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World Meteorological Organization

El Niño Update

INTRODUCTION

WMO has produced this El Niño Update in order to ensure that the most effective and accurate information is made available. It is a summary of: (i) our knowledge of the El Niño phenomenon, (ii) its associated impacts on a global scale, and (iii) forecast information for the coming months. This Update is compiled from a variety of scientific sources (see References) and is intended to address the questions and concerns of an audience that ranges from the general public to the policy maker.

PART I: BACKGROUND INFORMATION ABOUT EL NIÑO

(1) What are El Niño, ENSO and La Niña?

"El Niño" is the term that is used for an oceanographic phenomenon: an extensive warming of the upper ocean in the tropical eastern Pacific lasting three or more seasons. The negative or cooling phase of El Niño is called La Niña. El Niño events are linked with a change in atmospheric pressure known as the Southern Oscillation (SO). This is characterized by a see-saw in the atmospheric pressure between the western and central regions of the Pacific Ocean, with one centre of action located in the vicinity of Indonesia and the other centre located over the central Pacific Ocean. The index that measures the magnitude of the SO is known as the Southern Oscillation Index (SOI) and it is obtained by calculating the difference in atmospheric surface pressure between Tahiti and Darwin, Australia. Because the SO and El Niño are so closely linked with each other, they are collectively known as El Niño-Southern Oscillation, or "ENSO". The system oscillates between warm (El Niño) to neutral (or cold) conditions with a natural periodicity of roughly 3-4 years between El Niño events.

Here we refer to the coupled atmosphere-ocean phenomenon as "El Niño," as the public has adopted that broader definition.

(2) Is El Niño a new phenomenon?

El Niño is not a new phenomenon. Evidence suggests that El Niño events have existed for thousands of years in the past. Even so, the 1982-1983 El Niño, one of the strongest of the century, responsible for extreme impacts on the global climate, wasn't recognized as an El Niño until it was half over. Only in the last decade has satisfactory understanding of how El Niños form and are maintained been gained. Only recently have coupled models been able to put together the complex interactions and massive amounts of data and predict the phenomenon.

(3) How are El Niño events detected?

The intense El Niño of 1982-1983 served as an impetus for the organized international monitoring and research programme that resulted in the development of the Tropical Ocean Global Atmosphere (TOGA) programme (1985-1994), under the World Climate Research Programme (WCRP). Mainly as a result of TOGA, El Niño events can now be detected by many methods, including satellites, moored buoys, drifting buoys, sea-level analysis and expendable bathythermographs (XBTs). This research observing system is now evolving into an operational climate observing system. Large computer models of the global ocean and atmosphere use data from this observing system as input to predict El Niño. Other models are used for research to further the understanding of El Niño.

(4) What are the typical global impacts of El Niño events?

Precipitation and temperature anomaly patterns that are highly consistent from one episode to another are shown in Figure 1. Within the tropics, the eastward shift of thunderstorm activity from Indonesia into the central Pacific during warm episodes usually results in abnormally dry conditions over northern Australia, Indonesia and the Philippines in both seasons. Drier than normal conditions are also usually observed over southeastern Africa and northern Brazil. During the northern summer season, the Indian monsoon rainfall tends to be less than normal, especially in the northwest. Wetter than normal conditions during warm episodes are usually observed along the west coast of tropical South America, and at subtropical latitudes of North America (Gulf Coast) and South America (southern Brazil to central Argentina).

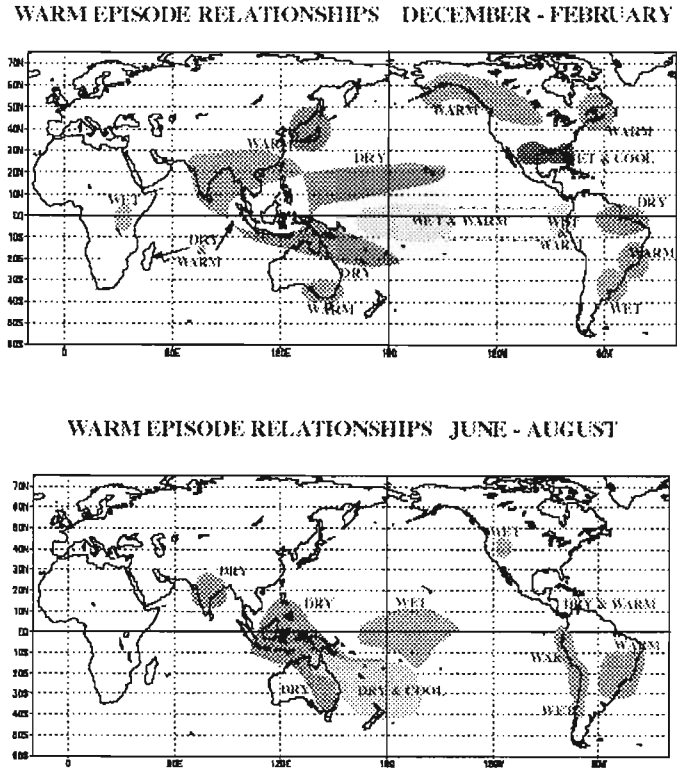

Figure 1 — Typical global impacts of temperature and precipitation anomalies associated with El Niño

PART 2: INFORMATION ABOUT PRESENT EL NIÑO

Summary

Strong warm episode conditions have persisted in the tropical Pacific since July 1997. Sea surface temperatures (SSTs) throughout the equatorial east-central Pacific increased during April and May, when normally temperatures decrease in this region. During August-October ocean surface temperatures were at record monthly levels in many sections of the equatorial Pacific. Departures from normal exceeded +4°C along the equator east of 120°W, and were greater than +5°C near the Galapagos Islands.

(5) How strong is this El Niño?

Very strong warm episode (ENSO) conditions continue, as SSTs and anomalies increased in the central and eastern equatorial Pacific during November. SSTs in the east central and eastern tropical Pacific were the warmest for November in the historical record dating back to 1950. SST anomalies exceeded +2.0°C over the equatorial Pacific east of 170°W and were greater than +5.0°C from 115°W to 90°W. The November value for Niño 3 is the largest anomaly observed during any month. The abnormally warm SSTs along the South American coast have resulted in well above normal temperatures in coastal Peru (November temperatures 5-6°C above normal), with record monthly air temperatures recorded in Talara, Peru since May (NCEP, 11 December).

(6) What is the current forecast of the El Niño of 1997-1998?

The latest forecasts indicate that this strong warm episode, comparable in strength to the 1982-1983 El Niño, will continue through March-May 1998. Thereafter, several forecast models generated in early December (COLA, Scripps, NCEP, Lamont-Doherty) indicate the re-establishment of normal conditions, which are characterized by a cold tongue of water in the eastern equatorial Pacific. Figure 2 illustrates SST anomaly predictions from NCEP. Some models indicate rapid cooling and establishment of La Niña conditions by the second half of 1998.

(7) What are the regional impacts of the 1997-1998 El Niño?

A summary of reports provided by WMO Members and affiliated institutions on regional impacts is provided below.

Australia: Total spring rainfall over eastern Australia was generally close to normal, although much of South Australia received well above average rainfall for the period and parts of eastern Victoria and Tasmania received well below average rainfall. The good spring rainfalls were unusual for an El Niño event but proved timely and beneficial for much of the agricultural and pastoral community. However, overall autumn-winter-spring rainfall totals were much below average across most of southern Australia, putting pressure on water storage levels. Historical precedent indicates that the influence of El Niño would persist at least until mid-summer.

The latest outputs from computer models point to a high probability of these strong El Niño conditions persisting for a few months before a rapid cooling of the surface waters of the central and eastern Pacific Ocean. After mid-summer the timing of the breakdown of the El Niño influence is uncertain, with relieving rains most likely in late summer or early autumn.

The persistence of El Niño for the next few months increases the bushfire risk in south-eastern Australia, and is likely to delay the onset of the monsoon over tropical northern Australia.

The number of tropical cyclones over Australian waters during the wet season is likely to be below normal, particularly in the Coral Sea. BOM's SOI-based statistical outlook system shows that the Atherton Tableland region in northeast Queensland is the area which faces the highest risk of total summer rainfall being significantly below average (BOM, 3 December).

Indonesia

In view of the continued strength of the anomalous warming of the central Pacific region, the tendency would be for an overall weaker monsoon period across S E Asia. The major concern rests on the extent to which ground moisture levels would be recharged as the region moves into the next dry season.

Eastern and Southern Africa

It is expected that atmospheric and oceanic anomaly patterns typical of those generally associated with El Niño events will dominate the eastern and southern African subregion during the next several months. The prevailing warm episode conditions coupled with general warm SST anomaly patterns in the Indian ocean are therefore expected to enhance convection over much of eastern Africa and suppress convection over parts of southern Africa. Consequently, most parts of the east and central African sector are expected to receive well above normal rainfall while the southern sector is likely to experience near-normal to below normal rainfall (DMC Nairobi and ACMAD).

Eastern Africa: Most parts of the sector are likely to receive above normal rainfall during December. The rains are expected to continue into the usually dry January and February over the western and southern parts but are likely to reduce over the northeastern parts of the sector towards the end of December (DMC Nairobi, 10 December).

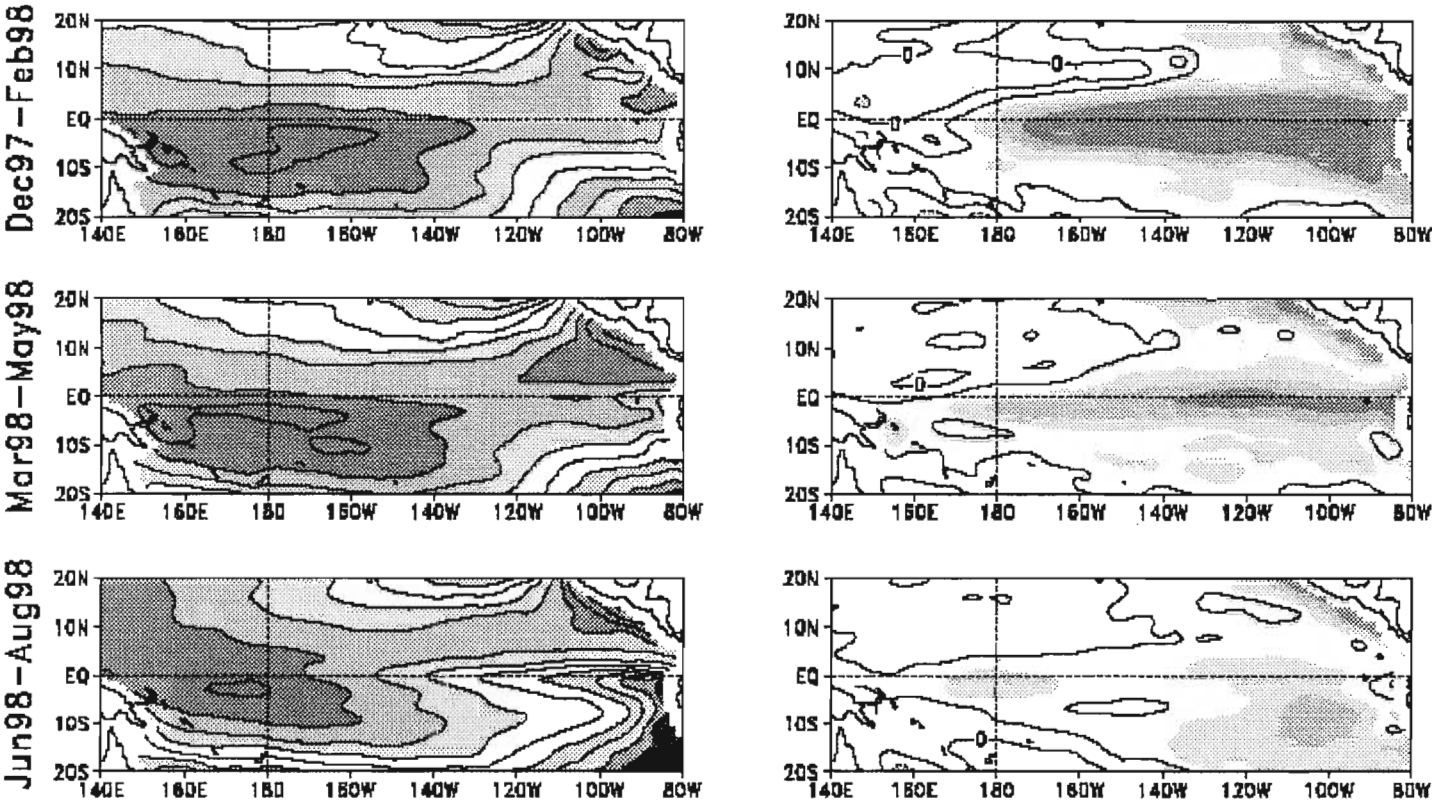

Figure 2 — Predicted three-month average sea-surface temperatures (left) and anomalies (right) from the NCEP coupled model. Contour interval is 1°C, with additional contour for 0.5°C and -0.5°C. Negative anomalies are indicated by dashed contours

Southern Africa: Moderate to heavy rain continued to pound southeastern and extreme northern areas of the region during the last ten days of November. Heaviest falls (above 90 mm) were confined to the east of South Africa (KwaZulu-Natal), northeast Zimbabwe, northwest Mozambique and bimodal rainfall areas on Tanzania (Lake Victoria basin and coastal areas). Meanwhile, the southwestern areas have remained relatively dry. Near-normal to above normal rainfall has been experienced from 1 July to 30 November across the bulk of the region except in southern Lesotho and central South Africa where cumulative seasonal rainfall to date has been generally below 65 per cent of normal.

The most recent forecast update indicates high probability of the latter half of the rainy season (January to March 1998) experiencing low rainfall in areas of southern Africa south of about 10°S. The intensity of the deficits are likely to be highest in the southernmost areas of the region (DMC Harare, 10 December).

Pacific South America

A Climate Outlook Forum was convened on 28 October 1997 to formulate consensus guidance for the summer season for Pacific South America. A Climate Outlook for the summer season (December-March) was prepared. It is based on probability distributions, provided by experts, which indicate the likelihood of below, near or above normal rainfall for each subregion. Users are strongly advised to contact participating institutions (see References) for interpretation of this Outlook and for additional guidance on the actual probabilities agreed to at the Forum.

Recent El Niño events resulted in extreme rainfall in some regions of Pacific South America and extreme dry conditions in other regions. The consensus is that the current strong El Niño event will remain strong over the forecast period.

Above normal rainfall is expected along the coast of Ecuador and northern Peru, with the detailed structure reflecting the topographic relief of the region. Proceeding north, the regions of eastern Ecuador, Colombia and northern Peru are expected to experience drier than normal conditions, especially the northwest region of Colombia. The Altiplano region of southeast Peru and western Bolivia is expected to experience drier than normal conditions. Most of northeastern Bolivia has a slightly higher than average probability of a wet summer season. South-central Chile is expected to see above normal precipitation for the remaining austral spring season. Information received following the Climate Forum suggests that the Chaco region of southern Bolivia may experience drier than normal conditions associated with El Niño.

South-eastern South America

On 10 December 1997 a South-eastern South America Climate Outlook Forum convened to formulate consensus guidance for the early 1998 season in the region (see References). A summary of the conclusions follows.

Wetter than average conditions over the period January-March 1998 are expected over much of the central parts of south-eastern South America, including north-eastern Argentina, southern Paraguay and parts of southern Brazil and western Uruguay. Dry conditions are expected only in areas further north and close to the Andes. Stronger impacts in the year following El Niño events typically occur only in autumn and early winter, after the period covered in this Outlook. Although much stronger impacts in the year following El Niño events typically occur only in autumn and early winter, after the period covered in this Outlook, recent El Niño occurrences have had significant

impacts on rainfall across much of the region south of 20°S during January-March.

Uruguay: The river Uruguay flooded in October. The maximum discharge of this flood was 31 356 m^3/s making it the second largest discharge on record from the period January 1898-November 1997. The largest discharge was in April 1959 with a value of 35 500 m^3/s. For this river, the present knowledge of El Niño indicates that October and November are months in which higher discharges can be expected during an El Niño event (Uruguay Hydrological Institute).

Tropical storm and hurricane activity

Atlantic and North Pacific: The El Niño contributed to markedly reduced tropical storm and hurricane activity over the North Atlantic during August-October 1997, and to an enhanced area of favourable conditions for tropical cyclone and hurricane formation over the eastern North Pacific.

The 1997 Atlantic hurricane season featured seven named storms (normal is 9.3), three of which became hurricanes (normal is 5.8). The net tropical cyclone activity was only 52 per cent of normal for the season as a whole. The El Niño impacts on tropical storm activity were most evident during August-October, when only three systems developed. In fact, a record low of only one system formed during August and September, normally the peak tropical storm months.

The 1997 eastern North Pacific hurricane season featured 17 named storms, nine of which became hurricanes and seven of which became major hurricanes. This compares with an average of 16 named storms, nine of which typically become hurricanes and five of which typically become intense hurricanes. The 1997 season also featured an expanded area of tropical cyclone activity, with four systems moving well west of 135°W and two major hurricanes affecting North America (NOAA/NWS/NCEP Special Climate Summary 97-4).

Eastern Pacific: The extraordinary pattern and characteristics of typhoons in 1997 in the eastern Pacific have been highly abnormal with possible links to the current El Niño event. Features so far include two exceptionally early typhoons striking Japan in June, a very late start of the typhoon season in China, much below normal typhoon activities in the Philippines and the South China Sea and the rare event of a tropical cyclone hitting southern Viet Nam and southern Thailand in early November 1997 (Thirtieth Session of the Typhoon Committee, Hong Kong, China, 25 November-1 December 1997).

(8) Where can I learn more about El Niño?

The WMO Home Page (http://www.wmo.ch) has an "El Niño Information" button which provides links to a number of the major climate prediction centres and to many WMO Members with Web and Gopher servers.

Inquiries concerning a specific country should be directed to the WMO Permanent Representative in that country who will provide details and specific information on the local-scale manifestations of ENSO.

Sources

A partial list of sources of information used in this Update includes ACMAD: African Centre of Meteorological Applications for Development; BOM: Bureau of Meteorology, Australia; Lamont-Doherty; COLA Ben P. Kirtman, J. Shukla and Zhengxin Zhu Published in the Experimental Long-Lead Forecast Bulletin, December 1997; DMC Harare: Drought Monitoring Centre in Harare, Zimbabwe; DMC Nairobi: Drought Monitoring Centre in Nairobi, Kenya; Economic and Social Commission for Asia and the Pacific and WMO Final Report on the Thirtieth Session of the Typhoon Committee, Hong Kong, China, 25 November-1 December, 1997; NOAA/NWS/NCEP/CPC: National Oceanic and Atmospheric Administration/National Weather Service/National Centers for Environmental Prediction/Climate Prediction Center; Pacific South America Climate Outlook Forum, 28 October, 1997, Peru; South-eastern South America Regional Climate Forum, 10 December 1997, Montevideo, Uruguay; Uruguay Hydrological Institute.

References for Climate Forums

Climate Outlook Forums were convened to formulate consensus guidance for the upcoming season. The Forums were comprised of representatives of national Meteorological Services and climate researchers from universities and international research institutes. These specialists reviewed the state of the global climate system and its implications for the regions.

Pacific South America Climate Outlook Forum, 28 October 1997, Peru: One of the principal factors experts took into account at the Pacific South America Forum was the strong El Niño event currently under way in the tropical Pacific Ocean.

Participants at the Forum included representatives of national Meteorological Services of several countries of the region (Bolivia, Chile, Colombia and Ecuador) and climate scientists and other experts from national, regional and international institutes (Universidad Nacional de Colombia, Universidad de Chile, University of Washington, Instituto del Mar del Peru (IMARPE), Instituto Peruano de Investigaciones Pesqueras (INPESCA), Dirección de Hidrografía y Navegación de la Marina (HIRDRONAV), NOAA's National Centers for Environmental Prediction and NOAA's Office of Global Programs, International Research Institute for Climate Prediction (IRI), and the Inter-American Institute for Global Change Research (IAI)).

South-eastern South America Regional Climate Forum, 10 December 1997, Montevideo, Uruguay:
The Forum for South-eastern South America was co-sponsored by the Asociación Rural del Uruguay, the IAI, NOAA, IRI and WMO. Participants at the Forum included experts from the Meteorological Services of MERCOSUR countries, and climate scientists and other experts from national, regional and international institutes and organizations (University of Buenos Aires, Department of Atmospheric Sciences; CIMA/CONICET/UBA; Federal University of Paraná, Department of Physics; INPE/CPTEC; National University of Asunción, Faculty of Exact and Natural Sciences; University of the Republic, Uruguay; IRI; NOAA's Office of Global Programs).

For further Information about WMO, please contact:

Information and Public Affairs Office
World Meteorological Organization
41, avenue Giuseppe-Motta
P.O. Box 2300
1211 Geneva 2
Switzerland
Tel. (+41 22)730 83 15; Fax (+41 22)733 28 29
E-mail: gorre-dale_e@gateway.wmo.ch
http://www.wmo.ch
or your national Meteorological or Hydrometeorological Service