

Surface temperatures

The estimated departures from normal (1951 to 1980) for the 1993 surface global mean temperature varied from $+0.18^{\circ}\text{C}$ to $+0.24^{\circ}\text{C}$. These estimates vary, primarily because of slight differences in resolution, analysis, amount and distribution of data, although all estimates relied heavily on the 1993 land surface temperature data from the monthly CLIMAT messages exchanged over the Global Telecommunication System. Surface temperature data over the oceans were based on sea surface temperature measurements from ships. All of these estimated global surface temperature anomalies (departures from normal) were lower than the peak values reached in 1990 (Figure 1).

The 1994 estimated global mean surface temperature anomaly (departure from normal calculated relative to the 1951–1980 base period) for land and marine areas, was $+0.31^{\circ}\text{C} \pm 0.03^{\circ}\text{C}$ (Figure 1). The uncertainty in this estimate results mainly from data sparsity, especially in the southern hemisphere oceans and parts of the tropics, and lack of data from Antarctica. As a result, different analysis techniques yield recent global mean anomalies that vary by a few hundredths of a degree. All estimates for 1994 rely heavily on land surface air temperature data from about 1 400 surface stations, mostly distributed as WMO monthly CLIMAT messages, and on oceanic surface temperatures based on approximately two million measurements from ships and buoys. Most of these data were exchanged over the Global Telecommunication System.

THE WARMEST YEAR SO FAR

The globally-averaged surface temperature for 1995 was 0.40°C above the 1961–1990 average, according to observations made at land stations along with sea-surface temperatures measured from ships and buoys. The previous warmest year since 1861 was 1990, which had an anomaly of 0.36°C for the year as a whole (see front cover).

Based on observations over both land and ocean, the 1996 estimated global mean surface temperature anomaly was 0.22°C above the 1961–1990 base-period average. This made 1996 the eighteenth consecutive year with positive global temperature anomalies and the eighth warmest year since 1860. However, the magnitude of the positive temperature departure was only about half the record 0.38°C experienced in 1995. The relative cooling over much of

The 1997 global mean surface temperature anomaly, 0.43°C above the 1961–90 base-period mean temperature, was the highest since records began in 1860. The previous highest anomaly was $+0.38^{\circ}\text{C}$ in 1995. One major contributing factor was the El Niño/Southern Oscillation (ENSO) episode with temperatures in the tropical belt being the second highest in the historical record. However, mid-latitude temperatures were also a major contributor as temperatures averaged above normal during the year over a large part of central and western Russia, western Europe, Alaska and the west coasts of the Americas. Areas that were colder than normal included the eastern two-thirds of North America, the Middle East, northern India and large parts of Australia.

The Earth's global surface temperature in 1998 was the highest since reliable worldwide instrument records began in 1860, 0.57°C above the recent long-term average based on the period 1961 to 1990. As we approach the end of the century, the global temperature is almost 0.7°C warmer than at the end of the 19th century. It was the 20th consecutive year with an above-normal global surface temperature. The regional temperature patterns show all of the continents with above-average temperatures.