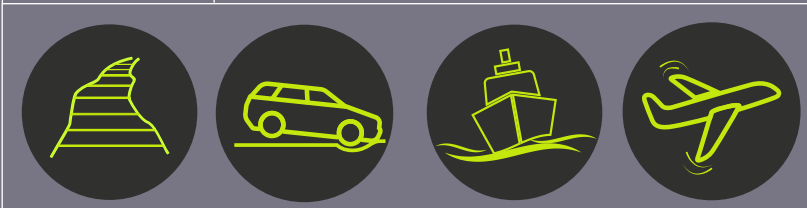
What are the impacts of extreme weather on the UK transport sector?

Extreme weather events – such as very high and low temperatures, heavy rainfall, and strong winds – can lead to:

Direct Impacts



Infrastructure damage (e.g. buckled rails and degraded road surfaces)

Operational difficulties (e.g. docking at ports and take–off / landing at airports)

Indirect Impacts

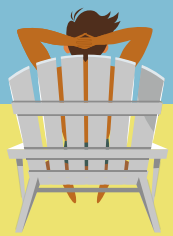
Service disruptions, delays and cancellations

Risks to staff and passengers' safety and comfort

How has the UK climate changed already?[1]

Higher maximum temperatures

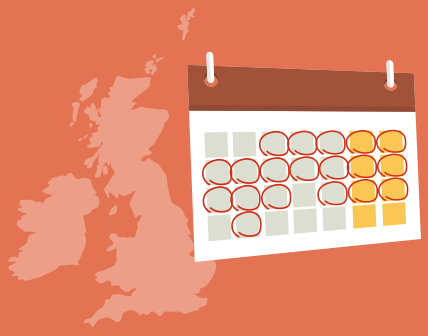
The average hottest day of the year has increased by 0.8 °C.



2008–2017 average: 26.8 °C
1961–1990 average: 26.0 °C

Longer warm spells

Warm spells have more than doubled in length – increasing from 5.3 days in 1961–1990 to 13.2 days in 2008–2017.



Higher minimum temperatures and fewer very cold days

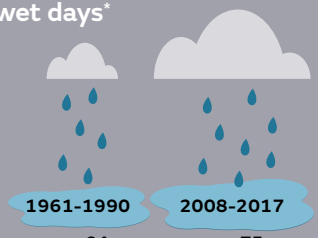
The average coldest day of the year has become 1.7 °C milder.

The number of days where temperatures do not rise above 0 °C has been decreasing.
4.8 days in 1961–1990,
3.2 days in 2008–2017.

More rain in winter and summer and on the wettest days

Total rainfall from extremely wet days* has increased by about 17%.

Summers (2010–2019) have been 13% wetter and winters (2010–2019) have been 12% wetter compared to the 1961–1990 average.[2]



*days exceeding the 99th percentile of 1961–90 rainfall

What is DfT doing to better understand the impacts of climate change?

DfT have a wide–ranging set of "reasonable worst–case scenarios" for contingency planning purposes – including for high and low temperatures, surface water and fluvial flooding, wind, and snow. DfT and the Met Office have explored these scenarios using data from the past and current climate, and extended them to consider the future climate using UK Climate Projections (UKCP18) and other methodologies.

These projections are produced using computer models of the atmosphere and oceans, which capture recent understanding of how the climate system works. The new scenarios are intended to be useful to transport stakeholders, for raising awareness of how weather could impact the transport sector in the future.

How could the UK climate change in future?

We have already experienced changes in climate. Further changes are expected in future. Future climate changes depend strongly on how global greenhouse gas emissions evolve.

Weather will continue to vary in future, and may become more variable.

There is an increased chance of warmer, wetter winters and hotter, drier summers.

Hot summers are expected to become more common and the frequency of hot spells could increase.

There will be fewer frost days, and reduced snowfall amounts.

Extreme daily rainfall events (1 in 20–years or rarer) in all seasons show increases in median estimates.

Sea level around the UK will continue to rise.

By the end of this century, all areas of the UK are projected to be warmer.

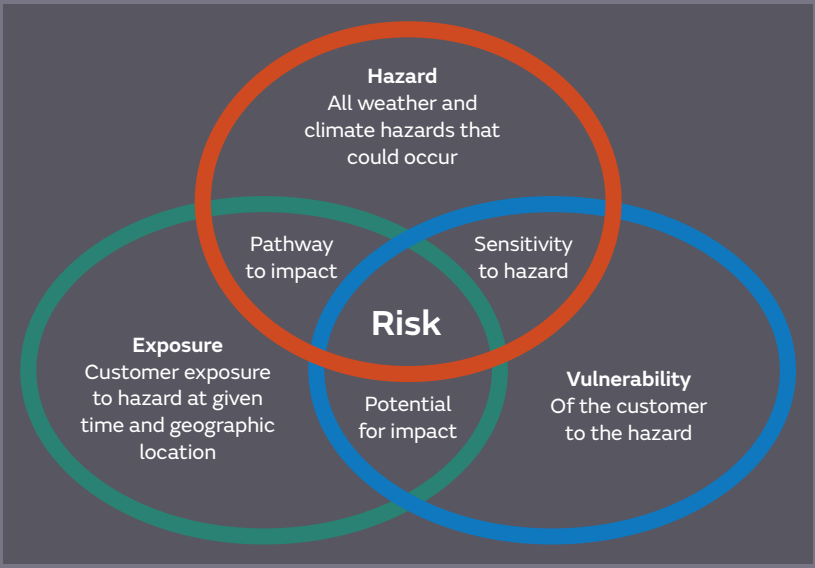
The latest UK climate projections show a slight increase in average wind speeds over the UK through the second half of the the 21st century.

Assessing risk

The risk of a weather event having an impact on the transport sector depends on three key factors; the **hazard**, the **vulnerability**, and the **exposure.**

An example: the risk of asphalt melting, leading to long journey times, can depend on:

- the occurrence of a heatwave – the hazard;
- whether the surface temperatures on the road exceed the threshold at which the asphalt starts to melt – the vulnerability; and
- the number and location of the roads that this affects – the exposure.

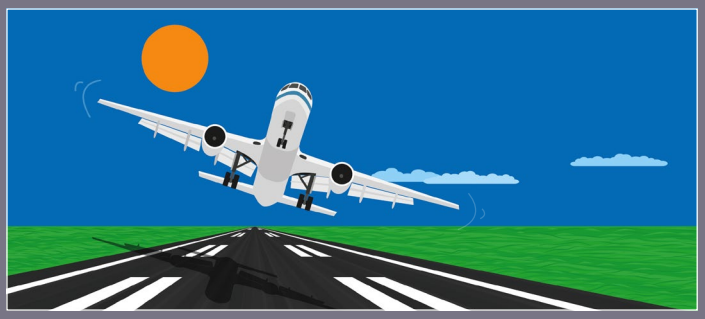


Systemic risks, interdependencies, and indirect impacts

Transport modes are interdependent, and the transport system itself is interdependent with other systems such as energy and waste. All hazards therefore have the potential to result in systemic risks, i.e. risks across the transport system or across multiple systems including transport.

Examples include the impact that an issue with one transport mode could have on a separate transport mode – e.g. flooding of major rail lines could lead to more road journeys, as people change their choice of transport. This in turn could cause more road congestion, resulting in delays to journey times.

Weather can also affect other infrastructure systems which then has the potential to have an impact on the transport sector – e.g. strong winds could disrupt the electricity supply, which in turn could impact safety–critical systems in the transport sector, such as traffic lights and railway signals.



Heatwaves

Can lead to:

- road surfaces cracking, rutting or melting;
- rails buckling; and
- higher speeds required for aircraft to take off.

The heatwave of summer 2018 disrupted the transport system, causing:

- asphalt melting on roads across the country. Several local highway authorities deployed winter gritters, spreading rock dust to create a "non–stick" layer on the road;[3] and
- buckled rails. However, due to Network Rail improving their asset management and taking preventive measures, only 23 buckled rails were experienced in Apr–Aug 2018, in contrast to 137 during the comparable high temperatures of Apr-Aug 2003.[3]

Storms

Can be associated with:

- floods; and/or
- high winds.

This can lead to:

- impassable roads and tracks;
- damage to roadside and lineside assets;
- cancellation and disruption of shipping and flights; and
- vehicles overturning on exposed roads and bridges.

In December 2015 the UK experienced three storms: Desmond, Eva, and Frank. These caused major disruption to both the road and rail network. Across Northern Ireland and northern Britain, roads were closed and many road bridges were destroyed or severely damaged.[4] Rail services were also affected due to flooding and infrastructure damage. The economic impact of these storms on the UK road and rail network was an estimated £341 million.[5]

Low temperatures and snow

Can lead to:

- hazardous driving conditions;
- disruption of access to ports; and
- icing of aircraft and railway overhead line equipment.

The winter of 2009/2010 was the 7th coldest UK winter since records began in 1910, with spells of freezing and snowy conditions affecting most areas of the UK from mid–Dec to mid–Jan.[6]

The estimated cost of travel disruption to the economy due to the severe winter weather was £280 million per day.[7]

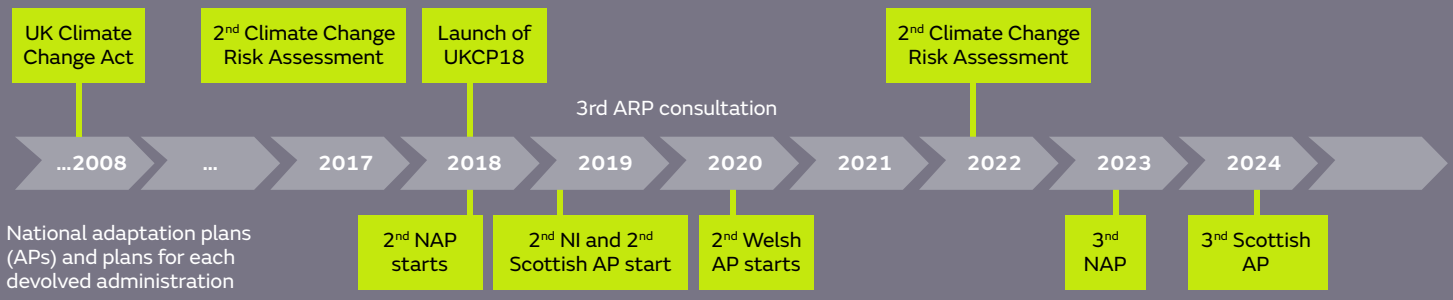
Surface water flooding

Can lead to:

- impassable roads and tracks; and
- damage to roadside and lineside assets.

On the 30th July 2019, part of northern England experienced torrential downpours. In one or two hours, some locations received their usual monthly total rainfall for the whole of July. As a result, flash flooding occurred in parts of the Yorkshire Dales, leaving some roads impassable. A bridge collapsed near Grinton and a landslip closed the railway line between Carlisle and Skipton.[2]

Climate change governance in the UK



The Climate Change Act (2008) covers both mitigation and adaptation. For the transport sector:

- mitigation is taking action in the sector to reduce the emission of greenhouse gases, thereby lessening transport's impact on climate; and
- adaptation is taking action to adapt to observed and anticipated changes in climate, in order to reduce climate impacts on transport.

The Act also established the Climate Change Committee (CCC), an independent, statutory body whose purpose is (i) to advise the UK and devolved governments on emissions targets, and (ii) to report to Parliament on progress made in reducing greenhouse gas emissions, and preparing for and adapting to the impacts of climate change.

For adaptation:

- The Act requires a UK Climate Change Risk Assessment (CCRA) every 5 years (latest 2017; next 2022).
- Via the Adaptation Reporting Power (ARP), organisations can report on their progress in climate risk assessment and adaptation.
- Adaptation programmes/plans (APs) are produced at a UK–wide level and for each devolved administration.
- Adaptation policy is a devolved matter: Scotland, Wales and Northern Ireland have each established their own APs. A national AP (NAP) exists and is primarily for England, as well as covering UK "reserved matters" (those which are not devolved).
- The CCC has evaluated past and current APs.

Further reading on climate change and transport

CCRA2 (2017)	ARP	APs	CCC	UKCP
Infrastructure chapter	First round reports (allorganisations, includes transport)	NAP1 (2013–2018)	About the CCC	Guidance, fact sheets, science reports
Infrastructure fact sheet	Second round reports (all organisations, includes transport)	NAP2 (2018–2023)	First evaluation of NAP1	Key results
Infrastructure infographic		Scottish AP (SCCAP)	Second evaluation of NAP1	Using climate projections in risk assessment
		Welsh AP	First evaluation of NAP2	
		NI AP (NICCAP2)	Evaluation of SCCAP	

This fact sheet can be viewed online at https://bit.ly/climatetransport

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[1] Met Office, National Climate Information Centre. (2018). State of the UK Climate 2017: Supplementary report on Climate Extremes.
[2] Kendon, M., McCarthy, M., Jevrejeva, S., Matthews, A., Sparks, T. and Garforth, J. (2020). State of the UK Climate 2019. International Journal of Climatology, 40(S1): 1–69.
[3] House of Commons Environmental Audit Committee. (2018). Heatwaves: adapting to climate change: Government Response to the Committee's Ninth Report. Tenth Special Report of Session 2017–19.
[4] CEH. (2016). Briefing Note: Severity of the December 2015 floods – preliminary analysis.
[5] Environment Agency. (2018). Estimating the economic costs of the 2015 to 2016 winter floods.
[6] Prior, J. and Kendon, M. (2011). The UK winter of 2009/2010 compared with severe winters of the last 100 years. Weather, 66: 4–10.
[7] House of Commons Transport Committee. (2011). Keeping the UK moving: The impact on transport of the winter weather in December 2010. Fifth Report of Session 2010–12.