

WEATHER EXTREMES IN THE UK

by David Wood

BETWEEN 2009 AND 2013, the British Isles experienced a number of weather events that were significantly different from the average conditions. These can be described as ‘extreme’ weather events. Examples included:

- the snowy winters of 2009 and 2010
- a drought which affected large parts of southern and eastern England in spring 2012 following two abnormally dry winters
- the exceptionally wet summer and autumn and associated floods of 2012
- the long, cold March and early April of 2013.

Extreme weather events are not that common in the British Isles, so when exceptional floods, droughts, severe storms or unusually intense snowfalls occur, we are often taken by surprise and are ill-prepared to handle them. This unit explores the theory behind our increasingly erratic weather patterns in the UK and illustrates these through three case studies of events in recent years.

Britain’s temperate maritime climate

Of course, Britain’s weather is famously variable. This is largely because the British Isles lie where five different air streams cross overhead, producing our changeable weather (Figure 1). This mix of weather types, with an absence of regular extremes, is what gives the British Isles their temperate maritime climate.

Extreme weather and the jet stream

In the last five years or so, our usually temperate, ocean-influenced weather has been interrupted by a series of more

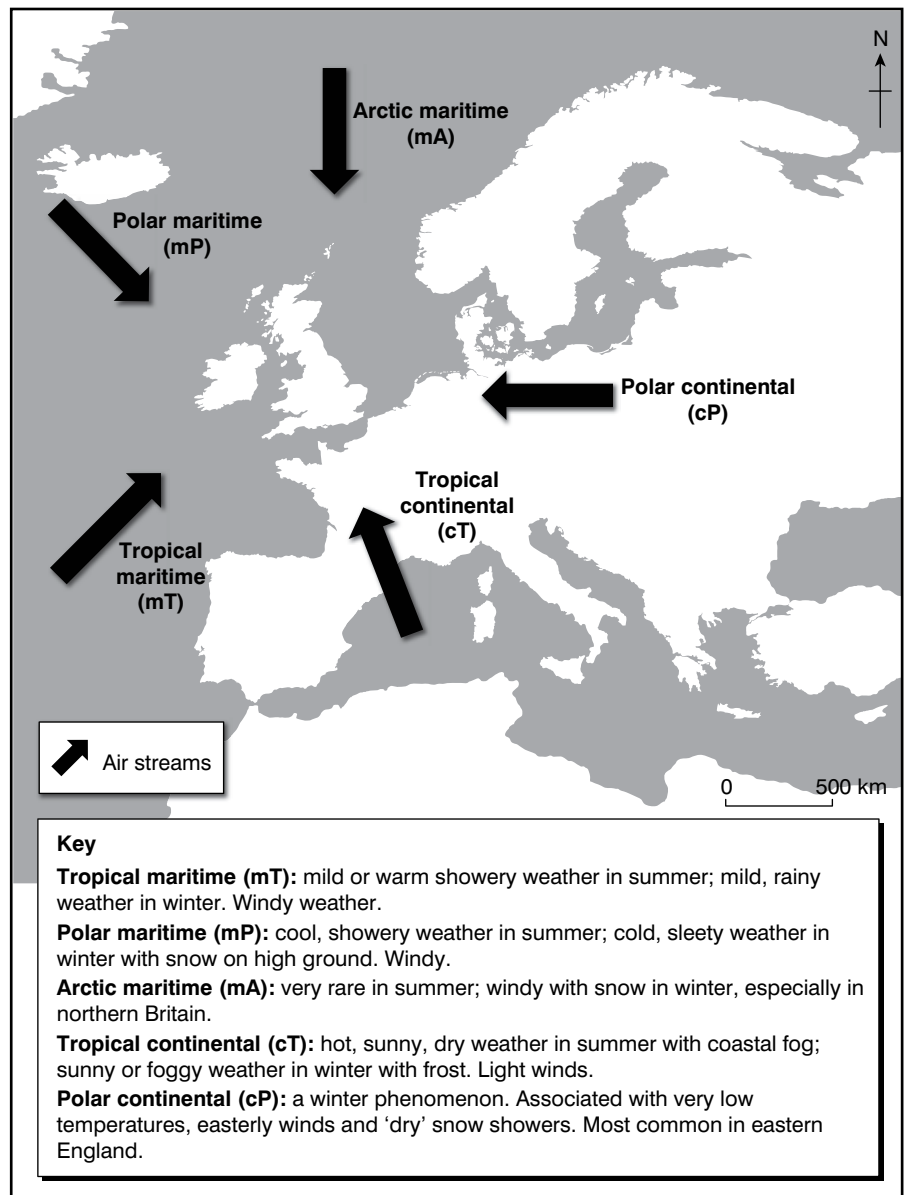


Figure 1: Main airstreams affecting the British Isles

‘extreme’ weather events (Figure 2). This extreme weather has been associated with the position of the jet stream. There may be several factors behind Britain’s recent extreme weather events, but one likely trigger is unusual movements of this high-altitude air current.

The jet stream is a fast-moving current of air which circulates from west to east in the northern

hemisphere at a height of 10–15 km. This air moves at speeds of up to 400 km/hour. Its position and circulation usually ensures that much of Britain’s weather is ‘pulled in’ from the Atlantic Ocean as tropical maritime (mT) or polar maritime (mP) air masses. This process leads to our normally mild, moderately wet climate linked to a series of fast-moving low pressure systems.

2009

- Widespread snow disruption in February, especially in south-east England
- Widespread summer floods, for example in western England
- The wettest July (up to that point) recorded for much of England and Wales
- Severe flooding then followed in November in the Lake District
- Very heavy snow at the end of the year in Scotland and north-east England

2010

- Coldest December since nationwide records began in 1910 – widespread transport disruption
- Disruptive snowfalls in January in many parts

2011

- Warmest spring and April on record
- Highest October temperature on record (29.9°C: Gravesend, Kent)
- Wettest year on record in Scotland (1,859.5 mm on average)

2012

- Following two dry winters, a major drought reached its peak in March 2012 in south-east and eastern Britain – hosepipe bans widely applied
- Drought then followed by the wettest spring and summer for 100 years!

2013

- Britain experienced its second coldest March ever, matching that of 1947 (although 1962 still holds the record)
- Mean average March temperature 2.2°C – that is, 3°C below the average
- Wattisham, Suffolk, recorded its lowest ever daytime temperature for April at 2.7°C on 4 April
- The first day of British Summertime was matched by a temperature of -11°C at Braemar!

Figure 2: Extreme weather events in Britain

However, in recent years, the jet stream has begun to meander away from its usual path for weeks or months at a time. The impact of these movements has been to 'lock' the British Isles into long periods of 'untypical' or extreme weather. A good example was seen in March and early April 2013. During this time, the west Atlantic part of the jet stream meandered north towards Greenland, before taking

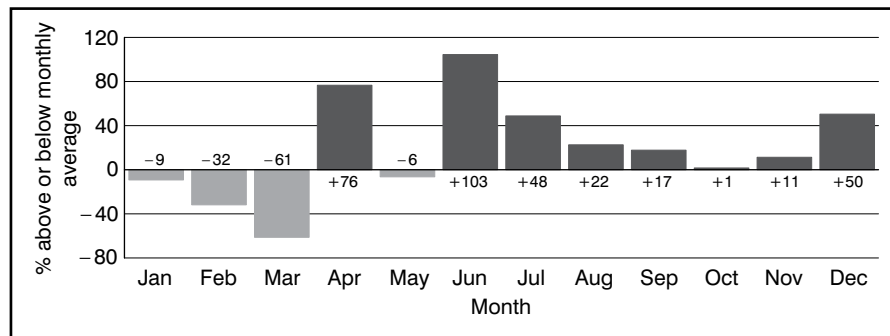


Figure 3: Rainfall by month in the UK, 2012 (percentage above or below average)

Source: Met Office, reprolicence 88174

a loop south towards France. This replaced its usual position of running in a north-westerly direction over the British Isles.

The meandering of the jet stream resulted in over six weeks of below average temperatures and frequent snow showers from the east. A blocking system of high pressure formed of cold, continental air replaced our usual mild, maritime westerlies. Instead of the average 5.5°C, Britain averaged a chilly 2.2°C, giving the second coldest March in 100 years!

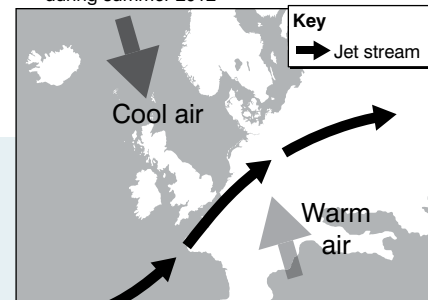
As to why the pattern of the jet stream is changing, there are no proven answers. However, one theory links this to the thinning of sea ice across the Arctic Ocean. For example, in March 2013, Arctic sea ice covered an area of 15.04 million km². This is 710,000 km² below the 1979 to 2000 average extent. The shrinking of the ice is thought to affect the pattern of the jet stream, although the exact processes are complex.

Case Studies

Summer of 2012

After starting with an extended drought, much of Britain – excepting the far north-west of Scotland – suffered its second wettest year on record, with an average of 1,330 mm of rain. Figure 3 shows how the months of April, June, July and December were particularly wet. This was only 6.6 mm short of the record wet year of 2000. For the summer, at

(a) The average position of the jet stream during summer 2012



(b) The normal summer position of the jet stream over the British Isles

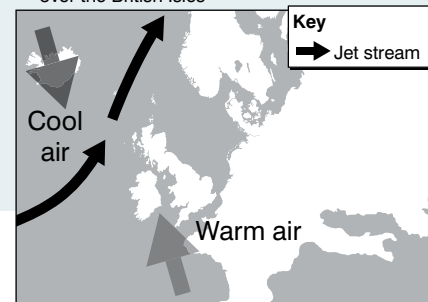


Figure 4: Positions of the jet stream

least, the position of the jet stream was again to blame (Figure 4).

Figure 4a shows clearly how the jet stream lay much further south than usual, influencing particularly the weather in the southern part of the British Isles and in northern France.

By the end of 2012, the Met Office was able to state that the year had been the wettest on record for England, the third wettest for Wales, the seventeenth wettest for Scotland and the fortieth wettest in Northern Ireland since records began in 1910 (Figure 5).

Consequences of the wet summer of 2012

Flooding was one of the worst consequences of the 2012 extreme

Figure 5: Top five wettest years in Britain since 1910

	Year	Total rainfall (mm)
1	2000	1,337.3
2	2012	1,330.7
3	1954	1,309.1
4	2008	1,295.0
5	2002	1,283.7

rains. From April, flood alerts were issued on one of every three days to the end of the year by the authorities. Over 8,000 homes were flooded and the Environment Agency issued a record 1,000 flood warnings in November and December alone in England and Wales. At one point, Devon and Cornwall were cut off from the rest of the country by both road and rail. Meanwhile, the Automobile Association (AA) responded to 8,000 calls from motorists – double the total for 2011. The cost of cleaning up the flood damage to property and transport links was estimated to be in billions of pounds.

Also hit were Britain's farmers. Fields were flooded in many parts of the country and at least £600 million worth of crops such as wheat and potatoes were lost. Farmers also found that machinery such as tractors and combine harvesters sank up to their axles in the saturated ground. The apple crop was the worst in 15 years and many bees died in the wet conditions, raising the cost of honey.

The Environment Agency did emphasise, however, that at least 200,000 homes in England and Wales had been protected from the flood disaster thanks to the recent building of new flood defences.

September 2012: the floods reach Scotland

For Scotland, worse was to come in September 2012. Extreme events included:

- the lowest September air pressure in 30 years (973 mb) with winds of 73 mph (117 km/h) in central Scotland

- roads and railways blocked by fallen trees
- London to Edinburgh trains halted by flooding and high winds
- one-third of Scotland's September average rainfall falling in one day (50 mm).

Coping with flooding

Flood events appear to be increasing in frequency in Britain. This may be partly to do with an increase in 'heavy rain events' (Figure 5) but also because in recent years there has been an increase in new homes built on natural floodplains.

A survey in 2011 also suggested that up to 50% of British gardens have been paved over in recent years, so rainfall over urban areas no longer naturally soaks into the soil but, instead, is diverted straight into the drains, leading to rapid increases in river flow and flooding.

There are two major costs in coping with floods:

- 1 The cost of making good the damage after an event, and paying increased insurance protection fees.
- 2 The costs of trying to prevent floods occurring by building flood defences.

While coping with the aftermath of a flood is a traumatic and often unpleasant experience, building flood defences is simply very costly.

In 2012, the Department of the Environment stated that it intended to spend £2.17 billion over four years to increase flood protection in England and Wales. Local authorities and private businesses also spend large amounts on defences. Between 2013 and 2014, the government announced a total of 93 new flood defence schemes for river and coastal protection. The target was to protect another 115,000 homes by 2015.

March 2013

Temperature records going back to 1892 showed that during 2013 Britain suffered its second coldest March since the spring of 1962. An area of high pressure sat to the north-east of the country for almost six weeks, blocking off the normal flow of mild, showery Atlantic air streams. Sea temperatures in the North Sea dropped 2–5°C below normal levels, adding to the chill of the easterly winds blowing in from Russia.

These were some of the consequences of the cold weather:

- The loss of thousands of newly born lambs buried under snow drifts in highland regions.
- Loss of power during blizzards.
- 3,000 people in Arran and Argyll spent almost a week without power.
- Some farms in Northern Ireland had animal food dropped by helicopter as rural roads were impassable.
- Household heating bills soared as night-time temperatures plummeted.
- Arable farmers were 3–4 weeks behind sowing spring crops because soil temperatures were too low for seeds to germinate.
- Only the Scottish skiing industry remained overjoyed, with some of the best skiing conditions in years.

Weather in the future

Even with our normally moderate temperate maritime climate, the British Isles have always suffered periodic extreme weather events. Storms, harsh winters and floods are itemised in the historical records.

However, the Met Office has identified recent trends towards heavier, more intense rainfall periods in recent years linked to an increased variability in the pattern of the north Atlantic jet stream. At the same time, the area of summer Arctic sea ice continues to decline. We may or may not be suffering the effects of a man-made climate change – but clearly something is changing and affecting our normal British weather patterns.

Activities

1 Write a sentence explaining the term *extreme weather*. Give examples.

2 Study Figure 1. Which air streams bring the following types of weather to the British Isles?

- (a) Our rather infrequent hot, sunny summers
- (b) Our more frequent warm (mild), showery summers
- (c) Our frequent cold, windy, rainy/sleety winters
- (d) Our rarer cold, dry, frosty winters

3 Study Figure 2. Write a paragraph summarising some of the extreme weather events that have affected Britain since 2009. Try to 'group' similar events such as floods in your summary.

4 Re-read the section headed 'Extreme weather and the jet stream' and answer the following questions.

- (a) What precisely is the jet stream?
- (b) How fast can the jet stream move?
- (c) How does the jet stream affect Britain's 'normal' weather?
- (d) What happened to the jet stream in March 2013? What effect did this have on Britain's weather?

5 Study Figure 3. Carefully describe the extent and pattern of 'above average rainfall' which occurred during seven months in 2012.

6 Study Figure 4.

- (a) Carefully sketch both maps on one page.
- (b) Annotate your maps to explain why the summer of 2012 was wetter than usual.

7 Study Figure 5. Use the data to draw a suitable graph headed 'Britain's top five wettest years since 1910'.

8 Study Figure 6. You may also wish to refer to an atlas. Use the map to describe the pattern of rainfall across Britain in 2012

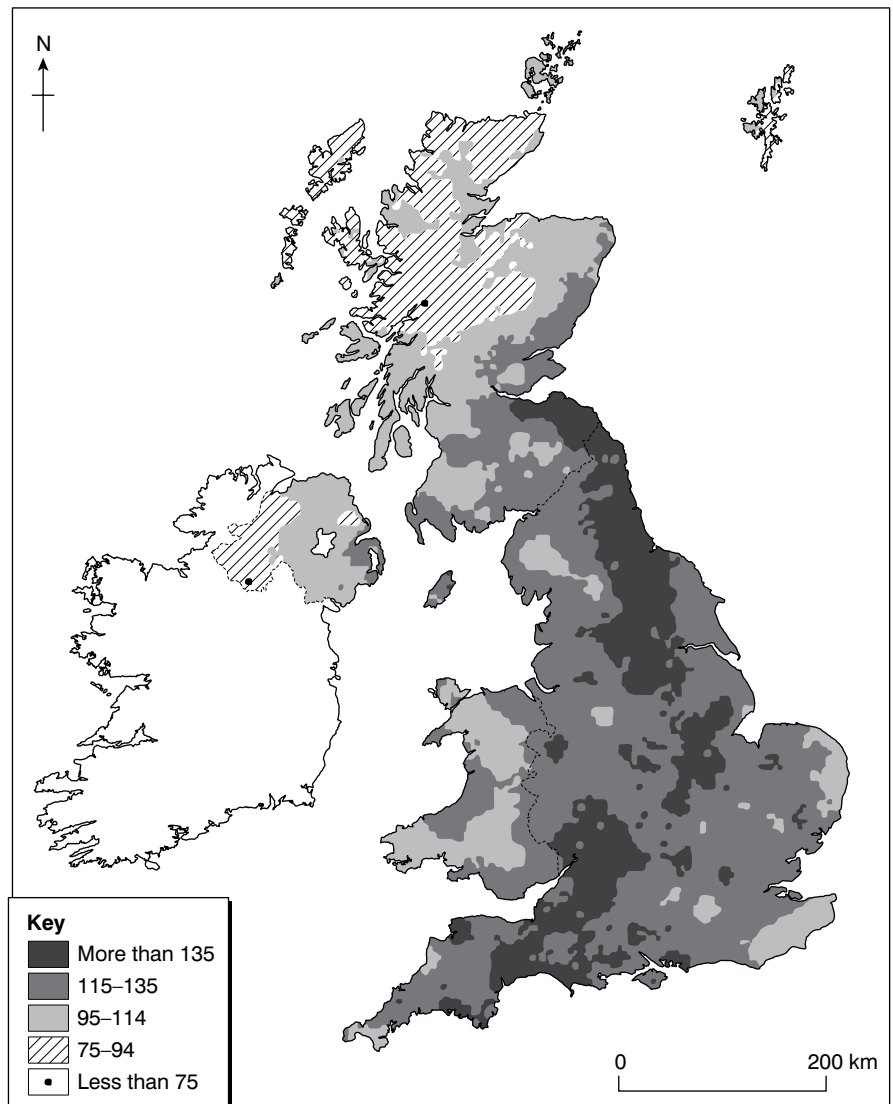


Figure 6: Annual rainfall in the British Isles, 2012 (shown as a percentage of the 1981–2010 average)

Source: Met Office, reprolicence 88174

'There's no doubt that the recent weather has been highly changeable – on both sides of the Atlantic,' said meteorologist Nicholas Klingman of Reading University, describing weather patterns observed in 2012 and early 2013. 'We've had blizzards and flooding. America has had droughts and scorching temperatures.' Linking this to the changing movement of the jet stream, he continued: 'Its behaviour has changed dramatically in the past few years and has produced these lengthy bouts of extreme weather. The real question, of course, is an

obvious one: why has the jet stream changed its behaviour?'

The answer to this question could be significant, because if the movements of the jet stream become unpredictable, meteorologists will find it difficult to make reliable long-term forecasts of weather in the future. Earth's weather systems are being disrupted, and the reason why is closely linked to climate change: the result of the vast quantities of carbon that we humans have released – and are releasing – into the atmosphere.

Figure 7: Extract from a newspaper article

Source: Adapted from an article in *The Observer*, 7 April 2013

as a percentage of average rainfall 1981–2010. Be sure to comment on the variations across the country.

9 Carefully read the newspaper extract in Figure 7.

- (a) In groups, research the

arguments for and against man-made climate change.

- (b) Report your findings, for example in the form of an illustrated PowerPoint presentation.