THE UK'S WEATHER IN 2023

Paul Homewood

The Global Warming Policy Foundation
Briefing 73

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About the author

Paul Homewood had a career as an accountant in industry. He has been writing on climate and energy issues since 2011 and has written several papers for GWPF. This is his fifth annual review of the UK climate for GWPF.

Executive summary

According to the Met Office, the UK climate 'is continuing to change' and become more extreme.[1] But what does the actual evidence tell us? Using official data up to 2023, from the Met Office and other sources, this paper examines UK climate trends, and assesses the truth of these claims. The results are as follows:

- The rate of increase in average temperatures has been markedly lower since 2007 than before. The rate from 1987 to 2007 was 0.06°C per annum, but since then it has been 0.01°C per annum.
- Although June 2023 was the hottest in the UK in records dating back to 1884, it was only fourth hottest on the longer CET series, a full degree cooler than June 1846.
- Previous Met Office studies indicated that much of the warming since the 1970s was the result of increased sunshine, likely due to cleaner air. These findings contradict more recent Met Office claims that UK temperature changes are linked primarily to global warming.
- The frequency of days with extreme temperatures has been in decline since the 1970s, as more hot days have been offset by fewer cold ones.
- Annual rainfall averages in England and Wales during the last decade have been at similar levels to earlier periods, such as the 1870s and 1920s.
- While winters have become slightly wetter, there has been little change in rainfall trends for the other seasons. In particular, summers are not getting drier, as projections have suggested.
- Rainfall is not becoming more extreme, whether on an annual, monthly or daily basis.
- Sea levels have been rising at between 1.3 and 2.0mm a year around the UK, after taking account of vertical land movement, and there has been no acceleration in the rate of rise on multi-decadal scales.
- Wind storms have been declining in frequency and intensity since the 1990s.

In short, although it is slightly warmer than it used to be, the UK climate has changed very little in recent years. Long-term trends are dwarfed by the natural variability of British weather. Nor is there any evidence that weather is becoming more extreme. Nothing in the data indicates that climate will become more extreme in future.

1. Temperatures

The annual mean temperature in the UK in 2023 was 9.97°C, the second highest on record. Following the warm weather in 2023, the 10-year running average has risen slightly above the peak reached in 2007.

Following 25 years of warming from 1980, an unpredicted hiatus of about 10 years caused the overall warming rate since 1980 to be reduced from 0.4°C to 0.1°C per annum.

The rate of rise since 2007 is similar to the warming trends between the 1880s and 1950s. It is also worth noting that the 10-year average fell at a similar rate between 1961 and 1987. This raises the question of how much recent warming is due to natural variability.

As far as temperatures are concerned, the most notable feature was the warmest June on record since 1884, both in the UK and the Central England Temperature series (CET). However, although the UK record started in 1884, the CET goes back much further, and this shows that June 1846 was actually 1.2°C hotter; the Junes of 1676, 1822 and 1826 were also hotter. This destroys the notion that June 2023 was exceptional.

Moreover, daily temperatures did not get anywhere near record levels for the month in June last year, on CET peaking at 28.6°C. By contrast they hit 30.3°C in June 1976. The UK record for June still stands at 35.6°C, set in 1957 and 1976 in Southampton and London respectively, compared to a high of 32.2°C in June 2023.

Despite the warm weather in June, the summer of 2023 overall was unremarkable.

Figure 1: UK mean temperatures

Source: Met Office.[6]

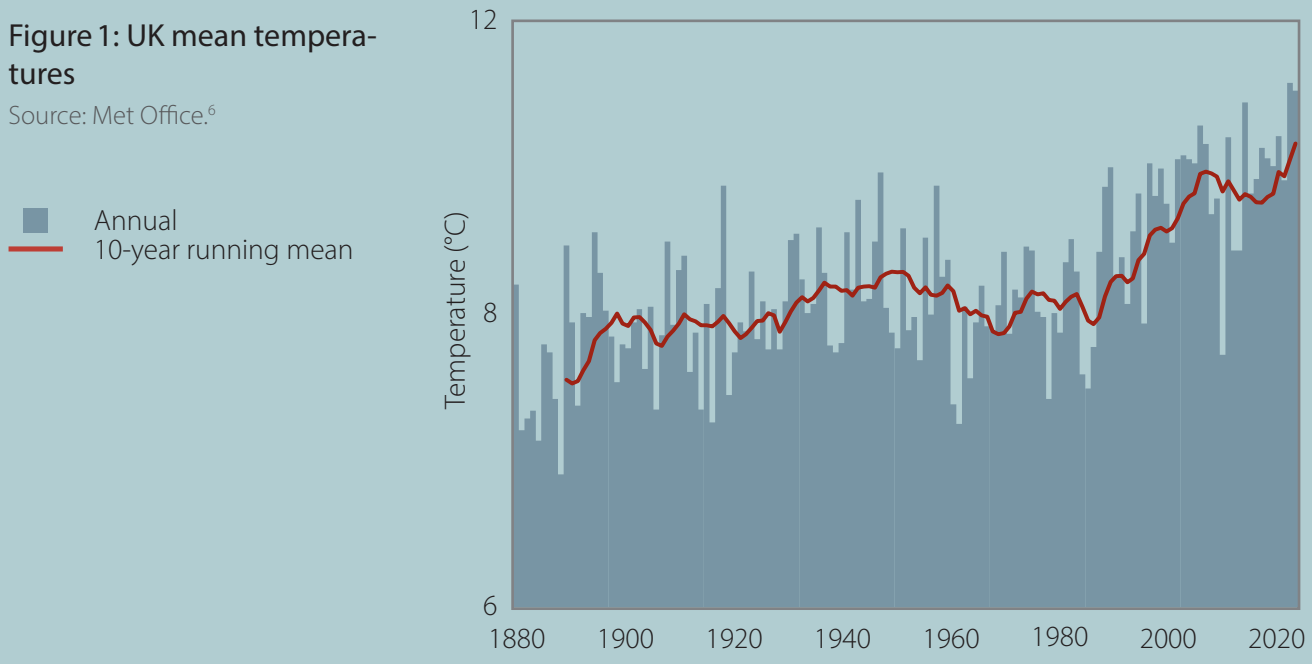

Figure 2 shows the daily CET mean temperatures for the year as a whole, and they indicate that apart from a handful of days, every day was within the 'normal band' between the 5th and 95th percentiles. However, there was a predominance of warmer than average weather.

The British weather is always highly variable, and can swing backwards and forwards from extremes of warmth and cold. In 2023, warmer-than-average weather predominated, but this is a weather phenomenon, not a climatic one.

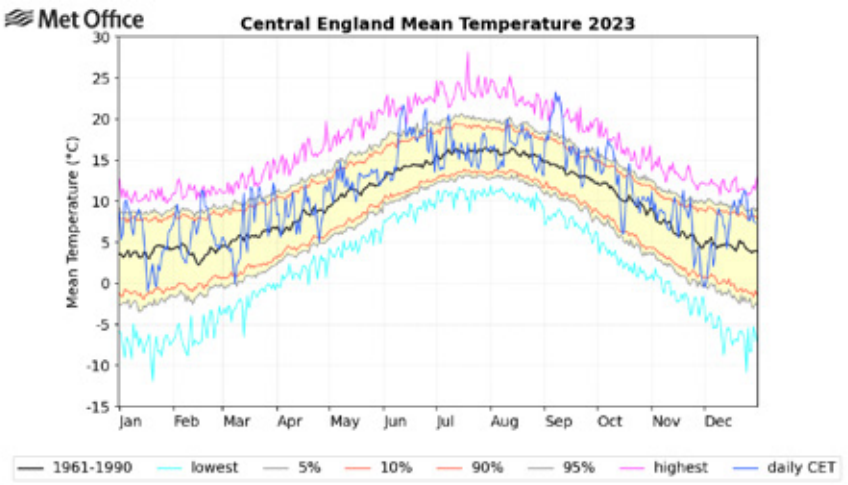

Figure 2: Daily CET temperature values for the year against 1961–1990 climatology

Source: Met Office.[7]

Temperature trends

All seasons display a similar pattern to the annual temperature trends, with a sharp rise in the 1980s and 90s, followed by much slower rise – or none at all – since 2006 (Figure 3). It is significant that this same period was marked by an increase in sunshine hours, particularly in autumn and spring (Figure 4). This increasing trend appears to have ended in the last decade.

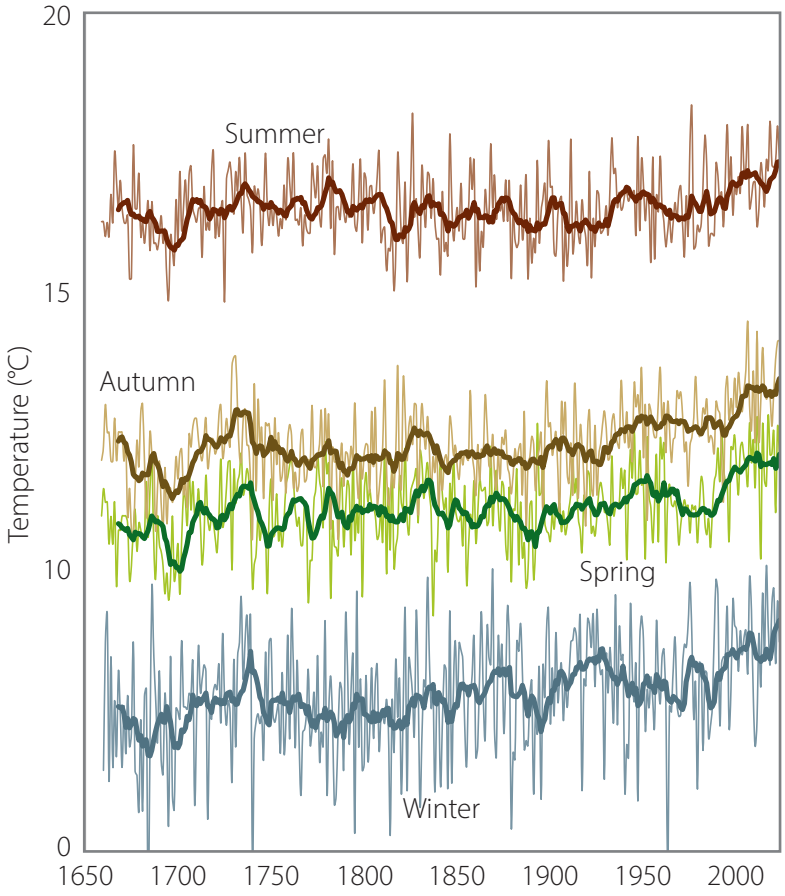

Figure 3: Seasonal temperatures, 1659–2023.

Bold lines are 10-year running averages. Source: HadCET.[5]

Correlation with sunshine

A Met Office study published in 2006 found there was a strong positive correlation between sunshine and mean temperatures, particularly in autumn and spring.[2] It also found little correlation, whether positive or negative, during winter. There is therefore evidence that some of the warming since 1980 could be the result of more sunshine. The report stated that this increase in sunshine was likely linked to reduced air pollution, following successive Clean Air Acts.

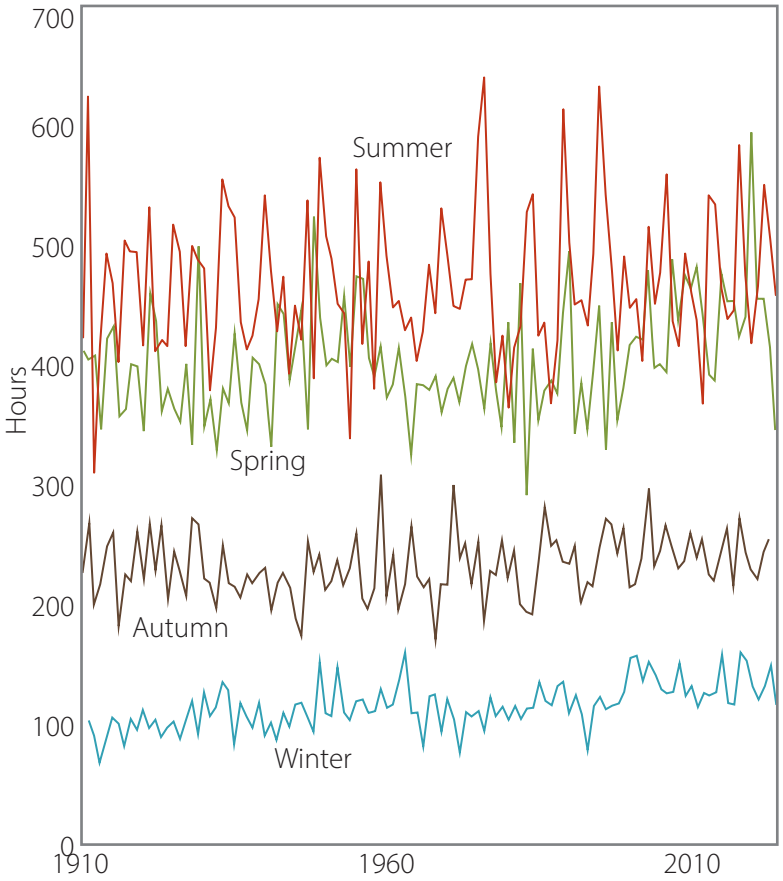

Figure 4: Sunshine hours, 1910–2023.

Source: Met Office.[7]

Winter temperatures, which are notably little higher than in the 1920s, are highly linked to the North Atlantic Oscillation (NAO), which has been strongly positive since 1980. Strong positive phases of the NAO in winter tend to be associated with above-normal temperatures in northern Europe.

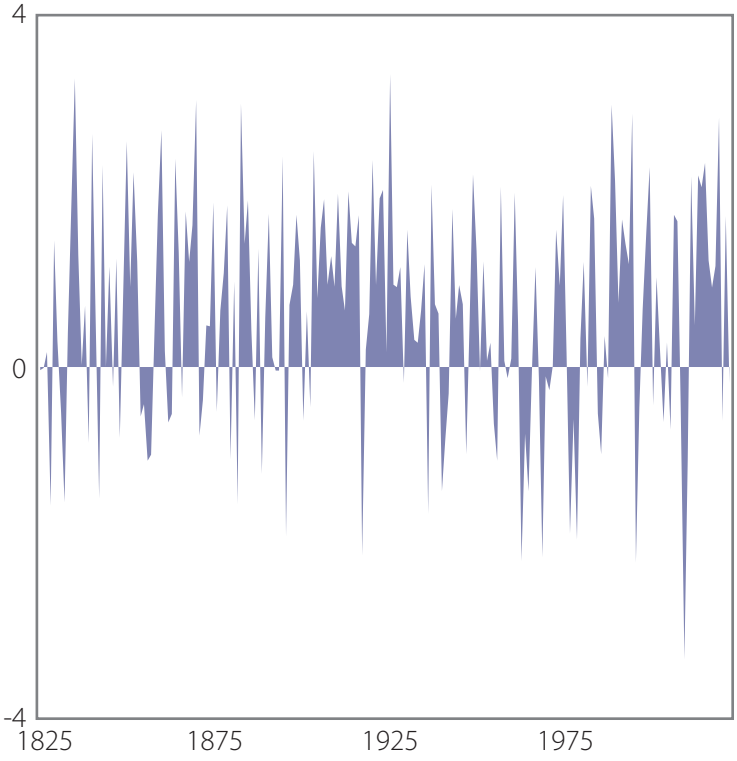

Figure 5: Winter North Atlantic Oscillation Index, 1825–2023.

Souce: Climatic Research Unit.[8] The y-axis is unitless.

The extremes of temperatures in Central England, as measured by the difference between average summer and winter mean temperatures, have been steadily declining since 1940 (Figure 6).

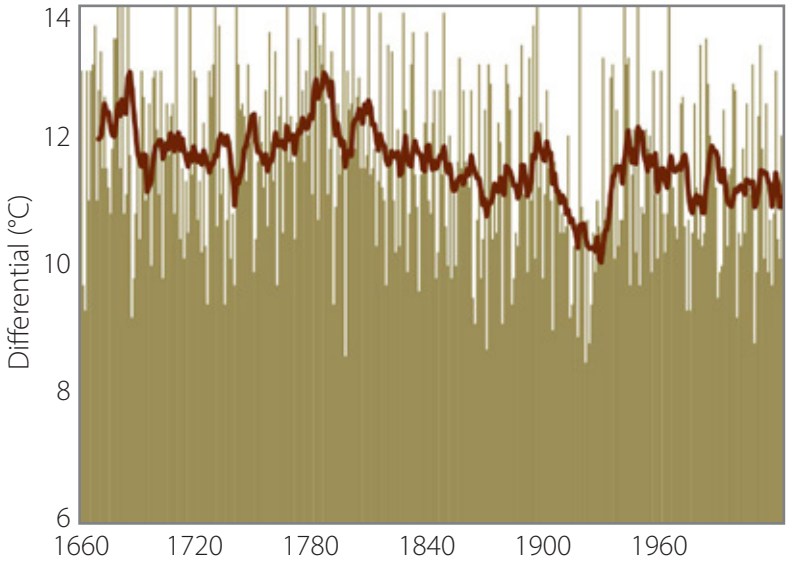

Figure 6: CET summer/winter temperature differentials, 1659–2023.

Red line is ten-year running average. Source: HadCET.[9]

Since the 1960s, the frequency of extremely hot days, as measured by the 95th percentile, has been increasing (Figure 7a). However, this has been accompanied by a similar reduction in the number of extremely cold days (Figure 7b) a phenomenon that has deadlier consequences.

When hot and cold days are combined, there is no long-term trend (Figure 7c). The most extreme years were 1963, 1976, 1983, 1995, 2010 and 2018.

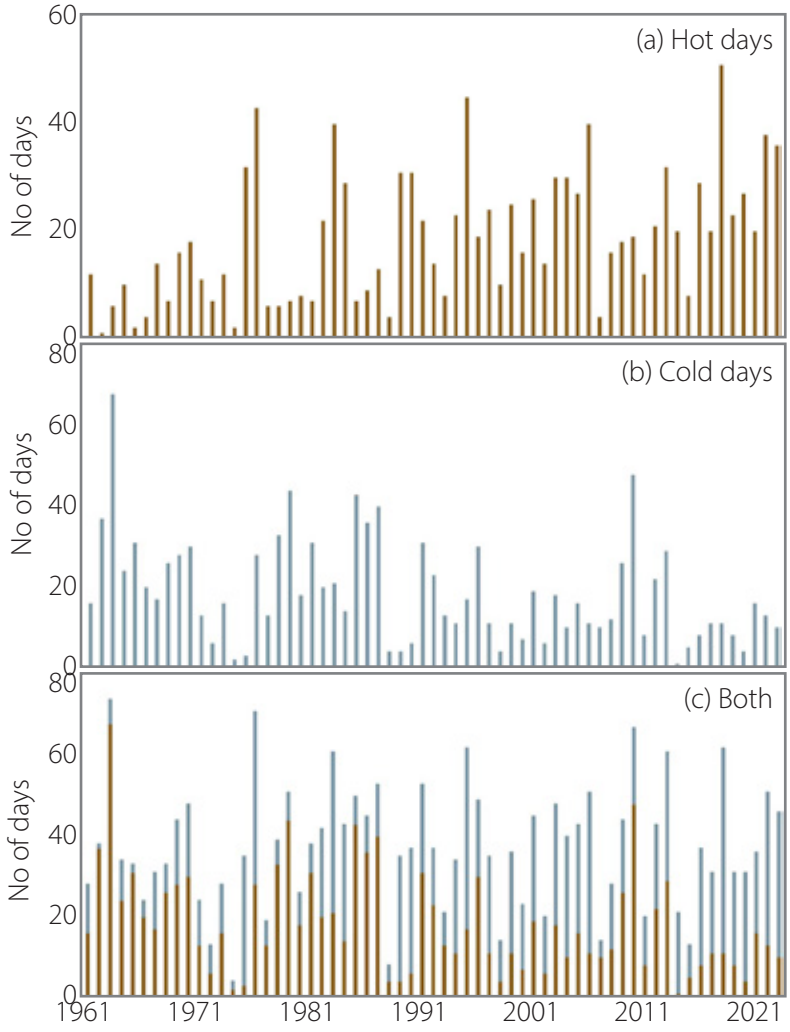

Figure 7: Frequency of temperature extremes, 1659–2023.

Red line is ten-year running average. Source: HadCET.[10]

2. Precipitation trends

Annual

Annual rainfall in England and Wales has been increasing since 1980 (Figure 9a), but the 10-year average is at similar levels to earlier periods, such as the 1870s and 1920s. There was a significant rise in rainfall in Scotland during the 1980s (Figure 9b), but there has been little change in trend since. Rainfall trends in Northern Ireland have barely changed since 1931 (Figure 9c).

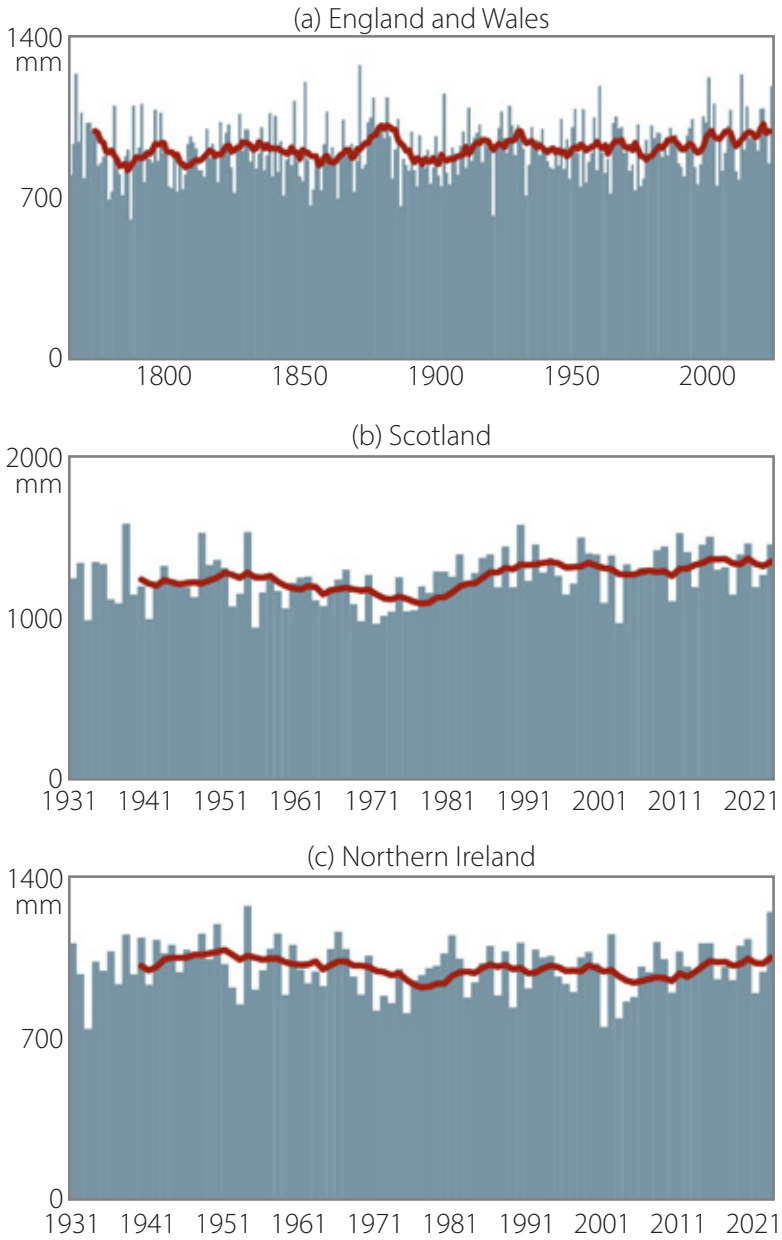

Figure 8: Annual precipitation by country.

Red line is ten-year running average. Note the different scales on the *x*-axes. Source: HadUKP.[11]

Seasonal

Other than winter, there are no obvious long-term trends in seasonal rainfall. Although winters have been wetter than average in recent years, the 10-year average is only slightly higher than during the 1910s and 20s. The principal reason is the record wet winter of 2013/14.

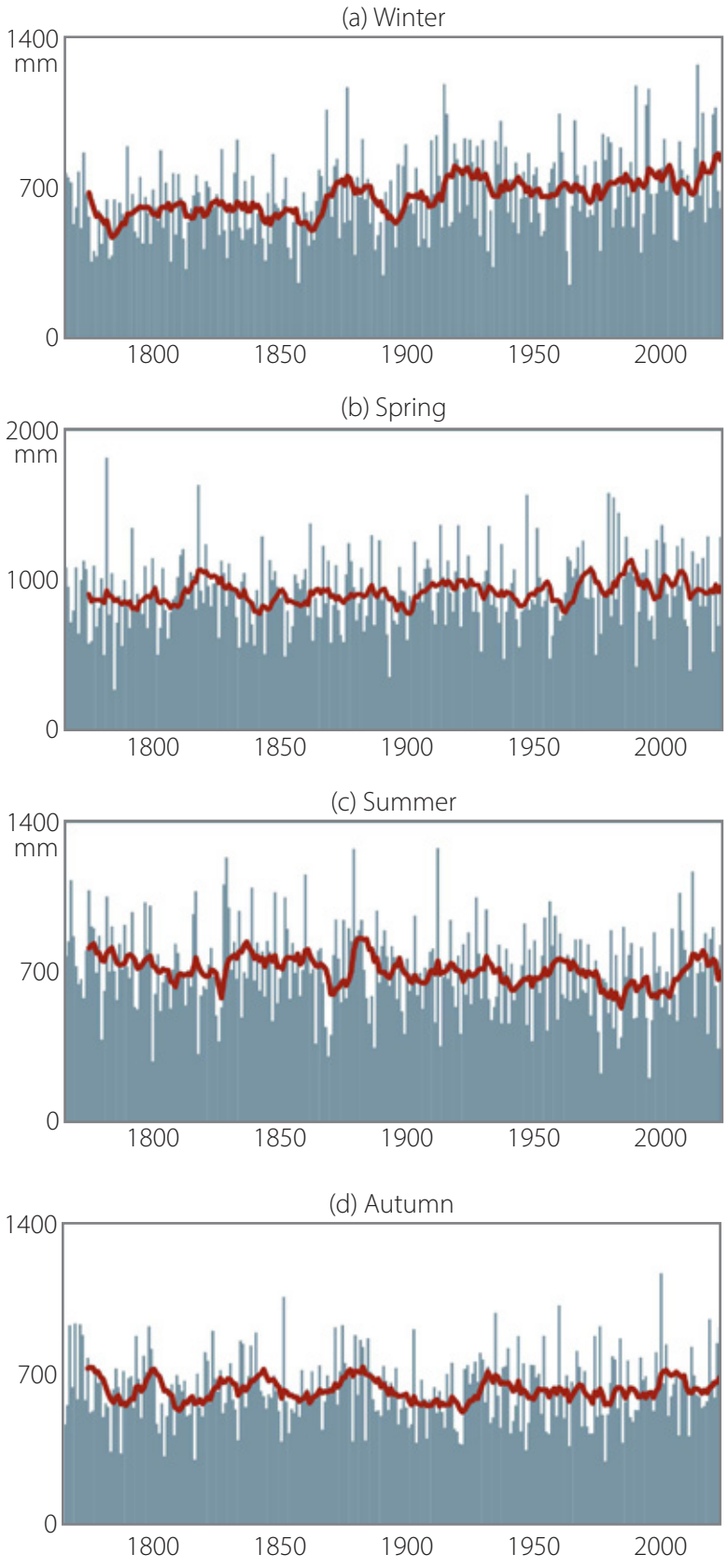

Figure 9: Annual precipitation by season, 1766–2023.

England and Wales only. Red line is ten-year running average.
Source: HadUKP.[11]

Extremes

In England and Wales, most of the ten wettest years occurred in the years up to and including 1960 (Figure 10a). The only two exceptions are 2000 and 2012. The situation regarding the ten driest years is even starker, with the most recent significant year being 1964 (Figure 10b).

October was the wettest month in 2023 in England and Wales, with 177.6 mm of rain. This was the 25th-wettest month in the series, but well below the record set in October 1903 of 218.1 mm.

There have been 37 months with more than 170 mm of rain since 1766, about once every seven years on average (Figure 11a). Prior to last year, the previous month in the list was January 2014, an indication that extreme rain months are not becoming more common. Indeed, of the ten wettest months, only one has occurred since 1970; this was November 2009.

Analysis of daily rainfall also shows there is no evidence of rainfall becoming more extreme (Figure 11b). During Storm Babet, 22.82 mm fell on 19 October 2023, the 44th highest daily rainfall in England and Wales since 1931. It was therefore not an unusual event. That day was the only one last year when more than 20 mm fell.

Seven days have exceeded 30 mm since records began in 1931, but none of these have occurred since 2000.

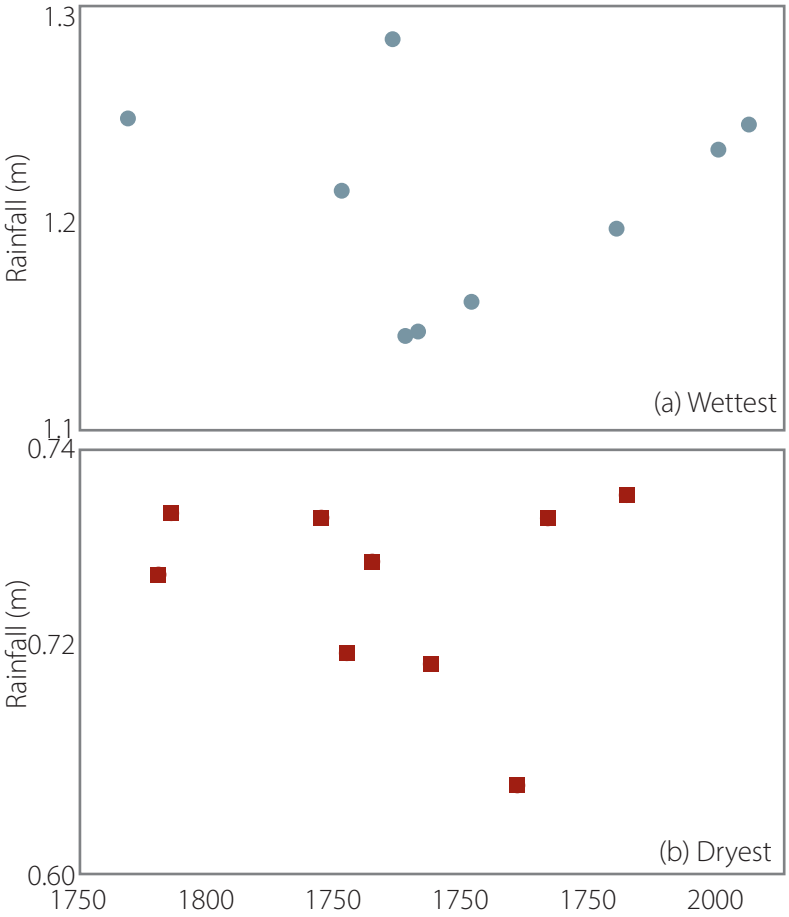

Figure 10: Extreme rainfall years, 1760–2023.

(a) top 10 wettest years and (b) top 10 driest years. Source: England & Wales precipitation series.[10]

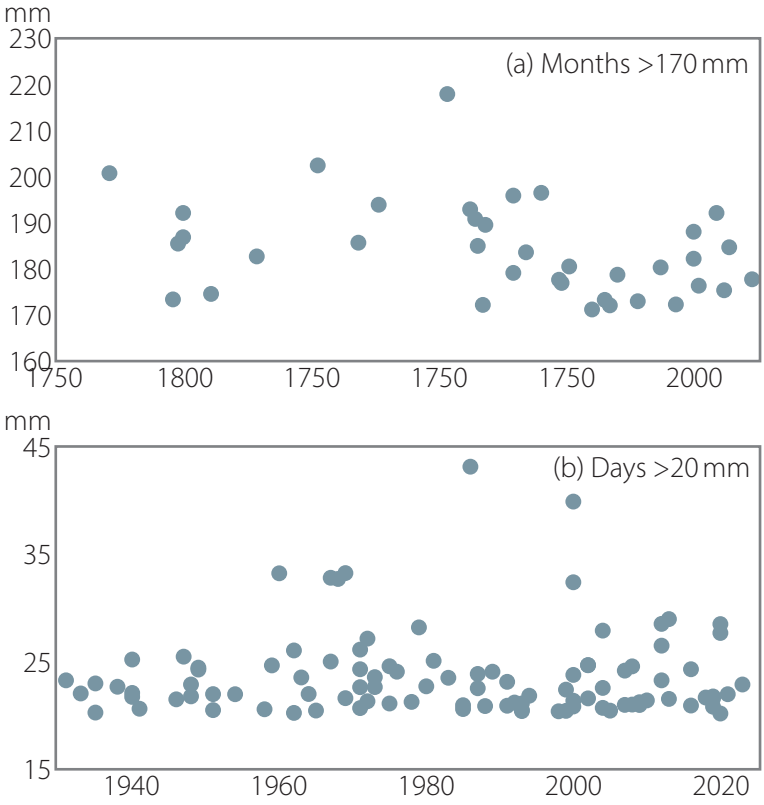

Figure 11: Extreme rainfall: monthly and daily.

Note different timescales in the two graphs. Source: England & Wales precipitation series.[11]

3. Sea-level rise

Any analysis of sea-level trends needs to first consider vertical land movement. Generally speaking, the land mass of Scotland and Northern Ireland is rising, while the rest of the UK is sinking, by perhaps as much as 1 mm per year in the extreme south west. This is the result of isostasy, a brief explanation of which follows. During the Ice Age, glacial ice forced the Earth's crust down, squeezing the mantle below to the sides, thus raising the Earth's surface there. As the ice melts, the process reverses, the crust below rebounds where the ice was, but subsides at the edges.

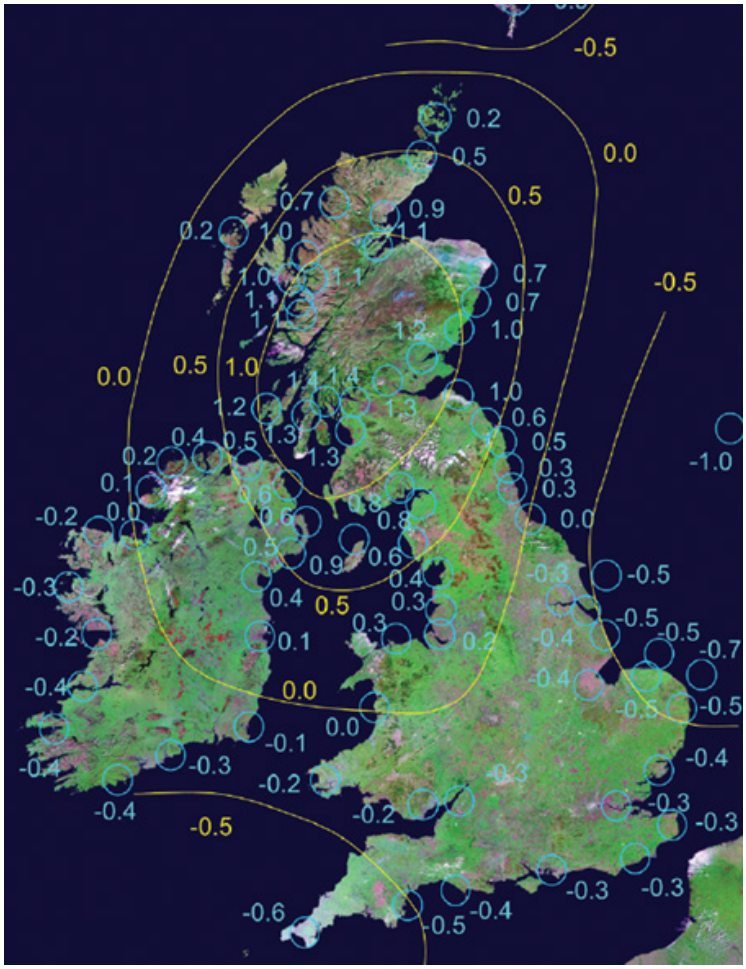

Figure 12: Land and sea movement

Current rate of relative land- and sea-level change in the British Isles in millimetres, showing relative land uplift as positive and relative subsidence as negative. Source: Shennan et al.[12]

There are only three tidal gauge stations in the UK with long-term, relatively uninterrupted and high-quality data – North Shields in Northumberland, Newlyn in Cornwall and Aberdeen in Scotland. According to Peltier 2004, the land at Newlyn is sinking at about 0.64mm per year, and rising by 0.11mm per year at North Shields, and 0.56mm at Aberdeen.[3] Tidal gauges at the three sites show that sea levels have been rising at 1.89mm, 1.94mm and 0.78mm per year respectively, or 2.00mm, 1.30mm and 1.34mm after excluding the element of vertical land movement. Note, however, that start dates are different for the three sites, so direct comparisons cannot be made.

Analysis of the rolling 50-year trends (Figure 14) suggests higher current rate of rise than in the first half of the 20th century for North Shields and Newlyn. This was followed by a decline in the rate of rise, with a minimum reached in the 50 years from 1950 to 2000. This minimum coincides with the long period of Northern Hemisphere cooling after the war, particularly in the 1960s and 70s, and is associated with the cold phase of the Atlantic Multidecadal Oscillation.[4] Sea level rise in Aberdeen is currently similar to the rate in the first half of the twentieth century.

Despite an acceleration in sea-level rise since 1970 at all three sites, the data shows similar rates of increase during periods prior to 1940.

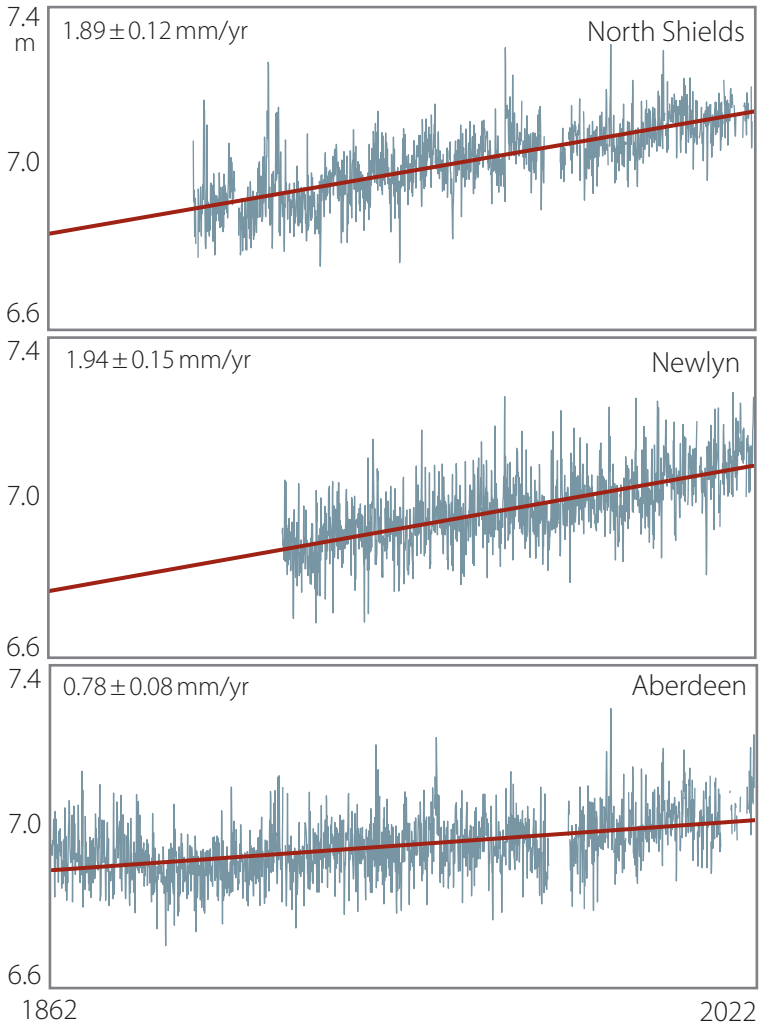

Figure 13: Long sea-level records: annual changes.

Source: NOAA.[3]

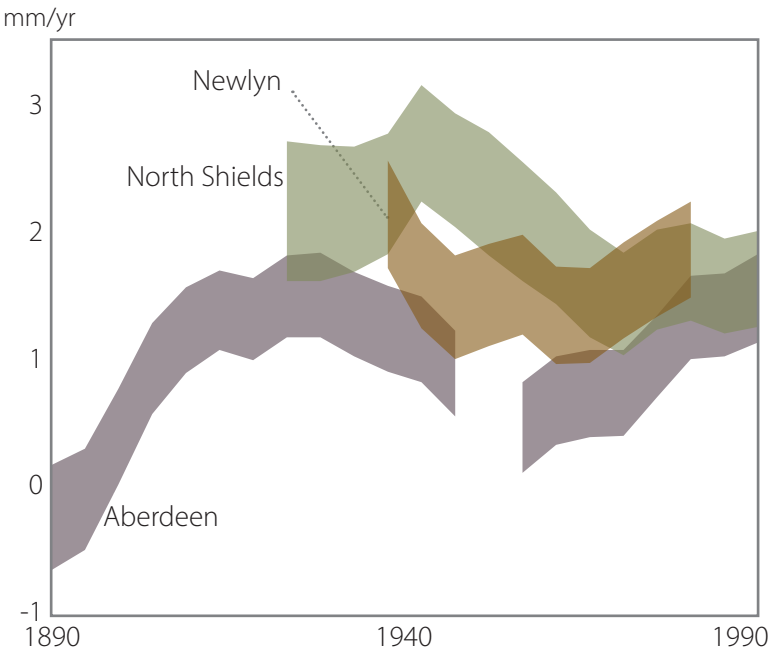

Figure 14: Long sea-level records: 50-year trends.

Source: NOAA.[3]

4. Storms

The naming of UK storms by the Met Office in 2015 may have encouraged the belief that storms are becoming more powerful. In fact, the opposite is true, as the Met Office have themselves frequently confirmed (Figure 15).

The Met Office's *State of the UK Climate 2023* report makes it clear that the Burns Day storm in 1990, the Boxing Day storm in 1998 and the Great Storm of 1987 were very much more severe than any storm in the last decade.

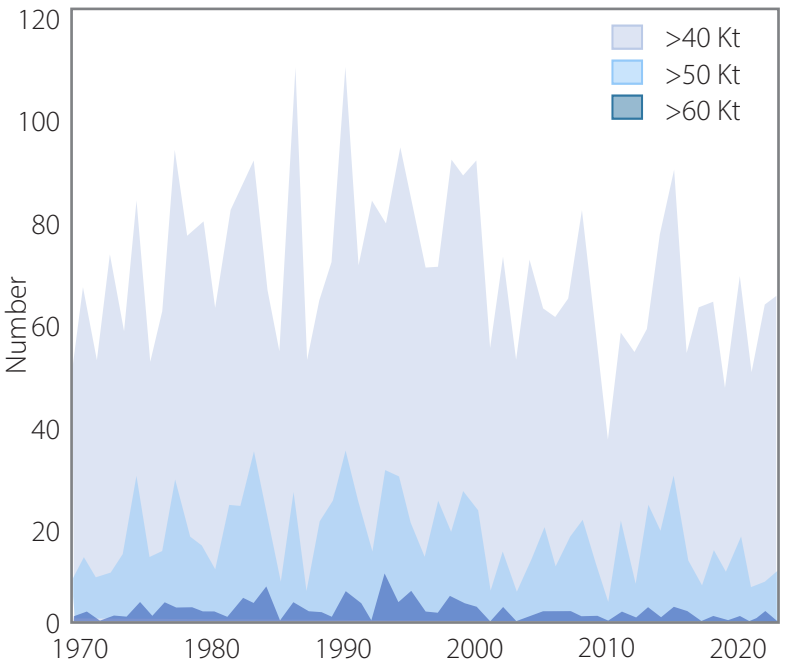

Figure 15: Wind speeds, 1969–2023.

Number of days each year on which gusts exceeding given speeds are recorded by at least 20 or more UK stations, from 1969 to 2023. Stations more than 500 m above sea level are excluded. Source: Met Office, State of the UK Climate, 2023.[1]

Another Met Office report found that there is no evidence of any upward trend in wind gust speeds since 1969, the date from when reliable data is available.[5] One analysis of the top wind gust speeds at Bingley each year confirms these findings, and suggests that, if anything, wind speeds have been falling.

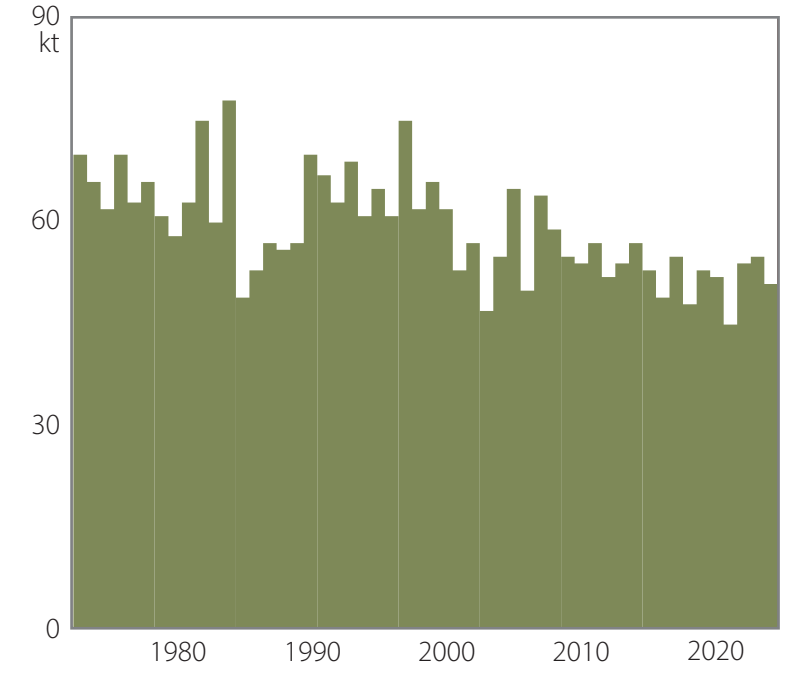

Figure 16: Wind gusts at Bingley, 1972–Jan 2024.

Strongest gust each year. Source: Met Office.[13]

Notes

1. Met Office State of the UK Climate 2023. - https://www.metoffice.gov.uk/research/climate/maps-and-data/about/state-of-climate
2. Met Office - https://web.archive.org/web/20151001000000*/https://www.metoffice.gov.uk/media/pdf/q/h/uk_climate_trends.pdf
3. https://www.tidesandcurrents.noaa.gov/sltrends/sltrends_global.html.
4. NOAA - https://www.aoml.noaa.gov/phod/faq/faq_fig2.php
5. Met Office - https://www.metoffice.gov.uk/research/news/2021/recent-trends-and-future-projections-of-uk-storm-activity..
6. UK Met Office - https://www.metoffice.gov.uk/research/climate/maps-and-data.
7. https://www.metoffice.gov.uk/hadobs/hadcet/cet_info_mean2023.html
8. https://crudata.uea.ac.uk/cru/data/nao/
9. https://www.metoffice.gov.uk/hadobs/hadcet/data/download.html
10. CET Daily: https://www.metoffice.gov.uk/hadobs/hadcet/graphs/index.html
11. Met Office: https://www.metoffice.gov.uk/hadobs/hadukp/data/download.html
12. Late Holocene relative land- and sea-level changes: Providing information for stakeholders – Shennan et al: https://www.geosociety.org/gsatoday/archive/19/9/abstract/i1052-5173-19-9-52.htm.
13. Data supplied by Met Office - https://notalotofpeopleknowthat.wordpress.com/2024/02/08/.wind-speeds-at-bingley/

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