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UKCP09 gridded observation data sets — frequently asked questions

The following questions are considered to be those most likely to be asked. Others are welcome and may be sent to the Customer Centre.

Questions

1. **How accurate are the grids?**
2. **What quality control has been applied?**
3. **How many observations were used to produce the grids?**
4. **Why are there no data before 1961 for many variables and no data at all before 1914?**
5. **How often are new grids added to the website and when will data for the most recent years be added?**
6. **Why are the monthly temperature (rainfall) grids not equal to the average (sum) of the corresponding daily grids?**
7. **Are the annual grids consistent with the daily temperature/rainfall grids?**
8. **How are 'degree days' calculated?**
9. **Why are the daily temperature maxima and minima for different 24-hour periods?**
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15. **Why are there non-integer values in the 'Days of X' grids?**
16. **Why is the period 1961 to 1990 used for the long-term averages?**
17. **What advantages do gridded data have, compared to station data?**
18. **I am having problems unzipping the data files. What is the solution?**
19. **Why do the grid text files apparently contain only '-9999' values?**
20. **How do I find out which 5 km grid cell or 25 km grid box includes a particular location?**

Answers

How accurate are the grids?

An indication of the quality and accuracy of the grid values is given by the root-mean-square Errors (RMSE) at verification stations. For the daily grids, the RMSE values averaged over each day of a test year are as follows:

Climate variable	Verification RMSE
Rainfall amount	1.23 mm
Mean temperature	0.94 °C
Maximum temperature	1.06 °C
Minimum temperature	1.27 °C

For the monthly grids, the average RMSE values for 12 test months are as follows:

Climate variable	Verification RMSE
Rainfall amount	16 mm
Mean temperature	0.36 °C
Maximum temperature	0.66 °C
Minimum temperature	0.45 °C

RMSE values for monthly grids of other climate variables and for annual grids are given in the paper 'Generation of monthly gridded data sets for a range of climatic variables over the UK' (PDF, 590 kb).

All the monthly and annual values are given with a precision of two decimal places and the daily values are given with a precision of one decimal place. This is to facilitate onward calculation and is not a reflection of the accuracy of the values.

What quality control has been applied?

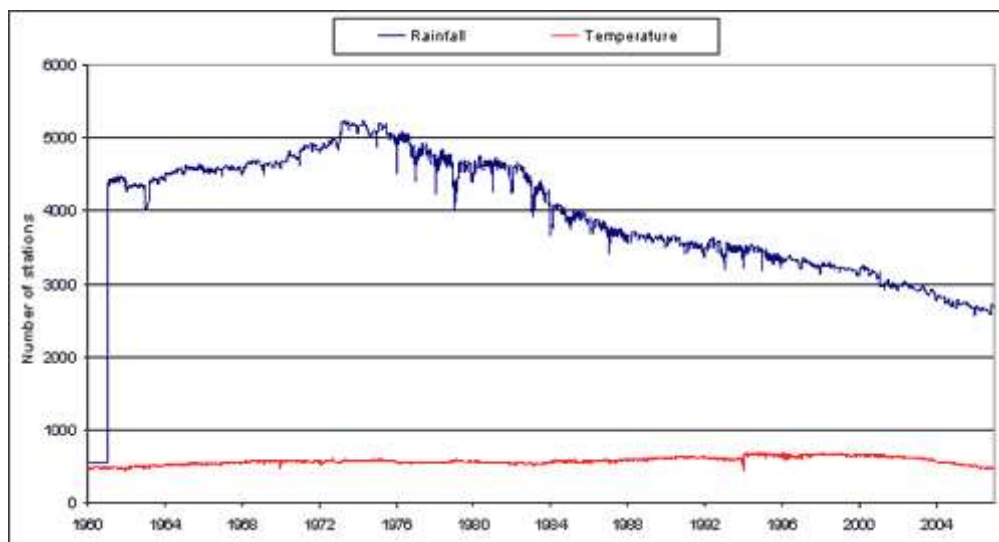
The station observations used to produce the grids have undergone a quality control process which corrects or removes erroneous data. In addition, some stations were excluded (e.g. due to a localised microclimate). No attempt was made to homogenise the input data. All the daily grids were checked to ensure that no erroneous station data had been used, as described in 'The generation of daily gridded data sets of temperature and rainfall for the UK' (PDF, 2.37 MB).

How many observations were used to produce the grids?

The number of stations used as input to the gridding varies with time, partly due to changes in the size of the observing network and partly due to the availability of digitised data. A typical starting year for daily and monthly data is 1961, although some monthly data have been digitised further back (see Q4). During the period 1961 to 2000, the average number of stations used is shown in the following table.

Climate variable	Average no. of stations
Air temperature	540
Rainfall	4400
Sunshine duration	290
Pressure, cloud, wind speed	70

The variation in the numbers of rainfall and temperature stations used from 1960 to 2006 is shown in the following graph.



Why are there no data before 1961 for many variables and no data at all before 1914?

To create gridded data sets, observations from an evenly distributed network of stations are needed in digital format. For many climate variables, sufficient data only exist in the Met Office electronic databases from 1961. However, as a result of an ongoing programme to digitise published station records, the monthly sunshine series extend back to 1929 and the monthly air temperature and rainfall series extend back to 1914.

How often are new grids added to the website and when will data for the most recent years be added?

The policy for adding more gridded data, e.g. for years after 2006, is under discussion with stakeholders. In the mean time, ad hoc updating is expected. The Met Office Customer Centre is able to advise about the provision of grids for recent years and any associated costs.

Why are the monthly temperature (rainfall) grids not equal to the average (sum) of the corresponding daily grids?

The monthly grids were prepared using monthly station data as input and then, later, daily grids were produced using daily station data as input. Hence these were separate interpolation exercises. Comparisons between the monthly grids and the average/sum of the daily grids were carried out, confirming that the largest differences tend to occur over upland areas. However, no adjustments have been made to make the two types of grid equivalent.

Are the annual grids consistent with the daily temperature/rainfall grids?

Yes. The annual variables, such as growing season length and consecutive dry days, are calculated from the daily temperature and rainfall grids.

Up to and including the 2009 update, a different method was used. The annual variables were calculated for each station, using that stations daily temperature and rainfall measurements. These station values were then interpolated onto the grid. The grids already produced by this method are still available (on request through our customer centre) but are no longer be updated. This means that for the most recent few years, only the new method grids are available.

How are 'degree days' calculated?

Degree days are defined as the mean number of degrees by which the air temperature has gone above, or below, a threshold, calculated day by day and summed over a period of days. Days when the temperature has not gone above (or below) the threshold at any point in the day do not contribute to the total.

Grids of degree day values are available for three thresholds:

- Below 15.5 °C (heating degree days)
- Above 22 °C (cooling degree days)
- Above 5.5 °C (growing degree days)

The formulae used for calculating degree days above a threshold are as follows (equivalent formulae are used for degree days below a threshold).

Temperature	Day value (above threshold)
$T_{\max} \leq T_{\text{threshold}}$	0
$T_{\min} \geq T_{\text{threshold}}$	$T_{\text{mean}} - T_{\text{threshold}}$
$T_{\text{mean}} \geq T_{\text{threshold}} \text{ \& } T_{\min} < T_{\text{threshold}}$	$0.5 (T_{\max} - T_{\text{threshold}}) - 0.25 (T_{\text{threshold}} - T_{\min})$
$T_{\text{mean}} < T_{\text{threshold}} \text{ \& } T_{\max} > T_{\text{threshold}}$	$0.25 (T_{\max} - T_{\text{threshold}})$

The daily mean temperature T_{mean} is calculated from the daily maximum temperature T_{\max} and the daily minimum temperature T_{\min} as $0.5 (T_{\max} + T_{\min})$

Why are the daily temperature maxima and minima for different 24-hour periods?

Conventionally, maximum and minimum temperatures are recorded for 24-hour periods ending at 0900 GMT each day. Maximum temperatures tend to occur during mid-afternoon, so the relevant maximum for a given calendar day is the one recorded between 0900 on the day in question and 0900 on the following day. However, minimum temperatures generally occur around dawn, so the relevant minimum temperature for a given calendar day is the one recorded between 0900 on the previous day and 0900 on the day in question.

The Met Office uses two types of sunshine recorder. How does this affect the sunshine grids?

The majority of the stations in the Met Office network that record sunshine duration use a Campbell-Stokes recorder. However, a significant proportion of the stations that report in real time now use a Kipp & Zonen sunshine sensor (the first such sensors were installed in 2000). The characteristics of the two instruments are not identical and therefore some adjustment of the observations to a common standard is required. Currently, Kipp & Zonen monthly totals are adjusted to Campbell-Stokes equivalent values prior to generating the sunshine grids. The correction methodology is described in a paper by A. Kerr and R. Tabony: 'Comparison of sunshine recorded by Campbell-Stokes and automatic sensors' (*Weather*, April 2004, vol. 59,90-95), but additional overlapped data was used by M. Perry in 2007 to produce improved monthly adjustment factors (study to be published).

How are the monthly cloud cover statistics calculated?

Hourly or three-hourly station observations of total cloud amount in oktas are converted to percentages (1 okta = one eighth of the sky = 12.5%). The average cloud amount, in per cent, is calculated for each month from these observations prior to interpolation to the 5 x 5 km grid.

How are the monthly wind statistics calculated?

The standard exposure for wind sensors is at 10 m above ground in an open, level area (such as an airfield). Hourly observations of mean wind speed are used to calculate monthly means which are then interpolated to the 5 x 5 km grid, taking into account altitude. The resulting grid therefore reflects general topography (e.g. hills, and coasts) but not the sheltering effect of urban or forested areas. The speeds are in knots, the internationally agreed meteorological unit (1 knot = 0.514 m/sec = 1.15 m.p.h.).

Daily precipitation data sets - date of greatest N-day rainfall total

Where the same highest total has occurred more than once in a season or year, the date given is that of the first occurrence.

How are the seasons defined for the daily precipitation and 25 km baseline data sets?

Each season is comprised of three calendar months, as follows.

Winter

December, January, February

Spring

March, April, May

Summer

June, July, August

Autumn

September, October, November

For the daily precipitation data, the winter data sets are named according to the year in which January falls, e.g. Dec 1960 to Feb 1961 is 'Winter 1961'. Seasonal data sets have been produced for 46 years, from Winter 1961 through to Autumn 2006, inclusive.

Why are there non-integer values in the 'Days of X' grids?

The original station observations of these quantities are all integer values. However the interpolation process generates non-integer values between stations and these are presented without rounding. Note that for relatively rare events (e.g. snow), where some stations will have reported a zero value, the interpolation process will generate fractional values less than 1 at some grid points.

Why is the period 1961 to 1990 used for the long-term averages?

The 30-year period 1961 to 1990 has been designated as the international standard reference period for climate averages by the World Meteorological Organization. Averages for the period 1971 to 2000 have also been produced for the UK, but the earlier period has been chosen for the UKCIP grids as it represents a better baseline for placing recent climate change into context.

What advantages do gridded data have, compared to station data?

The advantages of gridded data include:

- regional values can be produced for any arbitrary area (county, unitary authority, river catchment, etc.) with greater accuracy and consistency
- they facilitate the creation of contoured or colour-shaded maps, e.g. of 30-year averages

- they can be combined with other spatial data, such as transport routes, to study links between them
- less reliance on a weather station network that is irregularly spaced and changing with time
- reliable climate estimates for points some distance from weather stations, e.g. in upland areas
- a consistent series of climate data, enabling comparisons to be made in time and space
- a complete series of climate data, without missing values (a problem to which weather stations can be prone)

I am having problems unzipping the data files. What is the solution?

We are aware that some users are getting error messages when trying to unzip the data files. The following are some suggestions for how to get around this problem.

- If you have a choice of web browser, try using Firefox, Google Chrome or Opera, as these browsers do not appear to generate errors.
- If you are using Internet Explorer, please consult the advice in **this article** in the Microsoft Knowledge Base.
- If you still have problems with Internet Explorer, try changing your Internet Options to *disable* the use of HTTP 1.1.

Why do the grid text files apparently contain only '-9999' values?

The 5 km grids cover a rectangular area that encompasses the whole of the British Isles and surrounding sea areas. However, climate data are only given for grid points on the land. Points in the sea, such as those in the rows and columns in the top left corner of the grid, have the value -9999. Try scrolling down and to the right and you will find some data values over the land.

How do I find out which 5 km grid cell or 25 km grid box includes a particular location?

Locate a 5 km grid cell

Locate a 25 km grid box

When deciding which data are relevant to your chosen location, please bear in mind that the 5km values are estimates for the centre point of a 5 x 5 km grid cell, whereas the 25 km values are estimates of the average over a 25 x 25 km grid box.