

2.1.2 Global mean surface temperature

Our primary concern is with the mean surface temperature averaged over the whole surface of the Earth, both land and sea — the **global mean surface temperature (GMST)**. Usually the average is over one or more years. Thus, to obtain the GMST, we have to obtain the mean surface temperature at a very large number of locations across the globe, and work out *their* mean value, as follows:

$$\text{GMST} = \frac{\text{sum of all mean surface temperatures}}{\text{number of surface locations}} \quad (2.3)$$

This is illustrated for a more restricted region in Question 2.4.

Question 2.4 (a) Calculate the UK 30-year mean surface temperature, from the data given in Figure 2.5. Give your answer to two significant figures.

(b) What would need to be done to obtain a more representative value? ◀

The value for the UK 30-year mean surface temperature given by the data in Figure 2.5 is not as good as it could be. This is because the locations do not give an even coverage of the UK: there are too many in the south, and too many at the coast. A more representative value is 9.2 °C, obtained from 25 weather stations distributed more evenly across the country. For calculating the GMST, it is desirable to spread thermometers uniformly over the globe. In practice, however, the spread is not uniform, with weather stations being few and far between in remote cold polar regions and over the oceans. To avoid the GMST being biased towards values from densely-monitored areas, a mean temperature is calculated for each region of the Earth and these mean values are combined into a single GMST. Whatever the method, finding the GMST involves a huge international effort requiring literally millions of measurements, all carefully done, documented and assessed for accuracy.

If the GMST corresponds to 30 consecutive years of averaging then it is called the 30-year GMST. Table 2.2 summarizes our naming convention for all these different mean temperatures. For the period 1961 to 1990, the 30-year GMST is 15 °C. But given our concerns about possible changes in the GMST, we will need to look at the history of variation in annual GMST values.

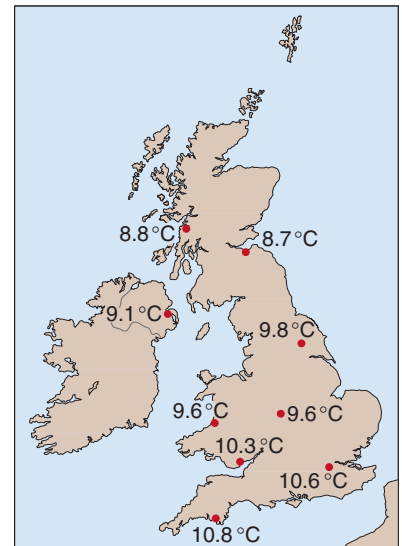


Figure 2.5 The 30-year mean surface temperature at a few locations in the UK.

Table 2.2 The naming convention for the various mean temperatures.

Name	Meaning
mean surface temperature	the surface temperature at some location or over some region, averaged over some (unspecified) time-span
annual mean surface temperature	the surface temperature at some location or over some region, averaged over a year
30-year mean surface temperature	the surface temperature at some location or over some region, averaged over 30 consecutive years
global mean surface temperature (GMST)	the mean surface temperature averaged over the whole globe, usually over one or more years
30-year global mean surface temperature (30-year GMST)	the mean surface temperature averaged over the whole globe, over 30 consecutive years