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World Meteorological Organization

El Niño/La Niña Update

Produced in collaboration with
IRI
INTERNATIONAL RESEARCH INSTITUTE
For Climate Prediction

PREAMBLE

The northern winter of 1997 to 1998 was witness to one of the strongest El Niño events on record, followed in turn by a La Niña of substantial magnitude during the later part of 1998 and into 1999. Throughout this period WMO, through the World Climate Programme, and specifically the Climate Information and Prediction Services (CLIPS) Project, has produced a series of El Niño/La Niña Updates in collaboration with the International Research Institute for Climate Prediction, and with inputs from national Meteorological and Hydrological Services (NMHSs), particularly the Bureau of Meteorology in Melbourne, and other sources. The objectives of the Updates have been to provide timely information on the current status of the El Niño/La Niña system, comments on possible climatic impacts from the event, information on predictions of conditions in the tropical Pacific Ocean, and details of latest consensus rainfall forecasts for various parts of the globe produced at Regional Climate Outlook Fora (RCOF).

In this latest update the focus has been changed somewhat to include a brief overview of events and impacts during the 1997 to 1999 El Niño/La Niña. Sometimes referred to as the "El Niño of the Century", although it can be argued that the 1982 to 1983 El Niño was the larger of the two depending on the precise measure selected, the event was accompanied by notable weather and climate anomalies in many parts of the globe. As outlined in Update No. 8, these anomalies have been detailed at a major UN/WMO meeting in Ecuador, as well as at other regional conferences. A major issue in climate research is the extent to which specific anomalies may be directly linked to sea-surface temperature departures in the tropical Pacific Ocean. It is known that departures in other tropical ocean basins, in addition to other factors such as soil moisture anomalies and the natural internal variability of the atmosphere, all contribute towards the variations in anomalies observed between El Niño and La Niña episodes. Specific attribution of given anomalies to changes in the Pacific Basin is not currently achievable for many regions of the globe.

REVIEW

The most recent three- to four-year period has been the most active in the tropical Pacific since the early 1970s. An alternating sequence of La Niña and El Niño conditions has been accompanied by a possibly-unprecedented sequence of rainfall and temperature extremes over many regions of the globe. Here, the evolution of the El Niño/Southern Oscillation (ENSO) episodes over this remarkable period is summarized.

By late 1996 La Niña conditions had peaked and climate forecasters were already turning their attention to the possibility of a new El Niño forming in 1997. By early in the year (1997) most numerical models and empirical forecast schemes had started to indicate the inception and evolution of a possible major El Niño episode. The forecasts came to pass with unusually strong El Niño conditions dominating the climate throughout much of 1997 and into early 1998. This "El Niño of the Century" then abruptly gave way to moderate La Niña (cold episode) conditions by mid-year. The sequence of events starting in early 1996 is well documented by the alternating relatively cold (La Niña) sea surface temperature and warm (El Niño) sea-surface temperature in the equatorial Pacific (Figure 1).

The period of highly active ENSO provided an ideal test bed for the newly-developed coupled ocean-atmosphere models for real-time climate prediction. To their credit this generation of models did well in forecasting the continued evolution of equatorial Pacific sea-surface temperatures. Numerical forecasts of seasonal temperature and precipitation based on these sea-surface temperatures, while far from perfect, also provided useful climate information to a wide range of users. Empirical models additionally provided acceptable forecasts in general. Development of empirical models, not only at major centres but also at a growing number of NMHSs, was spurred by both the El Niño event itself and the series of RCOFs.

For the most part the rainfall and surface temperature patterns followed those often considered typical during warm and cold episodes. In particular, a sequence of

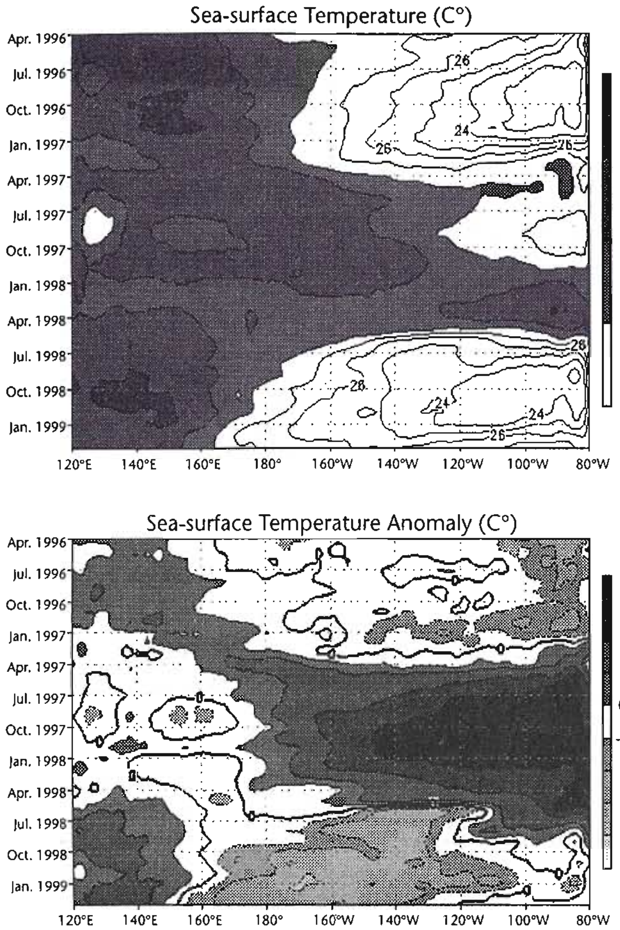

Figure 1 — Time-longitude cross-section of equatorial sea-surface temperatures plus associated anomalies in the Pacific Ocean averaged between 5°N and 5°S. Negative anomalies are indicated by dashed lines (NOAA/NCEP data)

extremely wet and dry years during La Niña and El Niño periods respectively in the far western tropical Pacific Basin, including over Indonesia, was mirrored by markedly dry and wet years eastwards from the dateline. As in northern Australia, the summer of 1996/97 was very wet over Indonesia. However, the second half of March 1997 saw an abrupt and early end to the wet season over the entire maritime continent region of Indonesia, Papua New Guinea and northern Australia, as strong high-pressure anomalies became established over the whole region. Occasional storms continued over the area for the next few months, but rainfall was generally well below normal. In July, as the El Niño gathered strength, clouds cleared almost completely from Australia and southeast Asia. Strong subsidence, clear skies and dry air associated with intense anticyclones over the Australian region penetrated virtually to the equator north of Australia: resultant devastating frosts in the New Guinea highlands added to the already serious situation produced by the drought.

Towards mid-August attention was drawn to forest fires burning out of control in Indonesia. Fire and drought also hit hard at some industries, with the bulk of the country's palm oil crop being lost. Associated haze hindered, and often stopped, traffic by land, sea and air, and was a primary factor in several serious accidents. By November at least 500 deaths were being attributed directly to the drought (starvation and malnutrition), with hundreds of thousands of others being regarded as seriously at risk.

Convection remained almost absent from the Indonesian–Papua New Guinea area through October and well into November, and rainfall in December continued patchy and mostly well below average. Exceptionally low rainfall occurred between January and April 1998 over Celebes and eastern Borneo. However, rainfall became generally above normal in most areas of Indonesia from July (corresponding to the onset of La Niña), with particularly heavy rains in July and October.

On the opposite side of the Pacific Basin reverse anomalies were observed. Exceptional rains hit the west coast of South America in 1997 and into 1998, bringing floods, infrastructure damage and loss of life. Advanced warning of El Niño permitted many appropriate mitigative activities to be undertaken. In Peru, for example, certain rivers were drained to provide additional storage capacity, an action thought to have saved damage and lives. The rains effectively continued through the life of El Niño, dry conditions returning only with the onset of La Niña.

Further from the tropical Pacific itself ENSO signals weaken so that, although a characteristic signal might be identified in terms of statistics, there is no guarantee that a similar response will occur in all El Niño years. Even given the strength of the 1997/98 event, not all of the 'expected' ENSO signals occurred. In particular, the 1997 monsoon season in India and the 1997/98 season in Australia produced near-average rainfall amounts despite fears that the El Niño would bring disastrous droughts (as had happened in Australia during the 1982/83 warm episode). Drought was also anticipated by many in southern Africa, but few areas were affected by below-normal rainfall and some localized flooding occurred. In contrast, some of the anomalies were much stronger than typical during an El Niño event. For example, eastern equatorial Africa, Kenya, southern Somalia, the Ethiopian Highlands and northeastern United Republic of Tanzania experienced extremely heavy rainfall in late 1997 into early 1998. On the other hand, conditions in Africa during the La Niña have been closer to those expected during cold episodes, including dry conditions (and some drought) in East Africa, and above-normal rainfall in the south. Parts of Mozambique were particularly hard hit by floods following three months of persistent heavy rainfall in early 1999. In Australia the "Wet" has been particularly early and active. There have been some major flood events and a number of unusually intense cyclones.

In middle latitudes the control over climate anomalies exerted from the tropical Pacific becomes weaker still. For example, Canada experienced an unusually warm winter during the El Niño event, an anomaly that might be considered consistent with expectations. However, most of Canada was exceptionally warm during the La Niña period also.

One of the lessons for seasonal climate forecasting emphasized during the past couple of years is that regional, i.e. ocean basin-scale, sea-surface temperature anomalies can have a stronger influence than El Niño/La Niña on atmospheric circulation and rainfall patterns over adjacent land. One prime example from the 1997/98 period relates to an area of strong positive sea-surface temperature anomalies in the western tropical Indian Ocean. These anomalies are thought to have been partially responsible not only for the near-average summer monsoon rainfall in India in 1997 and the tropical Australia rainfall in 1997/98 but also for the heavy rainfall in eastern equatorial Africa and the favourable rainfall over much of southern Africa during 1997/98.

During mid-1998, the equatorial Pacific sea-surface temperatures fell rapidly as El Niño conditions gave way to La Niña. However, the far eastern tropical Pacific sea surface temperatures remained above average through the year. During late February and early March of 1999 these lingering warmer-than-average coastal ocean temperatures gave some concern that El Niño was back despite continuing La Niña conditions in the central equatorial Pacific. Concern was heightened by reports of rainfall in Peru and other locations that generally received no rain during this time of year. These concerns were alleviated by the end of March when the unusual rainfall ceased and the positive temperature anomalies declined along the South American Coast.

TROPICAL STORM ACTIVITY

Researchers have linked decreased Atlantic Tropical Storm activity to El Niño and increased activity to La Niña conditions. The 1998 hurricane season saw a total of 14 named Atlantic storms, twice the number experienced in 1997 with El Niño conditions and considerably more than the average of 9 to 10 storms per season. Hurricane *Mitch*, the strongest October hurricane ever recorded, was marked by its duration, strength and persistent destructive rains over Central America. Several intense storms occurred in the western Pacific Ocean, including *Thelma*, a category 5 storm that was the most powerful recorded off the north-west coast of Australia, *Dani*, that caused severe damage in Vanuatu, and *Rona*, that presented Queensland with over 600 mm of rain in only 72 hours.

OUTLOOK

Most current numerical model forecasts suggest that La Niña conditions will slowly decrease over the coming three to six months (Figure 2). It should be recalled, however, that forecast models are still working through the so-called '[northern] spring predictability barrier' (see Update No. 8), and that, consequently, forecast skill is on average relatively low at this time of the year.

RECENT CLIMATE FORECAST FORUM OUTLOOKS

Since the previous El Niño Update No. 8 issued in February of this year, Regional Climate Outlook Fora have been held in Panama for Mesoamerica and Paraguay for South-east South America. The resulting seasonal outlooks are summarized below.

Both regional climate assessments began with consensus that La Niña conditions are likely to decay over the forecast period. For the Mesoamerica Forum, important climatic factors related to the decaying La Niña include the behaviour of the Atlantic Inter-tropical Convergence Zone (ITCZ) and tropical cyclone activity and suggest that the ITCZ will be located somewhat north of its climatological position. In addition, the Forum considered that the weak La Niña conditions also favour normal to slightly above-normal Atlantic hurricane activity. Slight recent anomalous warming of equatorial sea-surface temperatures off the west coast of South America was also noted, a factor also emphasized at the Paraguay Forum.

MESOAMERICA CLIMATE OUTLOOK FORUM

Panama City, Panama, 29–30 March 1999
(for May to July 1999)

The outlook applies to precipitation for the May–June–July 1999 period, as a longer time frame would increase uncertainty in the outlook. May represents the onset of the rainy season for most of Mesoamerica, except for Panama, Colombia and Venezuela, which generally experience the beginning of the rainy season in April. The activity of the ITCZ, easterly waves, and hurricane and storm activity in the Pacific and the Caribbean will likely influence the amount of rainfall in the Mesoamerican region.

There was a consensus that the rainy season will begin in mid- to late-May for most of this region. It should be noted that, in many regions of Mesoamerica, the rainy season may be preceded by one or two "false starts". In summary, elevated probabilities of

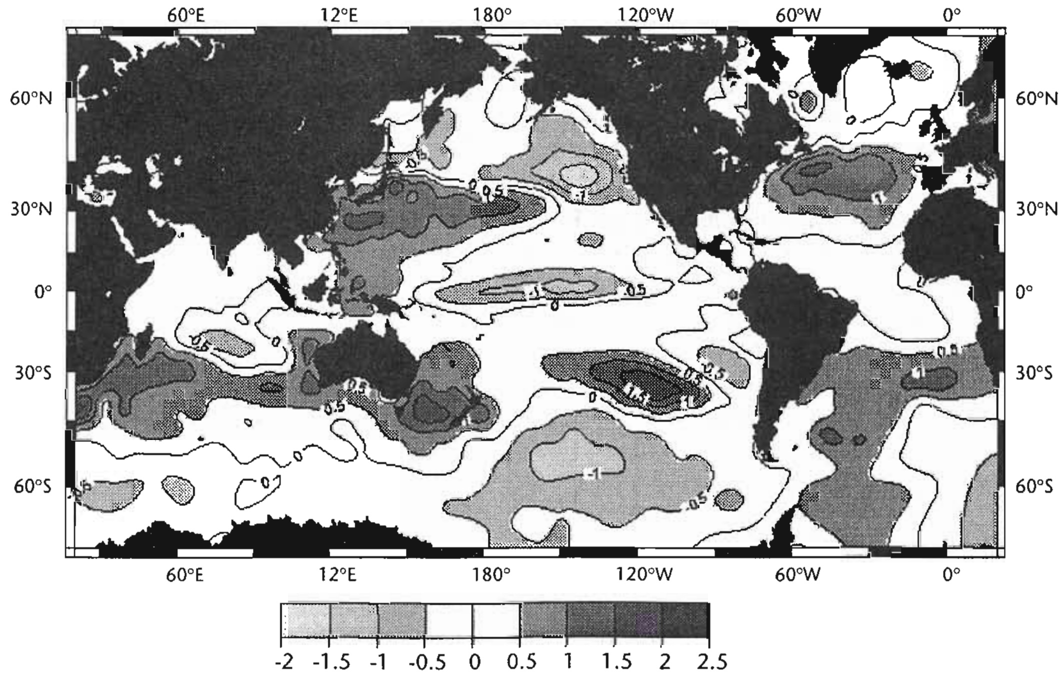

Figure 2 — Sea surface temperature anomaly forecasts from NOAA/NCEP for the three-month period April to June 1999

above-normal rainfall are projected along the Pacific coasts of Nicaragua, Costa Rica and extreme southwest Panama, while normal to above-normal rainfall is most likely in extreme northwest Panama, the eastern half of Costa Rica and extreme southeastern Honduras (Figure 3). Near-normal rainfall is the most probable outcome in most of El Salvador, and central and western Honduras, while climatological probabilities (each rainfall category having approximately the same probability) are given for southern Belize. Near-normal rainfall is the most likely outcome in eastern Panama, Columbia and Venezuela.

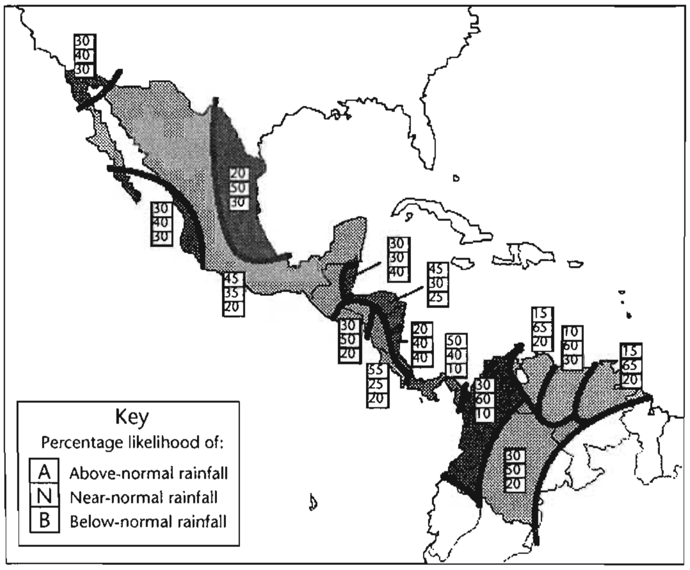

Figure 3 — Mesoamerica Climate Outlook Forum rainfall forecast for May to July 1999

SOUTH-EASTERN SOUTH AMERICA CLIMATE OUTLOOK FORUM

Mariano Roque Alonso, Paraguay, 15–16 April 1999 (for April to June 1999)

From April to June 1999, it is most probable that the greater part of the region will have close to or slightly above-normal amounts of rainfall, except in the west and central parts of the region.

Normal precipitation is forecast for the region comprising the centre and west of Paraná, Santa Catarina and Rio Grande do Sul in Brazil; centre and west of Uruguay; centre and north of Chaco and north-eastern part of the east of Paraguay; the province Entre Rios, centre and south Santa Fé, north and north-east of Buenos Aires in Argentina; and the region between the Jujuy plateau and the east of the Andean provinces in Argentina. Normal to slightly above-normal precipitation is forecast for the region comprising the states of São Paulo, Paraná, Santa Catarina and Rio Grande do Sul and the extreme west of Chaco in Paraguay; and the central part of the north and centre, east of La Pampa, and west and south of Buenos Aires in Argentina. Above-normal precipitation is forecast for the north of Patagonia, including the extreme south-west of Buenos Aires. Normal to slightly below-normal precipitation is forecast for the Bajo Chaco, centre and south of Paraguay; east of the provinces of Formosa and Chaco, north of Santa Fé, Corrientes and Misiones in Argentina. Below-normal precipitation is forecast for the Argentine part of the Andes.

NOTES:

Forecast contributors to the Mesoamerica Forum included researchers and representatives of NMHSs from Mexico, Belize, El Salvador, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Colombia and Venezuela, as well as the Universidad Nacional de Colombia, Ministerio de Agricultura y Ganadería, Instituto Mexicano de Tecnología del Agua (IMTA), Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE), Empresa de Energía Eléctrica de Panamá (ETESA), Panama Canal Commission, Centro de Investigaciones Hidraulicas e Hidrotécnicas (UTP), MIDA, Universidad de Panamá, Universidad Santa María la Antigua, EDELCA, International Research Institute for Climate Prediction (IRI), Autoridad Nacional del Ambiente (ANAM), Centro del Agua del Trópico Húmedo para América Latina y el Caribe (CATHALAC), National Oceanic and Atmospheric Administration — Office of Global Programs (NOAA-OGP), and the US Agency for International Development — Office of Foreign Disaster Assistance (USAID-OFDA).

The south-eastern South America Forum was organized by the Rural Association of Paraguay and the Federation of Rural Associations of MERCOSUR, with support from the Polytechnical Faculty of the National University of Asunción, National Directorate of Civil Aviation, World Meteorological Organization, International Research Institute for Climate Prediction (IRI), Itaipu Binacional, National Development Bank, Peruvian Chamber of Construction (CAPECO) and the Entidad Binacional Yacyretá.

The participants included experts from the Meteorological Services of Argentina, Brazil, Paraguay and Uruguay and scientists from the University of Buenos Aires (Argentina), Federal University of Paraná (Brazil), Universidad Nacional del Litoral (Argentina), National University of Asunción (Paraguay), University of the Republic of Uruguay (Uruguay), Centre for Weather Forecast and Climatic Studies (CPTEC, Brazil) and the IRI.

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