El Nino/La Nina

What is El Nino? From NOAA website

El Nino was originally recognized by fishermen off the coast of South America as the appearance of unusually warm water in the Pacific Ocean, occurring near the beginning of the year. El Nino means The Little Boy or Christ child in Spanish. This name was used as a tendency of the phenomenon to arrive around Christmas.

La Nina means The Little Girl. La Nina is sometimes called El Viejo, anti-El Nino, or simply "a cold event" or "a cold episode".

ENSO is the Southern Oscillation Index

El Niño is a disruption of the ocean-atmosphere system in the tropical Pacific having important consequences for weather around the globe.

Among these consequences are increased rainfall across the southern tier of the US and in Peru, which has caused destructive flooding, and drought in the West Pacific, sometimes associated with devastating brush fires in Australia. Observations of conditions in the tropical Pacific are considered essential for the prediction of short term (a few months to 1 year) climate variations. To provide necessary data, NOAA operates a network of buoys which measure temperature, currents and winds in the equatorial band. These buoys daily transmit data which are available to researchers & forecasters around the world in real time.

In normal, non-El Niño conditions, the trade winds blow towards the west across the tropical Pacific. These winds pile up warm surface water in the west Pacific, so that the sea surface is about 1/2 meter higher at Indonesia than at Ecuador.

The sea surface temperature is about 8 degrees C higher in the west, with cool temperatures off South America, due to an upwelling of cold water from deeper levels. This cold water is nutrient-rich, supporting high levels of primary productivity, diverse marine ecosystems, and major fisheries. Rainfall is found in rising air over the warmest water, and the east Pacific is relatively dry. The observations at 110 W (left diagram of 110 W conditions) show that the cool water (below about 17 degrees C, the black band in these plots) is within 50m of the surface.

During El Niño, the trade winds relax in the central and western Pacific leading to a depression of the thermocline in the eastern Pacific, and an elevation of the thermocline in the west. The observations at 110W show, for example, that during 1982-1983, the 17-degree isotherm dropped to about 150m depth. This reduced the efficiency of upwelling to cool the suface and cut off the supply of nutrient rich thermocline water to the euphotic zone. The result was a rise in sea surface temperature and a drastic decline in primary productivity, the latter of which adversely affected higher trophic levels of the food

chain, including commercial fisheries in this region. The weakening of easterly tradewinds during El Niño is evident in this figure as well. Rainfall follows the warm water eastward, with associated flooding in Peru and drought in Indonesia and Australia. The eastward displacement of the atmospheric heat source overlaying the warmest water results in large changes in the global atmospheric circulation, which in turn force changes in weather in regions far removed from the tropical Pacific.

Recognizing El Niño

El Niño can be seen in Sea Surface Temperature in the Equatorial Pacific Ocean

El Niño can be seen in measurements of the sea surface temp. In Dec. 1993, the sea surface temp & the winds were near normal, with warm water in the Western Pacific Ocean, & cool water, called the "cold tongue" in the Eastern Pacific Ocean. The winds in the Western Pacific are very weak & the winds in the Eastern Pacific are blowing towards the west (towards Indonesia). Dec. 1997 was an anomaly, the warm water spread from the western Pacific Ocean towards the east (in the direction of South America), the "cold tongue" weakened, & the winds in the western Pacific, usually weak, are blowing strongly towards the east, pushing the warm water eastward. The anomalies show clearly that the water in the center of Pacific Ocean is much warmer than in a normal December.

Dec. 1998 was a strong La Niña event. The cold tongue is cooler than usual by about 3° Centigrade. The cold La Niña events sometimes (but not always) follow El Niño events.

Typically, El Niño occurs more frequently than La Niña. A list of El Niño and La Niña years is provided by the National Center for Environmental Prediction (NCEP).

El Niño and La Niña events vary in strength. For example, the La Niña in 1987 was stronger than the La Niña in 1995, and the 1997-1998 El Niño is unusually strong.

La Niña impact on the global climate

Global climate La Niña impacts tend to be opposite those of El Niño impacts. In the tropics, ocean temperature variations in La Niña tend to be opposite those of El Niño. At higher latitudes, El Niño and La Niña are among a number of factors that influence climate. However, the impacts of El Niño and La Niña at these latitudes are most clearly seen in wintertime. In the continental US, during El Niño years, temperatures in the winter are warmer than normal in the North Central States, and cooler than normal in the Southeast and the Southwest. During a La Niña year, winter temperatures are warmer than normal in the Southeast and cooler than normal in the Northwest.

My Thoughts on El Nino 2007

Don Anderson; February, 2007
Gathered from a wide spectrum of documents on the subject. Prepared primarily in response to requests from cruising sailboats about to depart west coast ports for the Marquesas and on west to other parts of French Polynesia and the far Southwestern Pacific.

Conclusion

It is unlikely that the current El Niño episode will have any significant effect on normal weather patterns throughout the Pacific, at least through May 2007.

The Next El Niño Episode.

We are presently experiencing a mild El Niño episode.

The equatorial upper-ocean heat content (average temperature departures in the upper 300 m of the ocean) peaked in late November 2006 and has been decreasing rapidly since that time, with the latest values being negative for the first time since early April 2006. These trends in surface and subsurface ocean temperatures indicate that the warm episode (El Niño) is weakening. It is still possible for some areas to experience El Niño-related effects during the next month, primarily in the region of the central tropical Pacific.

Most of the statistical and coupled models, including the NCEP Climate Forecast System (CFS), indicate that SST anomalies will continue to decrease and that ENSO-neutral conditions are likely to develop during March-May 2007. There is considerable uncertainty in the forecasts for periods after May 2007.

Introduction.

There is a very large amount of data on the effect of an El Niño episode on land masses but a paucity of data on its effect on ocean passages of the world. This is because there are literally tens of thousands of meteorological and other weather recording sites on land, but very few along the ocean passages. Furthermore, the studies aimed at predicting the effect of an El Niño on weather are driven by the need to predict events and thereby reduce losses to life and property, most of which reside on land.

No doubt the advent of satellite imaging, especially the surface wind vector computational capability of NOAA's latest satellite, the QuikSCAT Scatterometer launched in 1999, will allow the development of more precise predictions of El Niño and La Niña episodes on the vast ocean expanses of the globe.

Impact on Passages Mexico/Central America to French Polynesia, March-May 2007

My guess is that conditions will be about normal, i.e. wind and sea conditions should be expected to be similar to what one finds in the pilot charts for any given month. Nothing unusual should be expected for the ITCZ.

Impact on Passages French Polynesia to Western Pacific, August-November 2007

I don't know. It's too early to say. It simply bears watching closely by cruisers contemplating remaining in French Polynesia or making the run west toward New Caledonia and/or points SW toward New Zealand.

Basis for My Thoughts.

I'm a scientist but not a professional meteorologist, so here are my notes taken from a large number of professional meteorologist's opinions and publications. They are the principal basis for my present thoughts on the subject.

The La Niña-El Niño Cycle.

The La Niña-El Niño cycle is referred to as the El Niño/Southern Oscillation (ENSO). It is a coupled atmosphere-ocean phenomenon that is believed to be triggered by anomalous bursts of westerly winds that originate in the western Pacific. These anomalous westerlies with concomitant reduction in intensity of the NE and SE trade winds, reverse the normal westerly movement of warm surface waters in the equatorial Pacific. This eastward movement of warm surface waters reduces the normal upwelling of deep cold waters along the coasts of Peru and Ecuador. This reduced upwelling enhances the increase in the coastal sea surface temperatures.

During a La Niña episode, stronger than normal trade winds prevail across the Pacific. My records developed while doing weather routing for yachts on passages from Mexico or Central America to the Western Pacific between March and September last year (2001) showed NE and SE trade winds frequently on the order of 25 to 30 knots for several periods lasting a week or more. These wind speeds are stronger than average and are consistent with a La Niña condition when atmospheric pressure is high in the Eastern Tropical Pacific and low in the Western Tropical Pacific. These stronger than normal trades causes warm water to build up in the Western Pacific. The trade winds then decrease and the warm water moves back across the Equatorial Pacific towards the coasts of Ecuador and Peru. This eastward movement of warmer water strengthens the warm eastward North Equatorial Countercurrent while weakening the cold westward South Equatorial Current. The result is an increase in warmer upper level water along the shores of Ecuador and Peru thereby causing an El Niño condition. Although the onset of an El Niño is signaled by warming of the waters in the Western Pacific, the El Niño phenomenon over water is felt most strongly in coastal waters of Peru where it has been occurring at approximately 3 to 6 year intervals for over a thousand years and where it was named for the Christmas season when it always begins, hence El Niño, the Christ Child. El Niño sea surface temperature anomalies off Peru reach their maximum of up to +7˚C during extreme episodes.

During an El Niño episode, the warmer equatorial waters enhance the Hadley circulation, named for the English meteorologist George Hadley. In 1735 he put forward a hypothesis to explain the persistent trade winds. He suggested a meridional atmospheric circulation where the warm tropical air ascended and moved toward the polar regions

while the cold polar air descended and moved toward the equator. This circulation, coupled with the rotational effect (Coriolis force) of the earth, bent the tropical air mass toward the west, thereby causing the easterly flow of the trades.

Any enhancement of the Hadley circulation tends to weaken the trade winds while increasing the intensity of the mid latitude westerlies.

Impact of an El Niño on Land Mass Areas.

As the warmer surface water moves eastward across the Equatorial Pacific, it leaves behind it increased drought in Indonesia, New Guinea and Northeastern Australia increasing the probability of brush fires and crop and livestock losses. As the warm waters intensify in the Eastern Pacific they bring increased thunderstorms with torrential rains to Ecuador and Northern Peru resulting in widespread flooding with consequent severe loss of life and property. The North Pacific, during an El Niño episode, experiences more frequent storms with increased intensity between October and March. The 1982/83 El Niño was the most intense in the past 55-year record. During that El Niño episode, Eastern Australia suffered the worst drought in 200 years while Ecuador suffered record rainfall of over thirteen times normal. Drought conditions extended from the Philippines to Hawaii. During the same period, California coastal areas suffered extensive damage from unusually high sea levels and record wave heights caused by unusually intense storms. A rare winter storm with gale force winds from the south struck the Baja California peninsular on December 8, 1982 causing the complete loss of 27 cruisers in the Cabo San Lucas anchorage.

The 1997-1998 El Niño episode was a strong one that brought three times the normal rainfall to Ventura County, California.

Consequences of El Niño to Pacific Marine Environment.

During an El Niño episode normal upwelling of cold water off Peru is shut down so that nutrients are no longer brought to the surface. The consequence is that fishing dies but the fish do not; they migrate to greater depths. The secondary consequence is a greatly increased mortality rate in seabirds and sea lions. During the 1982/83 El Niño episode, seventeen million birds disappeared from Christmas Island (01˚N 160˚W). They left the nestlings presumably in search of food.

Consequences of El Niño along the Pacific Equatorial Trough.

The warmer Equatorial Pacific waters cause heating of the lower atmosphere that in turn increases its buoyancy leading to increased convection This means an increase in intensity of the Intertropical Convergence Zones both north and south of the equator. These zones, now more often referred to as Near Equatorial Tradewind Convergence Zones (NETWZ), exist as a band around the world's oceans between about 15N and 10S, moving north and south with the sun, lagging it by about two months. They are characterized by clumps of cumulonimbus clouds with low ceilings but towering to 45,000 feet, torrential rain with low visibility and squally conditions with winds

commonly on the order of 35 kts. During an El Niño episode, there is an increase in frequency and intensity of thunderstorm activity, with extremely heavy increased amounts of rain, as much as five times normal annual precipitation. The north-south extent of the ITCZ decreases. During extreme episodes, such as occurred in 1882, the trade winds reverse direction and sea level rises of almost 12 inches occur along the entire Republic of Kiribati (a string of about 50 islands strung along the equator between about 155˚W and 170˚E. Dense fog develops over the Central Pacific. The normally westward-setting surface current reverses direction.

Effect of El Niño on Tropical Cyclones.

The South Pacific tropical cyclone season is December through April. The majority of tropical cyclones originate west of 170W in the Near Equatorial Trough. They typically travel at speeds of 12 to 17 knots. During an El Niño episode the warmer waters increase the number of thunderstorms with consequent enhancement of tropical cyclone activity. On the her hand, during an El Niño episode, the upper level winds over the United States change direction and inhibit hurricane development in the North Atlantic, Caribbean and Gulf of Mexico. For example, during the 1997/98 El Niño episode, one of the strongest on record, there were only seven tropical storms, three hurricanes and one severe hurricane in the Western Atlantic. In the Northern Pacific between 1989 and 1995 there were 230 major cyclonic storms (hurricanes and typhoons). During the period 1995 through 2000 there were only 183. Two of the most damaging hurricanes to hit Hawaii in modern times were Iwa in 1982 and Iniki in 1992. These two years were strong El Niño years and showed the largest sea surface temperature positive anomalies in the record between 1945 and 2000. During this 55-year period there were 12 El Niño episodes each lasting 12 to 18 months.

During normal years the North Pacific tropical cyclones, most of them born a few hundred miles SW of Acapulco, travel WNW towards Hawaii and rarely have sustained gale force winds west of 145W. During strong El Niño episodes, tropical cyclones of storm or hurricane force intensity may track well past the dateline.

During strong El Niño episodes, tropical cyclones in the South Pacific may extend east of the dateline as far as the Marquesas, The Gambier in the Southeastern Tuamotus and even further to the southwest as far as the Pitcairn Group. In 1982, French Polynesia experienced six major tropical cyclones. The first occurred in November at the beginning of the season and was the most devastating.

Conclusion

It is unlikely that the current El Niño episode will have any significant effect on normal weather patterns throughout the Pacific, at least through May 2007.