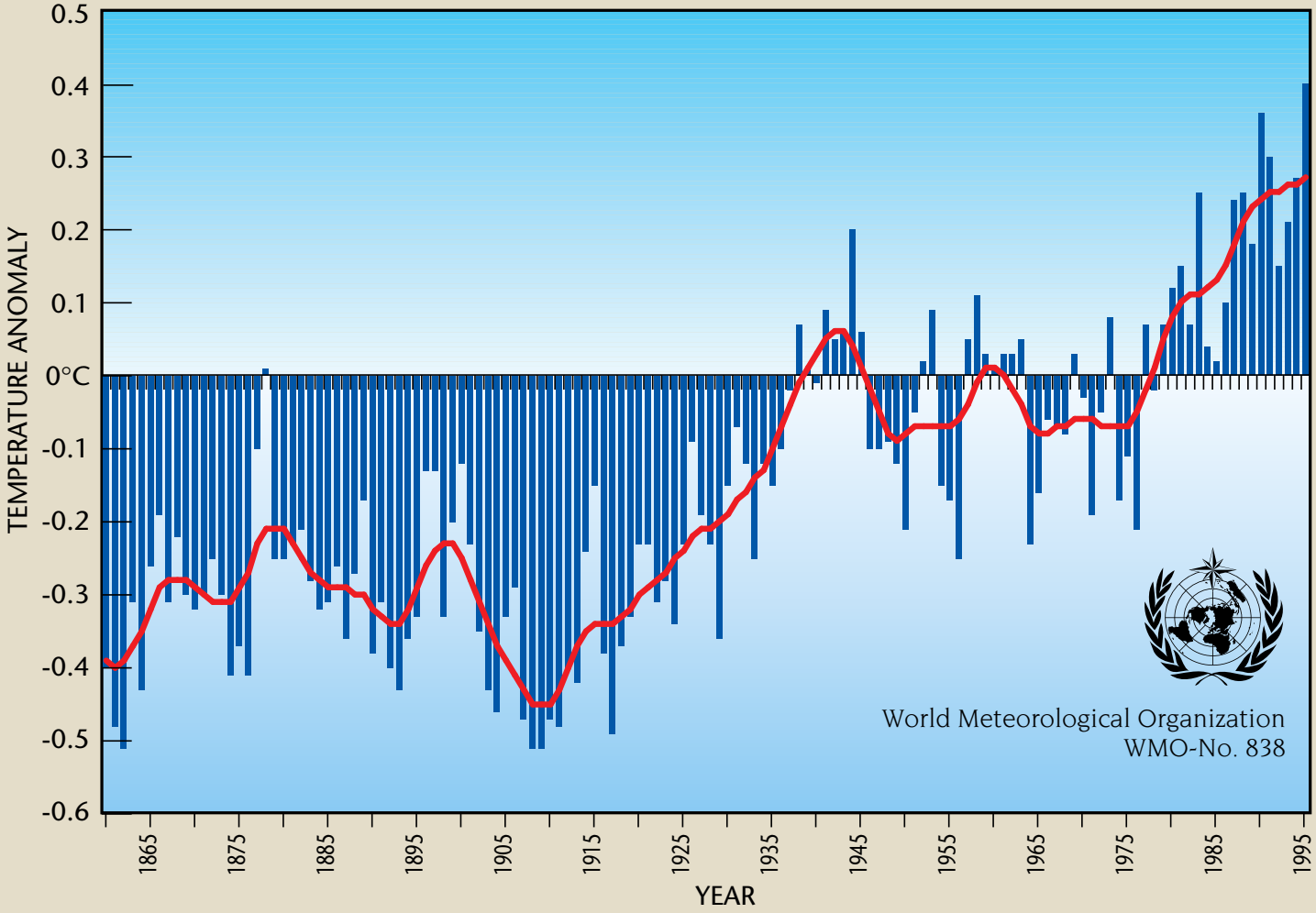
WMO STATEMENT ON THE STATUS OF THE GLOBAL CLIMATE IN 1995



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Front Cover: 1995 — GLOBALLY, THE WARMEST YEAR ON RECORD

Global land air and sea-surface temperature anomalies (°C) are computed departures from the 1961-1990 base-period means. The fitted curve is a 21-point binomial filter. (Source: Hadley Centre, Meteorological Office and Climatic Research Unit, University of East Anglia, United Kingdom)

Back Cover:

Sea-surface temperature anomalies (°C) for December 1994-January 1995 (top) and November 1995 (bottom) computed as departures from the adjusted optimally-interpolated climatology which includes ship observations during the period 1950-1979. (Source: Climate Prediction Center, United States)

Special appreciation is extended to Mr C. Ropelewski, Chairman of the WMO Commission for Climatology Working Group on Climate Change Detection, to other members of the Working Group, and to Mr M. Halpert of the Climate Prediction Center in Washington, D.C., who helped prepare the statement.

World Meteorological Organization
Geneva - Switzerland

FOREWORD

There is continuing international concern about global warming and its potential to cause serious disruption to vulnerable social and economic sectors of society as well as to sustainable development efforts. As recently as December 1995, scientists of the World Meteorological Organization/United Nations Environment Programme (WMO/UNEP) Intergovernmental Panel on Climate Change stated that "the balance of evidence suggests a discernible human influence on global climate", through emissions of greenhouse gases. At the same time, there is a developing capability within national Meteorological and Hydrological Services (NMHSs) to provide comprehensive information on past, present, and future (seasons to a year ahead) climate and its variations, to a wide spectrum of users. The rapid development of global communications systems means that such information can be provided on a timely basis and is, therefore, of great use to national decision makers.

Much of our knowledge on climate comes from global scientific and technical programmes coordinated by WMO.

WMO is responsible for the routine publication of the *Climate System Monitoring Monthly Bulletin* and the biennial *Global Climate System Reviews*, which are outputs from the Climate System Monitoring Project of the World Climate Data and Monitoring Programme (WCDMP). Beginning in 1993, WMO, in its role as a provider of credible scientific information on climate and its variability, began issuing statements on the status of the global climate. This booklet, the third in the series, focuses on the status of global climate during 1995, and is provided through the Climate Change Detection Project of the WCDMP.

This statement is a summary of the information provided by the Climate Prediction Center (CPC) in the United States with inputs from climate centres in Australia, Canada, Germany, Iceland, Netherlands, Russian Federation, Spain, and the United Kingdom. The contributions were based, to a great extent, on the observational data collected and disseminated on a continuing basis by the NMHSs of the WMO Member countries.

(G. O. P. Obasi)
Secretary-General

SUMMARY

The 1995 estimated global mean surface temperature over land and marine areas was the warmest since 1861. The warmth could not be attributed to El Niño/Southern Oscillation (ENSO) since the contrasting equatorial Pacific Ocean surface temperature anomalies were averaged to be near normal for the year. In the North Atlantic, however, sea-surface temperatures were more than 1°C warmer in an area centred on the Azores. Parts of Siberia averaged more than 3°C warmer than the 1961-1990 period and many heat-related deaths occurred in both the midwest United States and India during the northern hemisphere summer. As is usual, there were regions where the temperatures were cooler than normal in 1995, including Greenland and the adjacent north-west Atlantic Ocean as well as mid-latitudes of the North Pacific Ocean.

With respect to atmospheric constituents, the ozone hole, which has become a feature of the Antarctic spring period, began earlier and lasted longer than in any previous recorded year — ozone in the lower stratosphere was once again almost totally destroyed. Carbon dioxide and methane concentrations in the atmosphere increased in 1995 at their recent historical rates following a slow-down in rates of increase in 1992 and 1993.

There were many extreme climatic anomalies and weather events in 1995. The most active hurricane season in the Atlantic Ocean since 1933 caused considerable property damage in the Caribbean islands and the south-east coastal areas of the United States. Following prodigious rains in January and February, which caused massive flooding along major continental European rivers, the summer over the same region was of near record heat and, in the United Kingdom particularly, serious precipitation deficiencies caused widespread restrictions on water usage. There were examples of beneficial events, including the return of abundant rains to such widely separated but drought-stricken regions as north-west Africa/Iberian Peninsula, southern Africa, and Australia.

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).

Global surface temperatures have now completely recovered from the cooling effects associated with the June 1991 eruption of Mount Pinatubo in the Philippines. A prolonged period of the El Niño/Southern Oscillation (ENSO) warm episode, which dominated the 1991-1994 period, ended in early 1995. A narrow band of the eastern equatorial Pacific is now cooler, indicating a weak cold episode (La Niña) condition and suggesting that, on a global average, 1996 may be slightly cooler than 1995 (see back cover).

In 1995, the northern hemisphere was warmer than in all previous years, but the southern hemisphere was relatively less warm. Parts of Siberia were about 3°C warmer than usual in 1995, because the early part of the year was exceptionally warm, whereas 1995 was slightly cooler than normal over the Greenland/north-west North Atlantic region and over the mid-latitude North Pacific. It was the coldest year in Iceland since 1983. These features (see

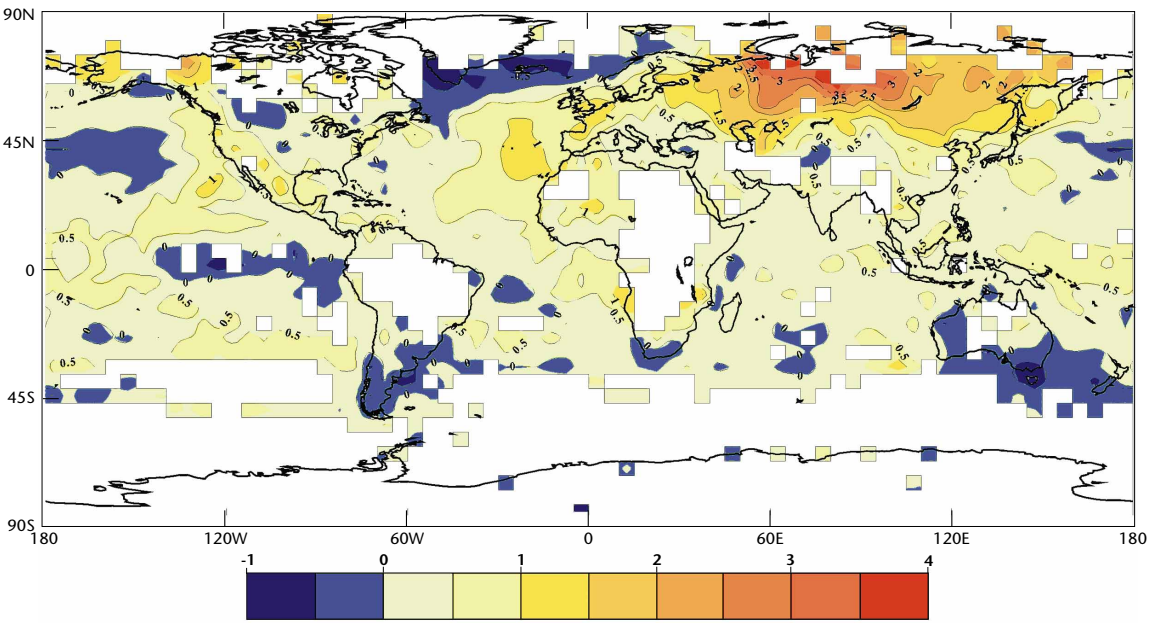


FIGURE 1. *Surface temperature anomalies (°C) for January-December 1995. The analysis is based on at least eight months of data for each grid square. Areas with insufficient data are blank. Anomalies are departures from the 1961-1990 base-period means.* (Source: Hadley Centre, Meteorological Office and Climatic Research Unit, University of East Anglia, United Kingdom)

Figure 1) have recurred in many recent years. Also in 1995, the ocean surface was more than 1°C warmer than usual near the Azores.

Warm conditions characterized much of western Europe, reaching record or near record annual means. For instance, in the Netherlands, the mean, spatially-averaged temperature for 1995 reached 10.4°C, more than 1°C higher than the 1901-1987 average. Intense heat, along with high humidity, was a feature in July over large areas of the central and eastern United States, and extending into central Canada where it was accompanied by severe forest fires. There were over 1 000 deaths related to the heat. Very high temperatures were also prevalent in northern India during much of June with temperatures averaging up to 5°C above normal, maximum temperatures reaching 50°C and night-time temperatures failing to fall below 25-30°C.

Cooling in the lower stratosphere stabilized in 1995 (see Figure 2) with anomalies remaining near the lowest values observed in the 17-year satellite-measured record.

PROLONGED ENSO WARMING ENDS

The ENSO warm episode conditions dominated the tropical Pacific during the period from 1990 to early 1995. Thereafter, equatorial central and eastern Pacific Ocean surface temperature anomalies steadily decreased, becoming negative during the latter half of 1995, as weak cold episode conditions developed in the region. For the first time since 1989, equatorial Pacific Ocean surface temperatures were below normal throughout the region from the International Date Line eastward to South America. Negative sea-surface temperature anomalies also spread both north and south from the Equator, so that by the end of 1995 a rather broad band of negative anomalies covered the region (see back cover). Consistent with the reversal in the sign of ocean surface temperature anomalies, cloudiness and rainfall decreased to less than normal over the central equatorial Pacific and increased to greater than normal over Indonesia.

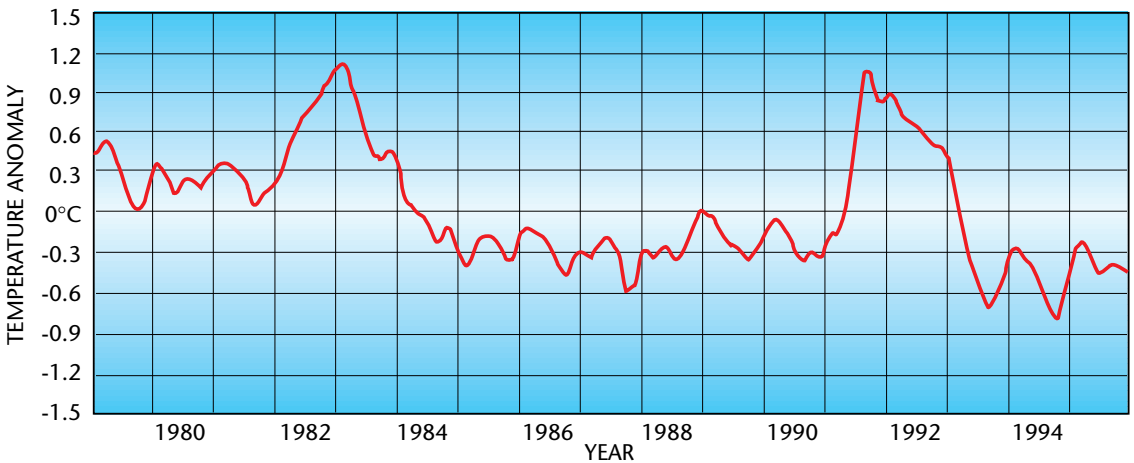


FIGURE 2. *Global mean lower stratospheric temperature anomalies (°C) from the Microwave Sounding Unit channel 4. The two sharp peaks were associated with the major volcanic eruptions of El Chichón (March, 1982) and Mount Pinatubo (June, 1991). The base period is for 1982-1991.* (Data provided by the University of Alabama at Huntsville)

LONGEST ANTARCTIC OZONE HOLE DURATION ON RECORD

Ozone measurements during the winter-spring of 1994/1995 indicated that total column ozone was unusually low over most of the northern hemisphere. For middle and high latitudes, ozone values were an unprecedented 10-20 per cent lower than the average values observed during the 1957-1980 period.

Over Antarctica, ozone depletion began earlier in August than previously and, by late September and for the whole month of October, the deficiency was more than 50 per cent, which was comparable to that observed over the previous six years. Ozone soundings from a number of Antarctic stations during the period from mid-September to October showed near complete destruction of the ozone at altitudes between 14 and 21 km. The area of the ozone hole exceeded 22 million km^2 and was similar to the recent record set in 1993 (see Figure 3). In 1995, however, the duration of the time with lower ozone values was longer than ever previously documented.

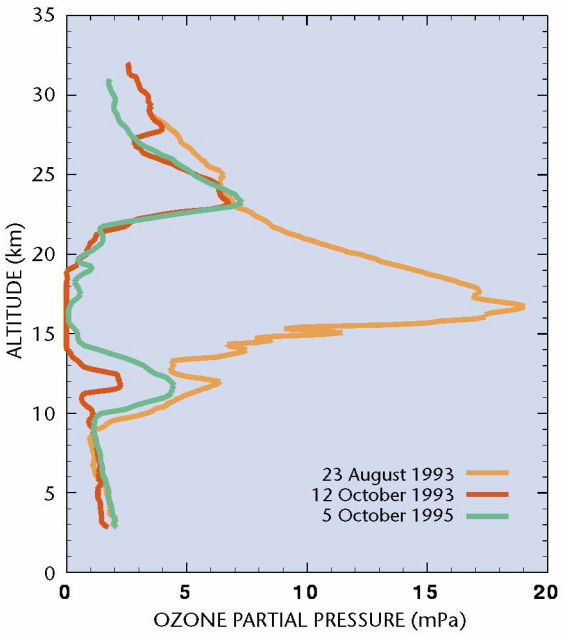


FIGURE 3. Vertical ozone profiles from balloon soundings at the South Pole on 23 August 1993 (close to normal values) and on two typical days in October (1993 and 1995) when total ozone was severely depleted. October 1993 showed the highest level of ozone destruction on record. This illustrates the complete ozone destruction in the lower stratosphere (in these cases between 14 and 21 km). This feature was observed at all Antarctic stations, especially during the second half of September and throughout October during the "ozone hole" events of the past seven years.

(Source: Climate Prediction Center, United States)

CARBON DIOXIDE AND METHANE INCREASE

Provisional indications show that atmospheric concentrations of both carbon dioxide and methane, two principal greenhouse gases, increased in 1995 at rates which are in line with their recent historical trend. It is recalled that these gases exhibited a noticeable slow-down in their rates of increase during 1992 and 1993 for reasons that are not presently understood. The atmospheric concentration of carbon dioxide now stands at about 360 parts per million volume (ppmv) compared to an estimated 280 ppmv before the start of widespread industrialization around 1850.

SNOW COVER OVER THE NORTHERN HEMISPHERE

The last five months of 1995 showed positive snow cover anomalies over the northern hemisphere. This was the first time since 1984 that positive global snow cover area anomalies were observed for each of these early months of the upcoming snow season. A predominance of negative snow cover anomalies early in the year resulted in a 1995 annual mean of 24.5 x 10^6 km^2, only slightly

less than the 1973-1995 yearly average. The coincidence of near-average snow cover area with near-record land surface temperatures is in marked contrast to the record warm year of 1990, which had the least snow cover in the satellite record.

Central African Republic
Photo: H. Fromm

REGIONALLY SPEAKING…

Abnormal precipitation in central South America

Persistent below normal precipitation occured over parts of South America in early May and continued into mid-December. Large sections of central and southern Brazil, southern Paraguay, and central and north-eastern Argentina received less than 75 per cent of normal precipitation during the period 1 May-19 December, with less than 50 per cent of normal totals recorded in parts of the northern state of Rio Grande do Sul in Brazil, south-eastern Paraguay, and the Argentine provinces of Corrientes, northern Santa Fe, and a few other areas along the western tier of the region. Forest fires, the worst in living memory, broke out in some areas of Argentina. In late December, however, torrential rains (467 mm on 24-25 December) fell along the coast of the state of Santa Catarina in southern Brazil, and heavy showers (100 to 250 mm on 24-30 December) were recorded in much of the states of Paraná, Minas Gerais, Rio de Janeiro, and São Paulo. Locally, severe flooding affected Santa Catarina and Minas Gerais, according to Brazilian authorities.

Dryness in Africa and the Mediterranean

Significant below normal precipitation anomalies during 1995 were recorded in both north-west and southern Africa, which extended to both the western Mediterranean and the Middle East. In the north-west, well below normal rainfall was recorded across the region during the periods from January to early February, and from late March to May, adding to long-term moisture deficits throughout much of Morocco, Algeria, and Tunisia that had started in November 1994. Less than 50 per cent of normal precipitation was measured from 1 November 1994 to 25 June 1995 across northern and western Morocco, central Tunisia, much of central and north-eastern Algeria, and the Iberian Peninsula and southern France. Long-term shortages remained until surplus November and December precipitation fell over most of the region.

In southern Africa, the 1994-1995 wet season (October-April) was slow to commence across much of Botswana and northern and central South Africa. Dry conditions spread across most of the region in

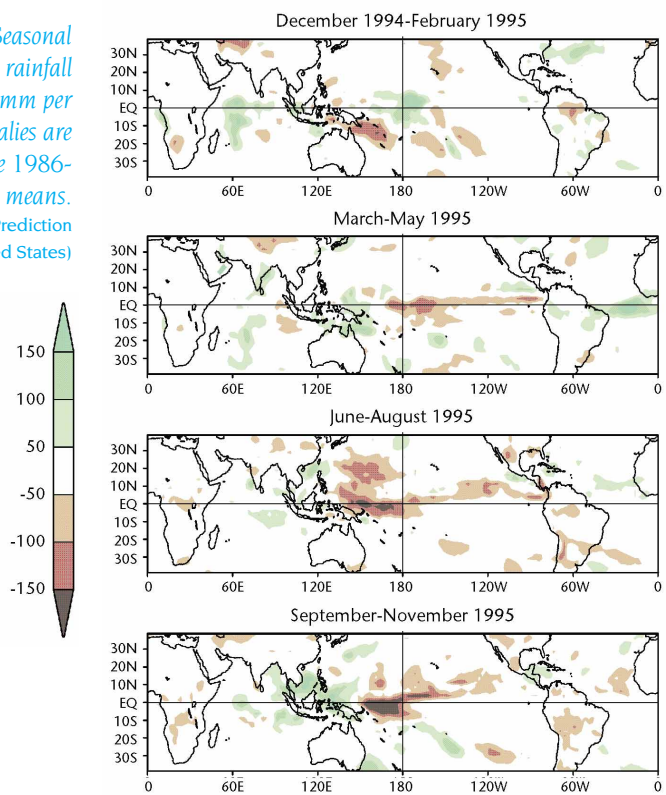


FIGURE 4. *Seasonal satellite-derived rainfall estimates in mm per month. Anomalies are departures from the 1986-1993 base-period means.* (Source: Climate Prediction Center, United States)

November, with near normal rain confined to north-west and south-west Botswana. Subnormal monthly totals, however, were again reported over much of central and north-central South Africa and western Botswana, despite significant December rains in some north and eastern areas of the region. As a result, long-term moisture shortages covered much of southern Africa as 1995 began. Although occasional significant rains drenched parts of the area up to the end of April, for the 1994-1995 wet season as a whole, subnormal rains were the general rule over the vast majority of the region.

The "big dry" ends in Australia

The ENSO event that had plagued most of eastern and southern Australia with drought during 1994 slowly diminished through 1995. By the middle of 1995, most tropical Pacific indicators showed the termination of the ENSO conditions. Towards the end of 1995, these same indicators suggested the development of a *La Niña* event. As the ENSO declined, rainfall across Australia returned to normal (see Figure 4), and often above normal levels, breaking the drought in many areas. However, this transition from drought was neither abrupt nor uniform, with dry conditions lingering in some areas until well into the year. January saw the first signs of a break from the dry conditions.

The period from February to April saw a return to drier than normal conditions across most of eastern Australia, although April was wet over the far south-east and most of western Australia (except the south-west). The period from May to July was particularly wet over eastern South Australia, Victoria, and south-west New South Wales — totals for June and July were among the highest on record, and flooding became a regular occurrence. By the end of July, these rains had removed most long-term deficiencies (as measured from April 1994) from south-eastern Australia. August stood out as an exceptionally mild and dry month over most of extra-tropical Australia — across large areas it was both the warmest and driest August on record.

Coinciding with the onset of *La Niña*-like conditions over the Pacific Basin, the period from September onwards saw a trend toward distinctly wetter than normal conditions

across north-eastern South Australia, most of New South Wales, and Queensland. Wet conditions were particularly marked in November, when large areas received abundant rainfall, with local record-breaking precipitation and significant flooding in southern Queensland, and parts of southern Victoria during both October and November, although western Victoria and southern South Australia had a dry spring. In the tropics, active convection produced an early start to the wet season.

Abnormal conditions from the British Isles to central Asia

The main feature of 1995 over the region was abnormal warmth. In central England, however, 1995, as a whole, was not as warm as 1990 or 1949 due to a cold month of December. Taken together, July and August, were the warmest ever in the record for central England since 1659. Temperatures reached 34°C in some places and 30°C was even reached in northern Scotland. Combined with this record summer warmth was extreme dryness. Rainfall over the summer in England and Wales was similar to that experienced in 1976, which was the driest in the series since 1766. Spain also experienced hot, dry weather with temperatures soaring to a record 47°C at Seville and Cordoba in July.

Russia and adjacent central Asia meanwhile generally experienced their warmest year on record in 1995 (see Figure 5). Weekly temperatures of 15°C above normal were common north of the Arctic Circle from mid-February to the end of April. In early July, temperatures soared to 47°C in parts of Turkmenistan and the Republic of Kazakhstan. Abnormal warmth was evident during the last four months of 1995 in most of the region.

Central Europe began the year with abundant rainfall and rapidly melting snow, which caused flooding and widespread damage along major rivers, especially in the Netherlands.

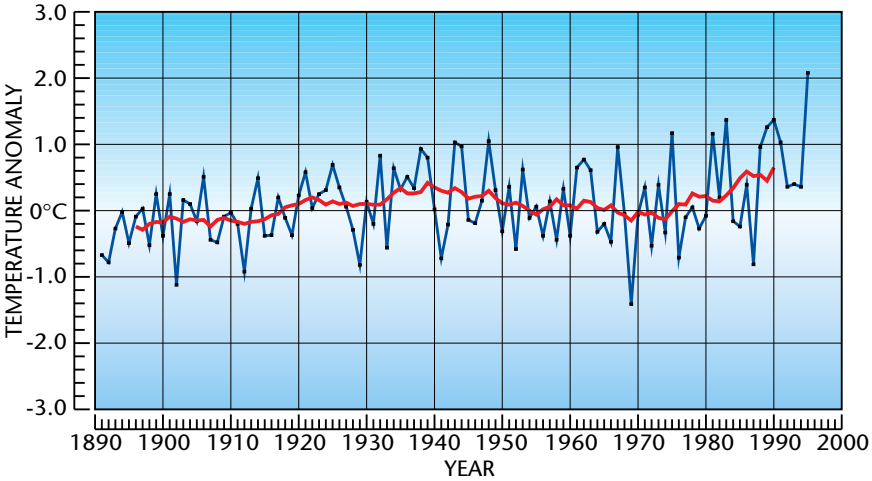


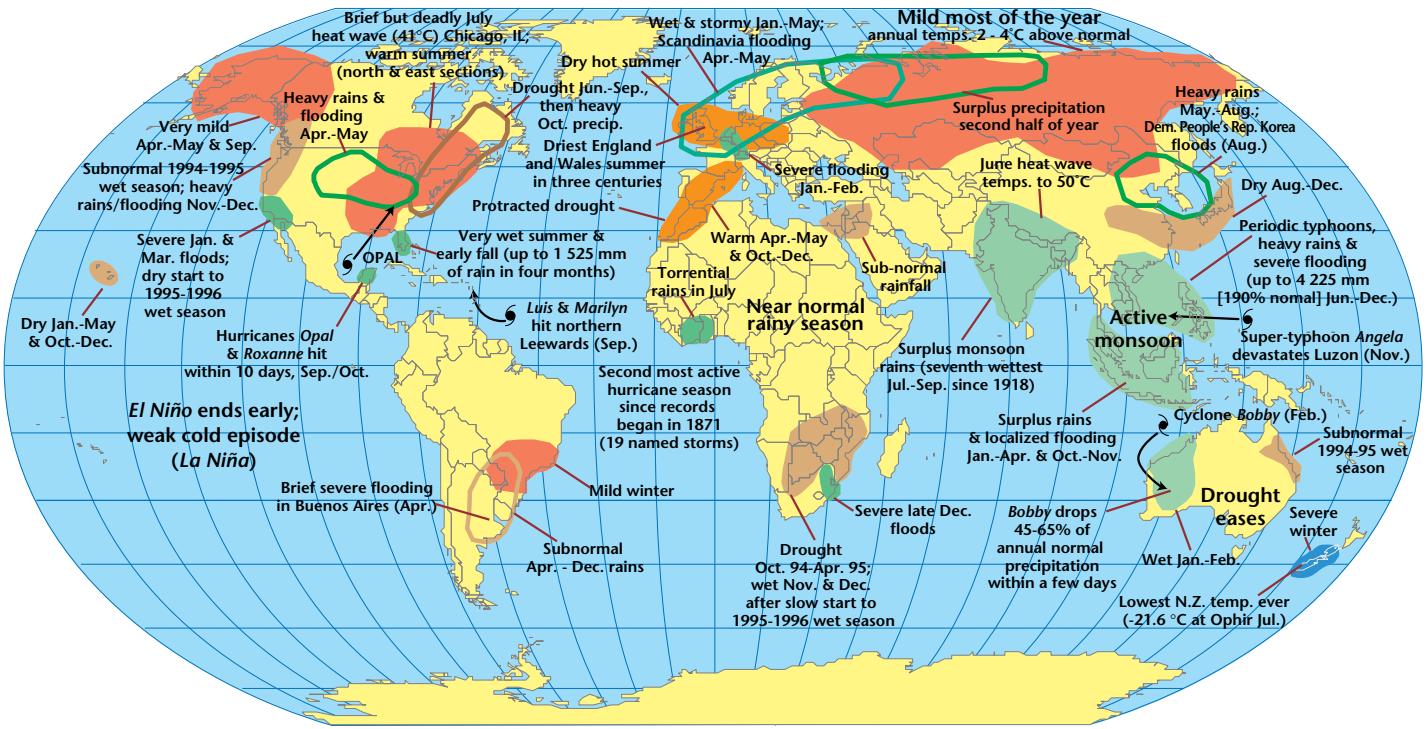
FIGURE 5. *Annual surface temperature anomalies for the former Soviet Union. The red curve is an 11-year running mean. Anomalies are departures from the 1951-1980 base-period means.*
(Source: Institute for Global Climate and Ecology, Russia)

A very active Atlantic hurricane season

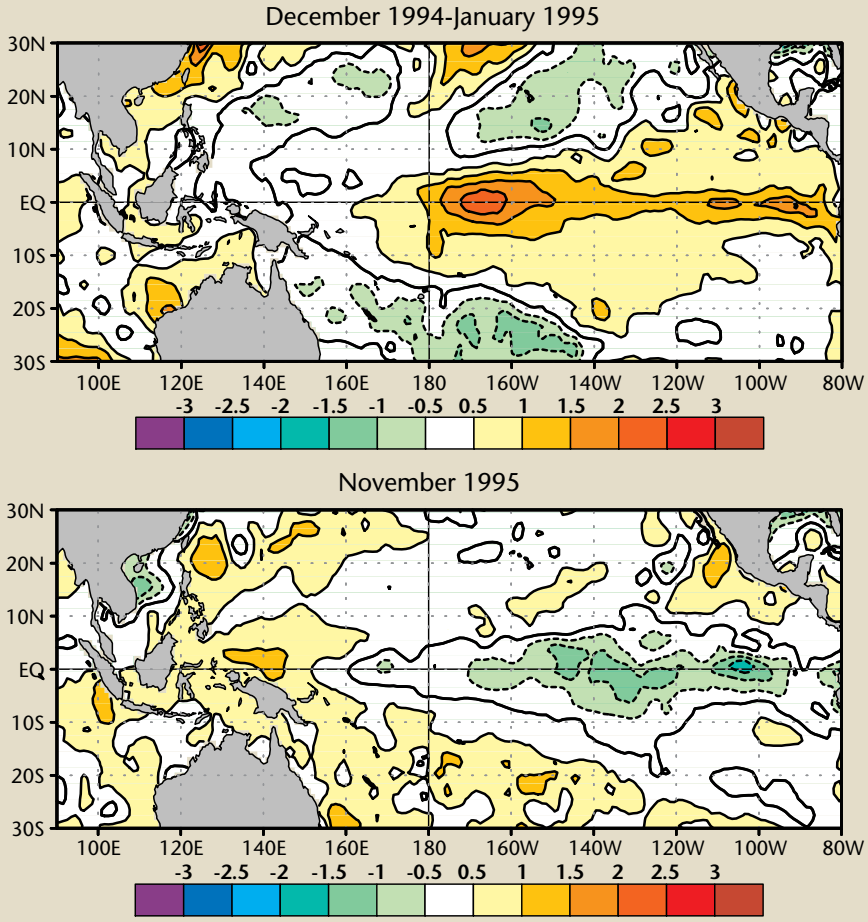
The 1995 Atlantic hurricane season featured 19 tropical storms, 11 of which became hurricanes. This was the second largest number of storms (21 in 1933) observed in any hurricane season since records began in 1871, and the second greatest number of hurricanes (12 in 1969) in one season since hurricane statistics began in 1886. The season started early as Hurricane *Allison* became the first June hurricane since *Bonnie* in 1986. August was a busy month with Hurricane *Erin* dumping 100 to 250 mm of rain over central and extreme north-western Florida. In mid-August, Hurricane *Felix*

stalled offshore 240 km east of Cape Hatteras, North Carolina lashing much of the East Coast with rough surf and beach erosion. Hurricane *Luis* raked the north-eastern Caribbean with destructive winds (gusts up to 235 km/h on Antigua before the anemometer blew away) and heavy rains (up to 210 mm in Puerto Rico). Hurricane *Marilyn*, a particularly compact hurricane, caused extensive damage on the islands of St. Croix, Culebra, and St. Thomas. Winds were clocked to 200 km/h in St. Croix. In early October, Hurricane *Opal* became the fourth tropical system to affect Florida in 1995, and the second hurricane to strike the western Florida Panhandle since early August. Torrential rains (300 to 430 mm), a five- to six-metre storm surge, and winds gusting to 230 km/h buffeted the western Florida Panhandle and adjacent Alabama. Hurricane-force (121 km/h) winds penetrated as far inland as Atlanta, Georgia causing considerable property damage and disrupting electrical power in many areas from the central Gulf Coast north-eastward to the Carolinas. Farther south, Hurricane *Roxanne* buffeted the Yucatán Peninsula and Cuba. At Cancún, 400 mm of rain accompanied this hurricane.

Significant climate anomalies and events during 1995



Source: Climate Prediction Center, United States


December 1994-January 1995
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November 1995
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