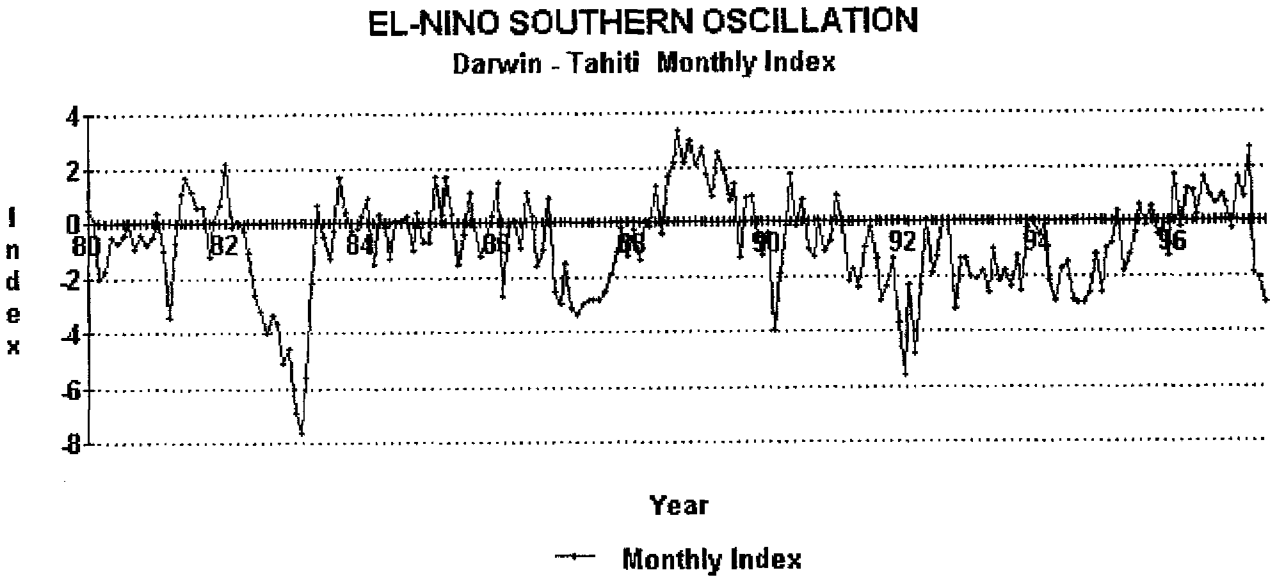
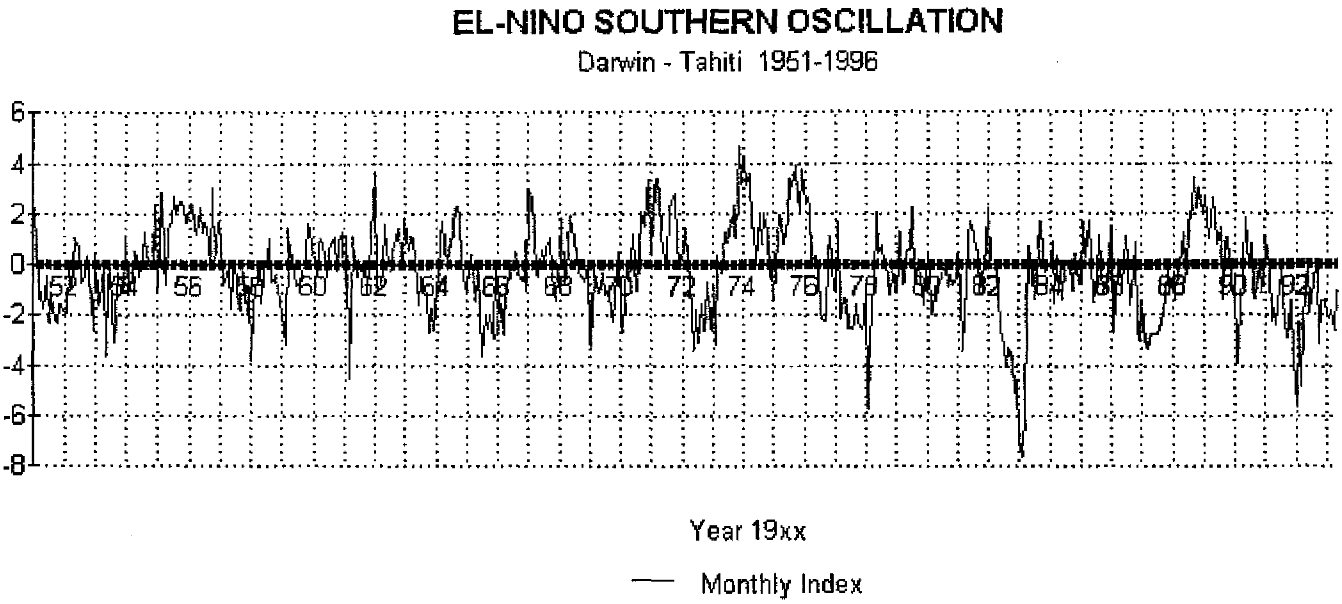


This graph will be updated monthly, so watch this space

If you want a longer-term perspective, here is the Southern Oscillation Index since 1951



What does the SOI Index tell us?

In the case of Australia, a negative SOI means there is an El-Nino under way, and therefore drought conditions can be expected in eastern Australia. The more negative the number, the further south does the drought extend. For example, the severe 1982-83 El-Nino was thankfully short-lived, but it's intensity was such (as shown by the deep plunge in the graph) that even regions as far south as Tasmania were severely affected by drought.

THE EL-NINO SOUTHERN OSCILLATION (ENSO)

John L. Daly

What is the El-Nino Southern Oscillation?

The El-Nino Southern Oscillation is the result of a cyclic warming and cooling of the surface ocean of the eastern Pacific. This region of the ocean is normally colder than it's equatorial location would suggest, mainly due to the influence of a cold current flowing up the coast of Chile, and to the upwelling of cold deep water off the coast of Peru.

At times, the influence of these two cold water sources wanes, causing the surface of the eastern Pacific to warm up under the tropical sun - this is an EL-NINO event. This results in heavy rainfall in South America, but severe droughts in eastern Australia. The more intense the El-Nino, the more intense and extensive the Australian droughts.

At other times, the injection of cold water becomes more intense than usual, causing the surface of the eastern Pacific to cool - this is a LA-NINA event. This results in droughts in south America and heavy rainfall, even floods, in eastern Australia. In this way, Australia experiences it's characteristic cycle of droughts and floods - all caused by the El-Nino/La-Nina cycle described above.

For more information on El-Nino see the NOAA El-Nino Theme Page.

Why are "El-Nino" and "La-Nina" so named?

"El-Nino" is named after a Peruvian Christmas festival where the warming of the waters off Peru is said to occur near the birthday of "The Boy" (El Nino), or the Christ child. Meteorologists thus named the phenomenon the "El-Nino Southern Oscillation", or ENSO for short. The reverse phenomenon, the cooling of the eastern Pacific waters, was at first called "Anti-El-Nino", until it was realised that this literally meant the Anti-Christ ! To avoid this unfortunate connotation, it was renamed "La-Nina" (or "The Girl").

What is the Southern Oscillation Index?

It has been found that the cyclic warming and cooling of the eastern Pacific makes leaves it's distinctive fingerprint on sea level pressure. In particular, it has been found that when the pressure measured at Darwin is compared with that measured at Tahiti, the differences between the two can be used to generate an "index" number. When there is a positive number, we have a La-Nina (or ocean cooling), but when the number is negative we have an "El-Nino" (or ocean warming). The following graph shows the SOI Index from January 1980 to May 1997

ENSO LATEST - ENSO LATEST - ENSO LATEST - ENSO LATEST - ENSO LATEST

***** ENSO HAS SWUNG TO EL-NINO MODE DURING THE 1997 AUTUMN *****
This may be the forerunner to a drought in Eastern Australia this year.

Conversely, the period in 1988 when the index went positive indicated a major La-Nina event, which in Australia was accompanied by severe flooding in Queensland and New South Wales. In 1996, we had another La-Nina event, albeit a weaker one than in 1988. However, there was extensive rainfall throughout eastern Australia in 1996 as a result of this.

The period from 1991 to 1995 was a weaker El-Nino than the 1982/83 event, but it was much more long-lasting. The effect of this has been that southern states like Victoria and Tasmania have not been affected by drought, due to the weakness of the event, but Queensland and inland New South Wales suffered a long crippling drought for the full four years of the El-Nino event. The recent 1996 La-Nina has given welcome relief. Latest indications for 1997 are for a return of El Nino, caused by warming of the surface oceans off Peru and Ecuador during March this year.

In other words, it is both the intensity of an event and it's duration which determines who gets floods and who gets drought, and for how long.

And what is in store during 1997? This is a major unknown, although extensive research is being carried out by the Australian Bureau of Meterology and the CSIRO to enable long-term forecasting of this phenomenon to be made.

At present (5th June 97), it looks very much as though a major El-Nino is underway, raising the prospect of a coming drought in Queensland and New South Wales. Farmers are strongly advised to consult their local Bureau of Meteorology before making any rural long-term decisions which may be affected by the onset of a drought, and to keep abreast of latest Bureau information and forecasts on El-Nino.

ENSO research is a matter of vital national interest to Australia and deserves the major portion of any climatic research. Few, if any, other countries have such a vested interest in ENSO as Australia does and they would be unlikely to commit the necessary resources for successful prediction. It is a strong argument for Australia not to waste it's limited research resources on Greenhouse, an issue which is already the subject of saturation research by other developed countries, and which is likely to prove to be a non-problem anyway.

John L. Daly

You are the th guest to visit this site

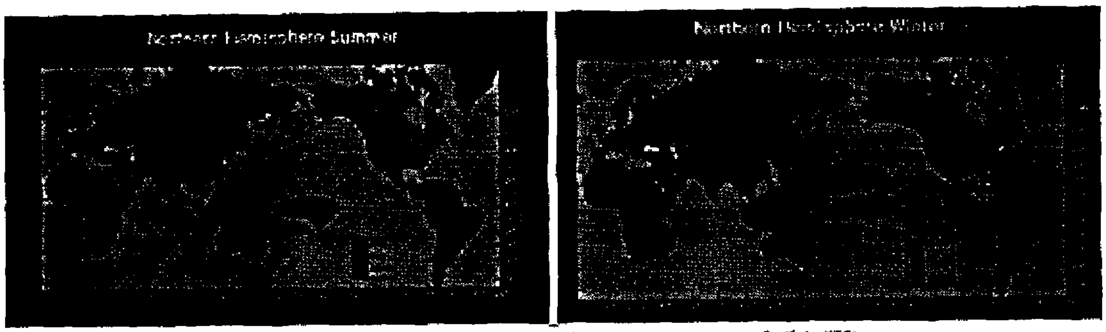
BACK TO "STILL WAITING FOR GREENHOUSE"

El Nino Theme Page: Impacts of El Nino and Benefits of El Nino Predicton

Table of Contents

- Global Consequences of El Nino
- Regional Consequences of El Nino (United States)
- Benefits of El Nino Prediction
- *List of Illustrations*
- List of Impacts and Prediction Benefits

Global Consequences of El Nino



Precipitation anomalies during El Nino in (a) Summer and (b) Winter

The twists and turns in the ongoing dialogue between ocean and atmosphere in the Pacific can have a ripple effect on climatic conditions in far flung regions of the globe. This worldwide message is conveyed by shifts in tropical rainfall, which affect wind patterns over much of the globe. Imagine a rushing stream flowing over and around a series of large boulders. The boulders create a train of waves that extend downstream, with crests and troughs that show up in fixed positions. If one of the boulders were to shift, the shape of the wave train would also change and the crests and troughs might occur in different places.

Dense tropical rainclouds distort the air flow aloft (5-10 miles above sea level) much as rocks distort the flow of a stream, or islands distort the winds that blow over them, but on a horizontal scale of thousands of miles. The waves in the air flow, in turn, determine the positions of the monsoons, and the storm tracks and belts of strong winds aloft (commonly referred to as *jet streams*) which separate warm and cold regions at the Earth's surface. In El Nino years, when the rain area that is usually centered over Indonesia and the far western Pacific moves eastward into the central Pacific, as shown on p. 17, the waves in the flow aloft are affected, causing unseasonable weather over many regions of the globe.

See **The Big Dry Breaks**, a description of the dramatic impact of El Nino in Australia - *may be temporarily unavailable.*

Regional Consequences of El Nino (United States)

Anomalies of Winter (a) temperature and (b) precipitation during El Nino.

The impacts of El Nino upon climate in temperate latitudes show up most clearly during wintertime. For example, most El Nino winters are mild over western Canada and parts of the northern United States, and wet over the southern United States from Texas to Florida. El Nino affects temperate climates in other seasons as well. But even during wintertime, El Nino is only one of a number of factors that influence temperate climates. El Nino years, therefore, are not always marked by "typical" El Nino conditions the way they are in parts of the tropics.

Benefits of El Nino Prediction

As El Nino develops, it perturbs marine life in the Pacific and influences weather patterns throughout the world (See El Nino and Climate Prediction - Reports to the Nation on Our Changing Climate). The abnormal atmospheric and oceanic conditions during El Nino affect human beings. See *Economic impacts of the 1982-83 El Nino*, the *1982-1983 El Nino: The worst there ever was*, some *Social Economic Costs of El Nino*, and *Ocean Planet: El Nino (Smithsonian).*

Scientists are now taking our understanding of El Ninos a step further by incorporating the descriptions of these events into *numerical prediction models* (computer programs designed to represent, in terms of equations, processes that occur in nature). Such models are fed information, mostly in the form of sets of numbers, describing the present state of the atmosphere-ocean system (for example, observations of wind speeds, ocean currents, sea level, and the depth of the thermocline along the equator). Updated sets of numbers, which the models produce, indicate how the atmosphere-ocean system might evolve over the next few seasons or years. The results thus far, though by no means perfect, give a better indication of the climatic conditions that will prevail during the next one or two seasons than simply assuming that rainfall and temperature will be "normal."

Peru provides a prime example of how even short term El Nino forecasts can be valuable. There, as in most developing countries in the tropics, the economy (and food production in particular) is highly sensitive to climate fluctuations. Warm (El Nino) years tend to be unfavorable for fishing and some of them have been marked by damaging floods along the coastal plain and in the western Andean foothills in the northern part of the country. Cold years are welcomed by fishermen, but not by farmers because these years have frequently been marked by drought and crop failures. Such cold years often come on the heels of strong El Nino years. Hence, Peruvians have reason to be concerned, not only about El Nino events, but about both extremes of the El Nino cycle.

Since 1983, forecasts of the upcoming rainy season have been issued each November based on observations of winds and water temperatures in the tropical Pacific region and the output of numerical prediction models. The forecasts are presented in terms of four possibilities: (1) near normal conditions, (2) a weak El Nino with a slightly wetter than normal growing season, (3) a full blown El Nino with flooding, and (4) cooler than normal waters offshore, with higher than normal chance of drought.

Once the forecast is issued, farmers' representatives and government officials meet to decide on the appropriate combination of crops to sow in order to maximize the overall yield. Rice and cotton, two of the primary crops grown in northern Peru, are highly sensitive to the quantities and timing of rainfall.

Rice thrives on wet conditions during the growing season followed by drier conditions during the ripening phase. Cotton, with its deeper root system, can tolerate drier weather. Hence, a forecast of El Nino weather might induce farmers to sow more rice and less cotton than in a year without El Nino.

Countries that have taken similar initiatives include Peru, Australia, Brazil, Ethiopia, and India. Although tropical countries have the most to gain from successful prediction of El Nino, for many countries outside the tropics, such as Japan and the United States, more accurate prediction of El Nino will also benefit strategic planning in areas such as agriculture, and the management of water resources and reserves of grain and fuel oil.

Encouraged by the progress of the past decade, scientists and governments in many countries are working together to design and build a global system for (1) observing the tropical oceans, (2) predicting El Nino and other irregular climate rhythms, and (3) making routine climate predictions readily available to those who have need of them for planning purposes, much as weather forecasts are made available to the public today. The ability to anticipate how climate will change from one year to the next will lead to better management of agriculture, water supplies, fisheries, and other resources. By incorporating climate predictions into management decisions, humankind is becoming better adapted to the irregular rhythms of climate.

List of Illustrations

- Global precipitation anomalies during El Nino in Summer
- Global Precipitation anomalies during El Nino in Winter
- Distribution of rainfall in the tropical Pacific.
- U.S. temperature anomalies during El Nino in Winter
- U.S. precipitation anomalies during El Nino in Winter
- Economic impacts attributed to the 1982-83 El Nino
- 1982-1983 El Nino: The worst there ever was
- Ocean Planet: El Nino (Smithsonian)
- El Nino prediction depends on observed data and numerical models.
- Tropical Pacific Ocean observing system

List of Impacts and Prediction Benefits

Global Impacts

- ENSO forecasting as a weapon against Infectious disease
- Value of climate prediction to the insurance community
- Social Economic Costs of El Nino
- ENSO and Atlantic Hurricane Frequency
- Equatorial Pacific events are used to forecast global climate - ***NEW***
- Effects of the 1982-1983 ENSO in different countries - ***NEW***
- ENSO, droughts, and forecasts - ***NEW***
- Effect of El Niño on Corals and fish and birds of the Pacific - ***NEW***
- Advances in the Theory and Modeling of ENSO - ***U.S. National Report to IUGG, 1991-1994 - NEW***
- Historical and Paleolithic aspects of El Nino: Global and In the tropics- NEW

Regional Impacts

- Effects of El Niño on the US - ***NEW - excellent resource regarding drought, fire, agriculture, snow, fisheries, etc.***

- Effects of El Niño on North American Climate - ***NEW***
- El Nino and US Agriculture - NEW *from the US Dept of Agriculture*
- Unusual US weather in 1995-96 concurrent in time with a cold event (La Nina)

- Relation of ENSO to Florida Wildfires (and Wildfire Season forecast)
- Crazy Weather in Australia due to El Nino. - ***Under reconstruction, may be unavailable...***
- Impact of El Nino prediction on Brazil crop yields
- El Nino Records in Lakes in Papua New Guinea - *NEW*
- El Nino and the Indonesian Throughflow - *NEW*
- ENSO and US Climate Variablity
- ENSO and Florida Precipitation
- ENSO and Chilean Precipitations (1961-1994)
- El Nino Induced Ocean Eddies in the Gulf of Alaska - ***NEW***
- Variations in Mauna Loa carbon dioxide induced by ENSO - ***NEW***
- Link Between El Nino and Rainfall in Israel Discovered - ***NEW***
- Interannual variations in Antarctic precipitation related to El Niño - ***NEW***
- ENSO effects in California
- El Niño and the southwestern US - ***NEW***
- El Niño and the southwestern US - ***NEW***
- Theory and Modeling of ENSO - ***NEW***
- El Niño and Salmon in the Northeast Pacific Ocean - ***NEW***
- The Great Missippi river basin flood in 1993 - ***NEW***

Text *- from El Nino and Climate Prediction - Reports to the Nation on Our Changing Climate, Spring 1994*
Graphics *- from NOAA/PMEL/TAO and FSU/COAPS .*
Other Credits *- from the Distributed data sources linked by the El Nino Theme Page*
Additional Information *- Understanding and predicting ENSO, D.S. Battisti and E.S. Sarachik; U.S. National Report to IUGG, 1991-1994 Rev. Geophys. Vol. 33 Suppl., © 1995 American Geophysical Union.*

Back to El Nino Theme Page
Nancy Soreide, nns@pmel.noaa.gov

EL NIÑO/SOUTHERN OSCILLATION (ENSO)

DIAGNOSTIC ADVISORY 97/3

issued by

CLIMATE PREDICTION CENTER/NCEP

May 9, 1997

The evolution of the atmospheric and oceanic conditions in the tropical Pacific during the past few months is consistent with the beginning stages of warm episode conditions. Since early 1997 sea surface temperature (SST) anomalies have increased throughout the equatorial Pacific (Fig. 1), with areas centered on the date line and near the South American coast experiencing anomalies in excess of $+1^{\circ}$ C during April (Fig. 2). In addition, the oceanic thermocline has deepened in the central equatorial Pacific and the oceanic heat content has increased throughout the western and central equatorial Pacific.

During the past several months enhanced tropical convection has gradually shifted eastward toward the date line, accompanied by a transition to suppressed convection over the western equatorial Pacific and Indonesia (Fig. 3). Accompanying this evolution has been an overall weakening of the equatorial low-level easterlies across the central and eastern Pacific and a strengthening of low-level equatorial westerlies over the western Pacific. As a result, low-level westerly wind anomalies during March and April extended across the entire tropical Pacific (Fig. 4). In addition, the SOI has switched from positive to strongly negative during the period. Collectively, this evolution indicates the early stages of a warm (ENSO) episode.

In recent months, the NCEP coupled model and CCA statistical technique have been consistent in indicating the development of warm episode conditions during the first half of 1997. The latest forecasts from these two techniques indicate a continued warming trend through the end of the year. Based on the recent evolution and the indications given by these forecasts we can expect warm episode conditions to intensify during the next several months.

The Climate Prediction Center will continue to monitor the evolution of oceanic and atmospheric anomalies and additional advisories will be issued as warranted.

Climate Prediction Center

National Centers for Environmental Prediction

NOAA/National Weather Service

World Weather Building

Washington, D.C. 20233

e-mail: wd52vk@hp31.wwb.noaa.gov