



# PACIFIC



# UPDATE

## *A Quarterly Bulletin of the Pacific El Niño-Southern Oscillation Applications Climate (PEAC) Center*

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*Providing Information on Climate Variability in the U.S.-Affiliated Pacific Islands for the Past 20 Years.*

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

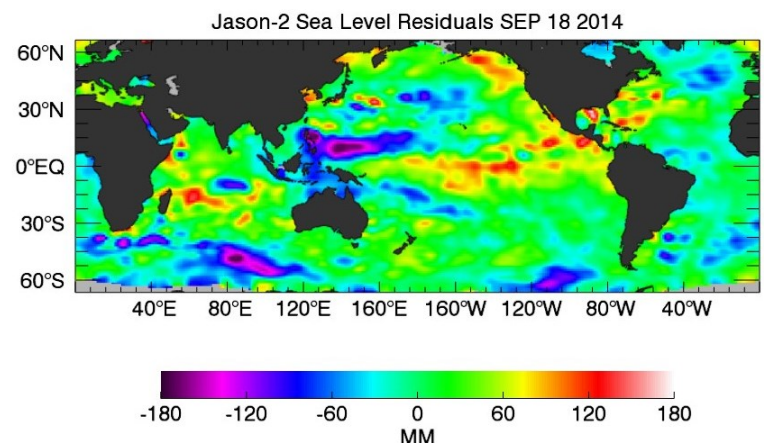
### CURRENT CONDITIONS

The weather throughout the U.S.-affiliated Pacific Islands (US-API) has been highly variable over the past several months. Very large month-to-month differences in rainfall were observed at many locations. A temporal distribution of rainfall consisting of a very wet July, a dry August, and a wet September/early October, with recent dryness again in the latter half of October was seen across most of Micronesia (See last section for rain charts Fig. 6a and Fig. 6b). Similar wild swings were seen in tropical cyclone activity, with the western North Pacific having a very active mid-July to mid-August, a quiet period from mid-August to mid-September, another busy period in the latter half of September into early October, and a peculiar shut-down of activity in the second week of October that continued to the last week of the month. The eastern and central North Pacific had an extraordinarily active period of tropical cyclone activity extending from August through September. In mid-October, tropical cyclone, Hurricane Ana (02C), formed in the central North Pacific and passed just to the south of the Hawaiian Island chain during 18-21 October. The Atlantic hurricane season was mostly extinguished, with a very low number of cyclones observed in the heart of their hurricane season. A sudden burst of activity in Mid-October added three cyclones in quick succession to the extremely low Atlantic total for 2014, raising the total from 6 to 9 numbered cyclones. One might suspect the high month-to-month swings of rainfall and cyclone activity to be related to the Madden-Julian Oscillation, but time series of its evolution during the past several months have been surprisingly weak and chaotic, suggesting that other factors were governing the strong month-to-month oscillations of rainfall and storminess in the Pacific. Sea level has fallen dramatically across most of Micronesia, with the largest fall noted in Palau. While the actual stand of the sea is now near normal at most reporting sites in Micronesia, this represents a large fall of sea level stands from high values early in the year. In fact, the current sea level residual in the equatorial western North Pacific is at its lowest value for the past decade (Fig. 1). Four typhoons have formed within the boundaries of Micronesia so far during 2014. All four of these passed near Guam and Saipan, with the eyewall of Typhoon Vongfong passing over Rota on the night of 5 October. Both Guam and Hawaii have had more close passages of tropical cyclones during 2014 than in any year over the past decade (Fig. 2a and 2b) See Tropical Cyclone Activity and summary and Local Summary for more details.

Many of the odd weather patterns discussed above occur during El Niño. The climate system index has stayed just beneath the CPC definition of El Niño for several months, and refuses to cross the +0.5 C threshold in the Niño 3.4 region. Other ENSO indexes such as the MEI have indicated El Niño conditions during some of the past few months. Anticipation of an impending El Niño allowed the PEAC Center to correctly forecast high tropical cyclone activity for Micronesia and for Hawaii. This high activity could continue for another three months. In the absence of a clearly defined moderate or strong El Niño the next forecast challenge is whether or not very dry conditions will materialize during the first few months of 2015. A region-wide extreme drought such as 1983, 1992, and 1998 are not anticipated. However, local or regional pockets of dry conditions at some islands and atolls are likely during the first few months of 2015.

The following comments from the EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION were posted on the U.S. Climate Prediction Center/NCEP<sup>1</sup> and the International Research Institute for Climate and Society website on 06 November, 2014: ENSO Alert System Status is set to **El Niño Watch**<sup>1</sup>. The synopsis by CPC/IRI states that there is a 58% chance of El Niño during the Northern Hemisphere winter, which is favored to last into the Northern Hemisphere spring 2015.

<sup>1</sup>Climate Prediction Center National Centers for Environmental Prediction. NOAA/National Weather Service. College Park, MD 20740.



**Figure 1.** This image was created with data collected by the U.S./European OSTM/ Jason-2 satellite during a 10-day period centered on Sept. 18, 2014. It shows a red and yellow area in the central and eastern equatorial Pacific, indicating that the ocean surface is about 4 to 6 inches (10 to 12 centimeters) above normal. Green indicates near-normal conditions. These regions contrast with the western equatorial Pacific, where sea levels (blue and purple areas) are 3 to 6 inches (8 to 15 centimeters) lower than normal (red arrow).

SEA SURFACE TEMPERATURES

For the past Quarter (August, September, and October), ENSO-neutral conditions persisted under an El Niño Watch Status. Overall, across the Pacific representative conditions of El Niño were present however, the atmospheric and oceanic states remain neutral. Above-average SSTs remained across the equatorial Pacific. The subsurface heat content warmed slightly during the start of the Quarter and has remained average despite a new downwelling Kelvin wave carrying increased temperatures at depth to the central Pacific. Low-level winds remained average with the occasional westerly wind anomalies. At the beginning of the Quarter the Upper-level winds prevailed and reduced to average conditions for the remainder of the Quarter.

SOUTHERN OSCILLATION INDEX

The 3-month average of the Southern Oscillation Index for the 4th Quarter of 2014 including August, September, and October remained negative at -0.7. The respective monthly values were -0.7, -0.7, and -0.6. Consecutive periods of negative SOI values and warm ocean waters across the eastern tropical Pacific are indicative of El Niño.

Normally, positive SOI values in excess of +1.0 are associated with La Niña conditions, and negative SOI values below -1.0 are associated with El Niño conditions. Low SOI values suggest a weak coupling between the ocean and the atmosphere. The SOI is an index representing the normalized sea level pressure difference between Darwin, Australia and Tahiti.

TROPICAL CYCLONE ACTIVITY

The PEAC archives western North Pacific tropical cyclone numbers, track coordinates, and 1-minute average maximum sustained wind taken from operational warnings issued by the Joint Typhoon Warning Center (JTWC) of the U. S. Air Force and Navy, located at Pearl Harbor, Hawaii. Western North Pacific tropical cyclone names are obtained from warnings issued by the Japan Meteorological Agency (JMA), which is the World Meteorological Organization's Regional Specialized Meteorological Center (RSMC) for the western North Pacific basin. The PEAC archives South Pacific tropical cyclone names, track coordinates, central pressure, and 10-minute average maximum sustained wind estimates from advisories issued by the Tropical Cyclone Warning Centers at Brisbane, Nadi, and Wellington. The numbering scheme and the 1-minute average maximum sustained wind estimates are taken from warnings issued by the JTWC. There are sometimes differences in the statistics (e.g., storm maximum intensity) for a given tropical cyclone among the agencies that are noted in this summary.

Tropical Cyclone Summary

Through mid-October of 2014, the JTWC numbered 19 significant tropical cyclones. Eighteen of these were named by the JMA, which named an additional tropical storm (Mitag) that JTWC declared to be sub-tropical and did not provide warnings. Ten cyclones became typhoons as per JTWC estimates. An additional cyclone (Hurricane/Super Typhoon Genevieve (07E) moved into the western North Pacific after a long track across the eastern and central North Pacific. Several tropical cyclones formed within Micronesia and a nexus of tracks is clustered near Chuuk, Guam and the CNMI (see Fig. 2b). Three of the basin's TCs formed near or east of Kosrae. Such eastward displacement of TC formation is typical during El Niño. An abundance of early season tropical cyclones as was seen during 2014 is also a typical response to El Niño onset in the western North Pacific. Eastward displacement of tropical cyclones is anticipated for the remainder of 2014 and perhaps extending into January 2015. This presents an elevated risk of a late-season typhoon throughout Micronesia. Specific island risks are found in their respective local variability summaries.

The number of cyclones to-date in the western North Pacific (standing at 20, counting Genevieve) has fallen below normal. Typically through September, the JTWC numbers 22 tropical cyclones, and through October, 26. The 2014 typhoon season had a remarkable clustering of cyclone activity, with 5 of the year's typhoons occurring during July through early August. After Genevieve moved into the western Pacific, there was a long quiet period with no further typhoon occurrence until Kalmaegi became a typhoon near the Philippines in mid-September. Two more cyclones became typhoons in late September and early October, then another prolonged quiet period ensued with no further activity noted for the rest of October.

The eastern and central North Pacific had a bumper crop of tropical cyclones during 2014. To-date the NHC (Miami) has numbered 20 storms, with an additional two numbered by the CPHC (Honolulu). Four hurricanes affected the Hawaiian island chain: Iselle, Julio, Genevieve, and Ana. Iselle made landfall on the Big Island of Hawaii (Fig. 3) during the early morning of 08 August. Hurricane Ana passed just offshore to the south of the Hawaiian Island chain during 18-21 October, with heavy rainfall the most notable effect.

4<sup>th</sup> Quarter, 2014

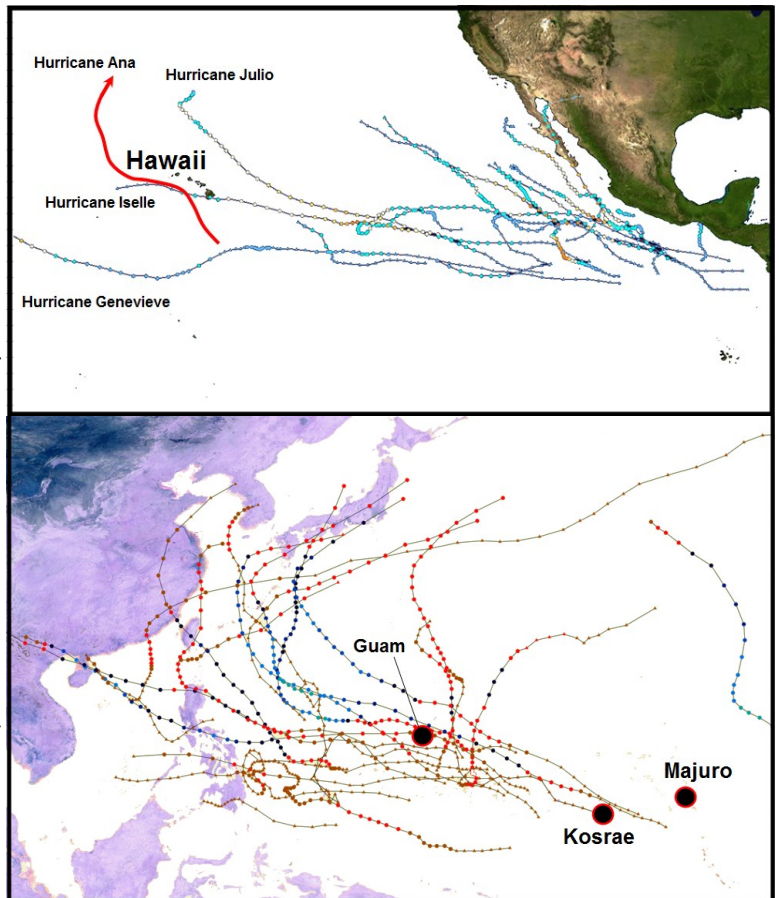


Figure 2a and 2b. Pacific tropical cyclone tracks through 25 October 2014. The bold red track is the latest central North Pacific hurricane, Ana (02C). Note the nexus of typhoon tracks near Guam and the high number of tracks originating to the east of Guam's longitude. Note also the four hurricanes passing near or over Hawaii. This distribution of tropical cyclones is typical of El Niño.

## TROPICAL CYCLONE ACTIVITY

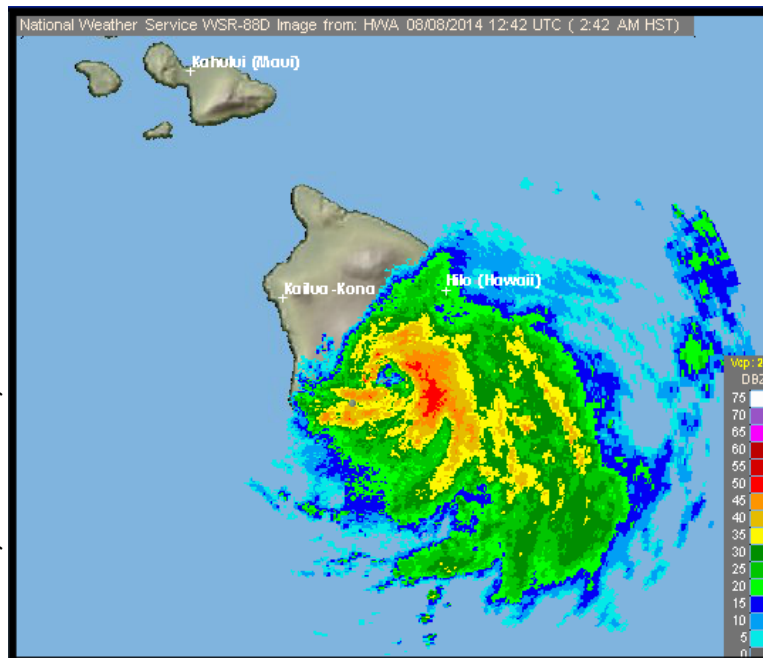
**PEAC Center Tropical Cyclone Assessment****Western North Pacific and American Samoa**

Three organizations typically produce seasonal outlooks for tropical cyclone activity in the western North Pacific that are routinely used by the PEAC Center for guidance on the upcoming typhoon season: (1) The Guam Weather Forecast Office (WFO), (2) The City University of Hong Kong Laboratory for Atmospheric Research, and (3) The Benfield Hazard Research Centre Tropical Storm Risk (TSR) research group 1. On the 5th of August, the TSR group provided an update to their forecast of tropical cyclone activity in the western North Pacific. At that time, they were still calling for slightly above normal activity during 2014, with an outlook for a total of 26 (TS + TY) and 16 (TY). The total as of late October was 19 (TS + TY) and (10 TY). The curious breaks in cyclone activity have cut into the annual total to such a degree that it seems unlikely the basin will achieve these numbers, and the year as a whole will see below normal activity, with the exception of Micronesia, which seems to be the nexus of cyclone formation this year. At the time of this writing the Hong Kong forecast for 2014 was not issued as their prediction scheme is undergoing revision, and the complete WFO Guam forecast is on hold pending further development of the data base.

Based on available guidance<sup>1</sup>, the forecast behavior of ENSO, and the season characteristics to-date, the PEAC Center

Tropical Cyclone Outlook for the upcoming western North

Pacific typhoon season of 2014 is for slightly below normal activity in the whole basin, but perhaps another cluster of cyclone formation during November and/or December. Please see the local variability summaries for the anticipated typhoon risk for each island group. Regionally enhanced cyclone activity could spill over into American Samoa during their next (2014-2015) cyclone season.



**Figure 3.** The “eye” of Hurricane Iselle makes landfall on the southeastern shores of the Big Island of Hawaii on the early morning of 08 August 2014. The image is a screen capture of the composite reflectivity product of the NEXRAD weather radar located at South Point (KHWA) on the Big Island. Iselle had been downgraded to a tropical storm at this time.

**Hawaii**

Hawaii (Fig. 3) was affected by an above-average number of tropical cyclones during 2014. This was foreseen by Hawaii forecasters. Higher-than normal cyclone activity in the central Pacific region has two sources: (1) hurricanes moving into the central Pacific region from the eastern North Pacific, and (2) enhanced formation in the region itself. Both these factors were in-play during 2014. Such a distribution of tropical cyclones is common during El Niño. For the remainder of 2014, there may still be time to squeeze out one more tropical cyclone in the central North Pacific, either from the transition of a Kona low to a TC west of Hawaii, or emerging from the ITCZ south of Hawaii, but the probability of this is low (20%).

<sup>1</sup>The PEAC tropical cyclone forecasts for 2014 were and are based on forecasts of the status of ENSO and input from four seasonal outlooks for tropical cyclone activity in the western North Pacific basin: (1) A statistical outlook prepared by Paul Stanko (a lead forecaster at the Guam WFO), (2) The City University of Hong Kong Laboratory for Atmospheric Research, under the direction of Dr. J. C-L. Chan, (3) The Benfield Hazard Research Centre, University College London, Tropical Storm Risk (TSR) research group, UK, led by Dr Adam Lea and Professor Mark Saunders, and (4) the Central Pacific Hurricane Center (current contact: Chris Brenchley, 808-973-5275).

**SEASONAL SEA LEVEL OUTLOOK FOR THE US-AFFILIATED PACIFIC ISLANDS**

The following sections describe: (i) the Canonical Correlation Analysis (CCA) forecasts for seasonal mean and maxima sea level anomalies (seasonal cycle removed) for the forthcoming seasons October-November-December (OND), November-December-January (NDJ), and December-January-February (DJF) of 2014, (ii) OND return values at 20 and 100-yr period, (iii) the observed monthly mean and maximum sea-level anomalies for the previous season JAS 2014, and (iv) Seasonal sea level variability: Island Summary. *Note that, seasonal cycles have been removed for the data anomalies that are defined as ‘deviations or departures from the normal’ using the 1983 through 2001 mean sea level value computed at each station. Also note that CCA-forecasting technique adopted here does not account for sea level deviations created by other atmospheric or geological factors such as tropical cyclones, storm surges or tsunamis.*

**Seasonal Sea Level Forecast (anomalies with respect to climatology) for OND, NDJ, and DJF of 2014**

Forecasts of the sea-level anomalies in the USAPI (see <http://www.prn.noaa.gov/peac/map.php>) are presented using CCA statistical model. Based on the independent SST and zonal wind (U) (SST-U) values in JAS of 2014, the resulting CCA model has been used to forecast the sea level of three consecutive seasons: OND, NDJ, and DJF (see Table 1: left panel shows values for seasonal mean while the right panel shows the seasonal maxima). All the tide gauge stations (at 0 to 2-months lead time) show skillful forecasts for these three consecutive seasons.

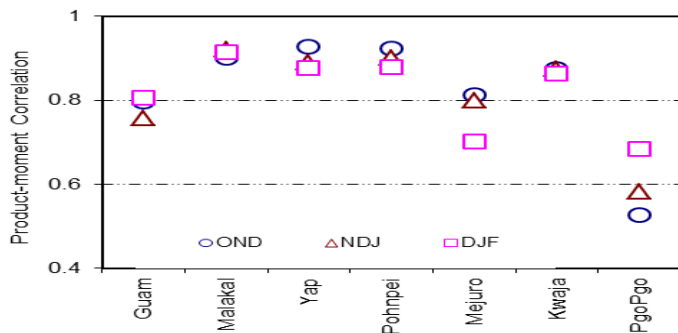
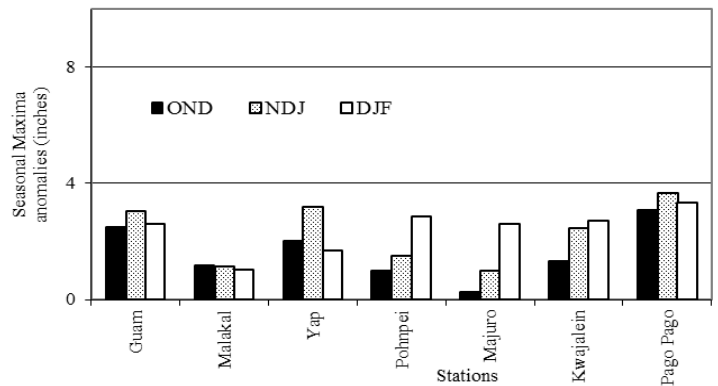
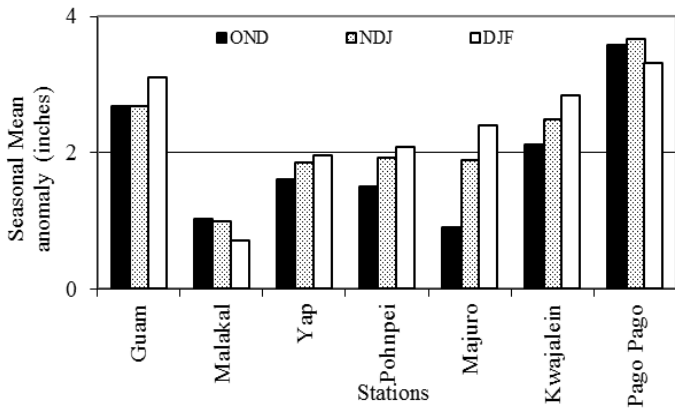
The forecasts values of sea level for OND, NDJ, and DJF seasons (Table 1) indicate that most of the stations in the north Pacific regions are likely to be marginally (e.g., 1-3 inches) higher than normal in the forthcoming seasons. Only, the lone South Pacific

SEASONAL SEA LEVEL OUTLOOK FOR THE US-AFFILIATED PACIFIC ISLANDS

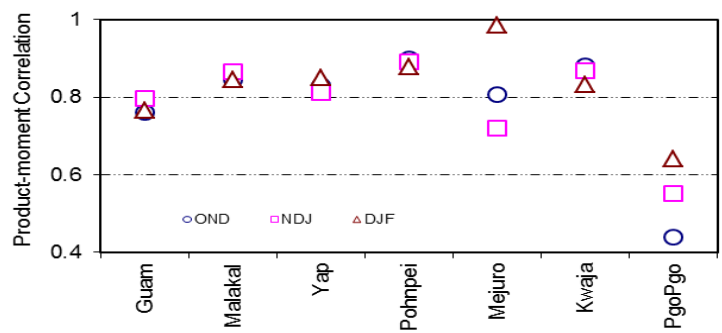
Island, Pago Pago, is likely to be 3-4 inches higher than normal. In Hawaii, both Honolulu and Hilo are likely to be slightly elevated during the same time period. As compared to the previous Quarter, the current sea level shows a falling trend. This trend is very supportive of the on-going El Niño predicted trend. However, the fall is directly related to the strength of the on-going El Niño like state. Therefore further fall of sea level will depend on how strong this year's El Niño turns out. Currently, the forecast values of sea level for OND, NDJ, and DJF seasons are likely to be close to normal for the forthcoming seasons.

Table 1: Forecasts of sea level anomalies in inches (OND, NDJ, and DJF)

Tide Gauge Station	Seasonal Mean Deviations <sup>1</sup>				Seasonal Max Deviations <sup>2</sup>					
	OND	NDJ	DJF	Forecast Quality <sup>3</sup>	OND	NDJ	DJF	Forecast Quality <sup>3</sup>	OND: Return Period <sup>4</sup>	
Lead Time <sup>5</sup>	0M	1M	2M		0	1M	2M		20- YR	100-YR
Marianas, Guam	+2	+2	+2	V. Good	+18	+18	+18	Good	6.5	9.1
Malakal, Palau	+1	0	0	V. Good	+38	+38	+38	V. Good	6.1	6.4
Yap, FSM	+1	+1	+1	V. Good	+28	+29	+29	V. Good	8.2	11.0
Chuuk, FSM**	+1	+1	+1	N/a	+28	+29	+29	N/a	n/a	n/a
Pohnpei, FSM	+2	+2	+2	V. Good	+30	+31	+32	V. Good	9.1	11.8
Majuro, RMI	+1	+2	+2	V. Good	+40	+41	+42	V. Good	5.7	6.4
Kwajalein, RMI	+2	+2	+2	V. Good	+40	+40	+40	V. Good	6.6	8.4
Pago Pago, Am. Samoa	+4	+4	+3	Good	+29	+29	+29	V. Good	4.9	6.1
Honolulu, Hawaii	+2	+2	+1	Fair	+21	+12	+21	Poor	3.0	3.7
Hilo, Hawaii	+2	+2	+2	Fair	+24	+24	+24	Poor	3.2	5.2



CCA Cross-validation Skill in JAS, ASO, and SON



CCA Cross-validation Skill in JFM, FMA, and MAM: Max

**Table 1 and Supporting Statistics:** (-) indicate negative anomalies (fall of sea level from the mean), and (+) indicate positive anomalies (rise of sea level from the mean), n/a: data not available. Anomalies from -1 to +1 inches are considered negligible and anomalies from -2 to +2 inches are unlikely to cause any adverse climatic impact. Forecasts for Chuuk (\*\*) are estimated subjectively based on information from WSO Chuuk and observations from neighboring stations of Pohnpei and Yap. See <http://www.prn.noaa.gov/peac/> for the explanations of footnote (1 to 5). Also note that all information is based on the 1983-2001 epoch.

SEASONAL SEA LEVEL OUTLOOK FOR THE US-AFFILIATED PACIFIC ISLANDS

Observed Monthly Mean Sea Level Anomalies (with respect to climatology) for JAS 2014

The monthly time series (July to September) for sea level anomalies have been taken from the UH Sea Level Center. The full time series (in mm) for monthly mean is available at: <ftp://ilikai.soest.hawaii.edu/islp/slpp.anomaliess>. Locations of all these stations can be found at <http://www.prn.noaa.gov/peac/map.php>. As compared to previous months, the monthly mean sea level in September recorded fall in some stations while others remained stable. Only Pago Pago and Guam recorded rise again. A comparative perspective of seasonal sea level variability of Palau is given in (Fig. 4). Sea level fall in 2014 is clearly visible; it is quite significant when compared to 2013 and the average values of 2004-2013. However, 1997 values were much lower than the current state of sea level in Palau. All stations, except Kapingamarangi and Pago Pago, are either normal or very close to normal (+/- 1inch). Honolulu and Hilo are also stable, but slightly elevated. The monthly maximum values remained static for most of the stations. The recent falling trend of sea level is very supportive to the on-going El Nino state. Normally sea level is lower than normal during an El Nino year.

Table 2: Monthly observed mean/maximum sea-level anomalies in inches (JAS)

Tide Gauge Station	Monthly Mean Deviations <sup>1</sup>				Monthly Max Deviations <sup>2</sup>			
	July	Aug	Sept	Standard Deviations	July	Aug	Sept	Sea level Trend
Marianas, Guam	+3.6	+0.5	+1.4	+2.8	+21	+17	+17	Stable
Malakal, Palau	0	-0.5	-1	+1.4	+37	+38	+37	Falling
Yap, FSM	+1.8	+2	0	+2.1	+28	+29	+30	Falling
Chuuk, FSM*				+2.1	*	*	*	Falling
Pohnpei, FSM	+3.4	+1	+0.5	+2.3	+31	+29	+27	Falling
Majuro, RMI	+2.1	+2	+2.2	+2.2	+43	+44	+44	Stable
Kwajalein, RMI	+1	+0.5	+1.1	+3.1	+40	+40	+39	Stable
Pago Pago, American Samoa	+8.6	+8.6	+9.3	+4.2	+35	+35	+36	Stable
Honolulu, Hawaii	+1.5	+2.2	+4.4	+3.1	+20	+20	+25	Stable
Hilo, Hawaii	+1.7	+4	+2.8	+3.1	+26	+26	+23	Falling

Table 2. +/- indicate positive anomaly (rise) and negative anomaly (fall) respectively. Note that any changes between (0~±1)inch is considered to be negligible. Also note that changes within the range of (+/-)2 inches are unlikely to cause any adverse climatic impact., \* Data currently unavailable; 1: Difference between the mean sea level for the given month and the 1983 through 2001 mean sea level value at each station (seasonal cycle removed); 2: Same as 1 except for maxima.

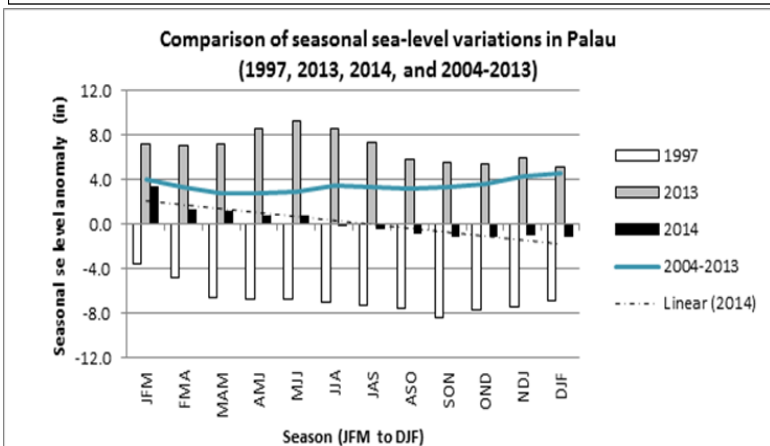


Figure 4. Summarized sea level outlook for Palau since 20014 (in comparison to 1997 and 2004-2013 values).

Seasonal Sea Level Variability: Island Summary

Most of the islands recorded a fall in sea level. This falling trend is very supportive to the on-going El Niño state. Normally sea level is lower than normal during an El Niño year and higher than normal during a La Niña year,. The fall or rise of sea level is directly related to the strength of El Niño and La Niña event. So, further fall of sea level depends on how strong this year’s El Niño is going to become. Several features across the tropical Pacific are characteristic of borderline El Niño conditions, but collectively, the ongoing lack of clear atmospheric and oceanic coupling has reduced confidence that El Niño will fully materialize. If El Niño does emerge, the fore-caster consensus favors a weak event. In summary, according to CPC/IRI, there is a 58% chance of El Niño during the Northern Hemisphere winter, which is favored to last into the Northern Hemisphere spring of 2015.

LOCAL SUMMARY AND FORECAST



American Samoa:

American Samoa will soon transition to its rainy season, with monthly average rainfall rising from about 7 inches in September to nearly 15 inches in December. Whereas July was very wet across American Samoa, the months of August and September were very dry. Heavy rainfall during the period 29 July to 03 August caused damaging floods and landslides in American Samoa. On August 25, 2014, Governor Lolo M. Moliga requested a major disaster declaration due to the severe storms, flooding, and landslides. On September 10, 2014, President Obama declared that a major disaster occurred in the Territory of American Samoa, making available disaster assistance for monetary losses estimated at over \$US 2 million.

**LOCAL SUMMARY AND FORECAST**

Subsequent dry conditions over the following two months produced brown grass, but no problems with water supply were reported. Weather during September, in addition to being very dry, was also breezy, with persistent gusty trade winds. Since January 2014, the monthly mean sea level in Pago Pago remained above normal and in May it was reading +4.5inches above normal. It again registered a rise in July (+8.6) and has stayed in that rising condition since. Currently, it is at +9.3inches above normal. This rise is expected, as American Samoa displays a couple of months delay with respect to the north Pacific Islands.

American Samoa Rainfall Summary: 2014 Third Quarter and 9-month						
Station		Jul	Aug	Sep	3rd Qtr	9- Month
Pago Pago (WSO)	Inches	18.48	3.22	2.60	24.30	92.79
	% Avg	294%	48%	39%	123%	108%

**Climate Outlook:** American Samoa is about to enter its 2014-2015 rainy season. Climate models favor near normal rainfall over the next 3-month period. American Samoa lies in an area of the Pacific where the relationship between rainfall and ENSO is complex, with few consistent relationships that can be used to make a reliable long-range forecast. Rainfall in American Samoa is closely tied to the location of the South Pacific Convergence Zone (SPCZ), which is itself, difficult to predict for long periods of time. Only during the mature phase of a strong El Niño (e.g., January-May 1983 and January-May 1998) does American Samoa typically experience a prolonged period of well-below average rainfall extending a month or two on either side of March. In the absence of strong El Niño, an extended period of dry weather is not anticipated for the foreseeable future at American Samoa, and is so-indicated in the rainfall outlooks below.

If the climate system transitions to El Niño over the next few months, tropical cyclone activity could be drawn eastward into the South Pacific east of the 180° meridian. This would elevate the risk of tropical cyclone development near American Samoa beginning in November 2014. Whereas sea level has fallen dramatically across Micronesia, the sea level has remained above average at American Samoa. The fall of mean sea level at American Samoa in response to El Niño typically reaches its lowest point in March of the year following El Niño.

Predicted rainfall for American Samoa from October 2014 through September 2015 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>
Oct - Dec 2014 (Onset of Rainy Season)	100% (34.59in)
January - March 2015 (Rainy Season Continues)	95%
April - June 2015 (Onset of Next Dry Season)	90%
June - October 2015 (Heart of Next Dry Season)	90%

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

**LOCAL SUMMARY AND FORECAST**



**Guam/CNMI:** Compared to conditions over the past several years, the recent weather throughout Guam and the CNMI has been quite dramatic, with episodes of high surf, some high daily rainfall events, several passages of tropical cyclones (Fig. 5), and an extraordinary month-to-month variation of rainfall totals. The rainfall during the 3rd Quarter, and overall for the 9-month total to-date, has been above normal. July and (oddly) January had the highest and 2nd-highest rainfall totals of the year, respectively, at most locations. The spring (March-May) was quite dry. August was also very dry, with the 3.23 inches in the southern mountain location of Guam one of the driest August readings in any Guam rainfall time series. River levels fell, and there were some isolated brush fires during August on Guam. High rainfall returned in September. Some notable high 24-hour rainfall events include 8.27 inches at Saipan International Airport on 25 September, 11.66 inches at the Guam International Airport during 29-30 July, and 6.93 inches at AAFB Guam on 05 October. Each of these high rainfall events occurred during the nearby passages of tropical cyclones. The close passage of Typhoon Vongfong on the night of 04-05 October was the most serious of the 2014 tropical cyclone threats to Guam and the CNMI. The eye passed just north of Rota, placing Guam and Saipan at almost equal distances to the north and south of the cyclone center. Wind gusts to near 60 mph were noted at both Guam and Saipan (on Guam from the west, and on Saipan from the east). Minor damage to vegetation was noted on both Guam and Saipan, with a bit heavier damage to trees and property occurring on Rota. Vongfong was only a Category 1 typhoon while passing through the CNMI, but became a strong super typhoon a few days after moving away to the northwest. High surf from several tropical cyclones has markedly eroded and reshaped the beach on some of the coastal areas on the west side of Guam. Since January 2014 the monthly mean sea level in Guam is rather steady and staying above normal. This station remained above normal up until June (+5.9inches). It started to fall from July and fell very quickly. In July it was +3.6 and in August it was marginally above (+0.5inches) normal. Although, September registered slight rise, currently sea level is stable. Even though sea level is stable at near normal levels on Guam, it actually represents a much lower stand of the sea than the continually very high stands of the sea that have been observed over the past decade of La Niña-dominated climate.

CNMI and Guam Rainfall Summary: 2014 Third Quarter and 9-month						
CNMI						
Capitol Hill	Inches	10.26	7.10	21.30	38.66	79.36
	% Norm	114%	57%	158%	110%	134%
Saipan Intl. Airport	Inches	10.64	9.33	19.31	39.28	71.53
	% Norm	131%	75%	143%	115%	134%
Tinian Airport	Inches	8.98	8.03	22.84	39.85	69.10
	% Norm	100%	64%	169%	114%	117%
Rota Airport	Inches	20.19	5.42	13.99	39.60	71.46
	% Norm	193%	41%	105%	107%	106%

**LOCAL SUMMARY AND FORECAST**

Guam and CNMI Rainfall Summary: 2014 Third Quarter and 9-month						
Station		Jul	Aug	Sep	3rd Qtr	1 <sup>st</sup> Half
<b>GUAM</b>						
<b>GIA (WFO)</b>	<b>Inches</b>	27.48	9.08	13.66	50.22	87.34
	<b>% Norm</b>	261%	66%	101%	133%	134%
<b>AAFB</b>	<b>Inches</b>	26.87	6.63	11.07	44.57	86.63
	<b>% Norm</b>	246%	49%	83%	118%	123%
<b>Southern Mountains</b>	<b>Inches</b>	29.44	3.23	15.94	48.61	80.71
	<b>% Norm</b>	270%	24%	120%	129%	115%

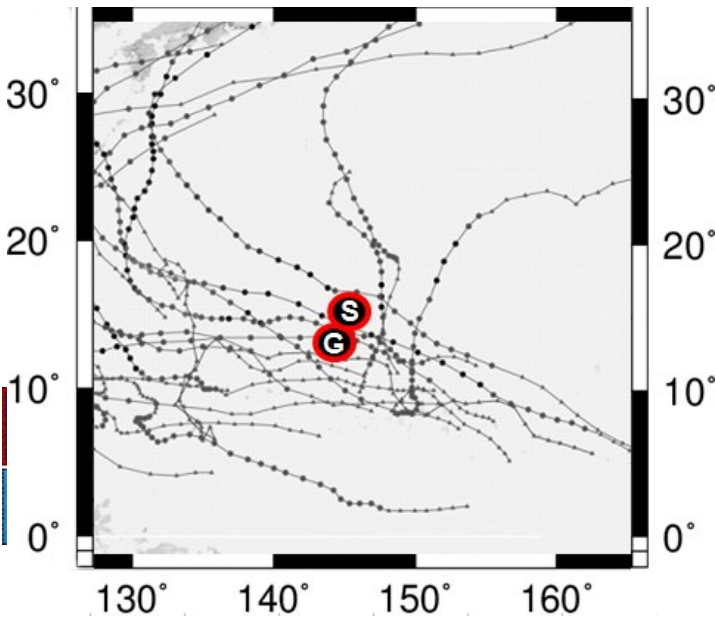


Figure 5. Guam (G) and Saipan (S) are the focus of several tropical cyclone tracks during 2014.

**Climate Outlook:** During the months of November and December, trade winds strengthen on Guam and the CNMI, and rainfall amounts begin to diminish as the rainy season comes to a close. Despite the gradually retreating rains, the threat of a typhoon on Guam and in the CNMI is highest in the final three months of the year. A majority of the major typhoons affecting Guam and Saipan occurred in November (e.g., Karen and Yuri on Guam and Kim on Saipan) or December (e.g., Paka and Pongsona). These late-season major typhoons are usually associated with El Niño. Although the status and the near-term evolution of ENSO remains uncertain, it is thought that the risk of a damaging typhoon remains higher than average (25%) for Guam and Saipan through January 2015. This is based primarily on the persistence of westerly winds across Micronesia at low latitude, and the season’s distinctive flavor to-date featuring a focus of tropical cyclogenesis in eastern Micronesia, with tracks toward Guam and the CNMI.

Unusually dry conditions tend to follow El Niño in Guam and in the CNMI. Rainfall anomalies are strongly related to ENSO in these islands. It is nearly certain to be severely dry in the first half of the year following a strong El Niño (e.g., January-June 1983 and January-June 1998), and likely to be at

**LOCAL SUMMARY AND FORECAST**

least moderately dry following a weak or moderate El Niño. With current climate conditions flirting with the El Niño threshold, we anticipate at least a moderate dry spell in the first few months of 2015. This is indicated in the rainfall forecasts. In addition for the next seasons OND, NDJ, and DJF there are indications for a slightly elevated rise( +2 to 3 inches) in sea level for Guam.

Predicted rainfall for the Mariana Islands from Oct 2014 through September 2015 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>	
	Guam/Rota	Saipan/Tinian
<b>Oct – Dec 2014 (End of Rainy Season)</b>	120%* (30.76in)	110%* (24.27in)
<b>Jan – March 2015 (First Half Dry Season)</b>	90%* **	85%**
<b>Apr – June 2015 (End of Dry Season)</b>	85%**	90%**
<b>July - September 2015 (Heart of Rainy Season)</b>	95%	95%

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

\* A typhoon occurrence could push these rainfall totals much higher

\*\* The severity of dryness depends on the strength of El Niño



**Federated States of Micronesia**

**Yap State:** Abundant rainfall was recorded at most locations across Yap State during the 3rd Quarter and during the first 9-months of 2014.

But, there was very large month-to-month variation in rainfall with a distribution similar to that seen at other locations within Micronesia: a very wet January, some dry months in the spring, a wet July, and a dry August followed by a wet September. During the first 9 months of 2014, January was the wettest month and May the driest. Much of the monthly variation of rainfall in Yap State occurred in association with the notable clustering of tropical cyclone activity in the western Pacific Basin (see the TC discussion). Wet monsoon conditions and the passage to the north of Yap State of several TCs generated heavy rainfall across most of the State. There were no reports of any problems with water supply or coastal inundations from the monsoonal episodes or the passing tropical cyclones. The sea level recorded at the tide gauge located at the outer part of the harbor in Colonia exhibited a large drop over the course of 2014, with high positive values at the beginning of the year falling to zero by September (see the sea level discussion). Farther south at Woleai and likely at several of the other southern atolls, conditions were drier in all months, but especially in August when the entire State was dry. While the large number of storms moving north of Yap State brought wet conditions to the northern Yap Islands, it caused high pressure to build over the southern islands, suppressing rainfall. The monthly mean sea level in Yap displayed a considerable fall in the last couple of months. Currently it is normal; the anomaly in January was +8.9inches above normal.

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Yap State Rainfall Summary: 2014 3rd Quarter and 9-Month						
Station		Jul	Aug	Sep	3rd Qtr	9-Month
<b>Yap State</b>						
Yap WSO	Inches	16.62	9.58	16.89	43.09	102.28
	% Norm	114%	63%	125%	100%	114%
Ulithi	Inches	22.74	7.73	15.75	46.22	85.03
	% Norm	184%	60%	137%	126%	111%
Woleai	Inches	12.57	2.65	12.75	27.97	64.19
	% Norm	90%	18%	109%	69%	62%

**Climate Outlook:** Above average rainfall is anticipated for most locations across Yap State at least through November. If El Niño conditions become established over the next few months, dry weather could become established across Yap State at the beginning of 2015 and continue to be drier than normal in the first half of 2015. The severity of the dry conditions depends on the strength of El Niño, with a strong El Niño causing the greatest reduction of monthly rainfall amounts and the most prolonged period of dry conditions. The observed eastward displacement of tropical cyclone formation and the year to-date nexus of TC tracks through the Mariana Islands passing thereafter to the north of Yap State, are indicators that the chances for tropical storm-force winds near Yap Island or any of its northern atolls will be above normal for the remainder of the year. A shift of the climate to El Niño will prolong the threats posed by tropical cyclone into January 2015.

Predicted rainfall for Yap State from October 2014 through September 2015 is:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>	
	Woleai	Yap & Ulithi
<b>October – December 2014 (End of Rainy Season)</b>	<b>100% (34.54in)</b>	<b>110% (33.45in)</b>
<b>January – March 2015 (Heart of Next Dry Season)</b>	<b>85%</b>	<b>90%</b>
<b>April – June 2015 (Extension of Dry Season)</b>	<b>85%</b>	<b>95%</b>
<b>July – September 2015 (Heart of Rainy Season)</b>	<b>90%</b>	<b>95%</b>

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

**Chuuk State:** Rainfall was above average throughout much of Chuuk State during the 3rd Quarter and during the first 9 months of 2014. As noted elsewhere in Micronesia, there was very high month-to-month variability in the rainfall across Chuuk State. During June, rainfall increased, and from July onward, the monsoon trough has been near Chuuk State, continually bringing heavy rains from developing tropical cyclones and other monsoonal rain systems. September 2014 was particularly rainy and windy as several tropical cyclones were spawned in the monsoon trough in the vicinity of Chuuk State. Southerly winds gusted to 26 knots at the Weather Service Office (WSO). On several occasions, heavy rains

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produced minor road flooding impeding traffic flow. An extreme daily rainfall of 5.96 inches occurred at the Chuuk WSO on 21 September. No mudslides were reported on the high islands of Chuuk Lagoon during this event. Deadly mudslides are a recurring problem associated with very high daily rainfall and saturated clay soils. Rainfall deficits at the western atoll of Polowat mirrored those of the southern Yap State atolls.

Chuuk State Rainfall Summary: 2014 3 <sup>rd</sup> Quarter and 9-month						
Station		Jul	Aug	Sep	3 Qtr	9-Month
<b>Chuuk Lagoon</b>						
Chuuk WSO	Inches	14.92	15.55	19.44	49.91	134.79
	% Avg	123%	107%	169%	131%	135%
<b>Southern Mortlocks</b>						
Namoluk	Inches	20.71	10.98	21.01	52.70	131.22
	% Avg	135%	84%	207%	137%	120%
<b>Northern Mortlocks</b>						
Nama	Inches	15.42	9.17	12.73	37.32	110.44
	% Avg	127%	63%	110%	98%	111%
<b>Northern Atolls</b>						
Ounoun	Inches	24.01	12.83	17.55	54.39	128.76
	% Avg	198%	88%	152%	142%	129%
<b>Western Atolls</b>						
Polowat	Inches	9.56	7.04	7.87	24.47	66.39
	% Avg	68%	47%	59%	58%	74%

**Climate Outlook:** The monsoon trough will likely continue to stretch across the northern half of Chuuk State for at least the next three months. The monsoon trough (with its associated disturbances) is inherently episodic, with periods of gusty southwest winds and heavy rainfall lasting for two or three weeks, interspersed with one- or two-week breaks when winds become light, rainfall abates and daytime temperatures approach 90°F. Overall, the rainfall should be abundant across Chuuk State at least through November, then begin to lessen, particularly if El Niño finally becomes established in the Pacific Basin. The level of risk for at least one named tropical cyclone moving through the region will remain high through January 2015. A longer term climate risk is the drought conditions that typically follow El Niño. This dryness could become a serious problem in early 2015. The depletion of rainfall is dependent on the strength of El Niño, with a strong El Niño causing a greater reduction of rainfall for a more prolonged time period (through May for a strong El Niño and only through March or April for a weaker El Niño). With the current state of the climate system in ENSO-neutral -- but at the threshold of El Niño -- a widespread prolonged drought is not anticipated. Rather, more localized dryness for a month or two at some islands or atolls is likely at any time during January through June 2015.

Predicted rainfall for Chuuk State for October 2014 through September 2015:



## LOCAL SUMMARY AND FORECAST

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>			
	Chuuk Lagoon, and Nama	Polowat	Northern Atolls	Mortlocks
Oct – Dec 2014	120% (42.67in)	100% (35.55in)	120% (42.65in)	110% (39.11in)
Jan – Mar 2015	85%	80%	80%	90%
Apr – June 2015	85%	75%	75%	95%
Jul – Sep 2015	95%	80%	95%	100%

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

**Pohnpei State:** For the first time in several years, the monsoon trough continually reached eastward into Pohnpei State, and on occasion even out to Kosrae and the Marshall Islands. During the past three months, there were many days with west and southwest winds reported at the WSO Kolonia and at the Pohnpei International Airport. Occurrences of westerly wind on Pohnpei Island are easily determined: airplanes land from the east at the Pohnpei International Airport. When winds are easterly, or very light, the typical approach to the runway is from the west, flying past Sokehs Rock. The monthly rainfall was more evenly distributed at some locations in Pohnpei State than elsewhere in Micronesia. For example, 6 of the first 9 months of 2014 were within plus-or-minus 2 inches of 16 inches at the WSO Kolonia. Nine-month rainfall totals were mostly near average to above average at most locations on Pohnpei Island and on most of the atolls of Pohnpei State. Palikir on the west side of Pohnpei Island had the highest reported 9-month total rainfall (155 inches) in Pohnpei State. The dryness at Pingelap was in stark contrast to the abundant rainfall elsewhere, but is certainly plausible in a region where concentrated rainfall of convective origin is the norm. Pohnpei Island experienced continuous heavy rainfall in early October, with a 24-hour extreme of over 5 inches observed on the 5th. The heavy rainfall that day caused a mudslide that killed one person. This is the 2nd weather related death of 2014 for Pohnpei. Earlier in the year a fisherman was struck and killed by lightning while fishing from a small boat in the waters off of the reef around Pohnpei Island. The monthly mean sea level in Pohnpei displayed a rapid fall in the last couple of months. While the sea level anomaly in January was +8.2inches above, the anomaly in May was -0.5inch below normal. Currently, it is normal. Mean sea level recorded at Pohnpei Island has been slowly falling, which is consistent with the possible ongoing shift of the climate system to El Niño.

Pohnpei State Rainfall Summary: 2014 3rd Quarter and 2014 first 9-months						
Station		Jul	Aug	Sep	3rd Qtr	9-Month
<b>Pohnpei Island</b>						
Pohnpei WSO	Inches	16.74	10.52	16.06	43.32	141.07
	% Norm	91%	64%	100%	85%	100%

## LOCAL SUMMARY AND FORECAST

Pohnpei State Rainfall Summary: 2014 3rd Quarter and 2014 first 9-months						
Station		Jul	Aug	Sep	3rd Qtr	9-Month
<b>Atolls of Pohnpei State</b>						
Nukuoro	Inches	9.44	11.10	10.94	31.48	129.34
	% Norm	66%	98%	99%	86%	113%
Pingelap	Inches	16.76	2.40	5.93	25.09	71.44
	% Norm	105%	16%	40%	55%	53%
Kapingamarangi	Inches	12.16	7.84	10.86	30.86	89.43
	% Norm	117%	127%	184%	137%	101%

**Climate Outlook:** The monsoon trough should continue to reach into Pohnpei State over the next three months, with near average rainfall expected at most locations. The monsoon trough is inherently episodic at monthly time scales. Thus, one- or two-week periods of wet weather will be separated by one- or two-week periods of hot dry weather. Based upon the continued presence of the monsoon trough in Pohnpei, and the movement of the Pacific climate system towards El Niño, a tropical storm is at least 50% likely to form within or east of Pohnpei State through January 2015. Any such storm will likely pass north of Pohnpei Island, bringing gusty southwest winds into the State. In the longer term, there is a slight risk of drought across most of Pohnpei State in early 2015, contingent on the development of El Niño. A strong El Niño can bring a severe prolonged drought to Pohnpei, but during a weak or moderate El Niño, the State can also experience near normal to slightly wet conditions. Forecasts for the next seasons (OND, NDJ, and DJF) indicate normal to marginally higher sea level (0 to +1inches above) for Pohnpei.

Predicted rainfall for Pohnpei State from October 2014 through September 2015 is:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>	
	Pohnpei Island and Atolls	Kapingamarangi
Oct - Dec 2014	100% (47.68in)	100% (21.73in)
Jan - Mar 2015	900%	100%
Apr - Jun 2015	95%	95%
Jul – Sep 2015	100%	95%*

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

\* Note: if La Niña returns in 2015, then while rainfall recovers across most of Pohnpei State, the rainfall at Kapingamarangi gets less.

**Kosrae State:** The total rainfall for the first 9 months of 2014 was slightly below average at all Kosrae reporting sites. The monsoon trough extended to Kosrae during April, with accompanying heavy rains. An early appearance of the monsoon (i.e., westerly winds) is a typical sign of impending El Niño. During May and June, the monsoon trough weakened and winds became light easterly at Kosrae. Rainfall was near average to below average. During July, monsoonal westerlies

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returned, bringing abundant rainfall from its associated tropical disturbances. During August, there was another break in the monsoon across most of Micronesia as enhanced rainfall and tropical cyclone development shifted into the region of the ITCZ in the central and eastern Pacific. August was a very dry month on Kosrae. September continued the August dry spell, but the monsoon returned and helped spawn two tropical cyclones (Phanfone and Vongfong) that formed in the Marshall Islands and passed close-by to the north of Kosrae in their developmental stages on the 27th of September and the 2nd of October, respectively. Heavy rain showers were the only effects of these tropical cyclones on Kosrae. No reports of damaging sea inundation were received from Kosrae.

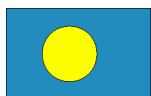
<b>Kosrae State Rainfall Summary: 3rd Quarter 2014 and first 9 months</b>						
Station		Jul	Aug	Sep	3 Qtr	9-Month
<b>Airport (SAWRS)</b>	<b>Inches</b>	<b>26.06</b>	<b>8.32</b>	<b>11.00</b>	<b>45.38</b>	<b>146.32</b>
	<b>% Avg</b>	<b>153%</b>	<b>50%</b>	<b>64%</b>	<b>90%</b>	<b>92%</b>
<b>Utwa</b>	<b>Inches</b>	<b>28.19</b>	<b>10.89</b>	<b>11.31</b>	<b>50.39</b>	<b>150.90</b>
	<b>% Avg</b>	<b>166%</b>	<b>66%</b>	<b>66%</b>	<b>99%</b>	<b>95%</b>

**Climate Outlook:** Episodes of unusual westerly winds will likely be experienced on Kosrae through mid-January. Rainfall totals for the remainder of 2014 should be near or slightly above average. Through January 2015, there remains an elevated risk of a tropical storm passing close to Kosrae. Looking forward into early 2015 (January through May), there is a risk of drier than average conditions; however in the absence of a moderate or strong El Niño, we do not expect dryness to be severe.

Predicted rainfall for Kosrae State from October 2014 through September 2015 is:

<b>Inclusive Period</b>	<b>% of long-term average / Forecast rainfall (inches) <sup>1</sup></b>
<b>October – December 2014</b>	<b>110% (51.26in)</b>
<b>January – March 2015</b>	<b>95%</b>
<b>April – June 2015</b>	<b>90%</b>
<b>July - September 2015</b>	<b>95%</b>

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.



**Republic of Palau:** The monthly rainfall distribution at Palau during the first nine months of 2014 is representative of most of the rest of Micronesia: very wet conditions during January, April, July and September; and relatively dry conditions during February, March, May, June and August. The total rainfall during the 3rd Quarter and during the first 9 months of 2014 was near average (e.g., 102% at Koror) to above average (e.g., 123% at the International Airport based on the WSO average). However, the International Airport is usually wetter than the WSO, and the PEAC will likely generate a new set of averages for the Airport at the end of the year. Roughly half of the western North Pacific

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basin’s output of tropical cyclones (through October 2014) passed close enough to Palau to influence the weather there in some way (e.g., a period of enhanced showers and thunderstorms and/or an increase in the strength of the monsoon westerly winds). Persistent monsoonal flow was observed at Palau during most of the 3rd Quarter. The windiest month at the Koror WSO was July, with September coming in second place. On some days during July, September and early October, wind gusts of 30 mph were observed at Koror. No reports, however, were received of any severe impacts from gusty winds or heavy rain showers. A long monsoon break occurred during August, with lighter winds, less rainfall, less cloudiness and higher temperatures. So far during 2014, there has been a continual fall of the mean sea level in Palau as recorded at the tide gauge located in Malakal. The monthly mean sea level in Malakal displayed a rapid fall in the last couple of months. While the sea level anomaly in January was +7.6inches above normal, Palau touched the normal value in April (+0.3inch above). In September, it was -1.0inch below. Currently, it stands at -0.3inch below normal.

<b>Republic of Palau Rainfall Summary: 3rd Quarter 2014 and first 9-months</b>						
Station		Jul	Aug	Sep	3rd Qtr	9- Month
<b>Koror (WSO)</b>	<b>Inches</b>	<b>22.45</b>	<b>10.40</b>	<b>16.10</b>	<b>48.95</b>	<b>110.80</b>
	<b>% Norm</b>	<b>124%</b>	<b>70%</b>	<b>136%</b>	<b>109%</b>	<b>102%</b>
<b>Intl. Airport</b>	<b>Inches</b>	<b>23.82</b>	<b>12.71</b>	<b>20.20</b>	<b>56.73</b>	<b>136.83</b>
	<b>% Norm</b>	<b>132%</b>	<b>85%</b>	<b>170%</b>	<b>126%</b>	<b>123%</b>

**Climate Outlook:** Near average rainfall is anticipated across the Republic of Palau over the next few months. If a typhoon were to pass close enough to Palau, an extreme daily rain event could push an otherwise dry month to above average. During November 2014 through January 2015, the risk of a tropical cyclone passing near Palau will be near average (about 15%). A longer term risk is the possible onset of El Niño-related dry conditions beginning in late 2014 and extending into the first few months of 2015. We anticipate a high likelihood of monthly rainfall less than 6 inches (less than 65% of average) during any one or two of the months in the period February 2015 through May 2015. Severe drought conditions are not foreseen at this time. Forecasts for the next seasons (OND, NDJ, and DJF) indicate near normal sea level (0 to +1inch) for Palau.

Predicted rainfall for Palau from October 2014 through September 2015 is:

<b>Inclusive Period</b>	<b>% of long-term average / Forecast rainfall (inches) <sup>1</sup></b>
<b>October – December 2014</b>	<b>105% (39.23in)</b>
<b>January - March 2015</b>	<b>90%</b>
<b>April - June 2015</b>	<b>85%</b>
<b>July - September 2015</b>	<b>100%</b>

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.



**Republic of the Marshall Islands:** The monthly rainfall distribution in the RMI during the

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first 9 months of 2014 was somewhat similar to its distribution across all of Micronesia: a very wet April; relative dryness during May and June; a wet July; and a dry August followed by a wet September. The 9-month sum of rainfall was above-average at most of the atolls of the RMI. Only the two of the northern atolls, Wotje and Utirik, measured a 9-month rainfall sum that was below average. Two tropical disturbances formed in the RMI in late September that were the seeds for typhoons Phanfone and Vongfong after moving out of the RMI to the west. On August 7, Hurricane Genevieve crossed the 180° meridian into the western North Pacific basin at Category 4 (130-kt sustained wind) super typhoon status, and later the same day, the Joint Typhoon Warning Center (JTWC) upgraded the system to a Category 5 (> 135 kt) super typhoon. Genevieve tracked at a safe distance from the most heavily populated atolls of the RMI. At closest approach it was about 700nmi to the northeast of Kwajalein and 500 n mi to the northeast of Utirik. After Genevieve’s dissipation well north of Wake Island on the 11th of August, the RMI (and the rest of Micronesia) entered a month-long hot dry spell.

The very high rainfall in the RMI during this year’s dry season, unusual occurrences of westerly wind, the formation of tropical cyclones in RMI waters, and the approach toward the RMI of tropical cyclones from the Central Pacific are canonical signs of El Niño. Another typical sign of El Niño is a Micronesia-wide fall of sea level. During the course of the first 9 months of 2014, the sea level dropped considerably in the RMI and at other locations across Micronesia. However, NOAA’s El Niño index (based on the SST in an equatorial region just east of the Date Line) is still in ENSO-neutral territory. We are still confident that the index will cross the El Niño threshold at some time during November 2014 through January 2015.

During the 7th through the 10th of October, a long-period south-southeast swell affected Majuro. Some minor road flooding was reported. This latest coastal inundation episode at Majuro was caused by a combination of long-period S-SE swells and spring high tides. The S-SE swells were generated by fresh winds near and east of American Samoa on the 4th of October 4. These swells began to arrive in the RMI on the 7th and reached peak heights on the 9th. The worst inundation occurred during the two high tides of October 9. Moderate inundations (estimated at 2 feet) were reported along the south facing shores of Majuro Atoll. Areas affected included Delap Point, Batkan Bridge, Jable and Rairok. The monthly mean sea level in Kwajalein and Majuro continued to fall rapidly in the last couple of months. Currently for both islands the sea level stand is marginally above normal.

RMI Rainfall Summary: 2014 3rd Quarter and first 9 months						
Station		Jul	Aug	Sep	3rd QTR	9– Month
RMI Northern Atolls						
Kwajalein	Inches	11.88	5.61	9.49	26.98	87.60
	% Avg	114%	55%	80%	83%	123%
Wotje	Inches	16.59	7.81	9.31	33.71	56.82
	% Avg	167%	81%	83%	110%	84%
Utirik	Inches	7.73	6.52	8.00*	22.25	43.64
	% Avg	87%	76%	80%	80%	72%

\* Station percents based on Majuro WSO averages

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RMI Rainfall Summary: 2014 3rd Quarter and first 9 months						
Station		Jul	Aug	Sep	3rd QTR	9– Month
RMI Central and Southern Atolls						
Majuro WSO	Inches	22.49	9.63	14.93	47.05	115.50
	% Avg	226%	68%	85%	123%	122%
Mili	Inches	17.18	10.44	16.15	43.77	112.95
	% Avg*	132%	91%	130%	118%	122%
Aling-laplap	Inches	13.36	8.27	11.35	32.98	82.15
	% Avg*	114%	76%	94%	95%	100%
Arno	Inches	17.71	7.65	20.29	45.65	135.62
	% Avg*	136%	66%	163%	124%	146%

\* Estimated

**Climate Outlook:** The weather patterns throughout the RMI so far during 2014 are consistent with a developing El Niño. The atolls of the RMI are typically very wet during an El Niño year. The normal progression of El Niño-related rainfall is for wet conditions to persist through October, with high month-to-month variability, and then toward the end of the year, dry conditions arrive and persist through the early part of the following year. The magnitude and duration of dry conditions depend on the strength of El Niño. At this time, we do not foresee severe widespread drought in the RMI, but a month or two of very dry conditions could occur on any atoll (particularly north of 7° N) during February through May of 2015.

The risk of a tropical cyclone in the RMI is almost wholly dependent upon El Niño. The greatest threat is during November through January, but El Niño-related typhoons have occurred during other months. During the summer months, tropical cyclones tend to pass well to the north of the RMI, and affect Wake Island and sometimes even Midway Island. Historical El Niño-related tropical cyclones in the RMI include: The November 1918 Typhoon that killed over 200 people, Typhoon Zelda (November ‘91), Typhoon Axel (January ‘92), and Typhoon Paka (December ‘97). Typhoon Gay severely affected some of the atolls of the RMI in November 1992, which was a year not universally accepted as a continuation of the ‘91 El Niño, but it certainly occurred during a decade dominated by El Niño. Forecasts for the next seasons (OND, NDJ, and DJF) indicate slightly higher than normal sea level of up to +2inches for the RMI.

Predicted rainfall for the RMI from October 2014 through September 2015 is:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>		
	South of 6°N	6°N to 8°N	North of 8°N
Oct – Dec 2014	110% (41.85in)	110% (41.85in)	110% (33.16in)
Jan – Mar 2015	100%	90%	90%
Apr – Jun 2015	90%	80%	75%
Jul – Sep 2015	95%	100%	95%

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

SEASONAL RAINFALL OUTLOOK FOR THE US-AFFILIATED PACIFIC ISLANDS

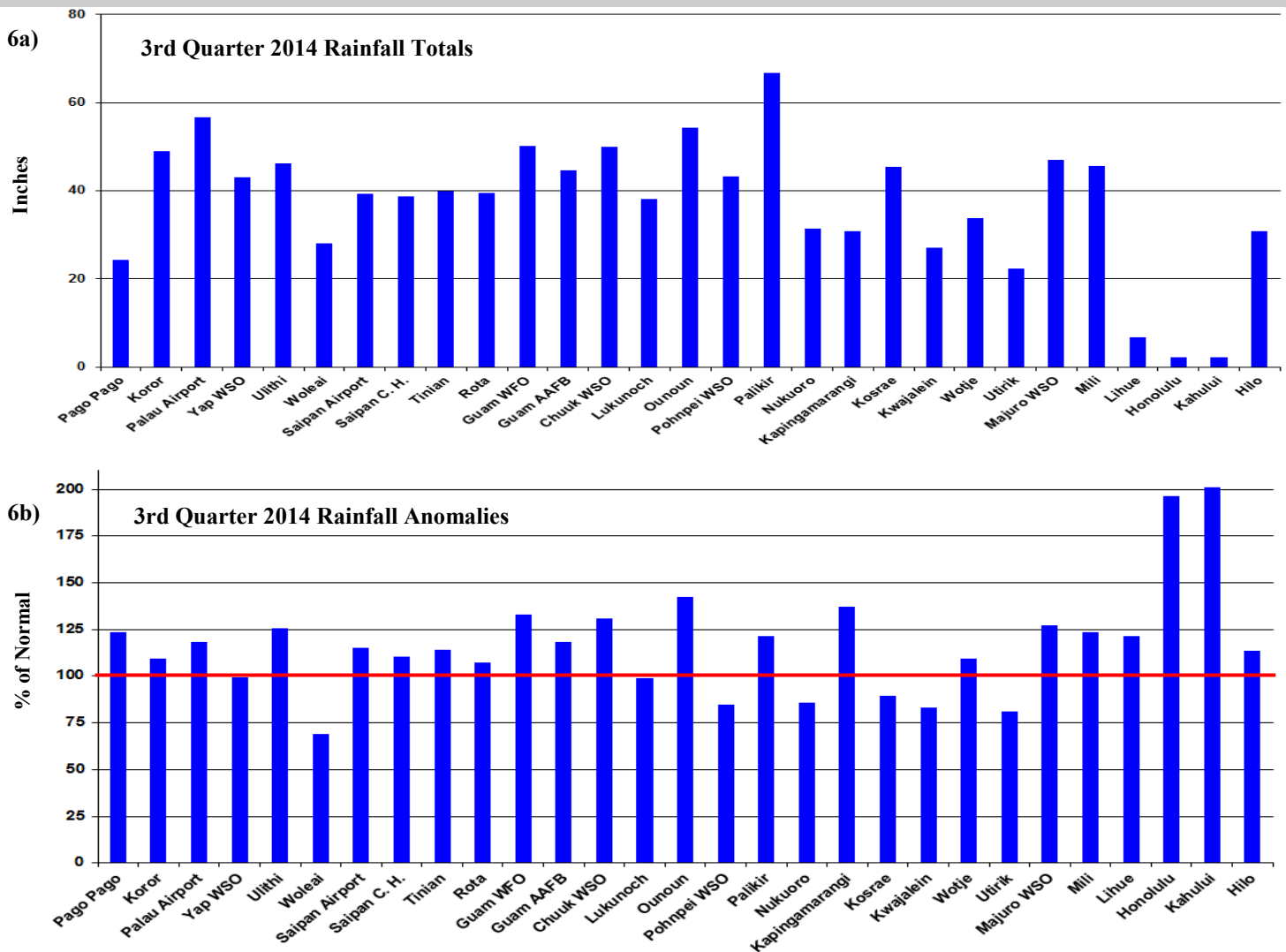


Figure 6a and 6b, 2014 July, August, September (JAS) totals (a) in inches and (b) anomalies (expressed as % of average). In 6b, solid line indicates normal rainfall (100%).

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 HIG #340, 2525 Correa Road, Honolulu, Hawai'i 96822  
 LTJG G. Carl Noblitt IV, Pacific Region Climate Officer, at 808-956-2324: for information on PEAC, the Pacific ENSO Update and ENSO-related climate data for the Pacific Islands.  
 Dr. Rashed Chowdhury, Principal Research Scientist, at 808-956-2324: for information on ENSO and sea level variability in the USAPI.  
 Alejandro Ludert, Graduate Research Assistant and Webmaster, at 808-956-2324 for: information related to the PEAC website.

**University of Hawai'i - Joint Institute of Marine and Atmospheric Research (JIMAR), School of Ocean and Earth Science and Technology (SOEST), Department of Oceanography:**  
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**NOAA National Weather Service Weather Forecast Office (WFO) Guam:**  
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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](mailto:peac@noaa.gov) or at the address listed below.

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