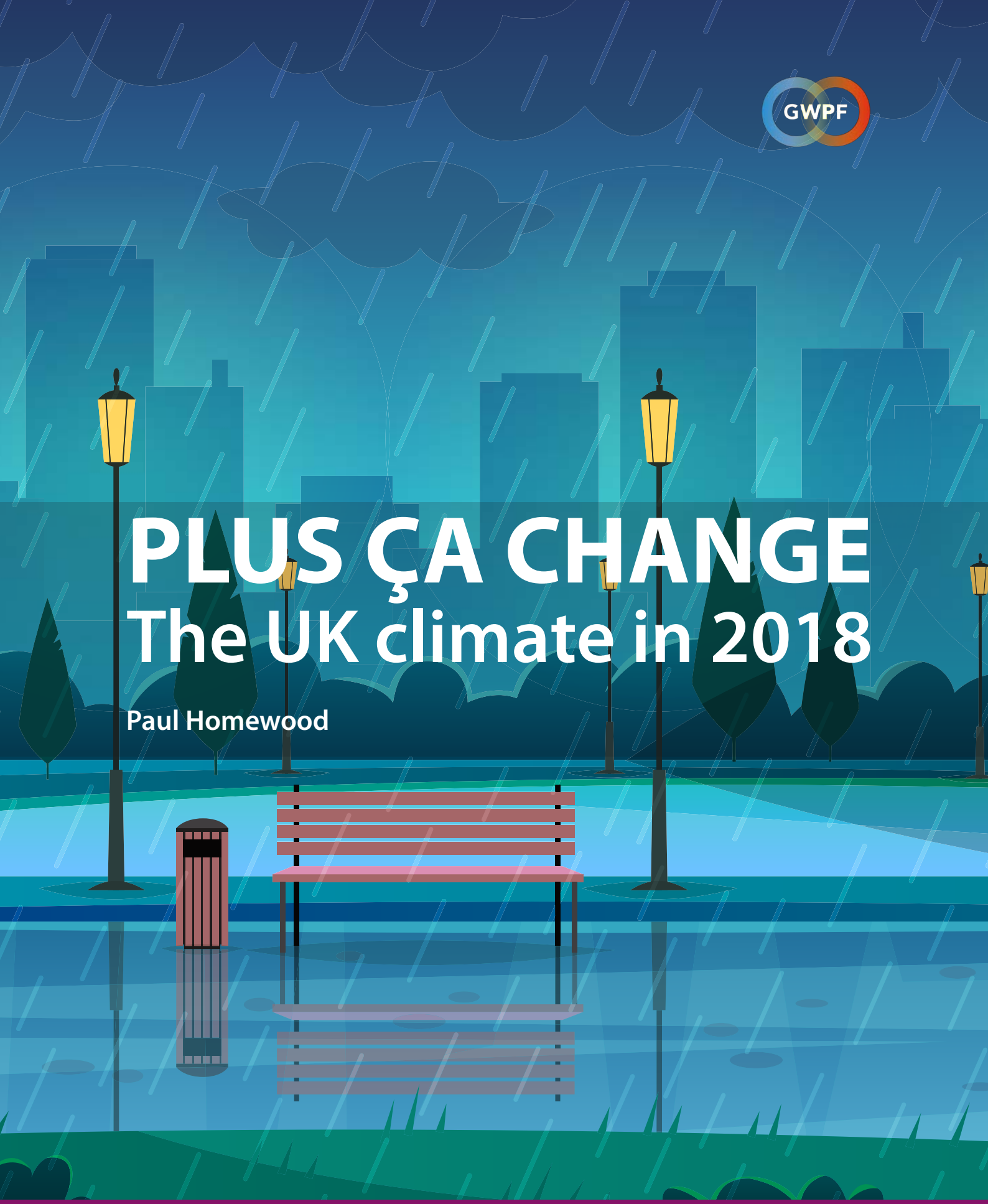


PLUS ÇA CHANGE
The UK climate in 2018

Paul Homewood

The Global Warming Policy Foundation

GWPF Briefing 43

PLUS ÇA CHANGE
The UK climate in 2018

Paul Homewood

Contents

About the author

Paul Homewood had a career as an accountant in industry. He has been writing on climate and energy issues since 2011.

Executive summary

The UK Parliament declared a climate emergency earlier this year. And they are not the only ones. It is estimated that half of the UK's principal local authorities have done the same. Meanwhile the Committee on Climate Change claims that extreme weather events are increasing, and the head of the Environment Agency has stated that global warming is driving both more extreme weather and hotter drier summers.

But where is the evidence for any of this? After all, it should be obvious by now, if there really was such an emergency.

Using the recently published UK Met Office's *State of the UK Climate 2018*, along with other Met Office data, this paper examines UK climatic trends and assesses the truth of climate emergency claims. The analysis finds that:

- There was a step up in temperatures between the 1980s and early 2000s, since when temperatures have stabilised. This increase is closely associated with a rise in sea surface temperatures around the same time, itself connected to the Atlantic Multidecadal Oscillation, a natural cycle, which is currently in its warm phase.
- The temperature data provides no evidence that temperatures will resume their upward trend in the foreseeable future.
- Seasonal temperatures follow a similar pattern.
- In particular, summer temperatures have still not exceeded those of 1976, despite last year's long heatwave.
- Based on the Central England Temperature series (CET) daily temperatures, the heatwaves of 1975 and 1976 were much more intense than anything since, including last summer, with daily temperatures peaking at higher levels and for longer. For instance, in 1975 and 1976, there were four and nine days respectively with temperatures over 30°C. By contrast, last summer there was only one.
- Whilst daily temperature extremes are not rising at the top end of the scale, extremely cold days have become much less common. In short, UK temperatures have become less extreme, contrary to common belief.
- Although the UK Met Office claimed that last summer in the UK tied with 1976 as the hottest on record, the well-respected CET tells a different story. In fact, it shows the summer of 2018 as only fifth warmest, not even as hot as 1826. This casts doubt on the reliability of the Met Office's UK gridded temperature network, which provides its official climate data, but which relies on many sites affected by the urban heat island effect, such as Heathrow.
- Although there has been a clearly increasing trend in UK precipitation since the 1970s, this is largely due to increasing totals in Scotland. In the rest of the UK, there appears to be little in the way of long-term changes.
- The long-running England and Wales Precipitation series (EWP), which begins in 1766, offers a longer perspective, and shows that the higher levels of rainfall experienced in the last two decades are not unprecedented.
- Seasonal analysis of the EWP shows few trends in winter or summer rainfall since 1900, nor, for that matter, spring or autumn. This runs counter to regular claims of 'wetter winters' and 'drier summers'.

- Analysis of the EWP series also provides no evidence that rainfall is becoming more extreme, whether on a decadal, monthly or daily basis. There is, however, evidence that extremely dry years have become less common.
- Sea levels have been rising at around 1.4 mm per year, after correcting for vertical land movement. Recent rates of sea-level rise are similar to those in the first half of the 20th century. There is no evidence that sea level has been accelerating.
- There is little long-term data for storms, but limited data from the UK Met Office indicate that storms have not become more frequent or stronger in the last five decades.

In short, although it is slightly warmer than it used to be, the UK climate has actually changed very little. In particular, there is no evidence that weather has become more extreme. Heatwaves have not become more severe, nor droughts. Rainfall data offers no evidence that floods have become worse either. Neither is there any evidence from past trends that the climate will become significantly hotter, wetter or drier, or that sea-level rise will accelerate.

Widespread claims that we are now living through a climate emergency or breakdown are just so much hot air.

1 Introduction

The UK Parliament declared a climate emergency earlier this year. And they are not the only ones. It is estimated that half of the UK's principal local authorities have done the same. Many others in authority have also warned of increasing extreme weather events. The Committee on Climate Change, for instance, recently stated as fact:

> In recent weeks, the Committee on Climate Change and the Environment Agency have warned of the risks of failing to prepare for extreme weather events, which are increasingly common as our planet warms.[1]

And in June this year, Sir James Bevan, head of the Environment Agency, was absolutely clear about climate changes. In a speech entitled *It's the climate emergency, stupid*, he said:

> Global heating is driving more extreme rainfall and rising sea levels, which is putting more people at risk of flooding. It's driving hotter and drier summers, putting our country – already experiencing water scarcity – at risk of what I call the Jaws of Death: the point twenty or so years out from now where the lines on the graph showing rising water demand and diminishing water supply cross, and we don't have enough water. Climate change is damaging our air, our water and our soils, as pollution incidents spike in more extreme hot weather. During last summer's prolonged dry spell, the Environment Agency responded to more than three times the normal amount of environmental incidents: fish kills, fires, water pollution, etc.
>
> And climate change risks undermining our ability to deliver the sustainable growth that people need and demand. That's because more extreme weather will increasingly damage the inputs and the infrastructure on which our economies depend.[2]

But where is the evidence for these apocalyptic claims?

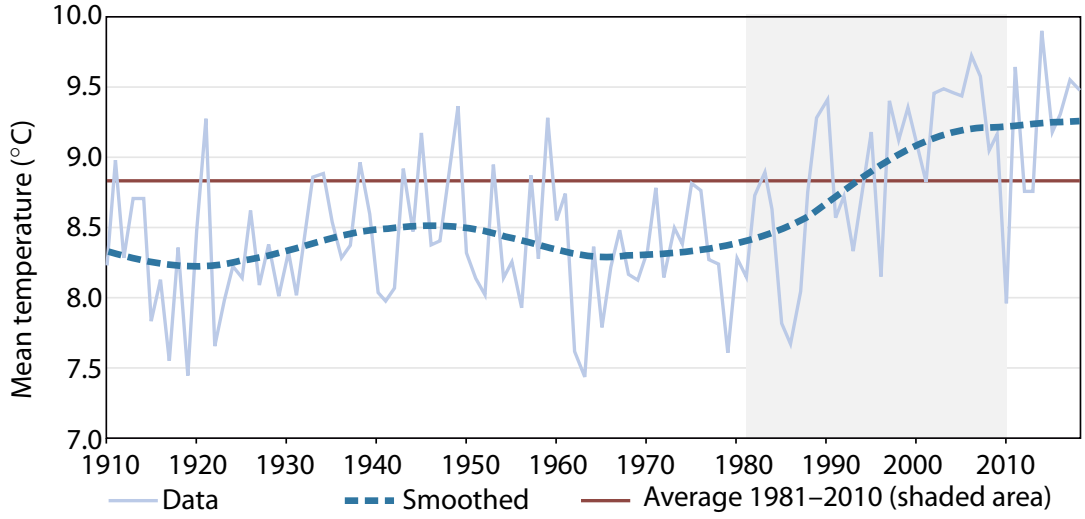
Using data from the UK Met Office's *State of the UK Climate 2018* [3] and other official sources, this paper examines whether there is any substance behind these allegations, as far as the UK is concerned. It analyses in detail for the UK:

- temperature trends
- temperature extremes
- precipitation trends
- precipitation extremes
- sea-level rise
- storms.

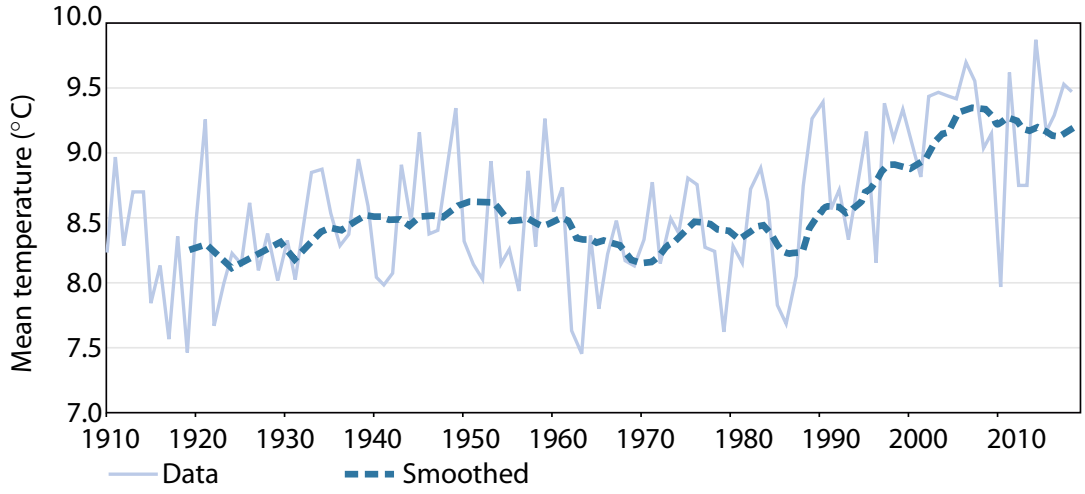
2 Temperature trends

The Met Office has reported that 2018 was the seventh warmest year since 1884, and that all of the top ten warmest years for the UK have occurred since 2002.[4] These are the bald facts, but they don't tell the whole story. As Figure 1a indicates, annual temperatures changed little between 1910 and 1980, before a sudden and sharp rise took place in the 1980s and 90s. Since the early 2000s, temperatures have stabilised again. Figure 1a uses a kernel filter, but we can get a clearer picture from Figure 1b, which uses a running ten-year mean. This clearly shows that the ten-year average has declined since peaking in 2008.

Moreover, the most recent decade has been colder than the previous one (Table 1), a rather salient fact which the *State of the UK Climate* report fails to point out.



(a)



(b)

Figure 1: UK annual mean temperatures.

Smoothed with (a) kernel filter; (b) ten-year average. Source: UK Met Office data.[5] 2018 value is provisional.

Table 1: UK decadal temperature averages

Decade	Average (°C)
1989–1998	8.91
1999–2008	9.36
2009–2018	9.18

Seasonal temperature trends (Figure 2) follow a similar pattern as annual ones, with a steady rise during the 1980s and 90s, but little change since. The Central England Temperature series shows the same pattern. It is worth noting though that similar sharp rises have occurred in the past, notably between the 1690s and 1730s (shaded in Figure 3).

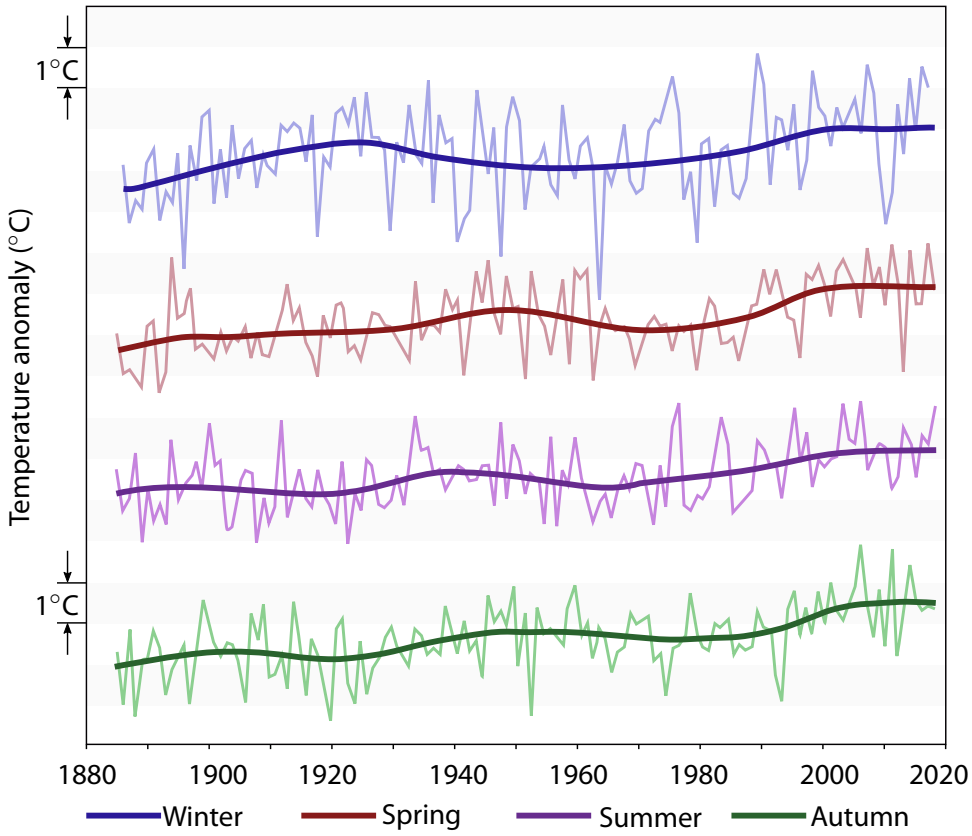


Figure 2: UK seasonal mean temperatures, 1884–2018

Source: State of the UK Climate 2018 Report.[6]

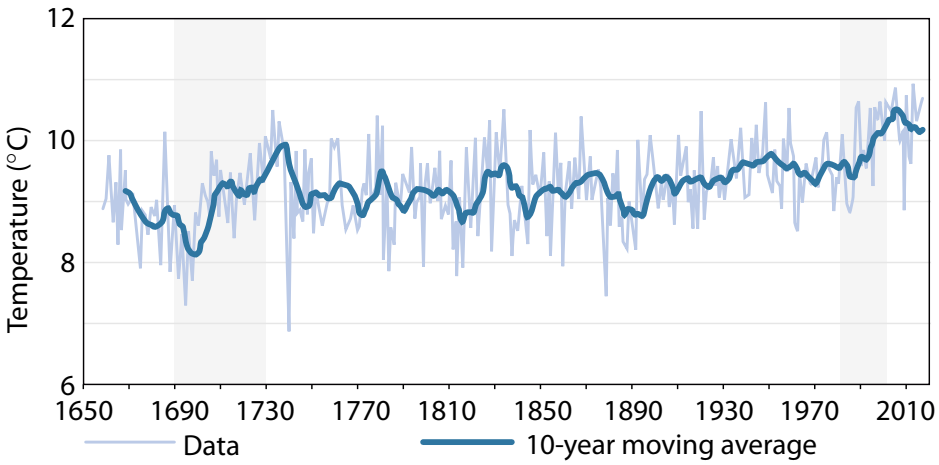


Figure 3: Central England Temperature Series 1659–2018

Annual means.

Figure 4 plots temperature anomalies for both land and near coastal waters, with sea temperatures showing a very similar rise. The Met Office note that there is a high correlation between land and sea temperatures:

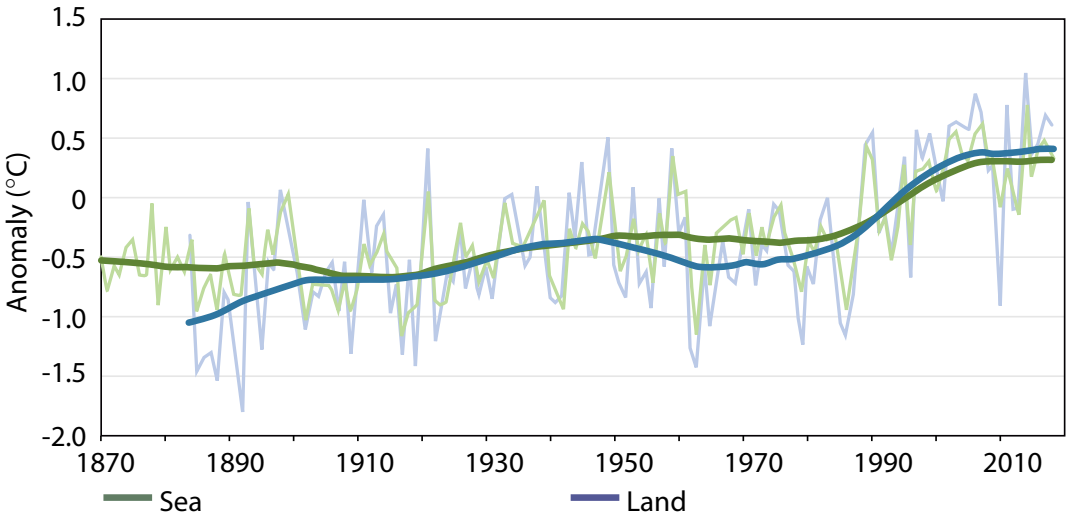


Figure 4: UK annual mean land and sea-surface temperatures.
UK annual mean temperature over land 1884–2018, Central England temperature trend and UK annual mean sea surface temperature across near-coastal waters around the UK 1870–2018, expressed as anomalies relative to the 1981–2010 long-term average . Source: *State of the UK Climate 2018*.[3]

It is widely accepted that ocean temperatures regulate land temperatures, rather than the other way round.[7] The rise in both land and sea temperatures, however, do broadly follow the switch of the Atlantic Multidecadal Oscillation from cold to warm phase, which took place between 1976 and 1998 (Figure 5).

Since then, the AMO has remained in its warm phase, which historically can last for between 20 and 40 years.[7] The AMO is a natural cycle,[7] 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.

3 Temperature extremes

Despite the rise in average summer temperatures since 1980 (Figure 6), no summer since has been hotter than that of 1976, over the season as a whole.

The same is true of daily temperatures. The highest daily maximum temperature recorded in the Central England Temperature series is 33.2°C, set in 1976, and matched in 1990 (marked with crosses in Figure 6). The highest last year was 30.7°C.

No year on record has matched the heat intensity of 1975 and 1976, when there were four and nine days over 30°C respectively. Last year, there was only one day (see shaded areas in Figure 6).

When we look at the coldest days, however, we get a different picture (Figure 7). The really cold days, with minimum temperatures below −10°C, are virtually a thing of the past. With the exception of December 2010, there have been no such days at all since 1982. To this extent, it would be true to say that daily temperatures have become less extreme in recent years.

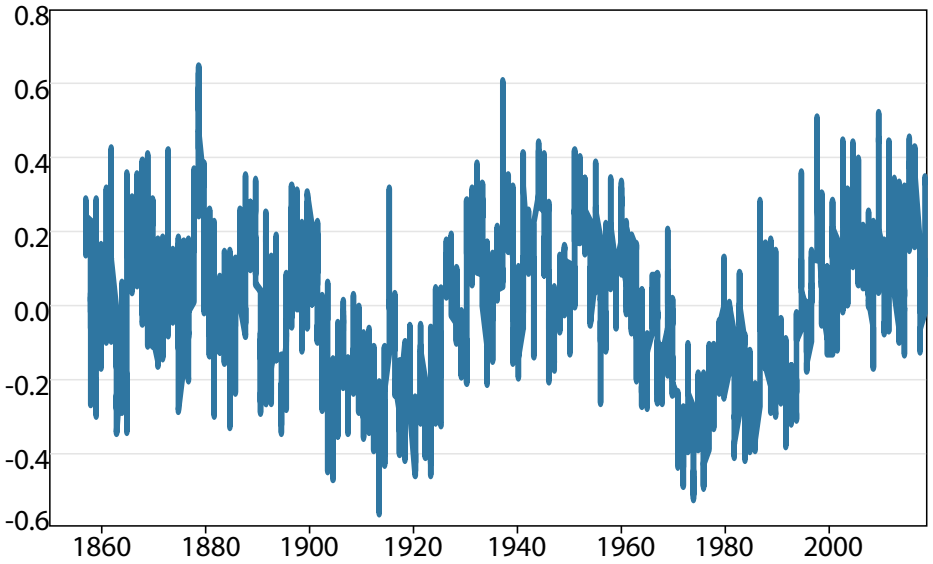


Figure 5: Atlantic Multidecadal Oscillation 1850–2019
Source: Global Climate Observing System Working Group on Surface Pressure.[8]

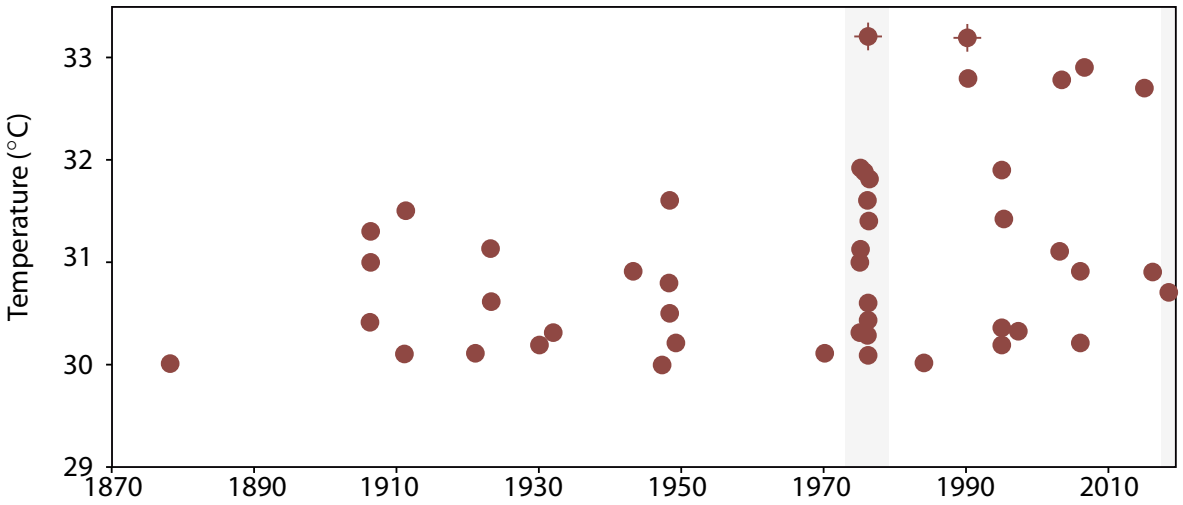


Figure 6: Distribution of days 30°C and over in the Central England Temperature Series[9]

The concept of an 'extreme temperature' is, of course, a relative one. London has a warmer climate than Newcastle, but does that mean that London's summer temperatures are more extreme? Or Newcastle's winter ones? Obviously not. One measure of extremes is the difference between summer and winter temperatures. This yardstick shows that the differences have been at very low levels in recent decades, similar to the 1910s. Much of the CET record prior to 1900 exhibits much greater extremes between the two seasons, indicating intensely cold winters, hot summers, or both, in relation to the normal climate at the time.

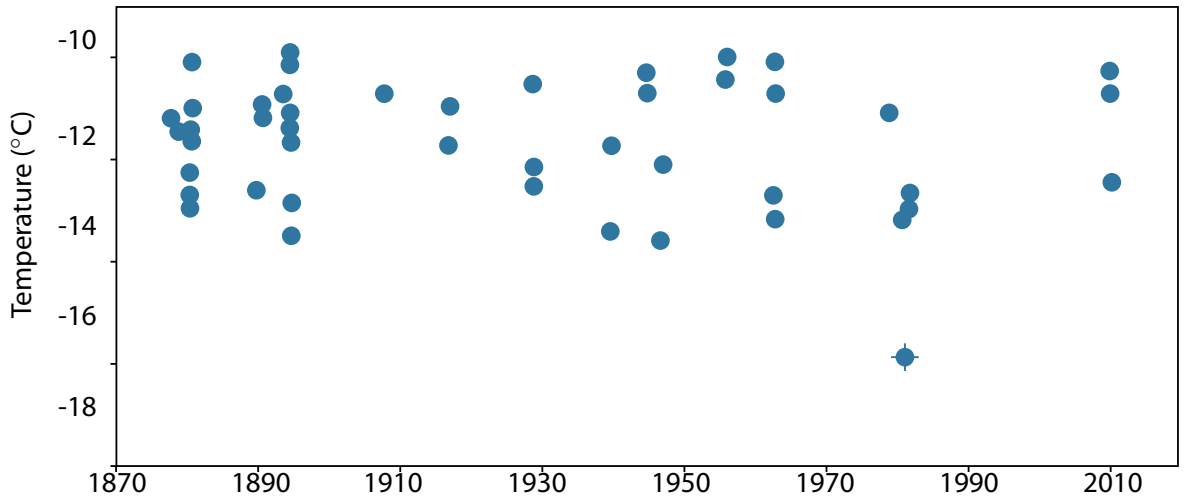


Figure 7: Distribution of days −10°C and below in the Central England Temperature Series
Source: CET[9]

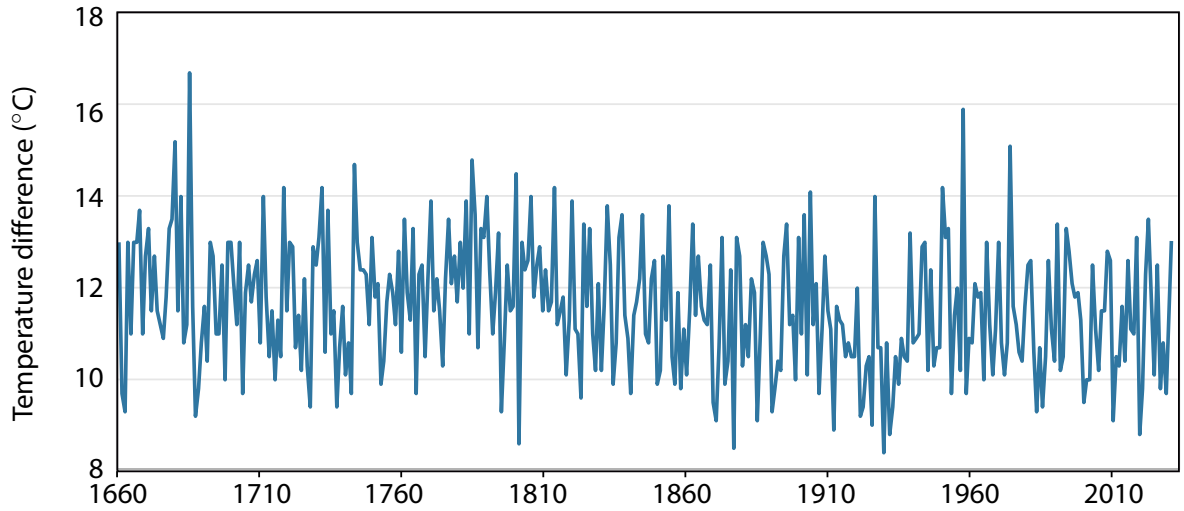


Figure 8: Difference between average CET summer and winter temperatures

Summer of 2018

The summer in 2018 is worth a separate note. According to the Met Office, it tied with the summers of 1976, 2003 and 2006 as the hottest on record in the UK since 1910 (Figure 9). The CET, however, shows a slightly different picture (Figure 10). The summer of 1976 was 0.5°C hotter than 2018's, which only ranked fifth warmest, behind 1826, 1995 and 2003. This discrepancy is not a geographical one, as the Midland region subset of the Met Office UK series, which covers a similar area to the CET, lists 2018 as being warmer than 1976.

This divergence between the two datasets raises questions about the accuracy of either or both. It is known, for instance, that the Met Office UK series includes a number of sites, such as Heathrow, Kew, Cambridge, Faversham and Motherwell, which are known to

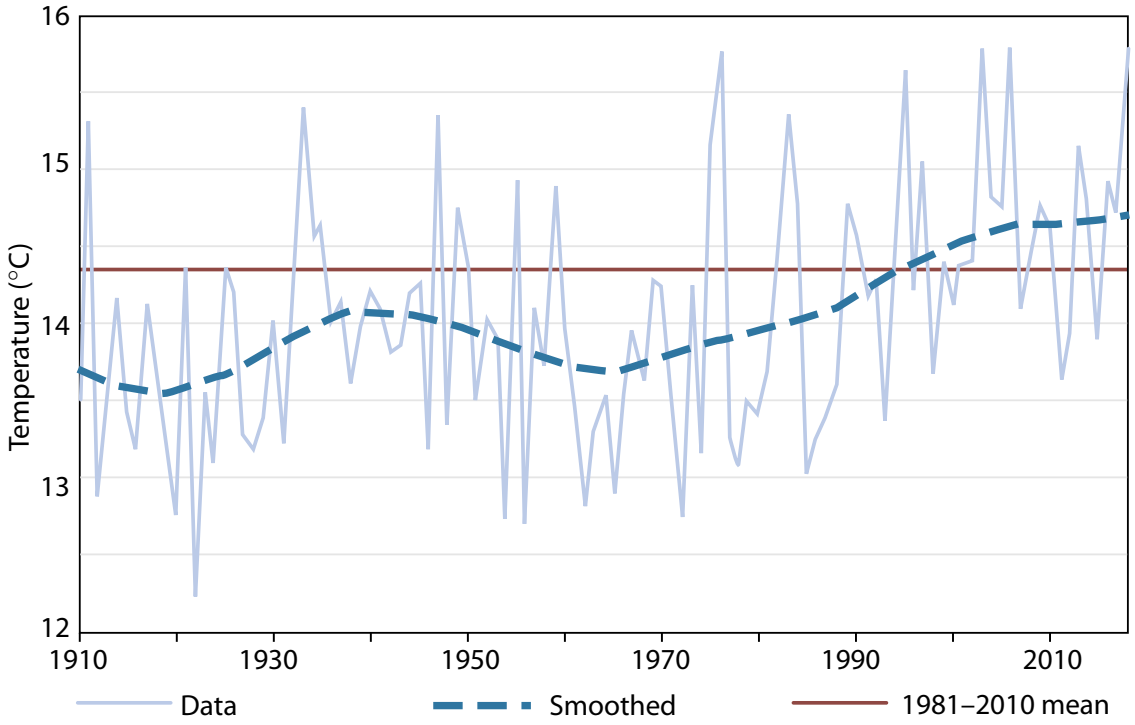


Figure 9: UK summer mean temperatures[10]

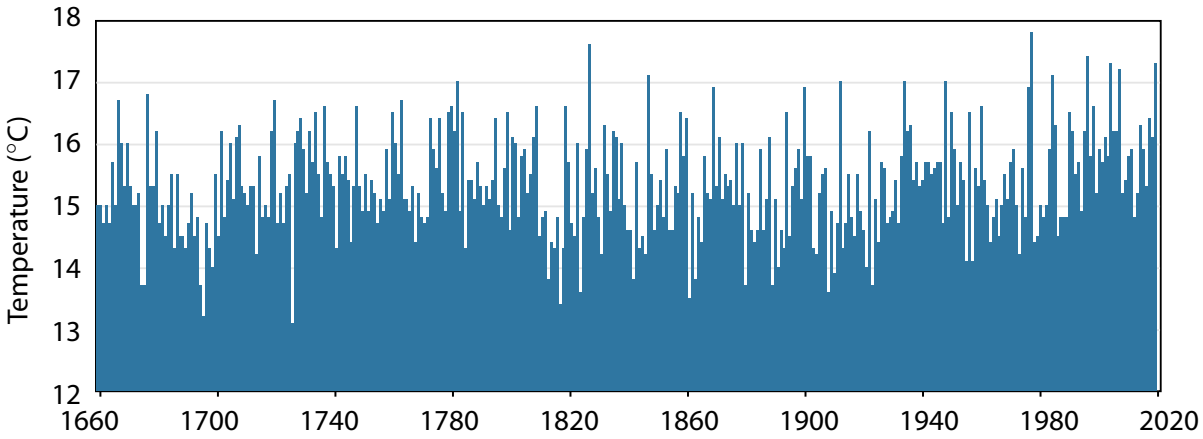


Figure 10: CET summer mean temperatures

be significantly affected by the urban heat island effect, or other siting issues. The UK series is also subject to a constantly changing mix of stations. By contrast, the CET is based on high-quality sites, and has been very carefully corrected over the years to allow for station changes.

Given these issues, the claim by the Met Office that the summer of 2018 was the equal hottest on record should have been qualified to reflect the uncertainties. Regardless, it was an exceptionally hot summer. However, the heat was not as intense as 1976. Figure 11 shows that nine days that year exceeded 30°C, with a peak of 33.2°C. By contrast, only one day exceeded 30°C in 2018, and this only reached 30.7°C. On the other hand, 2018 recorded more days with temperatures between 22°C and 28°C.

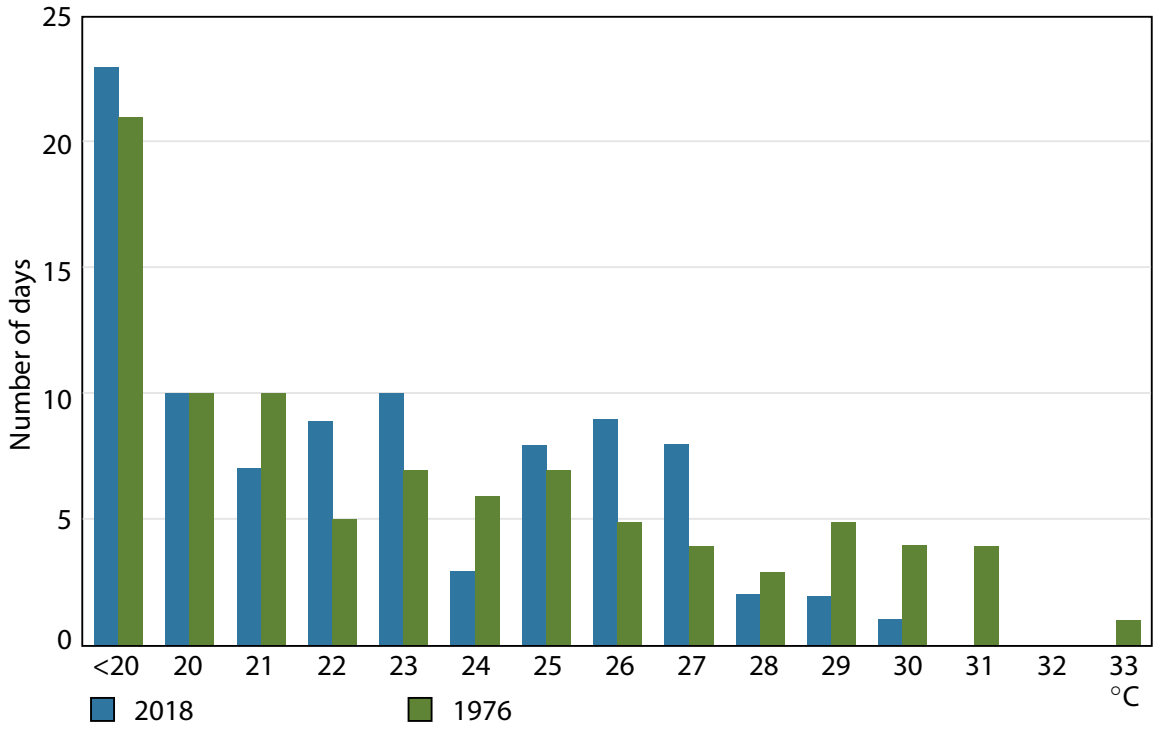


Figure 11: Comparing the summers of 2018 and 1976
Number of days per temperature band

4 Precipitation trends

Precipitation was slightly below normal in 2018 (Figure 12). Longer-term trends indicate a wetter climate since around 2000. However, regional analysis (Figure 13) shows that this effect is confined to Scotland. In the other three nations, there is little or no long-term trend at all.

In both the UK as a whole, and England in particular, 2000 and 2012 appear as standout years, with record precipitation. However, the long-running England and Wales Precipitation (EWP) series, which dates back to 1766, offers a truer perspective. As Figure 14 shows, the rainfall of 2000 and 2012 is not unprecedented. Furthermore, the 10-year trends have been as high or higher in the past, notably in the 1870s, 1880s and 1920s. Significantly, in recent decades there have been no severe drought years of the kind experienced, for instance, in 1788 and 1921.

The following points can be highlighted:

- Long-term winter trends have changed little since the 1910s. Winter precipitation appears to have been consistently lower in the early record, until around 1860. However, recent research by Murphy *et al.* suggests that winter rainfall was systematically underestimated prior to 1870, because of under-catch of snowfall.[12] They find that 'When these factors are accounted for in our reconstructions, the observed trend to wetter winters in EWP is no longer evident'.
- Summer rainfall fell to unprecedentedly low levels during the 1970s, 1980s and early 1990s, but has since returned to earlier levels. Again, Murphy *et al.* question the summer rainfall data prior to 1820, suggesting it may have been overestimated, raising

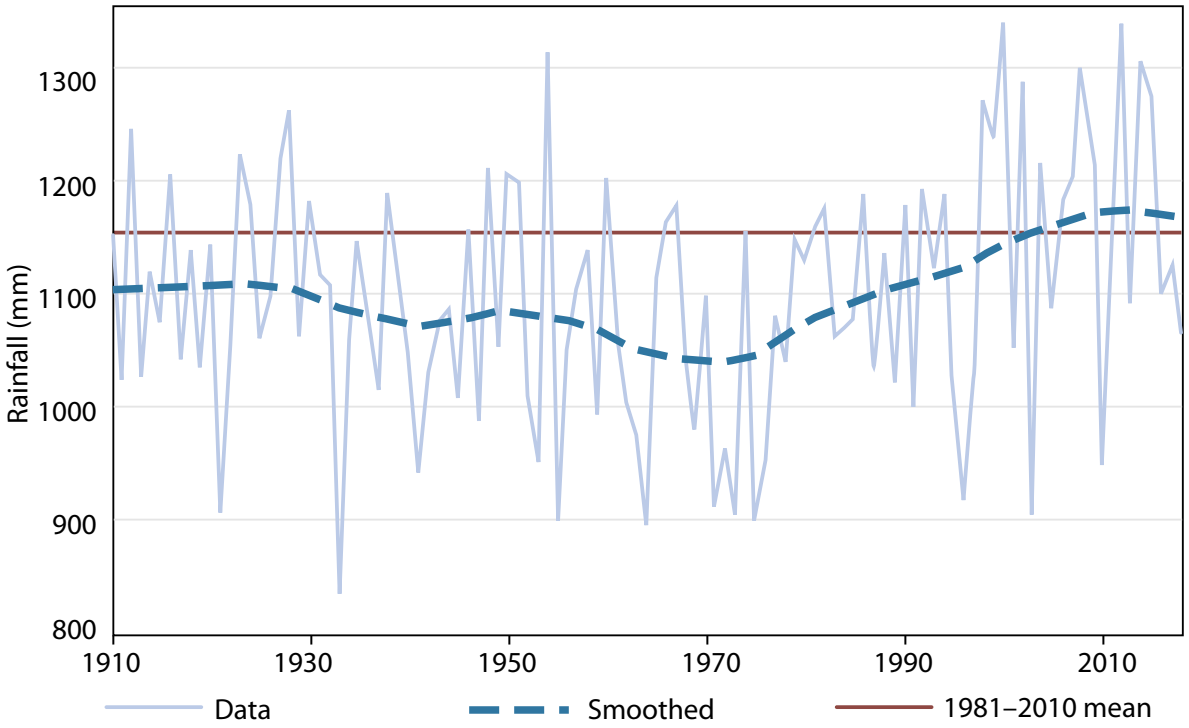


Figure 12: UK annual precipitation.

Source: UK Met Office.[11]

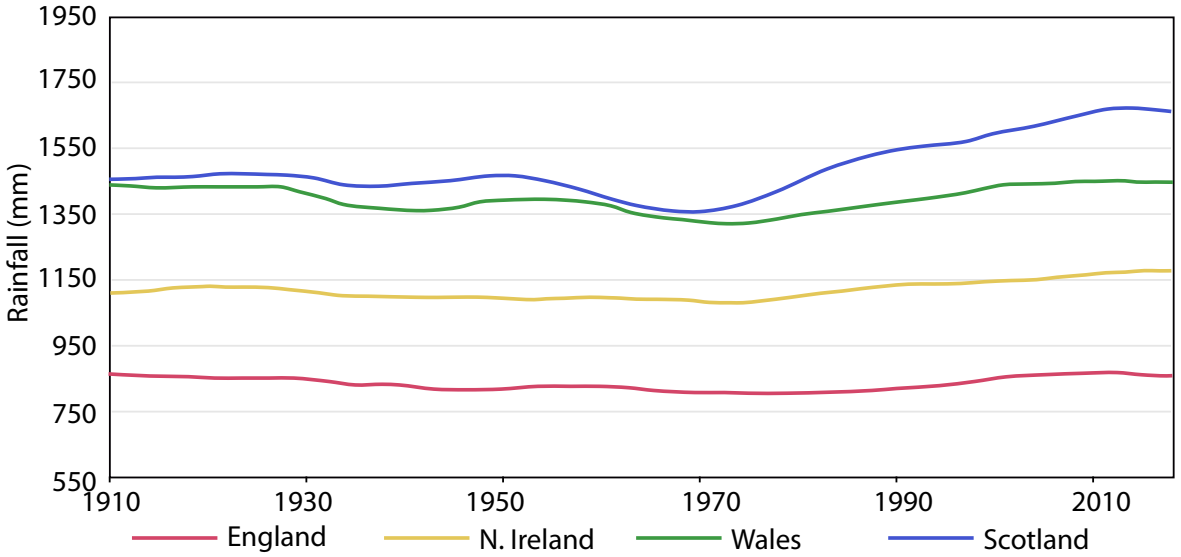


Figure 13: Regional precipitation trends.

Source: UK Met Office data.[11]

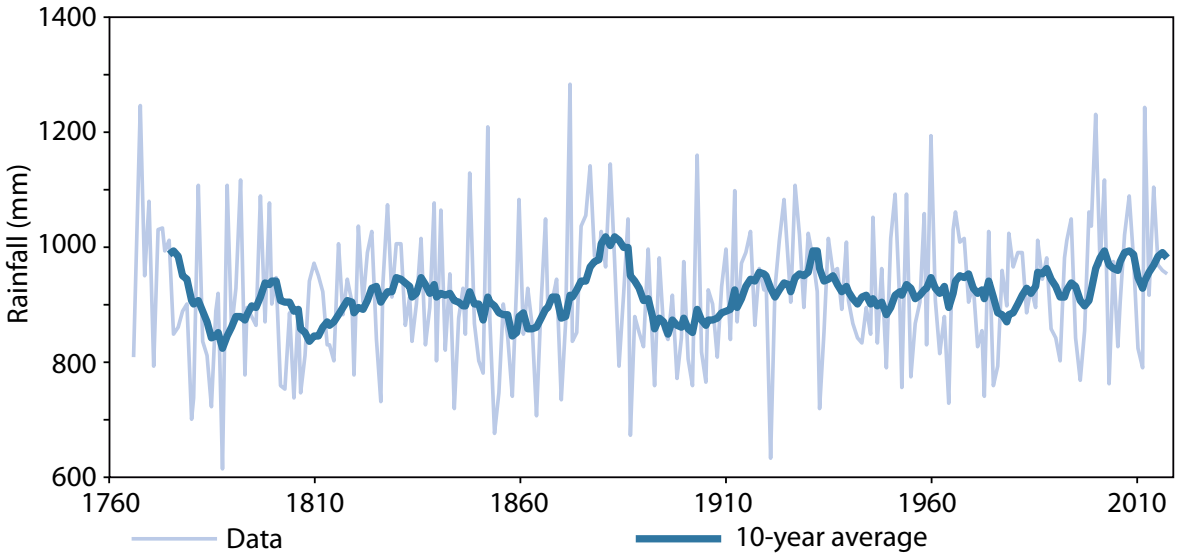


Figure 14: Long-term precipitation record for England and Wales.

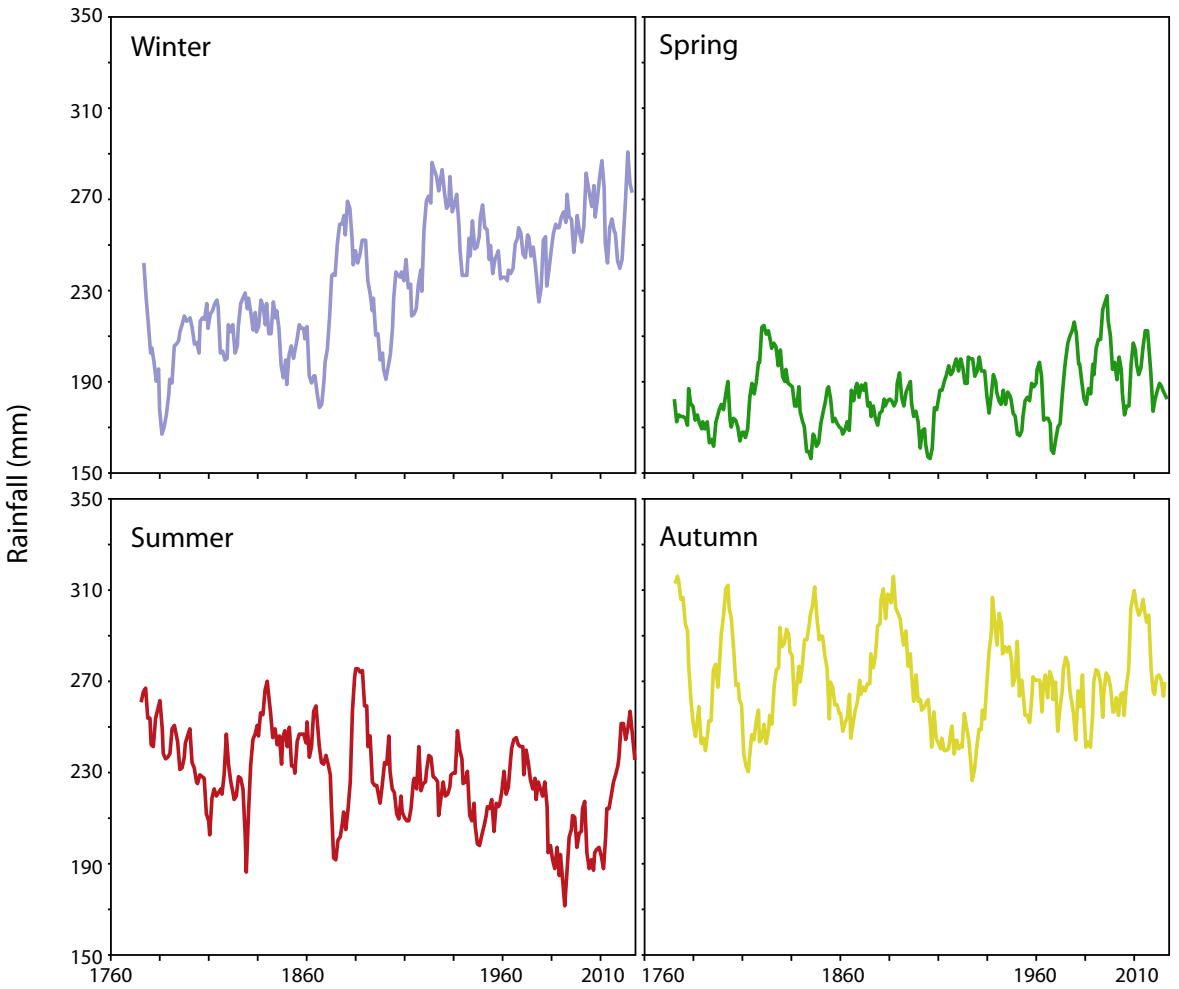


Figure 15: Long-term records of seasonal rainfall.[11]

doubts about claims of a trend to drier summers.

- There has been little change in trend for either autumn or spring.

The overall conclusion is that there has been little long-term change in precipitation, either annually or seasonally, except in Scotland. The only significant change in recent decades has been the return to wetter summers, following the unusually dry period of the 1970s to 1990s.

Surprisingly the Met Office's *State of the UK Climate 2018* makes no mention of these longer-term trends, preferring to misleadingly highlight shorter-term trends. For instance, they state:

> - The most recent decade (2009–2018) has been on average 1% wetter than 1981–2010 and 5% wetter than 1961–1990 for the UK overall.
> - For the most recent decade (2009–2018) UK summers have been on average 11% wetter than 1981–2010 and 13% wetter than 1961–1990. UK winters have been 5% wetter than 1981–2010 and 12% wetter than 1961–1990.

The implication is that the UK climate is getting wetter. But as the EWP series charts clearly display, the climate is no wetter than it has often been in the past. The Met Office also fail to distinguish between rainfall in Scotland and the rest of the UK, a signif-icant omission.

5 Precipitation extremes

One of the most common claims about climate change is that it is causing more extreme rainfall. It is presented as a 'fact' whenever there is a flood or untoward event. It was one made again very recently by Sir James Bevan, head of the Environment Agency.[13] However, it is a claim that has no basis in fact, at least as far as the UK is concerned. The EWP series shows that the wettest decade on record was the 1870s, followed by the 1990s, 1920s and 1910s (Figure 16). The data shows no evidence of a wetter climate .

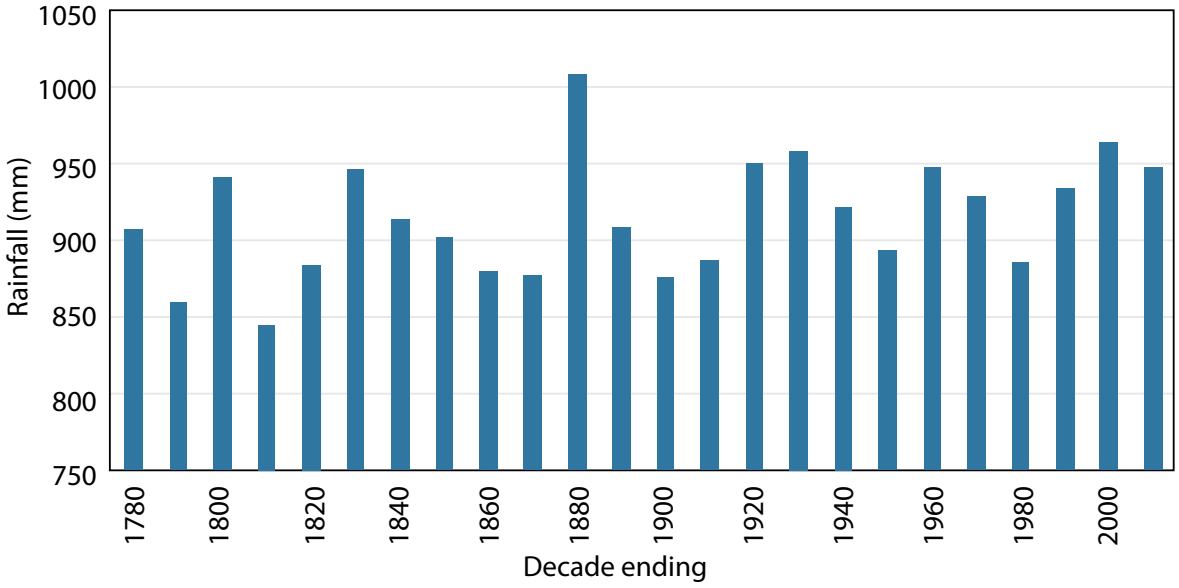
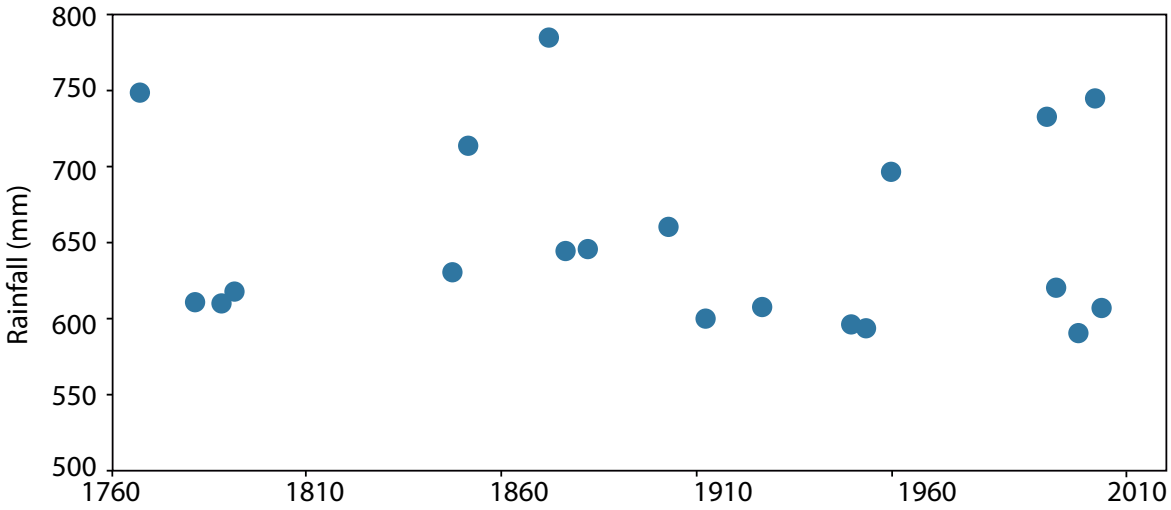
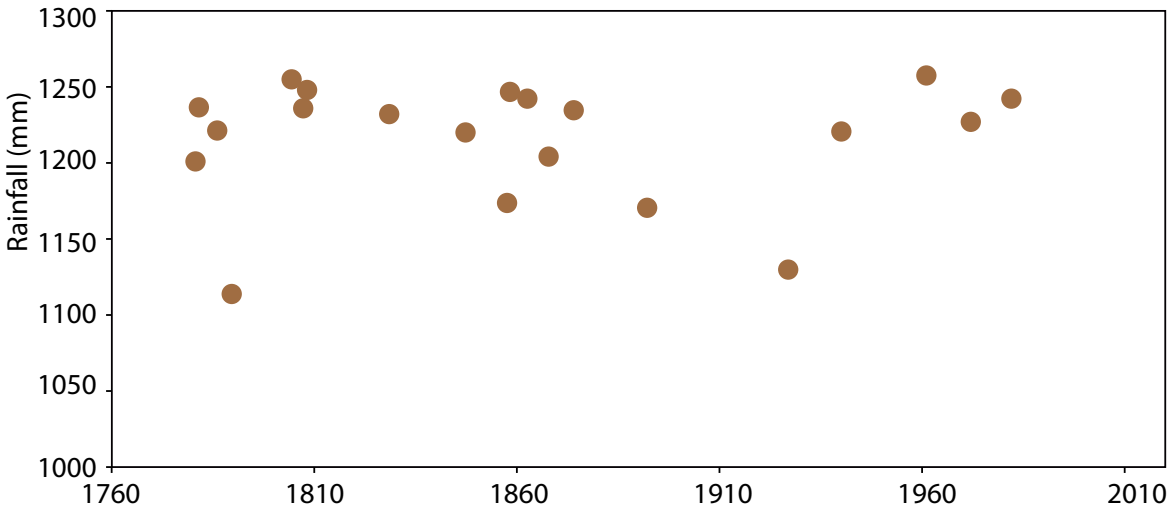


Figure 16: Decadal precipitation in England and Wales.[11]

In annual terms, the wettest years were 1872 and 1768. While wet years appear to come in clusters, recent years have not been unprecedented (Figure 17a). There is strong evidence however that the driest years have become much less common in recent decades (Figure 17b). The last top-20 year was 1973.



(a) Wettest years



(b) Driest years

Figure 17: Years of extreme precipitation.
(a) 20 driest and (b) 20 wettest years. Source: Met Office data.[11]

Figure 18 shows all months with more than 150 mm of rainfall. Altogether there have been 98 such events since 1766, 3% of the total. By far the wettest month was October 1903, when 218 mm fell. Although they appear to have been less common prior to 1900, there is no evidence of any significant change in the distribution of extremely wet months since that time.

We can also drill down to daily data, although this is only available from 1931 in the EWP series. Figure 19 shows that the wettest day by far, across England and Wales as a whole, was

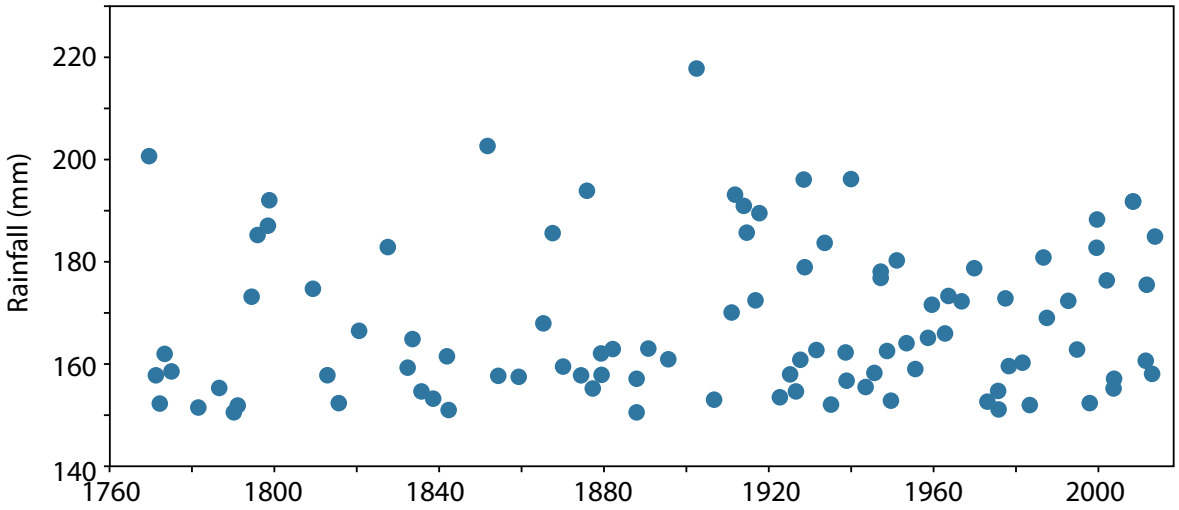


Figure 18: Months of heavy precipitation.

All months with rainfall >150 mm. Source: Met Office data.[11]

in 1986. During the last decade or so, the incidence of heavy rain days does not appear to be significantly different to earlier periods, such as the 1960s and 70s.

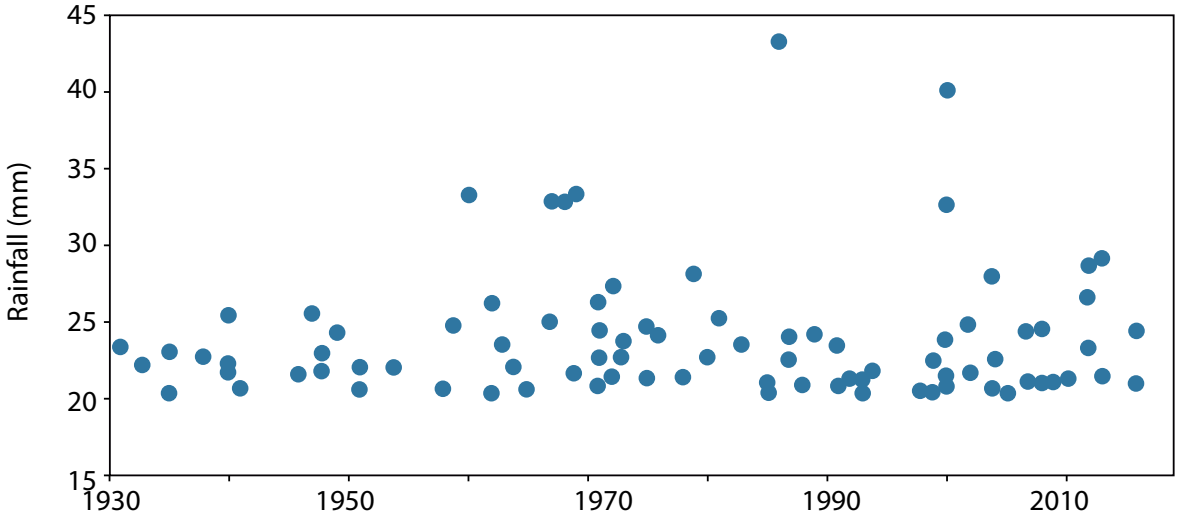


Figure 19: Days of heavy precipitation.

All days with rainfall >20 mm. Source: Met Office data.[11]

As noted, the daily series does not extend back to earlier extremely wet periods such as the 1870s and 1910s. However, one of the longest-running rainfall data records is at Oxford. Figure 20 plots the distribution of days with 30 mm of rain and over, since 1827. Some exceptionally wet days appear between 1951 and 1973. No such days have occurred since, while the distribution of days in the last two decades is similar to many other decades earlier in the record.

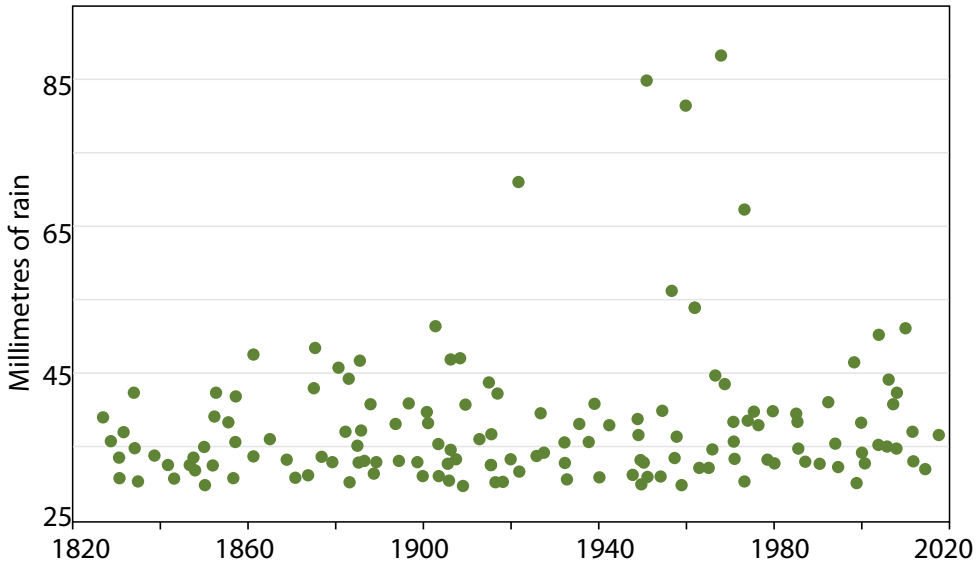


Figure 20: Heavy rainfall days in Oxford.

Days with daily rainfall of more than 30 mm. Source: KNMI Climate Explorer[14]

Naturally, the EWP series averages across the two countries, which may hide regional variations. However, the series also has a monthly regional breakdown, as shown in Figure 21. Storm Desmond is clearly evident in the North-west in December 2015. Other than this though, there is no evidence that extreme rainfall is either becoming more intense, or more common, on a monthly basis in any region. In summary, the data is clear that rainfall

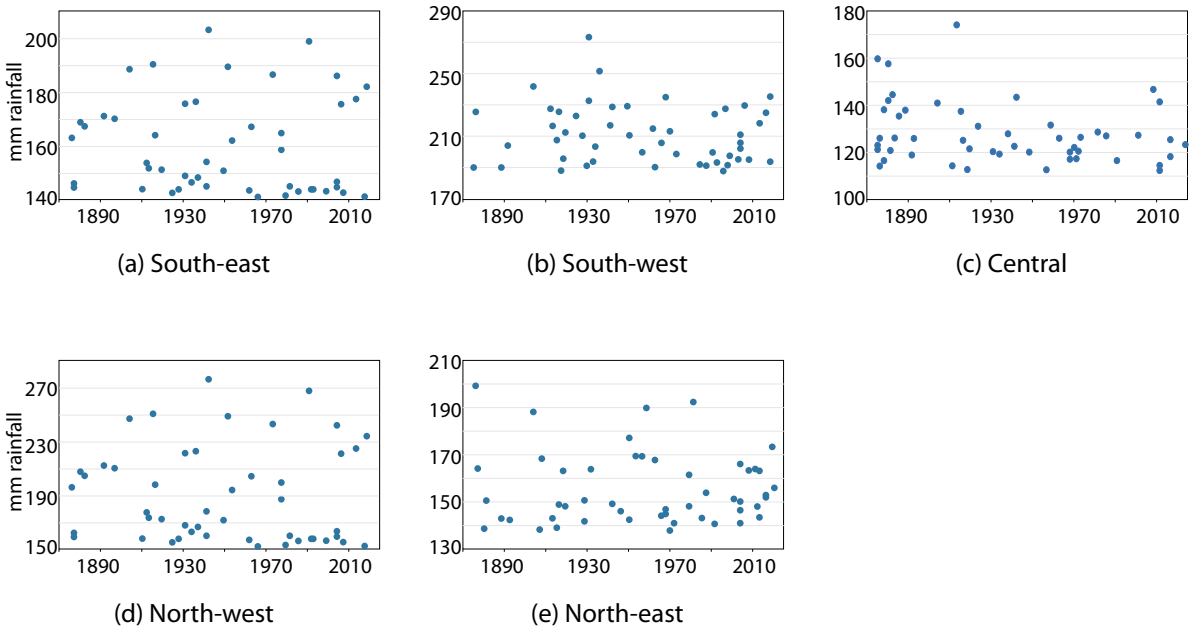


Figure 21: Months of heavy rainfall by region

Months over 150 mm of precipitation in England and Wales regional precipitation series 1873–2018. Source: HADUKP Regional Precipitation Series.[15]

is not becoming more extreme, whether in decadal, annual, monthly or daily terms. There is however strong evidence that exceptionally dry years have become much less common.

6 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/yr in the extreme south west (Figure 22).

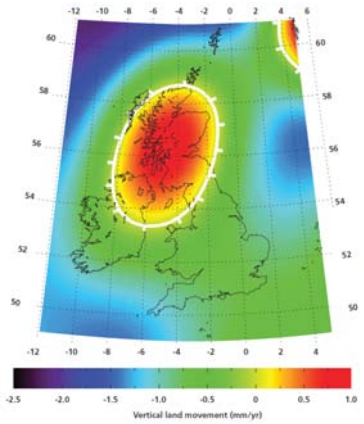
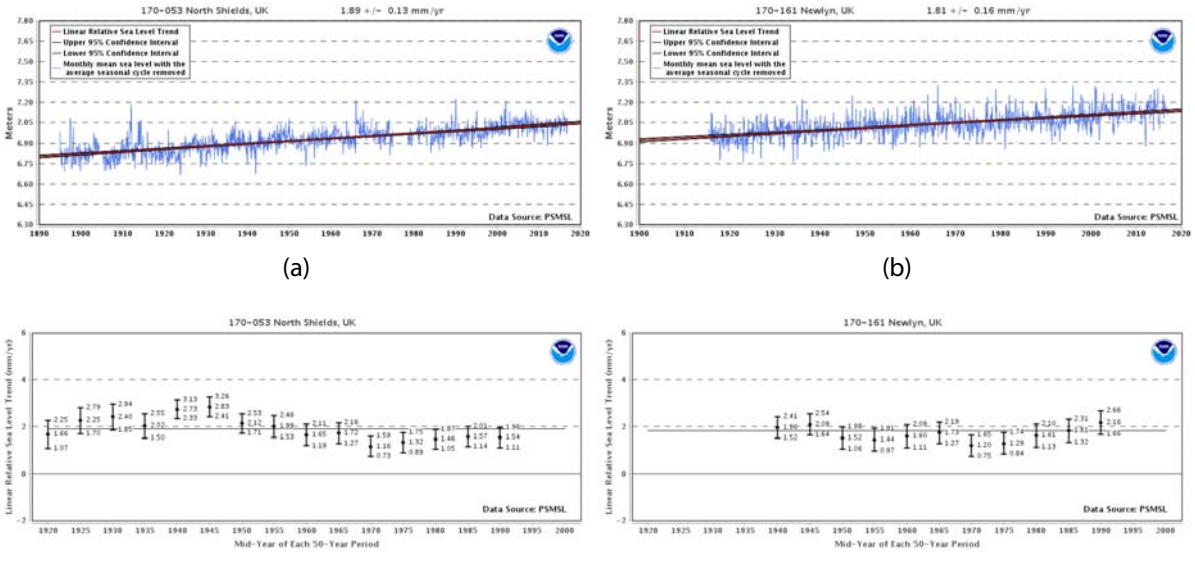


Figure 22: Vertical land movement for the UK

UK Climate Projections.[16]

An analysis by Woodworth *et al.* estimated a rise in sea levels since 1901 of 1.4 mm/yr, after correcting for land movement. This figure was based on readings from five stations:



(a) (b)

(c) (d)

Figure 23: Sea level at two UK towns

Sea level at (a) North Shields (b) Newlyn. Relative sea level trends at (c) North Shields and (d) Newlyn. Source: Sea-level trends, NOAA.[17]

Aberdeen, North Shields, Sheerness, Newlyn and Liverpool. However, there is a lot of missing data for Aberdeen, Liverpool and Sheerness.

Charts provided by NOAA give sea-level trends for North Shields and Newlyn, both of which have very long and largely complete tide gauge records (Figure 23a,b). Because of a lack of recent updates by NOAA, both finish in 2016.

At neither of these stations is there any evidence of recent acceleration in the rate of rise, and what changes there are appear to be broadly consistent with the Woodworth study.

NOAA also provide graphs which illustrate the variation of sea level trends, based on overlapping 50-year periods updated every five years (Figure 23c,d). For instance, at Newlyn the linear sea level trend was 2.16 mm/yr between 1966 and 2015. At both sites, there is clear evidence of a cyclical pattern, with a rate of rise similar to present or higher until the mid-20th century. There followed a slow down in the rate of rise, which seems to have bottomed out in the 1970s. Sea-level rise in recent years is higher than the 20th-century average, but this is only because the latter includes the slow down.

It is important to look at sea-level trends over at least 50 years, as it is well established that sea level trends obtained from tide gauge records shorter than about 50–60 years are corrupted by interdecadal sea-level variation.[18]

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.[19]

7 Storms

According to the Met Office, 2018 was an unexceptional year, as far as storms are concerned. Although there is no established database of storms in the UK, the Met Office have published the data reproduced in Figure 24:

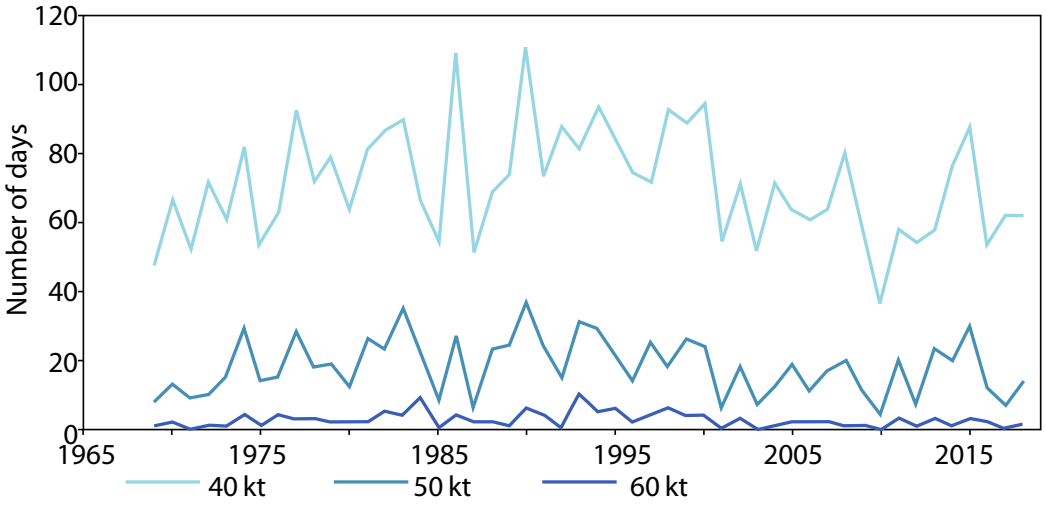


Figure 24: Winds and storms in the UK.
Count of number of days each year in which a maximum gust of particular speeds are recorded at more than 20 UK weather stations. Source: UK State of the Climate Report 2018.[6]

They conclude:

> As a measure of storminess [Figure 24] counts the number of days each year on which at least 20 stations recorded gusts exceeding 40/50/60 Kt (46/58/69 mph). Most winter storms have widespread effects, so this metric will reasonably capture fairly widespread strong wind events. The metric will consider large-scale storm systems rather than localized convective gusts. There are no compelling trends in max gust speeds recorded by the UK wind network in the last five decades, particularly bearing in mind the year-to-year and decadal variations and relatively short length of this time series.

Notes

1. https://www.theccc.org.uk/2019/08/05/spotlight-on-uk-infrastructure-as-climate-changes/.
2. https://www.gov.uk/government/speeches/its-the-climate-emergency-stupid.
3. Met Office. *State of the UK Climate 2018* https://rmets.onlinelibrary.wiley.com/doi/10.1002/joc.6213.
4. mohcsoc
5. https://www.metoffice.gov.uk/climate/uk/summaries
6. State of the UK Climate 2017. https://rmets.onlinelibrary.wiley.com/oc/10970088/2018/38/S2.
7. NOAA https://oceanexplorer.noaa.gov/facts/climate.html.
8. https://www.esrl.noaa.gov/psd/gcos_wgsp/.
9. Central England Temperature Series https://www.metoffice.gov.uk/hadobs/hadcet/index.html.
10. Met Office https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-temperature-rainfall-and-sunshine-time-series.
11. England and Wales Precipitation Series, https://www.metoffice.gov.uk/hadobs/hadukp/data/download.html.
12. Murphy C *et al.* Multi-century trends to wetter winters and drier summers in the England and Wales precipitation series explained by observational and sampling bias in early records. *International Journal of Climatology.* https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/joc.6208.
13. Sir James Bevan speech https://www.gov.uk/government/speeches/its-the-climate-emergency-stupid.
14. KNMI Climate Explorer http://climexp.knmi.nl/selectdailyseries.cgi?id=someone@somewhere.
15. HADUKP Regional Precipitation Series https://www.metoffice.gov.uk/hadobs/hadukp/.
16. UK Climate Projections. Marine and Coastal Projections (14)https://webarchive.nationalarchives.gov.uk/20181204111026/http://ukclimateprojections-ukcp09.metoffice.gov.uk/22530.
17. NOAA. Sea Level Trends https://tidesandcurrents.noaa.gov/sltrends/sltrends_global_country.html?gid=1222
18. Bruce Douglas, Global Sea Rise: a Redetermination http://www.psmsl.org/train_and_info/training/gloss/gb/gb3/douglas.html.
19. IPCC AR5 https://www.ipcc.ch/report/ar5/wg1/.

About the Global Warming Policy Foundation

The Global Warming Policy Foundation is an all-party and non-party think tank and a registered educational charity which, while openminded on the contested science of global warming, is deeply concerned about the costs and other implications of many of the policies currently being advocated.

Our main focus is to analyse global warming policies and their economic and other implications. Our aim is to provide the most robust and reliable economic analysis and advice. Above all we seek to inform the media, politicians and the public, in a newsworthy way, on the subject in general and on the misinformation to which they are all too frequently being subjected at the present time.

The key to the success of the GWPF is the trust and credibility that we have earned in the eyes of a growing number of policy makers, journalists and the interested public. The GWPF is funded overwhelmingly by voluntary donations from a number of private individuals and charitable trusts. In order to make clear its complete independence, it does not accept gifts from either energy companies or anyone with a significant interest in an energy company.

GWPF BRIEFINGS

1	Andrew Turnbull	The Really Inconvenient Truth or 'It Ain't Necessarily So'
2	Philipp Mueller	The Greening of the Sahel
3	William Happer	The Truth about Greenhouse Gases
4	Gordon Hughes	The Impact of Wind Power on Household Energy Bills
5	Matt Ridley	The Perils of Confirmation Bias
6	Philipp Mueller	The Abundance of Fossil Fuels
7	Indur Goklany	Is Global Warming the Number One Threat to Humanity?
8	Andrew Montford	The Climate Model and the Public Purse
9	Philipp Mueller	UK Energy Security: Myth and Reality
10	Andrew Montford	Precipitation, Deluge and Flood
11	Susan Crockford	On the Beach
12	Madhav Khandekar	Floods and Droughts in the Indian Monsoon
13	Indur Goklany	Unhealthy Exaggeration
14	Susan Crockford	Twenty Good Reasons not to Worry about Polar Bears
15	Various	The Small Print
16	Susan Crockford	The Arctic Fallacy
17	Indur Goklany	The Many Benefits of Carbon Dioxide
18	Judith Curry	The Climate Debate in the USA
19	Indur Goklany	The Papal Academies' Broken Moral Compass
20	Donoughue and Forster	The Papal Encyclical: a Critical Christian Response
21	Andrew Montford	Parched Earth Policy: Drought, Heatwave and Conflict
22	David Campbell	The Paris Agreement and the Fifth Carbon Budget
23	Various	The Stern Review: Ten Years of Harm
24	Judith Curry	Climate Models for the Layman
25	Fritz Vahrenholt	Germany's *Energiewende*: a Disaster in the Making
26	Hughes, Aris, Constable	Offshore Wind Strike Prices
27	Michael Miersch	Truly Green?
28	Susan Crockford	20 Good Reasons not to Worry About Polar Bears: Update
29	Mikko Paunio	Sacrificing the Poor: *The Lancet* on 'pollution'
30	Mikko Paunio	Kicking Away the Energy Ladder
31	Bill Gray	Flaws in Applying Greenhouse Warming to Climate Variability
32	Mikko Paunio	Save the Oceans: Stop Recycling Plastic
33	Andy Dawson	Small Modular Nuclear: Crushed at Birth
34	Andrew Montford	Quakes, Pollution and Flaming Faucets
35	Paul Homewood	DEFRA vs Met Office: Factchecking the State of the UK Climate
36	J. Ray Bates	Deficiencies in the IPCC's Special Report on 1.5 Degrees
37	Paul Homewood	Tropical Hurricanes in the Age of Global Warming
38	Mikko Paunio	The Health Benefits of Ignoring the IPCC
39	Jack Ponton	Grid-scale Storage: Can it Solve the Intermittency Problem?
40	Robert Lyman	Carbon Taxation: The Canadian Experience
41	Rémy Prud'homme	La Transition Énergétique: Useless, Costly, Unfair
42	Judith Curry	Recovery, Resilience, Readiness: Contending with Natural Disasters
43	Paul Homewood	Plus Ça Change: The UK Climate in 2018

For further information about the Global Warming Policy Foundation, please visit our website at www.thegwpf.org.

The GWPF is a registered charity, number 1131448.