THE UK'S WEATHER IN 2020-21

Paul Homewood

The Global Warming Policy Foundation
Briefing 60

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Contents

Executive summary

The UK Parliament has declared a climate emergency and, as a result, enacted a legal obligation for Net Zero greenhouse gas emissions by 2050. Meanwhile, the UK Met Office has declared that 'climate change is already being felt across the UK', amidst claims that our weather is becoming more extreme. And the Environment Agency asserts – without the slightest evidence – that climate change 'will drive higher rainfall in shorter periods, faster coastal change, longer droughts'.

But what does the actual evidence tell us? Using official data up to 2021, 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:

- Although temperatures rose between the 1980s and early 2000s, average temperatures have remained stable since then.
- This warming interlude could be connected to natural oceanic cycles, and also the reduction in air pollution following the Clean Air Acts of the 1950s and after.
- Seasonal temperature trends display the same pattern as annual ones. In particular, summer temperatures have still not exceeded those of 1976.
- Heatwaves in 1975 and 1976 were much more intense than anything that has followed.
- In contrast, extreme coldwaves have become much less common.
- Although rainfall has increased in Scotland in recent decades, over the rest of the country there has been little change.
- In England and Wales, annual rainfall totals in the last two decades are not unprecedented.
- There has also been little change in seasonal rainfall trends in England and Wales. Notably, winters are not wetter than in the past, nor are summers drier.
- Analysis of data for England and Wales shows that rainfall is not becoming more extreme, whether on a decadal, annual, monthly or daily basis.
- Although 2020 boasted the wettest February on record, that month was actually unremarkable in historical terms, being only the 38th wettest in England and Wales.
- Met Office data clearly shows that wind storms have declined in strength since the 1980s.
- Sea levels around the UK have risen at a rate of about 1.5 mm per year, after allowing for vertical land movement. This is a similar rate to the early 20th century, and there is no evidence of acceleration.

In short, although it is slightly warmer than it used to be, the UK climate has changed very little. Long-term trends are dwarfed by the natural variability of weather. Nor is there any evidence that weather is becoming more extreme, whether in terms of heatwaves, rainfall or droughts. The main difference is the relative absence of extreme cold nowadays; nothing in the data indicates that climate will become more extreme in future.

There is no climate emergency in the UK.

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 fourth annual review of the UK climate for GWPF.

1. Introduction

According to the UK Met Office's State of the UK Climate 2020 report, 'climate change is already being felt across the UK'.[1] But what does the actual data tell us? Using the official data from the Met Office and other sources, this paper examines UK climate data for 2020 and 2021, and assesses the truth of this claim. It analyses:

- temperature trends
- temperature extremes
- precipitation trends
- precipitation extremes
- February 2020 storms
- sea levels
- wildfires
- sunshine hours.

2. Temperature trends

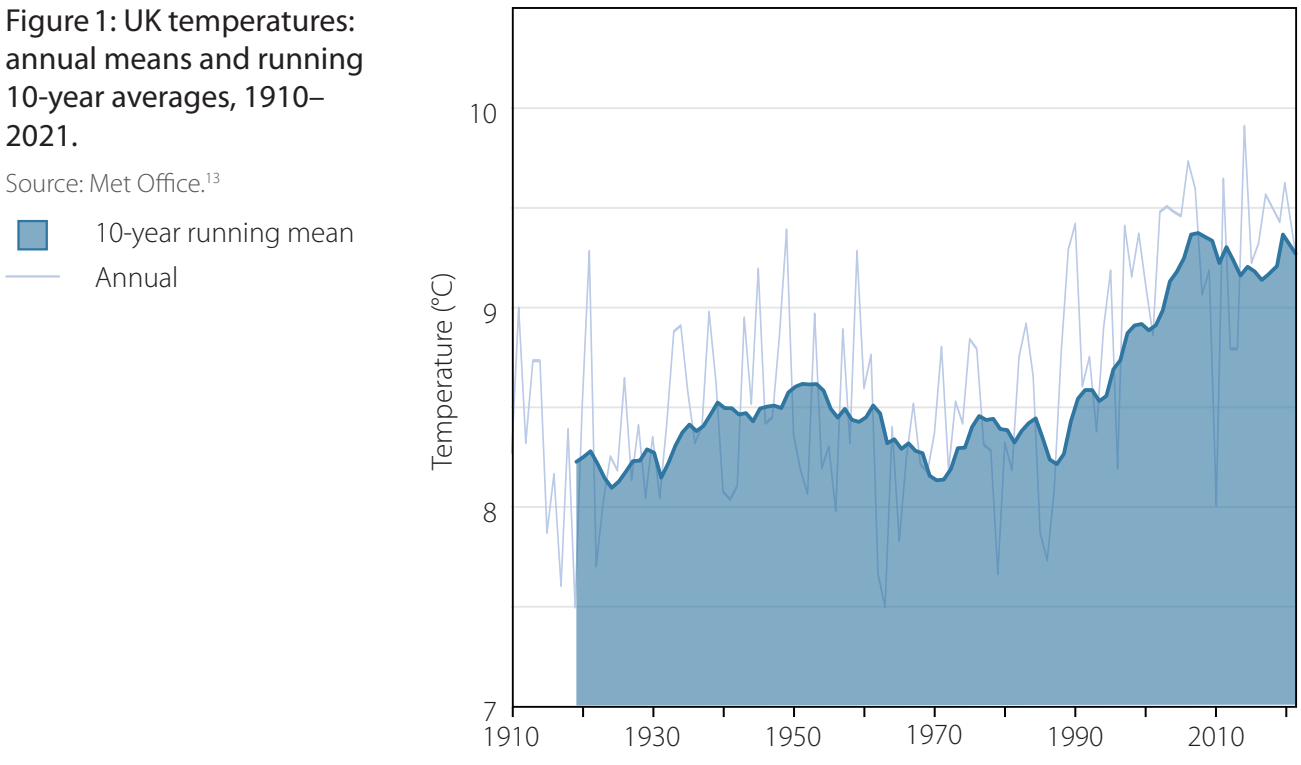
According to the Met Office:

> All of the top-ten warmest years for the UK in records back to 1884 have occurred since 2002, and, for central England, the 21st century so far has been warmer than the previous three centuries. The last 30-year period (1991–2020) has been 0.9°C warmer than the preceding 30 years (1961–1990).[1]

But this fails to tell the whole story. As Figure 1 shows, UK temperatures have been stable since 2006, following a sharp rise in the 1980s and 90s.

Figure 1: UK temperatures: annual means and running 10-year averages, 1910–2021.

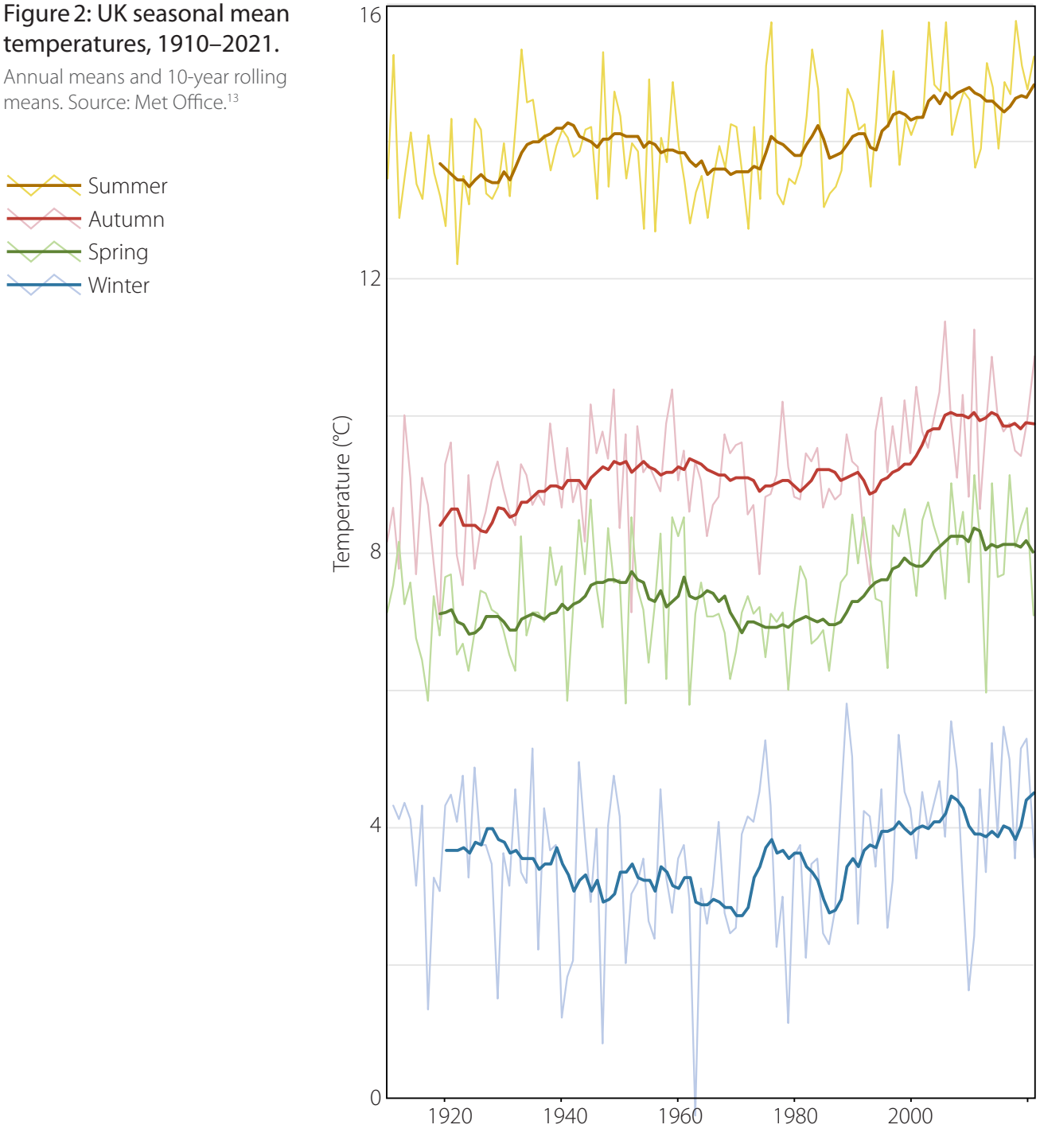
Source: Met Office.[13]



We find this pattern repeated for each season, with a rapid rise in the 1980s and 90s, followed by little change since (Figure 2). It is notable that long-term winter temperature trends appear to be little higher than during the 1920s.

Figure 2: UK seasonal mean temperatures, 1910–2021.

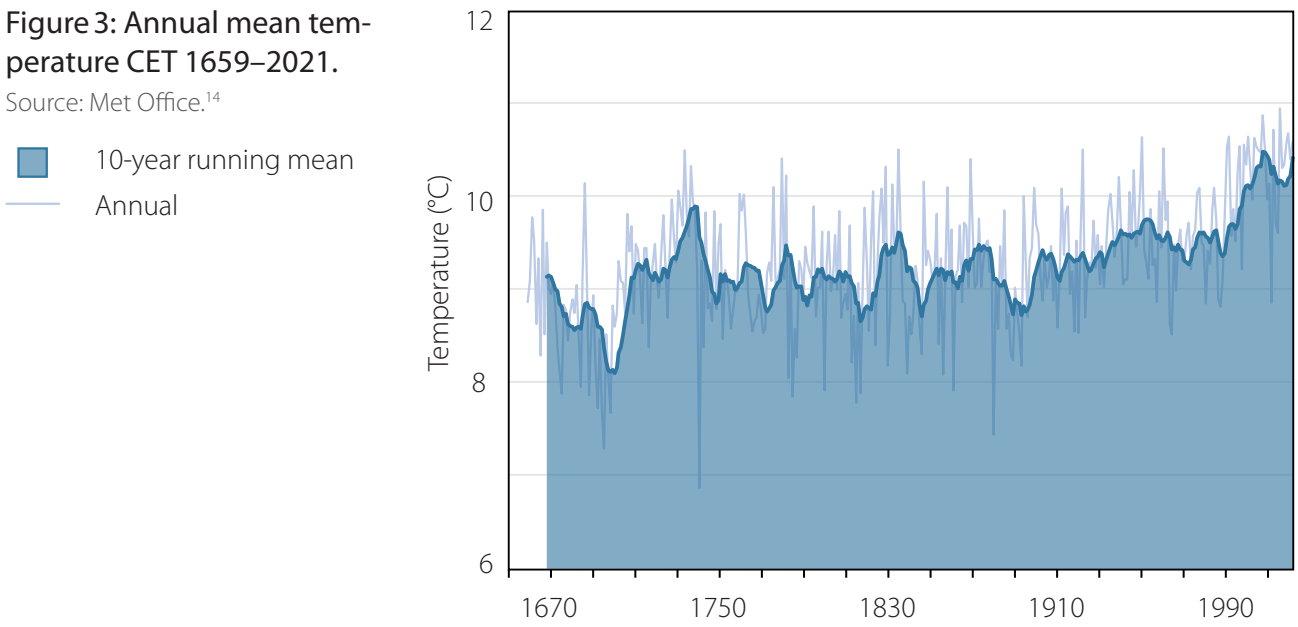
Annual means and 10-year rolling means. Source: Met Office.[13]



The Central England Temperature Record (CET) clearly shows the warming pause of the last decade too. It is also notable that there have been periods previously when temperatures jumped sharply, as they did during the 1980s and 90s. The decades leading up to the 1730s are another example. There is, therefore, nothing unusual about recent years. What we have seen is a rise in temperatures over a period of about 20 years, followed by 15 years of standstill.

Figure 3: Annual mean temperature CET 1659–2021.

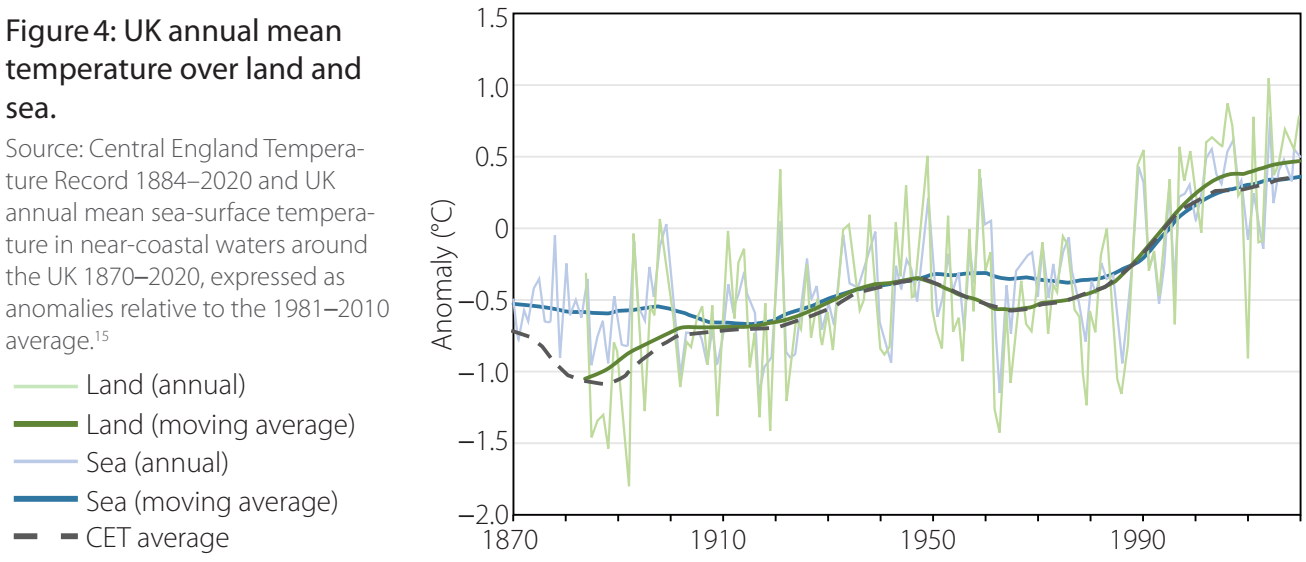
Source: Met Office.[14]



There is a clear correlation between CET trends and UK sea surface temperatures (Figure 4).

Figure 4: UK annual mean temperature over land and sea.

Source: Central England Temperature Record 1884–2020 and UK annual mean sea-surface temperature in near-coastal waters around the UK 1870–2020, expressed as anomalies relative to the 1981–2010 average.[15]



It is widely accepted that ocean temperatures regulate land temperatures, rather than the other way round.[2] The rise in both land and sea temperatures broadly follow the switch of the Atlantic Multidecadal Oscillation (AMO) from its cold to its warm phase, a transition that took place between 1976 and 1998. Since then, the AMO has remained in its warm phase; historically, this can last for between 20 and 40 years.[3]

The AMO is a natural cycle (Figure 5),[3] so it is likely that Atlantic Ocean cooling will take place at some stage in the next decade, with a resultant impact on UK temperatures. Significantly, the standstill in UK temperatures since 2006 is closely matched by a plateauing of the AMO, which began around the same time.

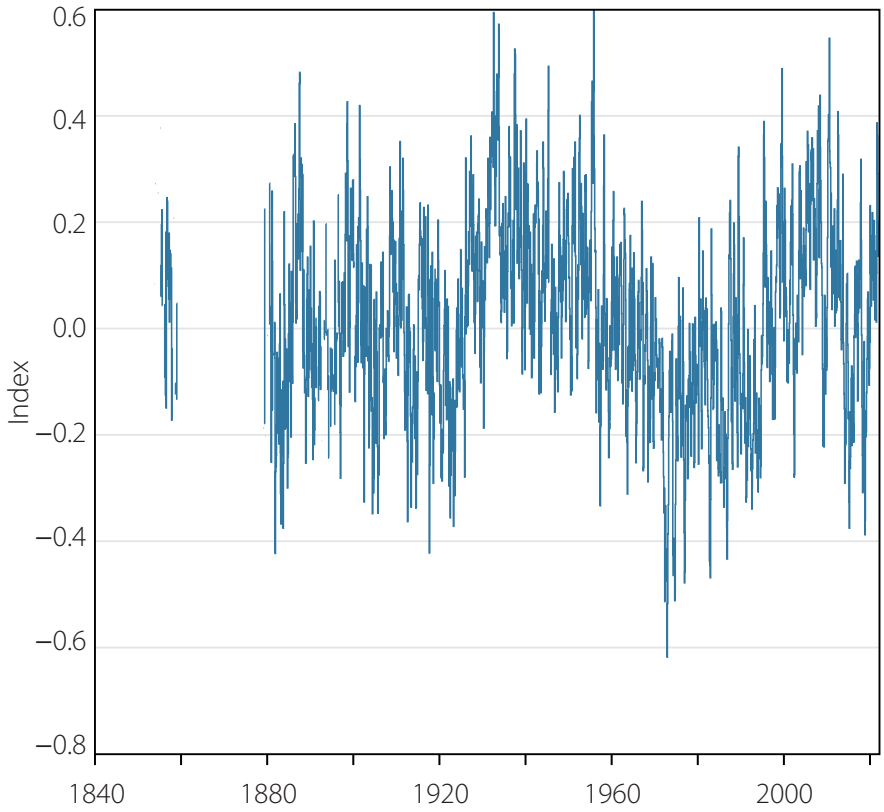


Figure 5: Atlantic Multidecadal Oscillation 1857–2021.
Source: KNMI.[16]

3. Temperature extremes

In central England, the hottest summer remains that of 1976. The second hottest was 1826. The data does not support the proposition that UK summers are becoming progressively and significantly hotter – the Mediterranean summers we have been promised for many years.[4] What is apparent, however, is that extremely cold winters are now rare (Figure 6). It is also worth noting, however, that even the mildest winters in recent years have not been unprecedented. The warmest winter was in 1868–69; and 1833–34 and 1988–89 also appear in the top four, along with 2015–16. This indicates that mild winters are meteorological phenomena, rather than climatic ones.

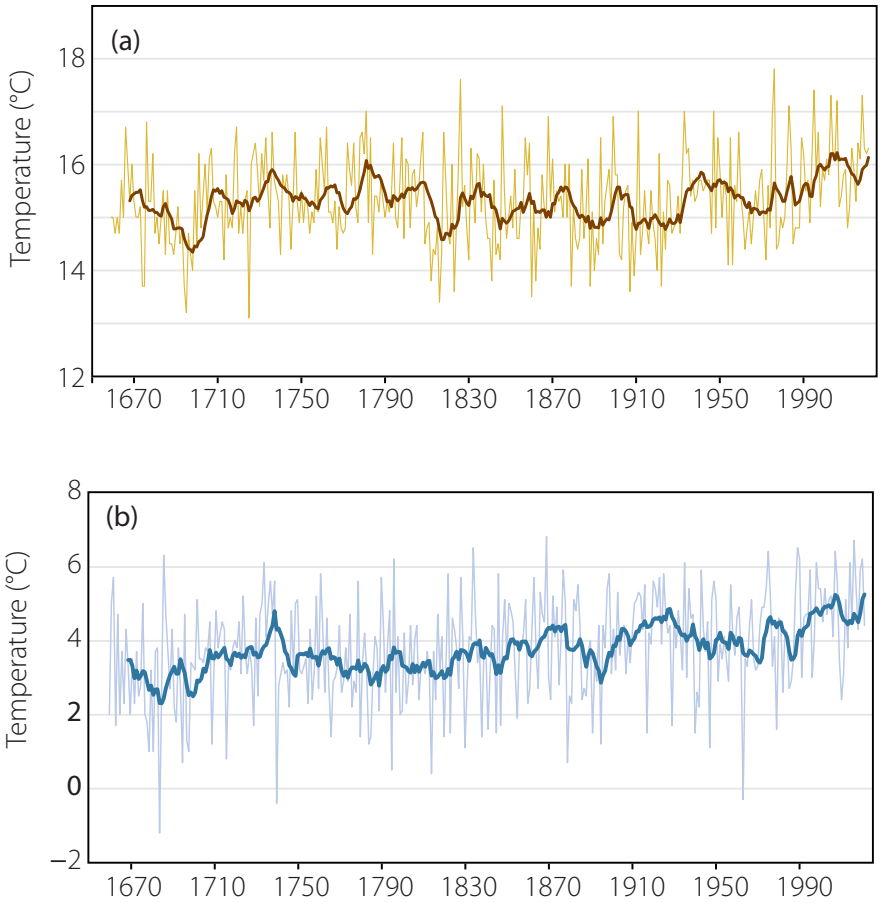


Figure 6: UK summer and winter temperature trends 1659–2021.

(a) mean maximum summer temperature, (b) mean minimum winter temperature. Bold lines are 10-year running means. Source: CET.[14]

The concept of 'extreme temperatures' is, of course, a relative one. London's summer temperatures are not more extreme than Newcastle's simply because average temperatures are higher. The best measure of temperature extremes is the difference between summer and winter temperatures, as shown in Figure 7. It is evident that in the past much greater extremes than we see nowadays were commonplace. In other words, we are experiencing a much more moderate climate now.

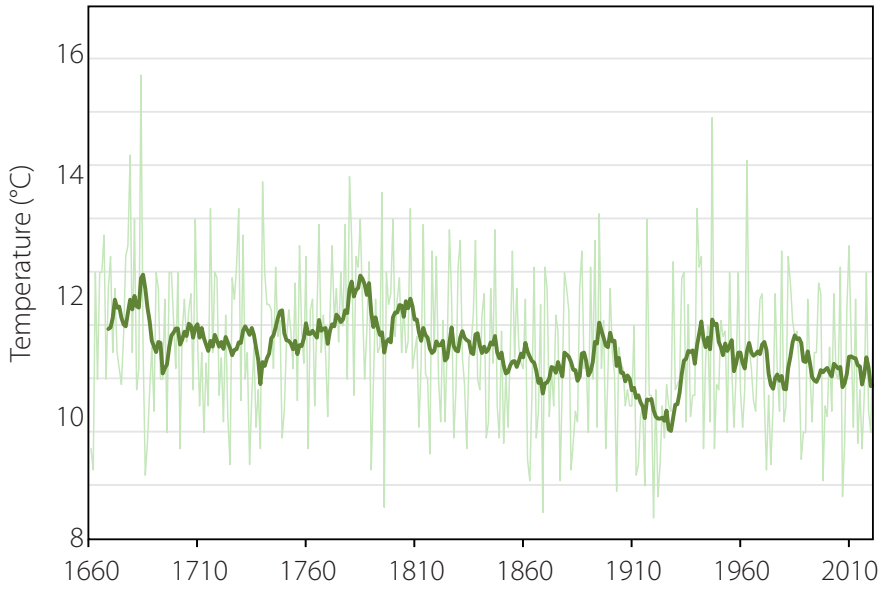


Figure 7: Difference between average CET summer and winter temperatures, 1660–2020.

Annual averages, with 10-year running mean in bold. Source: CET.[14]

Analysis of CET daily temperatures also shows that the number of days of extreme temperatures, both hot and cold, has declined since 1900:

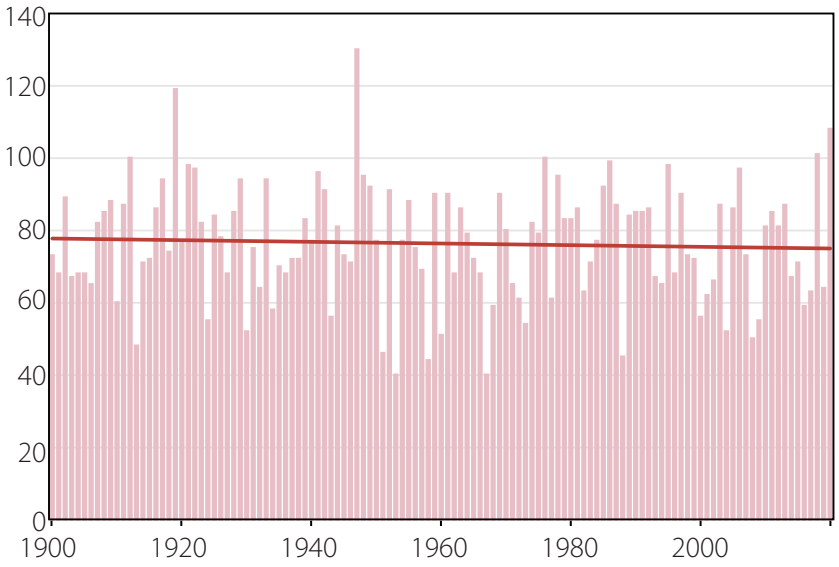


Figure 8: Number of extreme temperature days, 1900–2020.

Number of days below 10th or above 90th percentile. Source: CET.[14]

Analysis of daily extreme temperatures shows that hot summer days are not becoming more frequent or warmer, notwithstanding one notably hot day in July 2019 (Figure 9a). Nevertheless, no recent summer has matched the intensity of the heatwaves in 1975 and 1976, when there were four and nine days over 30°C respectively. In 2020 there were three.

As with the seasonal averages, exceptionally cold days are virtually a thing of the past (Figure 9b). Apart from December 2010, there have been no days below −10°C since 1982.

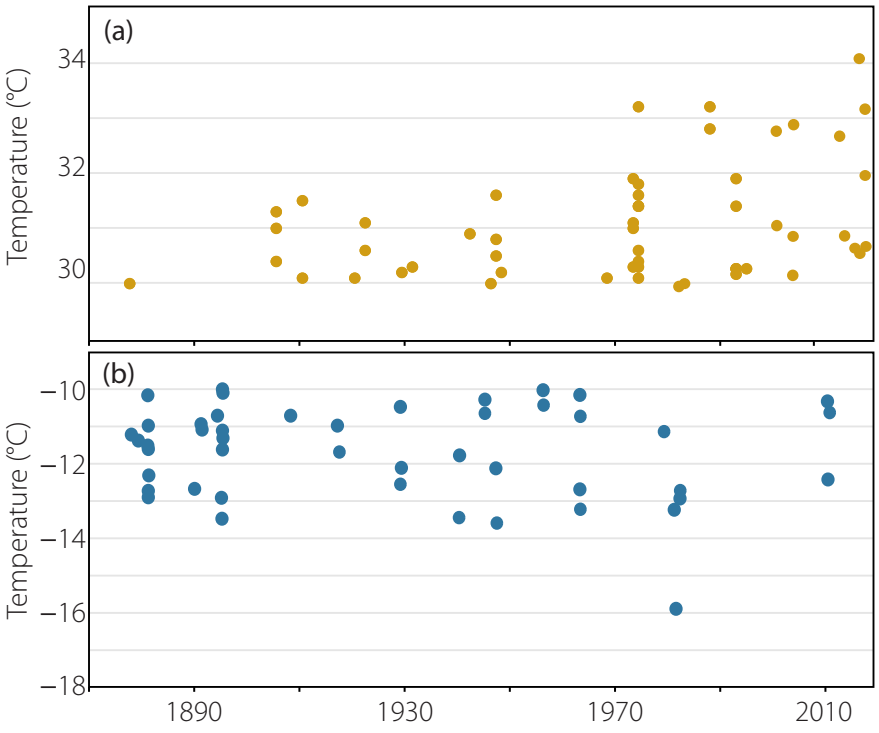


Figure 9: Extreme daily temperatures, 1870–2021.

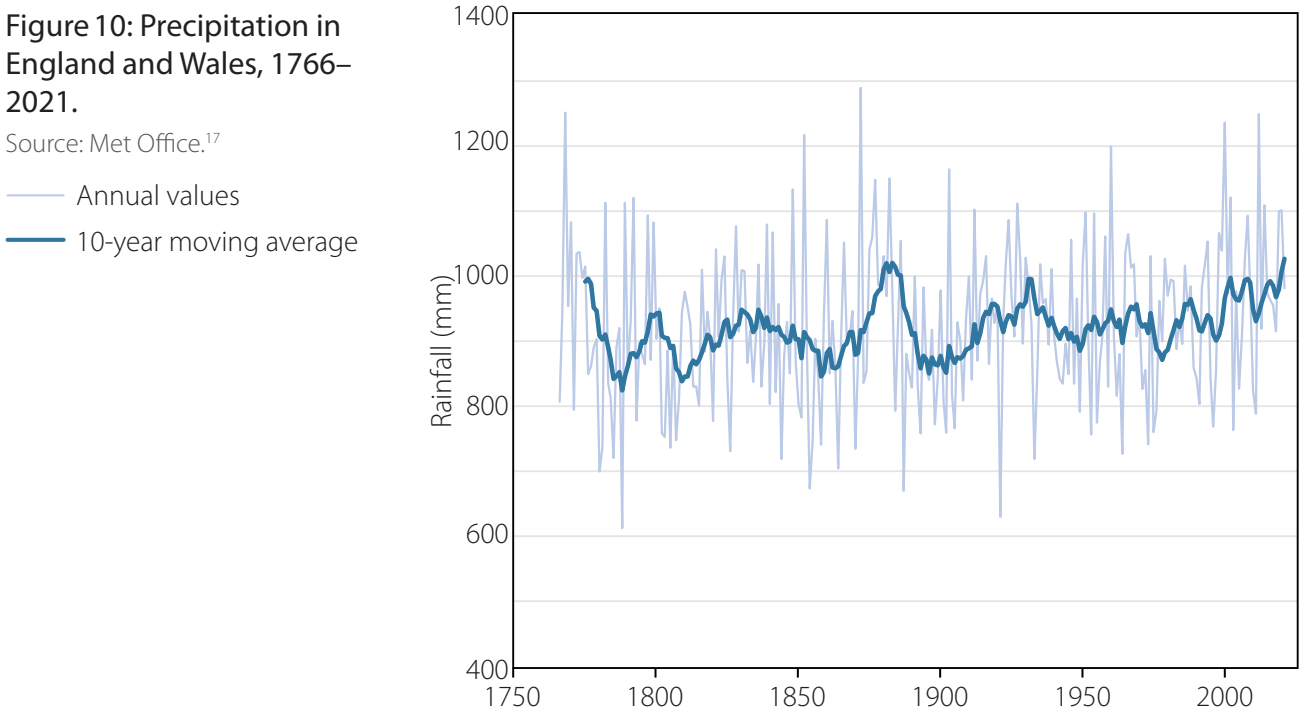
(a) Days over 30°C and (b) days below −10°C. Source: CET.[14]

4. Precipitation trends

In England and Wales, long-term precipitation averages are higher than they were in the mid-20th century, but are at similar levels to some earlier periods (Figure 10). The two wettest years were 1872 and 1768. Last year was only the 18th wettest year.

Figure 10: Precipitation in England and Wales, 1766–2021.

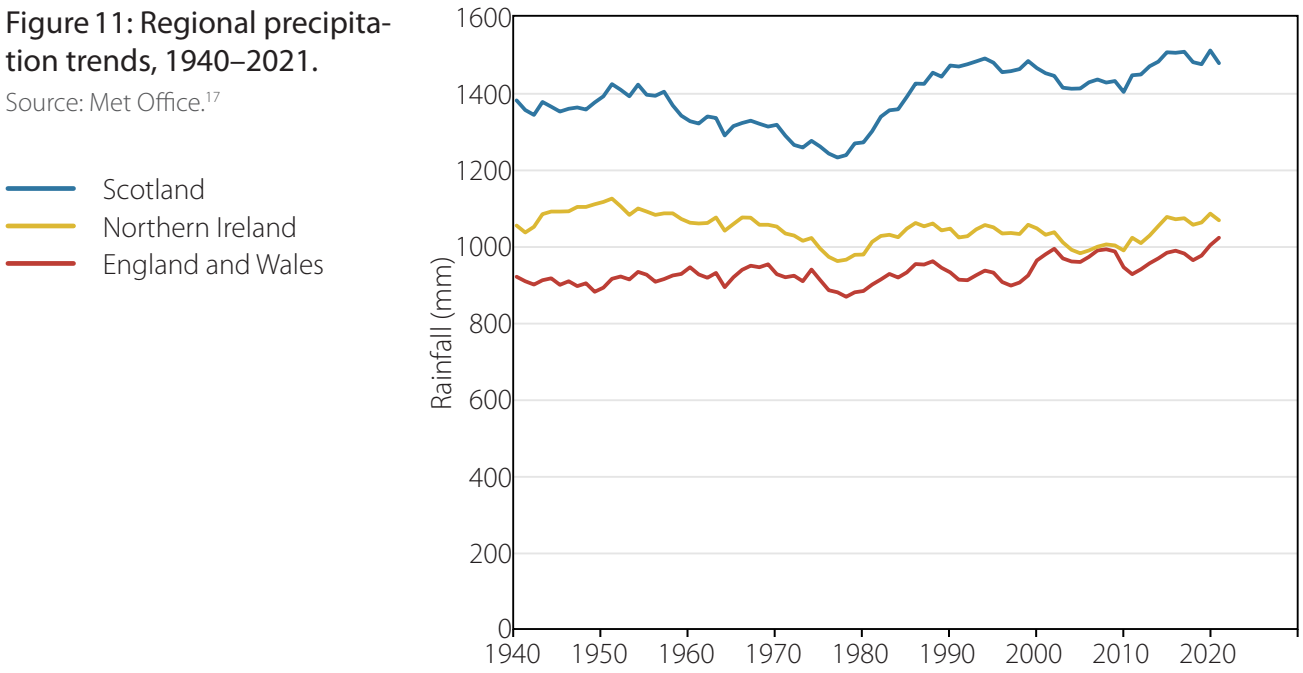
Source: Met Office.[17]



What is particularly significant is the absence of severe drought years in recent decades. In Northern Ireland and Scotland, the series are shorter (Figure 11). In the former there is very little trend at all since 1940. In Scotland, however, rainfall levels rose till the early 1990s, since when there has been little change in the 10-year average.

Figure 11: Regional precipitation trends, 1940–2021.

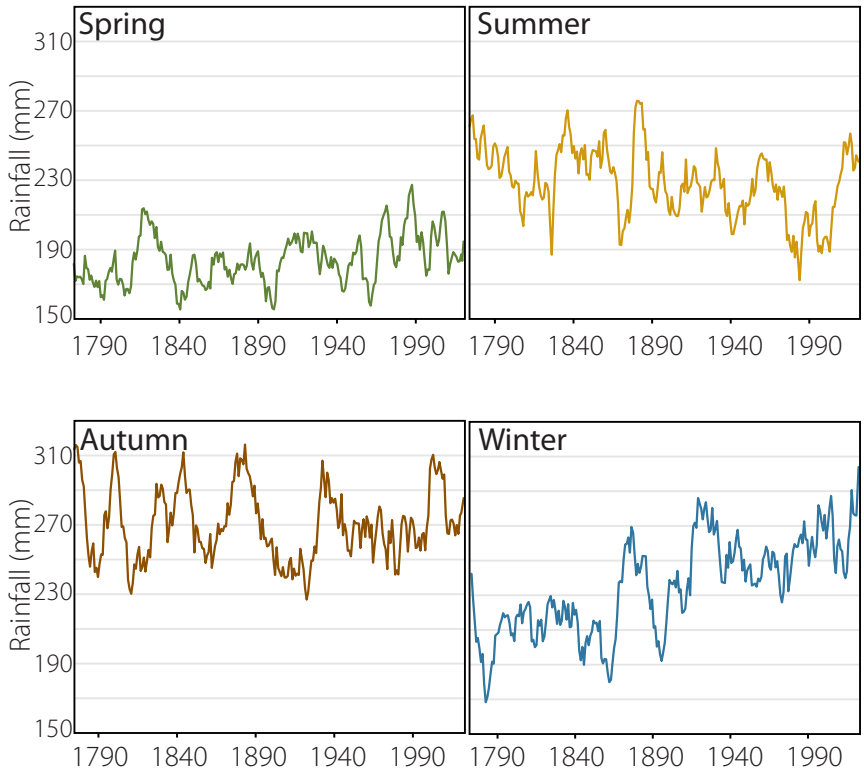
Source: Met Office.[17]



Seasonal trends for England and Wales show that winter rainfall averages are similar to the 1870s and 1910s (Figure 12). While there have been small decadal variations, the overall trend since 1910 has been flat. Precipitation trends in spring seem to have barely changed over the record. There was a string of notably dry summers during the 1970s and 80s, but since then precipitation has returned to more typical levels. As with spring, there has been little long-term change in autumn rainfall.

Figure 12: England & Wales precipitation, seasonal trends, 1775–2021.

10-year moving averages. Source: Met Office.[17]

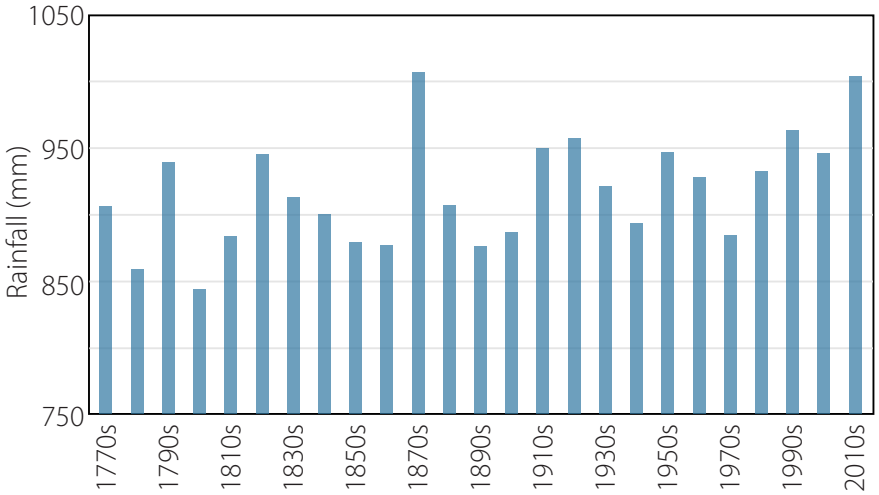


5. Precipitation extremes

It is commonly claimed that rainfall is becoming more extreme in the UK, for instance by the Met Office.[1] However, as far as England and Wales are concerned, this claim is not supported by the data. The England and Wales Precipitation Series, for instance, shows that the wettest decade was the 1870s (Figure 13). Although the

Figure 13: England & Wales decadal precipitation, 1770s–2000s.

Source: Met Office.[17]



last decade was almost as wet, there is no sign that this is part of a longer-term trend.

In annual terms, the wettest years were 1872 and 1768 (Figure 14a). While wet years tend to come in clusters, there has been nothing unprecedented about the last decade. Only one year since 2000 has been amongst the top 10 wettest; this was 2012.

More significantly, there has been a marked absence of extremely dry years (Figure 14b); the last top-20 year was 1973. It is this lack of dry years that is largely responsible for the apparent increase in average rainfall in the last decade.

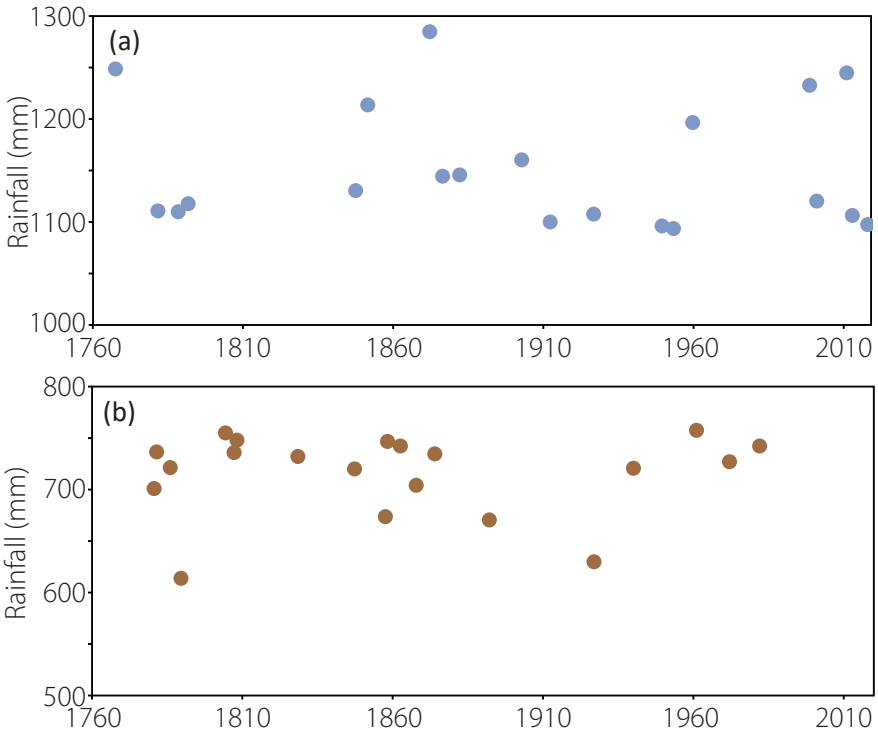


Figure 14: Extreme rainfall years, 1760–2021.

(a) top 20 wettest years and (b) top 20 driest years. Source: England & Wales precipitation series.[17]

Figure 15 shows all months with more than 170 mm of rainfall. There have been 36 instances since 1766, an average of one every seven years. The last occurrence was in January 2014. There have been two months in the last ten years, the other being December 2012. In contrast, there were five such months in the 1910s.

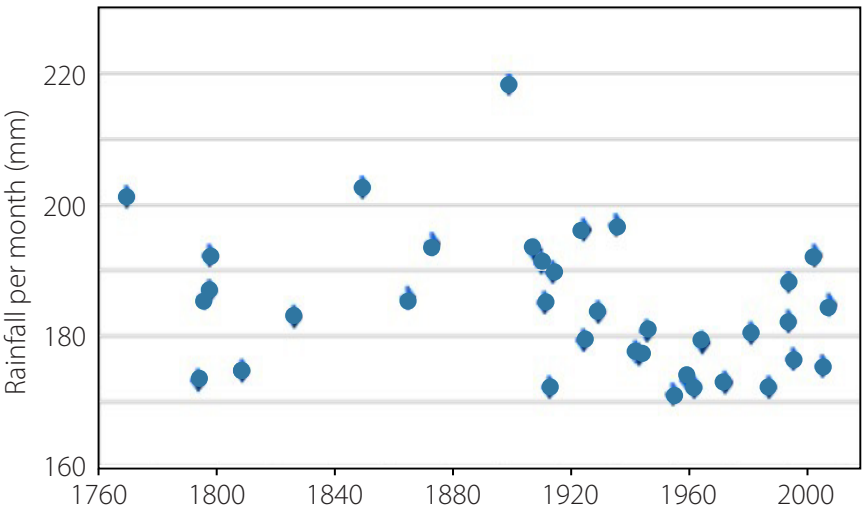


Figure 15: Extreme rainfall: months with more than 170 mm of rain, 1760–2021.

Source: England & Wales precipitation series.[17]

The wettest month this century was November 2009, with 192.1 mm of rain, but this was only the eighth wettest month on record, tied with August 1799. By far and away the wettest month on record was October 1903, with 218.1 mm.

As for daily rainfall totals, there were three days with 20 mm or more of rainfall in 2020, the wettest being 3 October, with 28.48 mm (Figure 16). However, this was only the tenth wettest day since the start of records in 1931.

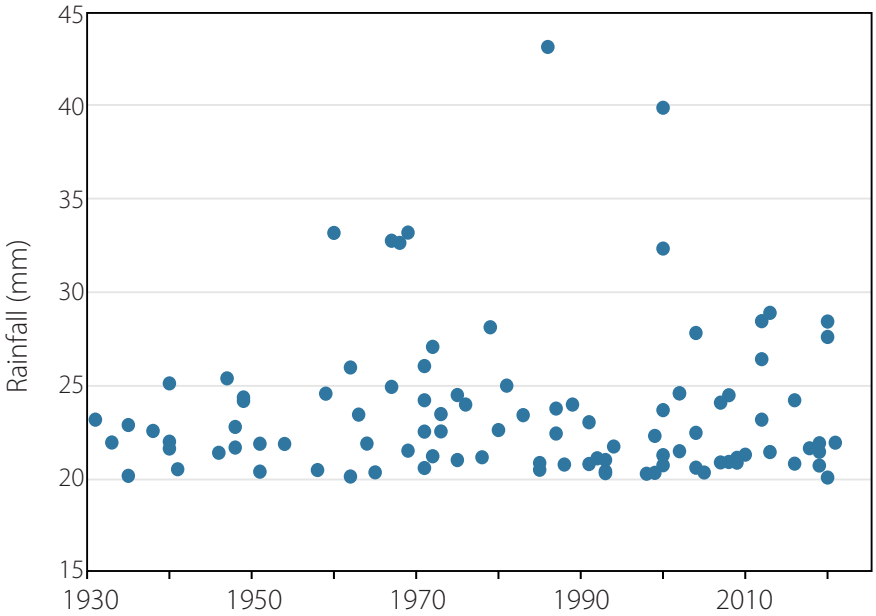


Figure 16: Extreme rainfall: days with more than 20 mm of rain, 1931–2021.

Source: England & Wales precipitation series.[17]

In terms of extreme daily rainfall, the 1960s was certainly the most intense decade – four of the six wettest days occurred between 1960 and 1969. The wettest day by far was 25 August 1986, when 43.23 mm fell. There have been 96 days with 20 mm or more since 1931, effectively one per year on average. In the last decade, there have been eleven such days, in other words, well within the normal range.

The England and Wales daily rainfall series only goes back to 1931. However, a selection of long-running stations shows no evidence that daily rainfall is becoming more extreme (Figure 17).

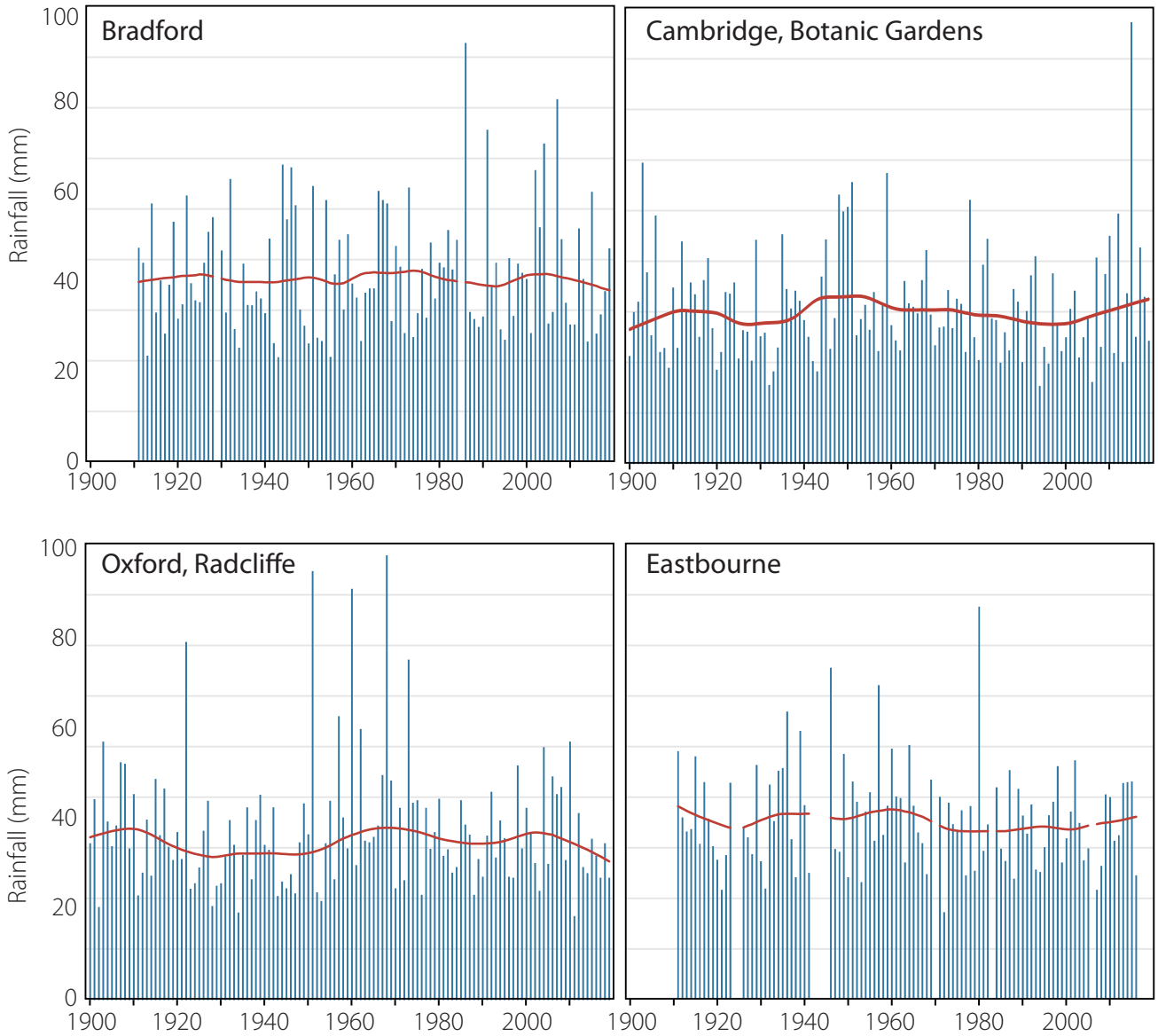


Figure 17: Highest daily rainfall each year for selected locations.

Source: European Climate Assessment.[18]

6. February 2020 storms – case study

February 2020 was the wettest February on record, both in the UK as a whole, and in the England and Wales Series. The high rainfall totals were the result of three named storms – Ciara, Dennis and Jorge – which coincidentally all occurred within one calendar month, despite being three weeks apart. From a wider perspective, rainfall in the preceding and succeeding months – January and March – was below average. Therefore the fact that the storms all fell in February should be regarded as a statistically meaningless curiosity.

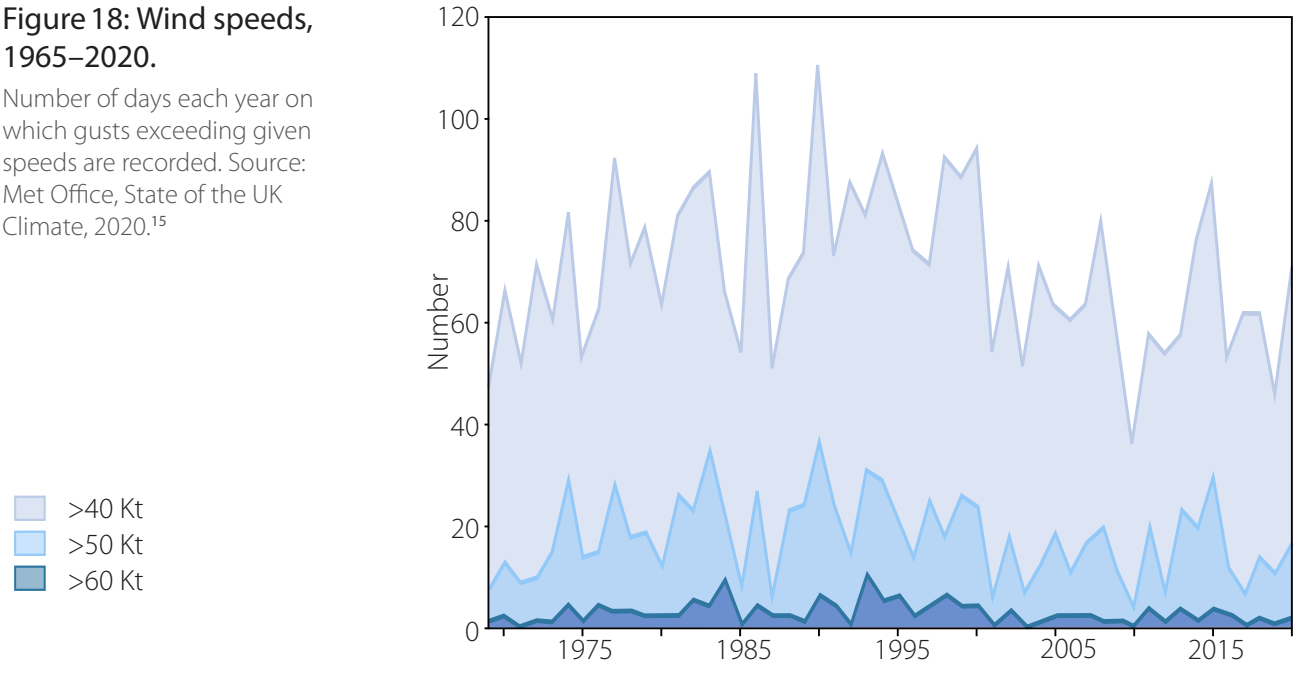
Moreover, February 2020 was still a very long way from being the wettest month on record. In England and Wales, where the brunt of the storms impacted, it was only the 38th wettest, with 169 mm, suggesting that there was nothing remarkable about it at all.

As for the storms themselves, the daily rainfall from Dennis peaked at 27.65 mm in England and Wales on 15 February, making it the 13th wettest day since 1931, hardly a remarkable event. Rainfall from Ciara and Jorge was much less, at 13.3 mm and 16.31 mm respectively; the sort of daily totals that occur several times every year. To put it into perspective, there have been 94 instances of rainfall totals above 20 mm since 1931.

We also need to consider the impact of the storms in terms of wind. There has naturally been more public awareness of storms since the Met Office began to name them in 2015, and a consequent misunderstanding that they are getting worse. This is exacerbated by the misleading practice of publicising wind speeds at exposed coastal and upland stations, such as The Needles, Capel Curig and Aberdaron. However, Met Office data clearly shows a sharp decline in the windiness of storms at more representative low-lying sites since a peak in the 1980s and 90s (Figure 18).

Figure 18: Wind speeds, 1965–2020.

Number of days each year on which gusts exceeding given speeds are recorded. Source: Met Office, State of the UK Climate, 2020.[15]



7. Sea levels

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 as much as 1 mm per year in the extreme south west (Figure 19).

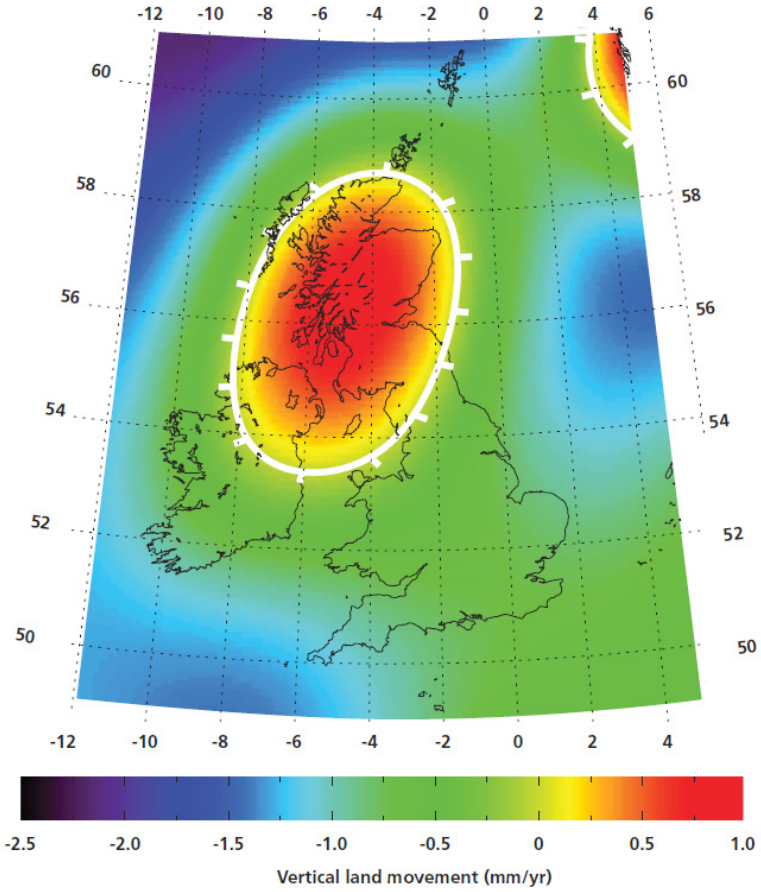


Figure 19: Vertical land movements.[15]

An analysis by Woodworth et al. estimated a rise in sea levels since 1901 of 1.4 mm per year, after correcting for land movement.[5] This was based on five stations: Aberdeen, North Shields, Sheerness, Newlyn and Liverpool. However, there is a lot of missing data for Aberdeen, Liverpool and Sheerness.

North Shields and Newlyn have virtually full coverage, as well as a long record of data, going back to 1895 and 1915 respectively. They also have the advantage of representing diagonally opposite sides of England: north east and south west. North Shields in Tyne & Wear is in an area of little vertical land movement, whereas Newlyn in Cornwall is subsiding by about 1 mm per year. Long-term sea-level rise at the two locations are 1.89 mm and 1.81 mm per year respectively (Figure 20). After allowing for land subsidence, sea-level rise at Newlyn appears to be lower, however, at around 1 mm per year.

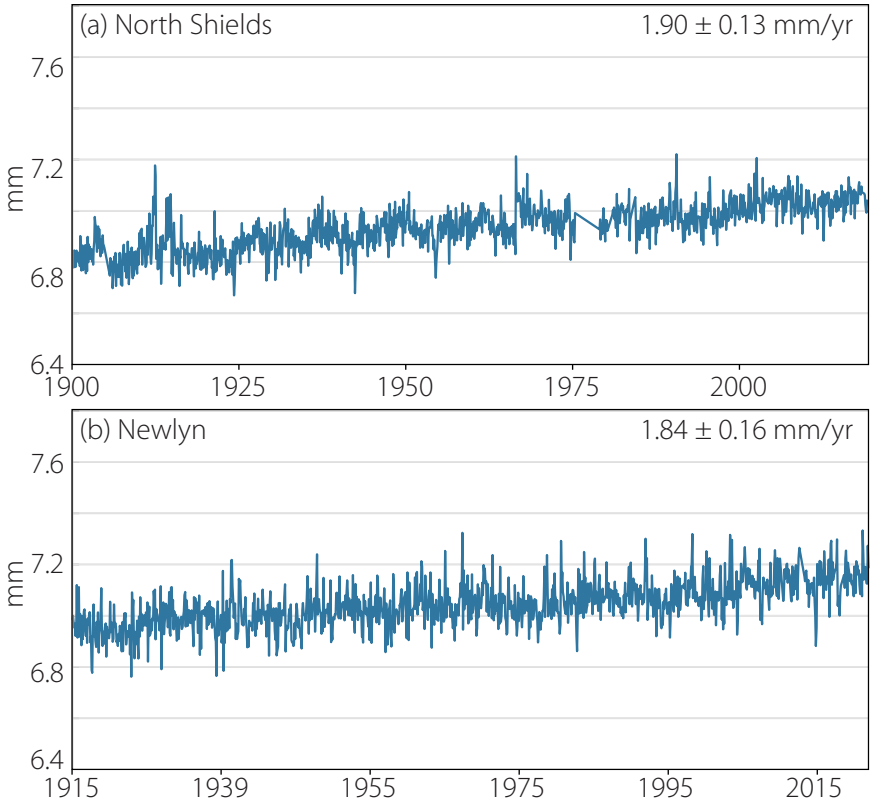


Figure 20: Sea level rise, for two selected UK tide gauges.[19]

Analysis of overlapping 50-year trends (Figure 21) indicates a cycle. Sea levels were rising as fast as now, or faster, in the first half of the 20th century. There was then a distinct slowing of sea-level rise after 1950, before it returned to earlier rates in recent decades. Over the full record, there is no evidence of acceleration in sea-level rise.

It is important to look at sea-level trends over at least 50 years, as it is well established that trends obtained from tide-gauge records shorter than about 50–60 years are corrupted by interdecadal sea-level variation.[6]

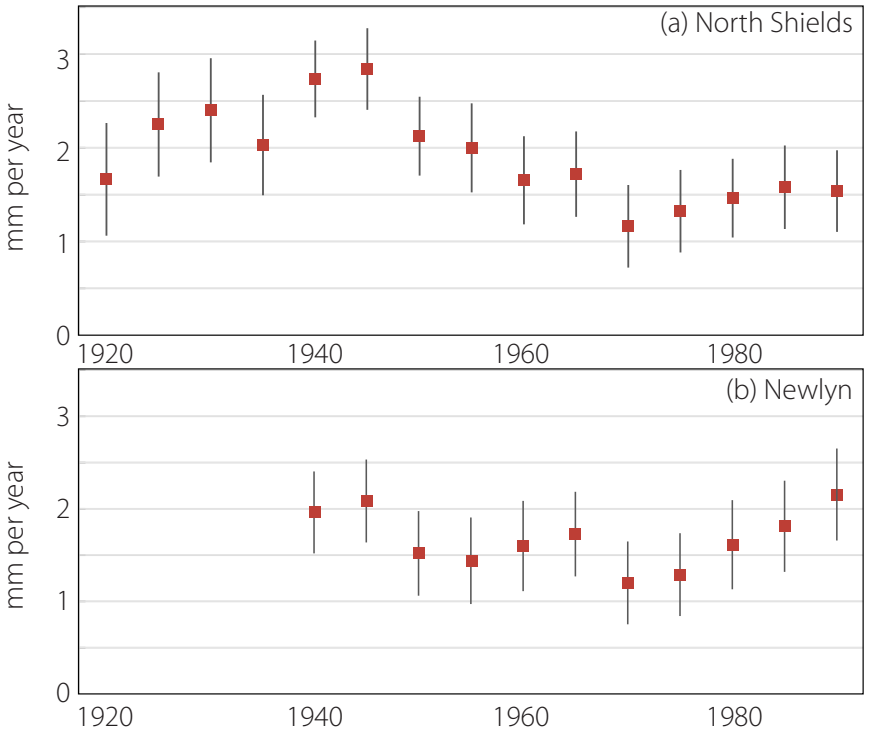


Figure 21: Long-term sea-level trends, 1920s–1990s, for two selected UK tide gauges.[19]

The above pattern of sea-level rise is also exhibited globally. IPCC AR5 stated:

> It is very likely that the mean rate of global averaged sea level rise was 1.7 [1.5 to 1.9] mm/yr between 1901 and 2010 and 3.2 [2.8 to 3.6] mm/yr between 1993 and 2010. Tide gauge and satellite altimeter data are consistent regarding the higher rate during the latter period. It is likely that similarly high rates occurred between 1920 and 1950.[7]

8. Wildfires

Wildfires are not a climatic phenomenon. Nevertheless, it is often claimed that climate change has made them worse. It is not possible to quantify trends in UK wildfires because the data is so sparse. The most recent figures published by the Forestry Commission for England only cover the period from 2009 to 2016 (Figure 22). This data indicates a decline in wildfire acreage, with 2011–12 being an outlier. Data from the Joint Research Centre, however, shows a rebound in fire activity for the UK as a whole, when looking at the period 2015–19 (Figure 23).

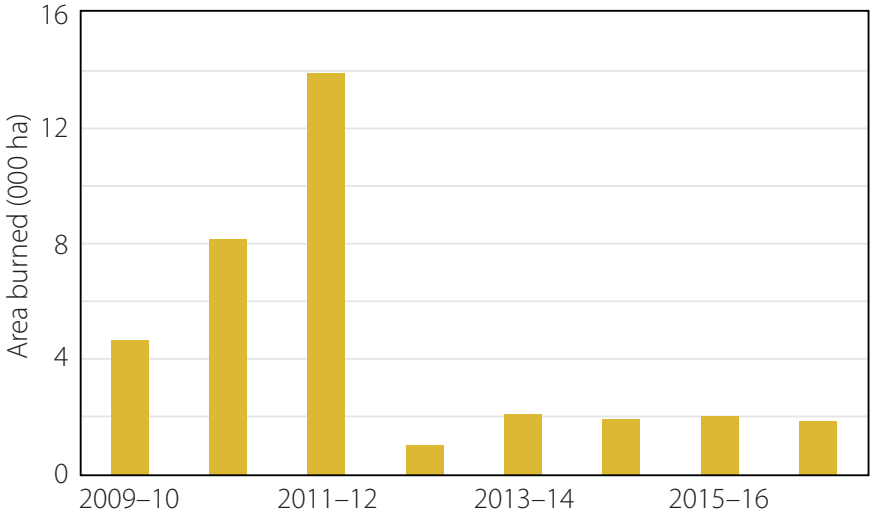


Figure 22: Wildfire statistics for England, 2009–2017.
Source: Forestry Commission.[20]

Clearly the overall picture is confusing, with no identifiable trends overall. The high fire activity towards the end of the record

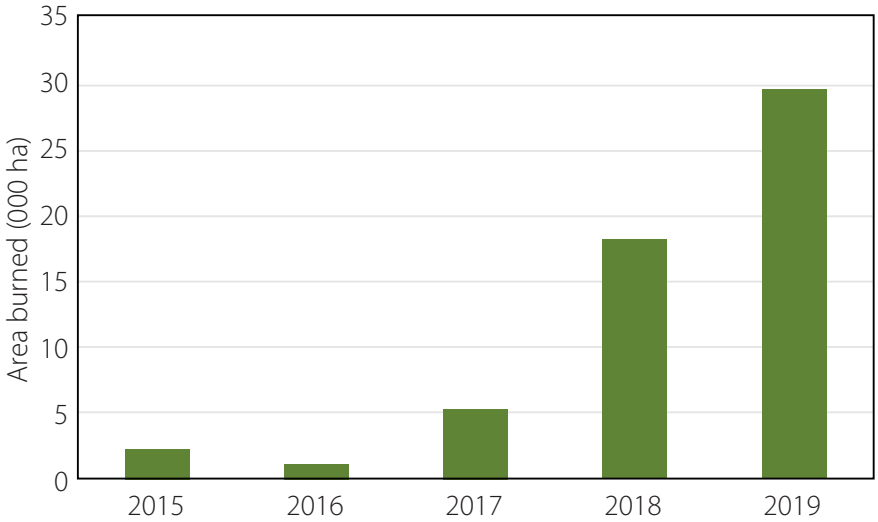


Figure 23: UK wildfire statistics, 2015–19.
Source: JRC data republished by Climate Change Committee.[21] No more up-to-date data is available.

is connected with spates of moorland fires, for instance on Saddleworth Moor in the summer of 2018, and the fires in Morayshire and Sutherland in the spring of 2019. These are both times of the year that are highly vulnerable to wildfire, because of low vegetation moisture. But are springs or summers becoming drier? Or were summer 2018 or spring 2019 unusually dry?

Looking at spring first (Figure 24a), there has been little change in rainfall trends throughout the record. In fact, rainfall was slightly above average in spring 2019, not only in the UK as a whole but also in northern Scotland. Clearly the wildfires in Morayshire and Sutherland were not caused by a lack of rainfall.

The summer of 2018 was certainly very dry (Figure 24b), but there have been many other summers that were much drier. Again there is no trend to summers becoming drier.

All fires, of course, need a source of ignition, and it is accepted that the majority of wildfires in Britain are human caused, some accidental and others deliberate.[8] Increased public access to moorland areas in recent years is therefore a major factor in wildfire trends. But one particular concern in recent years has been the increasing popularity of disposable barbeques, which have been

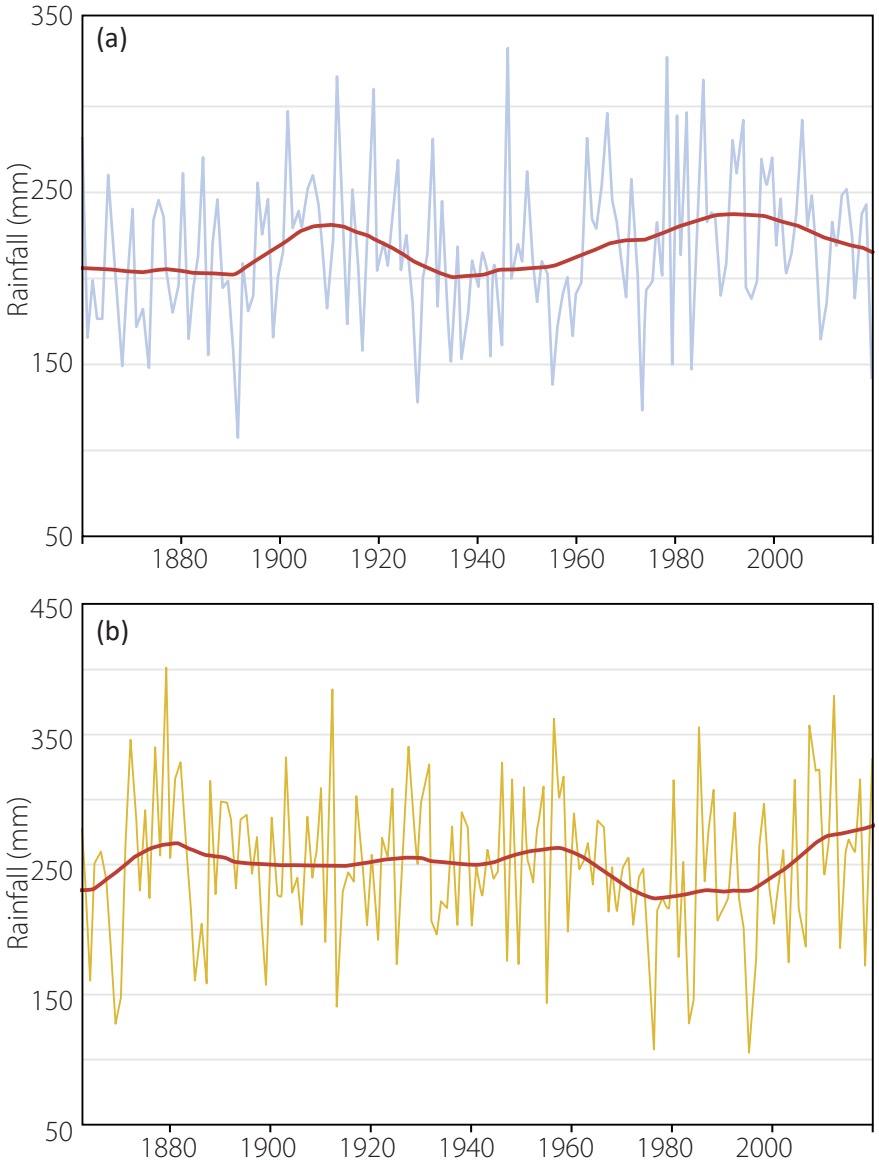


Figure 24: Seasonal rainfall trends, 1870–2020

(a) spring and (b) summer. Source: Met Office.[13]

found to be the cause of many recent fires.[9] By their very nature, these pose a much greater risk of ignition than other human activities.

It is of course during periods of warm, sunny weather that visitor numbers to moorland areas climb rapidly. Any study into the linkage between weather and wildfire needs to take this factor into account.

9. Sunshine hours

There has been a significant increase in sunshine hours in the UK in recent years (Figure 25), beginning in the mid-1980s, which of course is the same time that temperatures began to rise.

A Met Office study in 2006 noted this increase, and also found a strong positive correlation between sunshine hours and temperature during spring, summer and autumn. During winter there was only a weak negative correlation.[10] In simple terms, the authors found that rising temperatures had, in part at least, been a consequence of sunnier weather. The author of the study speculated that the increases in sunshine hours were the result of the Clean Air Acts from 1956 onwards. This speculation was reinforced by the fact that the greatest increases in sunshine were in, or downwind of, major industrial conurbations. Other meteorological experts have concurred in this belief.[11,12] Whether the increase in sunshine hours is an artefact of cleaner air or a meteorological phenomenon, these studies certainly cast doubt on the consensus that temperature rise is caused by greenhouse gases.

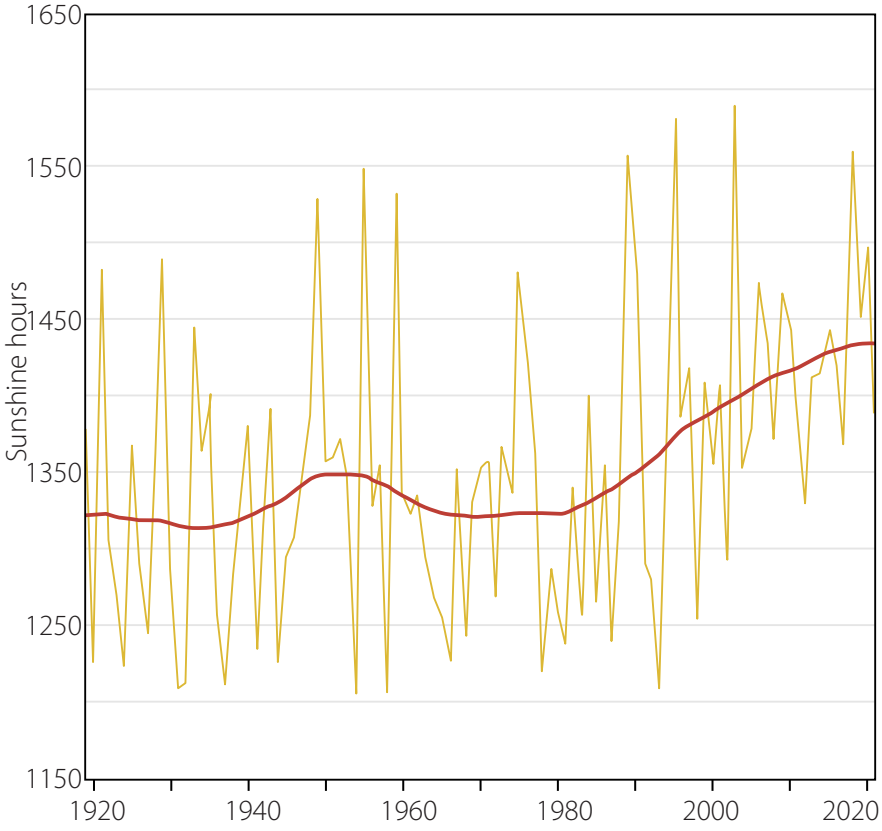


Figure 25: Sunshine hours, 1920–2021.
Source: Met Office.[13]

Editor's note

GWPF invited the Royal Society and the Met Office to review and submit a response to this paper, to be published as an addendum to it. The invitation was not taken up.

Notes

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5. UK Climate Projections Marine & Coastal Page 28 - https://webarchive.nationalarchives.gov.uk/20181204111026/http://ukclimateprojections-ukcp09.metoffice.gov.uk/22530
6. Bruce Douglas - Global Sea Rise: a Redetermination - http://www.psmsl.org/train_and_info/training/gloss/gb/gb3/douglas.html
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10. UK Met Office – https://www.metoffice.gov.uk/media/pdf/q/h/uk_climate_trends.pdf
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19. NOAA – https://www.tidesandcurrents.noaa.gov/sltrends/sltrends_global.html
20. Forestry Commission – https://www.gov.uk/government/publications/forestry-commission-england-wildfire-statistics-for-england-2009-10-to-2016-17
21. Committee on Climate Change - https://www.theccc.org.uk/publication/research-to-review-and-update-indicators-of-climate-related-risks-and-actions-in-england-adas/

About the Global Warming Policy Foundation

People are naturally concerned about the environment, and want to see policies that protect it, while enhancing human wellbeing; policies that don't hurt, but help.

The Global Warming Policy Foundation (GWPF) is committed to the search for practical policies. Our aim is to raise standards in learning and understanding through rigorous research and analysis, to help inform a balanced debate amongst the interested public and decision-makers. We aim to create an educational platform on which common ground can be established, helping to overcome polarisation and partisanship. We aim to promote a culture of debate, respect, and a hunger for knowledge.

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