Extreme Weather and Safety for Sports Grounds

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Development lead

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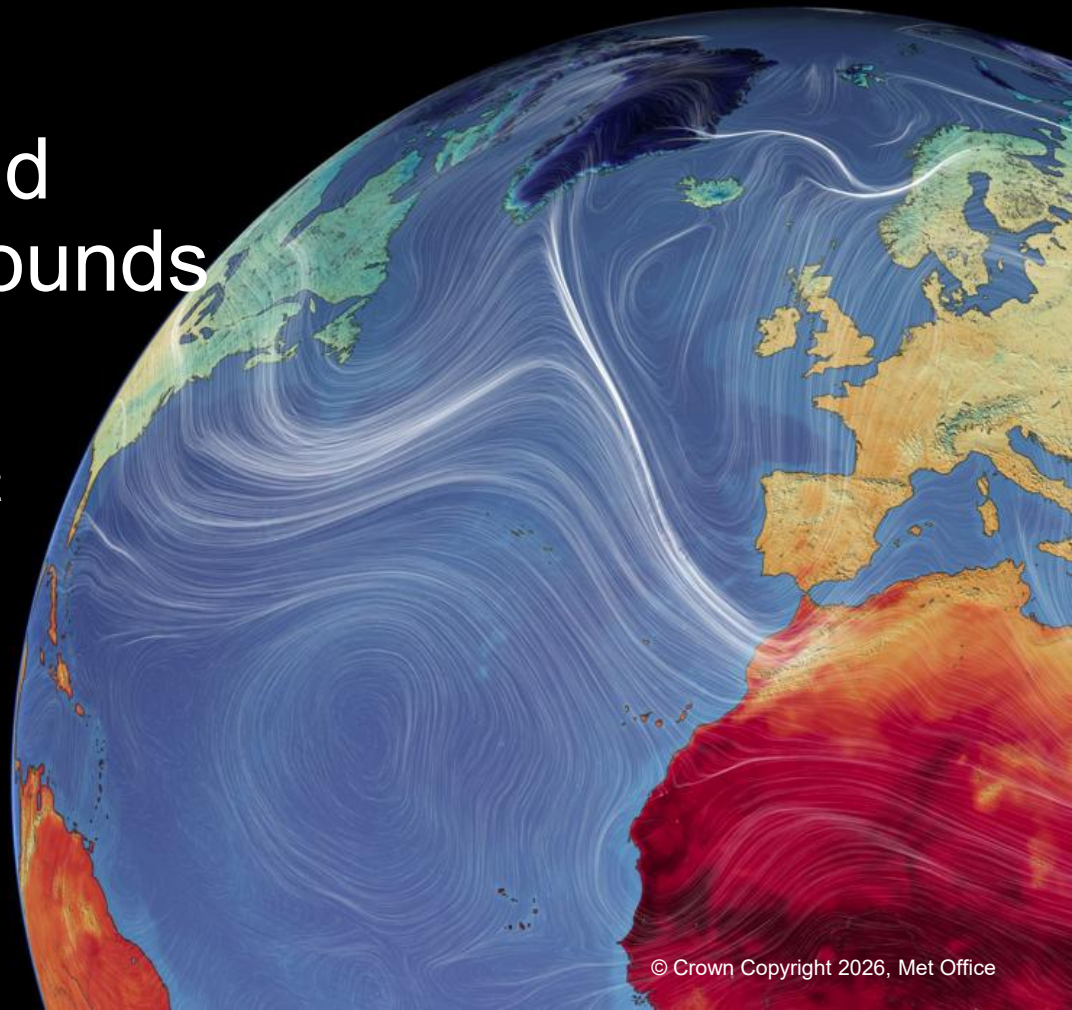

Content

- The role of the Met Office
- Our changing climate
- What it means to safety at sports grounds
- What is available to you, what can you expect?
- Human factors and weather

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Our **customers** and **partners**

- Environment and energy
- Citizens and media
- Defence
- International engagement
- Transport
- UK government business
- Academia
- Charity and not-for-profit

Climate change is now an operational problem

In 2020 we produced a hypothetical forecast for July 2050 to raise awareness of climate change. July 2022 we forecast +40c for real

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Carbon dioxide concentration (parts per million)

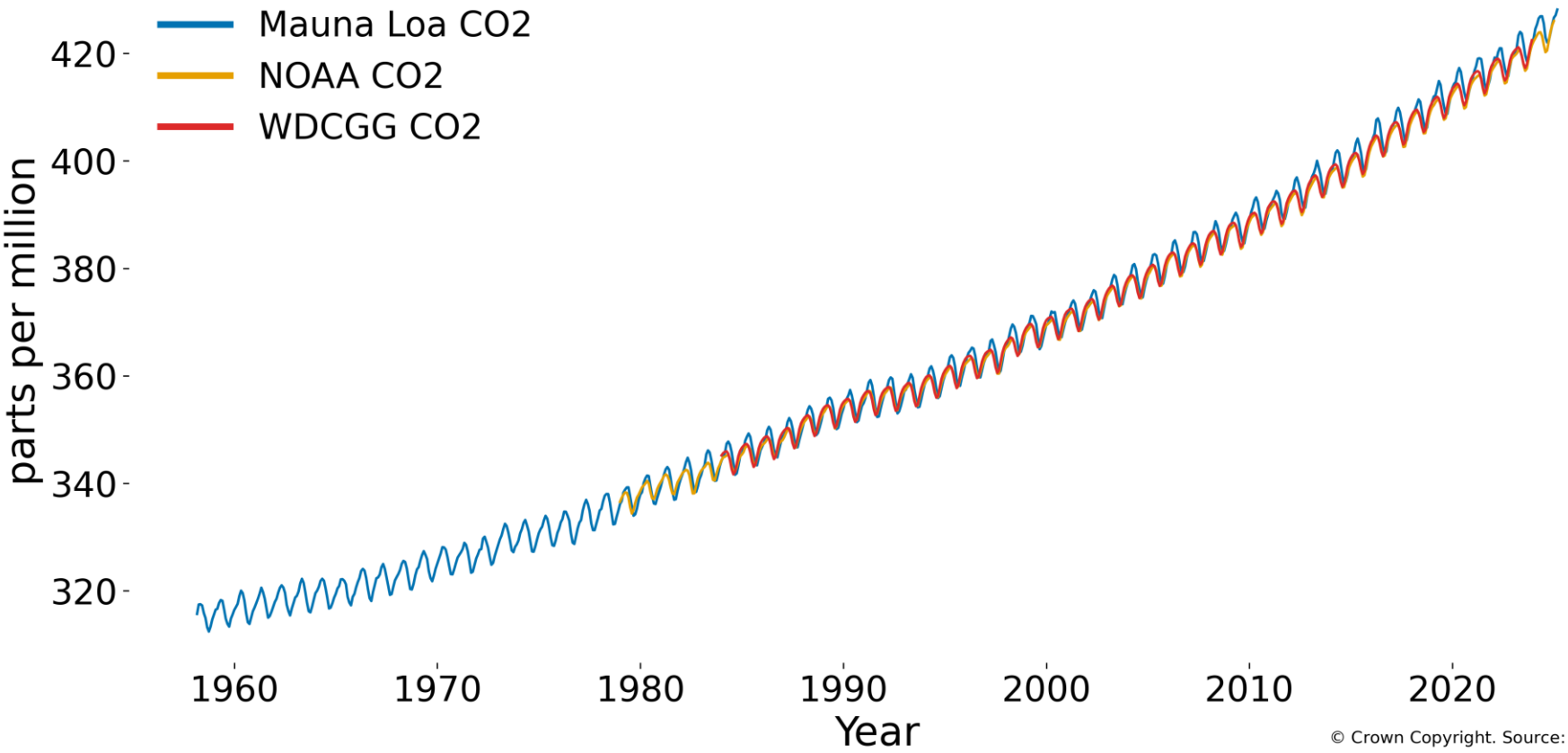


Figure updated: 15/04/2025

Climate change is already impacting extreme weather across the planet…

Siberian heatwave

- Widespread, prolonged event over the first 6 months of 2020 resulting in wildfires and loss of permafrost
- Event was 600 times more likely due to climate change

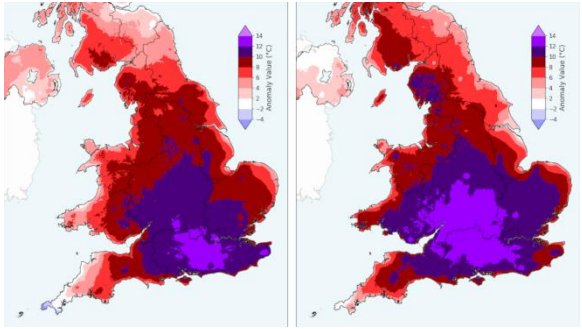
European heavy rainfall

- July 2021 heavy rainfall event resulted in extreme impacts, and led to over 200 deaths
- Event was 1.2 to 9 times more likely and rainfall intensity 3-19% higher due to climate change

North American heatwave and wildfires

- Record breaking temperatures in June 2021, 49.6°C recorded in Canada
- Almost impossible to hit such record-breaking temperatures in the Western United States without human-caused climate change

… and in the UK



Heatwaves

- The Summer 2020 heatwave was the most significant heatwave of the last 60 years, leading to over 2,500 excess deaths across the UK
- Southern England experienced successive days exceeding 34°C and ‘tropical’ nights exceeding 20°C
- By 2050 hot summers could happen every other year

Heavy rainfall

- February 2020 was the wettest February on record
- Storm Ciara saw a month’s worth of rain fall across parts of West Yorkshire in just 18 hours, leading to widespread flooding
- By 2070, similar winter rainfall events are expected to increase by up to 25%

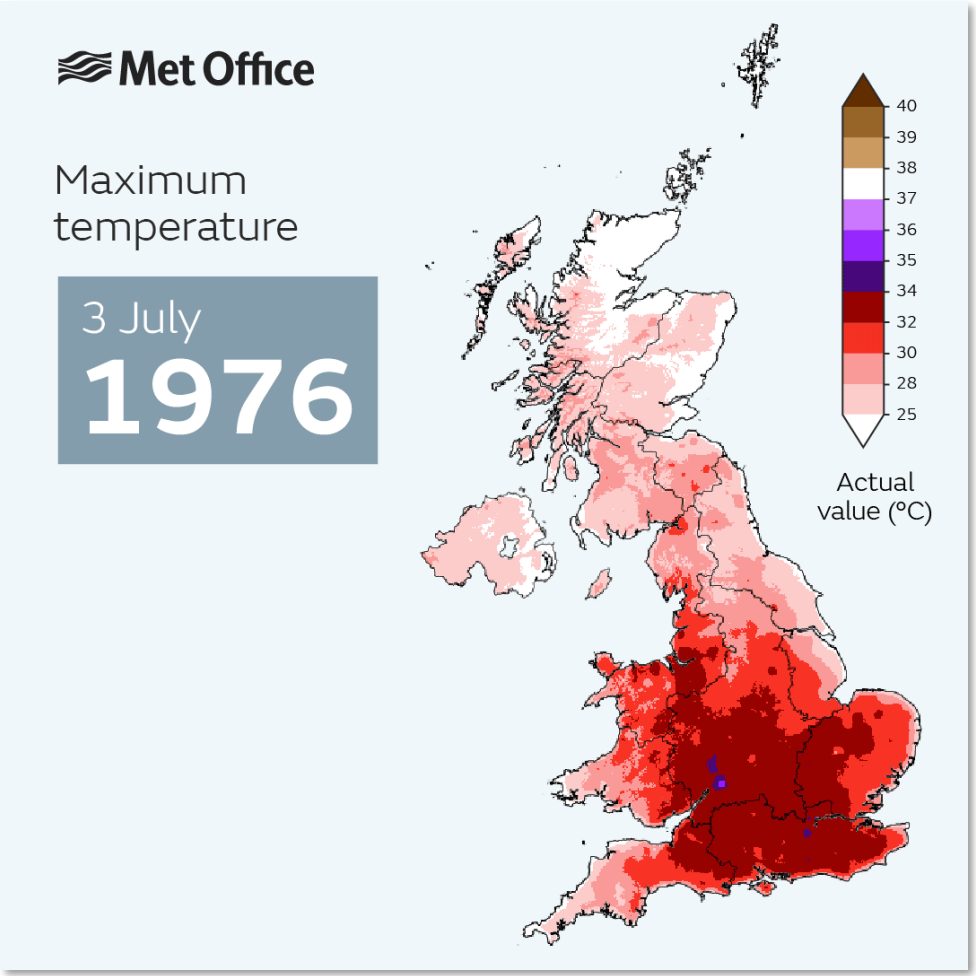
Wildfires

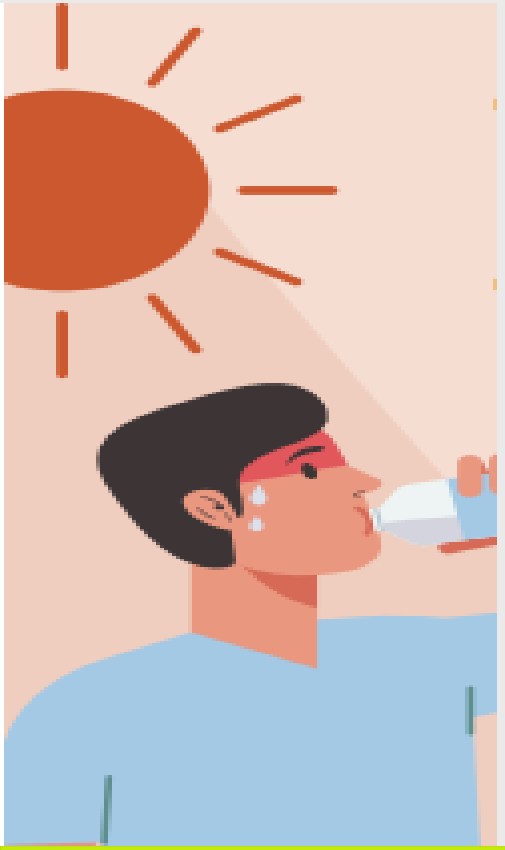
- Figures suggest the number of UK wildfires has been increasing in recent years
- Wildfires could be 5 times more likely by 2100 due to increases in high temperatures and low summer rainfall; conditions highly conducive to wildfires
- In record 40C heat on 19 July 2022, 18 homes were lost in village of Wennington, (east London)- *David Shukman, The Guardian*

UK summer heatwave 2022

A new record daily maximum temperature was reached on 19 July 2022, with 40.3°C recorded at Coningsby, Lincolnshire, **exceeding the previous record by 1.6°C**

A total of 46 stations across the UK exceeded the previous UK record of 38.7°C





Extreme Heat

- A recent Met Office study has found the chance of exceeding 40°C has been rapidly increasing, and it is now over 20 times more likely than it was in the 1960s.
- The study estimates **a 50-50 chance of seeing a 40°C day again in next 12 years and that temperatures several degrees higher than in July 2022 are possible in today's climate.**
- Temperatures will increase during the day and night with an increasing chance of tropical nights, where temperatures don't drop below 20°C. This additional heat-stress will increase the risk of heat-related mortality.

Heavy rainfall

- Rainfall varies annually and seasonally but has generally increased, especially in winter.
- Climate projections suggest wetter winters and drier summers, with exceptions due to natural variability.
- A warmer atmosphere holds more moisture, causing more intense downpours, particularly in autumn and western UK.
- Climate change has intensified storm rainfall in autumn and winter, a trend expected to continue. Other factors like land use and local conditions also affect flooding.

Intense rainfall from thunderstorms

- Climate change is expected to increase extreme rainfall, like thunderstorms.
- **Heavy rainfall over 20mm/h, which can cause flash floods, may become four times more frequent by the 2070s** under high emissions.
- These changes may occur in clusters rather than gradually, varying across UK regions.
- Lightning strike frequency is hard to track due to changing detection technology, but **some studies predict more summer lightning in the UK.**
- Short-lived but damaging squalls are associated with intense rainfall from heavy showers and thunderstorms

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Impact on safety at sports grounds

Planning for heat

- Heat exposure
  - Temperatures are highest nearer the ground- surface type/colour has an effect
  - Shade- consider inside and outside eg fanzones
  - Wind flow
    - Low flow means reduced evaporation; consider ventilation and passive cooling
  - Crowding- increased heat (bottlenecks in sun?)
  - Hydration- are water stations in safe places?
  - Queuing- safety and comfort outside and inside
    - Flow rates change quickly during downpours or extreme heat
    - Staff may also need to leave positions to take water, reducing resilience
  - Air quality- including raised dust a well as ozone
  - Wildfire- an increasing threat, especially on the bounderies of urban areas
  - Heat affects on infrastructure, including increased pressure on emergency services
  - Crowd behaviours/movement modified by weather *and* by how it is communicated (people respond to a forecast)
- *You should generally get several days to a few weeks notice of high heat events*
- *Caution- heatwave alerts are triggered by longevity. Conditions affecting crowds can be short-lived*

Planning for downpours and thunderstorms

- Downpours and thunderstorms
    - Multiple hazards
    - Lightning
    - Gusts/squalls- not always strongest at height
    - Funnelling between structures
    - Flash flooding
        - Drainage in and around stadiums
        - Slower response times for emergency services
    - Damaging hail
    - Rapid temperature change
    - Respiratory conditions (thunderstorm asthma)
    - Crowd behaviours/movement- surge
    - Not all signage visible during a downpour
    - Evacuation rates over flooded/wet/muddy surfaces
- What about outside the stadium and links to transport networks?
- *Caution- Unlike other weather phenomena, convective downpours/ lightning only last 10's of minutes so you may be aware of the risk but have little notice of a specific event at the site- note convective storms rarely move in straight lines!*

Planning for future stadiums and rebuilds

- Rising sea levels
  - Global sea level has risen about 20cm since the beginning of the 20th century and is accelerating.
- Flooding
  - “Almost a third of the European river network experienced flooding in 2024” ESOTC
  - In the 250+ year England and Wales precipitation series, six of the 10 wettest winter half-years have occurred in the 21st Century so far, with October 2023 to March 2024 the wettest winter half-year on record.
- Changes in vegetation and land use
  - Impacts on run-off
  - Natural shade and wind disruption
  - Soil erosion and landslips
- Heat
  - Shade temperatures/humidity also increasing
  - Temperature ranges (just cold less often)
- Wildfire
  - The threat is increasing at the urban boundaries
  - What has happened elsewhere could/will happen in the UK
- Seasonal and regional variations
  - May be more difficult to schedule events than before as variability increases
- External pressures from climate change
  - Health, water protection, urban planning, infrastructure resilience, wellbeing

Weather and behaviours at sports grounds

- Weather directly affects arrival patterns and where people dwell or congregate
- Sudden downpours can cause a rush to covered areas
- Strong sunshine and heat can make people congregate in covered areas
- Weather will directly influence choices for travel away from the ground
- Staff performance and fatigue are also impacted by being hot, dehydrated, cold and wet
- BBQ’s in car parks increase wildfire risks

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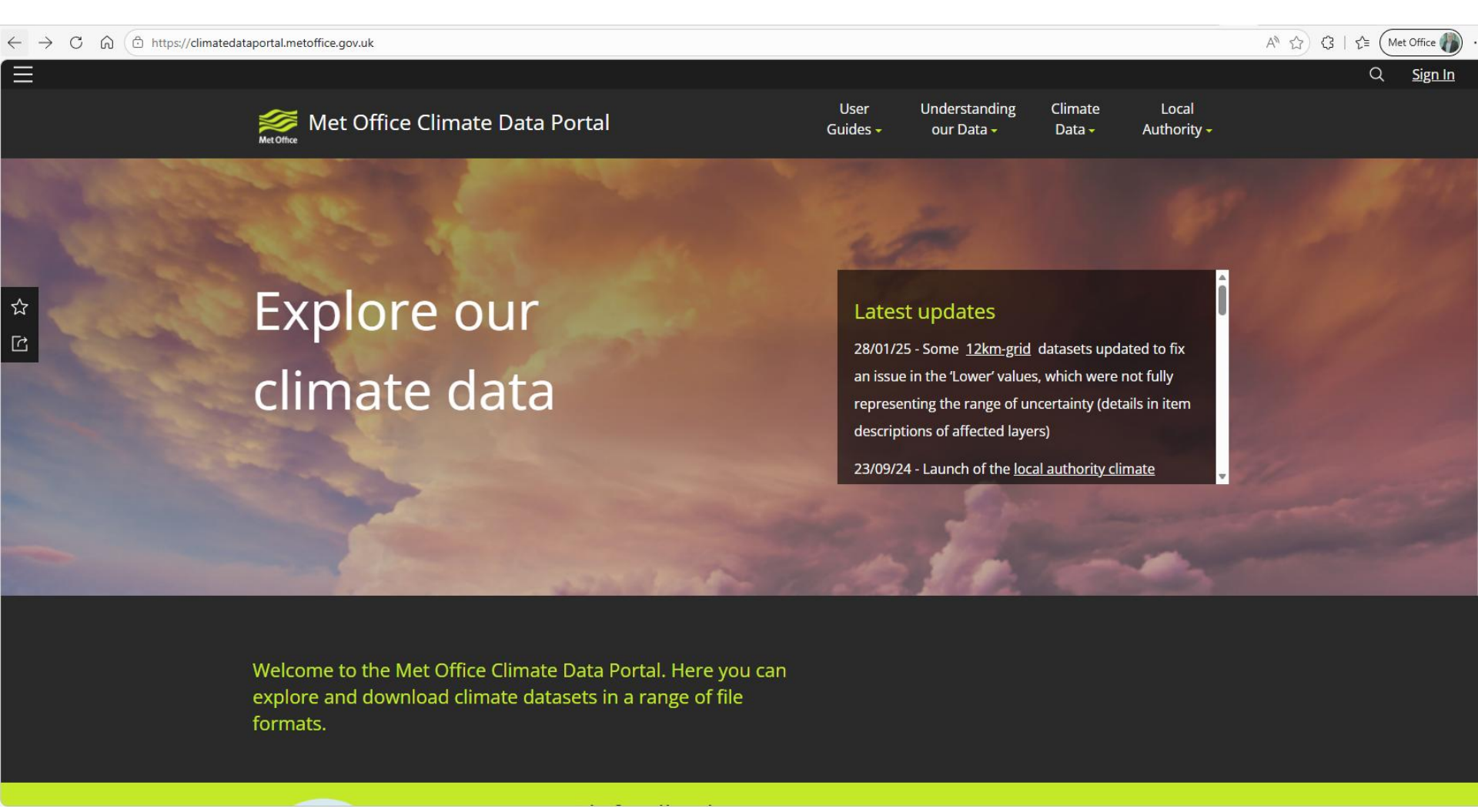
The world is **changing**

Climate extremes, artificial intelligence and global instability **demand new solutions**


https://climatedataportal.metoffice.gov.uk
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User Guides
Understanding our Data
Climate Data
Local Authority
Explore our climate data
Latest updates
28/01/25 - Some 12km-grid datasets updated to fix an issue in the 'Lower' values, which were not fully representing the range of uncertainty (details in item descriptions of affected layers)
23/09/24 - Launch of the local authority climate
Welcome to the Met Office Climate Data Portal. Here you can explore and download climate datasets in a range of file formats.

Local Authority Climate Explorer [Beta, v2.0]

Select a Local Authority
North Northamptonshire

Generate Report for North Northamptonshire

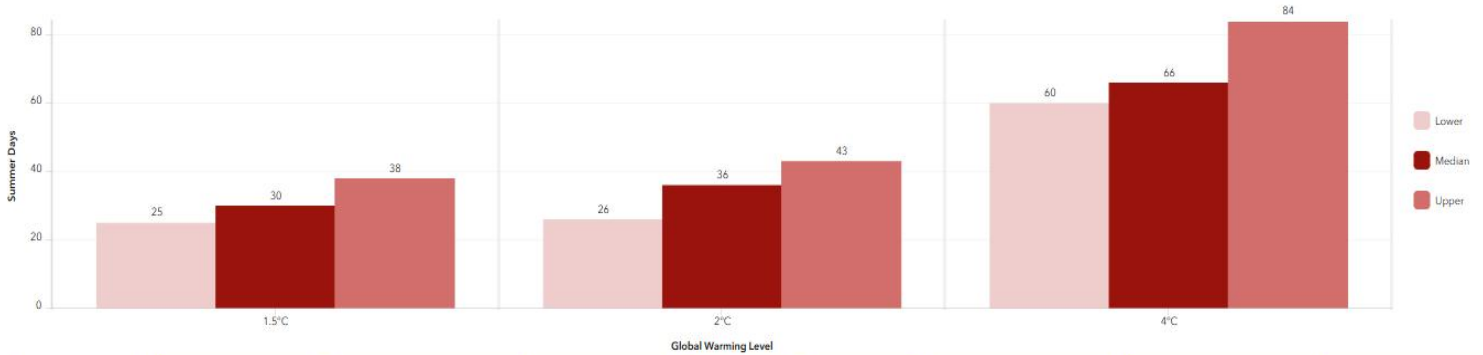
To get started:

1. Select a Local Authority (top right)
2. View projected changes in climate for the selected Local Authority in **graphs** using the tabs in the bottom left corner.
3. View different Climate Averages or Climate Indicators (bottom left) using the green tabs or arrow buttons (and), including Sea Level rise for coastal areas.
4. View a detailed **Climate Report** for the selected Local Authority using the button above.

Find out **further information** about this explorer and **provide feedback** via the menu in the top right of the page.

Average number of Summer Days in North Northamptonshire

The average number of summer days per year modelled in 1981-2000 was 16. In the most recent decades, 2001-2020, the average number of summer days modelled per year was 27.



Description: Projections for three future Global Warming Levels of the annual number of days where the daily maximum temperature is above 25°C. One Summer Day is one day in which the threshold is passed in a year.

Impact relevance: High daytime temperatures with health impacts for vulnerable people at risk of hospital admission or death. Transport disruption - e.g. track buckling on railways. Can also indicate periods of increased water demand.

This dataset can be viewed on the Climate Data Portal - Summer Days.

Information on global warming levels and lower/median/upper estimates can be found in the Scientific Detail.

Summer Days | Hot Summer Days | Extreme Summer Days | Tropical Nights | Frost Days | Icing Days | Growing Degree Days | Heating Degree Days | Cooling Degree Days

Climate Averages | Climate Indicators

UK weather warnings

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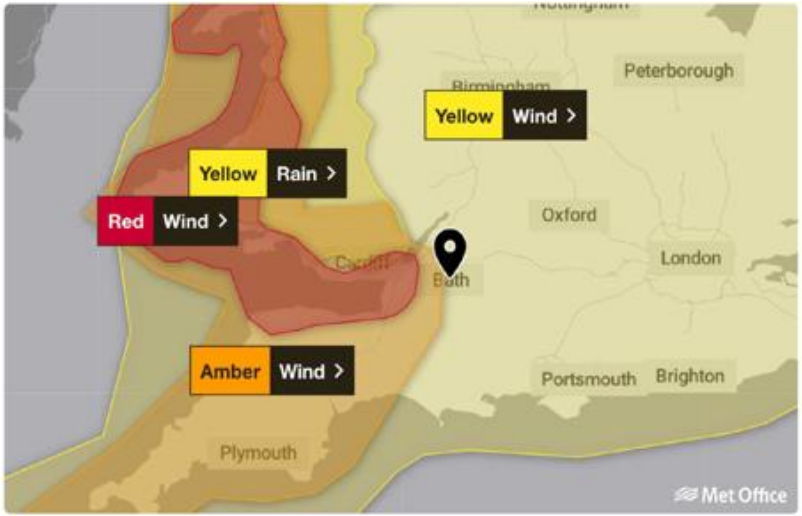
Protecting the UK with **National Severe Weather Warnings**



Helping the nation prepare for extreme weather **up to seven days in advance**

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10 Day Trend Forecast UK ▶ Play all

Meteorologists explore trends affecting the UK weather in this 10-day forecast. We take a closer look at the jet stream, weather systems and the latest forecast models from the supercomputer.

10 Day Trend 22/04/2026 – Dry for the whole of next ... · Met Office - UK Weather · 67k views - 6 days ago

10 Day Trend 15/04/2026 – Turning drier – Met ... · Met Office - UK Weather · 99k views - 13 days ago · Subtitles

10 Day Trend 01/04/2026 – Low after low for Easter – ... · Met Office - UK Weather · 49k views - 3 weeks ago

10 Day Trend 25/03/2026– When will it warm up?– Met... · Met Office - UK Weather · 209k views - 1 month ago

10 Day Trend 18/03/2026 – High pressure comes and ... · Met Office - UK Weather · 64k views - 1 month ago · Subtitles

10 Day Trend 11/03/2026 – Not especially spring-like fo... · Met Office - UK Weather · 38k views - 1 month ago

Met Office explains ▶ Play all

Our experts answer weather questions, including: what is a monsoon, hurricanes and why they form, definition of a UK heatwave, what is a weather bomb, plus many more.

How does weather radar work? - UK Weather - Met ... · The big freeze of 2018 - UK Weather - Met Office Explains · Why the Equinox Isn't Equal Day and Night - UK Weather... · Why black ice is dangerous - UK Weather - Met Office ... · 5 fascinating facts about snow - UK Weather - Met ... · Is thundersnow a thing? - UK Weather - Met Office Explains

UK national weather forecast ▶ Play all

Daily afternoon forecasts and evening forecasts for the UK. Met Office Meteorologists keep you up to date with the latest weather news and weather warnings.

28/04/2026 - Cloudy and cooler - Afternoon Weather... · Met Office - UK Weather · 6k views - 3 hours ago

28/04/2026 - Mild, breezy, clearing up - Morning ... · Met Office - UK Weather · 17k views - 12 hours ago

27/04/2026 - Cloudy overnight, drying tomorrow ... · Met Office - UK Weather · 18k views - 22 hours ago

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27/04/2026 - Northern showers, dry in the south - ... · Met Office - UK Weather · 23k views - 1 day ago

26/04/2026 - Showers across the north, cool - Evening ... · Met Office - UK Weather · 26k views - 1 day ago

Deep Dive Forecast UK ▶ Play all

Join Met Office Meteorologists as they analyse the UK weather forecast using in-depth computer models, charts and weather graphics on the touchscreen.

Deep Dive 21/04/2026 – What high pressure means–... · Met Office - UK Weather · 66k views - 6 days ago

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Deep Dive 07/04/2026 – UK heat and Tropical cyclones–... · Met Office - UK Weather · 41k views - 2 weeks ago

Deep Dive 31/03/2026 –Low after low – Met Office weekl... · Met Office - UK Weather · 35k views - 4 weeks ago

Deep Dive 24/03/2026 –What is post processing? – Met ... · Met Office - UK Weather · 11k views - 1 month ago

Deep Dive 17/03/2026 – Crazy snow and damaging ... · Met Office - UK Weather · 141k views - 1 month ago

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Thoughts on Human Factors….

The impact of communication

Does the weather or the forecast drive behaviours?

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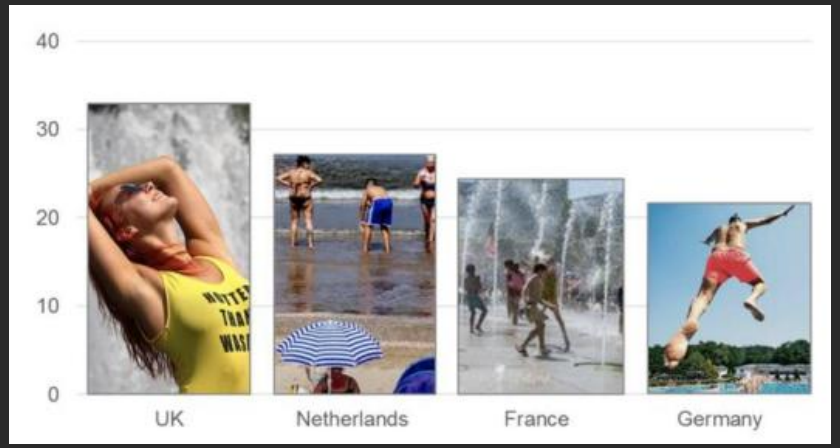
Weather warnings and alerts will drive behaviours.

Media narrative may not help..

Irish edition of the Daily Mirror



Heat wave alerts often lead to a spike in antisocial behaviour and 999 calls

Representation of most commonly used heatwave images in newspapers in UK, Netherlands, France and Germany during 2019

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Our experiences from our National Severe Weather Warnings service

What AND why

~~Don't travel unless necessary~~

'Using public transport during a heatwave puts you at risk of being stuck on a hot broken down train'

~~Do not have a BBQ~~

'Having a BBQ during a heatwave risks starting fires'

Specific and actionable

~~Keep an eye on vulnerable people~~

~~Check in on elderly relatives~~

'Ensure that your elderly relatives drink at least 2 litres of water a day'

Or… "taking a water break in the shade at half time will help you enjoy the rest of the game…"

Helen Roberts, Socio-Meteorologist, Met Office

And finally

- It’s not what the weather is, it’s what it does or can do- be aware of the impact and the implications, the increased complexity weather can bring to a routine problem, and the cascading effects to your plans
- Weather is often multi-hazard; persistent heat followed by flash flood; lightning accompanied by damaging winds
- Weather impacts at different timescales; a dry summer may prime the environment so that moderate rates of rain have exaggerated flooding effects
- Not all weather forecast data are the same, especially in the way they are presented and interpreted- are all decision makers on the same page?
- It’s not about cancelling because of weather, though this may happen, but maximising the safety and enjoyment for everyone