pacific ENSO update

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A Quarterly Bulletin of the Pacific El Niño/Southern Oscillation Applications Climate (PEAC) Center
Providing Information on Climate Variability for the U.S.-Affiliated Pacific Islands

http://www.prh.noaa.gov/peac

El Niño Likely During the Boreal Summer/Fall 2014

This is a special bulletin of the Pacific ENSO Applications Climate (PEAC) Center. This bulletin has been issued to alert the Pacific community to the likely development of El Niño during the next few months. The atmosphere and ocean are already exhibiting features that indicate the early stages of an El Niño event. Further, these features suggest that the developing El Niño could be strong, perhaps the strongest event since 1997-98.

ATMOSPHIERIC INDICATORS OF IMPENDING EL NINO

1. Very persistent westerly winds at equatorial latitudes.
2. An eastward displacement of westerly winds at equatorial latitudes with southwesterly winds recorded as far east as the Marshall Islands.
3. A large area of enhanced convection at low latitude near the International Date Line in association with the development of all of the early season tropical cyclones and other tropical disturbances. Record-breaking rainfall at Kwajalein through mid-April 2014 appears to be associated with this eastward shift.
4. An unusual number of early season tropical cyclones observed in the western North Pacific. To-date the Joint Typhoon Warning Center (JTWC) has numbered five significant tropical cyclones with an intensity distribution of four tropical storms and one typhoon. The season's first typhoon formed within Chuuk State in early March and passed to the east of Guam.
5. An eastward displacement of the season's early tropical cyclones, with the earliest stages of development of these cyclones occurring in the Marshall Islands.
6. An intense burst of typhoon activity from mid-September through early November 2013 may have been a precursor to an impending change of state of the Pacific climate toward El Niño. This burst included the notorious Super Typhoon Haiyan in early November 2013. A similar period of active typhoon formation and bursts of strong equatorial westerly winds occurred in November and December of 1996. This activity was seen after the fact, as a contributor to the strong 1997 El Niño.

OCEANIC INDICATORS OF IMPENDING EL NINO

1. A dramatic deepening of the upper warm layer across a large swath of the equatorial central and eastern Pacific with subsurface temperature anomalies as high as 6°C (Fig. 1). This level of upper ocean heat increase has not been seen since the early stages of the 1997 El Niño event.
2. A rapid fall of sea level in the western portion of Micronesia including Palau and Guam. An impressive 9 inch fall of sea level was recorded in Palau between February and March of 2014. At Guam the fall was recorded at nearly 6 inches.
3. A large area of enhanced sea surface temperatures (SSTs) at low latitudes near the International Date Line that may have been associated with the development of the early season tropical cyclones and other tropical disturbances. Record-breaking rainfall at Kwajalein through mid-April 2014 may be associated with these warmer SSTs (See also number 5 of the Atmospheric Indicators section). Increased SST in the central Equatorial Pacific is one of the key factors that helps to shift typhoon formation eastward into the heart of Micronesia. During November and December of strong El Niño years, typhoon formation can even shift to the south of Hawaii; for example: Hurricane Iwa (1982) and Typhoon Paka (1997).

DISCUSSION OF EL NINO

For nearly a decade the state of the Pacific climate has been dominated by a cool phase of the Pacific Decadal Oscillation (PDO) with a La Niña-like background state. The last major El Niño occurred during 1997 with substantial effects such as major drought conditions across Micronesia lasting into 1998. Weaker El Niño conditions were seen in 2002, 2004, 2006, and lastly in 2009. These latter El Niño events were not nearly as strong as the 1997-1998 event.; they had lesser impacts and the impacts that did occur were of shorter duration. The dominance of a La Niña-like background state for the better part of the last decade has been associated with persistent easterly wind anomalies that shifted typhoon tracks to the north and west of Micronesia.

Enhanced trade winds, combined with global sea level rise, have led to historical sea level highs throughout the western Pacific (See Figs, 2 and 3). The sea level across Micronesia has not been below the 1970-2000 average since early 1998. The 1970 through 2000 period saw a particularly more variable state of the Pacific climate system, with several strong El Niño events recorded. These are readily seen in the Guam sea level record, as is the dramatic rise of sea level and reduction in trade wind driven variability after the 1997-1998 El Niño (Fig. 2).

FORECAST ANOMALIES

With El Niño seemingly imminent and the probability increasing of a moderate to strong event, the following climatic anomalies are likely to be observed across Micronesia:

1. An eastward shift of typhoon formation into the heart of Micronesia, with the risk of a typhoon in some way affecting nearly all islands and atolls increasing dramatically. Enhanced typhoon activity begins in the boreal spring and persists throughout the El Niño year. Some notable El Niño related typhoons of the boreal spring include: Typhoon Pamela– May 1976; Typhoon Lola– May 1986; and Typhoon Isa– April 1997). Some notable El Niño-related typhoons of the boreal fall include: Typhoon Yuri– 1991; Typhoon Paka– 1997; and Typhoon Pongsona– 2002).
2. A strong monsoon is likely, with a sharp and active monsoon trough, and with accompanying tropical cyclone activity, monsoon squalls, high seas and extreme rain events.
3. A major Micronesia-wide drought is likely to begin as the El Niño reaches maturity, beginning in the west of Micronesia in the late fall of 2014 and spreading to all islands by early 2015 (Fig. 4a,b).
4. A continued sharp drop of sea level through December 2014, and then a sharp rebound of the sea level during the first half of 2015 can be anticipated. The monthly average sea-level typically shows large negative deviations during strong El Niño events beginning from the time of the onset of events i.e. boreal summer and continuing up to March of the following year. (See Figs 2, 3, and 5). The extreme negative departure usually occurs in December of the El Niño year.
5. Very warm temperatures under conditions of clear skies and light winds could lead to substantial coral bleaching in the late spring of 2015.
6. For Hawaii, the development of El Niño may mean a return to drought-like conditions and an increase in hurricane threats to Hawaii, as well as large wave activity for the northern shores.

In American Samoa, most tropical cyclone activity during the upcoming 2014-2015 cyclone season could be well east and equator-ward of the islands in the case of a strong event. If it is moderate, American Samoa could see high levels of tropical cyclone activity. Regardless, drought conditions will likely occur as American Samoa enters its dry season. The dry season could begin early and end late, extending the drought period. As the wet and dry phases of the El Niño evolve, the impacts in American Samoa usually lag those of the northern hemisphere by 3 to 4 months.

FIGURES

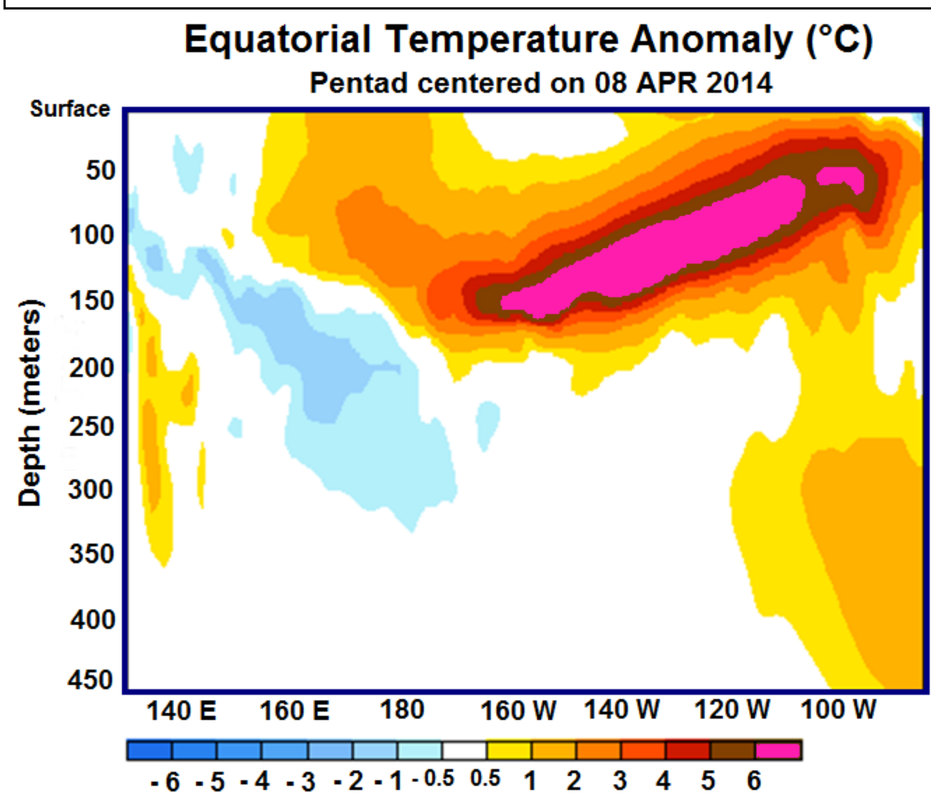

Figure 1. *Subsurface ocean temperature anomaly (°C) along the equator from 140° E to 100° W longitude. A large area of very warm subsurface water is found in the eastern equatorial Pacific. This warmth rivals the magnitude of the warmth seen during the onset of the 1997 El Niño.*

For additional information on the Pacific ENSO Application Climate Center please visit:

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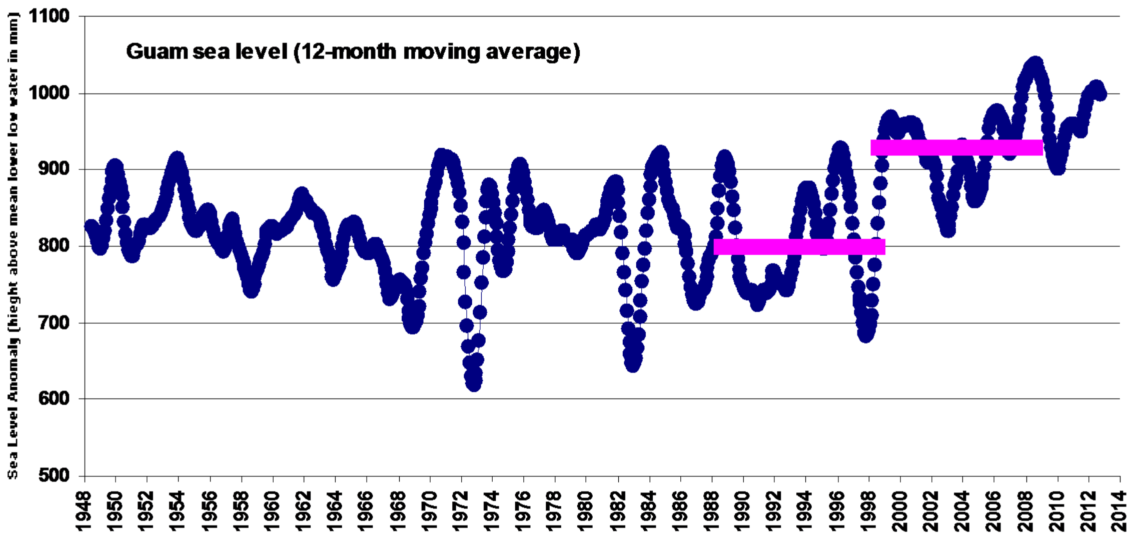


Figure 2. *The time series of mean sea level at Guam for the period 1948 through the present. The plotted values are a 12-month moving average of the raw values of the monthly mean sea level. The two horizontal bars show the mean sea level during two consecutive 10-year periods, The sea level has been substantially elevated from 1998 to present. Note how the period 1970 through 1998 was dominated by strong inter annual fluctuations with three extreme sea level minima in association with the 1972, 1982 and 1997 El Niño events, respectively. After the 1997 El Niño, the Pacific climate became dominated by persistent La Niña, interspersed with a few weak El Niño events. The recent extreme elevated sea level across Micronesia is an artifact of the persistence of La Niña. The extreme lowering of sea level during a strong El Niño is abrupt, large, and short-lived. It reaches a minimum in December, and then typically rises rapidly in the first half of the year that follows El Niño. On Guam, the range of sea level between strong El Niño and strong La Niña is nearly 2 feet; which is on par with the range of the astronomical tide!*

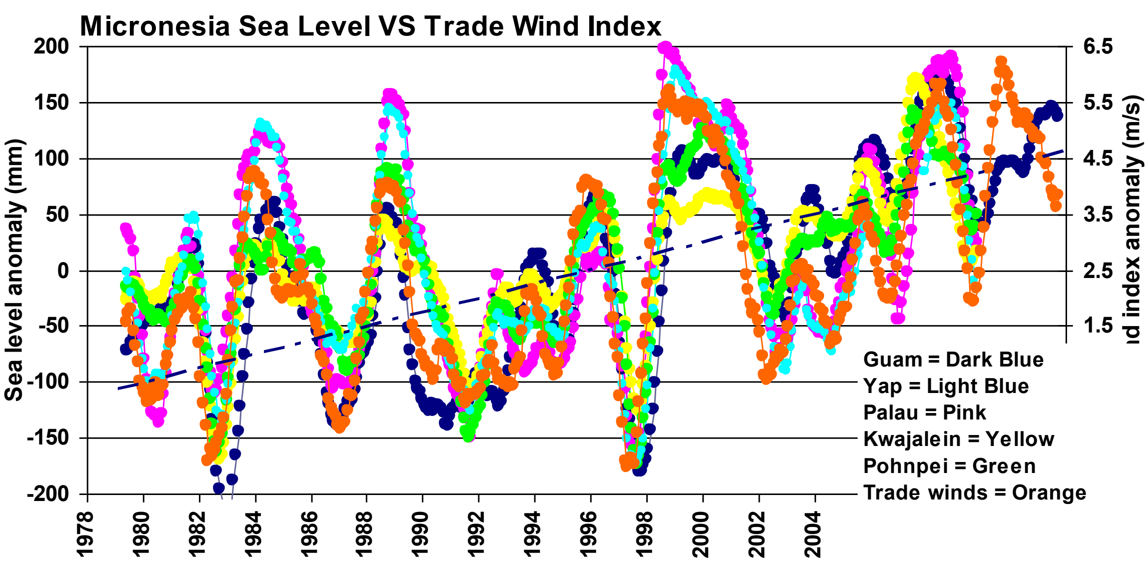


Figure 3. *The time series of mean sea level at Guam, Yap, Palau, Kwajalein, and Pohnpei for the period 1948 through the present. The plotted values are a 12-month moving average of the raw values of the monthly mean sea level. Also plotted (orange) is an index of the trade wind strength along the equator from 135°E to the 180° meridian. It is quite clear that fluctuations of mean sea level across all of Micronesia are coherent. It is further clear that the large inter-annual fluctuations of sea level across Micronesia are tracking the trade wind index, which itself is a good index of ENSO (during El Niño, the trade winds weaken or become westerly, and during La Niña, the trade winds become very strong). The huge upward trend of sea level in Micronesia is thus seen to be an artifact of the behavior of the Pacific trade wind system. Note, the recent dramatic sea level rise across Micronesia is an artifact of changes in the trade winds and is not the signal of global warming. The plotted trend of 7 cm per decade for the period 1980 through 2010 is over twice the reported rising trend of global sea level.*

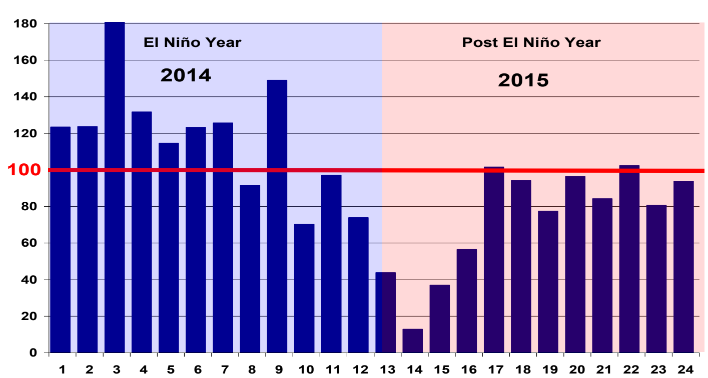


Figure 4a. *Average rainfall, % of monthly mean, for a composite of historical El Niño years and the years following El Niño for Majuro. Note that during El Niño there is abundant rainfall, with some very high monthly values. Dryness starts late in the El Niño year, and worsens in the first few months of the year following El Niño. This chart is not a specific forecast, but represent plausible rainfall behavior at Majuro for 2014 and 2015. Drought severity and recovery of rainfall after El Niño varies from island to island .*

For additional information on the Climate Prediction Center ENSO Discussion please visit:
http://www.cpc.ncep.noaa.gov/

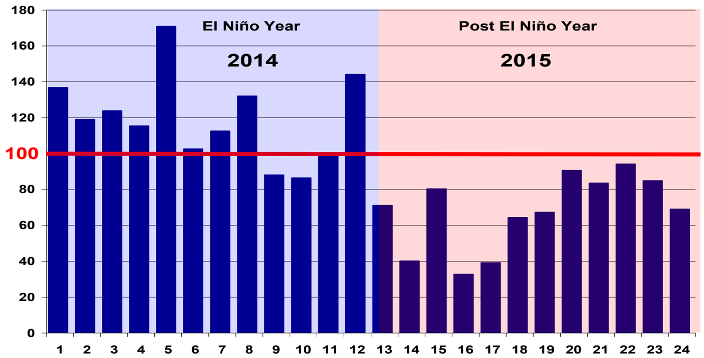
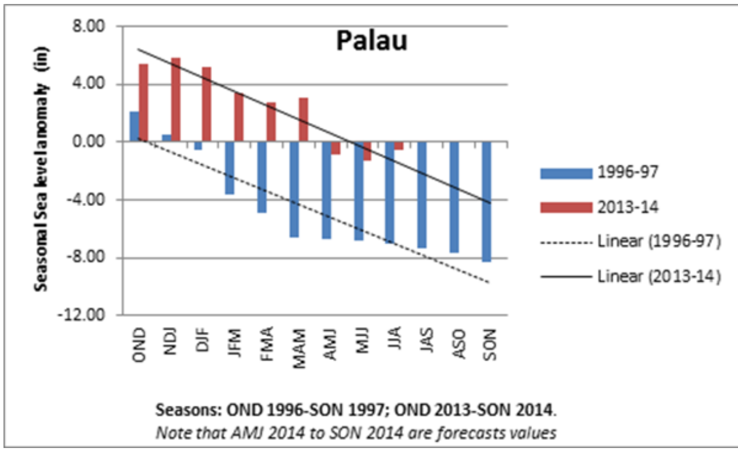


Figure 4b. *Average rainfall, % of monthly mean, for a composite of historical El Niño years and the years following El Niño for Guam. Note that during El Niño there is abundant rainfall, with some very high monthly values at Guam. Dryness starts late in the El Niño year, and worsens in the first few months of the year following El Niño. Note that at Guam the dryness is more prolonged and persists across the whole post-El Niño year. This chart is not a specific forecast, but represent plausible rainfall behavior at Guam for 2014 and 2015. Drought severity and recovery of rainfall after El Niño varies from island to island .*



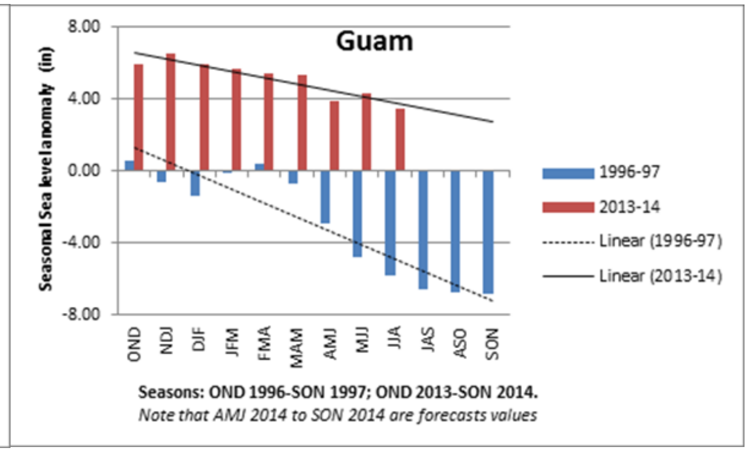


Figure 5 . *The sea level throughout Micronesia falls during an El Niño year. The behavior of the sea level during the strong 1997 El Niño is indicated by blue bars for Guam and Palau. The sea level to-date is shown by the red bars. The red bars also provide a three month outlook through JJA of 2014.*

ACKNOWLEDGEMENTS AND FURTHER INFORMATION

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Alejandro Ludert, Graduate Research Assistant and Webmaster, at 808-956-2324 for: information related to the PEAC website.

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The Pacific ENSO Update is a bulletin of the Pacific El Niño-Southern Oscillation (ENSO) Applications Climate (PEAC) Center. PEAC conducts research & produces information products on climate variability related to the ENSO climate cycle in the U.S. Affiliated Pacific Islands (USAPI). This bulletin is intended to supply information for the benefit of those involved in such climate-sensitive sectors as civil defense, resource management, and developmental planning in the various jurisdictions of the USAPI.

The Pacific ENSO Update is produced quarterly both online and in hard copy, with additional special reports on important changes in ENSO conditions as needed. For more information about this issue please contact the editor, LTJG G. Carl Noblitt IV, at peac@noaa.gov or at the address listed below.

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