# UK climate trends, as revealed by 1981-2010 statistics

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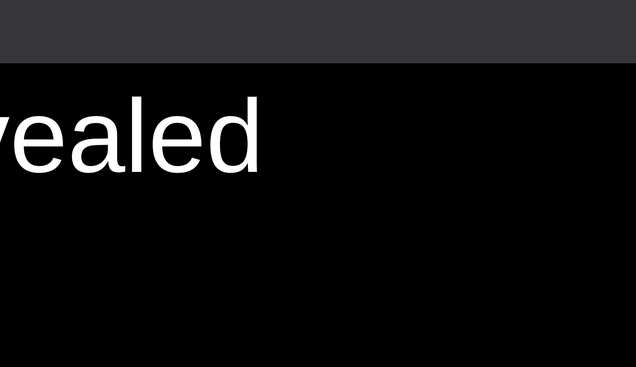
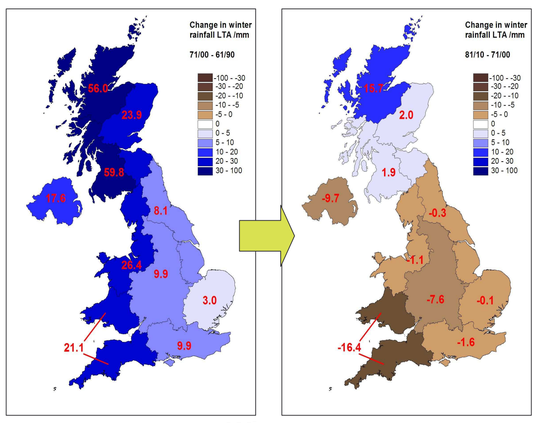
## Introduction

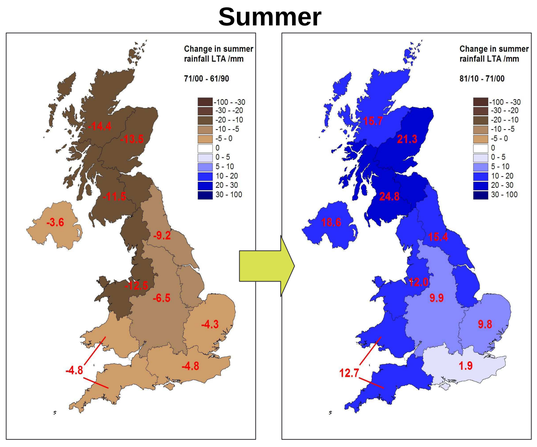
The Met Office has recently calculated a new set of 30-year normals for temperature, rainfall, sunshine and a number of associated variables. This has been done in line with WMO recommendations, and in common with many other meteorological services around the world. The new long-term averages (LTAs) have been produced as gridded datasets, from which regional and national values are calculated, and will provide the normal values against which the next decade of weather will be assessed. In addition, the averages can be compared to previous averaging periods (1961-1990 and 1971-2000) to reveal trends in the data. This poster gives an overview of the methodology, a selection of the results, and some analysis of trends.

## Method



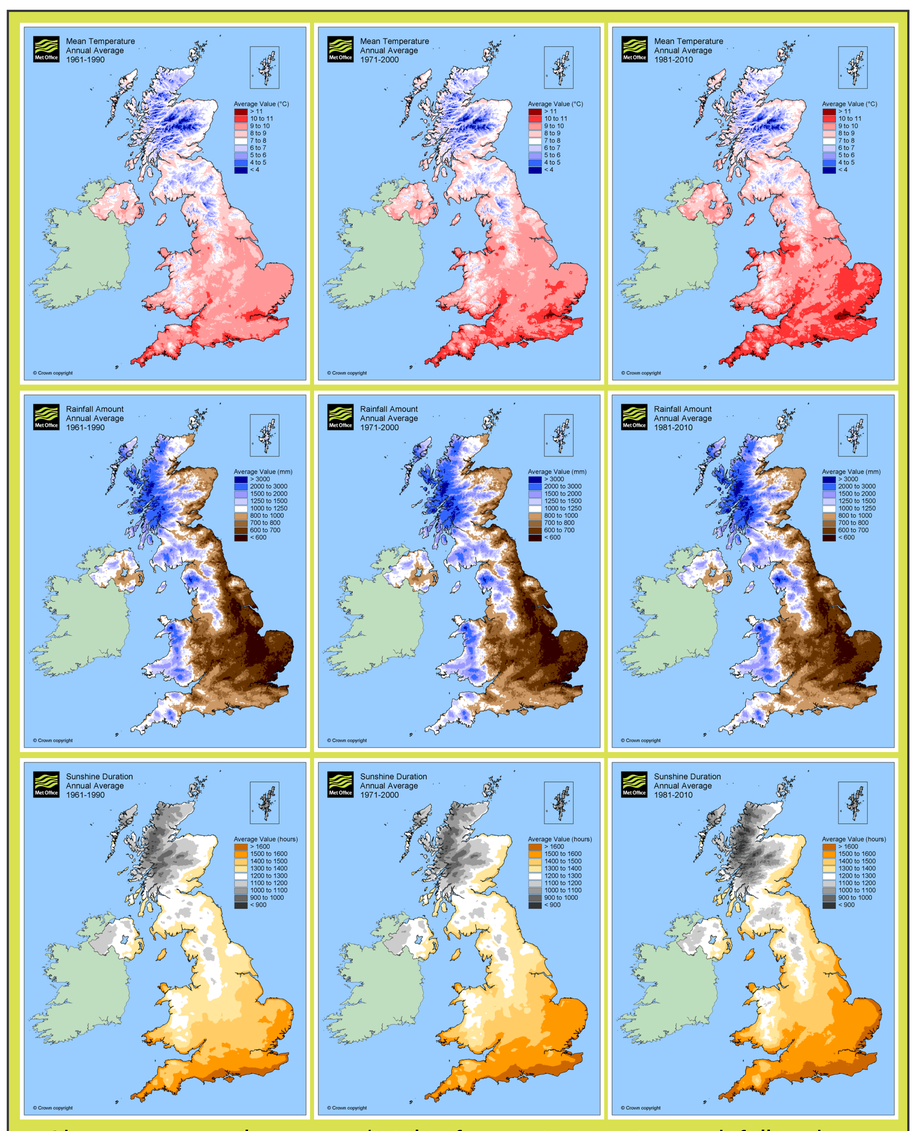

**Winter**




**Summer**

Areal averages are produced for 10 regions of the UK, on monthly, seasonal and annual timescales. Shown above are changes from one averaging period to the next. Except for Scotland in winter, both seasons show opposite trends from one period to the next.

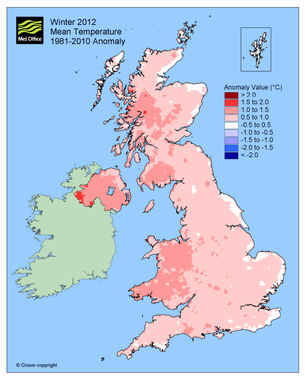
## Regional changes

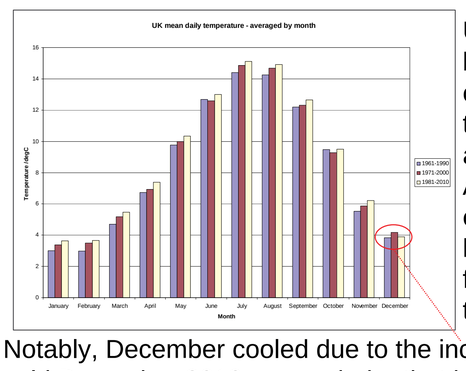



Above are annual averages/totals of mean temperature, rainfall and sunshine for the three averaging periods. Effects of altitude – lower temperature and sunshine, higher rainfall – are visible on all maps. Upward trends have occurred in many areas for all three variables; these are most evident for temperature.

The border of this poster shows maps of winter mean temperature as an anomaly relative to the 1981-2010 average. The series runs from winter 1911 until the most recent winter, December 2011-February 2012.

The period 1998-2008 is notable for a run of mild winters. Winters 2010 and 2011 broke this run, with the 2010 winter being the coldest since 1979. Other particularly cold winters include 1963, 1947 and 1929. For further details see Prior & Kendon (2011).



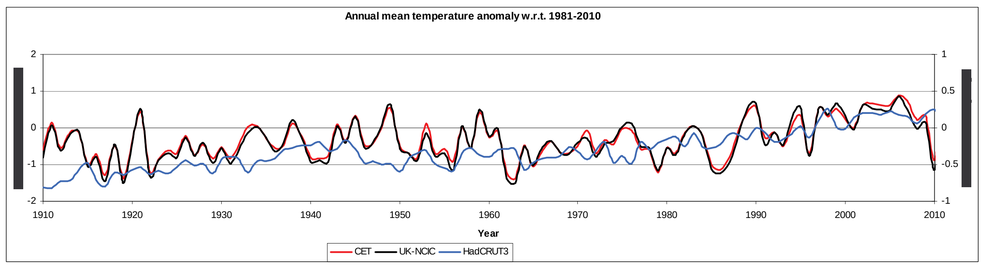




UK mean temperature by month – a comparison of the three different averaging periods. Almost without exception, each month has become warmer from one period to the next.

Notably, December cooled due to the inclusion of the very cold December 2010 – a reminder that individual events can have an impact on long-term averages!

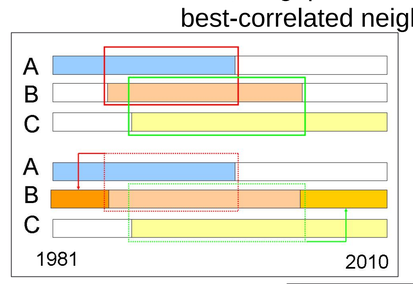
## Trends

Annual mean temperature anomaly for the UK, with the Central England Temperature (CET) series, and HadCRUT3 global average, for comparison. Correlation with the CET is good throughout. The general late 20th century warming trend is in common with the global series, but earlier in the series, differences exist.

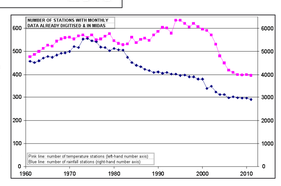



## Infilling missing data

The gridding process starts with station data. Most stations do not have 30 years of data without breaks, so gaps are filled in using the best-correlated neighbour stations. Correlations are based on the 50-year period 1961-2010.

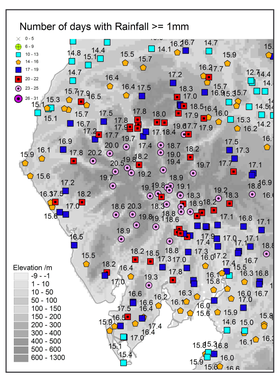



The chart, right, shows the size of the network over the last 50 years – generally 400-600 temperature stations (left axis), and over 5000 rainfall stations at times (right axis).




## Quality control

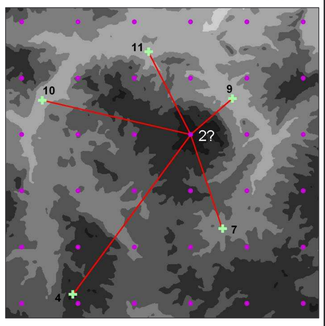
All of these had to be quality controlled manually, using mapping tools like that shown on the left – a strain for the eyes and the brain!




After the infilling process and quality control, station averages were used to produce 1km grids. A regression analysis was used to account for location, altitude, terrain shape, proximity to coast, and urban land use.

## Interpolation to grid

Residuals from this regression analysis were interpolated using inverse distance weighting.
The value at any grid point is the sum of the regression term and the interpolated residual.




## Time series

## References

Perry, M. and Hollis, D. (2005), The development of a new set of long-term climate averages for the UK. Int. J. Climatol., 25: 1023–1039. doi: 10.1002/joc.1160

Prior, J. and Kendon, M. (2011), The disruptive snowfalls and very low temperatures of late 2010. Weather, 66: 315–321. doi: 10.1002/wea.874

P. Brohan, J.J. Kennedy, I. Harris, S.F.B. Tett and P.D. Jones, Uncertainty estimates in regional and global observed temperature changes: a new dataset from 1850. J. Geophys. Res, 111, D12106, doi:10.1029/2005JD006548

Parker, D.E., T.P. Legg, and C.K. Folland. 1992. A new daily Central England Temperature Series, *1772-1991. Int. J. Clim.,* ***Vol 12****, pp 317-342*

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