead the wind had increased gradually due to the progressive movement of deep cyclonic depression originating off Iceland across Europe.

1921		3	British Isles	The Guardian & The Observer	18/03/1921	<p>It was also reamrked the storm happened to coincide with the 40th annivesary of "bLack Tuesday" on 18 Jan 1881 "when the country form Land's End to john O'Groats was swept by a blizzard". The storm was most damaging in London however were districts were flooded and great destruction was wrought on the Thames.</p> <p>An article in the Guardian concerning the construction of a long-distance telephone system in the UK and the discussion following a paper proposing this which was presented to the "memebers of the Institution of Eleccrical Engineers" and Sir William Boble. It was noted a line between London-Manchester was under construction which would be placed in a Duct as opposed to above ground. This was stated to reduce the present congestion of telephone transmission andd "the risks of interruption of the services by storms. This would produce a service with "quality and stability ... equal to, if not better than, any in the world".</p>
1921	04-Jan	5	North-west Britain	The Guardian & The Observer	05/05/1921	<p>Following a morning which was "unusually sultry for the season, several very heavy showers of rain" fell around Liverpool and the area which were accompanied by loud claps of thunder and lightning. The lightning was noted to have struck several workman and kncked them over with one recieving a cut on his fall. A girl was also raised up by the effected and "benumbed for some time after". A coachman was stuck but was only stunned whilst a woman sewing was stung. Several inmates had a "surprising escape" from a house which was badly damged by the lighting which was thought to have ben conducted by the iron railings in front of the house and</p>

1921	23-24	7	North-west Britain	The Guardian & The Observer	27/07/1921		had shattered bricks and timber alike as well as creating a notable hole in the roof. An adjoining house also recieved minor damage. The Meterological Office stated that a depression off the West of Ireland moving eastwards enduced a rapid fall of barometers and thus strong winds from the south and west were induced. The cyclone also brought torrential rain to the North-West coast and the winds were so strong at Blackpool that steamer traffic was stoppped before a donwpour proceeded.
1921	30-Jan	7	North-west Britain	The Guardian & The Observer	31/07/1921		A severe rain storm swept oer Loch Lomond, the Vale of Leven and the Clyde which "swamped out" many campers. A Major Anderson had two friends were out on the Loch in a motor boat which capsized during the storm but they were fortunately good swimmers and swam to shore 300 yards away.
1921		11	Western Britain	The Guardian & The Observer	07/11/1921 - 08/11/1921	5	5. A great gale accompnied through heavy winds and thunder swept through the England and Wales. In North Wales trees were uprooted and the rivers were in full flood due to the tremendous snowfall. At Padstow three vodies were washed ashore and two at Port Isaac where wreckage was found. "the bodies had not been long in the water and all wore lifebelts" and were believed to be from a vessel which foundered off the Cornish coast. Two other bodies were also noted omniously floating off the coast. A large oceanic steamer the SS Mongolia arrived at Plymouth over a day late having experienced a tumultous journey in the Atlatntic and her passengers were badly shaken.

1921	15-16	11	Western Britain	The Guardian & The Observer	17/11/1921		A strong south-easterly gale which prevailed in the Irish Sea produced a terrific sea that was such that steamers were obliged to pass to the west of the Isle of Man and land their passengers at Peel as opposed to Douglas. As a consequence the conveyance of people and goods was much delayed.
1921	23 to 4	12	British Isles	The Guardian & The Observer	22/12/1921	3	3. It was stated in the Guardian on the 22 that the appearance of seagulls as far inland as Leicestershire was "said to be a sure sign of rough weather" and indeed a storm set in on the 23rd bringing with it considerable rain from the west whilst snow fell in areas of higher elevation in Wales. The meteorological correspondent noted on the 27th that "the clerk of the weather" was not obliged to produce the pleasant spells following a tumultuous period and instead the pressure fell inducing a strong wind which brought with it heavy rain. off Argyll a motor vessel dragged anchor and drove on rocks before subsequently catching fire and was totally destroyed although the crew escaped by scrambling up the rocks to safety. There were also reports of signals of distress being fired in Liverpool Bay off Southport and although the "sea was wild" and lifeboatmen heard the sound of rockets the lifeboatmen did not assemble thinking it was a Christmas festivity. However neither the Receiver of Wrecks nor the Police heard any news of a shipwreck and the incident was quite the mystery. The River Dee and Vyrnwy were in a state of great flood as a result of the rain and had flooded their middle and lower courses but no major damage was reported on the coast. On the 31st it was reported gusts of 60-70 mph had been produced by the "depression of

considerable intensity" and rough seas were experinced throughout the west coast. Heavy rain of up to 1.10 inches fell at Oban and > 0.30 inches fell throughout western coasts whilst the temperature rose at all Western ports. The rains in Scotland caused a landslide on the West Highland railway near Lochaber and a train fell down an embankment leading to 2 injuries. Two trains with medicial staff and workmen attended to all injuries and quickly repaired the line respectively. Floods occured in the Glasgow district as the River Cart flooded large stretches of land. As a reuslt residents in nearby districts had "an anxious time, fearing an inundation" with many trying to remove carpets and belongings fromt he bottom floors but fortunately no flood came. In Wales the barometer fell more than 1.2 an inch and the spring tide rose very high in the Conway estuary with the wind belowing right across the channel. A fishing vessel drifted from its moorings and way considerable damaged and a furtniture van was also damaged on the Llandudno promenade. In Moelfre Bay a man was killed and his son injured on a steamboat when they lost control of the windlass in the storm and the anchor spun round and struck the father on the head and istantly killed him which the son fractured his arm in three places. In the Mersey a small boat containing tow men was capsized off the landing stage and one drowned. The storm surge in the Ribble caused flooding in Preston as the river overflowed its banks and flooded hundreds of acres. The floods submerged major traffic routes and flooded houses causing great inconviene. Near Campbeltown a cart was

1922	05-Jun	1	North-West Britain	The Guardian & The Observer	14/01/1922 - 20/01/1922	<p>blown over and the driver crushed and killed. In Glasgow six people were killed when a tennament roof collapsed and 1 person was killed when a house collapsed at Aberavon. By the 1st it was exclaimed "Not within living memory has there been experienced so great a ale as that which swept the Irsih Channel" as the sea became mountainous and 90 mph winds were recorded causing much inconvenience to cross-channel steamers. Steamers could not dock their passengers and goods for hours at major ports and a steamer went aground off Southport. The Southport lifeboat set out in response to the vessel in distress and the vessel fought through the storm for 3 hours with many lifeboatmen having narrow escapes. A Fench schooner parted cables in Torbay and was saved from being wrecked on the Brixham Breakwater by a tug. The lifeboat also put out and the small boat transferring the crew to the slipway was swamped several times although no injury was sustained. On the 2nd 3 steamers collided in the Barry Roads which was caused by one vessel dragging in the strong westerly and considerable damage was done.</p> <p>A considerable gale and snow was felt across the British Isles and was believed to have been the key caused of an incident near Formby in which a motorcyclist collided with a telegraph pole on the 5th. The man had emerged from a plantation of trees and was immediately struck by a severe gust after leaving the shelter causing his cycle to swerve. A verdict of "death from misadventure" was returned.</p>
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1922	13-15	1	British Isles	The Guardian & The Observer	15/01/1922 - 17/01/1922	<p>Considerable snow storms were felt throughout Britain with heavy snow occasioning telephone delays in the west as the snow storm had done considerable damage to the telephone lines. The areas of Barrow and Widnes were amongst the worst affected whilst areas around Preston also suffered and communication with Blackpool was cut off for hours. On the 15th the snow largely turned to rain yet snow fall still continued in Wales.</p>
1922	19-Jan	3		The Guardian & The Observer	19/03/1922	<p>A Professor J.T MacGregor-Morris of the Electrical Engineering at East London Colledge delivered a lecture named "Thunder and Lightning" to the Royal British Nurses' Association. His talk featured a number of electrical demonstrations to illustrate "on a small scale, what actually takes place in a thunderstorm". He explained that any pain people may feel was because the electrically charged clouds were exercised a pulling effect on their hair. It was stated that the statistics exhibited the Peak district was the most common places for thunderstorms with Norfolk in second with no locations in the west of Britain being often frequented with thunderstorms. The lecturer explained that "many so-called conductors were really sources of danger, as they not properly inspected" and he spoke of the danger of standing under trees stating "the safest thing to do was to lie flat on the ground in bad storm". He then ridiculed many popular myths regarding conduction and stated the main thing to do was not to make oneself a conductor by placing objects above the head. It was also stated that "artificial respiration" should continue for an hour after someone was struck by lightning.</p>

1922	20-21	3	North-West Britain	The Guardian & The Observer	22/03/1922	6	6. The meteorological correspondent of the Guardian noted the formation of a low pressure system over Western Europe and the Mediterranean produced NE breezes and a development of a "considerable anticyclone" served to strengthen the breezes in the North and Irish Sea. Off Stornoway an easterly gale and snow squall capsized several fishing boats off Lewis and one vessel containing 6 crew was lost and all were feared to have perished. At Southport a blinding snowstorm was experienced for a short period before several hours of sunshine whilst the wind was "bitterly cold" as temperatures did not exceed 40 degs F.
1922	31 to 1	4	Western Britain	The Guardian & The Observer	01/04/1922 - 04/01/1922	1	1. A considerable snowstorm fell across the North-West of England covering areas of the coast from Preston and Barrow making transport quite difficult as water accumulated in the streets. On the 1st the intensity of the storm increased and consequently much inconvenience was caused throughout the west of Britain as travel and work was largely retarded. The South of Wales was particularly badly hit and the miners could not be conveyed to work via train or foot which affected 20,000 men who were largely rendered idle. All sporting fixtures in the district were cancelled. Many sheep and lambs were buried to a great depth and undoubtedly perished. One train took nearly 6 hours to travel 17 miles from Newport to Abertillery and had to be pulled by 3 engines. Two men were found dead in Ebbw Vale having succumbed to hypothermia. The snowfall at Cardiff was stated to be the "heaviest for had a century" and tram cars were run all night to keep tracks clear. An old man died at

1922 14-16	4	South-West Britain	The Guardian & The Observer	16/04/1922 - 17/04/1922	5	<p>Abergavenny from hypothermia. A London barge with telegraph cables was noted in distress off Paignton and was in danger of driving ashore in the easterly gales. However a tug deployed and managed to take the her tow and brought her into the safety of Brixham. The new motor lifeboat was launched and stood by as a safeguard. A colliers' train was held up by the storm near Port Talbot and the miners were compelled to take refuge in a tunnel. "When their plight was made known the villagers took them hot tea and coffee". There was 9 inches of snow at Bristol and the trains from Cardiff to the city were much delayed and motor buses stranded.</p> <p>5. A gale swept over the South-West Britain and a steamer wirelessly into Falmouth stating she needed medical assistance as several of her crew were seriously injured as huge waves washed over the vessel killed two onboard and washing another 2 over totalling 4 deaths. A Blue Funnel liner was also buffeted by the storm and recieved 4 injuries. One young apprentice had a "miraculous escape" cinging to the rail he saved his life but he did dislocate a shoulder. The cabins of the vesel were flooded and the chief officer had one of his legs fractured. Another steamship from Mandala could not land at Plymouth owing to the heavy gale. An excursion of school children from London and climbers who visited Dolgellau experienced a hail storm of a very heavy variety when scaling Cader Idris. In the Bristol Channel the wind was estimated at 60 mph and many vessels were in distress with even more windbound. One vessel bound from</p>
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1922	27-Jan	4		The Guardian & The Observer	28/04/1922	<p>Newport to Rio Janeiro arrived back with dead and injured men.</p> <p>An article entitled "The Marvels of the Thermionic Valve - How Storm Damage To Communications is Done Away With" concerned the opening of the new underground telephone cable between Manchester which marked a great development in telephone efficiency in the country. It was noted the "greatest and most obvious drawback to an aerial system of telephonic communication is its liability to interruption by even moderate storms or to complete breakdown in a heavy gale". Installing the system underground removed this direct risk but it was the invention of the thermionic valve which allowed the amplification of "sound currents" so a voice from London to Manchester was as clear as if someone called at Didsbury.</p>
1922	6 to 8	7	British Isles	The Guardian & The Observer	07/07/1922 - 09/07/1922	<p>A series of depressions which skirted east from the Atlantic Ocean and over the western coasts producing strong breezes as the pressure fell as low as 28.88 inch/hg and movements of 0.37 inches were recorded over 3 hours off Pembroke. Gales bringing winds with gusts in excess of 50 mph with a constant windspeed of 40 mph blew in the South-West. In Cumbria and Lancashire wind and rain swept over the area laying much hay flat and trees were uprooted whilst a tent erected for a county convention was blown down and many rivers were in flood. A heavy gale raged in Mount's Bay and information reach Penzance that a steamer was in danger near Wolf Lighthouse having lost her propeller and becoming</p>

1922

15-Jan

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The
Guardian &
The
Observer

15/07/1922

completely unmanagable. A lifeboat and tugs were put out from Falmouth to render assistance.

A detailed Guardian article concerned protective measures to ensure the safety of a garden from the dangers of a gale and birds. It was noted the fact trees were in full leaf during the summer amplified the natural damage done by summer storms. It was noted non-pruned trees were prone to splitting due to the gradual widening of the distance between the top branches which rendered them liable to breaking whilst saying in the wind. It was noted "for really valuable trees it is wort while to get in an expert who will support the branches by connecting them with an iron rod" and various other mechanical supports. Such work was more easily done in the winter and it was stated "a makeshift with ropes has to be resorted to" in the summer. Further advice was given to support overladen fruit trees which involved shortening broken branches and pruning. It was stated "All wounds should immediately be dressed with coal-tar". Pulling branches off in a way that stripped bark was described as "melancholy" and instead it was directed they should be sawn off close to the tree trunk. it was stated "one needs to have a great love for bird to forgive them their depredations" for eating fruit. It was stated mesh nets could protect some fruit but it was stated were birds were very abudnant "standard trees can be protected only by shooting, and those who cannot bear to do this must be prepared for heavy losses". The correspondent stated all "scarers" never had any effected. The clear growth rain stimulated with lawns and hedges

1922	16-19	9	British Isles	The Guardian & The Observer	18/09/1922 - 21/09/1922	1	<p>were noted and thus constant maintenance of both was recommended.</p> <p>1. A depression from the Atlantic brought strong westerly gales to the Irish Sea which caused heavy seas which resulted in considerable destruction on an Isle of Man steamer Viking on which many passengers were injured with three being injured so badly they had to be taken to hospital. Many of the passengers were "sky-larking" on the top deck such was their fear that the vessel would founder as waves broke over the steamer. The captain's composure and handling was much praised by all. A steamer also suffered partial engine failure but managed to limp across the Irish Sea with the wind behind her. One man drowned after a boat capsized off Dumbartonshire in the storm but three were rescued. In Cheshire large damage was sustained to the fruit crop. In Barmouth heavy rains were noted and the floods were such a chapel was undermined and carcasses of sheep were regularly coming down the channel. The Barmouth fire brigade were busy all night pumping the water out of flooded cellars at Dolgellau and a relief fund was opened for the "benefit of poor sufferers". All rail journeys to Devil's Bridge were postponed as the bridge itself was flooded. The raging waters destroyed three bridges in the Vale of Rheidol and much damage was done in the vicinity of Aberystwyth where boats had to be used to reach one part of the town.</p> <p>A procession of cyclonic depressions were responsible for a stormy period which brought strong winds from Pembroke to Northern Scotland which caused gale force</p>
1922	5 to 6	11	North-West Britain	The Guardian &	07/11/1922		

				The Observer		winds from the South to North-West. In the Scillies gusts of 45 mph were registered and rain widely fell with half an inch being registered at Southport and Liverpool. Polar steams following in the rear of the depression were set to sweep over the isles and cause significant snow fall in the wake of the depression.
1922	20-30	12	British Isles	The Guardian & The Observer	22/12/1922 - 23/01/1923	The meteorological correspondent on the 21st noted that a disturbance of a great magnitude had developed in the Atlantic 700 miles due west of Ireland as liners had reported the barometer to fall as low as 28.1 inches and 60 mph winds known "technically as 'whole gale'". A thunderstorm accompanied such conditions and the depression was rapidly heading towards the British Isles. The strong but mild winds from the south-west were forecast to give a "Green Christmas" however they caused a great deal of mischief throughout the kingdom. In Llandudno Bay two fishermen were caught in the gale and the lifeboat was quickly launched on the sighting of a distress signal and the two were rescued in the very rough seas. The Maryport Christmas market was ruined by the "blizzard of hail, rain, and wind which drove the customers home and reduced the sales by half". Many farmers were almost exhausted having travelled so far in the storm only to be exposed to the elements for hours. In the Celtic and Irish Seas one vessel was lost and passengers from America to Liverpool had an unpleasant time during their voyages. Heavy rains in North and Mid Wales flooded many dwelling houses in low-lying areas in flood plains as rivers burst their banks. At Dolgellau the hurricane uprooted trees and blew in windows as slates

1923 7 to 11

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British Isles

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12/02/1923

fell from the roofs. The river Wnien was in "high flood, and fields for miles around resembled huge lakes". The storm was also seriously felt at Bangor where a heavy thunderstorm accompanied the gale and hail which dramatically reduced customers to the extent a shop had to resort to an auction to get rid of it's perishable goods. A Manx ferry was forced to return to the Mersey and a collision occurred in the estuary causing major damage to one vessel to the extent it nearly sank but for the efficient pumping and rescue operation. At Falmouth on the 28th half an inch of rain fell and thunderstorms were frequent from Nairn to Plymouth. Liners were damaged in the mountainous Celtic Sea and a body was washed ashore at St. Leonards which was thought to be a result of a sailor being washed overboard. On the 23rd January it was reported the storm surge had disturbed weed covering a large mussel bed off the Fal which was previously unknown. As a result a large ctach resulted and also many pearls were found, however the fisherman knew not of their discovery and in fact sent them off to market to be eaten before the fact came to light. It was remarked the cooks of England must have been disposing of "some rather precious refuse with the boiling water". It emerged the fisherman had not disclosed their dsiccovery earlier due to a fear the price of mussels would depreciate and thus no expert was on hand to identify the pearls before they were disposed of.

A strong southerly gale sprang up which extened throughout the British Isles which was the result of the progression a low pressure system "literally from Land's

The
Observer

End to Joh o'Groat's". A "whole gale" with wind speeds in excess of 60 mph was observed at Pendennis Castle whilst a "strong gale" with winds of 50 mph was noted at Pembroke and Holyhead. 70 mph gusts were later recorded in the Scilly Isles. A small boat was swamped in Fleetwood harbour and its occupant drowned. He was one of the oldest smack fisherman who had "innumerable narrow escapes from drowning. It was his avowed conviction that he would never be drowned". Across Cheshre many trees were brought down whilst telegraph wires were widely felled and roofs and walls recieved considerable damage. A barque on her first voyage from Bremen to Barry was wrecked off the Lizard on the 10th as she was driven ashore by the fierce south-westerly fale. The lifeboat was immediately launched but could not help the crew despite the fact she got so close she was "almost hurled on to the deck of the ship". Fortuantely rocket apparatus established communication between the ship and shore and the 20 men aboard were winched to safety. Nevertheless the captain and four officers couldn't reach the rope and instead had to endure a night lashed to the rigging. Whilst their shouts could be heard from the shore nothing could be done for them and the lifeboat had to retreat to port. They were eventually saved however although the barque was thought to be condemmed. A large steam hopper was forced onto the Swansea Sands after breaking loose in the gale and dry. The Mumbles lifeboat put out to render assistance which wasn't required.

1923	17-18	2	British Isles	The Guardian & The Observer	18/02/1923 - 22/02/1923		<p>Many vessels were wrecked throughout a "wild weekend" with a blizzard in the Irish Sea causing great disruption and damage to steamers. One vessel arrived at Fleetwood nearly 5 hours late after meeting the gale head on in the Irish Sea and making practically no progress. She rolled so heavily many of the cattle she was carrying had to be slaughtered. There was also a heavy fall of snow in Furness and snow covered the lowlands of the North-West to a depth of a foot.</p>
1923	25-27	3	British Isles	The Guardian & The Observer	26/02/1923 - 28/02/1923	2	<p>2. A meteorological correspondent stated that the month of February 1923 had been "a month conspicuous for storms". A general gale followed after the identification of a "large cyclonic depression of some intensity" off the south-west coasts. Rain fell over a wide area ranging from Holyhead to Portland and the barometer dropped an inch in 6 hours at all meteorological stations on the South-West coast. Winds were strong with a constant 60 mph speed being recorded at Falmouth and Pembroke. In the afternoon of the 26th 76mph was registered at the Scilly station with the winds being easterly in the North and westerly in the South. In North Wales the south-westerly gale brought sleet and hail. Off Penzance a vessel radioed in stating she was in the process of foundering with various messages stating the "Main hatch being stove in: any got at any moment, then we abandon". The operator then indicated the men had taken to their boats before indicating another vessel was standing by as they floated in the Bristol Channel being washed from "stem to stern". The local lifeboats were launched although it "was feared at the time that there was little chance of their</p>

mission being successful, as night must have fallen before they could reach the distressed crew". Nevertheless the fact another vessel was standing by was reassuring. News came from Cork that a vessel encountered the full force of the storm in the Bristol Channel off Minehead and the captain had lashed himself to the wheel for 36 hours whilst one man was seriously injured and washed overboard. The Tenby lifeboat performed 3 rescues. One vessel drove ashore in Carmarthen Bay off Pendine beach and the 10 crew were rescued as the vessel was in the process of breaking up. following this on the 27th the lifeboat was called out again to rescue two off a French ketch in distress off Caldy Roads. A steamer was also observed in distress off Caldy Island and the lifeboat and a tug put out to her assistance. Two bodies were washed ashore at Pendine from an unknown vessel which was feared to have been lost during the height of the storm in Carmarthen Bay. Rainfall was considerable on the west coast with 0.80 and 0.84 inches falling at Penzance and Tenby respectively. A steamer was also sighted in trouble off Carnarvon and ran ashore near Penrhyn Point after dragging anchor although her crew were fortunately saved by the Abersoch lifeboat and the vessel was not wrecked. Much damage was done at Pwllheli and many shoop windows were blown in. The River Wnion at Dolgellau was in flood and carried materials out to sea. The rivers of North Wales were described as raging torrents and many houses in the coastal flood plains were flooded with a postman being forced to deliver his mail on horseback. At Portmadoc many trees were uprooted and

1923	7 to 10	9	British Isles	The Guardian & The Observer	09/07/1923 - 12/07/1923		<p>the embankment tollgate was destroyed. In Bangor the high wind and heavy rain caused the River Ogwen to overflow and flood a neighbourhood and submerged acres of surrounding land. The Mersey was also in full flood and many areas in its middle course were inundated to a depth of 6 feet in some cases after the river bank was breached through one gap.</p> <p>A violent thunderstorm of wind and rain visited the British Isles and much damage was done to buildings and many injuries were sustained during the intense storm. In North Wales at Abersoch a chapel was struck which did considerable damage to the minister's house and the telephone and telegraph services in the Llyn peninsula were interrupted for several hours as a dog was killed in the street in Nefyn. In Exeter a church was struck and "a fire ball exploded in the clock chamber and passed upwards, doing much damage to the bell tower". The "most remarkable" event of the storm was that 12 men were knocked over whilst working on a housing scheme near Whitehaven. One man was taken to hospital with severe shock and another suffered with temporary paralysis in his legs. At Braystones a house was split in two and several people injured. Many telegraph poles were struck on the national railways which considerably delayed communication.</p>
1923	2 to 3	8	North-west Britain	The Guardian & The Observer	04/08/1923	3	<p>3. A heavy south-westerly gale struck the North-West coast of Britain which was severely felt in coastal areas and in the Irish Sea. All passengers aboard steamers in the Irish Sea declare the conditions were worse than any ever experienced in August. Telegraphic and telephone</p>

1923	25-30	8	British Isles	The Guardian & The Observer	28/08/1923 - 01/09/1923	1	<p>communications were interrupted throughout the West coast. A territorial army camp at Rhyl suffered greatly when several tents were "torn to ribbons" and great mischief was done to the gardens and orchards across North Wales that suffered great losses. A Liverpool steamship from Blackpool to Llandudno encountered the full force of the gale in Liverpool Bay and arrived 3/4 of an hour late and several bathing huts at Deganwy were damaged. At Maryport a wooden pavilion collapsed during a concert and "men in the audience endeavoured to hold up the tottering sides while the women escaped" but the building crashed down and two people were seriously injured. Motor-cars conveying the injured home were held up by an uprooted tree. In Morecambe Bay a fishing party of 3 was reported missing after the storm and neither boat nor the bodies were found. The Fleetwood lifeboat was summoned wireless to a vessel in distress in Morecambe Bay. The lifeboat with the assistance of a tug found a vessel ashore near Heysham but there were no signs of anyone aboard. The Pwllheli lifeboat was also called out to save two motor yachts which broke free of their anchors at St. Tudwals and one was found and recovered after a 5 hour struggle.</p> <p>1. A great gale from the west produced a "considerable sea" which wrecked a steamer off Longships, Cornwall and whilst the captain and the crew were able to escape in the ship's lifeboat and landed at Padstow the engineer was drowned. In North Wales the Rhyl lifeboat was out to assist a schooner in distress near the Point of Ayr lighthouse off the mouth of the Dee estuary. Thousands</p>
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gathered on the surrounding dunes to watch the efforts of the lifeboat and the rescue in the north-westerly gale which sent "immense breakers on to the shore" through which the lifeboat was launched with great difficulty. The vessel was successfully rescued and towed into the safety of the port of Mostyn. Fishermen from Manchester were caught in a squall and were rescued by the Nevin lifeboat when in imminent danger of being swamped. One of the rescued fishermen, a Captain Birchenhall, returned to Manchester and went to the offices of the National Lifeboat Institution to thank the institution for their assistance. At Barmouth the lifeboat was deployed but could not locate a vessel supposed to be in distress. There was a "thrilling story of a fisherman's peril" off Anglesey after he was marooned on "the Beacon", an islet off Holyhead for 24 hours. He was however saved by the now famous Rhoscolyn lifeboat "which, it will be recalled, lost five members of its crew in 1920 during a gallant attempt to take off the crew of a distressed steamer". The lifeboat was "buffeted by the wind and tossed about by the sea" as it made several attempts to rescue the old fisherman on the shore which was described as the "most dangerous spot in Anglesey" due to the rocks and "numerous cross currents" which were a great threat to approaching boats. It was remarked by a captain "it was a hell of a sea. Nothing could live in it" and eventually the man was rescued by the crew who were accompanied by a Sir Harry Verney and Captain Davies. The elderly man "seemed none the worse after his experience" and afterwards said in an interview "I nearly broke my heart this afternoon

when I saw the lifeboat was forced to return without me. I thought I was done for". The coxswain of the lifeboat remarked on the mountainous nature of the sea and stated his "men were great, and I cannot praise them too much". Also on the North Wales coast the Porthdinllaen lifeboat was called out to assist a steamer and succeed in getting the vessel and her crew to safety. In Liverpool it was remarked the ferries were much delayed as the Mersey felt the full force of the NW gale but travel still continued thanks to the great handling of the captains. 10 small craft were overwhelmed by waves and sank at their moorings near Egremont Pier. The "blow-hole" a passage between the Royal Liver and Cunard Building was a difficult passage for pedestrians due to the channelled winds which took down lampposts. Many of the "ornamental trees on the outskirts of the city were uprooted or snapped off whilst many windows were shattered as chimney pots and slates fell. The New Brighton lifeboat was summoned to an American tanker which was in difficulty off Garston but "her long and arduous journey was unnecessary" as a tug had already taken the ship in tow. On the North Wales coast it was difficult to walk and handbags were torn from the hands of visitors and carried away by the wind. A motor boat in Llandudno Bay was sunk when the tide rose and then she was dashed against the shore and much damaged. A show at a Colwyn Bay theatre had to be abandoned such was the alarm raised by the storm amongst the guests. In Rhyl damage was done to the roofs of building in the harbour and some visitors were badly shaken having

1923	3 to 12	10	British Isles	The Guardian & The Observer	04/10/1923 - 15/10/1923	2	<p>been blown against walls. It was remarked "there was quite a run on drapers' ships on Thursdday morning for hats". At Nevin two boats were badly damaged with one being sunk and another swamped. The Colwyn Bay sea wall was much damaged by the storm surge and strong winds as coping stones were torn uand iron railings twisted like wire. A tar footpath was also uprooted and debris was thrown over a carriage way which was impassable. The council staff were busy repairing the surge damage and enacted all temporary repairs before hte next high tide to mitigate further loss.</p> <p>2. A storm "described as of cyclonic violence" was felt throughout the British Isles and caused considerable damage on land, sea and in air as the air mails were held up. At Port Talbot three steamers broke adrift and considerable damage ensued whilst cyclists were blown off their bikes. A motor car was also blown over in the main streets of the town and a coal merchant's shed was demolished. Trees were uprooted and houses partially destroyed in Llanelly where a football stand was also wrecked. Several Pwllheli fisherman were caught in the gale off Clan Head and several boats had their sails torn to ribbons. One man was washed overboard but was picked up and a smack towed another vessel to safety. At the Plymouth House of a Lord and Lady Astor great damage was sustained when a chimney-stack fell through a roof and completely wreck the study. Much damage was done to the roofing and furniture. Near Barnstaple a woman farmer was killed when an elm tree fell upon her and she was "shockingly injured". 16 of the 24 telephones lines</p>
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connecting the continent were down with Bristol having 6 trunk lines out of service. Two Swedish and British steamers drove right through the Brixham fishing fleet and "the services of motor fishing boats, tugs, and the lifeboat were requisitioned to get the smacks to safety" with 12 being aken into the harbour badly damaged. The pleasure resorts along the Severn and at the head of the Bristol Channel were badly damaged with one new holiday resort being completely wrecked although there was fortunately no loss of life. The storm surge washed away many of the cafes, huts and recreational facilities and much debris was noted floating in the Severn. Burnham was flooded by the storm surge with a major portion of te town being under water and The clarence Hotel suffered greatly as "People had to barricade themselves in their homes". In the Mersey two lifeboats were called out and at least one vessel sank. The seafronts at New Brighton and also further south at Barmouth were extensively damaged by the storm surge. At Wallasey "the promenade was repeatedly deluged by hugh waves for almost its entire lenght of four miles, and hotels and other establishments on the immediate front at New Brighton were flooded. At Leasowe the storm surge completely washed over the sand dunes and "fair-sized dwelling-houses were completely washed away b the force of the waves". The New Brighton lifeboat attended to a 30ft motor-yawl at the mouth of the Queen's Channel but the vesseldeclined assistance despite appearing to be in difficulty. The essel stood by however for safety purposes as "tempestuous seas continually washed over the

lifeboat, and on several occasions members of the crew only succeeded with the greatest effort in avoiding being washed overboard". They were "drenched to the skin and numbed with the biting cold" but bravely stuck by the yawl, however until the sea abated and the yawl was clearly no longer in danger. The Hoylake lifeboat deployed in the teeth of the gale in response to rockets and flares in Liverpool Bay although despite an exhaustive battle for 4 hours no vessel could be found apart from a large piece of wreck belonging to a Liverpool fishing vessel. At Birkenhead flat broke from its moorings and sank and a cargo of fruit washed up on the shore and was collected by children. On the eve of the 13th a brief thunder and lightning storm followed by torrential rain continued intermittently for several hours. For the first time in a long time notices appeared at the pierhead "advising passengers by the Wallasey ferry-steamers to refrain if possible from crossing the river between midday and 2 pm high tide being at 1.10 pm due to the fears of a heavy sea and a storm surge. Two bodies were later washed ashore who were believed to be fisherman whose boat had been overwhelmed in the Mersey. It was thought this was the boat the Hoylake lifeboat crew had been looking for but did not find. In Wales severe coastal erosion was reported as the storm surge washed away a considerable length of the Barmouth promenade and railway sleepers that had been erected as a temporary defence. A number of houses close to the huge "fissure" were in considerable danger of being eroded away.

1923	27-29	10	Western Britain	The Guardian & The Observer	28/10/1923 - 30/10/1923	1 1. Stormy weather was noted in the South and South-West of England and in Wales as a heavy sea ran causing much damage in the Celtic and Irish Seas as the wind gust speed reached 80 mph which was so strong people were knocked over and one woman was "rather seriously hurt". A motor boat used to convey men to larger shops was forced ashore and struck rocks and sank. Many vessels were weather bound in the sound. At Teignmouth there was a very high tide with the storm surge waves breaking over the promenade wall and spray broke over the passing trains. Tons of sand was deposited on the foreshore and some of the lower parts of the town were flooded. Heavt rains were experienced throuhout Exeter with over an inch falling in a short period. The rivers were in flood and much low lying land was under wanter. Minor damage was reproted at Swansea and an electric standard collapsed on a passing ramcar doign damage to the vehicle but resulting in no injury. The crew of the French schooner Ravenbinic were landed at the Swansea Sailors home the vessel having gone ashore between the Swansea piers and the crew being rescued by the Mumbles lifeboat. The vessel was to be saved. The meterological correspondent noted that "teh steep and rapidly chanding atmospheric gradients during the month, eivdienced by the switch back movement of the barometer, caused a violent circulation of air over the country and in the Channel and at exposed places on the coast wind velocities exceeding sixty miles an hour, and occasional gusts at over eighty miles an hour, have been expereinced". The temperatures had bene above normal
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1923	14-16	12	British Isles	The Guardian & The Observer	15/12/1923 - 17/12/1923	<p>owing to the persistent moist strong winds from the south-west. Off the North Wales coast three fishing boats were caught outside the buoy at Llandudno as they were driven by strong south-easterly winds and the Llandudno lifeboat was summoned to the rescue of one of the vessels. The pier lifeboat was also launched to rescue the occupants of the other two vessels. All vessels were towed back to safety by the main lifeboat. The Beaumaris lifeboat was deployed to assist a crew of a schooner Baltic and rescued the crew. Although the crew were returned when the gale moderated, there was a sudden increase in the magnitude of the gale and distress signals were once more shown and they were again taken off. Many of the major rivers of North and South Wales were in flood and the lower-middle courses of the Clwyd, Rhuddlan and Severn were inundated with houses submerged and livestock affected. A donkeyman on a steamship in the Celtic Sea was washed overboard and drowned.</p> <p>The meteorological correspondent noted on the 16th a "deep and vigorous depression off the north-west coasts of Ireland yesterday morning move eastwards to Scotland. It was associated with stormy weather and winds strong to gale force over England, southerly at first, veering to south-west or west later". Windspeed of 50 mph were experienced in the Scill Isles and at St. Ann's Head in Pembrokeshire whilst hail and snow were experienced in the north-west whilst heavy rain of 13 mm fell at Holyhead and 12 mm at Morecambe. A heavy storm was experienced in the Irish Sea with snow and sleet adding to further dangers of the small cross-channel cargo</p>
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1923	12	British Isles	The Guardian & The Observer	02/01/1924	<p>boats. Preston "experienced every possible kind of weather" on the 15th from frost and calm to snow, rain and later thunder and lightning and sunshine with a half gale of wind. There was an "extraordinary wreck in the Mersey" as a steamship bound from Liverpool to Adelaide ran on to the coastal defence revetment in the Crosby Channel and became a total wreck. This occurred as the ship struck during the Ebb and as the water and thus support ebbed away from beneath her she broke her back and disintegrated. The 3 passengers, crew of 103 and 5 stowaways were all taken off to safety. It was noted the revetment had been constructed through the sandbanks to prevent siltation and had been carried out by the Mersey Docks and Harbour Board before the war. It was noted the process was "an orderly abandonment" and there had been no great commotion amongst the crew who immediately "received instructions to don lifebelts and prepare the boats for launch". A flotilla of tugs quickly responded as well as the New Brighton steam lifeboat. As soon as it was noted the steamer was condemned the three passengers were lowered into the lifeboat by means of a ladder and transferred to a tug before being taken to shore.</p> <p>A review of the weather of 1923 which stated the year had produced "many records of the wrong kind". December was described as a "Month of very varied character" with rainfall in Liverpool being an inch more than normal whilst in Falmouth the rainfall of 4.69 inches was 1.58 inches short of the average. No comment was made regarding wind velocity variability.</p>
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1924	9 to 13	1	British Isles	The Guardian & The Observer	10/01/1924 - 15/01/1924	An "intense depression" moved across the English Channel producing gales of great ferocity in the British Isles. In Southern England a blizzard was experienced with gusts exceeded 50 mph whilst the temperature dropped to below freezing as snow fell creating drifts feet in depth. The wind produced great waves in the Irish Sea and English Channel which did great damage to shipping which included damage to the battleship Resolution in Plymouth. vessels were wrecked on the Isle of Man and crew were forced to climb perilous cliffs 300ft high although all reached the top in safety. One of the crew remarked "It was a terrible climb in the darkness with an incessant fall of snow". At Barmouth the storm surge made a breach in the rail embankment and a large gang was engaged to repair the damage which included importing huge boulders to fill the gap and protect the railway from the sea. It was estimated £10,000 damage had been done. Recreation spaces including tennis courts were also damaged as the sea swamped the coastal resort and eroded large areas. Lifeboats were out across the UK but little needed on the West coast.
1924	28 to 1	3	British Isles	The Guardian & The Observer	01/03/1924 - 03/03/1924	A depression which moved eastwards from Iceland to the Shetlands produced gales from the NW in the North of the Kingdom which were felt throughout the west of Scotland and as far down as Liverpool. What was termed a "typical 'line squall'" and "its passage was accompanied by violent gusts of wind, heavy hail" as well as a fall of temperature. Just north of Blackpool a caravan was overturned by the wind and set on fire killing two occupants as screams were heard by nearby holidayers.

1924	12 to 14	4	South-West Britain	The Guardian & The Observer	14/04/1924 - 15/04/1924	<p>The groundmen at the resort made "a gallant effort to save the two" with an axe but could not render assistance and the two were charred. Gale and hail caused much disturbance to farmers in the Ribble district but no surge was noted. In the Hebrides the storm was so severe the islands were cut off as steamers were unable to land and travel to many parts of Lewis was impossible owing to the heavy snow fall. All fishing had stopped due to the severity of the seas and the mail steamers had to return to port being unable to progress beyond Raasay Island. Gales were also severely felt in the North Atlantic but thankfully without loss of life.</p> <p>A gale struck the South-West rendering severe damage to a several vessels on the Cornish Peninsula with one motor ketch being driven ashore at Beacon Point Ilfracombe after the vessel's engine packed in. The vessel struck the rocks and was wrecked but the crew survived by escaping in their lifeboat. A steamer arrived at Almouth having been battered by the "westerly hurricane" off the Wolf lightship. The crew were prepared for evacuation however the vessel just managed to limp into port.</p>
1924	27 to 3	5	South-West Britain	The Guardian & The Observer	28/04/1924 - 04/05/1924	<p>A terrific south-westerly gale of great force created great havoc in the Celtic Sea and a "strong gale" was reported from all the major ports on the West coast as heavy rain also fell. The gale also resulted in tremendous damage at Warrington where a fire started in its midst and consequently an entire pavilion worth £10,000 was burnt to the ground whilst there was widespread damage to wireless aerials throughout the kingdom as the BBC blamed amateur setups and installation as opposed to</p>

1924	1 to 3	7	British Isles	The Guardian & The Observer	03/07/1924 - 05/07/1924	<p>their transmitting station. Thunderstorms were also noted throughout SW England although they were most notable in Bristol "where the city of the city was shaken as if by a great explosion". This was due to the "extradordinary atmospheric conditions" and was preceeded by flashes of forked lightning. Power was cut off and the tramcars stopped working and the sky order the city was "brilliant" in nature as a "curious light attracted the attention of thousands" who were arrested by the violence of the explosion. One man was unerved and a woman fainted but no serious incidents occured.</p> <p>The yacht Siren had "a thrilling experience" in the Irish Channel having crossed the Irish Sea from Milford Haven to Dungarvan in a great storm. The vessel was struck by a huge wave which disabled the vessel and the crew were left near helpless as "ave after wave washed the decks" and the crew were consigned below for 6 hours as the vessel drifted helplessly. Fortunately the vessel was skilfully assisted by a gallant captain of a trawler who succeeded in getting a lifeline aboard and the two brothers were brought aboard his vessel. The yacht was lost however and the men lost much money and many possessions. Congratulations were issued to the rescued and the rescuers on being brought to Dublin. Along the south-west coast the wind reached 40 mph average which was due to the sudden passing of a low over the region to the north.</p> <p>A gale in the Solway meant that 16 choir boys could not complete their return motor boat journey across the Solway and thus were compelled to stay in Kippford</p>
1924	28-29	7	North-West Britain	The Guardian &	30/07/1924	

				The Observer		overnight before returning back to Maryport on what should have been a day excursions. Following this it was remarked "steamers will not pay" to cross the solway such were the conditions and it was said this experience of the boys could bring an end to plans to set up a regular motorboat ferry and excursion service in the Solway.
1924	17-20	8	British Isles	The Guardian & The Observer	19/08/1924 - 21/08/1924	A gale raged for 24 hours round the coast of Britain with wind speeds of 60 mph from teh south-west being recorded in the channel and 15ft rolling waves being reported in the celtic Sea. A massive Cunard liner Laconia dragged her anchors in the Mersey and was drifting down the river until she was swiftly arrested by tugs. Much inconvenience was experienced by shipping and flying was undertaken with great difficulty. The depression moved swiftly over Iceland and the pressure gradient was very steep with windspeeds increasing from very light to gale force in a few hours on the coasts as moderate rainfall fell and the temperature sharply dropped. In Southport the rowing races on the marine lake became a great spectacle as two vessels capsized due to the force of the wind and height of the waves whilst another was immersed before racing was abandoned.
1924	21-Jan	8	British Isles	The Guardian & The Observer	21/08/1924	News was received by the Chamber of Shipping that the air ministry planned to broadcast gale warnings via wireless from the major wireless stations in Britain which included Fishguard and Land's End. The purpose was "to give an indication of the position of the centre of the depression and the direction in which the centre is moving". The "amplified messages were to start as of September 1924.

1924	21-24	8	British Isles	The Guardian & The Observer	23/08/1924 - 25/08/1924	1	<p>1. A storm brought high winds and heavy rains which caused flooding in Bristol which was "the worst known in local history for many years" but was largely confined to the outskirts of the town. Large tracts of land were under water 6 feet in depth and houses inundated completely on the 1st floor which occasioned tremendous damage to property. At Portishead the water was two feet deep and the floods caused much alarm amongst the inhabitants. At Stapleton a boy bathing in the river was swept away and drowned. In Lancashire the River Ribble was in full flood and one vessel in the Preston quay broke free from her mooring and collided with another vessel doing great damage. A sailor trying to render assistance with one other were helpless to stop the vessel being swept downstream by the torrent as the vessel careered down the river. Eventually the tug boats of the Preston docks came to the rescue and arrested the vessel and no lives were lost.</p> <p>A great gale swept the British Isles causing wild scenes on the west coast were considerable losses amongst shipping were sustained. Mountainous seas were experienced with vessels for Ireland being forced to seek shelter in Ramsey Bay or put back to British ports. An Irish Mail boat was swept with huge seas on her way from Holyhead with many passengers receiving minor injuries and two major. Much damage was done to property throughout Wales and Lancashire and telegraph wires were largely felled. The rain was heavy throughout Wales and in Holyhead the rain was so heavy that the furnaces at the gasworks were extinguished. In Lancashire it was said the farmers</p>
1924	20-24	9	British Isles	The Guardian & The Observer	22/09/1924 - 25/09/1924		

1924	9	British Isles	The Guardian & The Observer	02/10/1924 welcomed the gales as the high winds dried the corn and hay and as a result "there was a large resumption of harvesting operations" whilst the potato crops also prospered with the wind dispersing stagnant water from the recent heavy rains. A vessel arriving in Dublin from Glasgow was "at the mercy of the waves and the hurricane of wind" for 6 hours with only "expert seamanship" keeping the vessel afloat. She consequently arrived with damage and slight loss of cargo. The telegraphic damage was such that Barrow was cut off and messages had to be conveyed by train. Very heavy rainfalls were recorded throughout the South and West of England as the intense low brought in moist air from the Atlantic however a following burst of polar air following the storm produced highly unstable and stormy conditions. The storm cones were hoisted in all major ports in the west multiple times to warn mariners of the succession of depressions which brought the sustained period of strong winds. A summary of the weather of September described as "a month of many gales". The storms were caused by the succession of Atlantic depressions which brought rain and strong winds as well as thunderstorms and hail to the kingdom. The gale on the 17th brought winds as strong as 50 mph to Liverpool although the worst conditions were noted on the 20th and 21st which have "rise to remarkably severe gales everywhere, which caused much structural damage both inland and on the coasts". Record rainfall was recorded at Holyhead with a fall of nearly two inches in a day. Floods were reported in the South-West
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1924	6 to 8	10	British Isles	The Guardian & The Observer	08/10/1924 - 09/10/1924	<p>were excessive rain also with the final depression producing a remarkable "line-squall" felt across the North in particular.</p> <p>Very strong winds prompted a discussion regarding the accuracy of recording wind strength through human observations with the meteorological correspondent noted the Met Office employed specially trained observers before noting "exaggeration of the real velocity being quite the usual feature of most amateur reports on strong winds". It was stated a full description of what windspeed constitutes a hurricane was necessary as the wind had obtained a great velocity on the eve of the 7th and it had been remarked "the hurricane, which must have been the worst we have ever had". The cessation of other sounds at night was said to falsely amplify the perceived strength of the wind as the wind only reached a maximum hourly average of 35 mph on the mainland. The low to the south-west of the Scillies produced gales there recorded at 55 mph on the 8th and torrential rain was experienced in the South-West with 2.80 inches being registered at Falmouth whilst 2.92 inches was experienced at Penzance. Devon, Somerset and Dorset also experienced heavy rain whilst the temperature dropped marked by 8 degrees F.</p>
1924	23-29	11	British Isles	The Guardian & The Observer	24/11/1924 - 30/11/1924	<p>Severe storms and rain from the south-west produced rough seas which delayed a liner landing at Plymouth and the "virulent depression" produced very strong winds across the South coast. Lighter winds of 35 mph were obtained at Liverpool and heavy rain was felt throughout. Local gales were predicted but overall the wind was predicted to remain "strong" by forecasters. A vessel</p>

1924		11	British Isles	The Guardian & The Observer	02/12/1924		<p>foundered in the Irish Sea as a vessel sighted "the stem of a steamer, apparently of the coasting type, disappear in the water" and despite the best efforts of the search party "no trace of life was seen" and it was impossible to pick up the ships floating boat such was the sea state whipped up by the gale.</p> <p>A monthly summary of the November weather noted frequent fogs, one very cold day and "a remarkable gale over southern England" defined the weather of the month. The gale had brought substantial rain with it as well as a drop of temperature throughout. Wind speeds of 70 mph were noted in the English Channel and considerable damage was occasioned at Sea as most rain gauges collected 1.2 and inch or more in an hour whilst thunder was also sporadically noted.</p>
1924	4 to 5	12	British Isles	The Guardian & The Observer	06/12/1924		<p>A deep low pressure system with a high gradient brought remarkable changes in windstrength with winds increasing rapidly on the north and west coast from a gentle breeze to a gale which in certain locations reached 40 mph. A general downpour occurred throughtout the kingdom although it was heaviest felt in Lancashire and North Wales were 3/4 inch were measured.</p>
1924	15-16	12	British Isles	The Guardian & The Observer	16/12/1924		<p>A gale sprang up in English channel and a gale was recorded at Plymouth although damage was little and stronger winds were felt in the east.</p>
1924	23 to 2	12	British Isles	The Guardian & The Observer	24/12/1924 - 03/01/1924	3	<p>3. Mammoth damage throughout. A succession of storms caused much havoc throughout the United Kingdom over a 2 week period. Strong winds caused much disruption in the Irish Sea as passengers felt the full force of the winds</p>

and mountainous seas as they crossed from Liverpool to Holyhead. The captain of the vessels stated "I do not remeber such a dirt night, and I do not want to go through another one like it". The vessel "stood up bravely" and it was thought it remarkable no damage was done. Passengers told terrific stories: "The noise was terrific: quite a number of us were ill" whilst many were frightened by the noise "like a bombardment". Other vessels sighted were "bobbing about like corks" before they disappeared beneath huge waves and many were "enveloped in the huge waves". A mail boat Scotia sustained considerable damage when struck by a "tremendous wave" which "crashed on the deck, bending iron plates and damaging doors and rails". Nearly all the passengers suffered from seasickness. Throughout the coast winds of 40-50mph average were noted with gusts of 60 mph. The weather was wet and mild however with 57 F being noted at Llandudno. A blaze started on a vessel in the Avonmouth Docks during the storm which was exacerbated by the heavy gale with firemen struggling to containing the blaze due to the wind and location and the vessel was severely damaged. Glasgow was "rain-soaked" on the 27th with 1 1/4 inches of rain falling whilst many incoming liners reported "terrific battles" with the elements in the Atlantic and Celtic Seas. A body of a man in his mid 40s was washed up on the Laugharne sands at the mouth of the Three Rivers Estuarine Complex. It was thought he was the captain of a vessel wrecked in the Carmarthen Bay and that the crew and officers had abandoned their vessel in their lifeboat which

subsequently was overwhelmed. Another body believed to be from the same French vessel was also washed up at Pembrey Beach, Carmarthenshire whilst much wreckage and a small boat had been recovered. A vessel was also reported ashore at Freshwater near Tenby and it reported one of the crew had drowned whilst others were saved by the rocket apparatus from Linney. One vessel was also blown ashore on the rocks at Sully near Barry and was left high and dry when the tide receded and it was feared she would become a total wreck. The gale was described as being of "fair and open-handed character as to compel the admiration of the most reluctant". It was stated the gale "made no discrimination" such was the magnitude and expanse of the low which meant the whole of the Kingdom was enveloped in a "general outpouring of wind and rain". In many places it was described as "the worst experienced for thirty years" and almost all shipping traffic in the English Channel was held up. At several Welsh coastal resorts promenades and sea walls were badly damaged by the storm surge whilst landslides and flooding suspended rail travel in many places. In the flood plains of the Douglas and Alt as well as the Ribble severe flooding ensued to the extent travel was done via boat and many houses were flooded. "Fleetwood was flooded and cut off by gale-driven tide" whilst the Lune Valley also suffered. A later meteorological report exclaimed however "the velocity which the wind attained was not phenomenal, and reports that the gale was the worst for many years should not be accepted altogether without reserve". In South-West Scotland however at Eskdalemuir

a gust of 99 mph was recorded owing to the very steep pressure gradient over that area whilst an average of 60 mph was reported at Plymouth. Occasion hail and lightning were noted over Scotland. In South Carnarvonshire ten acres of saturated land "slid into the sea" in a giant land slip whilst part of a quarry was also lost. Livestock were drowned and the quarry caretaker had a "miraculous escape" as he got clear just before he was overwhelmed by the slide. At Barmouth officials asked for state assistance to repair damage to a key railway bridge down by a surge whilst the line was completely submerged and all traffic stopped. The leisure facilities in the area had also been completely destroyed and several houses were under 4 feet of water and much anxiety arose amongst the inmates although fortunately the wind abated and the surge decreased before any loss of life occurred. A man was lost on a liner from South Africa when he was swept into the sea from the decks by a huge wave and never seen again. In Cumbria a serious flood occurred at Wigton and several sheep were washed down the River Caldew and Wampool whilst houses were flooded to the height of the window sills with many having to scarp up stairs to safety. "Roads were turned into rivers" and one major road subsided to the extent it had to be closed doing great bother to those attempting to attend the farmers market. Carlisle streets were also underwater after a channelisation wall collapsed flooding the main railway and the streets as pots and slates were also blown off roofs. Several more livestock were drowned on the banks of the Eden. The Derwent also

burst its banks and flowed into a new channel being dug near Workington doing hundreds of pounds of damage. On the banks of the Ribble a road was submerged delaying all traffic into Blackpool as the flood waters inundated the thoroughfare to a height of a foot whilst the strength of the flow was enough to knock people off their feet. Tons of silt was left as a residue after the floods subsided. On New Year's Day the gale renewed in strength with wind speeds of 60 - 70 mph being reported on the West and South coasts which was caused by a great depression moving eastwards over West Scotland. In Pembroke a whole gale was reported and 70 mph was reported at Sealand. Snow and sleet fell over Scotland with rain in Wales and Northern England. At the seaside resort of Blackpool the gale blew shop windows in and "the sea lashed over the promenades" although little damage was done when the severity of the storm surge and winds were considered. Slates widely fell from houses and a few chimney pots fell although the most extensive damage was done when tonnes of sand was blown from the St Annes dunes and deposited on the railway which meant rail traffic was delayed and had to be rerouted whilst gangs cleared the lines. A house in the course of erection was blown down at Pwllheli whilst the River Avon rose nearly 10 feet at Bath with tram services having to be suspended owing to the flooding on the Bath-Bristol road. The storm surely did considerable damage to a landing stage in Anglesey which was nearly completely wrecked. At Preston a huge oil tank was blown down by the wind near the Prince Edward Dock and about £1500 of damage

1925	3 to 5	1	British Isles	The Guardian & The Observer	05/01/1925 - 12/01/1925	2	<p>was done. Trees blocked a road in North Wales causing disruption to road travel. A Romanian steamer was in distress off Land;s End having lost her rudder and the Penzance and St. Ives lifeboats along with a tug deployed to her assistance. The meterological correspondent stated the final low of this storm period formed near the Azores initially before moving up to Scotland and producing the vehemently strong winds. A hurricane force gust was noted at Plymouth whilst gusts of 64 mph were noted at Chester and 60 mph and 60 mph squalls were recorded at Holyhead and Liverpool respetively. For perspective it was noted these figures were far from remarkable in terms of wind speed records although the expansive nature of the event meant it would "take its place among the remarkable gales of the century".</p> <p>2. Minor damage due to forecasting. Another depression swept in from the Atlantic causing strong south-westerly breezes throughout which later veered west and north-west. Gales were felt throughout with Sealand, Pembroke and Scilly all registering 40 mph constant breezes with a gust at Scilly measuring 61 mph. Rain fell widely but was not generally heavy. The gale did little to help the Welsh towns which were still severely suffering from the gales as more trees were felled and agriculturalland damaged. In Bargoed, Glamorgan a train toppled over an embankment which gave wave with the driver and fireman being killed as the train plunged down the valley into the river below. A eye witness reported hearing "a terrible crash, accompanied by flashesof flame" before he saw the dead fireman and driver dead pinned beneath the train in the</p>
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1925	13-14	1	British Isles	The Guardian & The Observer	14/01/1925 - 16/01/1925	<p>2</p> <p>clayey soil of the river. This accident threw two collieries idle as the train severed electricity lines supplying the mines and 2,000 men were without work. A 50 ton crane and acetylene welders were immediate sent to the scene to remove the wreckage. Overall it was noted that "the help of a few ships' observations" conveyed by telegraph had enabled appropriate gale warnings to be given so preparations had largely been adequate and damage minimised. It was stated that a polar anticyclone now brought polar airs to the Azores which made the creation of new depressions impossible. Moreover the polar anticyclone formed a "formidable obstacle to another depression which is now crossing the Atlantic" and thus the UK would hypothetically be shielded from the worst of weather in the near future and the weather would be fine. A later report on the 14th noted the succession of tempests had resulted in a scarcity of fish supplies throughout the UK and in London and it was exclaimed such scarcity escaped living memory. As a result fish prices soared to "ridiculous figures" although the fair weather to come was predicted to result in the normal supply levels being met and a drop in prices.</p> <p>2. Moderate Damage. A violent gale occasioned much damage to the Sidmouth sea front as the sea wall which had previously been undermined collapsed into the sea over 40 feet whilst a hole was left in the roadway behind and property was in great peril. The southerly gale swept the kingdom and all fog was quickly dispersed and temperatures rose rapidly. "Exceptional winds" resulted as the warm air came into collision with the lingering</p>
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<p>1925 29-30</p>	<p>1</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>30/01/1925</p>	<p>cooler poalr air mass which was particularly felt over the North-West of England and Scotland. In the Scillies 60 mph or a "whole gale" was observed. Gusts of over 70 mph were also noted at Holyhead and Eskdalemuir and West Lancashire also felt the full force of the gale whilst it was remarked "conditions out in the Irish Sea must have been terrific". Two lives were sadly lost in the Mersey when a steam flat of the Lever Brothers of Port Sunlight was swamped by the heavy seas and sank. Both the captain and engineer were drowned and one was saved by a passing steam barge. A Liverpool steamer was also towed into Fleetwood in a helpless condition by a traler. She had been incapacitated in the huge seas and great gale in the Irish Sea and had hoisted the disabled signal before the tralwer located her and took her in tow. A Belfast steamer was also sevrely buffeted off the Isle of Man and many livestock. were killed. Slight damage. A "day of gales" was most severely felt on the Lancashire coast and it was remarked the month had not gone "out like a lamb". The cause of this was a swiftly moving depression across the Atlantic which centred between Iceland and Scotland and had moved at "the astonishing rate of some 75 miles per hour". The west coast of Britain once more bore the brunt of the gale force winds with the coasts of North Wales and North-West England experiencing violent squalls. The rain which also fell was heaviest in Morecambe where 1.1 inch fell over 24 hours. The gale was forecast tocontinue in the Irish Sea on the 30th.</p>
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1925 9 to 12	2	British Isles	The Guardian & The Observer	10/02/1925 - 22/02/1995	<p>A gale caused notable damage as it swept over Wales and the west coast. At Pwllheli a fishing boat was caught in the gale and the lifeboat was deployed to save the crew of 3 as the vessel foundered in Cardigan Bay. One man was injured due to falling objects in a construction site and a chimney of a house fell through the roof and caused considerable damage. The gale reached 70mph in South carnarvonshire and huge tress were uprooted blocking the main roads in the district whilst a number of people had lucky escapes. Many ancient trees near the ruins of Cymmer Abbey were also uprooted whilst many mtors were held up in Trefechan as spray covered roads, knocked over a horse and trap and prevented all vehicular travel. A ketch was also brought into Ramsey having being blown helplessly across the Irish Sea in a damaged state until she was rescued by the lifeboat who found the family exhausted having been working the pumps for several hours to keep the boat afloat. All liners in the Atlantic relayed reports of severe squalls from the west and mountainous seas. On Benbecula a house was struck by lightning and the seven occupants had remarkable escapes as the furniture was smashed to matchwood and doors torn off with pieces of masonry. A large landslide occurred on the GWR with a passenger train narrowly escaping disaster as the slide happened just three minutes before the "aast mass of earth weighing thousands of tons fell from the embankment on to the track, completely blocking both lines". Danger signals were quickly sent down the line and trains stopped as soon as the damage was reported and traffic was</p>
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1925	24-26	2	British Isles	The Guardian & The Observer	25/02/1925 - 27/02/1925	2	<p>completely suspended as gangs worked to clear the huge landslide. At Plymouth the wind was recorded averaging 50mph whilst hail showers fell in South Wales. Much concern was felt for a missing schoolboy who did not return to boarding school was believed to have been drowned by the storm surge on the beach. "Search parties have been out all along the coast northwards, the direction in which the tide currents set". It was noted that the recent gales had been "altering the map" around Britain due to the "serious coast erosion through gales" which on the west coast had particularly affected Sidmouth where 50 feet of sea wall had been undermined and eroded. Part of the road leading from Plymouth to Downton had also subsided and was closed to traffic with "the cliff threatening to break away entirely and bring about a complete collapse of the roadway".</p> <p>2. Moderate Damage. The British Isles experienced "every possible variety of weather - except a heat-wave" as the pressure wildly fluctuated and all forms of precipitation fell in the South. Severe gales were experienced in the English Channel and Celtic Sea with 60 mph being recorded at Scilly whilst heavy rain fell over the Cornish peninsula. The weather was characterised by a "line squall" with the wind veering from south to west with strong gusts. In South Wales a thirty-foot tide was driven by the strong winds with the storm surges sweeping low-lying low lands and up major rivers Taff and Ely. At Porthcawl huge waves deposited stones and boulders on the beach and onto the esplanade and streets and the surge penetrated inland. The sea wall was much damaged</p>
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1925	2	British Isles	The Guardian & The Observer	04/03/1925	<p>and the Esplanade Hotel was buried in spray. The high tide did considerable damage to the railway line between Towyn and llwynwriol as the embankment was breached and all train service was stopped and cars used to convey passengers. The railway was also inundated at Barmouth and the Towyn golf links were flooded. A house was struck by lightning at Barmouth and the roof partially damaged and all electric wires damaged. Extensive damage was also done at the embankment in Pwllheli and the Llanbedrog tramway track was eroded away in several parts. The "line squall" also caused much disturbance to aircraft, many of which were severely inconvenienced. Two lives were also lost off Mumbles when two boys were caught by a huge wave surge breaking over a coastal slipway. Although another was saved thanks to the "remarkable presence of mind of his companions". A young man heard the commotion and dived in to save the boys whilst fully dressed and was promptly drowned. About 120 people carrying storm-lanterns searched the coast for the bodies but it was not until the tide had receded were they found. A steamer from Penzance to the Isle of Scilly was compelled to turn back. The telegraphic cable between the mainland and the islands was also severed and thus communication with the Scilly residents was incredibly difficult.</p> <p>A meteorological review of the weather of February which alluded to the gales in the west and particularly in the South-West of England and Wales. Twice the normal rain was noted in February throughout the UK. Whilst a "family of lows" brought storms to the west coast which</p>
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1925	15-16	4	British Isles	The Guardian & The Observer	15/04/1925 - 17/04/1925	<p>occassioned moderate damage. During the gale of the 24th-26th the lowest pressure in 5 years was recorded at 28.35 inHg off the coast of Ireland.</p> <p>The whole of the British Isles experienced strong winds from the WSW with the worst squalls occurring in North Wales. The barometer's rapid fall indicated the coming troughs of low pressure which rapidly progressed eastwards between Scotland and iceland producing general rain and high winds over the UK. Liverpool and Chester both experienced 50 and 60 mph winds whilst sleet was reported in South Scotland. A Mersey Dock Board dredger went aground on the BrazilBank two miles out from Wallasey and the New Lighton lifeboat proceeded to the scene and eventually took the crew off and landed them all in the safety of Liverpool. The dredger was badly damaged and was marooned on the sandbank after failed attempts to get her off at high tide. Telegraph and telephone wires were widely severed and poles felled ocassioning much delay and soem of the gusts registered at Liverpool were some of the greatest recorded in 1925.</p>
1925	30-Jan	5	British Isles	The Guardian & The Observer	01/06/1925 - 04/06/1925	<p>The Whitsun Holiday was a highly stormy affair with the considerable rain and strong winds forecast by the Met Office materialising over considerable areas. The strong winds produced high scores at the Welsh Golfing Union meeting on th Rhyl links which lead to some players recording "extraordinary figures". The rianfall was "excessively heavy" across Scotland as the "vigorous depression" progressed over the British Isles crossing</p>

1925	5 to 9	9	British Isles	The Guardian & The Observer	08/09/1925 - 10/09/1925	<p>Ireland in a NE direction producing rainfall in the north but also in the extreme south.</p> <p>A great storm was severely felt in the Irish Sea and 1200 "storm-tossed and shaken" passengers arrived at Fleetwood from the Isle of Man 4 hours overdue and their "arrival was awaited by a large crowd of anxious friends" who all anxiously sought to catch a glimpse of the vessel and their loved ones. One other vessel put back to Douglas as the vessel was crippled in the heavy seas. Most were transferred onto another steamer but some were afraid of other voyage so spent the night in Douglas. Three special trains were put on to convey the passengers to Manchester, Blackpool and East Lancashire due to the lateness of arrival. The gale was severely felt at Holyhead and across Lancashire whilst snow fell on Ben Lomond. This weather was a result of a polar low over Scandinavia and another low between Iceland and the Azores which produced the stormy yet highly variable and wet weather. The heaviest rain was in and around Liverpool Bay.</p> <p>"Under difficult conditions excellent rescue work was performed" by a large motor lifeboat at New Brighton which rescued the entire crew of a London oil barge which experienced engine trouble in Liverpool Bay and could not be saved by a local pilot such was the nature of the strong winds and mountainous seas. The lifeboat gallantly deployed to save the oil vessel which was "at the mercy of the waves, her anchor also having gone" and after two attempts to take her in two the crew were taken aboard and the vessel abandoned. Most personal possessions of the crew were lost with only documents and few precious</p>
1925	26-27	9	British Isles	The Guardian & The Observer	28/09/1925	

1925	16-Jan	10	British Isles	The Guardian & The Observer	16/10/1925	<p>valuables being saved. All three ocean liners scheduled to sail were unable to leave their moorings on the morning tide and 2,000 people had to travel along 3 miles of dock to board the ships. The wind attained a velocity of 40-50 mph which detained the three ocean liners for several hours. The regional coastal ferry services were also much delayed but all eventually sailed. The weather was described to be of "infinite variety" by the meteorological correspondent who pointed to the Irish Sea being the area where storms were the most severe and wind speeds in excess of 40 mph were reported throughout the coasts of North Wales and North-West England. It was noted "had the tides been spring instead of neap ones some flooding would also have been extremely likely along the sea-fronts".</p> <p>An announcement concerning the effect of storms on broadcasting. It was reported that the BBC stations had been difficult to receive in Stornoway during stormy weather despite the fact they were only transmitted from Aberdeen and Glasgow whilst several other broadcasts were too weak to be understood. Captains crossing the Irish sea had also reported being able to only receive foreign stations and no British stations when the storm centre was south of Stornoway. It was noted the BBC were "particularly interested in the effect of bad weather on their transmission and listeners are invited to report to them as to what stations come in best during the next south-westerly gales".</p> <p>A large depression over the Atlantic covering all the area between Iceland and the Azores produced strong south-</p>
1925	21-22	10	British Isles	The Guardian &	23/10/1925 - 24/10/1925	

				The Observer		westerly winds and wet weather throughout the UK. There was a rapid drop in pressure over the Scilly Islands where the barometer reached 28.5 inHg and a gust of 70 mph was noted at Plymouth where a mean velocity of 40 mph was noted. The storm cones were widely hoisted at the order of the Met Office to inform all of the incoming gales.
1925	6 to 8	11	British Isles	The Guardian & The Observer	08/11/1925 - 11/11/1925	"Tempestuous weather everywhere" was the opening heading of the Guardian meteorological column as a "large and intense cyclonic disturbance" travelled from the Azores to the West of Ireland bringing with it severe gales over expansive areas causing much stress to shipping. Torrential rain also fell in the South with 10 inches falling in parts of the South-West and the temperature plummeted in Scotland. In Liverpool several houses in low lying areas were completely flooded and streets were turned into rivers. Many thousands of acres in West Lancashire were underwater and heavy agricultural losses were sustained although "farmers have removed their flocks and herds to safe pastures". Many vessels were delayed leaving the Mersey and those incoming reported a torrential gale in the Irish Sea where "vessels large and small experienced a very trying time" and several vessels were hours late coming into Holyhead. One of the passengers "I have crossed scores of times, but I have never been in such a gale ... at times the waves rose mountain high". Many passengers were so ill they could not travel by train after and had to stay in Holyhead. Two cattle were killed on one steamer whilst 6 others had to be killed due to their injuries. A woman was rescued by

<p>1925 19-22</p> <p>12</p>	<p>British Isles</p> <p>The Guardian &</p> <p>20/12/1925 - 28/12/1925</p>	<p>lifeboatmen from a schooner in the Mersey but the crew remained aboard despite the grounding of the vessel. A cold period followed the gale as a low brought arctic wind from polar regions which was also accompanied by hail, sleet and snow with localised thunder and lightning in some regions. A Falmouth schooner which nearly sunk in huge seas of Fishguard whilst on tow from an assisting vessel was thought would be salvagable and no personal injury was recorded. A cable ship which limped into an Irish port recorded having heard 6 calls of distress. The ship itself was hit by a huge wave on their broadside and the officer remarked "we thought the ship was about to sink and an SOS signal was sent out" and all the lifeboats were washed overboard or ruined. The vessel was flooding and much of the bridge and telegraph room was destroyed. The vessel was then forced to run before the gale and in the darkness they almost collided with two ships coming in response to their SOS as all lights had been extinguished. Several large buoys became loose on the foredeck and the chief officer and several men volunteered to brave the elements on the deck and the officer was almost swept overboard but for a "huge Newfoundland member of the crew" who "grabbed him by his clothes and pulled him back. He then continued his work as if nothing had happened". Several crew received injuries but none were seriously injured and the vessel managed to reach the nearest port unaided.</p> <p>A blizzard struck Scotland as well as North-West England and North Wales causing considerable disruption to train services and telegraphic services in Wales in particular.</p>
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				The Observer			Heavy snow 6-12 inches deep was recorded in Southern Scotland and temperatures as low as -13 were noted at Glasgow although in the South-West temperatures were mid owing to the south-westerly gales. Gales occurred in the Irish Sea and the Ramsey lifeboat was called out to rescue several a vessel in distress. A Geek auxiliary motor-vessel almost sunk off Land's End after being crippled by the tempest and out of fuel. The vessel was leaking badly but the captain did manage to find shelter in a bay and the humane assistance from the shorefolk allowed the crew to be landed at Boskenna and the men later taken to Penzance. After the storm there was much work to be done repairing telegraphic and telephonic wires throughout the kingdom and broken lines meant many messages had to be transmitted by roundabout routes. The holidays had greatly reduced the disruption to the nation but there were difficulties in recruiting gangs to repair damages. The post office noted that the reduced disruption compared to previous years was "justification of the policy of transferring important cables to underground ducts".
1925	28-31	12	British Isles	The Guardian & The Observer	29/12/1925 - 01/01/1926	1	1. Major damage. In a storm in the Celtic Sea a Swedish farmer jumped overboard and despite the best efforts of the ship and a lifeboat no evidence of the man could be found and the vessel returned to Plymouth. A defendant at Rhyl charged with drunkenness lost his bail as he was delayed in reaching the court on horseback due to the severe storm. High winds swept large areas on the west coast and the Mersey and other major ports were crowded with vessels seeking refuge. On the coastal

railway line in North Wales railway tracks were underwater having been submerged by the storm surge. Windspeeds of 62 mph and 52 mph were recorded at Holyhead and Chester respectively whilst the pressure gradient was noted to be very great. The storm was also attributed to have caused the death of one man blown into a dock and drowned. The train services in the Vale of Conway were suspended owing to flooding on the line after the river burst its banks. The gale in the Mersey was registered at 70 mph and coincided with high tide. The mountainous seas made it impossible to change the lighthouse crew on the North-West Lightship who still remained at station whilst cross-river traffic was interfered with and ferry services ceased for periods as several shop windows in the city were also damaged. On the 30th a gust of 80 mph was registered at Holyhead which was the national record for the year and in Lancashire it was remarked as being the "worst gale in 18 years". A train from Barmouth to Birkenhead collided with a felled tree on the line and it was remarked passengers owed their "immunity from injury to the moonlight, which enabled the driver to see the obstruction as the train emerged from the tunnel and apply the brakes". The entire train jumped the rails but "by a stroke of good fortune did not overturn". Many passengers were alarmed but none injured and a repair gang was sent from Bray as soon as the issue was known of. Near Portmadoc a chapel slate roof was entirely blown off and a proportion fell onto three houses smashing roofs and windows but

1926	26-27	1	British Isles	The Guardian & The Observer	28/01/1926 - 01/02/1926	<p>fortunately no one was hurt although the damaged houses were evacuated although injury was nearly sustained. A great gale struck the Welsh coast and Carmarthenshire was visited by a south-westerly gale which raged for 24 hours. One boat foundered in the English Straits but its crew were fortunately brought ashore as the vessel settled onto a bank but was not wrecked. An inquest also found a Finnish man had died of fright when the ship he was sailing came close to hitting rocks at Holyhead. The master and crew "struggled valiantly to save the vessel and the deceased was reported to have rushed into his cabin for a lifebelt only to be found dead shortly after.</p>
1926	2 to 3	3	British Isles	The Guardian & The Observer	04/03/1926	<p>Arctic weather spread over the entire British Isles and a sudden fall of temperature ensued and snow fell on Loch Lomond and the surrounding mountains. Atlantic liners struggled against the strong northerlies and gales "sprang up rapidly in almost all parts" with gales averaging 50 mph being registered at Liverpool and gusts of 65 mph at Holyhead. At Fleetwood the gale rendered ferry landings impossible and services were suspended as the "heavy seas swept the landing stage" and a storm surge of nearly two feet was noted. A vessel was wrecked in Carmarthen Bay after battling the elements for 24 hours in an ever deteriorating condition. In the bay she struck a bank on the flood-tide and the crew had to abandon her making for Llanelli in the ship's lifeboat. They were twice almost swamped and eventually driven onto a slag bank near Llanelli lighthouse where they were thrown out and then waded to shore.</p>

1926	8 to 9	3	British Isles	The Guardian & The Observer	10/03/1926	A gale occasioned considerable amount of material damage across Northern England which included the sinking of a vessel in Morecambe Bay and the abandonment of it's survey by Trinity House. Winds of 50-60 mph coincided with low water and Trinity House vessel could not proceed to the spot of the wreck which was blocking the traffic due to the mountainous seas accompanied with blinding snow and hail. The vessel's identity remained a mystery with all registered steamers being accounted for and it was hypothesised it could have been an Irish coaster caught in the storm and blown across the Irish Sea before sinking off Fleetwood. Little damage was noted on the Lancashire coast at Blackpool although many aerals were damaged throughout the region rendering radio communication difficult. Such weather was caused by a the swift eastward passage of a depression over Iceland and Scandinavia which also prompted a rapid drop in temperature as Artic winds battered the North with the greatest recorded snowfall being at Eskdalemir outside of Glasgow.
1926	22-23	3	British Isles	The Guardian & The Observer	23/03/1926 - 24/03/1926	A great Siberian blizzard engulfed the UK with many Atlantic liners due at Plymouth being delayed by the gales as temperatures dropped to 15 degs F or -9 degs C at Chester. The cold weather produced a "sad look-out for the fruit crop in most districts" and the harm was described to be "incalculable". At Burnham, Somerset the gale accompanied with sleet, snow and deluges caused much difficulty for the Cambridge and Oxford golfers on the links.

1926	29-30	5	North-West Britain	The Guardian & The Observer	01/06/1926		Several boaters were noted in distress in a gale off Colwyn when they were caught offguard by a gale which quickly sprung up and placed them in a perilous position. The boat was observed off Penmaenrhos Point with the occupants waving a garment from an oar as a sign of distress. A localman immediately launched his motor boat and eventually found the distressed and rescued two men and towed their boat to Colwyn Bay.
1926	10 to 15	6	British Isles	The Guardian & The Observer	11/06/1926 - 16/06/1926	3	3. Moderate damage. A gale struck the coast of Wales and caused great panic at Portmadoc where a marquee belonging to a travelling circus was felled by the wind but the 300 children inside all escape without serious injury. Thunderstorms were frequent and a property at Bath was struck by lightning and badly damaged. A golfer was struck on the heel whilst putting at Yelverton but came to no major harm. A vessel was wrecked in the Clyde leading to 3 deaths in what was presumed to be a terrible yachting accident with the occupants being caught offguard by the sudden gale arising. The police found the all three bodies washed up on the shore and it was later discovered the boat had been stolen by inexperienced yachtsmen who subsequently perished.
1926	18-19	7	British Isles	The Guardian & The Observer	20/07/1926	2	2. Substantial damage. A storm swept the country doing great damage and occasioning great losses to farmers, severe damage in towns as well as two deaths from lightning strikes in Merioneth. Torrential rain was noted in Liverpool which was the heaviest for 2 years and roads were impassable in the Wirral. The mayor of Wallasey whose house was struck claimed "The house seemed to be ablaze, in one huge flash" and the house was full of smoke

1926	21-22	8	British Isles	The Guardian & The Observer	21/08/1926 - 23/08/1926	<p>having recieved major damage and the mayor himself felt "a stinging sensation all over his body". At Wigton a 60 ft chimney was damaged and telephone wires fused and a gaspiper was severed and the methane ignited although all workmen got out before the blaze spread. A church in BATH was aalso struck during a service and the "flash appeared to pass right through the church, casuing consternation among the worshippers, one of whom fainted" whilst a stone cross was hurled to the ground. A labour hall int he course of erection was razed tot he ground at Swansea and railway traffic was held up near Llandovery when a landslide occurred and swept the debris down the mountainside. A slide on the railway between Bala and Dolgelly held up two excursion trains and platelayers from Bala worked for hours through the thunder storm to rebuild the line as the excursionists amused themselves.</p> <p>The first gale of the summer struck the UK and was caused by a deep depression from the Atlantic Ocean although it was noted there wee no tremendous gusts to record with winds reaching around 35 mph on the coasts. The storm cones were hoisted around the which was a surprise to many who had "been lulled into unsuspecting peace by the absence of high winds". It was again clarified that it was the Met Office not the local fisherman who hoisted such cones. It was remarked "that there is considerable amount of reliance to be placed in local weather forecasting, yet this idea of cones being hoisted promiscueously with one port showing a cone while one only a few miles away had an empty flagstaff, would lead</p>
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1926	30-Jan	9		The Guardian & The Observer	30/09/1926	to such alarming confusion that all trust in efficacy of the warning would vanish". The reliability of the barometric information and the ofrecasting of the Air Ministry coupled with the quick dissemination of forecast to all ports using telegraphs was noted. Strog winds were noted from Eskdalemuir to Southampton with speeds exceeding 35 mph. Sberal Liverpool yachts which took part in the Menai Straits Regattas were driven driven back to Beaumaris after encountering the full force of the gale on the North Wales coast. This storm was caused by a deep depression over the north of teh kingdom with the depression reaching a low of 28.85 inHg and over an inch fell in most North-Western counties. In Abersoch a racing yacht was sunk in Abersoch Bay and in the Firth of Clyde one yacht from the Royal Gourock Yacht Club was was dismantled and others sustained damage. Only 11 of the total entry of 48 yachts finished in the Clyde racing and one man had to have his foot amputated after it was partially severed by an anchor chain. It was hoped the boat sunk in Abersoch Bay would be refloated as she was a successful vessel.
1926	9 to 10	10	British Isles	The Guardian & The Observer	10/10/1926 - 12/10/1926	An announcement concerning the broadcasting of gale warnings from the Met Office and Air Ministry via the wireless. This was to start on the 1st of October after daily weather reports. A meterological correspondent told of gale force westerly gales in the Irish Sea and english Channel with winds obtaining a velocity of 60 mph in gusts in North Wales. Such winds were the result of an eastward moving trough which brought in the milder air from the south-west as

rain fell throughout much of Northern Britain. A forecast on the 10th warned of further impending gales throughout. On the Firth of Clyde there was damage to shipping but fortunately no serious injuries were sustained. The two liners Aurania and Caledonia were blown into each other in a "sea whipped up into angry waves" and the impact was highly alarming although no panic ensued and a rapid investigation confirmed no damage below the waterline. A new oil tanker was also driven onto a sandbank and other mishaps occurred but with no highly serious consequences beyond vessels beaching. The storm surges inundated the coastal fronts from Fleetwood to Rhyl in Liverpool Bay. The new promenade at Blackpool which had been turned into a racing track for an event was completely inundated with the gale blowing down barriers and the press box. "The heavy rain rendered the track too unsafe for speeds trials" and thus the event was postponed as surge waves dashed against the sea wall reaching heights of 30-40 feet as "the sunken gardens along this new stretch of promenade were quickly converted into miniature lakes two or more feet in depth" as seats on the promenade were scattered across the tramlines as spectators sought shelter behind trams which had been placed there as stands. The Colwyn Bay lifeboat was launched to assist a schooner in distress off the coast in the mountainous waves. The lifeboat "encountered the roughest sea the crew has experienced for a long time" but could not find the vessel which was believed to have headed for the Dee and its shelter. Indeed a later message from the Hoylake lifeboat stated

1926 1 to 2

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British Isles

The
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The
Observer

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04/11/1926

that the schooner had drifted into the Mostyn Roads and anchored before the Hoylake lifeboat could reach her. In Colwyn Bay a seawall 100 yards in length was eroded away by the waves have been undermined by the waves. All resources of the Colwyn Bay Council under the direction of an engineer were diverted to repairing the wall to prevent further damage. Several maor ocean-going liners were held up in the Mersey with many being unable to come up to the landing stage due to the fury of the sea and embarking from the shore was just as difficult. A coaster also "crashed intot hte north end of the landing stage with such force as to dislodge the foundations". The observed tide on the Wirral side was the highest for 30 years due to the onshore norhterly and many lowlying roads were submerged. The sea wall at Egrement was damaged with "fissures six feet deep appearing in the roadway in some parts". A vain search for a vessel ccurred off the Isle of Man which involded the coastguards and two lifeboats bit no vestige off any vessel in distress was found.

A violent gale was felt in North Wales which was accompanied by torrential rain. A "thrilling experience" was noted at Workington where there was much anxiety for 4 shipmates who eventually returned after a thrilling experience. They remarked "A south-east snorter of a gale sprang up when we reached the fish-ground" which completely destroyed their rigging and waves claimed to be 20feet high inundated the boat to the extent the propeller was out of the water. The men could not moor on the lightship but they stated "Fortunately we never

<p>1926 4 to 5</p>	<p>11</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>06/11/1926</p>	<p>shipped a green sea" and eventually reached the calmer area of sea at St. bees Head were their "troubles were over". Torrential rains and an "abormally high tides which served to dam up the estuaries at a time when the rivers were sending down huge columes of flood water reuslted in extensive inundations in the Lake District, North Lancashire, Wales and Western Scotland". The very strong 24-hour gale produced a storm surge which flooded many properties in estuarine flood plains and damage rail and road. In the Cylde the waters were the highest recorded since the self-acting gauge installed in 1992 as it reached 26 feet. The surge flooded the quays and sheds and "operations on the new Gasgow bridge were completely suspended" as the quays were awash with floating timber. All shipping was to the greatest extent suspended. The roads leading to Pwllheli from Criccieth and Abersoch were inundated to an extent of 4 feet in some places and a motorcyclist was saved from the flood waters by bus drivers. A large number of farm building weredamaged and trees widely blown down. Large tracts of the Conway valley were inundated with Llanwrst recreational facilities being flooded and the promenade under water. At Barmouth the promenade was once again breached and the sea undermined the temporary groynes and washed away temporary works whilst many dead livestock floated into the Mawddach estuary owing to the torrential rain in the catchments. Dovey junction was flooded for considerable distance with passengers having to be conveyed by bus. At Fleetwood the high tide and flooding</p>
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1926	10 to 11	11	British Isles	The Guardian & The Observer	12/11/1926	isolated the village for three hours as the sea penetrated the defence on the wets of the town. The waters "rushed irresistibly through and over the protective works with a thunderous roar, creating consternation throughout the town". Undreds of acres were inundated all around and the sea "Obliterated the tramway between Fleetwood and Blackpool". The predicted height was 26 feet whilst the tide rose to 31 feet backed a 55 mph gale. In Tiree a gust of 81 mph was noted which was defined as "sufficient ot uproot the largest trees, while no sailing ship could keep a shred of canvas hoisted against it". Heavy rain was general with 2.21 inches being measured at Eskdalemuir as showers accompanied the squalls.
1926	13 to 14	11	British Isles	The Guardian & The Observer	15/11/1926	A terrific gale off Plymouth prevented a trans-Atlantic liner from landing and although an attempt was made to take off the 3508 sacks of mail for England neither pilot nor mail tenders could get alongside owing to the gargnatuan waves. Damage to small shopping was noted. Stormy weather came ot the British Isles along with torrential rains which inundated the South of England. It was remarked "The cause of the ceaseless visitation of abnormally deep depressions which is giving rise to this serious state of affairs it is impossible to sumrise". It was also noted November "should prove the worst ever recorded since observations were first made. Its series of gales and its terrific rainfall mark it already well above the ordinary experience for this month". On the 14th the pressure dropped to 28.2 inHg as a steepressure gradient moved east over the isles. More than 50 mph

1927	8 to 13	1	British Isles	The Guardian & The Observer	12/01/1927		was recorded at Holyhead and huge seas were observed throughout the seas.
1927	26-30	1	British Isles	The Guardian & The Observer	27/01/1927 - 01/02/1927	11	A great gale disabled a vessel in the entrance to the Bristol Channel and she was observed drifting helplessly by another vessel which immediately went to her assistance and towed her 75 miles to safety in Swansea. News of safety were telegraphed to the owners in Fleetwood. 11. Great damage. Hurricane gusts. Bath flooding. A gale raged around the coasts of the British Isles which saw many incidents at sea as the short but intense gale registered winds of near hurricane force in the gusts in some locations. After a fruitless search for a vessel in distress in the Irish Sea the Ramsey lifeboat was hurled against a pier at the entrance to the harbour and badly damaged but without loss of life. The barque it was looking for was later washed ashore and the crew rescued by the rocket brigade. Damage was also reported from several quarters on Merseyside as windows were widely blown in and a fireman was drowned in Wyre Dock after falling in whilst trying to cross to his vessel. The strong winds were caused by a depression which moved quickly from the Azores in a NE direction bringing with it 50 mph winds throughout most of the Isles as Holyhead recorded gusts of 68 mph and Falmouth 67 mph whilst 59 and 60 mph was recorded near Liverpool and Chester. 60 mph was recorded in the South-West and in Tiree whilst rain was most abundant in Scotland with 1.38 inches falling in Tiree. Temperature remained constant at 50 - 54 degrees throughout. In Wales and Western England the Severn, Vyrnwy and Wye were in full flood and hundreds of acres

of land were inundated. A terrific thunderstorm was also noted at Barmouth and many residents were woken as "lightning being most vivid, illuminating Cardigan Bay for many miles, followed by loud thunder". The marshes of Hrllech and Dyffryn were completely inundated by the combination of great fluvial floods and the incoming storm surge which served to dam the river and flood countless acres of land. Fleetwood steamers reported terrible weather at sea and one steamer whilst sailing the Mich had her lifeboat carried a distance of 100 yards by the mountainous seas and it was remarked by the captain "It was lucky none of the crew were on deck at the time or they would have been swept overboard and lost". A steamer also went aground on Tiger's Tail outside Fleetwood harbour but escaped without damage. By the 28th the maximum gusts reached 84 mph at Holyhead and at Renfrew near Glasgow 102 mph was recorded as squalls far over the force 12 mark battered the kingdom. As Glasgow suffered heavily as chimneys were felled and buildings virtually destroyed and 11 people were killed with more injured. On the 29th it was reported "Bodies still lie under the debris of the warehouse, a further fall putting an end to rescue work" whilst over 100 were treated at hospitals for injuries received as a consequence of the gale. Telegraphic services experienced widespread disruption with a 6 hour delay in messages between England and Ireland. The Avon rose nine feet at Bradford-on-Avon and 6 at Bath causing extensive flooding as the football ground and lower road and tram lines were submerged. "Great havoc was wrought in the woodlands

1927	2 to 3	3	North-West Britain	The Guardian & The Observer	04/03/1927		of the Scottish borders" by the gales as many "forest giants which have defied the storms of many generations" were felled. It was reported the RNLI "was tested in a marked degree, for no fewer, than fourteen lifeboats were launched 'on service,' and as the result the lives of many humble breadwinners were saved and valuable fishing cobs escorted safely into harbour". During an easterly gale at Holyhead a pavilion erected for the National Eisteddfod was wrecked doing damage of £1,000.
1927	25-27	3	British Isles	The Guardian & The Observer	23/03/1927 - 29/03/1927	6	6. Moderate damage. Gale warnings were issued all-round the coast as the Guardian meteorological correspondent reported on the 23rd the approach of a "secondary" depression off South-West Ireland as the barometer fell rapidly and the gale cones were hoisted all round the western coast and sailors prepared themselves for high winds and squalls. The depression's formation was due to "convergence upon winds of a warmer and moister nature blowing from the south". Winds of 50 mph were noted in St George's Channel with gusts of greater velocity and the "squally nature of the wind making it more dangerous than usual". Thunderstorms and falls of fleet were noted throughout England and Wales and cool air covered the kingdom. Steamers arriving at Falmouth reported terrible weather and the steamer Clan Macintyre encountered the full force of the gale in the storm with some of the lifeboats being washed loose and a native African man died following injuries sustained whilst trying to save the vessel. A man was also severely injured on a vessel

1927	1 to 2	4	South-West Britian	The Guardian & The Observer	04/04/1927	<p>heading to Beunos Ayres when a huge wave knocked him down and he fractured his collar bone and gashed his head. Another man was injured when a wave knocked him over and the knife he was carrying "thrust into the lower part of his jaw, inflicting a nasty wound". A steamer was also lost off Widemouth Bay from a Norwegian vessel which foundered in the Bristol Channel. A coroner examined the five bodies washed up an dproclaimed the verdict of accidental death through drowning following a shipwreck. The fragements of the vessel were noted floating off Port Isaac near Bude.</p> <p>There was an amsuing story of a vessel which was abandoned in St. Georges Channel in a WSW gale after it was discovered she was leaking badly and the breakage of steering equipment further rendered the vessel disabled. "The waves broke clean over her and the water gained rapidly on the pumps" and the vessel had to be abandoned as the crew jumped into their lifeboats despite the mountainous seas before they were rescued by a Norwegian steamer. Their signal of distress was "the captain's underwear pants hoisted on hte boathook". The vessel caused further disruption as another liner failed to realise she had been abandoned.</p>
1927	10-Jan	5		The Guardian & The Observer	10/05/1927	<p>An article dedicated to explaining thunderstorms in a scientific sense and the fundamental atmospheric processes which occur during storms.</p>
1927	19-22	6	Irish Sea	The Guardian &	20/06/1927 - 23/06/1927	<p>The "first gale of summer" struck the South-West of Britain with 40 mph winds being measured from Plymouth to Kent whilst 35 mph was recorded at Pembroke and</p>

1927 25-27	6	Irish Sea, North Wales, Mersey	The Observer The Guardian & The Observer	<p data-bbox="1332 183 2125 702">gusts of 50-60 mph were recorded in the Irish Sea. The pressure fell rapidly at 1/2 inHg in 24 hours as the depression rapidly progressed and heavy rains were felt at Chester and Aberystwyth of 0.79 in and 0.83 in. At Renfrew 50 mph was nearly attained and 35 mph constant blew at Liverpool. The low number of hours of sunshine on the Lancashire and Cheshire coast were noted. 240 visitors to Blackpool had a very rough crossing from the Isle of Man as the south-westerly gale whipped up great seas and blinding showers of rain inundated the decks. Only one of the women aboard was not ill and it was remarked by regular users it was one of the worst trips ever.</p> <p data-bbox="1332 702 2125 1366">A gale in the Irish Sea occasioned for heroic rescue scenes off the Isl of Man where a lifeboat deployed to save the crew of steam trawler under the rocks at Ballure. The lifeboat was dragged along the sandy beach and propelled into the rough sea with one of the launchers nearly drowned. All were saved with great difficulty and the vessel was wrecked. In Merseyside the Formby lighthouse dragged anchor but remained in her regulation position before aid was rendered by a steamer. The New Brighton lifeboat "stood by the lighthouse until all possibility of danger was past". Shoals of porpoises were sighted off the Fleetwood Promenade and this presence "so close inshore at this period of the year is regarded by fishermen as a harbinger of bad weather". A few hours later a gale sprang up and winds of 45 mph was noted with gusts of 49 mph. At Llandudno the storm did considerable damage and a motor launch was blown from her moorings and</p>
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1927	14-15	8	Barrow, South-West Scotland	The Guardian & The Observer	16/08/1927	<p>several were damaged. It was noted that the proaction of many oweners at 4 am undoubatebly saved many vessels. The rivers Dee, Severn and Wye are over their banks and houses were flooded. The Colwyn Bay promenade was also damaged and the coldest and wettest June on record was said to have been experienced.</p> <p>A storm of high wind and heavy rain did much damage to property and crops across Western Britiain. Barrow experienced the heaviest rainfall in 50 years and In Appleby a landslide held up the expresses from Scotland to London which had to be diverted via Penrith. Attempts to fly the Altanic were also thwarted and hampered.</p>
1927	21-22	8	Lancashire, Irish Sea, Cornwall	The Guardian & The Observer	22/08/1927 - 24/08/1927	<p>A weekend of "storm, rain and consequent floods in England and Wales has caused consdierable damage and inconiveince". In the Clitheroe district in the Norht the Ribble burst it's banks and houses were flooded and sheep drowned. Water impeded traffic and produced several accidents without serious casualties. Two Rosslare-Fishguard steamers collided in the heavy seas and strong winds at the entrance to Fishguard Harbour. hey were birthed without casualties however. ANother collision between vessels occurred off Douglas. Sporting fixtures were widely abandoned throughout the West of Britain due to the rain. The farmers fo Lancashire and particularly Cheshire suffered greeat crop loss and it was estiamted 25% of the hay crop was worthless which was "likely to render milk production very costly during the coming winter". The fruit harvest was also substantially affected and would "not be anything like the average; indeed, plums and damsons are already decalred a</p>

1927	25-26	9	North Wales, Cumbria	The Guardian & The Observer	28/09/1927		<p>failure". In Southern Scotland thundery showers were noted for most of the duration of the storm. In Bath 0.9 inches of rain was noted whilst Tenby and Scilly were unaffected with 11.2 and 10.5 hours of sunshine respectively.</p> <p>News of a yachting party's ordeal in a storm off Anglesey when a vessel was caught in a storm and dashed against rocks as a gale sprang up "snapping our main anchor chain" and throwing the boat onto the rocks. They were fortunately driven towards a small sandy beach and the party escaped by clambering over rocks and jagged ridges over 20 feet high and leapt across a chasm over a yard wide with the raging sea below and with the help of the light of the moon. It was stated had it have been ""a dark night we should never have got ashore at all". Some of the party sustained minorinjurie but quickly found a pilots' cottage where they were cared for. The boat was later got off the rocks by the men although much damage was done to possessions and cargo aboard.</p>
1927	1 to 2	10	Liverpool Bay, Cumbria, South-West Scotland	The Guardian & The Observer	03/10/1927 - 05/10/1927	4	<p>4. Great damage and flooding. A great fale caused the death of two people in Chester as an Elm Tree fell on a man and his wife in the car and killed them. It was discovered the trunk was rotten. Seven families in Greenock was rendered homeless after unprecadneted rain caused flooding in the Clyde which penetrated homes and eroded a railway embankment. Hundreds of tons of sediment was deposited on the roads by the great torrent and 300 telephone lines were knocked down. A large tree also fell near the mainline near Carlisle and was struck by an oncoming train which was fortunately not derailed.</p>

Many passengers were greatly alarmed but no material damage was done except the breaking of windows. The rainstorm was at its worst on Loch Lomond and the Loch Lomond road was impassable whilst Alexandria and Jamestown were both flooded. The cause of the two gales and rainfall in quick succession was the movement of a deep depression between Iceland and Scandinavia with the "convergence of mild upon cooler winds, and again by cooler winds undercutting the mild ones". The "well developed" disturbance consequently produced gale force winds throughout all the British Isles. The depression moved swiftly however with the intense storm ending in 2 days. In Fleetwood gusts of 68 mph produced a storm surge tide with an overall elevation of 26 ft 3 inches rendering it a record storm surge of 3 feet 9 inches. The ferry steamer on the Wyre was suspended due to the "impossibility of the steamers getting alongside the landing stage". Only a 1/4th of the fishing trawlers returned to Fleetwood with the others all sheltering in the lee of the Isle of Man. A liner was also unable to dock at Liverpool on account of the high winds and heavy seas whilst several people received minor injuries due to falling trees and chimney stacks. At Parkgate on the Dee Estuary "for the first time in the history of the little fishing village ... the tide failed, and the fishermen waited in vain". It appeared that "a huge bank of sand was blown up by the gale on Sunday, and this had the effect of holding back the tide" which was 6 feet less than expected and thus not sufficiently high to reach Parkgate. This was to be the first event to mark the start of the receding and failing tide at

1927	21-29	10	Liverpool Bay, Cumbria, South Wales, North Wales, Lancashire, Irish Sea	The Guardian & The Observer	23/10/1927 - 05/11/1927	33	<p>Parkgate due to rapid saltmarsh accretion in the estuary. Whilst the storm played a key part on this occasion there is no doubt that the increasingly vast amount of sediment available due to accretion played the key role.</p> <p>33. Great damage. Storm surge. The Llandudno lifeboat experienced great peril in a terrific storm but managed to take 2 men and a boy off a large motorboat in distress which was ashore near the Great Orme. The 50ft long motorboat had it's dinghy smashed by large waves in Liverpool Bay but "beyond expereinceing discomfort from the roughness of the weather, matters went fairly well". However her engine was to fail and she was carried by the great sea into the pillars of the Llandudno pier and her mast and dummy funnel were destroyed. The lifeboat thankfully spotted their predicament and rowed out to take off the exhausted crew. One of the lifeboatmen was injured when fit of the head by a davit and recieved a "fairly serious scalp wound". It was remarked a motor lifeboat could have possibly saved the vessel but there was no hope in a rowed craft. A large crowd came out to watch the lifeboat land in safety and the anxious relatives of the crew were telephoned in liverpool to assure them of the safety of their beloved. The Criccieth lifeboat crew and many inhabitants ket vigil throughout yesterday due to the condition of a three masted schooner struggling in the bay and being unable to enter Portmadoc but no assistance was required. In Liverpool gusts of 30-80 mph were noted and two workmen were blown into a dock in the darknes sbut rescued. A woman was also struck by a falling sign but was able to go home and several windows</p>
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were blown in a tree hurled across tramlines in suburban districts. The Ribble also flooded adding further trouble at Preston and a "blank wall came away as though cut by a guillotine" as a house was severely damaged but no injury was done. The Ribble burst its banks and flooded the whoel of the lower part of the town with water rushing down streets like torrents and it was remarked "there is every prospect of a record for floods". On the Firth of Forth there was widespread havoc as over 20 lost their lives. In Lancashire the storm surge "tidal wave" inundated a low-lying hospital near the River Lune and three patients were droned as "the fale transformed the quiet estuary into a raging sea". Quayside boatmen went to resuce 19 patients cut off by the water and the police and locals helped to rescue several more as the water lay 4 feet deep. AT Fleetwood five drowned as caravans were overturned by the storm surge and a mother and her three children were taken to hospital suffering from gas poisoning after the floods burst a gas main. All surrounding neighbourhoods were flooded and main livestock and pet ssuccumbed whilst all electricity was cut off in Fleetwood. All business in preston was suspended and the mail train was waterlogged. AT Blackpool great damage occurred as our huge water colling towers were torn down by the gale and damage amounting to thousands of pounds was done and the neighbourhood was left without electricity. Scoreds of glass windows were broken and chimney stacks felled and the roofs of 6 companies were stripped. The marine promendade at Aberswysth was also swept by the breakers and falgging

ripped up and all ornaments destroyed. 60 yards of Rhyl Pier was washed away and only a "tangled mass of wreckage and concrete" remained. In Morecambe Bay the western and Durness shores were also greatly damaged by the surge and the Arnside promenade and pier was wrecked along with fishing boats. The new £40,000 embankment was breached and heavy losses of cattle and sheep which were grazing on the low-lying land were sustained. The embankment was also overtopped at Llandudno and the sea ran down roads "like a mill race, nearly converted the town into an island for the second time in four years". Families occupying cottages by the seashore at Criccieth were rendered homeless and there were "pitiful scenes in the darkness as little children were being hurriedly snatched from sleep and carried to the houses of neighbours close by as their homes were being rapidly washed away by the raging sea. Only the skeletons of the cottages remain standing". Much damage was noted to the promenade and coastal seating was damaged. Hundreds of slates and scores of trees and telegraph poles were felled in the region which hindered road travel. A girder bridge of the Great Western Railway was washed away and the buttress weighing three tons was flung fifty yards. The Holyhead lifeboats were all out and was damaged but managed to return. The sailing lifeboat could do nothing to render assistance to one vessel according to the second mate of the vessel as the vessel was in the breakers where waves ran mountains high. Another vessel did stand by and the second mate remarked "the captain deserves great honour for his

noble action" despite the failure of rescue attempts. The vessel however drifted onto a rocky perch and the sailors got off on low-tide. A doctor in Pwllheli was also injured by a falling tree which crushed his car near Pwllheli where winds reached up to 80 mph and the sea flooded several houses. Several motorists near Barmouth also had remarkable escapes when two great trees blocked the roads in either direction whilst roads were widely blocked. The mail train from Barouth was also stranded as the surge swept away the railway embankment and a tunnel was blocked by falling trees with passengers being compelled to clear the lines. An explosion on a vessel off Arklow lightship in the storm caused a fire which forced the crew to take to the boats in the storm. 21 of the crew made it ashore on the Caernarvonshire coast but 5 were missing and presumed burnt alive and all the remaining men were completely exhausted from their exertions. At Blackpool the sunken gardens were "now a mass of debris" deposited by the storm and the 800 yard parapet which surrounded the promenade sea wall was washed away. The Moelfre lifeboat was also majorly damaged after she was holed and nearly sunk after an "epic fight with sea and gale which lasted for nearly eighteen hours". The crew were much worn by their ordeal. The captain of the rescued vessel stated in an interview "We shipped several big seas and the bulwarks started. Soon water was pouring into the engine-room, putting the machinery out of action" before distress signals were flown. Although rescued by a German steamer the lifeboat coming to their rescue struggled to render assistance as she "made

<p>1927 6 to 7</p>	<p>11 South Wales</p> <p>The Guardian & The Observer</p>	<p>08/11/1927</p> <p>straight for use. It was an heroic thing, to do" as the vessel began to sink herself. The coxswain of the lifeboat stated that his vessel was badly damaged and sinking whilst a man from the other vessel and the lifeboat died aboard. Due to loss of the gib she had no choice but to shelter and wait for another lifeboat. One of the dead lifeboat men left and widow and son who was a master of a coasting boat. The death was attributed to a head impact when flund against one of the stanchions by a huge wave. The lifeboat coxswain had sevre eye injured which were bandaged. The village of Moelfre was very anxious and saddened by the loss. The inquest of the two dead men stated that the man from the vessel was dead when he was helped intot he lifeboat. It was statedthat Moelfre ws "of one mind that the present tpe of lieboat ought to be superseded by a motor-boat". Although splendid work had been down by the saillifeboat and hardly a year had past without lifesaving since 1852 it was stated "there would be less risk on a notoriously dangerous seaboard if there was a moro-lifeboat at Moelfre as at Beaumaris". As a result of the recent gale coal shipments from the West of Britain had been considerably delayed without a decline of 42,930 tons to 412,9000 in Wales and 19,156 to 243 tons in Scotland.</p> <p>Thunderstorms, rains and a gale caused damage which was partiucularly notable in South Wales were great flooding ensued. Over 100 telephone lines were disconnected in Port Talbot and "extremely vivid" lightning was noted. A heavy snowstorm followed and the electrcity generator was put out of action. Farmers also</p>
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1927	20-21	11	Mersey	The Guardian & The Observer	21/11/1927	<p>moved their flocks to valley pastures in anticipation of the severe weather.</p> <p>A gale and heavy rain were felt on the West coast with 1.81 inches of rain falling at Plymouth and 1.42 inches at Bath. Such weather was a result of "rather unusual situation of depressions forming over Spain and travelling roughly northwards towards Cornwall instead of eastwards to the Mediterranean". This was the result of an intense anticyclone over Norway as well as a complex low over Greenland. AS such rain moving north-westwards were produced in the British Isles. It was also reported "An exciting adventure befell two Wallasey youths who set off from New Brighton stage today in a small boat". Their failure to return reslted in the local lifeboat being summoned but before they could deploy one of the boys turned up to inform them they had beached the boat norht of the New Brighton Pier and waded ashore.</p>
1927	8 to 9	12	Hebredies	The Guardian & The Observer	10/12/1927 - 14/12/1927	<p>"A thrilling story of the sea was told by the crew of the Fleetwood fishing steamer" who encountered a great storm off the Isle of Lewis and were struck by a mountainous sea which caused themto almost founder but for the crews' constant efforts for 60 hours. Great efforts of the crew guided the vessel into Stornoway Harbour where repairs were made. One of the crew stated "A huge wave 70 feet high struck the vessel, displacing the coal, samping the dish room, and carruing away the wheel-house rood, compass, and one of the engine room ventilators". The vessel listed and was on the verge of foundering with no other vessels in sight.</p>

1927 26 to 31

12

Celtic Sea,
South-West
England, Bristol
Channel

The
Guardian &
The
Observer

27/12/1927 -
02/01/1928

However the wind fortunately abated and the vessel limped into port running with the wind for 35 miles. Liners in the Celtic Sea also experienced the fury of the storm and a huge wave struck one ship and passengers "were scattered in all directions, one being forced through a glass partition" and several had minor cut injuries. Another trawler went aground in the Mull of Galloway with the captain being woken by a grinding noise of the vessel coming into contact with the shore. He noted something white appeared out of thick fog and "some of the crew got a little scared, for it looked like an apparition" however it was soon found to be a farmhouse. The whistle was blown in distress and the coastguard appeared with the life-saving rocket although seven attempts were needed to reach the steamer. However all men were eventually rescued using the breeches buoy. Despite the captain's questioning of the state of the shoreline (rocky or beach) the coastguard replied "South-east gale working up. Coastguard says safest ashore". Therefore all were evacuated to safety and the drenched crew cared for by the Shipwrecked Mariners' Society. All efforts to refloat the steamer had proved unavailing and another attempt was to be made on the next large tide in a fortnight. A tremendous storm swept Britain and its coast causing considerable destruction on land. Many liners were delayed leaving from Plymouth due to the mountainous seas. In Devon drifts of snow of 10-12 ft in height closed many roads and made travel very difficult. The storm caused many communication disruptions for the post

1928 6 to 10

1

Mersey

The
Guardian &

07/01/1928 -
11/01/1928

office throughout the kingdom. In the River Weaver catchment in Cheshire the flooding areas froze proving excellent skating rinks. Fear was also noted amongst the navy and shipping as a floating mine was known to be floating off Start Point but the weather and heavy seas had prevented its destruction. A ship's captain was found dead in a hospital in Swansea after shooting himself during the great gale in the hospital. He had previously broken his legs and drunk a lotion and a verdict of "suicide while of unsound mind by shooting with a revolver" was found. It was noted many aeriels had come down during the storm and ice on insulators had also caused trouble for some listeners. With the exception of a slight interuption when snow had to be cleared from a transmitting staion the national broadcasts went succesfully. In Wales the storm, in general terms, was said to be as severe as any in the last 20 years. The Observer also offered a prize of 3 guineas for the best personal experience story of the snow storm in not more than 200 words. The Guardian meterological correspondent stated that the arriving mild air from the south-west over Cornwall made very little progress due to the heavy cold dense air lying over the kingdom which brought about the prolonged snowy period as the wet mild low pressure added moisture to the cold atmosphere as the winds also rose. Heavy rain and the thaw of snow at the tail of the storm produced considerable flooding in the south of England.

A depression passed over the British Isles producing "a trail of wreckage" but "no grave accidents". There was

				The Observer					
1928	23-25	1	North Wales, Mersey, Lancashire, South-West Scotland	The Guardian & The Observer	25/01/1928 - 26/01/1928				serious flooding all over Wales including in the valleys of the Dovey and Severn with many villages left isolated. The Mersey was also in a turbulent state and winds reached up to 78 mph. Ships came into the river for shelter and "ferryboats became a perilous adventure" as they were tossed about in an alarming fashion. A steamer lurched heavily and ripped up planks from the landing stage and two vans were blown over. A £2000 roof of a garrage in Crosby was wrecked and a steamer was unable to berth. The cyclone rapidly changed and the depression was "intense" with "the steepness of the gradient being well shown by the rapidity with which the barometer fell and then rose again". Heavy rain preceded the gale which was most severe in Lancashire in Morecambe and Southport where 8-10 inches. 74 mph gusts were recorded at Eskdalemuir in Dumfriesshire. The rain and sleet also prevented one launch of a large vessels at Greenock. Torrential rains and gale force winds battered the West coast and obtained a near hurricane velocity at Holyhead. The river Mersey was in full flow and large areas were flooded in Cheshire and Lancashire with farmers being the principal sufferers. A steamer's crew had a trying ordeal off Anglesey and were forced to abandon their sinking ship which ran ashore and they had a 12 hour struggle in their lifeboat. Fortunately they reached land later and were cared for at the Sailors' Home at Holyhead. The captain remarked "we were very nearly swamped several times... we suffered intensely from the cold". They lost all their belongings including valuable oil paintings. The conditions were produced by an intense low which

1928	1 to 2	2	Cumbria, Cornwall, South-west Scotland, Irish Sea	The Guardian & The Observer	03/02/1928	<p>produced gusts of 75 mph from the Scillies to Tiree. It was remarked the weather of the 1st month of 1928 was "proving worse than most of its twelve predecessors of 1927".</p> <p>In the Solway Firth a vessel lost it's rudder in great seas and was rescued by a another vessel after 24 hours adrift. The crew suffered dreadfully but still reported to dock for the arrival of towing gear immediately after their ordeal. The meteorological correspondentstated the distrubance of wind, rain and snow across all areas was a result of two depressions in quick sucesion which passed over the British Isles. The wind rose rapidly to gale force over the England and Wales and gusts over 50 mph were reported at the more exposed stations. Rain fell in all districts and half an inch fell on the Conrish Peninsula although hail and colder conditions were noted over Southern Scotland and Northern Ireland.</p>
1928	11 to 13	2	Celtic Sea, Irish Sea, South-West engalnd, North Wales, Mersey, Lancashire	The Guardian & The Observer	11/02/1928 - 16/02/1928	<p>A great tempest sprang up producing winds of 104 mph at Liverpool which was a "record since reliable observations began" and there were widespreads reports of destructions. The windspeed ranked amongst the highest from any station with only 5 recordings which were highest whilst 81 mph was also noted at Sealand and hurricane force gusts were noted in the Scillies and Falmouth. The winds delayed the return of the Colonial Secretary who couldn't land at Liverpool whilst shipping efficiency was badly affected. The North of England experienced the worst of the gale and most of the area was completely inundated. Off the Cornish coast there was much anxiety for travellers off the coast as the</p>

coastguard noted a steamer in distress and the lifeboat and the rocket brigade were summoned. The lifeboat "Arab" ploughed through heavy seas which constantly broke aboard" and "a huge breaker caused her to stand almost upright on her rudder" however the lifeboat reached the distressed vessel and took off all 18. There was thought to be the prospect that ship and cargo may be salvaged. A vessel was also saved by the Holyhead lifeboat with a sailor relaying the distress signal by morse code from the top of the mast. All were thankfully rescued although many crew were injured when leaping from boat to boat. The skill of the lifeboat coxswain was mentioned. Much damage was done in North Wales with a motorist having a "providential escape" when a boulder loosened by rain fell down the mountainside and destroyed his car but he was unhurt. Two hundred people in a whist drive near Pwllheli had an alarming experience when the windows were blown in and lights extinguished. A house in Abersoch was struck by lightning and the chimney wrecked. Many windows were broken at Pwllheli and for a time Pwllheli and Criccieth were without electric light. Several all remarkable escapes occurred when trees were blown down on cars and several farms were unroofed. There was heavy flooding the Vale of Clwyd where several roads were impassable. Motor buses from Rhyl to St Asaph were diverted. Two Fleetwood fishing steamers returned to port damaged by the gale off the Hebrides and a hand was saved when the mate "climbed down the fishing net into the sea and at considerable risk dragged" the hapless man back aboard. A navigation buoy broke

1928	28	3	The Guardian & The Observer	29/03/1928	<p>from its moorings off Allonby and went aground up the Solway Firth. The Cunard liners were delayed crossing the Atlantic and in the Celtic Sea by the hurricane force winds and large seas which damaged one vessel and another stood by as cover. A fund was started for the village of Talsarn which was devastated by the flooding as farmers lost scores of livestock and much property was damaged when a storm surge tidal wave swept inland.</p> <p>The Prince of Wales spoke at the annual meeting of the RNLI and offered a highly amusing speech of praise. Medals were given to those who had shown extreme gallantry. The prince stated it was "his duty to give it publicity". It was noted that "the work of the lifeboat crews was carried on mostly in the darkness of a winter's night at some remote spot on the coast... it required great imagination to realise what the lifeboat service meant". The national character and international scope of the service was mentioned. 18 new boats were commissioned to transform the "fleet of pulling-and-sailing lifeboats into one of motor-boats". The "wisdom of the change is obvious. Except in the case of the Moelfre lifeboat nearly all the most successful rescues were recognised today have been carried out by motor-lifeboats". A plea for donations was made and the ability for generous people to buy boats and name them accordingly was stressed. The prince suggested that one or two of the shipping lines could make a donation. The progress of the "Ladies' Lifeboat Guild" established in 1921 was also noted and the Prince noted "that the secret of success lies in enlisting the interest and help of our</p>
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1928	29	3	Lancashire, Cumbria, South-West Scotland, Cheshire	The Guardian & The Observer	30/03/1928	<p>women". Their self-sacrifice and generosity was particularly commended. The men appealed for the support of the whole nation to support the righteous work of the institution. A message from the King was read in which he stated "I rejoice to hear that its high traditions have been maintained during the past ear. Those to whom you will make awards today I would convey my congratulation on their devoted service".</p> <p>Heavy rain and strong winds reaching gale force were felt throughout the western coasts. At Morecambe and Southport 0.83 in and 0.59 in of rain were recorded whilst in Southern Scotland heavy sleet was widespread. At Chester the wind was the strongest reaching 48 mph. The weather however was "much less severe than might have been expected, for the bad weather was due to a depression whose depth easily exceeded that of any other 'low'" of the year as the pressure reached 28.5 inHg around Glasgow. It was noted that the reduced fury was due to the fact the depression was "dying" was because most of its energy had been expended over the Atlantic Ocean.</p>
1928	17-18	5	Lancashire	The Guardian & The Observer	19/05/1928 - 20/05/1928	<p>Repeated strong gales on the North-West Coast at Blackpool caused the windows of a furriers shop to be blown out. He noted his shop had never been successful as storms "repeatedly blew in plate glass windows". On one occasion £1000 of furs had been blown out of the shop and into the sea. His business was to eventually go bankrupt with the storms attributed as the key reason of failure.</p>

1928	18-19	5	Lancashire	The Guardian & The Observer	19/05/1928 - 20/05/1928	Storms of rain and hail were widespread throughout the kingdom with flashes of lightning and a "heavy cannonade of thunder" widely felt across South-West England, Wales and the North-West.
1928	8 to 9	6	Irish Sea, North Wales	The Guardian & The Observer	10/06/1928 - 11/06/1928	Boisterous weather delayed the landing of Sir Alan and Lady Cobham from landing in a flying boat in the Mersey. On their journey across the Irish Sea they encountered a wind of 50-60 mph and had to change route. At Llanduno there was considerable misplaced anxiety for a vessel in need of assistance in the heavy sea and freshening south-westerly winds. The lifeboat was launched on the sighting of distress signals from the coastguard with considerable difficulty owing to the wind direction and tide although no vessel in danger was spotted so the crew were forced to return. After landing it was found the yacht had safely come ashore off Hoylake and the yachtsmen were unaware of the search that had been undertaken for them. The two men "had an adventurous night, but told me they had no idea that their safety had been questioned". Both men "were emphatic that they saw no flares" and had not considered themselves in danger despite damaging a storm sail and losing their dinghy. The father of one of the men told the correspondence "experienced yachtsmen had endeavoured to dissuade the two young men from setting out". Three men also had an "alarming experience" off Bardsey Island when their vessel was leaking badly and their vessel was wrecked on the rocks but all escaped safely. A lifeboat later towed their damaged vessel to harbour.

1928	25-26	6	North Wales, Cheshire, Irish Sea	The Guardian & The Observer	27/06/1928	A "second summer gale" came to the British Isles causing considerable damage to fruit and other crops throughout as "heavy showers of a thundery nature" deluged the land. Windspeeds of 50 mph were noted in Cheshire as the anticyclone passed over the land. Th heavy seas produced by the bad weather held up the King's yacht Britannia at Holyhead harbour and the crew were "very much concerned" whether she would be able to reach the Cylde in tiem for a racing series.
1928	27-29	8	Devon, Blackpool, North Wales, Irish Sea, Torbay	The Guardian & The Observer	28/08/1928 - 30/08/1928	Storm and flood havoc hit the UK with several towns in Wales being inundated by uncontrollable raging torrents. At Newport "the main streets resembled miniature rivers while the storm was at its height". The first day of the Torbay Royal Regatta was "adversely affected by a strong wind" which at times reached gale force which caused all but two boats to retire and "these two ploughed through heavy seas". In Blackpool a "waterspout wonder" occurred which entertained many thousands of holiday-makers. A great cloud drove up from the seas "drenching the town with rain" and the rain "seemed to descend from the clouds like the huge trunk of an elephant until it reached the surface of the sea, which it churned into white foam". As the cloud drew closer to the land the waterspout ceased and the atmosphere became very clear. At Morecambe lightning struck a house in which an old pensioner was lying ill. Despite falling debris all around him produced by the lightning impact he was only suffering shock but this made his condition critical. One of the residents nearby remarked "I lived three years in Ypres during the war and I have been in terrific

1928	10 to 14	10	Irish Sea, Lancashire, South-West England, South Wales	The Guardian & The Observer	12/10/1928 - 15/10/1928		<p>bombardments, but I never experienced anything like the awful crash". He stated it "completely unnerved me, though I have laughed and joked while being bombarded in France". Several parties of motorists were held up by a thunderstorm near Towyn as streams quickly swelled with the torrential rain and many roads became impassable. Many houses at Barmouth were flooded and debris floated in the streets. Witnesses stated "that it suddenly became completely dark and there was vivid lightning". A succession of disturbances from the Atlantic produced severe storms in the Celtic Sea and heavy rain was felt across Northern England. The severe squalls produced havoc at sea and the crew of a Fleetwood sailing trawler were rescued by a steam trawler. In an interview with the skipper he stated he was caught in a gale off thte Selker lightship and the sails had been blown away and the vessel left to drift helplessly. He stated "I cannot tell you how relieved I was" when the rescuer appeared. The rapid changes of the weather brought a quick decrease in temperature throughout the UK apart from in Cornwall and Devon. The heaviest rainfall occurred in South-West England and Wales.</p>
1928	18-21	10	Irish Sea, North Wales, South Wales, Clyde, Lancashire	The Guardian & The Observer	19/10/1928 - 22/10/1928	1	<p>1. Serious damage. The stormiest weather experienced in the Autumn of 1928 broguth gales from the south-west, torrential rainfall and local thunderstorms. A "powerful dsiturbance" associated with a depression moved in from the Atlanic at a rapid rate with barometers dropping rapidly across Northern Scotland. Severe gusts of 60 mph in the Scillies and 50 mph at Pembroke and Eskdalemuir were noted. An average speed of 50 mph was noted at</p>

Holyhead which was the fiercest gust at that station since anemometer installation in 1912. In certain places in Western Scotland gusts of >70 mph were noted whilst a 91 mph gust was noted at Holyhead. Considerable damage was noted in South Wales with torrential rain causing flooding at Tretafod and in the Rhondda Valley where a number of houses were inundated. Serious damage was done to property in Gasgow and the district which were inundated by torrential rains. The River Clyde was much swollen by floods and "shipping was suspended and several liners were unable to leave". A vessel was wrecked on the Isle of Coll but the crew were saved. Throughout the Birtish Isles over 105 trunk telephones were disconnected. The greatest fury of the storm was felt in the Irish Sea and the Belfast-Heysham vessel experienced the full fury of the storm which caused much alarm to the 300 passengers and carried the vessel against a stone pier with such force considerable damage was done and the vessel rendered unusuable. A "tremendous sea" dislodged hatches of a cargo hold and considerable goods were saturated and the vessel was 1 1/2 hour late. A shipwrecked crew endured a "Night of terror" when it went ashore off Pan Bay and one man was swept off the vessel to his death. The vessel struck a reef and lurched agains the rocks and the men had to jump a large gulf to reach the rocks. The deceased had been swept away by a huge wave on making the jump. All the men clung on for dear life and although the siren of the rawler was sounded to attract assistance only farm servants who were unable to see the ship and approach the shore due to the huge

1928	26-31	10	North Wales, South Wales, Hebrides, Cornwall, Irish Sea	The Guardian & The Observer	27/10/1928 - 01/11/1928	<p>waves were on hand. At daylight the men left alive scrambled the cliggs in an exhausted condition and wandered the moors until they saw a farm where they were given food and warmth before being taken to Stranraer. In Port Talbot a man and horse were killed by a lightning strike. The man had his hair "singed, his neck and chest burned and his clothing torn off" whilst the horse was also badly burnt.</p> <p>Serious damage. Gales and floods caused extensive damage in South Wales and across the south coast of England. The Rhondda River rose 3-4 feet and overflowed its banks. Near Pontypridd the storm centre, streets and houses were flooded to a depth of 5 feet. Trams and cars were held up and flooded by the overflowing rivers and travel was much hampered with ambulances prevented from conveying the sick to hospital. In North Wales the Conway River and tributories flooded causing disruption for motorists. Heavy rain throughout as the cyclonic disturbance moved eastwards over the North Sea. Heavy rains were recorded in the Wye Valley although Lancashire to a large part escaped the heavy rain. Cunard liners struggled immensely in the Celtic Sea and Atlantic as the gales whipped up mountainous seas. Several vessels arrived at Plymouth with damage and having been driven off their course. A crew also battle the 70 mph wind in "imminent peril of being cast on to the dangerous Longships Reef off Land's End". The vessel "rolled from side to side in an alarming fashion" which shifted her cargo making the boat list heavily. The vessel was "absolutel at the mercy of the sea. The waves were</p>
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1928	16-18	11	South Wales, Cornwall, North Wales, Irish Sea, Lancashire	The Guardian & The Observer	17/11/1928 - 20/11/1928	10	<p>breaking over the deck in great mountains of water". The vessel was fortunately saved by some of the crew who crawled forward and hoisted the forestay and the vessel crept away from the "white flurry of foam that marked the rocks". Six men were also rescued from a previously marooned wreck by the Coverack lifeboat in Cornwall. A strong NE caught the men who were disassembling the wreck, offguard and displayed distress signals which prompted the quick launching of the lifeboat to rescue to men. The storm saw the end of a "particularlry blustery month" as the roaring gale whipped up the Irish Sea into the caulderon. The "coming at the time of the full moon... caused abnormally high tides along the north coast of Wales and in the Mersey" whilst very rough Irish Sea crossing were endured. Holyhead recieved winds and gusts of 51 and 49 mph whilst a mean speed of 50 mph was recorded in the Hebrides as a second depression swept over from west of Scotland to the Midlands in 24 hours. Southport recorded 1/2 inch of rain whilst 9.6 inches and 11.7 inches fell at Blackpool and Eskdalemuir across the month.</p> <p>10. Serious damage. Lifeboat gallantry. A great tempest brought destruction to widespread areas across the United Kingdom with the South of Wales and South-West England sevrelly affected. In Devonshire a man was killed when a tree was uprooted and fell on his car. Fifty houses in the course of erection at Newport were destroyed and 280 trunk telegraph lines were blown downn influencing most of Britain. Great Western railway stated "The gale is so powerful that even the giant locomotives find it</p>
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difficult to make their way. Connection between signalboxes is slow because so many telegraph wires are down". Six lifeboats were deployed and shipwrecked crew were saved. The meteorological correspondent noted the "chart had so completely and unexpectedly altered that the barometer in South-West Ireland was tumbling down at an unusual rate, and the centre of an extremely intense depression was located just to the westward of Valentia". Hence there was only just time for the Meteorological Office to hoist the warning cones all round the coast before the storm hit. Terrific gusts were recorded on the anemometers at the official stations with gusts of 60 mph being noted at Holyhead and across South England and Wales. Heavy rain visited most districts with snow falling in Scotland as the depression crossed the Atlantic. In South Caernarvonshire hundreds of acres were flooded and the water entered houses in Pwllheli and Abersoch flooding them to a depth of 2 feet. Floods again occurred in the Conway Valley inundated all the low-lying agricultural land. A Liverpool crew suffered great peril in Wigton Bay when their vessel was swept "from stem to stern" and their funnel was carried away as they lay at the mercy of the elements and were almost blinded by smoke from the funnel but all survived. A chooner was wrecked on Dulas Island off the north coast of Anglesey and five perished with only one surviving. The schooner tried to return to Moelfre but was overwhelmed by the full fury of the gale and one youth aged 17 with a dog was found left alive and in "a very weak state through lack of food and exposure, and his feet were badly cut". A doctor on the

1928	23-27	11	North Wales, Mersey, Lancashire, Irish Sea, Cornwall	The Guardian & The Observer	24/11/1928	-	28/11/1928	3	<p>pilot boat tendered to him as he collapsed and he was to be brought ashore and taken to hospital. The vessel was a complete wreck. A steamer was also escorted into Milford Haven with her steering gear much damaged by the sea and with one washed overboard and three injured who were promptly treated by a doctor. The vessel had been inundated near-completely and much damaged. One vessel was also towed into Falmouth badly damaged and was saved by a German tug off Land's End until the hawser broke and the vessels lost contact before refinding her and towing her into Falmouth with three lifeboats smashed and a sailor with a broken leg. A telegram was received at Portmadoc that another man had been washed overboard and drowned off the Lizard and left a wife and 8 children. Five quarrymen from a South Caernarvonshire quarry had an exciting experience as their steamer was almost wrecked after an 8 hour fight to Holyhead harbour. Much anxiety prevailed among their relatives who were relieved on their return.</p> <p>3. Serious damage. Lifeboat gallantry. Gales from the south-west of exceptional strength covered all of the British Isles with 60 mph being noted in Holyhead and Liverpool. In North Wales there was a considerable spectacle as the rivers of the region were in full flow. A considerable storm surge at Llandudno occurred as the high tide was propelled above the sea defence by the strong winds and the grass plots and roadway was inundated. Houses were inundated from their basements up to a depth of 12 ft and occupants were compelled to move furniture upstairs. At Towyn the gasworks were</p>
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marooned and the manager had to commute via boat. Thousands of acres of land were flooded in the Dee valley and many livestock were lost. Portions of Portmadoc Baptistst Chpel were blown in and the main roads approaching Pwllheli were flooded with traffic interrupted until the tide receded over the five mile area. Trees were blown down across the Corwen electrical supply cables and a powercut was noted. At Preston the wind reached a velocity of 80 mph and the Ribble overflowed at high tide causing temporary suspension of the tramway services and "flooding the cellars of the houses in vicinity to a depth of some feet". Tributaries of the Clyde also overflowed and large areas of land were inundated. Several Dumbarton streets were inundated and a large portion of port Glasgow were underwater. By Carlisle a large tree felled by the wind covered the main lines and the Royal Scot express was delayed for 40 mins by strong headwinds whilst going uphill. 23 men were saved and 1 life lost in the Mersey yesterday when the New Brighton lifeboat deployed in gale conditions to rescue those aboard a foundering vessel. It was stated a SOS was recieved at Seaforth and the New Brighton lifeboat was dispatched within 30 mins. This vessel was "the most powerful lifeboat in the world" and crewed by 7 men and covered 15 miles in 3 hours in "terrible seas". They found the vessel helplessly drifting and they had trouble communicating with the crew being French. It was stated "At last they realised that they must 'jump for it'." Some climbed down others leapt for a net whilst the captain left with tears in his eyes. A great wave struck the

lifeboat which itself was damaged and three were thrown into the sea and one drowned as the 18 stone man "slipped through lifebuoy, and was never seen again". The captain paid tribute to the bravery of the lifeboat's crew who were given a heroes welcome. At Liverpool gusts of 93 mph were noted whilst at Scilly 83 mph was noted with shipping and telegraph services suspended. At Holyhead and Chester maximum gusts of 81 mph and 88 mph. Several large liners attempted to proceed down the Mersey but were all compelled to return. In Dumfries a large part of the grand stand was blown down and carried 150 yards whilst 8 mainroads were blocked in the area by fallen trees. On the Galloway line engines were blown to a standstill. At Soutport the stand of a football club and the roofs of several garages were blown down while the sea lashed into the marine lake with two waggons being washed into it. A church window was also blown in in the town. In the Wyre Dock at Fleetwood the storm surely lashed the quayside and three men had a narrow escape from the dock as their vessel almost sank. There was also news of a missing vessel which was overdue in Norway. Liners in the Celtic Sea encountered wind speeds of 100 mph as they fought the elements and numerous SOS messages were also received. The gale cones remained up for the duration of this prolonged storm. A skipper of a Cardiff trawler was washed overboard by a huge wave and subsequently drowned whilst a Manx boat came into port with two sailors with severe injuries. Another life was lost in the Irish Sea when a deck hand was washed off the vessel by a huge wave when on its way home from the

West Scottish fishing ground. An inquest revealed "the force of the wave striking the ship caused the vessel to lurch" and the captain had been carried overboard. Although the body was recovered in 7 mins and "artificial respiration" was tried for 3 hours all attempts were unsuccessful. Thus "the verdict was accidental death". A crew of a German ship landed at Plymouth having had their 3 masts carried away in the Celtic Sea and her boats smashed before they were hauled through the sea by the rescuing tug. In Colwyn Bya the storm surge damaged the sea wall at Penrhyn and the tide "poured through the smashed fences and over the tram-track" inundation the golf links and forming a waterfall from road to green. Tram and road travel was suspended and a temporary gangway erected for those wishing to make a considerable detour on foot. A local architect remarked "At any time there may be a combination of circumstances which would lead to flooding of the whole of this valley" as the land lay 5-6 feet below the mark of the highest tides. He exclaimed that "it is a perilous position, and there would be grave danger if a gale from the north-east coincided with a high tide". Much debris was left on the inundated area but little or no damage was done. The surge conditions also produced a remarkably low ebb and a local fisherman on the River Conway remarked "in thirty years' experience of the coast he had never known the ebb to recede so slightly during so long a period". A man near Abersoch was hurled from his cycle by a gust and was picked up unconscious and suffering from serious head injuries. A considerable

1929	12 to 13	5	Cornwall, Celtic Sea	The Guardian & The Observer	14/05/1929	<p>quantity of wreckage was washed up between Barmouth and Harlech whilst a plumber in Barmouth recieved injuries when he was thrown from a ladder and fractured his leg and recieved several other minor injuries.</p> <p>A woman in an open boat drifted into Porthsactho, Cornwall having been adrift for 11 hours having come apart from her father's motor boat. Her brother in another tender also was many hours adrift. The vessel had experienced engine failure in a heavy sea and the hawsers had snapped. The woman had bailed all night and done her best to keep the boat into wind with only one oar and the boat held an even keel. The Fowey lifeboat was put to sea but encountered nothing. The woman "made light of the whole affair ... although there were times when what with the water coming in and the storm had several narrow escapes".</p>
1929	03-Jan	9	North Wales, South Wales	The Guardian & The Observer	04/09/1929	<p>Thunderstorms broke out over the British Isles which were particularly notable in Chester and South Wales. The storm was produced by a warm air belt mixing with cooler air from a depression off Western Ireland. In Pembroke 0.98 inches of rain fell and in Tenby and Aberystwyth 0.35 inches fell. At Little Haven in St. Bride's Bay a hole 12 ft long was ripped in the roof of a school by a lightning stroke. An eye-witness saw what "appeared to be a ball of fire flash across the sky. This was accompanied by a crash of thunder that shook the buildings and stampeded a herd of cattle in a neighbouring field". The schoolroom floor was covered with debris but no one was present to be injured. A severe hailstorm and torrential downpour of rain fell. In South Wales vivid flashes of lightning and</p>

1929 20-22	9 Irish Sea, Mersey, Western Scotland	The Guardian & The Observer	<p>21/09/1929</p> <p>-</p> <p>25/09/1929</p> <p>1 sharp peals of thunder were noted throughout and at Abercarn a water main burst and a chimney was hit and the fireplace was partially blown out.</p> <p>1. Moderate Damage. Autumn gales spread across all parts of England and Wales and were particularly notable in the Irish Sea with the wind rising to gale force at Holyhead, Liverpool and Chester were 57 mph, 69 mph and 56 mph were noted. Showers were notable throughout Northern England and in many places in Scotland. Four workmen engaged in building a new tower of Liverpool Cathedral had narrow escapes when "three massive timber and iron piers collapsed in the strong gale and toppled over". In the Irish Sea a mn was washed from a steamer and drowned during the last Livepool to Isle of Man ferry to be made that year. She was passing the Mersey Bar and encountered a huge sea and the men on the foredeck encountered huge waves with Cain unable to save himself. "Cain's wife was waiting on Douglas Pier, with her child, for her husband to arrive, and when she heard the news she collapsed". At Rhyl rough weather and a storm surge was also noted which inundated the seaside parade. Many visitors watched the spectacle from the shelters and parade houses and no major was done. At Barmouth a sea wall collaspsed with 100 yards being eroded away whilst other portions of the 20ft high structure were undermined. Colwyn Bay promenade was also awash with spray 20-30 ft high dashing over the electric standards and onto the promenade making it impassable. At Liverpool liners were delayed with 1000s of passengers in waiting as ferry steamers were tossed</p>
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1929 5 to 6

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South Wales,
Celtic Sea

The
Guardian &
The
Observer

07/10/1929

like small boats on the rough river. An "exciting incident occurred" when a woman with a 10 month old baby was blown into the dock. Seven men all divided into the dock to rescue the woman and infant. "A fireman, who dived from the deck of a liner berthed in the dock, succeeded in taking the baby" and then several other men succeeded in rescuing the woman. In the Clyde a severe gale held up liners and ferrys with many unable to make their journey across the Clyde. Several small rowing boats and a small yacht were washed ashore at Largs and at Fraserburgh the steamers and trawlers were held up. In the Dee estuary at West Kirby the "full force of the gale" was felt and several small yachts belonging to members of the local sailing club "either foundered or were washed from their moorings". The Guardian meterological correspondent noted that fales were widespread throughout the North of England and in Scotland throughout the end of the storm with the maximum velocity being 69 mph in Liverpool as winds remained squall throughout before pressure quickly rose and the skies cleared as the winds faded as the South endured a drought.

A gale rage over the west and south of the British Isles. In Aberavon the River Avon burst its banks and flooded a long row of cottages making 25 people homeless as they had to evacuate in the middle of the night in heavy rain. The torrents swept through the streets cutting deep ravines. The south coast also suffered with 77 mph being recorded at Falmouth. In Cardiff the lower parts of the city and streets were flooded as 4-f feet of flood ater held up traffic. The situation was much the same in Newport

1929	24-25	10	North Wales, Lancashire, South-West England, Cumbria, North Wales, Irish Sea	The Guardian & The Observer	25/10/1929	<p>where trees and telegraph-poles were blown down. A liner was also encountered heavy seas in the Atlantic which was so severe the vessel could not land passengers at Moville with the vessel forced to head straight to Glasgow.</p> <p>Britain was once again storm-swept with high winds, torrential rain and flooding widely reported. In North Wales there was serious flooding in the Conway Valley and many "miles of farmland were covered with swirling waters, and hundreds of acres, including footabll grounds and bowling green". Heavy rain fell over Lancashire and trains on the Scottish line between Morecambe and Lancashire were delayed by the overflow of the River Wenning whilst the Heysham boat train passed the area which caused the bank to give way as tons of ballast were removed and a gap left under the tracks. Trains had to be divertted via Carnforth whilst a gang of fifty repaired the cavity. The River Wyre also overflowed and flooded the low-lying land and roads. At Fleetwood a cloudburst showered the town and surrounding areas causing flooding so serious that the drains were incapable of aborsbing the water and many houses were flooded with families having to transfer their fruniture upstairs. A woman stated "We could not sleep for the terrible downpour and the thunder. Glancing out of our windows we thought the great flood of 1927 had come again". Water poured into the houses and reached a depth of 6-8 inches as 2.3 inches of rain fell with 0.8 inches falling in just 45 mins. In Morecambe 1.69 inches fell whilst Southport recieved 1.10 inches, Blackpool 1.54 inches,</p>
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1929	4 to 5	11	North Wales, Irish Sea, Mersey	The Guardian & The Observer	07/11/1929	<p>Scilly Isles 1.26 inches, Holyhead 1.92 inches and Ilfracombe 0.95 inches. The weather in the North was caused "directly by a deep depression travelling eastwards to the north of Scotland" whilst another system which "formed to the west of Ireland and followed an eastward track during the day across Ireland" was responsible for the stormy weather in the South.</p> <p>Moderate damage. A liner arrived in Liverpool with four men from a Mersey dredger aboard which had broken adrift from tugs in an Irish Sea gale and was left helpless. Having attempted to seek shelter and head for Fishguard the hawser parted and three rockets were sent up and the men were left drifting for hours until rescued by a vessel. After much difficult manoeuvring in the heavy seas they eventually were picked up from their lifeboats from a position of greater peril and the crew "expected every minute that she would capsize". Men of the Abersoch lifeboat put up to assist and eventually the tug came back to retrieve the men.</p>
1929	11 to 17	11	Cornwall, Celtic Sea, South Wales, Liverpool Bay, North Wales, South-West Scotland	The Guardian & The Observer	12/11/1929 - 18/11/1929	<p>Great damage. A gale of great severity swept over the whole country and heavy rainstorms caused widespread floods particularly in Wales and Cumbria. At Sealand the wind speed reached 69 mph whilst the Scillies and Eskdalemuir experienced 65 mph and 60 mph. In Cheshire the crops were submerged and badly damaged due to surging floods over large areas. Two Minehead fisherman were blown across the Bristol Channel with two men "entirely at the mercy of the gale" and were feared lost. However they eventually landed at Barry despite their frail craft. Snow, sleet and hail fell throughout North</p>

Wales and the Dee, Severn and Wye were all in full flood with lowlands swamped and dwelling-houses underwater and a ship's boat was ominously washed ashore at Barmouth. The gale in Cardigan Bay caused havoc at a Pwllheli fairground which was badly damaged and windows were blown in of a school whilst a shelter was badly damaged. At Llnarwst promenade a park and recreational facilities were all submerged and Caernarvon roads were widely inundated along with low-lying houses as the rainstorm incessantly poured for 12 hours. In the Irish Sea the wind frequently exceeded 60 mph at it rose to a storm force of 70 mph at Pembroke. These conditions were produced by "a very intense and very fast moving depression" from the mid Atlantic which travelled 1200 miles in 18 hours passing near NW Scotland formed by a convergence of two air currents from sub-tropical and polar regions. Near Dinas a serious landslide owing to the rain caused the suspension of traffic on the Dinas street of the Great Western Railway as tons of material was pushed onto the railway track and the rushing water made it very difficult for the workers to clear. Flares were also seen near Hoylake and the New Brighton lifeboat was launched but after several hours of searching no vessel in distress could be found. In the Rhondda valley 8 inches of rain fell in 24 hours which caused a landslide at Pontygwaith which threatened to overwhelm houses and residents had to evacuate. A steamer for Patras from Swansea put into Falmouth with the loss of 2 lifeboats whilst a motor-ketch had her mainmast carried away off St. Govan during a

1929	23 to 2	11	South Wales, Liverpool Bay, Conrish Peninsula, Lancashire, North Wales, Irish Sea	The Guardian & The Observer	25/11/1929 - 03/12/1929	7	<p>strong SSE gale and had to be assisted into Milford Haven having sustained great damage.</p> <p>7. Serious damage. Lifeboat gallantry. "The Canadian Pacific liner Duchess of Richmond did not come alongside the Liverpool Landing-stage" owing to strong winds and heavy seas which stopped the liner landing and 20,000 passengers were held with one or two sustaining considerable injuries. Heavy showers were noted throughout and especially prevalent at Falmouth and Torquay although 0.71 in fell at Holyhead. This was produced by low-pressure off the west coast of Ireland as the cold air swept round and gave rise to rough weather. A steamer was forced ashore near Milford with 7 onboard drowned although news was patchy due to the disconnection of all telephone lines in the area. A later search recovered 2 bodies and the jury returned the verdict of "death from accidental drowning". A man whose wife had been lost stated the "a sudden squall had hit her, and she would not answer" and despite the best efforts of navigating through the Jack Sound they foundered. The coroner stated "You know Jack Sounds is very dangerous?" to which the engineer stated he knew but had no choice. It was stated the vessel was seaworthy but the weather simply overwhelmed them. The lifeboatmen were powerless to render help due to their perilous position. The engineer stated "They could not have done anything, and we would not have known she was there". There had been no panic at all. A Maltese fireman was also rescued from the rocks when presumed dead and the police constables remarked "I didn't think it possible" and</p>
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"neither did I" to survive in the sea. To which the coroner stated "miracles do happen sometimes". One of the constables stated everything was done to save the ship and reported that the wide had perished being overwhelming sea. Overall it was concluded by all onboard and all officers and coastguard officials that everything possible was done and the lifeboat could not have done any more given the conditions. The coroner summed up "there was proper life-saving apparatus, and everything possible was done in such weather" and paid tribute to the lifeboatmen for their immense gallantry and much sympathy was stressed. South Wales had very heavy rain and five feet blocked the Bridgend by-pass road. South Devon also experienced much flooding whilst 66 mph was noted at Liverpool as snow fell in Scotland and the famous Devil's Elbow road was snowbound. The River Neath overflowed and the whole valley was inundated with many dwellings going underwater with houses at Resolven inundated once again. Three 3ft of water was noted in houses at Gyfeillion and railway traffic was stopped at In Cheshire bricklayers and slaters were idle as the high winds forbade work as fallen trees blocked roads. The Rivers Dee and Severn were in full flood with large areas inundated throughout North Wales. "The greatest menace however, is at Trehafod" where great cracks appeared today in the river wall and water seeped out into the main streets and mothers were seen hastily seen dressing their children in readiness for a quick evacuation. In Lancashire the crops had been devastated with 100s of acres underwater and it was feared the

1929	4 to 12	12	British Isles	The Guardian & The Observer	06/12/1929 - 23/12/1929, 28/12/1929	39	<p>potatoes would be "attacked by disease, resulting in serious losses".</p> <p>39. Serious damage. Lifeboat & non-organised gallantry. A tremendous storm raged around the British Isles for a prolonged period causing much destruction and death. Off the Longships Lighthouse 16 lives were lost in the tremendous seas as a vessel named the "Frances Duncan" was capsized and sank. Wreckage was everywhere and men were seen floating on the wreckage before sinking. The lifeboat "put out in the teeth of the gale" but could not find any crew and eventually but back whilst two of the ship's lifeboats were washed ashore. An observer stated "The wave appeared to turn her over like an eggshell. She sank in full view of the shore" as people watched "breathlessly while the efforts at rescue were made". The lifeboat secretary stated the lifeboat "did not have a chance". Five members were later rescued by the steamer Alice Marie. In the Irish Sea a crew of 3 on a fishing yawl were overcome by tremendous waves and drowned. They endure a "tremendous struggle lasting for over three hours" as the wind rose to 70 mph and all other vessels nearby were powerless to help. Their companion vessel sank and the men scrambled ashore reporting the destitute situation to their comrades and the coastguard who readied the rocket saving apparatus but nothing could be done. An all night search followed and two bodies were discovered with one still missing. A Spanish steamer was also in distress with a broken propeller off Portcawl and tugs failed to assist her and she remained in a perilous position. The Mumbles lifeboat</p>
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was also deployed in Swansea Bay in response to distress signals but her search was fruitless. In some places the wind reached over 90 mph. The flooding was so bad in the kingdom that the RAC issued a "general warning to motorists that many roads in various parts of the country are impassable". Hundreds of barrels were carried off by the River Lowe from the Tiverton brewery and a hotel was also underwater in Devon. The Exeter railway station was flooded and the Exe inundated homes and businesses. The flooding of the electrified railway track meant "steam trains had to run". The gale sprang up off the western coast of Ireland and winds covered a ginormous area from the Shetlands to North Spain with 94 mph and 82 mph being recorded at Falmouth and the Scillies respectively. 59 mph was noted at Liverpool and 71 mph at Holyhead whilst the South of England was inundated most heavily. All was produced by a depression moving in from the Western Atlantic which deepened as it moved eastwards and the lowest pressure recorded in 44 years of 28.01 inHg was reported in Northern Ireland. Throughout the UK 128 telephone trunk lines were down with Plymouth and Liverpool being unreachable from afar. A youth was blown into a dock at Fleetwood early yesterday and injured but 2 men managed to rescue him. On the 7th the "Stop-Press News" was that the wind had reached 108 mph and many roads on the Cornish peninsula were forced to close whilst in South Wales landslips occurred at Tretower and Llangatock with motorists urged to take extreme care. A steamer was also missing in the Irish Sea and no news had been heard. The Llandudno lifeboat was

launched to assist a vessel drifting across the bay but the two occupants drifted to safety. Thunderstorms were noted at Pembroke, Bude, Newquay, Paignton and Torquay and the extreme rapid fall of pressure brought strong winds rising to hurricane force. 87mph was noted at Falmouth and 83 mph in the Scillies whilst winds above 50 mph were reported from Holyhead to Liverpool. The pressure as low as 28inHg had not been seen in living memory. The Blue Star liner Andalucia sent out distress messages in the Celtic Sea saying her rudder was damaged and she was drifting in a heavy sea, An admiralty tug was dispatched and repairs effected by engineers and she could sail to Falmouth. A french seamer was driven ashore near Penzance with all crew saved but the vessel was much damaged. She was "struck by a terrific sea which swept the deck almost clear in Mount's Bay" and although she righted herself the rudder had broken thus she began to drift but fortunately ended up in a tiny cove in Perrair. The rescuing lifeboat was completely swamped and the rocket brigade was again unsuccessful. Eventually the crew were rescued by a young man named Laity who led a group to the shore and succeeded in getting all the men off. "Laity ran into the sea and clambered over the rocks towards the boat. Battling against tremendous seas Laity gradually got nearer the boat". He rescued a man washed overboard and Laity and helpers secured ropes allowing the men to leave the ship whilst doctors and ambulances waited ashore whilst warm food and clothing was also provided. He stated he was "very much afraid" that the crew would try to jump overboard and swim and

drown on the treacherous rocks. "I simply showed them the way" he stated modestly. In the succession of gales on the 8th the town of Llanely was plunged into darkness when a chimney stack fell upon the Llanely powerstation and wrecked the plant. The tram services were suspended and oil and candles had to be used to aid travel. No injury was sustained and it was hoped the damage would be quickly repaired. Shipping on the Mersey was completely disorganised and floods reported in many low-lying districts in Cheshire. The roof of the Grosvenor Hotel in Cardigan was lifted off during the gale and deposited in the roadway but fortunately no one was injured. The proprietor stated "I should probably have been killed". In Bridgwater Somerset, a tree fell on a motor car killing 1 girl and seriously injuring one other whilst the driver had a miraculous escape. The mystery surrounding a disabled 7,000 ton steamer in the Irish Sea was solved by a telegram from Belfast stating she had been towed into Belfast by another vessel with the loss of a propeller. Two steamers had tried to render her initial assistance on seeing the signs of distress but the heavy seas and darkness had rendered their attempts fruitless. All Mersey shipping was much delayed as liners could not come up to the stage or depart owing to the huge waves and tenders which tried to act as ferries for passengers were "buffeted about like a cork and had to abandon efforts". Many ships slipped anchor but did not come to any trouble and the ferry steamers and landing stage were "drenched with spray, and the waves dashed over the promenade over the Wallasey side of the river". A Bath a doctor's house was

badly damaged when a chimney-stack crashed through the skylight into the hall and a ton of debris landed in the street just missing a car. Near Exeter two girls sleeping in a bed were badly injured when a tree fell through their roof and debris fell onto their bed. Several other lucky escapes from falling chimneys were also noted throughout the South-West. Near Athleney 150 people were rendered homeless when the River Tone burst its banks and inundated many low-lying houses with hundreds of livestock also being drowned. All round the coast the sea was "lashed into fury, and the worst storm for many years left a train of shipping disasters". Numerous calls for help and assistance were noted and the "rescue efforts of lifeboat crews added another chapter to the records of heroism at sea". The worst disaster occurred near Bideford in Devon and a vessel sent out the SOS.. Lifeboat crews at Appledore and Clovelly rushed to help but the seas were so high it was impossible to leave harbour as the vessels tried helplessly to make headway "against the overwhelming force of the storm". A constant look out was kept in the hope of finding survivors who evacuated but no vessel was ever found. The lifeboat was washed up empty on Bideford Bar and two bodies were noted washed up so it was presumed all 19 had drowned. In North Wales over 60 vessels sought shelter on the Moelfre Roads, Anglesey whilst a vessel went ashore at Penmaenmawr with heavy seas breaking over the quarry jetties. She was initially in a perilous position however the captain skilfully got her head round to beach where she lay on an even keel. There were a crew of 6 aboard who

were all anxious but relieved. The lifeboat and coastguard services were ready but were not needed. At Towyn a storm sureg surrounded the gasworks with water and the managers and staff had to use a raft to escape. A shop was also demloshed at Pwllheli and the river Dee was in full flood. At Barmouth huge quantities of sand from the dunes were blown onto the railway which had threatened to stop railway and tram services. The severity and widespread nature of the storm prompted the Guardian to write an article on the great storm of 1703. By the 8th 108 mph was recorded a Falmouth which was the record for the South-West as the tempest continued to devastate the kingdom. A whole gale was noted at Pembroke and Plymouth where squalls of over 64 mph were recorded. Hevay rain and thunderstorms were obsrved throughout Southern England. The meterological correspondent noted "Our glorious summer has vanish in a winter of worse than mere discontents. Rain was needed in order to repress the shortage left by the drought, we we may well wish that the balance had been adjusted by gentler methods". GWR trains were abandoned near Westbury due to flooding and passengers diverted whilst a landslide occurred near Minehead which blocked all travel whilst floods "tore up pavenements in the Avenue, one of the principal streets in the town". Flooding of the Somerset moorland spread to such an extent hundreds of families were homeless. The Mayor tried to reach Stoke St. Gregory to discuss relief measures but his car was held up and boats were needed to reach isolated towns and the "a good deal of courage and skill" was required to reach such

towns due to the storm waves which had formed in the flooded areas. Damaged ship after damaged ship arrived at the Western Ports with several vessels having onboard shipwrecked sailors whom they had saved from certain death in the Atlantic. Wreckage was notable throughout the Cornish coast which had ominous signs for the fate of many a vessel. Snow and sleet was noted at Blackpool on the 9th whilst snow and hail exacterbated flooding in the catchments of the Dee and Dovey as well as the Wye in Lancashire. in Pntypridd 9000 families were affected and 30 were held at the central homes of the Pontypridd Guardians. Many had seen their homes destroyed and the "distress relief fund has now reached nearly £6,000". Fishing fleets off Falmouth and the Scillies limped home with one killed and many injured seriously and the Siclly lifeboat was deployed to reach the ship along with an ADmiralty tug but they could make no headway. A Cunard liner arrived at Plumouth having altered course to assist the ship. --- A highly interesting topical lecture was given at the Manchester SOciety of Associates in Commerce by Mr Walker who spoke on "The householder and law". He stated no one was "responisble if a tile or chimney-pot was blown off the roof and injured somebody in the street below, becasue a gale was an act of God; but if that tile, chimney-pot, or iron piping was dislodged because of its disrepair through faulty cementing or rust and injured a passer-by then the tenant of the house was respnsible, and not the landlord". It was stated a tennant would be responsible for this maintenance and "the wealthy landlordcould survey such action with a smile and not be

liable to be sued". It was also noted that insurance of this nature was rare. "Speaking of the age-old dictum that an Englishman's house is his castle" he referred to Richard II's statute that no man or object could ever break into a man's house as "such action would occasion a breach of the peace" and thus the law. The issue of defending a house with force against such a burglar was raised and Mr Walker pointed to the liability of the defender if aggression was used. Relating this back to storm incidents he noted the issue of safety being impacted by the nature of a neighbour's premise stating "you have a perfect right to cut off the branches, but you must be careful - like Shvlock - to not go an inch over the wall". It was said a man could go into a neighbour's garden to do this act but he must give the neighbour notice. It was finally stated "This might lead to the neighbour setting his dog on the visitor. A man was also liable for damage done by dog" in a way to perfectly illustrate how many legal barriers prevented tenants from aptly securing their homes from storm damage. --- It was stated the coal exports from Scotland and South Wales had been majorly impacted by the storm with exports throughout falling by 158,620 tons to 388,120 tons. By the 14th it was reported a vessel had been battling the storm for 9 days in the Irish Sea in a journey from Liverpool to Bantry which usually lasted 36 hours in which the crew were starved and the captain lashed to the wheel in the near-destroyed wheelhouse by great waves. A great ceremony was given in Manchester attended by all notable political figures and marine businessmen to appaul the gallantry of a Manchester

regiment ship crew who saved many lives on a sinking vessel in the Northern Atlantic. They were also given monetary prizes and awards for officers and soldiers/crew alike. An article in the Observer was dedicated entirely to the immense erosion caused by the high tides and storm surge which had washed away tons of shingle on beaches which were now exposed to encroachment and erosion of the sea. Longshore drift was noted "one curious fact discovered in connection with this is that there is a steady and persistent eastward drift of shingle" on the southern coasts. A liner arrived at Falmouth on the 17th under tow having attempted to set sail for Jamaica from London and having encountered terrific storms in the Atlantic. She had sent out an SOS which brought a tug to the rescue and the hawser had broken with the liner rolling helplessly in the sea before being recovered on the abatement of the storm. It was noted "The woman behaved magnificently" and "great damage was done on board by the heavy seas, and the roll was terrific and horrifying". By the 20th snow was falling all over Northern England and Southern Scotland as Liverpool, Blackpool, Morecambe and Chester were all covered with snow. In the Scottish lowlands at Eskedalemuir it was an inch thick as a deep depression approached the west coast of the British Isles causing winds to rise once more. --- Following the storm there was a plea for Scottish fishermen who required £150,000 following the storm. As of the 23rd £21000 had been raised. A national fund had been set up in co-operation with the chairman of the Fishery Board of Scotland. An award on vellum from the RNLI was presented to a 70

1929	25-26	12	British Isles	The Guardian & The Observer	27/12/1929 - 28/12/1929	<p>year old aged coxswain of the Torbay of the motor-lifeboat who "His courage and endurance" during the gales. He had been out 4 times between the 4th-7th fighting in the "teeth of the whole gale" when she searched for vessels who had issued distress calls but only floating wreck could be found on most occasions with her crew on service for 26 hours on one occasion. A letter of appreciation was also sent to the motor mechanic. It was remarked "Not even the approach of Christmas could infuse a spirit of goodwill into a singularly wild and riotous December". "One of those fashionable Atlantic 'depressions' which was promptly dispatched to this country" produced great gales from the Celtic Sea to the Minch. There were thrilling rescues at Fleetwood where the lifeboat had the very hard task of removing 6 men from a foundering French steamer. The lifeboat was launched in the teeth of the gale in response to burning mattresses which were burnt in distress. Two vessels were badly damaged in the Celtic Sea with one vessel being 60 hours at sea battling the gale and the crew spent 48 hours over Christmas and Boxing days bailing.</p> <p>"Yet another severe gale was experienced in most parts of the country over the weekend" with the wind coming from the south-west and wind speeds of 83 mph and 80mph being noted in the Scillies and at Falmouth respectively. North Wales was widely inundated with many roads being inundated when the River Dee burst its banks with many farmers losing scores of livestock despite frantic rescue attempts. Rain was also abundant in the North of England and Scotland and the weather was</p>
1930	30-2	01-Jan	British Isles	The Guardian & The Observer	30/12/1929 - 03/01/1929	

1929	30	1	British Isles	The Guardian & The Observer	06/01/1930	<p>produced by a deep depression travelling eastwards across the Atlantic and across Scotland bringing with it damp but cool air. Telegraph and telephone services were interrupted to a degree and Irish ferries endured a rough crossing with passengers being injured and ferries being unable to come up to the landing stage in Liverpool owing to the state of the weather. On the 31st a record wind speed of 110 mph was obtained. In Southport the wind reached 91 mph and a tree blown down on a motorcyclist who crushed death in Preston and discovered on the side of the road. A trawler encountered a great battle with the waves in the Irish Sea and a voyage of 50 miles took 10 hours such were the conditions. At Fleetwood the tide was such it was 4 ft above the predicted height with the storm surge measuring 27ft and 7 inches. The bad weather "caused wholesale prices of fish to increase almost every day" to the extent some buyers could no longer operate in the market.</p> <p>A meteorological article concerning the weather records of 1929 which focussed on the exceptional wet spell towards the end of the year which brought "frequent storms whose track lay across the British Isles and winds of record-breaking speed". These storms followed a drought period from May to September before the wettest November in the last 60 years set in. With rainfall of 34.4 at Snowdon. In one day a record of 9.56 in fell at Bruton, Somerset. The gales were "unparalleled in their severity for a very long time. Wind speeds exceeding 80 mph occurred so frequently that one lost appreciation of their destructiveness. The worst occurring last month, gave the</p>
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1930	4 to 5	1	South-West Britian	The Guardian & The Observer	06/01/1930		<p>speed of 110 miles an hour in the Scilly Isles, a record value for Great Britain".</p> <p>Severe storms produced "a chasm 25 feet deep and 50 feet long" on the GWR between Dawlish and Dawlish Warren thus all traffic was suspended. The heavy SW gales produced an eroding storm surge which undermined the track to the extent the entire embankment was eroded and the track left hanging. This was to be expected as a crack in the sea wall had appeared during the Christmas storm and the large quantities of sandbags placed at the foot of the wall had been washed away with the temporary repairs underdone. The gangs of men set hard at work were in peril from encroaching spring tides and storm surges which exposed the line to the full force of the waves. The constant expense of the line was noted and the considerable delay in time before us was stressed particularly given the tempestuous period and spring tides. All passenger were as of present having to be conveyed by bus from Dawlish to Starcross. Mainline trains were to be diverted on the Southern main line to Plymouth. It was remarked this latest in a catalogue of disasters could hasten putting of a permanent diversion plan into action.</p>
1930	10 to 13	1	British Isles	The Guardian & The Observer	12/01/1930 - 14/01/1930	3	<p>3. Major damage. The British Isles endured a tempest which for 3 days brought squalls registering 70-80 mph to the kingdom. Snow fell as far south of Falmouth and in the South of Scotland. Mild conditions South-West however and Weston-Super-Mare was much damaged in particular. A Cardiff steamer was heavily damaged in the channel and forced to put into Falmouth and required major repairs. The captain had a "marvellous escape from</p>

1930	1	British Isles	The Guardian & The Observer	04/02/1930	<p>being drowned" as he was almost swept from the bridge by a huge wave. The meteorological office reported 102 mph at Falmouth and 97 mph in the Scilly Isles as well as 61 mph at Holyhead. A man was killed whilst fixing a lamp in Somerset, whilst another was killed by the fall of a tree. Another was killed at Teignmouth and a motorcyclist killed at Bath. The 36 inhabitants of Bardsey experienced considerable plight as no communication had been received with them for 5 weeks as bad weather had prevented travel and only beacon communication was left. The Dawlish railway was again blocked by a falling tree and all rail traffic had to be stopped. Several football grounds were wrecked in the Somerset and Devon region. The AA reported 3-5 inches of snow in the Lake District and roads throughout Scotland were generally treacherous. In Western-super-Mare a pavilion was damaged completely by a fire which started in the storm doing a damage of £200,000. The gale force winds hampered the firemen's attempted rescue diverting the water plumes intended to douse the fire. This caused a great spectacle when combined with the surge waves during high tide with spray lashing over the front. An update on the success of the lifeboats who throughout the past 4 months had saved 194 lives throughout the British Isles launching 174 times. The largest number of lives saved throughout the region in one month was 56 in December. In January 54 lives had been saved whilst 53 and 31 lives had been saved in November and October respectively. There were a maximum number of launches</p>
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1930	20	3	Mid Wales	The Guardian & The Observer	21/03/1930		of 15 on the 7th December when a wind speed 110 mph had been recorded. Minor damage. Lifeboat action, unorganised rescue and gallantry. Two men had an exciting time in Cardigan Bay when their sailing boat was caught in a south-westerly gale and became unmanageable and in response the Newquay lifeboat was launched. The fishing boat was driven across the bay and narrowly missed the rocks at Castle Point, Aberystwyth and ran ashore near the lifeboat slip. The two men were previously taken off by means of a small boat launched from the slip and the Aberystwyth lifeboat was held in readiness but it was not required.
1930	3 to 5	4	Western Scotland, Irish Sea, Mersey, Cornish Peninsula	The Guardian & The Observer	05/04/1930 - 07/04/1930	2	2. Moderate damage. Impromptu and official gallantry. "A spaniel dog's devotion to a child was revealed" near Minehead when the dog was found guarding the body of a sadly deceased 2 year old on the moor. The two had wandered off together in a storm and a community and official search party had later tracked the pair only to find the dead body and dog alive on the exposed moor. The dog guarded the child fiercely. Many ships in the Irish Sea were forced to seek shelter in Peel Bay such was the strength of the wind and size of the waves. Extensive damage was done during a vessel collision in Holyhead. Travel was considerably delayed on the Mersey with many vessels inbound and outbound delayed by hours. In Runcorn a chimney stack was destroyed causing considerable alarm but the occupants of the houses involved were largely unijured. A Fleetwood trawler returnign from fishing in the Atlantic and lost a man overboard when he was thrown overboard by the wind

1930	16-18	4	Irish Sea	The Guardian & The Observer	19/04/1930	<p>whilst hauling a net up off the Mull of Galloway. He sank and drowned near instantly and left a widow and two young children.</p> <p>Moderate damage. Impromptu gallantry. A Fleetwood vessel which enjoyed a 12 hour tow of a steam drifter having initially succumbed to an engine defect in a storm from the north-west in the Irish Sea. The rescuing vessel was signalled and she put the vessel in tow during the terrific storm which broke many of the tow ropes as the vessels fought against the gales. The crew of the vessel in tow "thought they were finished" as they were swept "from stem to stern" and two of the crew lay on the bridge with axes at the ready in order to free the lifeboat. They were luckily rescued by another steamer in the vicinity who proceeded to Fleetwood with the stricken vessel in tow at 2 mph. All were safely rescued as their tow rope held.</p>
1930	18	6	Wirral, Lancashire, Cheshire, Mersey	The Guardian & The Observer	19/06/1930	<p>A storm in the North-West drastically influenced golf play in the Open Championship at Hoylake when Cotton played extraordinarily well despite the conditions. Heavy rain fell in the vales of Lancashire which were quickly turned into a furious flood. A Mersey bank was breached and a new bridge swept away preventing travel. A 0.86 inches of rain was recorded in one day whilst lightning and thunder was heard to crackle "like bacon and eggs frying in a pan". A hotel in Carlisle was struck by lightning and the current travelling down the chimney fused the electrical wiring and burst a gaspipe and firemen who had been bailing water from their flooded houses turned out to offer assistance but no fire was noted.</p>

1930 20-21	8 Cornish Peninsula The Guardian & The Observer	22/08/1930 6 6. Minor damage. A yachting disaster occurred off Cornwall when a Royal Yacht Squadron vessel was "dashed to pieces on the Cornish cliffs near Fowey" and all 6 onboard drowned despite the best efforts of would-be rescuers. All six were esteemed officers of the Royal Navy and one was also an MP. The Fowey lifeboat was launched in response to the Polruan coastguards setting off distress signals but there was not time before the gale was overcome by the wind and waves and left helpless on a rocky reef as the seas prevented the lifeboat from getting inshore. The coastguards "in imminent peril to themselves, climbed down the cliff face hoping to get nearer the yacht" and although a lifeline was thrown the vessel was quickly washed off the reef and broke up. Cries for help could be heard from the figures who clung to the rails and one man flung himself out in an attempt to swim ashore "In a sea that no swimmer could have conquered" before he was swiftly drowned. The wife of the Fowey coxswain stated the crew "tried all possible ways to get to the yacht, but it was too rough to get the people off, and a lot of rocks were between the lifeboat and the yacht". It was remarked the rope could not be held onto long enough by the men aboard despite accurate throws from the coastguard. A local man stated how he and his son had tried to help and in throwing the rope which reached the yacht "it nearly dragged my son into the water and drowned him". No evidence of the bodies had been found as just wreckage drifted ashore being propelled by breakers "rearing to a height of thirty feet as they crash shorewards". A Sir Arthur Quiller-Couch who lived nearby
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<p>1930 10 to 11</p>	<p>9</p>	<p>Glasgow</p>	<p>The Guardian & The Observer</p>	<p>10/09/1930 - 11/09/1930</p>	<p>stated "everything possible was done to attempt a rescue but the section of the coast and the prevailing conditions combined to make the task too great". He believed the "tragedy is one of the results of doing away with the coastguards" as their had formerly been an observatory close to the point of wreckage.</p> <p>An article concerning how thunderstorms occurred was published in the middle of a thundery period. It was firstly noted "thunderstorms are not invariably associated with warm weather" whilst they could also occur in sync with cool weather. Instead "favourable vertical air movements on a relatively large scale" had to occur. These movements had to be over 15-20 thousand feet and produced the "towering thunderclouds" followed by "well-known electrical manifestations". The rate of temperature fall throughout the 15-20 thousand feet had to be 5.5 degrees F as this allowed near indefinite rising as "its own rate of cooling by expansion as it rises will be the same as that of the surrounding air, and it will therefore maintain its difference of temperature at all points". In all a steep fall of temperature with height was needed to produce a thunderstorm providing this occurs over a "sufficient thickness of atmosphere". A heat wave could produce this providing that it disproportionately warmed the layers of the atmosphere at elevations less than 20,000 feet. The electricity of the thunderstorm in a typical lightning flash was 20-50 coulombs according to a Cambridge professor whilst their voltage was "colossal" estimated to be approx. "a thousand million volts". An effective lightning conductor was only deemed effective if</p>
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<p>1930 18-23</p>	<p>9</p>	<p>Cumbria, Cornwall, South-west Scotland, Irish Sea, Lancashire, Cheshire, North</p>	<p>The Guardian & The Observer</p>	<p>19/09/1930 - 24/09/1930</p> <p>it could handle 100,00 amperes without overheating. The occupants of a motor car had been said to be safe because the vehical was "insulated by the tyres" however it was remarked "it is difficult to see what basis there is for this belief". When struck a "current of the order of 100,00 amperes the body of the car would be raised to an enormously high voltage, and violent discharges would occur from part to part of the car and from the car to earth". Therefore the windows would be shattered and the occupants injured even if they were protected by the bodywork of the car from the elctrical discharges themselves. Following this article, on the 10th vivid flashes of lightning were observed over Glasgow as a tremndous thunderstom broke over the city. rian "fell in sheets and the streets becaem flooded" with water rising up in shops and houses and "shop girls and office girls waded through pools of water which passed over their knees". Much damage was done and the fire brigades were very busy. Stock sstored in ships and basements was also damaged by the flood waters whilst businessmen were almost crushed at a bar by a falling rianwater pipe which came through the ceiling and the building proceeded to flood. Thousands of pounds worth of damage was done according to the police. Major damage. A severe gale hit the UK bringing with it heavy rain which was noted most prominently in the Irish Sea and Southern Scotland. AtLiverpool the wind reach 72 mph whilst 58 mph was noted at Chester but these speeds only lasted a few hours. Likewise 70 and 60 mph winds were noted at Plymouth and Falmouth. Rianfall of 1.69 in</p>
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Wales, South
Wales, Cornish
Peninsula,
Celtic Sea, Irish
Sea

was noted at St. Ives. A continued deepening of the depression as it travelled NNE up St. George's Channel and the wind reached its maximum intensity as it veered to a more westerly point. The heavy rain first noted in Cronwall "proved to be typical of that encountered over much of Wales, the Isle of Man, Southern Scotland and Ulster". Rain fall of 1/2 an inch was common in Lancashire and much of Southern England. The rainfalls were "unusually severe for a depression travelling, as on this occasion, with an average speed of about 25 mph". It was noted that "mild moist air from which the rain fell must have risen very steeply over the cooler air ahead of the depression to give rise to such rainfall totals". Considerable damage resulted at a Llandudno flying-ground where a marquee collapsed and much cutlery was smashed and the watchmen just avoided being crushed to death. The pilots encamped in the field also had "a treacherous night". One plane was badly damaged and smashed its wing. The Blackpool illuminations were damaged at an estimated cost of £200 while shops and private property also incurred moderate damage. In North Wales the heavy rain swelled the Rivers Conway, Clywd and Dee and corn crops were washed from the hills into the streams. At Barmouth many pleasure boats were submerged and a number of motor-boats broke loose from their moorings and many were out trying to recover them. The 100 men "employed on the sea-defence had to cease work". Precautions were being taken all over South Wales where near-incessant heavy rain was feared to cause greater flooding and low-lying areas had already

1930	8 to 9	10	Cornish Peninsula, Celtic Sea, Irish Sea, Mersey	The Guardian & The Observer	09/10/1930	<p>"suffered extensively with a number of houses being flooded as "angry torrents swept down" from the valleys. A school suffered serious subsidence when rain water initiated the degradation of its foundations. Two Balckpool were admitted to hospital in Fleetwood whilst receiving injuries at sea due to the mountainous waves which thrown the men around. The Plymouth and Torbay lifeboats both put off in response to a distress signal in heavy fog and large seas. The rocket apparatus with the coastguard was also rushed to the scene but the ship was not in immediate danger. Another Flettwood vessel limped in with only ten boxes of fish having encountered a great gale and large seas which damaged the vessel in the Outer Hebrides. Despite their best attempts to effect temporary repairs there was too much swell and the vessel subsequently struggled 85miles to Tobermory where she was beached. Temporary repairs were made at Oban allowing her to reach home in safety.</p> <p>Moderate damage. A great gale blew over the South and West of the British Isles with the strong winds first being noted in the Scillies whilst squalls of 56 mph were noted in Liverpool. This was the cause of an intense mid-Atlantic depression which spread eastwards to Scotland. IN Troon 1.38inches of rain was noted. Elsewhere, away from the West coast, the R101 airship was disabled by the gale and lead to great casualties.</p>
1930	21-24	10	Liverpool Bay, Wirral, Cumrbia	The Guardian & The Observer	23/10/1930 - 25/10/1930	<p>Moderate damage. A gale in the Irish Sea did notable damage to the promenade at Hoylake where 40 yards collapsed and the Leasowe embankment was dislodged by the force of the storm surge. This was one of many coastal</p>

1930	2 to 3	11	Celtic Sea, Cornish Peninsula, Cheshire, Bristol Channel, South Wales, Irish Sea	The Guardian & The Observer	03/11/1930 - 04/11/1930	<p>issues in the area in recent history. The number of bird fatalities in the storm was seen as a barometer of its intensity and rapid onset.</p> <p>Moderate damage. Heavy rain and a severe gale came to the southern half of the British Isles with maximal wind speeds reaching 78 mph in the Scillies and 43 mph at Chester. The storms were a result of a "double-centred depression travelling eastwards" although the position of the low over Wales and Northern England meant the areas experienced relatively minor gales at first. However by the 3rd heavy rains came to North Wales and heavy seas ran on the Welsh coast. The major rivers were all in full flood. In the Bristol Channel a small two-masted schooner was seen "lying upturned on one of the treacherous sandbanks near Flat Holm in the Bristol Channel. There was no sign of life aboard". A lookout in Penarth noted "It was impossible for anyone who might have been on board to be alive, so it was no use sending the lifeboat out". A tug was to investigate and the finding of a lifebuoy found drifting gave a clue she was a French barquentine.</p>
1930	22-23	11	Cheshire, North Wales, Cumbria	The Guardian & The Observer	24/11/1930	<p>1. Moderate damage. "Two separate gales swept the greater part of England and Wales" with high winds reaching 78 mph at Chester. Thunderstorm damage was noted near Pwllheli where a farmhouse was partially wrecked by a lightning strike and the two occupants narrowly escaped injury. At Crediton the thunderstorm "shook the town" and property was singed by the lightning strikes. Many low-lying districts around Exeter were flooded. In Barmouth a storm sureg inundated the</p>

1930	26-27	11	Irish Sea	The Guardian & The Observer	31/12/1930	<p>coastal railway line and the local army volunteer corps were called out for life-saving duty" as passengers and engine-men were drenched by the waves at the station. Rivers and streams were also in full flood holding up motorists and the Conway valley "resembled a series of lagoons". Many houses and shops were inundated with water a yard deep and several small boats at anchor in the Conway estuary were swamped and sunk. A man fell into the sea at the Penmaenmawr Pier and drowned.</p> <p>Moderate damage. A Fleetwood trawler was swept by huge storm waves in the Northern Irish Sea off Tory Island and was struck broadside as she was near overwhelmed by the seas. Eight of the crew on deck found themselves clinging on for their life. One man clung onto another's leg for dear life and the weight of the anchoring man was said to have saved the others' life. Water had gone down the funnel and partially extinguished the furnace and the crew's quarters were flooded. A crew member stated "it was pure luck that we were not all swept overboard and drowned". Another trawler also encountered a "severe buffeting" and fishing operations had been much hampered whilst boats had been lost and a boatswain needed medical attention.</p>
1931	16-17	1	Mersey, Liverpool Bay, Lancashire	The Guardian & The Observer	17/01/1931	<p>In Liverpool a 60 mph gale held up and hampered shipping operations with one large liner not being able to embark despite the aid of tugs due to the strong north-westerly wind. Several other vessels were also windbound.</p>
1931	11 to 12	2	Mersey, Irish Sea, Lancashire	The Guardian &	13/02/1931	<p>Minor Damage. There were widespread gales from the North and North-West with 78 mph being recorded at Liverpool and 70 mph at Holyhead whilst the temperature</p>

				The Observer					
1931	21-22	2	Celtic Sea, Cornish Peninsula	The Guardian & The Observer	22/02/1931 - 24/02/1931				also dropped distinctly. At Liverpool many ships and liners were storm-bound and a barge capsized. A mail vessel had to return to Liverpool such was the sea state. Liners arriving at Plymouth reported having "encountered fierce storms at sea" a South African vessel arrived 2 days late due to stormy weather in the East Atlantic. 5,000 tins of tomatos were condemned by the Port of Manchester Sanitary authority after a ship battened down all hatches whilst in the Celtic Sea due to the storm and mountainous waves. The result of this was that the hold next to the boilers rose to 140 degrees and the cans corroded ruining the tomatoes inside and all had to be discarded on the grounds of a hazard to human health.
1931	6 to 8	3	Cornish Peninsula, South Wales, Western Scotland	The Guardian & The Observer	08/03/1931				Minor-moderate damage. Storm Surge. "Wintry weather" continued to be felt throughout the UK with cold easterly winds bringing snow to Scotland and the North of England. At Minehead "the fisherfolk fought the highest tide known for generations" as every house was barricaded to prevent "the invasion of the sea" but the streets flooded to 2-3 feet. The Minehead railway was flooded and the sea poured into the goods yards. At Teighnmouth the mountainous seas washed away 10 ft of sands along the stretch of Teignmouth beach and the wall at the main entrance to the pier was undermined at the western end with a gaping hole being made on the promenade. Damage was also done tot he Swansea and Mumbles electric railway by the high tide and easterly wind as the storm surges onto the lines and the embankment was partially undermined. A small ketch sank but no one was aboard at Mumbles.

1931	28-29	3	Cornish Peninsula	The Guardian & The Observer	30/03/1931	Moderate damage and official gallantry. A schooner was forced onto rocks near Looe after dragging her anchor in a strong south-easterly gale but all crew were saved. The vessel had arrived in Looe Bay with granite and was waiting for the tide to enter to harbour before being driven onto the rocks. The crew including her skipper "were rescued by the pilot boat".
1931	4 to 5	4	Western Scotland	The Guardian & The Observer	06/04/1931	Minor damage and official gallantry. A man named Edwin W. Parker had a "trying ordeal on Loch Lomond" when the small boat he hired nearly sank in a gale. He had been advised by the boatmen not to go but refused to accept their advice and fears were aroused after he did not return for some time. In the morning of the 7th a police sergeant and a boatman searched the loch and "found arker in the half-swamped boat drenched to the skin and in a dazed condition". He had spent the night on Luss island and was taken back to his hotel exhausted.
1931	27-28	5	Cornish Peninsula, Severn Valley, South Wales	The Guardian & The Observer	28/05/1931 - 31/05/1931	Violent storms were noted throughout the West of Britain. Torrential rain as well as "thunder and sheet-lightning" was noted over Plymouth as the storm burst over the city in intervals. The rain was "so heavy that sewers and drains were burst and at various points the covers of manholes were shot into the air and water rose to a height of many feet, flooding streets, business houses, and cellars". The fire brigade were hard at work removing flood water with pumps and men and women with buckets worked hard at work bailing the water out. A house was hit by thunder and a policeman was thrown out of a telephone box when struck. Waer rushed through the Mutley railway station tearing up great stone flags and

1931	5	6	Lancashire, Irish Sea, North Wales	The Guardian & The Observer	06/06/1931	<p>goods in the docks were "attacked by the flood" until removed. In Exeter the streets were flooded and traffic had to be suspended as rain deluged the town whilst hail and thunder and lightning was also noted. Massive iron gates were wrenched from their supports. Some residents were for a brief part marooned. Many local rural roads were inundated to a level no traffic could pass. At Cardiff a man was struck by lightning at a dog race and then had to be conveyed to hospital. The city itself was partially flooded as rain swelled in the streets and the Glamorgan Canal flooded causing floods of up to 5-6 feet on some rural roads. The Isle of Scilly was also struck but no major was reported. The violent thunderstorms were also noted in the Severn Valley but little flooding occurred in the lower reaches.</p> <p>Moderate damage. A trawler of Morecambe was punded by heavy seas in Morecambe Bay when it broke adrift in a north-easterly gale and was now drifting derelict. Extensive damage was also done in Swansea by thunderstoms and torrentrial rains. "the town was so fark that all businesss premises were illuminated artificially all day". Walls were submerged and rivers and bridges were washed away. A young man had to be rescued by ropes and houses were flooded to a depth of 4 feet n some casses. A large tree fell on a ocastdal roads in North Wales near Aber bringing down telephone wires and interupting communication throughout the district.</p> <p>"A terrific thunderstorm" lasting more than 2 hours broke over Blackpool with flooding occurring in scores of streets and causing many hundreds of pounds of damage. The</p>
1931	14	6	Lancashire, Mid-Wales, North Wales	The Guardian &	15/06/1931	

			The Observer		flood attained "riverlike proportions and ran a course of over a quarter of a mile, ripping up the road at one point for over twenty yards and causing a tramcar to leave the rails". Passengers getting off trams had themselves in knee deep water and men took many women and girls in their arms. Hundreds could not get back to their homes owing to the flooding and "Bowling greens were ruined" and many areas of green space "resembled lakes" whilst gardens were widely ruined. At Preston the floods stopped all traffic along the Liverpool and Blackpool main road and all streets were flooded. Many man holes were shot up as the rains overwhelmed the drains. Some paving was undermined and sank whilst paving was widely damaged.
1931	23	6	The Guardian & The Observer	23/06/1931	A incerpt from the "Quarterly Insurance Review" stating "Risks not usually insured - Earthquakes, Storms and Floods". It was noted the past quarter had been notable for its demonstration of risk which were not usually insured. Despite the frequency of such natural hazards it was noted "None of these things has yet become regular subjects for insurance in this country". It was noted that there was consdierable amount of earthquake insruance in London in the "earthquake zone". It was noted that ordinary fire policies usually excluded fires resulting from natural hazards.
1931	10 to 11	7	The Guardian & The Observer	13/07/1931	A vessel was adrift for 20 hours in the Irish Se and landed on Bardsey Island with the man aboard being in an exhausted condition. The gale haad carried him out to the sea and he was unable to return and he had been tossed about throughout the day by large waves which swept the

1931	2 to 8	8	Cornish Peninsula	The Guardian & The Observer	03/08/1931 - 09/08/1931		<p>boat several times. He tried to attract the attention of passing vessels without success. In spite of this he was in good health and preparing to leave the island the day after.</p> <p>Minor Damage. "Two secondary offshoots of a large cyclonic system covering Scandinavia and the Baltic developed near the Scilly Isles and over Ireland". The centres increased rapidly in intensity to form a vigorous disturbance which brought boisterous weather across all parts. On the North Wales coast 1 1/2 inches of rain was noted. Squalls of gale force were noted in the North Irish Sea.</p>
1931	15-25	8	Cornish Peninsula, Celtic Sea, North Wales, Lancashire, Bristol Channel	The Guardian & The Observer	16/08/1931 - 26/08/1931	4	<p>4. Major Damage. Floods throughout the country and landslides in North Wales were the main feature of a severe storm across the UK where serious damage to crops occurred. A man perished on the Fastnet yacht race and the crew of the vessel were otherwise saved by a trawler. On the wireless the message from the trawler "Abandoned ship. Colonel Hudson lost overboard" was heard. Efforts to save the yacht were made by four trawlers. The owner of the yacht stated the incident occurred due to the "seas made terribly steep by a gale blowing against a strong tide". Waves broke over them and completely deluged the boat washing the colonel overboard. None of the seventeen yachts that had departed arrived with the rest (excluding the retiree) presumed to be hove-to off the Fastnet waiting for the weather to moderate. The deceased Lieutenant Colonel Hudson was well known in Hull in the fishing industry and had been awarded an OBE for "distinguished services in East</p>

Africa". He was 53 and married with no mention of children. Motorists were warned widely of the dangers of floods and landslides by the AA. In South-West Lancashire a torrential downpour was noted and crops widely destroyed. Roads were widely flooded near Preston where a thunderstorm brought heavy rain and short-term intense floods. Two Preston houses were damaged by lightning strikes. An inhabitant saw "hat he believed to be a ball of fire flash through the living-room" and the curtains caught fire and destroyed the chimney and multiple items in the house. At Fleetwood £1,000 worth of damage was caused by the storm surge and £3,000 worth was down in Barmouth. Flooding North Wales were terrific and many crops were lost as rivers overflowed their banks due to torrential rain. The storm sufficiently bad enough in the Bristol Channel to hinder and delay the crossing of pleasure steamers from Wales to Devon and Somerset with the "high seas raging" over the landing stages preventing many landings. Three people were drowned whilst watching the storm surge at Torquay as they were drawn into the surf by the backdraw of the waves. A witness stated "I saw a tremendous wave break and envelop them" and a young man trying to throw them a lifebuoy was sucked in. Despite of no shortage of willing assistance it was stated "even the strongest swimmer would have been dashed to pieces in a few seconds in such a sea". Much anxiety prevailed when a woman's husband tried to rescue those in the sea but he escaped with only a drenching. It was said that the reason the initial party of two had been close to the sea was trying to

save a dog. According to the meteorological records the Channel gale was the worst ever in the month of August with windspeeds of 90 and 72 mph in the Scillies and at Falmouth being recorded and it was also the coldest August day for 50 years. Four holiday makers were marooned on a rock off Babbacombe, Torquay having been cut off from the mainland by the stormy weather. The gale had destroyed their tent and they were short on supplies. The storm surge made it impossible to launch their boat until winds moderated. One of the rescued brothers said "one of us was going to risk going ashore in a canoe to get food, for we had only had a nibble all day, and our water ran out yesterday". In Exeter "scurrying clouds" and the "fury of the waves" created many a grand spectacle. Much havoc was done to orchards and traffic in telephone lines increased 100% as lines were felled. Dwalish Warren flooded with a storm surge and waves crashed against the rocks with "great force" inundating small huts and a golf links, while bungalows fronting the railway "appeared in jeopardy". 1.81 inches of rain fell in four days compared to the previous monthly total of 1.28 in. At Instow storm surge waves topped the sea wall submerging the roadway. A refreshment tent belonging to a Mrs Reed of Braunton was blown over and its contents washed away while the bar byou marking the entrance to Bideford Bay was also washed ashore. Corn had suffered severely being beaten by the wind and rain. The crew of the new lifeboat Henry Finlay was standing by and she was deployed for her first time at 4.30 and rowed over the bar before being sailed to a schooner in distress. The

1931	7	10	Irish Sea, Lancashire	The Guardian & The Observer	08/10/1931	4	<p>lifeboat behaved splendidly and on her Teignmouth arrival she was cheered by 2,000 spectators. The boy who was rescued was taken to the tea tent by an Ambulance brigade member and was greatly distressed and upset but was soon composed. It was remarked "Fahher Neptune, helped by the south-west wind" caused "a lot of commotion on the sea front" at Teignmouth. The high tides and storm surge scoured the beach from end to end with waves breaking with force against the sea wall. The promenade was strewn with beach tents, shingle, brushes and allsorts of beach equipment the day after. The harbour master noted the storms had the impact of eroding the bar at the entrance of the river. The scene was much the same at Exmouth with beach huts having to be scoured and moved landward to avoid destruction and two-three girl bathers were assisted to the shore by a lifebelt at Orcombe Point. The Teignmouth lifeboat put out to check on a vessel in the bay. At low tide the beach huts and bathing tents were put in a precarious position but the south-westerly winds afforded protection with minimal damage sustained.</p> <p>4. Moderate Damage. Four yachtsmen were believed to have lost their lives in a violent gale off the Fylde coast. Three were very experienced at sea and were overcome by the rolling waves. The keepers at the Wyre Lighthouse signalled a dismantled yacht was being driven up the channel and a steam trawler reported the runaway vessel. She was driven against the shore near the Fleetwood pier where she was sunk and pounded by the rough waves and</p>
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1931 29 to 4	11	Irish Sea, Lancashire, Cumbria, North Wales, Celtic Sea, Cornish Peninsula, Firth of Clyde	The Guardian & The Observer	30/10/1931 - 05/11/1931	<p>no signs of life was noted aboard. It was noted no lifeboat had been carried aboard.</p> <p>Moderate damage. A heavy gale struck the North-West and the Piel motor-boat was called out to rescue three men from a fishing boat in Morecambe Bay. The Bblue Bell had been the last off the Duddon Estuary and the coastguard station had reported her missing. The bat was taken in tow and the sailors were exhausted. In North Wales and the Lake District the floods were severe and the river Kent rose two feet in it's middle-lower course due to the flooding. In North Wales many rurual areas where underwater and serious floods were sustained in the Festiniog district as "lowland farmers brought their animals to safety with much difficulty". The River Conway rose rapidly and several tributaries burst their banks with the syrrounding areas and roads inundated. In Pwllehli a number of people had narrow escapes when windows were blown into the street and the West End Parade was wrecked. Trees were blown down near Bangor and a post office worker near Aberdaron had a "miraculous escape. She had only just left the kitchen when the chimney crashed through the rood, causing considerable damage". The overflowing River Ogwen or Lake left the main road "virtually impassable for two hours" and traffic was halted. The seas near the south-west coast were so mountainous that a liner from Australia was unable to enter Plymouth Harbour. Winds of 60 mph were noted off Plymouth. The gale was also responsible for a 2 hour breakdown of the BBC North Regional wireless program. Three men were adrift in the Firth of Clyde in a small</p>
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1931	10 to 15	11	Mid and North Wales, Irish Sea, Hebridies	The Guardian & The Observer	11/11/1931 - 16/11/1931	<p>motor boat when they were driven back a mile from Greenock and could not reach the shore being "battered about the firth all day" and the boat was damaged before the men sought shelter at Helensburgh Police Station. Major Damage. Organised welfare. Impromptu gallantry. "A fierce gale, described as one of the worst for many years" swept the South and West of England and flooding was general due to large storm surges. At Barmouth damage to the new sea defence works estimated at £15,000-£20,000 was sustained. The sea undermining the promenade wall and steps causing thousands of tons of material to be eroded away. "The sea invaded the roadway, and workmen risked their lives to save expensive machine" and 100 men were to be out of work for several days. The sea surged over the embankment near Towyn on the Cambrian coast and many trains were delayed with one being hit by the huge waves as they washed over the defences. In South Caernarvonshire "hundreds of acres of land have been converted into lakes following the flooding of rivers" with houses on the Llanbedrog and Abererch roads being flooded and the workmen of the corporation keeping watch. "High tides and heavy rains worked havoc in the lower-lying villages, where thousands of residents were kept prisoners in their own homes. Grave fears were entertained for several hours on Saturday as to the safety of the inhabitants of Aberdaron". The River Daron overflowed its banks and the water "rushed with great force into the village flooding the houses" and furniture floated about in the flooded ground floor rooms as residents took shelter upstairs. A family of</p>
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1931 22-23	11	Celtic Sea, Cornish Peninsula	The Guardian & The Observer	23/11/1931	<p>six had a miraculous escape when Bodvean Lake burst its banks and swept over the nearby properties. A family would have been swept away if it wasn't for the action of husband and son who saved the family and their stock. Several buses and cars were stranded in water by Pwllheli and many livestock were swept away by the floods although many were saved thanks to the swift actions of farmers and their assistants. A stranded tralwer was exacuated from the Sound of Islay by a tug after running onto the rocks and losing its propeller. "So bad was the weather that on Monday night the vessels had to seek shelter in Stranraer harbour". Another vessel was also stranded by the storm surge in the same place on Islay. Outside Carmarthen in the village of Pensam four families had their homes extensively damaged by flooding of the Tywi and they were given temporary accomodation in the disused Carmarthen Prison as a "precautionary measure against further floods".</p> <p>Minor Damage. A yacht bound from Falmouth to Plymouth came a cropper in a gale after the rigging was carried away leaving the vessel wallowing in the terrific sea which flooded her cabin and engine. One man was swept overboard but was swept back and pulled onboard. A distress rocket was fired and the Plymouth lifeboat deployed and a rocket line was cast to the yacht although such were the conditions it could not be used to convey man and the yacht was instead towed. It was reamrked "the crew of the yacht were exhausted after their fight". The crew of the aycht were exhausted and stated the trip had been risky as they had been waiting for more than a</p>
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1931	27 to 4	12	Liverpool Bay, Irish Sea	The Guardian & The Observer	01/12/1931 - 05/12/1931	<p>week for favourable weather and then had to reply. The owner stated they had "just about given up hope when the lifeboat came into view ... By marvellous seamanship the lifeboat took us in tow and brought us to Plymouth". He even noted "it was a terrible experience at the time, but now it is all over I rather enjoyed it".</p> <p>Moderate Damage. Official gallantry. A storm in the northern Irish Sea did great damage to a trawler which almost sank after the ferocious seas battered the vessel as men worked "up to their waists one minute and up to their neck the next". Their efforts were successful to the extent the vessel managed to limp to a beach and she later sailed back to Fleetwood where she was taken out of the water. Gales of 64 mph were noted at Liverpool as well as 62 mph and 60 mph at Holyhead and Chester and Estdalemuir. The gales were sourced from a very deep depression travelling at an average speed of 60 mph from the Atlantic to the Hebrides which caused snow in north England. Another Fleetwood trawler was forced ashore off the Isle of Man and the crew were saved by breeches-buoy. Another ran ashore off Islay and a salvage ship went to her assistance. On the 4th 77 mph gusts were noted in Liverpool and 72 mph at Holyhead which was the second highest and highest wind speeds of years respectively.</p>
1931	28-30	12	Western Scotland, Irish Sea, Mersey	The Guardian & The Observer	29/12/1931 - 31/12/1931	<p>Moderate damage. Localised storm perception. Snow storms came to Scotland and North-West England bringing intense cold and strong squally winds of 61 mph at Liverpool and 56 mph at Holyhead. The change was caused by a depression moving rapidly eastward from the Faroes to the Baltic bringing strong flows from the Arctic</p>

Cricle with the gradient exacerbated by a strong flow over the Atlantic. Snow showers were common on the mountains of North Wales and a boat sunk on Loch Lomond when it was driven against the shore during the "exceptionally fierce gale". One of the largest cinemas in Cheshire was destroyed by a fire which was "fanned by a wind approaching gale force, which caused the fire to spread and increased the difficulties of the brigade". The fire was very notable and provided a "thrilling spectacle from the river and the Liverpool Landing Stage". The dropping of a storm lantern caused a fire in a farm outside Chester and 300 pedigree pigs had a narrowed escape but considerable damage was done. An article published "An Iona Storm" also described the "Heralds of the Storm" on the island and the local intelligence of the populace. The crofter the correspondent was with knew a storm was coming "for a flock of wild swans then flew over with some haste". He stated "Don't you hear the storm? The swell it is rising". A natural "change of note" was felt as the "gurgling of the tide among the rocks has turned to a sharp growl, and there is a hiss every time the water recedes from the sands. Not yet does the moving tide throw up one white horse, though in an hour the offshore reefs may be smoking with spray and the rocks throwing great billows from their shoulders". Whilst Coll and Tires broke the storm the "remnant which survives is sufficiently severe". Although the crofter stated the storm would blow out during the night it was stated "the rising tide will bring in heavy water" and he also stated how the storm directly affected his hunting plans due to the

1932 3 to 5	1	Irish Sea, Lancashire, Cornish Peninsula, Celtic Sea	The Guardian & The Observer	04/01/1932 - 11/01/1932	2	<p>storm's affects on geese activity. The storm bringing with it torrential rain and a great surge "blew itsself out with the stars" leaving only the rough sea as it's memory. On the abatement the host humuorously stated "But it will be raining on Mull" before going off to hunt wild geese which he had initially predicted would be active following the storm.</p> <p>2. Official gallantry. A storm was believed to have resulted in the loss of two men in the Ribble Estuary who were transferring between vessels and were swamped in very heavy seas and strong winds from the SW drowning both men. Lifebuoys were flung out and a search was carried out but it grew dark and all hope was lost. Both men were experienced and married. The storm also brought torrential rains to the North and SOuth Wales and prevented many vessels fromt he Royal Navy Atlantic Fleet from beginning their spring cruise. An SOS was recieved at Plymouth of a distressed vessel off the Devon coast and a Battleship waiting to come into port was ordered to render assistance. A cruiser Exeter later went to stand by the disabled vessel. She was later towed in by a tug. The Salcombe lifeboat was also out in response to distress signals from a freighter off Prawle Point and the Torbay was also launched however the fregither escaped it;s "heavy battle against wind and seas" without assitance. The AA reprot from Nothern England warned of great floods on roads all around the NORth-West and North Wales which retarded travel significantly. A vessel also encountered the gale and had a terrific struggle in the Celtic Sea. A SOS was sent out and the Plymouth and</p>
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1932	14-17	1	Irish Sea, Mersey	The Guardian & The Observer	15/01/1932 - 18/01/1932	<p>Brixham lifeboats were put out but the vessel weathered the gale "by very fine seamanship".</p> <p>Minor damage. Official gallantry. The steamer Camlough was caught "in a severe gale in the Irish Channel" and drifted helplessly until she was blown ashore in Wigtownshire and two lifeboats went to her assistance rescuing all men. On the 16th the meteorological correspondent stated "last night gave one of the worst gales of the winter, and it spread to all parts of the British Isles". 78 mph and 73 mph were reported in the Scilly Isles and Tiree. Gales and thunderstorms were widespread felt at Pembroke and Chester with rainfall generally heavy in the North-West and North Wales. The depressions brought such winds that 51 steamers were forced to shelter in Ramsey Bay from the South-Westerly winds with steamers unable to call at Douglas. The intense "cyclonic activity over the North-East Atlantic" was responsible for the "boisterous conditions" as violent gales repeatedly swept over the country. Interestingly it was noted "the high winds themselves were largely responsible for the mild "heat waves; that accompanied and followed them, for the warm air, blown at high speeds had little time to cool on its journey to this country from the South Atlantic". Gales and torrential rain raged in the South coast of Scotland but no major damage occurred. "Messages from British ports last evening indicate that shipping arrivals before the end of Free Trade were well above normal. A heavier rush had been expected but adverse weather conditions checked it". In the Mersey 42 vessels entered compared to 20 but that would have been</p>
1932	30-31	2	Cornish Peninsula, Mersey, Celtic Sea, Irish Sea,	The Guardian & The Observer	01/03/1932	

			Glasgow, BristolChannel						
1932	7 to 8	4	Liverpool Bay, Cheshire, Lancashire, Western Scotland	The Guardian & The Observer	08/04/1932				more it was thought, had it not been for the gale. In Bristol many vessels found themselves "without hope of reaching port in time" due to the storm and were still out at sea "having a pretty rough time". Minor damage. Impromptu gallantry. As dawn broke on th 7th a gale spread across the British Isles from the Scillies to Edinburgh with snow over Scotland and the North-West. Gusts of 72 mph were noted at Chester with simiarl figures at Holyhead and Holyhead. A trawler to Fleetwood had to be taking in tow of another after struggling against rough weather near Belfast. SOS signals had been sent out and a vessel stood by to ensure the safety of the other. A liner was also forced ashore in Rothesay Bay after being driven ashore but little damage had been down. A thundestrom over Chester hit the electrical station and part of the city was short of electricity for a while.
1932	11 to 17	4	Irish Sea, Hebrides, Celtic Sea	The Guardian & The Observer	19/04/1932				Minor damage. Two Norwegian steamers arrived in Cork having encountered a fierce Irish Sea storm. One vessel had sailed from South Wales and had been swept by heavy sails. Another had fought the gales round the Hebrides and run into heavy storms with the trawler battling storms for weeks as "heavy seas continually sewpt over the vessel, washing her from stem to stern". The saloon was flooded and food was hastily snatched.
1932	4	7	South-West Scotland	The Guardian & The Observer	05/07/1932				In a thunder and lightning storm six holiday-makers were struck by lightning at Gourock and were thrown to the ground. Four were badly burnt and the falgpole splintered.
1932	22	7	Cheshire, Wirral	The Guardian &	23/07/1932				Heavy rain storms came to the British Isles as a shallow storm centre moved across the islands into the North Sea.

1932	19-21	8	Irish Sea	The Observer The Guardian & The Observer	22/08/1932	<p>Rainfall was heavy at Wallasey reaching 0.59 inches which was an "outstanding exception" as the temperature dropped across the North-West.</p> <p>Minor damage. A large storm enveloped the Irish Sea causing torrential rain and minor flooding in the North of England. The storm stretch from Southampton to Edinburgh with some of the worst of the storms being felt in Cumberland. "Lightning flashes illuminated the streets for several seconds at a time and in Carlisle the bus accommodation was taxed to its utmost with crowds of people anxious to get home during the storm". Electric lighting failed in many places after lightning impact and candles had to be used in the emergency. Telephone services were widely interfered with in the Cumberland area from Barrow to Carlisle. Several workers at the telephone exchange complained of receiving electric shocks caused by the lightning and many would not answer their calls for the fear of conducted electricity shocks.</p>
1932	3 to 4	9	Irish Sea, Liverpool, Lancashire	The Guardian & The Observer	05/09/1932	<p>Minor damage. It was remarked September had "come in like a March lion" with high winds reaching gale force being felt on all coasts. Several Atlantic liners were unable to leave Liverpool for over 24 hours owing to the storm conditions. Manx steamers received a buffeting in the Irish Sea as they left Heysham barely getting out into the open sea "when a terrific wave pounded in the hatch covering of the first-class lounge and saloon, into which the water rushed in torrents. Heavy seas swept the ship rendering repairs difficult and the ship's journey was much delayed. The West End Promenade was flooded at</p>

1932	10 to 11	9	Irish Sea	The Guardian & The Observer	12/09/1932		Morecambe by the storm surge at high tide. Liners bringing important government officials from Canada also chose to divert from Plymouth sailing instead to the safer port of Southampton. The inter-city Liverpool-Manchester air race was won by Flight Lieutenant Comper who fought a fierce gale from the West as well of the competition as the light aircraft recieved a severe buffeting. Minor damage. A gale swept the South and West coasts of Britain with the Air Ministry reporting gales reaching 60 mph at Liverpool although the Irish boat-trains in the Irish Sea ran largely to time. It was reported a steamer had been driven ashore on the Isle of Lewis and distress signals were sent up but the crew got ashore in their own boat. The rocket apparatus was sent by the coastguards but not required and as the vessel was on an exposed coast it was thought to "become a total wreck".
1932	13-14	10	Cornish Peninsula	The Guardian & The Observer	15/10/1932		Minor damage. A severe gale was felt in the English Channel and Celtic Sea with the wind rising to 70 mph in the Scillies. The rapid change in conditons was caused by a depression centred west of Ireland movng east which brought the strong winds and rain to the South. At Falmouth 1.38 inches fell and 1.42 fell at Penzance. A Fleetwood trawler was disabled in the Irish Sea after striking a submerged object and two trawlers came to her assistance.
1932	17-18	10	Liverpool Bay, North Wales, South-West Scotland,	The Guardian & The Observer	19/10/1932 - 22/10/1932	3	3. Minor damage. Official welfare. "Hurricane velocity of 78 mph was recorded at Liverpool" during an intense gale. The wind "Increased with startling rapidity" before a gale enveloped the north-western seaboard. The South of Scotland and North-West Engand and Wales were most

			Cumbria, Irish Sea			affected with wind speeds above 56 mph being recorded across the region. Rainfalls reached 0.75 inches in many areas in the North-West. A "vigorous storm centre" moving eastwards over the Atlantic, southern North Sea and the Baltic was responsible for the conditions. A "St. Luke's summer" followed the storm which referred to the fine weather after the October storm. On the 21st there was also an extract entitled "Rural Doctors Devotion" referring to the efforts of various doctors to see certified patients in the Hebrides. On one occasion a doctor had travelled twenty miles by road and after boatmen declared the sea too rough the doctor had rowed to the island himself only returning home at 4 am. On another occasion a fishing smack was procured and manned by four men who took a doctor to a patient on distant island. Not only was the boat wrecked but "the doctor, though soaked with water, saw the patient, who had had a minor epileptic fit". It took him three days to get off the island staying in a small house with there being no hotels on the island. A fishing vessel was found drifting off Whitehaven having broke from her moorings off Wigtownshire. In trying to secure the boat three men rowing out drowned and the boat continued to drift.
1932	29-30	10	Liverpool Bay, North Wales, South-West Scotland, Cumbria, Irish Sea	The Guardian & The Observer	31/10/1932 - 01/11/1932	1. Major damage. A gale accompanied by heavy rain and hail swept over the Isles with a maximum of 75 mph being recorded at Holyhead. Off Cornwall a "thrilling rescue of a shipwrecked crew was enacted by the life-saving brigade of of St. Agnes with three shipwrecked men being pulled up the face of a 400-foot cliff. Huge waves broke over the ketch and the men jumped overboard and with the aid of

the rocket line were able to scramble to a rocky ledge from which point they were drawn up. The ketch was "smashed to matchwood" by the time the final man was rescued. The White Star liner Britannic was held up at the Mersey Bar and embark her passengers onto smaller boat there owing to the fury of the storm and sea state on the Mersey. Storm surges did great damage on the coasts of the North-West and North Wales with the sea breaking over the whole length of the North Promenade at Llandudno. 1. Moderate damage. Official gallantry. Shelters were smashed and seats flung up and churchgoers were unable to attend a service. All transport was suspended and an electric fuse box smoked. The fire tender drove through the floods but was not needed. "Great Ormer Nearly an Island" such was the level of storm surge of inundation with the sea entering basements of some properties. The Colwyn Bay promenade was also torn up and property badly damaged and "one large motor-boat was lifted and left stranded in the centre of the promenade". "Great waves crashed on to a length of walling which had been undermined by previous storms" and this gave way causing iron and concrete to be fall into the sea and the sea to breach the structure flooding the Penrhyn Bay golf course and tram track. High quantities of sediment were deposited on the tramlines which had to be cleared by a gang of men. A breach was also made in the Abergele and Towyn sea wall with the railway being flooding to a depth of two feet. In one place the water was up to the train firebox. Flooding was widespread with the Kinmel Bay Post Office being inundated and the Rhyl

1932 27-29	11	Irish Sea, Western Scotland, Liverpool Bay	The Guardian & The Observer	28/11/1932 - 29/11/1932	<p>promenade gardens were completely underwater as water entered a hotel and other buildings. The Llandudno lights also failed when the electric light supply was flooded leaving areas in darkness. At Liverpool and "Unknown youth was blown off the wall at the Gladston Dock into the river and drowned". A skipper of a trawler enacted a "daring feat" in the gale when rescuing another traler from being wrecked off Rathlin Island, Nrothern ISland. The sea was so large "she was lifted up on one huge wave, a nd when she struck the trough tthe impact smashed her rudder to pieces" and driven towards dangerous rocks. She signed for assistance via the wireless and she was saved thanks to the gallantry of another trawler. The captain of the rescuing tralwer stated "to thow a line aboard appeared utterly impossible in such seas" however it was "our last chance of saving the trawler with darkness approaching" and the vessel manoeurved within yards of the stricken trawler despite if "we had collided we ould oth have gone tothe bottom".. A tow rope was fortunatley established and the men and vessel saved. It was remarked the skipper's "daring expedient of running alongside the rudderless vessel in a gale was loudly praised by the Wigan's crew".</p> <p>Minor damage. Official gallantry. Lifeboat and Coastguard. A Fleetwood trawler was eight hours at sea in a gale near the dangerous sound of Islay as the gale force winds swepth the entire British coast. The crew were rescued by the ocastguard rocket apparatus and the Campbeltown lifeboat deployed after receiving an SOS but was not needed. The lifeboat was "frequently driven off her</p>
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1932 17-18	12	Lancashire, Cumberland	The Guardian & The Observer	19/12/1932	<p>course by large waves" and the trawler wa left high and dry on the Islay rocks by the storm surge. The lifeboat crew only found out some hours later the crew had been rescued by rocket apparatus. Salvage men had been sent from Fleetwood. A liner dragged her anchor in Greenock while the gale was at it's height and passengers were being disembarked forcing tenders to chase the ship down the Firth of Clyde. A vessel was driven ashore in the Sound of Islay and a steamer laid up at Rothesay Bay until a tug secured her. Liners were also held up on the Mersey Bar and couldn't land their passengers at the landing stage for several hours due to the sea state. In the North Wales barricades of sandbags were erected to protect the pumping station at the drainage outfall works of the Conway Rural District Council at Penhryn as a storm surge had been anticipated and the sea wall was breached several weeks before by a storm surge causing coastal flooding. All Irish Sea steamers were retarded by the gale and the mountainous seas and were late reaching Belfast. Moderate damage. Official gallantry. Official welfare. Impromptu gallantry. Torrential rainfall caused serious flooding in Cumberland and the South of Scotland rendering many roads impassable and causing great damage to agriculture. In Maryport two houses were flooded to a depth of 5 feet when a steam flooded the surroudnign area and the residents were conveyed to safety in lorries. Rescue work began in darkness and in a 30 mph gale as sheets of rain fell. Local footballers carried women and children on their backs to a local schools which served as a distress centre where a canteen was</p>
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1932	26-27	12	North Wales	The Guardian & The Observer	28/12/1932	<p>provided and fire lit. Police came with two lorries and "ladders were erected to upper windows to rescue old people and children and to pass up cans of hot tea". At the coal depot two horses were led out of their stables with only their heads showing and coal carts were completely submerged and Christmas parcels ready for delivery were floating about. Relief was obtained by breaking a hole in a wall and allowing a local football ground and adjoining land to flood. Two hours later the floods subsided to three feet and most families were able to return home. At Carlisle the River Eden overflowed its bank and "Carlisle Memorial park was like a huge lake" and the cricket ground was also submerged. At Loughtown the flood of the Esk was one of the highest know in recent years.</p> <p>The Barsey Islanders off South Caernarvnshore could not corss to the mainland for their Christmas mails owing to stormy weather and thus a large amount of mails awaited them. The president of the isle had taken ample winter supplies over with them 2 weeks previously so food was not an issue for the 45 residents and this issue of Christmas mails not being recieved due to stormy weather was a common one.</p>
1933	31 to 3	1	South Wales, Liverpool Bay, North Wales	The Guardian & The Observer	02/01/1933 - 04/01/1933	<p>Moderate damage. Official gallantry. It was remarked that a "most intense gale" spread across the British Isles. At Towyn the force of the wind was such a train from Barmouth to Towyn was brought to a stop by the force of the wind. Men working on the Barmouth sea defence had to stop work and railwaymen were kept busy clearing sand depoisted by aeolian and marine means from the</p>

railway line. The sea swept over the Protmadoc emankment drenching walkers and giving bus passengers and other motorist huge excitment. A man on a ladder was knocked off and fell from a great height sustaining severe head injuries. A steamer dragged in Holyhead Harbour and was in danger of being wrecked and the coastguard stood by but were not required as a Trinity House tender went to the rescue and towed the vessel to safety. The gale was severely felt on the English Channel with the breeze from the South-West and driving rain making visibility diifficult at sea. WInds of 71 mph were recorded at Holyhead and 65 mph at Eskdalemuir. The gale "Brought with it unusually mild weather, with temperatures in all districts of 50 degrees F and hgiher on the West coast. The depression was so immense that it extended "right acorss the Atlantic to the American coast and southwards to the Azores". In Aberdoey two large trees were blown down by the wind across the road and telephone lines were broken. A man on a motorcycle was stopped such was the force of thw idn. Teh River Dovey was in flood and much damage had already been done. The Dee, Wye, Severn, Clwyd and Conway were in full flood. A car fell into a stream carrying the grandsons of a Lord and Lady and only the "great presence of mind" of the chauffeur saved the boys who escaped from the rapidly filling car and changes of clothing were found for them by the nearby crofters. They had only traversed the bridge as Loch linnhe was too stormy to traverse to Congalen house. Over 300 sheep drowned in the River Nith when it broke it;s banks in Dumfires. The village of

<p>1933 23-26</p>	<p>2</p>	<p>Liverpool Bay, Caernarvon Bay, North Wales, South Wales</p>	<p>The Guardian & The Observer</p>	<p>25/02/1933 - 27/02/1933</p>	<p>Kirkton was inaccessible for several houses due to the flooding of 5 feet and an ill man lay in bed as the waters lapped around him. Two farms were vacated and a bridge washed away by the torrential storm rain. Major damage. Official damage. The Hoylake lifeboat was launched in a "Blinding snowstorm when two young brothers were seen to be in difficulties after the sail of their small boat had been blown away". They beach on East Hoyle and were able to get ashore without aid. The meterological corespondent in the Guardian remarked it was the "worst storm since 1927" has hevay snow falls were widespread and windspeeds of 69 mph were recorded at Holyhead and snowfall was heaviest "est fo a line from Liverpool to Weymouth" with 2 feet at Swansea and 4 1/2 at Liverpool. The AA issued widespread warnings for travel due to snow and ice on the raods in the North of England. Wales bore the brunt of the storm with the North in particular feeling to full affects of the blizzards with the fall being "On of the heaviest within living memory". Communication services were largely delayed and disroagnised and many small towns and businesses were at a standstill. Mainline trains from Llandudno Junction were suspended and delayed as a result of the pints freezing and the Irish boat with mail was several hours late to leave Holyhead due to the delay. In the Llyn Peninsula there was a wholesale suspension of bus services and coastal transport services were maintained with difficulty. A storm surge at Rhos-on-Sea caused widespread coastal flooding of the promenade and business and shops were cut off for an hour. Some by-</p>
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roads off the coastal routes were "snowed up hedge high" and snow found its way inside the new tunnel at Penmaenach. Many individuals who relied on car or bus took the train or the day off and school children in Caernarvon were sent home. At Portmadoc a bus and a car were involved in a collision which resulted in severe injuries to the car driver who went through the windscreen whilst several bus passengers were very much injured by flying glass. Cardiff was without trains as the railway and dock work was suspended by the snow fall causing much anxiety especially as telephone communications were also retarded. 5,000 miners were out of work and 4,000 lambs and sheep were buried causing much anxiety to shepherds who spent all day trying to dig them out. A Great Western Railway passenger train from Barmouth ran into a snowdrift near Tonfanau and was trapped for several hours. Railway services throughout the North and West. The Barmouth Junction station was badly damaged and huge trees were blown across the main roads near Harlech and Barmouth roads. The RAF flying boats made an emergency landing at Porthdinlleyn, Caernarvon Bay when they were purposefully beached to prevent them being swept out to sea". They had been flying from Stranraer and had met with "bad flying conditions when they reached the Welsh coast and eventually were forced to land" in the "teeth of the gale". Sixty children were missing near Neyland and were presumed stranded and could not be contacted owing to the telephone situation.

1933	15-17	3	Cornish Peninsula	The Guardian & The Observer	17/03/1933 - 18/03/1933	Minor damage. Heavy gales, strong winds and heavy rain visited the British Isles causing havoc in a 1,000 mile motor race in which many drivers didn't finish with one ending up "enmeshed in the wire entanglements of a "no man's land" after running into the wires of a telegraph pole which had been blown down. Cornwall and Devon received the heaviest rains in general with St. Ives and Penzance receiving a max of 1.54 inches and 1.14 inches in 24 hours.
1933	21	5	Lancashire	The Guardian & The Observer	22/05/1933	Minor damage. The Lancashire golf championship was suspended by 2 hours owing to a "heavy downpour of rain" with players and followers alike being forced to dash for shelter if hole.
1933	17-18	6	North Wales	The Guardian & The Observer	19/06/1933	Minor damage. It was remarked "June 'borrowed' two days from March" as "bitterly cold winds of gale force and heavy falls of rain during the squalls" hit Britain. The Rain was such in North Wales the River Dee rose three feet.
1933	7	7	North Wales, Lancashire, Merseyside	The Guardian & The Observer	08/07/1933	Minor damage. Storms were felt over much of the British Isles and in North Wales horses and sheep were killed near Colwyn Bay when they struck by lightning. Blackpool Tower was also struck and the "flash was seen to encircle the tower's nest and travel down the pillars to the bottom of the lift well". An official stated that there was not "the slightest risk in a thunderstorm, as the Tower itself was a conductor and broke the shock of any flash". The tramcar service was held up for nearly an hour by the storm and one or two occupants needed treatment following a shock. A high power cable was struck over Fleetwood and fuses were blown out near Kirkham and tram services were stopped. Two buses were hit and a schoolboy who

1933	21	7	Fleetwood	The Guardian & The Observer	21/07/1933	<p>had run for shelter found his bike a twisted heap of metal on his return. Lightning damage also was sustained by houses in the area and at Morecambe lightning damaged a flagpole and plate-glass window. The storm was equally severe in Merseyside and North Wales with lightning damaging telegraph cables and fires occurred in Birkenhead. At Chester the pinnacle of a church was struck and broken off.</p> <p>At Fleetwood the lack of gale at high tide was said to be causing an issue as the "supplies of gravel on the beach have become seriously depleted". The revenue derived from beach gravel which "the rough seas of Morecambe Bay so obligingly throw up on the beach" had resulted in a £50,000 profit for the ratepayers of Fleetwood and made it possible for the local council to provide extensive amenities for visitors without increasing taxes as the gravel was sold for roach construction and building purposes throughout the area.</p>
1933	27-31	7	North Wales, Liverpool Bay, Lancashire, Cumbria	The Guardian & The Observer	28/07/1933 - 02/08/1933	<p>Minor damage. Official gallantry. Official welfare. A gale which "attained a velocity of 60 mph sprang up on the Fyde and Wirral coasts" causing inconvenience to steamers and some damage to the Marine Gardens whilst a vessel was lost off Hoylake. A Manx steamer had difficulty entering Fleetwood and had to land in a more sheltered place than usual but no damage was done and no alarm raised. Special expresses in the forms of boats and trains had to be put on for passengers to reach their destination. In the Marine Gardens on the Wirral a sand storm covered the areas as the dunes were battered by the gale and all recreational activities postponed. A small steamer</p>

sunk off the Wirral and the Hoylake lifeboat went out through heavy seas to aid the crew although the crew had already been rescued. Two men were taken to the local hospital and treated for shock before being transferred to the sailors' home. The captain declined hospital treatment. A fire broke out on Morecambe pier resulting in £60,000 worth of damage as the entire pier was completely enveloped by the flames. The ballroom, skating-rink, cafe and shops were all destroyed. Only one person was on the pier who escaped without harm and tried his best to work the emergency fire hydrant but failed leading to the fire growing to an extent flames 100 feet high covered the scene. The sparks were blown into the town and caused several small fires which did little damage. Valuable help was given by volunteers who carried every imaginable object to safety. It was remarked it was particularly disastrous as the "Piers just about pay for themselves up to the end of July ... then we expect to make some money. This is a disaster for us and for Morecambe". It was remarkable he stated, that lessons hadn't been learnt after similar disasters at Morecambe and Southport. Much damage was done to marquees and tenets at Blackpool and the surrounding district with many campers finding their tents missing or destroyed. Crops were badly damaged and a steamer from Liverpool to Llandudno met such heavy seas it had to return. Winds of 67 mph were felt at Liverpool and across the Irish Sea the seas were very high which damaged the Manx steamers who bravely fought the elements and several passengers aboard were injured on one steamer and first

1933	13-14	8	South-West Britain, North Wales, North-West England	The Guardian & The Observer	14/08/1933 - 16/08/1933	<p>aid had to be rendered and cabins were flooded. Three lifeboats were deployed to distress calls one of which was near Penmon when a small boat got into trouble but the passengers waded ashore and left the boat.</p> <p>Minor damage. A thunderstorm accompanied vivid flashes of lighting broke over Colwyn Bay and "after a tremendous thunder-crash all the electric lights in the vicinity went out as rain fell heavily. Plymouth likewise endured a severe thunderstrom with telephone communications being much inferred with and motorists were held up when the storm was at its height. The meterological correspondnet noted that several towns in the North-West and North Wales recieved a downpour of rain with 0.36 inches at Ehyl and in the South-West 0.83 inches was noted at Exmouth. Several tents belonging to a military camp were blown down by a gale in Pwllheli. The officers had to "hurry out and pull on the ropes until help arrived" to secure the main marquee from being blown away.</p>
1933	28	8	Blackpool	The Guardian & The Observer	29/08/1933	<p>Minor damage. Official gallantry. A violent storm was felt at Blackpool which received a torrential rain to the extent "many districts were flooded to depths varying from one to four feet". Roads became impassable and many properties were flooded with many people rapidly deploying sandbags to prevent inundation. Nevertheless in some houses water poured in and residents were forced to escape upstairs as furniture floated around below and a large lake formed in a town square making it near impossible for any form of transport to operate. The flooding caused shock amongst many people who</p>

1933	27-29	10	Skye	The Guardian & The Observer	30/10/1933	<p>returned home to flooding and many called on the authorities for assistance although the floods and rains rapidly subsided.</p> <p>Minor damage. Northerly gales struck the Hebrides and Isle of Skye forcing a steamer to strike rocks on the entrance to Broadford Bay, Isle of Skye. She managed to limp ashore and was purposefully run aground and was found to be leaking heavily.</p>
1934	6 to 18	1	Lancashire, North Wales, Cornish Peninsula, Firth of Clyde, Irish Sea, Bristol Channel	The Guardian & The Observer	08/01/1934 - 19/01/1934	<p>Major damage. Official gallantry. Impromptu gallantry. Severe injury. "Heavy rain brought relief to many rural areas which have been suffering severely from water shortage" as storms hit the British Isles bringing with them gale force winds. The River Conway was brought to flood level and a nearby lake rose 3 feet. The Ribble and Hodder were reported to be very high following the rainstorm and the district reservoirs were replenished. It was noted the storm was to enhance the issues surrounding fish shortages in the Irish Sea and "famine prices for all kinds of fish" prevailed due to ongoing temptous weather in the Atlantic. One trawler had voyaged 700 miles for only 6 boxes of fish and one of the crew was seriously injured and major damage sustained. Medical attention was obtained at Stornoway and "continuous gales made fishing almost impossible". However the gale had the opposite effect at Plymouth where after a poor season 1,500,000 herrings were landed which was the largest catch in 12 months. The gale was stated to have disturbed the fish near the seabed and "working in the teeth of the storm the fishing fleet reaped a rich harvest". One trawler did sustain great damage and loss of nets valued at £120</p>

and many were forced to return owing to the storms fury on the 14th however. Ashore many slates were ripped off the roofs of houses in Plymouth. Passengers arriving from Atlantic voyages stated they had very rough voyages as "Huge sea swept over the liner, smashing the portholes, bending the iron rails and stanchions, and damaging furniture and crockery" in the East Atlantic and Celtic Sea. A distress signal was received by the Plymouth lifeboat who deployed to search an area 10 miles off the coast and although no vessel was found it was believed, from the tale of a trawlerman, to be a Danish yacht just 30 feet in length who had declined assistance in the mountainous seas. On deploying two members of the Plymouth lifeboat was washed overboard and it was remarked by a crew member "It was one of the worst experiences we have had in recent years. We were very lucky to come back with all our crew". Both were treated in hospital. It was also reported that two men were seriously injured on the Dubh Artach Lighthouse but the storm which resulted in "waves 30ft high ...beating on the rocks" made it impossible to render assistance. The men had been injured when preparing the derrick to land supplies before a huge wave swept over them and dashed the men against the rocks and one of the men had a fractured leg. In Glasgow trees and chimney pots were widely blown down and the storm prevented many trawlers from leaving port. At Eskdalemuir 62 mph was noted and 54 mph was recorded at Liverpool. The storms were a result of "rather vigorous depressions" which skirted the western coasts of Ireland and Scotland bringing mild air from the

Azores. Rainfall relatively heavy with a maximum of 0.43 inches being recorded at Fleetwood whilst 2 inches were recorded over a 48 hour period at Eskdalemuir. "Owing to the severity of the gale in the English Channel the Cunard liner Mauretania" had to abandon her attempt to land at Plymouth and instead proceeded directly to Cherbourg. The storm weather also cut off the inhabitants of Bardsey from the Ilyn peninsula once again and the head mistress of Bardsey School was unable to return from the mainland so the children had an extra week's holiday. In the Bristol Channel the gale was remarked as one of the worst for a long time with hoardings and walls blown down in Cardiff and the countryside was "strewn with snapped tree branches". On the 16th snow fell over large parts of the Lancashire and the North-West and the Duke of Gloucester travelled 30 miles in a heavy snowstorm. The gale renewed on the 17th and storm conditions on the Mersey caused a barge to break loose and sink whilst being towed into the Mersey. Nine members of the crew of the Royal Navy destroyer Wolfhound were in great peril of being swamped in the Firth of Clyde when their pinnace was blown across the bay. Although they were rescued by the destroyer who was forced to simply give it shelter as conveying the men aboard was impossible in the storm. A steel-screw trawler when ashore in Whitsand Bay near Plymouth and nine men were rescued by breeches buoy wholsearchlights from the Plymouth lifeboat assisted the operation. The trawler remained fast on a ridge of rock. Distress signals were fired and the "little Cornish village of Rame summoned the life-saving corps at Rame Head" to a

1934 14-18

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Irish Sea, North
Wales, North-
West England,
South Wales

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rough pathless cliff top to enact the courageous operation. A vessel was also driven ashore near Workington on the north bank of the Derwent after her steering gear broke and she was rendered disabled. The Maryport lifeboat saved all included one man who fell into the sea whilst jumping from the steamer. It was expected she'd be totally wrecked. "Exceptionally high tides on the west coast, backed by the gale, caused huge waves to break over the promenades at Lancashire resorts and Llandudno also suffering flooding from the sea". The Clyde also overflowed causing flooding in low-lying Glasgow and Renfrew areas. Considerable damage was sustained by the CSouth Caernarvonshire fishing fleet out of Pwllheli and hundreds of acres of land were flooded near Pwllheli were rivers overflowed. Trees were widely uprooted and many of the new lambs did not survive. Many steamers sought shelter in St. Tudwall's Roads near Abersoch for several days. Near Rhu, in the Firth of Clyde two liners lying in Care Loch dragged their anchors and were nearly blown ashore and electric cables were felled by trees. A large oil tank was blown into Gare Loch and several trees were blown down on the banks of Loch Lomond. Moderate damage. Voluntary gallantry. Official gallantry. A heavy south-easterly gale caused great concern to a Isle of Man steamer traversing the Irish Sea which could not land at Douglas and was instead forced to land at Peel. The Midland and Scottish air service which opened on the 14th could not call at the Isle of Man owing to the fury of the gale and instead proceeded from Belfast straight to Liverpool. A vessel under tow in the Irish Sea was forced

1934	31	12	British Isles	The Guardian & The Observer	02/04/1934	<p>ashore onto rocks off Cardigan Island although the four men aboard managed to scambled ashore and were later rescued by the Gwbert on the Sea voluntary rocket service. Two lifeboats were deployed but were not required and one crew memeber was washed ashore when a huge wave swamped the lifeboat and he was "rescued after much difficulty and was unconscious". On the 15th the gales in md Wales shifted to the south-west and the River Doverly rose into flood. The Great Western Railway line was flooded at Aberdovey and the main roads on the coast were inundated by storm surge. The Royal Automobile Club's 1,000 mile rally took place in "gruelling conditions" and two female compeitiors got into arrears when their car was overturns near Bristol when she swerved to dodge a dog and promptly crashed into a wall. Both were seriously injured and taken to hospital and many other drivers wereun accounted for. Snow chains were advised for motoriss in the North-West whilst there were 2 1/2 inches of snow in North Wales and 6 inche sin South Wales on the roads. A strong north-westerly gale prevented ships docking at Liverpool and there were frequent rain and hail sotrms in the area.</p> <p>A summary of the weather for the winter of 1933/34 focussed on the "ramrkable lack of rainfall with as "november gave England and wales only 59 per cent of its average raingall, Decmeber 29 per cent, and Febryart 22 per cent. In November and December this was the lowest total since before 1870 when accurate records began. At Southport the month of Devenber "was the quitest since win records began in 1897, but these still conditions also</p>
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1934	6	5	Lancashire, Merseyside, Clyde	The Guardian & The Observer	07/05/1934	2	<p>helped to bring a plague of fogs". The causes of the weather was "rather far to seek" with an emphasis being placed on the large changes of pressure around the world being responsible for weather changes many months later.</p> <p>2. Minor damage. Official gallantry. Heavy winds swept the North of England and were especially violent in Lancashire and North Wales. Two yachts were in trouble off Llandudno with both being towed and assisted by the motor lifeboat with minimal human loss although one vessel was badly damaged. A vessel was also damaged and blown onto the Holyhead breakwater but her crew rescued by the local lifeboat. Three Irishmen were rescued after being swept on to the revetment wall in the Crosby Channel. The crew worked the pumps to keep her afloat and the Hoylake and New Brighton lifeboats responded to her distress plea and all were saved although the vessel was much damaged. "two people lost their lives on Saturday in an incident in the River Clyde at the mouth of the River Leven, near Dumbarton Castle" when a man and his son capsized in a small vessel. Although a strong swimmer brought them to shore the boy had drowned and the man died from shock. The lifeboat was tested at Lytham St Annes due to the questions that had been raised about the ease and safety of boarding the vessel in strong breeze. Their performance was considered satisfactory by local officials of the RNLI. The Lytham motorboat club also had to postpone their opening cruise.</p>
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1934	17	7	Lancashire, Liverpool Bay	The Guardian & The Observer	18/07/1934	Moderate damage. Official gallantry. A great storm broke out on the Flyde coast and over an inch fell in an hour at Blackpool. A fire broke out in the pleasure beach at the height of the storm thought to be caused by lightning and a miniature railway and theatre was damaged. "Flames seen 20 miles away" was the headline as thousands watched the inferno reach a height of 100 feet which made quite the spectacle. The firemen were rendered powerless by the ferocity and immensity of the inferno despite their rapid response but eventually got the flames under control and were able to largely save the theatre. The Fleetwood area also felt the storm and many acres of the town were quickly under water and the electricity supply failed. A bus nearly overturned due to subsidence in a flooded road as the wheels sank nearly 3 feet. "The screams of the passengers brought residents into the streets" and all were helped from the bus without injury. Traffic was widely in chaos. Houses were flooded all around and "occupants spent the night bailing out water" throughout Blackpool whilst Fleetwood injured a short blackout.
1934	28 to 2	8	North Wales, Lancashire, Merseyside, Bristol Channel, Irish Sea, Cornish Peninsula	The Guardian & The Observer	30/07/1934 - 03/08/1934	Minor damage. Official gallantry. Impromptu welfare. A fierce gale struck Merseyside which considerably held up international shipping with the Cunard-White Star liner Georgic being unable to leave Gladstone Dock to embark her passengers. Cross river ferries were also suspended due to the mountainous seas and a bather was rescued at Egremont by the coastguard having almost been overcome. Several light craft were swamped during a regatta and sank. Damage was also done ashore and a

<p>1934 20-21</p>	<p>8</p>	<p>Lancashire, North Wales, Irish Sea</p>	<p>The Guardian & The Observer</p>	<p>21/08/1934 - 23/08/1934</p>	<p>2 horse-drawn van was turned over but the driver escaped injury. A large plate glass window was blown out and narrowly missed a little girl passing by. The Tenby lifeboat rescued two men from a small pleasure boat drifting in Carmarthen Bay and the "rescue was witnessed by thousands of visitors to the town". Distress signals were noted in the channel and Plymouth lifeboat put out to assist during the 60 mph gale while the Bristol Channel vessels were said to be in much danger. Much anxiety was held for a three-ton yacht that had gone missing out of Torquay. Aketch was driven ashore near Barry whilst the Cardiff pleasure steamers had to abandon all trips. Near Bridgeend a girls camp was blown down but they were later catered for in a village. Streets were flooded by the torrential rain in Maryport as flood waters inundated roads to a depth of 2 feet and "ater was mounting the doorsteps of the houses when the rain stopped". Bardsey Islanders were again cut off owing tot he stormy weather and heavy seas but the supply of provisions on the island was plentiful. Very heavy winds were reported on the Lancashire coast.</p> <p>2. "Wind reaches hurricane force" was the main title of the Guardian on the 21st as the Nroth experienced "some of the wildest August weather it is possible to imagine" and 77 mph was recorded at Liverpool. The hurricane forces and velocities were "so unprecedented ... that the complete records for the past fourteen years comprising the whole of the ritish Isles show only one or two isoltated cases of August gales with speeds approaching these figures". The weather was a result of the north-eastwards</p>
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advance of a deepening Atlantic disturbance from off the West of Ireland progressing over the kingdom. Lancashire and the North felt the full force of the gale but Scotland was largely exempt from the weather which passed to the south. A woman was killed at Blackpool when she was hit by a large sign blown by the wind which crushed her and she died on reaching hospital whilst hundreds of tents in holiday camps were blown down and the campers had to face a considerable sandstorm. This was the most "extraordinary seen for years" as dense clouds of sand were blown across the promenade at the South Shore and the tram service struggled to operate. Much damage occurred along the front where buildings and temporary stands were damaged and blown down as hats of all sorts blew around in the streets. In Liverpool a child was killed when hit by a falling slate blown by the wind whilst three others had narrow escapes and two more were injured. Air services struggled in the 80 mph winds and one "suddenly dropped 300 feet in an air pocket" over the Irish Sea although no major damage was sustained by those in operation. At Morecambe a plane was blown into a wall and broke in two. Three men in a yacht were rescued by the Llandudno lifeboat and a girl and two men had a narrow escape in the Irish Sea being also rescued by a lifeboat. The Isle of Man steamer Ben-my-Chree was much damaged in the Irish Sea and arrived late at Liverpool. "The sea was so high all passengers were ordered below". Other vessels also sustained moderate damage in the Irish Sea and several vessels were compelled to return to Liverpool. A Pwllheli fishing vessel issued signals of

distress and was rescued by other fishermen who "went to his assistance at considerable peril to themselves". The vessel in distress was "tossed like a ball with the sails torn to ribbons" but it was eventually towed to safety with the skipper exhausted. At Fleetwood a serious railway accident resulted from the gale as 11 goods wagons were blown by the gale and crashed into massive crossing gates with the affect of destroying them and blocking the crossing for all traffic for some time. Many trees were blown down across Lancashire and Cheshire holding up traffic in some instances and nearly causing accidents in others. Thousands of holidaymakers throughout North Wales were caught unawares and campers were decimated retreating home from their holidays early and the Barmouth bathing tents were torn to shreds. Two men had a near escape from being crushed by a fallin tree at Abergele and the Kingstown to Holyhead race across the Irish Sea was abandononed along with the yacht race from BEaumaris to Holyhead. A large motor-yacht was also assisted to safety from a position of peril by the Holyhead breakwater with assistance fromt he Trinity House seamer and the coastguard. Many yachts belonging to the South Caernarvonshire Yachting Club dragged anchor in Aersoch Bay and memebers had difficulty in manoeuvring boats to safety whilst one sunk in St. Tudwal's Causeway. By the 21st the gale moderated with winds dropping to 40-50 mphon the North-West coast of England. Mail planes from Glasgow and Belfast were delayed by gales in the Irish Sea and on the West coast. Leisure activities including the

1934	30	8	Lancashire, Fleetwood	The Guardian & The Observer	31/08/1934	<p>circus and tennis had to be abandoned in Pwllheli although the Southport flowershow still went ahead. "Freakish weather" was noted in Lancashire and a sudden squall and downpour over the Fleetwood boating lake caused a yacht to overturn with the occupants falling into the lake although no harm was sustained despite the panic and anxiety that ensued. Lake attendants quickly came to the rescue of the distressed and towed in vessels. A woman was struck by lightning around Preston and was admitted to hospital suffering with slight paralysis of her arms. A Soviet steamer had some of her timber cargo carried away at the mouth of the Mersey. The electricity gird failed in parts of Lancashire after being struck with lightning. At Morecambe the storm did considerable damage as the storm surge flooded the promenade and streets near the front and boats were smashed to pieces whilst the illuminations were destroyed and landing stages damaged. The flooding was the most dmaaging with the cellars of a hotel being flooded and furniture ruined. The Clareendon Hotel caught the full foice of the gale which reached 70 mph and produced a huge storm tide. Many customers nearly drowned as water poured into the downstairs bar and were only saved by the swift action of the barmen as water reached their armpits. Men in swimming costumes carried pedestrians from the torrents which the roads had become whilst many were marooned by the sea water and a bus was disabled and had to be towed to safety. Fishing boats were sunk on their moorings at Hoylake on the Dee and the prpmenade and seats were smashed by the storm sugre. The</p>
1934	17-24	9	Lancashire, Merseyside, North Wales, Irish Sea, Firth of Clyde	The Guardian & The Observer	18/09/1934 - 25/09/1934	

Liverpool-Llandudno ferry had to abandon its trip due to the huge waves in Liverpool Bay. A record high tide of 31ft and 9 inches was recorded on the Mersey. The pier on the River Wyre was destroyed by high seas whipped up by the storm causing much inconvenience for travelling holidaymakers. Many houseboat owners had an anxious time on the river and were kept up all night whilst yachts were torn from their moorings and sunk. One boatowner stated "We were afraid our boat would be carried away, and with stormlamps we waded into the sea and made our craft as secure as we could". Waves covered both the Prestayn and Rhyl promenades and thousands of tons of sand was swept away from the sandhills which formed the barrier between the coast and the surrounding low land. Both promenades suffered greatly with seats torn up and strewn around the shore. The Rhyl sunken gardens were flooded and many bathing chairs and tents were carried away. At Blackpool "Mighty seas pounded" the promenade and the illuminations were put out as water flooded the entire promenade with the damage done estimated to be £1,000 to the leisure facilities. Southport shore was also damaged by the inundations and a rowing boat was driven ashore with no occupants causing anxiety. At West Kirby the storm was one of the wildest experienced "for some years" and the seafront gardens were "invaded" by the sea whilst a 12-ton fishing craft foundered and broke its back whilst other vessels sank but were to be raised the following morning. A yachtman perished battling with heavy seas in the River Dee between Hilbre Island and the Mostyn Deeps. He sailed

1934	4 to 5	10	South Wales, Celtic Sea, Cornish Peninsula	The Guardian & The Observer	05/10/1934 - 06/10/1934	<p>into Mostyn Dock and was taken exhausted to an inn where he died. William Coath was "a prominent member and ex-captain of the West Kirby Sailing Club". The gale caused some anxiety before the launch of a new Cunarder at Clydebank but it did not dampen the anxiety of the people of Glasgow who eagerly anticipated the launch of the world's largest ship.</p> <p>A "whirlwind" was noted in South Wales which swept through the South-East of the home nation and iron sheets and hundreds of slates were hurled from roofs and strewn over roads whilst trees were widely blown down. A number of chimney stacks were felled and several people had narrow escapes whilst several houses were in darkness. The roof of several houses were blown off near Llanhilleth. The intense storm caused confusion all around the Rhondda Valley where there was much damage to property. Two doctors were hauled up cliffs when their 18ft dinghy was wrecked at Rame Head. The vessel was forced on the rugged shore and their plight noticed by coastguards at Rame Head and the Plymouth lifeboat. The coastguards had already clambered down the cliff and reached the occupants and hauled them up the cliffs before the lifeboat reached them and they were unhurt by their experience. The severe gale was felt in the Scilly Isles where 54 mph was registered. An intense depression was responsible for the weather as it crossed the Irish Sea.</p> <p>A gale struck the Irish Sea and the Lancashire coast and two lifeboats were summoned to aid a vessel which was disabled and drifted helplessly with the wind. A wireless message of distress had been conveyed when the vessel</p>
1934	14-15	10	Irish Sea, Lancashire	The Guardian & The Observer	15/10/1934 - 16/10/1934	

1934	25	10	British Isles	The Guardian & The Observer	26/10/1934	<p>broke free of her tow boat and a trawler set off to assist her. After hours of searching she was eventually found by a lifeboat and contact was made before the vessel was conveyed safely to shore in tow of another tug.</p> <p>Great rains deluged the British Isles as storms swept in from the South-West of Ireland. The "vigorous and deepening disturbance advancing north-eastwards" produced the gale that enveloped the Celtic and Irish Sea coasts with velocities >50 mph being recorded at Eskdalemuir and Holyhead. Heavy rainfall of 1.57 inches fell at Eskdalemuir but only 0.1 inches fell in Liverpool however 1.85 inches were noted at Fleetwood whilst the temperatures were "unduly high" rising to a max of 63 degs F at Manchester.</p>
1934	8 to 9	12	British Isles	The Guardian & The Observer	10/12/1934	<p>A severe storm hit the North of England with tow main roads near Cumberland being blocked by trees felled by the gale. The full force of the gale was experienced in Carlisle itslef were the roof of the railway premises was blown off. 50 mph gales were noted at Merioneth and seas lashed against the rocks and at Llwyngwriil sea spray doused the train from Dovey Junction. A motorist had a narrow escape near Machylleth when a tree nearly fell upon him. Rivers overflowed their banks across North Wales and many miles of arable land were flooded. At Pembroke 64 mph was recorded whilst a hurricane speed of 75 mph was recorded on the Lizard with 61 mph being reocrded at Liverpool and Holyhead. "A country diary" from Cumberland told of the heavy south-westerly gale in the Solway describing the "immense flocks of oyster-catchers and dunlins stood facing the wind". How birds</p>

1934	25-26	12	Western Scotland, Outer Hebridies, Irish Sea, Lizard	The Guardian & The Observer	22/12/1934 - 27/12/1934	<p>"hovered over the sea for a few seconds like a huge umbrella" in the storm.</p> <p>Moderate damage. Religion. During a fierce storm a vessel bound to Barry experienced grave conditons in the Celtic Sea losing her steering gear and the ship's officer sustained serious injuries. An "Arab seaman, with the ceremonial attached to the religious rites which he observes, broke a live chicken;s neck and threw the body overboard with a prayer for deliverance". The skipper slept for one of eighteen nights during the Atlantic crossing which was the worst he had ever experienced in his 45 years at sea. It was stated "most places on the western coasts from the Lizard to Stornoway experienced gales on Christmas Day". In Lochaer the "worst windstorm since January 1927" was recorded and the streets of Fort William were littered with fragments of slates and chimney pots as well as smashed windows. At Torlundy fallen trees and telegraph poles made roads impassible whilst a family were forced to abandone their beds as their roof was stripped by the wind. Many fishing vesselsin the ports of the West Highlands were stormbound and the "islands of Coll and Tiree were isolated" whilst the mailboat could not reach Oban. A Manx steamer was unable to leave Douglas due to the sea state in the Irish Sea and heavy rain fell.</p>
1935	12 to 13	1	Irish Sea	The Guardian & The Observer	14/01/1935	<p>2. Minor damage. A gale swept over the Irish Sea and two lives were lost aboard a Cardiff trawler when two hands were swept overboard and she arrived at the Cardiff Docks "with her flag flying at half-mast". The gale lasted for more than 12 hours and the captain told the reporter</p>

<p>1935 25-26</p>	<p>1</p>	<p>Irish Sea, Pembrokeshire, Liverpool Bay, Lancashire, Western Scotland</p>	<p>The Guardian & The Observer</p>	<p>26/01/1935 - 28/01/1935</p>	<p>that "it was only by a chance that the boat did not go down". Large waves swept over the vessel and the two men were carried off the deck by a huge wave and not seen again. In Portmadoc the sea swept over the Ffestinog railway embankment stopping all traffic and soaking pedestrians. Fields on the banks of the Dee were also flooded by the torrential rain. Merseyside was swept by a 70 mph winds during the blizzard and a Cunard White Star liner was delayed by 14 hours in sailing from Liverpool whilst three children fainted in the cold. The meterological correspondent noted the cold northerly winds brought occasional snow showers to the North-West whilst the heaviest snowfall was at Eskdalemuir at 4 1/2 inches. Milder winds from the South-West started to fill in leading to rising temperatures in the South-West. Minor damage. Official gallantry. Scientific insight. With a full cargo of passengers and mails the Fleetwood Corporation ferry steamer went ashore in the Wyre Estuary as despite the "prompt efforts of her crew" she beached on a sandbank and was left high and dry when the tide receded. All services were completely held up across the Wyre causing much inconvenience to ferry passengers. A pilot boat got into extreme peril in the Mersey when it's steering gear broke and after a great struggle it was brought alongside the Crosby Lightship. Both the Hoylake and New Brighton lifeboats were deployed in assistance and stood by until the pilot boat was towed away. A barge carrying grain sank in the Mersey and the crew were rescued whilst liners were unable to leave dock. Much anxiety prevailed amongst the</p>
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wives and children of the men of the Hoylake lifeboat which was reported "lost" after the crew did not respond to the recall rocket and no communication could be established with the bar lightship via wireless. After five hours the anxious wait prevailed until she was sighted off Hilbre Island and then landed two hours later. The coxswain was "lashed to the wheel" and reported "It was one of the worst trips I have ever experienced. We could not see anything for mountainous seas which swept over us. Fortunately, the boat behaved splendidly and emptied very quickly, but time and time again we were drenched by the seas" but all the crew were in good condition. The storm was described as being of "Arctic origin" and rose to "the hurricane force of 86 miles an hour at Liverpool" and in many places exceeded 60 mph. Snow and thunder were reported as three inches fell at Eskdalemuir and the gales spread from Western Scotland across the British Isles. At Pembroke 74 mph was noted and 65 mph was noted at Sealand as well as 62 mph at Hoylake. The "common enemy" was cited to be "the same depression as had given intense cold and heavy snowfalls" across North America. This was later described by the meteorological correspondent as a "popular fallacy" as "No cold wave moving eastward across so extensive a stretch of relatively warm water could survive long enough to reach our shores. Rigorous weather in this part of the world comes sometimes from Greenland, sometimes from the Arctic regions, sometimes from Scandinavia, Central Europe, or Russia; never from the west". On the 26th the headline read "Britain Shivers in Polar Storms" as

<p>1935 15-20</p>	<p>2 Western Scotland, North Wales, Liverpool Bay, Cornish Peninsula, South Wales</p> <p>The Guardian & The Observer</p> <p>17/02/1935 - 20/02/1935</p>	<p>temperatures dropped below 0 throughout the kingdom. At Pembroke on the 27th the velocity reached 88 mph. On a wider front the Arctic winds were so strong and cold they had been felt as far south as Algeria. Strong winds and storm conditons came to the Uk with gusts of 79 mph at Liverpool whilst torrential rain fell across Lancashire. The Ribble burst it's banks in it's middle course and extensive flooding of agricultural property was widely flooded. A Glasgow steamer ran aground on the Ayr breakwater and the rocket brigade stood by but were not needed. Wales experienced te wild weather and many rivers including the Conway flooded their valleys and agriclutral and human resources were inundated to great extents. At Llandudno and Conway the electric lights dailed when the generating centre was inundated stopping cinema showiings and tram services. There was also extensive flooding in the Carlisle area and the River Caldew threatened to inundated a railway goods shed. Telephone and telegraph lines were widely felled in the South-West and the delay between London and Somerst was described as "indefinite". The Rivers Severn, Vyrnwy and Dovey were all in high flood and their valleys were widely inundatd. In South Wales the gale came in gusts "like a whirlwind, and pedestrians had difficulty in keeping their feet in the streets". A man was "lifted bodily from the ground and blown into th dock" but was fortunately rescued by the customs officials and taken to hospital. Traffic was also much delayed in rural districts of South Wales as large trees blocked the roads. The Mersey also rose rapidly but the flooding was largely contained in the</p>
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1935	1 to 3	4	Celtic Sea, Merseyside	The Guardian & The Observer	04/04/1935	1	<p>upper course near Sale. The strong gales and mountainous seas held up many liners and liners were unable to land at Plymouth for 24 hours. Portions of Glasgow were inundated as the Clyde flooded it's banks and large tracts of low-lying land were inundated and "the flood brought an extraordinary amount of wreckage downstream" which was thought to cause danger to small ships and watches were kept onboard all coasters who were in the main concerned about propeller damage.</p> <p>1. Moderate damage. A gale and mountainous seas in the Celtic Sea swept a Liverpool seaman overboard and passengers were swept from their feet with two lifeboats smashed. In the gale a three-storey building belonging to the Manchester Ship Canal Company works at Runcorn burnt down doing several thousand pounds worth of damage but no injuries were sustained.</p>
1935	6 to 9	4	Irish Sea	The Guardian & The Observer	08/04/1935 - 11/04/1935		<p>A Fleetwood trawler arrived having been towed 160 miles in the Irish Sea having struck a submerged reef in a gale and being completely disabled. A member of the rescuing crew stated "It was a nightmare of a time, and throughout the night we ploughed through heavy seas. Snow and sleet fell in solid sheets and for long periods we could not see the ship we were towing". Much peril was experienced when getting another line aboard. 77 mph was noted at Liverpool and 62 mph was noted at Pembroke.</p>
1935	4 to 6	6	Irish Sea, Lancashire	The Guardian & The Observer	05/06/1935 - 08/06/1935		<p>Spring gales and showers came to the British Isles which resulted in the postponement of the "midnight yacht race to the Isle of Man from Rock Ferry" whilst the resorts of Blackpool and Fleetwood prepared for the conditions.</p>

1935	9 to 10	6	British Isles	The Guardian & The Observer	11/06/1935		Considering the conditions the transport minister forewarned stated "Don't forget to be careful ... Last Whitsun fortnight 747 people on average every day would have been saved from death or injury if this small message of counsel had been more universally observed". The end of the bank holiday saw a belt of rain crossing over England and Wales with violent thunderstorms occurring in some places. Cricket matches were widely abandoned at Bristol and Cardiff. The weather forecast and warning helped to deter motorists as traffic was much reduced reducing the number of accidents.
1935	15-21	9	Hebridies, Celtic Sea, Cornish Peninsula, South Wales, Bristol Channel, Cumbria	The Guardian & The Observer	16/09/1935 - 22/09/1935	1	1. Major Damage. Impromptu gallantry. Severe weather struck the British Isles with particularly strong and destructive winds being felt across Cheshire. The high tides and strong winds produced a specacle at Morecambe where the waves "rolled over the west end promenade". Although the highest tides in 40 years were excpeted in South Cumberland the water did not reach such a high level as predicted although hundreds of acres of land were flooded and roads impassable as flooding occurred in estuaries. A RAF Perth flying boat was badly damaged when trying to take off in heavy seas off Stornway and the lifeboat and drifter took the crew to safety whilst the aircraft was rescued. A vessel with 50 men aboard sent out an SOS off Land's End. The captain asked for a vessel to standby and shelter the vessel before issuing the following "Please come at once. Most of our crew injured. Very anxious". The vessel eventually got into port with 3 severely injured performing a task to secure a drifting steam locomotive and a barge which had come

loose on deck and presented a hazard to the ship itself. Six steamers were in the vicinity of the vessel although no definite news of safety was reported by the 17th as 96 mph winds were recorded on the Scilly Isles. At Pembroke wind speeds of 50 mph were noted and 40 mph was reported at Plymouth. "Ships in the Bristol Channel were asked last night to keep a look-out for a drifting submarine. The message was broadcast as a navigation warning" and the old disused submarine had broken from her tow off Lundy Island. The storm was unusually extensive, spreading from Ireland to Denmark and on to the Baltic. Many roads were blocked due to falling trees across the kingdom and as many as 40,000 telephone wires were blown down. In Barmouth, North Wales an engine was delayed by a large accumulation of sand blown onto the lines by the storm-force winds and all services were suspended. A steamer arrived in the Mersey having been majorly damaged by huge waves sweeping the deck. The chief officer stated "We were all hurled off our feet and washed across the deck" before he found three crew severely injured and the boatswain dead. The famous schooner Blue Nose "champion of the Canadian fishing fleet" put back to Plymouth after suffering major damage and loss of two lifeboats and two members were washed overboard but they saved themselves thanks to their lifelines they had attached. In North Wales a bus was forced through a hedge when a squall caught the bus broadside but the conductor and driver had "a remarkable escape" leaving with only minor cuts. A trawler sent SOS distress signals off the west of the Isle of Man and a

1935	8 to 10	10	Irish Sea, Liverpool Bay, North Wales	The Guardian & The Observer	10/10/1935 - 11/10/1935		<p>trawler immediately deployed to aid her and stand by as she limped to Dublin where repairs were to be enacted. 66 mph was recorded at Pembroke and 65 mph at Tiree as well as 62 mph at Eskdalemuir where 1.61 inches of rain fell whilst 0.57 inches fell at Blackpool. The strong winds from the south-west also brought warmer milder weather particularly in the South.</p> <p>Minor damage. Official gallantry. Strong winds from the west caused dangerous conditions on the Irish Sea and a vessel under tow snapped it's hawser and almost came stranded on rocks off the island but for "skilful manoeuvring" by the tugs which guided her out to sea. "Special concerts and dances were arranged for the passengers, who put with their enforced stay on the vessel with good spirits". The captain stated "the tugs acted magnificently". Heavy rain also accomapnying the storm cause the Mersey to rise rapidly and flood it's middle course although no flooding occurred at the coast. In Wales the Dee, Severn, Wye and Clwyd were in heavy flood and much agricultural land was inundated whilst the Dovey also burst it's banks flooding an arterial road between North and South Wales. Two lifeboatmen in a motor-launch went across the River Mersey who rescue a small yacht in danger on the dock wall and all were rescued.</p>
1935	18-20	10	North-West England, Irish Sea, North Wales, Hebridies	The Guardian & The Observer	20/10/1935 - 21/10/1935	2	<p>2. Major Damage. "Scotland and the northern half of England were yesterday swept by the worst gale experienced for years" with many vessels stormbound and other were in distress whilst there was widespread destruction ashore. In Cumberland it was stated the gale</p>

was "the worst within living memory" and 85 mph was noted in Liverpool and 76 mph was recorded at Holyhead. As a result all air services from Liverpool Airport were cancelled bar one and the ground staff experienced great difficulty in scuring planes. It was remarked the westerly breezes caused the Isle of Man plane to be "practically blown across the Irish Sea to Speke in half-an-hour, the shortest time ever taken for the flight". In Glasgow a man was blown in front of a moving car and killed whilst 5 others were injured by falling debris. In Carlisle a youth was blown off his cycle and killed by a passing bus whilst roofs were also blown off and hundreds of trees were uprooted with many completely roads. A finnish steamer was wrecked on rocks off Bootle, Cumberland but they were resuced by locals and brought ashore to safety. Traffic between Conway and Llanrwst was held up by a tree blocking the roads and the Conway valley flooded holding up work on the £12,000 flooding scheme of the River Conway Catchment board designed to prevent flooding. "Huge waves were dashed against the promenades at Llandudno, Colwyn Bay, and Rhyl, and clouds of sand were blown on to the shore". Several small vessel were forced to shelter at moelfre whilst the lighting failed at Bethesda and menai Bridge plunging the area into darkness. Several farm animals were killed in the storm. The Donaldson Line cargo vessel Vardulia was abandoned 400 miles west of the Hebridies and six or seven vessels were taking part in the search of the crew. Wireless messages reported a fruitless and the offices were specially opened abd vusuted vt nabt rekatuses and

1935	26-28	10	North-West England, Pembroke	The Guardian & The Observer	28/10/1935 - 29/10/1935	<p>friends of the crew whilst "anxious inquires were recieved by many relatives and friends of the crew".</p> <p>Minor damage. Another gale developed over the West and North of the British Isles with wind speeds of 66 mph and 63 mph reported at Sealand and Pembroke which were caused by another depression travelling eastwards across Scotland. Rainfall was greatest in Fleetwood on the North-West where rain reached 0.51 in. During a cycle race a man was blown off but managed to reach his destination. The Ribble was in high flood and several bridges were destroyed in the middle course.</p>
1935	16-21	11	North-West England, Cornish Peninsula	The Guardian & The Observer	18/11/1935 - 22/11/1935	<p>Minor damage. Heavy rain caused flood damage across the country with flooding noted in the upper courses of the Mersey. An article from the 'Meterological Magazine' featured in the Guardian. It concerned "deposits on the windows in Cornwall" which were "grey and sometimes dark brown" and were thought to have blown over five hundred miles before reaching the Scillies which ruled out a desert or industrial origin. The grey and white deposits were thought to be salt in partial solution. The brown deposits was most likely thought to be "oil or other waste scum brought i from the sea". It was said that the coastguards at St. Ann's Head were smetimes covered by "oily flith when spray is carried over by strong westerly winds".</p>
1935	30 to 2	12	North-West England, Southern Scotland, North	The Guardian & The Observer	01/12/1935 - 03/12/1935	<p>Minor damage. Gales and heavy rain came to the British Isles with the "small but intense depression" travelling eatwards over the Isle of Man to South Norway producng 71 mph winds in the Scillies and 65 mph at Holyhead. Scotland had wintry conditons with 2 inches of snow at</p>

			Wales, Scilly Isles					Eskdalemuir whilst many important arterial routes in North-West England and South-West Scotland were snow and ice bound. The strong winds blew large quantities of sand onto the Barmouth railway line on the coastal and trains were delayed. The wind also did considerable damage to property at Prestatyn and an arcade was damaged with a 20 ft sand drift left as evidence of the immense wind speeds.
1936	5 to 6	1	Bristol Channel, South Wales	The Guardian & The Observer	07/01/1936	4	4. Moderate damage. A severe gale resulted in a severe accident in the Irish Sea and three members of the crew of a Blue Funnel liner were killed and four injured when they met a heavy sea near the mouth of the Bristol Channel. The steamer put back into Swansea Bay but found it impossible to land the injured and dying while the police waited on the dock and the tugs said the weather was so bad they could not come alongside the vessel. A doctor was conveyed out to the vessel in a cutter to treat the men as best he could on the vessel.	
1936	9 to 12	1	Bristol Channel, South Wales, North-West England, Irish Sea, Celtic Sea	The Guardian & The Observer	10/01/1936 - 14/01/1936	8	8. Major damage. Official gallantry. Impromptu gallantry. Britain was hit by a tremendous storm as a violent south-westerly gale swept across the kingdom producing winds of 100 mph at Pembroke. The Menai suspension bridge was damaged and traffic was suspended as it was predicted it would be closed for 2 weeks. Ten yards of the Burnham-on-Sea seawall gave way leading to the storm surge inundating the town and the local gasworks flooded to a depth of nine feet. At Weston-super-Mare the streets near the sea front were flooded by the surge as waves burst over the sea walls and roads were soon rendered impassable. Trams and bus services were suspended and	

the ornamental garden became a lake 2-3 feet deep. In North Wales and Lancashire there was widespread damage as roads were widely blocked by fallen telegraph poles and trees. "Virtually the whole of North Wales from the coast down to Barmouth was in darkness for a time in consequence of failure in the electricity supply when the storm was at its height" and this shortage continued for several hours. Bangor was particularly badly affected and the police believed there had been a short circuit. The gale was caused by an "Intense depression which travelled at the extraordinary speed of seventy miles an hour from north of the Azores to South-West Ireland. The police issued a "Keep indoors" appeal via wireless. At Morecambe the wind reached 100 mph and a number of casualties resulted from falling slates whilst the double-decker buses "threatened to overturn". The electric railway near Heysham was partially damaged forcing capacity to be reduced to just one track as market stalls were "hurled about like skittles". At Blackpool windows were widely blown in and roofs widely damaged. The Winter Gardens suffered particular damage. One man was injured in Southport when blown off a ladder and suffered head injuries. Damage was also noted in Runcorn to roofs. In Colwyn Bay candles had to be used to transact business and a workshop was demolished. The Conway was widely flooded and the main road was inundated to 3 feet whilst 2000 chicks and several hundred pedigree stock were drowned with the property being widely damaged. In Chester a man had his skull fractured and a house had its entire roof blown off. Two lifeboats from Plymouth and

Torbay "raced to the assistance of a small vessel flying distress signals off Bolt Head, near Salcombe". The heavy seas carried the vessel to shore as she dropped anchors and steamed against the gale. She was fortunately taken in tow by the Torbay lifeboat and returned to harbour. A liner "had an unprecedented experience" when she was unable to call at Queenstown due to the ferocity of the seas in the Celtic Sea. The lifeboat deployed from the New Brighton station after an SOS in the Mersey after a vessel signalled they were in distress from the "dreaded revetment in the Mersey Channel but no vessel was found. Five seamen perished when their vessel was wrecked on a sandbank off the Lancashire coast near Formby and the sole survivor swam two miles to the shore although it was too late to save his companions. In an interview the survivor stated "as we sent out distress signals high seas were washing over us, and it was evident that the ship would soon become a wreck. We put our lifebelts on" as the vessel began to break up. The man was then washed ashore where he found a man who gave him clothes and directed him to the nearest telephone box to inform the police. He stated "I got so cold I could not feel whether I had any boots or stockings on". In spite of his exhaustion Ball insisted in taking part in the search with the police and Southport residents but there was no hope of finding anyone else left alive. The "Powerfully built man and strong swimmer" then consented to be taken to hospital. A Liverpool vessel nearly capsized in the Irish Sea after her cargo shifted and she was left at a list of 45 degrees before seeking shelter in Fleetwood. Another

steamer limped home 450 miles from the Rockall fishing grounds with her pumps working hard during the 53 hour anxious sail home. A steamer was reported on fire off Torbay however a tug injected sixty cylinders of carbonic acid into the holds to keep the fire at bay. The vessel remained afloat and no injury had been sustained and it was hoped she would soon be guided into shore. All aeroplanes "wisely refrained from rising". An Ellesmere Port man was blown off a roof and killed whilst a cyclist was blown under a bus and killed. The gale "backing up" the tides caused heavy damage at Aberystwyth and Llandudno where hundreds of tons of shingle were carried up on to the front and wall eroded away. Railway traffic on the North Cardigan Bay line was stopped and 400 sheep were drowned by the storm surge on the marshes of the Solway Firth. The "highest tide within memory" came over the sea walls at Maryport and major damage was done to the port and pier. In North Wales a bus roof was blown off but all escaped injury. The Rivers Dee, Alwen and Clywd were all in full flood whilst debris straggled the Colwyn Bay promenade. A woman died of shock and most likely a heart attack when she believed the house was falling in when in fact only minor damage had occurred. The verdict of "death by misadventure" was returned at an inquest. The body of a fisherman who was caught mussel fishing in the gale was discovered ashore in Llanelli, Carmarthen Bay. After the surge did such damage at Maryport it was stated that more money was needed from the Commissioner for Special Areas to keep the port functioning after the damage and previous support for

1935		12	British Isles	The Guardian & The Observer	23/01/1936		<p>much needed dredging. Unless a grant extending to "five figures and possibly six, is forthcoming to repair the damage the port is virtually finished".</p> <p>The annual lifeboat report detailing the heroric acts of the organisation. The RNLi had saved 494 lives which was the highest in 7 years. The work cost £250,000 over the year and of every £100 spent only 4 guineas went into administrative expenses. They had 124 motor-lifeboats and 44 "old-fashioned pulling and sailing boats, and these last never took to the water withoout the gravest peril to the men who manned them". It would cost £500,000 to replace the latter. Their was not a shortage in men, more a shortage in the ability to select appropriate skills. Women had been instrumental when launching at several stations "and of the crew at Tenby which was out all night looking for two men in a coble, which came into harbour while they were out, but when the cheque for the payment of 37s 6d a man to compensate them for their time was sent, it was returned with the simple statement that the two men were their neighbours".</p>
1936	10 to 14	2	British Isles	The Guardian & The Observer	11/02/1936 - 15/02/1936	2	<p>2. Major damage. Official gallantry. A fierce gale swept the Isle of Man and steamers had to shelter near Ramsey before proceeding to Peel such was the wind strength from the West. A tanker's steering gear became disabled off the Lizard and a tug was dispatched to their assistance. The vessel was in contact with the Lizard motor-lifeboat and was in no imminent danger. French sailors were rescued from off Land's End by another vessel. A vessel also transmitted an SOS from the Celtic Sea stating "Want tug from Queenstown. Partly out of control and drifting</p>

1936	21-22	6	British Isles	The Guardian & The Observer	23/06/1936	1	<p>on lee shore". Four men and a dog were rescued by the Sennen lifeboatmen from the ketch Albatross off Cornwall which was anchored and dragging in a bay. The cold winds continued to affect the Menai suspension bridge and only one carriageway was in use whilst pedestrians fought the strength of the wind. Two men were swamped in Plymouth Sound and two men perished as the vessel sank. At Barmouth an arcade was wrecked on the promenade by the winds and storm surge whilst the bus services were suspended due to the frozen roads. Roads in the Bristol and Bath area were similarly treacherous and impassable.</p> <p>1. Minor Damage. Another short period of storms hit the North-West and the open championship at Wallasey was "washed out" by torrential rainfall as both the Hoylake and Wallasey courses were turned into "a series of lakes". The Lancashire side of the Mersey was also deluged with the streets flooded at Bootle and one cyclist drowned in the floods which reached an incredible depth of 12 feet. The tram service was also suspended. Southport was also flooded with water reaching the hubs of cars in the streets but the waters rapidly subsided. Several high rise buildings were struck by lightning and the AA reported several cars had also been struck. it was noted that "Theoretically, of course, the framework of car is insulated from the earth by its rubber tyres" however rain associated with thunder and lightning enabled the conduction which potentially endangered the car far more than in dry weather.</p> <p>Minor damage. Bristol Floods. Underground Frome. "Remarkable scenes followed torrential rain" which lasted</p>
1936	29	6	South-West Britain	The Guardian &	30/06/1936		

				The Observer		20 mins over Bristol. Two streets over the course of the underground River From were flooded to a depth of more than a foot and many shops had their basements flooded as cars were left mid-stream. In Colston Avenue the wooden paving blocks were torn up and a bus became stuck with the passengers being forced to quickly evacuate.
1936	23-24	7	British Isles	The Guardian & The Observer	24/07/1936 - 25/07/1936	Minor Damage. Official welfare. Heavy rain fell throughout the kingdom and gales were widely felt. In Campbeltown in the Mull of Kintyre a territorial camp was flooded by the considerable rain and the troops were sheltered in two schools. County cricket experienced its worst day in more than four years with no games being played. The Lake district experienced 2 inches of rain in 24 hours which threatened to cause the destruction of marquees but this did not occur.
1936	30	7		The Guardian & The Observer	30/07/1936	An article concerning support for saplings in a gale stressing the importance of staking. The specific methods of staking were stated and guidance for the particularly vulnerable trees such as acacias was noted.
1936	6 to 7	9	Western Scotland, Pembroke	The Guardian & The Observer	08/09/1936	Minor damage. The "first autumn gale" brought winds of nearly 80 mph to Britain with the strongest winds of 79 mph being noted at Pembroke. The gale was caused by a deep depression travelling eastwards from Ireland at nearly 60 mph. Rainfall was heaviest over Scotland measuring 1.46 in at Tiree. Photography of a Lytham windmill in a damaged state was noted
1936	17-19	10	Irish Sea, Western Scotland	The Guardian &	19/10/1936 - 20/10/1936	Moderate damage. Official gallantry. Impromptu gallantry. Strong winds battered the British Isles from the very North of Scotland to Pembroke. At Stornoway 64 mph was

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recorded whilst 64 mph was recorded at Sealand. At Oban 1.61 inches were recorded. A vessel vessel was driven on Grey's Rocks in the Sound of Mull although most of the crew were taken off by the Coast Line steamer and 4 remained aboard on the vessel. The Stornoway lifeboat was called out, tugs sent from Glasgow and a steamer sailed 120 miles to the rescue but was not needed. The distress rockets were quickly answered from Tobermory and all were saved with high efficiency according to the chief officer who stated the heavy seas made the rescue difficult and dangerous. Many ships ran for shelter on the Scottish coast and the first report of an airplane aided rescue was mentioned off Islay when "two passenger planes flying between Glasgow and Skye on Saturday exchanged a radio conversation which resulted in the Islay lifeboat's being sent to the aid of a Glasgow cargo steamer on the rocks". One pilot on sighting a vessel in difficulty off Port Ellen had relayed a message to another pilot who then "veered off his course and located the vessel. He circled low, saw that she was on hte rocks, and was able to read the name Shuna. He sent a message to the control tower at Renfrew and a further message was sent from there to Lloyd;s". The Islay lifeboat was then deployed and they took 6 off and left 14 onboard before tugs set out from Glasgow to tow the ship out of danger. Rough seas at Blackpool provided a spectacle for those who had come to see the illuminations which lit up the surging sea. On Merseyside air and shipping services were much affected with a Cunard liner being held up at the Mersey Bar before the sea state abated. Two small yachts sank at

1936	24-30	10	Western Scotland, North-West England	The Guardian & The Observer	26/10/1936 - 01/11/1936	1	<p>their moorings and wreckage was transported around the Mersey causing hazards to navigation. The Isle of Man steamers were much delayed in the Irish Seas due to the heavy seas sweeping the ships. Air services across the Irish Sea with westerly services taking twice their usual length whilst a record was set from Dublin to Croydon as an liner averaged a then record of 220 mph. An accident occurred on a Fleetwood trawler fishing off Western Scotland when an engineer sustained severe injuries due to the heavy weather and he was later taken to hospital.</p> <p>1. Gales raged off the West of Scotland and throughout the North of the kingdom. A steamer was at the mercy of the gale for many hours with a useless rudder and was towed into Greenock after flying distress flags from the masthead. The Girvan lifeboat was deployed but heavy seas made the rescue impossible and the crew were obliged to stand by before Three steamers and tugs came to the assistance. The Loch Lomond area was covered with snow. The gale was induced by a depression travelling rapidly eastwards across the Atlantic whilst the heavy rain was most notable in Eskdalemuir where 2.4 inches of rain fell in 24 hours. The highest winds were noted at Tiree where 63 mph was recorded although 62 mph and 51 mph was recorded on the Lizard and at Sealand. An 80 mph gale was recorded at Glasgow where a tramcar was thrown over but luckily no one aboard was injured despite the fact the conductor had to be freed from a precarious position. Pedestrians who went to assist had to be warned to be kept back for fear of electricution as the car lay on the live rails. During the rescue to</p>
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1936	6 to 17	11	North-West England, South Wales, Irish Sea, Celtic Sea	The Guardian & The Observer	07/11/1936 - 18/11/1936	5	<p>policemen 6ft tall and weighing over 12 stone were blown over. At Renfrew and Abbotsinch the hangars and a number of planes were damaged. During the night of the 26th slates and chimney fell widely. A man was killed when thrown to the ground in Glasgow and he succumbed to his injuries later in hospital. The Solway Firth fishing fleet was caught in the storm and distress flares were fired causing the lifeboat to deploy but had to return due to the fact one of the crew was suffering from exposure and hypothermia but the 14 boats later struggled into port.</p> <p>5. Moderate damage. Official gallantry. Voluntary gallantry. Storms raged in the Eastern Atlantic and swept across to the British Isles with strong winds being registered at 75 mph at Pembroke and 73 mph at Scilly Isles as well as 71 mph at Eskdalemuir. This provided a "remarkable mixture, rain and hail showers separated by periods of sunshine occurring in almost all districts". Rainfall of 1 inch at Morecambe and 0.8 inches at Bath fell as the depression passed across North-West Scotland. One boy was picked up drifting in a boat off Land's End near where an SOS was sent out and little of the vessel or none of the other crew were found. The captain stated "it was hopeless for any ship whose hatches or steering gear had been damaged to live in those terrible seas". The passengers on the rescuing Queen Mary had also received injury in some instances. The Lytham lifeboat was deployed after sighting flares in the Ribble although no traces of the vessel could be found by the lifeboat as 100s watched the operation. The fishing boats off New</p>
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<p>1936 29-30</p>	<p>11</p>	<p>Mersey</p>	<p>The Guardian & The Observer</p>	<p>01/12/1936</p>	<p>2</p> <p>Brighton had to seek safety when the gale strick and the New Brighton lifeboat delployed to aid a vessel in distress which was saved along with the crew. The Guardian also featured a piece on the 1703 storm entitled gales ancient and modern. A crew of five were taken off by the Breeches Buoy at the point of Ayre after she was struck by huge seas and was on the verge of sinking. Lifeboats deployed as well as the coastguard in Ramsey as the seas washed the "steamer from stem to stern and the holds were full of water". All rescued men were taken to Ramsey and given good hospitality. The Fleetwood lifeboat also deployed to save a broken down vessel and was photographed on it's return early in the morning. The fill force of the gale was felt on a transcontinental liner in which 17 were injured. A fire broke out aboard a destroyer in Plymouth and the gale helped to fan the flames.</p> <p>2. Moderate damage. Official gallantry. Voluntary gallantry. Two men drowned and 7 had narrow escpaes when two barges sank during a gale. Distress signals were sent up and the New Brighton lifeboat was launched with great difficulty and rescued the lives of sailors aboard a foundering vessel. Three men were rescued by dock gate men at the Salisbury Dock after lines were thrown and they were dragged up the wall. They were "taken to hospital suffering from severe shock and immersion". There was a sad seen when two sons witnessed his father drowning but was powerless to help. One other barge continued to drift down the river and caused a menance to shipping.</p>
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1936	4 to 6	12	North-West England, Western Scotland, North Wales	The Guardian & The Observer	05/12/1936 - 07/12/1936	1	<p>1. Moderate damage. Official gallantry. A strong westerly gale swept over the North of Britain as an intense depression passed eastwards with winds of 77 mph at Eskdalemuir and 71 mph at Holyhead. The cold winds brought snow showers to the region. A youth and bicycle were blown under a bus and crushed to death. Eleven men were brought ashore by the Lytham St. Annes motor-lifeboat when a vessel was forced aground in heavy seas off the Ribble Bar in a storm of wind, snow and lightning. The men were rather cold on landing and taken to the Clifton Hotel where they were provided for. They intended on returning to the vessel on the next tide with the assistance of a tug. An icy wind swept Blackpool and the Fylde sweeping tons of sand onto the Blackpool railway which was derailed and all 60 passengers were forced to walk to the station as gangs of men cleared the line working all night. At Prestatyn several residents had to evacuate their houses by the windows as sand blown from the dunes blocked their doors and escape and haystacks were also damaged. A severe storm of hail and sleet was experienced in Rhyl and the streets were littered with hailstones.</p> <p>Major damage. A great tempest brought widespread flooding over huge areas of the kingdom with gale force winds accompanying the heavy rains. The Flyde district was particularly affected as the waters and silt deposited by the floods ruined homes and the roads in many places impassable. Roads were widely flooded with 10 feet flooding on some Cardigan roads whilst between Carmarthen and Llanelli there is eight feet of water and a</p>
1936	14-23	12	Western Scotland, North-west England	The Guardian & The Observer	15/12/1936 - 28/12/1936		

road was completely blocked by a landslide near Dolgellau. Around Preston hundreds of acres of land remain under water and farmers suffered dreadfully with thousands of poultry being lost in the Ribble and Wyre and the Fire Brigade were deployed to pump water out of homes. About 1,200 telephones were put out of use. A renewal of the gale caused considerable damage in Scotland with the Uig pier in the Isle of Skye being severely damaged by the storm surge whilst many vessels were damaged and washed away. Corn and hay stacks were widely damaged as the shroes of Loch Broom were strewn with pleasure-boats which were torn from moorings and smashed. A trawler went ashore on the Island of Calve near Tobermory but no immediate danger was posed to the crew. Wind gusts further south reached 79 mph at Pembroke and 76 mph at Holyhead with 71 mph on the Lizard. A liner was delayed reaching Plymouth owing to the severity of the storm in the Celtic Sea. Rain fell throughout with 0.9 inches at Paignton and 0.83 inches at Ambleside. Torrential rain flooded streets at Fort William and seriously interfered with trade and a ferryboat sank in the storm. "The highest tide for more than forty years was experienced at Strontian, Argyllshire" and a Glasgow boat was thrown high and dry on a sandbank. Many houses were flooded throughout the Highlands and Glens due to a combination of the flucial floods and storm surges. Lochs flooded covering huge areas to a depth of 2 feet near Fort William and encroached on the stone embankment and trees lined the roads of the Western Highlands.

1936		12	British Isles	The Guardian & The Observer	02/01/1937	The annual weather review of 1936 for Great Britain concluded that the year "was notable for the frequency of gales and the outstanding severity of some of them. The maximum gust of 100 mph at Pembroke on the 9th January was the record gust in the year."Gales were both frequent and severe during October and the first part of November".
1937	24	1	British Isles	The Guardian & The Observer	25/01/1937	A convict escaped from Dartmoor Prison in a gale with 70 mph winds was raging across the Cornish Peninsula. Conditions on the moor were "at their worst, and the heavy rain and hail driven by the gale soaked the searchers to the skin". Nevertheless the hunt continued all day and the convict was eventually caught.
1937	27-28	1	British Isles	The Guardian & The Observer	29/01/1937	Moderate damage. Severe gales raged round the coast of Great Britain and although the damage was largely confined to the east coast and North Sea parts of the South-West were also swept by the blizzard as snow fell in Ilfracombe for the first time in almost 6 years. "Huge waves crashing on promenades did considerable damage to a number of seaside resorts, one of the worst sufferers being Rhos-on-Sea, which was badly flooded at high tide". Shops on the promenade were marooned and trams were halted by the flooded area.
1937	28 to 1	3	British Isles	The Guardian & The Observer	01/03/1937 - 03/03/1937	Major damage. The "wildest weather of the winter" came during the last weekend of February. The cold winds produced very severe gales which blanketed the British Isles with snow with Lancashire and North Wales being some of the worst hit. Winds reached 98 mph at Holyhead and 81 mph at Pembroke whilst 78 mph was noted in the Scillies. This was a record at Holyhead. In Preston a roof

collapsed and injured a husband and wife, the latter of whom had to be freed by the police at great peril. Bot suffered from sever shock. "Mr Dodgson stated afterwards that he was dreaming he was back in France when there was a thud and a great weight of material fell on their bed". A large area of North Wales was affected by a large blackout when the storm damaged the power generator at the elecrical company. Services in chapels were conducted with candles. Colwyn Bay and Llandudno could not run tram services whilst all business dependent on electricity were unabel to operate. The telephone system n South Caernarvonshire and Anglesey was dislocated and several villages were isolated being cut off by telephone and road owing to the snow and gales. Moutanious seas and storm surges did damaged at Llandudno on the promenade whilst spray flew for 100 yards past the embankment in Colwyn Bay. Rhyl also felt the full fury of the storm with two houses having their roofs nearly completely stripped and tons of sand being blown inshore. The BBC broadcast a storm SOS whilst four lifeboats were deployed from Llandudno, Moelfre, Beaumaris and New Brighton to assist a British oil tanker who had transmitted an SOS. The vessel drifted 15 miles but was secured and secured anchor after eight hours of distress. 25 stevedores loading dynamite aboard a vessel off the Mersey Bar due to explosive port regulation came back exhausted as it was impossible for them to transfer back to the tug so they faced the exposure of the elements of all night. Those aboard an Irish Sea ferry also faced "a wild passage" as the wind and seas struck the

1937 10 to 13

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British Isles

The
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The
Observer

12/03/1937 -
14/03/1937

seas at full force. Many passengers were woken and much glass was smashed as the ship rolled in the seas. "The worst moments came near the Welsh coast, where there are cross-currents, and when the ship shaped for the entry of Holyhead harbour". Many rugby enthusiasts returning were ill onboard. Gangs of linesmen were forced to work under trying conditions in order to keep railways functioning throughout North Wales. A wireless station was forced to close at Waefawr as the blizzard snapped 10 masts whilst the BBC had to close its transmitting station at Penmon. Buses were stopped near Corwen and Rhyl due to the entanglement of fallen wires and snow whilst all quarries were closed. All main roads out of Aberystwyth were blocked by fallen trees and a servant girl was pinned beneath wreckage of a fallen tree but received little serious injuries. Preston wireless subscribers were largely cut off due to felled telegraph wires in the Lancashire region and to restore the service to full efficiency was predicted to take months.

" 'A dry March' according to Francis Bacon, is one of the things that foreshadow a wholesome summer, and by the proverbial wisdom of our ancestors 'March dust' is worth a king's ransom to the farmer". However it was remarked the "trouble this March would be to sift the dust from the snow, and snow at this time to of the year is no aid to agriculture". It was also remarked "if statistics can be trusted at all, it seems, more than likely that Britain's siege by snow, rain, sleet, and howling tempest is about to be raised, after the worst weather of its type for sixty-seven years". Records from South Kensington stated that

1937	20-22	3	British Isles	The Guardian & The Observer	21/03/1937 -24/03/1937	1	<p>when January and February had, when combined, been the worst in terms of precipitation since 1870. A mention of the use of aircraft in meteorology to "further probe the secrets of the unfriendly heavens" in its early form was referred to.</p> <p>1. Minor damage. A summary of the March weather during Easter stated since "March Easters - a hundred and ten of them since 1500 - have a bad record". Of particular note were the gales of 1850 which "for years afterwards, seamen talked of" which included the wreck of the Royal Adelaide off Margate. Weather related crop failures of 1845 and 1861 were also noted with the 1845 failure being strongly associated with the Great famine associated with the corn laws. On returning to Whitehaven a hand was lost overboard near St. Bee's Head during a gale and drowned without a trace. A "gale that blew many hopes before it" substantially influenced the professional golf tournament at Southport. As a result there were "an appalling number of eighties" showing many were far over par as golfers struggled against the wind.</p> <p>Thunderstorms and heavy winds swept the South of England and vivid lightning and intense thunder were felt widely throughout.</p> <p>Major damage. Thunderstorms and hailstorms caused a deluge on St. Swithin's day on which it was originally thought if it rained "for forty days it shall remain". At Bristol 3.33 inches was recorded whilst 2.40 inches was recorded at Ross-on-Wye. Hundreds of houses in Bristol</p>
1937	4 to 5	5	Lancashire	The Guardian & The Observer	06/05/1937		
1937	10	6	Western Britain	The Guardian & The Observer	11/06/1937		
1937	15	7	Bristol, Cornish Peninsula, North-West England	The Guardian & The Observer	16/07/1937		

1937	12 to 13	9	Irish Sea, Bristol Channel	The Guardian & The Observer	13/09/1937 - 14/09/1937	<p>were flooded, some to a depth of 6 feet. "resdients in the poorer areas suffered most, and after a two-hour downpour they put on bathing costumes and fought to save property". A landslide occurred on the Bristol-Avonmouth railway bt the driver saw the slide in time to stop and prevent major incident. He stated "Passengers had to wait until the floods, which had come up to the doors of the carriages, had subsided, and they then waded back to the station" and gangs worked for several hours to clear the obstruction. The North-West experienced more localised storms than most districts as the storm belt worked it's way slowly eastwards across England and Wales.</p> <p>Minor damage. Impromptu gallantry. Two yachtsmen during an "adventurous month at sea" were landed at Milford y a trawler having foundered in a gale in the Irish Sea. One of the sailors stated "We were in trouble on Wednesday night about forty miles west of the Smalls. There was a howling gale and seas were running mountain high. Suddenly out of the driving rain the huge bulk of a steamer was upon us, and it missed us by inches". The mast was severely damaged and water pured into the boat and water poured into the boat. The sailors did manage to signal a trawler with a towel and were rescued by "wonderful seamanship" by a trawler.</p> <p>Scientific understanding. A section on the "meterological myth" of equinoctial gales which stated "There is no conceivable reason why the sun's crossing of the equator should generate storms". Indeed only one on the 19 March 1933 had a storm directly coincided with the</p>
1937		9	British Isles	The Guardian & The Observer	26/09/1937	

1937 23-27

10

Irish Sea, North
Wales, North-
West England,
Cornish
Peninsula,
South Wales

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Observer

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28/10/1937

equinox over the period 1909-1935. The ancient Greek and Roman scientific writers made no mention of such gales precisely on the equinox and instead the only reference was a rather general one from Bohun (1671) who stated "About the time of either Aequinox (sic) are the most flatulent seasons of the yeere (sic)". Another article refereed to the value of the telegraph in transmitting meterological knowledge and it's dramatic influence on meterological development with the ability to communicate the storm centres. It was also noted that there was correspondence between thunderstorms and clay soils and it was stated "earth and the lower sky are in alliance". The reporter also noted that "I watched a black cloud divide like a capital Y as it came to the sources of the two chalk steams, each of which a moiety of the storm followed". The storms have "their favouirte routes like migrating birds" it ws said. It was also humoursly stated "clouds are more visible than birds, and we are all weather prophets (or were before we were pauperised by the six o'clock news)". It was stated the average observer could contribute to improving weather knowledge through the conveyance of observations in collaboration with the "learned men who look from real observatories". Moderate damage. Official gallantry. Heavy rain and gale force winds were widespread throughout the British Isles quelling any arising fears of a water shortage. The captain and crew of four of a tug used for laying RAF targets in the Irish Sea had to be rescued by the Moelfre lifeboat when the tug sprung a leak in the mountainous seas and water poured in dousing the furnances. The tug drfited ashore

1937	25-26	11	Celtic Sea, Cornish Peninsula	The Guardian & The Observer	27/11/1937	1	and was thought to be salvagable. In the South-West 83 mph and 08 mph was noted in the Scilly isles and on the Lizard. Rainfall was heaviest near Tenby where 1.85 inches of rain fell and Pembroke here 1.46 inches fell with 1.42 inches falling at Holyhead. Two houses at Ellesmere Port were struck by lightning during a brief thunderstorm and the masonry and roofing was damaged. 1. Minor damage. Impromptu gallantry. Atlantic gale came to Britain yesterday and many liners could not leave Plymouth owing to the fury of the seas. A fog shrouded most of the South and in the confusion a woman accidentally fell into the Exe and drowned whilst three others also fell in but were all rescued.
1937	1 to 4	12	Irish Sea, South Wales, Western Scotland, North-West England	The Guardian & The Observer	02/12/1937 - 05/12/1937		Minor damage. Official gallantry. Strong gales resulted in the deployment of the lifeboat off Fishguard and 3 men were saved from a motor schooner. Liners reported battling great seas in the Celtic Sea. Two Scottish lifeboats delayed on the West coast but could not find the vessels who had indicated their distress.
1937	11 to 12	12	North-West England, Western Scotland	The Guardian & The Observer	13/12/1937		Minor damage. A weekend of snow and gales resulted in much disruption and damage particularly on the Lancashire and Scottish coasts which were battered by mountainous seas. Heavy frost and ice covered roads which became highly dangerous and the RAC issued warnings to all motorists.
1938	14-21	1	The Hebridies, North-West England, North Wales, South Wales, Bristol	The Guardian & The Observer	14/01/1938 - 26/01/1938	31	31. Major damage. Official gallantry. Impromptu gallantry. Official welfare. Storm of wind and rain. Lifeboat action off Pembroke one missing. Vessel missing off Seaforth all 4 hands lost. 60 mph wind in Mersey. Destroyer deployed to aid tug in the Celtic Sea. £20,000 promenade surge

Channel, Irish
Sea

damage at Aberystwyth. Three rescued with difficulty from a storm surge near Aberystwyth which destroyed a house. Thousands of sandbags were brought from Liverpool to barricade the road against the waves. Female college students were ordered home. Hundreds of tons of boulders missing. Successive storm surges "broke down the last line of defence" completely exposing houses. "The conditions within the houses beggar description". Representations were made to discuss the opening of a relief fund to cover the damages sustained by home owners thought to be £10,000. Damages to the sea wall corporation were worth £20,000-30,000. The Public works committee met and "unanimously resolved to support the Mayor in his endeavour to establish a relief fund". An engineer was to be employed to ensure the protection of the remaining structures and foundations of houses on a seafront terrace as well as to re-erect the sea wall. Students were thanked for their great assistance in aiding workmen to erect barricades. A warning from the south-west for the final "battle against tides" on the 19th and workmen re-erect defences as more strong south-westerlies were forecast. A Ministry of Health inspector arrived on the premise of offering a potential repair and support grant and the engineer set to work fortifying the defences for the forthcoming tides. Fortunately this gale did not materialise on the 20th and much relief was felt although workmen remained on high alert. The appeal for a relief fund was well received. At Pembroke winds reached 100 mph. Lifeboats widely deployed. Maryport lifeboat fruitless search. Two men washed overboard when giant

1938 26-30

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North-West
England, North
Wales

The
Guardian &
The
Observer

28/01/1938 -
31/01/1938

seas off the Small swept their bridge. One death on a steamer caused by skull fracture on wave impact and another on trawler in the Bristol Channel. Dramatic photos published on the flooding on 17/01/1938. Two lifeboats were washed ashore from a ship near Swansea which was later presumed to have sunk after two bodies were washed up and no trace of the vessel was found. 17 hands all perished. The owner of the shipping company stated "We are afraid the ship was overwhelmed, possibly as she was turning to run before the wind while most of the crew were below". Another ship sank in the Irish Sea and bodies were found in her boat having perished hypothermia. Spring tides were the cause of the floods which inundated wide low-lying areas on the West coast. Residents of Haverigg had the tide come up to their back doors but they had prepared such an emergency having regularly experienced marine flooding as "They had fitted additional doors outside their ordinary doors and filled the crevices with clay".

Minor damage. Large areas of North-West England were flooded around North Cumberland. A pavilion was wrecked at Glasgow. Wind speeds of 96 mph were noted at Pembroke. The cause was a "Burst of Polar air" bringing snow and rain down from Scotland. A ferry boat was damaged in heavy seas when a mooring was damaged on the Wirral peninsula. The temporary defences at Aberystwyth were damaged but held and protected houses owing to the smaller surge. A man was blown under a tram in Blackpool but recovered.

1938		1	British Isles	The Guardian & The Observer	01/02/1938	Review of the January weather which was described as a month of storms and gales on the West coast of Britain caused by "vigorous depressions".
1938	2 to 3	2	Bardsey Island, North Wales, North-West England , South-West England	The Guardian & The Observer	03/02/1938 - 19/02/1938	Minor damage. Storms of rain and hail were widespread throughout the kingdom with flashes of lightning and a "heavy cannonade of thunder" widely felt across South-West England, Wales and the North-West. Bardsey Island was once more isolated for several days as vessels could not land in the heavy seas and basic provisions were rationed.
1938	19-20	3	North Wales	The Guardian & The Observer	21/03/1938	Minor damage. South-westerly gales once more damaged the Aberystwyth sea defences and large gaps were made in the temporary structures as the spring tides brought moderate surge conditions. The beach was littered with concrete defence bags but houses were little damaged. Work on the coffer dam was progressing to protect the houses from surge inundation.
1938	14-21	1	Aberystwyth, North Wales	The Guardian & The Observer	10/05/1938	An extract on the progression of the sea defence at Aberystwyth. The sea was described as an "uncertain ally" which had caused almost annual damage to the shorefront due to frequent surges. It was stated even "the best Cardiganshire granite and the most skilful engineering were treated with contempt by spring tides and south-westerly winds". The new promenade was protected by "a steel coffer-dam" which was to provide protection to seaward of the old promenade. The concrete base was 12ft wide and the face designed to dissipate the force of waves and prevent surge inundation. The cost was thought to be between £15,000-

1938	1 to 3	6	North-West England, North Wales, Irish Sea, Bristol Channel, South Wales	The Guardian & The Observer	02/06/1938 - 04/06/1938	<p>£50,000. The excaerbation of damage in some quarters was thought to potentially scare visitors as it had been reported by some the town was "entirely wiped out" and the GWR had invited a series of pressmen to see the damage and report the fine condition of the town so to encourage visitors to come. It was stated by the borough surveyor the public "must not be annoyed or put to inconvenience" by the new coastal defence scheme.</p> <p>Moderate damage. A gale came to the South with nearly two inches of rain falling on the Scillies. The wind reached 90 mph at Plymouth. The "exceptional June gale" also brought thunderstorms to the North-West of England, North Wales and over the Irish Sea as well as South Scotland. Fleetwood recieved 1.68 inches of rain. A gale damaged an army mlitary camp at Manorbier where the anti-aircraft guns over the Bristol Channel were placed forced a temporary evacuation but troops returned within 2 days as the camp was repaired.</p>
1938	27-28	6	Bristol Channel, North-West England, Western Scotland, Cornish Peninusla	The Guardian & The Observer	28/06/1938 - 29/06/1938	<p>Minor damage. Rain an gales from the Atlantic brought hevay rain to North-West England and Scotland. Windspeeds reached 66 mph at Eskdalemuir and 2.31 of rain was reported at Dunoon with 1.94 at Ambleside. A pleasure steamer out of Torbay ran into a gale and many passengers were "prostrate with sea-sickness". Considerable damage was done by a storm surge at Weston-super-Mare with tourist stalls destroyed, a man waded in to save tills and thousands watched the spectacle as waves topped the sea wall.</p>
1938	1 to 2	7	Western Scotland,	The Guardian &	03/07/1938	<p>Mixed weather included gales and heavy weatehr came to the UK during a summer storm due to a "cool north-</p>

			South-West England	The Observer		westerly stream of air". 50 mph gales prevented a liner from calling at Plymouth whilst 77 mph of wind and 2.31 inches of rain were noted at Dunoon.
1938	8	7	Celtic Sea, Cornish Peninsula	The Guardian & The Observer	09/07/1938	Gales were noted in across the Isles as a deep depression swept across the UK producing 40-45mph winds in the Celtic Sea and 0.99 inches of rain fell at St Ives whilst 0.26 inches fell at Southport.
1938	4 to 12	8	Cornish Peninsula, North-West England	The Guardian & The Observer	05/08/1938 - 13/08/1938	Moderate damage. Official gallantry. Impromptu gallantry. Severe thunderstorms were noted across the Cornish Peninsula, flooding occurred damaging property and buildings were damaged by lightning whilst animals were also killed. A railway near Dartmoor was flooded to a foot and roads were washed away. The incoming tide meant the River Teign flooded marooning 15 in their cottages and the police rescued people by boat. The streets of Torquay became "running rivers" as cars were abandoned in the streets and "tenement houses were flooded to a depth of nine feet". Children were rescued through trapdoors in the ceilings. The connection between the sighting of the aurora borealis in England and storms was noted. It was stated the aurora borealis was at its greatest when "the sun's emission of radiative energy...is at or near a maximum" enhancing the heat in the atmosphere causing greater cloud formation in the tropics and greater gradient winds between polar and tropical regions causing the more frequent thunderstorms in temperate regions. The St. Helen's district and Liverpool was flooded with cellars being inundated but the Mersey tunnel remained dry. Floods receded when the tide turned allowing swifter drainage from the flooded

1938	17-18	8	Blackpool	The Guardian & The Observer	18/08/1938 - 19/08/1938	<p>urbanised Lancashire shore. Trains were held up due to flooding on the low-lying land approaching Liverpool from Manchester. Heavy rains fell on the 12th with over an inch falling throughout Lancashire.</p> <p>Minor damage. A storm of strong wind wrecked marquees at a Blackpool Show.</p>
1938	14-21	1	Aberystwyth, North Wales	The Guardian & The Observer	20/09/1938 - 24/09/1938	<p>Review/inquest. More information relating to the storm surge damage at Aberystwyth concerning an application for rent reduction by the students and authorities of the university. Due to the damage "great expense had been incurred" especially when finding alternative accommodation for students. As a result a sub-committee stated rents should be reduced until all sea defence work had been undertaken. Reductions of 5-25% were made. A Bangor builder also was in court for insolvency and stated that the destructive storms of the winter were a key cause of his financial failings as he had lost two contracts and the value of his property had plummeted. Most prominently "32 houses were blown down in a storm and he was not covered by insurance. This resulted in a loss of £2,000".</p> <p>Moderate damage. Official gallantry. Storms did damage to the Blackpool and Morecambe illuminations and several were cut and taken to hospital by flying glass and wood. Criticism was made stating the abandonment of the lights had lost £20,000 of revenue when it would have cost £1,500 according to a councillor. Repairs were impossible due to the continuous high winds. Emergency services were stressed with 20 casualties taken to hospital</p>
1938	2 to 7	10	North-West England.	The Guardian & The Observer	03/10/1938 - 11/10/1938	

1938	15-16	10	Irish Sea	The Guardian & The Observer	17/10/1938	in 3 hours due to the strong wind. Huge sand drifts stopped traffic near Blackpool. Many photos of gale damage were displayed on the 5th. Widespread flooding occurred in Glasgow and thousands of pounds of damage was occasioned to farmers lands. Road and rail traffic was much disrupted. The Oban railway was blocked when a train was derailed as the track was washed away for 100 yards. Two men were blown from scaffolding at Bellshill. Several injuries from falling material were sustained in Merseyside. The Pwllheli lifeboat was deployed after distress signals were noted but the crew were saved by the Aversoch lifesaving crew. The lifeboat later towed the vessel to safety in spite of the perilous rocks nearby. Shipping was delayed in the Mersey. 38 trees were blown down in Port Sunlight and much damage was done. A woman was admitted to hospital. Colwyn Bay was strewn with wreckage and at Prestatyn the storm "raged with an intensity more severe than any experienced in recent years".
1938	28	10	British Isles	The Guardian & The Observer	28/10/1938	Moderate damage. Official gallantry. A vessel in the Irish Sea had her hatches stove in and began to take on water and sent out an SOS. The lifeboat was deployed and all were saved and "soon afterwards the Marjorie sank". Advice on animals which visit the garden in a gale included the hedge hog and tawny owl.
1938	1	11	Hebridies, North-West England,	The Guardian &	02/11/1938	Rain and stormy weather visited the British Isles. In the squalls the wind rose to 66 mph at Tiree and 61 mph at Pembroke. Rainfall exceeded an inch at Ambleside. Rain,

1938	10 to 12	11	Western Scotland, South Wales	The Observer			hail and thunderstorms were widespread across the North-West and South-West Scotland where some snow fell.
			Western Scotland, Cornish Peninsula	The Guardian & The Observer	13/11/1938		The official meteorological report in the The Observer told of a "deep complex depression" west of Scotland with rain and gales throughout the west coast which included a tremendous storm which was photographed over the Salcombe Estuary.
1938	19-23	11	North Wales, South Wales, South-West England	The Guardian & The Observer	21/11/1938 - 25/11/1938, 30/11/1938	4	4. Official gallantry. After weeks of sunshine and mild weather gales came to the British Isles and squalls exceeding 100 mph were recorded in Pembrokehire according a 108 mph squall which was "a speed that had never been exceeded on the mainland". Winds of 78 mph and 77 mph were noted on the Lizard and the Scilly Isles. A man was killed in Cardiff by falling iron blown from a roof whilst a man was killed by falling timber at the Barry Docks whilst a stewardess died aboard a vessel on the Irish Sea. A bridge was swept away by torrents near Criccieth after a train carrying 60 children passed over a bridge. Low lying parts of Portmadoc were inundated and the harbour completely flooded by the surge, 100 yards of railway was washed away near Barmouth and all railway and road traffic was stopped as the sea inundated the coastal road. Heavy storm surge flooding also occurred at Morecambe where children had to be carried home from school due to the marine inundation whilst there were waves 80 feet high at Blackpool. The new Brighton lifeboat was deployed following a call for distress at sea. The Queen Mary could not call at Plymouth. A boxing entire was destroyed and a man was killed with

<p>1938 26-29</p>	<p>11</p>	<p>Cornish Peninsula</p>	<p>The Guardian & The Observer</p>	<p>27/11/1938 - 01/12/1938</p>	<p>thousands of pounds worth of damage encouraging such destruction. Three vessels broke away from moorings in the Cardiff Docks and three men in a narrow boat narrowly escaped drowning. One ship broke away at Barry Dock but was contained. The Towyn sation master had a narrow escape from drowning as he clung to a ground frame signal lever for three hours with water up to his neck until he was rescued by Constable Rowley". He had become encricled by the ever advancing surge adn then rescued using rope. Llandudno's sea defences wre damaged and temproary protection work was swiftly carried out to protect the large breaches. The expansive floods and widespread damages were photographed in the Guardian on the 25th.The RNLI offered £420 of awards tot he crews of the 26 launches throughout the kingdom. Minor damage. Official gallantry. Insurance. Gales swept over the British Isles. At Plymouth an aircraft carrier had to be assisted by the lifeboat when finding a vessel in distress. At Mount Batten there was a fall of an inch. A barriester also wrote an article addressing tennants in it he stated "Many of them will be more ruefull still when they doscover that they must pay for the repairs. WHO is liable for the storm damage?". The article decribed the different responsibilty for different types of occupant with a particular focus on "tenantable repair". Negiligence of others including leaving unstable material in dangerous wind-exposed places and rotting trees was also covered. Insurance also was mentioned as when the owner had purchased insurance which covered "damage by storm, tempest, or flood" the compensation was "usually limited</p>
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1938	17-18	12	North-West England, Western Scotland, North Wales, South Wales, South-West England	The Guardian & The Observer	19/12/1938		to 5 per cent of the full value. Therefore studying one's insurance policy for such clauses was strongly noted. Severe frost and gales hit the UK and temperature plummeted in the North-West of England and North Wales in particular as the cold air from a Siberian anti-cyclone invaded the UK. Gales were noted in the South-West and South Wales whilst the wind reached 59 mph at Tiree.
1938		12	British Isles	The Guardian & The Observer	25/12/1938, 31/12/1938		The yearly weather reviews spoke of "unseasonable heat and gales" which were particularly prominent in January and February. "Hurricane force" gales of 100 mph were noted at Bidston and Pembroke during these months. Crop damage was widespread due to the June gales whilst snow fell in Southern Scotland in July whilst Torquay had record rainfall of 6.4 inches on the 4th of August. The wetness of October and the record breaking temperatures of November were noted.
1939	7 to 8	1	North Wales	The Guardian & The Observer	09/01/1939		Moderate damage. Floods and south-westerly gales caused havoc throughout North Wales and particularly in Llandudno where the promenade was partially eroded away and undermined. Workmen were sent to dump coping stones and blockas temporary repairs and the promenade was barricaded with sandbags. Two feet of water swept over the road as the wind reached 67 mph at Holyhead where many vessels sheltered behind the breakwater.
1939	14-23	1	Cornish Peninsula, South Wales,	The Guardian &	16/01/1939 - 31/01/1939	14	14. Major damage. Official gallantry. Inquest. A southerly gale blew over the Western coasts and the Celtic Sea with 83 mph noted at Pembroke and 80 mph at Holyhead. The

Western
Scotland, North
Wales, North-
West England,
Celtic Sea, Irish
Sea

The
Observer

gale produced a 26ft tide with 5 ft storm surge on the Fylde coast causing much anxiety due to the temporary defences and repair on the Fleetwood seawall. Two RAF planes were damaged and a coaster dragged. Flooding in North Wales caused a landslide near Plas-y-Nant which tore up a road. The roughness of the Celtic Sea forced many trawlers to shelter and the Fastnet Rock lighthouse men could not be relieved. Liners arrived at Plymouth with "portholes smashed and furniture damaged by the worst gale the ship has ever encountered" in the Celtic Sea. Waves crashed over the bridge and a well known economist who had made the journey many times sated "the seas were mountainous ... at times the ship rolled so much that the promenade deck, 40 ft above the water line, seemed to heel over and touch the sea". Sleep was also impossible. The Severn and Avon were also in flood and warnings were issued to motorists. A old naval vessel went ashore on the Cornish coast and one man was washed overboard and drowned. The St. Ives lifeboat was launched in answer to a distress signal and capsized and thrown back on land with the deaths of 7 of the 8 crew. The vessel was "swept helplessly across the bay, each time sending one or more members of the crew to his death" until only one was left. This lost "reminds us again of the unselfish work done by the many crews for little reward more than the honour which comes to them among the men who use the sea. They risk their lives continually in peace and for the highest purpose". This crew had saved 66 lives. AN inquest by the RNLI found "a verdict of death from drowning by misadventure".

Sympathy was extended to all those connected with the crew and tribute was paid to the seven gallant crew. A colonel affiliated with the RNLI stated "the town could be equipped with whatever boat they thought best if something was done to the harbour". The mayor considered a breakwater "absolutely necessary" and they had trying for 100 years to get one. The only survivor was congratulated on his escaped stated "I only heard one shout out of the blackness". Ruins of the boat were later found and the seaworthiness and boat design was questioned. The survivor stated there were no doubts about seaworthiness and the lifeboat righted itself quickly although the sailor stated "It was not very long, and when you are in a position like that you have little idea of time". It was pointed out the same boat was badly damaged in the storm of 1929 but self-righted and limped back to port. The "deputy chief inspector" of the RNLI was asked if it "did not strike him that there must be something wrong with this type of boat, seeing that two had turned turtle". A fisherman and lifeboatmen stated "This lifeboat went out in conditions which were not suited to her". The coxswain was stated to have gone without "the slightest hesitation". Another retired fisherman stated the "boat was useless for rescue work in the angry seas of the Atlantic. They wanted a bigger type of boat". The coroner stated the authorities governed what vessel was assigned to the RNLI in St. Ives but it seemed advisable the boat was changed. The colonel and secretary of the RNLI stated it was their duty to provide the most suitable vessel for the conditions. Coastguards were hard at work in the rain

1939	11 to 13	2	Western Scotland	The Guardian & The Observer	13/02/1939	and snow recovering the bodies as they washed up. A body was washed ashore near St. Ives with wreckage whilst two young sisters were crushed to death when their house collapsed. Their sisters were in hospital as 70 mph gales battered the town. The Padstow lifeboat also had a terrible ordeal and almost suffered the same fate at the St. Ives boat whilst trying to rescue the same vessel and had to stay out at sea for 5-6 hours owing to the mountainous waves breaking near the shore making it impossible to land. On the 23rd winds reached 94 mph on the Scilly Isles and 65 mph at Pembroke. rain reached 0.75 inch at Tenby and 0.68 inches at Ambleside. A liner lost her lifeboats and eight men were injured when a trawler was struck by a massive sea and six were taken to the Royal Cornwall Sailors' Hospital. Two men of the ketch fosco were found washed up and one crew member was lost overboard from a steamer. A vessel was taken in tow and berthed safely in Plymouth having been disabled in the Celtic Sea.
1939	20-21	2	Western Scotland	The Guardian & The Observer	22/02/1939 - 23/02/1939	A fishing vessel caught in heavy seas and a storm off the West Scottish coast was driven before the wind until she was rescued by another trawler and towed to Fleetwood.
1939	8 to 9	3	North-West England	The Guardian &	09/03/1939	Minor damage. Off Galloway coast a submarine broke adrift in a storm and caused anxiety amongst shipping however two vessels stood by and the BBC warned of issues to navigation. Moderate damage. Official gallantry. A strong gale swept the North and the Crosby lightship broke adrift in the Mersey and the five crew had to taken off by the New

				The Observer		Brighton lifeboat. Serious damage was sustained by Fleetwood's sea defences which have cost £150,000. Morecambe was also inundated by a surge with houses flooded.
1939	21-26	3	Irish Sea	The Guardian & The Observer	21/03/1939 - 30/03/1939	Minor damage. Official gallantry. After a battle with gales in the North Atlantic and Irish Sea a vessel arrived in Birkenhead with cargo for John Summers and Co steel works. She was substantially damaged and doors leading to the crew's quarters had been torn away leading to the inundation of many cabins. The captain praised the crew and officers for their gallant acts to save the ship and a man had nearly been swept overboard but saved himself.
1939	22-24	4	North-West England	The Guardian & The Observer	23/04/1939 - 25/04/1939	A gale sweeping through the Isles interfered with golf at Birkdale as players were swept off their feet by gusts of 60 mph.
1939	19-20	7	British Isles	The Guardian & The Observer	20/07/1939 - 21/07/1939	Minor damage. A summer storm swept over the North and several houses were struck by lightning at Morecambe and electricity was cut off as torrential rains brought floods of a foot at Morecambe. Several homes were badly damaged with all electrical appliances broken. More than 30,000 homes suffered a blackout as electricity sub-stations were struck. A woman was struck by lightning and seriously injured. Thousands of people in Blackpool ran for cover as torrential downpours deluged the town and a bus crashed in the floods. Basements and shops were flooded in Garstang and tow houses were struck in Birkdale. A bowling club was struck by lightning and badly damaged in Carlisle.

1939	20-27	8	British Isles	The Guardian & The Observer	21/08/1939 - 28/08/1939	<p>Storms came to the South-West and Swansea experienced a deluge and multiple lightning strikes. Wexham-super-Mare was likewise hit and suffered a blackout as the grid system was hit and some areas were flooded to a foot. Houses were flooded and holiday makers drenched during a thunderstorm at Blackpool and a boy was struck but uninjured. Thousands of telephone subscribers were cut off in the South of Wales and the South-West.</p>
1939	21-22	12	British Isles	The Guardian & The Observer	23/12/1939	<p>An account of a Hebridean storm from the Isle of Eigg. The arrival and transfer of the mail from steamer to ferry was described. "The white crests of the waves seemed to grow more vivid as the darkness fell" as a ferry tentatively approached through "turbulent waters". The anxiety of those ashore for those on the ferry asking "Will they make it?" was exhibited. The risk of approaching the steamer in the treacherous conditions was weighed up with the benefit of the weekly provisions for the entire island. The writer exclaimed "the rain was crashing down on us. It made an independent noise within the bluster of the wind". as froth from the sea blew across the roads as the islanders struggled against the wind. As the storm increased in velocity "its shriek rose to an hysterical yell" whilst the "machine-gun rattle of the slates" was noted as the island appeared adrift at sea as it came "crashing round and round our little shores". The ferry boat had vanished and whilst it was presumed to be sheltering it was noted that the danger and anxiety of the storm had been increased by Nazi U-boats described as "those round black objects wandering idly in the smothering waves. And men in open boats drifting away from sinking vessels,</p>

1891	9 to 13	3	Western Britain	The Guardian & The Observer	12/01/1941	<p>peering hopelessly into the impenetrable storm". This anxiety was quelled after the arrival of the postman who exclaimed "A dirty night" and his "stolid bearing shamed us somewhat out of our agitation".</p> <p>200. Major damage. A 50 year review of the great blizzard of 1891 which created a new word "blizzed". In Devon and Cornwall the chimney stacks were "wrenched away, ancient trees uprooted, roofs wrecked, trains snowed up, communications shattered, ships driven ashore". The "very voice of the gale was terrifying" and it was described to resemble "the frantic yells and flendish laughter of millions of liberated maniacs". At sea the iron steamer Marana was wrecked off Start Point with the loss of 24 lives whilst a crew of 22 onboard a rigged ship went down 2 miles from Start Point. A vessel was also wrecked at Penare Point where 19 of the 40 crew drowned or froze to death in the rigging. The West Country was isolated and cut off from the "hellish storm which never rests" as drifts burie houses. A fire broke out in a house in Devonport and was completely destroyed. The temperature was never very low it was the intense cold which came fromt eh widn strength which devastated the region as a maximum of Force 12 was reached.</p>
1940	22-27	2	British Isles	The Guardian & The Observer	28/10/1940	<p>Minor damage. A significant storm hit the British Isles causing damage along the Cornish coasts. There were accounts of minor injuries from falling debris in Liverpool. Cornish villages experienced significant storm surge spray on the main coastal roads. Trees were widely blown down blocking roads across the South-west and North Wales. Parrallels were drawn between the storm and bombing.</p>

1941	18-20	10	Liverpool Bay	The Guardian & The Observer	30/10/1941	Minor damage. Official gallantry. A tempest swept across the North-West with heavy rain causing flooding throughout Cheshire and Lancashire were miniature lakes formed on low-lying land around the Mersey. Roofs or houses suffered throughout and along the Lancashire coast people on the promenades at Blackpool and Southport had "a grim struggle to hold their own against it". A cargo steamer was run ashore off Waterloo but immediately aided by tugs who worked through blackouts to remove it. There was no personal injury in Merseyside and damage was limited.
1943	30-31	1	South-West England	The Guardian & The Observer	10/02/1943	Minor damage. Widespread gale damage occurred in the South but no damage was noted at sea. Heavy rain also caused widespread inundation in the South-West but no major damage resulted.
1943	16-18	4	North Wales, North-West England	The Guardian & The Observer	17/04/1943	Moderate damage. Storm Surge. A gargantuan storm swept the British Isles with winds of 90 mph noted in South Scotland whilst 60-70 mph was noted in the North-West. By the Point of Ayr and Little Orme waves 30 ft high pounded the embankments and sea walls. The storm surge breached the embankment at Abergele and the water inundated the railway forcing an immediate response from 200 men. The remnants of the old sea wall by Rhos-on-Sea was demolished and tons of shingle was deposited on the private road and tram services were suspended. A breach was made at Colwyn Bay but the breach was quickly repaired.
1943	31 to 1	8	Southern Britain	The Guardian &	11/08/1943	Intense heat was followed by a severe storm of rain. The "freak downpour" was "ushered in by a few minutes' gale which ruined roofs and uprooted trees.

1944	16-20	5	Western Scotland	The Observer The Guardian & The Observer	24/05/1944	Moderate damage. Mountainous seas whipped up by a 100 mph gale caused a destroyer to have to alter depth charges in the middle of the ship broke loose. Two seaman and an officer offered to secure the charges but ammunition locker broke away as the vessel was washed by a huge sea and all severely injured their legs whilst an officer was knocked unconscious.
1944	6 to 8	6	North-West England	The Guardian & The Observer	09/06/1944	Minor damage. A great storm swept over the British Isles causing much damage. Although this was mainly concentrated in the east strong winds were felt on the North-West coast.
1944	3 to 4	10	North Wales	The Guardian & The Observer	14/10/1944	Moderate damage. Storm damages resulted from a gale and high tide in North Wales. A 21 ft tide "whipped into fury by a gale" of a velocity of 60 mph caused various breaches between the Point of Ayr and Little Orme. Losses at Colwyn Bay to property and sea defence were estimated at £4000-5000. Near Old Colwyn the sea defences were breached several times and the Old Colwyn railway viaduct and pier was damaged whilst the highway was littered with wreckage. Huge waves also inundated basements of shops and houses at Rhos-on-Sea whilst a tram was blocked by the masses of shingle deposited by the storm surge.
1945	18-19	1	Southern England	The Guardian & The Observer	20/01/1945	A gale swept over Britain reaching 100 mph in Southern England and South Wales. Damage was largely confined to the east however.

1945	31 to 1	4	Western Scotland, North-west England	The Guardian & The Observer	02/04/1945	"The Easter week-end opened as a "fur-coat" holiday". In Scotland winds reached 70 mph and steamers found it difficult on the Clyde with the large seas. Despite the blustery weather the North-West resorts were packed with visitors despite the bracing winds.
1945	14-16	7	Western Scotland, North-west England	The Guardian & The Observer	16/07/1945-17/07/1945	Minor damage. Official gallantry. Thunderstorms followed a warm period in the North and many areas were "floodlit" by lightning. Near Chester at least a dozen villages were without electricity when overhead cables were damaged by lightning impact. Blackpool was also in darkness during the thunderstorm with no illuminations in sight. Two trees were also struck near Southport and a heavy gale and rains covered the area. Holiday-makers at Dunoon were cast adrift during the storm by strong winds and naval vessels manned by police came to their rescue as the distressed scrambled to safety on floats of the Clyde Defence boom. Seven girls who clung onto rocks off the Gantocks were marooned for over an hour by the tide until they were rescued.
1945	26-27	7	Celtic Sea, Southern England	The Guardian & The Observer	28/07/1945	A gale spread across the South where heavy rain fell reaching gale force in the Celtic Sea.
1945	24-25	9	North Wales, Irish Sea, North-West England	The Guardian & The Observer	25/09/1945 - 26/09/1945	Moderate damage. Official gallantry. A great gale produced a large storm surge on the North Wales coast and the seawall protecting the railway line near Penmaenbach was breached and the line flooded before a swift repair. Damage was in an exposed area where £7,000 had recently been expended on repairs. The sea tore up "extensive strips of macadam surface" with coping stones

1945	23-27	10	North-West England, Bristol Channel, Western Scotland, Cornish Peninsula	The Guardian & The Observer	24/10/1945 - 28/10/1945	1	<p>and slabs of asphalt being hurled onto the road by the invading sea. A beer cellar was flooded in Rhos-on-Sea and the firebrigade was required to pump out water which was 5ft deep. The tram track was covered with deposited shingle by the surge and services delayed. Rhyl promenade was eroded and undermined and collapsed leading to inundation on the seafront where properties were flooded. The firebrigade was once more at hand whilst an army amphibious vehicle assisted in the rescue. Temporary precautions were taken in the case of immediate flooding on the next tide which didn't come. The Anglesey coast was strewn with wreckage of several battered lifeboats presumably torn from the davits of ships at sea. The surge was such in low-lying marsh areas wreckage was carried a mile inland on the south-wets coast of the island. The Blackpool promenade was much damaged and hundreds of yards of sea wall were swept away as water inundated the sea front and tore up paving and roads. The North shore boating pool was destroyed and the boats ruined. An Irish Sea ferry sprang a leak but made the journey safely to Kingstown from Holyhead but had to be withdrawn from service.</p> <p>1. Moderate damage. A gale raged through the British Isles with gale force winds being registered in Pembroke. No the North-West coast the surge was photographed breaking over the Blackpool promenade where 68 mph was recorded and the wall was breached in 2 places. In the Bristol Channel a tug gate was sunk by a floating lock gate they were trying to restrain in heavy seas and the tug sank with the loss of one man. A Severn Carrier was lifted</p>
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1945	18-19	12	Celtic Sea	The Guardian & The Observer	19/12/1945-20/12/1945	from the river and deposited by the surging tide on a Gloucestershire sandbank. Such were the gales in the Irish Sea that ferry services to the IOM were suspended. At Pembroke 85 mph was reached and 81 mph was reached on the Lizard. AT Pembroke it lasted for 63 hours. South-West Scotland was also visited by gales of 50 mph. Moderate damage. A gale spread throughout the British Isles being particularly prominent in the South as the depression passed over the Hebrides. A US aircraft carrier was damaged in the Celtic Sea and many troop ships were partially disabled in the English Channel and the carrier was compelled to put into Plymouth for repairs.
1945	26	12	Celtic Sea, Irish Sea, Western Scotland, Cornish Peninsula	The Guardian & The Observer	27/12/1945	Minor damage. The gales renewed once more after a mild Christmas. A steamer with 400 soldiers grounded near Loch Ryan and was much damaged. The Portpatrick lifeboat answered the vessel's distress call but was recalled owing to the great sea. A crew also spent "their Christmas holiday on the rocks at Plymouth" after the ship carrying 2,000 tons of coal dragged anchor and drifted onto the shore. It was expected she would be got off once the coal was transferred.
1946	31-4	2	South Wales, Bristol Channel	The Guardian & The Observer	01/02/1946 - 05/02/1946	Minor damage. Official gallantry. An intense depression brought a storm to the British Isles with gale force winds in South-west Scotland of 57 mph at Stornoway. The storm waters caused the collapse of a bridge in Somerset which reduced railway traffic. At Aberporth 66 mph was noted. whilst .54 inches fell at Tenby. A Dutch vessel was sinking off Ramsey but the crew were saved by a Dutch naval vessel. A submarine was also "helplessly adrift off the Pembrokeshire coast" and drifted to Aberystwyth

1946	20-24	2	North Wales, North-West England, Cornish Peninsula	The Guardian & The Observer	21/02/1946 - 25/02/1946	4	<p>witht eh south-westerly gale. A destroyer was escorting the vessel and coastguards were following along cliff roads. All but one crew remained aboard. The St. David's lifeboat stood by all night with a trawler.</p> <p>4. Minor damage. Official gallantry. Squalls visited the west of Scotland with 82 mph at Machrihanish and 80 mph at Stornoway. Snow fell widely causing disruption to travel. A trawler was forced aground and crew rescued by the Fleetwood lifeboat from the dangerous Pilling Sands. The crew sent distress signals and burnt oil rags. There were issues launching the Fleetwood boat as the landing slip had silted up and the Barrow lifeboat could not get near the trawler. The Fleetwood lifeboat rescued all abaord. A large port of Morecambe promenade was evacuated due to the deposition of a mine on the beach by the storm but it did not detonate. 73 mph was noted at Pembroke. The Torbay lifeboat lanuched with a launch from a minesweeper to search for missing men from the waterlogged whaler in Babbacmbe Bay. Al men were missing and not seen again. The River Dovey burst it's banks at Dovey Junction flooding the railway and road. The Mersey again rose but any flooding was confined to the middle course.</p> <p>Thunderstorms were reported at Southport and Fleetwood as well as in North Wales but no damage ensued.</p> <p>Minor damage. Official gallantry. Gales and squals came to the coasts and in Liverpool Bay the New Brighton lifeboat deployed to the assistance of 4 25ft yachts in</p>
1946	21	5	North-West England, North Wales	The Guardian & The Observer	22/05/1946		
1946	9 to 10	6	Liverpool Bay	The Guardian &	11/06/1946		

				The Observer			distress battling the north-westerly gale. They all decline the assistance of the lifeboat despite the fact one man was washed overboard but all made it safely back up the Mersey.
1946	30	7	North Wales, North-West England, Irish Sea	The Guardian & The Observer	31/07/1946		A July gale hit the North with a Irish Sea pleasure steamer from North Wales arrivving 5 hours late due to the high seas which caused much disruption for passengers and special trains had to be run to convey them home. Holiday-makers returning from the Isle of Man had a rough passage from Douglas to Fleetwood. The lifeboat at Llandudno saved two youths who had drifted out into Colwyn Bay caught by the south-westerly gale.
1946	11 to 12	8	Irish Sea, South-West England, Bristol Channel	The Guardian & The Observer	12/08/1946 - 13/08/1946		Minor damage. Official gallantry. Another summer storm brought heavy rain to Bristol and Weston were cars were axle deep in water due to the deluge of rain. Anxiety was felt in the Mersey but the rainfall didn't materialise. "Battling through gigantic seas, the Padstow lifeboat last night rescued the crew" of a steamer which had broken from it's tow. The vessel had 7 hours at sea and was damaged. teh vessel was in great peril as she dragged towards the rocky shores of Cornwall. A crew member satted "you can imagine how glad we were to see the lifeboat struggling towards us". Heavy rians fell right across the Irish Sea.
1946	28 to 4	9	North-West England, South Wales, South-West England	The Guardian & The Observer	28/08/1946 - 05/09/1946	1	1. Minor damage. Rains and gales came to the South-West from Atlantic. Winds of 68 mph were noted on the Lizard and 54 mph in Dumfiresshire whilst 49 mph was noted at Pembroke. By the 4th rainfalls of 1.86 inch were noted at Tenby and 0.97 inch at Newquay and Paignton. Blackpool experienced a blackout and trams ceased when the

1946	19-20	9	North-West England, South-West England	The Guardian & The Observer	21/09/1946	2	generation station was hit by lightning. A German prisoner of war was killed by lightning when hit near Ormskirk. 2. Minor damage. "Continuous heavy rain for twenty hours" caused flooding throughout Lancashire and the South-West of Britain was battered by a 100 mph gale registered on the Scilly Islands. Two people were killed near Bristol when a tree fell on a car.
1946	16-17	11	Celtic Sea, Southern England	The Guardian & The Observer	18/11/1946		A southerly gale bringing heavy rain produced heavy seas in the Celtic Sea but no damages were reported.
1946	24-25	11	North Wales, South Wales	The Guardian & The Observer	26/11/1946		Minor damage. Heavy rains and gales were noted throughout and flooding was particularly prominent in the Dee catchment were hundreds of acres and many roads were flooded. A track subsided due to the influence of heavy rain in Carmarthen and an engine and wagens fell down an embankment but only slight injuries were noted to the train driver and fireman.
1946	31 to 1	12	Bristol Channel, Irish Sea, South Wales, Western Scotland	The Guardian & The Observer	02/12/1946		Minor damage. Arctic winds brought snow which fell throughout Scotland. A missing steamer arrived in Belfast having had to shelter in Swansea due to the gale force winds which produced mountainous seas in the Irish Sea. An American tanker was also forced ashore on the Kenfig Sands in Swansea Bay but was not in any danger and assisted off by tugs. The gale in the Irish Sea delayed the arrival of 2,000 German prisoners of war needed for building and land work in Britain.
1946	11	12	South-West England, Celtic Sea	The Guardian & The Observer	12/12/1946		Minor damage. Gales came to Britain producing a storm surge which flooded Brunel's GWR main line between

1946		12		The Observer The Guardian & The Observer	01/01/1947		Starcross and Teignmouth and passengers had to be diverted. A review of the weather of 1946 which ran the headline "Last Year's Weather Worst Since 1903". The frequent gales of Spetmeber were noted especially when a wind of 100 mph was noted in the Scilly Islands on the 20th. The wet weather and storms of November and the accompanying flooding was noted. For rainfall it was the worst year ever since 1903.
1947	11 to 17	1	South-West England, Celtic Sea	The Guardian & The Observer	12/01/1947 - 18/01/1947		A considerable tempest came to the Isles bringing strong winds and rain. A convict escaped from Dartmoor prison but was recaptured. The Queen Elizabeth arrived in New York having battled against a 60 mph gale in the Atlantic and Celtic Sea when waves 50-90ft high swept her decks.
1947	15-17	3	Bristol Channel, North-West England	The Guardian & The Observer	17/03/1947 - 18/03/1947		Winds reached 98 mph as a tempest hit the UK and thousands of acres were under water in the Bristol Channel. Snow inundated the North and there was no open route to Scotland on either coast.
1947	7 to 8	4	Bristol Channel, North-West England	The Guardian & The Observer	08/04/1947 - 09/04/1947	1	1. Minor damage. Official gallantry. Violent storms were noted throughout the West of Britain. A search was abandoned for a local sportsman by the Mumbles lifeboat who searched Mumbles Head for his missing canoe but no vestige was found. Snowstorms, sleet and rain from the east meant damage was largely confined to the east coast. However flooding in Morecambe meant chefs had to cook in deep water as floodwaters seeped into underground basements which was a combination of high tides and large fluvial flows which raised the water table. In Merseyside 1 1/4 inch of rain was recorded.

1947 20-25	4	Western Scotland, Celtic Sea, Cornish Peninsula, North-West England, Bristol Channel, Irish Sea	The Guardian & The Observer	21/04/1947 - 26/04/1947	48	48. Major damage. Official gallantry. Inquest. Gales were felt throughout the West Coast of Scotland were 57 mph wwas recorded at Eskdalemuir and 54 mph at Stornoway. Storm surges were noted in the Solway area. In Annan the abnormally high springs and gales caused over 20 square miles to be inundated in the lower Solway. A shrimp factory was inundated and several premises were inundated. A wall collapsed in Glasgow and 16 families had to evacuate their tennament. In Morecambe several cyclists were blown from their machines. A warship broke form it's tow on route from Devonport to the Clyde in the Celtic Sea but was not in any immediate danger, however the vessel later drifted onto Cornish rocks and her crew was rescued by a lifeboat. It was thought she would be completely wrecked. A Cunard White Star liner the Mauretania on trial was unable to dock owing to the mountainous wave sin the Mersey and was kept riding out beyond the Mersey Bar. The captain stated on the 23rd "in a gale such as has developed today ... no big ship should attempt to enter any port in the world, let alone one like Liverpool with a difficult curving channel" which at places was only 700 ft wide. The ship was out in 70 mph gales for the night of the 23rd. A Dutch student was knocked over a killed in Freshwater Bay, Pembrokeshire having been blown over a cliff. At Renfrew "six ground mechanics had to hold down an aircraft from which a cargo of 45 cases of Irish whisky was unloaded during the storm". An engineer was seriously injured when a wall collapsed upon him. Squalls of 80 mph were measured at Carlilse and 73 at Anthorn as well as 68 mph at Southport.
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1947	14	5	North-West England	The Guardian & The Observer	15/05/1947	3	<p>A steamer went ashore near Porthcawl in the Bristol Channel and was reported to be breaking up and a lifeboat crew stood by. The lifeboat itself was wrecked and all 8 members aboard "Edward Prince of Wales" perished whilst the crew of the steamer also perished and an inquest was to be opened. A fund for the dependents of the lifeboat opened by major papers in the district and a Middlesborough paper opened a fund for the dependents of the steamer crew. Both reached £4000 and £1000 respectively. In all 47 men lost their lives in the Bristol Channel storm. The RNLI stated "it will pension the dependents of the lifeboat crew as if the men had been killed in action in the Navy". A gust of 88 mph was noted at Holyhead. At Campbeltown winds reached 70 mph and several boxes of bombs were washed ashore whilst other explosives were found off Arran.</p> <p>3. Minor damage. A storm off the Mersey resulted in the loss of three men on a journey to Fleetwood and the coastguard saw no sign of them despite vigilance throughout the coast. "Freak storms" also caused flooding throughout West Cumbria after intense storms of thunder and lightning accompanied by heavy rain and hailstones inundated the area. At Whitehaven lightning impacted a pylon causing power cuts throughout the area and flooding was widespread in Workington and Cockermouth with many premises flooded to a depth of several feet. In Southport an inch of rain fell in 15 mins severely impacting visibility. A house was badly damaged by a chimney lightning impact. Blackpool had 2 thunderstorms in 4 hours and a gas main was shattered.</p>
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1947	29-30	5	North-West England	The Guardian & The Observer	31/05/1947	Minor damage. Rain and thunderstorms came to the North drenching thousands at Blackpool whilst lightning struck and damaged two houses and a pier pavilion.
1947	4	6	Western Scotland, South-West England	The Guardian & The Observer	05/06/1947	Minor damage. Thunderstorms which occurred though the country and an ordnance factory was struck near Glasgow but no one was hurt. A man was taken to hospital near Bristol suffering from temporary blindness when the hut he was in was struck lightning.
1947	8	6	North Wales, South-West England	The Guardian & The Observer	09/06/1947	Minor damage. Official gallantry. Gales and thunderstorms once more came to the UK. The storms were most notable in North Wales where rain doused the countryside and coast. The Abersoch boatmen was deployed to rescue a capsized sailing dinghy caught in a sudden squall half a mile offshore. Two men were eventually rescued. Rain came to the South-West from the Atlantic.
1947	16-17	7	North-West England	The Guardian & The Observer	17/07/1947 - 18/07/1947	A storm of thunder, lightning and heavy rain came to the North-West but no damage was reported.
1947	22	9	Liverpool Bay	The Guardian & The Observer	23/09/1947	Official gallantry. The New Brighton lifeboat evacuated 6 anti-aircraft men from a battery on one of the three forts in the Mersey channel. Because of deteriorating conditions of the forts the commanders had decided to evacuate the men but the conditions were such the army launches had to turn back. The 6 men all jumped from the fort as the lifeboat rose and fell with the churning sea.
1947	12 to 13	11	Celtic Sea	The Guardian &	14/11/1947	Atlantic shipping was delayed by gales stretching from the Gulf of Mexico to the Celtic Sea.

1947	22-23	11	North-West England, Western Scotland and Wales	The Observer The Guardian & The Observer	24/11/1947		Storms brought widespread flooding to the North-West England, Western Scotland and Wales. In the west of Scotland torrents poured across roads and "affected hydro-electric power schemes" whilst landslides were widespread and caused great issue for traffic. Near Morecambe a 20 yard section of road was undermined by the floods and fell into the River Lune. The Ribble was in flood with large tracts in the middle and lower course being underwater. A fishing party capsized in a dignhy in the Mersey but were rescued by a smack. Four members were taken to hospital.
1947	27-28	12	North-West England, Western Scotland, Irish Sea, Cornish Peninsula, North Wales	The Guardian & The Observer	28/12/1947 - 29/12/1947		Minor damage. Cold north-westerly winds and heavy rain were widespread throughout Western Scotland and North Wales. The Dovey flooded it's plain and "farmers hurriedly removed stock from riverside meadows" whilst several main roads were flooded. 60 mph gusts in the Irish Sea and at Fleetwood meant only two trawlers returned from their Irish Sea fishing grounds with the rest seeking shelter off Northern Ireland and Western Scotland. 52 mph gusts were noted in Liverpool with hail showers which smashed windows and rendered many vessels storm-bound. Rainfall was heavy in the South-Wets with 1.18 inches at Ilfracombe.
1948	12 to 13	1	Western Scotland, South-West England, North-West England	The Guardian & The Observer	12/01/1948 - 14/01/1948	8	8. Moderate damage. Eight were killed as a bus hit them in Glasgow and many more injured. The bus had lost control in a storm of rain and sleet and careered into the queue leaving many more injured. The Mersey and Severn were both in flood in their middle courses. The Severn

1948	25 to 2	1	Western Scotland, Celtic Sea, Cornish Peninsula	The Guardian & The Observer	27/01/1948 - 02/02/1948	<p>was 12ft 7 inches above it's normal level at Worcester and the Avon 9ft above it's mean level at Bath. The Exe was also in full flood and villagers in Exe Bridge were forced to move into upper rooms as ground-floor rooms were flooded to a depth of four feet. Houses were flooded and grain damaged at Tiverton. 65 mph winds were noted in the Solway Firth and 60 mph was reported at Exeter as 57 mph gales were reported in the Isle of Man.</p> <p>Minor damage. Official gallantry. The "worst gales of the winter" battered the coasts of Britain. Trains were halted near Penzance where the storm surge invaded the line near Dawlish and eroded the supporting ballast and coping stones. Gusts in the West of Scotland reached 80 mph whilst on Bishop Rock and Wolf Rock lighthouse the men remained marooned as "relief boats stood by again yesterday in a vain hope of reaching lighthouses isolated by storms". The lighthouse keepers were now on iron rations. A tug stood by a disabled 10,000-ton freighter in Falmouth Bay after heavy seas had damaged her in the Eastern Atlantic. The Queen Mary liner was reported 30 hours late at New York as she had been held up by the severe storms from the South-West in the Atlantic.</p>
1948	30 to 4	4	Western Scotland, South-West England, Cornish Peninsula, Irish Sea, Celtic Sea,	The Guardian & The Observer	31/03/1948 - 05/04/1948	<p>Moderate damage. Official gallantry. A lightship went adrift off the Isle of Sicily leaving a dangerous reef exposed. Coastguards immediately notified and she deployed a subsidiary anchor off St. Ives. She was attended to by a Trinity House vessel and a lightbuoy was being towed to her station to mark the reef temporarily. A train was derailed by a rock which had fallen onto the track due to the force of storm wind on Welsh side of the</p>

			North Wales, Liverpool Bay				Bristol Channel near Lydney. Winds of 92 mph were noted off the West of Scotland whilst 81 mph was recorded in Anglesey and 63 mph at Pembroke. Pressure dropped to 27.91 and the storm belt stretched from Biscay to Iceland. Shoppers had a narrow escaped from falling masonry in Preston with only two having minor injuries as paving stones and windows were destroyed. Six hundred teachers attending a conference in the Isle of Man had their return delayed due to the mountainous waves in the Irish Sea and two passengers had to embark passengers in the dock at Liverpool as oppose to the landing stages. Heavy rain and gale scame to England and Wales with rain of 0.88 inches at Llandudno and 0.67 inches at Morecambe. No major damage was reported on the coast.
1948	2 to 3	6	North-West England, North Wales	The Guardian & The Observer	03/06/1948 - 04/06/1948		
1948	3 to 4	7	Irish Sea, North Wales	The Guardian & The Observer	05/07/1948	2	2. Minor damage. Official gallantry. A doctor and his firend went missing in a 16 ft sailing boat after being caught in a sudden storm in Cardigan Bay. They had left for a morning sail and no more was heard of them.
1948	20-21	7	North-West England, North Wales, South Wales, South- West England	The Guardian & The Observer	22/07/1948		A large depression moved over the North of the kingdom brining gales to the South-West and South Wales were 71 mph winds were reported at Pembroke. In the North-West and North Wales the gales were also felt with 70 mph winds at Anglesey and 62 mph at Southport. Nine trawlers were stormbound at Fleetwood and the fruit crop was damaged throughout the South-West.
1948	8 to 10	8	South-West England	The Guardian & The Observer	09/08/1948 - 11/08/1948		Moderate damage. Gales and torrential rain combined with high seas produced damage throughout the UK although this was largely in the east and south. Harvests were severely damaged throughout the South-West with

1948	22	8	North-West England, North Wales, South- West England	The Guardian & The Observer	23/08/1948	the corn being particularly badly affected by the torrential rain. Gales, heavy wind and sunshine came to the British Isles with rainfall being heaviest in the Western parts of England and Wales. 60 mph was noted at the Lizard and 53 mph at Holyhead. 0.92 inches fell at Tenby and 0.87 inches at Southport. Thunderstorms developed in West Cumberland, South-West Scotland and Renfrew. No damages were reported.
1948	12	9	North-West England, South Wales	The Guardian & The Observer	13/09/1948	Heavy gales and rain were felt throughout and many towns in Wales and Lancashire measured more than an inch with 1.65 inches at Tenby and 1.31 inches at Southport as well as 1.17 inches at Weston.
1948	2 to 7	12	Hebrides, North Wales, South Wales	The Guardian & The Observer	03/12/1948 - 08/12/1948	Moderate damage. Official gallantry. In a severe storm from the West a trawler was wrecked on Islay and 15 men were rescued by the Port Askaig lifeboat. Distress rockets were launched from a fishing vessel off Stornoway and the Stornoway lifeboat also delayed to their rescue. Winds at Benbecula reached 82 mph and 83 in Anglesey. Winds reached 93 mph at St. Ann's head in Pembrokeshire and in North Devon which were the highest of the winter so far.
1948	13-14	12	South-West England, Celtic Sea	The Guardian & The Observer	15/12/1948	Minor damage. An report on RAF exercises in the Atlantic in which 4 of 25 bombers could not take off due to a ferocious storm which was defined by stormclouds "from 100 feet solid to 25,000 with heavy icing". One aircraft was struck by lightning and one forced down to sea level such was the density of ice in this cloud. In Bristol the Fishponds area was flooded due to torrential rain over the South-West.

1948	28-30	12	Western Scotland, North-West England, North Wales	The Guardian & The Observer	29/12/1948 - 31/12/1948		Minor damage. Official gallantry. An intense depression south of Iceland produced severe gales in Scotland reaching over 70 mph. Rain spread over Scotland, Wales and North-West England as milder air from the South-West came in. Rainfalls of 0.75 inches and 0.63 inches were noted at Eskdalemuir and Renfrew. A trawler ran aground on the Scottish coast near Islay in a heavy snowstorm and the crew of 16 were rescued by the port Askaig lifeboat.
1949	17-21	1	Western Scotland, North-West England	The Guardian & The Observer	18/01/1949 - 22/01/1948	1	1. Moderate damage. Severe gales struck Britain and heavy rains caused flooding in Scotland. Rivers and streams burst their banks and flooding would be widespread by Lochaber and in Fort William houses were flooded to a depth of 4 feet. A man in a crane fell 50 feet when struck by another falling crane which had been blown over by the wind and died on impact. At Liverpool more than 12 shops were stormbound.
1949	8 to 9	2	Western Scotland, North-West England	The Guardian & The Observer	10/02/1949		Snow, sleet and rain came to Northern England and Scotland. RAC warnings for motorists were widespread as many roads froze due to the plummeting temperatures and precipitation.
1949	21-22	2	Western Scotland, Irish Sea	The Guardian & The Observer	23/02/1949		Minor damage. Impromptu gallantry. Strong winds caused issues for trawlers in the Irish Sea and one steamer went ashore in Stornoway Harbour. The Marchioness of Lorne also went ashore in the Firth of Clyde but all were rescued by a nearby motor-boat. Winds of 76 mph were noted at Holyhead.
1949	4	4	North-West England, Western Scotland, South	The Guardian & The Observer	05/04/1949		Minor damage. Official gallantry. Gales came to Scotland and Northern England and the lifeboat was launched twice at Fleetwood to rescue the crew of distressed vessels. One vessel was forced on a sandbank and the crew of 8

			Wales, South-West England						were all rescued whilst the lifeboat stood by ready to tow the vessel back to safety come high tide. The rescued skipper stated "we are the luckiest men alive" and all men were given appropriate refreshments on coming ashore having been exhausted and without provisions for hours. The wind rose to 80 mph at Southport, 74 mph at Pembroke as well as 69 mph at Holyhead.
1949	13-17	7	North-West England	The Guardian & The Observer	14/07/1949 - 18/07/1949				The North of England was hit by a storm which brought torrential rains, thunder and lightning throughout. A car was abandoned near Mossley Hill, Liverpool when drains were overwhelmed and flooded a street forcing a man to swim to safety. Heavy rain flattened corn near Ormskirk and lightning interrupted telephone services. Electrical supplies were affected by cheshire when struck by lightning whilst the Chester cricket ground was flooded by the rising Dee.
1949	2 to 6	8	North-West England, North Wales, South Wales, South-West England, Irish Sea, Celtic Sea	The Guardian & The Observer	03/08/1949 - 08/08/1949	4			4. Moderate damage. Official gallantry. Thunderstorms and strong winds were noted from North Scotland to Sussex. Three drowned when overwhelmed whilst bathing in heavy seas off Llandudno. An inquest found they were not strong swimmers and had been overwhelmed by the large waves and under currents and a verdict of "death by misadventure was returned". A man was also drowned in the sea Prestatyn when overwhelmed by a under current and carried out to sea. A man was lost overboard from a Fleetwood trawler in the Irish Sea and all trawlers in Fleetwood remained stormbound. Due to the amount of shingle deposited on the Fleetwood lifeboat slipway in recent storm surges the lifeboatmen had to dig their way down to the water before delploying to rescue a Bermuda-

1949	25-26	8	North-West England	The Guardian & The Observer	27/08/1949	rigged yacht near the Wyre lifehouse. The yacht was escorted back to Fleetwood with assistance and all those onboard were safe. North Wales pleasure steamers to Liverpool were held up and the duty pilot was forced to seek shelter whilst a large troop ship bound to Hong Kong was delayed by the driving westerly winds. At Penzance people walking on the promenade were blown off their feet by the gusts and torrential rain was noted. Members of the Falmouth lifeboat stood by as a passenger ship broke from her moorings but were not needed as she was taken in tow by another vessel. A 7 ton vessel was swept on the rocks near Porthcawl but the crew were rescued by two Army amphibious ducks. The vessel had encountered 13ft high waves in the Bristol channel whilst leaking and the broken engine had left them helplessly drifting. A fishing boat netted a mine in the Firth of Clyde and towed it for eight hours before it was sunk. Six men were forced upon Burbo Bank in a disabled vessel and rescued by the New Brighton lifeboat which towed them to safety. Several vessels were swamped at Aberdovey and 5 men fought for hours to save a launch from being smashed upon a promenade which they achieved. Storms were noted throughout Lancashire and the North-West but little damage resulted in coastal regions despite violent thunderstorms.
1949	12 to 13	9	North Wales	The Guardian & The Observer	14/09/1949	Minor damage. Official gallantry. Two well-known racing yachts anchored in Abersoch Bay dragged anchors in a strong easterly with one being wrecked and the other being rescued with major damage by a trawler two miles

1949	25-26	10	Irish Sea, North Wales, South-West England	The Guardian & The Observer	26/10/1949 - 27/10/1949		<p>from Pwllheli. The men decided to sail the latter yacht back to Abersoch but the sea was too rough for her to come ashore when they arrived hence the Pwllheli lifeboat was deployed only to find the men had been taken ashore on a small boat. "On her return the lifeboat took the stranded trawler in tow".</p> <p>Moderate damage. Official gallantry. Gales and exceptionally heavy rain caused widespread flooding across Scotland whilst the Dawlish railway was once more threatened by the storm surge at Dawlish. Huge waves pounded trains before the railway was declared a hazard. The Carlisle Edinburgh road was once more unsafe for use. At Douglas 2.31 inches of rain fell. A vessel off the Lizard was in a sinking state and fired distress rockets. She was aided by oil tankers and the Falmouth lifeboat. A vessel grounded off Holyhead but the lifeboat got alongside and rescued all those who required rescuing although the captain and a few others stayed on. "The Holyhead life-saving apparatus later got a communication line on board the vessel and rescued them by means of the breeches buoy" after it was clear they were in peril. The aircraft carrier Illustrious stood by.</p>
1949	13-14	11	South-West England, Celtic Sea, Bristol Channel, North-West England	The Guardian & The Observer	13/11/1949 - 14/11/1949	18	<p>18. Moderate damage. "An unstable westerly airstream" brought showers and gale force winds to the west of Britain with 69 mph recorded at Blackpool. Many Irish Sea vessels sought shelter in Douglas Bay. A man fell in the heavy seas on a vessel and killed. A tug sank in the Gladstone Dock and salvage operations were undertaken. Lifeboats abandoned the search for 6 missing crew of a Spanish steamer which sank off Lundy Island after huge waves</p>

1949	4 to 5	12	North-West England, North Wales, South Wales	The Guardian & The Observer	05/12/1949	<p>stove in her bows. There were 25 survivors and 12 dead with the Ilfracombe lifeboat deploying to the SOS "Urgent. Abandoning ship". The master noted off Bull Point in the Bristol Channel: "the ship was sinking at the bows and the stern was running out of the stern. I tried to turn her round to take shelter, but could not do so. Big waves broke the rudder and finally smashed the side of the ship, and water poured in. The ship exploded and sank". An interpreter translated stories of one lifeboat not being able to deploy quick enough before the vessel exploded. A small boat was washed into shore near Ilfracombe with only one man alive who was taken to hospital. Three lifeboats, three vessels and a warship all searched but found nothing. On arrival at Ilfracombe women brought the men clothes and blankets, and hotel-keepers provided hot meals and baths". An armistice service at Appledore held the silence for a few more moments to remember the dead of the war and the Monte Gurugu sailors.</p> <p>Minor damage. Squally winds from the west 74 mph at Pembroke. Rising of the River Dovey of 9 feet inundated surrounding areas. Ribble floods in Lancashire.</p>
1949	10 to 11	12	North-West England, Western Scotland, Hebridies	The Guardian & The Observer	12/12/1949	<p>Minor damage. Icy winds and snow covered the British Isles. Damage to the grid caused the British Electricity Authority to call for power economy. Rain was noted in the Hebridies and Western Scotland.</p>
1949	17-19	12	North-West England, North Wales	The Guardian &	18/12/1949 - 20/12/1949	<p>Minor damage. Snow and gales continued in the North-West and North Wales. Winds of 81 mph at Blackpool whilst Cumbria received heavy snow. Photographs of large</p>

1950	2 to 5	2	North-West England, South-West England	The Observer The Guardian & The Observer	03/02/1950 - 07/02/1950	storm surges at Llandudno covering coastal roads and breaching the sea wall and inundating coastal gardens. Moderate damage. Official gallantry. Severe gales in the South-West with squalls of 80 mph and sotrm surges at Torquay flooding the coastal roads to 2 feet. Newquay 100 mph gust. Falmouth lifeboat deployed to aid vessel in ditress but not needed. Weston lifeboat rescued 16 men in broken vessel. Sinking abandoned vessel in the Bristol Channel with crew were marooned on St. Tecla rock island. Flooding accompnied rainfall in South-West with 1.67inches at Dawlish adn 0.75 inches in the North-West. 73 mph gale at Lerwick.
1950	11 to 14	2	South-West England, Mersey, Celtic Sea, Irish Sea	The Guardian & The Observer	12/02/1950 - 15/02/1950	Minor damage. Sweeping gales hit the British Isles and warnings were in operation in all seas. Coastal traffic at a stanstill. Heavy rain over the South-West and Wales. Flooding confined to upper reaches of the Severn. Large vessels stormbound in the Mersey. Queen Mary liner damaged in Atlantic.
1950	19-20	3	Celtic Sea, Irish Sea	The Guardian & The Observer	20/03/1950 - 21/03/1950	Minor damage. Vessel forced into Fishguard due to damage sustained in Irish sea storm with passenegrs conveyed by rail instead. Queen Mary again held up by bad Atlantic weather.
1950	1 to 2	4	North-West England, North Wales, Irish Sea	The Guardian & The Observer	03/04/1950	Moderate damage. Official gallantry. Bracing gales were warned about and struck with a wind speed of 69 mph at St. Annes. Five merchant ships and the St. Mary's lifeboat were seaching the Atlantic after white rockets were sighted but no sign of the vessel. Storm-bound liners in Liverpool docks. High snow fall in North Wales and North-Wales. Lifeboat took medical aid 17 miles out into the

1950	9 to 10	4	North-West England, North Wales	The Guardian & The Observer	10/04/1950 - 11/04/1950	Irish Sea after coastguards spotted a medical assistance flag flying. Minor damage. Bad weather plagued the bank holiday. Strong winds resulted in large aeolian transport of sand and deposition of roads near Blackpool and St. Annes. Sailing prevented at Heysham due to very strong onshore winds. Heavy snowfall in North Wales.
1950	23	7	North-West England	The Guardian & The Observer	24/07/1950	North-West experienced severe thunderstorms.
1950	6 to 7	8	North-West England	The Guardian & The Observer	08/08/1950	Storm bringing hail and heavy rain hit the North of England.
1950	29-30	8	North-West England, North Wales	The Guardian & The Observer	30/08/1950 - 31/08/1950	Minor damage. Official gallantry. Heavy floods resulting thunderstorms caused the greatest losses since the war. A high tide and heavy rain of 1.51 inches caused heavy flooding in basements and the fire brigade were widely on demand. A hotel and new ballroom floor was completely ruined. The staff at one hotel worked allnight to save carpet. roads were flooded to 2 feet. In Dovey the river flooded to road to a depth of a foot. Harvest losses were serious in Wales. Blackpool had 1.77 in of rain in 24 hours which was half a month's rain in 24 hours with 1.42 inches falling 3 hours.
1950	6 to 8	9	North-West England, North Wales	The Guardian & The Observer	07/09/1950 - 09/09/1950	Minor damage. Official gallantry. "Unusually severe gales developed on Western coasts" and gale warnings were widespread Four hundred passengers were unable to return from the Isle of Man to Llandudno due to the

1950	15-19	9	North-West England, Western Scotland, North Wales	The Guardian & The Observer	16/09/1950 - 20/09/1950	1	<p>heavy seas produced by the wind. Velocities of 83 mph at St. Anne's head. 30 caravans overturned near Conway. AA reported many roads near Portmadoc were blocked due to torrential rain and flooding. Railway lines were blocked in Barrow-in-Furness and the ballast holding the railway collapsed leading to subsidence and the removal. St. Anne's fireman were again out dealing with floods on the promenade but serious damage was prevented.</p> <p>1. Minor damage. Official gallantry. Impromptu gallantry. Heavy rain and thunderstorms were widespread throughout England and Wales. A cyclone warning was provided as it was noted developing 1000 miles west-south-west of Ireland. On the 17th the hurricane brought gusts of 88 mph to the U. A canoeist was missing in the River Lune after he drifted off and his canoe was found on a weir. Eight men were rescued by breeches buoy when a steamer went ashore near Campbeltown. The illuminations at Blackpool and Fleetwood were damaged whilst storm surges swept over the Fleetwood sea wall and the police warned of flooding danger. Storm surges were noted at Llandudno as the sea overtopped and carved a large gap in the sea wall and sailings were cancelled. Steamers struggled to return to port at Ilfracombe. Winds at St. Anne's head reached a max of 82 mph and 64 mph noted at Blackpool. 40 cattle died on an Irish Sea steamer whilst crew and cattlemen struggled to control all 470. A Cunard liner Georgic was prevented from docking at Liverpool due to the gales and heavy sea. The New Brighton lifeboat rescued the crew of a disabled schooner off Southport. Fish shortages were noted in Fleetwood as</p>
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1950	15-17	12	Celtic Sea, North-West England	The Guardian & The Observer	16/12/1950 - 20/12/1950	storms had prevented feasible trawling and prices rose to £ 12s for cod and £6 8s for haddock. Minor damage. Gales from the South-west caused mountainous seas in the the Celtic Sea with one vessel sustaining loss of deck cargo and 24 passengers as well as crew were injured. The captain stated "The seas were mountainous and I ordered broadcasts, warning passengers to look after themselves and to keep to their bunks if possible". High winds prevented the troopship Empress of Australia from berthing at Liverpool with servicemen and families from the Far East. One battalion was coming home after 23 year abroad. Snow fell and the Cardigan to Aberayron road was two to three feet deep.
1951	21-22	1	Hebridies	The Guardian & The Observer	23/01/1951	Minor damage. Official gallantry. A vessel bound to Newcastle and then to India was driven aground at Coll in the Hebridies and began sinking. The crew were gallantly rescued by the Mallaig lifeboat and landed at Tobermory. The first officer stated "The only trace of the ship was a pile of wreckage".
1951	4 to 5	2	Irish Sea, Celtic Sea, Western Scotland	The Guardian & The Observer	05/02/1951 - 06/02/1951	Minor damage. Official gallantry. Impromptu gallantry. 80 mph gusts swept Britain from Conrwall to North Scotland. The high winds were accompanied by hevay rain and sleet in the North. Gusts reached 80 mph in the Scilly Isles and 74 mph in the Isle of Man. Small vessels in Scotland were stormbound. Naval vessels and the Campbeltown lifeboat answered SOS messages from a towing ship concerning a distressed landing craft which had fallen off tow and the craft was secured. An air and sea search was carried out for a trawler in the Celtic Sea involving eight trawlers and one RAF Sunderland flying boat but no sign was found.

1951	23-24	3	British Isles	The Guardian & The Observer	25/03/1951	The trawler owners "appealed to radio amateurs to keep silent last night to avoid confusion of messages" and to aid the trawlers seeking to vessel. Snow and gales were widespread throughout the west but damage was minimal although business in Blackpool was slow.
1951	8 to 9	4	British Isles	The Guardian & The Observer	10/04/1951	Gales delayed the census in British Islands. It was stated "in the case of lighthouses off the Scottish west coast this will be in about nine days". Trawlermen were likewise affected.
1951	8 to 12	8	British Isles	The Guardian & The Observer	10/08/1951 - 13/08/1951	Minor damage. Heavy storms of thunder and lightning were noted over the North-West but little damage was noted. A yacht in the RORC Fastnet Rock race returned to port flying a signal showing a doctor was required. One of the crew had sustained severe rib injuries having been thrown across the vessel in the Celtic Sea and he was taken by motor launch to hospital.
1951	3	11		The Guardian & The Observer	03/11/1951	A succinct article from the National Physical Laboratory concerning vessel storm testing using wax models in observation chambers and storm tanks. The models were made exactly to the lines submitted by the naval architects which took a month and model engines were installed. The wash of the ship and it's handling in different sea states were recorded and seaworthiness assessed. Propeller pitch was altered to ensure the most efficient yet stable manoeuvring of the vessel.
1951	4 to 5	11	British Isles	The Guardian &	05/11/1951 - 06/11/1951	Moderate damage. Official gallantry. "Gales take their toll round the coast" as shipping and coastal communities were majorly affected by severe gales. The vessel was a

				The Observer			complete loss. On the Cornish coast 17 men were rescued by the Coverack lifeboat. A schooner with treasure finding intentions in the South China Sea was dismasted. In Torbay gusts of 80 mph were noted at sea spray was carried to a height of 200 ft. A man was washed off the Rock Ferry pier but was rescued by the pier master. Floods were widespread in the South-West of England and in the South Wales with several major roads flooded to 6 feet and 4 feet.
1951	28	11	North-West Britain	The Guardian & The Observer	29/11/1951	2	2. Minor damage. Two were killed by a falling sea wall in Liverpool as brickwork gave way. Sea defences near Fleetwood were badly damaged and hundreds of sandbags were used to dam the wall and prevent a school flooding. All flights from the four Scottish aerodromes were cancelled.
1951	27 to 2	12	British Isles	The Guardian & The Observer	28/12/1951 - 10/01/1952	6	6. Major damage. Official gallantry. Gales battered the British coasts and a seaman at land's End was "engulfed by a wave" and lost to sea after trying to secure a boat. A radio message from Campbeltown stated that a oil tanker vessel was damaged off the Hebridies in the mountainous seas and a vessel was standing by. The Scillies recorded a gust of 99 mph. A schooner capsized off South Devon with the death of of 5 although 9 were saved by a Devonport Dockyard tug. The Plymouth lifeboat and another vessel deployed to an SOS sent by a tanker for a schooner off Bolt Tail. The schooner was the only "remaining topsail schooner sailing under the British flag" and an earlier attempt by a French trawler had failed. Spray again reached 200 ft on the Bishop Rock lighthouse. Liners Empress of Canada and Hildebrand making her maiden

voyage to the Amazon were galebound all day. At Port Talbort a sandstorm occurred with drifts of 5 feet being blown from the dune. A 28 foot storm surge at Blackool nearly submerged the piers and the sunken gardens were inundated and sea wall panelling damaged. Many telephone lines were down in the Southport and Birkdale district when heavy rains penetrated the main junction cable. The South emergency services established 4 radio stations so that people could get in touch with them in case of accident as 1.71 inches of rain fell. It was implied some vessels may have been lost at sea. The rarity of hurricane gusts exceeding 100 mph was stressed. The Craignure village hall was swept away by a surge. A United States Maritime Commission vessel the Flying Enterprise foundered in the storm off the Lizard in gale force westerly winds and she was photographed listing on her side after attempts to tow her failed. It was discovered that she had suffered structural damage and a crack was found across the weather deck from a rogue wave. The cargo then shifted. An SOS was issued on 28 December, by which time she was listing 45 degrees to port. She was beaten by 20 foot swells making vessel salvaging impossible. All evacuated on the 28th with the loss of one life except the captain and officer who gave up on the 6th as Captain Carlsen and Dancy finally abandoned ship at 15:22 hrs and were picked up by Turmoil. The captain had initially refused assistance from the a British ship preferring American assistance and asking the British ships to standby. Tributes poured in from America with an American admiral Robert B. Carney

<p>1952 9 to 18</p>	<p>1</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>10/01/1952 - 17/01/1952</p>	<p>stating "Your courage matches the great performances of hisotry, and is an inspiration to men of today to equal or surpass the deeds of their forefathers". Large queues developed on the coast and coastguards were on alert. The town of Falmouth waited in hope the men would be ok. It was later reveal it was believed the men had stayed onboard as the vessel secretly contained important high-grade zirconium important for the US Navy's nuclear submarine project but all hope of rescuing the vessel eventually faded.</p> <p>Moderate damage. Official gallantry. At Fleetwood 9 workmen were marooned on the skeleton frame of the Wyre lighthouse after their dinghy was swamped in the gale. Attempts to take them off failed and they were forced to wait 10 feet above the water. They then bravely went across the sands for 9 miles in the dark at low water.. It was remarked "it was a tricky job - suicide for anybody not knowing the banks like the back of their hand". The moral boost of seeing the lights of the shore helped the men throguht the storm. The Mersey experienced heavy gales driving ships into dock. Empress of Canada was 9 hours late in reaching Liverpool being forced to seek shleter in the Irish Sea. 13 of the crew of a Liberian cargo vessel wrecked near Land's End were brought aboard by breeches buoy after rescuers had previously left thinking they had saved everyone. Ice and snow were widespread on the roads of England and Scotland making vehicular transport difficult. The ship was a blazing as a fire that broke out caused 3 explosions and broke into her cargo hold. The AA issued warnings.</p>
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1952	28	1		The Guardian & The Observer	29/01/1952		A article on wave research undertaken by the government concerning an example of the analyses of the swell off Cornwall "from which distant storm centres have been plotted" and a twelve inch movement had been traced to the Falklands. Broad theories realting to frequency and velocity.
1952	15-16	8	British Isles	The Guardian & The Observer	17/08/1952 - 03/09/1952	34	34. An article on the notorious Lynmouth Flood in Cornwall. A thunderstorm storm bringing with it torrential rain burst over the catchment of the Lyn and flood waters swept down bringing huge boulders and carrying away all before it including bridges and power cables. Mary-Anne Shelley's cottage was demloished as along with an estimated 100 buildings as the recently engineered culvert chocked with debris and flooded the town. "The area has been declared an emergency one. Special constabulary have been drafted into the district. The military have been called in, and amphibious vehicles have been sent to Lynmouth". On the 3rd after it was reported the survivors were to be returned by the 14th September between 50-60 of the 200 properties could be reinhabited. The cause had been detrimented to be 90 inches of rain falling within 24 hours on Exmoor's already saturated surface which had overwhelmed the small catchment and culvert. Eight permant houses were to be built for the homeless and 20 temporary houses were to be built whilst others were repairable. The relief appeal on the eve of the 2nd rose to £395,552 from citizens all across the country.
1952	25-26	9	British Isles	The Guardian &	27/09/1952		Minor damage. Liners were held up in the Mersey as strong onshore winds came to Britain with 1928 travellers

1952	23-28	10	British Isles	The Observer	25/10/1952 - 29/10/1952		stranded. Irish Sea vessels were 5 hours late. Blackpool's illuminations were quickly taken down by workmen for fear of damage in the gales and some sustained damaged. Minor damage. Impromptu gallantry. A vessel was abandoned in the Celtic Sea and the occupants saved by a motor-vessel which itself sustained damaged. They had lost most of their possessions. Shipping was warned to keep a look out for their drifting vessel. Mail boats in the Irish sea had a rough journey to Kingstown and Clyde steamers were affected by gusts of 55 mph. Flooding was notable near Dovey and Cardiff as well as Dolgelly and the Conway was in full flood.
1952	16-18	12	British Isles	The Guardian & The Observer	18/12/1952 - 19/12/1952	1	1. Major damage. Official gallantry. Impromptu gallantry. The Guardian headline read "Britain's third worst storm on record" as gusts of 111 mph caused large shipping delays. The wind speed at Liverpool hit 100 mph whilst 94 was noted at Tiree and 91 at Blackpool. This resulted from a severe depression north of Scotland with a low of 28.35 inhg. Winds damage lockgates at Birkenhead and the waterlevel fell 6 feet and a large Panamanian freighter nearly listed over having grounded. The New Brighton lifeboat searched for 5 hours after a ships rowing lifeboat was swept off course when deployed to save one man who was lost at sea. Liners were held up leaving Liverpool and many liners and troopships had to seek shelter off on the North Wales coast. Heavy damage was caused by a gale and heavy seas at Llandudno were the storm surge inundated seafront properties and flooded shops and hotels. Penrhyn Bay experienced great erosion undermining cliffs. At Rhyl traffic was interrupted by the

1953	30 to 2	2	British Isles	The Guardian & The Observer	01/02/1953 - 03/02/1953, 12/02/1953	133	<p>storm surge and sand drifts. Lytham St Annes registered a gust of 93 mph and patients were injured when a window was blown in at the Lytham St Annes hospital. 40 workmen had a narrow escape when the roof was ripped off an 800 ft shed. Fleetwood trawler sailings were stopped and vessels could not enter port. In Preston two firemen were hurled 35ft to the ground when a fireescape ladder was blown away and they were taken to hospital. The AA stated frozen snow would cause hazardous driving conditions in Scotland, Wales and Cumberland. Damage was so widespread it was estimated the cost would total £1,100,000 as the post office and insurers worked tirelessly to process complaints and assess the damage. Several electricity shortages happened in Birkenhead and the Wirral with sand and salt being blamed as it interfered with insulators at Bromborough Power station.</p> <p>133. Major damage. Official gallantry. Impromptu gallantry. Widespread damage was reported throughout England with gusts of 113 mph. A man was killed in Liverpool when a tram shelter collapsed on him. Jetties were smashed and an oil leaked into the Mersey as the tanker was caught by a gust and was cast open. A vessel belonging to the British Transport commission vessel the Princess Victoria sank off Wigtownshire with the loss of 133 lives. Lifeboats, a destroyer and merchant ships all came frantically to the rescue. Many were rescued and scores of dead were picked up having died of hypothermia and shock. It was remarked "Natural calamity is a salutary reminder of the littleness of man: he may harness atomic energy, but a gale from the north still makes the seas</p>
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1953	8 to 13	2	Western Scotland	The Guardian & The Observer	09/02/1953 - 14/02/1953	perilous and can demolish his dwelling-places far inland". Whilst the Lynmouth disaster of 1952 was referred to this was largely in response to the devastation North Sea storm surge which had just occurred. As had often followed many tremendous storms a historical article concerning the 8,000 lives lost during the Great Storm of 1703 was published perhaps as a barometer. Moderate damage. A great storm came to Britain felling an estimated 20,000,000 cubic feet of trees throughout Scotland and timber merchants were flooded with offers to take the felled trees. There was not the skilled labour available to cut the vast amounts of wood that had been blown down and it was estimated it would take 2 years to clear the mass of felled trees.
1954	3 to 9	3	British Isles	The Guardian & The Observer	11/03/1954	"The traditional lion-like emergence of March has not failed us this year" with moderate storm surge conditions on the Lancashire coast although little damage ensued due to the improved storm surge defences. The mildness of the conditions was contrasted with the blizzard of 1891.
1954	19-20	8	British Isles	The Guardian & The Observer	20/08/1954 - 21/08/1954	Minor damage. impromptu gallantry. Gales swept the coast in the North-West causing cruising cancellations from Liverpool to Llandudno and many vessels hurried for shelter on the Menai Straits to avoid mountainous seas. A football match was in peril as heavy seas meant a goalkeeper marooned on a lighthouse without relief could not make it back to the mainland. A Dutch freighter made port in the Mersey despite the fact she had a 30 degree lost after damage on route round Scotland. A swing bridge was blown into a wheel house of a tug but the driver

1954	9 to 16	9	British Isles	The Guardian & The Observer	10/09/1954 - 17/09/1954		<p>escaped. A man was also hit into a dock by the swing bridge and saved by colleague.</p> <p>Minor damage. A southerly gale swept the Blackpool and Fylde coast with gusts of 52 mph. All work on the seafront was promptly stopped in fear on the storm surge but no considerable damage resulted. Air liners over the Irish Sea were 28 minutes ahead of schedule from Manchester to Belfast. Watch was kept on the River Dovey near Merioneth after it flooded inundated agricultural land and put roads under 2 feet of water.</p>
1954	26-29	11	British Isles	The Guardian & The Observer	27/11/1954 - 30/11/1954	2	<p>2. Major damage. Impromptu gallantry. Official gallantry. "Gales at seas and floods ashore brought distress" across much of Britain. At Land's End surges broke on the sea wall with spray reaching the full height of the hotels. At Gunnislake a flash flood forced an evacuation after floods covered the town. The parish hall was used as an evacuation centre as water rose 3 feet in some homes. The sea wall was breached in Torquay and the coastal road flooded and thus became impassable. Isle of Man ferries had much difficulty in the Irish Sea. A Liberian tanker found a sinking coaster off the Lizard but all sight was lost and it was presumed she had sunk. The caves in Glastonbury were flooded "as they were a million years ago". Flooding was interrupted in Lancashire and 7000 acres of farmland was underwater. A RN helicopter attempted to rescue men in a Liberian tanker but all were later rescued by the lifeboat. The remains of the vessel (in half) was towed up the Irish Sea and the Mersey Docks refused to accept the tugs given the chance of explosion. An article followed on repairing storm damage called "In</p>

1954	4 to 8	12	British Isles	The Guardian & The Observer	05/12/1954 - 09/12/1954	<p>Readiness for More" indicated further storms as floods swept through the West Country and Wales. Bristol and the SW suffered electricity shortage and all of electricity company employees were fully mobilised. To get to one sub-station in Devon a boat was required. A transformer was also swept out to sea along with power lines. A Dutch ship was lost off the Lizard and deceased were picked up by the lifeboat.</p> <p>Minor damage. Liners were delayed as gusts of 98 mph were noted in North Wales and gale warnings were in operation. A woman and daughter were almost crushed in Glasgow. The Mersey was too hazardous for liners to dock. A 40 foot iron tram standard blew into the path of a tram in Liverpool but damage was avoided by quick thinking. Northern air services were cancelled due to snow and the high winds causing dangerous conditions and poor visibility. The RAC stated these were "the worst road conditions this winter" as snow, ice and fog together with fallen trees and landslides caused havoc across the UK.</p>
1954	21-23	12	British Isles	The Guardian & The Observer	22/12/1954 - 24/12/1954	<p>Moderate damage. Westerly gales swept the UK and a vessel was forced ashore in the Firth of Clyde and could not be towed off. Pupils in Glasgow were almost crushed by a falling verandah but escaped as storm winds swept the city. Most air services in Scotland were grounded. Liverpool's civic Christmas tree was broken in two. The Empress of Australia was unable to dock in Liverpool and had to ride out the gale beyond the bar. 28 1/2 hours of full gale were recorded at Bidston. A man collapsed from exposure on a roof and was taken to hospital.</p>

1955	3 to 4	1	British Isles	The Guardian & The Observer	04/01/1955		Minor damage. Snow was driven across Devon by a gale and covered the ground an inch deep. In South Wales power cables were blown down and linesmen who tried to climb the poles to repair were ordered down due to the current danger.
1955	23-24	3	British Isles	The Guardian & The Observer	24/03/1955 - 29/03/1955	1	1. Moderate damage. Gales reached 80 mph around the coast of Britain. A boy was seriously injured in Torrington when he was blown from a roof with his father whilst trying to secure it. At Aberavon a motocyclist was blown into a bus and the rider killed. A ship went ashore in Plymouth along with a tug which was also swept onto the rocks. The tug was got off but the liner remained stuck. A vessel was almost forced onto the sands at Port Talbot but docked safely after the seas swept over her and the crew fought a fire. The crew refused to be taken off by helicopter. Two passengers were cut by flying glass on a ferry across the Mersey. A coaster was also blown aground on the Mersey. A 9,500 ton vessel launch was postponed at Birkenhead due to the wind. This also occurred in the Clyde. At Bristol port and sherry was dumped overboard after the vessel was damaged in the Irish Sea and the casks split.
1955	17 to 18	5	British Isles	The Guardian & The Observer	18/05/1955 - 21/05/1955		Minor damage. A May storm brought snow to Britain in select areas as well as moderating gales. Crops were greatly damaged in the North whilst the continuing storms reduced lamb numbers by 20%.
1955	7 to 8	6	British Isles	The Guardian & The Observer	08/06/1955 - 09/06/1955		A freak storm off the Isle of Arran swamped by heavy seas but although the vessel foundered the crew escaped. It was carrying coal recruited to ease the emergency following the rail strike.

1955	12 to 14	7	British Isles	The Guardian & The Observer	13/07/1955 - 15/07/1955	1	<p>1. Major damage. A deluge of rain caused a landslide which "threatened to overwhelm many houses in the mining village of Blaengwynfi, near Port Talbot". One villager said "I thought the end of the world had come" when the storm broke. 6 families were rendered homeless and 13 other homes had to be evacuated but were not materially damaged. Water poured into the houses "bringing with it boulders and earth sheared from the mountain" which piled 12 feet high against the back of houses as the ground floors were inundated to 4 feet. Fathers and sons ran from the pit calling in fear as they watched the landslide approach. One woman stated "The storm was terrifying. Rain, thunder and lightning lasted for an hour and a half and we could do nothing". Glamorgan County Council social welfare scheme was put into operation for the homeless families who were housed in a chapel and school meals were provided. One boy was killed in a thunderstorm having been struck on the playing fields in Frome in an area greatly affected by the thunderstorm as temperatures of 83 F were noted which rapidly dropped with the approaching thunderstorms.</p>
1955	12 to 13	8	British Isles	The Guardian & The Observer	13/08/1955 - 15/08/1955	1	<p>1. Minor damage. An emergency occurred when a water pipe was hit by a lightning strike near Polzeath and holidaymakers were rationed to 2-3 pints of water due to the induced drought. A woman was killed at Cardiff by a lightning strike when sheltering under a tree. Shops in Runcorn were also flooded when the rains overwhelmed the drainage but no major damage was reported.</p>

1955	9 to 14	9	British Isles	The Guardian & The Observer	10/09/1955 - 15/09/1955		Minor damage. Lightning and heavy showers were present throughout the South-West. Snad-yachters enjoyed the strong winds at Lytham St. Annes with one vessels obtaining 45.85 mph. Heavy rains cause a landslide which blocked a road into Aberystwyth causing much annoyance for motorists although no casualties occurred. A family of 7 escaped injury at Wallasey when a TV aerial was blown 60 feet and crashed through their window. The Cunard liner Saxonia had to embark six hundred passngers in the Sandon basin as high winds pevented her reaching the landing stage and she was much delayed in leaving the Mersey.
1955	5 to 6	10	British Isles	The Guardian & The Observer	07/10/1955	1	1. Minor damage. "Very deep depressions" brought windspeeds of 71 mph to the UK. All shipping on the Mersey was stormbound and rough passages were had across the Mersey. A man was drowned in a launch when an anchor was blown into it by the wind and the vessel sank. Dublin packets were much delayed. The New Brighton seawall was breasched and the sea "ripped up apts of the promenade" which was strwen with broken debris and Hoylake fishing boats were damaged. Two firemen were blown down taking down a nameplate and one broke a foot. Fallen trees blocked roads throughout the North-West and 50 men worked at Blackpool to repair damage to the illuminations and aircraft were delayed over the area.
1955	1 to 2	11	British Isles	The Guardian & The Observer	03/11/1955		Minor damage. Gale force winds battered the west of the British Isles. An Irish Sea fery was delayed for 14 hours from leaving Liverpool due to the sea state and the danger of the Mersey Bar. A vessel under tow in the Ribble ran

1955	28-29	12	British Isles	The Guardian & The Observer	29/12/1955 - 30/12/1955	<p>aground and four tugs maneourved her off. Many flights were dalyed over the Irish Sea.</p> <p>Winds fo 75 mph were noted at Blackpool as gales hit the Uk. Two people were injured in Glasow when a chimney stack fell throguh the ceiling of their houses. The gale put 150 lines at Blackpool. The Mepress of Drance was unable to leave Gladstone Dock owing to the furry of the waves and wind on the mersey and passengers embarked in the dock. 14 trawlers were stormbound at Fleetwood. 81 mph at Liverpool and 73 mph at Pembroke. At Seamcombe the flaoiting roadway was damaged and emergency repairs were undertaken. The Manchester Ship channel was stopped for 18 hours.</p>
1956	9 to 10	1	British Isles	The Guardian & The Observer	11/01/1956	<p>Minor damage. Impromptu gallantry. Official gallantry. The Workington lifeboat was called out to aid the Fleetwood trawler Tranquillity and towed to port. She was a notorious vessel for requiring lifeboat aid. She had broken down of St Bees Head and after a failed towing attempt she anchored before the lifeboat came to her rescue.</p>
1956	28 to 2	3	British Isles	The Guardian & The Observer	01/03/1956 - 03/03/1956	<p>Minor damage. Gale force winds and thunderstorms were notable throughout Northern England with 73 mph at Liverpool. Three men narrowly escaped injury when falling masonry narrowly missed them in Wallasey.</p>
1956	2	6	British Isles	The Guardian & The Observer	04/06/1956	<p>"In spite of gale warnings, the handicap races from West Kirby to Mostyn and back to Hilbre Island were sailed" with boats competing for the Modwen cip and Farrar salver. A strong westerly required boats to reef during a strong beat against the wind.</p>

1956	4 to 5	6	British Isles	The Guardian & The Observer	06/06/1956	Official gallantry. The Douglas lifeboat was launched in the Irish Sea to evacuate a sick man off a vessel in huge seas off the a vessel several hundred yards outside the harbour. The man was escorted to hospital safely and Canadian Pacific liner was 17 hours late inot Liverpool having been held up by gales in the Celtic Sea.
1956	11	6	British Isles	The Guardian & The Observer	12/06/1956	Minor damage. Houses were damaged and roads were flooded across the North-West during widespread thunderstorms.
1956	17	7	British Isles	The Guardian & The Observer	18/07/1956 - 19/07/1956	Moderate damage. Official gallantry. Impromptu gallantry. Substantial rainstorms came to the North-West causing widespread flooding. At Hoylake flooding reached a foot on roads which was a result of the very high tide and substantial rainfall which overwhelmed sewers and drainage capacity causing the flood. Fleetwood was also flooded as people moved carpets and furniture upstairs to prevent daamage. In Preston over an inch of rain fell in one hour ad visisbility was much reduced as houses were flooded and the fire brigade were deployed to pump water out of homes. Near chester the flooding was reported to be 5 inches over a 2 mile stretch of road. Photos of buses travelling through a feet of water were noted and holiday makers formed bucket chains to bail boarding houses. In some areas of the town 2 feet of water accumulated on the ground floor. Lightning also tore slates off the roof of a children's home in Lytham St Annes. A boys brigade camp was wrecked at Wallasey when 16 tents were wrecked by the storm. A house in Ellesmere Port had a hole ripped in the roof.

1956	29-30	7	British Isles	The Guardian & The Observer	31/07/1956	Moderate damage. Official gallantry. Impromptu gallantry. High winds were noted throughout the north of the kingdom which were particularly prominent in Lancashire and South-West Scotland. 11 cars were trapped in landslides off Caernarvonshire and villages were without electricity for 22 hours. Crops were widely damaged across Devon and the NFU expressed their concern that the fruit crop would be hard hit. A vessel was overwhelmed in the Celtic Sea but the crew was aided by a French trawler and brought to newlyn. Another vessel was evacuated in the vicinity by a coaster and the lifeboatmen later saved the vessel. Winds of 55mph made Mersey shipping difficult and a number of vessels at the Mersey bar had to "scatter for shelter" with some taking refuge off Anglesey. A vessel broke free in a dock but was later secured and hundreds who had paid to go on a pleasure cruise were refunded. The lifeboat at Portpatrick Wigtownshire was launched to assist a naval minesweeper but the latter was later escorted in by a frigate to Belfast. The "famous breezes of Blackpool, blew sea spray and sand over the promenade" damaging the illuminations and marquees and flowers at the Royal Lancashire show although this still went ahead despite the conditions and 45-60 mph of wind.
1956	14 to 19	8	British Isles	The Guardian & The Observer	15/08/1956 - 20/08/1956	Minor damage. Gales struck Britain causing delay to pleasure steamers from the Mersey whilst the Fleetwood to Douglas steamer was much delayed. Air liners were widely delayed across the Irish Sea.
1956	29 to 2	9	British Isles	The Guardian &	30/08/1956 - 03/09/1956	Minor damage. A winter's gale in August caused much disturbance but largely on the east coast. Four yacht,

				The Observer		eight motor boats and several rowing dinghies were damaged in South Caernarvonshire by gales from the east in Abersoch Bay. Two yachts sank at their moorings and others were swamped off the Llyn Peninsula.
1956	4	10	British Isles	The Guardian & The Observer	05/10/1956	Minor damage. Strong winds and a heavy hail storm meant two ships were delayed from the Mersey owing to the very high winds. A man was blown into a 30 ft hole in the West Canada Dock and was admitted to hospital.
1956	13 to 16	12	British Isles	The Guardian & The Observer	14/12/1956 - 17/12/1956	Windspeeds of 101 mph were noted on Tiree in the Inner Hebrides as gales hit the UK. An assistant lighthouse keeper on the Outer Hebrides was drowned having been washed off the rock by a mountainous waves at the height of the gales despite the best attempts of his colleagues to save them. The conditions were such they could not be relieved by the lighthouse ship from Oban. At Stevenston a factory was strick by lightniing and the roof fell in cuasing a fire which burnt 2 employees. Many roads in the Western Highlands were blocked by snow and workmen were widely deployed. At Bristol strong winds and hailstones shattered a window of a radio store after a "tremendous blast of wind and rain". A liner at Liverpool was delayed 24 hours afte strong winds and mountainous seas prevented her from leaving the Mersey. Isle of Man steamers were 3 hours late to Liverpool.
1957	30 to 1	1	British Isles	The Guardian & The Observer	31/12/1957 - 02/01/1957	Minor damage. Road traffic across Britain was much hampered by floods brought by torrential rains and storms. The Severn flooded in it's middle-lower course inundating the county cricket ground and racecourse.
1957	31 to 5	2	British Isles	The Guardian &	01/02/1957 - 06/02/1957	Minor damage. Official gallantry. Impromptu gallantry. Gales and rain swept over South-West and North-West

				The Observer			England as well as Scotland. Loch Linnhe was so rough ferry services were suspended and 42 school children had to detour aground Loch Eil to get home. Roads were blocked traffic around Strontian and power cuts were noted around Fort William due to fallen trees felling power lines. A search was carried out for a missing trawler off Tobermory but it was a false alarm. The Barrowlifeboat deployed to aid a disabled Fleetwood trawler and a tow was attached and lifesaving teams were prompted by the coastguard to stand by with rockets at Bootle and Foxfield. Heysham tugs eventually came to the rescue. In a Clyde loch a vessel broke loose and swung across an entrance but did little damage. Manchester flights to Dublin were cancelled and several passengers instead caught the Liverpool ferry. A vessel drifted helplessly near Tiree and three trawlers and the Islay lifeboat stood by and managed to take the vessel into Tobermory Bay to safety. A trawler was also aided off Walney Island and a urkish vessel was towed to safety having been drifting helplessly toward the Plymouth Sounds breakwater.
1957	26-28	3	British Isles	The Guardian & The Observer	29/04/1957	1	1. Minor damage. A woman arrived back in Barrow-in-Furness having been conveyed home after her yacht sunk and her husband was lost off Land's End.
1957	5	5	British Isles	The Guardian & The Observer	06/05/1957		Sleet and snow was noted through Scotland and the North-West. Linvers were two days late reaching Liverpool due ot gales in the Celtic Sea and eastern Atlantic.
1957	24	6	British Isles	The Guardian &	25/06/1957		Minor damage. Heavy rains and thunderstroms came to the British Isles with rainfall in Torquay reaching 0.26

1957	29-30	6	British Isles	The Observer The Guardian & The Observer	01/07/1957	1	<p>inches and South-West Scotland and much of England experienced thunderstorms.</p> <p>1. Minor damage. Impromptu gallantry. Widespread thunder and lightning was widespread throughout but particularly notbale at Bristol were lightning ruined a concrete chimney and sent it crashing through the roof of a house, narrowly missing a woman. A man drowned off Morecambbe when his dinghy capsized. Another man survived and an off duty police constable attempt to hellp the drowned man but "a three-hour fight to bring him round failed". A woman fee off a Mersey ferry adn three men dived in and heorically saved her.</p>
1957	3 to 7	7	British Isles	The Guardian & The Observer	07/07/1957 - 08/07/1957		<p>Minor damage. Official gallantry. Storms were widespread over the South of England with damage widely repoorted. At Rhyl an intense downpour of 0.84 inches of rain fell in 10 minutes and house basements were flooded to a depth of 2-3ft. Crowds were forced to paddle to the railway station. A cruiser and 2 married couples was saved by the Campbeltown lifeboat from the Otter Rocks and taken safely into harbour.</p>
1957	19	7	British Isles	The Guardian & The Observer	20/07/1957		<p>Minor damage. A day of storms were felt across the North-West with a freak thunderstorm at Preston causing torrential rain in isolated pockets whilst several cows were killed and injured by lightning strikes.</p>
1957	6 to 8	8	British Isles	The Guardian & The Observer	07/08/1957 - 09/08/1957		<p>Storms passed over Wales and Northern England causing electricty breakdowns throughout Cheshire after a plyon was struck. Liverpool had 8 hours of thunderstorms and sporadic flooding occurred around Warrington due to hevay rains.</p>

1957	9 to 14	8	British Isles	The Guardian & The Observer	10/08/1957 - 15/08/1957	Moderate damage. Official gallantry. Thunderstorms struck the North causing flooding once more near Warrington. A Shackleton aircraft spent time searching the Cornish coast for small vessels later reported safe. Several vessels had to retire racing in the Celtic Sea in the Fastnet race due to the mountainous seas and heavy winds with 18/43 starters persisting. Heavy rain caused minor flooding in the streets of Bath. The Severn was 10 ft and 4 inches above it's normal level in the middle course. At New Brighton "holidaymakers helped to mop out flood water from hotels and boarding houses following torrential rain and shops were flooded to a depth of 1 ft as the fire brigade answered >20 flood related calls. A landslip on the main railway line at Bangor took 18 hours to clear. A female American distance swimmer was delayed from swimming the Irish Sea.
1957	25-26	8	British Isles	The Guardian & The Observer	26/08/1957 - 29/08/1957	Major damage. Strong winds and gusts up to 70 mph came to Britain preventing steamers from leaving the Mersey. In Lytham four men saw their car roll past them into the water and heavy seas at Morecambe eroded away part of the sea wall at the end of the promenade. The damage was so great it was estimated it would cost £10,000 and this was not insured. The Heysham-Belfast ferry was also postponed owing to the heavy seas. Damage was noted at the Blackpool Pleasure Beach and the illuminations were wrecked. Boats sank at their moorings at the North Shore whilst two women were forced to evacuate their property. The fairground sustained thousands of pounds of estimated damage. At Wallasey the surge eroded the sea defences and the

1957	6 to 13	9	British Isles	The Guardian & The Observer	07/09/1957 - 19/09/1957	2	<p>international model yacht championship was cancelled. Many tents for the Southport show were wrecked and damage was estimated at £5,000 but the organisers went ahead anyway. On the Firth of Clyde £1,000 worth of damage was done to Dunoon pier as the storm surge caused significant inundations.</p> <p>2. Minor damage. Official gallantry. Impromptu gallantry. Two men were stranded on a bell buoy for five hours off Workington after their transport vessel suffered engine failure and driven off down the Solway. Whilst the vessel and its captain was rescued, however the men were left on the 12 ft wide buoy and were violently sick in the heavy seas. Both men were suffering from exposure when they were finally rescued. In Colwyn Bay two youths were drowned when they capsized at sea in a dinghy but the 2 girls they were with were rescued. There was a "south-westerly gale blowing, and the boat had not gone far out when distress signals were seen from the pier". A county surveyor and chief clerk went out in their motorboat and saved the two girls but the boys disappeared. The motorboat was then itself rescued after the petrol ran out. The Pwllheli lifeboat deployed to save a family cruising in Carnarvon Bay in 52 mph winds. A frigate rescued a distressed German ship. A coaster beached at Tranmere near Liverpool after springing a leak in the Irish Sea. A salvage tender met her and towed her into dock. A Cunard liner Sylannia was 8 hours late berthing due to the heavy seas. The Empress of England was late leaving Liverpool. Minor damage. Widespread flooding occurred over the West Country and Wales following heavy rains. The towns</p>
1957	24-25	9	British Isles	The Guardian &	25/09/1957 - 26/09/1957		

				The Observer		"On the seaboard in West Carmarthenshire felt the full effects of the floods". At Laugharne houses were flooded 3 times in 24 hours which "thirty miles of the Towy Valley from Ilandoverly to the estuary of the river at Ferryside is under water". Flooding also inundated the line to Birkenhead outside of Chester. At Amroat storm surge flooding inundated the sea front and thousands of people went to watch teh spectacle.
1957	5	11	British Isles	The Guardian & The Observer	06/11/1957	Minor damage. Rain and gales were widespread and particularly felt in the North-West caused power shortages in Lancashire and Cheshire. Flights were diverted to many North-West airports due to 60 mph gusts.
1957	8 to 10	12	British Isles	The Guardian & The Observer	09/12/1957 - 11/12/1957	Minor damage. Official gallantry. Impromptu gallantry. A race to a ship in distress occurred when 5 vessels sought to offer the Dutch ship Tubo assistance when in distress off Lundy isladn in 70 mph winds. The ship was saved by a tanker although navy ships had also delployed. Heavy falls of snow were widespead throughout Scotland blocking roads. 81 mph hurricane force winds were noted at Plymouth where a car ferry was lown ashore and left high and dry. Two other vessels also broke adrift but were rescued. The Torbay lifeboat was deployed after sighting wistressed lights and two men were taken off their yachts. Trains were delayed due to storm surge damage of the Devon railway line. Flights were widely cancelled from Belfast, the Isle of Mana nd Glasgow owng to the wind.
1958	5 to 11	1	British Isles	The Guardian &	06/01/1958 - 12/01/1958	Minor damage. Official gallantry. Very strong gales reaching wind speeds up to 95 mph were noted in the Hebrides as the West coast of Scotland was severely

				The Observer		battered by the rain. A submarine went aground on a shunngle bank off Campbeltown Loch after dragging her anchor at the entrance to the loch, although the 69 men aboard were in no danger and would later be got off by a naval tug. A Clyde tug went aground on the Ayrshire coast after damaging her propellor and the troon lifeboat stated they were in no danger after aassessing the situation. Four trawlers were unable to leave Fleetwood whilst ferry services were suspended. High seas and the surge inundated the Blackpool seafront. Waves crashed over the Leasowe embankment with waves cutting off the approach to a children's hospital. New Brighton also suffered from the storm surge overtopping and eroding defences. A transporter bridge between Widnes and Runcron could not be used owing to the strong winds. Several pigs died when a paraffin lamp was dislodged by the gale and started a fire in Lytham.
1958	19	1	British Isles	The Guardian & The Observer	20/01/1958	Minor damage. Snow and very low temperates susbtanitally affected traffic in the North-West of England and Scotland. Two double decker buses collided in Warrington with three taken injured. A van skidded on ice and was torn in hlaf with the driver seriously injured. A Preston pilot was forced ashore in the Ribble after having tried to sail the veshire single-handed to Preston but was later taken back to Preston on tow.
1958	7 to 9	3	North-West Britain	The Guardian & The Observer	08/03/1958	Minor damage. High tides and gales from the north-west caused considerable storm surge damage on the Wirral and Merseyside coasts. At Blackpool cars were stranded in water and foot deep, an hotel was cut off and people had to wade. At Hoylake the tide breached a 30 foot gap in the

1958	4	4	British Isles	The Guardian & The Observer	05/04/1958	<p>promenade and houses were marooned by the surge waters. New Brighton also experienced storm surge inundation and damage on the promenade.</p> <p>Snow, gales and floods were prevalent throughout the North and Scotland. In St Ives holiday makers experienced snow showers. Fleetwood experienced little sun and tourist guides as well as "promenade parkettes" were sent home due to the weather.</p>
1958	23	5	British Isles	The Guardian & The Observer	24/05/1958	<p>The Llyn peninsula experienced 50-65 mph winds and a boat was dismantled at Abersoch with coastguards being on 24 hour watch.</p>
1958	10	8	British Isles	The Guardian & The Observer	11/08/1958	<p>"Sharp thunder and heavy rain broke over Lancashire and Cheshire" as a low pressure system moved north-east across England. Heavy rain caused flooding at Blackpool were 40 calls for the fire brigade were answered. In Southport and Morecombe roads were inundated and Fleetwood traffic was diverted due to floods 3 feet deep. Three hours were damaged by lightning in Liverpool. Power supplies were cut off due to electricity transport damage in Barrow and Furness.</p>
1958	19-20	8	British Isles	The Guardian & The Observer	20/08/1958 - 21/08/1958	<p>Moderate damage. Floodwaters caused damage throughout the West. Lightning struck power cables in Southport and Swansea causing power cuts. The West of England bore the brunt of the storm and in many parts of Devon and Cornwall half an inch of rain fell. The Cornwall firebrigade experienced 15 calls to deal with flooding. The worst affected areas were around Clovelly and Bude where rain was so heavy drivers could not see and were forced to stop. At Stratton furniture and farm animals were</p>

1958	3 to 5	9	British Isles	The Guardian & The Observer	04/09/1958 - 08/09/1958	<p>swept away from the low-lying lands and villagers sought refuge upstairs. At combe martin tons of water swept through the village after lightning struck and damaged a wall retaining an Exmoor stream. A shop was washed away, "4ft channels were torn in the beach, and a 6ft flood gushed through a guest house". A fireman stated "It was like the Severn bore" andd 50 houses were flooded whilst 100s of telephone were put out of action. Flooding was also reported in Carmarthen but no major damage resulted.</p> <p>Minor damage. Heavy rains were noted in North Wales causing minor inundation in a number of Llandudno basements and other coastal towns. Power shortages were noted in Rhyl, Prestatyn and Llandudno.</p>
1958	24 to 3	9	British Isles	The Guardian & The Observer	04/10/1958	<p>Moderate damage. Official gallantry. During a storm a wall collapsed and killed a child in Liverpool. Floods were also noted in the west country and the Severn rose 8 ft baove normal levels but no major damage resulted. Liners were delayed from Liverpool due to rough weather and the Campbeltown lifeboat rescued a yacht off Machrihanish Bay with two occupants aboard. £1000 worth of damage was done to the Blackpool illuminations. W hirlwind was noted at Exeter and the RAX reported "the river Exe was in flood, and boulders, some weighing half a hundredweight, litrered roads near the river". At Ttones the whirlwind was described "like a train approaching". A house experienced damage at Exeter when the whirlwind came towards it. A liner was damaged by 30ft waves in the Atlantic and many sustained minor injuries aboard.</p>

1958	1 to 2	11	British Isles	The Guardian & The Observer	03/11/1958	Gales were widespread through Southern England and flights to the north of England and across the Irish Sea were delayed.
1958	19-23	12	British Isles	The Guardian & The Observer	20/12/1958 - 27/12/1958	Gales battered the coasts holding up shipping from Scotland to the scilly Isles. The RMS Scillion battled her way from Scilly to Newlyn but heavy seas breaking over the quay forced were return. Gales off western Scotland forced Cunard to cancel the Greenock call of the liner Sylvania and proceeded straight to Liverpool.
1959	1	1	British Isles	The Guardian & The Observer	02/01/1959	A "snap storm" burst out across Lancashire with several houses sustaining minor to moderate lightning strike damage.
1959	18-19	1	British Isles	The Guardian & The Observer	20/01/1959	A storm in the Celtic Sea and eastern atlantic with waves 50 feet high washed a man off his yacht in the mid-atlantic and then back on again. Despite being thrown around and not being able to swim he survived with minor injuries. He stated he thought it was "the end."
1959	8	5	British Isles	The Guardian & The Observer	08/05/1959	A storm passed over the Lancashire coast and a Blackpool church was hit by lightning but no damage was noted.
1959	15	7	British Isles	The Guardian & The Observer	16/07/1959	Telephone communications were disrupted over the Nroth of England due to a thunderstorm with Preston being affected.
1959	27	7	British Isles	The Guardian &	28/07/1959	Storms and torrential rain caused widespread flooding in Britain. In Western Scotland flooding of 6 inches was noted on the roads by the AA. At St. Annes 1.5 inches of

				The Observer			rain fell in 2 hours. 2ft and 6 inches of rain was cleared from a hotel basement and a chef went about his business in sea boots. Parts of Southport were flooded to 6 inches and floodwaters at Waterloo, Liverpool interferred with a level-crossing. In Blackpool cars and trams were stranded in floodwaters and traffic jams hindered the emergency services from dealing with distress calls. Rain flooded hte New Brighton promenade.
1959	14-21	8	British Isles	The Guardian & The Observer	15/08/1959 - 22/08/1959	1	1. Moderate damage. Two men trapped in a aycht were rescued by the Hoylake lifeboat and a pilot. Communicationg an SOS with a lamp the men ran into difficulty in a gale in the Dee when their jib halyard broke and the engines were out of commission. The Portpatrick lifesaving company saved five men from a fishing vessel which ran aground in a gale and was holed off Corsewall Point. A lifeboat took the vessel in tow but it later sank. A father was drowned off Pembrokeshire when he and his son were trapped by incoming tide in a cove at Weaterwynch, Pembrokeshire. A man swam out to save the boy but the father drowned. A doctor and two lifeboat crew tried their best to recover the father but to no avail. During a thunderstorm heavy rains flooded the Mersey Tunnel to a depth of 18 inches and sewer manholes were pitched into the air and many cellar and basements flooded in the city. Trains were much delayed and road traffic was impeded by the floodwaters. Flooding was also widespread near Chester.
1959	13-20	11	British Isles	The Guardian &	14/11/1959 - 22/11/1959	1	1. Minor damage. Official gallantry. Strong gales caused distress off the west of England with the Appledore lifeboat bringing a polish ship to safety in the Lundy

				The Observer			Roads. The Fleetwood lifeboat launched to search for two 40 ton fishing boats who had been struggling to weather port. A gust of 104 mph was noted off the Lizard and a Cornish fisherman was swpt overboard and drowned. Liners on the Mersey were dealyed leaving due to 60 mph winds creating dangerous conditions on the Mersey Bar. Minor damage. Official gallantry. Great storms swept the UK although the damage was largely confined to the North Sea. The Torquay lifeboat was launched in the evening when a barge broke free and the men aboard was brought ashore. The navy later blew a hole in the barge to sink it and stop the vessel damaging the promenade. Royal marines also fired bullets into the vessel to reduce buoyancy.
1959	6 to 10	12	British Isles	The Guardian & The Observer	08/12/1959	11/12/1959	1. Minor damage. During holiday storms four people drowned off St. Ives when caught by surprise and swept into the sea by a storm surge wave. The lighthouse keepers on Eddystone off Plymouth were on iron rations whilst the keepers on Bishop Rock and Round Island were also without provisions. Floodwater delayed traffic in North Wales and flooding was widespread in the Conway valley where farmers waded waist deep to protect their livestock. At Yealmpton in Devon a tree elm across a car killing the driver.
1959	25-27	12	British Isles	The Guardian & The Observer	27/12/1959	-	4. Minor damage. Official gallantry. A series of storms swept over North Wales and Lancashire and lightning was accompanied by torrential rain. Beaches were emptied as deluges fell in Lytham St. Annes, whilst trees were felled and yachts capsized all around Fairhaven lake. A storm surge swept Blackpool beaches and many chairs were
1960	5	6	British Isles	The Guardian & The Observer	06/06/1960		

1960	7	7	British Isles	The Guardian & The Observer	08/07/1960	1	<p>taken to sea. A rush to the train station at Southport was so great the police had to deploy an emergency strategy. Four men were drowned in Gair Loch when their rowing boat capsized whilst 4 men were also missing.</p> <p>1. A 16 year old girl was killed in a Glasgow thunderstorm when a chimney pot was struck and fell, crushing her to death.</p>
1960	6 to 7	8	British Isles	The Guardian & The Observer	07/07/1960		<p>Bumper crops across the Uk survived heavy rain storms and it was remarked that the next few weeks would determine the overall yield.</p>
1960	24	8	British Isles	The Guardian & The Observer	25/08/1960		<p>Minor damage. A storm caused considerable disruption during the Enterprise sailing championship at Plymouth where more than 15 boats capsized. "Two boats had their masts snapped in tow, another had a split mast, and there was one collision". Less than half the fleet finished.</p>
1960	1 to 4	11	British Isles	The Guardian & The Observer	03/11/1960 - 05/11/1960		<p>"A storm swept through Cheshire and parts of Lancashire yesterday, leaving a trail of wreckage". Whirlwinds uprooted trees and ripped off roofs in places. A watch was being kept in the River Exe after flooding damaged property and £26,126 was given to the Devon flood appeal. Sailings from Liverpool were delayed and the Barrow and Fleetwood lifeboats were launched after a vessel drifted off her anchor but was later secured. 90 mph gusts were noted at Blackpool and 60 ft seas sprayed over the promenade flooding it to a depth of 4 feet. At Mrecambe 2 ft of water from the surge did £10,000 worth of damage to an amusement park. A fire engine became stranded blocking the main Fleetwood-Blackpool road.</p>

1960	30 to 5	12	British Isles	The Guardian & The Observer	05/12/1960	High winds also stopped the operation of a transport-bridge across the Mersey. Minor damage. Official gallantry. "Gale, Hail, Snow" game to the UK and was particularly noticeable in Scotland which experienced low temperatures. Gales were also particularly prominent in the North-West with emergency services widely deployed to aid people who had experienced trouble due to felled trees and building damage.
1961	25-26	3	British Isles	The Guardian & The Observer		Official gallantry after 2 RAF pilots were rescued from the Irish Sea by the ramsey lifeboat after their vessel became overwhelmed in a gale.
1961	14	7	British Isles	The Guardian & The Observer		Minor damage. Gales and rain majorly disrupted sporting events including the Open at the Royal Birkdale where the course was flooded. Hail 6 inches deep came ot Lancashire.
1961	7 to 8	8	British Isles	The Guardian & The Observer		Moderate damage. Official gallantry. Heavy rains and strong winds came to Britian and gusts of 70 mph weere noted at the Scilly Isles. Trees and hoardings were widely felled. A road subsided into a basement of a hotel due to heavy rains in Blackpool. Flooding was widespread in SW Soctland the Cylde area. Thousands of pounds worth of damage was sustained to farmland. At Greenock many shops were inundated and emergency response teams were called to secure three ships which were in danger of being swept out by the floodwaters which poured in "like the Niagara Falls". Four cars collided in the flood waters in Dumbarton and the railway line was damaged at Bowling.
1961	2 to 9	9	British Isles	The Guardian & The Observer		Minor damage. Storms left a trail of damage across the North, and a railway line was eroded away by a surge near

1859	27-29	10	British Isles	The Guardian & The Observer		Oban. 10,000 telephones were disconnected throughout the North-West.
1961	11 to 12	11	British Isles	The Guardian & The Observer	14/11/1961	The Royal Charter Gale Minor damage. Heavy gales in the Celtic Sea delayed liners by 8 and 7 hours from reaching Liverpool.
1961	4 to 5	12	British Isles	The Guardian & The Observer	06/12/1961	Minor damage. Official gallantry. The AA stated that 10 people and multiple vehicles were stranded by heavy snow on the roads around Glencoe and Fort William. Throughout Scotland planes were widely delayed and steamers unabel to sail. Preston trains were delayed due to heavy snowfall. Morecambe and Flyde suffered a blackout following a lightning strike impact on an electricity plant.
1962	11	1	British Isles	The Guardian & The Observer	12/01/1961	Minor damage. Gale force winds of 103 mph and 94 mph were noted in Devon and the Scilly Isles. AT Chester a roof collapsed on 2 men with minor injuries whilst 6 ships were prevented from leaving Liverpool.
1962	11 to 18	2	British Isles	The Guardian & The Observer	13/02/1961 - 24/02/1961	Minor damage. Gales reaching up to 123 mph in Orkney caused havoc across the UK with much damage been cuased. A Isle of Man to Liverpool steamer was held up for 12 hours owing to the gales on the Mersey. Flights were widely cancelled between Liverpool and Manchester and shipping was delayed in the Clyde. "The first sailing on the Londonderry to Preston shipping container service had to be postponed". The goverment promised aid to those severely affected by the gales who were now without a house although these were almost all in the East. Owing

1962 7 to 8	3	British Isles	<p>The Guardian & The Observer</p> <p>to the damage slate production was booming with quarries working overtime.</p> <p>Major damage. Official gallantry. Organised Welfare Gales hit the South-West of Britain and the Penzance sea wall was breached several times and quickly filled with sand from a nearby quarry. The mayor of Penzance opened a diaster fund and estimated £200,000 of damage had been caused by the storm and surge. Gales swept across the Bristol Channel and Tenby was affected by a large storm surge which swept along the seafront were beach walls were brought down and hundreds of tones of cliff descended into the sea. 45ft feet of jetty was demolished and a cafe neabry washe dinto the sea. A farmstead was whisked off its foundations due to torrential rains in Haverfordwest. Roads were also closed as boulders and pebbles were carried up by the surge. Fallen trees blocked main roads near Milford Haven. 50-60 fishing vessels were damaged. Three men were swept overboard but were saved by their companions from a trawler. The storm surge stripped the foundations of an inn bear but it didn't collapse. "The promenade looks as if it had been hit by an earthquake or major blitz" it was remarked. Shingle was also tossed onto the Dawlish railway line which was damaged but one line still remained open. Penzance station was closed and holiday beaches at Falmouth were in disorder and the sea front was twice breached. A groyne near Toxeth dock was damged by the wind and the 32ft storm surge. Tugs were deployed to clear floating driftwood. Considering the floods in Cornwall the government made a promise to aid the affected</p>
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1962	19-23	5	British Isles	The Guardian & The Observer	20/05/1962 - 24/05/1962	communities as it was remarked by the minister of housing Dr Hill that "an undue burden galls on the rates". Minor damage. Impromptu gallantry. In a strong storm from the south-west three people were rescued from a distressed yacht fitted out fro a world cruise by a steamer. The yachts whereabouts was not known and it contianed all their possessions. Winds reached gale force around South Wales. A gable collpased in an Anfield house and damaged cars and a motorcycle. Vessels were delayed leaving the Mersey.
1962	24	6	British Isles	The Guardian & The Observer	20/06/1962 - 21/06/1962	Sir Francis Chichester's report of very strong gales in the Celtic Sea and the Atlantic which reached 100 mph and slowed his progress.
1962	23	9	British Isles	The Guardian & The Observer	23/09/1962	A radar assessment of a storm revealing cloud strucutre via a density assessment revealing the presence and abunance of water of different forms.
1962	30	9	British Isles	The Guardian & The Observer	01/10/1962	Moderate damage. Official gallantry. Gales blew across the West of Britain and many roads in the West Country were blocked due to falling trees. A lighthouse was put out of action on Canna by the storm which hampered a lifeboat rescued of a ship which grounded on Canna shortly after. She later dragged the vessel clear and to shelter 15 miles away in Rhum. Storm surges did damage in Penzance. Fleetwood fishing boats were also damaged by the gale as the surge resonated around the quayside doing great damage. A family of four had a narrow escape when a chimney stack crashed through their roof but only cuased minor injury to a wife and 6 month daughter.

1962	15-17	11	British Isles	The Guardian & The Observer	18/11/1962		Minor damage. Official gallantry. A drifting tanker went ashore off North Devon after parting from a tow. A lifeboat was launched but had to return due to damage. Lines were fired from 400ft high cliffs in 70 mph winds in a very challenging operation which took two coastguard teams.
1962	9 to 16	12	British Isles	The Guardian & The Observer	15/12/1862 - 18/12/1962	2	2. Moderate damage. Official gallantry. Impromptu gallantry. Official welfare. After a dense fog a gale swept England. Russian trawlers were driven to seek shelter off Devon and Cornwall and 30-40 vessels anchors in Torquay. The Fleewood lifeboat rescued electricians from the Wyre lighthouse. Coastguard and Police raced to saved a boy trapped by a swollen river and rising tide in 60 mph winds. He was eventually rescued from his marooned tidal island. Rwi wineb were killed by falling masonry in Liverpool. Families were evacuated from flats in Birkenhead when they were decalred unsafe when damaged by the wind. A boy was trapped in his bedroom by falling slates and rescued by firemen and another trapped under rubble but saved by his motor. £10,000 was thought to have been done in Liverpool and 25,000 houses were without elecrricity in Lytham and Blackpool. Snow falls hit the North of England and West country cuasing issues for traffic.
1962	31	12	British Isles	The Guardian & The Observer	01/01/1963		
1963	16-20	8	British Isles	The Guardian & The Observer	18/08/1963 - 22/08/1963		Gales and thundestroms were widespread along the South coast.

1963	24-27	9	British Isles	The Guardian & The Observer	27/09/1963 - 28/09/1963	Minor damage. Gales swept across the country and were most prominent in Scotland and the North-West. An injury was sustained to a known singer whilst 17ft waves, the highest of the year were recorded at the Mersey Bar. Gales in the Celtic Sea delayed steamers.
1963	30	10	British Isles	The Guardian & The Observer	31/10/1963	
1963	12	11	British Isles	The Guardian & The Observer	13/11/1963	Minor damage. Official welfare. Official gallantry. Heavy gales were felt all throughout Britain with 75 mph and torrential rain in the North-West. A vessel dragged anchor due to high winds in Heysham harbour and blocked traffic flow whilst 3 women was blown over in Blackpool with one engineer trapped. A derlict house collapsed and the neighbours had to be evacuated.
1964	3 to 8	5	British Isles	The Guardian & The Observer	08/05/1964 - 09/05/1964	Minor damage. Impromptu gallantry. Two well known yachtsmen were from Hoylake SC were rescued by the lifeboat secretary who lowered himself down the promenade wall and through a rope to their safety. The boys were shocked and soaked but little worse for wear. The winds also affected the golf tournament at Llandudno although Allis played particularly well.
1964	27-30	5	British Isles	The Guardian & The Observer	30/05/1964 - 01/07/1964	Minor damage. Lightning and thunder storms were noted in the North-West accompanied by heavy rain. Stormy weather meant passengers from Llandudno to Liverpool had to travel back via train as the ferry could not embark the passengers in the heavy seas.
1964	16	9	British Isles	The Guardian &	17/09/1964	Minor damage. A storm of heavy rain and wind resulting in flooding in the North-West and one three-storey house and shop in Birkenhead was completely flooded, when

1964	13-14	10	British Isles	The Observer			water poured underneath the eaves due to drainage issues. The shop furniture was ruined and electricity cut off.
1964	15	11	British Isles	The Guardian & The Observer	14/10/1964 - 15/10/1964		Minor damage. Storms of wind and rain came to the North-West causing minor flooding.
1964	15	11	British Isles	The Guardian & The Observer	17/11/1964		Minor damage. Official gallantry. Strong winds from the south-west produced large seas in the Celtic Sea and Bristol Channel with one vessel in distress offering a mayday call which was received by a tug who rescued her. Two frigates, helicopters, a RAF Shackleton and two lifeboats were looking for the vessel. Heavy snow fell over North-west Scotland causing considerable inconvenience to traffic.
1965	13-20	1	British Isles	The Guardian & The Observer	14/01/1965 - 21/01/1965	2	2. Major damage. Official gallantry. Impromptu gallantry. Organised welfare. Strong winds and blizzards were felt throughout the North of England and Scotland. A vessel developed engine troubles and was blown onto a Mersey revetment but was later removed by two tugs. A vessel lost a man overboard off Land's End and due to shifting cargo it was impossible to turn back. All but one road from England to Glasgow was snowed up. 9 families were forced to leave their home in Glasgow when the storm destroyed the roof. Blackpool train station was closed due to the danger of falling glass from the roof. A Fleetwood man was rescued by the fire brigade from his roof when a gust blew the ladder down. Flooding occurred on minor roads in Somerset. Many large ships came into Torbay, South Devon and at Dartmouth eight trawlers

1965	16-17	2	North-West Britain	The Guardian & The Observer	18/02/1965	2	<p>sought shelter. At Penarth wind was believed to have resulted in a crash which killed one man and injured 7 others. A man saved himself from storm surge waters on the marshes at Preston, and four people were taken to hospital after a roof collapsed on them at Morecambe. Three men in distress in a dinghy were rescued. Blackpool promenade was damaged as waves from the storm surge washed across it and winds smashed in shop windows. " A hurricane warning "something almost unheard of" was issued to vessels in the Irish Sea. In North Wales sea defences held well and damage was limited to blown-down trees and television aerals. A 30ft storm surge swept over the Leasowe embankment and flooding roads hitting cars and forcing it's closure. Cornwalla nd Decon recieved heavy snow. Shipping at the Mersey resumed but one vessel was left disabled at the Mersey Bar.The snow called "absolute chaos" in Wales and major roads from Swansea and ABerystwyth were blocked.</p> <p>2. Minor damage. It was remarked "it was absolute folly" that several inexperienced wildfowlers perished by going out on the Ribble marshes and drowning in a storm surge which was accompanied by hail showers as the sea was "lashed into foam" across the marshes. Searchers in a line went out but the incoming tide barred their progress. It was stated by the inquest "it was impossible for anyone to save them in those conditions". The bravery of the local wildfowlers and police was commended by the coroner. Minor damage. A ship ran aground in the gale outside Heysham harbour as gale-force winds, snow and violent hailstorms came to the North of England and Scotland.</p>
1965	11	4	British Isles	The Guardian &	12/04/1965		

1965	11 to 12	7	British Isles	The Observer The Guardian & The Observer	12/07/1965 - 13/07/1965	Glasgow and the Clyde area was particularly hard hit and many roads were treacherous. Minor damage. Official gallantry. Impromptu gallantry. Heavy seas generated by a 35 mph gale swamped 6 power boats off Llandudno and three lifeboats, an RAF helicopter and fishing boats escorted them to safety. All was abandoned after 45 minutes but to the fact the marker boat could not stay at the buoy. Waves of 15-18ft were noted and one man remarked "It was the roughest race I have ever been in".
1965	25-29	7	British Isles	The Guardian & The Observer	26/07/1965 - 30/07/1965	Minor damage. A storm caused issues for road traffic in South-east Wales and part of a railway track was washed away and all trains had to be diverted. Gales at Hoylake also "upset Cheshire amateurs" but no major loss resulted.
1965	24-25	8	British Isles	The Guardian & The Observer	25/08/1965 - 26/08/1965	Minor damage. Gales in the Celtic Sea roduced large waves preventing a long distance swim whilst in the Irish Sea a vessel was unable to land at Llandudno due to the heavy seas making berthing difficult. The Southport flower show still went ahead despite the fact one 160 ft marquee collapsed and 30 exhibitors had to run to safety.
1965	14-16	11	British Isles	The Guardian & The Observer	15/11/1965 - 17/11/1965	Minor damage. Official gallantry. Snow and ice accompanied gale throughout most of the UK. Many main roads in Scotland and in South Wales were covered in snow. Bulldozers were out in Devon in an attempt to keep country roads open. AA land rovers helped stranded mototrists stuck on the moorlands. North Wales was also badly hit. A Preston road was clsoed due to a blown over tanker as 90 mph winds strafed the area.

1965	8 to 9	12	British Isles	The Guardian & The Observer	10/12/1965	Minor damage. Torrential rain and gales brought floods in many parts but they were particularly noticeable over North-west and Wales. Winds of 80 mph were recorded on the Mersey with pilot boats being forced to seek shelter and many vessels sought shelter off Anglesey. Wallasey ferry services were delayed. The AAs stated 20 counties were delayed. Customers had to wade out of the Royal Ferry Hotel when a 30 ft storm surge overtopped defences and inundated the coastal property. The Severn flooded in its lower-middle course onto agricultural land with little damage.
1966	21	3	British Isles	The Guardian & The Observer	21/03/1966	A short article on the provision of gale insurance for yachts and the thinking behind a "Force 8 Endorsement" which was triggered when yachtsmen were unconvinced by storms, often at considerable expense. A considerable amount of weather statistics research had gone into deciding these premiums and it was only valid between April-October for storm-related reasons. In essence this was a clear attempt to use weather statistics to directly inform storm insurance but the scheme failed as the premiums were considered to be high by the majority. It was stated the division of a future scheme with more attractive terms may allow sailors to venture further afield and reduce risk when sailors felt compelled to return in dangerous conditions on the onset of a Force 8 due to the risk of being stranded without insurance and the additional expenses involved.
1966	15-16	8	British Isles	The Guardian &	15/08/1966 - 18/08/1966	Minor damage. Official gallantry. A ferocious gale hit the British Isles and the Glasgow_Euston express was delayed after heavy rains caused an embankment to subside near

1966	14-15	9	British Isles	The Observer		Glenairlie Bridge. The Cumberland Fire Brigade dealt with 69 calls for assistance with the flooding and Carlisle's handled 40. At St. bees 2.54 inches was recorded in a day, the usual monthly total.
1966	5 to 6	11	British Isles	The Guardian & The Observer	15/09/1966 - 16/09/1966	Minor damage. "Some stupendous golf" was played in a half gale at Royal Porthcawl. Sailings from Stranraer across the Irish Sea where postponed whilst one of the largest ships ever to enter the Mersey the British Admiral had to remain at station off Rock Ferry as high winds prevented her entering dry dock. Marquees and stands were blown down at a Southport exhibition and the marine lake was strewn with canvas. Gusts of 70 mph did £200 worth of damage to the Blackpool illuminations whilst storm surge conditions stopped the promenade tram service.
1966	30 to 3	12	British Isles	The Guardian & The Observer	06/11/1966	Storms hit the West Country and South Wales with rail and road travel disrupted by heavy rains. Bristol received 3 inches and traffic was halted. Frome was described as "suddenly cut off from the outside world". Motoring organisations were inundated with driving enquiries in the West. Police in Bath were to engage the "flood disaster emergency plan" if the Avon rose another 9 inches as it had driven 8 feet above its usual level.
1966	30 to 3	12	British Isles	The Guardian & The Observer	02/12/1966 - 04/12/1966	Gales reaching force 10 and heavy seas in Liverpool Bay delayed the relief of the Bar lightship master who had fallen ill although a doctor had been taken aboard by a lifeboat. A school was flooded in Cumberland and two cars overturned near Workington. A 30ft tree fell on a car but the driver emerged unhurt. At Llandudno two farmhouses were destroyed by the gale. Morecambe's FA Cup replay was postponed as the course was waterlogged.

<p>1967 23-28</p>	<p>2 British Isles</p> <p>The Guardian & The Observer</p> <p>24/02/1967 - 01/03/1967</p>	<p>15 men were rescued with two injured from a drifting Greek ship off Anglesey by the Holhead lifeboat and Moelfre lifeboats. A helicopter had been deployed but the the gales were too strong. Later and RAF Shackleton "dropped a string of dinghies as the two lifeboats lit up the stricken ship" for evacuation. 4 men refused to abandon ship and the lifeboats stood by. Two Shackleton's patrolled the Irish Sea looking for several vessels in trouble as gusts reached 100 mph. She was eventually towed off by a tug and landed in Liverpool. Police and firemen rescued a woman trapped in rubble where the two top floors of her house collapsed and she was admitted to hospital with minor injuries. A 22,000-ton vessel was forced to shelter off the Irish coast and omitted a stop at Greenock. Roads were treacherous. In North Wales gales of 95 mph and heavy rain brought down wires and damaged underground cables and damaged 5 telephone exchanges. Trees were widely felled along the Denbighshire coast. In Liverpool two ferries collided on the Mersey, a lorry blew over and a stadium was damaged. Blackpool was battered by hurricane force winds and buildings were secured with ropes due to damage to walls and chimney stacks. A steeple blew off a church in Lytham. Damage was also noted in Bebeington to an ambulance garage.</p> <p>Severe gales and heavy snow came to Scotland and the north-west of England. Ambulances were held by snowploughs to rescue distressed in Dumfriess. Policemen worked to clear blocked drains in Carlisle where residents stemmed floods using sandbags. At Mryport storm surge</p>
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1967	26-27	3	British Isles	The Guardian & The Observer	27/03/1967	<p>waves inundated the town and more than 100 families were forced to move upstairs as 12 fishing boats were wrecked. Firemen were widely deployed to drain properties and rescue the distressed. A steel company were forced to cease working at Workington when floodwaters inundated an electric motor. The railway was also damaged by the storm surge rendering it unpassable. Stornoway streets were flooded along with a main road. A steeply was felled in Glasgow 60ft waves crashed over the Blackpool sea wall damaging 120ft of sea wall. Tram services were halted and traffic diverted from the front as nearly 1 mile was underwater. North Wales roads were blocked with fallen trees. Llandudno was also flooded by storm surge. The Ormskirk valley was widely inundated. A woman was taken to hospital after being blown from a quay onto a trawler 18 feet below.</p> <p>Snow, gales and rain came to the north-west of England, Western Scotland and North Wales. A ketch was forced ashore on Loch Striven. The RAC reported great damage on North Wales roads owing to the weather and holiday season.</p>
1967	10	4	British Isles	The Guardian & The Observer	10/04/1967	<p>An article concerning the protection of animals in coastal gales aboard vessels. The exhaustion and stress suffered by animals aboard a vessel in a storm was noted. An animal welfare organisation wanted to see "a regulation making it obligatory for livestock to be left behind, when a ship is heading out into sea areas for which official gale warnings are in operation".</p>
1967	20-21	4	British Isles	The Guardian &	22/04/1967	<p>A thunderstorm with strong winds was reported in the North-West and a Boeing 707 was struck by lightning.</p>

1967	22-23	7	British Isles	The Observer The Guardian & The Observer	23/07/1967 - 24/07/1967		A severe thunderstorm in the West Country caused blackouts in the Plymouth area when transmission stations were hit. 11 people lost their homes in Somerset when they were set alight by lightning strike. Severe rain produced flash flooding on Dartmoor which saw 19 teenagers have a narrow escape from drowning when the river tavy burst its banks.
1967	30	7	British Isles	The Guardian & The Observer	31/07/1967		"A day of heat and storms" was noted at many resorts including Blackpool which caused much inconvenience for holidaymakers.
1967	8 to 11	8	British Isles	The Guardian & The Observer	10/08/1967 - 12/08/1967		Heavy rains and severe storms caused floods throughout Lancashire. Several low-lying areas near Bootle were flooded. On the Menai straits dinghies were upset during a sudden storm causing much distress to the 205 boats competing and guard boats and the RNLI inshore lifeboat was kept busy rescuing many of the upturned boats but no major loss resulted.
1967	23	8	British Isles	The Guardian & The Observer	24/08/1967	2	2. The North-West was again hit by thunderstorms which brought torrential rains. At Blackpool 11 people collapsed in the intense heat and 2 died.
1967	17-18	10	British Isles	The Guardian & The Observer	18/10/1967		Minor damage. Widespread storms affected 20 counties throughout the UK. The rain was such the subsequent floods inundated the Barrow-Carlisle railway and forced it to close. The roads to Hexham were flooded. A BOAC Boeing was struck by lightning near Prestwick but no one was hurt.

1968	15-16	1	British Isles	The Guardian & The Observer	16/01/1968 - 19/01/1968	20	20. Major damage. Official gallantry. Official welfare. A hurricane struck West Scotland with 118 mph winds recorded at Tiree as a severe low pressure system passed over the north of Scotland. Damage was such the scenes resembled the Clydebank Blitz of 1941 and 20 people perished with around 700 estimated to be homeless. Thousands were evacuated when Europe's allest flats began swaying in the breeze and 7 ships sank or went adrift causing hundreds of thousands of pounds worth of damage. A electricity generating station was damagedand most of Glasgow was left in darkness causing much anxiety amongst the population. The goverment later gave a £500,000 loan to the the affected areas and 150 trrops were delployed to help with the clean-up operation. Frankie Vaughan a singer held a concert to raise funds. The Glasgow City Council quickly imposed a ew policy to improve public housing after.
1968	14-15	6	British Isles	The Guardian & The Observer	16/08/1968		Minor damage. A huge storm hit a yacht race in the Celtic Sea causing great distress and damage but all competitors carried on into the Atlantic.
1968	1 to 2	7	British Isles	The Guardian & The Observer	02/07/1968 - 03/07/1968		Minor damage. Storms of thunder and lightning were widely expereinedced throughout the North-west were heavy rain fell. Flooding was widespread in low-lying suburbs of Liverpool but was largely more of an insue inland.
1968	10 to 11	7	British Isles	The Guardian & The Observer	11/07 - 13/07/1968	9	9. Major damage. Official gallantry. Official welfare. Violent thunderstorms and torrential rain produced extensive floods throughout the West Country. Bridges were washed away and trees felled. A woman drowned

1968 12 to 16

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in her bed in Sidbury when floodwaters swept through the ground floor of her cottage and in Sidmouth the floods were the worst in memory. Families in the Exe valley were in 48 hour flood alert and a Devon River authority engineer noted that 21/2 inch of rain fell over Exmoor and roads were widely impassable. Bristol was very badly affected with cars stranded and devastation occurred. Hopes for the rescue of a 21 girl were fading after she was washed away by floodwaters on a bridge in Somerset whilst her to-be-husband was saved. Several bodies were recovered in the Harcliffe Way suburb of Bristol and one body was recorded at Blackford Somerset when a 70 year old was washed away from their home. An incredible 5.14 inches of rain fell in the Bristol and Bath area. Four hundred council houses were damaged and 5,000 telephones out of action. The army was placed in charge of bridge repair. Rail links were severed by collapsed embankments and fallen bridges which cut off Bristol from rail transport. Overall 3,000 properties were affected and 8 people died in Bristol in the Great Flood. A "row over aid occurred in Bath" when the flood cost was estimated to have topped £100,000. An issue blew up over the Bath flood corporation;s decisions "not to launch a distress fund for flood victims but to rely on a special fund and the Ministry of Social Security". A Bristol MP stated "he did not think the corporation appreciated what many families of modest means had lost in the dsaster". Huge traffic jams ensued in the days after. Minor damage. Official welfare. Storms of heavy rain brought floods to Cumberland throughout the catchment

				The Observer		of the River Eden which flooded roads and buildings. An article was also published concerning "the unfairness of storm and flood" and the Institute of Hydrology was stated to be undertaking a £250,000 study regarding the causes of flood looking into meteorological, land-use and river management. It was also remarked floods "created bitter unfairness" and that natural disasters never had equitable consequences. It was stated storms were not just in their treatment and the deprived always came off worse. The emphasis was placed on the government to address issues of floodign inequaltiy and "make a storm's consequences less unfair".
1969	27-28	8	British Isles	The Guardian & The Observer	28/08/1969	The Southport Minor damage. Flower show was greatly damaged by 60 mph winds which tore loose canvas roodinf and a bar tent was destroyed. The main marquee was evacuated when it threatened to collapse and one woman was injured by a falling sign and taken to hospital with head injuries. Show officials were hard at work trying to repair the work and "icy winds and overcast" skies were attributed to have reduced attendance.
1969	20-21	9	British Isles	The Guardian & The Observer	22/09/1969	The roof of a Blackpool threatre was blown down during a 60 mph gale.
1969	22	10	British Isles	The Guardian & The Observer	22/10/1969	An article concerning threats to pylons in the North-West during winter gales. The regional electricity board had determined that in several regions the pylon system was exposed to dangerous gales from the North-East due to their NW-SE orientation which potentially endangered residential and industrial power supplies durign storms.

1969	8 to 12	11	British Isles	The Guardian & The Observer	10/11 - 13/11/1969	2	<p>Altitude was said to be the issue and it was stated to be impossible to provide complete protection.</p> <p>2. Minor damage. Gales, rain and snow swept over Britain and caused much disturbance amongst shipping. A man in car plunged 100ft over the cliff at Hartland Quay on the Debon coast and was presumed dead although the coastguard could not descend down to the ar due to the heavy seas that swept the rocks below. An RAC spokesman put out widespread warnings of black ice and blocked roads due to fallen trees. Snow and fleet fell widely in Borthenr England. A man was killed in a collision when losing control on a ice road in Glasgow and another car accidnet rsulted ina hospital admission.</p> <p>Minor damage. A storm battered Western Scotland which raged for 30 hours bringing heavy snow.</p>
1970	19-20	1	British Isles	The Guardian & The Observer	21/01/1970		
1970	15-21	8	British Isles	The Guardian & The Observer	16/08 - 22/08/1970	1	<p>1. Moderate damage. Official gallantry. Storms from the South-West battered a Scillonian ferry which docked at Penzance with 3 injured. Rescue teams were seaching the north Pembrokeshire coast for a boatman in a 14ft dinghy who was missing. One gust of 70 mph was reported in Anglesey and winds of 50 mph were also noted in Liverpool and Blackpool. Despite warnings from a beach patrolmen a father and son went into the surf in Blackpool and drowned in the seas. Hotel staff at Blackpool aware on high alert in case of flooding at Blackpool. Ferryboats were tossed around on the Mersey and vessels had to wait at the Mersey bar for pilots to board in the rough seas. 30 dinghies were wrecked on North Wales and a</p>

1970	8 to 9	9	British Isles	The Guardian & The Observer	10/09/1970	2	family of 5 had a near escape after after being blown over in Cemaes Bay. A unmmanned vessel ran ashore at Mostyn. Sveral camp sites were wrecked in North Wales. 2. Minor damage. Heavy winds and rain in the Bristol Channel were noted which made golf difficult at Royal portcawl. Two men from a Greenock coaster were presumed drowned after they went missing in a Force 9 gale in the Irish Sea. The remaining memeber sof the crew were picked up by the coastguard. The Blackpool illuminatons were much damaged. four men were injured in the Flyde when a tree fell on a van and they were ommitted to hopsital.
1970	25 to 3	11	British Isles	The Guardian & The Observer	26/10/1970 - 04/11/1970		Moderate damage. Very heavy gales reaching 150 mph in the Irish Sea hit the British Isles. This was believed to be the highest wind speed ever recorded in the British Isles ever. Part of the a railway near Gare loch was swept away by the storm surge and a mile of Morecambe seafront was inundated under 9 inches. Hexham races were abandoned. Large seas off Anglesey forced a small fleet to take shelter. At Barmouth a cuiser was swept up the Mawddach estuary and another vessel was beached up the coast. Over 600 acres was inundated after the embankments were breached in the Mawddach estuary. The town of Blackpool was damage by the high winds and huge amounts of sands covered the promenade with workmen struggling to keep the tracks clear.
1971	9 to 10	4	British Isles	The Guardian & The Observer	11/04/1971		Minor damage. Official gallantry. Mountainous seas and fale force winds crippled a ship in the Celtic Sea and the weather presented difficulties in towing her into the Solent.

1971	17-18	6	South-West Britain	The Guardian & The Observer	19/06/1971	2	2. Moderate damage. Official gallantry. A gale hit the South-West causing havoc in a Royal Navy sailing race off the Cornish coast. Three died and 30 were taken to hospital after storms registered as force 8 overwhelmed the small fleet of boats. Navy helicopters, tugs and lifeboats were all delpyed to assist the destroyed fleet although the search was difficult due to poor visibility. Three went ashore with he crew of one scrambling up the cliffs to safety. It was stated by an Admiral there was no warnings of gale force winds. Some of the younger crew were "obviously distressed" as sailors clung on to their vessels up to their knees in water. It was remarked all possible safety precautions were taken and this minimised the disaster.
1971	31 to 1	9	British Isles	The Guardian & The Observer	02/09/1971		Gales in Scotland significantly affected the performance in a Scottish golfing competition in Ayr played in "foul weather".
1971	10 to 11	10	British Isles	The Guardian & The Observer	12/10/1971		Gales were widely felt throughout Britain but their affects were largely felt on the East coast due to the easterly wind direction.
1971	17-18	10	British Isles	The Guardian & The Observer	18/10/1971	2	2. Minor damage. Official gallantry. Gales and heavy seas further excaebated the deteriorating situation on a carrirer which cuahgt fire off the Scillies which killed 2 crew. Helicopters and a fleet auxiliary ship stood by while a tug was delpyed from Falmouth. It was remarked by the captain without the help of the Royal Navy in dousing the ship's fire and evacuating men more lives could have been lost.

1971	18-19	12	British Isles	The Guardian & The Observer	20/12/1971		Minor damage. Impromptu gallantry. A coaster sank in a gale and heavy seas off Land's End and all took to the lifeboat and were later rescued by a trawler.
1972	1 to 6	12	British Isles	The Guardian & The Observer	02/12/1972 - 07/12/1972	1	1. Moderate damage. Official gallantry. Heavy storms with 50 mph winds battered the British coast. The West Country experienced the full brunt of the gales and heavy rains with the villages of East Budleigh and Sidmouth being evacuated due to the treacherous conditions. Boats were used to evacuate houses and shops in Midsomer Norton as the River Somer overflowed due to the intense rainfall. Cars were submerged throughout the town and homes were flooded in Totnes and Teignmouth. The A303 road to Exeter had to close and a train was stranded due to a rain induced landslide near Honiton. The gales last for six days and an Able Seaman was swept off a nuclear submarine and drowned in the Outer Hebrides. An unsuccessful navy search over raging seas was carried out by helicopters. At Radstock 430 children were given the day off due to the risk of flooding in a nearby Somerset coal tip. A main road had to be sandbagged to prevent flooding of a carpet factory. A spokesman for the Bristol Avon River Authority stated 1 1/2 inches of rain had fallen in 12 hours in the Fromme area.
1973	19-20	5	Western Britain	The Guardian & The Observer	21/05/1973		Minor damage. Strong winds in the Irish Sea swept two men for two nights in a gale from the Ribble Estuary to Anglesey in their disused lifeboat vessel. Both men were unharmed but one remarked "I thought our number was up, because it was so rough".

1973	17-19	11	British Isles	The Guardian & The Observer	19/11/1973 - 20/11/1973		Minor damage. Force 9 gales blew over the British Isles and no oil drilling was carried out producing large losses for Shell.
1974	5 to 16	1	British Isles	The Guardian & The Observer	06/01 - 17/01/1974, 08/03/1974	1	1. Major damage. Official gallantry. Official welfare. Major floods and strong gales in Wales resulted in great floods measured at 3ft 6 inches to Caernarvon as the Cadnant overflowed. A couple and three children were evacuated when their roof was blown off in Caernarvon. Sandbag barriers were erected in the Bank Quay to try and stop repeated flooding. Scotland was lashed by south-westerlies and ferry services were disrupted from Glasgow and roads into the south-west of Glasgow were blocked by fallen trees. Wales and the west coast also experienced high tides and storm surges but no serious casualties occurred. Four roofs in Aglesey were torn off. The Amroth sea wall was completely overtopped in "waht was believed to be the highest tide for 300 years". Furniture from some houses floated in the street and council workmen with sandbags helped villagers dam their homes. Barnstable was also hit when the Taw and Yeoburst their banks swamping houses and an industrial estate. Barriers were erected in expectation of greater storm surges. In Stornoway police had to divert traffic as shops and properties were inundated as the harbour was flooded by a surge whilst the airport was underwater. Two Navy helicopters rescued seven survivors and two dead from a distressed Danish vessels in the Celtic Sea which had been overwhelmed and disabled by the heavy seas. A boy died in a Bristol School when hit by a falling debris. An

1974	22-23	6	British Isles	The Guardian & The Observer	24/06/1974	<p>inquest found bolts had been missing although the builder stated the roof still complied with the building code. Another boy stated the roof was "lifted up like a great kite" and then struck his friend. It was noted in the 25 years of the existence of prefabricated classrooms only 1 other roof had collapsed. No verdict was reached by the inquest at the time of session.</p> <p>Violent storms and rain came to the UK causing issues for farmers throughout the nation. According to a Professor of meteorology this was due to the anticyclonic weather system domination which brought periodic dry weather interspersed with high intensity storms.</p> <p>Gales and strong winds postponed the start of Olympic sailing on the South-west coast.</p>
1974	1 to 4	7	British Isles	The Guardian & The Observer	02/07/1974 - 05/07/1974	<p>Minor damage. Winds sometimes reaching 100 mph produced by a deep depression tore across the UK. At Milford Haven 80 mph almost wrenched a 250,000 tanker from its moorings but the tug crews on strike did not go to the rescue. The tall ships race in the Clyde was abandoned due to the conditions whilst winds tore down tents and chalters in North Devon. Drivers were halted due to waters entering their electrical systems. Liverpool FC played through a force 11 storm. In Wales hundreds of acres were flooded when the Severn burst its banks and a "heartbreak harvest" was predicted for Welsh farmers.</p>
1974	7 to 8	9	British Isles	The Guardian & The Observer	08/09/1974 - 09/09/1974	<p>Minor damage. Gales were widespread across Britain as high winds felled trees blocking roads and many trees</p>
1974	27-28	12	British Isles	The Guardian &	29/12/1974	

1975	4 to 7	1	British Isles	The Observer The Guardian & The Observer	07/01/1975 - 08/01/1975	2	were damaged. All major incidents were away from the West coast however. 2. Minor damage Great gales came to the British Isles and 2 men were drowned when their boat was overwhelmed in the Irish Sea. One man climbed a 200ft cliff to raise the alarm after he and his companions struck a rock off the Wigtownshire coast. One of the survivors was taken to hospital.
1975	22-25	1	British Isles	The Guardian & The Observer	23/01/1975 - 26/01/1975		Minor damage. Official gallantry. Severe storms brought havoc to the Isles and in the Bristol Channel a coaster sank off Lundy Island having dragged her anchor in a Force 10 gale. The captain and crew were taken off by lifeboat. Snow covered the west of Scotland making travel difficult.
1975	14-18	7	British Isles	The Guardian & The Observer	15/07/1975 - 19/07/1975		Minor damage. Heavy rainstorms caused flooding throughout the North-West but no notable damage was reported.
1975	13-14	9	British Isles	The Guardian & The Observer	15/09/1975	4	4. Minor damage. Official gallantry. Impromptu gallantry. Gales swept the coast and 5 men were missing with two definitely found drowned when a motor vessel capsized in the Bristol Channel. One man scrambled ashore having been drifting in a liferaft for several hours. The Police stated "there seems to be little hope of survival". They had struck a rock near the Holm islands and then 4 had evacuated with one remaining behind in the sinking vessel. The dinghy they evacuated in soon capsized. Heavy rain fell throughout the South coast.

1976	2 to 5	1	British Isles	The Guardian & The Observer	03/01/1976 - 06/01/1975	2	2. Major damage. Official gallantry. Storms of torrential rain and snow were accompanied by 90 mph gales disrupting traffic and power supplies throughout the UK. Two men were swept off rocks in Pembroke and the search had to be abandoned after the storm became too violent. In morecambe the surge was so great that a boat was swept through a shop window and areas of Blackpool were flooded by the sea. Parts of Hcester near the Dee were also inundated with damage to property. An Irish Sea ferry the King Orry broke free at Glasson Dock and drifted onto sandbanks. The line flooded St. Geroge's Quay threatening to inundate warehouses. Rail services were in disaray due to power shortages in the Norht-West. 75 mph gales on the Mersey caused a 200,000 ton tanker to break free but she was cuahgt. Narrow escapes from flying glass and falling chimneys were noted in Blackpool. Emergency services stated it was the worst storm in Britain for almost 30 years. A meterological spokesmen stated the "grea rapidty and almost explosive violence" of the storm. The landing stage at Liverpool was wrecked with a cost of £1.25 million. Trhoughout the UK the damage was estimated to be up to £70 million. Household insurance was said to have taken a hit. An article on how the meterological office processed public weather inquiries. It was stated "doctors and weathermen could be said to form a modern riesthood standing between a godless people and the two last great mysteries - death and the weather". It was stated th sailign Prime minister even called for such meterologica diagnosis. It was stated there had been 16,300,000 calls
1976	5	1	British Isles	The Guardian & The Observer	05/01/1976		

1976	19-20	1	British Isles	The Guardian & The Observer	21/01/1976	2	<p>inn 1974 and the oil and gas industry was by far the largest client. It was stated swell amplitude forecasting using a super computer had now become a key area of concern.</p> <p>2. Moderate damage. Official gallantry. Impromptu gallantry. Dangerous gales swept Britain causing widespread damage to buildings and accidents on the roads. In Lanarkshire a woman was killed when blown into the path of a lorry by a gust of wind and a man was killed near Bath when a van was blown onto his car. A man was hit by a falling chimney in Glasgow and was seriously injured. A bus was caught by a gust of wind and crashed which injured a woman in Birkenhead. A 20 mph limit was put on the M6 due after a vehicle was blown across the carriageways. Workers of the Mersey Dock Company managed to save the £1.5 million second section of the Mersey landign stage which was exposed to a battering from large waves and strong winds. A 32ft storm surge tide was whipped up by a 60 mph gale at Blackpool where the promenade was closed to traffic. Some families were marooned by floods on a housing estate in Fleetwood near the sea wall by surge waters. Hundreds of caravans were flooded by the storm surge at Towyn and Abergele. Glasgow was placed on full storm alert and practically all sailings were cancelled. A French trawler was in distress off Barra and the seas were such the Barra lifeboat couldn't reach her but she was later saved by the trawlers.</p>
1976	12 to 13	3	British Isles	The Guardian &	15/03/1976	21	<p>21. Moderate damage. official fallantry. In mountainous seas and gale-force winds a French trawler was wrecked with the loss of 15 off the Isles of Scilly. Helicopter sea</p>

				The Observer			kings were up on a constant rescue service but darkness fell. All hope was eventually abandoned of finding anyone despite the best efforts of the Royal Navy as 70 knot winds and 60 foot waves caused danger to the helicopters due to the salt ingestion and balance. Another vessel was also in distress and 6 men aboard were deemed to have also died after their liferaft was sighted upside down.
1976	25-26	9	British Isles	The Guardian & The Observer	27/09/1976	2	2. Official gallantry. Official welfare. During a thunderstorm a three year old girl went missing in Somerset whilst a 81 year old man was swept to his death in Polerro when a freak flood raged through the village. Four feet of water poured through the town and villages and properties were closed. The heavy rain coincided with the highest tide of the year. 5 inches of rain fell in two hours. One man was electrified in a cottage and needed the kiss of life to be kicked into life again. The floods and torrential rains damaged the water supply and 100,000 consumers were without running water for several days and under a rationing programme which was stated by an MP to be unfair and blighted by many anomalies. He stated "I cannot tell you what harm all this had done to public relationships with the water authority and even with MPs in the area. There must be an inquiry not to apportion blame, but to see that these mistakes are not made again". Action groups in North Devon were in the process of organising a march to the headquarters of the water authority.

1976	14-15	10	British Isles	The Guardian & The Observer	15/10/1976 - 16/10/1976	2	2. Official gallantry. Impromptu gallantry. Heavy seas and stormy winds were noted in the Celtic Sea causing distress to yachts. Hundreds of acres were flooded in Devon after downpours and air and sea transport to the Isle of Scilly were disrupted. Two Anglesey fishermen were drowned off the north coast after an all-night search by coastguards and volunteers. A man was stranded on the roof of his car and then airlifted to safety in Somerset.
1977	13-15	3	British Isles	The Guardian & The Observer	14/03/1977, 14/03/1977, 16/03/1977, 17/03/1977		A 'country diary' extract from the Lake District noted how a 'force seven gale pounded the Cumbrian coast' while walkers in Cumbria were 'bowled over' and unable to stand such were the force of the gusts. The Welsh rugby team beat Scotland as a storm swept the latter nation and hailstorm affected play. A football game in Bristol was reported played in storms which produced conditions that 'were conducive to desperation' Winds 'approach gale force blew gusts of rain ' towards one goal which was said to have been advantageous for the team shooting towards it. A weather report from the 17 also depicted a great low South of Iceland with very close isobars highlighting the large pressure gradient and strong winds over South Wales and Western Britain.
1977	20	3	British Isles	The Guardian & The Observer	21/03/1977		In Devon a brother and sister were hit by lightning near Chudleigh during a thunderstorm and seriously injured.
1977	31 to 1	11	British Isles	The Guardian & The Observer	01/11/1977	1	1. Moderate damage. Gales wrought havoc throughout the UK, with rains so severe that most roads in the West were flooded and the main railway line to London was closed due to electrical damage. Wales, Cumbria and the

1977	10 to 13	11	British Isles	The Guardian & The Observer	16/11/1977	1	<p>West Country suffered heavy flooding and a Force 12 hurricane winds were recorded off the Lizard. A Soviet seaman on a visiting tug was believed to have drowned in Falmouth Harbour having been washed overboard by a large wave.</p> <p>1. Major damage. Official gallantry. Official welfare. Storms left a trail of damage throughout the UK including the destruction of Morecambe Pier which collapsed during a storm surge as the waves flooded 3 miles of seafront. 80 mph gusts were recorded as cars floated and premises were evacuated. Gusts of 92 mph were recorded in Devon. Several vehicles were blown onto their sides on the Severn Bridge which was later closed. Telephones lines and cables as well as trees were widely felled in the West Country. Snow showers were widespread across the North as well as thunder and hail. Rge government hinted it may give "special financial assistance to Lancashire seaside resorts" due to their severe sufferingafter telegrams from the Blackpool and Flyde and Wyre district were recieved asking for national funds for repair exceeding £1 million. The primeminster stated "Government facilities can be made available if necessary". In many places weakened coastal defences were plugged with sandbags. MPs from the North-West were toe appeal not only for cash aid but for the use of the job creation scheme to repair the damage. A extra £1 million was epxected to be needed fro the reapiir work alone. AT Tremadoc rescuers rescued a trapped housewife from her home after an avalanche had overwhelmed the property. The woman was taken to</p>
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1977	10 to 11	12	British Isles	The Guardian & The Observer	14/12/1977 - 15/11/1977	2	<p>hospital. A ship's engineer died in stormy seas in the Irish Sea after being washed overboard and drowned.</p> <p>2. Major damage. Official gallantry. Storms blew throughout the North-West doing more than a £1 million in the North-West. In Southport a supermarket windows were battered in by the winds. In Devon a seven-year-old boy was drowned after his mother's car was swept into the water by torrential rain. More than 200 police officers and volunteers undertook a search in 70 mph and torrential rain for a missing boy across Mid-Wales but he was not found.</p> <p>Moderate damage. Official gallantry. In a great tempest from the South-West a 1,200-ton trawler was wrecked off the the Cornish coast near Mousehole and 16 of 27 men were taken off by helicopter. A French trawler was also missing off the Scillies and a French military aircraft launched a second search for him.</p> <p>Minor damage. Storms from the East battered Britain and in Cornwall four German seaman swam to shore after their vessel ran ashore in St. Ives Bay. Plans to call "red alert" flood warnings were issued but largely in the South-Eaast due to the risk of storm surge conditions.</p> <p>Minor damage. Official gallantry. Impromptu gallantry. Official welfare. A blizzard came to the South-West with snow so heavy it formed 8 foot drifts in Somerset which made travel extremely difficult. Only Land-Rovers were able to make progress and 50 people were forced to sleep in a church unable to get home from Bristol to Shepton Mallet due to the blanket of snow on the roads. A whole "flotilla of snow ploughs" worked the roads of the</p>
1977	27-28	12	British Isles	The Guardian & The Observer	28/12/1977		
1978	11 to 12	1	British Isles	The Guardian & The Observer	12/01/1978		
1978	19-21	2	British Isles	The Guardian & The Observer	21/02/1978		

1978	11 to 17	9	British Isles	The Guardian & The Observer	12/09/1978 - 18/09/1978	2	<p>South-West in an attempt to open up frozen arteries. Children cleared cars of snow to check for any trapped travellers. Travellers in South Wales were also held up and marooned in Cowbridge owing to the heavy snow blocking roads. In the town "the ships were fast running out of food, pubs low on alcohol and the banks out of money".</p> <p>2. Minor damage. Official gallantry. A great tempest caused disruption throughout the UK and her coats with huge waves in the Atlantic injuring people onboard the QE2. A body of a woman was washed up in Blackpool and the sloop she had been in and another man was missing. Two brothers were rescued by helicopter a mile out to sea in a plastic dinghy by helicopter. Their parents were prevented from going to the rescue by the coastguard who alerted the coastguards at Falmouth via radio. A Royal Navy Frigate rescued a trawler off the West Coast of Scotland which was overwhelmed in the storm and suffered engine failure.</p>
1978	15-16	10	British Isles	The Guardian & The Observer	16/10/1978		<p>Moderate damage. Official gallantry. Official inquiry. Heavy gales forced a Greek oil tanker off St. Bride's Bay and 4,000 tons of oil was spilt as a result. Despite calmer forecasts of force 6 a force 8 was experienced and the ship was in danger of completely foundering. Emergency services began pumping the oil still onboard off but the gales threatened to cease operations as the ship lurched dangerously on the rocks. Emergency measures were taken to prevent oil polluting nearby habitats. At least 1,000 birds were thought to have been affected or died as oil spread throughout the channel due to the strong winds. There were issues as no British port would accept</p>

1978	12 to 14	12	British Isles	The Guardian & The Observer	14/12/1978	21	<p>the holed tanker. AN investigation had begun into how the tanker was forced aground. Whether it was the owenr's navigational decision or that of the captain to cut the corner around the dangerous coast was yet to be decided. The potential of a machinery malfunction had not been ruled out. It was noted that under-secretary of state had noted there wwer eissues with having compulsory pilots in British waters but it was noted by Mr Prescott that "the cost would be tiny in proportion to the environmental bill of continuing great oil spillages".</p> <p>21. Moderate damage. Official gallantry. Storms and hurricane-force winds claimed many lives around the West coast. In all 15 died in the South-west with 10 missing from a wrecked French trawler presumed dead whilst 28 from a German trawler were unheard of. Land's End coastguards noted that 8 vessels were trying to find the German vesseland the US Air Force Nimrods were also deployed. 400 ft spray was noted topping the cliffs of Lundy where 80 mph was recorded. Two policemen were amongst the dead when their car was swept into the quay at Porthleven leaving wives and children. At Bovisand Fort a body of a canoeist was discovered next to the capsized boat. A motorist died near Truro when his car was hit by a falling tree. A house was blown down at Abergavenny adn a village hall lifted off it's foundations. The community of Lundy was also marooned with the supply ship unable to delivery it's goods due to the condition.</p>
1979	2 to 5	1	British Isles	The Guardian &	05/01/1979		<p>Minor damage. Official welfare. Havoc was once more wrought by gales and snooze and ice were widespread throughout the UK causing great issues for road users. A</p>

1979	30-31	5	British Isles	The Observer	31/05/1979		character from help the aged concerned with possible risk of hypothermia urged aged to "stay inside their homes and avoid slipping on pavements" and it was noted the recent aged weather awarness campaign had paid off. Minor damage. Official gallantry. "Freak rainstorms" throughout southern england resulted from a small depression moving quickly up the Bay of Biscay. Several rivers burst their banks in Somerset and Devon cutting off low-lying houses which were evacuated by police whilst electricity supply was affected. In Bridport the County Council headquatres were flooded to a minor degree and "two amphibious troop transporters helped with evacuations". A woman was rescued from the water by boat in Bridport and taken to the hospital suffering from shock. Police told farmers to move cattle to higher ground near Exeter and in Devon whilst trains were delayed due to water on the line. The AA reported Somerset roads were widely blocked in low-lying areas due ot the floodwater.
1979	12 to 17	8	British Isles	The Guardian & The Observer	15/10/1979 - 18/10/1979	19	19.Moderate damage. Official gallantry. Unofficial gallantry. Official Welfare. Inquiry"The biggest disaster in the history of ocean racing overtook the Fastnet Race fleet" as 19 died in the Celtic Sea during a force 11 storm which produced mountainous seas. 24 yachts were abandoned and 5 sunk. Navy and lifeboats rescued scores from handicapped yachts and liferafts and it was proclaimed by one lifeboatman "It was hell, just hell out there". A Fastnet Race disaster appeal was launched by the Mayor ofPlymouth whilst an inquiry intot he running of the race was to be held concenring "Should the race

1979	7 to 8	10	British Isles	The Guardian & The Observer	08/10/1979	2	have gone ahead and were the competitors capable of meeting all weather conditions?". 2. Official gallantry. Impromptu gallantry. Two anglers were rescued from the Irish Sea in a dinghy by an RAF helicopter having been driven in a force 7 gale. They were ill-equipped and the engine had broke. Their disappearance catalysed a huge search involving an RAF helicopter, two lifeboats and a frigate as well as numerous fishing vessels. It was remarked "They are fantastically lucky to be alive" by the coastguard. The men had been driven 18 miles to sea in a force 7 gale for 17 hours but were largely unharmed.
1979	15 to 17	12	British Isles	The Guardian & The Observer	16/12/1979 - 18/12/1979	3	3. Moderate damage. Official gallantry. 100 mph gales hit the South with mountainous seas observed in the Celtic Sea. Two french tralweres were missing off the Lizard and a coaster picked up a liferaft containing a body of a trawlerman. A sea king helicopter scoured the area looking for those in distress. A nimrod also had no luck only finding an empty liferaft. In Devonport a giant crane was blown over crashing across two frigates cuasing moderate damage. A whaler was destroyed. The RAX reported the winds had uprooted many trees and blocked roads. A woman was killed in Ayrshire when a tree was blown down on her car. A woman was killed in Glasgow when a chimney stack toppled on her whilst a man was trapped by fallen trees in his car.
1979	27-28	12	British Isles	The Guardian & The Observer	28/12/1979	2	2. Major damage. Official gallantry. Impromptu gallantry. Official welfare. Torrential rains and high winds resulted in serious flooding in Britian leaving a trail of distruction. In South Wales two people died and thousands of homes

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3 British Isles

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were flooded as rivers burst their banks cutting off villages and troops and police had to coordinate "an enormous rescue operation". In South-west England many towns were inundated. Rianfall was the heaviest in South Wales for 10 years. Many of the evacuated were taken to hospital and babies were evacuated from roof tops. In Carmarthen it was stated by a police spokesman "Today has seen the worst flooding ever to occur in this force's area". The telephone exchange and Post Office were evacuated as firemen struggled to prevent overflowing water seeping into the properties. A circus was evacuated in Cardiff and a bridge collapsed in Port Talbot as a river overwhelmed it. Three people were taken to hospital near Newport. In Preston a police officer had to jump into the Ribble to rescue a woman from drowning. In the South-west major towns were sealed off as Newton Abbot was encircled by waters 5ft deep and 100 were evacuated. Channel ferries were held up and a helicopter rescued 8 Maericans from the ocean-going tug Gulf Majesty which had lost its giant oil-rig support barge which ran ashore near Fowey. In Bideford 75 were evacuated from flooding homes and sailors on leave assisted the emergency services. At Ridgewater and Fiddington the waters inundated acres of countryside to a depth of 4 feet in places. In Somerset several key towns and villages were closed to traffic. Eight British pilots were also stranded on Eastern Block freezer factory ships as the seas prevented their relief.

Minor damage. Official gallantry. A tremendous storm from the South-west produced mountainous seas in the

1980	18 to 19	3	British Isles	The Observer The Guardian & The Observer	19/03/1980		Celtic Sea which included a wrecking of a large oil tanker off Ushant. Minor damage. Official gallantry. Heavy rain and snow storms once more produced widespread flooding in North England and Scotland whilst snow blocked roads. Huge seas and 65 mph winds battered the North Wales coast breaching a gap in the sea wall at Rhos-on-Sea flooding property and homes.
1980	20-21	4	British Isles	The Guardian & The Observer	21/04/1981		Minor damage. Gales of force 8 lashed coastal towns although surge and wind damage was largely confined to the east coast.
1980	5	6	North-West Britain	The Guardian & The Observer	06/06/1980 - 07/06/1980		Minor damage. Storms of rain, thunder and lightning swept the North causing great disturbance but damage was largely inland or in the East. A great clear-up operation involving workmen, police and the fire brigade ensued.
1980	26-27	7	British Isles	The Guardian & The Observer	27/07/1980		Minor damage. Violent storms struck the UK causing flash flooding and interrupting sport and travel. In South Wales a woman narrowly escaped injury from a falling chimney struck by lightning.
1980	5 to 7	10	British Isles	The Guardian & The Observer	07/10/1980 - 08/10/1980	1	1. Moderate damage. Official gallantry. "Rain and gales lash country" was the opening headline of the Guardian as gales of up to 60 mph caused widespread destruction and disturbance. Flooding of 4ft was noted in many places in Cumbria. Police issued flood warnings in South Wales and there was serious flooding in the Conwy and Dovey estuaries whilst trees were blown across roads in North Wales causing much disruption. A woman was swept to her death by a storm surge off the Morecambe seafront

1980	6 to 7	11	British Isles	The Guardian & The Observer	07/11/1980		by waves whipped up by Force 10 winds. 86 mph was recorded near Ilfracombe. Flooding was widespread in Ayrshire and around Glasgow and Renfrewshire. Minor damage. Official gallantry. A German ship was driven by heavy winds onto Lundy Island and the crew scrambled ashore through icy waves to safety. A Sea King rescue helicopter was scrambled and rescued all sailors.
1980	14 to 15	12	British Isles	The Guardian & The Observer	15/12/1980		Minor damage. Gales accompanied with snow struck the British Isles with 80-90 mph winds noted throughout. The North and Scotland was particularly badly affected with many roads being closed and traffic frozen. The River Clyde burst its banks and flooding was widespread in West Scotland whilst Irish Sea ferry services were suspended.
1981	31 to 1	1	British Isles	The Guardian & The Observer	02/01/1981		Minor damage. Storms swept over the Irish Sea and Britian doing most damage in Ireland. Roads were covered with ice and snow while high winds made driving dangerous. Roads were largely deserted according to the Royal Automobile Club.
1981	14-16	1	British Isles	The Guardian & The Observer	16/01/1981		Stormy weather was observed throughout Scotland and the North of England which made for treacherous conditions.
1981	11 to 12	3	British Isles	The Guardian & The Observer	12/03/1981 - 13/03/1981	1	1. Minor damage. Official gallantry. A gale made rugby difficult in Bristol whilst a boy was swept aware by a flooded stream near Cardiff and teams of policemen with tracker dogs were out seraching for any signs of him.
1981	2 to 6	6	British Isles	The Guardian & The Observer	03/06/1981 - 08/06/1981		Minor damage. Thunderstorms left a trail of chaos throughout Britian with Devon demergency services receiving hundreds of calls from people whose homes had

1981	9	7	British Isles	The Guardian & The Observer	10/07/1981	1	been flooded. A yacht race braved mountainous seas in the Celtic Sea as they proceeded into a storm. 1. Minor damage. Official gallantry. Lightning and thunderstorms were widespread throughout the kingdom with one woman being struck and killed in Somerset. She was dead by the time she reached hospital.
1981	23-24	11	British Isles	The Guardian & The Observer	24/11/1981 - 25/11/1981		Minor damage. Ferocious gale from the east came to the British Isles but largely caused issues in the East and North Sea.
1981	13-15	12	British Isles	The Guardian & The Times	14-15/12/1981	1	1. Major damage. Official gallantry. Impromptu gallantry. Official welfare. Floods and very high tides caused extensive flooding along the coasts of the Bristol Channel after a day of blizzards "hich brough near-Siberian conditions to Britain". Seawalls were breached in several places along the Weston-Super-Mare seafront causing houses to have to be evacuated and the "police appealed for small boats and inflatables to be taken to the Western General Hospital, near the seafront where instructions were given about the worst affected areas". Houses were flooded in Burnham-on-Sea and in the Cumberland Basin near the city of Bristol. The flooding was reported to have began as the armer conditions changed the snowstorm to heavy rain whilst the high tides were whipped up by the rain. Blackout were experienced thoroughout the West Country and their were shipping emergencies in the Bristol Channel as 36 people were rescued in "diabolical conditions" by a rescue fleet of ships and helicopters from a stricken Ecuarordian cargo ship off the Dorset coast. One crew member drowned

whilst another broke their legs and the coastguard stated the operation had been "tremendously difficult". Four men were also rescued from a vessel listed at 20 degrees off Start Point, Devon. The maximum gust windspeed in the South-west reached 90 mph and snow blew near horizontally. Many cables were welded together by frost and telegraph poles were felled. The Torbay lifeboat was launched to assist a struggling vessel. Following the reports on the specific storm event the Guardian also ran a headline stating "Britain sliding towards a 'little ice age'". A front page article on the 15th stated the death toll had risen by a further 8 which included 4 missing seaman whose vessel had sank in a force 10 gale in the Irish Sea although a French trawler and an RAF helicopter saved others. The other four deaths occurred due to the exposure from the blizzard in various locations in middle England. A pregnant woman was also airlifted to hospital from a snowbound house and gave birth 15 minutes after her arrival. Many families in Weston-super-Mare were forced to shelter in church halls and temporary accommodation whilst the council workers fought against the renewed gale to repair the sea walls. Flooding was exacerbated by a thawing of snow on the Mendip Hills. Powercuts continued and it was estimated by the Electricity Board that 100,000 people were still without electricity and 500,000 had been affected in total. The M4 and Severn bridge were blocked along with the Holyhead railway line between Bangor and Llandudno. A train was also stuck without heat for four hours in Somerset leaving 125 stranded and the Exeter Salisbury line was blocked in

1981	19-30	12	British Isles	The Guardian & The Observer	20/12/1981 - 31/12/1981	52	<p>several places by falling trees and telegraph cables. The same was true of the Exeter to North Devon line. One more fatality was recorded in Carmarthen when a tree fell on their car which also injured another individual.</p> <p>52. Major damage. Official gallantry. Impromptu gallantry. Official welfare. Impromptu Welfare. A small coaster was lost off the Cornish coast in a snow storm and moutainous seas and the crew of the rescuing Penlee lifeboat also perished as the Solomon Browne lifeboat was wrecked. The Panamanian vessel Mark was also lost with German merchant ships reporting seeing a liferaft and floating body. Helicopters also spotted empty liferafts. The Penlee lifeboat disaster evoked great sorrow throughout Cornwall and the wider nation reminding ht epopulation of theperils of the sea. A new boat was to be brought to Penlee and a new crew trained to replace the experienced deceased. The inquest intot he loss of the Union Star and rescuing Penlee lifeboat found the Union Star had been wrecked due to "the irreparable failure of the ship's engines due to contamination of fuel by sea water while off a dangerous lee shore; the extreme severity of the weather, wind and sea; and the capsiz of the vessel on or shortly after stranding". The inquest concluded the lifeboat was lost "the irreparable failure of the ship's engines due to contamination of fuel by sea water while off a dangerous lee shore; the extreme severity of the weather, wind and sea; and the capsiz of the vessel on or shortly after stranding."The disaster fund donations for the relatives of the victims exceeded £3 million. The cargo ship Marina di Equa was also lost in the Western</p>
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1982	9	1	British Isles	The Guardian & The Observer	09/01/1982		Approaches off Land's End with the lost of 30 crew with the only evidence of the vessel being the sighting of a white distress flare and empty liferafts from the air by a French search aircraft. The last SOS message from the vessel was that it was sinking fast with the hatch open and the insurers were soon to open an inquiry. An RAF Nimrod also joined in the search along with a small number of vessels in the vicinity. According to the correspondent the events served as "a grim reminder of the power of the seas off Cornwall".
1982	14	1	British Isles	The Guardian & The Observer	14/01/1982		An article relating rising temperatures, the melting Antarctic ice sheet and rising sea levels to increasing atmospheric storminess and storm surges in particular.
1982	3 to 4	3	British Isles	The Guardian & The Observer	04/03/1982	1	An extract concerning how Scots pines near the windswept coasts of Scotland thrive due to the saline inundation brought by strong coast winds during winter storms. The winds brought "enough potassium, magnesium, sodium, chlorine and other essential minerals to offset the leaching in heavier rain" and thus were essential to forest growth. 1. Minor damage. Gales and rain "of almost tropical intensity hit many parts of the United Kingdom" leaving a trail of damage. This included the wrecking of the Cypriot motor oil tanker vessel Craigantlet off the south-west of Scotland and her cargo including chemical waste was washed into the sea. "Police warned the public to stay away from the coast while scientists considered way of neutralising the waste if it was washed ashore". 50mph gales were noted and a girl was killed when her car

1982	2 to 4	5	British Isles	The Guardian & The Observer	03/05/1982 - 04/05/1982	struck a tree which crushed her as it was felled. Power failures were widespread throughout Cumrbia adn in Scotland with thousands of households wihtout power. Minor damage. Official gallantry. Snow and gales caused much disruption throughout Britain. In the Irish Sea lifeboats were launched to aid struggling sailors and a trawler wrecked at Workington. "Lifeboatmen and coastguards braved the force 9 gales" and the trawler with the 3 crew was towed back to port until the tow rope broke and the trawler was wrecked. Coastguards waded through the raging sea to rescue the men. Caravans were widely blown over and caused serious hazards to motorists accoridng to the RAC.
1982	25	6	British Isles	The Guardian & The Observer	26/06/1982	Reports of an "electrical storm" over Royal Porthcawl which dramatically affected players and caused a one hour suspension of play due tohigh winds and heavy rains which "Was hissing down" causing many mistakes.
1982	29-30	8	British Isles	The Guardian & The Observer	30/08/1982	Minor damage. Official gallantry. Two families were rescued y lifebaot and helicopter from the Irish Sea when their boat was overwhelmed to the south of the Isle of Man. A distress call was responded to by the Raf and lifeboat on the isle. Two were winched off and th elifeboat guided the vessel back to shore.
1982	26-28	9	Western Britain	The Guardian & The Observer	28/09/1982	Moderate damage. Official gallantry. Gales of 80 mph battered the West coast with torrential rain. 60 caravans were wrecked in conway and 10 hurt. It was described as "utter devastation". Dozens of trees were torn up in the West Country and Wales with a policeman being struck in Somerset and badly injured. 1,500 homes outside Dartmoor were without electricity when a flying roof

1982	17-18	10	British Isles	The Guardian & The Observer	18/10/1982	1	<p>severed high voltage lines. In Plymouth the water mains were overwhelmed and burst causing severe floods whilst 12 cows were killed by a fallen power cable in Devon. The weather was caused by colliding cold and warm front in the Bay of Biscay.</p> <p>1. Minor damage. Force 10 storms lashed the Welsh coast and a diver was drowned in West Glamorgan when a huge storm surge wave swept his van into the sea although 3 others escaped. Waves crashed over the 20 foot high breakwater near an iron ore terminal where they were working. 85 mph hurricane force gusts were recorded at Falmouth. Flooding was widespread throughout the West Country.</p>
1982	12 to 13	11	British Isles	The Guardian & The Observer	13/11/1982		<p>Minor damage. Official gallantry. Official welfare. Storm and flood engulfed the UK with damage all around. In North Wales floods were widespread and 20 pensioners were evacuated from an old people's home in the Conway Valley when 2 feet of floodwater swept through the building whilst hundreds of acres were underwater and flood alerts were issued for the rivers Conway, Dovey, Mawddach and Towey with farmers forced to quickly evacuate their livestock to higher ground.</p>
1982	19-20	12	British Isles	The Guardian & The Observer	19/12/1982 - 21/12/1982	1	<p>1. Minor damage. Official gallantry. Official welfare. Gale warnings preceded severe storms of snow, heavy rain and gales. In Scotland and Cumbria snow blocked many arteries whilst flood alerts were widespread in North Wales where flooding was widespread in the Conway Valley and towns were put on full alert after the river rose 2 feet in an hour due to the continuous rain and snow melt. Flood alerts were again heeded by farmers</p>

1983	31 to 2	2	British Isles	The Guardian & The Observer	02/02/1983	<p>throughout North-west Wales in the Dovey and Mawddach rivers. Rivers were also in heavy flood in South Wales and a major road was blocked by a landslide in Glamorgan. A transatlantic sailor was feared lost in a storm 200 miles west of Land's End in the Celtic Sea. He had been hoping to cross the Atlantic in the smallest ever craft. No sign of the vessel was picked up by the RAF Nimrod. Other distress calls were answered from freighters and a fishing boat off Land's End with success. Irish Sea ferries were postponed due to the sea state. Storms and floods closed railway lines between Llandudno Junction and Blaenau Ffestiniog. Traffic slowed to a crawl in North Wales and a 30 mph limit was imposed on the Severn Bridge. Snow was widespread throughout Scotland closing roads in the Highlands.</p> <p>Moderate damage. Official gallantry. Official welfare. Flooding was widespread throughout Britain with strong breezes from the east causing much disruption. A Birkenhead gentleman was severely injured when his greenhouse was blown down on top of him. Merseyside recorded 100 mph and 66 were taken to hospital some with fractured skulls. Emergency services appealed to the elderly and frail to stay indoors after 27 pensioners were knocked over. The Holyhead-Liverpool railway line was blocked by flooding in Rhyl and snow trapped scores of cars throughout North Wales.</p>
1983	9 to 11	4	British Isles	The Guardian & The Observer	11/04/1983	<p>Minor damage. Official gallantry. Gales once more battered the British Isles and were severely felt in the Celtic Sea where they produced mountainous waves and caused considerable expense to shipping. A Sea King</p>

1983	18-19	4	British Isles	The Guardian & The Observer	19/04/1983 - 27/04/1983	helicopter was searching off the Lizard for a missing yacht but she was later spotted although she was to later rescue 6 men from a liferaft who had abandoned their vessel 100 miles south-west of the Lizard. A Greek vessel was also abandoned after it's engine room flooded. Six divers were saved off Start Point and a lifeboat capsized during rescue attempts but it righted itself despite near loss of crew. Heavy gales hit the west of Europe although their damage was largely confined to France.
1983	8	6	British Isles	The Guardian & The Observer	09/06/1983	Minor damage. "Freak storms" hit Wales and Northern England which flooded and damaged many homes. Thousands were without power electricity and traffic was completely blocked in Aberport after 5 1/2 inches of rain fell which was more than a "tropical intensity".
1983	15-16	10	British Isles	The Guardian & The Observer	16/10/1983	Torrential rain and high winds battered the UK and rugby in South Wales and Scotland was much affected with matches abandoned.
1984	13-16	1	British Isles	The Guardian & The Observer	17/01/1984 - 21/01/1984	Major damage. Official gallantry. Gales once more came to Britain causing considerable disruption and damage as Force 12 winds were recorded. In Glasgow the River Cart overflowed and fireman helped families escape in boats from their homes. Millions of pounds of damage was inflicted on buildings with the 375 ft cooling tower being blown down at Widnes after being hit by an 82 mph gust. It would cost £5 million to replace. Blackouts were widespread as cables were damaged. At Oban a car was blown down an embankment but the driver unhurt. The

1984	21-23	8	South-West Britain	The Guardian & The Observer	23/08/1984		<p>Severn bridge was closed to high-sided vehicles. Irish Sea ferries were much delayed.</p> <p>Moderate damage. Floods brought chaos to the South-west but the water influx relieved an anticipated drought problem which could have required rationing. Rain gauges were largely put out of action by lightning, pumping stations were affected and several thousands were left without electricity and telephones as homes and communications were struck. At Paignton a man was taken to hospital after he was struck by lightning. Dozens of homes were flooded in Devon and roads blocked by landslides. Torquay was badly hit and a French yacht ran aground in the storm in Falmouth.</p>
1984	6	9	British Isles	The Guardian & The Observer	06/09/1984		<p>An article on the reported increase in UK underwriting losses after heavy storm damage from the Sun Alliance and Guardian Royal Exchange. This was principally because of the storms of the winter plus a rapid increase in subsidence claims. It was estimated the weather resulted in a cost of £17.3 m net of reinsurance to Sun Alliance. Guardian Royal Exchange also blamed UK weather and issues for rising losses of £43.9 m.</p>
1984	14-15	9	South-West Britain	The Guardian & The Observer	16/09/1984 - 20/09/1984	1	<p>1. Minor damage. Impromptu welfare. Two seaman on their quest for an English pint got into great trouble in the Bristol Channel. Two men in an inflatable dinghy were caught in a heavy swell and swept off course by a 50 kt squall. The vessel capsized several times and eventually drifted to shore. One man ran a mile and clambered up cliffs to a local shop looking for aid in an exhausted state whilst the other drowned and no sign of the body was</p>

1984	17-19	10	South-West Britain	The Guardian & The Observer	24/11/1984 - 28/11/1984	<p>found. Heavy seas and gales were noted throughout the Southern coast.</p> <p>Minor damage. Official gallantry. A great tempest blew over the South-west and residents suffered from flooding. A sailing ship ran aground and the Falmouth lifeboat was delployed before itself becoming disabled by the towing line used to free the former. The lifebaot was rescued by the Lizard lifeboat and a Royal Fleet Auxillary ship whilst a tug aided the sailing ship. A Navy helicopter rescued 6 German sailors from a disabled vessel off Land's End which had 20ft waves washing over it. Drums of chemicals were washed up on the beaches thought to have come from a vessel which had foundered in the Bay of Biscay. In Northern England, Wales and Scotland many roads were flooded and impassable. force 10 gales over the Irish Sea halted all ferry services and two fishermen aboard a lugger cpasized off Falmouth but were rescued by Sea King.</p>
1985	13-15	2	British Isles	The Guardian & The Observer	16/02/1985	<p>Minor damage. Official gallantry. Artic winds and storms brought very low temperatures to the Scottish Highlands and a woman was found dead in Glencoe having died of hypothermia. Winds of 70 mph and mountianous seas were noted in the English Channel. The Falmouth lifeboat and a naval helicopter were deployed to aid a vessel foundering off the Lizard which was supplied with a new pump. French rescue services responded to a May day call from a French tralwer 55 miles off Plymouth. A lifeboat from Brixham was launched to aid a cutter and a 700 ton coaster was torn from it's anchor at Teignmouth. The blizzard uprooted trees and felled power lines throughout</p>

1985	4	8	British Isles	The Guardian & The Observer	06/08/1985	<p>Cornwall cutting electricity to 3,000 homes. 38,000 homes in North Wales faced rationing because of the freeze which had frozen Welsh reservoir outlets. They used explosives in an effort to restore flow by breaking the ice. The statistical approach to storms was explained to be regular based off the Meteorological Office's assessment of weather statistics. This was much to the contrary of the average weather observer's observations in different UK sectors of society. An official stated "People have very short memories ... they are thinking of the last three good years with a distant tinge of 1975 and 1976. All that is happening is that we are getting back to the normal pattern of westerlies". The mean temperature of 14.7 did not compare with 1976 but was much better as in 1725 when the tempature was as low as 13.1. The worst rainfall was recorded to have been between 1310-1320 when cattle drowned in the mud of wheat fields and "every harbour in the land was inundated" in 1315-1316. Intasun added 60,000 extra holidays for the late summer.</p>
1985	11 to 12	8	British Isles	The Guardian & The Observer	12/08/1985	<p>Minor damage. Official gallantry. A heavy gale devastated the Fastnet fleet in the Celtic Sea with 108 of 236 retiring from the race due to the conditions and force 8 gales. One vessel worth £1 m capsized and 6 crew were trapped in an air pocket in the hull including Simon Le Bon. They were eventually rescued by a Royal Navy helicopter who delployed rescued divers. The falmouthlifeboat also rescued the crew. A helicopter also winched 9 people off a 37 ft yacht which was in distress off the Lizard. Three men were rescued by the Salcombe lifeboat after being overwhelmed by a large wave.</p>

1985	26-27	12	British Isles	The Guardian & The Observer	27/12/1985		Minor damage. Official gallantry. Impromptu gallantry. Storms of floods of gales made for a wet Christmas and a "wind-lashed Boxing Day" which brought widespread flooding to the West Country were hundreds of homes were flooded and thousands of acres of farmland was inundated. Main routes into Devon were blocked and police toured homes in the Exe valley warning of possible further flooding. Even rugby union "traditionally the last of the sports to admit defeat at the hands of the weather" was cancelled at Exeter. An man was rescued by white water canoeist from his vessel near Bath whilst heavy snow fell throughout the South-west.
1986	11 to 19	1	British Isles	The Guardian & The Observer	12/01/1986 - 20/01/1986	3	3. Minor damage. Official gallantry. Official welfare. Three died as storms catalysed a rock-fall in Somerset. The worst gales swept the Scottish west coast and the island of Colonsay was left isolated with the seas being too rough to supply the inhabitants. The hotel was reported to be "shaking even though it is 200 years old" and although food was scarce they still had plenty of alcohol. Winds of 90 mph buffeted the island which had 130 people and 1 doctor. Those trapped waiting to get back to London were rather distressed. On Syke a school bus was blown over but no one was hurt. More than 1,000 homes in the west of Scotland were without electricity and all ferries were stormbound. Lifeboatmen rescued a crew of French trawler, entertaining and housing them until salvage could be agreed. The Irish Sea was so rough that food supplies had begun to run out with Marks and Spencer having to charter aircraft to fly in provisions. Gales caused chaos in many regions and police warned motorists to take care. A

1986	27-28	2	British Isles	The Guardian & The Observer	28/02/1986		<p>search persisted off Colwyn Bay for two men who went missing in a 10-foot dinghy in the storm but this was later called off with them presumed dead. Railway lines were blocked and trees widely felled.</p> <p>Minor damage. Gales and storm surge conditions wrecked the sea wall at Dawlish and passenger trains were delayed as all rail services were stopped and bus diversion put in place.</p>
1986	20-21	3	British Isles	The Guardian & The Observer	21/03/1986	4	<p>4. Minor damage. Official gallantry. Impromptu gallantry. Storms of force 10 winds covered the Irish Sea and a trawler went down off Fleetwood with the loss of four men. The Ramsey and Douglas lifeboats along with a Dublin ferry joined the search for survivors with two RAF helicopters but only one body was found. Northern England, Scotland were badly hit and the Raf and coastguard were stretched to their limits whilst power lines were brought down in Scotland in many areas making roads impassable. The ROyal National Mission to Deep sea Fisherman stated all were were knoen and it was " a terrible shock" despite the constant awareness of tragedy. Delgates to the Scottish Liberal PArty conference on the Isle fo Bute were stranded on the mainland and a coaster ran aground off Cumbrae with no loss. A lifeboat had to escort a trawler into Troon and an American submarine went adrift in Holy Loch but was later recovered by tugs.</p> <p>Minor damage. Hurricane-force winds battered the west of Europe however major damage was largely confined to the continent. Football was reproted to have been hindered by the tempestuous conditions in Liverpool.</p>
1986	24-30	3	British Isles	The Guardian & The Observer	26/03/1986 - 30/03/1986		

1986	27-28	5	British Isles	The Guardian & The Observer	28/05/1986		Gales lashed the north also damage was largely inland.
1986	21	6	British Isles	The Guardian & The Observer	22/06/1986	3	3. Minor damage. Three died in severe storms when a lifeguard was killed as storm waters eroded a cliff away which subsided on to his hut which two men were washed into a slurry pit near Launceston and perished. Storms bringing a "fierce wind" hit Scotland affected the athletes at the Commonwealth Games.
1986	2 to 3	8	British Isles	The Guardian & The Observer	03/08/1986 - 04/08/1986		Minor damage. Storms of lightning, rain and strong winds hit the South with torrential rains preventing Princess Anne competing at a horse trails in Devon.
1986	7 to 8	8	British Isles	The Guardian & The Observer	11/08/1986		An article concerning an airlines, independent forecasters and Met Office forecasting cost disagreement. It was believed independent forecasters were stealing Met Office information through "piracy". Disparities in the cost paid by the airlines and the free services offered to shipping were noted. A Met Office executive stated he believed airlines were getting good value for money as "since the ofundation of the Met Office some 100 years ago, we have provided elements of a free service particularly for fishing fleets in the form o gale warnings and such. But the Aviation industry is jollylucky to be getting a superb, highly sophisticate service". It was noted that the Met office was considered better than all private forecasters and was cheaper by most world airline
1986	15	8	British Isles	The Guardian & The Observer	15/08/1986		

1986	19-20	11	British Isles	The Guardian & The Observer	20/11/1986		<p>services. A consultant from the British Civil Aviation Standing Conference stated that the Met Office systems were only useful for the North Atlantic and global computerised systems would be better value and higher quality and thus stated they should pay less to the Met office who held a "quasi-monopolistic situation so far". A Met office executive stated that the Met Office was so superior due to technological investment and it offered an enduring superior service.</p> <p>Minor damage. Official gallantry. Official welfare. Storm force winds came to England and Wales and heavy rains were thought to have catalysed land flow and an earthquake near Balenau Ffestiniog. In some areas of Glamorgana nd South Wales homes were flooded to 7ft and families evacuated by emergency services.</p>
1987	23-24	8	British Isles	The Guardian & The Observer	24/08/1987		<p>Minor damage. Official gallantry. Official welfare. The worst thunderstorms to hit Britain in an otherwise previously fine 1987 struck the South causing widespread flooding whilst Lancashire also suffered with several characerts having to be resuced through their bedroom windows by emergency services and by boats after a deluge of rain.</p>
1987	15-18	10	British Isles	The Guardian & The Observer	17/10/1987 - 22/10/1987, 14/11/1987	1	<p>1. Major damage. Official gallantry. Impromptu gallantry. Official Welfare. A 1/200 year storm came to Western Europe and Britian causing complete havoc. Financial markets were paralysed, all recreation halted and £1.4 billion of losses were estimated. Insurers' share prices were badly hit as motor and domestic insurance claims went through the roof. Rescue services had their busiest night on record although damage was greater in the</p>

South-east. The Guardian published advice regarding how to make a personal insurance claim after the storm giving hints how best to make the claim as efficient as possible. The meteorological conditions were described as a "weather explosion" and the sudden violence of the storm was described as "virtually unpredictable: the product of a freak interaction between the original, harmless depression, a complex of surrounding weather systems, warm air above the Channel and the jet stream. AT Liverpool a motorcyclist was blown off a motorway and killed. An estimated 15 million trees were felled with fallen trees blocking roads and railways across the South-West. Several hundred thousand people were without power. An ensuing argument developed that the storm could have been predicted as some "continental weathermen" had predicted the storm 36 hours before British meteorologists. It was however questioned whilst it had been a lack of foresight on the Met Office's behalf what would one have done even if they knew of such impending tempestuousness? Two inches of rain fell in Glamorgan flooding roads as rivers burst their banks. A man died hiking when swept into a torrent near Bangor whilst floodwater 6 feet deep swept through Goodwich near Fisguard. In Whitehaven, Workington and Barrow hundreds of repair works struggled through floodwaters to repair pylons and mend high-voltage cables which had been blown down leaving many without power. Farmers had been devastated with the NFU requesting aid from the EEC as many were not insured for wind damage. The value and resourcefulness of the emergency service and

1987	11 to 12	11	British Isles	The Guardian & The Observer	10/11/1987 - 12/11/1987		<p>welfare workers was greatly praised. Both the Met Office set up an internal inquiry whilst the MoD set up an external inquiry into the failure to predict the storm which was a result of the "alarm in Whitehall at the scale of destruction caused by the lack of storm warnings". Councils were also blamed by the Environment Secretary who stated councils should have made contingency measures and would not be exempt from overspending penalties for the initial cleanup operation. Special help was to be given to those who had more to spend than the income of a penny rate as this would not be charged as overspending. It was later stated the storms uncovered a tale of widespread underinsurance as an insurance expert dealt with readers claims in the Guardian.</p> <p>Minor damage. The Meteorological Office were quick to issue warnings of a 70 mph gale across Britain being particularly harsh in South Wales and the South-West as well as the South of Scotland. It was stated they were "clearly determined not to be caught twice" following the previous disaster. Flooding also ensued in Cornwall and Devon but not to a serious level.</p>
1988	3 to 6	1	British Isles	The Guardian & The Observer	03/01/1988 - 07/01/1988	2	<p>2. Moderate damage. Official gallantry. Warnings of gale-force winds across England and Wales were issued as another storm struck. Force 11 was forecast in the Celtic Sea as many small vessels sheltered off Cornwall. Fallen trees blocked roads in Devon and 88 mph gusts were recorded in South Wales. A walker died from severe exposure on Rhum and rescue teams had to be conveyed by lifeboat as the blizzard conditions were too severe for a helicopter. The fiercest winds gusting 70 mph were</p>

1988	13	10	British Isles	The Guardian & The Observer	13/10/1988	<p>noted in Merseyside where a woman sustained injuries. Emergency services were on full alert in North Wales as the Dee threatened to burst its banks. Coastguards were warning people to stay off beaches due to the fear of dangerous storm surges. International rugby was played in a bitter gale at Swansea. An angler was caught by the storm off Blackpool and died. An inshore rescue boat hauled him out but he died as soon as he reached hospital. One angler was recovering in the hospital and another still missing as the RAF was forced to cancel the search due to the conditions. 90 mph gales were noted on the Mumbles and 2,000 people were without power in West Glamorgan. A bus was blown over in Cardiff and a lorry toppled in Bridgend.</p> <p>An article on the influence of computing developments on the performance of the Met Office. This followed the failure of the Met Office during the Great Storm of 1987. Forecasters were also able to break into BBC programmes to offer flash warnings. The Met Office had installed 3 observational buoys in the North Atlantic and 10 drifting buoys to better weather feedback and reporting to improve the long-term accuracy of storm forecasts. Storms from the east hit the British Isles although damages were confined to the east and North Sea.</p>
1988	10 to 11	11	British Isles	The Guardian & The Observer	11/11/1988	
1988	28	12	British Isles	The Guardian & The Observer	28/12/1988	<p>An article explaining the cause of gales and storms in the United Kingdom with reference to storms of the past. Deeper depressions and greater temperature contrasts in the winter were described as the essential causes of the</p>

1989	1	3	British Isles	The Guardian & The Observer	01/03/1989		greater storm frequency in the winter. With the exception of a few localised issues lee-wave gales all were a result of depressions passing over the British Isles in a NE direction. An explanation of coastal weather focussing on the sea breeze effect. The increased frequency of gales "typically 20 days a year on our western coasts compared with perhaps two days a year of true gales inland". The influence of these weather patterns on retirement locations were mentioned. The thermal and humidity impacts of the maritime climate were noted. Extreme examples included a sea-fog in the summer under anticyclonic conditions.
1989	12 to 14	3	British Isles	The Guardian & The Observer	13/03/1989-14/03/1989	1	1. Minor damage. Official gallantry. Tremendous winds hit the South-west with Navy helicopters being scrambled to assist in two rescue operations in the celtic Sea. A man was lifted off a Spanish trawler and 16 removed from a Panamanian freighter off Trevose Head with 12 onboard with one feared drowned after he fell 180 feet into the sea from the rescue helicopter. The vessel struck rocks off Falmouth and the coastguards oversaw the rescue of the others.
1989	23-26	3	British Isles	The Guardian & The Observer	28/03/1989		Heavy spring gales game to the Uk and Europe with winds up to 80 mph in the former.
1989	24-25	5	British Isles	The Guardian & The Observer	25/05/1989		Minor damage. Thunderstorms, hail and flash floods came to the Uk and were partiucularly prevalent in Cheshire and Lancashire where rivers flooded and blocked transport.

1989	13-15	8	British Isles	The Guardian & The Observer	15/08/1989	Minor damage. Official gallantry. Official welfare. A gale swept North Wales and 6 were injured in a Pwllheli holiday camp. All were treated by the medic on site and "social services arranged emergency accommodation".
1989	21-22	10	British Isles	The Guardian & The Observer	22/10/1989	Moderate damage. Official gallantry. Storms lashed the South coast and caused much disruption in the South-west as thousands of homes were without power as trees fell across powerlines whilst roads were widely blocked and several houses unroofed. 99 mph winds were noted in Pendennis point. Police issued flood warnings in the Rhondda, Loughor, Taw, NEath and Ebbw rivers as 3 inches of rain fell in 24 hours.
1989	29-30	10	British Isles	The Guardian & The Observer	30/10/1989	Minor damage. Winds of up to 100 mph battered the UK coastline in the South and flights were diverted from Cardiff due to 90 mph winds.
1989	16-18	12	British Isles	The Guardian & The Observer	17/12/1989 - 18/12/1989	A great storm brought winds of 90 mph to the South-West where widespread flooding occurred due to the spring tides. Blizzards were noted in Cumbria and several lorry accidents were reported. Plymouth was flooded by a storm surge in the low-lying Barbican area. Winds prevented ferries berthing at Devonport. A tug was used to stop the Falklands museum ship from drifting in the Sound and many villages in Devon were hit with floods with roads impassable. Two restaurants in Plymouth were wrecked when masonry from the damaged West Hoe harbour walls came through the roofs and windows. An "immense" band of rain and thunderstorms hit Scotland and heavy snowfall partially blocked the M8 between Glasgow and Edinburgh route. Glasgow and Carlisle routes

1990	24-27	1	British Isles	The Guardian & The Observer	26/01/1990 - 27/01/1990	3	<p>were dangerous due to melting snow and traffic much disrupted whilst rail traffic was slowed. The AA urged caution in Scotland and councils deployed all gritters. Six trawlermen were feared dead after a trawler sank in heavy seas off Gourock. Police divers, lifeboats and ministry of defence and a helicopter undertook a search but nothing was found. Newgale ws cut off by heavy floods and 13 rescued by helicopter from a pub. Vehicles were washed out to sea along the Cardiganshire coast and a shingle bank was breached by the surge leaving drivers at Newgale to scramble to safety. A lighthouse at the entrance to St Mary's harbour in the Isle of Scilly was washed away. Pendennis Point recieved it;s highest every wind speed of 117 mph and 1 1/2 inches of rain fell over the South-West. The Penzance and London line was closed after the storm surge swept ballast across the tracks at Dawlish.</p> <p>3. Major damage. Official gallantry. Official welfare. The great tempest of Burns' Day wrought deadly havoc throughout Western Britain in the worst weather since the 1987 storms as 100 mph were recorded. Roads, bridges and railways were closed due to the extreme winds and thousands of homes were without power as the Atlantic depression swept across the region. The Met Office once more failed to predict the severity of the storm before the gales had hit the South-west. Insurance comapnies estiamted damages of £3.37 b as insurer shares sunk once more. Scientists "Beleive the storms may be a result of the Greenhouse effect as the collision of warm air in the tropics and cold air at the poles causes</p>
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depressions that sweep across the Atlantic. A Professor at Durham stated "The theory is that the vortexes become deeper and the isobars closer together and therefore the storms more violent". A school died and four were injured as a roof collapsed at a school in Bristol. 600 gale-related reports were issued nationally. Cornwall was the worst affected with 1000s without electricity as powerlines were felled. Two motorists were killed in South Brent and Newquay. Camping stoves and candles were pressed into service in Cariganshire as electricity was cut. The Severn Bridge was closed to traffic along with the Cleddau Bridge near Milford Haven. A number of lorries overturned near Bristol. The storm surge in Devon was 6 ft high. Soldiers, council and electricity workers were all drafted up to repair the damage. Three million trees were blown down according to the Forestry Commission with the most damage being in the South-west. Farmers faced bills of millions. Labour tabled a motion stating "the Government's failure to issue full and frequent American-style hurricane warnings had contributed to Thursday's injuries and traffic chaos". The risk and gallantry of rescue services in such trying conditions were again praised. It was stated whilst the wind speed were forecast but late on it was the gusts that did the damage which were very difficult to judge. It was stated in the Guardian "Certainly ministers should examine whether there could be a better public warning system". Thousands of historic sites were reported to have sustained gale damage. It was stated the precision of two exceptionally severe storms so close

1990	29 to 4	2	British Isles	The Guardian & The Observer	28/01/1990 - 05/02/1990	to each other were early signs of a trend of increasing atmospheric storminess resulting from global warming. Major damage. Official gallantry. Warnings of another of series of storms were issued by the Met Office on the 28th and emergency services but on full alert. The public were on alert and warned to "be aware that structures already weakened by the storm last Thursday may be vulnerable to further damage". When the storm struck 110mph was recorded and in hte Bristol Channel a surge of 3.1 m above predicted sea level was recorded but did not coincide with peak high tide. Snowgall was widespread throughout Scotland and flooding was noted in the Severn estuary. Many seabirds were washed up dead in Cornwall and Devon when oil from the seabed with stirred up by waves produced by 134 mph winds. Belfast to Liverpool ferries and flights across the Irish Sea were cancelled. Agriculture in Devon to Lancashire was widely ruined with 7000 claims for agricultural property damage whilst a quarter of all farmers suffered roof damage totalling £40 million. Horticulture was also widely damaged whilst the Forestry Commission believed 2.3rds of a year's timber fell. It was noted however that the UK must avoid repeating the great ecological damage done in the clear up of the 1987 storm and recognise storms were "rare and wonderful event, good for wildlife". Blizzards were widespread in Devon and Cornwall.
1990	7 to 10	2	British Isles	The Guardian & The Observer	08/02/1990 - 12/02/1990	Minor damage. Official gallantry. Official welfare. A tempest hit Wales and the West Country causing widespread floods as heavy rain fell. Winds of 88 mph were recorded and 1.5 inches of rain was recorded in the

1990	8	2	British Isles	The Guardian & The Observer	08/02/1990		West Country. Ther River Taff overflowed in Cardiff and police warned residents to preare for flooding coincidng with the rising tide. Flooding was widespread in Glamorgana dn South Wales The Dart, Axe and Teign were all in flood in Devon. Throughout Gwent scores of families had to take refuge after the Wye and Esk burst their banks rising 15 ft. There were widespread landslides near the Welsh border. The miliatry issued 3,000 sandbags and the mergency contrl room was on full alert aiding people in stranded in villages which had been cut off by the floodwaters. In Cardiff the 1979 flood barrier worked well. Tree damage was heavy at Tresco Abbe on the Scilly Isles. The Scillies had requested £1m to repair a breakwater at Hugh Town and 100 houses lost their roofs. As a result of the sotrms trails to decide whether to resume 30-day long rnage forecasting were being conducted. A meterological article on storm formation.
1990	14-15	2	British Isles	The Guardian & The Observer	14/02/1990	1	1. Minor damage. Official gallantry. More snow and gales hit the UK and one man died in a car collision outside Glasgow.
1990	15	2	British Isles	The Guardian & The Observer	15/02/1990		Fundamental storm meterology and a succinct history of notable sotrms in the UK.

1990 26-27	2 British Isles	<p>The Guardian & The Observer</p> <p>27/02/1990 - 04/03/1990</p> <p>2 2. Major damage. Official gallantry. Official welfare. Severe gales swept across Britain and in Towyn serious storm surge flooding occurred with 2,000 people having to be evacuated as the embankment was breached and destroyed along 200 yards sending 5ft of water into the town. Lifeboats were used to convey people from a 25 mile stretch. 4 RAF helicopters lifted 100 people to safety and 30 went to hospital with hypothermia and shock. A leisure centre in Colwyn Bay was used as an evacuation centre. All houses at risk were assessed by emergency services. A telephone inquiry bureau was set up to deal with inquiries. Warnings of 80 mph gales were issued to the South-west. Thousands were without electricity and winds overturned vehicles and felled trees blocking roads. A woman was killed by a falling chimney in Preston. A vigorous depression over central Scotland progressing to Scandinavia was the cause of the storm which registered 100 mph winds off Rhyl. It was remarked by the Met Office it was unusual but not unprecedented to have such a precise cluster of extreme events and whether global warming was the cause was still up for question. A man died in Blackpool when a chimney fell through his roof in Blackpool. A block of flats was evacuated in Liverpool and coastal defences on the Mersey were damaged by the surge. Councils were promised extra funds for councils to deal with the damage caused by storms over the 1990 period. A body of a climber was brought down to Fort William having died in a fall induced by the conditions and rescue teams rescued 4 climbers trapped in blizzards in Glencoe. The storms</p>
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1990	15-16	8	British Isles	The Guardian & The Observer	17/08/1990	were a result of the jet stream being notable further south bringing arctic weather to the UK and the head of the forecasting at the Met Office exonerated the greenhouse effect. Damage to insurers over the early period of 1990 was double that of the Great storm of 1987 at £2.5 b and it was questioned whether premiums would have to rise as a result. Strong winds came to the British Isles including 50 mph winds at Blackpool. The focus was more on the repeated August storms of the recent years including the gales of 1989, 1986 but most notably the disaster of the 1979 Fastnet race.
1990	21	9	British Isles	The Guardian & The Observer	21/09/1990	A meteorological article on the history of cloud science and their ability to highlight incoming storms.
1990	7 to 8	10	British Isles	The Guardian & The Observer	08/10/1990	Moderate damage. Official gallantry. Official welfare. Heavy floods came to Glasgow as storms deluged the area with 200 families in Glasgow being forced to evacuate due to flooding. At Egremont an 11 year old girl was swept away by a torrent and drowned on a walk. Town residents celebrated after their new reinforced sea wall held the force of the storm surge.
1990	27 to 30	10	British Isles	The Guardian & The Observer	27/10/1990 - 06/11/1990	Minor damage. Official welfare. Winds reaching 85 mph hit the UK with the Met Office issuing widespread warnings. The track of the depression from Newfoundland was commented on and the mixing of tropical air and polar winds was noted as the cause of the storm. Although the storms were not on the same magnitude as 1987 it was stated people should take appropriate

1990	14	11	British Isles	The Guardian & The Observer	14/11/1990		precautions by securing loose objects and reviewing their properties. Insurance companies place their staff on standby fearing another deluge of claims and inquiries whilst the home service agents were also prepared and ready for mobilisation. On the West coast the winds soon reached a severe gale of 70 mph and brought 1 - 1 1/2 inches of rain.
1990	12 to 13	12	British Isles	The Guardian & The Observer	13/12/1990		A succinct meteorological description of why storms develop in November principally due to enhanced temperature gradients whilst there was also a focus on historical events.
1990	26-28	12	British Isles	The Guardian & The Observer	27/12/1990 - 28/12/1990	1	Minor damage. A storm brought great gales to the North of the British Isles. The storm tide warning service was active but largely concerned with issues on the East coast.
							1. Moderate damage. Official gallantry. Storms ringing winds of 70 mph were felt throughout the British Isles with weather warnings offered far and wide. A Soviet seaman was reported drowned off Lancashire when blown off a cargo ship. Avon was the worst hit with 100,000 homes without power to cook Christmas lunch and in Devon 3,000 were without electricity for 6 hours. Flood issues were issued for the rivers Conway, Dovey and Wnion in Wales. A main road was cut off by flood water at Taff's Well near Cardiff and a 30mph speed limit was in force on the Severn Bridge. Ice and flooding posed issues on roads in Scotland and Cumbria. Three seaman were winched to safety by helicopter when their trawler hounded in 30 ft waves 200 miles off Land's End. The Cleddau Bridge between Neyland and Pembroke Dock was

1991	4 to 6	1	British Isles	The Guardian & The Observer	03/01/1991 - 07/01/1991	12	closed. Mototways and main roads throughout Scotland were severely affected by the heavy snow. 12. Official gallantry. Forecasts from the London weather centre of 70-90 mph gales were issued throughout the UK. This was again described to be a function of the jet stream bringing warm air from the Gulf meeting very cool Polar air creating great pressure gradients and more intense storms in the winter period. The ensuing gales did much damage and reached 100 mph in Cornwall and thousands of homes in South-West England and Wales were without power. In Ayrshire 45ft waves breached a sea wall and 100 shops and homes were flooded by a surge to 4ft depth. Flood alerts were in force and 95 mph were recorded at Menai Bridge. Insurers were once more on red alert as a deluge of claims came their way and contingency response staff both in office and in person were deployed. A tanker capsized off the Welsh coast near Port Dinllaen and helicopters and lifeboats were quickly deployed. It was believed 10 of 12 died. These deaths were attributed to only having buoyancy aids not lifejackets. In Glamorgan a boy was crushed by a wall blown over by the wind. A man died in Strathclyde checking the moorings of the Girvan lifeboat. Several Scottish towns were flooded by surges and the Irish Sea ferry services were suspended.
1991	28 to 1	9	British Isles	The Guardian & The Observer	30/09/1991 - 03/10/1991	16	16. Moderate damage. Official gallantry. A strong gale in the Irish Sea forced a vessel ashore in Ireland and all ferry crossings were subsequently cancelled. The shipping company said everyone was fine and stated "It was an act of God and everyone understood". Hopes faded for 16

1991	16-18	10	British Isles	The Guardian & The Observer	16/10/1991 - 18/10/1991	<p>trawlermen missing in an area off the Hebrides near Rockall after an RAF Nimrod found nothing and coastguards conceded they had found nothing. One survivor was found in a liferaft.</p> <p>Minor damage. Violent storms bringing gusts of 80 mph came to the UK with gale warnings widely issued. Scottish inter-island ferries the Caledonian McBrayne did not sail to the Hebrides due to the gale. The Blackpool illuminations and seafront suffered some damage due to the winds and a storm surge.</p>
1991	25	10	British Isles	The Guardian & The Observer	25/10/1991	<p>A report of the meeting of the first ever IPCC gathering and the opposition from industry and the climate council.</p>
1991	30 to 4	11	British Isles	The Guardian & The Observer	01/11/1991	<p>Gales and torrential rainstorms came to the South-west and Wales. Flood alerts were issued in several river catchments in Wales.</p>
1929		11	British Isles	The Guardian & The Observer	13/11/1991	<p>A report on the wettest November on record of 1929 when 680 mm of rain fell in Treherbert in South Wales. The weather was a product of the constant passage of depressions across the Isles and widespread flooding ensued in Wales, the Lake District and the Cornish Peninsula. This however did serve to ease drought issues that had persisted earlier in the year. It was seen as a reminder of "just how quickly the pendulum can swing from one extreme to another".</p>
1991	23-24	12	British Isles	The Guardian &	24/12/1991	<p>Minor damage. Official gale. Strong winds came to the UK causing much disturbance to road traffic. A maximal wind speed of 97 mph was measured at</p>

				The Observer		Mumbles and the Severn bridge was closed to traffic and farmers used boats to rescue stranded cattle. Many trees were felled blocking minor roads in Devon and Cornwall. Ferries were delayed between Wales and Ireland over the Irish Sea. Coastal train services between Abersyswyth and Pwllheli were stopped due to storm surge inundation. The Milford Haven to Pembroke bridge was closed and buildings were damaged at Haverfordwest. Throughout Scotland minor roads were blocked by flooding.
1992	20-21	7	British Isles	The Guardian & The Observer	21/07/1992	Minor damage. Official gallantry. Great thunderstorms struck the South and many roads were left impassable as the fire brigade were widely deployed to aid flood victims.
1992	3 to 4	8	British Isles	The Guardian & The Observer	04/08/1992	Gales strafed the South coast causing much disruption to shipping in the Celtic Sea and Channel. Welsh coastguards criticised the organisers of a race in Swansea Bay which was devastated leaving 65 children swimming after 18 dinghies capsized. A force 8 was noted in a race involving 273 boats during the Optimist National Championships off the Mumbles.
1992	28	8	British Isles	The Guardian & The Observer	28/08/1992	A review of hurricane dynamics and their development over tropical regions. The concept of latent heat regarding the evaporation of vast amounts of water forming tremendously powerful hurricane clouds. The dissipation of hurricanes over land was touched upon due to the lack of warm moisture needed to fuel the hurricane. It was noted the scientific community were pointing to the greenhouse effect enhancing the frequency of high magnitude tropical storms although at this point it was

1993	10 to 11	1	British Isles	The Guardian & The Observer	13/01/1993 - 16/01/1993	6	<p>said such definite conclusions between hurricane frequency and global warming could not be drawn.</p> <p>6. Moderate damage. Official gallantry. Official welfare. The deepest depression recorded by the Met Office swept over Britain. One woman died whilst canoeing in Loch Etive during the storm as the torrential rain created difficult conditions. The police, coastguards and the RAF were also searching for a diver who had gone missing on Loch Long. A Dutch ship was ran ashore by the gales in the Bristol Channel making for Newport. Action by the National Rivers Authority who erected temporary flood defences on the coast using sandbags saved homes form inundation in the North-West. Severn Bridge transport was restricted to 30 mph and all high sided vehicles banned and the Clude flooded at Renfrew and inundation was also ntoed in Argyll. Farmers were warned to move livestock to high ground to flooding in the CONway, Convey and Mawdach valleys. Two bodies were found on a hill near Sellafield when a feight plane crashed in the storm. Two died in a car crash near Wigton when a lorry was blown over and crushed their car. Police appealed to all drivers to stay clear of the M6 after the accident. A plane made an emergency landing at Glasgow after being hit by lightning.</p> <p>Minor damage. Official gallantry. Official welfare. Storms hit the British Isles leading to one serious injury on a scooter in Merseyside. Motorists were advised not to travel by police in Cumbria.</p> <p>Minor damage. Storms battered the UK although the damage was largely east-centric.</p>
1993	24-26	1	British Isles	The Guardian & The Observer	25/01/1993		
1993	21-22	2	British Isles	The Guardian &	22/02/1993		

1993	17	3	British Isles	The Observer The Guardian & The Observer	17/03/1993	A review of the storm history of March largely focussing on the previous two decades. Thunderstorm hail was mentioned to be common however it was noted it was an indicator of the coming summer as many were triggered by the gradient of increasing warmth.
1993	22	7	British Isles	The Guardian & The Observer	22/07/1993	A review of the development of meteorology with a particular focus on Lewis Fry Richardson who inspired his grandson to become another pioneer in meteorology.
1993	19	8	British Isles	The Guardian & The Observer	19/08/1993	An article on the origins of the word blizzard stemming from a US storm in 1888.
1993	17	11	British Isles	The Guardian & The Observer	17/11/1993	A history of the recent November storms from 1960-1991.
1993	7 to 9	12	British Isles	The Guardian & The Observer	10/12/1993	Moderate damage. A strong gale produce mountainous seas in the South-West with a freighter sinking off Start Point. A xylene spill resulted causing considerable concern. All crew were rescued. Winds reached 98 mph at Pembrey and the Bristol met station was damaged.
1993	22-25	12	British Isles	The Guardian & The Observer	28/12/1993	Minor damage. A gales did damage to the first British commercial windfarm as gales ripped off blades off the turbines near Machynlleth. Even though only gusts of 100mph had been recorded damage occurred despite assurance turbines could manage winds of up to 135 mph. It was stated by the managing director of national wind

1993	29	12	British Isles	The Guardian & The Observer	29/12/1993		power that it was an isolated incident that should not be used "to damn the wind power industry". A summary of the Weatherwatch series for 1993 which had reviewed storm history and basic storm meteorology. Climatological knowledge of atmospheric physics was still limited and needed to be improved should forecasting were to improve. It was stated observation was simple and essential to this process. Anybody who was interested in contributing and becoming an observer was directed to TORRO and Dr Derek Elsom. A conference on the physics of thunderstorms was also to be held and all with a developed knowledge were invited to attend.
1994	19	1	British Isles	The Guardian & The Observer	19/01/1994		The Weatherwatch summary of exceptional January weather from 1945-1963.
1994	26	1	British Isles	The Guardian & The Observer	26/01/1994		History of gales and blizzards in January.
1994	4 to 5	2	British Isles	The Guardian & The Observer	05/02/1994		A heavy rainstorm was observed in the Western British Isles making sport difficult.
1994	31 to 3	4	British Isles	The Guardian & The Observer	01/04/1994	1	1. Moderate damage. Gale force winds hit the UK causing havoc in the South-West where winds made travel very difficult. One man was killed in a wind-related traffic accident near Stratclyde. Ferries to the Western Isles were diverted and lorries were diverted off the Forth Bridge. In Maesteg winds did damage to a bank and a massive

1994	24-25	7	British Isles	The Guardian & The Observer	25/07/1994	landslide inundated houses in the Rhondda Valley. High seas and a storm surge halted trains on the Whitehaven coastal line. The Western Isles received 1/3rd inch of rain. Minor damage. Official gallantry. Intense thunderstorms bringing torrential rain and hail did great damage as a humid heatwave hit Britain. This was due to cool air in the Atlantic colliding with hot high-pressure atmosphere over the east producing such thunderstorms. Lightning set fire to a refinery in Milford but it did little overall damage as it was quickly put out.
1994	17	8	British Isles	The Guardian & The Observer	17/08/1994	A history of August storms since 1940 to 1952 including the devastating Lynmouth flood of the 15th of August and its catastrophic effects.
1994	28-30	12	British Isles	The Guardian & The Observer	29/12/1994	Minor damage. Official gallantry. Official welfare. Over 50 river warnings were issued as torrential rains and gales swept Britain. Of particular concern were rivers in South Wales and the Rhondda Valley and the South-west and Cornish peninsula. Approximately 100 sheep drowned near Lampter despite the best efforts of the RSPCA. The Exe, Torridge and Mole in Devon were all in flood and an RSPCA official had to be rescued by RAF helicopter whilst trying to rescue animals. Winds reaching 70mph were noted throughout Mid and North Wales and a speed restriction was imposed on the Severn bridge. Other exposed roads in South Wales were also closed. Train services were much delayed in South Wales and in the West Country by flooding. The National Rivers Authority stated that flood risk would reduce. A Hiroshima couple

1995	4	1	British Isles	The Guardian & The Observer	04/01/1995	flew to Lamphey to get married in the storm and believed it would bring good luck. Following the tragedy of the MS Estonia in a storm in the Baltic Sea with the loss of 900 lives the Royal Academy of Engineerign published a report stating that ferries must be able to withstand the very worst of storm conditions at sea. A key part was the "30-minute stability recommendation" 93 British ships had been detained for being unseaworthy which was 8% of the fleet with fire fighting and life-saving equipment defienicies being a key araa of failure.
1995	17-18	1	British Isles	The Guardian & The Observer	18/01/1995	Gale force winds hit the UK affecting animal protests at Swansea and sailing from Plymouth.
1995	19	1	British Isles	The Guardian & The Observer	19/01/1995	An article comparing the destructive power and energy of a storm compared to nuclear bombs. It was stated it was a fallacy to belueve a nuclear bomb could influence the weather on a global scale.
1995	22-23	2	British Isles	The Guardian & The Observer	23/02/1995	Minor damage. Snow and gales caused much difficultly to traffic near Bristol and the Severn Bridge was closed for an hour as 70mph winds blew across the South-west. Rainfalll was heavy across the North-west.
1995	16-17	3	British Isles	The Guardian & The Observer	18/03/1995	Minor damage. Storms struck the South with 96 mph winds registered. Many high sided vchiles were blown over across the South-west and Wales.
1995	11	7	British Isles	The Guardian &	12/07/1995	1 1. Minor damage. Official welfare. Thunderstorms swept across Britain. Government air quality warnings were described to have prompted "confusion and alarm"

				The Observer		among asthma sufferers. A farmer died in Preston when struck by lightning. It was stated the warnings were "too little and too late" and it was said they should incorporate some form of tangible advice after hospitals had suffered with a ten-fold increase in asthma sufferers during the storms of the previous summer. Diagrammatic explanation of tropical storms.
1995	16	10	British Isles	The Guardian & The Observer	16/10/1995	
1996	25-26	1	British Isles	The Guardian & The Observer	27/01/1996	Storms from the east brought bitterly cold conditions and resulted in the hastening the migration of several rare birds to the UK.
1996	16-18	2	South-West Britain	The Guardian & The Observer	18/02/1996	Minor damage. Official gallantry. Official welfare. Inquiry. Huge storms forced a supertanker ashore off St. Ann's Head sustaining minor damage including a 300 tonne oil spill which pollution workers dealt with in the Milford Haven estuary. Only 10 birds were reported dead by the national pollution control unit and a few had been cleaned from oil. The Department of Transport launched an investigation into how the tough shipping laws had failed to prevent the incident. Several tugs were used and the 27-strong Russian crew was highly co-operative. Partially due to the SAC nature of the site the local Labour MP stated all single hull tankers should be banned and instead entirely replaced with the safer twin hull.
1996	18-19	5	British Isles	The Guardian &	20/05/1996	Minor damage. Official gallantry. Driving rain and gales force the cancellation of a walk in Cornwall. "The army launched a search and rescue operation to bring hundreds

1996	28-29	10	British Isles	The Observer The Guardian & The Observer	29/10/1996 - 30/10/1996	4	of young walkers off the exposed moors" as bitter 80 mph winds blew. The ambulance and police were also involved. 4. Official welfare. "The strongest winds since the hurricane of 1987 swept across the country" leaving a trail of destruction and causing "travel mayhem". Ten of thousands of homes were blacked out as power lines crashed down across West Wales as 90 mph remnants of Hurricane Lili battered the region. Two people were swept into the sea at Minehead and the local lifeboat could not be launched due to the conditions. Roads and railways were widely blocked by falling trees. Two anglers in South Wales were swept into the sea and drowned. The clean up began shortly after.
1996	21-22	11	British Isles	The Guardian & The Observer	23/11/1996		Official welfare. Snowstorms hit Britain bringing freezing temperatures. An emphasis was placed upon homeowners making preventative measures and on paying attention to policy details. The 24-hour helplines of insurance firms were also mentioned in case of disaster. It was stressed immediate damage repair by local firms connected to the insurers was essential on both a temporary and permanent basis. It was stated weather damaged items must be kept in case the insurance companies wanted to see them during a post-disaster assessment.
1997	16	1	British Isles	The Guardian & The Observer	16/01/1997		An article on Met Office research concerning the first attempt to complete a profile of an Atlantic weather system still at sea as part of a storm tracking experiment named Fastex. The planes used Doppler radar systems to measure the storm movement and wind currents whilst weather ships measured the weather using weather

1997	19-25	2	British Isles	The Guardian & The Observer	25/02/1997 - 26/02/1997	5	<p>balloons and the latest equipment. Remote sensing satellites were also used to forecast the system approach. The large uncertainty in the understanding of weather systems were stressed. The prediction of the development of a front was stressed as one of the most difficult jobs in forecasting and relied on chaos theory mathematically hence why it remained so difficult to accurately forecast the development and the approach of the largest storms. The phrase "forewarned is forearmed" was used to convey the importance of accurate forecasting. The importance of computers and computing power development was also stressed to be key in real-time forecasting development. It was stated such development would eventually spare Michael Fish's blushes would be spared.</p> <p>5. Moderate damage. Official welfare. A tempest swept the UK and although damage was largely confined to the east and South coasts 3 people died on the M5 at Bristol when conditions resulted in a traffic collision and a subsequent explosion.. The Met Office believed flood damage would be reduced compared to 1990. Flood warnings were issued throughout the South-west and coastal communities were warned of storm surge danger. The Environment agency issues amber wave warnings for North Cornwall, Weston-super-Mare and Clevedon, Somerset. Insurance companies were hoping Met Office predictions for greater gales were wrong. On the 25th another motorist died near Bristol in a storm-related crash. A man died at Pontnewydd when a tree fell onto his car. It was stated by railtrack that "high winds</p>
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1997 25 to 5	1	British Isles	The Guardian & The Observer	27/12/1997 - 06/01/1998	9 had exposed a fundamnetal weakness along some of Britain;smost modern railway lines" and millions owuld need to be spent to reduce vulnerability. 9. Major damage. Official gallantry. Official welfare. A tremendous storm hit the Uk from the West killing 3 people in west Wales when a tree fell upon their car. Strom conditions also resulted in another traffic accident in Liverpool killing one and injuring another.On the 28th thousands of households were still without electricity chiefly in Lancashire, North Wales, Cheshire and Cumbria. The Irish Sea was one of the worst affected areas hit by hurricane force winds. Rescue services including a nimrod and 9 trawlers searched for a French trawler and its 5 crew off the Welsh coast at St. David's Head but found only the wreckage of the vessel. On the 1st an oil tanker went ashore in Torbay and was being secured by a coatguard tug having dragged it;s anchor in the gale. Enigneers worked frantically to convey any fuel oil away to prevent an oil spill and were observed by the Marine Pollution Control Unit. Choas ensued on West Country roads as trees were brought down and 5,000 homes were without powr whilst the old Severn bridge was closed. The weather was to continue according to the Met Office. Many western coastal raods were closed due to storm surge risk and 3 vehicles were blown off the M5 in Somerset with all Great Western trains cancelled in South Wales. Ten SPanish fisherman were rescued from a trawler in mountianous seas by RAF helicopters 200 miles SW of Land's End after a container vessels had to abort in the 70 mph winds. The headline read "Worst storms since
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1998	12 to 13	4	British Isles	The Guardian & The Observer	13/04/1998	<p>1987 hurricane". The South-west had 85,000 homes without power by the 5th. All animals in Bristol Zoo were locked in their enclosure as storm damage made escape possible. Motorists were urged to avoid the Stratclyde main road were the surge had hauled up huge boulders. An old woman was in a critical condition having been struck with debris in Cardiff. Coastguards in the South-west attended to multiple incidents. Many motorists were left stranded as the RAC and AA were overwhelmed. A mammoth clear-up operation ensued. It was later stated that the BBC shipping forecast indicating the all-engulfing storms was a "national lullaby" which conjured the "peculiarly British love of thoroughly nasty weather". An article on the 11th on the British approach to storms and the impact they had on the imagination concluded "the good news is that with global warming Britain is likely to be hit by ever weirder weather and tornadoes, as the Met men say, there's more to come".</p> <p>Minor damage. Official gallantry. Floods and strong winds wrought havoc throughout the South and the Avon and the rivers Severn and Avon were in full flood with EA red flooding alerts widely issued.</p> <p>The combined floods and storms of January and Easter had left insurance companies "nursing a £600 m headache" which was to be met for in increased premiums. Home owners were to meet a predicted 5-6% rise with building and content insurance increasing £300 and £15-18.</p>
1998	11	7	British Isles	The Guardian & The Observer	11/07/1998	

1998	3 to 4	8	British Isles	The Guardian & The Observer	04/08/1998	A force 9 gale on the South coast and Celtic Sea did much damage to sailing vessels but no major losses were reported.
1998	23-24	10	British Isles	The Guardian & The Observer	25/10/1998 - 31/10/1998	Minor damage. Official gallantry. Official welfare. Floods and severe winds hit Britain. A canoeist died when caught under the Holne bridge on the Dart in a torrent. A body was found in a Cardiff River. Traffic jams were widespread and it was estimated £200 m of damage had been done. Stranraer was particularly badly affected by flooding. Devon and Cornwall roads were blocked and in a terrible flooded condition according to police. Thousands of acres were underwater and 400 people were evacuated. It was stated the insurance outlook was now "even bleaker" with the storms set to further increase premiums which was to affect all home owners throughout the UK. Insurers such as Abbey National spoke of >1,000 claims over the period and Direct Line stated 1,735 claims had been made. Both also offered general advice to protect property from storm and flood damage. Both stressed the importance of "adequate insurance" as 1/3 owners in the UK had no contents insurance. It was stressed to check the "small print" of cheap policies that omitted major clauses. An acceptance of a higher excess was also posed as a potential financial solution which loyalty discounts were missed. In short it was advised to stringently consider all options given the increasing frequency of high magnitude storms.
1998	25	11	British Isles	The Guardian &	25/11/1998	An article on the impact of climate change and increasing storminess on drainage and sewerage. It was stated that

				The Observer			Severn trent water's profits had fallen by 7.7% partially as a result of storm damage and it was stated severe water price cuts proposed by regulators would slow down investment into a sewer system that was already in need of major development. An ongoing discussion between regulator and Severn trent ensued.
1998	25-28	12	British Isles	The Guardian & The Observer	27/12/1998 - 29/12/1998		Storms brought huge waves to the South-west coast as well as heavy rains. A man was swept to his death when the River Dart overflowed and amber flood warnings were widely issued by the EA. The "stormy onslaught" soon spread to the rest of the UK and snowfall covered most of Lancashire, Wales and finally in Scotland were thousands of houses faced days without power after lines had been felled. Rail travel was much disrupted around the west coast due to felled poles and storm surge risk on the coast.
1999	2 to 4	1	British Isles	The Guardian & The Observer	04/01/1995 - 05/01/1995	1	1. Moderate damage. Official gallantry. Much destruction was occasioned as 75 mph gales hit the South. A Somerset man was killed in Bridgewater when struck by a falling factory roof. A car was crushed in Exeter and the driver outside the car sustained severe injuries. Pill flooded on the River Avon after the gates of a £5m flood defence were left open. More than 13,000 homes in Dumfries and Galloway were without electricity when storms brought down power lines. Rail services from Glasgow were also much disrupted. Most ferry sailing to the Hebrides and from the Clyde were cancelled due to the mountainous seas and the M8 in Glasgow was closed when two lorries overturned. Near Largs and Skelmorlie an A road was shut after storm surge inundation.

1999	29	5	British Isles	The Guardian & The Observer	30/05/1999	Minor damage. Heavy thunderstorms battered the South-west leaving 4,000 homes without power. The meeting of cooler mild Atlantic air with the hotter continental air mass produced great hailstones with thundered down in Torbay and convective breezes hit Plymouth of 70 mph. Normally popular holiday spots were deserted. The weather also brought major traffic delays in Devon and Cornwall and a Swansea church was damaged when hit by lightning.
1999	24	9	British Isles	The Guardian & The Observer	24/09/1999	Clear safety guidance for thunderstorms for the general public.
1999	24-25	10	British Isles	The Guardian & The Observer	25/10/1999	Minor damage. Official welfare. Heavy rains, strong winds and mountainous seas were observed on the South coast and severe gale warnings were issued by the Met Office as force 8 winds from the SW came to the British Isles. There was danger of storm surge inundation due to the conditions and the equinox spring tides.
1999	26 to 3	12	British Isles	The Guardian & The Observer	27/11/1999 - 05/12/1999	Minor damage. Official gallantry. Impromptu gallantry. Official welfare. Gale force winds once more battered Britain causing terrific conditions in the Irish Sea delaying many ferry sailings. Roads in Cumbria were closed to caravans and high-sided vehicles whilst the Maryport and Silloth coast road was closed due to storm surge inundation along with many other coastal roads in the regions. Gusts of 89 mph hit Merseyside. In Devon the driver Nigel Mansell rescued his nephew's girlfriend from the wreckage of her overturned car and she was treated for minor injuries in hospital. A train was derailed in the

1999	25-27	12	British Isles	The Guardian & The Observer	26/12/1999 - 27/12/1999	4	<p>Scottish west due to the heavy snow on the line. Roads were closed in Cardiff and the flagpole was brought down on the Welsh Assembly building. Firemen in an inflatable boat rescued a man in a transit from rising floodwaters in Renfrewshire.</p> <p>4. Moderate damage. Official gallantry. Official welfare. Another tempest buffeted Britain over the Christmas holiday with thousands being interrupted by power shortages, flooding and fallen trees. A man died after being blown from the New Brighton promenade into the Mersey where the gales were 70 mph. A friend of his was also being treated for hypothermia. A member of the coastguard said the incident was clear evidence of people ignoring warnings about proximity to the sea. A man also went missing from a capsized dinghy off Skye whilst his companion was found and saved by the coastguards and was treated in hospital. Flooding in Devon resulted in the drowning of an 85 year-old in their Bungalow and his wife was rescued by boat by the fire and police. The EA staff battled to restore the coastal defences otherwise they predicted 1,000s of homes would have to be evacuated. In Wales 1,500 homes were without power and electricity workers had to work throughout Christmas Day to restore power. Very cold conditions brought black ice and snow which made driving treacherous in the North. Off the Scillies a Belgian sailor died when his vessel was hit by huge seas and he died from his injuries.</p> <p>A review of the book "Gale force" which assessed the relation between weather, war and the development of a variety of civilisations. The author fundamentally</p>
2000	3	6	British Isles	The Guardian &	03/06/2000		

				The Observer			expressed the viewpoint that "sudden and unexpected meteorological calamities and our failure to predict them have changed the results of battles, leading indirectly to the fall of civilisations". The book Floods, Famines and Emperors: El Nino and the Fate of Civilisations recived greater acclaim.
2000	29-30	10	British Isles	The Guardian & The Observer	30/10/2000	2	2. Moderate damage. Official gallantry. The worst storms in several years lashed the South of Britain leaving a trail of carnage and destruciton. Gusts approaching 100mph upended trees and tens of thousands of homes have been left without power in the worst weather since the great hurricane in 1987. And another man was reportedly killed when his motorbike was believed to have a hit a tree on the A387 at Wrantage, near Taunton, Somerset. At sea, the 33-year-old captain of a Dutch ship was killed last night as he was swept off balance and thrown down 30ft into the hold of his ship, anchored off Torbay. The port of Fowey, near St Austell, was cut off by fallen trees blocking the roads, and a 20,000-tonne vessel ran aground in rough seas and force nine gales off Cornwall overnight. Additionally, all Virgin west coast services were suspended between Euston and Birmingham, Liverpool, Manchester, Glasgow and Carlisle. The west country was one of the worst affected regions. Avon and Somerset Police closed all roads into flood-hit Taunton to everything but emergency traffic. Green lobby groups were today urging politicians to act now over wild weather conditions. The gales and storms battering Britain "are just a taste of things to come" according to Friends of the Earth. However, Mr Meacher, said: "It would be wrong, every

<p>2000 7 to 8</p> <p>12</p>	<p>British Isles</p> <p>The Guardian & The Observer</p> <p>07/12/2000 - 09/12/2000</p> <p>2</p>	<p>time there is a climatic impact, to assume that it is climate change, global warming." He did, however, acknowledge that the gales "almost certainly have climate change as a contributory cause". Mr Meacher said that much was being done to prevent people being continually flooded, especially in high-risk areas. The Ministry of Agriculture had now put £4bn into capital improvement works to strengthen flood defences over the next three years, he said.</p> <p>2. Moderate damage. Official gallantry. Gale force winds and severe flooding was forecast as a "vigorous depression" approached the Uk from the Atlantic. The EA published flood risk maps coincidentally at the same time which some feared with further complicate insurance issues. 40 flood warnings were issued and some areas were predicted to recieve 2 1/2 inches of rain and this was anticipated to cause flooding. In Dawlish trains were pounded by the storm surge at high tide and the line heavily impacted as the line was closed due to a landside. The forecast storm struck with great fury and an elderly couple's car was swept into the Hollywater river and the two drowned. Rail throughout the country were massively retarded and it was predicted it would take months to get everything back into order causing fustration amoungst rail action group memebers who stated more should be expect from Railtrack. Wales ws practically cut off in the height of the storm when major roads were forrced to close and 1,000 homes and businesses in South Wales suffered power cuts. 31 were airlifte to safety at a campsite in Dawlish Warren. Severe flood warnings were</p>
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2000	12 to 13	12	British Isles	The Guardian & The Observer	13/12/2000 - 15/12/2000	<p>issued in the Severn catchment. In Glasgow a major A road was flooded whilst severe key arteries were flooded in Devon and Cornwall.</p> <p>Minor damage. Official gallantry. Official welfare. Area in England and Wales were again on flood alert as high tides, heavy rains and strong winds "combined to create severe weather conditions". Around 80 flood warnings were in place largely in Wales and South England. Areas between Gloucester and Avonmouth were issued a severe warning with force 9 winds and a very high tide predicted to produce a large surge. The EA had told people to be prepared to evacuate their homes where there was a high flooding probability and they should "expect the emergency services to call at any moment asking them to evacuate their home". The strongest winds were predicted by the Met Office to be in the Bristol Channel and Celtic Sea. The widespread flooding that followed caused great damage as well as power and transport disruption. In Blackpool parts of the promenade were sealed off after scaffolding was torn from the Royal Carlton hotel. In Cardiff 28 residents were evacuated when a roof collapsed. The River Wye was anticipated to flood at Newport due to the seasonal high tide and heavy rains. Royal and Sun Alliance doubled its loss estimate for the floods and storms of the autumn to £200 which prompted a sharp downgrade in profits. The loss estimates were approx £80-£110m originally and raised to £180-200m. It was stated such loss was expected to increase premiums. However it was stated overall 2000 had been a benign</p>
2001	19	1	British Isles	The Guardian & The Observer	19/01/2001	

2001	28	2	British Isles	The Guardian & The Observer	28/02/2001	<p>year for insurers with storm losses of only £500m against the £2.5 b of 1991 and £1b of 1987.</p> <p>Another article concerning how CGNU, Britain's biggest insurer had suffered severe profit losses in the UK. The company had lost £1.4b in 2000 from a profit of £1.5b in 1999.</p>
2001	27-28	2	British Isles	The Guardian & The Observer	28/02/2001	<p>Minor damage. Snow from the east came to the UK and covered the Scottish Borders leaving 60,000 without power and snowdrifts of 12ft were recorded in places. Traffic was widely brought to a standstill and fallen power cables trapped a train in Glasgow forcing passengers to walk home.</p>
2001	5	7	British Isles	The Guardian & The Observer	06/07/2001	<p>Minor damage. Flash floods from thunderstorms hit West Scotland causing many to flee their homes. The EA stated climate change was the reason for increasingly extreme conditions. The rain was however beneficial for agriculture following months of drought which were near the extreme levels of the 1976 heatwave.</p>
2002	27-28	1	British Isles	The Guardian & The Observer	29/01/2002 - 30/01/2002	<p>Major damage. Official gallantry. Severe storms strafed the UK with 100 mph causing havoc across the UK. One man died in Glencoe when a truck was blown over. Almost all rail services in Scotland were suspended as debris and trees littered the tracks. Winds of over 100 mph were noted in Scotland and 50 mph was recorded in Cardiff. A flight from Glasgow to Stronoway was forced to return because of the weather. 40,000 homes in Argyll were cut off from power. A huge operation to clear up the devastation subsequently ensued with strong winds and snow hampering progress particularly in Scotland. The bill for insurers was expected to be hundreds of millions. The</p>

<p>2002 1 to 3</p>	<p>2 British Isles</p> <p>The Guardian & The Observer</p> <p>02/02/2002 - 05/02/2002</p>	<p>Scottish environmental protection agency issued 11 flood warnings as heavy rain and melting snow continued to cause flood-related issues. Flood warnings were in place for the River Severn and River Wye as well as the Dee valley. Several schools in Scotland lost their roofs and roads were severely clogged with traffic impeded by the weather. Structural engineers began a long process of assessing the damage to buildings.</p> <p>Moderate damage. Official gallantry. "The second bout of severe gales to abtter Britain in less than a week" claimed to the British Isles as 80 mph winds were recorded causing much disruption. More than 90 flood warnings were issued as high tides and driving rain and associated floods threatened areas on the West coast from south Cornwall to the west of Scotland. Thousands hoping to travel to Ireland via ferry to watch the rugby were stranded as ferries were delayed by the large waves. Huge waves inundated the Blackpool seafront and trams were towed to safety. Fears of an oil spill abated after a freighter was driven onto a Cornish beach. In South Wales residents began a tentative clean up following widespread fluvial inundation in valleys and the South. Police and breakdown ferries were widely busy attending to traffic accidents. A bus driver was injured by Bristol and a teenager was cut free from a blown over lorry at Bath. Off the Western isles a captain was swept overboard and drowned from a traveller. The 18 remaining crew were rescued by an RAF helicopter at the limit of it's fuel range as air-sea rescue was busy throughout the weekend. A vessel also went ashore on the Brixham coast and 16 Russians were taken</p>
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2002	22-23	2	British Isles	The Guardian & The Observer	23/02/2002 - 27/02/2002	<p>off by the RAF in a force 9 gale. Her cargo was blown ashore and many people stole the wood to the extent the police were called and reminded all that this act was theft. It was hoped the vessel would be towed off by a tug as she did not pose danger of an oil spill. The rivers Wye and Monnow were in full flood and 41 flood warnings were issued.</p> <p>Minor damage. Official gallantry. Official welfare. Strong gales and snow returned to the North sweeping across Scotland and Northern England. In Lancashire the Ribble flooded and 18 flood warnings were enforced by the EA. The Glasgow to London train was delayed by a falling tree on the line in Dumfries and Galloway. Gales of 98 mph caused travel chaos on the 26th with the number of flood warnings upped to 68.</p>
2002	22	8	British Isles	The Guardian & The Observer	22/08/2002	<p>An article concerning the impact of climate change on flooding and its future and present societal costs. An example of a successful society was given in the form of the Egyptians who were dependent on frequent Nile flooding. The nourishing influence of Rivers on Agriculture was mentioned whilst issues with short-term flood defence in the long-term were stated. An ecosystems services study named Living with Risks produced by the UN had found that environmental destruction may serve logging and fishing companies for instance however the destruction of natural resources in coastal and fluvial landscapes ultimately meant that society would incur greater costs. The impact of humanity's "changing the natural balance of the Earth" was mentioned by the UN secretary general Kofi Annan. Although global warming</p>

2002	23	9	British Isles	The Guardian & The Observer	23/09/2002	<p>was not directly mentioned it was stated that the Red Cross and Red Crescent had observed increasing disaster as 17/23 of the worst floods of the last 50 years had occurred in the last 10 years. The fact 6 out of the top 10 of the warmest years ever recorded were in the 1990s were also mentioned in relation to climate change. Relationships between thermal expansion, glacial melt and sea level rise were noted along with increasing storminess occurring due to warmer oceans which could have the affect of producing hurricanes and typhoons. Greater precipitation was also to occur due to increasing evaporation and relations were made to the predictions of the 1980s so a greater frequency of "extreme" climate events in a warmer world. The population distribution of 3 billion people on coastal plains and 13/15 of the largest cities in coastal zones was noted to most likely further exacerbated climate and marine disasters in the next century. 10 million were vulnerable to constatnt flooding risk, 40 million were vulnerable to storm surges and 25 million were counted as "environmental refugees". The exacerabted impact in developing nations was mentioned whilst the science editor concluded "It would be a lot cheaper to learn to live with risk - and with nature - than die from it".</p> <p>Halifax was to accuse the government over a deal concerning the provision of insurance for 2 m homes. The treasury had to agree an adequate flood defence plan before insurers were to start excluding areas fo high risk from flood cover. There were great fears the insurance industry would dump high risk cover within the</p>
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2002	27	10	British Isles	The Guardian & The Observer	27/10/2002	<p>government. It was stated severe flooding had been a near-annual problem with the cost running into millions. The sticking point concerned the influence of the insurance industry on what the government spent 150m of flood defence funding on and where it was expended. The insurance industry reminded the government large flood improvements had to be made and "Insurance is there to cover risk not certainties". After the floods of 2000 the insurance industry had given the government 2 years to outline a defence strategy. An offer was on the table but was to be discussed. Halifax was to continue providing cover in the short-term regardless but heavily criticised the government stating premiums would increase by no more than 5%. An ABI spokesman believed other insurers would follow suit as flood management talks continued.</p> <p>An article entitled "Watch out for gales in Wales" which concerned the increasing storm frequency and what a resident could do to prevent damage occurring to their property. Advice including "Using binoculars to check the roof for dislodged or broken slates" and taking a walk around the garden "checking for loose branches, fences and items of garden furniture". Consideration of windbreaks by landscaping and the purchasing of storm shutters was also discussed with the cost of shutters typically ranging between £70-£100 according to the Guardian.</p>
2002	27-29	10	British Isles	The Guardian &	28/10/2002 - 29/10/2002	<p>Major damage. Official gallantry. Impromptu gallantry. Official welfare. Extremely stern winds hit Britain with gusts of near 100 mph strafing the kingdom. The wind</p>

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speed at some places was comparable to the Great Storm of 1987. In the Celtic Sea two RAF helicopters thought to rescue an unconscious fisherman from the deck of a trawler 170 miles off the Scillies. He suffered internal bleeding and was then conveyed to hospital in Cornwall where he was said to be stable. The start of the fourth Clipper round the world race was postponed at Liverpool due to the high winds and great seas. At Mumbles 96.6 mph was recorded which was the strongest gust. The Association of British Insurers stated up to £50m in claims were to be dealt out. For much of Britain force 8-10 was noted as "low clouds scudded across the sky, delivering showers and bursts of sunshine". Emergency services were widely deployed dealing with road casualties and property issues. The M48 Severn Bridge was forced to close severely stemming traffic flows as the other bridge was limited to 1 lane and 30 mph. Train services were widely cancelled on the West coast due to felled powerlines with no replacement buses available due to the winds. A church roof was blown off in Powys and a caravan with its owner inside rolled onto a railway line near Aberystwyth. Roads were closed near the BT tower in Cardiff as panels blew off into roads. Traffic was diverted off the Swansea bridge. Irish Sea ferry sailings were cancelled from Holyhead due to the mountainous waves and strong winds from the SW. 15,000 were without power in Wales. Persistent rain continued throughout the 29th.

2003	30-31	1	British Isles	The Guardian & The Observer	31/01/2003	Minor damage. High winds and snow swpet across areas of Britain. Blizzards were widespread throughout Northern Scotland.
2003	23	6	British Isles	The Guardian & The Observer	24/06/2003	Intense thunderstorms shattered the hot spell as thunder and lightning along with rain was observed widely throughout Southern England.
2004	4 to 5	2	British Isles	The Guardian & The Observer	26/02/2004	Official welfare. Britain was braced for further snowfall and bitter winds today after a night of arctic weather in many regions. Many people in Scotland woke up to between 3-10cm of snow with 2-3cm elsewhere in the country as last night's snowfall settled, prompting warnings of treacherous driving conditions. Temperatures dipped to the lowest point in Tulloch Bridge, Lochaber, in the Scottish Highlands, last night at -8.1C (18F), according to PA WeatherCentre. And the strong winds and icy temperatures were set to continue with temperatures of -9C (16F) on high ground in Scotland and an average of between 1C to 4C (34F to 39F) elsewhere. PA forecaster Joanne Grimshaw said: "It's bitterly cold and there's strong winds. You really will feel the winds. At the moment Wales and south-west England have also got heavy snow showers and there's quite a few in south-west England and Northern Ireland. Drivers were also told to use a couple of rubber mats on the windscreen or a screen cover overnight to beat the freeze.
2004	8 to 9	8	British Isles	The Guardian &	09/08/2004	Minor damage. Thunderstorms and intense rain caused disruption in Southern Scotland and the South coast.

2004	17	8	South-West Britain	The Observer The Guardian & The Observer	17/08/2004 - 19/08/2004	<p>Major damage. Official gallantry. Official welfare. A torrential thunderstorm producing flash flooding result in more than a hundred people being evacuated and eight treated for conditions ranging from hypothermia to broken bones after a three metre high wall of water swept down a steep valley into the Atlantic at Bocastle. The deputy prime minister, John Prescott, praised the "sheer professionalism" of the emergency services on an early morning visit to Boscastle. Debris including trees, branches, stones and rubble reached 40mph as it tore through the steep streets after one month's worth of rain fell in less than two hours. A following article in the Guardian posed the question "How do you stop a flash flood?" before exclaiming: "The answer is: you don't. You get out of the way. Flash floods are an accident of timing and topography". The word "flash" is not hyperbole: wadis and dried up riverbeds become foaming torrents within minutes. Urban areas are increasingly at risk of local flash floods, simply because water cannot soak into tarmac or concrete. It was stated Bocastle was small compared to events in the Us. The peak flow was about 140 m³/s, between 5:00 pm and 6:00 pm BST. The annual chance of this (or a greater) flood in any one year is about 1 in 400. 75 cars, 5 caravans, 6 buildings and several boats were washed into the sea; approximately 100 homes and businesses were destroyed, and some had to be demolished; trees were uprooted and debris were scattered over a large area. In an operation lasting from</p>
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<p>2005 9 to 11</p>	<p>1</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>10/01/2005 - 12/01/2005</p>	<p>8</p> <p>mid-afternoon until 2:30 am, a fleet of 7 Westland Sea King helicopters rescued about 150 people clinging to trees and the roofs of buildings and cars. No major injuries or loss of life were reported. The estimated cost of damage was £15 million.[6]</p> <p>8. Moderate damage. Official gallantry. Official welfare. Torrential rains brought flooding the which swept through the North and caused great carnage on the Eden. The bodies of Margaret Isobel Threlkeld, 79, and Margaret Stainthorpe Porter, 85, both of Carlisle, and Michael Scott, 63, from nearby Brampton, were discovered on Saturday after nearly four inches of rain - the average for a whole month - fell in 24 hours and caused rivers to burst their banks. The two women lived in separate properties on Warwick Road, one of the worst-hit areas of the Carlisle. Inquests into all three deaths were opened and immediately adjourned at the city's coroner's court. Police refused to release any further details. Two people are still missing following the storms, which devastated almost 3,000 homes, 2,500 of them in Carlisle. Further misery was heaped upon residents forced out of their homes today when they were warned by police not to return to their flood-damaged properties. Although the water level has fallen by as much as one metre (3ft), concerns have been raised that contaminated water and damaged electric cabling may lead to further casualties. A Cumbria police spokesman said water was believed to have been contaminated with sewage, diesel and petrol. "The floodwater has rushed through all parts of Carlisle picking up all kinds of things and there are fears of contamination.</p>
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He added that some electrical circuitry could take weeks to dry out and that around 13,000 people were still without electricity. Almost half are in Carlisle, while a further 4,500 homes in north Cumbria and 2,500 in the south of the county remain without power. A spokesman for watchdog Energywatch North West said that power to south Cumbria should be restored by tonight, but that up to 2,000 homes in the north and around 3,000 properties in Carlisle city centre would be without power for a third successive night. The Met Office and the Environment Agency said they expected the wet weather to die down today, but warned that further heavy showers could hamper the clean-up operation tomorrow. At least five people are thought to have died in the hurricane-strength storms that hit Scotland, Northern Ireland and parts of northern England, it emerged today. Police in the Western Isles are reported to have recovered a body from a car in the sea off the island of Benbecula, and to have spotted the body of a man in the water nearby. A search was ongoing for four people missing from the village of Creagorry on the island and police could not rule out the possibility that more bodies might be found. The strongest winds of the storms that began to batter the country last night were recorded in the Western Isles, with gusts of 124mph in North Rona and 105mph on Barra, an island just south of Benbecula. Emergency services in Scotland were overwhelmed by calls, with residents in the Highlands and islands being advised not to ask for ambulance assistance unless faced with a life-threatening situation. The Diabaig and Scalpay areas of the Scottish

Highlands found themselves without a 999 service for a short while early today. The Scottish Environment Protection Agency issued 21 flood watches and 13 flood warnings during the course of the storms. Fort William Coastguard had to evacuate five elderly residents from 4ft flood waters in their housing complex, while Oban Coastguard rescued a man who was floating away inside his camper van. High tides were today expected to complicate matters. A Spanish fishing boat missing off the Western Isles overnight was found at first light this morning by an RAF Nimrod with all 19 crew accounted for. The Cibeles - which was 290km west of Lewis when it triggered its distress beacon late last night - was due to be towed back to shore and its crew evacuated. The Stornoway coastguard watch manager, Duncan Mackay, said the storms were the worst he had experienced for several years. "Some of our coastguard team members out on call tonight may be going back to homes without roofs themselves, and some staff will not be able to get home at all," he said at the height of last night's storms. Power supplier Scottish Hydro Electric said 60,000 customers had been cut off by the freak weather in Argyll, the Western Isles and Highlands, and in the central belt. Around 45,000 are still without power. A spokesman last night reported 150 major faults on the network across Scotland. "It seems as fast as we can repair infrastructure the wind is blowing it down again," he said. "We have had to stand our repair staff down for the night, because it's simply too dangerous for them to work in these high winds."

2005	23	6	South-West Britain	The Guardian & The Observer	24/06/2005	<p>Minor damage. Great thunderstorms and heavy rain hit the South-west with major flooding in the Somerset region. The ground, hard from the hot weather, could not absorb the sudden downpour and water sat on it in pools. Where it did drain into farmyard ditches, the muddy brown liquid rushed at the pace of a fast flowing stream. Local residents said the storms were the worst they had seen for 15 years. Sunburned festival-goers, who had only yesterday been enjoying the summer heat, swapped flip-flops for wellington boots. Those with a knack for improvisation wrapped their trainers in carrier bags to waterproof them. Storms cause chaos at Glastonbury Festivalgoers refuse to let the rain dampen their spirit Simon Jeffery in Glastonbury Fri 24 Jun 2005 17.14 BST</p> <p>The start of this year's Glastonbury festival has been badly disrupted by torrential rain today, with floods almost completely submerging some tents and power failures forcing organisers to cancel early performances.</p>
2005	21	8	British Isles	The Guardian & The Observer	21/08/2005	<p>An article about the tangible impacts of storms on British citizens and society. Aid and advice from the ABI was also given immediately following the disaster. Malcolm Tarling, the spokesperson for the ABI, says the first thing to do in the event of lightning damage - after making sure the property is safe - is to call your insurance company. According to the Met office, there are certain years when electrical storms are more common as well as certain times of year. 'They are most prevalent during the summer because of the extra heat and the increase in cumulonimbus, the type of cloud that you get lightning strikes from,' says a spokesman for the Met. Norwich</p>

2006	22	8	British Isles	The Guardian & The Observer	21/08/2006	<p>Union suggests that people invest in a surge protector, a common piece of electrical equipment that plugs into the wall and protects computers and other equipment from sudden electrical spikes. 'A modem is going to cost between between £50 and £100 to replace if it gets damaged but the excess on a standard policy is around £70 so you might be better off investing in a surge protector that generally retails for about £10,' says an NU spokesperson. According to the Met office the adage that lightning never strikes the same place twice is a myth. A "what to do in an electric storm" check list was noted. An article concerning the increasing impact of climate change entitled: "Drought, gales and refugees: what will happen as UK hots up". It was exclaimed: "Peering into the future is a tricky business, especially for something as volatile as weather and climate. But scientists know a lot about how events will unfold. They use giant computer programs, evolved from those that make weather forecasts, to work out how the atmosphere will react to the blanket of carbon dioxide we humans are steadily wrapping around the planet. As we do, and as more of the sun's heat is unable to escape, the air and the sea warm. But that takes time, which means that whatever we do, our climate destiny is fixed for the next few decades." Only now is the planet finally coming to terms with the carbon spewed into the atmosphere while the Beatles ruled the charts. And today's carbon pollution from cars, power-hungry plasma screen televisions and cheap flights will only wreak its havoc long after Coldplay and the Arctic Monkeys have faded into the distant past. That makes</p>
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predictions over the next few decades pretty accurate. Beyond that, the picture is fuzzier but experts use various scenarios to bring it into focus, which differ depending on how quickly we switch from sources of energy that rely on carbon. More good news than you may expect: British farmers may have something to smile about and the increased victims of heatstroke are more than compensated for by the thousands of vulnerable people saved from bitter winters. Summer fetes are less likely to be rained off and English wine could come in from the cold. But if that is the good news, here comes the bad: floods, malaria, shark attacks, sweltering summers and worsening drought. Rainfall will decline in the summer and the increased deluges in winter will struggle to replenish thirsty reservoirs because much of the water will run off the baked ground. Rapid changes in temperature will confuse wildlife and a white Christmas will be a distant dream. A break down of the potential impacts of climate change on Britain over different decades was noted whilst a specific focus on flooding and sea level rise as well as flora, fauna and public health. Minor damage. Official gallantry. Wild weather hit the UK with gusts of >100mph noted in the South. A tornado came out of Atlantic thunderstorms blowing north east from Cornwall on 60mph gusts of wind. Although the tornado appeared freakish, the Tornado and Storm Research Centre said the UK has the world's highest number of reported tornadoes for its land area. Terence Meaden of the Tornado and Storm Research Organisation said about 70 tornadoes were reported in the UK in 2004

2007 17-18	1	British Isles	The Guardian & The Observer	18/01/2007 - 20/01/2007	<p>and 2005, with 40 this year. Tornadoes are the result of warm and cold winds travelling at different speeds and in different directions in storm conditions, creating a build-up of energy like a pressure cooker. The weather fronts can come together to create a violent twisting vortex - similar to water swirling down a plughole - that drags along the ground at speeds of more than 100mph. The huge cloud, called a supercell, becomes much taller and more powerful than normal and lightning and hail from it are more ferocious.</p> <p>Major damage. Official gallantry. Official welfare. Cyclone Kyrill caused widespread damage across Western Europe, especially in the United Kingdom. Winds of up to 100 mph (160 kph) battered much of Britain on Thursday, causing transport havoc and damaging buildings. On the day of the landfall, an approximate 25,000 homes in southern England were without electricity after electricity pylons were damaged by the storm. The container ship MSC Napoli, whilst on its way to Portugal carrying 2,394 containers, of which 158 were classed as hazardous substances, had to be abandoned off Lizard Point in the English Channel on the 18th. The crew of 26 were picked up by British and French rescue services. The ship had suffered structural damage, including a 1 by 0.5 m (3.3 by 1.6 ft) hole on the starboard side and water flooding and had to be beached in the bay 1-mile (1.6 km) off the East Devon coast at Branscombe. The ship leaked oil, sparking a clean-up operation, and widespread reporting in the national news led to the wreck temporarily becoming a tourist attraction and subject to scavenging from the</p>
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<p>2007 10 to 25</p>	<p>7</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>11/06/2007 - 01/08/2007</p>	<p>containers which washed up on the beach. The ferry services between Fishguard and Rosslare were cancelled due to mountainous waves and heavy winds in the Irish Sea. Long queues developed around blackspots, in particular replacement crossings of the Manchester Ship Canal including routes through Warrington and over the Runcorn Bridge. The storm seriously affected the 18 January rush hour all over Great Britain, with heavy snowfalls in Scotland adding to the unpleasant situation. A general 50 mph (80 km/h) speed restriction was put in place by Network Rail to minimise possible damages. Virgin Trains West Coast services were cancelled from London to Scotland. A German lorry driver was killed when his vehicle overturned on the A55 near Chester's Forte Posthouse hotel. Martin Hunt, 58, was hit by a falling canopy at a petrol station in Bamber Bridge, Lancashire.</p> <p>Major damage. Official gallantry. Official welfare. Inquiry. A series of severe floods and rainstorms hit the Uk over the summer period. June was one of the wettest months on record in Britain (see List of weather records). Average rainfall across the country was 5.5 inches (140 mm); more than double the June average. Civil and military authorities described the June and July rescue efforts as the biggest in peacetime Britain. a slow-moving area of low pressure from the west of Biscay moved east across the British Isles. At the same time, an associated occluded front moved into Northern England, becoming very active as it did so with the peak rainfall on 15 June. Rainfall records were broken across the region, leading to</p>
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localised flooding. On 25 June, another unseasonably low pressure (993 hPa / 29.3 inHg) depression, Cyclone Uriah, moved across England. On 27 June, the Met Office released an early warning of severe weather for the approaching weekend, stating that 0.79 to 1.97 inches (20 to 50 mm) of rain could fall in some areas, raising the possibility of more flooding within the already saturated flood plains. On 20 July, another active frontal system moved across Southern England. Many places recorded a month's rainfall or more in one day. A primary school has been evacuated, and homes, pubs, and shops flooded in a Ceredigion town after parts of Wales were hit by downpours. Pupils were evacuated from Ffynnonbedr Primary School in Lampeter after a torrential downpour in the afternoon. On 12 June, Lostock Hall and Penwortham near Preston were hit by flash floods. On 3 July, heavy rain caused flooding in Earby and Ribchester, affecting homes and causing the Royal Lancashire Show to be cancelled on 9 July. On 4 July, the Blackburn Mela was cancelled due to ground conditions. On 18 July, Walton-le-Dale near Preston was hit by flash floods. On 18 July, floods wrecked homes in Closeburn, power was cut off at Eaglesfield, and roads were closed at Moffat and Lochmaben. On 22 June, heavy storms flooded roads and dumped debris on the railway line in Glasgow. The same day, torrential rain caused a landslide just south of Lesmahagow, closing the M74. On 20 July, flash floods affected the Vale of Glamorgan,[147] causing schools to be evacuated, roads to be closed, and boats used to rescue people from their homes in Barry. Following the flooding in July, the RAF

said it is carrying out its biggest ever peacetime rescue operation, with six Sea King helicopters from as far afield as RAF St Mawgan in Cornwall, RAF Valley in Anglesey and RAF Leconfield in the East Riding of Yorkshire rescuing up to 120 people. Environment Agency chief executive Baroness Young said that about £1 billion a year was needed to improve flood defences. The Association of British Insurers has estimated the total bill for the June and July floods as £3 billion. On 3 July, Environment Secretary Hilary Benn announced that the Government would increase the spending on risk management and flood defences by £200 million to £800 million by 2010–11. During Prime Minister's Questions in the House of Commons later that month, Prime Minister Gordon Brown promised £46 million in aid to flood-hit councils and £800 million rise in annual spending on flood protection by 2010–11, confirming Hilary Benn's announcement. Brown also pledged to push insurance firms to make payouts. On 22 July, the Government convened COBRA to co-ordinate the response to the crisis. In July, the Government came under mounting criticism of its handling of the crisis, the fact that responsibilities were spread across four departments and no single minister could be held responsible, and the fact that the Army had not been called in to assist. The Observer newspaper stated on 22 July 2007 that the Government had been warned in the spring by the Met Office that summer flooding would be likely because the El Niño phenomenon had weakened, but no action was taken.

2007	14-15	8	South-West Britain	The Guardian & The Observer	15/08/2007	Moderate damage. Official gallantry. The biennial Fastnet race was devastated by the summer's latest nasty surprise, as some 90 boats abandoned the 608-mile route in tempestuous rain and gale force winds. Lifeboats were called to a score of emergencies and moorings were crowded in Channel ports west of the Isle of Wight as a third of the 271 yachts ran for shelter. The disruption signalled the start of yet another spell of dreadful weather, as a two-day band of heavy rain with strong winds moved across southern Britain before heading north. Severe weather warnings were issued for most of the country, with rainfall of up to two inches in some areas. The Fastnet disruption claimed high-profile victims in 38 knot winds on the route from the Isle of Wight to the Fastnet Rock off southern Ireland. The start of the race was delayed a day from Sunday after forecasts of 50 knot winds. Record-breaking yachtswoman Dee Caffari, whose crew included the Olympic oarsman Matthew Pinsent, was among those who pulled out.
2007	23	9	British Isles	The Guardian & The Observer	24/09/2007	Minor damage. Official gallantry. Up to 11 tornadoes struck the UK today, ripping off roofs and flattening trees as widespread heavy rain led to long delays for rail commuters. A spokesman for the Met Office said the band of storms, which moved north eastwards from Devon, generated localised winds of up to 45mph. Witnesses said the tornadoes disappeared as quickly as they had come and were often followed by blue skies. "Thirty-five houses were affected and 10 houses were severely damaged," a fire brigade spokeswoman said.

2007	3 to 4	12	British Isles	The Guardian & The Observer	04/12/2007	Low pressure systems spiralling in the Atlantic had been monitored by experts who anticipated waves in the region of 40ft on the west coast likened by one broadcast to three double-decker buses balanced on top of each other. Reports urged boat owners to be vigilant and directly appealed to surfers to stay away from the water, resisting the temptation to test their capabilities.
2008	30-31	1	British Isles	The Guardian & The Observer	01/02/2008	Modarate damage. Official gallantry. Official welfare. Great storms hit the North-West and Irish Sea causing much disruption and disturbance. Helicopters and lifeboats were involved in a sea rescue last night after 19 people were stranded on a ferry adrift in "horrendous" weather on the Irish Sea, as forcasters warned that high winds and blizzards will spread across the country today. Three helicopters - two from the RAF and one from the coastguard - were scrambled after the Riverdance, a roll-on-roll-off ferry, was struck by a freak wave eight miles west of Fleetwood. The stricken vessel was listing at 60 degrees after its cargo shifted amid heavy seas and high winds. Emergency workers feared that the ship, carrying a cargo of transport vehicles, was likely to capsize, but rescue efforts were hampered by "appalling" weather conditions. Two all-weather rescue boats from the Royal National Lifeboat Institute (RNLI) were assisting with the operation, providing lighting for the airlift and standing by in case further assistance was required. John Matthews, from Fleetwood RNLI, said the rescue was progressing smoothly, and late last night eight people had been taken from the ship. He described conditions in the Irish Sea

2008	10	3	British Isles	The Guardian & The Observer	10/03/2008	<p>tonight as "horrendous", with seven-metre waves and winds of up to 60mph.</p> <p>A history of the greatest storms ever recorded in Britain began with the "Great Storm" although most had a focus on the east coast of England. The tempest hit southern Britain on the night of November 26 1703. By the next morning, between 8,000 and 15,000 people were dead, many of them on ships sunk at sea. Church spires were destroyed, tiles and chimney stacks covered the streets, and more than 400 windmills were broken. The worst storm since 1703 occurred in October 1987, making landfall in Cornwall before travelling north-east towards Devon and over the Midlands. In October 2000, during the UK's wettest autumn for 200 years, a storm caused five major rivers to reach record flood levels, causing an estimated £1bn worth of damage. Gusts of 93mph left about 60,000 houses in the East Midlands without power. Moderate damage. Official gallantry. Official welfare.</p>
2008	10 to 12	3	British Isles	The Guardian & The Observer, The BBC	10/03/2008 - 12/03/2008	<p>Severe storms battered the UK for 3 days leading to considerable disruption in the north-west of England and North Wales as gales with winds of up to 85mph swept in from the North Atlantic. Winds of up to 82mph (130km/h) have brought down trees in Wales and south-west England and left 10,000 homes without electricity. There are 36 flood warnings in place in England and Wales and it is feared water could spill over sea walls when high tides peak. Small-scale flooding has affected parts of the South West, with residents putting out sandbags to protect homes in parts of Devon and Cornwall. High winds have also caused considerable damage and disruption, blowing</p>

2008	22-23	3	British Isles	The Guardian & The Observer	23/03/2008	<p>off garage roofs in Devon and west Wales, uprooting trees and bringing down power lines. 7,000 homes in south-west England and 3,000 in Wales are without power. 82 mph was recored at Brixham and 49mph was noted in Crosby. The RAC advised drivers to take precautions. Several roads are blocked in Wales and south-west England and flooding on the Surrey stretch of the M25 is causing severe delays. The Met Office warns rail delays are likely, with the worst weather expected to strike on Monday afternoon. The Tamar Bridge between Devon and Cornwall has been closed to high-sided vehicles. The Environment Agency in Devon said the morning high tide had not been as bad as predicted and had passed without major incident, though there had been minor flooding around the coast. However, it said high winds and large waves were still a threat. It's not that likely there will be any more trouble," said an Environment Agency spokesman.</p> <p>Minor damage. Official gallantry. Sleet, snow and storms made one of the most miserable Easter weekends in years - with more bad weather to come. Snow showers fell across the north of England, while rain turned to sleet, then snow flurries, as far south as London. Temperatures generally were between 1C and 4C, well below the seasonal average of 7-11C.</p>
2008	5 to 7	9	British Isles	The Guardian & The Observer	08/09/2008 - 09/09/2008	<p>Minor damage. Official gallantry. Official welfare. An area of low pressure that moved slowly north-eastwards across the UK 5-6 September brought prolonged heavy rainfall to many areas, notably south-west England, Wales, the south-west Midlands. This rainfall followed well above</p>

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average rainfall in August and an unsettled start to September. On the 5th, there was flooding of homes and businesses and transport disruption across parts of the south-west Midlands, south and mid Wales, particularly the south Wales valleys forcing evacuations and causing damage. South Wales police promised a crackdown on thieves who have targeted elderly people following the floods. The inquiry into Friday's devastating floods in Morpeth, where repairs are estimated at over £1m, continued with claims that new defence "pillows", designed to absorb water and become like a sandbag, had floated uselessly away. Several cases have been reported in Tonypany and Hirwan of intruders stealing cash after gaining entry to pensioners' homes by saying that they needed to check equipment after the heavy rainfall. Minor damage. Official gallantry. Official welfare. Record low October temperatures and snow reported across many areas of the UK. Sleet and snow was also observed across many areas of the UK, notably over Northern Ireland and Scotland. The last occurrence of sleet or snow being reported across these areas was October 2003. Several football matches set to be played on the evening of 28 October in England and Wales were also abandoned or postponed due to the weather. An area of low pressure and associated frontal system over south-west England at 0000 UTC on 30 October 2008 (see chart below), resulted in localised but intense hail/thunderstorms over east Devon. 24-hour rainfall total (0900 UTC on the 29th to 0900 UTC on the 30th) of 78.4 mm, which would give a return period of 35 years. A woman in labour was among

<p>2009 2 to 10</p>	<p>2</p>	<p>British Isles</p>	<p>The Guardian & The Observer, BBC</p>	<p>02/02/2009 - 10/02/2009</p>	<p>1</p> <p>scores of people rescued today after heavy flooding caused road accidents and forced families to evacuate their homes in Devon. Police, the coastguard and fire services were called in after fierce storms struck the county around midnight. Firefighters said the flooding was the worst they had seen for 25 years. The emergency services received more than 150 calls reporting flooding. An evacuation centre was set up at a hospital in Ottery St Mary. Flood warnings are in place across Devon and a section of the A30 dual carriageway was closed after junction 29. here are flood warnings for the south Devon coast at Beesands, Torcross, Slapton, Torbay and Dawlish with high tide at 7am. Ottery St Mary resident Tony Fabry, whose wife Sharon is sub-post mistress in the town, said the post office sorting room was under six inches of water and a foot of water was flowing down the road. Many other businesses were underwater.</p> <p>1. Moderate damage. Official gallantry. Official welfare. A prolonged period of snowfall began on 1 February 2009 causing great nuisance in Britian. On the morning of 6 February the majority of Great Britain and Ireland had snow cover, with the area surrounding the Bristol Channel (South Wales (Cardiff area) and South West England (Bristol area)) being most affected – 55 centimetres (22 in) had settled overnight around Okehampton, Devon, South West England with similar depths in South Wales. Over 4,500 schools across the United Kingdom were closed on 3 February and the reasons given were mostly either accessibility or heating problems, although the blanket closures across whole districts demonstrate that this was</p>
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not always the case. Swansea University was closed on Tuesday 3 February through concern of the safety of students and staff using icy roads. The University of Exeter was closed from 15:00 on Friday 6 February because of icy conditions on its hilly campus, while the University of the West of England in Bristol and neighbouring institutions the University of Bath and Bath Spa University were closed on Thursday 5th and Friday 6th for similar reasons. On 9 February, heavy rain and melting snow caused flooding in southern England, exacerbated by high tides which trapped water in river systems. Heavy snow and floods closed roads in Cornwall, Devon, Oxfordshire, Somerset, Hampshire and Sussex. South West Trains's services to and from Waterloo were disrupted. In England and Wales both Severn crossings were closed on 6 February because ice began falling from overhead gantries, affecting both the M4 and M48 motorways across the Severn Estuary; traffic was diverted into Gloucestershire and onto the M50. This was the first closure because of a weather-related incident of the second Severn crossing since the structure opened in 1996.[28] They reopened on 10 February. Two military helicopters were called in to assist ambulance crews in Devon and Cornwall, some parts of which were under 4 centimetres (2 in) of snow and claimed to be cut off. North Devon District Hospital and several hospitals in the region cancelled all outpatient appointments, while others in the area restricted their services to emergencies only. Around 200 motorists had to be rescued in Devon on 6 February, after their vehicles became stranded in heavy

2009	7 to 8	7	British Isles	The Guardian & The Observer	08/07/2009	<p>snow. A mother gave birth to twins in Devon after firefighters were mobilised to her aid when ambulances and rescue helicopters were hindered by the snow. A man was killed in a car crash at Sandy Bridge in Llanelli, Wales on 2 February. In some regions of Britain, the response to the adverse weather conditions was considered an unnecessary panic the Devon and Cornwall Business Council stated: "We have had too many businesses closed unnecessarily because people were panicked by the weather forecast. (...) We have had too many schools closed down, which has an adverse impact on people who rely on carers to look after children. (...) I think we have over-reacted quite significantly." Britain was battered by wintry weather again on the 10th, as a storm brought gale force winds, torrential rain and snow that caused flooding, power cuts and widespread travel disruption in England and Wales. Fire brigades took hundreds of emergency calls from residents whose homes had been flooded and motorists stranded in floodwater. Emergency services in Kent received 28 reports of fallen trees, and roads were closed across Wiltshire, Somerset, Devon and Cornwall. Thunderstorms bringing heavy rain came to Southern England. A Met Office forecaster, Kevin Hogg, said July downpours were not uncommon. "Some of the most torrential downpours are in July because of the heat and humidity – although there wasn't much heat and humidity yesterday," he said.</p>
2009	13-19	11	British Isles	The Guardian &	14/11/2009	<p>Major damage. Official gallantry. Official welfare. Severe gales and heavy rain caused flooding and damaged property today, with strong winds uprooting trees and</p>

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blowing off roofs. Coastal regions in southern England and Wales were lashed by strong winds, lightning and driving rain in the worst storm of the year, with winds reaching up to 100mph on the westernmost point of the Isle of Wight. Weather forecasters said average wind speeds were closer to 70mph in exposed inland areas as storms swept the country. Fire crews across mid and west Wales had attended 141 separate callouts by midnight last night. Pembrokeshire was the hardest hit, with widespread flooding of the county's road network trapping people in their cars. Firefighters using a boat and a Land Rover rescued a woman stranded by floodwater in Milford Haven. In Haverfordwest, 12 people were rescued from a coach trapped in floodwaters. Floods in Tenby affected roads around the resort, and 14 people were rescued from vehicles. Even experienced drivers can be caught out, so it's important to drive more cautiously and allow extra time for your journey an AA official advised. The heavy rain was expected to move north into southern Scotland overnight, which could cause localised flooding. On the 15th the Environment Agency and Met Office warned that people living along the coast in Hampshire, West Sussex, Dorset and South Wales faced a risk of sea flooding caused by high tides, strong winds and "significant wave heights". Heavy rain led to coastal flooding in the south of the country. The Environment Agency lifted its severe flood warning for Dorset yesterday, but some 35 warnings remained – 18 in southern England, 11 in south-west England and six in Wales – as well as 97 "flood watch" alerts across England

and Wales. Hundreds of people were rescued from homes and vehicles after heavy rain and strong winds brought severe flooding to parts Scotland and Wales yesterday. Fire crews in parts of Wales rescued people from houses and cars, with the deluges forcing the cancellation of a number of train services. Five adults and a baby were reported to have been rescued from two houses in Meidrim, Carmarthenshire, while floodwater stranded two women in their car in Landore, Swansea, and four were stuck in two cars near Newcastle Emlyn. Cumbria bore the brunt of the storms with the village of Shap deluged by 38mm (1.5in) of rain in 12 hours. The EA had 31 flood warnings and 62 less serious flood watches in place for England and Wales with Cumbria likely to continue to be badly affected. Trains were delayed and drivers told to avoid unnecessary journeys as police shut the A595 and long delays hit the A590 after almost 480mm of rain fell at Lindal in Furness. The A591 between Keswick and Grasmere was flooded and littered with debris. Emergency plans have been drawn up for Carlisle, Keswick and other lowland areas vulnerable to flooding if rivers such as the Eden and Greta burst their banks. Parts of north Wales were also badly affected. Thousands of acres of farmland were awash in the Conwy Valley, where water levels were reported to be the highest for a quarter of a century. Lancashire is the main concern for the agency today, with Cumbria at highest risk tomorrow and Friday. "The ground's very wet, the rivers are rising and with heavy rain that we're expecting, in particular for Cumbria, that's where we'll be focusing our attention," the

2009	16 to 15	1	British Isles	The Guardian & The Observer	16/12/2009 - 15/01/2010	<p>spokesman said. Arriva Trains cancelled all services between Llandudno Junction and Blaenau Ffestiniog, in north Wales. The EA floodline received almost 5,000 calls over the weekend. The Guardian published a series of photos of the RNLI and RAF evacuating many residents flooded in Cockermouth.</p> <p>Moderate damage. A winter storm engulfed the UK for a prolonged period causing much disruption. On 16 December forecasters warned of very heavy snowfall to come. A band of rain moved southwards over the UK, which brought some snow. The first snowfalls on Thursday 17 to Saturday 19 December affected mainly eastern parts of the UK, but on Sunday 20th the focus shied to northern and western parts with Northern Ireland and the Manchester area experiencing heavy snowfalls. England and Wales also experienced hard frosts with temperatures in many areas falling below -7 °C. The difficult conditions continued from Christmas to the New Year, although there was a brief spell of milder weather in the south. Heavy snow on Tuesday 29th and Wednesday 30th across Wales. The freezing conditions continued into the New Year with widespread ice causing treacherous conditions on roads and pavements, resulting in a spate of accidents and falls. Minor roads were particularly badly affected as in many parts these were untreated by road grit and salt due to concerns over supplies running low. Heavy snowfalls on Monday January 4th across north-west England saw Manchester and Liverpool airports closed for a time, with further snowfalls on the 5th causing continuing problems. On Thursday 7th, electricity</p>
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2010	7 to 8	11	British Isles	The Guardian & The Observer	08/11/2010	<p>supplies to 25,000 homes were interrupted as trees and ice brought down power lines. Official gallantry. Official welfare. As a result of the snowfalls and freezing temperatures, thousands of schools remained closed through the week. A slight thaw on Sunday 10th and Monday 11th brought a brief respite. However, there were further snowfalls in south-west England and south Wales on the 12th, while on the 13th, these became more widespread to bring renewed disruption to roads, rail and air travel. It was only by Friday 15th that the thaw was well under way.</p> <p>Storms swept across the British Isles with gale force northerly winds and heavy rain widespread with snow in Scotland. The Met Office said in Cumbria, up to 30mm of rain is forecast on lower ground and drifting snow is expected in the hills with winds of up to 60mph. Forecasters said it was unlikely that any region would escape the storms as, after a brief respite in the middle of the week, heavier winds were due to return around Thursday, with the threat of thunder and lightning in western Scotland. In Scotland, gale-force winds and driving rain are battering large parts of the country. Travelling conditions have been poor and some ferries have been disrupted. There is also snow on the higher roads such as the A9 at Drumochter in the Highlands and on the M74 north of Moffat in Dumfries and Galloway.</p>
2010	16-18	11	South-West Britain	The Guardian & The Observer	18/11/2010	<p>Moderate damage. Official gallantry. Official welfare. Very heavy rain fell across the South-west and the Cornish Peninsula suffered from particularly damaging floods. A deep area of low pressure brought strong winds and</p>

heavy rain overnight on 16/17 November, with a line of intense rainfall developing to bring 40 mm or more in 2 hours in some places. The worst affected places were St Blazey, St Austell, Mevagissey and Lostwithiel. More than 100 properties were flooded with significant damage to houses and businesses. Roads were closed (including both the A30 across Bodmin Moor and the A38 for several hours) and motorists were stranded by floodwaters. The mainline railway between London and Penzance was closed due to landslides. A number of schools across Cornwall were closed for the day and the Eden Project was badly affected by flooding. The heavy rain was accompanied by strong winds, with gusts of 54 knots (62 mph) at St Mary's (Isles of Scilly) and 50 knots (58 mph) at Berry Head (Devon). A multimillion-pound mopping-up operation was on the 18th under way in Cornwall after flash floods forced hundreds of people from their homes and devastated businesses. All the flood and severe weather warnings for the area were lifted as the clean-up and recriminations continued. Environment ministers are expected to make a statement to parliament, setting out extra support for some of the worst-hit areas. The government faces criticism for cutting funding for flood defences, but promised yesterday that it would do all it could to restore towns and villages wrecked by the deluge. Agencies including the Met Office, the Environment Agency and Cornwall council also faced questions over whether they had given sufficient warning of the downpour and been well enough prepared to cope with the aftermath. Hundreds of residents spent last night

2010	25 to 9	12	British Isles	The Guardian & The Observer	29/11/2010 - 11/12/2010	<p>in emergency accommodation after being evacuated from their homes. The Highways Agency said all major roads in Cornwall had been cleared, but that problems remained on the railways. Great Western services between Par and Newquay are likely to be suspended for seven days while engineers repair damage caused by a landslip. The prime minister, David Cameron, promised the government would do all it could to help the affected areas to recover. However, the government was criticised by Labour for "slashing" investment in flood defences. The Exeter MP, Ben Bradshaw, asked Cameron during prime minister's questions: "Doesn't the devastation in Cornwall illustrate the false economy of your recent decision to slash investment in flood defences?"</p> <p>Major damage. Official gallantry. Official welfare. A prolonged spell of cold weather and blizzards from the East hit the British Isles. On the 22nd it was warned in the Guardian "The first significant winter freeze across the UK is likely to descend over the course of the week, with temperatures potentially dropping as low as -10C (14F) and snow flurries possible in many regions". By 26 November, nighttime temperatures fell well below 0 °C (32 °F), with the Welsh towns of Sennybridge and Trawscoed being among the coldest places at -10.2 °C (13.6 °F). The cold snap heralded the earliest winter snow fall for 17 years. The AA dealt with an estimated 15,500 calls regarding breakdowns on the same day. The mercury at Llysdinam near Llandrindod Wells in Wales plunged to -18C. The insurer RSA estimated that the freezing weather could cost the UK economy up to £1.2bn a day, with</p>
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2010	16 - 25	12	British Isles	The Guardian & The Observer	16/12/2010 - 27/12/2010	<p>retailers and the restaurant and bar industries likely to be the worst affected. By 6 December, snowfall in the Central Belt in Scotland led to the closure of the M8 motorway for two days with hundreds of motorists stranded overnight. The resulting political furore led to the resignation of Scottish Minister for Transport, Stewart Stevenson. Moderate damage. Official gallantry. Official welfare. Heavy snow showers and storms came to Northern Britain on the 16th which rapidly spread to the South-west as the country "battens down the hatches". Airports, rail operators and road gritting and breakdown services were preparing for snowfalls of up to 20cms (8in). Downing Street was forced to deny there was a heating oil crisis today as freezing conditions gripped the country again, closing almost 2,000 schools, causing flights to be suspended at regional airports, trains to be cancelled and long tailbacks on motorways. The AA said callouts were running at 1,500 an hour – 50% up on normal – as temperatures plunged to as low as -6C and roads became treacherous. Motorists have been warned that almost no area of Britain will escape potentially lethal driving conditions, with black ice posing a deadly threat, according to AA spokesman Peter Barnao. Icy blizzards and freezing temperatures caused major disruption on transport networks, with police in the Scottish Highlands warning commuters not to travel. Network Rail was running "ghost trains" to try to keep routes open and the Local Government Association said council gritting crews were out in force. Millions of people faced a struggle to get home in time for Christmas as travel plans were</p>
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<p>2011 26-27</p>	<p>11</p>	<p>Irish Sea</p>	<p>The Guardian & The Observer</p>	<p>27/11/2011</p>	<p>5</p> <p>thrown into chaos when planes were grounded, trains cancelled and roads made impassable by heavy snow. Further heavy snow early on Monday 20 December brought significant problems to both Devon and Somerset with the A38 closed near Exeter and widespread problems on the roads: the AA reported the busiest day in its 105 year history. British Airways cancelled all short-haul flights, shopping centres were forced to close and many motorways were blocked by heavy drifts of snow across much of the UK yesterday with freezing temperatures expected to remain for most of the week. The disruption that has ensued – the second serious episode of weather chaos to hit travel in Britain this month – led to calls from senior politicians yesterday for the government to make radical improvements in its ability to deal with cold weather. The second extremely cold winter in a row has exposed what plumbers say is a flaw with condensing boilers, the only sort permitted to be installed since 2005 under government regulations.</p> <p>5. Moderate damage. Official gallantry. Impromptu gallantry. Official welfare. "A grand storm in the Irish Sea produced mountainous waves which sank a cargo ship in the Irish Sea. Five crew from a cargo ship are feared dead after a huge wave snapped the vessel's hull in stormy seas off the coast of north Wales. Two men were rescued by an RAF helicopter co-piloted by Prince William. The 81-metre Swanland sank almost immediately 10 miles west of the Llyn peninsula following a distress call at 2am. While some of them were believed to be wearing survival suits, given sea temperatures of around 13C they would not be</p>
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expected to survive in the water beyond six hours, the coastguard said. A Ministry of Defence spokesman explained the role played by Prince William, who is based at RAF Valley as a flight lieutenant trained in search and rescue work. He said. ""It was a four-man crew – captain, co-pilot, radar operator and winchman – and he was the co-pilot. The weather conditions were described as extremely bad, with poor visibility and strong winds."" The two rescued sailors said the ship had sunk quickly in stormy weather of gale force eight and above. One of the survivors ""described a huge wave rolling the ship, and she broke her back. It was a catastrophic failure, and she obviously sank very quickly after that."" The coastguard stated Carson said: ""The two men recovered from the water were brought here before going to the hospital. I think they are OK and are just suffering from shock. A tanker, the Bro Gazelle, was very close to the Swanland when it sank and helped provide shelter and light before the helicopters and lifeboats arrived. Another vessel, the Monsoon, spent the night searching for survivors. The search, now covering 300 square miles, has been expanded to include four helicopters, from both RAF bases and the Dublin coastguard, as well as the Pwllheli and Porth Dinllaen all-weather lifeboats and two inshore lifeboats. An Irish navy boat has also joined the operation. Two other cargo vessels in the area at the time played a key role in saving the two sailors. A tanker, the Bro Gazelle, was very close to the Swanland when it sank and helped provide shelter and light before the helicopters and lifeboats arrived. Another vessel, the Monsoon, spent

<p>2011 8 to 13</p>	<p>12</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>08/12/2011 - 14/12/2011</p>	<p>the night searching for survivors. Carson said two liferafts had been spotted in the water. One was presumed to be empty, as it was the raft to which the survivors had clung. The other has washed up under cliffs at the tiny island of Bardsey and was inspected at close range by a helicopter winchman who saw no signs of life. The stretch of water is notoriously rough, he said. In January 1991 another cargo ship, the Kimya, was capsized by giant waves in a similar location, causing its consignment of palm oil to leak into the sea. The Swanland, with a gross weight of 1,978 tonnes, was carrying limestone from Raynes Jetty near Colwyn Bay to Cowes on the Isle of Wight. Reportedly built in the Netherlands and registered to the Cook Islands, the ship is believed to be operated by a company based in Grimsby.</p> <p>Major damage. Official welfare. Impromptu welfare. On 8 December 2011, a deep Atlantic low pressure system brought very strong winds across the northern half of the UK. The so named Hurricane Bawbag battered parts of the UK with millions of people in central Scotland warned to stay at home and avoid travelling after 165mph gusts left thousands of homes without power, closing bridges, rail lines and roads. One of the most powerful storms to hit inland areas led to the closure of thousands of schools across western, central and southern Scotland, and the shutdown of almost all public buildings, including sports centres, concert halls and libraries, in cities such as Glasgow and Edinburgh. One of the most powerful storms to hit inland areas led to the closure of thousands of schools across western, central and southern Scotland,</p>
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and the shutdown of almost all public buildings, including sports centres, concert halls and libraries, in cities such as Glasgow and Edinburgh. At one stage, more than 60 train passengers were stranded on the West Highland line after it was closed down near Crianlarich, north of Loch Lomond. A rescue train was sent from Glasgow to take them off the train. The gales appeared to cause a fire in one wind turbine in Ardrossan, Ayrshire, after dramatic images showed large flames engulfing parts of the machine, and pieces falling to the ground. Scotland bore the brunt of the storm, with winds gusting 60 to 70 knots (69 to 81 mph) and reaching well over 70 knots (81 mph) in exposed coastal locations. The Forth, Tay, Skye and Erskine road bridges were closed. Network Rail imposed a speed restriction because of the risk of trees and other debris on rail lines. Ferry services were delayed and some flights were cancelled. Thousands of people were left without electricity; an estimated 150,000 homes lost power during the 8th, mainly as a result of trees and other debris blown on to overhead power lines. Engineers were still trying to re-connect about half of these on the 9th. In northern England, localised flooding was reported with Cumbria particularly effected. During the day, hurricane gusts bringing heavy belts of rain and hail nearly broke records, reaching 165mph on Cairngorm, where a highest speed of 173mph was measured in 1986, and 145mph at Aonach Mòr near Fort William. About 60,000 people were left without electricity in pockets around Sanquhar, Dumfries, Dollar, Falkirk, Helensburgh and Stranraer after power lines were brought down by the wind. Some homes

<p>2012 2 to 3</p>	<p>1 British Isles</p> <p>The Guardian & The Observer</p> <p>02/01/2012 - 03/01/2012</p>	<p>will be without power until Friday. Some patients at Belford hospital in Fort William were sent home after a power failure, which also cut its phone lines. The Met Office spokesman said the red warning had been issued because the gales had struck large population centres, where the potential for damage and travel disruption was much greater. Much of the potential damage was offset by urgent warnings issued by Scottish government ministers and roads agencies late on Wednesday. After a furious public backlash about its handling of last winter's ice and snow, Scottish ministers have improved early warning and contingency planning. Most schools, businesses and council offices that had been forced to close early on Thursday (8th) afternoon reopened. Winds – which reached 165mph on Thursday – eased, with the worst weather confined to north-east Scotland and the Shetlands. Glasgow and Edinburgh airports were open but warned of severe delays and cancellations, while Scotrail services were still delayed across Scotland. The overall cost of disruption to Scotland's economy has been estimated at around £100 million. On the 12 and 13th the remnants of the storm caused travel disruption across Southern England and delayed several sailings in the Celtic Sea.</p> <p>Moderate damage. Official gallantry Official welfare. Gales of up to 106mph batter UK producing great devastation. Torrential rain downpours saw parts of Cornwall, Devon and Wales come close to flash-flooding with 5mm (0.2in) to 6mm (0.24in) of rain in an hour. But defences held although standing water on roads added to problems</p>
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caused by tree falls and high winds. Buses replaced trains in many areas, including all east coast services in Scotland. Other services between London and the north suffered heavy disruption, as well as some services in Cornwall. Environment Agency officers rescued a woman in her 40s who tried to drive across a ford on the swollen river Chew in Somerset and was swept away. Rescuers fitted the non-swimmer with a lifejacket before pulling her to safety and lashing the car with ropes to prevent it joining debris swirling downstream. Emergency services coped rapidly with hazards, closing bridges over the Foyle in Northern Ireland and the Forth, Tay and Clyde in Scotland as well as barring high-sided lorries from the Tamar bridge into Cornwall. More than 40 flood alerts were issued but the eye of the storm was highly concentrated and fast moving, with almost all the severe weather moving out into the North Sea by early afternoon. Gemma Plumb, a forecaster with Meteogroup, said: "Everywhere has seen strong winds today. We've seen plenty of gusts of up to 97mph across central and southern parts of Scotland, 65 to 75mph across northern parts of England, and 60 to 70mph across Wales and the south coast of England". Gusts of 97mph recorded at Islay rose to 102mph at Blackford Hill in Edinburgh. Glasgow's civic Christmas tree was topped, and the Edinburgh-based crime writer Ian Rankin tweeted that his chimney pot was now in his garden. Police in Strathclyde and Lothian and Borders advised people to travel only if their journeys are essential. Scottish transport minister, Keith Brown, denied that the storm had caught his staff on the hop. 70,000 in

2012	2 to 4	4	British Isles	The Guardian & The Observer	04/04/2012	Scotland, and 10,000 in Northern Ireland, are still without electricity as of 4.40 on the 3rd. Minor damage. Official welfare. The gale-force winds, snow, sleet and rain that battered parts of Britain and left around 10,000 homes across Britain. The Met Office has issued severe yellow weather warnings for snow and ice in parts of Scotland, Wales, northern England and the Midlands. Cumbria police said the A66 trans-Pennine route remained closed in both directions and advised drivers to use alternative routes. The A537 in Cheshire was badly affected by snow. Northern Powergrid's engineers worked through the night on faults across the north-east of England, following Tuesday's breakdown of supplies in Scotland to 11,000 Scottish Hydro customers.
2012	7 to 8	4	British Isles	The Guardian & The Observer	09/04/2012	A liner re-running the Titanic's cruise to mark the centenary of the vessel was delayed from leaving for Cobh due to high winds and tremendous waves in the Irish and Celtic Seas.
2012	28	5	British Isles	The Guardian & The Observer	28/05/2012	A period of sunshine ended with thunderstorms and heavy rain although the impact was eastern focused.
2012	28	6	British Isles	The Guardian & The Observer	28/06/2012 - 29/06/2012	Minor damage. Official gallantry. Heavy thunderstorms struck most of the UK. Later the storm spread north, closing both main rail lines between England and Scotland, with the west coast mainline closed at Tebay in Cumbria and a landslip blocking the east coast line near to Berwick. There were seven flood warnings in place for the Midlands, two for the north-east, one for the north-west and one for Scotland. The EA urged people to check its

2012	14-15	8	British Isles	The Guardian & The Observer	15/08/2012	1	<p>website and Twitter feed for the latest updates and flood warnings.</p> <p>1. Minor damage. Official gallantry. Official welfare. Torrential rain and strong winds are making it a miserable day for holidaymakers and a tricky one for drivers as a band of stormy weather sweeps across parts of the UK. The Met Office has issued a severe weather warning, predicting surface water flooding and difficult travelling conditions while the Environment Agency has put in place five flood alerts for areas of the south-west and the south coast of England. Winds up to 60mph were battering stretches of the coast and as much as 25mm of rain had already fallen in some parts of the south-west, the Met Office said on Wednesday. A spokesman said an area of low pressure off the west coast of Ireland was causing the band of rain that was expected to move from Cornwall, through the west country then up across Wales, Northern Ireland and parts of north-west England. Coastguards in south Wales have warned people to beware tides and currents after three children and their father had to be rescued after being swept out to sea off the Gower peninsula on Tuesday. All three were airlifted to hospital in Swansea, where they were treated for shock and the effects of swallowing seawater. An angler died on Tuesday after being swept off rocks near Tintagel on the north coast of Cornwall.</p>
2012	21-25	11	British Isles	The Guardian & The Observer	21/11/2012 - 29/11/2012	1	<p>1. Major damage. Official gallantry. Official welfare. "On the 21st householders, business people and motorists have been warned to prepare for flooding, gale-force winds and terrible driving conditions as another band of</p>

wet weather sweeps across the UK. The Met Office issued severe weather warnings for south-west England, the West Midlands, the whole of Wales and a good deal of Scotland, and said winds of up to 70mph could add to the misery. The number of flood warnings – meaning flooding is expected – issued by the Environment Agency climbed steadily throughout Wednesday after up to 30mm of rain fell in a few hours. The AA said that by 4pm it had attended 4,000 breakdowns, almost 40% more than normal. Schools were also closed, and the main train line between Devon and Bristol was disrupted. Firefighters had to wade through water to reach a woman when she went into labour in the Chew Valley, in Somerset. They got her into an ambulance and she was taken safely to hospital in Bath. In Devon a fire crew had to go the aid of two people who had become stuck when they tried to rescue stranded cattle. "Environment Agency teams have been mobilised across the country to check on flood defences, clear any river blockages and closely monitor river levels. These teams work around the clock to reduce the risk of flooding, and will be out in force over the coming days." By the 22nd homes and businesses were flooded, tens of thousands of pounds of damage caused by high winds, and journeys by road and rail disrupted as the UK was battered again by rain and gales. People in Halberton, Devon, were evacuated after a section of the 200-year-old Great Western Canal crumbled, allowing water to pour into fields. Hundreds of homes were left without power in parts of the south-west as lines were brought down by the high winds and dozens of schools

were closed. Christmas light switch-ons in Exeter and Plymouth and Cardiff's Winter Wonderland festivities were postponed. An RNLI lifeboat stood by on the Somerset Levels amid concerns that more rain falling on ground that has been sodden for months combined with a high tide could lead to severe flooding. Parish councils across Somerset were asked to turn village halls into makeshift shelters. People were evacuated from Billing Aquadrome campsite in Northamptonshire, while in Devon the coastguard warned people to stay out of the sea after a canoeist got into difficulty off Burgh Island, sparking an air and sea rescue effort. He managed to get back to shore under his own power. It all made for difficult driving conditions. The M48 Severn crossing was closed to all traffic while the Tamar bridge between Devon and Cornwall was shut to high-sided vehicles, caravans and motorcycles. The AA said it had experienced record callouts this week, receiving 900 breakdown reports every hour. On a typical Thursday it attends around 9,500 incidents. This Thursday it was expecting to reach the 13,000 mark. The Met Office issued severe weather warnings for Thursday covering much of England, Scotland and Wales. By nightfall, Anglesey had suffered the worst of the downpours with 42mm of rain falling in 24 hours. The Met Office's deputy chief forecaster stated ""There has been some torrential rain and squally winds on Thursday as a cold front moved across the UK, but another deep depression developing off Iberia will head towards us for the weekend. This is expected to bring more heavy rain and strong to gale force winds to many

parts of the country." The south west of England and parts of south-east Wales were bearing the brunt of the rain on Saturday night and Sunday morning as it poured down on saturated catchments. Further rain and travel disruption were warned off on the 24th. Work to clear a landslip at Mevagissey harbour in Cornwall has been completed, but the high winds and rain have meant very few fishermen have ventured out. Harbourmaster Hugh Bowles said: "Obviously fishing is completely weather-dependent, so it really does have an impact on fishermen wanting to get out on the water, particularly those with smaller, under-10-metre boats." Devon and Somerset fire and rescue service pumped 1m litres of water from fields below the Grand Western Canal near Tiverton after it burst its banks. Network Rail said trains were likely to be suspended between Exeter and Bristol until Monday because tracks have been flooded. Work to clear a landslip at Mevagissey harbour in Cornwall has been completed, but the high winds and rain have meant very few fishermen have ventured out. Harbourmaster Hugh Bowles said: "Obviously fishing is completely weather-dependent, so it really does have an impact on fishermen wanting to get out on the water, particularly those with smaller, under-10-metre boats." Devon and Somerset fire and rescue service pumped 1m litres of water from fields below the Grand Western Canal near Tiverton after it burst its banks. Network Rail said trains were likely to be suspended between Exeter and Bristol until Monday because tracks have been flooded. John Curtin, head of incident management at the Environment Agency, said:

2013	28-29	1	South-West Britain	The Guardian & The Observer	28/01/2013 - 29/01/2013	2 <p>""We would urge people to continue to be prepared for flooding, sign up for Environment Agency flood warnings, keep up to date with the latest situation, and stay away from dangerous floodwater. It was not only humans who were struggling with the conditions: a one-year-old monkey at the Wild Futures monkey sanctuary near Looe in Cornwall had to be resuscitated after falling ill in the wet weather. A woman died and two others were seriously injured after a tree fell on them as floods and high winds battered the south west. The woman was trapped under the tree and taken to hospital where she later died, Devon and Cornwall Police said. More than 800 homes have been flooded across the country and dozens of residents were evacuated. The south-west has been the worst hit area so far. The Met Office and the Environment Agency are warning of more flooding to come as heavy rain is forecast, particularly in the north. One severe flood warning remains in place for the River Cober at Helston. The Environment Agency currently has 224 flood warning in place and a further 274 flood alerts. The River Ton also burst it's banks causing widespread flooding in Ruishton, Somerset. On the 29th the weather turned frosty as temperatures although 106 warnings remained in place as the low passed over Britain."</p> <p>2. Moderate damage. Official gallantry. Official welfare. Two spells of very heavy rain and winds of up to 80mph caused flooding and travel problems in some parts of the UK on the 28th-29th. Staff at the Environment Agency are particularly concerned that by Tuesday there could be quite serious flooding in Devon, Somerset and parts of</p>
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south-east Wales. There was a happier ending on the Somerset coast after a six-month-old baby boy was swept into Watchet harbour by strong winds. Dockmaster George Reeder, 63, dived in and pulled the pushchair and child to shore. The child was revived by a passerby, who administered CPR, and is understood to be doing well in hospital. By Monday (28th) lunchtime the Environment Agency had more than 50 flood warnings – meaning flooding is expected – and more than 200 alerts (flooding is possible) in place. This was down on the number issued on Sunday but a spokeswoman said the combination of snow melt, further heavy rain and spring tides threatened to cause more intense flooding than over the weekend. Further south and west warnings were issued for areas including the Somerset Levels, which have been hit by a string of floods over the past year, and Dorset. There was also anxiety in areas of Devon, where flooding on rail-lines at the end of last year caused days of misery for train travellers. A very deep area of low pressure is to pass close to the north-west part of the UK on Tuesday bringing another spell of wet and windy weather. The committee chairman, James Morrish, said: "The increase is a clear statement of the determination to address the backlog of flood defence needs in Devon, Cornwall, Plymouth, Torbay and the Isles of Scilly, particularly following the repeated flooding throughout 2012 which saw over 1,000 properties flooded in 200 locations." Rescuers searching for a missing fisherman off the coast of Devon found a body, and in Scotland it emerged that a marine scientist died apparently after being hit by

2013	10 to 28	3	British Isles	The Guardian & The Observer	11/03/2013 - 31/03/2013	1	<p>lightning. Almost 50 properties in England and Wales have flooded since Saturday. About 50 flood warnings are in place, meaning flooding is expected, along with almost 200 alerts, meaning flooding is possible. The agency said the numbers were expected to grow. The spokesman said: "Larger rivers including the Lower Exe [in Devon] and the Severn will continue to rise throughout the week. Environment Agency teams are deploying mobile flood barriers at Ironbridge, Bewdley and Shrewsbury to protect communities from flooding from the river Severn." In Port Appin, Argyll, western Scotland, the body of a scientist, Tim Boyd, was found by a dog walker on a bridge near his home. Police are investigating the theory that he may have been struck by lightning. A large storm in the area at the time of his death on Sunday afternoon knocked down power and phone lines. Boyd worked at the Scottish Association of Marine Science (Sams) in Oban. A spokesman said: "We are grief-stricken about the tragic death of Tim Boyd, who was killed by a lightning strike on Sunday afternoon. Our hearts go out in particular to his wife and his two talented daughters he was so very, very proud of. Our thoughts are with his family."</p> <p>1. Moderate damage. Official gallantry. Official welfare. A prolonged tempestuous period of cold weather engulfed the UK for approximately a month. Snow and icily low temperatures have returned to the UK in force, with blizzards in southern parts of England and the freezing weather threatening even the Channel Islands. Strong winds have caused traffic problems and road closures from Cumbria to Wales and the West Country, with the</p>
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winds reaching gale force in some parts of the UK's western seaboard. One lane of the M48 Severn bridge has been closed. Other areas affected include Newquay in Cornwall, Lynton in Dorset and the A353 through Dorset. The RAC and other road services were on standby to deal with a 20% rise in callouts over the next three days. The Highways Agency said it was "well prepared", with more than 500 salt spreaders, snowploughs and blowers deployed at 100 depots on the main road network. On the 22nd Between 4cm and 6cm (1.6in-2.4in) fell over southern Devon and Cornwall on Friday, and up to 10cm (4in) on exposed southern slopes. There are reports of flooding across the west of the county, including around Newlyn and Penzance, as well as in Mevagissey in mid-Cornwall – a community still recovering from the impact of last year's torrential downpours. On the 22nd rescuers searching for a woman thought to have been trapped in a landslide at her home in Looe, Cornwall, have found a body. The woman, thought to be Susan Norman, was discovered after rescue teams spent the day looking through the wreckage with specialist search dogs. Identification of the body has not yet taken place. It is thought heavy rain triggered the landslide, which engulfed part of the property. Schools were cancelled and roads were closed across the Midlands, the north-west, and parts of Wales and Scotland. Parts of the Sellafield nuclear power plant in Cumbria were shut down and staff sent home due to the bad weather. The Environment Agency has issued 80 flood alerts ("flooding is possible") - mostly in the south east and south west - and 12 flood

warnings ("flooding is expected – immediate action required") - all of them in the south west. The Met Office's weather warnings show amber snow warnings ("be prepared") for Wales, the north-west, and parts of the west and east Midlands, as well as south-west Scotland and the east of Northern Ireland. Snow is expected to blanket everywhere north of the M4 corridor, with up to 20cm (8in) hitting the worst-affected areas of north-west England, north Wales and south-west Scotland. On the 22nd Between 4cm and 6cm (1.6in-2.4in) fell over southern Devon and Cornwall on Friday, and up to 10cm (4in) on exposed southern slopes. There are reports of flooding across the west of the county, including around Newlyn and Penzance, as well as in Mevagissey in mid-Cornwall – a community still recovering from the impact of last year's torrential downpours. The Environment Agency spokesman Ben Johnstone said: "We strongly urge people to sign up to flood warnings on the Environment Agency website, keep a close eye on local weather forecasts and be prepared for possible flooding. We also ask that people stay safe and not try to wade or drive through any deep water." Darron Burness, the AA's head of special operations, said: "It's going to be a real witch's brew of driving wind, rain and snow, which will inevitably cause disruption on the roads. Drivers should be well prepared as even short journeys can quickly turn bad." On the 23rd there were power cuts in parts of Scotland and Cumbria. Drivers had to contend with snow, strong winds and floods, with trees falling across a number of roads. Scotland, Cumbria, Staffordshire, Derbyshire and

Lancashire all had road problems, as well as Wrexham, north Wales, Cornwall, West Sussex and Dorset. On the railways, First Great Western train services were affected after flooding made a house unstable close to the line near Looe in Cornwall, and no alternative transport could be provided because of poor road conditions. A landslide and floodwater in Cornwall, thought to have been triggered by torrential rain, caused a building to collapse on Friday. Emergency crews found a woman's body after picking through debris at the Veronica flats in Looe. The body is believed to be that of Susan Norman, who is in her 60s and police said was unaccounted for, having not been heard from since returning to the flat on Thursday night. By the 24th the blizzard had left thousands without power and severe weather warnings persisted over much of the kingdom. Despite round-the-clock work by power company engineers, about 12,500 properties in Northern Ireland, 10,000 in Scotland, 500 in Wales and 200 in west Cumbria still had no electricity by Sunday evening. The body of a hill walker was recovered in the Scottish Highlands on Saturday by a mountain rescue team, the second death over the weekend linked to the weather. The man, 57, was found in Streap, near Fort William, where wind chill made the temperature feel well below freezing. On the Isle of Arran, where homes have been without power since Friday, an 80-year-old woman suffering from hypothermia was airlifted by helicopter to hospital on the mainland. The agriculture ministry was accused by one independent assembly member, Basil McCrea, of abandoning farmers unable to feed or check

2013 22 to 23

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British Isles

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on animals. Police called on dozens of motorists who had abandoned cars on the A595 in coastal Cumbria to coordinate recovery but warned them not to attempt to retrieve vehicles themselves, describing weather conditions as "still challenging". More than 1,000 homes in Scotland and Cumbria are not expected to be reconnected until late on Monday in spite of more than 200 engineers working throughout Sunday night in Dumfries and Galloway alone. Things are limping back towards normality on the Scottish island of Arran, which suffered a complete loss of power at the weekend, and in Kintyre where 3,500 homes were still blacked out on Sunday night. Helicopters have been used to find faults on power lines unreachable because of gale-force winds and drifting snow. Butterfly Conservation warned of a second worrying year for UK species after a fall in numbers last year because of wet weather at key times in the breeding cycle. By the 28th of March it was reported March is set to be the coldest in the UK since 1962, weather experts have said. Statistics from the Met Office showed that from 1 March to 26 March the UK mean temperature was 2.5C (36.5F), which is three degrees below the long-term average. This made it the joint fourth coldest in the UK, in records going back to 1910. On the 31st it was stated the UK has recorded its coldest Easter Sunday for more than 50 years, with overnight temperatures dipping to below -12C in Scotland.

Minor damage. Official gallantry. Following a period of intense heat and dry weather intense thunderstorms struck the UK resulting in waves of torrential rain, hail,

				The Observer		lightning and thunder bring threat of floods and damage. A forecaster from the MeteoGroup stated the main threat was from localised flash flooding as rain fell on imporous dry and solid ground baked by the intense heat. Lightning bolts were also mused as another threat. Rush-hour travellers in London, northern England, the west Midlands, south and east England and parts of Scotland were affected. Rail signals were also hit by lightning in eastern England, the west Midlands and Bristol. Thousands of homes were briefly without power in Bristol after electrical infastructure was struck. The hot weather has taken its toll on the UK, with grass fires in London, mountain blazes in the Welsh valleys and forest fires in Fife, Scotland. Wildlife experts warned of the risk of fires where there were "tinderbox" conditions after days of hot, dry, weather. Devon Wildlife Trust teamed up with the Devon and Somerset fire service to urge people in the region to avoid lighting fires, which could devastate habitats that are key for rare species and which can pose dangers to people and farmland.
2013	27-28	10	British Isles	The Guardian & The Observer	25/01/2013 - 30/10/2013	Moderate dammage. Official gallantry. Official welfare. On the 25th storm wannings were issued for the South as one of the greatest storms in years in the form of Storm Jude descended on the UK. The storm will develop over the Atlantic on Saturday before potentially hitting the south coast on Sunday night and into Monday, bringing exceptionally strong winds, forecasters predict. Gales could bring down trees and cause damage to roads and buildings, potentially causing major transport disruption and power cuts. The eact trac of the storm was

uncertainty but precautionary warnings were still widely issued. The chief forecaster at the Met Office stated: "With that in mind, people should keep up to date with and act on the advice in our forecasts and warnings as the situation develops." It was further remarked Atlantic storms of this type usually develop further west across the ocean, losing strength by the time they reach the UK and Ireland. This one, however, is expected to form much closer to land, potentially moving across the country while it is in its most powerful phase. A strong jet stream and warm air close to the UK are contributing to the development and strength of the storm thus the Met Office has issued severe weather warnings for wind and rain for all of England and Wales. On the 28th it was reported winds of more than 80mph could leave a trail of destruction across large parts of the UK, knocking down trees and causing major structural damage and power cuts. The storm, named after St Jude – the patron saint of lost causes whose feast day is on Monday – will develop over the Atlantic and is expected to hit the south-west late on Sunday, before moving north-east across England and southern Wales. Eight Aer Lingus flights between Ireland and London Heathrow have been cancelled because of the severe weather. South West Trains has advised passengers not to travel on Monday and announced a significantly reduced service, with most of its trains not expected to run until at least 8am. "Through the early hours much of southern England will see winds of 60-80mph, maybe closer to 90mph in exposed areas on the south coast. Further north, in south Wales, the

Midlands and East Anglia these will be between 50mph and 70mph." Downing Street said Cameron chaired a call that included transport ministers, the Highways Agency, Met Office, the Environment Agency, the Department for Communities and Local Government and the Cabinet Office. He received an update from Met Office and Environment Agency about the risk from the storm and associated flooding. No 10 said the prime minister heard that the storm could have a widespread impact, but that transport providers, local government, emergency services and power companies have plans in place to respond. The Environment Agency said it had teams working to minimise the risk of river floods by clearing debris from streams and unblocking culverts. Number 10 also warned people to stay away from seafronts, quaysides and jetties because of the risk of surging waves and wind-blown shingle. The Highways Agency, meanwhile, urged motorists to watch out for sudden gusts of wind and to give plenty of space to caravans, motorbikes and bicycles. The forecast has caused the cancellation of ferry services on Sunday and Monday between Plymouth and Roscoff as well as Penzance and the Isles of Scilly. The Local Government Association (LGA) said local authorities would divert staff from their normal duties to help out with emergency relief efforts if required. By 09:35 on the 28th UK Power Networks said 140,000 homes were without power in southern counties, while Western Power Distribution said 6,000 homes were affected in the south-west as 99mph winds hit the nation. Network Rail said more than 100 trees had fallen on the

<p>2013 4 to 5</p>	<p>12 British Isles</p> <p>The Guardian &</p> <p>05/12/2013 - 06/12/2013</p>	<p>tracks – it had cleared more than 40 blockages and was expecting to deal with more. There was also a landslip in the New Forest and a train was disabled after hitting a tree at Ivybridge, in Devon, although no one was injured. The Environment Agency has issued 17 flood warnings, 15 in the south-west, and 141 flood alerts for the rest of England and Wales. By 16:30 a huge operation is under way to try and restore power to thousands of homes and reopen transport networks after storm-force winds left four dead and cut a path of destruction across a vast swath of southern England. It was remarked although the storm – named St Jude after the feast day of the patron saint of lost causes – was not as ferocious as the great storm of 1987, and the authorities had better warning and were better prepared, it still brought fatalities in its wake. Special trains were used to clear tracks, the director of operations, Robin Gisby, said. "In four cases the train being sent through to inspect the line has hit a fallen tree and we have one train in Devon which is currently disabled following a collision with a fallen tree. By 09:20 on the 9th tens of thousands of homes remain without power. Dozens of areas in southern England still remain on flood alert, the Environment Agency said. Insurers are still counting the cost of the storm, dubbed St Jude after the patron of lost causes on whose day it struck. By the 30th thousands of homes still remained without power although mostly in the east. It was thought the storm had felled approx. 10m trees.</p> <p>On the 5th severe flood warnings were issued as gales battered the British Isles. A gust of 92mph was recorded</p>
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at Loch Glascarnoch in the Highlands, of 89mph at South Uist in the Outer Hebrides. The gale-force winds threaten to whip up the most serious tidal surge for 30 years. It was stated "The Environment Agency is monitoring the situation closely, working alongside partners including the emergency services, Met Office and local authorities". The Met Office has issued a wide range of weather warnings, with winds expected to gust to more than 80mph as they swing north-westerly in mid-morning, with gusts of more than 90mph in exposed parts. Thousands of train passengers in the north of England and Scotland were affected by reduced or cancelled services and the imposition of speed restrictions. The government's emergency Cobra committee met twice and local emergency plans swung into operation as the surge threatened to engulf areas of the east coast of England, from Northumberland to Kent plus parts of the north-west from Cumbria to Cheshire as well as communities in north Wales. Although flooding was most serious on the East coast the north west was also exposed. A flight to Glasgow was forced to abort two landing attempts in Scotland before being diverted to Manchester. In Rhyl in north Wales storm surge flooding meant 40 residents – and six dogs – were ferried to safety by teams from the Royal National Lifeboat Institution and North Wales fire and rescue service. About 400 people in all left their homes in the resort. In Whitehaven huge surges swept the quay and inundated the coastal areas and marooning cars. Britain's flood defences and flood warnings that led to thousands of people leaving their homes in the face of

2013	18-19	12	British Isles	The Guardian & The Observer	19/12/2013	<p>record-breaking high tides along the east coast have saved lives and property, according to the Environment Agency and police. The Environment Agency said that in some places on the east coast sea levels were even higher during Thursday's storm than they had been in 1953, when a similar flood claimed thousands of lives. But this time flood defences were much more effective, Jason Wakeford, an Environment Agency spokesman said. An EA spokesmen stated "It is quite clear from those numbers that events like this are hugely dangerous – the 1953 flood claimed thousands of lives so alerts and warnings are very important to prevent such a disaster happening again."</p> <p>On the 18th and 19th a renewal of storm ferocity caused further disruption Winds gusted at again at 60 to 70 kts across much of Scotland, the coast of Wales and South Coast of England. Flood warnings were issued across Wales and in parts of Scotland and western England and thousands of homes after were left without power on Wednesday night. People living in parts of western Scotland and Northern Ireland were told to be prepared for high winds. Electricity North West said that 3,500 properties in Cumbria and Lancashire were without power due to strong winds and debris bringing lines down. Nearly 900 homes were also left without power in the Neath Valley, south Wales, after a high-voltage electrical cable was blown down at around 6pm. Police closed the A595 at Moota in Cumbria after the roof was blown off a hotel. The Met Office issued 43 flood warnings in Britain on Wednesday night and into Thursday. Flooding was</p>
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2013	23-25	12	British Isles	The Guardian & The Observer	24/12/2013 - 27/12/2013	<p>3 expected across Wales, in much of Scotland and in both the north west and south west of England. There were also 126 less serious "flood alerts" issued throughout Britain.</p> <p>3. Moderate damage. Official gallantry. Official welfare. Another severe storm struck the British Isles and several thousand homes were without power with an estimated 300,000 people suffering. In Scotland, winds of up to 80mph caused further disruption on Christmas Eve, leaving some 800 homes without power in the north of Scotland. Three people died in rain-swollen rivers, including two men in Cumbria and Devon who were trying to rescue their dogs. A woman in Gwynedd, north Wales, was recovered from a fast-flowing river after she left her house to check on her water supply. With trains cancelled or severely delayed on a number of rail networks, crews have been working to clear storm debris from lines and repair power cables. The Environment Agency has 157 flood warnings in force, meaning flooding is expected, principally in the south-east and south-west of England, and a further 273 lower-level flood alerts. The Met Office has amber weather warnings in place for the west of Scotland and Northern Isles, cautioning of winds gusting to 90mph, with less severe warnings for wind and snow across all Scotland and Northern Ireland, as well as parts of north Wales and northern England. Passengers recounted storm-tossed descents into airports including Gatwick, Heathrow and Bristol, with some planes diverted at the last moment. Many other rail lines were less severely affected, including South West Trains, First Great</p>
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Western, East Coast, Virgin and local services in Wales and the Midlands. Travellers on a First Great Western service to Plymouth spent the night stranded at Taunton in Somerset. Many ferry services remained disrupted, including services between Scotland and Northern Ireland, and to the Isle of Man. By the afternoon, UK Power Networks said there were 23,379 households in the south-east without power, but added: ""Due to the severity of the storm damage in Kent, Surrey and Sussex, it may take until the end of the week to restore power supplies to the final pockets of customers in these areas, though work is continuing to reconnect supplies as quickly as possible.""

The Environment Agency (EA) said two severe weather warnings – the highest level of alert, meaning there is a danger to life – remained in place in the south-west. The EA issued 104 flood warnings across England and Wales on Christmas Day, mainly in the south-east, south-west and Midlands. The rain will exacerbate ongoing river flooding across the Somerset levels, river Severn. There are 52 flood warnings and 157 flood alerts in place, but the EA said the number of alerts may increase as rivers respond to the further band of rainfall. On the 27th it was exclaimed ""Thousands of homes are without power and many more threatened by flooding after the second major storm to hit the country in days, which saw wind gusts of more than 100mph"". The winds, which saw a peak gust of 109mph recorded at Aberdaron on the north Wales coast, sent trees crashing on to power lines, leaving tens of thousands without electricity, principally in Wales, Cumbria and the south of Scotland. Scottish Power said

2014	30 to 5	1	British Isles	The Guardian & The Observer	28/12/2013 - 06/01/2014	1	<p>the storm had knocked out electricity supplies for more than 20,000 of its Welsh customers, with supplies reconnected to all but about 5,000. Another 3,000 homes in Scotland, mainly in Dumfriesshire, remained affected. A Scottish Power spokesman said: "The main problem is the wind is still very strong, which means there is some work we can't do, for example at heights." Airports remained largely unaffected, aside from some early disruption to flights into Dublin and the Isle of Man."</p> <p>1. Major damage. Official gallantry. Impromptu gallantry. Official welfare. On the 28th forecasters warned of more wind and heavy rain to hit much of Britain before the new year as efforts continue to clear up the damage caused by last week's storms. On the 30th heavy rain forced the evacuation of families from dozens of homes, with seven people rescued by a Royal Navy helicopter from a farmhouse in Closeburn near Dumfries. About 40 houses in Kirkconnel, Dumfries and Galloway, were cleared, as were 25 in Dumfries after the river Nith burst its banks, flooding the Whitesands area. There were eight flood warnings and 119 flood alerts in place across England and Wales on Monday, with saturated ground in many areas caused by a week of downpours. The Environment Agency said it expected to issue several additional flood warnings for England and Wales on New Year's Eve and into 2014 due to a new storm heading in from the Atlantic. On the 3rd tidal surges and gusts of up to 75mph battered parts of the UK on Friday as officials urged the public not to put lives at risk by storm and wave watching, and ministers sought to tackle a potential political storm over</p>
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allegations that flood prevention could be a victim of spending cuts. Police said they were extremely concerned for the safety of Henry Martin, 18, who has not been seen since he left his home in Membland, Newton Ferrers, near Plymouth, Devon, to take pictures of the weather on Thursday. Air, sea and land searches were undertaken. Ferry services were cancelled, train services disrupted and roads closed, but conditions on Friday were not as bad as some authorities feared they might be. A check on wind speeds suggests December provided the stormiest end to the year since 1969 and one of the windiest months since January 1993. In Scotland, it was the wettest month in records dating back to 1910. A man was seen swimming in the flooded river Nith between Dumfries and Kingholm Quay, and Carmarthenshire council called in the police to move on sightseers at Burry Port, south-west Wales. The coastal town, which sits on a tidal estuary, was lashed by huge waves and winds of more than 70mph during the morning high tide. "What they cannot know is what is in these waves. The sea takes up a lot of rock, rubble and stones and throws them violently about," a council spokesman said. "Stones weighing up to one hundredweight were being flung into the car park and people were literally putting their lives at risk by being there." Tom Mansell, RNLI divisional operations manager and flood rescue team leader in the south-west, said: "The danger is really where people are going down to have a look. They don't understand how dangerous the sea can be. We would say please, please keep away from this water." As towns and villages across the country were

inundated by sea and river flooding, a pregnant woman in Cardigan was among people rescued from homes by firefighters. In Pwllheli, north Wales, the lifeboat crew helped the fire and rescue service move five people from a flooded caravan park. In Aberystwyth, Dyfed, coastal homes were evacuated. Millie Farmer, 19, a second-year undergraduate at Aberystwyth University, said the town's main beach had been destroyed and residents evacuated from seafront properties. In Scotland, the A75 in Dumfriesshire was closed for several hours after a lorry overturned in strong winds, and the A78 between Largs and Skelmorlie was closed by flooding. The Skye, Tay and Forth road bridges were barred to high-sided vehicles and speed restrictions put in place for other traffic. Owen Paterson, the environment secretary, is under pressure over job losses in roles connected to floods at the Environment Agency for England and Wales. He insisted "frontline services" would be protected, but Paul Leinster, chief executive of the agency, has admitted some roles in flood risk management are likely to go as part of 1,500 job losses. In Salcombe Devon the storm surge and fluvial flooding was such photos of people rowing down the streets were taken. Lynmouth was also highly flooded. Huge waves crashed against the promenade in Porthcawl. Surge waves also overtopped the Ardrossan harbour lighthouse in Ardrossan. The Blackpool seafront was also widely inundated with spectators having to run from the surge. A 5.6m high springtide and gale force south-westerly winds cause massive waves to pound against the promenade and harbour in Aberystwyth, Wales. The

entire promenade was closed to traffic by 8am due to safety fears and houses were evacuated. The coastal village of Sandside, Cumbria was hit by rising water as the high tide arrives. On the 5th it was stated there was relief as flood defences held but fears were still entertained for forthcoming storms. It was stated homes have been flooded from Cornwall to Scotland, although the estimated total yesterday was in the low hundreds, rather than thousands. Railway lines in north Wales were left buckled by the power of the sea, and a road collapsed in Amroth, Pembrokeshire. Police rescued four people from a flooded farm in Llanbedr, near Barmouth. Flooding in Looe and Port Gaverne in Cornwall yesterday was not as bad as feared. Indeed for much of the south-west it had proved a night of nasty weather and anxiety, but not disaster. A spokesman for Devon and Cornwall police said: "Over 100 members of the public have volunteered to assist with searches in the local area. We advise the public not to put themselves at risk." after a 18 year old boy went missing photographing the storm. His body was found 9 days later. With thousands of acres of low-lying fields transformed into small lakes as rivers overflowed, and others dotted with great grey puddles of rainfall, farmers are facing a tough time. Meurig Raymond, deputy president of the National Farmers' Union, said the report should be a "call to arms", because many rivers were not being dredged or maintained properly, leaving them susceptible to flood. The period was stated to be the worst for storms in 20 years. Coastal areas – particularly in southern England – are most at risk as they cope with a

combination of unusually high tides and another Atlantic storm on Sunday. The prime minister, David Cameron, praised the "great work" of the emergency services and Environment Agency in responding to the latest floods and defended the government's flooding policy in protecting 200,000 homes. A man and child were almost swept away by a huge wave at Mullion Cove in Cornwall as they peered over the sea wall to watch the raging sea, and elsewhere in Cornwall vehicles driving on a coastal road were swamped and almost washed away by a tidal surge. Elsewhere in Cornwall, Sergeant Regie Butler pulled a man who had been drinking from the sea at Towan Beach, Newquay, after he had ignored police warnings. In Aberystwyth, Dyfed a man was rescued by lifeboat after he defied police warnings and became trapped when photographing waves from a harbour jetty. In the town debris was strewn across the promenade, rail lines in north Wales were left buckled by the power of the sea and a road collapsed in Amroth, Pembrokeshire. The strong tides were said to be the worst to hit the Welsh coast in 15 years. Aberystwyth University has deferred the start of exams by a week and was advising students not to travel to the coastal town until the middle of next week. The environment secretary, Owen Paterson, said: "The worst of the bad weather is not yet over so I've chaired an emergency meeting of all departments involved to make sure that preparations to respond are in hand. "Our flood defences have worked very well and have protected 205,000 homes at risk."

2014	24-26	1	British Isles	The Guardian & The Observer	24/01/2014 - 27/01/2014	<p>Major damage. Official gallantry. Official welfare. Inquiry. On the 24th the flooding on the Somerset Levels was declared a "major incident" after the area was left devastated by floods covering thousands of square miles. The Avon and Somerset police chief constable, Nick Gargan, has been briefed on the situation and national resources such as large pumps are ready to be deployed. Homes and communities on the Levels remain cut off and around 17,000 acres of land lie underwater a month after the flooding began. The council is providing support to affected residents, including provision of temporary toilets, sandbag collection points in local villages and deliveries to the most vulnerable properties. The Met Office has issued an amber warning of rain for Somerset. The flooding in Somerset was discussed by MPs in the Commons this week. Ian Liddell-Grainger, MP for Bridgwater, said a huge area of Somerset was "drowning" and blamed the Environment Agency for not dredging rivers. He said communities remained cut off and important roads blocked. On the 26th it was exalimed the remnants of storm Jonas, which blanketed much of the east coast of America in deep snow, have begun to sweep in from the Atlantic. Scores of flood alerts were in place on Tuesday morning and the Environment Agency (EA) said areas already affected by record river levels, including Cumbria, Lancashire and Yorkshire. On the 27th it was reported 1 new plan to deal with the flood-stricken Somerset Levels will be drawn up within six weeks, the environment secretary, Owen Paterson, has announced during a visit to one of the worst-hit areas. Paterson said</p>
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the under-fire Environment Agency, which has been heavily criticised by local people and politicians for not dredging the area's rivers, and local councils would come up with a new scheme to alleviate flooding. Members of the Flooding on the Levels Action Group (FLAG) failed to get a word with Paterson. They remain to be convinced that things will really change. Bryony Sadler said: "We've had no answers. It's nice and tidy down here today because the minister is here but that's no good for us locals who live amongst all of it. There's no change. We needed to see this three weeks ago. We did ring them, we asked them to bring the pumps in, to get things moving but they didn't listen". "Life is stressful, exhausting, worrying. You have blue flashing lights outside your houses because we're an incident." Sue and Phil Crocker, who retired to the Levels, said the responsibility – and money – for dredging ought to be put into the hands of those who knew the ground best, the local people. "The rivers do need dredging but it's not only that: it's the whole infrastructure of the waterways. You need to go back to the local system when local people who knew the ground actually did the work." A farmer stated "The Environment Agency keeps saying that we can't stop the flooding. We all understand that. We know we are going to be flooded every so often and that's fine. But we shouldn't be flooded for months on end." The Bridgwater MP, Ian Liddell-Grainger, firmly blamed the Environment Agency for the problems on the Levels. He accused the agency of being more concerned with protecting flora and fauna than people and said the floods were the worst

<p>2014 2 to 13</p>	<p>2</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>02/02/2014 - 21/02/2014</p>	<p>2</p> <p>people could remember. Environment minister Paterson acknowledged there was legitimate anger felt among politicians, farmers and residents on the Somerset Levels. A long-term plan was to be devised to alleviate catastrophic flooding over 6 weeks which was to be devised by the EA and NGOs with a focus on sustainable urban drainage systems. "Although I am hugely disappointed that central government have not announced any additional funding, we will continue to keep the pressure on to secure a fair deal for Somerset's residents," conservative councillor Osman said. Snow was expected to fall across high ground throughout the UK, particularly across Wales, Scotland and northern England, with some hail storms and thunder predicted. Meanwhile, the Met Office said the counties of Hampshire, Dorset and Somerset remained at medium risk of flooding as another day of rain hit the regions.</p> <p>2. Major damage. Official gallantry. Official welfare. Inquiry. Another sequence of devastating storms and surges battered the British Isles with particularly devastating consequences on the West Coast. On the 12th the Met Office was warning the weather pattern that has caused flooding across swathes of the UK may continue for the rest of the month as the weekend's storms resulted in 180 more homes being inundated and led to a series of dramatic rescues. Forecasters say this week is likely to be blighted by torrential rain and winds of more than 70mph, while high tides and a heavy Atlantic swell will continue to add to the problems for the next day or so. People living near the Severn and other major rivers have been warned</p>
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of further flooding this week as water that has been gathering in uplands over the last few weeks feeds down into the system. Six crew members were rescued from their fishing boat after it was damaged in stormy seas off the wave-battered north Cornwall coast. Five were winched to safety by a Royal Navy helicopter and the sixth was recovered by the Padstow lifeboat. In Wales, 10 people were rescued from a bus in Newgale, Pembrokeshire, after it was hit by a large wave before being surrounded by floodwater. Scientists there have found that dirty floodwater contained high levels of bacteria, which could be a danger to health. The tests, by microbiologists from Reading University, on waters in Moorlands, Somerset, found 60,000-70,000 bacteria per 100 millilitres. By the 5th two severe flood warnings were in place in the south west of England on Wednesday evening as the region was hit by winds of more than 90mph, heavy rain and high tides. Around 70 flood warnings were in place across southern England, the Midlands and Wales. More than 200 properties have been evacuated in Somerset and Devon. Police used megaphone warnings from a helicopter to urge residents in the flood-stricken Somerset Levels to evacuate their homes. A 80m stretch of the seawall in Dawlish has been swept away leaving the main south-west rail line dangling over the sea. Network Rail said the extensive damage will take at least six weeks to repair, as commuters were warned of "continued significant disruption" to train services in the south-west. David Cameron pledged to take a grip on the chaos following a Combra emergency

committee meeting. The prime minister pledged to provide £100m to tackle the aftermath of the floods, including £75m to fund repairs, £15m on maintenance and £10m that has been earmarked for "urgent work" in Somerset. The Met Office and Environment Agency warned that the stormy weather is forecast to continue into the weekend. The sea raged as it thrashed the coast at Porthleven, Cornwall. Whilst waves battered coastal defences in Portmellon and the Dawlish line was completely inundated and undermined. At Portcawl in Wales waves broke over the breakwater producing spectacular scenes. Around 26 families – perhaps around 50 people – were evacuated from the seafront at Dawlish on Tuesday night. On Wednesday some of them were being cared for at the leisure centre, and Teignbridge district council housing staff were finding them temporary accommodation. Police declared a major incident and two people had to be rescued from a car. Emergency services asked sightseers to stay away as homes were also at risk of falling into the sea. The storms will have a lasting impact on people, not just here but much further west in Devon and Cornwall. An Exeter MP stated the "Loss of railway at Dawlish is true terrible news for Devon & Cornwall huge economic impact major resilience upgrades vital now." Business leaders claim the closure of the line will cost the south-west up to £30m a day in lost business. At the height of the problems on Wednesday there were nine severe flood warnings in place – meaning life is in danger. On the 6th Royal Marines who had been in the region building sandbag defences were drafted in to assist

with the evacuation of residents in the village of Moorland early on Friday morning. Prince Charles, who visited the Somerset Levels this week, telling a business conference the crisis there was a "classic example of what happens if you pay little attention to the accumulating impact of climate change". More than 140 miles away in the House of Commons, the communities secretary, Eric Pickles, announced an extra £30m for emergency repairs and maintenance. At Dawlish an estimated £100m of damage has been caused to the railway in the winter's storms by the 11th and it was predicted it would take months to repair. Coaches were required to convey passengers west of Weston-super-Mare. A top wind speed of 105mph was recorded in Aberdaron in north-west Wales, and Western Power Distribution said electricity supplies had been hit in south Wales, the south-west and the west Midlands. Gusts of 92mph have already been recorded in the Mumbles on the Gower Peninsula, south-west Wales, the weather forecaster Meteogroup said. Clifton suspension bridge in Bristol was briefly closed for the first time in its history, and the storms have also brought a number of trees down. By the 12th there are 131 flood warnings and 253 flood alerts, as of 11.06 pm. An estimated 140,000 properties were expected to be cut off from electricity overnight, mostly in Wales. A lorry driver was taken to hospital after high winds blew over his vehicle in Bristol. In Blackpool, buildings were wrecked as fierce winds savaged the Fylde coast. The storm shattered the windows of the seafront restaurant the Beach Hotel. In the Channel, an 85-year-old man died after being airlifted from a cruise

2014	Jan-00	Jan-00	British Isles	The Guardian & The Observer	07/03/2014	<p>ship that was hit by a massive wave. Bob Thomas, 77, from Caernarfon died from injuries sustained on Wednesday. A prehistoric forest, an eerie landscape including the trunks of hundreds of oaks that died more than 4,500 years ago, has been revealed by the ferocious storms which stripped thousands of tons of sand from beaches in Cardigan Bay. The forest of Borth once stretched for miles on boggy land between Borth and Ynyslas, before climate change and rising sea levels buried it under layers of peat, sand and saltwater.</p> <p>The winter storms that battered the country caused the greatest loss of trees in a generation in some areas, the National Trust has said. Woodlands, parks and gardens cared for by the trust have seen the worst damage for more than two decades, and in some cases since the "great storm" of 1987. Specimen trees have been badly damaged or blown over in gardens and parks, particularly in south-west England and Wales, but gardens outside the west have also suffered, with Tatton Park near Manchester, Nymans in Sussex and Scotney Castle in Kent all affected.</p>
2014	18-19	7	British Isles	The Guardian & The Observer	19/07/2014	<p>Minor damage. Thunderstorms and lightning were widely observed throughout Britain. Heart patients in a hospital ward in Somerset also had to be moved to safety when heavy rain brought down part of the building's ceiling in the early hours. Train services to and from Bath via Westbury were blocked by flooding on the line near Trowbridge.</p>

2014	27-28	7	British Isles	The Guardian & The Observer	28/07/2014	Minor damage. A thunderstorm struck the south with heavy rain and hail but minimal consequences beyond very localised flooding.
2014	10 to 14	8	British Isles	The Guardian & The Observer	07/08/2014 - 15/08/2014	Minor damage. Official gallantry. Impromptu gallantry. Official welfare. Impromptu welfare. Forecasters warned that Britain was to be struck by the impending remnants of Hurricane Bertha as it travelled across the Atlantic on the 7th. The Met Office has issued a severe weather warning for rain for Sunday covering Wales and southern England, bringing at least a temporary end to a glorious summer. The Met Office said the weather would turn wet and windy in many parts from Sunday morning, with severe gales likely along some southern coastal and inland areas. Ross Macleod, RNLI coastal safety manager, said: "Extreme wave heights combined with high tides can make some normal coastal activities significantly more risky. On the 10th moderate winds of 35mph were recorded in Cornwall, while Kent had up to a quarter of an inch of rain in an hour, the Met Office said. Met Office yellow weather warnings telling people to "be aware" of rainfall were issued for England, Wales and Scotland, and later extended to Northern Ireland. An EA official stated: "The Environment Agency is continuing to monitor the situation closely along with the Met Office and local authorities. Our teams are out on the ground, ensuring coastal flood defences are ready, rivers can flow freely and clearing trash screens." Almost 50mm of rain fell at Baltasound in Shetland and more than 40mm drenched Cardiff within a 12-hour period – roughly the average rain

fall for the whole of August. There were gusts of more than 50mph at Berry Head in Devon and at St Mary's airport on the Isles of Scilly on the 10th. Sporting events hit by the weather included the Sevenstar Round Britain and Ireland yacht race. The race committee initially ordered the competitors – which include Sir Robin Knox-Johnston – to sail anticlockwise to avoid the worst of Bertha. The final day of the Bristol Balloon fiesta was badly hit by the weather, with no ascents allowed. The poor weather even led to the postponement of an annual race of plastic ducks organised as a fundraiser for the lifeboat charity RNLi on the Swanbrook river in Dorset. Fire crews in Cardiff, Newport and west Wales helped householders and business people whose homes and premises were flooded by surface water. The Red Cross had hundreds of volunteers on standby to help anyone affected by the storm. Almost 60mm of rain fell at the Logan Botanic Garden in Dumfries and Galloway, south-west Scotland. Sporting events hit by the weather included the Sevenstar Round Britain and Ireland yacht race. The race committee initially ordered the competitors – which include Sir Robin Knox-Johnston – to sail anticlockwise to avoid the worst of Bertha, but with winds of more than 50mph howling up the Channel the start of the race was postponed until Monday. Fire crews in Cardiff, Newport and west Wales helped householders and business people whose homes and premises were flooded by surface water. The Red Cross had hundreds of volunteers on standby to help anyone affected by the storm. There were delays on the railways, with tracks

2014	9	British Isles	The Guardian & The Observer	<p data-bbox="1332 183 2123 821">01/09/2014</p> <p data-bbox="1332 183 2123 821">submerged in Surrey and around Bristol. Still, there was an air of defiance amongst holidaymakers and business owners at Bertha-battered Weston-super-Mare in Somerset. On the 11th in England and Wales, the Environment Agency had five flood warnings in place for the north-west of England, Wales and the Somerset coast. The rest of England, including the entire east coast, had 30 flood alerts. Severe weather warnings covering much of the country have been issued by meteorologists, while the Environment Agency has implemented 19 flood alerts. The Met Office said areas in Scotland, northern England and southern parts of Britain could see in excess of 30mm (1.2in) of rain in two or three hours. On the 14th it was stated rainfall of 'biblical' proportions had fallen but such rainfall eased as the low pressure system migrated eastwards over the North Sea.</p> <p data-bbox="1332 821 2123 1366">A return of the Guardian series Weatherwatch concerning September storms and their history. It was noted if September cannot compete with the summer months in terms of temperature, it certainly can when it comes to wind. Some of the fiercest autumn gales have occurred in September – usually towards the end of the month, but sometimes near the start. One arrived on 3 September 1964. Millibars rapidly crossed the Atlantic, bringing exceptionally high winds to west Cornwall. One of the worst windstorms ever to hit Britain happened on 17 September 1961, when parts of Ireland and western Scotland were hit by the tail end of hurricane Debbie. More recently, in mid-September 2011, the remnants of hurricane Katia led to near hurricane-force winds across</p>
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2014	6 to 7	10	British Isles	The Guardian & The Observer	06/10/2014 - 07/10/2014	<p>much of the UK, with a maximum gust of 132 km/hour (82 mph).</p> <p>Minor damage. Official gallantry. Storms came to the British Isles bringing heavy rain and strogn winds to much of the West and North. The Met Office had issued severe weather warnings for much of the western side of the country, and strong winds caused problems on the railways and for electricity suppliers. A fallen tree at Lambrigg, Cumbria, brought down the overhead power line on the west coast mainline, and affected services throughout the day. The strong winds, which reached 84mph overnight on South Uist in the Western Isles. About 2,000 homes in the Workington area of Cumbria were affected at around 8am, with most having supply restored within an hour. Heavy rain was reported across the west, with 44.8mm falling in Camborne, Cornwall, and 43.8mm in Llanfrynach, Powys. "It is windy and Scotland will get the worst of it tomorrow. In the Western Isles there will be some strong winds. On the 7th it was reported Autumn returned this week after a sun-soaked September with no let-up expected in the heavy rain and high winds battering Britain.</p>
1987	15-17	10	British Isles	The Guardian & The Observer	06/10/2014	<p>A historical reflection on the Great Storm of 1987. It was exclaimed: "outhern Britain went to bed on 15 October with warnings of high winds; it awoke to a scene of destruction unparalleled in modern peacetime. Trees blocked roads and railways, roofs were blown off, cars crushed and more than 20 people were killed". Famously, BBC weatherman Michael Fish dismissed the suggestion that a hurricane was about to hit, and technically of</p>

2014	20-21	10	British Isles	The Guardian & The Observer	16/10/2014 - 21/10/2014	<p>course he was right: the storm was a cyclone that arose as a deep depression in the Bay of Biscay, and then moved rapidly north-east during the night of 15 October to cross northern France and southern England. Winds exceeded 100mph in several places, with the highest gusting speed recorded in Gorleston, Norfolk: of almost 200km/h (122mph).The destruction was so great because many of the trees still had leaves on, which meant that instead of the wind blowing through the branches it met resistance, causing them to fall. Some good did come out of this terrible event: after an inquiry the Met Office overhauled its early warning systems, so that should such a storm occur again there will hopefully be fewer lives lost. Minor damage. Official gallantry. Official welfare. On the 16th remnants of Hurricane Gonzalo were predicted to hit the UK producing strogn winds as the systems tracked westwards. The large area of low pressure has conjured up warm air from the south, which is expected to send the mercury up to 20-21C in London over the weekend. But blustery showers will leave people feeling much cooler. Williams of the Met Office stated: "The bulk of the rain or showers will be in the west, but there is some dense cloud area over central parts of the south of the UK. There might be some wind and rain in those places." On the 20th it was said gusts of up to 75mph in coastal areas and 65mph inland will tear across much of the country bringing disruption to many areas, particularly to travel. "The area of rainy, windy weather will then move eastwards, varying in intensity across the UK, with the strongest gusts on the coasts. We can expect gusts up to</p>
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65mph in the north west tomorrow morning, and up to 50mph in central and eastern parts of England in the afternoon.” The Met Office had issued a yellow, ‘be aware’ weather warning. “There remains the potential for localised disruption to travel, especially as the strongest winds will coincide with rush hour in places. On the railways, poor conditions caused delays to commuter services, particularly in southern England, while on the roads some bridges in Scotland were closed to high-sided vehicles. The A87 Skye bridge and the A898 Erskine bridge were among those closed to high-sided vehicles. Flooding in Wales meant buses had to replace trains between North Llanrwst and Blaenau Ffestiniog, with the disruption likely to last for the rest of the day. A Network rail spokesman stated: “Our fleet of special leaf-busting trains are working to keep the rails clear of slippery leaf mulch and, where the railway is prone to flooding, we’ve made sure pumps are clear and in full working order should they be needed. Trees were uprooted across Cheshire as police warned motorists to drive carefully. Reports of trees down were made in Runcorn, Macclesfield, Tarporley and Rode Heath. A number of ferry crossings between Holyhead, North Wales, and Dublin were cancelled, Irish Ferries said. Flooding in Wales meant buses had to replace trains between North Llanrwst and Blaenau Ffestiniog, with the disruption likely to last for the rest of the day. A Network Rail spokesman said: “Strong winds, torrential rain and large quantities of fallen leaves are making conditions difficult on the railway today. Just like motorists on the roads adapt their driving style to the

2014	9 to 12	12	British Isles	The Guardian & The Observer	06/12/2014 - 12/12/2014	<p>conditions, train drivers are having to take extra care accelerating and braking to avoid overshooting platforms or signals.” “We’re working closely with train operators to keep people moving and have response teams ready to clear fallen trees and any other debris blown on to the tracks. In some locations, speed restrictions are in place so trains can stop in time if an obstruction is spotted.” North West motorway police said they had received many reports of standing water which led to hazardous driving conditions in the region. Sean Penston, a forecaster with weather company MeteoGroup, said: “The area of rainy, windy weather will move eastwards, varying in intensity across the UK, with the strongest gusts on the coasts. We can expect gusts up to 65mph in the north-west this morning, and up to 50mph in central and eastern parts of England in the afternoon.”</p> <p>Moderate damage. Official gallantry. Official welfare. On the 6th the Met Office warned a deep low pressure was approaching the British Isles which would bring a powerful storm which would cause inconvenience throughout the UK. Looking ahead to the coming week, a spokesman for the Met Office said: “We’re expecting the first real cold blast in these parts. We will see snow on the hills, and in the south of England perhaps some sleet and hail.” Scotland will be the worst-affected region, with around 10cm or more of snow expected on mountains. “Across the tops of the Scottish mountains it will be pretty horrendous.” On the 9th A “weather bomb” is expected to bring 80mph winds to the UK on Tuesday evening, as wintry storms batter parts of Britain. “weather bomb” is expected to</p>
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bring 80mph winds to the UK on Tuesday evening, as wintry storms batter parts of Britain. On the 10th it was reported Scotland and Ireland have been battered by gales today, with thousands left without power in the Highlands and Western Isles as winds reached nearly 150mph on some outlying islands. Waves of up to 50ft were recorded along the west coast of Scotland, with Stornoway coastguards designating the tidal surges as “phenomenal”. Many trains and ferry services across Scotland were cancelled overnight in anticipation of the extreme conditions, and the Forth and Skye road bridges were closed to vehicles for a time, with gusts of up to 70mph recorded on the Tay bridge. A gust of 81mph was recorded in Tiree while South Uist was hit by 79mph gales, according to the Met Office. The strongest wind – 144mph – was recorded on Hirta, the largest of St Kilda’s islands, in Scotland’s Outer Hebrides. In the Western Isles, the worst-hit area of the country, all schools, nurseries and council facilities were closed with police advising the public not to travel unless it is absolutely necessary. Fifteen flood warnings and twelve flood alerts have been issued by the Scottish Environment Protection Agency (Sepa), and the Met Office has upgraded its warning to amber “be prepared” status for the west coast of Scotland, the Highlands and Islands. People have taken to social media to warn fellow travellers of disruption, using the hashtag #weatherbomb. In the early afternoon, Network Rail Scotland tweeted that a garden shed had been blown on to a railway line near Bowling in west Dunbartonshire. Steve Willington, chief meteorologist at

the Met Office, said: "Very strong winds are likely to affect northern and central parts of the UK until early Thursday as a very deep low-pressure system moves slowly eastwards between Scotland and Iceland. A period of severe gales is likely over northern and central Britain, as well as the potential for storm force winds over north-western coastal areas of Scotland." Deputy first minister John Swinney, who met the Scottish government's resilience committee last night to plan for the bad weather, said: "It's important to keep this in context, it's not a surprise that Scotland faces severe winter weather. We face it to a greater or lesser extent every year". Swinney said: "The government has been working closely with the power companies, with our resilience partnerships throughout the country, and with transport providers to make sure that normal service is delivered as much as we possibly can do. "Obviously there has been transport disruption, principally on the ferry network and also on some of the coastal rail services where it's just been unsafe to run trains because of the dangers of the coastal flooding that could have taken place." By 16:00 on the 10th the Guardian reported: Power has been restored to 27,000 homes in Scotland, but thousands more remain with power in the Highlands, Shetland and Western Isles. Power has been restored to 27,000 homes in Scotland, but thousands more remain with power in the Highlands, Shetland and Western Isles. By the 11th engineers are still working to restore power to around 330 homes on the Western Isles after cables suffered lightning damage in the heavy storms. Schools, nurseries

<p>2015 8 to 15</p>	<p>1</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>07/01/2015 - 15/01/2015</p>	<p>and council facilities in the Western Isles, the worst-hit area of the country, are planning to open as usual after they were closed throughout the 10th. Scottish Hydro Electric Power Distribution said that, despite gale force winds and huge waves, it was lightning which caused the most damage to the electricity network. The company said bolts struck six wooden poles on the Skye transmission network, causing region-wide power loss across the Western Isles twice. When lightning struck equipment directly it took longer to restore power to customers because new equipment had to be installed. Alan Broadbent, director of engineering at Scottish Hydro, said: "We prepared for the storm with hundreds of additional staff and resources. "We knew that lightning would be a feature of this so-called weather bomb but predicting the intensity and frequency of strikes is almost impossible".</p> <p>Moderate damage. Official gallantry. Official welfare. On the 7th it was reported that Britain is set to be battered by gale-force winds this week as a 250mph jet stream surges in from the Atlantic. Experts warned that gusts of up to 90mph could lash the country on Friday, sparking fears it could tear down trees and power lines and wreak traffic chaos. The powerful jet stream will hit in earnest overnight on Thursday into Friday, triggering a yellow warning from the Met Office. Meteorologist Mark Wilson of the Met Office : "Our best advice is to be aware of the strong winds and to check our weather warnings. It could have an impact on transport and services and cause structural damage." The AA advised warned drivers faced</p>
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“potentially hazardous” conditions. On the 10th it was excalimed in the Guardian 113mph winds chill and batter the country this weekend, leaving tens of thousands of homes without power, and with snow on the way, it may be difficult to remember that the UK is having a milder-than-average winter. ScotRail temporarily suspended all services for safety reasons on Saturday, and ferries were cancelled, roads closed, trees uprooted, power lines toppled and lorries blown over. The 113mph wind was recorded at Stornoway on Lewis on Saturday, the strongest since records at that site began in 1970, while winds of 76mph were recorded at High Bradfield in South Yorkshire, and Aberdaron, Gwynedd. The worst-affected areas were the Highlands and islands of Scotland, where 100,000 properties lost electricity. The worst-affected areas were the Highlands and islands of Scotland, where 100,000 properties lost electricity. Met Office forecaster Simon Partridge said: “Another low pressure system is heading for north-west Scotland, bringing winds of 50-60mph and gusts of up to 80mph. Scottish Hydro Electric Power Distribution said staff were “facing a monumental task” in getting to damaged lines in remote parts of the country. “Welfare vans” have been sent to the worst-affected areas in the north of Scotland, offering hot food and drinks, while care has been organised for the most vulnerable customers, the company said. Partridge said the warm temperatures were “not quite record-breaking but very rare”. On the 15th it was stated: After snow and ice forced the closure of hundreds of schools and nurseries in Scotland, Wales and Northern Ireland, the UK

is facing several days of gale force winds and a weekend of sub-zero temperatures. The Met Office said another deep Atlantic low pressure system was affecting northern Britain, bringing with it high winds and heavy rain across much of the country. In parts of Cornwall, South Wales, Tayside and Teesside there have been reports of thundersnow – a storm with thunder and lightning but snow instead of rain. Heavy snowfall blocked the railway line in the Highlands between Blair Atholl and Drumochter as snowplough trains worked through the night to keep the rail network open. Network Rail said a limited number of train services were suspended from noon on Wednesday because of heavy winds and no trains would run on the Dumbarton central to Helensburgh central and Glasgow to Oban lines until 6pm on Thursday. As for Thursday, he said: “We may see wintry showers across the UK with sleet, snow and rain. The Environment Agency issued 32 flood warnings in England and Wales, and 149 flood alerts, while a further 21 flood warnings were issued in Scotland. The Environment Agency issued 32 flood warnings in England and Wales, and 149 flood alerts, while a further 21 flood warnings were issued in Scotland. The worst hit areas were south-east England, where 13 warnings were in force, and the south-west with seven warnings. The river Tone in Somerset burst its banks outside Taunton blocking dozens of lanes. First Great Western rail services to Devon and Cornwall were suspended after a train struck a fallen tree between Newton Abbot and Paignton in Devon. Western Power said that more than 400 homes in Cornwall faced power

cuts after high winds brought down lines. A Met Office “be aware” weather warning is in place for rain and high winds, with gusts of up to 80mph possible in coastal areas. The highest wind speed recorded by the Met Office was 96mph in Capel Curig, in Gwynedd, north Wales. In Scotland, severe weather, including heavy rain and snow, caused dozens of train services north of Glasgow to be cancelled until at least 6pm. Snowploughs and chainsaw gangs were deployed to try to clear the network of snow and fallen trees, Network Rail Scotland tweeted. Video footage showed storm surge waves lashing the line at Saltcoats, south-west of Glasgow, forcing the suspension of services. Some ferry services were suspended and more than 100 schools were shut in the Highlands and Islands, Perthshire and Northern Ireland due to the weather. Ferries between the region and Scotland have been suspended. The Stena Line ferry between Belfast and Liverpool has also been cancelled. Darron Burness, from the AA’s severe weather team, said: “Flooding could be an issue as the snow gives way to rain. If in any doubt, don’t risk crossing a flooded road or ford – just turn round and find an alternative route.” Several routes in the north of Scotland were closed due to drifting snow and fallen trees, and Cumbria police warned of icy conditions after receiving up to 40 reports of road collisions across the county. The British Red Cross urged people to prepare for adverse weather in the coming days. Simon Lewis, head of emergency planning, said: “Putting together an emergency kit to take with you on the move or keep at home is a great way to start – being sure to include items

<p>2015 28 to 3</p>	<p>2</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>28/01/2015 - 30/01/2015</p>	<p>such as a torch, spare batteries, emergency contact details, bottled water and, if travelling by car, consider taking a shovel.”</p> <p>Minor damage. Official gallantry. Official welfare. On the UK braced for the more snow across the large swaths as the Met Office sounded the meteorological pibroch. A Met Office yellow “be aware” warning is in place from noon for large parts of England. Meanwhile, Dr Angie Bone, head of extreme events team at Public Health England, said: “In this sort of weather we know that older people and people in poor health tend to stay indoors. “While this is sensible, it’s worth remembering these people may need help getting to a hospital or GP appointment, with shopping or prescription fetching, or just someone to talk to. If you know someone in this situation, and most of us do, think about what you can you do to help out”. By the 29th in Scotland, 29 schools and nurseries closed in the Highlands and 22 in Dumfries and Galloway. Cumbrian authorities closed 34 schools, half of them in Carlisle. David Cameron said he had asked for an update on heavy-snow contingency plans. He tweeted: “I have asked for an update on our heavy snow contingency plans. The gritters are out and people should listen to warnings.” Gritters and snow ploughs were out in force on the morning of the 30th as winter tightened its grip on large swaths of the UK. Northern parts of the UK were worst hit by the snow storms. Tulloch Bridge in Inverness-shire had 23cm of snow, while there was 21cm at Glenanne in Armagh and Spadeadam in Cumbria had 13cm. On the 3rd it was reported large swaths of the UK have woken up to a layer</p>
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<p>2015 21 to 22</p>	<p>2</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>22/02/2015</p>	<p>of snow after the coldest night of the year in England and Northern Ireland. Observation stations in Shap in Cumbria and Katesbridge in County Down both recorded temperatures of -9.1C, the lowest of the year. Northerly winds will bring snow to most areas of the UK, with only western coasts and some low-lying areas of Northern Ireland escaping with sleet and rain, the Met Office said. Moderate damage. Official gallantry. Official welfare. Strong winds and blizzard conditions hit Northern Britain. A yellow "be aware" warning is in place for the north of England and throughout Scotland. Meanwhile there are currently more than 50 flood alerts out across England and Wales, with the majority in the south of the country. Strong winds and higher tides than average have prompted a warning over a flooding risk brought on by large waves in coastal areas. People walking on coastal paths and promenades are urged to take care, the Environment Agency said due to storm surge risk. The incident happened as a blast of snowy weather brought blizzards and treacherous road conditions to parts of northern Britain. The wet weather arrived from the Atlantic Ocean on Sunday morning, bringing rain to much of the country as well as snow to Scotland and the higher areas of northern England. Forecasters said more is on the way. There are currently 16 flood warnings and more than 40 flood alerts in place across England and Wales, most covering western coastal areas. Strong winds and higher than average tides have prompted a warning of flooding risk caused by large waves.</p>
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2015	27-28	4	British Isles	The Guardian & The Observer	28/04/2015	Minor damage. Much of the North of Britain received an Article blast causing much inconvenience throughout. A Met Office forecaster warned of icy patches in Scotland and Northern Ireland, and said even the south of England woke up to frost. Wind and rain are expected throughout Britain overnight on Tuesday. Keates said: "Persistent rain will hit all areas through the course of the night. We will see a short, sharp burst of rain – squally rain.
2015	12 to 13	11	British Isles	The Guardian & The Observer	13/11/2015	Moderate damage. Official gallantry. Official welfare. On the 11th forecasters issued weather warnings for the impending storm Abigail. Initial yellow "be aware" warnings for rain and winds up to 80mph were issued for the Western Isles and the Highlands of Scotland for Thursday evening into Friday, and they have now been changed to amber "be prepared" warnings. The forecasters said gusts of 60-70mph were expected, with some gusts of more than 90mph in exposed locations. The ferry operator CalMac warned of likely disruption to services and urged travellers to think carefully if planning to visit the west coast. Its operations director Drew Collier said: "There is a clear warning that major weather-related disruption to ferry services on the Clyde and Hebrides routes is likely later this week, so I would urge people to factor this in when making travel plans. The sea conditions we are expecting could well be too treacherous to sail in." By the 13th thousands of homes lost power, dozens of schools were shut and bridges were closed to high-sided vehicles as storm Abigail brought gale-force winds of up to 84mph to northern Britain overnight. Scotland has been worst hit by the strong gusts, which prompted a number

of Met Office amber warnings, but the rest of the UK can expect heavy, thundery showers throughout the day as Britain's first named storm sweeps its way down the country. A yellow warning covered most of Scotland and part of the south-west of England and Wales. ScotRail said there was minor disruption on its routes from Glasgow to Carlisle/Newcastle, Glasgow to Ardrossan/Ayr/Largs and Kilmarnock to Ayr. Meanwhile, Dumfries and Galloway police said there are a number of trees down across the region. Traffic Scotland said a fallen tree on the A82 is partially blocking the road and affecting traffic in both directions. The Scottish Environment Protection Agency (Sepa) has flood alerts and warnings in place for Dumfries and Galloway, Argyll and Bute, Ayrshire and Arran, Skye and Lochaber, and Speyside. Members of the public have been asked to secure any loose debris, while builders have been advised to secure scaffolding and any loose items on building sites. The Scottish Fire and Rescue service has urged people to take extra care if they are using candles during any power cuts. The storm is the first such weather system affecting the country to merit a name as part of a Met Office project that invited the public to suggest names. Officials hope the initiative will help raise awareness of severe weather and ensure greater public safety. The Environment Agency has sent water pumps to Cumbria and issued flood warnings for areas in northern England this weekend as heavy rain is expected to fall on already saturated ground. The agency said Cumbria, Lancashire, Greater Manchester, and North and West Yorkshire were most at risk of significant river flooding

2015	17-18	11	British Isles	The Guardian & The Observer	16/11/2015 - 18/11/2015	<p>and localised surface water flooding on Saturday and Sunday. Leon Brown, a meteorologist at Weather Channel UK, said heavy rainfall could be expected across Ireland, Wales and north-west England, and eventually southern and western Scotland. "Since rivers are already high, local flooding is likely," he said. "We may see 100-150mm over west Cumbria and widely 50-75mm." There are two flood warnings in place, at Keswick campsite in Cumbria and Aberystwyth in west Wales, and 23 flood alerts. storm Abigail left more than 20,000 homes without power and forced schools to close in Shetland and the Western Isles. The Highlands and Islands were worst hit by gusts of 84mph while the rest of the UK experienced thundery showers.</p> <p>Minor damage. Official gallantry. Official welfare. Storm Barney was forecast to hit the UK with Met Office warnings being widely communicated on the 16th. The Met Office said Barney could bring gusts of up to 70mph inland and potentially 80mph along exposed coasts, particularly in Wales and through the Bristol channel on Tuesday. A yellow "be aware" warning for strong winds has been issued for parts of Wales, southern, central and eastern England. Meanwhile, north-west Scotland is facing severe gales on Monday, with a weather warning forecasting gusts of 65-75mph. On the 17th and 18th Thousands of homes were left without power in Wales, the Midlands and southern and eastern England, while rail services were disrupted as Storm Barney struck Britain. Neil Davies, duty flood risk manager at the Environment Agency, said: "The power of mother nature is a fascination</p>
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2015	28-29	11	British Isles	The Guardian & The Observer	29/11/2015	<p>to us all – and taking storm selfies may seem exhilarating – but over the last few years we’ve had an increasing number of people putting themselves and family members at severe risk along coastal paths and promenades.”</p> <p>Minor damage. Official gallantry. Official welfare. Storm Clodagh was forecast to hit the UK with gusts of 70 mph forecast by the Met office and several societal events cancelled due to the predicted oncoming depression. Blustery winds cancelled many illuminations for Christmas. The EA issued a number of flood warnings for much of England and Wales particularly in the North-west and South-west. Winds of 70mph set waves crashing over quays in the West and caused disruptions as felled trees blocked roads and railways. Sunday’s list of travel cancellations included Cambuslang in south Lanarkshire, Irvine in north Ayrshire, Kilmarnock, Stoke, Maidenhead, Lichfield and Gosport. Emergency services were called out on multiple occasions to aid the distressed.</p>
2015	4 to 6	12	British Isles	The Guardian & The Observer	04/12/2015 - 11/12/2015	<p>Major damage. Official gallantry. Official welfare. Impromptu welfare. Inquiry. Forecasters predicted heavy wind and rain would again strike the UK on the 4th as storm Britain enveloped the UK. The Met Office stated: “Be prepared for the likelihood of flooding affecting properties and parts of communities. Watercourses may become dangerous, deep and fast-flowing, while some transport disruption seems likely.” Forecasters said rainfall of 60-100mm was likely in the amber zones, with some mountainous areas seeing in excess of 150mm, possibly up to 200mm, over a 30-hour period. The Scottish</p>

Environment Protection Agency (Sepa) had 15 flood alerts in place around the country and three flood warnings in Tayside. Scotland's environment minister, Aileen McLeod, said the government and Transport Scotland were closely monitoring the situation, supporting the efforts of local authorities and the emergency services. By 20.30 on the 5th a major incident had been declared. The Guardian reported: Thousands of homes across northern England and Scotland are under threat of flooding in the wake of Storm Desmond, with Cumbria police declaring a major incident. Rainfall of 2.4in to 3.9in (60mm to 100mm) is likely in many amber zones, with some mountainous areas recording more than 5.9in (150mm) over a 30-hour period. The prime minister, David Cameron, tweeted on Saturday night: "My thoughts are with all affected by Storm Desmond. Teams are working to ensure swift response and help for those who need it." Cumbria fire and rescue service said the flooding was "unprecedented" as the Red Cross was called in to support affected residents. Police and mountain rescue teams helped residents in some parts of the Lake District to evacuate their homes, and several people were rescued from cars caught by floodwaters. Train services between Carlisle and Preston were cancelled due to flooding until Sunday. Dozens of flights were cancelled at Dublin airport along with many Aer Lingus regional flights. Roads were closed across large parts of the northern England and Scotland. Hundreds of homes in Wales were left without power as strong winds battered power lines. Ferries from Ireland to Britain have been cancelled while flights have been

diverted due to winds of up to 74mph (118km/h) whipping in from the Atlantic. Electricity North West confirmed that the majority face shortages for “a number of days” as it works to fix further faults caused by the flooding. The military have been on the ground. Around 350 army personnel have been made available from 2nd Battalion Duke of Lancaster’s Regiment, based in Weeton Barracks near Preston, to assist with the general flooding response since the early hours. Carlisle, in Cumbria, was one of the most worst hit areas. Hundreds of homes have been flooded and more than 1,000 people evacuated. Parts of Cumbria have been hit with more than a month’s worth of rain in just 24 hours. Shap in Cumbria, saw 262.6mm of rainfall. Environment Secretary Elizabeth Truss said: “We know what a devastating impact flooding has on communities and our thoughts are with those affected this weekend.” She added: “I urge people to check the latest flood updates via the EA website and Twitter.” Flood defences such as those used in Cumbria were built to withstand flooding “of a certain magnitude”, according to the Environment Agency – but they can be overcome in extreme storms or if they have been poorly maintained. In Keswick, another Cumbrian town, the primary flood defence is a reinforced concrete wall made out of local slate and a 122-metre-long glass panel. Further floodgates have been installed across roads in other at-risk areas of Cumbria, rising to 1.8 metres in the most vulnerable places. About 42,000 households in Lancaster, Morecambe and Carnforth in north Lancashire found themselves again with no power on Monday

evening, a failure that came hours after Electricity North West said it had restored power in the region. In Cumbria, 2,657 properties were still without power as night fell, with floodwater restricting access for Electricity North West teams. Cumbria police estimated that a total of 4,881 homes were flooded across the county, saying that in the “reasonable worst-case scenario” there could be a total of 6,455 homes affected. Thousands of people remained homeless. David Cameron visited Carlisle, where police estimated between 2,200 and 3,500 homes had been flooded. Touring one victim’s home, the prime minister promised to look again at the government’s response and said the Environment Agency would assess its response to see what lessons could be learned. “After every flood, the thing to do is sit down, look at the money you are spending, look at what you are building, look at what you are planning to build in the future and ask: ‘Is it enough?’” His visit came after ministers were accused of failing flood-stricken communities in north-west England, after Labour highlighted a £115m fall in spending on risk management and defences this year. The Labour leader, Jeremy Corbyn, accused Cameron of making “false promises” and ignoring projections from scientists about the scale of flooding that would be caused by climate change. In Carlisle, many residents had to be rescued by lifeboat as their streets were engulfed by the river Eden following heavy rain on Saturday. The night of the 7th, 16 severe flood warnings, 58 warnings and 30 alerts remained in force in England and Wales, relating to the rivers Eden, Greta, Caldew and Wyre. In Scotland, 11 flood

warnings remained in place. Train services were restored north of Preston, but major disruption continued in northern England, with services operated by the Caledonian Sleeper, TransPennine Express, Northern Rail and Virgin affected. Giving a statement to MPs in the House of Commons on Monday, Truss said temporary defences and pumps were moved to north-west England, with 200 military personnel mobilised and a Chinook helicopter made available as part of the emergency response on Saturday. A spokesperson for Cumbria county council said: "This level of damage is unprecedented and we have had staff working flat out to assess the scale of what's happened and begin to put plans in place. It's still dangerous out on the road network and we're urging people to stay away from closed bridges and damaged roads". By the 8th Storm Desmond has caused an estimated £500m of damage across Cumbria according to PwC which was double the cost of the storms of 2009. Barrie Cornes, insurance analyst at Panmure Gordon, agreed that insurers were braced for a larger bill. His estimate for claims was between £250m and £300m. The industry body, the Association of British Insurers, said it was too early to estimate the cost for the insurance industry. Rob Johnston, chief executive of the Cumbria Chamber of Commerce, said some smaller businesses were not insured because of the increased cost since the area was hit last time. He estimated that 4,000 out of the 25,000 businesses in the area were in some way feeling the impact of the floods. Johnston called for £10m from central government to help businesses in trouble and to

also help relocate them within the area to places where they can avoid being flooded next time. The government said it would give temporary relief on business and council tax for homes and businesses, a move welcomed by employers' body the CBI. "This is a helpful intervention from the government for families and businesses forced out of their properties by Storm Desmond," said Damian Waters, CBI North West director. But, he said: "These floods underline once again why we must continue to invest in our flood defences and review existing preparations for potential events like this in the future." United Biscuits were also affected and it was stated by an official spokesperson: "The company greatly appreciates the positive attitude and enthusiastic offers of help from the local employees and their colleagues across United Biscuits to resume business as usual." Consumers will be fearful that their insurance premiums will rise even further, although the introduction of the government-backed Flood Re in April should limit any rises. Flood Re is a way by which the cost of flood risk of insurers is reduced. It was a different matter for the homes and local businesses – the hotels, garages and hairdressers' – that have been flooded just before Christmas, Flanagan said. "For the individuals it's tragic, so close to Christmas." The government's spending on flood defences has come under criticism after it emerged that a prevention scheme for the Cumbrian town of Kendal, which was submerged by up to 5ft (1.5 metres) of water after the weekend's storm, was repeatedly postponed. On the 8th Flood waters were largely receding across the county on Tuesday, with the

<p>2015 23-25</p> <p>12</p>	<p>British Isles</p> <p>The Guardian & The Observer</p> <p>23/12/2015 - 27/12/2015</p>	<p>cleanup beginning in towns such as Carlisle, where footballers from Carlisle United were among those joining volunteers. The Environment Agency said 16 severe flood warnings remained in place for north-west England. The Labour leader, Jeremy Corbyn, had on Monday highlighted a £115m fall in spending on flood risk management this year compared with last when spending peaked after the floods of winter 2013-14. However, the National Audit Office has previously concluded that funding fell 10% in real terms in the last parliament, when one-off emergency grants were excluded, and the government's own climate change advisers warned of a £500m hole in spending. On the 11th it was stated manmade climate change was partly responsible for Storm Desmond's torrential rain which devastated parts of Scotland, the Lake District and Northern Ireland, scientists have concluded. The researchers at Oxford University and the Royal Netherlands Meteorological Institute (KNMI) calculated that climate change had made the flooding event 40% more likely, with the estimate of the increased likelihood ranging between 5% and 80%. "Ten years ago we could never make a link to climate change with a specific weather event. Now we can do it in real time. A positive attribution for an extreme rainfall event like Desmond is still rare." Moderate damage. Official gallantry. Official welfare. On the 23rd it was broadcast that storm eva was approaching and set to hit the United Kingdom. The EA issued flood warnings across the north-west and Wales and flood warnings were once again issued for areas still struggling</p>
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to clear up in the wake of Storm Desmond. Cumbria police said they did not expect the disruption caused by Storm Desmond to be repeated after Eva hits, but said rainfall would be falling on already saturated ground and is likely to cause surface water flooding on roads across the county. Warnings were issued widely to motorists to take extreme caution and not to ignore warnings as drivers were stated to be potentially putting their lives at risk. On the 26th almost 150 flood warnings issued as up to 120mm of rain set to fall in north of England – worsening situation in areas already saturated by winter storms. The warnings south of the border, which mainly cover the north-west and north-east of England and Wales, come as forecasters said up to 120mm (4.7in) of rain could fall in some areas already saturated by winter storms. A red weather warning, the most serious alert, for heavy rain and flooding in Lancashire. As members of the armed forces continued to assist in inundated areas of Cumbria on Christmas Day, the government’s emergency Cobra committee met and further flood warnings were issued. The Met Office said December had been the wettest since records began. The army was deployed in Cumbria to build up defences before the heavy downpours of Eva and 80mph winds hit. Floods minister Rory Stewart said that rainfall levels in the flood-hit areas were unprecedented. “We’re looking potentially again today at maybe a month’s rainfall coming in a day. That’s falling on ground that’s very saturated. As the rain falls, the rivers respond very quickly,” he told the BBC Radio 4 Today programme. Battalion Duke of Lancaster’s Regiment,

based at Weeton barracks near Preston, arrived in the beleaguered Cumbrian town of Appleby early on Friday morning to help build new flood defences, the Ministry of Defence said. Defra said more than 700 EA staff were on standby, many already checking flood defences, clearing blockages and monitoring water levels, with 85% of the country's temporary flood barriers now in use in Cumbria. "With heavy rain expected later today and tonight, we urge people to remain vigilant. We also want to remind people never to drive through flood water: just 30cm of flowing water is enough to move your car." High tides and strong waves are expected to hit the south and west coasts of England over the coming days, with the EA warning Boxing Day walkers to take special care on coastal paths and promenades as storm surge risk increased. On the 27th a letter in the Guardian from a reader read: Is it not time to think beyond the use of sandbags (Troops called into Cumbria, 26 December) and consider flood-defence systems that have worked elsewhere and have stood the test of time? We cannot just keep building higher banks and walls to keep each river within its existing narrow watercourse; the trend of increasing levels of flooding will go over the top or find a way round the side. Each area's remedy requires significant central government funding for the purchase of land and the relocation of communities from extreme locations. It's too much to accept being flooded out three times in a month. Overall it was stated "storm troops are no answer to the likes of Eva".

2015 29-31	12	British Isles	The Guardian & The Observer	28/12/2015 - 01/01/2016	<p>Moderate damage. Official gallantry. Official welfare. Impromptu welfare. The Met Office warned of yet another storm heading the way of North-west Britain as a depression named Storm Frank approached the UK from the West. Up to 80mm of rain is predicted to fall on high ground, and potentially in excess of 120mm in exposed areas, with large swaths of the UK seeing up to 40mm. Yellow warnings were widely issued for North-west England and Wales as well as amber warnings in Southern Scotland. Storm Frank is building up in the Atlantic, with the front to push in on Tuesday night into Wednesday. The centre of the low pressure system is expected to pass just north of the UK, but it will carry behind it a slow-moving front that will trail across the country bringing torrential rain. A yellow warning for wind on Wednesday was also issued for Scotland, northern Ireland, Wales, north-west England and south-west England. In Scotland, there were two severe weather warnings – signalling danger to life – for Whitesands in Dumfries and The Tweed in Peebles, and one severe weather warning in England, in Croston, Lancashire. The Clifton Suspension Bridge in Bristol was temporarily closed to vehicles because of the weather for only the second time in its 151-year history. High winds produced a 55mph gust in the Avon Gorge. In the English counties of Lancashire and Cumbria, where residents who have already been badly hit by flooding were braced for fresh inundations, people were breathing a sigh of relief as it appeared the sixth winter storm of the season had largely passed them by. On the 30th thousands were without power as the storm</p>
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battered Britain. In the English counties of Lancashire and Cumbria, where residents who have already been badly hit by flooding were braced for fresh inundations, people were breathing a sigh of relief as it appeared the sixth winter storm of the season had largely passed them by. An extra 10,000 sandbags were filled to combat what is expected to be widespread and significant flooding, particularly in Dumfries and Galloway and western parts of the Borders. Scottish Southern Electricity confirmed 5,500 homes were without power throughout the Inner Herides with engineers hampered by winds of 90mph. The government released a further £50m to councils to help households and businesses deal with the aftermath of the floods. PwC estimated losses from the recent succession of storms could reach £3bn. "The storms this time have generated a far greater proportion of non-insured losses compared to the total economic damage," said Mohammad Khan, general insurance leader at PwC, in a statement. Two children were among a total of 12 people who were rescued from a bus after it stranded in flood water in Scotland, according to new details coming through about that rescue which we reported on earlier. Ten passengers were airlifted by a Royal Navy helicopter from the vehicle when it became stuck in Dailly, South Ayrshire, at about 1.35pm on the 30th. The Chancellor, George Osborne, has been accused of jeopardising Britain's crumbling flood defences over the past five years by prioritising cuts to the deficit, and has also been warned that infrastructure spending may need to rise sharply to adapt to climate change. Professor Simon

Wren-Lewis, of Oxford University, who has analysed data on recent flood spending, said there was little sign that the government had changed course to take into account the growing threat of extreme weather. On the 31st Heavy rain continued to pour as Nicola Sturgeon, Scotland's first minister, visited shops and businesses devastated by the floods in Newton Stewart, Dumfries and Galloway. Corbyn praised local flood efforts and criticised the prime minister for his visits to less deprived neighbourhoods. In Dumfries, the recovery work focused on the Whitesands area by the river Nith, where one of the country's two severe flood warnings was issued on Wednesday evening. Teams of council workers were removing branches and other debris from the riverbank, while volunteers helped clear thick mud from a row of business premises. When the Nith overflowed on the 30th flood waters rose several feet into shops and cafes along the riverside. "It's sad, but I'm happy at the same time because people have been so good and helpful," he said. "It would have taken me weeks to clear this all on my own. My spirits have really been lifted." On the 1st the EA also warned of the potential of localised flooding on the Cornish peninsula. The Scottish government's environment minister, Aileen McLeod, thanked them, saying: "Local councils, emergency services and other responders have been working tirelessly over this festive period to minimise the impact on communities, ensure the safety of people and help local areas recover." She insisted that the situation was being "closely monitored 24/7" by the Scottish government, and encouraged

2016 29-30	1	British Isles	The Guardian & The Observer	<p data-bbox="996 271 1176 343">28/01/2016 - 29/01/2016</p> <p data-bbox="1332 199 2110 1366">members of the public to monitor Sepa’s Floodline website for the latest flood information. Minor damage. Official gallantry. Official welfare. On the 28th of January the Met office announced another onrushing storm to be named Gertrude was heading towards to the UK. All schools in the Western Isles of Scotland were shut as a precaution due to the oncoming heavy rains and strong winds of up to 90mph. Widespread disruption to travel throughout the North was anticipated and the Met office issued an amber "be prepared warning for Scotland and North-West England. Scot rail was to only operate limited services in the Western Highlands due to anticipated interruption on the Western coast. Ferry passengers on Scotland’s CalMac services have been told to expect disruption. Scottish Hydro Electric Power Distribution said: “We have 400 front line and support staff standing by and we have moved engineers to the areas we expect to be hit by the storm. Mobile generators and other resources are also being moved. “Members of the public should not approach fallen or damaged power lines, which may still be live.” Scottish Hydro stated it had to reconnect hundreds of homes in the west of Scotland with 400 frontline staff deployed. Gusts of 91mph were recorded in South Uist, in the Western Isles, and on the mainland winds of 69mph hit the Forth road bridge and Inverbervie in Aberdeenshire. Almost 40 flood warnings were put in place by the Scottish Environment Protection Agency covering Ayrshire, Tayside, west central Scotland and the Highlands. Derek Mackay, Scotland’s transport minister, said: “We are in regular contact with the</p>
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<p>2016 1 to 2</p>	<p>2</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>01/02/2016 - 02/02/2016</p>	<p>transport operators regarding the situation. They do not take the decision to cancel services lightly but safety is paramount.”</p> <p>Minor damage. Official gallantry. Official welfare. Storm Henry followed in the wake of Storm Gertrude as yet another low pressure system progressed towards the north of the UK. Scotland, Northern Ireland and parts of Wales and northern England had been warned to expect bad weather overnight on Monday and into Tuesday as Storm Henry bears down on Britain. High winds are forecast across Scotland, which has been issued an amber warning, the second most severe. Scotland’s transport minister, Derek Mackay, said there was “every likelihood” for travel disruption over the coming days. Traffic Scotland said only essential journeys should be attempted as roads, bridges and railway lines are battered by heavy rain and gale-force winds. Lorries have been blown over, trees uprooted and buildings damaged by the latest severe weather. The severe weather created difficulties for recovery teams attending to blown over vehicles, routes blocked by trees and buildings made unsafe by the extreme winds. Councils and travel operators in the Highlands and Western Isles responded to an amber “be prepared” warning from the Met Office, valid until 9am on Tuesday, by shutting schools and suspending train and ferry services. A 90mph gust was noted in South Uist and winds were so strong on Mull they inverted a waterfall causing it to spray backwards towards the course. Pascal Lardet from the Scottish Environment Protection Agency said: “There is a coastal flood risk for the Western Isles,</p>
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2016 7 to 8	2	British Isles	The Guardian & The Observer	07/02/2016 - 08/02/2016	<p>due to storm force winds generating a large surge and waves. The Scottish Environmental Protection Agency (SEPA) has 29 flood warnings in place.</p> <p>Moderate damage. Official gallantry. Official welfare. Britain was hit by 80 mph winds and heavy rain as another depression in the form of Storm Imogen hit the Isles. The Met Office widely issued be preapred warnings for the South of Britain. The Met Office has warned that there could be “very large waves”, especially along the north coast of Cornwall and Devon as well as the Bristol Channel. South West Trains said it was planning to run a normal weekend timetable on all routes but that the risk of trees and debris being blown onto the railway might require the train line to “make adjustments to trains in certain areas”. The Environment Agency issued almost 300 warnings across the UK, 59 of them calling for “immediate action”, particularly in parts of south-west England and Wales, some areas of which were expecting more than 1.5in of rain on Monday. A father and daughter near Exeter in Devon also reportedly had a lucky escape when a 30.5-metre (100ft) tree was blown on to their car, parked outside the house, minutes before they were about to leave for school. There was a river search for a man missing in Taunton, after Avon and Somerset police were alerted by a member of the public to reports that a man had entered the Tone, near Priory Bridge Road. Search units were later stood down and police said they were satisfied there was no one in the water. Meanwhile, almost 5,000 homes in south-west England, Midlands and Wales were left without power due to high winds, and</p>
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2016 2 to 4

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engineers worked through the night to restore affected services, Western Power Distribution said. Rail services in Wales, the south-west and southern areas were disrupted due to strong winds, with speed restrictions and cancellations. Speed restrictions at various times will be imposed on rail routes. On the Isles of Scilly, waves of 13.5 metres were recorded. A 19.1-metre wave was later recorded off the coast of St Ives in Cornwall. On the 9th all trains in and out of Cornwall were cancelled after a Cross Country service from Penzance to Glasgow struck a tree that fell across tracks about a mile from Bodmin Parkway at 9.30am. No one was injured and passengers were evacuated by firefighters, Network Rail said. The tree was later removed and the line running into Cornwall reopened, but services leaving the country are still suspended as the damaged train is yet to be removed. Arriva Trains Wales, Great Western Railway, the Gatwick Express, South West Trains, Southern and Thameslink services have all been hit with delays, alterations, cancellations and speed restrictions. The M48 Severn Bridge is shut in both directions because of strong winds, as is the A282 Dartford Crossing, east of London, which carries traffic southbound. Traffic was being diverted through one of the northbound tunnel bores, causing severe delays for traffic in both directions. Minor damage. Official gallantry. Official welfare. On the 1st it was reported temperatures were set to fall as Storm Jake swept in from the east with the Met Office issuing yellow warnings for snow, ice and wind. After what is expected to be the warmest winter on record, the arrival

2016	28	3	British Isles	The Guardian & The Observer	25/03/2016 - 28/03/2016	<p>of meteorological spring is being marked by a wintry spell, which is likely to bring up to 10cm of snow on high ground and severe gales in some places. In the UK, blustery weather is expected on Wednesday morning across south-west Wales and south-west England, where isolated gusts of 70mph are possible around exposed coasts, with gusts of 50mph inland. Heavy snow and icy, freezing conditions wreaked havoc across the north of the UK on the 2nd and 3rd as the storm swept in from the Atlantic. The north-west of England remains bound by the ice and snow with dangerous driving conditions set to continue into the early hours of Saturday. A Met Office forecaster said: "Two warnings are out for icy driving conditions tomorrow, as the snow over the north of England and Wales shifts down towards the south-east with the storm adapting on the 4th as the cold front passed over the Isles. Minor damage. Official gallantry. Official welfare. South England and Wales were forecasted to expect strong winds as Storm Katie approached as the Met Office warned of 70 mph winds causing considerable disruption. It was humourously remarked outdoor egg hunts on Easter Sunday are set to be interrupted with heavy showers, strong winds and maybe even thunder. Large waves and some heavy rain is also predicted. Travellers have been warned about potential disruption. A forecaster stated "There remains a fair amount of uncertainty over the track and timing of this system, and so where and when the peaks of strongest winds will occur". Showers were also expected. The Environment Agency issued 28 flood warnings, indicating that flooding</p>
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2016	8	5	British Isles	The Guardian & The Observer	07/05/2016 - 08/05/2016	<p>is expected and immediate action required – 18 of them in the south-east. Warnings were also in place in the Midlands, south-west and north-east of England. There were also 143 flood alerts, indicating possible flooding, mainly in the south-east, the south-west and Midlands. Retailers have been left counting the cost of Storm Katie after the wet and windy weather put a dampener on the traditional Easter spending spree.</p> <p>Official welfare. On the 7th thunderstorm warnings were issued for England and Wales following a excpetion spell of hot weather. The Met Office warned of the possibility of torrential downpours, lightning and hail, with resultant flooding. Some very localised strong and gusty winds were also possible, it said. The resulting thunderstorms produced relatively minor rain and there were no reported effects.</p>
2016	1	8	British Isles	The Guardian & The Observer	31/07/2016 - 01/08/2016	<p>Official welfare. On the 31st the Met Office warned that more rain could fall in 24 hours than fell in the Uk during the entirity of July. Strong rainfall fell particularly over Wales but did not cause major hazards in the form of flash flooding.</p>
2016	13-16	9	British Isles	The Guardian & The Observer	13/09/2016 - 16/09/2016	<p>Official welfare. Warnings of flash floods and storms followed on Britain's hottest September day for 105 years with areas in the North-west, West and South-west England expected to recive very heavy rainfall and hail. Weather warnings have been issued as thundery showers, torrential downpours and potential flash flooding look set to hit parts of Britain. Overnight 13 to 14 flooding affected parts of west Cornwall but with little distrubance as issues were largely in the South-east. On the 16th the Guardian</p>

stated the latest UK flood plans fail to address growing risk of flash floods. Even following the flash flooding it was completely excluded from the government's National Flood Resilience Review, which only concerned fluvial and coastal flooding. Worse, the risk of flash flooding is rising, as climate change leads to more intense, more frequent rainstorms: the Met Office has shown that extremely wet days have become more common. Flash flooding was the principal cause of the most damaging floods in UK history, which in 2007 caused over £3bn of damage, caused 13 deaths and was classified by the Environment Agency (EA) as a "national disaster". In 2013, new maps from the EA showed 3m properties were at risk from flash flooding in England, compared to 2m from river and coastal flooding. Most insurance claims made each year for flood damage are because of flash floods and there are at least 20,000 sewer overflows a year in the UK. After the 2007 disaster, the Pitt review led to new laws in 2010 to implement the use of sustainable drainage systems, which provide safe areas for water to pond. But the provisions were never implemented and instead a voluntary system asking developers to follow these practices was put in place. But it has not worked: the government's official advisers, the Committee on Climate Change (CCC), found that just 15% of planning applications in areas of flood risk incorporate sustainable drainage measures and in 2015 the CCC warned ministers their plans were inadequate. However, in May, the government successfully opposed a plan to make sustainable drainage compulsory, and to make developers increase the capacity of drains to which new

2016	19-22	11	British Isles	The Guardian & The Observer	20/11/2016 - 22/11/2016	<p>homes are connected. A director at the Grantham Research Institute on Climate Change and the Environment at the London School of Economics stated. "We know our major cities, including London, are vulnerable to surface water problems," he said. "But the UK remains at risk because the government refuses to confront the problem. The main problem is the inadequacy of the drainage system, which even nine years after the 2007 floods are still not up to the task." The EA maps showed that one home in particular is at risk of flash flooding: No 10 Downing Street. It was cynically remarked that "Perhaps this might spur prime minister Theresa May to finally take meaningful action".</p> <p>1. Moderate damage. Official gallantry. Official welfare. Storm Angus came to the UK causing the Met Office to issue widespread warnings of very strong winds approaching 80 mph along the coasts. Devon and Cornwall police declared a "major incident" at 4.15am on Sunday and evacuated a residential park when rain caused the river Mole to burst its banks. Devon and Cornwall police declared a "major incident" at 4.15am on Sunday and evacuated a residential park when rain caused the river Mole to burst its banks. A yellow warning zone covered approximately the area from Plymouth to Ipswich. On the 10th it was reported Exeter had had more than 2 inches of rainfall and by mid-morning 19 flood warnings were issued by the EA. The warnings came as the government was accused of failing to deliver on promises to fund "natural" flood management schemes such as planting trees. A freedom of information request</p>
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by the environmental group Friends of the Earth to the Department for Environment, Food and Rural Affairs (Defra) revealed that there was no funding earmarked specifically for natural flood management, despite ministers saying they would fund such measures. Guy Shrubsole, climate campaigner for Friends of the Earth, said last winter's floods "were a powerful reminder that we need to work with nature to reduce flood risk – and ministers wholeheartedly agreed". "Ministers must replace warm words with hard cash and announce a pot of at least £20m for natural flood defence in this year's autumn statement. Anything less will be a betrayal of the communities that flooded so terribly last winter." Alison Baptiste, national flood duty manager at the Environment Agency, said teams had been working through the night and were now preparing for further flooding as rain continues over the next couple of days. By the 21st Thousands of householders, business people and travellers suffered disruption after almost a month's worth of rain fell within hours, raising fresh concerns that not enough was being spent on flood defences and prevention measures. Devon and Cornwall police attended more than 60 road collisions during the day on Monday. Train lines were blocked between Swindon in Wiltshire and Bristol and Exeter while Bristol Temple Meads station was briefly closed because of flooding. The Labour MP for Exeter, Ben Bradshaw, said: "Once again the south-west has been severely affected by heavy rain. Our infrastructure has been shown to be unequal to the task of keeping things moving and functioning on what are

becoming much more regular weather events. More than a dozen schools in Devon were closed. The headteacher of Otterton primary in the east of the county, Carron Saunders, said she felt she had to close the school when it was in danger of being cut off. "Only one road is open," she said. "The other routes in are cut off." Staff were clearing up at the Mill on the Mole residential park on Monday. Manager Stephen Antram said eight people were evacuated over the weekend but all were back at home on Monday. "It was quite a mess," he said. "We had debris and mud and rubbish all over the place to sort out. The community has been brilliant. People came down to see if they could help." On the 21st it was reported more than 75 flood warnings were put in place across the south west, the Midlands, north east, north west, Wales and the east of England by the Environment Agency on Monday evening, with a further 207 flood alerts issued across England and Wales. Passengers onboard an Irish Sea Stena ferry were forced to stay onboard after the vessel failed to dock at Fishguard. The Environment Agency warned the forecast of "widespread heavy rain and showers" would affect most parts of England over the next 36 hours and could cause more flooding. Clare Dinnis, national flood duty manager at the Environment Agency, said: "Environment Agency teams are working hard to reduce the risk of flooding, but we want to remind people not to take unnecessary risks and avoid driving through flood water or walking near swollen rivers. "People should also take care if walking by the coast as there is a risk of large waves caused by strong and gale force winds." Devon

county council said 14 schools were shut owing to flooding and in Somerset, schools were closed due to weather-related problems. Meanwhile, fading light and treacherous conditions have forced police in south Wales to suspend the search for a pensioner who went missing on Sunday morning. The search for Russell Sherwood, 69, from Neath, will resume on Tuesday. Sherwood has not been seen since he left his home in his silver Ford Focus on Sunday morning to drive to Bridgend. He failed to arrive at the address and a search was launched by police. "Officers believe he reached Stormy Down, Bridgend, in his vehicle and are appealing to anybody who may have information," a force spokesman said. On the 22nd the EA had 65 flood warnings still in place with most centred on the South-west. The line between Tiverton Parkway and Exeter St Davids in Devon was severely damaged. The Barnstaple and Looe branch lines in Devon and Cornwall were also closed. On Tuesday morning Network Rail said no mainline trains from or to London would be able to arrive at or depart from Exeter for an estimated 48 hours because part of the tracks had been swept away at Cowley Bridge in the city. 96 mm of rain fell at Exeter airport which was close to the annual monthly mean for Devon in November of 136mm. Devon and Cornwall police attended more than 60 road collisions during the day on Monday. Fourteen schools in Devon were forced to close. On the 23rd it was reported the body of missing Russell Sherwood in the river Ogmere near Bridgend. Police divers entered the river when the search for Mr Sherwood resumed at first light this morning. A recovery

<p>2016 22-29 12</p>	<p>British Isles</p> <p>The Guardian & The Observer</p> <p>20/12/2016 - 25/12/2016</p>	<p>operation is underway and South Wales Police say enquiries to identify the body will follow in due course. Mr Sherwood's family had been informed of the discovery and were being updated and supported by specially trained officers.</p> <p>Moderate damage. Official gallantry. Official welfare. On the 20th it was reported that forecasters stated strong winds potentially reaching 90mph were set to batter Northern England and Scotland as Storm Barbara advanced across the Atlantic. Forecasters have warned that power supplies may be hit, ferries delayed and bridges closed due to strong winds on Friday and Christmas Eve. Nicky Maxey, from the Met Office, said: "It has the potential to be quite disruptive so we would urge people to think about their travel arrangements if they're trying to get away for Christmas. Ferry operator Caledonian MacBrayne has said 21 of its 26 routes had already been disrupted by the weather, with several services cancelled. The RAC suggested people should travel on Thursday or on the afternoon of Christmas Eve, when conditions are forecast to be more forgiving. The Local Government Association, which represents more than 370 councils in England and Wales, said its members were fully prepared for the possibility of storms, floods, snow, sleet and high winds. On the 24th >15,000 homes have been left without power by storm Barbara as millions took to the roads to avoid rail engineering works and make it home for Christmas. Winds of 60-70mph were expected across the west and north-west of Scotland, with gusts up to 120mph recorded on the</p>
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summit of Cairn Gorm on Friday. Properties in Aberdeenshire, Moray and on the Western Isles lost power. Scottish and Southern Electricity Networks confirmed its engineers had restored power to 14,855 homes, while they were working to help a further 445 customers in the north of Scotland. The worst of the storm conditions were forecast to be in the far north of the country and the Western and Northern Isles, but disruption to power supplies and travel was expected to be felt across the UK. The Met Office issued yellow warnings of snow and ice for parts of Scotland and flood alerts are in place for the Highlands and Western Isles, as well as Skye and the Scottish Borders. The Local Government Association, which represents hundreds of councils in England and Wales, said it was issuing renewed advice on how to deal with flash floods and had stockpiled more than 1m tonnes of salt to grit roads. Rail disruption is expected to cause more trouble for holidaymakers, with a number of lines closed for an extended period as Network Rail carries out up to 200 improvement projects costing £103m. On the 24th the stormy weather was amplified by the successive arrival of a new storm system named Conor. A lightning strike affected around 13,000 customers in Lewis and Harris, though all homes were reconnected within two hours. A total of 762 customers remain without power as a result of localised faults on the islands of Lewis, Jura and Shetland. A gust of 85.5mph was recorded at Scalpay Bridge in the Outer Hebrides on Sunday, while at Castlebay in Barra speeds reached 74.9mph, the Western Isles Council said. Flood alerts are

<p>2017 21-27</p>	<p>2 British Isles</p> <p>The Guardian & The Observer</p> <p>22/02/2017 - 27/02/2017</p>	<p>in place covering Tayside, Caithness and Sutherland, Orkney, Scottish Borders, Shetland, Skye, Easter Ross and Great Glen and Lochaber and the Western Isles, while local flood warnings have been issued for Tayside and Caithness and Sutherland. Scotland's transport minister, Humza Yousaf, chaired a meeting of the Scottish government's resilience team on Sunday with representatives of the Met Office, Transport Scotland, Police Scotland and the Scottish Environment Protection Agency (Sepa). By the 26th storm conor had brought swathes of snow which blanketed much of Scotland as well as accompanying 80mph winds. An amber warning was issued in the Highlands and Islands. High wind warnings were in place on bridges such as the Clackmannanshire Bridge, Forth Road Bridge, Dornoch Bridge and Erskine Bridge. Ferry operator CalMac warned that services across the network were subject to delays or cancellation at short notice due to Storm Conor. SEPA had four flood alerts including in Caithness and Sutherland and the Western Isles.</p> <p>Moderate damage. Official gallantry. Official welfare. A "weather bomb" in the form of Storm Doris brought great storms to the British Isles from the South-West. The EA issued amber be prepared warnings throughout. A yellow "be aware" warning of high winds has also been extended to include almost all of England, Wales and Northern Ireland. Warnings of violent force 11 winds were issued in the Hebrides. In Cornwall, a man was taken to hospital after being rescued by firefighters when a tree hit his van on the A374 near Torpoint. The port of Liverpool was</p>
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2017	25 to 3	3	British Isles	The Guardian & The Observer	26/02/2017	<p>closed due to the 100mph winds and the M80 out of Glasgow northbound was also closed. In Cornwall, a man was taken to hospital after being rescued by firefighters when a tree hit his van on the A374 near Torpoint. Ferries were unable to dock at Irish ports owing to the tremendous seas state. On the 27th chief meteorologist Andy Page said: "Polar maritime air is becoming established across the UK with colder conditions expected for the next few days, but nothing unusual for late winter. The week will be characterised by wet and windy spells across the southern half of the UK.</p> <p>Minor damage. Following in the wake of Storm Doris was Storm Ewan which was forecast by the Met Office to bring 60mph of wind. The Met Office issued a yellow alert for a "small area of very strong winds" likely to move north-eastwards over parts of the north-western half of the UK. Ewan wasn't a particularly strong storm, and came soon after Storm Doris which brought more widespread disruption across the UK. Ewan was felt more across southern parts of the Republic of Ireland. The storm only had yellow Met Office warnings for wind across parts of Scotland and Northern Ireland. Reports of minor flooding due to wave overtopping were noted on the North Wales coast where gusts reached 75mph at Conway.</p> <p>On the 27th the Met Office predicted torrential rain and thunderstorms could wreak havoc with bank holiday travel when a week of warm weather finally gives way to a cooler spell. An unsettled weather front moving through the United Kingdom from south-west England and Wales will bring torrential, thundery downpours across the</p>
2017	28	5	British Isles	The Guardian & The Observer	27/05/2021 - 28/05/2021	

2017 18-19	7	British Isles	The Guardian & The Observer	18/07/2021 - 19/07/2021	<p>country. A forecaster from the Met Office stated: "There could be some travel disruption across the transport network from Sunday afternoon into bank holiday Monday as surface water collects on the roads. The weather at the moment is quite unstable, as warm air and higher temperatures are the perfect ingredients for thunderstorms." The Met Office has also said lightning strikes could cause power outages in some parts of England. A bank holiday heatwave has seen sun seekers flood beaches across the country, but forecasters have warned that a very different kind of deluge is on its way. "Many areas will see rain at times but the extent of the most intense and thundery downpours will be limited. Only small areas are likely to see these downpours at any one time. "However, given the hit-and-miss nature of the heavy rain and thunderstorms, many places will likely see little or no impacts." This turned out to be the case. Major damage. Official gallantry. Impromptu welfare. Official welfare. Impromptu gallantry. On the 18th thunderstorms and potential flooding were forecast for large parts of the UK and weather warnings were widely issued throughout. The Met Office said there was also a chance of large hailstones and localised flooding of homes, businesses and roads. The meteorologist Claydon said the storms would cover a much wider area on Wednesday, "taking up all of Wales but stopping before Scotland", from the early hours through to 8pm. On the 19th dozens of homes have been evacuated on the south coast of Cornwall as flash floods sweep through the county after violent thunderstorms on Tuesday afternoon.</p>
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Cornwall Fire and Rescue told people to avoid the Coverack area due to major flooding. An eyewitness said the wet weather hit Coverack at about lunchtime, but got worse from around 3pm. "It literally just came over like a massive mist," Karla Wainwright told BBC News. Wainwright, who works in the village's Paris Hotel, said hailstones the size of 50p pieces smashed small panes of glass on the building. Residents have been cut off by the fast-moving flood with both access roads into the village swamped by the waters. The main road, the B3294, has been broken apart by the force of the storm and chunks of tarmac have been swept to the seafront. Bed and breakfast owner Anne Rogers said: "We got the helicopter overhead, which has just airlifted two people two people to safety from a bungalow near the river. The tarmac from the road is now along the seafront – it is just horrendous. It is utter devastation all along the seafront and the cliffside properties are all flooded." Coverack resident Adam Powers added that it had been a "scary afternoon". "Homes are flooded and there is no access by road. More rescue crews are arriving the helicopter is hovering. It is pretty full on," he said. Others have described watching "apocalyptic" scenes play out in the usually sleepy picturesque village. Another witness told how her neighbours lost a shed in the flood. "It was quite horrendous," said the local business owner, who did not want to be named. "It was torrential, the water that was coming down our road, but it's all subsided, it's much better now, except for the river itself is still quite a torrent. "I have never seen such big hail. The sun was

shining and the wind was blowing and it was hailing, all at the same time. It was quite amazing really.” Chief Inspector Mark Bolt, from Devon and Cornwall police, who is leading the response, said: “This will have been a very distressing incident for all those involved and our thoughts are with everyone who has been affected. “We would like to thank the crews from Cornwall Fire and Rescue Service, the Search and Rescue helicopter and HM Coastguard Service for their efforts.” A council spokesman confirmed some properties in the village and one of the roads suffered structural damage and are due to be inspected by structural engineers. A local hotel offered accommodation to anyone unable to return to their home, while one elderly resident was moved to a local nursing home. A meeting is due to be held for residents at the village’s Parish Hotel on Wednesday morning, which will be attended by council officers. By the evening of the 19th dazed residents in a Cornish fishing village have begun a huge clean-up operation following a flash flood that saw a torrent of water more than a metre deep rip up roads and damage 50 properties. Christopher and Penny Hammill were airlifted by coastguard helicopter after the water came downstream on both sides of their home, measuring more than a metre-and-a-half deep in places, before bursting through the door. Now in borrowed clothes, and staying with friends, Penny Hammill said it had been an “absolute nightmare” that had left the couple devastated. They had to flee upstairs until the helicopter arrived. “It took us out of the front window one at a time and dropped us in the field next door,” she said.

2017	25	7	British Isles	The Guardian & The Observer	25/07/2017	<p>The cost of repairs and insurance in Coverack is already estimated at more than £1m, with structural damage to roads and buildings in the area. Cornwall's council leader, Adam Paynter, said there were financial reserves to deal with the emergency. "It's been absolutely unbelievable to see. I think it's going to take a little while to get this sorted out and tidied up but obviously the main thing is that nobody's been injured and everybody is OK in the village." A schoolbus driver and his sole passenger had to be rescued. "The boulders from people's gardens were pummelling the bus," said Thomas Duffield, 33. Waste disposal tanker driver Jessie Richards, who was in the village in his 7.5-tonne lorry when the storm began, said: "I feel lucky to be alive. Within 20 to 30 minutes it was just dropping hailstones like marbles. It was just carnage." As thousands of gallons of water cascaded over the sea wall, "it was bringing boulders down the road", he said. Assistant chief fire officer Phil Martin said the flash flood had left a pile of rubble about a metre high stretched across the beach. The flash flooding in Coverack was the worst to hit Cornwall during the summer since the Boscastle disaster in 2004.</p> <p>A short extract on Met Office History and storm warnings was produced in the Guardian.</p>
2017	12 to 13	9	British Isles	The Guardian & The Observer	12/09/2017 - 13/09/2017	<p>Minor damage. Official gallantry. Much of the nation was engulfed by a moderately severely winter storm termed Aileen. Gusts of 75mph were predicted overnight on the 12th across England and Wales as well in Southern</p>

2017	16-17	10	British Isles	The Guardian & The Observer	14/10/2017 - 17/10/2017	<p>Scotland by the Met Office. Yellow weather warnings were in place throughout. It was warned road, rail and air services may be affected with longer journey times and cancellations possible, along with some restriction to roads and bridges. On Monday, flooding hit motorways, roads and railways in the north of England during morning rush hour. On the 13th thousands of homes have been left without power and travel was disrupted as Storm Aileen hit Britain. Winds of 55-65mph were widely felt throughout England and Wales with a peak wind of 74mph recorded at Mumbles. She added that Storm Aileen had caused widespread problems, including surface water flooding, bringing trees and branches down, and causing minor damage to homes. The Met Office said there was no connection between the high winds expected in the UK and the severe weather battering the Caribbean and the US, with the UK's weather system originating north in the Atlantic, independent of the hurricanes.</p> <p>Minor damage. Official gallantry. On the 14th warnings of the approaching tail end of Hurricane Ophelia were broadcast by the Met Office. Although the storm was losing energy as it crossed the cooler waters of the Atlantic 50-70mm of rain was still possible. On the 15th the Met Office warned of flying debris, potential power cuts, bridge closures and disruption to transport and mobile phone signal. There are yellow warnings for northern England and southern Scotland on Tuesday, but winds are expected to ease by the evening. In Portcawl huge waves covered the the front during a storm surge at</p>
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2017	20-21	10	British Isles	The Guardian & The Observer	20/10/2017 - 22/10/2017	1	<p>high tide dousing onlookers. Foam also covered the seafront at Holyhead. On the 17th hundreds of thousands of people remain without power in the UK and Ireland while several key rail lines were blocked in northern England and Scotland. Hundreds of thousands of people remain without power in the UK and Ireland while several key rail lines were blocked in northern England and Scotland. Virgin Trains said a tree blocking the railway at Lockerbie was causing disruption to journeys and work was under way to remove it. Police in the coastal Cumbrian town of Barrow urged people to avoid the town's football ground after the wind ripped off part of the roof of its main stand.</p> <p>1. Minor damage. Official gallantry. On the 20th it was exclaimed "Storm Brian thunders towards south coast of England" as the Met Office issued yellow warnings for wind across the western and southern coasts. A forecaster stated "The worst-risk areas are along the south coast and the west coast, but even heading as far north as north-west England, such as the west coast of Cumbria and Lancashire, which are now in the yellow warning area." Such conditions are caused when a jet stream of strong winds high in the atmosphere interacts with a low pressure system. The jet stream removes air from the low pressure system, reducing its weight and causing the pressure to fall. The Environment Agency has set up steel flood barriers in Fowey, Cornwall, in anticipation of the storm, as south-western towns braced themselves to become some of the worst affected areas. Gusts of 78mph (125km/h), the highest recorded on Saturday</p>
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<p>2017 22-23</p>	<p>11 British Isles</p> <p>The Guardian & The Observer</p>	<p>23/11/2017</p> <p>afternoon, struck the Llŷn Peninsula on the north-west coast of Wales, the Met Office said. Dozens of flights and ferry crossings have been cancelled because of the high winds, with British Airways cutting 10 flights to and from Heathrow to reduce the number of aircraft movements at the airport. The rough seas and strong winds have forced Brittany Ferries to cancel eight sailings, with Irish ports particularly affected by the rough conditions. P&O Ferries has also been hit by the disruption and on Saturday evening it cancelled all crossings of the Irish Sea between Dublin and Liverpool. Forecasters from the Met Office said the combination of high tides and winds gusting at 60 to 70mph could create dangerous conditions along exposed southern and western coastal areas. Torrential rain is expected to hit Wales and the west of England on Saturday night. On the 22nd a man was found dead on a Decon beach and an inquest had found he had drowned being overcome by storm surge waves near Dawlish Warren and his last comments had been about the size of the waves brewed up by the storm surge.</p> <p>Minor damage. Official gallantry. Official welfare. Snow, flooding and gales hit the UK causing several weather warnings to be issued in Scotland, Northern England and North-west Wales. A yellow severe weather warning has been issued for northern Scotland, valid until 1pm on Thursday. It warns that some roads and railways are likely to be affected, with possible longer journey times for road, bus and train services. Heavy and persistent snow of 2cm - 5cm was noted. Lancashire Constabulary said a number of homes had been evacuated after heavy rainfall</p>
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<p>2017 5 to 7</p> <p>12</p>	<p>British Isles</p> <p>The Guardian & The Observer</p> <p>05/12/2017 - 07/12/2017</p>	<p>caused localised flooding and “major disruption” overnight. The Isle of Anglesey county council said “major flooding” had hit Llangefni, where images showed water rushing down Church Street in the town’s centre. Meanwhile in Beaumaris rainwater caused the castle’s moat to burst, flooding a street in the town centre. The council said the majority of the island’s major roads were flooded “at some point”, including the A55 dual carriageway in both directions. Travel to Holyhead Port was “severely disrupted”, a “major landslide” completely closed a section of the A545 coastal road and a lorry crash closed the A5 on the island. Two lanes were closed on the M6 in Cumbria due to flooding and an overturned vehicle. And rail operator Northern tweeted that flooding had stopped services between Lancaster and Morecambe, Carlisle, Oxenholme and Windermere. Forecasters warn that spray and flooding on roads will make journey times longer while bus and train services are also likely to be affected. The Scottish Environment Protection Agency (Sepa) has issued flood alerts for Dumfries and Galloway and the Borders. There are seven flood warnings in force outside Scotland, mostly in north-west England, and 19 flood alerts.</p> <p>Minor damage. Official gallantry. Official welfare. On the 5th it was forecast that Storm Carlone was about to hit the north of Britain with winds of 80mph forecast prompting a severe weather warnings in Northern Scotland. The Met Office warned “Road, rail, air and ferry services may be affected, with longer journey times and cancellations possible. Some short-term loss of power and</p>
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other services is possible.” Forecasters said some gusts could be strong enough to bring down power cables. As the storm moved away from the UK and towards Scandinavia on Friday it would be followed by cold air. Snow showers were forecast to become increasingly frequent over northern Scotland late on Thursday and were expected across many other parts of Scotland, Northern Ireland, Wales and western England on Friday. On the 6th it was announced all train services in the Scottish Highlands will be cancelled on Thursday morning after forecasters predicted Storm Caroline would bring potentially life-threatening winds of up to 90mph. The ferry operator CalMac, which runs a large majority of services to the Hebridean islands, warned that numerous services had already been disrupted or cancelled, affecting travel to Barra, Tiree, Mull and Iona, Harris, Mallaig and Stornoway among others. A yellow snow and ice warning is in place for Friday in Scotland, Northern Ireland, western England and Wales. By the 7th severe gales and snow showers had caused travel disruption, school closures and power cuts. The storm brings the threat of injury and even loss of life to northern parts of the UK, Met Office forecasters said. An amber warning was widely issued for all of Scotland. About 2,000 Scottish and Southern Electricity Networks customers in the Western Isles and about 270 in Aberdeenshire had their power cut but it had since been reconnected. A gust of 73mph was recorded at Stornoway airport. “Storm Caroline is well on its way across northern parts of the UK,” said the meteorologist John West. Less severe

warnings of wind, snow and ice were in place for Friday and Saturday across northern and western parts of the UK, including all of Northern Ireland, most of Wales and Scotland and parts of England. By dawn on the 8th 8cm of snow had fallen in the Highlands and wide areas of Wales were also blanketed as schools were closed across Wales and Scotland. 500 homes in Scotland were affected by powercuts. In addition to the 1.5m tonnes of salt that councils have stockpiled in preparation for this winter, the LGA said they would send out local teams to assist the elderly and vulnerable in their communities, delivering hot meals, carrying out emergency household repairs and providing heating. Martin Tett, the LGA's transport spokesman, said: "Whether it's a quick knock at the door to check on an elderly neighbour, or helping carry out emergency repairs, everyone has a role to play to keep each other safe this winter." Planning for winter remains a key priority for councils, despite ongoing funding pressures and competing demands on their limited resources. Warnings were made that the storm winds would create a feeling of sub-zero temperatures as true temperature hovered between 2-3 degrees C. On the 9th it was stated about 18,000 homes across Scotland were affected by power cuts on Friday, according to Scottish and Southern Electricity Networks, but power was restored to the majority of affected homes by the evening. Dale Cargill, its director of customer operations, said: "Our network generally stood up well to Storm Caroline and I would like to thank all our customers who experienced a power cut for their patience as we battled

2017 30-31	12	British Isles	The Guardian & The Observer	30/12/2017 - 31/12/2017	<p>against the elements to restore their power. Warnings of more snow were also broadcast for the forthcoming Storm Ana which turned out to be unneeded to its minimal impact on the UK.</p> <p>Minor damage. Official gallantry. Storm Dylan was forecast on the morning of the 29th to bring heavy winds and rain to North-west Britain. Following this heavy snow, rain, thunderstorms and wind caused disruption across large swaths of Britain. "With thunderstorms and those sorts of systems you get rapidly rising and falling air," said Grahame Madge, a spokesman for the Met Office. "So it could have been convection that caused the problem (and damage to the house) rather than it being a typical tornado." A yellow warning for wind has been issued for Northern Ireland and Scotland between 12am and 3pm on Sunday when Dylan is expected to make landfall. "Large waves and beach material being thrown on to coastal areas could also be a hazard," the forecaster said. Heavy downpours are predicted across much of south-east Wales and south-western, central and southern parts of England over the weekend. On Friday morning parts of northern England and Scotland were greeted by thick blankets of snow while the south coast was lashed by torrential downpours and lightning. Glasgow saw the biggest snowfall in the UK, with more than 10cm recorded in Bishopton. On the 31s it was reported 70mph winds had been recorded as the storm lashed the North-west. The UK weather service has issued an amber warning covering Northern Ireland and parts of western Scotland, stating there is the potential for "injuries or danger to life"</p>
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<p>2018 2 to 4</p>	<p>1</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>02/01/2018 - 04/01/2018</p>	<p>from flying debris. Several ferry services on the west coast and some roads and train services were affected by high winds and heavy rain. The Erskine bridge was closed to high-sided vehicles across the Clyde. The Scottish Environment Protection Agency (Sepa) has issued seven flood warnings for parts of south-west Scotland, but with severe weather warnings due to expire by the afternoon of the 31st.</p> <p>Moderate damage. Official gallantry. Official welfare. Early on the 2nd it was stated that Britian was facing gusts up to 80 mph as Storm Elanor approached enhancing the vulnerability of coastal roads and properties along Britain's western and southern coasts prone to injury form a mixture of inundation and debris. "If you're travelling please check your route before setting off and don't drive through flood water." the Met Office warned. An amber weather warning has been issued for between 6pm on Tuesday and 8am on Wednesday for north-eastern and western England, Northern Ireland and parts of Scotland. Carol Holt, the Environment Agency's flood duty manager, said: "We urge people to stay safe on the coast – take extreme care on coastal paths and promenades, and don't put yourself in unnecessary danger trying to take 'storm selfies'. An amber weather warning has been issued for between 6pm on Tuesday and 8am on Wednesday for north-eastern and western England, Northern Ireland and parts of Scotland. On the 2nd Highways England said the M48 Severn Crossing and the Orwell Bridge in Suffolk were closed and the Queen Elizabeth II Bridge between Kent and Essex was due to shut at 11pm. Coastal roads</p>
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and properties along Britain's western and southern coasts were vulnerable to high waves throwing beach material on to seafronts. They predicted 60-70mph gusts, with winds of up to 80mph in some western coastal areas. "Strong or sudden gusts of wind are more likely on open stretches of road, when passing bridges or gaps in hedges, or when overtaking high-sided vehicles" it was warned. At Aberystwyth huge waves bombarded the seadefences and inundated the promenade. On the 3rd by 16:30 the Scottish Environment Protection Agency had originally issued 15 flood warnings, chiefly for Dumfries and Galloway, but has since lifted 12 of those. Only three remain in force, for West Luce Bay on the northern edge of the Irish Sea, with two still in place for the Firth of Forth at Grangemouth in West Lothian and Culross, Longannet and Kincardine in Fife. At the storm's peak, which saw roads flooded across Dumfries and Galloway and winds hit 77mph, high tides briefly flooded the inshore rescue station on the river Nith near Glencaple, which also had reports of a man stranded in his flooded home. A Met Office yellow warning of wind remains active for all of England and Wales, and Northern Ireland and the Scottish Borders until 7pm on the 3rd. Coastal towns and villages in north Cornwall are among the worst hit. A stretch of the harbour wall at Portreath was washed away forcing one family to flee their home. Around 2,500 properties between Cornwall and the Midlands were also hit by power cuts, according Western Power Distribution. Flooding, high tides and fallen trees have hit a number of rail routes including delays on the line between Cornwall

<p>2018 16-18</p>	<p>1 British Isles</p> <p>The Guardian & The Observer</p> <p>14/01/2018 - 18/01/2018</p>	<p>and Devon. The collapse of a 30ft stretch of a harbour wall in Portreath, Cornwall, prompted the council to set up a respite centre for seafront residents if they wished to leave their homes. Several ferry services were also cancelled. A man in Glamorgan, south Wales, was taken to hospital with minor injuries. Coastal towns and villages in north Cornwall were among the worst hit in the UK. The storm has been responsible for damaging harbour facilities and both cars and properties have been flooded in the county. As well as the problems posed by high winds, the Environment Agency issued 50 flood warnings and 110 flood alerts, with coastal areas under threat from a combination of a high tide and large waves. By the 4th Neil Davies, flood duty manager for the Environment Agency, said: "Although the stormy weather has passed, high tides combined with large waves from today until Saturday means there is still a risk of flooding along some coasts of England and the Bristol Channel. "Our frontline teams continue to be out on the ground, checking and maintaining defences. We urge people to stay safe on the coast – take extreme care on coastal paths and promenades, and don't put yourself at unnecessary risk trying to take 'storm selfies' or driving through floodwater."</p> <p>Minor damage. Two successive low pressures in the forms of storm Fionn and cyclone David hit the British Isles causing relatively minor damage in Britain. On the 14th the Met Office warned Scotland and northern England will be the worst hit by snow showers, which will follow a band of wet and windy weather on Sunday night and into</p>
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<p>2018 22-24</p>	<p>1</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>21/01/2018 - 24/01/2018</p>	<p>Monday. By the 15th snow forced all schools in the Scottish borders to stay shut. On the 19th, members of the public were urged to stay off the roads, with weather warnings covering much of the country. Dozens of schools around Scotland were closed while some shut early due to the weather.</p> <p>Minor damage. Official gallantry. Official welfare. The north of the Uk was struck by storm Georgina which brought more snow and heavy rain which resulted in flooding and minor disruption. The Met Office says there are likely to be icy patches on some untreated roads, pavements and cycle paths and that rain falling on to frozen surfaces could be a further hazard, particularly across Scotland. Traffic Scotland and North Ayrshire police warned people to drive “very carefully”. Five people were injured in a two-car crash on Sunday afternoon amid hazardous conditions in the Highlands. Yellow warnings were also in place on Sunday for rain, which if was feared could cause flooding in south-west England, Wales and Northern Ireland. Petagna said there would be a large contrast in temperatures on Sunday, with the mercury hitting 10C or 11C in Cornwall while struggling to get above freezing in northern and eastern parts. Flood warnings have been issued and treacherous conditions forecast across the UK as the recent cold snap gives way to milder temperatures. Heavy rain and meltwater have swollen rivers in parts of England and Wales, where the the Environment Agency has issued eight flood warnings and 52 flood alerts. On Sunday, homes were evacuated in north Devon as heavy rain caused landslides, road damage</p>
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<p>2018 26 to 3</p>	<p>2 British Isles</p> <p>The Guardian & The Observer</p> <p>27/02/2018 - 03/02/2018</p>	<p>1 and flooding, and Environmental Agency staff were deployed with pumps to assist those affected. Train services between London, Devon and Bristol, and services in south Wales were affected by flood waters on Sunday night. A Great Western Railway spokesman said: "Due to heavy rain flooding on the railway between Swindon and Chippenham all lines are blocked." In Dumfries and Galloway in Scotland, a 64-year-old man was rescued by a mountain rescue team on Sunday afternoon after he tried to walk to safety after spending a week cut off by snow. The Edinburgh to Glasgow railway line and five others in Scotland have been affected by landslides and flooding, leading to delays and cancellations. Landslides took place on Wednesday along two commuter lines, including the main route between Glasgow Queen Street and Edinburgh, plus Glasgow Central to Carlisle and the Newcastle line via Dumfries. The incidents followed the closure of the West Highland line north of Fort William, after a train to Mallaig became stuck in a heavy landslide on Monday. A gust of 85mph was recorded on South Uist in the Outer Hebrides on Wednesday morning, while there were 75mph winds at The Needles on the Isle of Wight and on Anglesey.</p> <p>1. Major damage. Official gallantry. Impromptu welfare. Official welfare. Impromptu welfare. A combination of Storm Emma and anticyclone Harmut collided over the UK to produced great disrutption and damage in what became know as the Beast from the East. On the 27th the Met Office stated the Uk was facing an "exceptionally cold" night with temperatures falling to -10C in Scotland.</p>
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By the 2nd police had declared a major incident across Avon and Somerset following severe weather across the region. Flood warnings have been issued for parts of Cornwall's south coast on Friday morning. Hundreds of homes across the UK are without power tonight as engineers struggle to reach areas in severe snow. Soldiers have been deployed to transport NHS staff in Scotland. Thousands of vehicles are currently stranded on roads in Devon, Dorset, Hampshire, Cambria and Scotland. A seven-year-old girl has died in a collision in Looe, Cornwall. Police confirmed the death was "weather related". It was stated that the collision has produced blizzards, strong winds, drifting snow and bitter cold have caused death and disruption. The Met Office issued a red warning – its most severe alert – on Thursday as temperatures plunged and up to 50cm (20in) of snow fell on high ground. Holyhead Marina in Holyhead, North Wales was destroyed due to the storm on March 1–2, 2018. Thousands of schools were closed across the UK and hospital operations were cancelled. The weather is costing the UK millions. The AA estimated that there were 8,260 collisions on Britain's roads from the snow chaos in just three days, with the insurance cost already above £10m. Major shopping centres and businesses closed early. The guesthouse Ally's Retreat in Newquay, Cornwall, offered a bed to any homeless person who needed it. Two nightclubs in south Wales opened up for rough sleepers. There were also numerous examples of good deeds. Many 4x4 drivers volunteered to ferry around health workers or get supplies to people who were stranded. By the 3rd it

<p>2018 30-31</p>	<p>5</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>30/05/2018 - 31/05/2018</p> <p>was stated gridlocked motorways, empty restaurants and idle diggers seen across Britain last week cost the economy at least £1bn a day and could halve GDP growth in the first three months of the year. "It is possible that the severe weather could lead to GDP growth being reduced by 0.1 percentage points in Q1 2018 and possibly 0.2 percentage points if the severe weather persists," said Howard Archer, chief economic adviser to the forecasting group EY ITEM Club. The Centre for Economics and Business Research said general output would fall 20%, despite the offsetting benefit of home working and the online industry, while energy production, which accounts for 8%-10% of GDP, would be at least 20% higher. An economist stated discomfort and delays from severe weather, which cut productivity and increased stress and anxiety, were also costs borne by households and businesses that were not calculated in the GDP figures. Minor damage. Official welfare. Lightning strike and flooding risks were increased by the hot humid conditions associated with thunderstorms which developed over the UK. On the 31st the Met Office has issued a yellow alert warning of thundery rain or showers that could bring local flooding to parts of southern England and Wales on Tuesday and into Wednesday morning. Forecasters say there is a small chance homes and businesses could be flooded or struck by lightning, causing damage to some buildings. More than 30 flood alerts are in place for England on Tuesday. On the 31st it was stated torrential rain had fallen producing flooding which posed a risk to life. In Bristol, roads in Bishopsworth were under a foot of</p>
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2018	13 to 14	6	British Isles	The Guardian & The Observer	13/06/2018 - 14/06/2018	<p>water. There is also a possibility of “frequent lightning and large hail”, the Met Office warned. It warned of “spray and sudden flooding probably leading to difficult driving conditions and some road closures and some communities likely to become cut off if roads flood”. The Environment Agency has urged people to check their flood risk, particularly if driving or staying in unfamiliar locations over the half-term break. The difficulty in predicting summer storms was noted and the manager of Natural Resources Wales therefore emphasised the need for the public to regularly listen to the latest weatehr reprotts and warnings.</p> <p>On the 13th weather warnings were issued as a very windy period in the form of Storm Hector began to set in. A weather warning has been issued with winds of up to 70mph expected to hit northern parts of the UK. A yellow weather warning denotign low risk to travel and damage to buidlings was issued. ScotRail said “chainsaw gangs” and overhead line teams had been deployed across the rail network to remove fallen trees and branches that were causing delays and cancellations to services. The storm brought heavy rain to parts of Cumbria with 3.2in (80mm) falling in the region and 5.1in (130mm) in the Isle of Skye in the past 24 hours. The Met Office meteorologist Aidan McGivern said: “The wetttest weather will be out of the way but there will be some blustery showers following and with the yellow warning in force disruption is possible.</p>
2018	28	7	British Isles	The Guardian &	28/07/2018	<p>Minor damage. Ifficial welfare. A series of heavy thunderstorms hit the Uk on the 28th with forecasters</p>

				The Observer		warning flash flash could pose a danger to life in parts of England. The Met Office issued a series of yellow and amber warnings for rain, thunderstorms and wind on Saturday and Sunday, and said delays to public transport and difficult driving conditions on flooded roads were expected. The Met Office also said thunderstorms in north-east Scotland could cause disruption on Saturday, and that power cuts, sea swells and damage to campsites were possible in south Wales and south-west England in the early hours of Sunday. Flights were widely delayed. Heavy, thundery showers continue in western areas and parts of Wales, the Met Office said, as changeable weather replaces the hot spell much of the UK has endured for weeks. "It's a very unsettled weather picture across the whole of the UK," Kent said.
2018	17 - 18	9	British Isles	The Guardian & The Observer	17/09/2018 - 18/09/2018	Storm Helene crossed the UK and Ireland on 17–18 September, with the Met Office and Met Éireann issuing yellow wind warnings. Helene was downgraded as it approached the British Isles, with winds gusting to only 40 to 50 mph (64 to 80 km/h) in isolated locations; as a result, all warnings were cancelled on 18 September as Helene was still crossing the UK.
2018	18-21	9	British Isles	The Guardian & The Observer	18/10/2018 - 21/10/2021	Moderate damage. Official gallantry. Official welfare. "A combination of storm Ali and Bronagh caused considerable disruption across Britain. On the 18th Scotland, Northern Ireland and the north of England have been advised to batten down the hatches for the first named storm of the season. The Met Office issued the weather alert from 6am on Wednesday, when Storm Ali was expected to roll in from the Atlantic bringing gusts of

80mph. Forecasters warned of danger to life from flying debris, while power cuts, damage to buildings, road closures and transport cancellations were also possible. The autumnal conditions come after commuters in Scotland and northern England experienced a wet and windy start to the day on Tuesday, as the remnants of Storm Helene, downgraded from hurricane force, tracked across the British Isles. Parts of the UK were hit by gusts of about 30-40mph, with wind reaching 50mph in Wales. Throughout the 19th thousands were left without power and facing severe travel disruption as lorries turned over and train services were cancelled. In west Scotland children were banned from walking home from school because of the risk of injury from flying debris. A major incident involving "serious risk to life" was declared in Dumfries and Galloway, south-west Scotland, by the police and local council. The council's virtual operations support team said that some children had already been injured and warned: "It is likely that, in order to keep pupils safe, we will not be allowing children to walk home from school at the end of the school day. The storm caused widespread travel disruption across Scotland's central belt, with all train services out of Edinburgh Waverley, Glasgow Queen Street and Glasgow Central's high level suspended by early afternoon after damage to overhead power cables. Flights from Glasgow and Edinburgh airports were also delayed. A ship became detached from its moorings in strong winds at the port of Greenock, Inverclyde. The Met Office also issued amber and yellow warnings for Cumbria, advising people to secure garden

furniture, be aware of flying debris and take extra care on the roads. By the 20th High winds and torrential rain were expected to cause travel problems across much of England, with drivers in Cumbria advised to avoid all but essential travel as the county braced itself for up to 10cm of torrential rain. Wind from Storm Ali cut power to 24,000 homes in Cumbria and north Lancashire on Wednesday evening, with 3,000 properties left in the dark overnight. Delays of up to an hour were expected until 1pm on Thursday between Preston and Glasgow, and the southbound and northbound Caledonian Sleeper Highlander services were cancelled. The Met Office issued weather warnings for many parts of England on Thursday. An area of persistent and heavy rain was expected to develop across Wales and north-west England, while strong winds were forecast for much of the rest of England on Thursday evening and overnight into Friday morning. Electricity North-West, which provides power to Cumbria and Lancashire, said engineers were working hard to mend broken power lines. On the 21st it was warned blustery winds cause a continued risk as Storm Bronagh continued to strafe Britain. Speed restrictions were in place for many trains across the network in Wales and the west and north of England due to high winds, which were forecast to reach 45-50mph across much of the country. In Wales, a landslip in the Dinas Rhondda blocked the railway line between Ystrad Rhondda and Porth, while a tree stopped trains between Carmarthen and Milford Haven. In south-west Wales, there were 12 flood warnings in place on Friday morning, with nearly 40

2018	11 to 15	10	British Isles	The Guardian & The Observer	13/10/2018 - 15/10/2018	1	<p>flood alerts issued across the country, while there were warnings in place in Staffordshire, Chesterfield and South Yorkshire, with more than 30 alerts across the north of England and West Midlands. Rainfall accumulations reached 70 mm (2.8 in) widely across Wales and northern England, with some parts of Wales recording up to 100 mm (3.9 in) of rain although most of the hazards materialised in the east with the west being relatively little effected."</p> <p>1. Moderate damage. Official gallantry. Official welfare. "Another intense low pressure named Storm callum battered the Uk causing severe flooding the Wales as torrential rain fell and strong winds blew. More than 30 flood warnings were in place in south-west Wales on Saturday, with a further five in England and two in Scotland.Amber warnings were issued in South Wales communicating that flooding could be a ""danger to life"". Fire crews rescued a resident of Aberaman, Rhondda Cynon Taff, from a first floor window on Saturday morning, the BBC reported. Many residents had stayed in their homes in the South Wales valleys despite many offers to leave. Several police forces reported road accidents caused by surface water overnight. A yellow warning covers much of the rest of Wales and parts of Scotland and the north-west and south-east of England. Some Arriva Trains Wales services were cancelled after flooding and fallen trees caused major disruption. On the 13th a man died in a landslide in Carmarthenshire near the Gwendraeth estuary causing much heartbreak for the family who stated ""We are heartbroken at the tragic loss</p>
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of our beautiful son". The man died in a landslide when he got out of the bus he was travelling in and was unexpectedly hit by a minor slide of rocks and an earth slip. Natural Resources Wales said some of the flooding in Carmarthenshire, south-west Wales, was the worst for 30 years. More than 70 flood warnings and alerts were put in place in Wales and England over the weekend. A former Carmarthen mayor exclaimed "These are the worst floods to hit Carmarthen since 1987. The old town bridge was shaking with the force of the water". Other towns affected included Crickhowell in Powys and Cardigan and Aberaeron in Ceredigion, where the storm damaged boats in the harbour. On its first day as Wales' new rail operator on Sunday, Transport for Wales said several trains suffered "significant damage" during the storm. "This will result in services being altered and operating with reduced capacity on Monday," it said in a statement. The deputy chief constable of Dyfed-Powys police, Darren Davies, tweeted: "Awful weather conditions for communities but superb effort in response by police staff, PCSOs and officers. This included incredible acts of bravery which no doubt saved life. Truly amazing stuff, which doesn't get counted in stats but is priceless." Floodwater also caused a 1.8m (6ft) hole to open up beneath the rail track along the Teignmouth Estuary in Devon. On the 15th it was reported the Isles of Scilly endured the fiercest gusts, as the third named storm of the season swept through south-west England, Wales and north-west England, while 60mph winds lashed Camborne in Cornwall and Milford Haven in Pembrokeshire. More

2018	29-30	11	British Isles	The Guardian & The Observer	21/11/2018	<p>than 2,000 homes in parts of Cumbria and Lancashire were left without power for several hours on Friday as the storm swept across the north-west of England. Some flights were cancelled at Cardiff and Exeter airports, while rail passengers in Wales and the south-west of England were warned of disruption to services amid high winds. The Met Office meteorologist Alex Burkill said: "We've got a wind warning which covers all the western side of the UK. That in itself is likely to bring disruption to roads and there is likely to be some bridge closures and power outages. We also have yellow and amber warnings of between 50mm and 150mm of rain for Wales. That's quite a substantial amount of rain to come and could bring flooding."</p> <p>Official welfare. After a spell of uncharacteristically mild weather icy winds, sleet and snow showers hit the UK which were particularly prevalent in Scotland and Wales. The Met Office advised people to be weather ready, tweeting a checklist that included getting the flu jab, checking tyres, packing a grab bag and making sure pipes were insulated.</p>
2018	15-17	12	British Isles	The Guardian & The Observer	15/12/2018 - 16/12/2018	<p>Minor damage. Official gallantry. Official welfare. On the 15th the Met Office stepped up weather warnings with snow and freezing rain due across large parts of the UK prompting fears of travel delays and power cuts. On the 15th Storm Deirdre has prompted six yellow and amber weather warnings that cover almost the entire UK apart from London and the south-east, where heavy rain is still expected. The Eden Project in Cornwall was forced to close its doors on Saturday because of flooding. The</p>

2019 14-18	1	British Isles	The Guardian & The Observer	13/01/2019 - 18/01/2019	<p>tourist attraction apologised on Twitter, and said it was offering refunds or exchanges to people who had booked tickets in advance. A new amber alert issued on Saturday warned of freezing rain and a prolonged period of heavy snow developing in the Scottish Borders in the afternoon. Freezing rain is rare in the UK and can be dangerous because of the rapid formation of black ice, which can be difficult to see and very slippery. Police Scotland said people should only travel if they consider it necessary. On the 16th people were warned of heavy snow, freezing rain and gales. The storm hit one of the last major shopping days before Christmas on Saturday, causing havoc on the roads and misery on the high street for retailers hoping for a festive sales boost. Wind speeds reached up to 73mph, the maximum recorded at Altnaharra in the Scottish Highlands. Between 40 to 50cm of snow fell in the central highlands, the Met Office said and 79 mph was recorded at Aberdaron. Curmbria's traffic police were forced to close several roads.</p> <p>Official welfare. On the 13th the Met Office forecasted Gusts of up to 80mph could hit parts of the UK as Storm Brendan sweeps in, prompting the Met Office to issue a weather warning. The windy weather will persist for England and Wales on Tuesday as the storm continues to move east. Forecasters said coastal routes, sea fronts and coastal communities may be affected by spray or large waves. A blast of Arctic air will bring freezing temperatures to the UK this week and end what has been a mild start to the new year. Overnight frost and the possibility of rain showers turning snowy in some parts</p>
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<p>2019 8 to 9</p>	<p>2 British Isles</p> <p>The Guardian & The Observer</p> <p>08/02/2019 - 09/02/2019</p>	<p>3</p> <p>are forecast by the Met Office, though no weather warnings have been issued. Bonnie Diamond, a meteorologist, said the cold polar air from the north-west will switch to a colder Arctic airflow from the north. "Through Wednesday a polar maritime air mass is going to push in from the west, but by the time we get to Thursday it will be an Arctic air mass," she said. The Met Office issued a yellow warning for possible snow on hills in the south of Scotland, northern England and the north Midlands from 1pm on Friday and through the evening. A yellow warning of hill snow in Wales was in place until 1pm. It said some roads and railways were likely to be affected as a band of rain, sleet and snow moved slowly east across England and southern Scotland, and 1-4cm of snow could accumulate in the highest areas. Alex Burkill, of the Met Office, said Wales could expect snow.</p> <p>3. Moderate damage. Official gallantry. Official welfare. On the morning of the 8th the arrival of Storm Erik was forecast which was expected to bring heavy rain and winds of over 70 mph to large areas of the British Isles. The Met Office issued two weather warnings on Friday: for strong winds across Northern Ireland and western Scotland until the evening, and for heavy rain in Scotland that will continue until Saturday afternoon. Welsh and Cornish coasts were expected to be exposed to winds of approximately 55mph, while along the coast of southern England, gusts may reach 50mph. While a lull is expected in the fiercest winds on Friday evening, gusts will pick up again at about midnight, when a warning will cover Northern Ireland, southern Scotland and much of</p>
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northern England. A article was also featured concerning the dangers of wearing raincoats engineered with chemicals which were damaging to the skin and body. On the 9th a kitesurfer was killed after an incident on a beach in north Devon, where winds of up to 56mph were recorded according to the Met Office. Police said the man, who has not yet been identified, had been airlifted to North Devon district hospital, but was confirmed dead later after sustaining fatal injuries on the beach at Saunton Sands, near Barnstaple, on Saturday morning. On Friday morning in Devon, a 50-year-old man was pronounced dead after a tree fell across the A384 in Buckfastleigh, trapping his vehicle beneath it. A second vehicle drove into the tree after it had fallen, with the sole occupant, the driver, treated at hospital for minor injuries. Also on Friday morning, a van driver was killed after he collided with a fallen tree on the B4306 between Pontyberem and Llannon in west Wales. "A large tree had fallen across the road and collided with the van," Dyfed-Powys police told WalesOnline. "Tragically, the male driver was pronounced dead at the scene and his family is being supported by police." A yellow weather warning for strong wind covered much of Wales, central and northern England, and southern Scotland, with a separate yellow warning for northern Scotland that said flooding could follow heavy rains. One lane was closed on the Severn Bridge between south Wales and south-west England due to the strong winds, and the A548 was closed in both directions around Mostyn, north Wales, because a tree fell across the carriageway. Although the wet and windy

<p>2019 2 to 4</p>	<p>3 British Isles</p> <p>The Guardian & The Observer</p> <p>02/04/2019 - 04/02/2019</p>	<p>weather was expected to ease, further difficult conditions were forecast. There would be showers in western and northern areas, with frost and fog forming as winds slowed down, and southern England could expect some rain, with patches of snow falling over hills.</p> <p>Minor damage. Official gallantry. Official welfare. On the 2nd it was declared that Storm Freya was to bring strong winds and produced dangerous conditions causing disruption in Britain. Forecasters predict the storm will hit on Sunday afternoon and may be severe enough to cause injuries and danger to life from flying debris and large waves. There could also be damage to buildings and trees, travel disruption and power cuts. Gusts between 55mph and 65mph are likely, with the potential for wind speeds of between 70mph and 80mph in some areas. Storm Freya's arrival will bring a much less spring-like start to March. Grahame Madge, a Met Office spokesman, said: "What we have got is a storm developing quite rapidly to the south and west of the UK. It will be developing as it goes across the UK and it will be bringing very strong winds." On the 4th a snow warning has been issued as Storm Freya sweeps across the UK and wind speeds approach 80mph in some parts of the country. The Met Office has warned that dangerous conditions will continue into Monday morning and there have been reports of flying debris and sailors stranded at sea. Hundreds of homes have been left without electricity and gales have also disrupted trains and closed bridges. Heavy rain hit Scotland on Sunday, with 34mm falling in Kinlochewe in Torridon in the north-west Highlands. In Shapp, Cumbria,</p>
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<p>2019 11 to 16</p>	<p>3</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>11/03/2019 - 20/03/2019</p>	<p>22mm of rain was recorded. The high winds were forecast to continue as the storm pushed north from south-west England. "Snow continues to fall across parts of northern England and Scotland, with 6cm reported at our Spadeadam station in Cumbria," forecasters said in a tweet. There were reports of heavy snow affecting travel on the A595 between Carlisle and Cockermouth on Sunday night, with video posted on social media showing cars at a standstill. One motorist said there was "chaos" on the A595, tweeting: "Shocked at how bad it is! Major problems in Cumbria due to the snow! Very severe." The strongest gust recorded on Sunday was in Mumbles, south Wales, at 76mph. The north Wales town of Capel Curig was a close second at 73mph. The M4 was blocked between Bridgend and Pencoed, in south Wales, after a car crashed into a central reservation and traffic was diverted off the M4 between junctions 41 and 42 because of winds on Briton Ferry bridge near Swansea. Nearby flooding closed a five-mile stretch of the A465 as a river burst its banks which caused more than 1,200 homes to be left without power. The Tamar Bridge running between Cornwall and Plymouth was temporarily closed to wind-susceptible vehicles such as caravans. Minor damage. Official gallantry. Official welfare. Meteorologists signalled the ensuing Storm Gareth would bring severe weather to the UK on the 11th as they issued a yellow weather warning for strong winds covering almost all of England, Wales and Northern Ireland as well as parts of Scotland. Another Met Office tweet added that northern England was particularly at risk of travel</p>
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disruption and localised flooding. There could be 50mm to 60mm of rainfall over higher ground in Cumbria. The Met Office chief meteorologist, Paul Gundersen, said: "The strong north-westerly winds will also affect south-west Scotland late on Tuesday, spreading across much of England and Wales through Wednesday. Gusts of 65mph were predicted along western coasts. There was the potential for gusts to peak at 80mph. A yellow alert was defined as meaning people should prepare for severe weather that could cause disruption to day-to-day activities and travel delays. On the 12th the heavy rain hit Wales, western Scotland and southern England with high winds affecting wide areas. The Environment Agency said staff had been working through the night in Cumbria and Lancashire to monitor rain and river levels and to remove debris. "Rain is falling on already wet catchments, therefore it's important that people do remain vigilant, be prepared and know your risk," it said. Strong winds were expected to follow the rain, raising the risk of damage to buildings, power cuts and travel problems. On Wednesday the weather was likely to be "cold and very windy with sunshine and showers, heavy in places with snow over northern hills. Showers will steadily ease but rain will reach the west later." On the 13th six crew members from a stricken fishing vessel have been rescued amid 20ft mountainous waves whipped up by the storm while rail and road links across Britain have been hit by storm-force winds. The fishermen were airlifted from a 79ft French fishing boat off Land's End after it suffered engine failure. Another fishing vessel went to help and a lifeboat was

launched after the Maritime and Coastguard Agency (MCA) said it was alerted at approximately 10pm on Tuesday night. "Despite atrocious weather, Sennen Cove lifeboat launched but due to 5-6 metre [16-20ft] waves on scene and storm-force winds, it was impossible for either the fishing vessel or the lifeboat to establish a tow with La Fanette," the MCA said. People using trains in Wales, Scotland, the north of England and East Anglia were warned that services could be disrupted by high winds with speed restrictions in place across a wide area. Meanwhile, the residents of Llandudno in north Wales had unexpected visitors as a result of the storm when a 122-strong herd of Kashmir goats were seen wandering into the town centre by local residents, having been driven from their home of Great Orme Park by the bad weather. Two articles related articles followed, one of which concerned the development of the Beaufort scale by Sir Francis Beaufort in 1805. Storm Gareth may have whipped up some very strong winds in parts of the UK last week, but mean wind speeds were generally about 25-30mph inland and about 40mph along the coastal areas of western Scotland and north-west England. This, according to the Beaufort scale, only classifies as a strong breeze inland and as a gale along the coast. The other concerned whether March really merited its reputation as the windiest month. It was stated March is breezy and gusty rather than having strong, sustained winds. Wind statistics show that while March has the highest chance of wind blowing more than 4 on the Beaufort scale at any given time – "moderate breeze, small branches moved" – the

2019	26 to 27	4	British Isles	The Guardian & The Observer	27/04/2019	<p>average wind speed is no higher than in December, January or February. The UK's wind turbines produce slightly less energy in March than in the winter months. So March's claim to be the windy month is perhaps overblown.</p> <p>Minor damage. Official gallantry. official welfare. Storm Hannah straffed the UK bringing with it strong winds reaching 60kts in west Wales. On Saturday afternoon, ESB Networks confirmed that 33,000 homes were affected at the height of the storm on Saturday morning. Yellow wind warnings covering Wales and central and southern England, and a yellow rain warning in Northern Ireland remained in place until 3pm. Western Power Distribution said more than 1,700 properties had been left without power on its network on Saturday morning, the majority of which were in Wales. The storm also led to the closure of the Severn Bridge in Wales. Transport for Wales said storm damage on the Conwy Valley line meant buses were replacing trains between Llandudno Junction and Blaenau Ffestiniog. The Llyn Peninsula experienced the highest wind overnight, when a gust of 82mph was clocked at Aberdaron. Reports of fallen trees coming into leaf caused disruption to rail and road services in West Wales.</p>
2019	9	5	British Isles	The Guardian & The Observer	09/05/2019	<p>An article concerned the need to managed reallignment and community relocation as a result of storm induced climate change in a world set to warm 4 degrees. The agency said on Thursday that difficult decisions would have to be taken in the coming years to make sure the UK was resilient amid flooding that would not be held back by</p>

higher land defences. The chair of the EA stated “The coastline has never stayed in the same place and there have always been floods, but climate change is increasing and accelerating these threats,” said Howard Boyd. “We can’t win a war against water by building away climate change with infinitely high flood defences. We need to develop consistent standards for flood and coastal resilience in England that help communities better understand their risk and give them more control about how to adapt and respond.” The strategy text says the approach to flood protection and assessing risk had to change. “We need to act now without delay ... we need to apply a different philosophy.” Instead of a reactive approach it was state the country needed to build "climate resilient" communities, homes and businesses. The policy calls for natural barriers and flood relief systems, but also for an increase in the resilience of homes and businesses against the inevitable flooding with such structures as flood doors and stone floors. The strategy also makes clear that some areas of the UK and some homes and businesses cannot be protected. “Despite our collective best efforts, we will not always be able to prevent flooding and coastal change happening.” The priority in these areas will be to keep people safe, minimise damage and aid quick recovery. Ultimately it may also mean supporting individuals and communities in a move from an affected area. “Resilience includes accepting that in some places we can’t eliminate all flooding and coastal change, and so we need to be better at adapting to living with the consequences – for example,

by designing homes that can be restored quickly after they've been inundated with water, or potentially moving communities out of harm's way." It is already thought unbeneficial to protect or adapt about 114 miles of coastline because of flooding, and more than 1,000 miles of coast are at risk of erosion. A recent report from the government's advisory panel the Committee on Climate Change said that by the 2080s up to 1.5m properties in England could be in areas of significant levels of flood risk. More homes would be at risk in the future as the number of properties built on floodplains was likely to double over the next 50 years, the agency warns. The agency set out a target, for up to 2050, for the UK to become resilient to flood and coastal risks, and for a policy of "resilience for places", referring to the ability of communities to cope with, and recover from, all sources of flooding or coastal change. The agency says an average outlay of £1bn a year will be needed to build traditional flood and coastal defences and allow for natural flood management. "Flooding of any kind is horrendous," the report says. "Erosion destroys. [Floods] are dirty, invasive, damaging, and can kill. They can force people to leave their homes and their businesses, cause prolonged mental ill health, and destroy livelihoods, natural habitats and other valued places. At best flooding and coastal change can be inconvenient and disruptive." Lord Deben, chair of the Committee on Climate Change stated "The Environment Agency is doing just that by setting out their flood strategy, but we won't be able to keep up with the pace of change if we don't reduce emissions to zero,". The

<p>2019 11 to 19</p>	<p>6</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>11/06/2019 - 19/06/2019</p>	<p>environment minister, Thérèse Coffey, said the government was already providing £2.6bn over six years, delivering more than 1,500 projects to better protect 300,000 homes. “But the threat of climate change will mean an increasing risk, and preparing the country is a priority for the government, and the nation as a whole,” she said, adding that the government would be launching a call for evidence to inform action on flood and coastal erosion risks.</p> <p>Minor damage. Official gallantry. Official welfare. Thunderstorms bringing heavy rain caused several hazards across the UK and the Met Office issued several yellow warnings across the kingdom. The agency said on its website shortly before 6pm on Monday: “River levels have risen as a result of localised thunderstorms. Flooding of property is expected imminently. “Please take action. Further thunderstorms are forecast over the next six hours. A further six flood alerts warned people to prepare for potential flooding in parts of south London, Nottinghamshire, Wiltshire and Devon. On the 12th Weather warnings have been put in place across Britain as rail passengers were advised not to try to travel between England and Scotland. The Met Office issued a yellow weather warning for rain and thunderstorms for parts of the north of England, the Midlands, Scotland and Wales on Wednesday. All lines are blocked on the West Coast mainline between Carlisle and Lockerbie because a tree fell on overhead equipment in Floriston, Cumbria. Network Rail sent out extra teams to repair the damage. A spokesperson said “trees, branches and other debris” had</p>
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<p>2019 28-30</p>	<p>7</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>28/07/2019 - 30/07/2019</p>	<p>been “blown on to the tracks, as well as some instances of flooding. We have extra teams on the ground at various locations across the country to deal with any disruption.” “The closure of our route to Scotland is causing significant disruption and we want to apologise to all our customers affected by this,” a spokesman said. The Environment Agency issued 44 flood alerts for England, advising flooding was possible, and five flood warnings, which mean flooding was expected and immediate action was needed. In Wales, people were advised not to travel unless it was essential. “Continued heavy rain during today means that travel to and from your desired destination cannot be guaranteed,” Transport for Wales tweeted. North Wales police tweeted about road closures in the area. “Good Morning, weather and road conditions are atrocious. Please slow down wherever you may be going. Assess the need for your journey, drive to the conditions and your driving ability. Please DO NOT ignore any road closure signs. Think Safety,” they tweeted. The weather was attributed to the impact of climate change on the jet stream. Heavy rains had greater impacts on eastern Britain and the storm moved from UK shores on the 28th. On the 28th torrential rain fell which in some places was more than 1/2 a months rain. The Minor damage. Official welfare. Met Office issued a yellow weather warning for rain across parts of the Midlands and the north-west of England until midnight on Sunday, with the Environment Agency also issuing flood warnings across the two regions, as well as for the east of England. The wet weather came</p>
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<p>2019 18 to 19</p>	<p>8</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>09/08/2019 - 11/08/2019</p>	<p>after record temperatures, thunderstorms and heavy rainfall wreaked havoc on the transport network. There were 20 flood warnings in place across north-west England on Monday morning, affecting parts of south Manchester. Forecasters said while the heavy rain would clear on Monday, a second band of low pressure will hit the country on Tuesday. The Met Office has issued a yellow weather warning for thunderstorms across much of the south-west and Wales for Tuesday with the risk of floods, lightning strikes, hail and strong winds. Wilson said: "An area of low pressure will bring the risk of quite heavy thundery showers into Tuesday. There's definitely a risk of flooding. Thunderstorms are a concern – there could be as much as 30mm to 40mm of rain. That's quite a lot of rain flowing in quite a short period of time." Transport delays were said to be likely. Power cuts and difficult driving conditions were also possible, and 20mm to 30mm (0.8-1.2in) of rain could fall in an hour in some areas. Met Office severe weather warnings covered swaths of England, Wales and Scotland across Tuesday and Wednesday. The area affected by Tuesday's warning has been extended, with storms expected to hit more of the country than previously thought. Minor damage. Official gallantry. Official welfare. Severe August thunderstorms and wet weather from the remnants of Tropical Storm Enesto "possibly driven by climate change" has caused widespread disruption and prompted the Met Office to issue yellow weather warnings across much of the UK. Festivals have been cancelled and floods are expected as the extreme weather</p>
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is forecast to continue over the weekend. Organisers cancelled the annual Race Across Torbay on Sunday as weather warnings for Devon and Cornwall were issued. On Sunday the bad weather is expected to concentrate over northern England, Scotland and Northern Ireland, with thunderstorms and 60mph winds in places. "Summer storms, compared with those in autumn and winter, always have the potential to create additional impacts because more people are likely to be outdoors, especially by the coast. Highways England urged people to travel by car only if necessary over the weekend. Conditions are expected to calm on Monday, when no warnings are expected. Thunderstorms and high winds are expected to cause to further travel chaos and cancellations of high-profile events across Britain this weekend. Yellow warnings for stormy weather in Scotland and Northern Ireland, and for strong winds across Wales and most of England, have been predicted by the Met Office. Heavy rain caused flooding on the west coast mainline between Carlisle and Lockerbie, leading to its closure. Network Rail Scotland tweeted pictures of the flooding and reported that the water level was up to 30cm above the rails. Snell said: "No matter where you are in the UK you're at risk of seeing some kind of localised disruption from wind. It's a case of staying in touch with weather forecasts and being prepared for extra travel time as there may be road closures due to localised flooding." Further north, heavy rain flooded the line between Penrith North Lakes and Carlisle, meaning trains were running at a reduced speed with many services delayed or cancelled. Music festivals

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British Isles

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and smaller events have been cancelled because of the bad weather. Boardmasters, a surfing and music festival in Cornwall, was the first to be cancelled when organisers blamed "severe weather conditions". Organisers of Bristol's international balloon fiesta scaled back the event, including cancelling Friday's mass ascent. The first day of Blackpool air show on Saturday was cancelled when afternoon winds of 45mph were forecast. "The safety of the pilots and the watching public is paramount," a spokesman said, adding that Sunday's events were still scheduled to go ahead. The nearby St Anne's international kite festival was also cancelled. On the 10th rail passengers 4ail passengers have endured a second day of disruption, this time caused by severe winds and flooding rather than power outages. The most high-profile victim was the west coast mainline between Scotland and England, closed after a foot of water submerged tracks between Carlisle and Lockerbie.

On the 25th flood warnings were issued as a low pressure system folowed byt he tailedn of hurricane Lorenzo hit the British Isles.. Forecasters have warned of potential widespread and dangerous flooding in south Wales as parts of the UK face heavy rain and a plunge in temperatures this weekend. South Wales is likely to be worst affected. An amber warning was issued and the Met Office told residents to expect "fast-flowing or deep floodwater". It said there was a strong chance some communities would be cut off and there was potential for power cuts. "We want people to be aware that flood water can be extremely dangerous, and people should not

attempt to walk or drive through it unless instructed by the emergency services," it said. The yellow warnings of rain covering northern and south western parts of the UK begin from 3pm on Friday and last for 24 hours. The amber warning for Wales begins from 6pm on Friday and lasts until 11am on Saturday. The Environment Agency has issued 82 flood warnings and 117 flood alerts, with the Midlands most affected by the wet weather. The Environment Agency said there would be travel disruption in the affected areas and some individual properties would flood. Northern Scotland and the far east of England could expect some showers, as could Cornwall, where it would be windy and cloudy. On the 28th the Met Office issued a yellow weather warning from 6pm on Saturday to 5pm on Sunday and warned of persistent rain and a risk of flooding across the north-west and south-west of England and Wales. The Met Office meteorologist Alex Burkill said areas such as Devon and Cornwall could experience coastal gales of up to 50mph, while 30mm-40mm of rain was expected to fall within short periods over the weekend. Cities including Manchester, Liverpool, Bangor, Swansea and Cardiff are covered by the weather warning. Parts of England and Wales are bracing for further heavy rain with forecasters warning up to 70mm could fall in some areas. Trains between Blackpool North and Preston were suspended due to flooding and parts of the Cheshire track were also affected. Police forces in England and Wales have warned drivers to take care on slippery and potentially treacherous roads, and rail passengers are advised to check their route for delays

2019	26-28	10	British Isles	The Guardian & The Observer	25/10/2019 - 28/10/2019	<p>before travelling. On the 30th a threat-to-life warning was issued. As of the afternoon of the 30th, there were 56 flood warnings in place across England and Wales, and a further 153 flood alerts. Dan Suri, the chief meteorologist at the UK's Met Office, said on the 2nd rain and heavy winds from hurricane Lorenzo would hit western parts of the UK from Thursday, with a risk of coastal gales in Northern Ireland and western Scotland on Thursday, and Wales and south-west England but little damage ensued. Minor damage. Official gallantry. Official welfare. On the 25th forecasters warned of potential and widespread and dangerous flooding in south Wales as heavy rain and falling temperatures were forecast. Weather warnings are in place for "heavy and persistent" rain stretching from the south-west of Britain, across the whole of Wales and through much of the Midlands, to northern England. South Wales is likely to be worst affected. An amber warning was issued and the Met Office told residents to expect "fast-flowing or deep floodwater". It said there was a strong chance some communities would be cut off and there was potential for power cuts. The yellow warnings of rain covering northern and south western parts of the UK begin from 3pm on Friday and last for 24 hours. The amber warning for Wales begins from 6pm on the 25th and lasts until 11am on the 26th. The Ea issued 82 flood warnings and 118 flood alerts on the 28th. River levels remain high after heavy rain led to the postponement of football matches, train delays and flooded roads. On the 28th it was warned Northern Scotland and the far east of England could expect some</p>
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2019	22-27	11	British Isles	The Guardian & The Observer	22/11/2019 - 27/11/2019	<p>showers, as could Cornwall, where it would be windy and cloudy over the next few days as the storm dissipated. Minor damage. Official gallantry. Official welfare. A tempestuous period resulting in heavy winds and strong winds caused many societal issues throughout the Isles. Heavy and persistent rain was due to start in south-west England from 12pm on Friday and last until 6pm on Saturday. About 20-30mm of rain was expected across the region, though the upper slopes of Dartmoor in south Devon could receive 40-50mm. The average rainfall for Devon and Cornwall during November is 135-145mm. Yellow warnings have been issued in north-eastern England and parts of Scotland, which will also experience wet weather throughout Saturday. Nine flood warnings are in place throughout England, predominantly in the south-west and north-east, alongside 85 less severe flood alerts. However, Wales, central and south-eastern England will escape the worst of the torrential rain. The Environment Agency has advised people in areas at risk of flooding to turn off the gas, water and electricity in their property, move possessions upstairs and ensure that residents, pets and any vehicles are moved to safety. In Devon and Cornwall, firefighters warned drivers to stay away from flooded roads after a number of calls overnight to stranded cars. Whitchurch in Cardiff recorded the second highest level of rainfall, with 30.6mm (1.2in) falling in 24 hours, although this represented about one-fifth of the average November deluge for the area. As of 8am, the Environment Agency had 21 flood warnings in place –</p>
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2019	8 to 9	12	British Isles	The Guardian & The Observer	09/12/2019	<p>meaning flooding is expected – largely across the south coast of England between Hampshire and Cornwall. Minor damage. Official gallantry. Official welfare. Storm Atiyah brought high winds triggering powercuts across the UK. Gusts of up to 100mph were predicted to cause disruption. Power companies registered 26 faults in the south-west on Sunday and two in Wales, which led to 5,500 customers being cut off. There were lane closures on the M48 Severn Bridge on Sunday, and coastal communities were warned tidal surges could throw debris over sea defences. The Met Office said delays were likely to continue on road, rail, air and ferry transport, and that short-term loss of power was possible in some areas on Monday. A silver lining of the blustery conditions was that a renewable power record was set on Sunday evening, when windfarms generated more than 16GW of power – five times the output expected from the new Hinkley Point C nuclear power plant, according to the National Grid. On the 8th the wind supplied 43.7% of British electricity against 20.5% for nuclear. Large waves were seen overtopping sea walls around many coastal parts of Wales and the southwest of England. There were also some reports of structural damage in Cornwall.</p>
2019	20-27	12	British Isles	The Guardian & The Observer	20/12/2019 - 27/12/2019	<p>Minor damage. Official gallantry. Official welfare. The remnants of two vast depressions collectively termed storms Elsa and Fabien causing heavy rain and strong winds which induced damage. Some areas of southern England and Wales recorded around 5cm of rain in 36 hours, and the Met Office issued dozens of flood warnings across England, with rain forecast to persist in some areas</p>

until Sunday. In Devon and Cornwall heavy rainfall and flooding had made some roads impassable. The Met Office said localised flooding was likely to cause delays in some areas through the weekend. The worst hotspots for traffic delays were expected on motorways, including the north-western M25, the M5 between Bristol and Weston-super-Mare and the M6 around Birmingham, the AA said. Millions of Christmas getaway motorists were hit by wet weather across large parts of the country on Saturday. More than 100 flood warnings were issued as downpours moved eastwards across southern England on Saturday afternoon and into the evening. A further 255 flood alerts were also in place across England, stretching into the north. Up to 30mm of rain was due to fall in nine hours on Saturday as December's unusually wet weather continues. A yellow heavy rain warning in southern parts of the country is in place until 9am on Sunday. The Guardian then ran an article questioning why the flooding was so impactful over the past 2 months. It was stated: There were several factors at play, but the most obvious was the sheer volume of rainwater that fell in a short period. It was estimated that a month's worth of rain – about 80mm – fell in 24 hours on already saturated ground in the worst-affected areas in early November. The country as a whole had received 92% of its average rainfall for December by last Thursday. The climate emergency may also have played a part, as the Met Office estimates that the amount of rain from extremely wet days in the UK has increased by 17% in the most recent decade measured, 2008-2017, compared with 1961-1990. The Conservative

party pledged in its manifesto to spend £4bn over the next five years on a new flood defence programme, a commitment repeated in the Queen's speech on 19 December. It said it was investing in 1,000 flood prevention schemes across the country to better protect 300,000 homes by 2021. However, the Environment Agency has said an average of £1bn a year will need to be invested in flood defences as well as a wider programme making all infrastructure flood-resilient by 2050. On the 27th it was again exalimed: Floods have closed roads in south-west England and dozens of warnings remain in place after wet weather blighted the Boxing Day sales. The rain is expected to ease into the weekend but groundwater levels continue to rise in parts of southern England after prolonged downpours. The Environment Agency (EA) has warned of flooding in 30 areas. The A35, A39 and A377 in Devon were closed on Friday and the fire brigade had to rescue motorists from a car and a lorry stranded by flood water and a fallen tree near Leigh Cross. Firefighters were also called to Plymtree in Devon on Thursday night to rescue a driver who was unable to leave their car because the water was too deep. Clare Dinnis, an EA flood duty manager, said: "While the weather outlook is improving, groundwater levels continue to rise after recent rainfall, meaning that there is a continued risk of groundwater flooding in parts of southern England over the next few days. "Our pumps also remain in place in Somerset where our focus is on reducing levels of water on Currymoor." The EA has issued 121 alerts of possible flooding over the past 24 hours, with 28 no longer in

2020	12 to 15	1	British Isles	The Guardian & The Observer	12/01/2020 - 15/01/2020	<p>place, across Devon, London, the Midlands and beyond. The Met Office said a period of high pressure was expected over the weekend, bringing a dry end to the year for many.</p> <p>Minor damage. Official gallantry. Official welfare. Storm Brendan swept in from the Atlantic causing great levels of disturbance across the west of Britain. Gales of up to 80mph are forecast to sweep across parts of the UK with the arrival of Storm Brendan. The Met Office issued warnings of disruption to travel services and potential power cuts. On Sunday, HM Coastguard urged people living in coastal communities to take care after a search-and-rescue operation in the sea off Blackpool was launched on Saturday night after a report of a man being swept away by large waves on the seafront.</p> <p>Meteorologically the conditions were described as a "weather bomb" with hurricane-force gales, 50ft-waves and snow will combine with the 1,500-mile Storm Brendan, named by the Irish forecaster, Met Éireann. The Met Office put yellow weather warnings of strong winds in place for parts of the UK from midday on Monday to midnight. Frank Saunders, chief meteorologist at the Met Office, said: "It's going to be windy across the western half of the UK, with gusts reaching 60 to 70mph along Irish Sea coastlines, the west of Scotland and perhaps some English Channel coasts – maybe even 80mph in a few exposed places." The severe conditions were predicted to cause travel disruption. Those in affected areas were advised to take extra care when driving on exposed routes such as bridges or high open roads. By Tuesday, the strongest</p>
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<p>2020 20-22</p>	<p>1</p>	<p>British Isles</p>	<p>The Guardian & The Observer</p>	<p>20/10/2020 - 22/01/2020</p>	<p>gusts are forecast along the the southern coast of England, along the channel, the south-west and south west of Wales. Strong winds and heavy rain battered parts of Scotland on the 11th, causing road closures and rail disruption as gritters attempted to deal with icy conditions. A number of ferry crossings between Northern Ireland and Scotland were also cancelled on Sunday by P&O, citing the storm. By the 13th the Met Office issued warnings of strong winds across much of the western half of the UK. Forecasters said coastal routes, sea fronts and coastal communities may be affected by spray or large waves. There may also be some short-term loss of power and other services. A 48-hour period of disruptive weather began Monday as hit Ireland, causing thousands of homes to lose power before bringing winds in excess of 80mph to parts of Scotland and England. Flights were grounded and Irish Sea ferries widely disrupted. On the 15th 13 flood warnings were in place on Wednesday afternoon – meaning flooding was expected and immediate action required – as well as 163 less serious flood alerts. The storm abated by the 17th.</p> <p>1. Moderate damage. Official gallantry. Official welfare. Storm Christoph hit the Uk bringing torrential rain and causing calamity in the North-west. People were also asked to leave their homes in parts of Ruthin and Bangor on Dee in North Wales, and Maghull in Merseyside. It comes as heavy rain and snow continued to fall across England and Wales, with many rivers at “dangerously high levels” according to the Environment Agency. Severe warnings were widely issued by the EA. Emergency crews</p>
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including specialist divers were searching the River Taff in Cardiff after a member of the public reported seeing a body in the river below Blackweir. South Wales police said: "Shortly after 9am this morning, a call was received from a member of the public concerning the discovery of what appears to be a body in the River Taff. A cordon has been put in place while emergency services attend the scene." Three "severe" flood warnings for danger to life issued by the Environment Agency remain in place: for the English River Dee at Farndon, the River Bollin and Agden Brook at Little Bollington and the River Bollin at Heatley. With heavy snowfall across much of Scotland closing roads in the Highlands and the Queensferry crossing near Edinburgh, the Scottish Environment Protection Agency issued four flood alerts across large areas of the north and north-east. In Carmarthen, south-west Wales, people were treated for the effects of fumes after using a generator to pump water from their homes. In south Wales, Rhondda Cynon Taf council said there was a landslip on the mountainside above the village of Pentre but it did not believe there was an immediate threat to the area. On the 22nd it was reported Temperatures could drop as low as -10c in the coming days as Storm Christoph gives way to colder winter weather.. It comes after hundreds of people were evacuated from their homes because of flooding and the body of a man was recovered from a river in Cardiff. Emergency crews including specialist divers found the man in the River Taff after being alerted by a member of the public. Care home residents were among those evacuated after floods in

several areas across the north-west of England and Wales following days of heavy rain. The alert – which stretches from the Scottish Highlands, down to the north west of England and into Wales, as well as covering Northern Ireland – says there is the possibility of injuries from icy conditions on ground which is already wet. An additional yellow warning for snow and ice is in place across northern parts of Scotland until Friday lunchtime. A major incident was declared in the village of Skewen in Neath, Port Talbot, after at least eight streets flooded and 80 people needed to be evacuated. It is thought the flooding may have been caused by a collapsed mine shaft. Homes were also flooded in Knighton and Borth, in mid Wales, and Crickhowell, in south Wales. “I didn’t think to put a mask on as it all happened so quickly and I was just trying to work out what to save. When I saw the fire service rescue team were all wearing masks, I thought: oh God, I should’ve put mine on,” she said. “I went to my sister’s who we are in a bubble with, but unfortunately she is also in a flood risk area so we will have to get emergency accommodation if there’s any more [flooding]. “It’s been a nightmare but the community has come together and displayed great spirit. Local people donated two-tonne sandbags and people were posting on the local Facebook group offering temporary accommodation.” Three yellow weather warnings have been issued by the Met Office, including an ice warning in place until 10am on Friday covering western Scotland, north-west England, Northern Ireland and much of Wales.

2020 8 to 17	2 British Isles	<p data-bbox="801 199 1164 343">The Guardian & The Observer</p> <p data-bbox="1003 199 1164 311">09/02/2020 - 19/02/2020</p> <p data-bbox="1303 199 2125 1367">3 1. Official gallantry. Impromptu gallantry. Official welfare. Impromptu welfare. A succession of two storms in the form of Storm Ciara and dennis battered the UK with great consequences for the population of Western Britain. Warnings were widely issued by travel and weather providers. By the 9th in the UK, about 118,000 people overall were without power as of 4pm, according to Energy Networks. Energy companies said they had reconnected 421,000 customers since the storm hit and work was continuing to restore electricity to the remaining homes. A number of schools in north Wales were to be closed on the 10th after being damaged in the storm. The shadow environment secretary, Luke Pollard, has thanked emergency services, the Environment Agency and communities who he said had worked tirelessly to protect homes and businesses, rescue people and animals from rising waters and reinforce flood defences. On the 10th a Met Office amber weather warning for wind, which had been in place across most of England, elapsed at 9pm on Sunday as Storm Ciara moved to the north-east of Scotland. A yellow warning for heavy snow and strong winds was in place for Northern Ireland and most of Scotland, and a yellow warning of snow and ice was in force for north-west England throughout Monday and Tuesday. The Met Office meteorologist Alex Burkill said: "While Storm Ciara is clearing away that doesn't mean we're entering a quieter period of weather. It's going to stay very unsettled. "We have got colder air coming through the UK and we will be feeling a real drop in temperatures, with an increased risk of snow in northern</p>
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parts of the UK and likely in Scotland. The River Irwell burst its banks at Radcliffe in Greater Manchester, while areas including Blackpool, Whalley, Longton and Rossendale were affected by flooding in Lancashire. By the 11th MPs have condemned the “completely unacceptable” failure of flood defences. A person died when a dog walker in his 60s was hit by a falling tree branch in Liverpool on Tuesday. The Met Office said Storm Dennis would bring further heavy rain and widespread gales at the weekend. Dozens of flood warnings remain in place across Britain as wintry showers and high winds hamper the recovery from Storm Ciara. Schools were closed from the Scottish Highlands down to Cumbria, where more than 400 people have been left without tap water due to mains damage. There were 57 flood warnings and 162 flood alerts in place across England on Tuesday. The Met Office also had weather warnings in place for wind, snow and ice from Scotland to the Midlands and Northern Ireland. The government has activated the emergency Bellwin scheme for communities affected in West Yorkshire, Cumbria and Lancashire. The environment secretary, Theresa Villiers, told MPs that the government would “take a fresh look” at flood defence programmes following Storm Ciara and was “determined to press on with major investments in our flood defences”. The trail of destruction left by Storm Ciara, was expected to cost up to £200m in insurance claims. On the 12th it was stated Snow and ice could cause travel disruption on Wednesday before Britain is struck by another burst of heavy rain and gales from Storm Dennis

over the weekend. People in Cumbria, Northumberland and vast swaths of Scotland have been warned of “blizzard conditions” by the Met Office as snow showers combine with strong winds. Gusts of 50mph were expected, with more than 60mph winds possible over hills, coastal areas and exposed locations, the Met Office said. Predicted heavy rain could also lead to further flooding, with 43 warnings in place in England, six in Scotland and one in Wales following recent heavy rainfall. Overnight in southern Scotland, mountain rescue teams were called out to rescue drivers stranded in their vehicles in extreme conditions. Moffat mountain rescue said 12 people were helped to safety after their cars became stuck on the A702, near Durisdeer village, Dumfries and Galloway. Travel disruption is expected to continue into Wednesday morning, with more snow and ice forecast across Scotland and a Met Office yellow warning in place in most areas until midday. Caroline Douglass, a flood duty manager at the Environment agency, said: “River and surface water flooding is possible on Saturday into Sunday due to Storm Dennis and we are advising people to check their flood risk and to stay safe on the coast or when walking or driving near swollen rivers.” By the 16th it was exclaimed there was “anger and fear” across the UK. Storm Dennis has wreaked havoc on Britain, forcing the cancellation of hundreds of flights and trains, and the deaths of at least two people yesterday. As the so-called bomb cyclone battered the coastline, as much as a month’s worth of rainfall was predicted overnight and into Sunday morning in some parts of the UK. There were

104 active flood warnings in England and Wales urging people to take immediate action, with another 369 flood alerts. The Met Office has issued eight weather warnings covering most of the UK for this weekend, with hundreds of homes and businesses at risk of flooding. Other parts of the coastline were battered by winds reaching 87mph. Coastal roads in Anglesey flooded, ferry services were cancelled from Portsmouth, Poole, Plymouth and across the Solent, while Brighton town hall was opened to rough sleepers on Saturday night. Flooding was already affecting some areas on Saturday. In Kendal, Cumbria, roads were impassable and railway tracks were flooded near Newquay, Manchester, Crewe, Kerne, Ebbw Vale, Windermere, Barrow in Furness and Carlisle, with several other line closures due to fallen trees. For many families across the UK, the great half-term getaway never really happened, with flights grounded for safety reasons and train routes disrupted. Many 'flood hubs' throughout the UK remained open. Some trains were also cancelled or delayed due to flooding or fallen trees blocking the tracks. A series of questions were posed by the Guardian on the 17th asking queries such as "How severe are the latest floods?" and "Did flood defences fail?" It was stated Storm Dennis affected huge swaths of Britain, from the Scottish Highlands to the Cornish coast and large parts of Wales and Northern Ireland. It triggered a record-breaking number of Environment Agency flood warnings and alerts in England on Sunday. The Environment Agency says its flood defences – both permanent and temporary measures – are working. It says that as many as 20,000

properties have been protected from storms Ciara and Dennis due to these measures. However, Britain has experienced an exceptionally wet winter and many rural areas, including towns and villages, have been left vulnerable to the higher river levels and saturated ground. Also, physical flood structures are only one part of the armoury. It was asked what more could be done? and whether the money was being spent in the right places? Flood barriers are a small but important part of the protection from devastating storms. Experts say that while Britain can never be fully flood-proof, much more could be done to better protect those in vulnerable areas. One way is to have a robust planning policy that keeps new housing developments out of flood plains. Another important tool is forecasting: the Met Office's new £1.2bn supercomputer could be a game-changer in predicting the areas most at risk of flooding. Experts say more energy should be devoted to contingency planning, local resilience measures and regular maintenance of flood defences and drainage systems. The government says it invests in areas of the highest priority. Critics say this often means protecting urban areas or properties of high commercial value, at the expense of rural communities, farms and villages. One problem is the fluctuating amount of money set aside for flood prevention each year, which means agencies cannot plan too far ahead or invest in radical changes to the landscape. Boris Johnson's government has committed to spending £4bn on the issue over the next five years but experts argue that a more ambitious programme needs to be implemented, looking

<p>2020 27 to 1</p>	<p>2 British Isles</p> <p>The Guardian & The Observer</p> <p>27/02/2020 - 01/03/2020</p>	<p>at a broader range of defence mechanisms. “Hard flood defences are just a tiny part of what we should be doing,” said Cloke. “There’s no realistic way we can manage future flooding with hard flood defences – we really need to be thinking more than that.” Flooding frequency was largely explained by saturated ground across Britain linked to the tremendous rain experienced. On the 19th it was exclaimed by Kate Marks of the Environment Agency (EA) said that while Storm Dennis had passed “we’ll be feeling the impacts for a few more days. There’s a lot more water in the river systems. In particular we are worried about the rivers Severn, Teme and Wye.” The EA said 599 properties had been flooded across England as of Tuesday afternoon. By the 19th about 800 homes in Wales had been directly affected by flooding, the first minister, Mark Drakeford, told the BBC. More than four miles of temporary flood barriers have been erected across the country and flood defences have protected nearly 25,000 properties from the impacts of the storm, the EA said. The Met Office has issued yellow weather warnings for persistent rain in Wales and north-west England for Wednesday and Thursday, and the north of England on Friday into Saturday.</p> <p>Major damage. Official gallantry. Impromptu gallantry. Official welfare. Impromptu welfare. On the 27th Storm Jorge was nearing the UK causing the Yellow Met Office weather warnings are in place for Friday and Saturday, with parts of Wales and northern England likely to see the worst of the rain. The forecaster has warned that further deluges are possible. The Met Office chief warned of</p>
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strong winds and rain warnings throughout large parts of the UK. Storm Jorge was named by the Spanish meteorological service and it is convention for other national services to refer to storms by the same name. Storm Jorge was expected to batter coastal areas with winds of 70 mph and downpours of 80 mm on already inundated areas. Yellow Met Office weather warnings are in place for Friday and Saturday, with parts of Wales and northern England likely to see the worst of the rain. The forecaster has warned that further deluges are possible. In Wales, where many homes and businesses were devastated in the aftermath of Storm Dennis, the forecaster warned that fast-flowing or deep flood water could cause “a danger to life” and some communities could be cut off by swamped roads. While rain warnings remain in place and spread to the east on Saturday, strong winds expected over the weekend could also cause delays at airports, train stations, ferry ports and on Britain’s roads. Flood-hit towns are bracing for further downpours as Storm Jorge pushes Britain into the wettest February on record. February’s third named storm is bringing rain, gales and snow, prompting weather warnings stretching from Cornwall to the north of Scotland and across to Northern Ireland. Pontypridd, which was also flooded two weeks ago, and the Ely area of Cardiff are among the worst affected areas. Residents have been advised to stay indoors to avoid winds of up to 70mph and have been warned that water levels could rise further. Police declared a critical incident in flood-hit south Wales overnight, as Storm Jorge brought heavy rain and strong

winds in what is Britain's fourth weekend of downpours. Cardiff council said its road team has answered about 100 incidents. It has deployed emergency teams to work throughout the night on flood defences and removing debris. More than 600 homes and a similar number of businesses have been hit in Wales, making up around a quarter of affected properties in the UK. South Wales police said emergency services, local authorities and other organisations were working continuously to ensure the safety and welfare of those affected, minimise damage to infrastructure and property, and minimise disruption. The Met Office has declared this month as the wettest February since records began in 1862 – with a UK average of 202.1mm, beating the February 1990 figure of 193.4mm. The rain warning was lifted before midday as showers eased but alerts remained in place for gales and the potential for power cuts, transport delays and large waves for coastal communities. The wind warnings last until 9am on Sunday across much of England and Wales and until 3pm the same day across Northern Ireland, southern Scotland, and northern England. A total of 83 flood warnings were in place across England and Wales, mostly in the south-west, along the English-Welsh border, and in Yorkshire. A further 211 "flooding is possible" alerts are also in force. The Environment Agency said 1,000 staff per day had worked on flood defences and pumps, clearing debris and repairing damaged defences, erecting 3.7 miles of barriers. It said the country needed to brace itself for "more frequent periods of extreme weather like this" because of the climate emergency. As the Met Office

declared last month to be the wettest February on record, police in flood-hit south Wales declared a temporary “critical incident”. Meanwhile, emergency services, councils and other bodies worked to protect property, infrastructure and residents. Many towns and villages were braced for further flooding as water ran off already saturated hills and fields along the western half of Britain. Hundreds of homes have been flooded. The Environment Agency in England and its counterparts in Scotland, Wales and Northern Ireland had put in place 106 flood warnings by last night, stretching from north to south and east to west, and a further 239 flood alerts. A local Plaid Cymru councillor, Heledd Fychan, who represents one of the worst-affected town-centre wards, said the Red Cross was on standby on Saturday night in case remaining residents such as Linda and Howard Davis had to be evacuated into the centre. “There was huge anxiety last night,” she said, as volunteers helped residents find buckets and bottles of bleach to disinfect their homes. “Many of the flood defences are broken – the walls have come down. It could happen again.” On the 1st it was stated Flood-hit areas have experienced further disruption after Storm Jorge battered the UK with strong winds and heavy downpours. In south Wales, police declared a critical incident during Britain’s fourth weekend of downpours, with Pontypridd and the Ely area of Cardiff among the worst affected areas. Residents were advised to stay indoors to avoid winds of up to 70mph and were told water levels could rise further, but the incident was no longer in place by mid-morning on Saturday. On the 28th when many yellow

<p>2020 16-18</p>	<p>6 British Isles</p> <p>The Guardian & The Observer</p> <p>17/06/2020 - 08/06/2020</p>	<p>Met Office warnings for rain remained in place, several flooded roads were closed in Wiltshire and people were rescued from cars stranded in both Devon and Somerset. On Sunday, only one yellow weather warning for snow was in place across parts of Scotland, while ice is expected to form overnight in north-western England and Scotland, bringing disruption to commuters on Monday morning. In south Wales, police declared a critical incident during Britain's fourth weekend of downpours, with Pontypridd and the Ely area of Cardiff among the worst affected areas. A bus replacement will be in place between Aberdare and Pontypridd until Wednesday after the line was damaged, while a section of the Conwy Valley line between Blaenau Ffestiniog and Llandudno, is still closed due to damage caused by Storm Ciara.</p> <p>Moderate damage. Official gallantry. Impromptu gallantry. Official welfare. On the 17th warnings were issued as a new wave of thunderstorms swept across southern England, threatening more lightning strikes and flooding. The Met Office issued a yellow warning for thunderstorms across most of England, Wales and southern Scotland between noon and midnight on Wednesday. It said: "Flooding of homes and businesses could happen quickly, with damage to some buildings from floodwater, lightning strikes, hail or strong winds." Another warning said there was a small chance of flooding on Thursday from thunderstorms between noon and 9pm in an area across southern England and south Wales. Flash-flooding in the north-west of England left roads submerged on Tuesday evening. Parts of Scotland were also affected by the wet</p>
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weather, which first struck overnight on Monday. On the 18th hundreds of homes and businesses were flooded, some for the third time this year, as heavy rain and thunderstorms continued to sweep across parts of the UK. Some residents in south Wales were forced to flee from homes that had already been inundated twice in 2020 and now face having to once again dry out and rebuild with the added complication of lockdown. Rhondda Cynon Taf council said almost 200 properties were flooded and politicians called for an inquiry into why the area keeps being hit so badly. There was also flooding or alerts in place across a swathe of the Midlands, and the Met Office put out a yellow warning for much of southern Britain for Thursday, saying that buildings could be damaged by flood water, lightning strikes, hail or strong winds. Fire service crews spent five hours pumping water out of homes in Pentre, south Wales, while local builders' merchants handed out sandbags. The Rhondda MP, Chris Bryant, urged the UK government to help his constituents. He told the House of Commons: "We're a resilient community in the Rhondda but I honestly don't think we can take any more without significant help from outside. "I spoke to one woman last night who was in tears because she'd only just managed to get builders to sort her home out, she was about to move back in and now it's ruined all over again. "The council is completely strapped for cash. We know we need £60m to mend the culverts, to make sure this doesn't happen all over again." The area had experienced a period of dry and record-breaking sunshine over the previous weeks, but she said locals had told her

2020 12 to 15	8	British Isles	The Guardian & The Observer	12/08/2020 - 15/08/2020	<p>that drains were still clogged up with silt from the the winter's floods. Plaid Cymru politician Leanne Wood, who represents Rhondda in the Senedd, said residents were "angry and frustrated" and called for an urgent inquiry into why homes flooded so quickly in the village following heavy rainfall just after 6pm on Wednesday. "What is needed is urgent assistance from the various authorities to prevent further flooding. Sandbags need to be delivered to every home that is at risk of further flooding throughout this spell of heavy rain. It should not be down to builders' yards to provide the sand needed to make a flood defence. The drains also need cleaning urgently as this has been identified as a cause of flooding in many areas." The leader of Rhondda Cynon Taf council, Andrew Morgan, said: "The flash flooding caused by yesterday evening's severe thunderstorms has unfortunately impacted upon communities which have already experienced the devastation of flooding earlier this year. Minor damage. On the 12th the Met Office warned of 'exceptional rainfall' across England. The Met Office has issued a yellow storm warning for all of England and the eastern half of Scotland, and a more serious amber warning for eastern Scotland between Edinburgh, Inverness and Aberdeen. Chief meteorologist Steve Ramsdale said in these areas "exceptional rainfall totals could be seen of 60 millimetres in an hour with a very small chance of 150 millimetres of rainfall in three or four hours". The Environment Agency has five flood alerts posted for possible flooding in areas around Birmingham, and 17 flood alerts are in place across Scotland. On the</p>
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2020	19-26	8	British Isles	The Guardian & The Observer	20/08/2020 - 25/08/2020	2	<p>14th it was stated thunderstorms and heavy rain are forecast to continue in parts of Britain this weekend, making it a total washout for many. By the 14th the Met Office has revised its yellow thunderstorm warnings for the weekend and removed them from some parts of England and Wales. They remain in place, however, for the south of England and south Wales, and from Saturday spread to the rest of Wales, the Midlands, and the north of England. Neil Davies, an EA flood duty manager, said: "Isolated thunderstorms could bring sudden surface water and river flooding, which may lead to flooded properties and severe travel disruption in some areas. Further surface water and river flooding is also a possibility until Sunday." Meanwhile, the fire service was warning of the potential dangers of visiting the coast during poor weather after beaches were closed in Cornwall. By the 15th it was stated thunderstorms and heavy rain are forecast to lash England and Wales over the weekend, triggering warnings of flooding and travel disruption. Flooding could cause roads to close, while extreme weather may damage buildings and cause power cuts and cancellations to train and bus services. The weather warnings for parts of England and Wales are likely to be in place going into the 17th.</p> <p>2. Moderate damage. Official gallantry. Official welfare. The succession of storms Ellen and Francis hitting the UK caused great disturbance throughout with multiple accounts of disruption and loss. On the 20th Britons on camping holidays have been warned of the possible danger of falling trees as parts of the UK brace for winds</p>
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of more than 70mph to hit. The Met Office issued yellow weather warnings for wind from Scotland to Cornwall. Britons on camping holidays have been warned of the possible danger of falling trees as parts of the UK brace for winds of more than 70mph to hit. "We are likely to see these swings in extreme events more frequently. Although I couldn't necessarily say these two events were directly caused by climate change, it's likely that these sorts of swings in our weather will become more frequent." Nearly 194,000 homes and businesses were hit by power cuts, and roads were blocked with fallen trees in Ireland as it bore the brunt of Storm Ellen this week. "There's going to be some squally heavy rain, chance of some thunder, widely 40 to 50mph gusts inland in the warning area." He added that 70mph gusts could possibly hit coastal areas, with the strongest winds expected in the south-west of England and west of Wales in the earlier hours of Friday. The Environment Agency has issued 42 flood alerts and 19 flood warnings – which urge people to take immediate action – largely along the south and south-west coastline of England. The agency warned people in the south-west to not "wave watch" and "stay away from sea promenades and exposed coastal areas", with tidal gates being closed on Cornwall's south coast due to storm surge risk. Natural Resources Wales has also issued seven flood warnings for the south-west coast of the country. Devon and Cornwall police have warned the public to be wary of "storm conditions" across their region, particularly on the coast where waves could reach up to 9 feet high. The force said strong winds could bring

“dangerous seas and strong rip currents” and urged beachgoers to check tide times, stick to life-guarded beaches, be aware water sports may be unsafe and avoid storm watching. On the 22nd it was reported a holidaymaker had died after drowning in the sea off the Cornish coast. The Met Office had issued a wind yellow weather warning for all of England, Wales and parts of Scotland on Friday, bringing the potential for travel disruption and large waves in coastal areas. A teenage boy who was related to the deceased was in a stable condition in hospital following the accident at Church Cove. South Wales police said the teenage girl died in east Cardiff on Friday. The force was called at 5.20pm to a river in Ball Lane, Llanrumney, and attended with other emergency services and the police helicopter. The Coastguard helicopter rescued two people from a cliff face near Lynmouth in Devon on Thursday after they became trapped by rising tides. The RNLi were unable to reach the pair so the coastguard stepped in to winch them to safety. High winds were causing “treacherous driving conditions”, according to the AA, which advised drivers to be alert for tree branches on the roads. The Met Office said strong winds could lead to some delays to road, rail, air and ferry transport and possibly some temporary power disruption. Mumbles in Swansea saw 68 mph. By the 24th storm Francis was impending. Forecasters predicted a deep area of low pressure would enter the UK on Monday night into Tuesday, bringing gusts of 60-70mph. Up to 90mm (3.54in) of rain was also expected in places during a 36-hour weather window. The chief meteorologist at the Met

Office, Andy Page, said: "There will be strong winds and heavy rain, especially in the west of the UK". A Met Office spokeswoman said: "Since 2015, when we started naming storms, we have never had to name a storm in August – and now we've had two in a few days. Hannah Cloke, professor of hydrology at the University of Reading, said: "This unseasonably wet and windy weather, which comes in the wake of a dangerous heat wave and destructive thunderstorms, makes us very keen to understand the links between such unusual weather and changes to our climate. Forecasters said such heavy wind was unusual for August and could disrupt transport and outdoor activities. The rain was expected to be heaviest in Northern Ireland and south-west Scotland, where 90mm could fall as the storm moves from west to east. On the 25th Homes have been flooded, travel disrupted and firefighters called out to rescue a group of campers stranded on a riverside site as Storm Francis swept across the UK. In St Clears in Carmarthenshire, south-west Wales, firefighters with rescue boats were called to a flooded campsite at dawn on Tuesday after a group of holidaymakers was stranded. Homes and businesses were flooded in areas of south Wales including Neath and Llanelli. Roads were closed and trains cancelled or delayed. National Rail tweeted that a line had been blocked in Neath. Traffic Wales warned of "extremely poor driving conditions" while South Wales police tweeted an image of a car stuck in flood water in the village of Merthyr Mawr in Bridgend. Strong winds caused the first Severn Bridge to be closed periodically. Firefighters in wading gear used lines to rescue nine

people and two dogs from the campsite in St Clears. Rescue services searched the River Taff after reports of a capsized canoeist. The Met Office issued a yellow warning, saying severe gales were forecast on Tuesday and Wednesday. It reported rainfall overnight of more than 40mm in parts of Wales and in Devon. The Met Office said a deep area of low pressure was crossing the UK, bringing gusts of up to 70mph in exposed western locations and also heavy rain for many. A yellow wind warning was in force for all of Wales and most of England. "Large waves are also expected in coastal areas around the south-west including the Bristol Channel throughout Tuesday, moving along the English Channel as the day progresses. Beachgoers are advised to take extra care. "The rain is expected to be heaviest in Northern Ireland and south-west Scotland where 60-90mm in total could fall as the storm moves from west to east. Storm Francis is due to clear to the east of the UK by Wednesday lunchtime." The Maritime and Coastguard Agency warned the public that cliff edges would be slippery and crumbly after the large volume of rain recently around the coast. Record-breaking winds and heavy rainfall have caused chaos in parts of the UK as Storm Francis swept the country, leaving two people missing, dozens of others needing rescuing and damaging hundreds of homes and businesses. A woman was pulled to safety from the Ely, another river in the Welsh capital. A woman was also rescued at the Ely in Leckwith, Cardiff. Penarth lifeboat station said it was believed the woman went into the river to help a dog that was rescued with her. Gusts of 68 mph were recorded at

<p>2020 2 to 4</p> <p>10</p>	<p>British Isles</p> <p>The Guardian & The Observer</p> <p>02/10/2020 - 05/10/2020</p>	<p>embrey Sands in south-west Wales. The Met Office issued an amber warning for very strong winds across most of Wales and central England between 2pm and 10pm on Tuesday. South Wales police were involved in two separate searches of the Taff on Tuesday. A spokeswoman said emergency services were searching the river in Cardiff after reports someone entered the water near the Principality Stadium shortly before 8.40am, while a search was under way in Taff's Well north of the city after reports of a canoeist having capsized. In Cardiff a restaurant was severely damaged by a falling tree. Fire crews rescued nine holidaymakers and two dogs from a flooded campsite, Lakeside, in the town of St Clears, Carmarthenshire, after river levels rose in the area. Fire crews also gave medical attention to one man and evacuated 30 from a flooded caravan site in Narberth, Pembrokeshire. A number of homes in south Wales were hit by flooding in Llanelli and Neath. The M48 bridge across the River Severn was closed in both directions due to the wind speeds while power cuts affected hundreds of homes. Trees blocked a number of rail lines and roads including the A30 in Cornwall. By late afternoon on Tuesday the Environment Agency had issued 26 flood alerts for the Midlands and the north of England. There were 20 flood alerts for Wales and 11 for Scotland.</p> <p>Minor damage. Official gallantry. Official welfare. Strong winds and heavy rain came to the UK in the form of Storm Alex from the south-west. Mark Newberry, the commercial director at Green Flag, said he expected the most callouts on Saturday, with a 10% increase in</p>
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breakdowns compared with usual. Western Power Distribution also recorded incidents in south-west England, affecting Devon, Cornwall, Dorset and Somerset. Maxey said the wet and windy weather would move up from south-west England and Wales towards the north of England, Northern Ireland and Scotland throughout Friday afternoon – though the rain was expected to become lighter. Amber weather warnings for the heaviest rainfall likely to cause transport disruption were in place for parts of Wales, the West Midlands and south-west England until 6pm on Sunday. Gale-force gusts brought by Storm Alex were expected to subside by the end of Friday, but yellow warnings for rain will remain in place for most of the UK over the weekend. Maxey said: “A second rain front is coming to replace Storm Alex over the weekend, pushing in from the east on Saturday morning and affecting western areas later on. On the 3rd it was stated “the grim conditions may persist for time”. The wet weather followed a low-pressure system named Storm Alex moving in from France and clipping the southern edge of Britain on Friday. The strongest gust, of 71mph, was recorded at Berry Head on the Devon coast. Amber weather warnings for rain are in place for Wales, the West Midlands, south-west England and parts of eastern Scotland on Saturday. The places worst hit so far include parts of Exmoor, with 84mm of rain recorded in 36 hours in Liscombe and 74.4mm in Brendon Hill. Yellow rain warnings are in place for the east of England, London and the south-east, plus much of Wales, western England and eastern Scotland, where heavy rain is set to push in from

2020	21-22	10	British Isles	The Guardian & The Observer	21/10/2020	the north-west. The rain is expected to last into Sunday in these areas. ScotRail announced that train services in amber warning areas would begin winding down from 4pm, with no trains running at all after 7pm. Police forces across the country issued warnings to drivers after a number of crashes on waterlogged roads. North West motorway police tweeted: "If you are using the network this afternoon, please slow down. Lots of stand water across the network today. Please allow extra time for your journey." The EA flood duty manager urged people to stay away from swollen rivers. Rod Dennis, a spokesman for RAC Breakdown, said road conditions would be "miserable, if not downright dangerous" this weekend. Rain showers and moderately strong winds came to the British Isles in the form of Storm Barbara. Weather warnings have been issued across the country, as heavy rain and gale force winds brought in by Storm Barbara batter the UK. Met Office spokesman Oli Claydon said: "From (Tuesday) evening into the early hours, there will be a band of rain moving in from the south, bringing some at times heavy rain.
2020	30 to 1	10	British Isles	The Guardian & The Observer & BBC	31/10/2020	Minor damage. Official gallantry. Official welfare. Storm Aiden straffed the Uk with heavy rain and strong winds. Yellow weatehr warnings were in force for the west coasts and power cuts and travel disruption was noted. The bad weather could last much of the weekend, and people have been urged to pay attention to the weather forecast as well as flood alerts and warnings in their area. Martin Young, deputy chief meteorologist at the Met Office, said: "As the heavy rain and strong winds from Storm Aiden

sweeps eastwards on Saturday, another system quickly follows on Sunday that contains the remnants of ex-Hurricane Zeta, bringing further heavy rain and strong winds. "Given that this is falling on already saturated ground from what has been a wet October, there is an increased risk of flooding in some warnings areas." Another yellow warning for rain covering Wales and north-west England is in force from 18:00 GMT on Sunday to 06:00 on Monday, and some communities could be cut off by fast flowing and deep floodwater. The duty tactical manager for Natural Resources Wales said flooding was likely throughout the nation. Heavy rain and strong winds are already causing flooding and travel disruption across Scotland, and Scotrail reporting delays on a number of routes. Very strong winds could also affect north-west Scotland between noon and 21:00 on Sunday, including the possibilities of power cuts and delays for high-sided vehicles and public transport. During the day they will ease across England and Wales but they will stay strong across Scotland and Northern Ireland into the evening, and there could be gusts of 75mph (121km/h) across the Western Isles and up to 70mph on the west coast. Lifeguards rescued a man at 05:00 GMT on Saturday morning after his yacht was capsized by a "large freak wave" off the Isles of Scilly, south-west England. Falmouth Coastguard's helicopter and an RNLI lifeboat rescued the French man and his 34-foot yacht six miles from the coast. Ian Guy, duty controller at the National Maritime Operations Centre, said the yachtsman described being hit

2020	3 to 5	12	British Isles	The Guardian & The Observer	05/12/2020	by a "large freak wave" which capsized, rolled and disabled the vessel. The man escaped all injury. Minor damage. Heavy rain fall and floods prompted warnings in the UK. Parts of Scotland and southern England experienced transpor disruption and multiple flooding warnings were issued. National Rail reported flooding on some of its Scottish routes, including trains through Livingston North, west of Edinburgh. The Scottish capital also reduced its tram services following the heavy rain. The cold weather is set to continue over the weekend, with the Met Office forecasting that temperatures will remain in single digits and icy conditions are likely to persist until Tuesday.
2020	25-27	12	British Isles	The Guardian & The Observer	24/12/2020 - 28/12/2020	Moderate damage. Official gallantry. Official welfare. On the 24th I was exclaimed that Storm Bella was expected to bring more heavy rain and induce flooding affected many homes and businesses. An amber national severe weather warning has been issued in parts of south Wales and across southern England, as the Met Office said conditions across the UK would turn increasingly unsettled through to 27 December, with strengthening winds and heavy rain moving in from the north. A yellow warning for wind was issued to the whole of England and Wales as well as Southern Scotland. The BBC reported the south Wales fire and rescue service received 500 calls for help on Wednesday as the downpours hit many parts of the country. The Environment Agency (EA) had issued more than 90 flood warnings for England as of 5am on Thursday, including 16 warnings related to the River Severn on the Welsh border. Nine further flood warnings

were issued by Natural Resources Wales. The Environment Agency also issued a further 149 flood alerts, which warn of possible flooding and urge preparedness. The heavy rain caused disruption to travel, with many areas, including Cardiff, reporting surface water on the roads. "Most places in England and Wales have been really wet and we've seen strengthening winds too, there have been some gales in exposed parts, so quite unpleasant really." The arrival of Storm Bella on Boxing Day will bring further downpours and winds of up to 70mph in exposed coastal locations. A yellow warning for wind for the whole of England and Wales as well as the far south of Scotland has been issued and will be in force from 3pm on Boxing Day. On the 26th torrential rain has brought widespread flooding elsewhere and people have had to be rescued from vehicles and homes. The arrival of Storm Bella on Boxing Day will bring further downpours and winds of up to 70mph in exposed coastal locations, according to the Met Office. Between 15 and 25mm of rainfall is likely to fall in Wales and south-west England, and up to 60mm is expected over some hills, the Met Office said. As of 5am on Boxing Day, England had 78 flood warnings and 99 flood alerts, Wales had two flood warnings and five flood alerts, and seven warnings and 13 alerts had been issued by the Scottish Environment Protection Agency. On the 26th flood defences were erected to mitigate the impacts of storms as 80mph was recorded in large parts of the UK. Warnings are in place across England and Wales, including two "threat to life" flood notices, and families have labelled their Christmas a

write-off after they were forced to evacuate due to rising water levels. An amber warning for wind is in place across the south coast and south Wales, with communities from Cornwall to Kent told to expect building damage and the possibility of flying debris in the stormy conditions. A gust of 83mph was recorded at Aberdaron in North Wales. In the early hours of Sunday, gusts reaching 79mph hit the Isle of Portland in Dorset, winds of up to 72mph were recorded on Mumbles Head, on Swansea Bay, 74mph in Mount Batten, near Plymouth, Devon, and 70mph in St Catherine's Point on the Isle of Wight, according to Met Office observations. The community secretary Robert Jenrick urged people to check government advice, such as from the Environment Agency, which has asked people to keep away from "swollen rivers and flooded land". A statement on the EA's website said: "It is often deeper than it looks and just 30cm of flowing water is enough to float your car." In addition to the stormy conditions, temperatures will stay frosty in some parts into next week, leading health professionals to offer advice on how to keep safe in colder weather. By the 27th coastal areas had been forced to erect flood defences to counter the impact of the storm surge threat produced by high tides and 100 mph winds. Hundreds in the Plymouth and Truro were left without power as electricity lines collapsed. Similar power losses were recorded in Cardiff, Swansea, Telford in Shropshire, and Nottingham. The Met Office warned of risks posed by flying debris and the Nequay police response team in Cornwall said the storm was "throwing trees over the roads". Scotland, Northern

Ireland, north Wales and parts of northern England are also subject to a yellow warning for snow and ice from Sunday night into Monday. Through the evening and into Monday, meteorologists are warning the snow and ice could also pose a risk to more central and southern areas of England. On the 28th it was reported that Storm Bella helps Great Britain set new record for wind power generation. More than half of Great Britain's daily electricity came from wind turbines for the first time on Boxing Day, as the country headed for its "greenest year on record", due in part to the coronavirus. As Storm Bella arrived, bringing gusts of up to 100mph, wind provided 50.7% of Great Britain's electricity according to data charting the power generation mix. While wind briefly hit 60% in August, it had not previously sustained such levels for 24 hours. The milestone follows a string of new low-carbon records set in 2020, as Covid-19 restrictions depressed power demand, helping wind and solar to claim a larger share of the mix. While Boxing Day set a record for the highest share of power generated by windfarms, it was not a record for the most power they have ever supplied. That was set earlier in December, when windfarms delivered 17.3 gigawatts. Because overall demand was higher at the time, their percentage share of total power generation was lower than it was on Boxing Day, at 40%.

Appendix 3: Chapter 8

The following tables illustrate variability in wind speed, precipitation and storm surge height during the storm period of Ciara and Dennis defined as from 00:00 04/02/20 to 00:00 19/02/20.

3.1. Meteorological Data

Appendix Table 3.1. Wind speed (ms^{-1}) variability during the storm period from 00:00 04/02/20 to 00:00 19/02/20.

Date and Time	Wind Speed (ms^{-1})							
	Stornoway	Bishopton	Blackpool	Valley	Mumbles Head	Usk	Chivenor	Camborne
04/02/2020 00:00	14.4	6.7	13.9	13.4	5.1	No Data	10.8	6.7
04/02/2020 01:00	11.8	8.2	12.3	13.9	7.2		11.3	8.7
04/02/2020 02:00	7.7	10.8	13.9	13.4	9.8		12.3	9.3
04/02/2020 03:00	7.7	10.8	12.3	12.9	8.7		13.9	8.2
04/02/2020 04:00	5.7	11.3	13.9	11.3	9.8		14.9	9.3
04/02/2020 05:00	6.2	8.7	13.4	12.9	6.7		12.9	10.3
04/02/2020 06:00	6.2	5.7	12.3	12.3	6.7		12.3	10.3
04/02/2020 07:00	4.1	7.2	11.3	11.3	7.2		12.9	9.8
04/02/2020 08:00	3.6	5.7	10.3	11.3	7.2		11.8	9.3
04/02/2020 09:00	3.1	7.2	10.8	7.2	6.7		11.8	9.8
04/02/2020 10:00	2.1	6.7	9.8	8.7	6.7		12.3	9.3
04/02/2020 11:00	1.5	6.7	7.7	8.7	8.7		12.3	9.3
04/02/2020 12:00	4.1	4.6	7.7	8.2	11.3		12.3	8.7
04/02/2020 13:00	4.1	6.7	9.3	9.8	9.8		10.3	8.2
04/02/2020 14:00	4.6	7.2	8.7	8.7	8.2		10.8	8.2

04/02/2020 15:00	4.1	6.7	8.2	7.7	7.2	8.7	8.2
04/02/2020 16:00	3.6	9.3	7.7	7.7	6.7	8.2	7.2
04/02/2020 17:00	4.6	7.7	8.7	6.2	8.2	7.2	4.1
04/02/2020 18:00	3.6	3.6	4.6	2.6	2.1	5.1	6.7
04/02/2020 19:00	3.6	5.7	7.7	4.6	3.1	3.6	4.6
04/02/2020 20:00	3.6	6.2	5.7	2.6	1.5	3.6	4.6
04/02/2020 21:00	3.6	6.2	4.6	1.0	2.1	4.1	5.1
04/02/2020 22:00	3.6	2.1	5.1	2.1	3.1	4.1	5.7
04/02/2020 23:00	4.1	3.1	2.6	2.1	3.6	2.1	0.5
05/02/2020 00:00	4.6	4.1	2.6	3.1	2.1	1.0	2.1
05/02/2020 01:00	4.1	3.6	4.6	1.5	4.1	2.1	3.1
05/02/2020 02:00	4.6	2.1	3.6	2.1	3.6	1.5	2.1
05/02/2020 03:00	5.1	3.6	3.1	0.5	3.6	1.5	2.1
05/02/2020 04:00	5.7	2.6	2.6	1.0	3.1	2.1	2.1
05/02/2020 05:00	6.2	3.1	2.1	0.5	3.1	3.1	1.5
05/02/2020 06:00	5.1	3.6	1.5	2.6	3.6	2.1	1.5
05/02/2020 07:00	6.2	3.6	2.1	2.6	3.6	4.1	2.6
05/02/2020 08:00	5.7	3.6	1.0	1.5	4.6	3.1	1.0
05/02/2020 09:00	6.2	3.6	1.5	4.1	1.0	1.5	1.5
05/02/2020 10:00	6.7	3.6	1.5	4.6	0.5	1.5	1.0
05/02/2020 11:00	7.7	3.6	3.6	4.6	2.6	2.6	3.1
05/02/2020 12:00	8.2	5.1	3.6	5.1	2.1	2.1	NA
05/02/2020 13:00	6.7	3.6	4.6	6.7	1.5	1.5	NA
05/02/2020 14:00	7.2	4.1	4.6	7.2	2.1	1.5	NA
05/02/2020 15:00	6.7	3.1	3.1	7.2	2.1	2.1	NA
05/02/2020 16:00	6.2	4.6	3.1	6.7	2.1	1.5	NA
05/02/2020 17:00	5.1	4.1	3.1	7.2	0.5	2.1	NA
05/02/2020 18:00	5.1	2.6	3.6	7.2	2.1	2.6	1.0
05/02/2020 19:00	4.6	4.1	3.1	6.2	3.1	2.1	2.1
05/02/2020 20:00	5.1	3.6	3.1	6.2	0.5	3.1	2.1
05/02/2020 21:00	4.6	3.1	2.6	5.7	2.6	3.6	1.5

05/02/2020 22:00	4.6	2.6	4.1	5.1	3.1	3.6	2.6
05/02/2020 23:00	4.1	3.1	3.1	6.2	3.6	3.6	2.6
06/02/2020 00:00	4.6	1.0	2.6	6.2	2.6	3.1	2.6
06/02/2020 01:00	6.2	2.6	3.1	5.7	3.1	3.6	2.1
06/02/2020 02:00	6.2	2.1	3.1	5.7	3.1	2.6	3.1
06/02/2020 03:00	7.7	3.1	1.5	4.6	3.6	2.6	2.6
06/02/2020 04:00	8.7	2.6	3.1	6.7	4.1	3.6	2.6
06/02/2020 05:00	7.7	4.1	3.1	7.2	4.1	3.1	3.6
06/02/2020 06:00	7.2	2.1	2.1	6.7	3.1	2.1	2.6
06/02/2020 07:00	8.2	2.6	2.1	5.7	4.1	1.5	2.6
06/02/2020 08:00	8.2	1.5	2.1	6.2	3.6	1.5	5.7
06/02/2020 09:00	8.2	2.1	1.0	6.2	3.6	1.5	6.7
06/02/2020 10:00	7.2	1.5	0.5	5.7	5.7	2.1	6.7
06/02/2020 11:00	8.7	4.1	2.1	5.1	6.2	5.7	6.2
06/02/2020 12:00	9.3	4.1	2.1	5.1	5.7	7.7	7.7
06/02/2020 13:00	9.8	3.6	2.1	5.1	6.2	8.2	9.3
06/02/2020 14:00	7.2	3.1	1.5	4.6	6.2	7.2	9.8
06/02/2020 15:00	7.2	3.6	1.0	4.1	7.2	7.2	8.7
06/02/2020 16:00	7.7	4.1	0.5	2.6	8.2	6.2	9.3
06/02/2020 17:00	6.2	1.5	1.5	2.1	8.7	8.2	9.8
06/02/2020 18:00	10.3	1.0	1.5	3.1	8.7	5.7	9.3
06/02/2020 19:00	10.3	2.1	2.1	2.6	8.7	7.7	7.7
06/02/2020 20:00	9.3	2.1	3.1	2.1	8.7	7.2	8.2
06/02/2020 21:00	9.8	1.0	3.6	1.5	7.2	5.7	7.7
06/02/2020 22:00	6.2	0.5	5.1	1.0	7.7	5.7	5.7
06/02/2020 23:00	7.2	1.5	4.6	3.6	7.7	5.7	7.2
07/02/2020 00:00	8.2	1.0	3.6	3.6	9.8	7.7	6.7
07/02/2020 01:00	9.8	1.0	4.1	2.6	10.8	7.7	7.2
07/02/2020 02:00	10.3	1.5	5.1	3.1	11.8	7.2	6.7
07/02/2020 03:00	7.7	1.0	3.1	3.6	11.8	5.7	4.6
07/02/2020 04:00	7.2	1.5	6.7	5.1	11.8	4.1	5.1

07/02/2020 05:00	7.7	1.5	7.2	4.6	10.8	5.1	5.1
07/02/2020 06:00	5.7	0.5	5.7	8.2	10.3	4.6	4.6
07/02/2020 07:00	5.1	2.1	6.7	5.1	11.3	4.1	4.6
07/02/2020 08:00	5.1	2.1	7.2	4.6	10.8	4.6	5.7
07/02/2020 09:00	5.7	1.5	5.1	7.2	12.9	6.2	6.2
07/02/2020 10:00	9.3	0.5	6.7	8.2	12.9	5.1	7.2
07/02/2020 11:00	10.3	2.1	9.3	7.7	12.3	6.2	7.7
07/02/2020 12:00	6.7	5.1	6.7	10.8	11.3	9.3	7.2
07/02/2020 13:00	8.2	4.1	8.2	11.3	12.9	6.2	8.2
07/02/2020 14:00	8.7	2.1	8.7	11.3	11.3	5.7	8.2
07/02/2020 15:00	11.3	4.6	7.7	9.8	9.8	7.2	8.2
07/02/2020 16:00	10.3	4.6	8.7	12.3	11.8	7.7	8.2
07/02/2020 17:00	11.8	6.2	8.2	12.3	12.9	5.1	8.7
07/02/2020 18:00	12.3	3.6	7.2	12.9	10.8	6.7	9.8
07/02/2020 19:00	11.8	4.1	8.2	14.4	7.7	7.2	10.3
07/02/2020 20:00	13.4	4.1	9.3	12.9	8.7	7.2	8.7
07/02/2020 21:00	11.8	5.1	7.2	12.9	9.8	6.2	8.2
07/02/2020 22:00	11.8	7.2	8.7	13.9	9.3	6.7	5.7
07/02/2020 23:00	12.3	5.7	9.3	15.9	13.4	10.3	7.7
08/02/2020 00:00	13.4	7.7	7.7	15.4	12.9	8.7	5.7
08/02/2020 01:00	10.3	7.7	9.8	15.9	11.3	6.2	6.7
08/02/2020 02:00	7.7	11.8	10.8	11.8	11.3	6.7	6.2
08/02/2020 03:00	4.6	8.2	12.3	9.3	11.8	6.7	8.2
08/02/2020 04:00	6.2	9.3	8.7	11.3	9.8	5.7	4.6
08/02/2020 05:00	7.7	5.1	9.8	10.3	7.7	5.7	3.6
08/02/2020 06:00	8.2	7.2	7.2	10.3	6.7	7.2	3.6
08/02/2020 07:00	8.7	6.7	7.7	11.8	9.3	3.1	3.1
08/02/2020 08:00	9.8	6.2	6.7	12.3	9.3	4.6	4.1
08/02/2020 09:00	10.8	6.7	6.2	12.3	9.8	2.6	4.1
08/02/2020 10:00	10.8	8.7	5.1	12.9	8.7	4.6	7.2
08/02/2020 11:00	10.8	7.7	5.1	11.8	11.3	6.7	8.7

08/02/2020 12:00	16.5	9.3	7.7	13.9	10.3	7.2	9.8
08/02/2020 13:00	17.0	10.3	7.7	14.9	13.4	9.3	9.8
08/02/2020 14:00	13.9	11.8	9.3	15.4	14.9	9.3	9.3
08/02/2020 15:00	19.5	10.8	11.3	17.5	15.9	9.3	9.8
08/02/2020 16:00	18.0	10.8	10.8	15.9	15.9	7.2	9.8
08/02/2020 17:00	12.3	13.4	12.9	18.5	14.4	9.3	10.8
08/02/2020 18:00	7.7	14.4	10.8	19.0	13.9	10.3	10.3
08/02/2020 19:00	7.7	13.4	10.8	19.0	15.4	11.3	11.3
08/02/2020 20:00	4.6	7.7	11.8	19.0	15.4	11.8	12.9
08/02/2020 21:00	8.2	5.1	10.3	20.6	17.5	11.8	13.4
08/02/2020 22:00	6.7	4.1	10.8	20.6	18.0	11.8	12.9
08/02/2020 23:00	5.7	2.1	11.3	22.1	19.5	12.9	14.4
09/02/2020 00:00	6.7	2.1	12.3	22.1	20.6	13.4	14.4
09/02/2020 01:00	5.7	1.5	12.9	19.5	21.6	13.4	14.4
09/02/2020 02:00	6.2	0.5	11.3	19.5	20.6	14.4	15.4
09/02/2020 03:00	4.1	2.1	14.4	18.5	24.2	13.4	14.4
09/02/2020 04:00	8.7	2.1	13.4	18.0	23.7	11.8	12.9
09/02/2020 05:00	9.3	2.6	14.4	17.5	25.2	9.8	13.4
09/02/2020 06:00	10.3	3.6	12.3	21.6	23.7	9.3	14.4
09/02/2020 07:00	10.3	6.7	10.8	19.0	24.7	11.8	15.9
09/02/2020 08:00	10.3	13.9	14.9	22.6	25.2	13.4	15.9
09/02/2020 09:00	10.3	12.3	14.9	23.7	26.2	17.0	15.9
09/02/2020 10:00	10.3	8.7	20.1	21.1	24.7	16.5	15.9
09/02/2020 11:00	7.2	9.3	13.4	14.4	23.7	18.0	15.9
09/02/2020 12:00	6.7	13.9	13.4	13.4	24.2	20.1	15.9
09/02/2020 13:00	8.2	13.9	13.9	14.4	25.2	21.1	15.9
09/02/2020 14:00	15.9	12.3	14.9	15.4	16.5	20.1	15.4
09/02/2020 15:00	14.9	11.3	15.9	12.3	20.1	16.5	15.9
09/02/2020 16:00	9.3	10.8	12.9	8.7	18.5	15.9	17.0
09/02/2020 17:00	7.7	9.3	17.0	13.9	20.1	16.5	16.5
09/02/2020 18:00	8.2	7.7	12.3	11.8	19.0	17.0	14.4

09/02/2020 19:00	10.8	9.3	13.9	11.8	22.1	15.4	12.9
09/02/2020 20:00	8.2	8.2	13.9	13.4	19.0	17.5	13.9
09/02/2020 21:00	9.3	6.2	13.9	14.4	19.5	15.9	13.9
09/02/2020 22:00	9.3	5.1	14.9	10.8	19.0	13.9	14.4
09/02/2020 23:00	10.3	4.6	12.9	12.9	19.5	13.9	13.9
10/02/2020 00:00	5.7	6.2	13.9	12.9	15.9	14.4	14.9
10/02/2020 01:00	9.3	7.2	14.9	14.4	10.3	14.9	14.9
10/02/2020 02:00	8.2	7.2	14.9	14.9	13.4	13.9	16.5
10/02/2020 03:00	10.3	8.2	14.4	13.9	14.4	15.9	15.4
10/02/2020 04:00	9.3	9.8	16.5	14.4	12.3	16.5	14.4
10/02/2020 05:00	7.7	8.2	15.9	14.9	13.4	12.3	14.4
10/02/2020 06:00	9.8	9.8	17.0	14.4	13.4	14.9	11.8
10/02/2020 07:00	11.3	8.2	16.5	14.9	12.3	14.4	10.8
10/02/2020 08:00	9.3	7.2	15.4	14.4	17.5	14.4	7.2
10/02/2020 09:00	9.3	7.2	17.0	14.9	18.5	12.3	6.7
10/02/2020 10:00	10.3	8.2	15.9	17.0	18.5	11.3	9.3
10/02/2020 11:00	9.3	7.7	15.4	15.9	19.0	13.9	13.9
10/02/2020 12:00	10.3	10.3	15.9	11.8	20.1	12.9	14.9
10/02/2020 13:00	9.8	6.7	12.9	10.8	22.6	15.4	15.9
10/02/2020 14:00	13.4	7.7	11.3	11.3	18.5	17.0	14.4
10/02/2020 15:00	9.8	5.7	13.9	14.4	19.0	12.9	14.9
10/02/2020 16:00	10.3	8.7	15.9	10.8	14.4	14.9	15.4
10/02/2020 17:00	10.8	9.3	14.9	15.4	7.2	14.4	12.9
10/02/2020 18:00	7.7	6.7	15.4	15.4	14.4	13.4	8.7
10/02/2020 19:00	8.2	9.8	16.5	17.0	12.3	15.9	12.3
10/02/2020 20:00	10.3	7.7	18.0	15.9	12.9	17.5	10.3
10/02/2020 21:00	9.3	9.3	19.5	15.9	14.9	15.4	10.3
10/02/2020 22:00	7.7	8.2	20.1	13.9	12.3	15.4	11.3
10/02/2020 23:00	12.9	6.2	19.0	13.9	11.3	14.9	13.9
11/02/2020 00:00	9.3	7.7	18.0	14.9	13.4	15.4	11.8
11/02/2020 01:00	12.9	9.3	19.0	15.9	10.8	14.9	11.8

11/02/2020 02:00	10.8	7.7	17.5	14.4	11.3	13.4	11.3
11/02/2020 03:00	10.3	9.3	17.0	16.5	13.9	14.4	12.9
11/02/2020 04:00	11.3	7.7	18.0	15.4	11.3	15.9	10.8
11/02/2020 05:00	12.3	10.8	16.5	15.9	9.3	12.3	10.8
11/02/2020 06:00	15.4	10.3	16.5	14.9	10.8	11.8	9.8
11/02/2020 07:00	14.9	8.2	14.9	15.4	10.8	14.4	11.3
11/02/2020 08:00	12.9	5.1	15.4	14.9	10.8	13.4	11.8
11/02/2020 09:00	14.9	8.2	14.4	13.9	9.8	14.9	10.8
11/02/2020 10:00	17.5	9.8	17.0	13.9	10.3	15.4	10.3
11/02/2020 11:00	16.5	9.8	15.9	14.9	9.8	14.4	10.8
11/02/2020 12:00	18.0	8.7	17.0	15.4	11.3	15.4	9.8
11/02/2020 13:00	17.0	7.7	16.5	16.5	10.3	12.9	9.8
11/02/2020 14:00	15.9	8.2	16.5	14.9	9.3	13.9	9.3
11/02/2020 15:00	12.9	8.7	16.5	14.9	13.9	12.9	11.3
11/02/2020 16:00	12.9	8.7	15.9	14.4	13.4	12.3	5.7
11/02/2020 17:00	12.9	7.7	17.0	13.4	11.8	11.3	8.2
11/02/2020 18:00	11.8	8.2	17.5	11.3	10.8	10.8	9.8
11/02/2020 19:00	12.9	9.3	17.5	12.3	10.3	8.7	9.3
11/02/2020 20:00	10.3	10.3	15.4	13.4	8.7	12.9	8.7
11/02/2020 21:00	5.1	8.2	15.4	13.4	6.7	9.8	9.8
11/02/2020 22:00	8.2	8.7	14.9	12.9	8.2	9.3	9.8
11/02/2020 23:00	12.9	6.7	15.9	11.8	7.2	10.3	10.3
12/02/2020 00:00	9.8	8.2	14.9	10.8	5.7	5.1	7.2
12/02/2020 01:00	11.8	9.8	13.9	11.3	5.7	7.7	9.8
12/02/2020 02:00	11.8	8.2	13.4	11.3	5.1	9.3	7.7
12/02/2020 03:00	10.8	7.7	12.9	9.8	4.6	10.3	9.3
12/02/2020 04:00	13.4	7.2	13.9	10.3	5.1	8.2	7.7
12/02/2020 05:00	15.4	6.7	12.9	10.8	6.2	10.3	6.2
12/02/2020 06:00	11.8	5.7	11.8	10.8	6.2	8.7	7.2
12/02/2020 07:00	14.9	6.2	11.8	10.8	6.7	7.7	6.2
12/02/2020 08:00	10.3	5.1	13.4	10.8	5.1	7.7	4.1

12/02/2020 09:00	8.7	5.1	11.8	9.3	5.7	7.7	5.1
12/02/2020 10:00	10.8	9.8	10.8	9.3	7.2	9.3	5.7
12/02/2020 11:00	12.9	5.1	9.8	10.3	7.7	8.2	4.1
12/02/2020 12:00	8.2	7.2	11.3	10.8	7.7	8.2	3.6
12/02/2020 13:00	13.4	2.1	10.3	8.7	5.1	7.2	6.2
12/02/2020 14:00	7.7	6.2	10.3	9.3	8.2	8.7	6.7
12/02/2020 15:00	9.3	5.1	9.8	8.7	9.3	5.1	5.1
12/02/2020 16:00	6.2	4.6	8.2	6.7	7.2	4.6	5.1
12/02/2020 17:00	6.2	3.1	7.2	6.2	10.3	4.1	4.6
12/02/2020 18:00	7.7	5.1	5.7	6.2	6.2	3.1	2.6
12/02/2020 19:00	4.1	2.1	4.1	7.2	8.7	4.6	5.1
12/02/2020 20:00	4.6	1.5	4.1	9.3	8.7	7.2	6.2
12/02/2020 21:00	4.1	1.5	4.6	8.7	9.8	5.7	8.7
12/02/2020 22:00	2.1	2.6	5.7	10.3	11.3	6.2	12.3
12/02/2020 23:00	2.6	2.6	6.7	10.8	10.8	6.7	11.8
13/02/2020 00:00	2.6	3.6	7.7	12.9	11.8	10.3	14.9
13/02/2020 01:00	1.0	5.1	7.7	10.3	12.3	11.3	13.9
13/02/2020 02:00	1.0	4.6	8.7	12.3	20.1	11.8	6.7
13/02/2020 03:00	1.0	5.7	10.3	14.9	8.7	3.6	8.7
13/02/2020 04:00	1.0	6.2	10.8	11.8	11.8	6.2	9.8
13/02/2020 05:00	1.5	7.7	7.7	10.8	10.3	8.7	10.8
13/02/2020 06:00	1.5	7.7	6.2	7.2	13.4	11.3	10.8
13/02/2020 07:00	1.0	8.7	5.7	8.7	17.5	11.8	12.9
13/02/2020 08:00	3.1	7.2	5.1	5.1	14.4	10.3	13.9
13/02/2020 09:00	4.1	6.2	4.1	3.6	12.3	6.7	13.4
13/02/2020 10:00	3.6	4.6	4.6	5.1	9.3	8.7	11.8
13/02/2020 11:00	3.1	5.7	4.6	6.7	8.7	7.2	10.3
13/02/2020 12:00	3.1	7.2	3.1	6.7	6.7	9.8	10.3
13/02/2020 13:00	1.0	7.7	3.1	6.7	8.7	11.3	9.3
13/02/2020 14:00	2.1	7.2	4.1	6.2	7.2	10.3	7.2
13/02/2020 15:00	2.6	6.7	3.6	5.7	7.7	8.7	7.2

13/02/2020 16:00	3.6	4.1	3.6	5.7	5.7	7.7	8.2
13/02/2020 17:00	1.5	3.1	3.1	5.1	3.6	7.7	9.3
13/02/2020 18:00	1.5	2.1	2.6	3.6	5.1	8.2	8.2
13/02/2020 19:00	1.5	1.5	2.6	2.6	5.1	6.2	6.2
13/02/2020 20:00	1.5	2.6	2.6	2.6	3.1	6.2	5.7
13/02/2020 21:00	1.0	1.5	2.1	2.1	3.1	4.6	5.7
13/02/2020 22:00	0.5	1.0	2.1	1.5	4.1	4.1	5.7
13/02/2020 23:00	5.1	1.0	0.0	1.5	3.6	2.1	2.1
14/02/2020 00:00	7.7	1.5	1.5	3.1	5.1	2.1	2.1
14/02/2020 01:00	7.2	1.5	2.1	5.7	3.1	1.5	3.1
14/02/2020 02:00	8.7	2.1	1.5	6.2	2.1	2.1	3.1
14/02/2020 03:00	9.3	2.6	2.6	9.8	1.5	2.6	4.6
14/02/2020 04:00	7.7	3.1	3.6	9.3	3.1	2.6	4.6
14/02/2020 05:00	10.3	4.6	3.6	12.3	3.6	3.6	6.2
14/02/2020 06:00	10.8	5.1	5.1	12.3	6.7	3.1	8.7
14/02/2020 07:00	13.4	5.1	6.2	12.9	8.7	2.1	8.7
14/02/2020 08:00	16.5	7.2	6.2	14.4	10.3	2.1	9.3
14/02/2020 09:00	15.4	6.2	7.2	13.9	7.2	4.6	9.8
14/02/2020 10:00	17.5	8.2	7.2	15.4	11.3	8.2	8.2
14/02/2020 11:00	15.4	7.7	10.3	15.9	12.9	8.2	9.3
14/02/2020 12:00	13.4	8.2	7.7	14.9	9.8	8.2	10.8
14/02/2020 13:00	13.9	9.3	9.3	13.9	13.4	8.2	9.3
14/02/2020 14:00	16.5	7.7	8.2	11.8	14.4	6.7	9.3
14/02/2020 15:00	15.4	7.7	8.2	10.8	13.9	5.1	8.2
14/02/2020 16:00	15.9	6.2	8.2	9.8	8.2	8.7	8.7
14/02/2020 17:00	13.9	6.7	7.7	7.7	9.8	5.1	5.1
14/02/2020 18:00	11.3	3.6	8.7	7.7	9.8	3.6	7.2
14/02/2020 19:00	10.8	5.1	5.7	7.2	4.6	2.6	4.6
14/02/2020 20:00	10.8	3.6	5.7	8.7	7.2	5.7	4.6
14/02/2020 21:00	7.7	3.6	3.6	8.7	8.7	3.6	5.1
14/02/2020 22:00	9.8	3.6	6.2	7.7	7.7	2.1	5.7

14/02/2020 23:00	8.7	4.6	5.7	7.7	7.7	3.1	5.7
15/02/2020 00:00	9.3	5.1	3.6	8.2	5.1	2.6	5.1
15/02/2020 01:00	11.3	2.6	4.1	8.7	2.1	3.1	5.1
15/02/2020 02:00	12.3	3.6	6.7	8.7	6.2	3.6	4.6
15/02/2020 03:00	13.4	3.1	5.7	9.3	10.3	3.1	8.2
15/02/2020 04:00	11.8	2.1	5.7	11.3	6.2	6.2	9.8
15/02/2020 05:00	13.9	4.1	4.6	10.8	7.2	8.2	12.3
15/02/2020 06:00	13.9	4.1	6.2	11.3	8.2	9.8	12.9
15/02/2020 07:00	13.9	6.2	5.7	12.3	11.8	11.8	12.3
15/02/2020 08:00	17.0	6.7	6.7	12.9	15.4	12.3	13.9
15/02/2020 09:00	15.4	7.2	8.2	15.4	14.9	10.8	12.9
15/02/2020 10:00	17.0	9.8	8.7	17.5	14.9	10.8	13.9
15/02/2020 11:00	17.5	10.3	10.3	18.0	16.5	10.8	13.9
15/02/2020 12:00	18.5	10.3	11.8	18.0	17.0	11.3	13.4
15/02/2020 13:00	16.5	8.7	8.2	19.5	20.1	10.8	13.9
15/02/2020 14:00	9.3	8.2	10.3	21.1	19.0	11.3	14.9
15/02/2020 15:00	10.8	7.7	10.8	22.1	17.5	12.9	15.4
15/02/2020 16:00	7.7	9.8	11.8	22.1	21.6	13.9	15.4
15/02/2020 17:00	7.2	8.2	12.9	19.0	27.3	13.4	15.9
15/02/2020 18:00	6.2	5.7	12.9	14.4	23.7	17.5	13.9
15/02/2020 19:00	6.7	4.1	9.8	13.9	22.1	18.0	12.3
15/02/2020 20:00	8.2	5.7	12.3	13.9	18.5	14.9	12.9
15/02/2020 21:00	6.7	6.2	11.3	15.4	18.5	11.8	13.9
15/02/2020 22:00	9.3	7.2	13.9	14.4	21.1	11.3	14.9
15/02/2020 23:00	10.3	6.2	11.3	13.4	25.2	12.3	15.9
16/02/2020 00:00	10.8	5.1	8.7	17.5	26.2	14.9	15.9
16/02/2020 01:00	12.3	6.2	11.8	17.5	25.7	14.9	15.9
16/02/2020 02:00	12.9	5.1	14.4	17.0	22.1	14.4	17.0
16/02/2020 03:00	12.9	7.2	15.4	17.0	8.2	14.9	15.4
16/02/2020 04:00	8.7	7.2	16.5	16.5	12.9	10.8	14.4
16/02/2020 05:00	6.2	10.3	15.9	15.9	11.3	9.8	8.7

16/02/2020 06:00	10.3	7.7	14.9	10.8	13.9	8.7	8.2
16/02/2020 07:00	8.7	9.8	9.8	12.3	11.3	9.3	8.7
16/02/2020 08:00	10.8	8.2	10.3	11.8	14.4	9.8	9.8
16/02/2020 09:00	9.8	12.9	10.8	13.9	14.4	9.3	6.7
16/02/2020 10:00	14.4	10.3	12.9	14.9	18.5	13.9	6.7
16/02/2020 11:00	16.5	10.8	11.8	13.9	19.5	13.4	10.8
16/02/2020 12:00	15.9	11.8	12.9	12.9	16.5	12.3	9.8
16/02/2020 13:00	18.5	11.3	13.4	15.4	15.9	14.9	9.8
16/02/2020 14:00	14.9	11.8	12.9	14.9	18.0	12.9	11.3
16/02/2020 15:00	13.9	11.8	14.9	15.9	18.0	13.9	10.8
16/02/2020 16:00	12.9	10.3	14.9	18.5	19.5	14.4	10.3
16/02/2020 17:00	12.9	11.8	15.9	17.5	21.1	14.9	10.3
16/02/2020 18:00	11.8	10.3	14.9	18.5	21.1	17.0	13.4
16/02/2020 19:00	12.9	11.3	15.4	14.4	21.6	17.5	12.3
16/02/2020 20:00	13.9	9.8	17.0	14.9	18.5	13.9	11.3
16/02/2020 21:00	12.3	10.3	16.5	18.0	18.0	13.9	11.3
16/02/2020 22:00	11.3	11.8	15.4	16.5	22.6	13.4	8.2
16/02/2020 23:00	14.4	13.9	16.5	17.5	22.6	12.9	10.8
17/02/2020 00:00	15.9	10.3	19.0	19.0	20.6	12.9	9.8
17/02/2020 01:00	16.5	13.9	18.0	18.0	22.6	12.9	10.3
17/02/2020 02:00	18.5	12.3	17.5	18.0	20.1	13.4	10.3
17/02/2020 03:00	19.0	11.3	16.5	18.5	22.1	10.3	7.7
17/02/2020 04:00	14.4	8.7	17.5	18.0	15.9	12.9	6.7
17/02/2020 05:00	14.9	8.2	14.4	17.0	19.0	9.8	6.7
17/02/2020 06:00	11.8	7.2	15.9	14.9	17.5	11.8	10.3
17/02/2020 07:00	10.8	6.7	14.4	13.9	19.0	16.5	10.8
17/02/2020 08:00	10.3	6.2	12.3	11.3	20.1	13.4	10.8
17/02/2020 09:00	13.9	6.7	11.3	9.8	13.9	10.8	11.8
17/02/2020 10:00	13.4	7.7	10.8	10.8	11.8	11.3	11.8
17/02/2020 11:00	10.3	8.2	10.8	11.3	11.8	10.3	9.8
17/02/2020 12:00	9.8	7.7	11.8	11.3	12.9	11.3	8.2

17/02/2020 13:00	11.8	8.7	11.3	10.3	13.4	10.8	11.3
17/02/2020 14:00	10.3	9.8	10.3	10.8	14.4	10.3	10.3
17/02/2020 15:00	10.8	8.7	9.3	11.8	14.4	11.3	7.2
17/02/2020 16:00	10.3	9.3	11.8	10.3	12.9	13.4	9.8
17/02/2020 17:00	8.2	9.3	12.9	12.3	10.3	9.8	10.3
17/02/2020 18:00	10.8	5.1	11.3	11.8	9.8	9.3	9.3
17/02/2020 19:00	9.8	6.2	12.3	11.3	8.2	10.3	7.7
17/02/2020 20:00	9.8	6.7	15.4	13.4	5.7	9.8	8.7
17/02/2020 21:00	10.8	3.1	15.4	12.9	8.7	9.3	7.2
17/02/2020 22:00	10.8	6.7	13.9	10.8	8.2	9.8	7.7
17/02/2020 23:00	7.7	7.7	12.9	10.8	9.3	9.3	6.2
18/02/2020 00:00	7.2	6.2	12.3	11.8	13.4	8.2	5.1
18/02/2020 01:00	10.3	7.7	12.3	11.3	14.9	8.7	7.2
18/02/2020 02:00	6.2	5.7	11.8	11.8	10.3	7.7	6.7
18/02/2020 03:00	4.6	5.1	11.8	12.3	11.8	7.2	7.7
18/02/2020 04:00	10.8	3.6	13.4	12.9	11.3	9.3	5.7
18/02/2020 05:00	8.7	6.7	13.4	11.8	11.8	8.7	5.7
18/02/2020 06:00	8.2	7.7	12.3	13.9	11.3	9.3	7.2
18/02/2020 07:00	8.7	6.2	12.9	12.3	12.9	8.7	6.7
18/02/2020 08:00	6.7	5.7	12.3	12.9	14.9	9.8	6.7
18/02/2020 09:00	10.3	8.2	13.4	12.3	15.9	9.8	7.2
18/02/2020 10:00	7.7	7.7	13.4	11.8	15.9	11.8	7.7
18/02/2020 11:00	7.7	6.2	12.3	11.8	14.4	10.3	9.3
18/02/2020 12:00	9.3	6.7	10.8	12.9	15.4	11.8	9.8
18/02/2020 13:00	7.7	6.2	12.3	11.8	14.4	13.9	10.8
18/02/2020 14:00	8.2	7.2	13.9	12.9	15.4	9.8	11.8
18/02/2020 15:00	5.1	8.7	11.8	10.3	16.5	12.9	11.8
18/02/2020 16:00	6.2	8.2	11.3	10.3	14.9	12.3	12.3
18/02/2020 17:00	9.3	8.7	9.3	9.8	9.3	11.8	9.8
18/02/2020 18:00	11.8	5.7	10.3	9.8	11.8	12.9	8.7
18/02/2020 19:00	10.3	7.2	8.2	10.8	7.7	13.4	8.7

18/02/2020 20:00	11.8	8.7	10.8	10.8	6.7	9.8	8.2
18/02/2020 21:00	8.7	6.7	10.8	11.3	7.2	9.3	8.7
18/02/2020 22:00	11.3	7.2	12.3	10.8	5.1	10.3	7.7
18/02/2020 23:00	10.8	5.1	11.3	10.8	5.7	11.8	8.2
19/02/2020 00:00	11.3	6.2	10.3	11.3	5.7	9.8	7.2

Appendix Table 3.2. Precipitation (mm) variability during the storm period from 00:00 04/02/20 to 00:00 19/02/20.

Date and Time	Precipitation (mm)								
	Stornoway	Bishopton	Blackpool	Valley	Mumbles Head	Usk	Chivenor	Camborne	
04/02/2020 00:00	0.6	0.2	0	0	0	0	0	0	0.2
04/02/2020 01:00	0.2	0.2	0.2	0	0	0	0	0	0
04/02/2020 02:00	1	0.4	0	0	0	0	0	0	0
04/02/2020 03:00	0.8	0	0	0	0	0	0	0	0.2
04/02/2020 04:00	0.2	0	0	0	0	0	0.2	0	0.4
04/02/2020 05:00	0	0	0	0	0	0	0	0	0
04/02/2020 06:00	0	0	0	0	0	0	0	0	0
04/02/2020 07:00	0	0	0	0	0	0	0	0	0
04/02/2020 08:00	0	0	0	0	0	0	0	0	0
04/02/2020 09:00	0	0	0	0	0	0	0	0	0
04/02/2020 10:00	0	0	0	0	0	0	0	0	0
04/02/2020 11:00	0	0	0	0	0	0	0	0	0
04/02/2020 12:00	0	0	0	0	0	0	0	0	0
04/02/2020 13:00	0	0	0	0	0	0	0	0	0
04/02/2020 14:00	0	0	0	0	0	0	0	0	0
04/02/2020 15:00	0	0	0	0	0	0	0	0	0
04/02/2020 16:00	0	0	0	0	0	0	0	0	0
04/02/2020 17:00	0	0	0	0	0	0	0	0	0

04/02/2020 18:00	0	0	0	0	0	0	0	0
04/02/2020 19:00	0.2	0	0	0	0	0	0	0
04/02/2020 20:00	0	0	0	0	0	0	0	0
04/02/2020 21:00	0	0	0	0	0	0	0	0
04/02/2020 22:00	0	0	0	0	0	0	0	0
04/02/2020 23:00	0	0	0	0	0	0	0	0
05/02/2020 00:00	0	0	0	0	0	0	0	0
05/02/2020 01:00	0	0	0	0	0	0	0	0
05/02/2020 02:00	0	0	0	0	0	0	0	0
05/02/2020 03:00	0	0	0	0	0	0	0	0
05/02/2020 04:00	0	0	0	0	0	0	0	0
05/02/2020 05:00	0	0	0	0	0	0	0	0
05/02/2020 06:00	0	0	0	0	0	0	0	0
05/02/2020 07:00	0	0	0	0	0	0	0	0
05/02/2020 08:00	0	0	0	0	0	0	0	0
05/02/2020 09:00	0	0	0	0	0	0	0	0
05/02/2020 10:00	0	0	0	0	0	0	0	0
05/02/2020 11:00	0	0	0	0	0	0	0	0
05/02/2020 12:00	0	0	0	0	0	0	0	0
05/02/2020 13:00	0	0	0	0	0	0	0	0
05/02/2020 14:00	0.2	0	0	0	0	0	0	0
05/02/2020 15:00	0	0	0	0	0	0	0	0
05/02/2020 16:00	0	0	0	0	0	0	0	NA
05/02/2020 17:00	0	0	0	0	0	0	0	0
05/02/2020 18:00	0.2	0	0	0	0	0	0	0
05/02/2020 19:00	0	0	0	0	0	0	0	0
05/02/2020 20:00	0	0	0	0	0	0	0	0
05/02/2020 21:00	0	0	0	0	0	0	0	0
05/02/2020 22:00	0	0	0	0	0	0	0	0
05/02/2020 23:00	0	0	0	0	0	0	0	0
06/02/2020 00:00	0	0	0	0	0	0	0	0

06/02/2020 01:00	0	0	0	0	0	0	0	0
06/02/2020 02:00	0	0	0	0	0	0	0	0
06/02/2020 03:00	0	0	0	0	0	0	0	0
06/02/2020 04:00	0	0	0	0	0	0	0	0
06/02/2020 05:00	0	0	0	0	0	0	0	0
06/02/2020 06:00	0	0	0	0	0	0	0	0
06/02/2020 07:00	0	0	0	0	0	0	0	0
06/02/2020 08:00	0	0	0	0	0	0	0	0
06/02/2020 09:00	0	0	0	0	0	0	0	0
06/02/2020 10:00	0	0	0	0	0	0	0	0
06/02/2020 11:00	0	0	0	0	0	0.2	0	0
06/02/2020 12:00	0.2	0	0	0	0	0	0	0
06/02/2020 13:00	0	0	0	0	0	0	0	0
06/02/2020 14:00	0	0	0	0	0	0	0	0
06/02/2020 15:00	0	0	0	0	0	0	0	0
06/02/2020 16:00	0	0	0	0	0	0	0	0
06/02/2020 17:00	0	0	0	0	0	0	0	0
06/02/2020 18:00	0	0	0	0	0	0	0	0
06/02/2020 19:00	0	0	0	0	0	0	0	0
06/02/2020 20:00	0	0	0	0	0	0	0	0
06/02/2020 21:00	0	0	0	0	0	0	0	0
06/02/2020 22:00	0	0	0	0	0	0	0	0
06/02/2020 23:00	0	0	0	0	0	0	0	0
07/02/2020 00:00	0	0	0	0	0	0	0	0
07/02/2020 01:00	0	0	0	0	0	0	0	0
07/02/2020 02:00	0	0	0	0	0	0	0	0
07/02/2020 03:00	0	0	0	0	0	0	0	0
07/02/2020 04:00	0	0	0	0	0	0	0	0
07/02/2020 05:00	0	0	0	0	0	0	0	0
07/02/2020 06:00	0	0	0	0	0	0	0	0
07/02/2020 07:00	0	0	0	0	0	0	0	0

07/02/2020 08:00	0	0	0	0	0	0	0	0
07/02/2020 09:00	0	0	0	0	0	0	0	0
07/02/2020 10:00	0	0	0	0	0	0	0	0
07/02/2020 11:00	0	0.2	0	0	0	0	0	0
07/02/2020 12:00	0	0	0	0	0	0	0	0
07/02/2020 13:00	0	0	0	0	0	0	0	0
07/02/2020 14:00	0	0	0	0	0	0	0	0
07/02/2020 15:00	0	0	0	0	0	0	0	0
07/02/2020 16:00	0	0	0	0	0	0	0	0
07/02/2020 17:00	0	0	0	0	0	0	0	0
07/02/2020 18:00	0	0	0	0	0	0	0	0
07/02/2020 19:00	0	0	0	0	0	0	0	0.2
07/02/2020 20:00	0	0.2	0	0.2	0	0	0	0
07/02/2020 21:00	0	0	0	0	0	0	0	1.4
07/02/2020 22:00	0	0.4	0	0.2	0.4	0	0	0
07/02/2020 23:00	0	0.4	0	0.2	1.4	0.2	1.4	0.4
08/02/2020 00:00	0.2	0	0	0	0	0.6	0	0
08/02/2020 01:00	0	1.8	0.2	0	0	0.6	0	0
08/02/2020 02:00	1.4	0.8	0	0	0	0	0	0
08/02/2020 03:00	2	0	0	0	0	0	0	0
08/02/2020 04:00	1.2	3	0	0	0	0	0	0
08/02/2020 05:00	0.2	0.2	0	0	0	0.2	0	0
08/02/2020 06:00	0	0	0	0	0	0	0	0
08/02/2020 07:00	0	0	0	0	0	0	0	0
08/02/2020 08:00	0	0	0	0	0	0	0	0
08/02/2020 09:00	0	0	0	0	0	0	0	0
08/02/2020 10:00	0	0	0	0	0.4	0	0	0
08/02/2020 11:00	0.4	0	0	0	0	0	0	0
08/02/2020 12:00	0.2	0	0	0	0	0	0	0
08/02/2020 13:00	0	0	0	0	0	0	0	0
08/02/2020 14:00	0	0	0	0.8	0	0	0	0

08/02/2020 15:00	0.4	0	0	0	0	0	0	0
08/02/2020 16:00	1.4	0.2	0	0	0	0	0	0
08/02/2020 17:00	6.6	1	0	0.2	0	0	0	0
08/02/2020 18:00	2.4	1.8	0	0.6	0	0	0	0
08/02/2020 19:00	0.2	3	0	0	0	0	0	0
08/02/2020 20:00	0.6	4.8	0	0.2	0	0	0	0
08/02/2020 21:00	0.2	2	0	0.8	0	0	0	0
08/02/2020 22:00	0	1.8	0.4	1.4	0.4	0.6	0.2	0.4
08/02/2020 23:00	0	1.2	3	3.6	0.2	1.6	0.4	0.2
09/02/2020 00:00	0	2.4	3.2	2.2	1	3.8	0.4	0.2
09/02/2020 01:00	0	1.2	3.6	1	0.2	4.2	0.4	0.6
09/02/2020 02:00	0	1.2	3.6	0.2	0	4.2	0.4	0.6
09/02/2020 03:00	0	0.6	3.2	0	0	4.8	0.2	1
09/02/2020 04:00	0	0	1.6	0	0.2	3.8	0.8	1.4
09/02/2020 05:00	0	1.8	3.4	4	0	1.6	0	0.2
09/02/2020 06:00	0	2	3.2	1	0	0	0	0.2
09/02/2020 07:00	1.4	5	3.6	5	0	0.6	0	0
09/02/2020 08:00	3.4	3.4	6	2.2	0	0	0	0.2
09/02/2020 09:00	2	2.6	1.2	0.2	0	0	0	0
09/02/2020 10:00	0.4	1.2	0.4	0	0.2	0.8	0	0
09/02/2020 11:00	0.8	0	4.8	4.8	0.2	5	0	0.2
09/02/2020 12:00	0.2	0	0.2	0	0.6	5.6	0	0.8
09/02/2020 13:00	0.2	0	0.8	2	1.2	3.6	0.4	0.2
09/02/2020 14:00	0.4	0	1.2	0	0.6	1.6	1.6	0
09/02/2020 15:00	0	0	0	0	0	1	0.6	0
09/02/2020 16:00	0.4	0.2	1	0.8	0	0.2	1.6	0.2
09/02/2020 17:00	0.2	0.4	0	0	0	2.8	0.4	0
09/02/2020 18:00	0.6	0.8	0	0	0	0.2	0.2	0
09/02/2020 19:00	1.6	0.8	0	0	0	0	0.2	0
09/02/2020 20:00	0.8	0	0.2	0	0	0	0	0.8
09/02/2020 21:00	0	0	0.2	0	0	0	0	0

09/02/2020 22:00	0.2	0	0.6	0.2	0	0	0	0
09/02/2020 23:00	0	0.2	0.2	0	2	2.6	0	1.6
10/02/2020 00:00	0.4	0.4	0.8	0	0	0	3.4	1
10/02/2020 01:00	0.2	0	0.4	0	0.4	0.2	0	0
10/02/2020 02:00	0.2	0.8	0.2	0	0	0	0.4	0.4
10/02/2020 03:00	0	0.2	0	0	0	1.6	0.6	0
10/02/2020 04:00	0	0.2	0	0	0	0	0	0
10/02/2020 05:00	0.2	0.4	0	0	0	0.2	0.2	0
10/02/2020 06:00	0.4	0	0	0	0	0	0	0
10/02/2020 07:00	0.2	0.6	0	0	0	0	0	0
10/02/2020 08:00	0.2	1.2	0	0	0	0	0	0
10/02/2020 09:00	0.2	0.2	0	0	0	0	0	0.2
10/02/2020 10:00	0	1	0.2	0	0	0	0	NA
10/02/2020 11:00	0	0.8	0	0	0	0.2	0	NA
10/02/2020 12:00	0.4	1.4	0	0	0.4	1.8	1.2	NA
10/02/2020 13:00	0.2	0.8	0	0	0	0.6	0	NA
10/02/2020 14:00	0	0.4	0	0	0	0	0	NA
10/02/2020 15:00	0	1.6	0	0	0	0.8	0.2	NA
10/02/2020 16:00	0	0.6	0.2	0.2	0.6	0.6	0.2	NA
10/02/2020 17:00	0.8	0	0	0	1.4	3.4	0.2	NA
10/02/2020 18:00	1.8	0.8	0	0	0	0	0.2	NA
10/02/2020 19:00	0.8	2.8	0.2	0	0	0.2	0	NA
10/02/2020 20:00	0.2	0.6	0	0	0	0	0	NA
10/02/2020 21:00	0.4	1.2	0	0	0	0	0	NA
10/02/2020 22:00	0.4	1	0	0	0	0	0	NA
10/02/2020 23:00	2.2	1.2	0	0	0	0	0	NA
11/02/2020 00:00	0.2	0.6	0	0	0	0	0	NA
11/02/2020 01:00	0	0	0	0	0	0	0	NA
11/02/2020 02:00	0.6	1.2	0	0	0	0	0	NA
11/02/2020 03:00	0.8	0.2	0	0	0	0	0	NA
11/02/2020 04:00	0.2	0.2	0	0	0	0	0	NA

11/02/2020 05:00	0	1.2	0	0	0	0	0.2	NA	
11/02/2020 06:00	0.4	0.2	0	0	0	0	0	NA	
11/02/2020 07:00	0	0.2	0	0	0	0	0.2	NA	
11/02/2020 08:00	1.4	0	0	0	0	0	0	NA	
11/02/2020 09:00	0.8	0.2	0	0	0	0	0	NA	
11/02/2020 10:00	0	0	0	0.2	0	0	0		0
11/02/2020 11:00	0.2	0.2	0	0	0.2	0	0		0
11/02/2020 12:00	0.2	0.2	0	0	0	0	0		0
11/02/2020 13:00	1.4	0.6	0	0	0	0	0		0
11/02/2020 14:00	0	0	0	0	0	0	0		0
11/02/2020 15:00	1	0.6	0.2	0	0	0	0		0
11/02/2020 16:00	0.8	0.6	0	0	0	0	0		0
11/02/2020 17:00	0	0	0	0	0	0	0		0
11/02/2020 18:00	0.4	0.2	0	0	0	0	0		0
11/02/2020 19:00	0.2	0.2	0	0	0	0	0		0.2
11/02/2020 20:00	0.8	0.2	0	0	0.2	0	0.2		0
11/02/2020 21:00	0.2	0.2	0	0	0	0	0		0
11/02/2020 22:00	0.4	0.6	0	0	0	0	0		0.2
11/02/2020 23:00	0	0.4	0	0	0	0	0.2		0
12/02/2020 00:00	0.6	0.6	0	0	0	0	0.8		0
12/02/2020 01:00	0.2	0	0	0	0	0	0		0
12/02/2020 02:00	0	0	0	0	0	0	1.4		0
12/02/2020 03:00	1.2	0	0	0	0	0	0		0.2
12/02/2020 04:00	1.4	0	0	0	0	0	0		0
12/02/2020 05:00	1	0	0	0	0	0	0.2		0
12/02/2020 06:00	3.4	0	0	0	0	0	0		0
12/02/2020 07:00	2	0.8	0	0	0	0	0.2		0
12/02/2020 08:00	0	0	0	0	0.2	0	0		0
12/02/2020 09:00	0.2	0.2	0	0	0	0	0		0
12/02/2020 10:00	0	0	0	0	0	0	0		0
12/02/2020 11:00	0.2	0.6	0	0	0	0	0		0

12/02/2020 12:00	0.6	0.4	0	0	0	0	0	0.4
12/02/2020 13:00	0.4	1	0	0	0	0	0	0
12/02/2020 14:00	0.6	0	0	0	0	0	0	0
12/02/2020 15:00	0	0	0.2	0	0	0	0	0.2
12/02/2020 16:00	0.6	0	0	0	0.4	0	0	0.4
12/02/2020 17:00	0	0	0	0	1	0	0	0
12/02/2020 18:00	0	0	0	0	0	0	0.2	1.2
12/02/2020 19:00	0	0	0	0	0	0	0	0.4
12/02/2020 20:00	0	0	0	0	0	0	0	0.2
12/02/2020 21:00	0	0	0	0	0	0	0	0.8
12/02/2020 22:00	0	0	0	0	0	0	0	0.6
12/02/2020 23:00	0	0	0	0	1.2	0.4	0.6	3
13/02/2020 00:00	0	0	0	0	2.8	2.4	1.8	2
13/02/2020 01:00	0	0	0.2	0.4	4.2	2.4	1.2	6.2
13/02/2020 02:00	0	0	1.6	1	2.4	5.4	3.4	0.6
13/02/2020 03:00	0	0	1.4	0.8	0.4	3.6	0.2	0
13/02/2020 04:00	0	0	1.8	0.2	0.2	1.4	0	0
13/02/2020 05:00	0	0	0.4	0	0	0	0	0
13/02/2020 06:00	0	0	0.2	0.4	2.6	0	0	0
13/02/2020 07:00	0	0.4	0	0	0	0.4	0.4	0.6
13/02/2020 08:00	0	1.8	0	3.2	0	0.4	0.2	0.4
13/02/2020 09:00	0	1.4	0	0.4	0	1	1.6	2.4
13/02/2020 10:00	0	0.2	0	0.2	0	0	0	0
13/02/2020 11:00	0	0	0	0	0	1.8	0	0
13/02/2020 12:00	0	0	0	0	0	0	0	0
13/02/2020 13:00	0	0	0	0	0	0.2	0.4	0
13/02/2020 14:00	0	0	0	0	0	0	0	0
13/02/2020 15:00	0	0	0	0	0	0	0	0
13/02/2020 16:00	0	0	0	0	0	0	0	0
13/02/2020 17:00	0	0	0	0	0	0	0	0
13/02/2020 18:00	0	0.2	0	0	0	0	0	0

13/02/2020 19:00	0	0	0	0.2	0	0	0	0
13/02/2020 20:00	0	0	0	0	0	0	0	0
13/02/2020 21:00	0	0	0	0	0	0	0	0
13/02/2020 22:00	0	0	0	0	0	0	0	0
13/02/2020 23:00	0	0	0	0	0	0	0	0
14/02/2020 00:00	0	0	0	0	0	0	0	0
14/02/2020 01:00	0	0	0	0	0	0	0	0
14/02/2020 02:00	0	0	0	0	0	0	0	0
14/02/2020 03:00	0	0	0	0	0	0	0	0
14/02/2020 04:00	0	0	0	0	0	0	0	0
14/02/2020 05:00	0	0	0	0	0	0	0	0
14/02/2020 06:00	0	0	0	0	0	0	0	0
14/02/2020 07:00	0	0	0	0	0	0	0	0
14/02/2020 08:00	1.6	0	0	0	0	0	0	0
14/02/2020 09:00	1.8	0	0	0	0	0	0	0
14/02/2020 10:00	1	1.6	0	0	0	0	0	0
14/02/2020 11:00	0.8	4.6	0	0	0	0	0	0.2
14/02/2020 12:00	1.6	4.8	0	1.4	0	0	0	0
14/02/2020 13:00	0	0.6	1.2	0.2	0.2	0	0	0.2
14/02/2020 14:00	0	0	1.4	0	0.2	0.2	0.2	1.2
14/02/2020 15:00	0	0	0	0	0.8	0.6	1	1.8
14/02/2020 16:00	0.6	0	0	0	1	0.4	1.2	0.8
14/02/2020 17:00	0.4	0	0	0	0.4	1.2	0	0.4
14/02/2020 18:00	0.2	0	0	0	0.2	0.6	0.2	0.2
14/02/2020 19:00	0.2	0	0	0	0	0.4	0.4	0.6
14/02/2020 20:00	0	0.2	0	0	0.2	1	0.8	0
14/02/2020 21:00	0.2	0	0	0	0	0.2	0.2	1.6
14/02/2020 22:00	0	0	0	0	0	0	0	0.8
14/02/2020 23:00	0	0	0	0	0	0	0	0
15/02/2020 00:00	0	0	0	0	0	0	0	0
15/02/2020 01:00	0	0	0	0	0	0	0	0.2

15/02/2020 02:00	0	0	0	0	0	0	0	0
15/02/2020 03:00	0	0	0	0	0	0.8	0	0.4
15/02/2020 04:00	0	0	0	0	0	1	0	0
15/02/2020 05:00	0	0	0	0	0	0.8	0	0.4
15/02/2020 06:00	0	0	0	0	0.2	0.6	0	0.2
15/02/2020 07:00	0	0	0	0.2	1.4	0.4	0.6	0
15/02/2020 08:00	0	0.2	0	0	0.8	1.2	0.4	0.2
15/02/2020 09:00	0.4	0.2	0	0	1	0.4	0	0
15/02/2020 10:00	1	1.6	0.8	0.2	0.6	0.4	0.4	3.2
15/02/2020 11:00	0.8	2.2	1.2	0.6	2.8	2	2.6	4
15/02/2020 12:00	1.2	3.8	0	0.4	1	4.6	1.2	3.6
15/02/2020 13:00	3	2.6	0.8	0	0.2	3.6	2.4	3.4
15/02/2020 14:00	2.4	4.8	0.2	0.4	2.4	5.4	3.2	3.2
15/02/2020 15:00	0.2	4.2	0.2	0.2	1.4	7.8	1.2	1.2
15/02/2020 16:00	0	5.8	0	0.4	0.4	6.4	1	1
15/02/2020 17:00	1	1.6	1.2	0.6	0.2	5	0.4	0.4
15/02/2020 18:00	0.6	2	4.4	1.4	0	4.6	0.2	0.4
15/02/2020 19:00	0	0	3	0	0	3.2	0	0
15/02/2020 20:00	0	0.4	0	0	0	0.4	0	0
15/02/2020 21:00	0.6	0	0	0	0.2	0.6	0.2	0
15/02/2020 22:00	0	0	0	0.4	1.2	4	1.6	0.2
15/02/2020 23:00	0	0	0.6	0.8	3.8	4.6	0.4	0
16/02/2020 00:00	0	0	2.6	2.2	0.2	3.8	0.4	0
16/02/2020 01:00	0	0.4	2	0.8	1	2.4	0.2	0.2
16/02/2020 02:00	2.2	3	1.2	0.6	1.4	4	2.8	2.6
16/02/2020 03:00	3.8	1	1.2	0.6	5	6	1	2.2
16/02/2020 04:00	0.6	0	1.8	0	2.4	6.8	0.8	2.2
16/02/2020 05:00	0.2	0	0	0	2.6	1.8	1.6	3.2
16/02/2020 06:00	0	0	0.2	0.2	1.2	2.4	1.6	0.8
16/02/2020 07:00	0.6	0	1.8	0	0.2	1.6	0.4	0.2
16/02/2020 08:00	0.4	0	0	0	0	0.2	0.4	0.4

16/02/2020 09:00	0.8	0	0	0	0.2	0.4	2.4	0.8
16/02/2020 10:00	0.4	0	0	0	0	1.4	0.6	1.4
16/02/2020 11:00	0.8	0	0	0	0	0.6	1.4	2.2
16/02/2020 12:00	0.6	0	0	0	0.4	0.8	0.4	0.8
16/02/2020 13:00	0.2	0	0	0	1.4	2.2	1.2	0.4
16/02/2020 14:00	0.4	0	0	0	0	1	0.8	0.6
16/02/2020 15:00	1.2	0	0	0	0	0.2	0	0.2
16/02/2020 16:00	0.4	0.6	0	0	0	0	0	0
16/02/2020 17:00	0.4	0.4	0	0.2	0	0	0	0
16/02/2020 18:00	1.2	0	0.2	0	0	0	0	0
16/02/2020 19:00	0.4	0	0	0	0.8	0.6	0.6	0.2
16/02/2020 20:00	0.2	0	0	0	0.8	0.2	0	0
16/02/2020 21:00	0.4	0	0	0	0.2	0.2	1.2	0
16/02/2020 22:00	0.4	0.2	0	0	0	0	0	0
16/02/2020 23:00	0	0.4	0	0	0	0	0	0
17/02/2020 00:00	0	0.8	0	0	0	0	0	0
17/02/2020 01:00	0	0	0	0	0	0.2	0	0
17/02/2020 02:00	0.2	2.4	0	0	0	0	0	0
17/02/2020 03:00	0.2	0.8	0	0	0	0	0.2	0
17/02/2020 04:00	0	1	0	0	0.2	0.8	0.2	0.8
17/02/2020 05:00	0	7.4	0	0	0.2	2.2	0	1.4
17/02/2020 06:00	0	4.6	0	0	0	0.4	0	0
17/02/2020 07:00	0	1.8	0	0	0.2	0.2	0	0.2
17/02/2020 08:00	0	0	0	0	0	1.4	0	0
17/02/2020 09:00	0.2	0.8	0	0	1.2	0.6	0.2	0.2
17/02/2020 10:00	0	0	0	0	0	1.4	0	0
17/02/2020 11:00	0.6	0	0	0	0	0	0	0.6
17/02/2020 12:00	0.8	1	0	0	0	0	0	0.4
17/02/2020 13:00	0	0.2	0	0	0	0	0	0
17/02/2020 14:00	0.4	0.2	0	0	0	0	0	0
17/02/2020 15:00	1	0	0	0	0	0	0	0.2

17/02/2020 16:00	0	0.4	0	0	0	0.4	0	0
17/02/2020 17:00	0.2	1.2	0	0	0	0	0	0.4
17/02/2020 18:00	0	0	0	0	0.2	0.6	0	0
17/02/2020 19:00	0	0.2	0.6	0	0.2	0	0.2	0.2
17/02/2020 20:00	0.4	3.8	0.8	0	0	0	0	0
17/02/2020 21:00	0	0.2	0	0	0.4	0	0	0
17/02/2020 22:00	0	0.2	0	0	0	0	0	0
17/02/2020 23:00	0.6	0.2	0	0	0	0	0	0
18/02/2020 00:00	0	0.8	0	0	0	0	0	0.8
18/02/2020 01:00	0	0	0	0	0.4	0	0	0.6
18/02/2020 02:00	0.2	1	0	0	0.2	0	0.2	0
18/02/2020 03:00	1.6	0	0	0	0	0	0	1.2
18/02/2020 04:00	1	1.4	0	0	0	0	0	0
18/02/2020 05:00	0.2	2.4	0	0	0	0	0	0.2
18/02/2020 06:00	0.2	0.8	0	0	0	0	0	0
18/02/2020 07:00	0	0.4	0	0	0	0	0.2	0
18/02/2020 08:00	0	0	0	0	0	0	0	0
18/02/2020 09:00	0.4	0	0	0	0.2	0.2	0.2	0
18/02/2020 10:00	0.2	1	0	0	0	1.6	0	0.2
18/02/2020 11:00	0	0.8	0	0	0	0	0	0
18/02/2020 12:00	0	0	0	0	0	0	2.8	0
18/02/2020 13:00	0.6	0	0	0	0	0	0	0
18/02/2020 14:00	0.2	0	0	0	0	0	0	0
18/02/2020 15:00	0	0.2	0.4	0	0	0	0	0
18/02/2020 16:00	0	0.4	0	0	1.4	1.6	0.2	0.2
18/02/2020 17:00	0.2	0.2	0.2	0.2	0	0.4	0	0
18/02/2020 18:00	1	0.4	0	0.2	0	0	0	0
18/02/2020 19:00	1	0	0	0	0.2	0	0	0
18/02/2020 20:00	1	0.4	0	0	0	0	0.6	0
18/02/2020 21:00	0.8	0	0	0	0	0	0.6	0
18/02/2020 22:00	0.2	0	0	0	0	0	0	1

18/02/2020 23:00	0	0	0	0	0	0	0	0
19/02/2020 00:00	0	0	0	0	0	0	0	0

3.2. Tidal Gauge Data

Appendix Table 3.3. Storm surge height (m) variability during the storm period from 00:00 04/02/20 to 00:00 19/02/20.

Date	Time	Stornoway	Millport	Heysham	Holyhead	Milford Haven	Hinkley Point	Newlyn
04/02/2020	00:00:00	0.269	0.332	0.429	0.078	0.091	0.393	-0.036
04/02/2020	00:15:00	0.272	0.375	0.448	0.113	0.097	0.352	-0.006
04/02/2020	00:30:00	0.281	0.384	0.453	0.105	0.105	0.299	-0.047
04/02/2020	00:45:00	0.199	0.404	0.474	0.084	0.083	0.223	-0.011
04/02/2020	01:00:00	0.252	0.448	0.477	0.118	0.098	0.174	0
04/02/2020	01:15:00	0.151	0.455	0.426	0.111	0.118	0.14	0
04/02/2020	01:30:00	0.211	0.47	0.463	0.15	0.084	0.11	0.01
04/02/2020	01:45:00	0.136	0.478	0.495	0.139	0.071	0.117	-0.038
04/02/2020	02:00:00	0.183	0.502	0.453	0.141	0.06	0.104	-0.021
04/02/2020	02:15:00	0.096	0.48	0.456	0.171	0.083	0.118	-0.055
04/02/2020	02:30:00	0.114	0.493	0.454	0.202	0.066	0.11	-0.048
04/02/2020	02:45:00	0.075	0.484	0.445	0.185	0.078	0.119	-0.04
04/02/2020	03:00:00	0.037	0.474	0.475	0.198	0.075	0.118	-0.03
04/02/2020	03:15:00	0.064	0.453	0.478	0.219	0.074	0.124	-0.054
04/02/2020	03:30:00	0.016	0.423	0.485	0.247	0.04	0.143	-0.078
04/02/2020	03:45:00	-0.004	0.413	0.475	0.194	0.056	0.17	-0.062
04/02/2020	04:00:00	-0.036	0.376	0.469	0.213	0.065	0.209	-0.083
04/02/2020	04:15:00	0.005	0.348	0.48	0.217	0.039	0.232	-0.074
04/02/2020	04:30:00	-0.067	0.323	0.51	0.231	0.043	0.255	-0.062
04/02/2020	04:45:00	-0.016	0.29	0.522	0.213	0.045	0.277	-0.066

04/02/2020	05:00:00	-0.069	0.249	0.485	0.198	0.043	0.294	-0.033
04/02/2020	05:15:00	-0.052	0.244	0.499	0.18	0.02	0.308	-0.068
04/02/2020	05:30:00	-0.042	0.203	0.518	0.183	0.026	0.319	-0.05
04/02/2020	05:45:00	-0.065	0.183	0.483	0.141	0.029	0.339	-0.057
04/02/2020	06:00:00	-0.063	0.174	0.468	0.157	0.024	0.368	-0.054
04/02/2020	06:15:00	-0.109	0.175	0.462	0.123	0.032	0.35	-0.041
04/02/2020	06:30:00	-0.09	0.195	0.442	0.087	0.012	0.323	-0.024
04/02/2020	06:45:00	-0.123	0.205	0.419	0.067	0.019	0.319	-0.001
04/02/2020	07:00:00	-0.114	0.226	0.397	0.079	0.033	0.307	0
04/02/2020	07:15:00	-0.182	0.217	0.367	0.046	-0.007	0.318	-0.017
04/02/2020	07:30:00	-0.137	0.226	0.314	0.004	0.009	0.325	-0.037
04/02/2020	07:45:00	-0.201	0.24	0.286	0.022	0.019	0.316	-0.01
04/02/2020	08:00:00	-0.169	0.253	0.264	0.033	-0.002	0.318	0.02
04/02/2020	08:15:00	-0.199	0.242	0.213	-0.01	-0.005	0.293	0.011
04/02/2020	08:30:00	-0.192	0.21	0.173	0.008	-0.008	0.28	0.014
04/02/2020	08:45:00	-0.219	0.162	0.149	-0.001	-0.044	0.271	0.014
04/02/2020	09:00:00	-0.233	0.146	0.114	0.006	-0.042	0.272	0.009
04/02/2020	09:15:00	-0.18	0.099	0.075	-0.025	-0.021	0.273	0.007
04/02/2020	09:30:00	-0.209	0.075	0.064	-0.033	-0.039	0.249	-0.007
04/02/2020	09:45:00	-0.197	0.036	0.059	-0.051	-0.041	0.195	0.028
04/02/2020	10:00:00	-0.189	-0.001	0.043	-0.088	-0.067	0.172	-0.013
04/02/2020	10:15:00	-0.193	-0.022	0.056	-0.091	-0.077	0.111	-0.03
04/02/2020	10:30:00	-0.196	-0.04	0.066	-0.084	-0.071	0.137	-0.024
04/02/2020	10:45:00	-0.201	-0.032	0.075	-0.129	-0.05	0.108	-0.035
04/02/2020	11:00:00	-0.196	-0.029	0.075	-0.12	-0.044	0.098	-0.048
04/02/2020	11:15:00	-0.189	-0.025	0.069	-0.128	-0.042	0.097	-0.081
04/02/2020	11:30:00	-0.147	-0.035	0.037	-0.141	-0.058	0.099	-0.093
04/02/2020	11:45:00	-0.2	-0.012	0.001	-0.142	-0.091	0.094	-0.086
04/02/2020	12:00:00	-0.122	-0.045	-0.046	-0.172	-0.073	0.08	-0.086
04/02/2020	12:15:00	-0.177	-0.082	-0.077	-0.173	-0.065	0.092	-0.115

04/02/2020	12:30:00	-0.13	-0.113	-0.081	-0.184	-0.052	0.078	-0.127
04/02/2020	12:45:00	-0.155	-0.115	-0.114	-0.214	-0.048	0.095	-0.12
04/02/2020	13:00:00	-0.151	-0.113	-0.135	-0.227	-0.08	0.106	-0.105
04/02/2020	13:15:00	-0.13	-0.107	-0.148	-0.235	-0.094	0.096	-0.144
04/02/2020	13:30:00	-0.152	-0.088	-0.153	-0.223	-0.088	0.078	-0.112
04/02/2020	13:45:00	-0.127	-0.1	-0.183	-0.234	-0.107	0.05	-0.126
04/02/2020	14:00:00	-0.143	-0.114	-0.23	-0.242	-0.101	0.033	-0.097
04/02/2020	14:15:00	-0.128	-0.134	-0.241	-0.243	-0.095	0.01	-0.112
04/02/2020	14:30:00	-0.186	-0.15	-0.263	-0.243	-0.096	-0.004	-0.12
04/02/2020	14:45:00	-0.153	-0.166	-0.28	-0.231	-0.123	-0.015	-0.133
04/02/2020	15:00:00	-0.185	-0.19	-0.286	-0.232	-0.149	-0.031	-0.091
04/02/2020	15:15:00	-0.191	-0.215	-0.29	-0.225	-0.111	-0.045	-0.111
04/02/2020	15:30:00	-0.214	-0.252	-0.275	-0.22	-0.132	-0.07	-0.089
04/02/2020	15:45:00	-0.211	-0.281	-0.272	-0.23	-0.153	-0.098	-0.089
04/02/2020	16:00:00	-0.222	-0.308	-0.274	-0.241	-0.121	-0.115	-0.089
04/02/2020	16:15:00	-0.231	-0.319	-0.283	-0.247	-0.113	-0.145	-0.096
04/02/2020	16:30:00	-0.244	-0.341	-0.267	-0.237	-0.132	-0.166	-0.116
04/02/2020	16:45:00	-0.237	-0.363	-0.262	-0.242	-0.13	-0.181	-0.116
04/02/2020	17:00:00	-0.226	-0.385	-0.239	-0.271	-0.123	-0.155	-0.078
04/02/2020	17:15:00	-0.258	-0.399	-0.221	-0.267	-0.12	-0.154	-0.09
04/02/2020	17:30:00	-0.19	-0.406	-0.213	-0.283	-0.141	-0.262	-0.093
04/02/2020	17:45:00	-0.221	-0.395	-0.22	-0.277	-0.136	-0.287	-0.047
04/02/2020	18:00:00	-0.193	-0.393	-0.228	-0.29	-0.129	-0.349	-0.046
04/02/2020	18:15:00	-0.189	-0.387	-0.22	-0.273	-0.109	-0.359	-0.023
04/02/2020	18:30:00	-0.179	-0.382	-0.24	-0.29	-0.116	-0.399	-0.053
04/02/2020	18:45:00	-0.17	-0.371	-0.256	-0.305	-0.103	-0.387	-0.032
04/02/2020	19:00:00	-0.194	-0.36	-0.27	-0.294	-0.115	-0.396	-0.029
04/02/2020	19:15:00	-0.182	-0.33	-0.278	-0.298	-0.109	-0.359	0.014
04/02/2020	19:30:00	-0.184	-0.311	-0.282	-0.288	-0.109	-0.281	-0.018
04/02/2020	19:45:00	-0.209	-0.295	-0.274	-0.296	-0.101	-0.221	-0.011

04/02/2020	20:00:00	-0.213	-0.274	-0.27	-0.288	-0.094	-0.243	0.017
04/02/2020	20:15:00	-0.21	-0.268	-0.283	-0.288	-0.072	-0.196	-0.012
04/02/2020	20:30:00	-0.217	-0.25	-0.287	-0.277	-0.047	-0.092	0.024
04/02/2020	20:45:00	-0.217	-0.233	-0.303	-0.273	-0.053	-0.04	-0.007
04/02/2020	21:00:00	-0.205	-0.226	-0.311	-0.281	-0.07	0.003	0.009
04/02/2020	21:15:00	-0.215	-0.22	-0.333	-0.278	-0.065	0.026	0.01
04/02/2020	21:30:00	-0.2	-0.222	-0.341	-0.257	-0.064	0.046	-0.005
04/02/2020	21:45:00	-0.217	-0.215	-0.351	-0.264	-0.034	0.071	-0.012
04/02/2020	22:00:00	-0.206	-0.206	-0.344	-0.247	-0.019	0.095	-0.011
04/02/2020	22:15:00	-0.184	-0.193	-0.337	-0.242	-0.015	0.116	-0.03
04/02/2020	22:30:00	-0.168	-0.187	-0.318	-0.232	-0.005	0.136	-0.01
04/02/2020	22:45:00	-0.191	-0.178	-0.297	-0.211	0	0.145	0.002
04/02/2020	23:00:00	-0.127	-0.169	-0.284	-0.208	-0.022	0.146	-0.024
04/02/2020	23:15:00	-0.162	-0.165	-0.284	-0.198	-0.003	0.157	-0.012
04/02/2020	23:30:00	-0.153	-0.15	-0.284	-0.18	0.015	0.175	-0.028
04/02/2020	23:45:00	-0.154	-0.14	-0.28	-0.168	-0.001	0.179	-0.01
05/02/2020	00:00:00	-0.159	-0.139	-0.281	-0.147	-0.002	0.2	-0.006
05/02/2020	00:15:00	-0.176	-0.139	-0.278	-0.123	0.003	0.207	-0.015
05/02/2020	00:30:00	-0.182	-0.14	-0.267	-0.119	-0.009	0.223	-0.024
05/02/2020	00:45:00	-0.168	-0.145	-0.238	-0.103	-0.001	0.216	-0.026
05/02/2020	01:00:00	-0.184	-0.149	-0.204	-0.106	0.004	0.191	-0.03
05/02/2020	01:15:00	-0.185	-0.156	-0.166	-0.106	-0.01	0.163	-0.016
05/02/2020	01:30:00	-0.201	-0.157	-0.134	-0.09	-0.013	0.125	-0.022
05/02/2020	01:45:00	-0.206	-0.168	-0.091	-0.077	-0.013	0.084	-0.036
05/02/2020	02:00:00	-0.225	-0.167	-0.071	-0.084	-0.008	0.035	-0.036
05/02/2020	02:15:00	-0.212	-0.176	-0.045	-0.086	-0.02	-0.011	-0.054
05/02/2020	02:30:00	-0.232	-0.162	-0.03	-0.045	-0.012	-0.045	-0.03
05/02/2020	02:45:00	-0.219	-0.164	-0.009	-0.059	-0.002	-0.078	-0.041
05/02/2020	03:00:00	-0.222	-0.156	0.008	-0.074	-0.009	-0.105	-0.055
05/02/2020	03:15:00	-0.226	-0.147	0.011	-0.064	-0.013	-0.131	-0.068

05/02/2020	03:30:00	-0.206	-0.133	0.018	-0.061	-0.007	-0.155	-0.094
05/02/2020	03:45:00	-0.215	-0.122	0.035	-0.049	-0.003	-0.163	-0.086
05/02/2020	04:00:00	-0.207	-0.105	0.042	-0.053	-0.031	-0.177	-0.08
05/02/2020	04:15:00	-0.208	-0.089	0.038	-0.056	-0.051	-0.19	-0.098
05/02/2020	04:30:00	-0.207	-0.077	0.039	-0.037	-0.063	-0.194	-0.101
05/02/2020	04:45:00	-0.162	-0.059	0.027	-0.049	-0.074	-0.195	-0.111
05/02/2020	05:00:00	-0.184	-0.052	0.009	-0.057	-0.042	-0.202	-0.124
05/02/2020	05:15:00	-0.153	-0.04	-0.016	-0.06	-0.054	-0.21	-0.138
05/02/2020	05:30:00	-0.155	-0.029	-0.032	-0.062	-0.067	-0.218	-0.12
05/02/2020	05:45:00	-0.136	-0.019	-0.038	-0.079	-0.077	-0.228	-0.13
05/02/2020	06:00:00	-0.151	-0.01	-0.047	-0.077	-0.104	-0.253	-0.118
05/02/2020	06:15:00	-0.111	0.002	-0.055	-0.066	-0.134	-0.304	-0.136
05/02/2020	06:30:00	-0.152	0.01	-0.062	-0.087	-0.129	-0.341	-0.123
05/02/2020	06:45:00	-0.133	0.006	-0.072	-0.11	-0.133	-0.38	-0.094
05/02/2020	07:00:00	-0.138	0.009	-0.078	-0.076	-0.113	-0.412	-0.11
05/02/2020	07:15:00	-0.165	0.004	-0.089	-0.066	-0.112	-0.423	-0.129
05/02/2020	07:30:00	-0.154	-0.004	-0.084	-0.107	-0.104	-0.427	-0.122
05/02/2020	07:45:00	-0.169	-0.021	-0.083	-0.144	-0.113	-0.411	-0.116
05/02/2020	08:00:00	-0.181	-0.035	-0.082	-0.112	-0.109	-0.381	-0.095
05/02/2020	08:15:00	-0.174	-0.064	-0.074	-0.136	-0.107	-0.339	-0.073
05/02/2020	08:30:00	-0.18	-0.077	-0.066	-0.154	-0.108	-0.334	-0.104
05/02/2020	08:45:00	-0.195	-0.103	-0.057	-0.159	-0.087	-0.282	-0.097
05/02/2020	09:00:00	-0.156	-0.128	-0.061	-0.14	-0.085	-0.211	-0.1
05/02/2020	09:15:00	-0.175	-0.145	-0.073	-0.174	-0.071	-0.141	-0.109
05/02/2020	09:30:00	-0.17	-0.165	-0.088	-0.177	-0.084	-0.069	-0.087
05/02/2020	09:45:00	-0.159	-0.185	-0.112	-0.189	-0.068	-0.03	-0.082
05/02/2020	10:00:00	-0.151	-0.192	-0.138	-0.182	-0.075	-0.025	-0.094
05/02/2020	10:15:00	-0.126	-0.204	-0.169	-0.183	-0.082	-0.03	-0.107
05/02/2020	10:30:00	-0.153	-0.21	-0.186	-0.188	-0.073	-0.004	-0.101
05/02/2020	10:45:00	-0.133	-0.21	-0.209	-0.201	-0.055	0.017	-0.092

05/02/2020	11:00:00	-0.096	-0.213	-0.231	-0.207	-0.077	0.027	-0.091
05/02/2020	11:15:00	-0.1	-0.205	-0.247	-0.216	-0.087	0.027	-0.098
05/02/2020	11:30:00	-0.089	-0.191	-0.27	-0.222	-0.079	0.04	-0.099
05/02/2020	11:45:00	-0.092	-0.172	-0.286	-0.207	-0.059	0.045	-0.099
05/02/2020	12:00:00	-0.098	-0.157	-0.29	-0.203	-0.049	0.058	-0.113
05/02/2020	12:15:00	-0.077	-0.134	-0.315	-0.225	-0.05	0.076	-0.092
05/02/2020	12:30:00	-0.088	-0.112	-0.316	-0.211	-0.043	0.106	-0.107
05/02/2020	12:45:00	-0.056	-0.1	-0.295	-0.215	-0.034	0.113	-0.102
05/02/2020	13:00:00	-0.089	-0.073	-0.295	-0.225	-0.033	0.12	-0.094
05/02/2020	13:15:00	-0.044	-0.055	-0.291	-0.212	-0.036	0.118	-0.098
05/02/2020	13:30:00	-0.067	-0.036	-0.282	-0.21	-0.053	0.109	-0.085
05/02/2020	13:45:00	-0.068	-0.019	-0.26	-0.228	-0.062	0.1	-0.071
05/02/2020	14:00:00	-0.077	-0.017	-0.236	-0.21	-0.07	0.072	-0.087
05/02/2020	14:15:00	-0.104	-0.012	-0.223	-0.21	-0.079	0.042	-0.094
05/02/2020	14:30:00	-0.079	-0.01	-0.221	-0.211	-0.079	0.017	-0.081
05/02/2020	14:45:00	-0.11	-0.014	-0.21	-0.186	-0.065	-0.003	-0.096
05/02/2020	15:00:00	-0.072	-0.021	-0.207	-0.187	-0.074	-0.025	-0.087
05/02/2020	15:15:00	-0.107	-0.032	-0.209	-0.182	-0.098	-0.058	-0.074
05/02/2020	15:30:00	-0.108	-0.042	-0.208	-0.18	-0.104	-0.095	-0.089
05/02/2020	15:45:00	-0.105	-0.051	-0.206	-0.173	-0.105	-0.139	-0.102
05/02/2020	16:00:00	-0.094	-0.066	-0.177	-0.163	-0.111	-0.175	-0.121
05/02/2020	16:15:00	-0.124	-0.073	-0.144	-0.152	-0.092	-0.216	-0.136
05/02/2020	16:30:00	-0.106	-0.081	-0.124	-0.134	-0.074	-0.237	-0.127
05/02/2020	16:45:00	-0.086	-0.097	-0.085	-0.116	-0.099	-0.257	-0.127
05/02/2020	17:00:00	-0.085	-0.104	-0.053	-0.103	-0.102	-0.276	-0.111
05/02/2020	17:15:00	-0.066	-0.11	-0.045	-0.103	-0.098	-0.295	-0.122
05/02/2020	17:30:00	-0.049	-0.115	-0.027	-0.105	-0.11	-0.311	-0.12
05/02/2020	17:45:00	-0.03	-0.104	-0.016	-0.098	-0.094	-0.327	-0.121
05/02/2020	18:00:00	-0.039	-0.106	-0.021	-0.085	-0.085	-0.344	-0.104
05/02/2020	18:15:00	-0.006	-0.09	-0.019	-0.089	-0.079	-0.353	-0.102

05/02/2020	18:30:00	-0.002	-0.091	-0.012	-0.061	-0.082	-0.379	-0.083
05/02/2020	18:45:00	-0.017	-0.079	-0.004	-0.081	-0.114	-0.399	-0.065
05/02/2020	19:00:00	-0.01	-0.06	-0.007	-0.09	-0.121	-0.421	-0.072
05/02/2020	19:15:00	-0.012	-0.05	-0.008	-0.093	-0.098	-0.441	-0.061
05/02/2020	19:30:00	-0.031	-0.028	-0.018	-0.066	-0.088	-0.454	-0.045
05/02/2020	19:45:00	-0.026	-0.014	-0.032	-0.066	-0.065	-0.452	-0.023
05/02/2020	20:00:00	0.003	-0.006	-0.036	-0.072	-0.065	-0.444	-0.025
05/02/2020	20:15:00	-0.041	0.01	-0.032	-0.071	-0.063	-0.416	-0.028
05/02/2020	20:30:00	-0.035	0.019	-0.035	-0.076	-0.048	-0.37	-0.023
05/02/2020	20:45:00	-0.031	0.028	-0.039	-0.068	-0.052	-0.309	-0.001
05/02/2020	21:00:00	-0.042	0.042	-0.033	-0.072	-0.031	-0.262	-0.005
05/02/2020	21:15:00	-0.042	0.049	-0.035	-0.077	-0.012	-0.189	-0.002
05/02/2020	21:30:00	-0.03	0.062	-0.048	-0.071	0.009	-0.095	-0.004
05/02/2020	21:45:00	-0.053	0.071	-0.055	-0.071	0.023	-0.023	-0.015
05/02/2020	22:00:00	-0.031	0.078	-0.063	-0.073	0.024	0.01	-0.006
05/02/2020	22:15:00	-0.022	0.078	-0.076	-0.066	0.021	0.056	0.011
05/02/2020	22:30:00	-0.014	0.073	-0.081	-0.064	0.017	0.09	0.001
05/02/2020	22:45:00	0.005	0.066	-0.085	-0.049	0.028	0.101	0.007
05/02/2020	23:00:00	-0.004	0.053	-0.084	-0.047	0.016	0.117	0.002
05/02/2020	23:15:00	0.01	0.037	-0.078	-0.046	0.005	0.139	-0.012
05/02/2020	23:30:00	0.009	0.011	-0.079	-0.047	0.017	0.157	0.006
05/02/2020	23:45:00	0.01	-0.015	-0.075	-0.035	0.021	0.173	-0.01
06/02/2020	00:00:00	-0.002	-0.036	-0.08	-0.032	0.032	0.186	0.014
06/02/2020	00:15:00	-0.001	-0.057	-0.085	-0.036	0.031	0.196	0.012
06/02/2020	00:30:00	0.004	-0.068	-0.093	-0.02	0.03	0.195	0.005
06/02/2020	00:45:00	-0.001	-0.074	-0.095	-0.018	0.028	0.204	-0.017
06/02/2020	01:00:00	-0.01	-0.075	-0.102	-0.02	0.017	0.21	-0.01
06/02/2020	01:15:00	0.003	-0.071	-0.102	-0.026	0.029	0.216	0.017
06/02/2020	01:30:00	-0.008	-0.059	-0.099	-0.018	0.029	0.212	0.007
06/02/2020	01:45:00	-0.007	-0.042	-0.073	-0.024	0.042	0.195	0.009

06/02/2020	02:00:00	-0.025	-0.02	-0.065	-0.031	0.041	0.169	-0.007
06/02/2020	02:15:00	-0.006	0	-0.043	-0.032	0.023	0.126	0.009
06/02/2020	02:30:00	-0.033	0.023	-0.022	-0.037	0.013	0.084	0.002
06/02/2020	02:45:00	-0.035	0.044	-0.002	-0.05	0.007	0.025	0.003
06/02/2020	03:00:00	-0.031	0.06	0.008	-0.055	0.011	-0.015	-0.003
06/02/2020	03:15:00	-0.034	0.07	0.009	-0.047	0.03	-0.043	0
06/02/2020	03:30:00	-0.038	0.079	0.007	-0.033	0.035	-0.063	0.003
06/02/2020	03:45:00	-0.018	0.084	-0.001	-0.034	0.013	-0.079	-0.007
06/02/2020	04:00:00	-0.029	0.084	-0.014	-0.05	-0.002	-0.097	-0.018
06/02/2020	04:15:00	-0.03	0.08	-0.026	-0.053	0.004	-0.125	-0.025
06/02/2020	04:30:00	-0.019	0.081	-0.04	-0.04	0.02	-0.153	0.001
06/02/2020	04:45:00	0.001	0.067	-0.043	-0.041	0.006	-0.174	-0.013
06/02/2020	05:00:00	-0.008	0.054	-0.037	-0.029	0.012	-0.192	-0.028
06/02/2020	05:15:00	-0.01	0.036	-0.024	-0.017	-0.005	-0.194	-0.041
06/02/2020	05:30:00	0.018	0.021	-0.012	0.002	-0.026	-0.198	-0.005
06/02/2020	05:45:00	-0.004	0.006	-0.004	-0.003	-0.016	-0.211	-0.017
06/02/2020	06:00:00	0.015	-0.003	-0.001	-0.021	-0.009	-0.214	-0.032
06/02/2020	06:15:00	-0.004	-0.007	-0.007	-0.02	-0.002	-0.225	-0.023
06/02/2020	06:30:00	0.009	-0.01	-0.018	-0.014	-0.003	-0.243	-0.001
06/02/2020	06:45:00	-0.021	-0.012	-0.024	-0.016	-0.001	-0.263	-0.007
06/02/2020	07:00:00	0.007	-0.013	-0.022	-0.031	-0.003	-0.29	0.004
06/02/2020	07:15:00	-0.022	-0.025	-0.024	-0.04	-0.008	-0.321	0.033
06/02/2020	07:30:00	-0.003	-0.023	-0.02	-0.042	-0.02	-0.349	0.033
06/02/2020	07:45:00	-0.024	-0.02	-0.015	-0.045	-0.02	-0.373	0.027
06/02/2020	08:00:00	-0.001	-0.027	-0.024	-0.055	-0.004	-0.38	0.052
06/02/2020	08:15:00	-0.026	-0.023	-0.026	-0.045	0.001	-0.373	0.052
06/02/2020	08:30:00	0	-0.028	-0.019	-0.049	0.003	-0.358	0.044
06/02/2020	08:45:00	-0.007	-0.041	-0.019	-0.051	0.032	-0.338	0.077
06/02/2020	09:00:00	0.012	-0.047	-0.023	-0.064	0.036	-0.292	0.088
06/02/2020	09:15:00	0.002	-0.048	-0.024	-0.064	0.035	-0.252	0.086

06/02/2020	09:30:00	0.007	-0.05	-0.028	-0.075	0.044	-0.211	0.081
06/02/2020	09:45:00	0.008	-0.047	-0.037	-0.076	0.054	-0.157	0.107
06/02/2020	10:00:00	-0.015	-0.049	-0.053	-0.071	0.067	-0.101	0.138
06/02/2020	10:15:00	0	-0.054	-0.066	-0.062	0.073	-0.083	0.132
06/02/2020	10:30:00	-0.026	-0.052	-0.086	-0.071	0.07	-0.019	0.118
06/02/2020	10:45:00	-0.009	-0.051	-0.099	-0.075	0.088	0.051	0.124
06/02/2020	11:00:00	-0.02	-0.051	-0.117	-0.079	0.084	0.084	0.148
06/02/2020	11:15:00	-0.022	-0.047	-0.113	-0.068	0.063	0.104	0.125
06/02/2020	11:30:00	-0.025	-0.055	-0.125	-0.07	0.07	0.101	0.142
06/02/2020	11:45:00	-0.011	-0.06	-0.131	-0.075	0.089	0.103	0.134
06/02/2020	12:00:00	-0.035	-0.066	-0.13	-0.079	0.1	0.107	0.13
06/02/2020	12:15:00	0	-0.068	-0.134	-0.064	0.111	0.119	0.148
06/02/2020	12:30:00	-0.025	-0.069	-0.137	-0.065	0.12	0.131	0.138
06/02/2020	12:45:00	0.001	-0.059	-0.15	-0.067	0.105	0.154	0.125
06/02/2020	13:00:00	0.004	-0.056	-0.161	-0.062	0.113	0.181	0.114
06/02/2020	13:15:00	0.015	-0.034	-0.171	-0.046	0.134	0.208	0.117
06/02/2020	13:30:00	0.026	-0.018	-0.173	-0.046	0.144	0.235	0.095
06/02/2020	13:45:00	0.017	-0.001	-0.175	-0.047	0.138	0.249	0.079
06/02/2020	14:00:00	0.035	0.019	-0.179	-0.038	0.145	0.247	0.095
06/02/2020	14:15:00	0.037	0.032	-0.155	-0.026	0.133	0.246	0.104
06/02/2020	14:30:00	0.032	0.05	-0.14	-0.024	0.121	0.217	0.095
06/02/2020	14:45:00	0.025	0.058	-0.112	-0.027	0.116	0.184	0.094
06/02/2020	15:00:00	0.03	0.068	-0.086	-0.013	0.119	0.143	0.09
06/02/2020	15:15:00	0.023	0.072	-0.06	-0.008	0.111	0.115	0.084
06/02/2020	15:30:00	0.007	0.065	-0.043	-0.014	0.119	0.101	0.107
06/02/2020	15:45:00	0.013	0.056	-0.035	-0.006	0.118	0.078	0.109
06/02/2020	16:00:00	0.003	0.041	-0.036	0.002	0.103	0.065	0.082
06/02/2020	16:15:00	-0.008	0.029	-0.043	0.003	0.104	0.035	0.082
06/02/2020	16:30:00	-0.01	0.019	-0.033	-0.002	0.112	0.011	0.091
06/02/2020	16:45:00	-0.013	0.012	-0.014	0.011	0.105	-0.019	0.089

06/02/2020	17:00:00	-0.027	0.013	-0.011	0.023	0.106	-0.044	0.073
06/02/2020	17:15:00	-0.024	0.013	0.01	0.031	0.098	-0.085	0.08
06/02/2020	17:30:00	-0.011	0.006	0.028	0.04	0.088	-0.116	0.084
06/02/2020	17:45:00	-0.017	0.006	0.053	0.046	0.085	-0.128	0.097
06/02/2020	18:00:00	0	0.013	0.059	0.051	0.086	-0.129	0.112
06/02/2020	18:15:00	-0.025	0.022	0.074	0.049	0.078	-0.123	0.119
06/02/2020	18:30:00	0.003	0.038	0.076	0.049	0.091	-0.136	0.114
06/02/2020	18:45:00	0.002	0.049	0.071	0.044	0.097	-0.148	0.109
06/02/2020	19:00:00	0.009	0.06	0.057	0.052	0.114	-0.172	0.119
06/02/2020	19:15:00	0.006	0.07	0.053	0.046	0.097	-0.202	0.129
06/02/2020	19:30:00	0.036	0.083	0.054	0.032	0.096	-0.232	0.146
06/02/2020	19:45:00	0.053	0.092	0.057	0.033	0.098	-0.262	0.146
06/02/2020	20:00:00	0.057	0.106	0.051	0.041	0.109	-0.283	0.147
06/02/2020	20:15:00	0.057	0.11	0.043	0.034	0.1	-0.294	0.162
06/02/2020	20:30:00	0.067	0.108	0.028	0.024	0.125	-0.291	0.176
06/02/2020	20:45:00	0.078	0.106	0.024	0.03	0.136	-0.281	0.17
06/02/2020	21:00:00	0.075	0.097	0.023	0.044	0.13	-0.249	0.18
06/02/2020	21:15:00	0.076	0.087	0.011	0.019	0.146	-0.212	0.17
06/02/2020	21:30:00	0.085	0.078	-0.002	0.011	0.164	-0.167	0.176
06/02/2020	21:45:00	0.104	0.065	0.004	0.026	0.157	-0.11	0.189
06/02/2020	22:00:00	0.095	0.05	-0.001	0.044	0.171	-0.051	0.192
06/02/2020	22:15:00	0.104	0.05	-0.015	0.039	0.184	-0.031	0.188
06/02/2020	22:30:00	0.119	0.048	-0.028	0.035	0.189	0.016	0.202
06/02/2020	22:45:00	0.091	0.043	-0.045	0.043	0.188	0.077	0.205
06/02/2020	23:00:00	0.108	0.047	-0.056	0.052	0.19	0.127	0.219
06/02/2020	23:15:00	0.095	0.044	-0.065	0.042	0.184	0.19	0.194
06/02/2020	23:30:00	0.086	0.043	-0.076	0.049	0.175	0.229	0.215
06/02/2020	23:45:00	0.089	0.046	-0.078	0.063	0.204	0.239	0.204
07/02/2020	00:00:00	0.089	0.046	-0.077	0.062	0.206	0.229	0.217
07/02/2020	00:15:00	0.069	0.038	-0.077	0.055	0.204	0.219	0.206

07/02/2020	00:30:00	0.079	0.031	-0.073	0.059	0.214	0.192	0.169
07/02/2020	00:45:00	0.069	0.029	-0.07	0.059	0.208	0.18	0.195
07/02/2020	01:00:00	0.06	0.022	-0.059	0.044	0.224	0.176	0.209
07/02/2020	01:15:00	0.054	0.019	-0.055	0.072	0.23	0.175	0.184
07/02/2020	01:30:00	0.061	0.023	-0.06	0.08	0.236	0.187	0.156
07/02/2020	01:45:00	0.055	0.032	-0.079	0.08	0.242	0.196	0.155
07/02/2020	02:00:00	0.068	0.041	-0.078	0.085	0.231	0.212	0.144
07/02/2020	02:15:00	0.078	0.052	-0.063	0.087	0.218	0.212	0.133
07/02/2020	02:30:00	0.073	0.075	-0.05	0.094	0.221	0.197	0.131
07/02/2020	02:45:00	0.078	0.087	-0.054	0.099	0.235	0.187	0.147
07/02/2020	03:00:00	0.093	0.115	-0.054	0.097	0.216	0.176	0.128
07/02/2020	03:15:00	0.087	0.127	-0.041	0.114	0.191	0.124	0.14
07/02/2020	03:30:00	0.092	0.143	-0.007	0.115	0.169	0.092	0.146
07/02/2020	03:45:00	0.106	0.153	0.024	0.112	0.167	0.066	0.145
07/02/2020	04:00:00	0.097	0.161	0.03	0.119	0.166	0.042	0.12
07/02/2020	04:15:00	0.121	0.178	0.043	0.13	0.179	0.034	0.128
07/02/2020	04:30:00	0.12	0.185	0.05	0.127	0.132	0.026	0.123
07/02/2020	04:45:00	0.137	0.2	0.067	0.121	0.13	-0.001	0.136
07/02/2020	05:00:00	0.142	0.192	0.075	0.139	0.157	-0.023	0.123
07/02/2020	05:15:00	0.147	0.199	0.081	0.117	0.146	-0.061	0.109
07/02/2020	05:30:00	0.164	0.202	0.088	0.12	0.156	-0.079	0.1
07/02/2020	05:45:00	0.157	0.221	0.105	0.149	0.176	-0.112	0.107
07/02/2020	06:00:00	0.148	0.232	0.118	0.153	0.14	-0.146	0.081
07/02/2020	06:15:00	0.158	0.248	0.138	0.143	0.12	-0.169	0.111
07/02/2020	06:30:00	0.159	0.24	0.146	0.14	0.142	-0.17	0.113
07/02/2020	06:45:00	0.156	0.237	0.159	0.152	0.175	-0.151	0.156
07/02/2020	07:00:00	0.147	0.245	0.162	0.16	0.16	-0.148	0.136
07/02/2020	07:15:00	0.142	0.253	0.155	0.149	0.139	-0.148	0.141
07/02/2020	07:30:00	0.157	0.261	0.141	0.133	0.154	-0.158	0.13
07/02/2020	07:45:00	0.162	0.257	0.134	0.136	0.143	-0.171	0.137

07/02/2020	08:00:00	0.16	0.244	0.13	0.142	0.125	-0.182	0.137
07/02/2020	08:15:00	0.156	0.234	0.124	0.141	0.129	-0.207	0.183
07/02/2020	08:30:00	0.174	0.232	0.108	0.123	0.152	-0.207	0.184
07/02/2020	08:45:00	0.172	0.228	0.09	0.124	0.153	-0.203	0.196
07/02/2020	09:00:00	0.175	0.206	0.089	0.139	0.168	-0.184	0.217
07/02/2020	09:15:00	0.168	0.182	0.079	0.132	0.17	-0.155	0.189
07/02/2020	09:30:00	0.205	0.159	0.063	0.111	0.202	-0.128	0.209
07/02/2020	09:45:00	0.199	0.135	0.062	0.114	0.186	-0.088	0.202
07/02/2020	10:00:00	0.211	0.127	0.06	0.137	0.218	-0.066	0.229
07/02/2020	10:15:00	0.216	0.113	0.055	0.128	0.228	-0.072	0.232
07/02/2020	10:30:00	0.228	0.099	0.066	0.112	0.216	0.005	0.233
07/02/2020	10:45:00	0.207	0.094	0.05	0.125	0.226	0.018	0.242
07/02/2020	11:00:00	0.229	0.088	0.05	0.138	0.223	0.028	0.231
07/02/2020	11:15:00	0.228	0.107	0.028	0.139	0.265	0.07	0.246
07/02/2020	11:30:00	0.228	0.129	0.016	0.137	0.293	0.148	0.242
07/02/2020	11:45:00	0.262	0.141	-0.003	0.135	0.292	0.265	0.217
07/02/2020	12:00:00	0.282	0.149	-0.008	0.109	0.286	0.316	0.209
07/02/2020	12:15:00	0.268	0.173	-0.007	0.107	0.261	0.355	0.196
07/02/2020	12:30:00	0.284	0.202	-0.008	0.139	0.292	0.328	0.195
07/02/2020	12:45:00	0.308	0.227	-0.015	0.124	0.325	0.295	0.205
07/02/2020	13:00:00	0.295	0.234	-0.009	0.103	0.302	0.273	0.193
07/02/2020	13:15:00	0.326	0.248	-0.002	0.121	0.308	0.272	0.192
07/02/2020	13:30:00	0.319	0.258	-0.013	0.155	0.293	0.3	0.184
07/02/2020	13:45:00	0.309	0.284	-0.015	0.146	0.294	0.317	0.175
07/02/2020	14:00:00	0.336	0.296	0.004	0.147	0.294	0.341	0.149
07/02/2020	14:15:00	0.339	0.309	0.002	0.159	0.298	0.351	0.161
07/02/2020	14:30:00	0.322	0.319	0.027	0.157	0.302	0.351	0.169
07/02/2020	14:45:00	0.336	0.312	0.045	0.166	0.282	0.342	0.172
07/02/2020	15:00:00	0.326	0.312	0.074	0.186	0.266	0.301	0.16
07/02/2020	15:15:00	0.33	0.323	0.094	0.189	0.286	0.259	0.16

07/02/2020	15:30:00	0.296	0.328	0.115	0.208	0.287	0.217	0.189
07/02/2020	15:45:00	0.307	0.34	0.148	0.209	0.283	0.177	0.206
07/02/2020	16:00:00	0.303	0.339	0.183	0.213	0.242	0.14	0.195
07/02/2020	16:15:00	0.298	0.349	0.204	0.228	0.208	0.113	0.187
07/02/2020	16:30:00	0.307	0.344	0.198	0.244	0.228	0.103	0.177
07/02/2020	16:45:00	0.325	0.356	0.207	0.229	0.279	0.085	0.169
07/02/2020	17:00:00	0.321	0.356	0.222	0.207	0.302	0.085	0.17
07/02/2020	17:15:00	0.349	0.353	0.246	0.217	0.299	0.08	0.154
07/02/2020	17:30:00	0.366	0.366	0.242	0.222	0.258	0.077	0.192
07/02/2020	17:45:00	0.361	0.384	0.255	0.235	0.254	0.055	0.152
07/02/2020	18:00:00	0.388	0.401	0.275	0.231	0.284	0.047	0.128
07/02/2020	18:15:00	0.411	0.414	0.297	0.213	0.321	0.03	0.192
07/02/2020	18:30:00	0.411	0.427	0.305	0.224	0.313	0.024	0.135
07/02/2020	18:45:00	0.431	0.435	0.308	0.254	0.299	0.043	0.189
07/02/2020	19:00:00	0.439	0.467	0.31	0.244	0.299	0.064	0.146
07/02/2020	19:15:00	0.456	0.485	0.303	0.223	0.308	0.078	0.187
07/02/2020	19:30:00	0.456	0.505	0.301	0.249	0.332	0.083	0.179
07/02/2020	19:45:00	0.448	0.514	0.285	0.254	0.361	0.073	0.17
07/02/2020	20:00:00	0.45	0.513	0.271	0.251	0.351	0.071	0.2
07/02/2020	20:15:00	0.455	0.528	0.261	0.244	0.352	0.062	0.174
07/02/2020	20:30:00	0.456	0.531	0.266	0.272	0.339	0.056	0.21
07/02/2020	20:45:00	0.453	0.538	0.249	0.256	0.363	0.065	0.207
07/02/2020	21:00:00	0.452	0.54	0.221	0.265	0.368	0.076	0.212
07/02/2020	21:15:00	0.47	0.538	0.211	0.286	0.35	0.11	0.182
07/02/2020	21:30:00	0.436	0.529	0.21	0.276	0.391	0.15	0.183
07/02/2020	21:45:00	0.465	0.517	0.214	0.279	0.386	0.191	0.211
07/02/2020	22:00:00	0.428	0.524	0.221	0.314	0.401	0.217	0.185
07/02/2020	22:15:00	0.453	0.516	0.238	0.319	0.402	0.236	0.185
07/02/2020	22:30:00	0.44	0.52	0.251	0.316	0.413	0.247	0.207
07/02/2020	22:45:00	0.443	0.524	0.264	0.327	0.423	0.27	0.154

07/02/2020	23:00:00	0.485	0.525	0.295	0.341	0.412	0.277	0.159
07/02/2020	23:15:00	0.486	0.521	0.314	0.332	0.423	0.325	0.12
07/02/2020	23:30:00	0.509	0.518	0.335	0.345	0.39	0.325	0.135
07/02/2020	23:45:00	0.508	0.511	0.354	0.376	0.362	0.448	0.141
08/02/2020	00:00:00	0.56	0.512	0.367	0.402	0.351	0.537	0.117
08/02/2020	00:15:00	0.561	0.529	0.375	0.409	0.346	0.582	0.082
08/02/2020	00:30:00	0.561	0.535	0.398	0.393	0.341	0.603	0.085
08/02/2020	00:45:00	0.573	0.546	0.431	0.407	0.317	0.613	0.04
08/02/2020	01:00:00	0.579	0.57	0.466	0.4	0.287	0.554	0.042
08/02/2020	01:15:00	0.573	0.583	0.473	0.388	0.244	0.508	0.008
08/02/2020	01:30:00	0.549	0.597	0.492	0.431	0.23	0.486	0.041
08/02/2020	01:45:00	0.511	0.578	0.532	0.411	0.216	0.451	0.071
08/02/2020	02:00:00	0.531	0.59	0.579	0.343	0.217	0.387	0.024
08/02/2020	02:15:00	0.479	0.599	0.618	0.385	0.201	0.359	-0.013
08/02/2020	02:30:00	0.45	0.65	0.697	0.369	0.207	0.317	-0.006
08/02/2020	02:45:00	0.459	0.717	0.801	0.319	0.19	0.295	0.007
08/02/2020	03:00:00	0.442	0.79	0.825	0.357	0.151	0.275	-0.04
08/02/2020	03:15:00	0.458	0.808	0.795	0.37	0.153	0.232	-0.006
08/02/2020	03:30:00	0.454	0.79	0.783	0.37	0.14	0.178	0.019
08/02/2020	03:45:00	0.366	0.774	0.742	0.345	0.128	0.142	0.009
08/02/2020	04:00:00	0.405	0.743	0.648	0.335	0.139	0.122	0.019
08/02/2020	04:15:00	0.483	0.736	0.586	0.328	0.107	0.088	0.025
08/02/2020	04:30:00	0.423	0.728	0.569	0.304	0.066	0.057	0.035
08/02/2020	04:45:00	0.441	0.703	0.543	0.35	0.058	0.032	0.021
08/02/2020	05:00:00	0.437	0.652	0.557	0.304	0.081	0.009	0.039
08/02/2020	05:15:00	0.426	0.599	0.563	0.259	0.072	-0.008	0.02
08/02/2020	05:30:00	0.481	0.55	0.57	0.283	0.097	-0.019	0.01
08/02/2020	05:45:00	0.471	0.522	0.539	0.265	0.124	-0.031	0.019
08/02/2020	06:00:00	0.469	0.507	0.474	0.269	0.101	-0.038	0.048
08/02/2020	06:15:00	0.464	0.513	0.406	0.243	0.114	-0.058	0.037

08/02/2020	06:30:00	0.499	0.495	0.394	0.25	0.133	-0.083	0.024
08/02/2020	06:45:00	0.496	0.489	0.388	0.24	0.137	-0.094	0.022
08/02/2020	07:00:00	0.512	0.509	0.366	0.223	0.14	-0.104	0.01
08/02/2020	07:15:00	0.487	0.522	0.336	0.213	0.18	-0.08	0.026
08/02/2020	07:30:00	0.495	0.531	0.319	0.239	0.194	-0.051	0.036
08/02/2020	07:45:00	0.512	0.524	0.294	0.235	0.152	-0.029	0.031
08/02/2020	08:00:00	0.473	0.507	0.261	0.178	0.166	-0.021	0.041
08/02/2020	08:15:00	0.518	0.5	0.243	0.171	0.191	-0.013	0.044
08/02/2020	08:30:00	0.471	0.513	0.229	0.176	0.19	-0.012	0.038
08/02/2020	08:45:00	0.41	0.51	0.229	0.145	0.214	-0.006	0.05
08/02/2020	09:00:00	0.406	0.487	0.208	0.149	0.197	-0.004	0.066
08/02/2020	09:15:00	0.442	0.458	0.192	0.145	0.221	-0.004	0.084
08/02/2020	09:30:00	0.347	0.43	0.188	0.122	0.2	0.012	0.089
08/02/2020	09:45:00	0.44	0.401	0.175	0.108	0.207	0.037	0.066
08/02/2020	10:00:00	0.351	0.38	0.165	0.105	0.234	0.057	0.059
08/02/2020	10:15:00	0.396	0.355	0.163	0.097	0.266	0.051	0.097
08/02/2020	10:30:00	0.329	0.304	0.162	0.102	0.233	0.099	0.137
08/02/2020	10:45:00	0.407	0.264	0.157	0.112	0.211	0.11	0.109
08/02/2020	11:00:00	0.352	0.224	0.164	0.106	0.214	0.117	0.142
08/02/2020	11:15:00	0.375	0.19	0.158	0.113	0.236	0.124	0.123
08/02/2020	11:30:00	0.431	0.182	0.152	0.11	0.263	0.136	0.118
08/02/2020	11:45:00	0.431	0.161	0.148	0.102	0.266	0.163	0.105
08/02/2020	12:00:00	0.329	0.139	0.13	0.109	0.248	0.201	0.081
08/02/2020	12:15:00	0.429	0.144	0.114	0.114	0.237	0.177	0.078
08/02/2020	12:30:00	0.4	0.156	0.109	0.103	0.245	0.217	0.115
08/02/2020	12:45:00	0.363	0.169	0.091	0.118	0.264	0.258	0.117
08/02/2020	13:00:00	0.415	0.216	0.087	0.123	0.26	0.266	0.072
08/02/2020	13:15:00	0.466	0.255	0.085	0.115	0.272	0.263	0.095
08/02/2020	13:30:00	0.406	0.294	0.088	0.123	0.226	0.239	0.09
08/02/2020	13:45:00	0.435	0.34	0.091	0.124	0.218	0.214	0.079

08/02/2020	14:00:00	0.419	0.395	0.11	0.133	0.222	0.201	0.021
08/02/2020	14:15:00	0.456	0.442	0.131	0.129	0.234	0.199	0.057
08/02/2020	14:30:00	0.507	0.473	0.151	0.115	0.271	0.199	0.042
08/02/2020	14:45:00	0.507	0.536	0.175	0.138	0.278	0.212	0.033
08/02/2020	15:00:00	0.498	0.582	0.201	0.175	0.274	0.214	0.056
08/02/2020	15:15:00	0.558	0.646	0.207	0.161	0.233	0.202	0.036
08/02/2020	15:30:00	0.566	0.681	0.22	0.171	0.237	0.196	0.037
08/02/2020	15:45:00	0.529	0.72	0.238	0.191	0.224	0.185	0.068
08/02/2020	16:00:00	0.528	0.755	0.255	0.173	0.255	0.171	0.088
08/02/2020	16:15:00	0.518	0.785	0.275	0.207	0.26	0.159	0.069
08/02/2020	16:30:00	0.521	0.817	0.301	0.26	0.259	0.166	0.119
08/02/2020	16:45:00	0.399	0.862	0.326	0.26	0.216	0.162	0.097
08/02/2020	17:00:00	0.471	0.889	0.363	0.242	0.251	0.151	0.062
08/02/2020	17:15:00	0.391	0.914	0.404	0.267	0.187	0.133	0.093
08/02/2020	17:30:00	0.516	0.767	0.427	0.258	0.225	0.114	0.153
08/02/2020	17:45:00	0.416	0.721	0.453	0.275	0.246	0.1	0.123
08/02/2020	18:00:00	0.453	0.738	0.469	0.292	0.22	0.098	0.123
08/02/2020	18:15:00	0.503	0.75	0.482	0.277	0.285	0.112	0.151
08/02/2020	18:30:00	0.484	0.752	0.526	0.282	0.285	0.109	0.194
08/02/2020	18:45:00	0.511	0.75	0.556	0.278	0.291	0.105	0.167
08/02/2020	19:00:00	0.476	0.744	0.577	0.288	0.316	0.099	0.131
08/02/2020	19:15:00	0.546	0.727	0.603	0.291	0.336	0.079	0.187
08/02/2020	19:30:00	0.544	0.699	0.644	0.303	0.357	0.049	0.181
08/02/2020	19:45:00	0.549	0.694	0.658	0.318	0.378	0.051	0.19
08/02/2020	20:00:00	0.529	0.667	0.684	0.351	0.429	0.075	0.213
08/02/2020	20:15:00	0.579	0.628	0.722	0.377	0.428	0.1	0.219
08/02/2020	20:30:00	0.511	0.599	0.723	0.381	0.472	0.107	0.234
08/02/2020	20:45:00	0.531	0.546	0.726	0.385	0.487	0.123	0.256
08/02/2020	21:00:00	0.514	0.502	0.718	0.403	0.513	0.154	0.278
08/02/2020	21:15:00	0.542	0.476	0.69	0.409	0.554	0.2	0.293

08/02/2020	21:30:00	0.492	0.431	0.659	0.417	0.589	0.245	0.309
08/02/2020	21:45:00	0.511	0.405	0.643	0.438	0.63	0.293	0.342
08/02/2020	22:00:00	0.545	0.379	0.635	0.458	0.659	0.297	0.309
08/02/2020	22:15:00	0.487	0.353	0.619	0.477	0.701	0.324	0.341
08/02/2020	22:30:00	0.509	0.35	0.632	0.503	0.731	0.38	0.274
08/02/2020	22:45:00	0.549	0.374	0.65	0.524	0.775	0.425	0.326
08/02/2020	23:00:00	0.51	0.39	0.639	0.566	0.779	0.451	0.384
08/02/2020	23:15:00	0.504	0.427	0.621	0.605	0.782	0.502	0.398
08/02/2020	23:30:00	0.548	0.473	0.598	0.646	0.774	0.574	0.376
08/02/2020	23:45:00	0.531	0.52	0.58	0.67	0.765	0.615	0.385
09/02/2020	00:00:00	0.529	0.579	0.577	0.673	0.809	0.671	0.34
09/02/2020	00:15:00	0.571	0.657	0.595	0.685	0.857	0.717	0.301
09/02/2020	00:30:00	0.58	0.693	0.611	0.693	0.862	0.801	0.298
09/02/2020	00:45:00	0.598	0.722	0.654	0.704	0.84	0.897	0.376
09/02/2020	01:00:00	0.617	0.746	0.722	0.736	0.785	0.972	0.347
09/02/2020	01:15:00	0.59	0.79	0.791	0.792	0.769	1.014	0.298
09/02/2020	01:30:00	0.662	0.788	0.871	0.79	0.775	0.981	0.337
09/02/2020	01:45:00	0.6	0.796	0.948	0.808	0.78	0.908	0.377
09/02/2020	02:00:00	0.637	0.744	1.02	0.803	0.75	0.842	0.349
09/02/2020	02:15:00	0.606	0.74	1.105	0.819	0.738	0.865	0.326
09/02/2020	02:30:00	0.578	0.707	1.164	0.829	0.718	0.843	0.35
09/02/2020	02:45:00	0.593	0.693	1.213	0.802	0.678	0.793	0.355
09/02/2020	03:00:00	0.556	0.673	1.26	0.819	0.672	0.777	0.301
09/02/2020	03:15:00	0.568	0.659	1.272	0.848	0.67	0.757	0.262
09/02/2020	03:30:00	0.568	0.633	1.272	0.83	0.654	0.718	0.248
09/02/2020	03:45:00	0.555	0.632	1.263	0.872	0.621	0.7	0.219
09/02/2020	04:00:00	0.52	0.645	1.21	0.875	0.622	0.67	0.25
09/02/2020	04:15:00	0.532	0.688	1.142	0.887	0.616	0.663	0.302
09/02/2020	04:30:00	0.54	0.718	1.073	0.878	0.612	0.625	0.307
09/02/2020	04:45:00	0.556	0.743	1.02	0.921	0.637	0.601	0.346

09/02/2020	05:00:00	0.558	0.778	0.961	0.865	0.624	0.519	0.336
09/02/2020	05:15:00	0.576	0.807	0.948	0.823	0.487	0.447	0.307
09/02/2020	05:30:00	0.617	0.83	0.998	0.879	0.491	0.381	0.291
09/02/2020	05:45:00	0.603	0.883	1.052	0.829	0.56	0.328	0.246
09/02/2020	06:00:00	0.608	0.935	1.086	0.775	0.592	0.321	0.356
09/02/2020	06:15:00	0.615	0.972	1.1	0.78	0.655	0.304	0.395
09/02/2020	06:30:00	0.642	0.963	1.082	0.797	0.634	0.316	0.384
09/02/2020	06:45:00	0.618	0.944	1.07	0.74	0.589	0.318	0.38
09/02/2020	07:00:00	0.658	0.964	1.121	0.68	0.637	0.309	0.393
09/02/2020	07:15:00	0.624	0.98	1.179	0.692	0.682	0.384	0.328
09/02/2020	07:30:00	0.683	1.019	1.198	0.63	0.717	0.445	0.304
09/02/2020	07:45:00	0.664	1.057	1.224	0.582	0.796	0.516	0.322
09/02/2020	08:00:00	0.704	1.059	1.227	0.63	0.872	0.611	0.338
09/02/2020	08:15:00	0.719	1.066	1.212	0.624	0.814	0.676	0.397
09/02/2020	08:30:00	0.766	1.087	1.197	0.604	0.832	0.718	0.412
09/02/2020	08:45:00	0.794	1.086	1.181	0.652	0.806	0.747	0.416
09/02/2020	09:00:00	0.83	1.109	1.178	0.69	0.791	0.793	0.384
09/02/2020	09:15:00	0.816	1.123	1.18	0.711	0.823	0.846	0.411
09/02/2020	09:30:00	0.774	1.107	1.175	0.768	0.904	0.867	0.36
09/02/2020	09:45:00	0.83	1.112	1.207	0.696	0.872	0.898	0.382
09/02/2020	10:00:00	0.766	1.111	1.268	0.677	0.877	0.923	0.419
09/02/2020	10:15:00	0.825	1.116	1.249	0.679	0.894	0.936	0.409
09/02/2020	10:30:00	0.765	1.095	1.247	0.883	0.908	0.932	0.438
09/02/2020	10:45:00	0.725	1.049	1.205	0.863	0.879	0.951	0.446
09/02/2020	11:00:00	0.796	1.007	1.077	0.712	0.914	0.958	0.453
09/02/2020	11:15:00	0.702	0.991	1.01	0.853	0.977	0.964	0.457
09/02/2020	11:30:00	0.781	0.993	0.991	0.897	1.045	0.974	0.493
09/02/2020	11:45:00	0.746	0.974	0.954	0.898	1.011	0.987	0.446
09/02/2020	12:00:00	0.734	0.957	0.96	0.979	0.993	1.056	0.442
09/02/2020	12:15:00	0.795	0.958	0.956	1.024	1.052	1.102	0.443

09/02/2020	12:30:00	0.782	0.971	0.924	0.874	0.992	1.109	0.428
09/02/2020	12:45:00	0.796	0.955	0.945	0.978	0.939	1.093	0.379
09/02/2020	13:00:00	0.832	0.938	1.026	1.115	0.863	1.073	0.37
09/02/2020	13:15:00	0.827	0.886	1.118	0.974	0.881	1.051	0.344
09/02/2020	13:30:00	0.819	0.887	1.195	0.91	0.882	1.125	0.343
09/02/2020	13:45:00	0.816	0.88	1.281	1.006	0.895	1.212	0.265
09/02/2020	14:00:00	0.782	0.927	1.347	0.987	0.899	1.194	0.244
09/02/2020	14:15:00	0.772	0.954	1.394	0.942	0.857	1.328	0.221
09/02/2020	14:30:00	0.744	0.983	1.438	1.004	0.82	1.448	0.2
09/02/2020	14:45:00	0.729	0.985	1.48	0.942	0.781	1.237	0.146
09/02/2020	15:00:00	0.693	1.007	1.505	0.998	0.702	1.151	0.144
09/02/2020	15:15:00	0.709	1.038	1.515	0.932	0.701	1.138	0.113
09/02/2020	15:30:00	0.668	1.08	1.515	0.991	0.682	1.076	0.18
09/02/2020	15:45:00	0.676	1.065	1.61	0.861	0.666	1.047	0.148
09/02/2020	16:00:00	0.637	1.022	1.587	0.936	0.677	0.949	0.101
09/02/2020	16:15:00	0.616	0.967	1.455	0.956	0.65	0.876	0.1
09/02/2020	16:30:00	0.613	0.938	1.296	0.915	0.619	0.804	0.161
09/02/2020	16:45:00	0.619	0.909	1.185	0.919	0.526	0.736	0.137
09/02/2020	17:00:00	0.591	0.892	1.223	0.889	0.532	0.687	0.131
09/02/2020	17:15:00	0.624	0.857	1.309	0.828	0.466	0.622	0.078
09/02/2020	17:30:00	0.603	0.832	1.374	0.746	0.386	0.598	0.143
09/02/2020	17:45:00	0.64	0.83	1.328	0.797	0.304	0.573	0.143
09/02/2020	18:00:00	0.625	0.805	1.289	0.832	0.349	0.53	0.112
09/02/2020	18:15:00	0.652	0.819	1.206	0.803	0.371	0.55	0.189
09/02/2020	18:30:00	0.604	0.828	1.182	0.688	0.38	0.561	0.204
09/02/2020	18:45:00	0.624	0.833	1.143	0.639	0.278	0.549	0.118
09/02/2020	19:00:00	0.622	0.829	1.084	0.626	0.164	0.475	0.16
09/02/2020	19:15:00	0.648	0.829	0.995	0.607	0.244	0.427	0.179
09/02/2020	19:30:00	0.631	0.834	0.89	0.576	0.32	0.444	0.167
09/02/2020	19:45:00	0.659	0.813	0.856	0.564	0.29	0.417	0.177

09/02/2020	20:00:00	0.598	0.796	0.858	0.523	0.318	0.39	0.122
09/02/2020	20:15:00	0.645	0.774	0.884	0.515	0.261	0.319	0.107
09/02/2020	20:30:00	0.624	0.759	0.867	0.447	0.277	0.293	0.031
09/02/2020	20:45:00	0.652	0.743	0.845	0.416	0.409	0.295	0.128
09/02/2020	21:00:00	0.669	0.739	0.853	0.381	0.385	0.333	0.236
09/02/2020	21:15:00	0.647	0.693	0.827	0.347	0.409	0.375	0.21
09/02/2020	21:30:00	0.692	0.648	0.826	0.304	0.428	0.427	0.159
09/02/2020	21:45:00	0.67	0.595	0.786	0.316	0.442	0.472	0.19
09/02/2020	22:00:00	0.678	0.544	0.698	0.317	0.4	0.517	0.268
09/02/2020	22:15:00	0.612	0.497	0.628	0.284	0.434	0.547	0.261
09/02/2020	22:30:00	0.68	0.472	0.583	0.275	0.402	0.602	0.198
09/02/2020	22:45:00	0.597	0.43	0.56	0.286	0.431	0.604	0.157
09/02/2020	23:00:00	0.625	0.374	0.499	0.29	0.537	0.634	0.336
09/02/2020	23:15:00	0.606	0.303	0.429	0.26	0.506	0.701	0.275
09/02/2020	23:30:00	0.611	0.25	0.446	0.266	0.469	0.758	0.274
09/02/2020	23:45:00	0.611	0.219	0.407	0.258	0.492	0.773	0.155
10/02/2020	00:00:00	0.616	0.205	0.419	0.223	0.495	0.8	0.136
10/02/2020	00:15:00	0.581	0.202	0.419	0.209	0.457	0.863	0.096
10/02/2020	00:30:00	0.603	0.189	0.376	0.265	0.422	0.903	0.084
10/02/2020	00:45:00	0.582	0.176	0.315	0.312	0.55	0.944	0.124
10/02/2020	01:00:00	0.591	0.163	0.297	0.269	0.492	0.978	0.099
10/02/2020	01:15:00	0.605	0.223	0.276	0.267	0.379	1.031	0.08
10/02/2020	01:30:00	0.629	0.214	0.284	0.246	0.387	1.062	0.04
10/02/2020	01:45:00	0.616	0.236	0.312	0.265	0.329	1.019	0.109
10/02/2020	02:00:00	0.654	0.299	0.352	0.294	0.364	0.987	0.015
10/02/2020	02:15:00	0.604	0.333	0.44	0.305	0.348	0.998	0.098
10/02/2020	02:30:00	0.621	0.34	0.52	0.235	0.349	0.992	0.057
10/02/2020	02:45:00	0.597	0.375	0.605	0.255	0.239	0.94	0.046
10/02/2020	03:00:00	0.578	0.38	0.683	0.297	0.219	0.765	0.029
10/02/2020	03:15:00	0.539	0.38	0.731	0.293	0.161	0.638	-0.007

10/02/2020	03:30:00	0.547	0.412	0.782	0.29	0.166	0.558	0.028
10/02/2020	03:45:00	0.505	0.393	0.811	0.305	0.216	0.5	-0.029
10/02/2020	04:00:00	0.503	0.385	0.829	0.306	0.113	0.479	0.066
10/02/2020	04:15:00	0.511	0.379	0.874	0.292	0.123	0.454	-0.07
10/02/2020	04:30:00	0.502	0.384	0.905	0.316	0.167	0.42	0.034
10/02/2020	04:45:00	0.471	0.343	0.856	0.32	0.04	0.396	-0.028
10/02/2020	05:00:00	0.533	0.394	0.804	0.261	0.066	0.348	0.007
10/02/2020	05:15:00	0.485	0.391	0.796	0.262	0.084	0.31	-0.005
10/02/2020	05:30:00	0.493	0.387	0.797	0.29	0.039	0.3	-0.002
10/02/2020	05:45:00	0.518	0.426	0.842	0.295	0.061	0.218	0.029
10/02/2020	06:00:00	0.462	0.419	0.876	0.269	0.05	0.156	0.097
10/02/2020	06:15:00	0.566	0.434	0.855	0.197	0.02	0.12	0.055
10/02/2020	06:30:00	0.54	0.475	0.86	0.259	0.071	0.088	0.022
10/02/2020	06:45:00	0.516	0.502	0.847	0.291	0.076	0.094	0.059
10/02/2020	07:00:00	0.544	0.526	0.885	0.258	0.068	0.073	0.093
10/02/2020	07:15:00	0.526	0.524	0.883	0.227	0.083	0.054	0.186
10/02/2020	07:30:00	0.519	0.502	0.834	0.24	0.126	0.075	0.166
10/02/2020	07:45:00	0.6	0.519	0.764	0.256	0.119	0.085	0.21
10/02/2020	08:00:00	0.531	0.509	0.742	0.262	0.207	0.148	0.133
10/02/2020	08:15:00	0.573	0.492	0.675	0.247	0.219	0.23	0.171
10/02/2020	08:30:00	0.584	0.481	0.645	0.26	0.189	0.272	0.143
10/02/2020	08:45:00	0.58	0.47	0.653	0.302	0.227	0.25	0.254
10/02/2020	09:00:00	0.584	0.416	0.606	0.265	0.287	0.285	0.245
10/02/2020	09:15:00	0.598	0.37	0.6	0.247	0.327	0.339	0.199
10/02/2020	09:30:00	0.589	0.358	0.555	0.275	0.38	0.355	0.256
10/02/2020	09:45:00	0.597	0.345	0.555	0.245	0.42	0.375	0.21
10/02/2020	10:00:00	0.579	0.298	0.565	0.29	0.42	0.42	0.32
10/02/2020	10:15:00	0.609	0.282	0.537	0.301	0.517	0.424	0.262
10/02/2020	10:30:00	0.516	0.315	0.535	0.19	0.565	0.461	0.25
10/02/2020	10:45:00	0.599	0.298	0.509	0.225	0.545	0.441	0.193

10/02/2020	11:00:00	0.489	0.251	0.506	0.253	0.591	0.45	0.25
10/02/2020	11:15:00	0.573	0.271	0.492	0.238	0.605	0.455	0.197
10/02/2020	11:30:00	0.548	0.256	0.532	0.266	0.572	0.456	0.232
10/02/2020	11:45:00	0.507	0.247	0.606	0.247	0.697	0.51	0.322
10/02/2020	12:00:00	0.562	0.253	0.596	0.318	0.768	0.589	0.24
10/02/2020	12:15:00	0.508	0.251	0.566	0.344	0.764	0.632	0.189
10/02/2020	12:30:00	0.567	0.298	0.558	0.306	0.765	0.717	0.258
10/02/2020	12:45:00	0.493	0.314	0.528	0.352	0.679	0.867	0.232
10/02/2020	13:00:00	0.559	0.285	0.503	0.442	0.53	1.028	0.19
10/02/2020	13:15:00	0.451	0.275	0.484	0.425	0.64	1.087	0.302
10/02/2020	13:30:00	0.578	0.326	0.445	0.41	0.658	1.156	0.267
10/02/2020	13:45:00	0.497	0.285	0.418	0.382	0.595	1.15	0.207
10/02/2020	14:00:00	0.544	0.316	0.393	0.4	0.445	1.172	0.198
10/02/2020	14:15:00	0.505	0.395	0.412	0.474	0.559	1.092	0.211
10/02/2020	14:30:00	0.577	0.362	0.445	0.572	0.478	1.064	0.142
10/02/2020	14:45:00	0.486	0.428	0.516	0.504	0.5	0.967	0.258
10/02/2020	15:00:00	0.54	0.471	0.598	0.573	0.524	0.921	0.341
10/02/2020	15:15:00	0.483	0.459	0.681	0.446	0.533	0.834	0.254
10/02/2020	15:30:00	0.559	0.469	0.767	0.316	0.425	0.798	0.14
10/02/2020	15:45:00	0.55	0.55	0.826	0.474	0.219	0.705	0.131
10/02/2020	16:00:00	0.508	0.527	0.94	0.459	0.156	0.646	0.193
10/02/2020	16:15:00	0.554	0.565	1.004	0.411	0.044	0.623	0.139
10/02/2020	16:30:00	0.533	0.584	1.044	0.396	0.27	0.646	0.074
10/02/2020	16:45:00	0.557	0.532	1.015	0.419	0.379	0.729	0.178
10/02/2020	17:00:00	0.567	0.545	1.019	0.359	0.368	0.692	0.147
10/02/2020	17:15:00	0.54	0.597	1.073	0.476	0.333	0.575	0.131
10/02/2020	17:30:00	0.535	0.557	1.096	0.395	0.338	0.461	0.008
10/02/2020	17:45:00	0.562	0.638	1.064	0.388	0.17	0.382	-0.007
10/02/2020	18:00:00	0.495	0.656	1.011	0.333	-0.008	0.357	-0.068
10/02/2020	18:15:00	0.541	0.638	0.997	0.279	0.199	0.317	0.014

10/02/2020	18:30:00	0.47	0.678	0.971	0.359	0.26	0.336	0.099
10/02/2020	18:45:00	0.572	0.705	0.878	0.361	0.254	0.26	0.14
10/02/2020	19:00:00	0.521	0.7	0.852	0.397	0.163	0.234	0.085
10/02/2020	19:15:00	0.49	0.734	0.901	0.445	0.077	0.236	0.061
10/02/2020	19:30:00	0.525	0.772	0.948	0.434	-0.02	0.272	0.184
10/02/2020	19:45:00	0.516	0.742	0.888	0.375	0.118	0.312	0.121
10/02/2020	20:00:00	0.518	0.732	0.843	0.379	0.24	0.324	0.034
10/02/2020	20:15:00	0.524	0.72	0.862	0.37	0.269	0.414	0.076
10/02/2020	20:30:00	0.563	0.675	0.871	0.324	0.199	0.424	0.172
10/02/2020	20:45:00	0.541	0.655	0.895	0.362	0.182	0.537	0.176
10/02/2020	21:00:00	0.532	0.638	0.909	0.393	0.204	0.521	0.11
10/02/2020	21:15:00	0.539	0.595	0.976	0.314	0.267	0.606	0.034
10/02/2020	21:30:00	0.518	0.576	1.024	0.301	0.35	0.651	0.068
10/02/2020	21:45:00	0.562	0.549	1.007	0.387	0.344	0.652	0.073
10/02/2020	22:00:00	0.52	0.445	0.96	0.356	0.324	0.635	-0.023
10/02/2020	22:15:00	0.547	0.42	0.948	0.283	0.374	0.709	0.03
10/02/2020	22:30:00	0.504	0.357	0.93	0.381	0.366	0.759	0.119
10/02/2020	22:45:00	0.513	0.305	0.89	0.359	0.348	0.807	0.084
10/02/2020	23:00:00	0.491	0.297	0.853	0.255	0.451	0.844	0.101
10/02/2020	23:15:00	0.476	0.296	0.835	0.267	0.37	0.839	-0.024
10/02/2020	23:30:00	0.495	0.233	0.791	0.299	0.322	0.812	0.023
10/02/2020	23:45:00	0.451	0.242	0.767	0.288	0.425	0.813	0.045
11/02/2020	00:00:00	0.495	0.253	0.803	0.312	0.437	0.809	0.078
11/02/2020	00:15:00	0.436	0.248	0.767	0.297	0.408	0.793	0.092
11/02/2020	00:30:00	0.477	0.241	0.708	0.304	0.426	0.843	0.063
11/02/2020	00:45:00	0.459	0.316	0.686	0.315	0.418	0.906	0.034
11/02/2020	01:00:00	0.468	0.331	0.625	0.324	0.378	0.955	0.1
11/02/2020	01:15:00	0.423	0.403	0.579	0.326	0.288	0.985	0.038
11/02/2020	01:30:00	0.411	0.449	0.535	0.353	0.319	1.005	0.062
11/02/2020	01:45:00	0.442	0.456	0.54	0.359	0.339	0.96	0.024

11/02/2020	02:00:00	0.383	0.487	0.539	0.337	0.231	0.95	0.203
11/02/2020	02:15:00	0.424	0.505	0.567	0.353	0.271	0.906	0.123
11/02/2020	02:30:00	0.427	0.496	0.634	0.36	0.273	0.769	0.115
11/02/2020	02:45:00	0.364	0.537	0.679	0.347	0.17	0.679	0.025
11/02/2020	03:00:00	0.439	0.56	0.738	0.366	0.136	0.563	0.086
11/02/2020	03:15:00	0.373	0.495	0.815	0.383	0.121	0.499	0.203
11/02/2020	03:30:00	0.427	0.509	0.871	0.378	0.136	0.464	0.089
11/02/2020	03:45:00	0.393	0.496	0.948	0.362	0.115	0.417	0.058
11/02/2020	04:00:00	0.441	0.491	1.046	0.322	0.16	0.331	-0.012
11/02/2020	04:15:00	0.419	0.46	1.137	0.387	0.132	0.27	0.105
11/02/2020	04:30:00	0.442	0.457	1.192	0.377	0.092	0.227	0.062
11/02/2020	04:45:00	0.471	0.425	1.209	0.35	0.107	0.181	0.065
11/02/2020	05:00:00	0.406	0.395	1.214	0.365	0.176	0.163	-0.042
11/02/2020	05:15:00	0.447	0.43	1.188	0.402	0.156	0.155	-0.033
11/02/2020	05:30:00	0.452	0.427	1.102	0.364	0.174	0.167	0.004
11/02/2020	05:45:00	0.409	0.434	1.026	0.409	0.104	0.173	0.037
11/02/2020	06:00:00	0.436	0.429	0.959	0.343	0.127	0.196	-0.063
11/02/2020	06:15:00	0.373	0.433	0.918	0.321	0.086	0.192	-0.037
11/02/2020	06:30:00	0.406	0.502	0.892	0.315	0.069	0.198	-0.039
11/02/2020	06:45:00	0.38	0.507	0.906	0.378	0.163	0.234	-0.024
11/02/2020	07:00:00	0.393	0.515	0.907	0.3	0.207	0.241	-0.041
11/02/2020	07:15:00	0.356	0.527	0.923	0.352	0.162	0.263	-0.013
11/02/2020	07:30:00	0.376	0.521	0.917	0.362	0.146	0.236	-0.005
11/02/2020	07:45:00	0.345	0.484	0.879	0.322	0.055	0.252	-0.017
11/02/2020	08:00:00	0.358	0.511	0.848	0.287	0.095	0.259	0.004
11/02/2020	08:15:00	0.349	0.472	0.785	0.336	0.128	0.327	0.01
11/02/2020	08:30:00	0.43	0.428	0.74	0.376	0.176	0.368	0.063
11/02/2020	08:45:00	0.348	0.432	0.708	0.34	0.189	0.413	0.059
11/02/2020	09:00:00	0.424	0.364	0.66	0.312	0.201	0.401	0.028
11/02/2020	09:15:00	0.373	0.354	0.624	0.301	0.185	0.383	0.034

11/02/2020	09:30:00	0.396	0.35	0.634	0.306	0.176	0.376	-0.012
11/02/2020	09:45:00	0.383	0.267	0.634	0.27	0.151	0.385	0.068
11/02/2020	10:00:00	0.404	0.264	0.644	0.211	0.221	0.436	-0.007
11/02/2020	10:15:00	0.434	0.255	0.595	0.235	0.265	0.443	-0.049
11/02/2020	10:30:00	0.432	0.195	0.617	0.252	0.282	0.533	-0.006
11/02/2020	10:45:00	0.427	0.184	0.616	0.17	0.261	0.567	0.023
11/02/2020	11:00:00	0.407	0.176	0.604	0.132	0.259	0.627	-0.009
11/02/2020	11:15:00	0.461	0.142	0.604	0.153	0.262	0.612	-0.069
11/02/2020	11:30:00	0.401	0.189	0.602	0.106	0.234	0.585	-0.042
11/02/2020	11:45:00	0.436	0.173	0.569	0.12	0.232	0.56	-0.047
11/02/2020	12:00:00	0.399	0.173	0.576	0.106	0.244	0.534	-0.043
11/02/2020	12:15:00	0.407	0.17	0.64	0.065	0.236	0.525	-0.022
11/02/2020	12:30:00	0.398	0.198	0.606	0.043	0.206	0.533	-0.008
11/02/2020	12:45:00	0.425	0.155	0.569	0.064	0.133	0.586	-0.032
11/02/2020	13:00:00	0.442	0.202	0.529	0.065	0.144	0.599	-0.052
11/02/2020	13:15:00	0.361	0.218	0.461	0.058	0.186	0.627	-0.075
11/02/2020	13:30:00	0.42	0.23	0.405	0.052	0.115	0.666	-0.056
11/02/2020	13:45:00	0.351	0.26	0.377	0.044	0.079	0.687	-0.012
11/02/2020	14:00:00	0.355	0.259	0.339	0.079	0.064	0.639	-0.015
11/02/2020	14:15:00	0.297	0.255	0.314	0.086	0.023	0.576	-0.068
11/02/2020	14:30:00	0.365	0.263	0.302	0.095	0.003	0.489	-0.085
11/02/2020	14:45:00	0.298	0.237	0.294	0.087	-0.033	0.371	-0.014
11/02/2020	15:00:00	0.314	0.259	0.322	0.062	-0.023	0.2	-0.028
11/02/2020	15:15:00	0.272	0.288	0.342	0.084	-0.057	0.058	-0.036
11/02/2020	15:30:00	0.318	0.226	0.416	0.099	-0.098	0.004	0.005
11/02/2020	15:45:00	0.264	0.263	0.503	0.056	-0.068	0.066	-0.002
11/02/2020	16:00:00	0.231	0.227	0.605	0.07	-0.089	0.062	-0.002
11/02/2020	16:15:00	0.293	0.23	0.719	0.029	-0.07	0.028	-0.047
11/02/2020	16:30:00	0.221	0.241	0.788	0.036	-0.059	0.011	-0.016
11/02/2020	16:45:00	0.252	0.246	0.838	0.116	-0.069	-0.004	-0.033

11/02/2020	17:00:00	0.258	0.251	0.851	0.087	-0.082	-0.076	0.063
11/02/2020	17:15:00	0.246	0.216	0.815	0.012	-0.043	-0.121	0.033
11/02/2020	17:30:00	0.248	0.21	0.814	0.058	-0.032	-0.122	0.02
11/02/2020	17:45:00	0.28	0.2	0.76	0.095	0.036	-0.109	0.032
11/02/2020	18:00:00	0.232	0.19	0.739	0.096	0.056	-0.096	0.033
11/02/2020	18:15:00	0.25	0.211	0.681	0.054	0.072	-0.079	0.026
11/02/2020	18:30:00	0.266	0.18	0.64	-0.019	0.07	-0.053	0.01
11/02/2020	18:45:00	0.253	0.161	0.674	0.077	0.081	-0.024	0.041
11/02/2020	19:00:00	0.249	0.202	0.675	0.011	0.145	0.029	0.017
11/02/2020	19:15:00	0.271	0.22	0.577	0.088	0.17	0.091	0.03
11/02/2020	19:30:00	0.2	0.205	0.613	0.089	0.148	0.106	0.058
11/02/2020	19:45:00	0.272	0.269	0.678	0.057	0.161	0.16	0.086
11/02/2020	20:00:00	0.198	0.201	0.662	0.14	0.183	0.225	0.092
11/02/2020	20:15:00	0.241	0.246	0.639	0.18	0.178	0.283	0.07
11/02/2020	20:30:00	0.213	0.252	0.577	0.14	0.228	0.356	0.079
11/02/2020	20:45:00	0.211	0.302	0.514	0.178	0.222	0.447	0.115
11/02/2020	21:00:00	0.222	0.319	0.512	0.204	0.214	0.448	0.091
11/02/2020	21:15:00	0.196	0.319	0.485	0.199	0.257	0.447	0.085
11/02/2020	21:30:00	0.213	0.26	0.427	0.216	0.274	0.413	0.102
11/02/2020	21:45:00	0.23	0.26	0.429	0.22	0.238	0.418	0.034
11/02/2020	22:00:00	0.189	0.238	0.415	0.204	0.236	0.386	0.049
11/02/2020	22:15:00	0.252	0.221	0.472	0.211	0.273	0.389	0.058
11/02/2020	22:30:00	0.221	0.226	0.492	0.241	0.208	0.382	0.096
11/02/2020	22:45:00	0.235	0.175	0.521	0.209	0.21	0.381	0.066
11/02/2020	23:00:00	0.239	0.147	0.525	0.198	0.29	0.365	0.099
11/02/2020	23:15:00	0.249	0.127	0.547	0.189	0.294	0.376	0.076
11/02/2020	23:30:00	0.257	0.122	0.565	0.19	0.298	0.391	0.068
11/02/2020	23:45:00	0.242	0.1	0.559	0.169	0.267	0.395	0.033
12/02/2020	00:00:00	0.255	0.111	0.518	0.175	0.243	0.416	0.033
12/02/2020	00:15:00	0.241	0.098	0.51	0.189	0.218	0.417	0.074

12/02/2020	00:30:00	0.197	0.111	0.499	0.182	0.215	0.385	0.081
12/02/2020	00:45:00	0.192	0.132	0.515	0.19	0.219	0.354	0.064
12/02/2020	01:00:00	0.196	0.185	0.548	0.185	0.208	0.352	0.052
12/02/2020	01:15:00	0.159	0.178	0.525	0.194	0.181	0.398	0.071
12/02/2020	01:30:00	0.179	0.202	0.5	0.19	0.177	0.446	0.085
12/02/2020	01:45:00	0.14	0.214	0.473	0.19	0.13	0.424	0.071
12/02/2020	02:00:00	0.109	0.22	0.411	0.174	0.09	0.451	0.078
12/02/2020	02:15:00	0.123	0.274	0.385	0.181	0.09	0.461	0.05
12/02/2020	02:30:00	0.089	0.299	0.355	0.181	0.096	0.384	0.066
12/02/2020	02:45:00	0.078	0.302	0.338	0.183	0.09	0.27	0.043
12/02/2020	03:00:00	0.094	0.289	0.303	0.169	0.089	0.14	0.072
12/02/2020	03:15:00	0.033	0.294	0.277	0.147	0.07	0.056	0.051
12/02/2020	03:30:00	0.073	0.271	0.29	0.168	0.051	-0.01	0.046
12/02/2020	03:45:00	0.053	0.265	0.311	0.183	0.02	0.015	0.075
12/02/2020	04:00:00	0.059	0.253	0.348	0.16	0.045	0.058	0.063
12/02/2020	04:15:00	0.042	0.226	0.38	0.137	0.037	0.077	0.043
12/02/2020	04:30:00	0.076	0.203	0.411	0.114	0.049	0.058	0.071
12/02/2020	04:45:00	0.022	0.178	0.451	0.123	0.042	0.056	0.097
12/02/2020	05:00:00	0.048	0.169	0.489	0.166	0.035	0.068	0.093
12/02/2020	05:15:00	0.037	0.171	0.524	0.122	0.071	0.023	0.061
12/02/2020	05:30:00	0.08	0.18	0.529	0.101	0.056	-0.015	0.084
12/02/2020	05:45:00	0.066	0.146	0.521	0.118	0.096	-0.039	0.089
12/02/2020	06:00:00	0.126	0.163	0.51	0.124	0.114	-0.042	0.116
12/02/2020	06:15:00	0.085	0.152	0.49	0.113	0.124	-0.001	0.089
12/02/2020	06:30:00	0.113	0.148	0.438	0.099	0.127	0.063	0.065
12/02/2020	06:45:00	0.148	0.178	0.389	0.079	0.131	0.105	0.075
12/02/2020	07:00:00	0.119	0.189	0.358	0.091	0.112	0.13	0.082
12/02/2020	07:15:00	0.133	0.204	0.363	0.085	0.161	0.156	0.08
12/02/2020	07:30:00	0.112	0.217	0.397	0.059	0.179	0.181	0.104
12/02/2020	07:45:00	0.14	0.219	0.424	0.083	0.205	0.194	0.081

12/02/2020	08:00:00	0.114	0.218	0.41	0.075	0.202	0.193	0.083
12/02/2020	08:15:00	0.136	0.217	0.377	0.099	0.179	0.212	0.101
12/02/2020	08:30:00	0.102	0.197	0.359	0.095	0.168	0.235	0.109
12/02/2020	08:45:00	0.097	0.187	0.319	0.081	0.153	0.267	0.121
12/02/2020	09:00:00	0.09	0.181	0.287	0.105	0.19	0.323	0.092
12/02/2020	09:15:00	0.077	0.176	0.249	0.105	0.195	0.36	0.114
12/02/2020	09:30:00	0.062	0.153	0.217	0.09	0.178	0.339	0.093
12/02/2020	09:45:00	0.062	0.135	0.227	0.102	0.197	0.288	0.114
12/02/2020	10:00:00	0.053	0.133	0.202	0.112	0.196	0.249	0.12
12/02/2020	10:15:00	0.041	0.112	0.193	0.099	0.165	0.182	0.145
12/02/2020	10:30:00	0.025	0.081	0.208	0.089	0.172	0.216	0.111
12/02/2020	10:45:00	-0.004	0.055	0.253	0.073	0.167	0.208	0.114
12/02/2020	11:00:00	0.035	0.021	0.258	0.07	0.171	0.194	0.131
12/02/2020	11:15:00	0.041	0.003	0.275	0.065	0.178	0.19	0.138
12/02/2020	11:30:00	0.045	0.002	0.313	0.056	0.202	0.201	0.144
12/02/2020	11:45:00	0.051	0.008	0.333	0.063	0.207	0.21	0.094
12/02/2020	12:00:00	0.054	-0.013	0.328	0.046	0.167	0.195	0.093
12/02/2020	12:15:00	0.068	-0.025	0.318	0.017	0.162	0.166	0.115
12/02/2020	12:30:00	0.087	-0.027	0.303	0.019	0.177	0.147	0.108
12/02/2020	12:45:00	0.072	-0.004	0.288	0.037	0.173	0.128	0.121
12/02/2020	13:00:00	0.138	-0.009	0.282	0.044	0.166	0.099	0.116
12/02/2020	13:15:00	0.085	0.001	0.305	0.046	0.167	0.107	0.123
12/02/2020	13:30:00	0.11	0.001	0.257	0.057	0.163	0.109	0.134
12/02/2020	13:45:00	0.101	0.001	0.231	0.056	0.152	0.126	0.117
12/02/2020	14:00:00	0.101	0.018	0.184	0.024	0.127	0.181	0.125
12/02/2020	14:15:00	0.073	0.038	0.127	0.024	0.145	0.209	0.094
12/02/2020	14:30:00	0.073	0.063	0.085	0.055	0.121	0.213	0.121
12/02/2020	14:45:00	0.041	0.069	0.039	0.044	0.106	0.23	0.096
12/02/2020	15:00:00	0.036	0.052	0.006	0.028	0.094	0.162	0.14
12/02/2020	15:15:00	-0.007	0.039	-0.033	0.032	0.095	0.075	0.167

12/02/2020	15:30:00	-0.025	0.044	-0.064	0.036	0.1	0.011	0.152
12/02/2020	15:45:00	-0.03	0.056	-0.074	0.029	0.124	0.004	0.159
12/02/2020	16:00:00	-0.052	0.056	-0.075	0.035	0.13	0.043	0.17
12/02/2020	16:15:00	-0.046	0.039	-0.063	0.024	0.114	0.091	0.203
12/02/2020	16:30:00	-0.053	0.02	-0.035	0.016	0.103	0.124	0.225
12/02/2020	16:45:00	-0.078	0.019	-0.015	0.03	0.136	0.107	0.226
12/02/2020	17:00:00	-0.069	0.029	0.017	0.019	0.171	0.086	0.196
12/02/2020	17:15:00	-0.041	0.043	0.042	0.02	0.185	0.09	0.228
12/02/2020	17:30:00	-0.057	0.028	0.044	0.037	0.178	0.09	0.263
12/02/2020	17:45:00	-0.059	0.021	0.034	0.04	0.19	0.064	0.273
12/02/2020	18:00:00	-0.018	0.007	0.042	0.038	0.21	0.051	0.266
12/02/2020	18:15:00	0.008	0.005	0.041	0.049	0.246	0.065	0.275
12/02/2020	18:30:00	0.004	0.007	0.022	0.05	0.277	0.085	0.233
12/02/2020	18:45:00	0.022	0.006	0.007	0.058	0.3	0.132	0.274
12/02/2020	19:00:00	0.011	-0.006	-0.002	0.06	0.299	0.187	0.297
12/02/2020	19:15:00	0.039	-0.02	-0.003	0.08	0.327	0.227	0.304
12/02/2020	19:30:00	0.033	-0.026	-0.027	0.055	0.351	0.248	0.277
12/02/2020	19:45:00	0.042	-0.027	-0.034	0.088	0.366	0.27	0.283
12/02/2020	20:00:00	0.049	-0.015	0.009	0.093	0.409	0.294	0.29
12/02/2020	20:15:00	0.033	-0.016	0.045	0.102	0.407	0.303	0.327
12/02/2020	20:30:00	0.045	-0.018	0.047	0.124	0.406	0.308	0.339
12/02/2020	20:45:00	0.039	-0.024	0.034	0.124	0.44	0.312	0.344
12/02/2020	21:00:00	0.058	-0.009	0.014	0.13	0.439	0.337	0.352
12/02/2020	21:15:00	0.053	0.023	0.009	0.151	0.431	0.36	0.361
12/02/2020	21:30:00	0.065	0.046	0.034	0.146	0.479	0.392	0.364
12/02/2020	21:45:00	0.061	0.063	0.071	0.146	0.455	0.405	0.371
12/02/2020	22:00:00	0.089	0.088	0.095	0.164	0.449	0.385	0.376
12/02/2020	22:15:00	0.089	0.109	0.095	0.179	0.53	0.328	0.392
12/02/2020	22:30:00	0.081	0.132	0.087	0.177	0.501	0.285	0.376
12/02/2020	22:45:00	0.095	0.162	0.055	0.172	0.525	0.258	0.418

12/02/2020	23:00:00	0.091	0.185	0.08	0.182	0.512	0.277	0.507
12/02/2020	23:15:00	0.093	0.201	0.185	0.191	0.515	0.278	0.535
12/02/2020	23:30:00	0.074	0.197	0.238	0.199	0.55	0.27	0.537
12/02/2020	23:45:00	0.105	0.209	0.254	0.216	0.609	0.271	0.536
13/02/2020	00:00:00	0.091	0.204	0.278	0.219	0.633	0.298	0.532
13/02/2020	00:15:00	0.111	0.216	0.306	0.224	0.695	0.309	0.517
13/02/2020	00:30:00	0.102	0.204	0.302	0.26	0.672	0.307	0.564
13/02/2020	00:45:00	0.102	0.204	0.264	0.306	0.684	0.313	0.545
13/02/2020	01:00:00	0.103	0.196	0.244	0.342	0.716	0.305	0.415
13/02/2020	01:15:00	0.075	0.197	0.237	0.4	0.611	0.299	0.431
13/02/2020	01:30:00	0.069	0.2	0.228	0.456	0.585	0.336	0.461
13/02/2020	01:45:00	0.049	0.201	0.223	0.465	0.612	0.381	0.531
13/02/2020	02:00:00	0.063	0.208	0.228	0.471	0.724	0.394	0.461
13/02/2020	02:15:00	0.023	0.204	0.214	0.475	0.617	0.407	0.481
13/02/2020	02:30:00	0.029	0.205	0.222	0.522	0.667	0.488	0.43
13/02/2020	02:45:00	0.022	0.214	0.229	0.502	0.677	0.657	0.435
13/02/2020	03:00:00	0.043	0.221	0.222	0.557	0.534	0.827	0.426
13/02/2020	03:15:00	-0.002	0.227	0.228	0.548	0.528	0.918	0.412
13/02/2020	03:30:00	0.043	0.249	0.225	0.558	0.584	0.77	0.356
13/02/2020	03:45:00	0.041	0.27	0.232	0.525	0.616	0.668	0.414
13/02/2020	04:00:00	0.07	0.303	0.249	0.559	0.722	0.651	0.422
13/02/2020	04:15:00	0.086	0.327	0.268	0.55	0.666	0.646	0.399
13/02/2020	04:30:00	0.123	0.345	0.295	0.508	0.608	0.547	0.463
13/02/2020	04:45:00	0.138	0.356	0.334	0.521	0.623	0.587	0.423
13/02/2020	05:00:00	0.176	0.355	0.369	0.517	0.658	0.646	0.413
13/02/2020	05:15:00	0.169	0.363	0.402	0.485	0.661	0.627	0.344
13/02/2020	05:30:00	0.162	0.38	0.425	0.498	0.659	0.628	0.472
13/02/2020	05:45:00	0.164	0.382	0.471	0.455	0.652	0.657	0.396
13/02/2020	06:00:00	0.161	0.385	0.509	0.521	0.672	0.673	0.432
13/02/2020	06:15:00	0.12	0.378	0.529	0.52	0.627	0.692	0.382

13/02/2020	06:30:00	0.133	0.374	0.526	0.526	0.615	0.694	0.449
13/02/2020	06:45:00	0.119	0.374	0.526	0.494	0.592	0.736	0.439
13/02/2020	07:00:00	0.112	0.371	0.54	0.534	0.61	0.752	0.396
13/02/2020	07:15:00	0.07	0.378	0.501	0.523	0.612	0.792	0.446
13/02/2020	07:30:00	0.089	0.379	0.45	0.488	0.595	0.794	0.401
13/02/2020	07:45:00	0.046	0.362	0.467	0.502	0.547	0.783	0.46
13/02/2020	08:00:00	0.054	0.354	0.481	0.549	0.543	0.756	0.445
13/02/2020	08:15:00	0.046	0.339	0.49	0.534	0.509	0.684	0.405
13/02/2020	08:30:00	0.049	0.327	0.503	0.546	0.525	0.63	0.367
13/02/2020	08:45:00	0.049	0.323	0.517	0.547	0.511	0.556	0.313
13/02/2020	09:00:00	0.047	0.317	0.528	0.536	0.504	0.515	0.332
13/02/2020	09:15:00	0.087	0.318	0.522	0.516	0.463	0.48	0.309
13/02/2020	09:30:00	0.085	0.314	0.513	0.496	0.424	0.464	0.276
13/02/2020	09:45:00	0.094	0.321	0.54	0.495	0.389	0.419	0.247
13/02/2020	10:00:00	0.094	0.33	0.567	0.479	0.405	0.373	0.226
13/02/2020	10:15:00	0.143	0.346	0.588	0.436	0.353	0.312	0.263
13/02/2020	10:30:00	0.131	0.364	0.59	0.436	0.338	0.286	0.207
13/02/2020	10:45:00	0.154	0.382	0.569	0.395	0.324	0.22	0.186
13/02/2020	11:00:00	0.156	0.399	0.589	0.383	0.294	0.221	0.215
13/02/2020	11:15:00	0.161	0.429	0.625	0.372	0.287	0.226	0.245
13/02/2020	11:30:00	0.172	0.444	0.635	0.361	0.285	0.2	0.182
13/02/2020	11:45:00	0.188	0.441	0.627	0.346	0.24	0.193	0.175
13/02/2020	12:00:00	0.173	0.449	0.635	0.34	0.237	0.18	0.189
13/02/2020	12:15:00	0.17	0.436	0.628	0.296	0.239	0.187	0.215
13/02/2020	12:30:00	0.182	0.416	0.592	0.285	0.261	0.2	0.225
13/02/2020	12:45:00	0.145	0.406	0.549	0.291	0.234	0.191	0.184
13/02/2020	13:00:00	0.16	0.383	0.499	0.254	0.213	0.195	0.202
13/02/2020	13:15:00	0.14	0.357	0.453	0.267	0.2	0.187	0.191
13/02/2020	13:30:00	0.133	0.316	0.417	0.265	0.17	0.207	0.199
13/02/2020	13:45:00	0.105	0.275	0.373	0.243	0.186	0.229	0.187

13/02/2020	14:00:00	0.133	0.245	0.337	0.234	0.162	0.271	0.169
13/02/2020	14:15:00	0.117	0.217	0.289	0.227	0.162	0.303	0.164
13/02/2020	14:30:00	0.089	0.171	0.232	0.22	0.158	0.352	0.107
13/02/2020	14:45:00	0.107	0.134	0.178	0.176	0.179	0.445	0.176
13/02/2020	15:00:00	0.088	0.074	0.145	0.165	0.193	0.513	0.148
13/02/2020	15:15:00	0.071	0.027	0.106	0.158	0.158	0.513	0.165
13/02/2020	15:30:00	0.055	-0.02	0.079	0.133	0.145	0.494	0.121
13/02/2020	15:45:00	0.105	-0.034	0.056	0.098	0.138	0.435	0.091
13/02/2020	16:00:00	0	-0.064	0.034	0.1	0.129	0.35	0.105
13/02/2020	16:15:00	0.073	-0.071	0.016	0.074	0.148	0.239	0.097
13/02/2020	16:30:00	0.028	-0.083	-0.002	0.056	0.18	0.116	0.121
13/02/2020	16:45:00	0.072	-0.088	-0.008	0.059	0.163	0.107	0.091
13/02/2020	17:00:00	0.05	-0.076	-0.023	0.025	0.104	0.111	0.09
13/02/2020	17:15:00	0.098	-0.061	-0.013	0.027	0.104	0.097	0.083
13/02/2020	17:30:00	0.031	-0.066	-0.026	0.025	0.091	0.098	0.12
13/02/2020	17:45:00	0.057	-0.047	-0.047	-0.011	0.093	0.098	0.1
13/02/2020	18:00:00	0.059	-0.039	-0.066	-0.013	0.096	0.101	0.077
13/02/2020	18:15:00	0.03	-0.045	-0.118	-0.008	0.062	0.096	0.075
13/02/2020	18:30:00	0.088	-0.051	-0.137	-0.034	0.055	0.09	0.077
13/02/2020	18:45:00	0.036	-0.053	-0.101	-0.044	0.054	0.066	0.098
13/02/2020	19:00:00	0.059	-0.06	-0.054	-0.057	0.033	0.034	0.058
13/02/2020	19:15:00	0.046	-0.068	-0.076	-0.059	0.02	0.033	0.083
13/02/2020	19:30:00	0.051	-0.051	-0.103	-0.082	0.033	0.027	0.086
13/02/2020	19:45:00	0.019	-0.051	-0.061	-0.082	0.042	0.019	0.094
13/02/2020	20:00:00	0.073	-0.037	-0.004	-0.114	0.039	-0.004	0.038
13/02/2020	20:15:00	0.018	-0.031	-0.02	-0.137	0.053	-0.017	0.017
13/02/2020	20:30:00	0.061	-0.025	-0.04	-0.134	0.039	-0.016	0.012
13/02/2020	20:45:00	0.027	-0.023	-0.01	-0.145	0.043	-0.02	0.041
13/02/2020	21:00:00	0.026	-0.022	-0.024	-0.138	0.045	-0.034	0.035
13/02/2020	21:15:00	0.049	-0.03	-0.094	-0.139	0.049	-0.034	0.042

13/02/2020	21:30:00	0.048	-0.025	-0.12	-0.128	0.093	-0.026	0.051
13/02/2020	21:45:00	0.046	-0.036	-0.14	-0.101	0.065	-0.007	0.065
13/02/2020	22:00:00	0.069	-0.046	-0.166	-0.096	0.045	0.031	0.091
13/02/2020	22:15:00	0.078	-0.044	-0.161	-0.092	0.053	0.047	0.084
13/02/2020	22:30:00	0.098	-0.058	-0.161	-0.107	0.026	0.04	0.072
13/02/2020	22:45:00	0.099	-0.071	-0.158	-0.105	0.056	0.029	0.079
13/02/2020	23:00:00	0.138	-0.097	-0.166	-0.085	0.097	0.006	0.065
13/02/2020	23:15:00	0.11	-0.099	-0.202	-0.094	0.066	-0.011	0.068
13/02/2020	23:30:00	0.152	-0.118	-0.214	-0.083	0.047	-0.031	0.077
13/02/2020	23:45:00	0.122	-0.13	-0.231	-0.075	0.031	-0.038	0.077
14/02/2020	00:00:00	0.124	-0.129	-0.139	-0.088	0.096	-0.014	0.128
14/02/2020	00:15:00	0.127	-0.147	-0.073	-0.058	0.12	0.008	0.08
14/02/2020	00:30:00	0.145	-0.146	-0.027	-0.069	0.092	0.007	0.077
14/02/2020	00:45:00	0.134	-0.172	-0.012	-0.098	0.157	0.034	0.118
14/02/2020	01:00:00	0.137	-0.176	0.008	-0.103	0.131	0.077	0.129
14/02/2020	01:15:00	0.107	-0.186	0.02	-0.049	0.124	0.104	0.086
14/02/2020	01:30:00	0.104	-0.18	0.004	-0.036	0.161	0.102	0.051
14/02/2020	01:45:00	0.098	-0.187	-0.008	-0.041	0.16	0.099	0.061
14/02/2020	02:00:00	0.108	-0.199	-0.009	-0.056	0.169	0.094	0.077
14/02/2020	02:15:00	0.098	-0.204	0.001	-0.01	0.176	0.138	0.073
14/02/2020	02:30:00	0.116	-0.211	-0.029	0.004	0.147	0.173	0.068
14/02/2020	02:45:00	0.079	-0.201	-0.044	-0.033	0.16	0.187	0.063
14/02/2020	03:00:00	0.124	-0.196	-0.045	-0.02	0.171	0.201	0.058
14/02/2020	03:15:00	0.113	-0.178	-0.031	-0.001	0.175	0.232	0.035
14/02/2020	03:30:00	0.117	-0.179	-0.041	0.006	0.163	0.229	0.055
14/02/2020	03:45:00	0.09	-0.151	-0.022	0.014	0.157	0.208	0.076
14/02/2020	04:00:00	0.104	-0.123	-0.05	0.032	0.177	0.159	0.059
14/02/2020	04:15:00	0.148	-0.075	-0.069	0.024	0.163	0.103	0.064
14/02/2020	04:30:00	0.13	-0.043	-0.078	0.041	0.145	0.042	0.051
14/02/2020	04:45:00	0.155	-0.019	-0.087	0.037	0.154	0.078	0.11

14/02/2020	05:00:00	0.166	0.006	-0.092	0.041	0.131	0.12	0.113
14/02/2020	05:15:00	0.168	0.048	-0.093	0.051	0.172	0.145	0.093
14/02/2020	05:30:00	0.193	0.081	-0.084	0.014	0.177	0.107	0.104
14/02/2020	05:45:00	0.224	0.109	-0.065	0.024	0.148	0.074	0.13
14/02/2020	06:00:00	0.184	0.125	-0.048	0.058	0.154	0.051	0.11
14/02/2020	06:15:00	0.251	0.123	-0.028	0.045	0.174	0.033	0.089
14/02/2020	06:30:00	0.205	0.129	-0.019	0.065	0.178	-0.002	0.128
14/02/2020	06:45:00	0.245	0.141	-0.01	0.037	0.198	-0.01	0.125
14/02/2020	07:00:00	0.251	0.162	0.001	0.048	0.229	-0.006	0.124
14/02/2020	07:15:00	0.22	0.16	0.026	0.052	0.233	0.005	0.131
14/02/2020	07:30:00	0.276	0.176	0.074	0.067	0.219	0.03	0.155
14/02/2020	07:45:00	0.282	0.179	0.096	0.092	0.195	0.07	0.12
14/02/2020	08:00:00	0.289	0.2	0.063	0.097	0.193	0.1	0.126
14/02/2020	08:15:00	0.296	0.234	0.056	0.11	0.238	0.123	0.115
14/02/2020	08:30:00	0.285	0.263	0.095	0.158	0.248	0.134	0.162
14/02/2020	08:45:00	0.312	0.286	0.103	0.165	0.288	0.153	0.148
14/02/2020	09:00:00	0.303	0.312	0.109	0.145	0.307	0.156	0.165
14/02/2020	09:15:00	0.318	0.321	0.107	0.204	0.288	0.169	0.145
14/02/2020	09:30:00	0.335	0.356	0.098	0.206	0.272	0.172	0.149
14/02/2020	09:45:00	0.307	0.392	0.095	0.192	0.286	0.183	0.153
14/02/2020	10:00:00	0.344	0.433	0.095	0.213	0.304	0.211	0.197
14/02/2020	10:15:00	0.325	0.464	0.147	0.206	0.319	0.238	0.166
14/02/2020	10:30:00	0.333	0.497	0.214	0.213	0.355	0.298	0.174
14/02/2020	10:45:00	0.351	0.51	0.254	0.234	0.331	0.285	0.165
14/02/2020	11:00:00	0.346	0.53	0.288	0.236	0.34	0.263	0.186
14/02/2020	11:15:00	0.397	0.55	0.315	0.213	0.381	0.211	0.194
14/02/2020	11:30:00	0.356	0.562	0.314	0.21	0.387	0.167	0.203
14/02/2020	11:45:00	0.409	0.583	0.384	0.225	0.394	0.162	0.215
14/02/2020	12:00:00	0.359	0.583	0.426	0.257	0.395	0.182	0.231
14/02/2020	12:15:00	0.401	0.591	0.472	0.279	0.387	0.187	0.254

14/02/2020	12:30:00	0.408	0.557	0.514	0.284	0.39	0.179	0.251
14/02/2020	12:45:00	0.427	0.539	0.551	0.306	0.406	0.185	0.248
14/02/2020	13:00:00	0.451	0.502	0.58	0.324	0.404	0.219	0.234
14/02/2020	13:15:00	0.463	0.487	0.582	0.355	0.406	0.249	0.214
14/02/2020	13:30:00	0.437	0.473	0.584	0.394	0.382	0.26	0.202
14/02/2020	13:45:00	0.489	0.454	0.583	0.401	0.356	0.282	0.214
14/02/2020	14:00:00	0.478	0.439	0.595	0.402	0.348	0.278	0.217
14/02/2020	14:15:00	0.455	0.424	0.587	0.421	0.368	0.287	0.177
14/02/2020	14:30:00	0.478	0.402	0.577	0.47	0.362	0.318	0.184
14/02/2020	14:45:00	0.513	0.405	0.581	0.469	0.363	0.359	0.181
14/02/2020	15:00:00	0.477	0.392	0.567	0.461	0.363	0.357	0.164
14/02/2020	15:15:00	0.476	0.395	0.542	0.467	0.354	0.371	0.153
14/02/2020	15:30:00	0.543	0.408	0.509	0.456	0.335	0.388	0.156
14/02/2020	15:45:00	0.453	0.409	0.482	0.451	0.3	0.39	0.147
14/02/2020	16:00:00	0.486	0.415	0.452	0.471	0.296	0.377	0.133
14/02/2020	16:15:00	0.482	0.412	0.429	0.467	0.259	0.33	0.103
14/02/2020	16:30:00	0.489	0.413	0.402	0.447	0.274	0.231	0.103
14/02/2020	16:45:00	0.459	0.412	0.392	0.432	0.239	0.143	0.155
14/02/2020	17:00:00	0.43	0.427	0.381	0.413	0.235	0.123	0.134
14/02/2020	17:15:00	0.46	0.426	0.386	0.424	0.198	0.138	0.129
14/02/2020	17:30:00	0.412	0.453	0.396	0.408	0.195	0.113	0.105
14/02/2020	17:45:00	0.454	0.451	0.405	0.362	0.172	0.102	0.132
14/02/2020	18:00:00	0.394	0.472	0.414	0.376	0.165	0.074	0.12
14/02/2020	18:15:00	0.469	0.484	0.426	0.36	0.173	0.051	0.128
14/02/2020	18:30:00	0.41	0.514	0.44	0.336	0.181	0.038	0.108
14/02/2020	18:45:00	0.491	0.512	0.447	0.324	0.179	0.044	0.088
14/02/2020	19:00:00	0.344	0.508	0.444	0.32	0.152	0.051	0.117
14/02/2020	19:15:00	0.497	0.511	0.442	0.302	0.147	0.026	0.175
14/02/2020	19:30:00	0.348	0.501	0.418	0.288	0.172	0.026	0.182
14/02/2020	19:45:00	0.385	0.477	0.393	0.284	0.147	0.024	0.128

14/02/2020	20:00:00	0.307	0.468	0.365	0.251	0.131	0.055	0.119
14/02/2020	20:15:00	0.37	0.432	0.351	0.23	0.146	0.085	0.141
14/02/2020	20:30:00	0.319	0.394	0.323	0.215	0.166	0.098	0.193
14/02/2020	20:45:00	0.347	0.378	0.309	0.208	0.136	0.115	0.159
14/02/2020	21:00:00	0.254	0.345	0.327	0.175	0.174	0.14	0.146
14/02/2020	21:15:00	0.322	0.309	0.335	0.165	0.147	0.156	0.137
14/02/2020	21:30:00	0.258	0.278	0.312	0.145	0.199	0.136	0.146
14/02/2020	21:45:00	0.297	0.237	0.294	0.137	0.189	0.135	0.123
14/02/2020	22:00:00	0.271	0.194	0.264	0.141	0.222	0.152	0.185
14/02/2020	22:15:00	0.272	0.157	0.218	0.143	0.235	0.168	0.15
14/02/2020	22:30:00	0.316	0.129	0.182	0.14	0.244	0.181	0.135
14/02/2020	22:45:00	0.275	0.099	0.136	0.112	0.231	0.2	0.115
14/02/2020	23:00:00	0.33	0.081	0.077	0.126	0.24	0.212	0.143
14/02/2020	23:15:00	0.312	0.073	0.076	0.115	0.232	0.222	0.165
14/02/2020	23:30:00	0.34	0.062	0.062	0.125	0.257	0.233	0.166
14/02/2020	23:45:00	0.332	0.06	0.033	0.078	0.269	0.197	0.157

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