

WMO Statement on the State of the Global Climate in 2018

WEATHER CLIMATE WATER



**WORLD
METEOROLOGICAL
ORGANIZATION**

WMO-No. 1233

DATA SOURCES AND BASELINES FOR GLOBAL TEMPERATURE

The assessment of global temperatures presented in the Statement is based on five datasets. Three of these are based on temperature measurements made at weather stations over land and by ships and buoys on the oceans, combined using statistical methods. Each of the data centres, NOAA NCEIs,¹ NASA GISS,² and the Met Office Hadley Centre and Climatic Research Unit at the University of East Anglia,³ processes the data in different ways to arrive at the global average. Two of the datasets are reanalysis datasets – from ECMWF and its Copernicus Climate Change Service (ERA-Interim), and JMA (JRA-55). Reanalyses combine millions of meteorological and marine observations, including from satellites, with modelled values to produce a complete “reanalysis” of the atmosphere. The combination of observations with models makes it possible to estimate temperatures at any time and in any place across the globe, even in data-sparse areas such as the polar regions. The high degree of consistency of the global averages across these datasets demonstrates the robustness of the global temperature record.

Global temperatures are usually expressed as “anomalies”, that is, temperature differences from the average for a particular baseline period. Although actual temperatures can vary greatly over short distances – for example, the temperature difference between the top and bottom of a mountain – temperature anomalies are representative of much wider areas. That is, if it is warmer than normal at the top of the mountain, it is probably warmer than normal at the bottom of it. Averaged over a month, coherent areas of above- or below-average temperature anomalies can extend for thousands of kilometres. To get a reasonable measurement of the global temperature anomaly, one needs only a few stations within each of these large coherent areas. On the other hand, obtaining an accurate measurement of the actual temperature requires far more stations and careful, representative sampling of many different climates.

¹ NOAA NCEI produce and maintain global temperature datasets called NOAAGlobalTemp.

² NASA GISS produces and maintains a global temperature dataset called GISTEMP.

³ The UK Met Office Hadley Centre and Climatic Research Unit at the University of East Anglia produce and maintain a global temperature dataset called HadCRUT4.

The period chosen as a baseline against which to calculate anomalies usually depends on the application. Commonly used baselines include the periods 1961–1990, 1981–2010 and 1850–1900. The last of these is often referred to as a pre-industrial baseline. For some applications, for example assessing the temperature change during the twentieth century, the choice of baseline can make little or no difference.

The period 1961–1990 is currently recommended by WMO for climate change assessments. This baseline period was used extensively in the past three IPCC assessment reports (AR3, AR4 and AR5) and therefore provides a consistent point of comparison over time. Considerable effort has been made to calculate and disseminate climate normals for this period.

A commonly used value for the absolute global average temperature for 1961–1990 is 14 °C. This number is not known with great precision, however, and may be half a degree higher or lower. As explained previously, this margin of error for this actual temperature value is considerably larger than is typical for an annually averaged temperature anomaly, which is usually around 0.1 °C.

The 1981–2010 baseline period is used for climate monitoring. A recent period such as this one is often preferred because it is most representative of current or “normal” conditions. These 30-year averages are, indeed, often referred to as “climate normals”. Using a 1981–2010 normal means that it is possible to use data from satellite instruments and reanalyses for comparison, which do not often extend much further back in time. The 1981–2010 period is around 0.3 °C warmer than 1961–1990.

The period 1850–1900 was used to represent “pre-industrial” conditions in the IPCC *Global Warming of 1.5 °C* report and is the period adopted in this Statement. Monitoring global temperature differences from pre-industrial conditions is important because the Paris Agreement seeks to limit global warming to 1.5 °C or 2 °C above pre-industrial conditions. The downside of using this baseline are that there are relatively few observations from this time and consequently there are larger uncertainties associated with this choice. The 1850–1900 period is around 0.3 °C cooler than 1961–1990.