Beyond Average Temperatures

Averages are a useful tracker for studying climate change, but hide a lot of the most useful information. Discover what averages can hide and the information you can look at to guide decisions.

Averages can be used to provide a quick summary of a data set.

There are three types: mean, mode and median.

MEAN

The mean refers to the number you obtain when you sum up a given set of numbers and then divide this sum by the total number in the set.

Here are temperature readings over a week: 10°C, 11°C, 11°C, 9°C, 8°C, 10°C, 11°C.

$10 + 11 + 11 + 9 + 8 + 10 + 11 = \frac{70}{7}$

MEAN: 10°C

MODE

The element that appears most frequently in a given set of elements. There can be more than one mode.

10 **11** **11** 9 8 10 **11**

MODE: 11°C

MEDIAN

The number in the middle of a given set of numbers arranged in order of increasing magnitude.

8 9 10 **10** 11 11 11

MEDIAN: 10°C

Generally when scientists refer to the average temperature they are referring to the mean temperature.

Remember what averages hide!

When seeing information about averages, it is important to remember what they hide. Averages do not tell you anything about:

The range of the data
The highest value minus the lowest value.

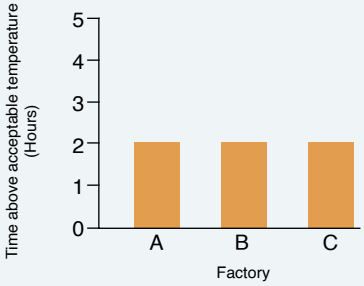
The spread of the data
A measure of how similar or varied the data is.

Outliers in the data
Unusually high or low values.

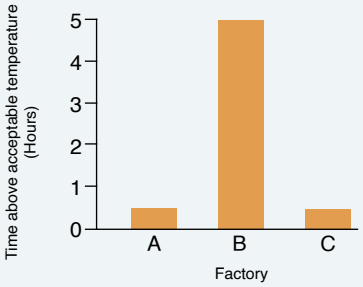
The two graphs have the same average (mean), but the distribution is very different.

The values in Picture 1 are all the same, while the values in Picture 2 are very different.

This means the spread is greater in Picture 2 than in Picture 1, but this is completely hidden by the average values.



Picture 1



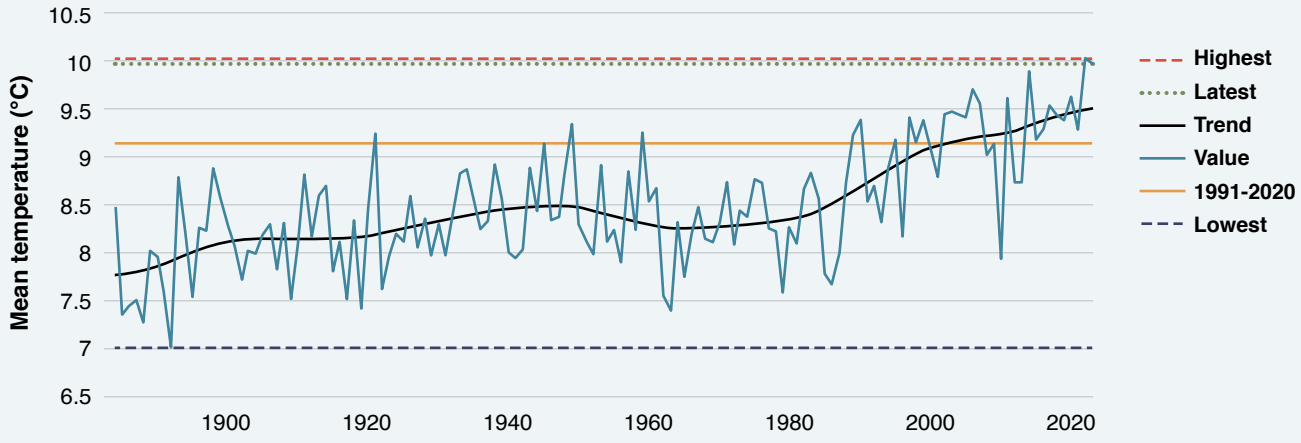
Picture 2

Looking beyond the changes in UK average temperature.

You have probably heard that global temperatures are rising, and this is the case of UK temperatures. The mean temperature over the period 1991-2020 was 0.9°C higher than the period 1961-1990 (Met Office).[1]

The graph below shows how annual mean temperature value in the UK has changed. Like global mean temperatures, there has been a steady increase in the value.

UK annual mean temperature[2]



0.9°C may not seem like a big difference, but it hides the true impact!

High temperature extremes.

Hot summer days are warming twice as fast as the summer mean temperature.[3]

This means high temperature outliers are getting more extreme.

Top ten hottest UK days on record[4]

The high temperature spells are lasting longer too.

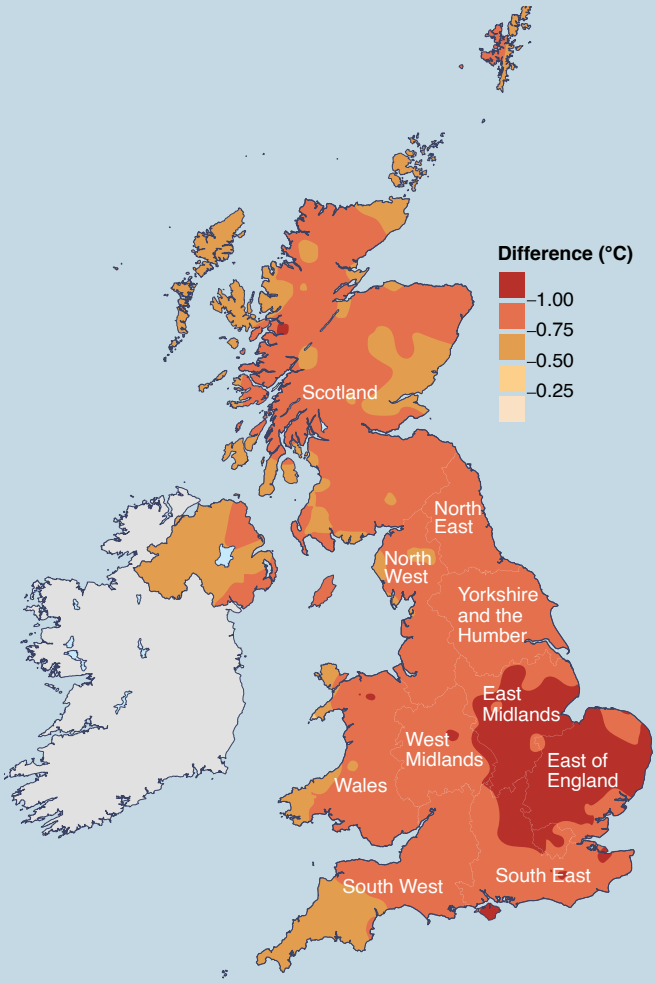
These periods of very high temperatures are already having an impact, especially on livestock. During the heatwave of July and August 2022, over 18,500 chickens died in transport due to heat stress—compared to 325 deaths in the same period in 2021.[5] **The change to the extremes are hidden by temperature averages.**

Chickens that died in transport due to heat stress

1. https://www.metoffice.gov.uk/weather/climate/solutions/climate-change-adaptation#:~:text=During%20the%20period%201991%2D2020,7.3%25%20over%20the%20same%20periods.
2. https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-temperature-rainfall-and-sunshine-time-series (the settings are UK, Mean Temperature, Annual)
3. https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2023GL102757
4. https://www.metoffice.gov.uk/weather/warnings-and-advice/seasonal-advice/health-wellbeing/hot-weather-and-its-impacts
5. https://www.frontiersin.org/journals/environmental-science/articles/10.3389/fenvs.2023.1282284/full

Different areas, different temperature increase.

Mean temperature, annual average, 1991-2020. Change from 1961-1990.[6]

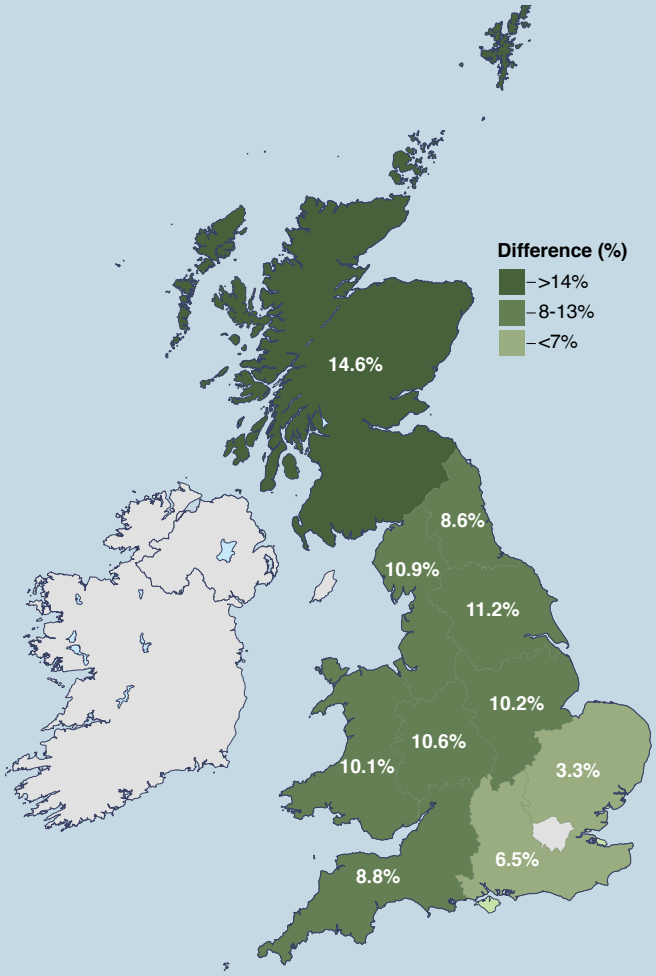


Not all of the UK is warming at the same rate.

This map shows that the east Midlands and East Anglia have experienced the greatest warming, with mean annual temperatures having increased by more than 1°C. The least warming has occurred around western coastal fringes and parts of Northern Ireland and Scotland.

This spread in the rate of temperature increase is hidden by the UK average temperature statistics.

2022 wheat yield difference relative to 2017-2021 average (%)



This regional difference in the rate of temperature increase means a regional difference in the impact, notably during hot spells.

Although the very hot year of 2022 still saw an increase in wheat yield, this increase was smaller in the southern/eastern regions of the UK where temperatures were higher.[7]

This North/West-South/East divide is expected to continue as temperatures increase.

6. https://www.metoffice.gov.uk/about-us/news-and-media/media-centre/weather-and-climate-news/2021/climate-change-continues-to-be-evident-across-uk
7. https://www.frontiersin.org/journals/environmental-science/articles/10.3389/fenvs.2023.1282284/full. The data is from table 1.

As UK temperatures continue to change, here are some more useful sites you can visit to find information beyond the climate averages.

UK climate maps and data, the Met Office

Here you can find summaries of climate trends in the UK, as well as regional climate information. **Remember** what the averages hide when looking at these trend summaries.

What will climate change look like near me?, the BBC

Here you can put in your postcode to see the predicted temperature increase, as well as other climate data, under certain emissions scenarios. This allows you to see beyond just the UK averages for climate trends.

Rothamsted climate projections

Find localised climate projection data.

The data set:

Semenov, M. A., Senapati, N., & Collins, A. L. (2024). CMIP6-based local-scale climate scenarios for impact assessment in Great Britain. (1.0) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.10556986

A Data in Brief paper:

Semenov, M.A., Senepati, N., Coleman, K. and Collins, A.L. (2024). A dataset of CMIP6-based climate scenarios for climate change impact assessment in Great Britain. Data in Brief 55, 110709. https://doi.org/10.1016/j.dib.2024.110709

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