

Storms Dudley, Eunice and Franklin, February 2022

Three named storms affected the UK within the space of a week, the first time this has occurred since storm naming was introduced in 2015/2016. Two rare red warnings were issued for storm Eunice, the most severe and damaging storm to affect England and Wales since February 2014. Winds gusted at over 70Kt (81mph) in exposed coastal locations and a gust of 106Kt (122mph) was recorded at Needles Old Battery, Isle of Wight, setting a new England gust speed record. Winds gusted widely at over 60Kt (69mph) across southern England. These storms formed part of a turbulent spell of wet and windy weather for the UK, associated with a powerful jet stream. Storms Dudley and Franklin also brought significant weather impacts.

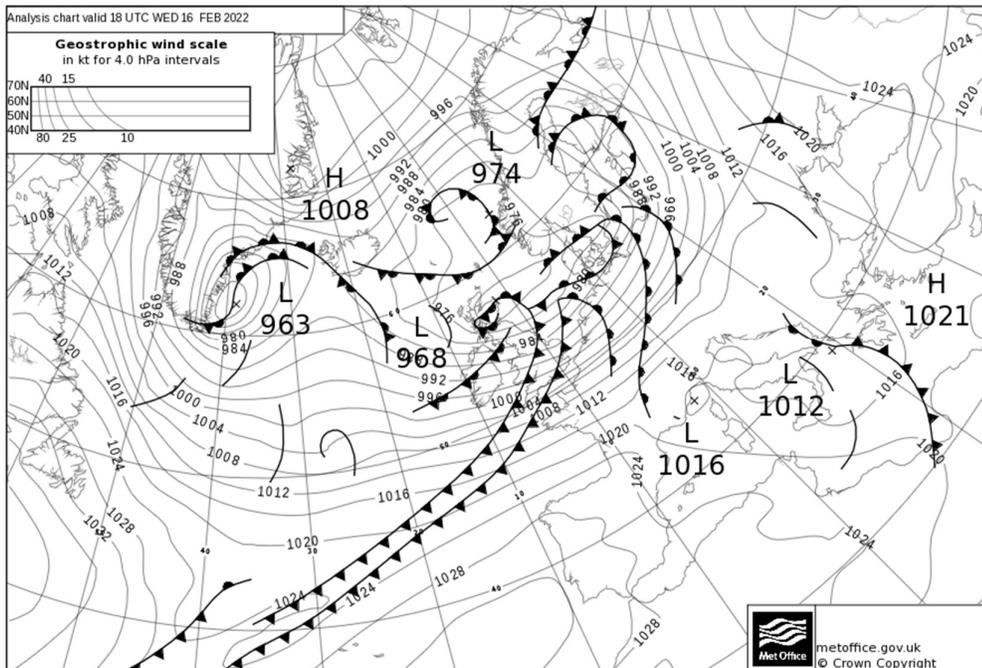
Impacts

Storm Eunice brought major weather impacts. Four people died in the UK and Ireland as a result of falling trees. Over a million homes were left without power as strong winds brought down trees, with ongoing power cuts lasting several days. Schools and businesses were closed across Wales and the worst affected areas of England. There was major transport disruption, with trains cancelled, roads were blocked by fallen trees and there were a number of overturned lorries e.g. on the M4 in south Wales. Several hundred flights in the UK were cancelled and many aircraft struggled to land in the strong winds. The Port of Dover was temporarily closed to all shipping, and the Humber bridge and both Severn bridges were closed for the first time in their history. There were widespread reports of structural damage. Roofs were torn off several buildings, the top of a church spire in Wells, Somerset was blown down and the Millennium Dome in London was damaged. Thousands of trees were felled – including large mature trees such as a local landmark tree in Bude, Cornwall, and at National Trust properties. Large waves battered exposed coastlines. Further north, there was also significant transport disruption in parts of Scotland and northern England from snow.

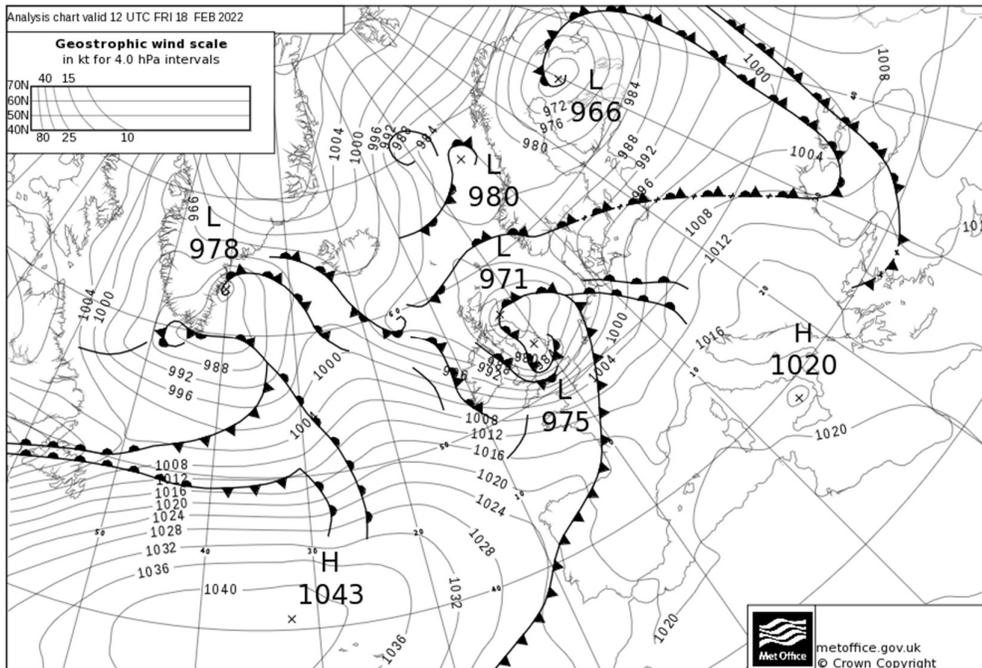
Storms Dudley and Franklin also brought impacts. Storm Dudley resulted in loss of power for thousands of homes across parts of Cumbria, Yorkshire and Lancashire, and rail lines heading north to Glasgow and Edinburgh were disrupted. The strong winds from Franklin hampered clean-up operations following Eunice. The persistent heavy rain through this spell brought significant flooding problems in parts of England, Wales and Northern Ireland. Around 400 properties were flooded, with severe flood warnings issued for several major rivers including the Severn. In Yorkshire, the River Wharfe bust its banks and the lines at Rotherham Central station were flooded. However, fortunately severe coastal flooding in the Bristol Channel was avoided.

Weather data

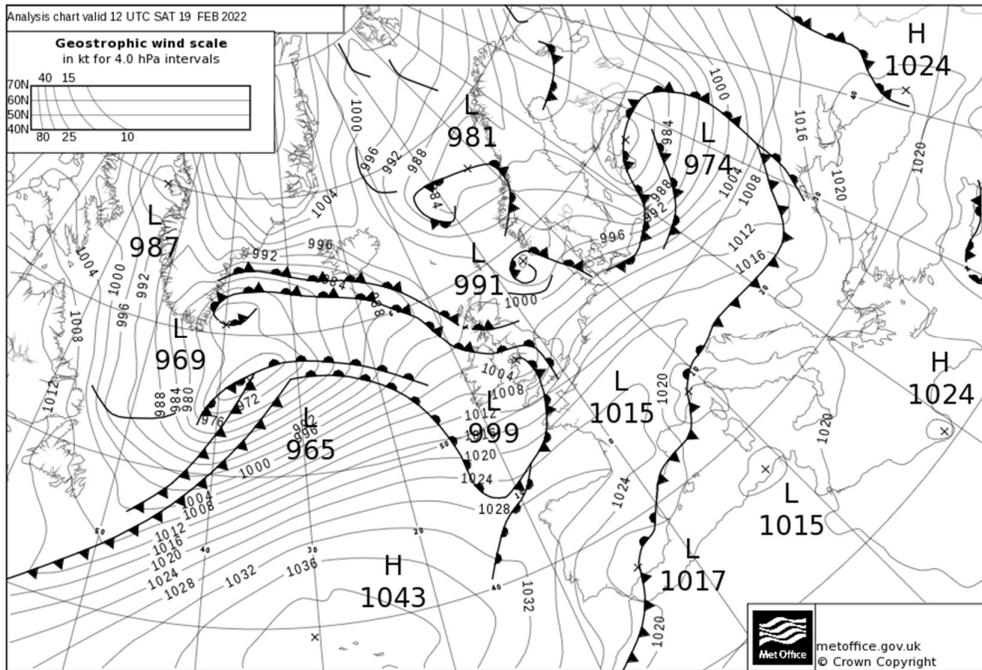
The analysis chart at 1800 UTC 16 February 2022 shows storm Dudley centred across Scotland with fronts sweeping south-east across the UK.



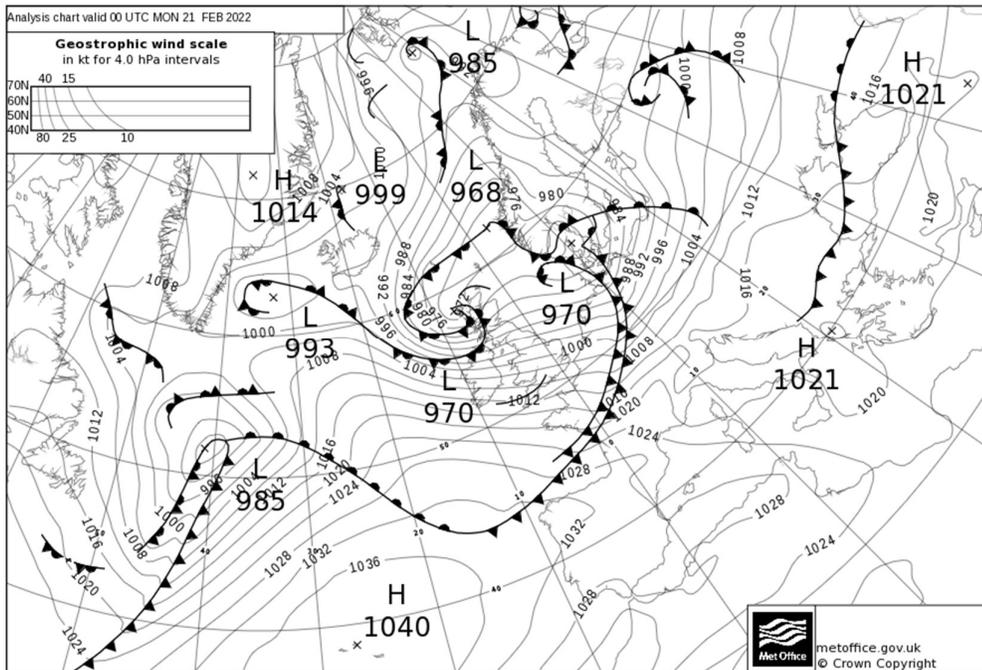
The analysis chart at 1200 UTC 18 February 2022 shows storm Eunice tracking rapidly east across England. The development of this storm was an example of explosive cyclogenesis, with the central pressure dropping by approximately 30hPa within 18 hours while the storm developed to the west of Ireland. The storm interacted with upper winds in the jet stream blowing at more than 200mph.



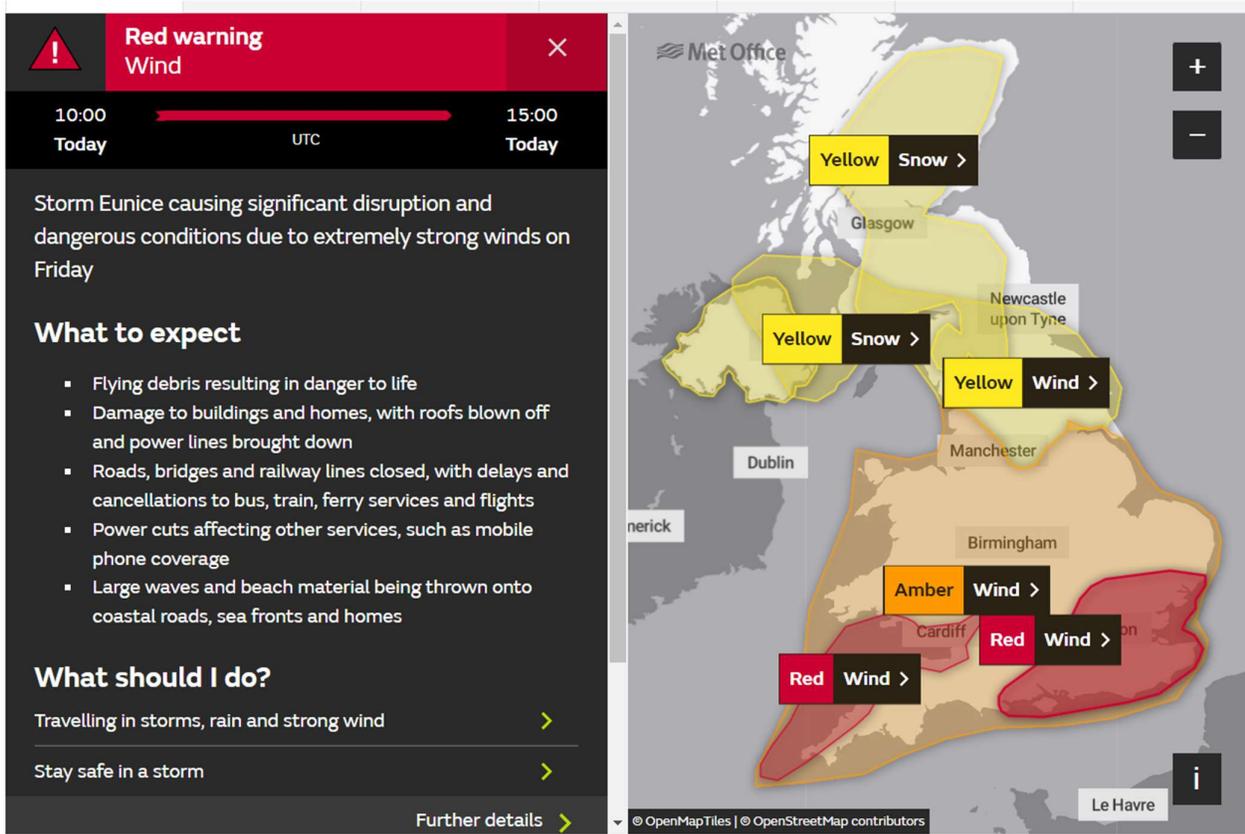
The analysis chart at 1200 UTC 19 February 2022 shows fronts bringing further strong winds and heavy rain across England and Wales. Storm Eunice is located over the Baltic, with storm Franklin approaching from the mid-Atlantic.



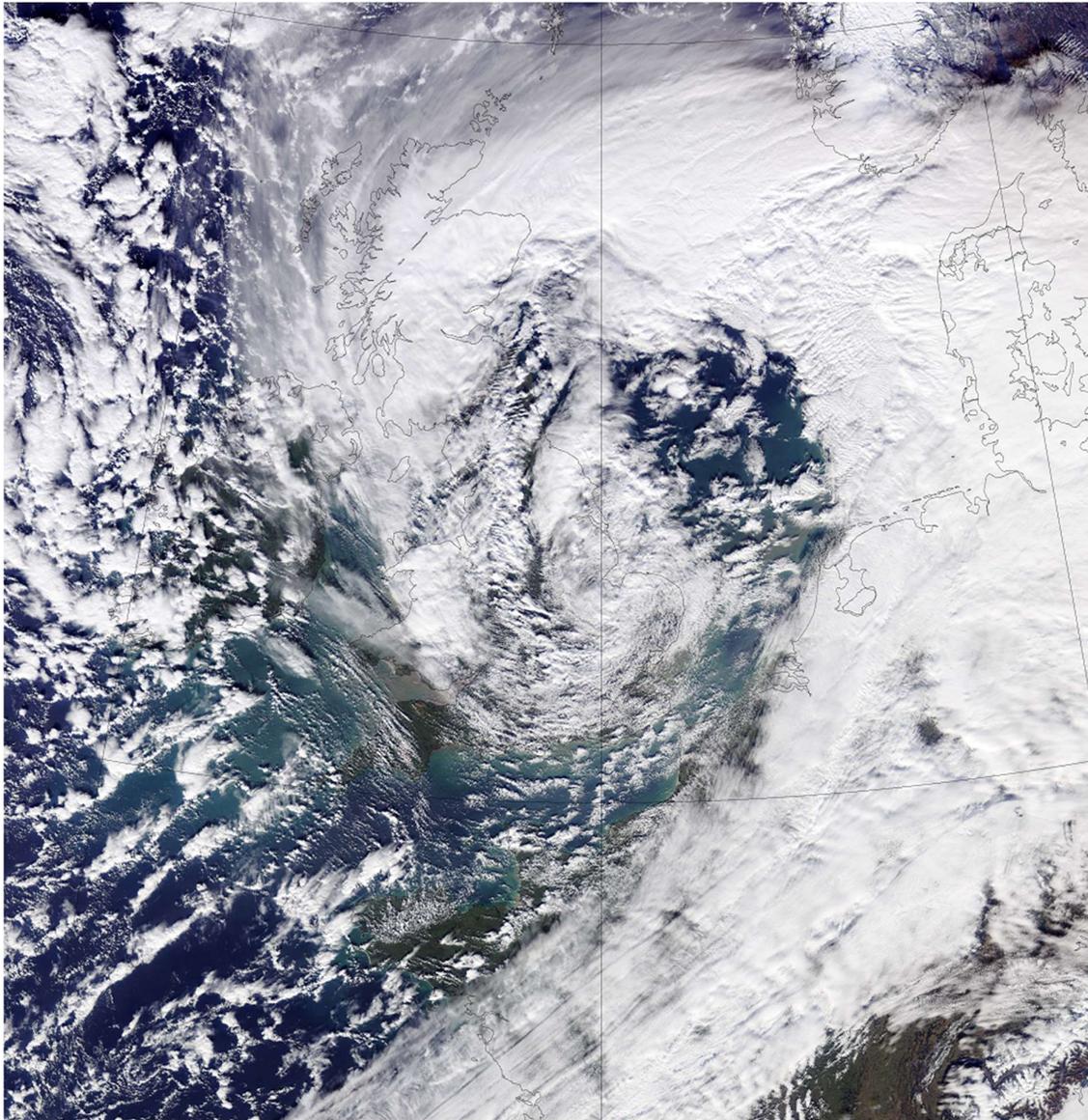
The analysis chart at 0000 UTC 21 February 2022 shows storm Franklin to the west of Scotland.



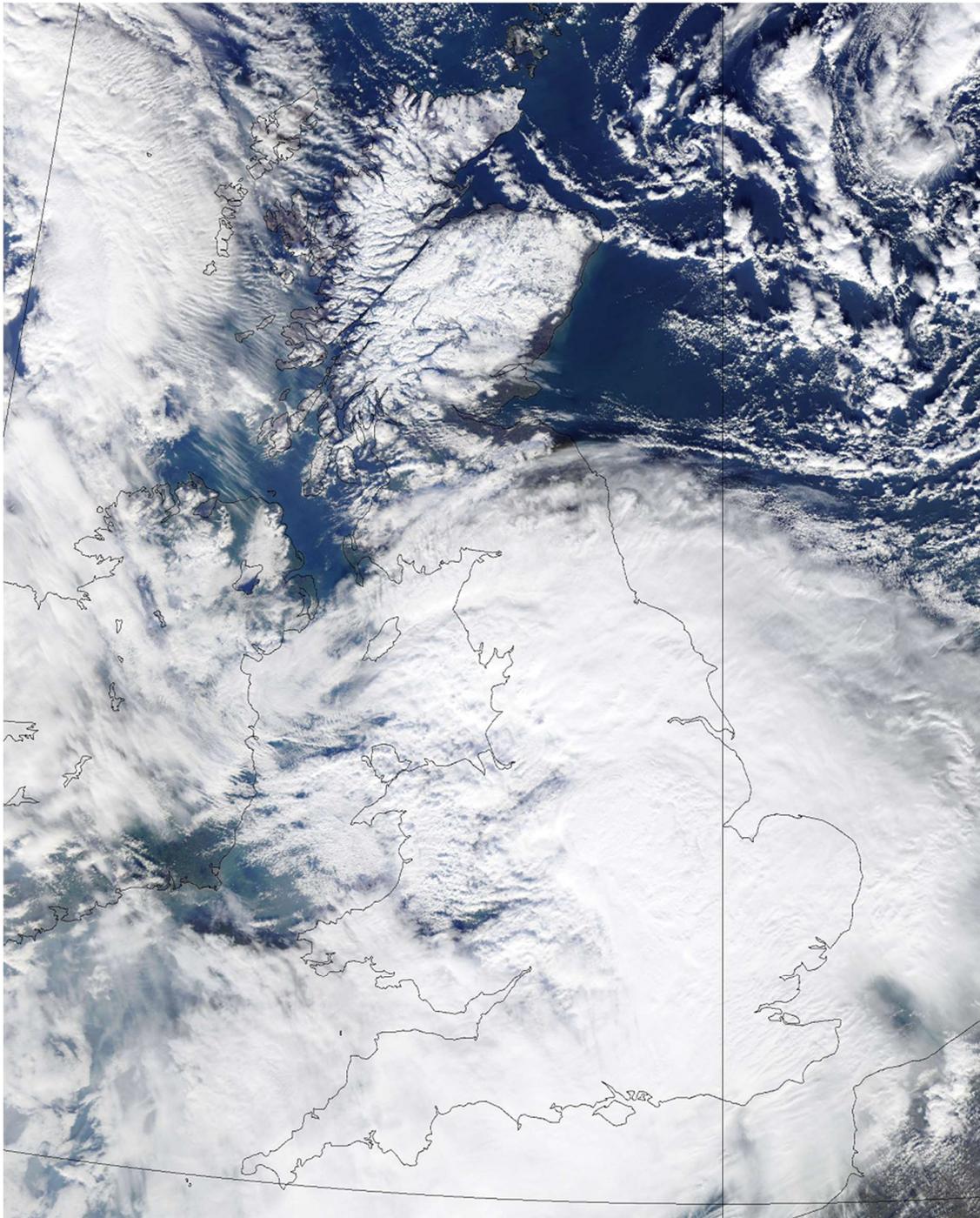
The figure below shows the Met Office warnings issued for storm Eunice, including two red warnings areas and a wider amber warning area covering most of England and Wales, with further yellow warning areas for wind and snow across parts of Scotland, Northern Ireland and northern England. This was the second red warning issued for wind for a storm during the 2021/2022 season, following the red warning for storm Arwen on 26 to 27 November 2021. It was also the first time a red warning has been issued for wind covering south-east England, including London.



The satellite image below on 18 February 2022 shows storm Eunice centred across eastern England with associated fronts sweeping from Scotland across the North Sea to the near continent. Image copyright Met Office / NOAA / NASA.

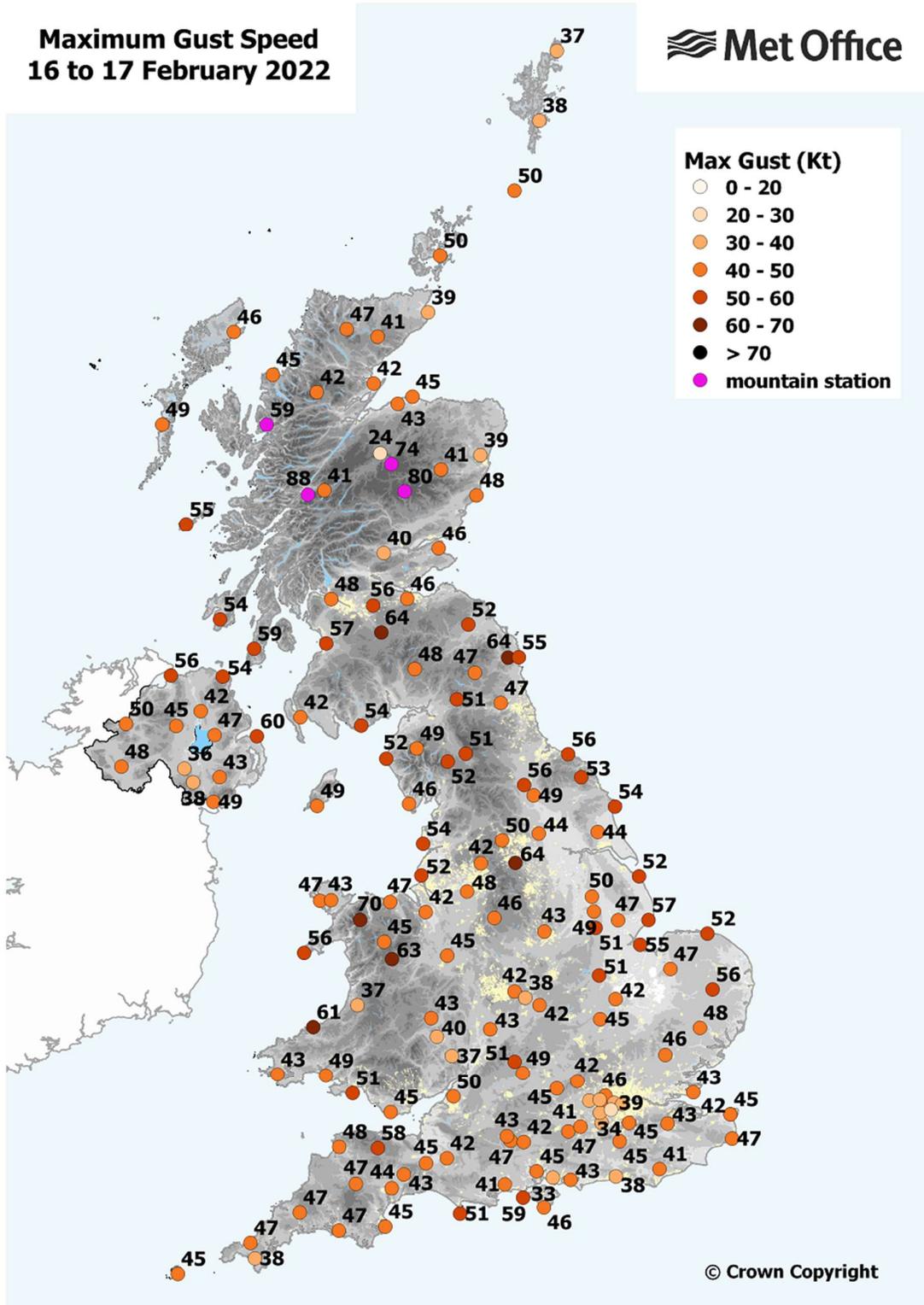


The satellite image below on 19 February 2022 shows England and Wales swathed in fronts bringing heavy rain to western areas, with clear skies across Scotland and extensive lying snow in the aftermath of storm Eunice. Lying snow is also visible over the hills of Northern Ireland. The snow caused significant transport disruption in Scotland and northern England with recorded depths on 19 February including 11cm at Oyne (Aberdeenshire) and 5cm at Copley (County Durham). Image copyright Met Office / NOAA / NASA.



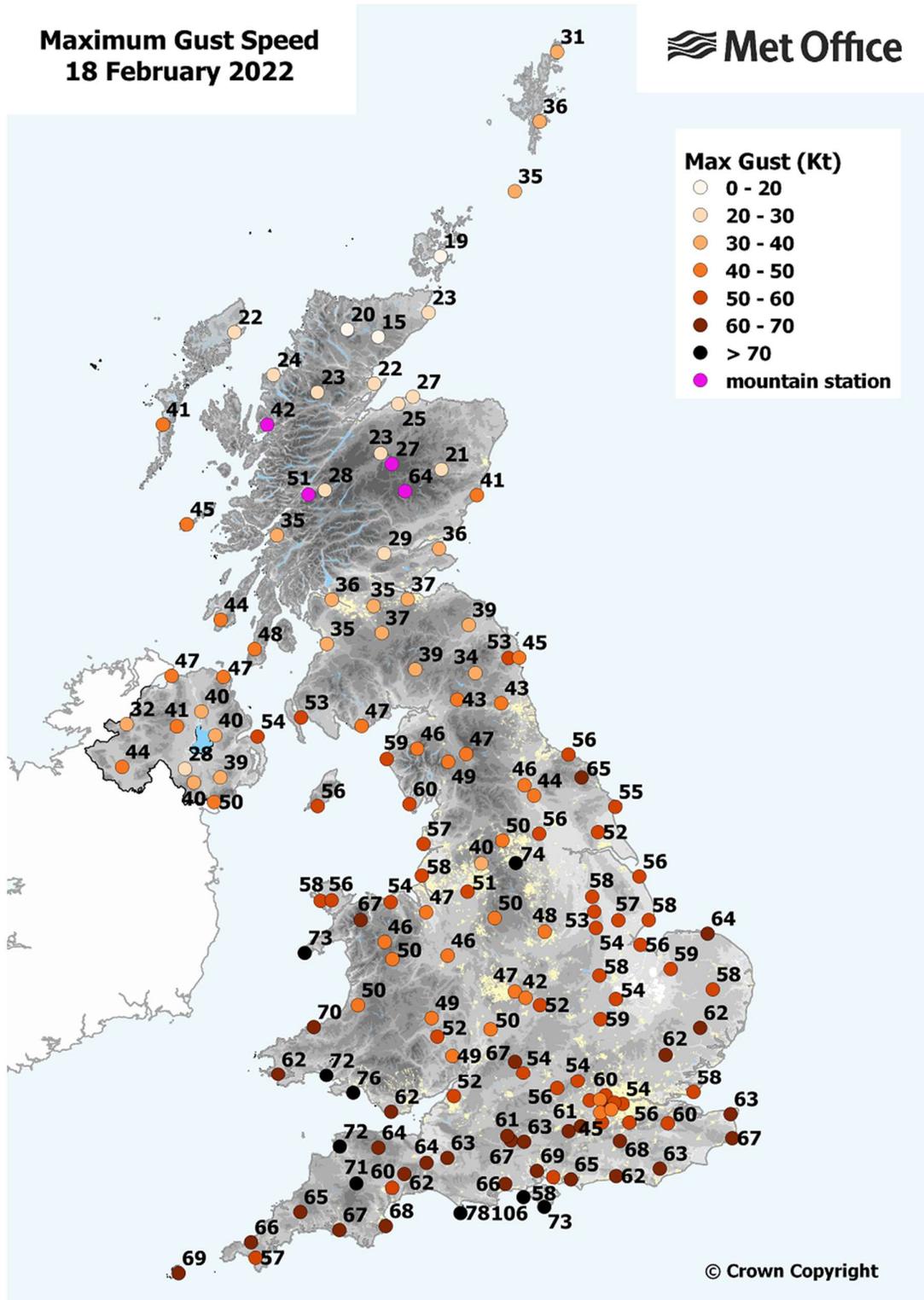
The map below shows maximum gust speeds from storm Dudley on 16 to 17 February 2022. The strongest winds were in a swathe across southern Scotland, Northern Ireland, Wales, northern and eastern England with gusts of 50 to 60Kt (58 to 69mph) in coastal locations and 40 to 50Kt (46 to 58mph) widely inland. This storm was notable but not especially unusual for the time of year. Capel Curig (Conwy) recorded a gust of 70Kt (81mph).

Maximum Gust Speed 16 to 17 February 2022

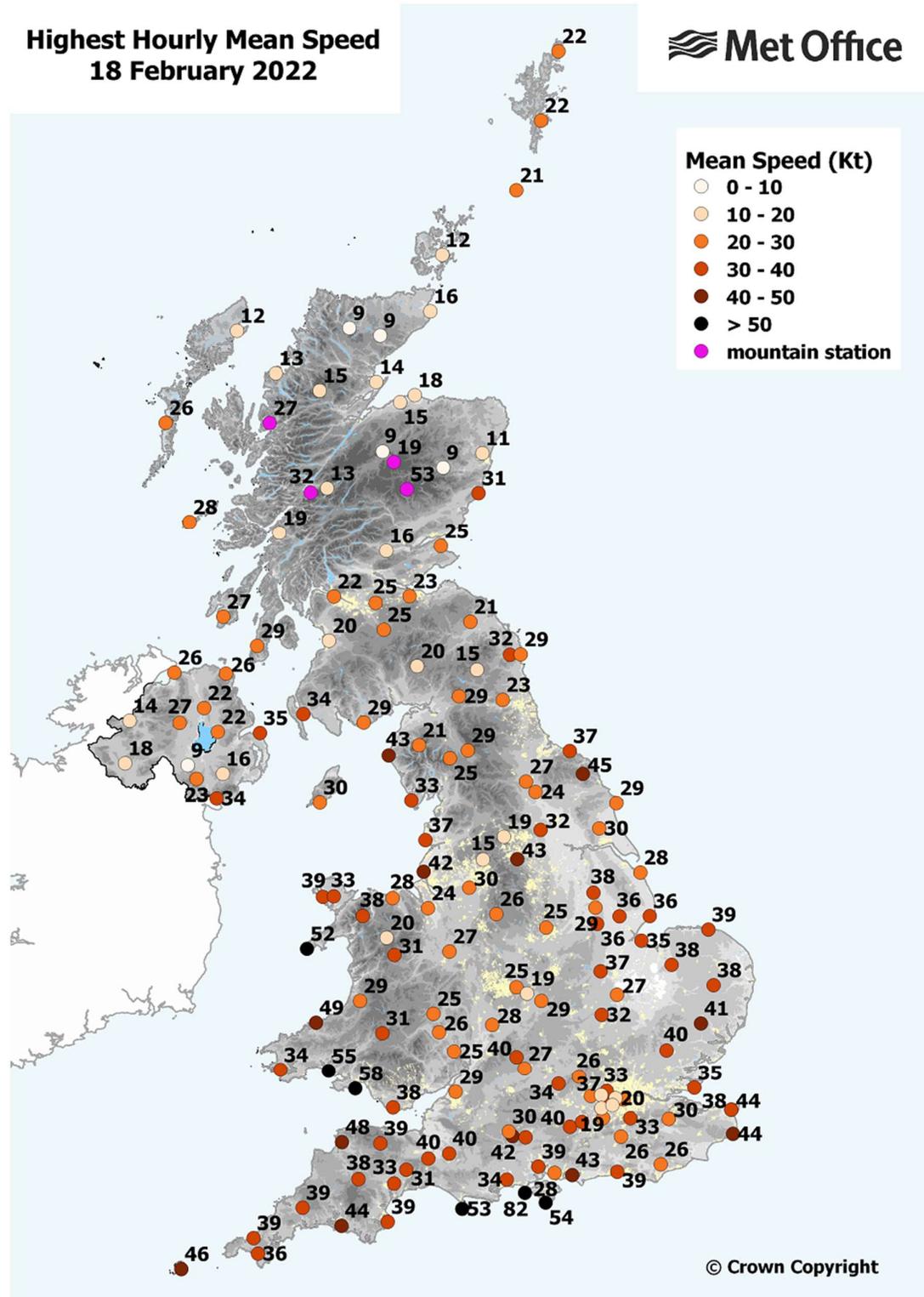


The map below shows maximum gust speeds from storm Eunice on 18 February 2022. The strongest winds were around the coast of Wales and south-west coast of England with several stations recording gusts of over 70Kt (81mph) including 106Kt (122mph) at Needles Old Battery (Isle of Wight), 78Kt (90mph) at Isle of Portland (Dorset), 76Kt (87mph) at Mumbles Head (West Glamorgan), 73Kt (84mph) at Aberdaron (Gwynedd) and 72Kt (83mph) at Pembrey Sands (Carmarthenshire) and Chivenor (Devon). Most stations in England south of London recorded gusts of over 60Kt (69mph) – such as 68Kt (78mph) at Charlwood (Surrey) and 67Kt (77mph) at

Boscombe Down (Wiltshire). Wind speeds as high as this are extreme for southern England and south Wales and might be regarded as approximately 10Kt higher than those experienced during a more typical winter storm. The 122mph gust at Needles Old Battery set a new England gust speed record, exceeding the previous record of 103Kt (118mph) at Gwennap Head (Cornwall) on 15 December 1979. Many stations recorded their highest February gust since 26 February 1990, and some recorded their highest February gust on record, such as Chivenor (37 years) and Thorney Island, West Sussex (33 years).

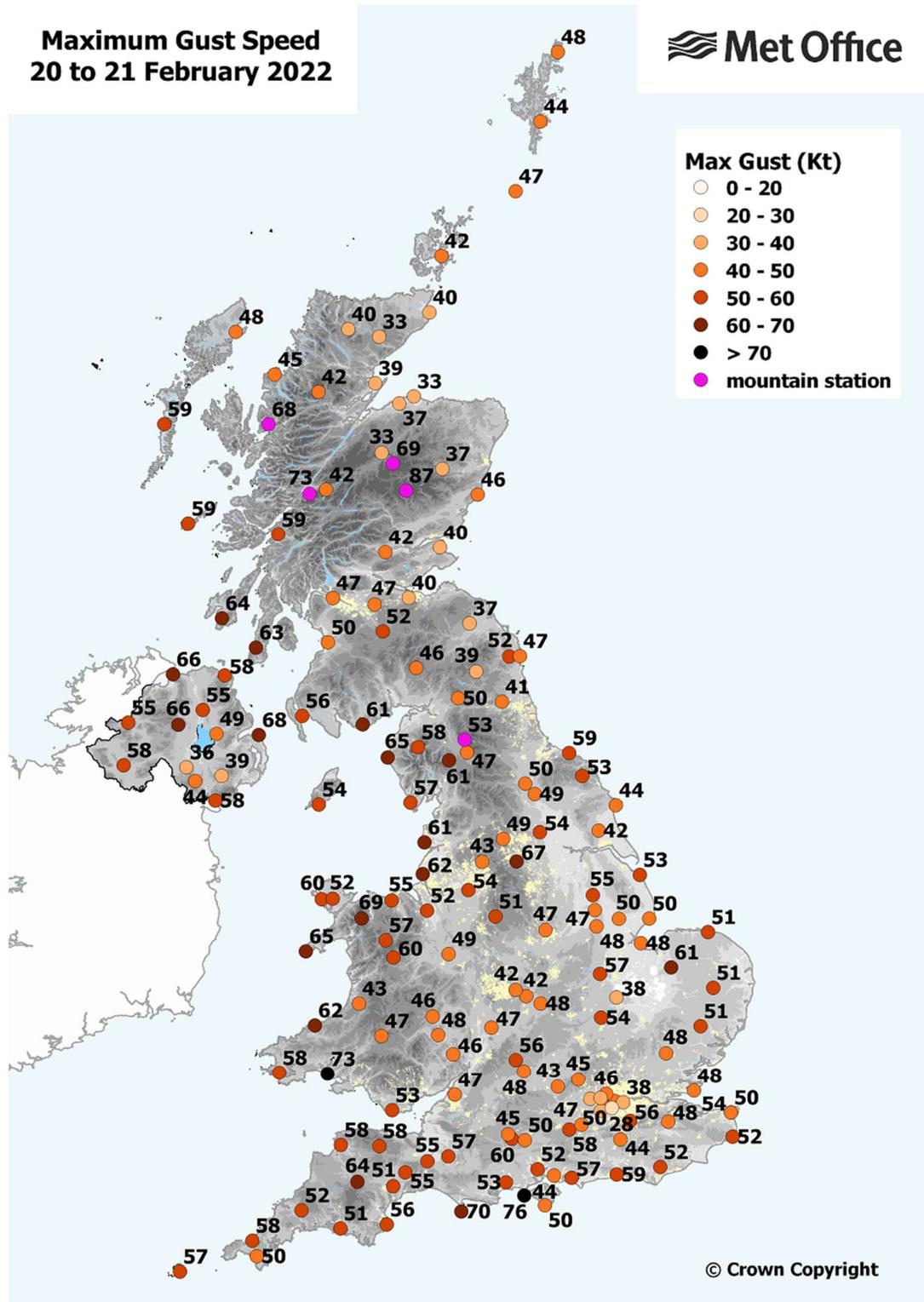


The map below shows the highest hourly mean wind speeds recorded from storm Eunice on 18 February 2022. Several coastal locations recorded an hourly mean wind speed of over 50Kt (58mph), while Needles Old Battery (Isle of Wight) recorded a remarkable hourly mean wind speed of 82Kt (94mph) for the hour to 1100 UTC at the height of the storm.



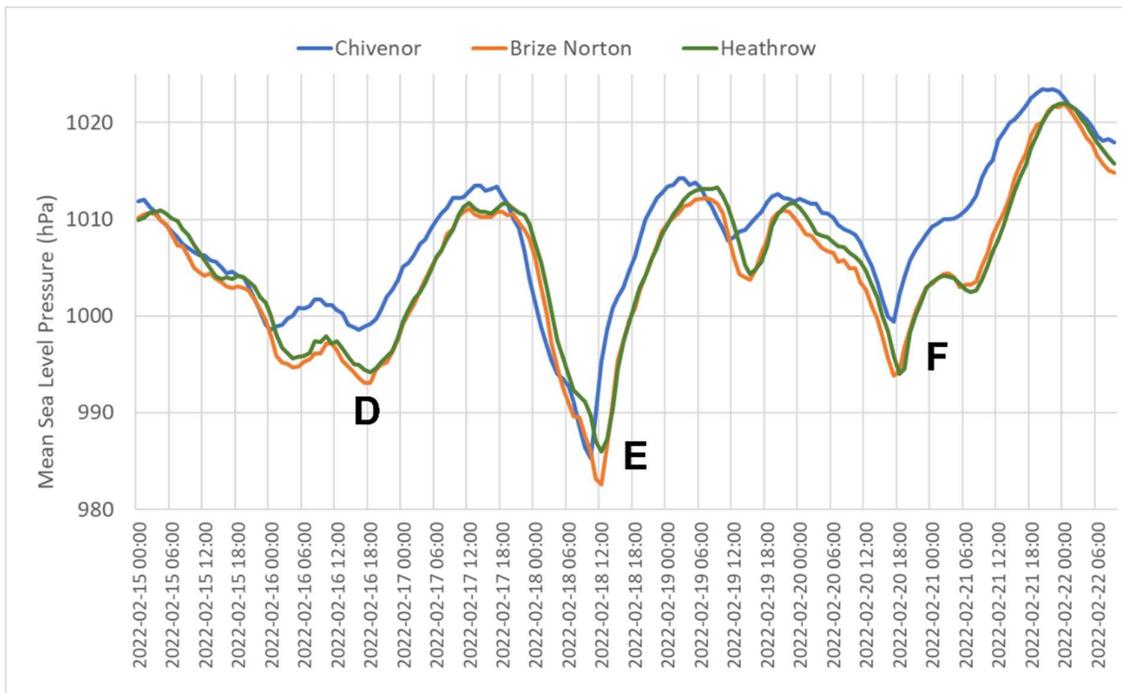
The map below shows the maximum gust speeds from storm Franklin on 21 to 22 February 2022. For most locations, wind speeds were generally not quite as high as for storm Eunice. However, this was a particularly severe storm across Northern Ireland and parts of north-west England, with

gusts of 68Kt (78mph) at Orlock Head (County Down), 66Kt at Magilligan and Lough Fea (both County Londonderry) and 65Kt (75mph) at St Bees Head, Cumbria. The strongest winds were particularly sustained for storm Franklin, with winds gusting at over 40Kt for a 36 hour period from midnight on 20 February to mid-day on 21 February, peaking in the early hours of the morning of the 21st.

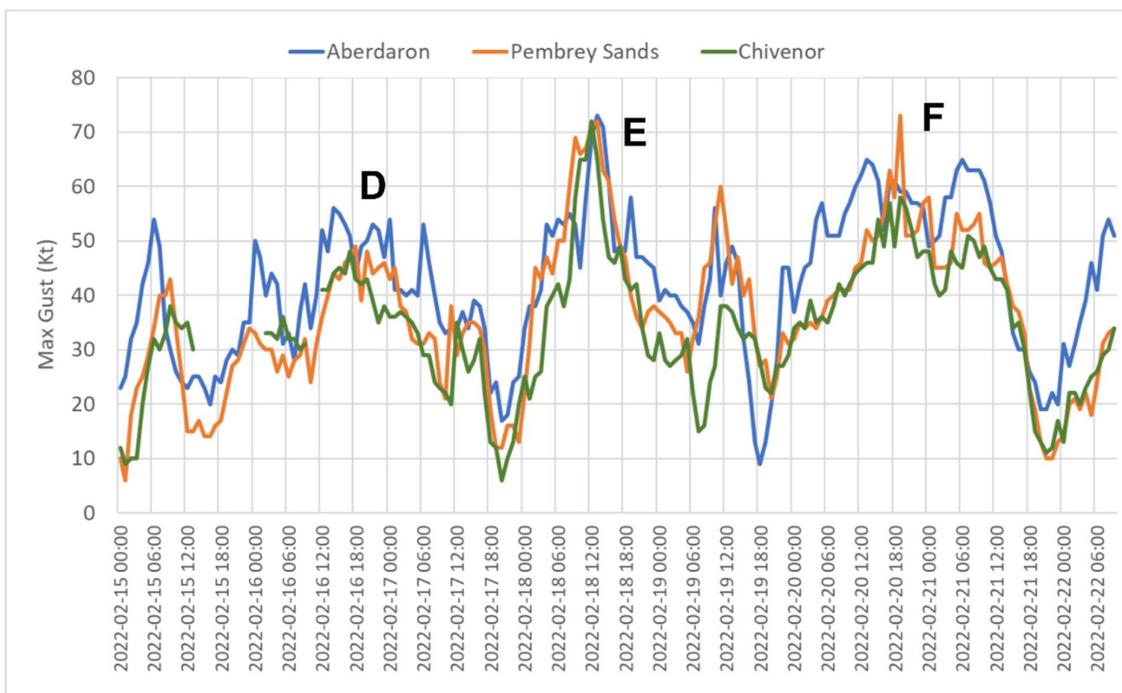


The chart below shows hourly mean sea level pressure at Chivenor (Devon), Brize Norton (Oxfordshire) and Heathrow (Greater London) during the passage of storms Dudley, Eunice and

Franklin. The strongest winds tend to coincide with the rapid rise in pressure, with gusts of 72Kt (83mph) at Chivenor, Devon, 61Kt (70mph), 54Kt (62mph) at Brize Norton and 61Kt (70mph) at Heathrow during the passage of storm Eunice.

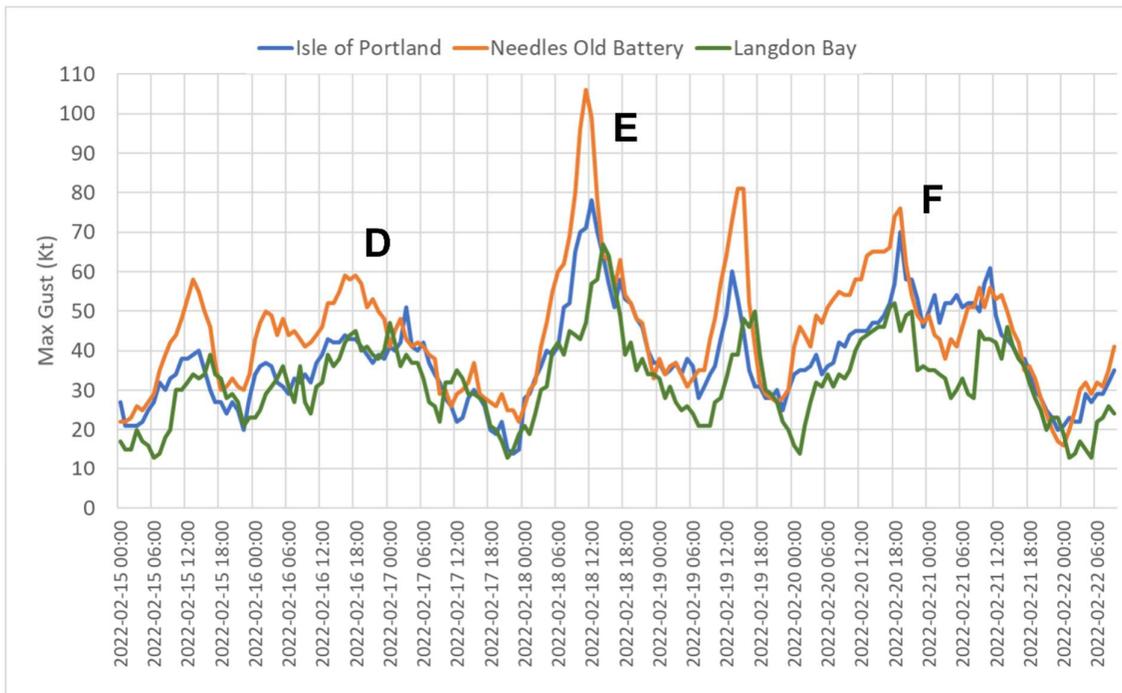


The chart below shows hourly maximum gust speeds recorded at three stations in the west of the UK: Aberdaron, Gwynedd (at the western tip of the Llyn Peninsula), Pembrey Sands (Carmarthenshire) and Chivenor (Devon) during the passage of storms Dudley, Eunice and Franklin, illustrating the relatively short interludes between these storms. While the most severe storm, Eunice, moved rapidly across the UK, strong winds were sustained for a longer period of time for storm Dudley and particularly storm Franklin.

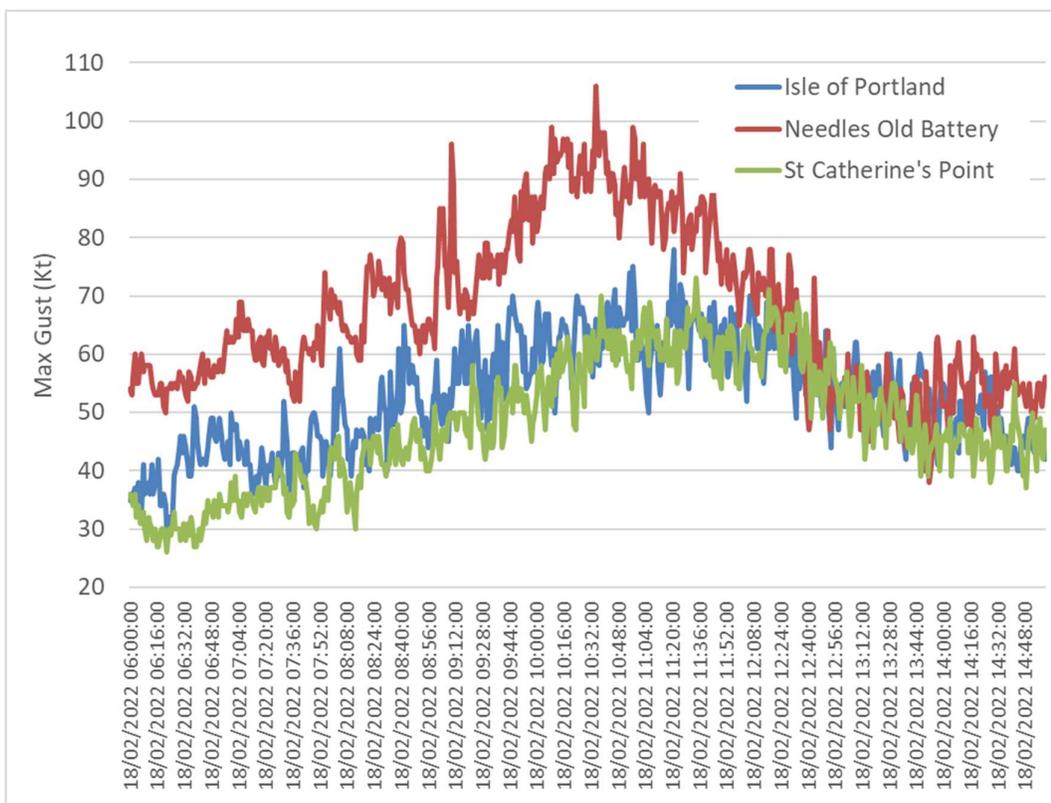


The chart below shows hourly maximum gust speeds recorded at three stations on the south coast of the UK: Isle of Portland, Dorset, Needles Old Battery, Isle of Wight and Langdon Bay, Kent. The

chart illustrates the particularly exposed nature of Needles, located at 80 masl (metres above mean sea level) on the western tip of the Isle of Wight and fully exposed to westerly winds blowing up the English Channel. The spike in wind speeds on 19 February 2022 was due to the passage of the frontal system between storms Eunice and Franklin.

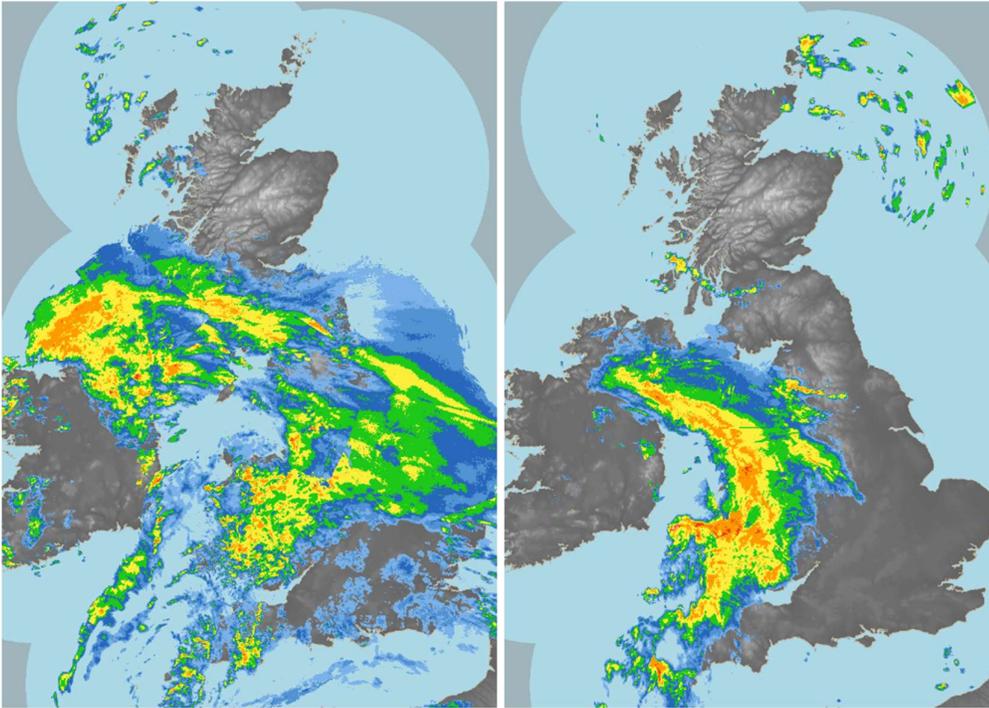


The chart below shows minute observations of maximum gust speeds at Isle of Portland, Needles Old Battery and St Catherine's Point (Isle of Wight) during storm Eunice on 18 February 2022. The highest gust speeds in these locations occurred between 1000 and 1200 UTC with the minute resolution data providing an indication of the fluctuations in wind speed over a time-scale of minutes, rather than hours, as shown in the hourly chart above.

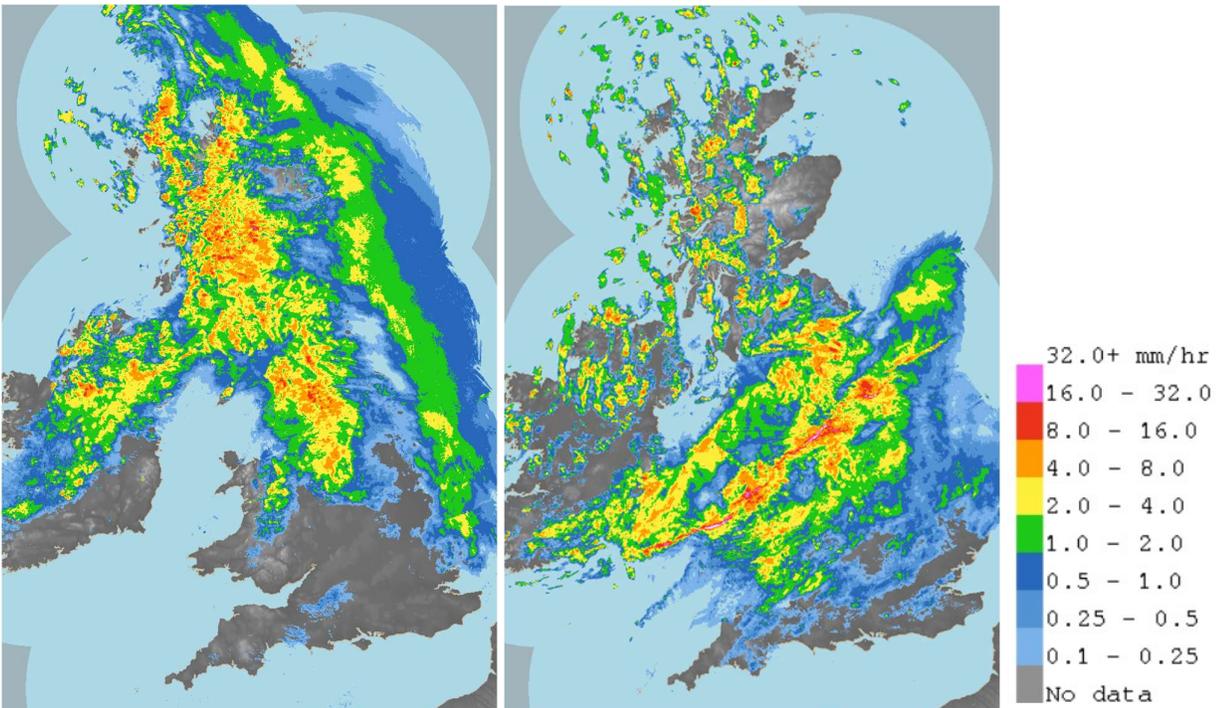


The panel of rain-radar images show the heavy rainfall experienced across parts of Wales, northern England and western Scotland through the period 18 to 20 February.

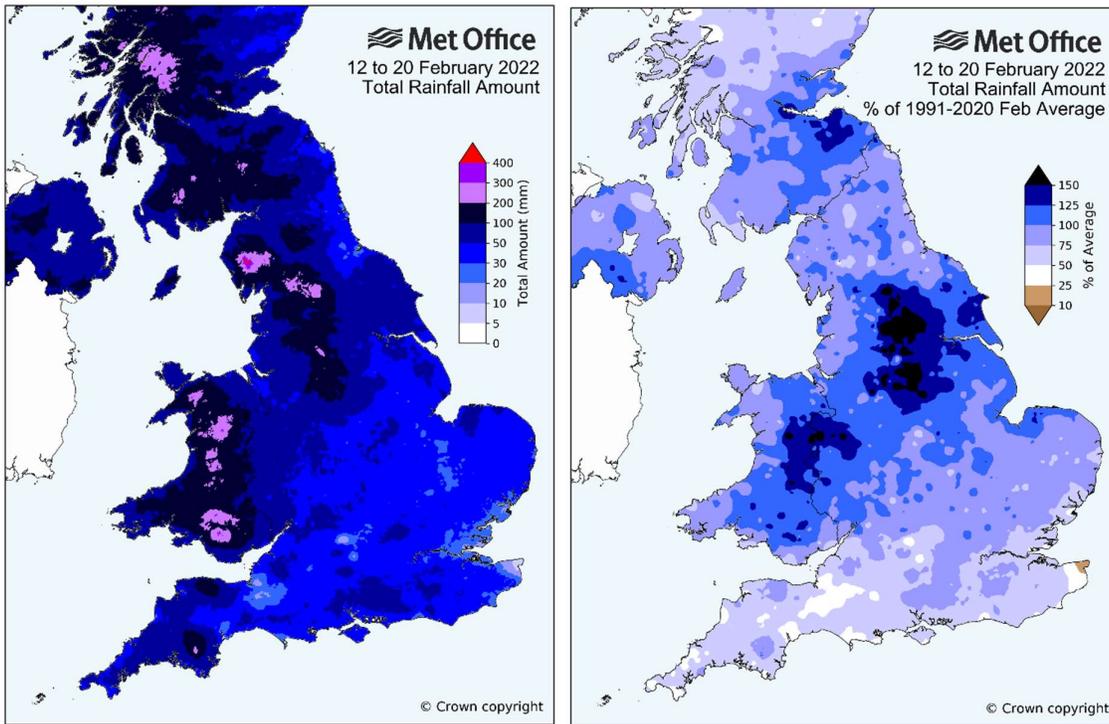
a) 0230 UTC 18 February 2022 b) 0900 UTC 19 February 2022



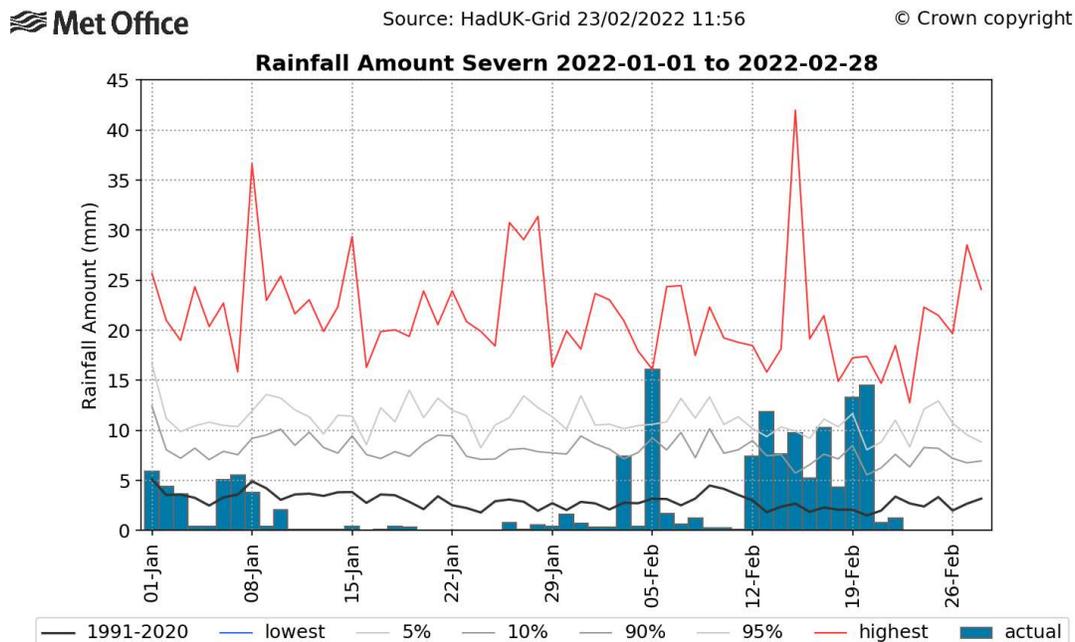
c) 0200 UTC 20 February 2022 d) 1430 UTC 20 February 2022



The maps below show rainfall accumulations across England and Wales for the nine-day period 12 to 20 February 2022, including these three named storms. More than 100mm of rain fell widely across upland areas, and over 200mm across parts of Wales and the Pennines. Much of Wales and northern England received the whole-month February 1991-2020 average rainfall, with some locations more than 150% of average. By 23 February, West Yorkshire had already recorded 224% of the February 1991-2020 long term average rainfall.



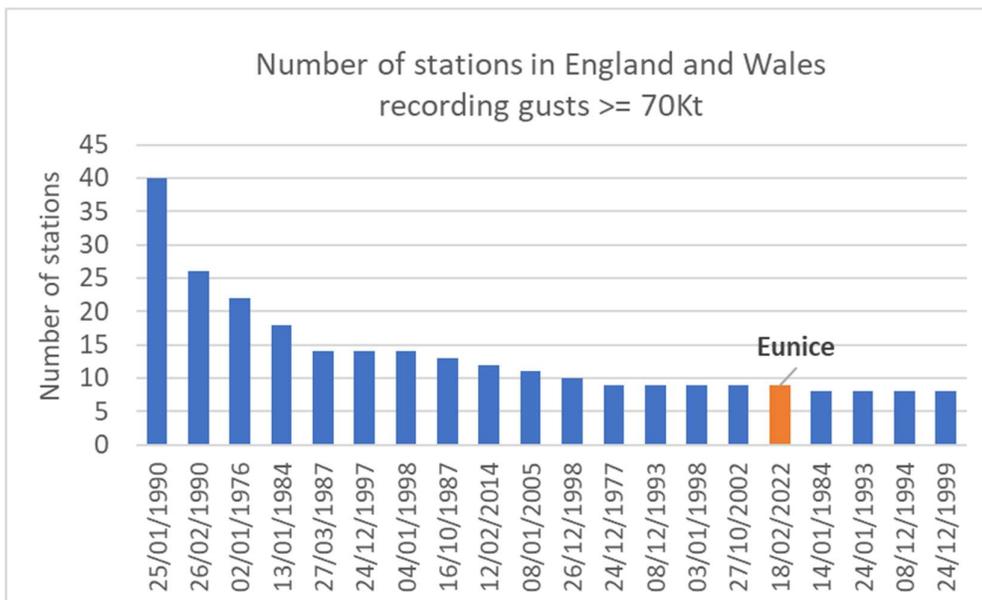
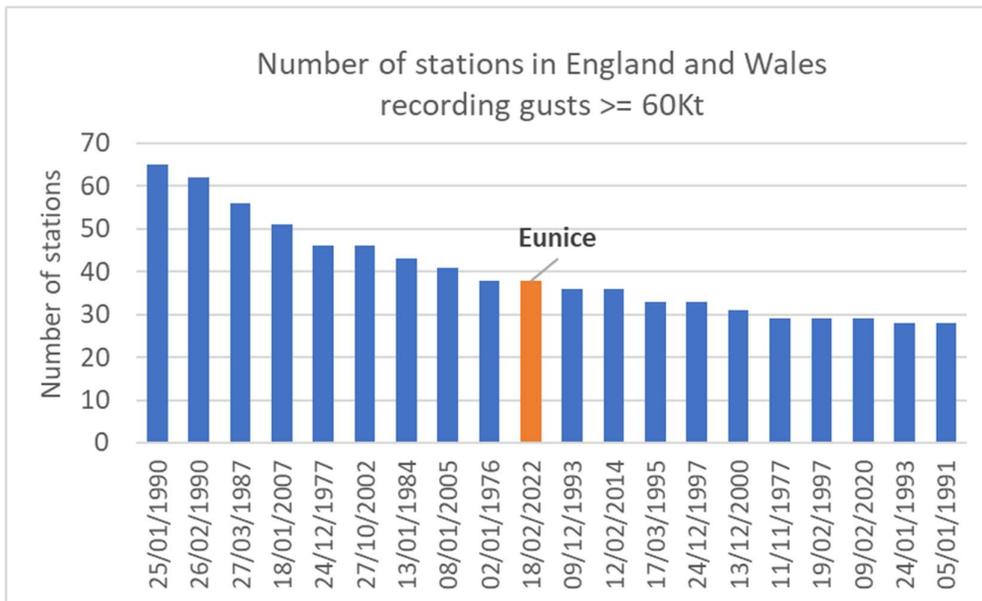
The chart below shows daily rainfall totals from 1 January to 22 February 2022 for the River Severn catchment. From 12 to 20 February, 84mm of rain fell on average across the catchment, 110% of the February 1991-2020 long term average. For each calendar day, the chart shows the wettest day on record (in red) and 90th and 95th percentile wettest days (in grey) for the daily series from 1891. While this period did not produce a stand out daily rainfall record, there was a sequence of notably heavy rain days with several well above the 95th percentile.



Storm Eunice – historical context

The charts below count the number of stations across England and Wales recording gusts ≥ 60 Kt (69mph) and ≥ 70 Kt (81mph) by date, based on observations from 1970 (i.e. over the last 50 years). These help compare storm Eunice with historical storms in the observational record, taking

into account a broad indication of severity and spatial extent. 38 stations across England and Wales recorded gusts in excess of 60Kt, and nine stations in excess of 70Kt. Based on these metrics, storm Eunice was the most severe storm to affect England and Wales since 12 February 2014. This 2014 storm was one of a sequence of major storms during the 2013/2014 winter, and a similar red warning was issued for wind. Storm Eunice was broadly comparable with this storm, although 12 February 2014 was more severe across parts of Wales (for example with gusts of 94Kt (108 mph) at Aberdaron, Gwynedd, 83 Kt (96 mph) at Lake Vyrnwy (Powys) and 81 Kt (93 mph) at Capel Curig (Gwynedd). Storm Eunice was more severe than other more recent storms, notably storm Ciara on 9 February 2020, but the charts show there are much more severe storms in the observational records. For example, wind gusts recorded during the Burns' Day storm of 25 January 1990 were approximately 10 to 15Kt higher than storm Eunice, and this storm resulted in widespread severe damage and almost 50 lives lost. The storm of 26 February 1990 was also much more severe.



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