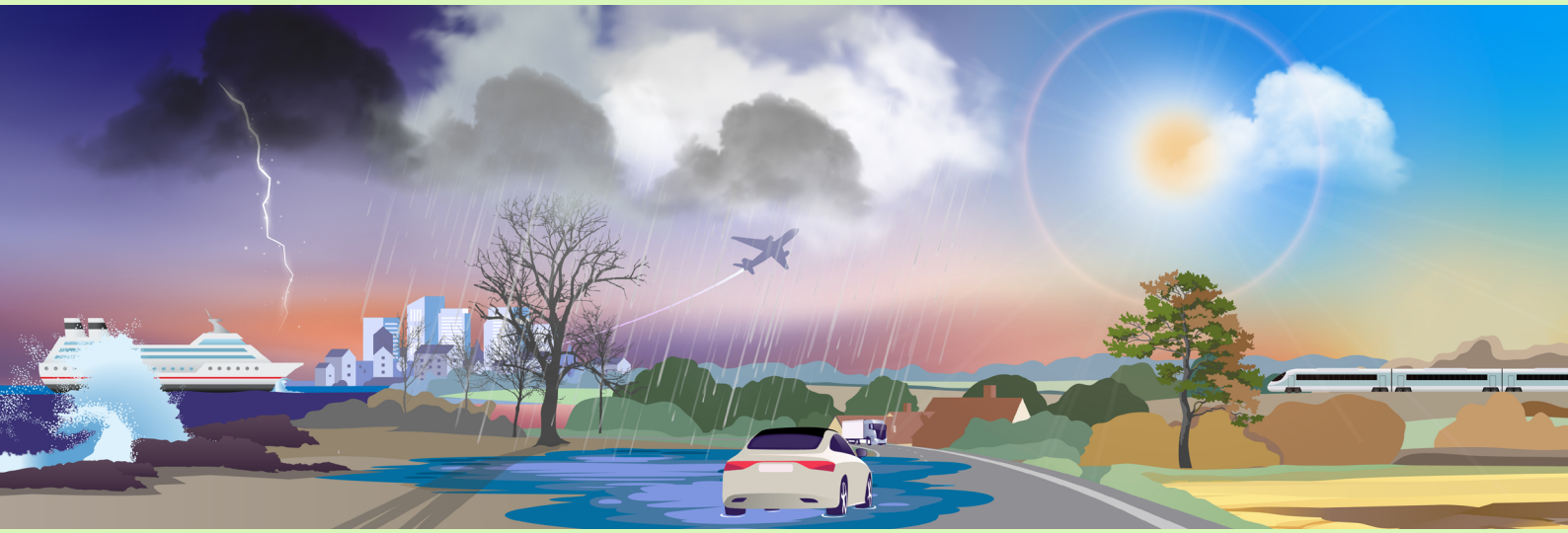
Department for Transport

Met Office

Issued May 2025

Transport hazard summary series

The changing climate



The climate of the UK has already changed significantly and continues to change rapidly. Even if ongoing efforts to limit global temperature rises are successful, some further changes to our climate are already 'locked in'. The transport network is particularly exposed to severe weather and climate-related hazards. Preparing for and adapting to the changing climate is critical to maintaining a resilient transport network. One that is capable of safely and efficiently moving people and goods, which are the societal and economic backbone of day-to-day life in the UK.

The Department for Transport, Met Office and partners have created this series of **transport hazard summaries** to explain natural hazards and other hazards that are not the result of malicious acts, their impacts and how they may change in future. This summary introduces common climate concepts that are used throughout the series. Further transport hazard summaries on specific climate-related hazards are available to give more information on projected changes and the impacts to transport.

Between 2013 and 2023, the number of very hot days (over 30°C) tripled compared to the decades between 1961 and 1990. It was also 10% wetter.*

* Kendon, M., Doherty, A., Hollis, D. and others, International Journal of Climatology, 'State of the UK Climate 2023', volume 44(S1), pages 1 to 117, available at: **https://rmets.onlinelibrary.wiley.com/doi/10.1002/joc.8553**

Climate-related hazards

Hazards related to our climate have always posed a serious risk to the transport network and will continue to do so. As well as hazardous weather, transport could be directly impacted by wildfire, landslides and sea level rise which are dependent on the weather. Indirect risks to transport as a result of climate-related hazards are also possible, for example, storms leading to power outages, which can in turn lead to delayed trains or airport disruption.

Weather hazards

Extreme heat, fog, hail, heavy rain, thunderstorms, ice and snow, wind storms

Other climate related hazards

Air quality, coastal erosion, drought, flooding, landslide, sea level rise, subsidence, wildfire

For more information on these hazards, their impacts on transport and how they may change in the future, see our other transport hazard summaries. An explainer from the Met Office on the causes of **climate change**, including greenhouse gas emissions is linked in the 'Further information' section of this summary.

Climate simulations of the future climate show that there is a greater chance of hotter, drier summers overall and warmer, wetter winters, with more intense summer rainfall when it does occur. Some weather events considered as extreme today could be commonplace within the next 25 years.* It is vital to consider how we can adapt transport to mitigate the increasing risks posed by climate-related hazards.

Understanding climate information

There is a wealth of climate information available showing how weather and climate related hazards are projected to change. This information can help you to assess how transport assets and infrastructure will need to adapt to be resilient. Further information on climate risk assessments and links to key resources can be found at the end of this summary. Here we explore some helpful pointers on interpreting climate data and terminology.

Climate: Climate refers to the statistical description of weather over a period of time ranging from months to thousands or millions of years. For resilience planning, 30 years is usually used to capture the variability of the weather in the UK.

Weather: Weather is the atmospheric conditions (such as temperature, wind, cloud cover, and rain) that are experienced at a particular time and place.

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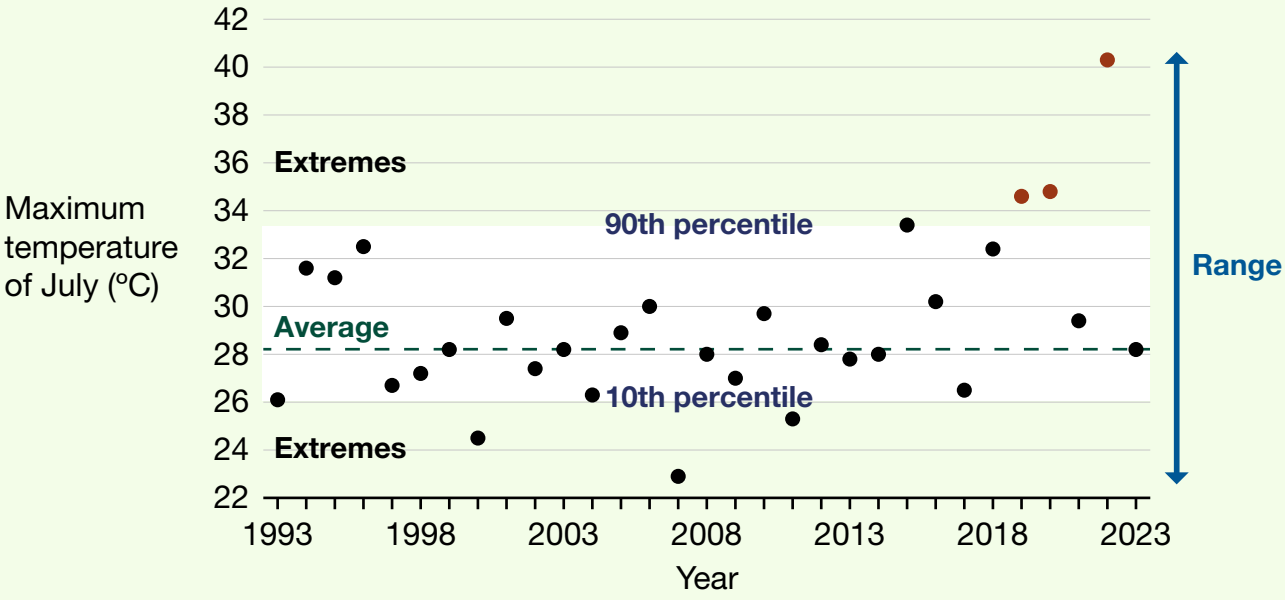
* Met Office Hadley Centre, 'UK Climate Projections: Headline Findings', 2022, available at: **www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18_headline_findings_v4_aug22.pdf**

Climate data

Climate data can be used to understand the past, present and future climate. There will be more information on climate projections later in this summary. We can use present-day climate data and the level of impacts that we see on transport to predict what the impacts could be in a future climate by using projections. We can then consider how the transport network will need to adapt to be resilient.

In figure 1 we look at some typical climatological terms that you are likely to encounter when using climate data. These terms could be applied to any aspect of the weather over a period of time, for example the average wind speed. In this example, we are using the maximum temperature observed on any day in July each year for a specific site.

Figure 1: Maximum temperature observed in July over 30 years at Coningsby



Average:
A central value (mean, median or mode) which can be used as a guide to typical conditions for a particular weather type.

Range:
The difference between the highest and lowest value that has been (or is projected to be) observed.

Extremes:
Outlying values which are unusual compared to normal. The record high temperature of 40.3°C during the July 2022 heatwave can be seen in the top right corner.

Percentiles:
These can be helpful to distinguish between typical weather and weather extremes. Values between the 10th and 90th percentile are seen 80% of the time, values above the 90th or below the 10th percentiles respectively, are only seen 10% of the time.

Estimating future changes to the climate

We have described how climate data can be used to help plan for a transport system that is resilient to the future climate. The future climate depends greatly on human actions and decisions around the world. As this depends on decisions that the world has not yet made, we do not know what future global greenhouse gas emissions will be. Therefore, we need to consider different scenarios when projecting the climate.

Future scenarios and pathways

Scientists have developed a number of pathways (scenarios) of future emissions that evolve over time and cover different views of how global technology, populations, wealth and policy will evolve. These aim to span the range of future emissions from low to high. Several versions of these scenarios have been developed over time and are in common use. The most likely sets you will come across are the RCPs (Representative Concentration Pathways) and the newer SSPs (Shared Socioeconomic Pathways). Both are valuable for climate risk assessment.

More information on RCPs and SSPs can be found in the 'Further reading' section at the end of this summary.

Climate projections: Computers are used to model the Earth system to predict how the climate will change. Climate models can use different emissions scenarios and pathways, allowing us to explore different possible futures. The Met Office provides the United Kingdom Climate Predictions (UKCP18) which give a range of data types for use in different contexts.

Uncertainty – Why is it so hard to be certain about what will happen?

Human choices: We cannot say for sure how human greenhouse gas emissions and land uses will change. This is why different scenarios, like the RCPs, are used to give plausible ranges which can be used in decision making.

Natural variations: Year-to-year changes in weather make short term predictions of climate particularly difficult. Events such as volcanic eruptions, which can change the composition of the atmosphere, can also have an effect.

Computer modelling: Computer models can never be perfect. Scientists represent different human and natural behaviours in models to give a range of results, so that we can understand the best and worst case scenarios to make planning decisions.*

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* UK Parliament, 'Understanding uncertainty in climate change predictions', 2024, available at: **https://commonslibrary.parliament.uk/understanding-uncertainty-in-climate-change-predictions/**

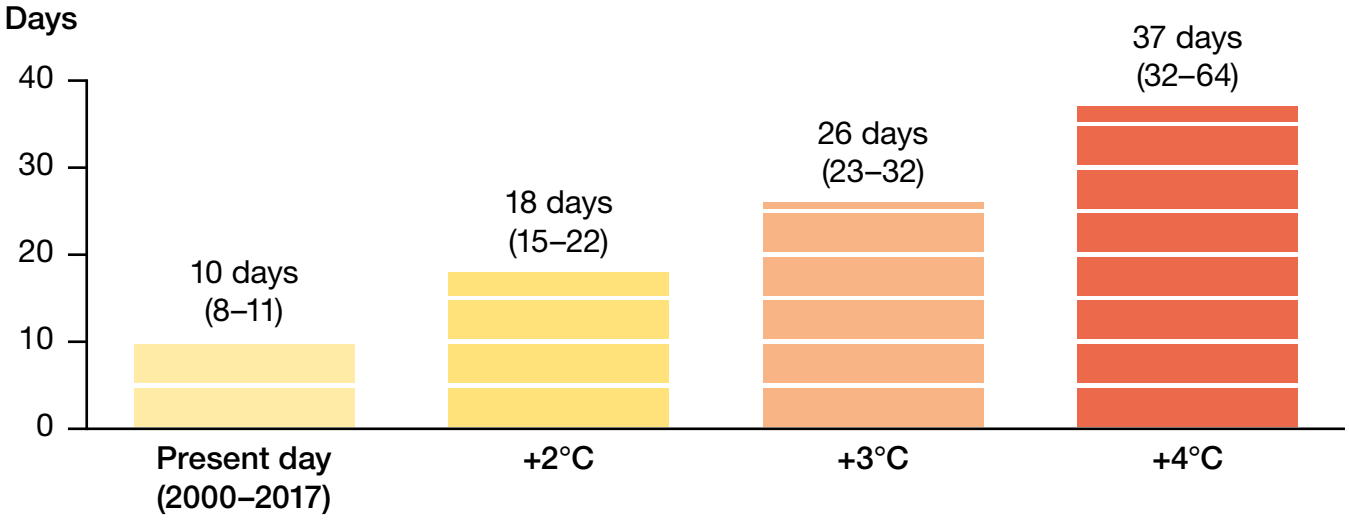
Global warming level

Global warming levels show the increase in the average temperature for the whole globe (in °C) compared to pre-industrial levels (between 1850 and 1900).

The current global warming level is estimated to be around 1.3°C. In other words, the global average temperature is currently 1.3°C higher than it was during pre-industrial times.*

The local impacts associated with different global warming levels can be estimated regardless of when and under which emissions scenario they may occur in the future. Figure 2 shows how the number of days where temperatures exceed 25°C in the UK is projected to change at different global warming levels. Note how seemingly small differences in the global warming level can lead to considerable changes in the UK climate.

Figure 2: Projected number of 'summer days' (>25°C) per year in the UK at different global warming levels with the range of the potential number of days†



It is not just the temperature in the UK that will change as the global warming level rises. Rainfall is projected to become more intense and sea levels are expected to rise. See our transport hazard summaries on specific hazards for more information on how these will change.

The climate of the UK has already changed, with higher maximum temperatures and evidence of more intense rainfall. As the climate continues to change, extreme events will intensify to levels not seen before. Conditions that are currently considered as extreme will occur more often and the range of conditions experienced will become broader. New hazards could emerge that we have not yet seen in the present climate.

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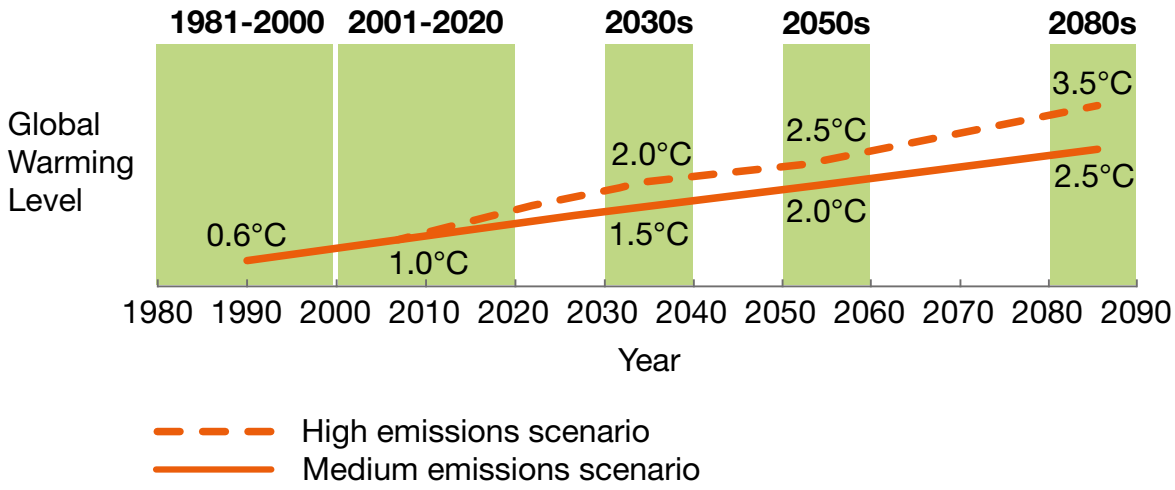
* Met Office, 'Indicators of Global Warming', 2025, available at: **https://climate.metoffice.cloud/current_warming.html**

† Hanlon, H.M., Bernie, D., Carigi, G. and others, Climatic Change, `Future changes to high impact weather in the UK', volume 166, article number 50, 2021, available at: **https://link.springer.com/article/10.1007/s10584-021-03100-5**

Climate change timelines

Timelines for when or if different global warming levels will be reached are estimated based on different emissions scenarios, like those shown in figure 3.

Figure 3: Projected timelines for global warming levels for a medium and high greenhouse gas concentration scenario*



- The global warming level is most likely to reach 1.5°C in the early 2030s.†
- Between now and the middle of the century, continued climate change is largely inevitable. Global warming of 2°C is reached by most emissions scenarios by the middle of the century.
- In the second half of the century, a wide range of global warming levels remain possible. 4°C is reached only by the higher emissions scenarios and not until later in the century.‡

* Met Office, 'How to Assess your Climate Risk', 2024, available at: **https://climatedataportal.metoffice.gov.uk/pages/lacs-assess-your-risk**

† UN Environment Programme, 'Emissions Gap Report 2024', 2024, available at: **www.unep.org/resources/emissions-gap-report-2024**

‡ Climate Change Committee, 'Proposed methodology for the Fourth Climate Change Risk Assessment – Independent Assessment', 2024, available at: **www.theccc.org.uk/publication/proposed-methodology-for-the-ccra4-advice/?chapter=3-proposed-methodological-approach-for-ccra4-ia**

Adapting to climate change

While **climate mitigation** seeks to reduce net human greenhouse gas emissions, **climate adaptation** is urgently required to make our transport network resilient to the changes in climate that are now unavoidable. The evidence shows that we must be ready for global warming levels of 2°C, which could happen as soon as the 2030s to 2040s, and be prepared for 4°C.* Below are some examples of how changing hazards could impact transport. More detail can be found in transport hazard summaries on specific climate-related hazards.

More severe flooding could mean a higher risk of damage to roadside and lineside assets.

Warmer winters could make risks from snow and ice occur less frequently.

Heatwaves can mean higher speeds are required for aircraft to take off.

Ports and other coastal transport infrastructure may be more vulnerable to flooding due to sea level rise.

* Department for Environment, Food & Rural Affairs, 'Third National Adaptation Programme', 2024, available at: **www.gov.uk/government/publications/third-national-adaptation-programme-nap3**

Further reading

Climate Models Factsheets – PRIMAVERA

Explainer: Shared Socioeconomic Pathways – Carbon Brief

UK Climate Projections (UKCP) – Met Office

UKCP18 Guidance: Representative Concentration Pathways – Met Office

UKCP data factsheets – Met Office

What is climate change? – Met Office

Climate information and risk assessment

Attributing extreme weather to climate change – Met Office – A series of studies to show how climate change has contributed to severe weather events in the UK with insight into how the likelihood of similar events will change in the future

Climate change adaptation reports – Climate adaptation reports from transport organisations under the **DEFRA Adaptation Reporting Power**

Climate Dashboard – Graphs and information showing past and current climate observations

Climate Risk Assessment Guidance for Transport – A step-by-step approach to completing a CCRA for the UK transport sector

Climate Risk Indicators – UK Climate Resilience Programme data and maps to show indicators of climate risks

Local Authority Climate Service – Essential area specific tools and climate reports from the Met Office and DEFRA

The Met Office climate data portal – Access to UKCP18 climate projection data

UK Climate Change Risk Assessment (CCRA3) Transport – A summary of transport climate risks from the UK government's **third mandatory CCRA**

UK Climate Projections User Interface – Access to maps and graphs showing UKCP18 climate projection data