pacific ENSO update

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Pacific ENSO Update

*The **Pacific ENSO Update** is a bulletin of the **Pacific El Niño-Southern Oscillation (ENSO) Applications Center (PEAC).** 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, with additional special reports on important changes in ENSO conditions as may be required from time to time.*

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CURRENT CONDITIONS

With few exceptions, the weather and climate of Micronesia through September 2005 has been unremarkable. Abundant (but not excessive) rainfall occurred at most islands. Other than very dry conditions throughout most of Micronesia in February, there were few noteworthy monthly anomalies, and very few noteworthy short-term extreme events. The number of tropical cyclones in the western North Pacific basin has been lower than average, and tropical cyclone formation was north and west of normal, keeping most of the tropical storms and typhoons away from Micronesia. Typhoon Nabi affected Saipan on the last day of August with high winds and heavy rain. Damage was relatively light, and the island was back to normal within a few days of the passage of this tropical cyclone. In American Samoa, rainfall has been above normal throughout the year with the most dramatic weather events occurring in February. During February, several hurricanes passed near American Samoa with Hurricane Olaf causing substantial damage.

According to the U.S. Climate Prediction Center (CPC), the climate of the tropical Pacific is now in **ENSO Neutral**, and has been in this state since El Niño conditions abated in early 2005. The islands of Micronesia are typically drier than normal in the first few months of the year following an El Niño. Also, during the entire year that follows an El Niño event, the month-to-month variability of rainfall is not as great as it is during El Niño (primarily a result of the westward shift of tropical cyclone activity).

During July, August, and September 2005, most of the islands of Micronesia had abundant rainfall (**Fig. 1a, 1b**). Only some of the islands in the northern portion of the RMI experienced persistent dryness that was considerably less than what is normally expected. 3- month July through September rainfall totals below 80% were experienced only in the northern islands of the RMI, including Kwajalein, Utirik, and Wotje. 3-month July through September rainfall

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CURRENT CONDITIONS

totals in excess of 120% of normal were experienced at islands in several groups: American Samoa (Pago Pago and Aafasou), Palau (Koror), Yap (Woleia), the CNMI (Saipan Capitol Hill and Rota), Guam (only at Andersen Air Force Base), and at some of the atolls of Pohnpei (Nukuoro and Kapingamarangi). The highest rainfall total recorded in Micronesia for the 3rd Quarter (JAS) of 2005 was 59.25 inches at Palikir on Pohnpei Island. The lowest recorded three month rainfall total during the 3rd Quarter of 2005 was 14.27 inches of rain at Wotje, RMI. Abundant (but not excessive) rainfall is anticipated throughout most of Micronesia and American Samoa for the next three to six months. Many of the islands of Micronesia north of 10° North Latitude will soon enter their dry season. Three or four tropical storms may form in the central Caroline Islands in the remaining months of

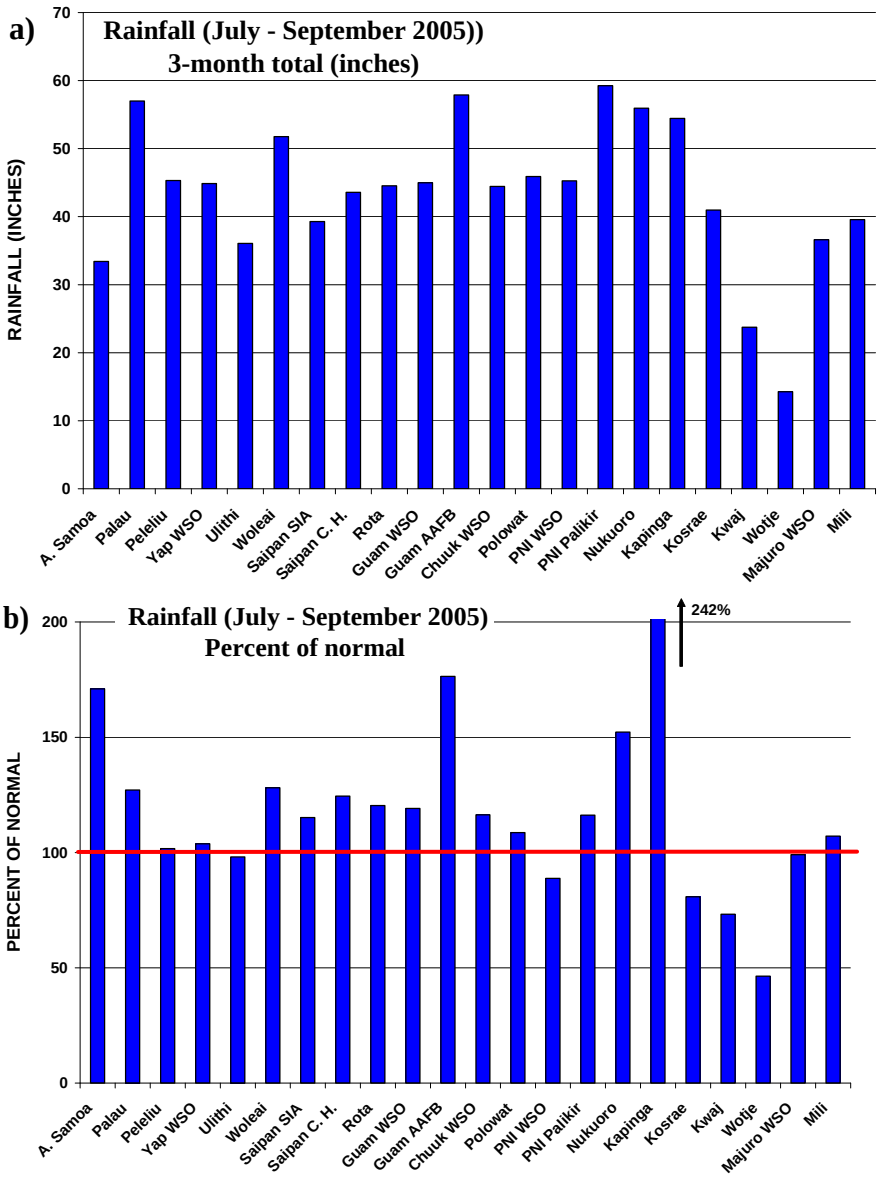


Figure 1. (a) Rainfall totals in inches and **(b)** anomaly (expressed as percent of normal) at the indicated islands for the 3rd quarter of 2005.

CURRENT CONDITIONS

2005 into January of 2006. One or two of these tropical storms could become a typhoon after moving out of the Caroline Island Group and then threaten Guam, the CNMI, or Yap State. This is normal (see each island summary for the meaning of a "normal" tropical cyclone threat).

The general consensus among international computer climate forecasts is for a **continuation of ENSO Neutral conditions for the next six months**. For more information, see the CPC EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION for October on p. 12.

SEA SURFACE TEMPERATURE (SST)

By the end of September 2005, equatorial SST anomalies greater than +0.5ºC were found between 160ºE and 170ºE (in the vicinity of Kapingamarangi), while negative anomalies cooler than –0.5ºC were observed at most locations between 130ºW and the South American coast.

Accompanying the warmer than normal SST in the region of Kapingamarangi, the subsurface water was about 1° C warmer than normal to a depth of 100 meters. In the eastern equatorial Pacific, the slightly cooler SST was underlain by water up to 2º C cooler than normal to a depth of 150 meters.

SOUTHERN OSCILLATION INDEX (SOI)

The middle of June saw a sharp rise in the 30-day SOI, returning to near zero. It has generally remained near zero since. The official monthly SOI for September was +0.4. For July and August, the monthly values of the SOI were 0.0 and -0.8 respectively. The 5-month running mean centered on July was approximately - 0.3. **With the climate expected to continue in a state of ENSO Neutral, the SOI should average near zero** for the next three to six months, with month to month fluctuations within the range of -1.0 to +1.0.

TROPICAL CYCLONE

TROPICAL CYCLONE SUMMARY

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). Western North Pacific tropical cyclone names are obtained from warnings issued by the Japanese Meteorology Agency (JMA). 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. Differences in the statistics (e.g., storm maximum intensity) for a given tropical cyclone among the agencies may occur; these are noted in this summary when appropriate.

By many measures, the Northern Hemisphere tropical cyclone season of 2005 will go down in history as one of the most active years ever seen in the North Atlantic Basin. Elsewhere, however, the TC activity was reduced. Through September 2005, the JTWC numbered 19 tropical cyclones in the western North Pacific. The JMA provided names for all of these. Normally there are approximately 22 numbered tropical cyclones in the western North Pacific basin during through September.

Only one of the year's tropical cyclones in the western North Pacific Basin, Nabi, adversely affected Micronesia. It went north of Saipan on 31 August and caused some moderate wind damage to vegetation (for more information see p.4). While in their early formative stages, about half of the tropical cyclones of the western North Pacific occurring through September 2005 brought some rainfall to the islands in the northwestern portions of Micronesia: Guam, the CNMI, Yap, and Palau.

PEAC TROPICAL CYCLONE OUTLOOK

In the 2nd Quarter Newsletter, the PEAC outlook for **tropical cyclones** in the **western North Pacific basin during 2005 was for no above-normal activity** in any category (e.g., number of typhoons and number of intense typhoons). Through September of 2005, this has held true, with numbers of tropical cyclones below normal, and locations of tropical cyclones shifted to the west and north of normal. For the remainder of the year (November and December) and into January 2006, we anticipate that three or four tropical cyclones will develop as far east as Pohnpei and then move west and northwest to track past Chuuk, Guam, the CNMI, Yap, and Palau as tropical storms, with one of them possibly a typhoon. This is an average number

TROPICAL CYCLONE

of such tropical cyclones for the affected regions of Guam, the CNMI, Yap, and Palau. No typhoons or tropical storms are anticipated for Pohnpei, Kosrae, or the RMI.

According to NIWA's Island Climate Update, the **South Pacific tropical cyclone season**, from November to May, is likely to be **near average** in both intensity and frequency due to the ENSO Neutral conditions. ENSO neutral conditions average approximately 9 tropical cyclones in the entire Southwest Pacific Basin with 4 reaching hurricane force winds (74 mph) and 2 reaching over 100 mph. For specific tropical cyclone information for American Samoa see the American Samoa Climate Outlook below.

LOCAL SUMMARY AND FORECAST

American Samoa: Now in its dry season, the total rainfall of 33.42 inches at Pago Pago WSO during the 3rd Quarter of 2005 was substantially wetter than normal (171%) with most of the rainfall occurring in August and September. July rainfall was near to below normal (95% of normal) to below normal (55% of normal). August and September rainfall was significantly above normal with rainfall at Pago Pago airport approximately double the normal amount (211% and 196% respectively). During September, heavy rains caused significant small stream flooding and landslides across Tutuila. Overall, rainfall has been above normal for the first nine months of 2005 (140% of normal).

America Samoa Rainfall Summary 3rd Quarter 2005

Station		Jan.	Feb.	Mar.	Total
Pago Pago WSO	**Rainfall (inches)**	5.43	13.56	14.43	**33.42**
	% of Normal	94%	211%	196%	**171%**
Aafasou	**Rainfall (inches)**	6.35	20.95	22.00	**49.30**
	% of Normal	55%	167%	157%	**126%**

Climate Outlook:

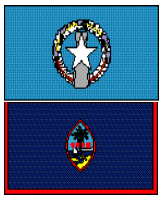
The **tropical cyclone threat for the 2005/2006 tropical cyclone season** is expected to be **near normal**. According to NIWA's Island Climate Update, normal for Samoa is one to two tropical cyclones passing within 300 nm of Samoa/American Samoa over the November through May period <http://www.niwascience.co.nz/ncc/icu/2005-10/article>.

Despite a long run of above normal rainfall at American Samoa, computer forecasts and a consensus of outlooks from several regional meteorological centers suggest **rainfall** in American Samoa will be **near normal** through the upcoming rainy season. Long-range computer rainfall forecasts, however, have only limited skill in the tropical Pacific islands.

LOCAL SUMMARY AND OUTLOOK

Predicted rainfall for American Samoa from November 2005 through October 2006 is:

Inclusive Period	% of long-term average
Nov - Dec 2005 (Onset of Rainy Season)	110%
Jan 2006 - Apr 2006 (Heart of Next Rainy Season)	100%
May - Oct 2006 (Next Dry Season)	100%



Guam/CNMI: Rainfall on most of Guam during the 3rd Quarter of 2005 was abundant (especially on the north side of the island at Andersen Air Force Base). The 3-month total of 44.99 inches at the Guam International Airport (GIA) in central Guam was 119 % of normal. Localized heavy daily rainfall in excess of 5 inches occurred twice during August at AAFB pushing that station's August total to 28.33 inches (213%). By contrast, at the GIA, the August total was 17.98 inches (133%). Ironically, the 3rd Quarter 2005 rainfall of 57.90 inches at AAFB was one of Micronesia's highest, and was second only to the 59.25 inches recorded at Palikir on Pohnpei Island. That AAFB could have one of Micronesia's highest rainfall values for this quarter is testimony more to the tranquil nature of 2005 throughout Micronesia rather than of adverse weather at AAFB. The rainfall extremes also reflect this year's tranquility. For Guam during June through September of last year (2004) there were twelve days with rainfall 2 inches and four days in excess of 4 inches at the GIA; this year during June through September, there have been seven and two such days at the GIA, respectively.

Guam and CNMI Rainfall Summary 3rd Quarter 2005

Station		Jul.	Aug.	Sep.	Total
Guam International Airport	Rainfall (inches)	9.72	17.98	17.29	**44.99**
	% of Normal	92%	131%	128%	**119%**
Anderson Air Force Base	Rainfall (inches)	10.14	28.33	19.43	**57.90**
	% of Normal	93%	211%	146%	**154%**
University of Guam	Rainfall (inches)	6.07	18.06	14.76	**38.89**
	% of Normal	N/A	N/A	N/A	**N/A**
Saipan International Airport	Rainfall (inches)	8.96	18.23	12.10	**39.29**
	% of Normal	111%	146%	90%	**115%**
Capital Hill	Rainfall (inches)	11.09	20.87	11.61	**43.57**
	% of Normal	123%	167%	86%	**124%**
Tinian Airport	Rainfall (inches)	10.60	22.45	8.40	**41.45**
	% of Normal	118%	180%	62%	**118%**
Rota Airport	Rainfall (inches)	12.11	15.99	16.45	**44.55**
	% of Normal	116%	121%	123%	**120%**

* Long term normal is not established for these sites

LOCAL SUMMARY AND FORECAST

During the 3rd Quarter of 2005, most of the CNMI rainfall stations reported slightly less total rainfall than on Guam (in inches), but slightly higher as a percent of normal. Saipan International Airport (SIA) and Capitol Hill experienced 115% of normal and 124% of normal, respectively. The heavy rains (6-9 in.) from Typhoon Nabi represented a large portion of Saipan's total rainfall for the quarter. Rainfall on Rota was also almost equal to that at the GIA on Guam with a 3-month total of 44.55 inches, or 120% of normal. Tinian reported 41.45 inches or 118% of normal.

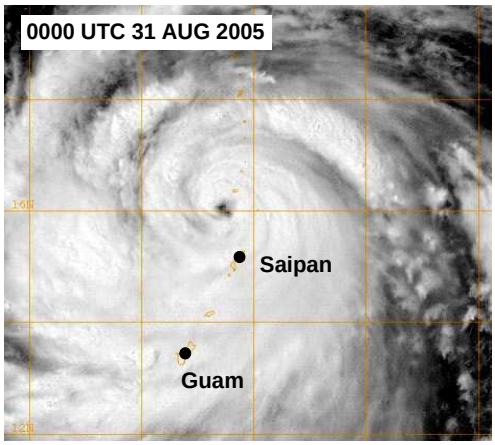


Figure 2. Typhoon Nabi. The eye is located approx. 100 miles north-northwest of Saipan in this visible satellite image taken at 10 a.m Saipan/Guam local time, August 31.

During the night of 30 August and into the morning hours of 31 August, Typhoon Nabi passed approximately 40 miles to the north of Saipan. Wind gusts of over 75 mph were likely experienced on parts of the Island. Damage to vegetation on the north side of the island (personally observed by UOG Meteorologist Mark Lander) was consistent with that of a Category 1 typhoon. The SIA, the public utilities, businesses and homes suffered only minimal damage. Saipan and Guam experienced very high surf for several days after Nabi's passage.

Climate Outlook:

The tropical cyclone distribution in the western North Pacific basin through September of 2005 was typical for a year that follows an El Niño event. The numbers of tropical cyclones have been below normal and the formation region has been west and north of normal. During the months of **November 2005 through January 2006**, the formation region of tropical cyclones is expected to expand into the Caroline Islands, resulting in a **near normal threat of a typhoon for Guam and the CNMI** during these three

LOCAL SUMMARY AND FORECAST

months. Thus, two tropical storms and possibly one typhoon should pass within 200 miles of any Guam and CNMI location between November 2005 to January 2006. The time of greatest threat will be November through mid-December. Dangerous surf from a typhoon does not require that the typhoon pass close to any location; at least one episode of dangerous typhoon-generated waves will occur. Every year several lives are lost due to hazardous surf.

Rainfall is anticipated to be near normal for Guam and the CNMI for the remainder of 2005 and through the next dry season. The rainy season of 2006 should begin on time in July 2006, with abundant (but not excessive rains) thereafter.

Predicted rainfall for the Mariana Islands from November 2005 through October 2006 is as follows:

Inclusive Period	% of long-term average	
	Guam/Rota	Saipan/Tinian
Nov -Dec 2005 (Onset of Next Dry Season)	110%	100%
Jan - May 2006 (Next Dry Season)	95%	90%
Jun - Jul 2006 (Onset of Next Rainy Season)	100%	100%
Aug - Oct 2006 (Heart of Rainy Season)	120%	110%

Federated States of Micronesia

Yap State: During the 3rd Quarter of 2005, the rainfall totals at most stations in Yap State were slightly above normal, with most stations reporting 3-month totals of approximately 45 to 55 inches. On Yap Island, the wettest 3-month total was 57.50 inches recorded at Gilman, and the lowest was 43.97 inches recorded at Tamil. In the whole of Yap State, Ulithi had the lowest quarterly rainfall total of 36.06 inches and was the only station with rainfall below 100% of normal. Farther south at Woleai Atoll, the quarterly rainfall of 51.77 inches was about the same as on Yap Island, and was 128% of normal.

Yap State Rainfall Summary 3rd Quarter 2005

Station		Jul.	Aug.	Sep.	Total
Yap WSO	Rainfall (inches)	16.97	16.70	11.20	**44.87**
	% of Normal	117%	110%	83%	**104%**
Dugor*	Rainfall (inches)	17.99	16.96	11.23	**46.18**
Gilman*	Rainfall (inches)	20.69	22.56	14.25	**57.50**
Luweech*	Rainfall (inches)	18.89	18.57	16.22	**53.68**
Maap*	Rainfall (inches)	16.50	16.63	11.49	**44.32**
North Fanif*	Rainfall (inches)	19.58	14.11	10.63	**44.62**
Rumung*	Rainfall (inches)	20.72	14.89	14.81	**50.42**
Tamil*	Rainfall (inches)	15.30	17.66	11.01	**43.97**
Ulithi	Rainfall (inches)	9.51	16.77	9.78	**36.06**
	% of Normal	77%	130%	85%	**98%**
Woleai	Rainfall (inches)	16.46	17.22	18.09	**51.77**
	% of Normal	118%	117%	155%	**128%**

* Long term normal is not established for these sites.

LOCAL SUMMARY AND FORECAST

Climate Outlook:

The **tropical cyclone threat** for the remaining two months of 2005 should be **near normal**. During the months of November and December 2005 and into January 2006, approximately 1 or 2 tropical cyclones should pass close enough to Yap (and/or its outer islands) to cause gales. The threat of a direct strike by a typhoon at Yap Island and at Ulithi is roughly one-half to two-thirds that of Guam and the CNMI. The threat is even less further south at Woleai. While we expect no direct strikes by a typhoon on any island or atoll of Yap State in the remainder of 2005 through January 2006, residents should always be prepared for the possibility.

Predicted rainfall for Yap State from November 2005 through October 2006 is as follows:

Inclusive Period	% of long-term average	
	Yap and Ulithi	Woleai
Nov – Dec 2005 (End of This Rainy Season)	100%	110%
Jan 2006 - May 2006 (Next Dry Season)	95%	100%
Jun 2006 – Aug 2006 (Next Rainy Season)	100%	100%

Chuuk State: Rainfall was near normal through most of Chuuk State during the 3rd Quarter of 2005. 3-month totals across the State were generally in the range of 35 to 45 inches. The WSO Chuuk was one of the wettest locations during this quarter with a 3-month total of 44.44 inches, or 116% of normal. At the WSO, September was particularly wet with 21.85 inches (190%). As it was for the first half of 2005, Polowat was again the wettest location in Chuuk State, with a total of 45.90 inches (109%) during the 3rd Quarter of 2005.

Climate Outlook:

The **tropical cyclone threat** for Chuuk State during the remaining months of 2005 is expected to be **near normal.**

Normal indicates that one or two tropical storms and one typhoon should pass near some parts of Chuuk State, accompanied by gales and high surf. A direct hit by a typhoon at any of the islands and atolls of Chuuk State is not expected.

Based on a continuation of ENSO Neutral conditions for the rest of 2005, **rainfall** at islands in the Chuuk Lagoon and on the atolls of Chuuk State **should be near normal through February of 2006,** then perhaps be slightly wetter than normal in the spring when the tradewind trough becomes established in the region.

LOCAL SUMMARY AND FORECAST

Chuuk Rainfall Summary 3rd Quarter 2005

Station		Jul.	Aug.	Sep.	Total
Chuuk Lagoon					
Chuuk WSO	**Rainfall (inches)**	11.72	10.87	21.85	**44.44**
	% of Normal	97%	75%	190%	**116%**
Piis Panew*	**Rainfall (inches)**	6.32	10.38	11.57	**28.27**
Xavier High School*	**Rainfall (inches)**	12.20	13.71	N/A	**N/A**
Mortlocks					
Lukunoch*	**Rainfall (inches)**	10.15	13.94	9.34	**33.43**
Ettal*	**Rainfall (inches)**	11.28	22.55	6.20	**40.03**
Ta*	**Rainfall (inches)**	10.62	16.36	9.48	**36.46**
Hall Islands					
Fananu*	**Rainfall (inches)**	10.88	10.95	15.39	**37.22**
Eastern Atolls					
Losap*	**Rainfall (inches)**	14.78	18.44	11.38	**44.60**
Nama*	**Rainfall (inches)**	13.50	11.41	115.33	**40.24**
Western Atolls					
Polowat	**Rainfall (inches)**	7.57	18.93	19.40	**45.90**
	% of Normal	54%	126%	146%	**109%**

* Long term normal is not established for this site
N/A Not Available

Predictions for Chuuk State from November 2005 through October 2006 are as follows:

Inclusive Period	% of long-term average			
	Losap/Nama	Polowat	Hall Is.	Mortlocks
Nov - Dec 2005	105%	105%	100%	100%
Jan - Mar 2006	100%	100%	95%	100%
Apr - Jun 2006	120%	120%	100%	110%
Jul - Oct 2006	100%	100%	100%	100%

Pohnpei State: The rainfall total for the 3rd Quarter of 2005 at the Pohnpei WSO (on the north side of Pohnpei Island) was 45.26 inches (89% of normal). At Palikir on the west side of Pohnpei Island, the rainfall total of 59.25 inches (116% of normal) was much wetter than at the WSO. The Palikir rainfall was the highest 3-month total recorded at any official recording station in Micronesia during the 3rd Quarter of 2005. Rainfall totals on the east side of Pohnpei Island (near Nan Madol) and the south side of Pohnpei Island (at Enipein School) were generally drier

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than the totals at the WSO and at Palikir. On the top of the highest mountain (Nahna Laud) in the middle of Pohnpei Island, a total of 68.97 inches of rainfall was recorded during the period 01 July through 15 September 2005. The University of Guam and the Conservation Society of Pohnpei have been recording the rain on top of Nahna Laud since June 2003.

Pohnpei Rainfall Summary 3rd Quarter 2005

Station		Jul.	Aug.	Sep.	Total
Pohnpei Island					
Pohnpei WSO	**Rain (inches)**	14.08	10.84	20.34	**45.26**
	% of Normal	77%	66%	127%	**89%**
Palikir	**Rain (inches)**	17.98	18.35	22.92	**59.25**
	% of Normal	98%	111%	143%	**116%**
Enipein	**Rain (inches)**	11.14	10.34	N/A	**N/A**
Nan Madol	**Rain (inches)**	9.56	9.19	17.41*	**36.16****
Nahna Laud	**Rain (inches)**	24.41	25.21	19.35*	**68.97****
Atolls of Pohnpei State					
Nukuoro	**Rain (inches)**	21.67	19.23	15.05	**55.95**
	% of Normal	155%	169%	140%	**152%**
Pingelap	**Rain (inches)**	N/A	13.75	14.89	**N/A**
	% of Normal		93%	99%	
Mwokilloa	**Rain (inches)**	N/A	10.44	24.08	**N/A**
Kapinga-marangi	**Rain (inches)**	17.09	18.82	18.54	**54.45**
	% of Normal	164%	306%	315%	**242%**

* Gauge read on 15 September. ** 01 Jul. through 15 Sep. 2005

The rainfall at the atolls of Pohnpei State was abundant, and exceeded the amounts at the WSO on Pohnpei Island at Nukuoro and at Kapingamarangi. The 3rd quarter total of 54.45 inches at Kapingamarangi was 242% of the normal rainfall for the period. Rain has been abundant on Kapingamarangi for many months now. This atoll (near the equator and south of Pohnpei Island) normally experiences a period of dry weather during the months of July through October, with less than ten inches per month. Abundant rainfall there may be related to the persistent warmer than normal sea surface temperatures in that region.

LOCAL SUMMARY AND FORECAST

Climate Outlook:

During 2005, the tropical cyclones of the western North Pacific have been forming to the west and north of normal. Thus, a direct strike by a tropical storm or a typhoon is unlikely at any island in Pohnpei State for the remainder of 2005 into the spring of 2006. Pohnpei is located close enough to the equator so that a direct strike by a typhoon is unlikely in any case (although one intense typhoon occurred 100 years ago during the El Niño year of 1905).

Based on ENSO Neutral conditions persisting for the next six months, **rainfall** at Pohnpei Island and at Pohnpei's atolls should be **near normal** for the next three to six months, and then potentially wetter than normal on Pohnpei Island and atolls to the east and west when the tradewind trough becomes established in the region by April 2006. Kapingamarangi may be wetter than normal for a few more months (as long as the SST remains above normal in that area), but the rainfall on this island should return to normal sometime in mid 2006.

Predicted rainfall for Pohnpei State from November 2005 through October 2006 is as follows:

Inclusive Period	% of long-term average	
	Pohnpei Islands/ Atolls	Kapingamarangi
Nov- Dec 2005	100%	120%
Jan - Mar 2006	100%	110%
Apr- Jun 2006	110%	100%
Jul - Oct 2006	100%	100%

Kosrae State: During the 3rd Quarter of 2005, rainfall totals on Kosrae were slightly drier than normal. The 3-month rainfall total of 40.98 inches at the Kosrae SAWRS (located at the airport on the north side of the island) was 81% of normal. Rainfall on the south side of the island at Utwa was a bit wetter than at SAWRS. At the Nautilus Hotel (on the east side of the island), the rainfall was the driest among the recording stations during July and September.

Climate Outlook:

The tropical cyclone distribution during 2005 has been shifted to the west of normal, and therefore, **no tropical storms or typhoons should adversely affect Kosrae**. Kosrae is located close enough to the equator so that a direct strike by a strong tropical storm or a typhoon is usually very unlikely in any case. During El Niño years the odds (however small) of a tropical storm or typhoon affecting Kosrae are increased. One of the worst typhoons to hit Kosrae in recorded history was in 1905, which was an El Niño year.

Based on the continuation of ENSO Neutral conditions for the remainder of 2005 into early 2006, rainfall at Kosrae should average near normal for the next year.

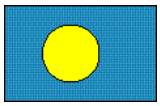
Predicted rainfall for Kosrae State from November 2005 through October 2006 is as follows:

Inclusive Period	% of long-term average
Nov 2005 - Jan 2006	95%
Feb - Jun 2006	100%
Jul - Oct 2006	95%

Kosrae State Rainfall Summary 3rd Quarter 2005

Station		Jul.	Aug.	Sep.	Total
Kosrae Airport (SAWRS)	Rainfall (inches)	12.96	12.60	15.42	**40.98**
	% of Normal	76%	76%	90%	**81%**
Utwa*	Rainfall (inches)	14.57	16.60	12.68	**43.85**
Nautilus*	Rainfall (inches)	12.32	N/A	11.34	**N/A**

* Long term normal is not established for these sites.



Republic of Palau: Most locations in Palau were wetter than normal during the 3rd Quarter of 2005 reversing a trend of drier conditions during the first half of 2005. Some of the tropical cyclones that have formed so far in 2005 have passed to north of Palau, contributing to the rainfall there. At the WSO in Koror, the rainfall total of 57.01 inches during the 3rd Quarter of 2005 was one of the highest recording stations in Micronesia. This total was 127% of normal for the 3-month period. The rainfall at WSO Koror and at the Palau International Airport (located a few miles from WSO Koror) was heaviest in July when approximately 25 inches of rain fell at both locations. On average, July is the wettest month of the year at the Koror WSO. Farther south, at Peleliu (at the southern end of the Palau Islands group), the 3rd Quarter rainfall was a bit drier than at Koror. The 3-month total of 45.32 inches was 102% of normal.

Republic of Palau Rainfall Summary 3rd Quarter 2005

Station		Jul.	Aug.	Sep.	Total
Koror WSO	Rainfall (inches)	25.69	13.16	18.16	**57.01**
	% of Normal	142%	88%	153%	**127%**
Nekken*	Rainfall (inches)	14.31	11.12	20.83	**46.26**
International Airport*	Rainfall (inches)	24.43	17.46	N/A	**N/A**
Peleliu	Rainfall (inches)	14.97	14.80	15.55	**45.32**
	% of Normal	84%	99%	131%	**102%**

* Long term normal is not established for these sites.
N/A Not Available

Climate Outlook:

Rainfall is expected be slightly wetter than normal for the next three months and near normal thereafter. This is due to the monsoon and a few tropical cyclones forming in the basin for the rest of 2005 through January 2006. These cyclones are likely to pass north of Palau and, along with the monsoon,

LOCAL SUMMARY AND FORECAST

contribute to slightly wetter than normal conditions in Palau.

A **direct strike by a typhoon is not likely to occur in Palau during 2005**. However, westerly gales may occur one or two times due to tropical cyclones passing north of Palau during the period November 2005 through January 2006.

Predicted rainfall for Palau from November 2005 through October 2006 is as follows:

Inclusive Period	% of long-term average
Nov 2005 - Jan 2006	110%
Feb - May 2006	95%
Jun - Oct 2006	100%

Republic of the Marshall Islands (RMI): The northern atolls of the RMI (Kwajalein, Utirik and Wotje) were the driest locations in Micronesia during the 3rd Quarter of 2005. The 3-month total of 14.27 inches at Wotje was the lowest rainfall recorded in Micronesia. Kwajalein recovered somewhat from very dry conditions in the first half of the year, but the 3rd Quarter total of 23.74 inches was still 73% of normal. Islands further south had more rainfall, which was closer to the normal. Majuro WSO had a 3rd Quarter 2005 total of 36.60 inches or 99% of normal. Only Majuro WSO and Mili had 3rd Quarter rainfall totals in excess of 35 inches.

RMI Rainfall Summary 3rd Quarter 2005

Station		Jul.	Aug.	Sep.	Total
RMI Central and Southern Atolls					
Majuro WSO	Rainfall (inches)	12.79	14.94	8.87	**36.60**
	% of Normal	98%	130%	71%	**99%**
Laura*	Rainfall (inches)	8.77	13.17	N/A	**N/A**
Arno*	Rainfall (inches)	13.13	N/A	10.57	**N/A**
Ailinglaplap	Rainfall (inches)	11.66	7.49	6.23	**25.38**
	% of Normal	99%	69%	51%	**73%**
Mili	Rainfall (inches)	11.44	14.36	13.76	**39.56**
	% of Normal	88%	125%	111%	**107%**
RMI Northern Atolls					
Kwajalein	Rainfall (inches)	8.57	7.14	8.03	**23.74**
	% of Normal	82%	71%	68%	**73%**
Utirik	Rainfall (inches)	N/A	5.34	5.84	**N/A**
	% of Normal	N/A	62%	58%	**50%**
Wotje	Rainfall (inches)	4.86	4.95	4.46	**14.27**
	% of Normal	49%	52%	40%	**46%**

* Long term normal is not established for this site

LOCAL SUMMARY AND FORECAST

Climate Outlook:

With tropical cyclones forming well to the west of normal, and the southwest winds of the Asian monsoon also staying west of normal, the RMI has a **very low risk of a typhoon** through the rest of 2005 and through early 2006.

Based on the continuation of ENSO Neutral conditions for the next several months, **rainfall** should continue to **average below normal in the northern islands** for the foreseeable future, and **near normal in the central and southern islands** with only moderate month to month variation. The northern Marshall Islands should not be as dry for first half of 2006 as they were in the first half of 2005.

Predicted rainfall for the RMI from November 2005 through October 2006 is as follows:

Inclusive Period	% of long-term average		
	S. of 6°N	6°N to 8°N	N. of 8°N
Nov 2005 - Jan 2006	100%	110%	90%
Feb - May 2006	100%	100%	85%
Jun - Oct 2006	95%	100%	95%

Rainfall normals and predicted rainfall outlooks are provided by University of Guam WERI.

SECOND QUARTER 2005 MONTHLY PRECIPITATION STATE OF HAWAI'I SUMMARY

July: Moderate to fresh trade winds persisted through the entire month of July across the Hawaiian Islands. No significant flood events occurred during the month but moist, shower producing areas embedded within the low level trade flow helped produce frequent rainfall over many areas of the island chain and especially over the east-facing slopes. Brief moderate to heavy afternoon showers produced minor flooding over the Kona slopes of the Big Island from Kailua-Kona to Honaunau on July 9, 14, and 17. Moderate to heavy trade wind showers also produced minor flooding over the windward slopes of the Ko'olau [mountain range] during the morning hours of July 12.

August: Rainfall during August across several areas of the state dropped off considerably from July's totals. The largest decreases occurred on Kauai and Oahu where most gages recorded totals well below the August normals. A couple of heavy rain events, described below, helped save the island chain from more widespread rainfall deficits...A surface low pressure trough associated with the remnant of Tropical Depression One-C helped bring heavy rains to the Big Island

HAWAI`I LOCAL SUMMARY

from August 6 through August 10...the second bout of heavy rains took place on August 28 through August 30 as a low pressure system moved westward to the north of the island chain....the remnant of Hurricane Fernanda brushed the Big Island and Maui on August 19 but did not produce any significant flooding.

September: After a rather dry August, rainfall increased dramatically over many areas of the state as a result of several upper level low pressure systems convecting tropical low level moisture.The first significant heavy rain event occurred from September 13 through 15 and affected primarily the north- and east-facing slopes of Kauai, Oahu, Maui, and the Big Island...On September 22 and 23, another upper level low dropped in to the north of the Hawaiian Islands bringing another round of unstable conditions over the state. This same upper low brought about the demise of Hurricane Jova due to the unfavorable levels of vertical wind shear. The heaviest rains occurred over the Koolau Range on Oahu during the late afternoon of September 23...The third significant event involved yet another unseasonably strong upper level low pressure system and the low level remnant of Hurricane Kenneth which moved into the Big Island on September 30. Like with Hurricane Jova, the upper level low played a key role in weakening Kenneth with strong vertical shear, but also brought very unstable conditions. Heavy rains commenced on September 30 and continued through the night of October 1. The rains of September 30 affected the Big Island, Maui, and Oahu but did not produce significant flooding.

Kevin R. Kodama, Senior Service Hydrologist
National Weather Service Forecast Office, Honolulu, Hawaii

Editor's Note: The Monthly Precipitation Summaries for Hawaii are issued monthly as a public service. Individual rainfall station information and specific island information for Hawaii can be found in the Monthly Precipitation Summaries which are located online at <http://www.prh.noaa.gov/hnl/pages/hydrology.php>.

HAWAI`I LOCAL SUMMARY

NEW – Experimental Sea level Forecasts *(deviations with respect to climatology)* for the U.S-affiliated Pacific Islands

The following sections describe: (i) the CCA-based forecasts for sea level deviations for the forthcoming season, and (ii) the observed monthly sea level deviations. All units are in inches. Note that the forecasting technique adapted here does not account for sea level deviations created by other atmospheric or geological conditions such as tropical cyclones, storm surges or tsunamis.

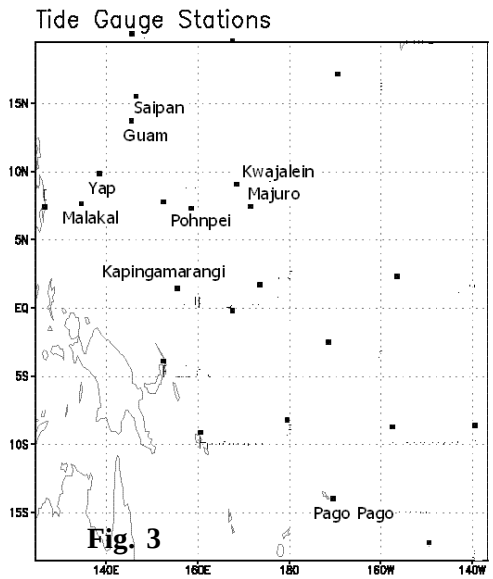


Fig. 3

Seasonal Sea Level Forecast for OND. NDJ, and DJF 2005-2006

Forecasts of the sea level anomalies in the USAPI are presented using CCA statistical model. Locations of all stations are shown in **Fig. 3**. Based on the independent SST values in JAS 2005 *(for SST data, see http://iridl.ldeo.columbia.edu/expert/SOURCES/.NOAA/.NCDC/.ERSST/.version2/.SST/)*, the resulting CCA model was used to forecast the sea level of three consecutive months: Oct-Nov-Dec (OND), Nov-Dec-Jan (NDJ), and Dec-Jan-Feb (DJF) (**Table 1**). CCA cross-validation forecast skills for 0, 1, and 2-month leads are presented (**Fig. 4**).

The OND season provided a more skillful forecast than NDJ and DJF. Most of the tide gauge stations show strong skill level (**Fig. 4**). Only Guam, Saipan, and Pago-Pago of south Pacific display a relatively lower skill, which is still close to 0.5. All three consecutive periods (OND, NDJ, DJF) of the majority of the tide gauge stations are very well predicted with a mean skill greaterthan 0.60 (at 0 to 2-month lead time). In the previous issue of the newsletter, it was stated that the forecast skill for the season of JAS — which is based on spring SSTs in AMJ — is slightly less skillful because of the effect of a spring barrier. As the year advanced, the effect of the spring barrier gradually decreased and the forecasting skill increased in OND.

Observed monthly sea level deviation in Jul-Aug-Sep (JAS), 2005

The monthly time series (July to August) for sea level deviations have been taken from the UH Sea Level Center. The full time series (in mm) is available at: ftp://ilikai.soest.hawaii.edu/islp/slpp.deviations. Deviations are defined here as the difference between the mean sea level for the given month and the 1975 through 1995 mean sea level value computed at each station.

Table 2 provides the monthly observed sea level deviations (in inches). All tide gauge stations recorded positive deviations in this quarter (3rd quarter) with Guam and Yap recording considerable positive deviations last quarter. As in previous quarters (JFM and AMJ), Guam continued to show sharp rise in this quarter too. The month of July and August displayed 12.3 and 10.5 inches of rise from the mean respectively (**see Table 2** and **Fig. 5;** sea level data for the month of September is not available from the UH sea level center at print time). Malakal and Pohnpei recorded marginal to moderate positive deviations. Malakal initially remained steady in July, however, considerable variations were observed in August. Similarly, Kapingamarangi, Majuro and Kwajalein also provided positive deviations during the same time period. The sea level of the lone south Pacific station (American Samoa at Pago-Pago) displayed a rise during the same time period.

NEW – Experimental Sea level Forecasts (con't)

Table 1: Forecasts of sea level deviation in inches (OND: Oct-Nov-Dec, NDJ: Nov-Dec-Jan, DJF: Dec-Jan-Feb)

Tide Gauge Station	OND	NDJ	DJF	[1] Forcst. Quality
Lead time [2]	0	1M	2M	
Guam	**	**	**	Good
Saipan	**	-1	-1	Good
Malakal	+1	**	-2	Very Strong
Yap	**	-1	-1	Strong
Pohnpei	+2	+1	+2	Very Strong
Kapingamar	+3	+3	+3	Strong
Majuro	+2	+2	+2	Strong
Kwajalein	**	**	**	Strong
Pago-Pago	+2	+2	+2	Good

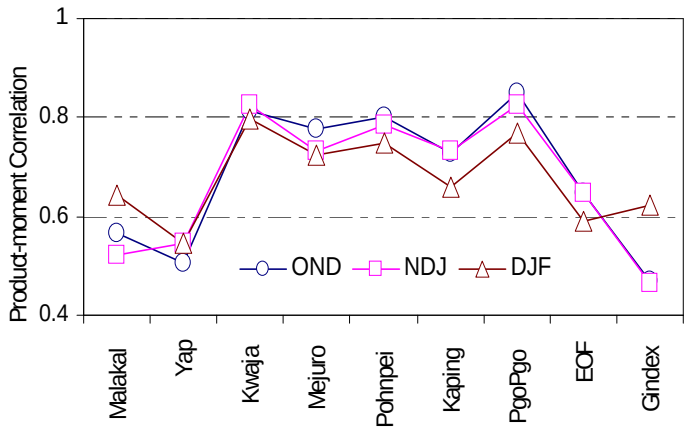


Fig. 4 CCA Cross-validation Skill in OND, NDJ, and DJF

Note: (-) indicates negative deviations (fall of sea level from the mean), and (+) indicates positive deviations (rise of sea level from the mean), N/A: data not available. Deviations of +/-1 in. are considered negligible and denoted by **. Deviations +/- 2 in. are unlikely to cause any adverse impact. Using a historical perspective, during OND 1997 and 1998, Yap recorded 8.6 inches of negative and 6.3 inches of positive deviations respectively. Pago-Pago recorded 1.5 inches of positive and 3.4 inches of negative deviations during the same period.

1. Forecast quality is a measure of the expected CCA cross-validation correlation skill. In general terms, these forecasts are thought to be of useful skill (or at least fair skill) if the CCA cross-validation value is greater than 0.3 (**Fig. 4**). Higher skills correspond to greater expected accuracy of the forecasts. Skill levels greater than 0.4 and 0.5 are thought to be moderate and good, while skill levels greater than 0.6 and 0.8 are thought to be strong and very strong respectively.

2. The lead time is the time interval between the end of the initial period and the beginning of the forecast period. For example, lead-0, lead-1M, and lead-2M means 'sea-level' of target season 0, 1, and 2 month leads based on SSTs of previous JAS.

In last quarter's issue, we forecasted positive deviations for all the tide gauge stations in JAS (**Fig. 5** dotted line). Real-time observed sea level data in JAS provided a very close match with the forecast values (**Fig. 5**). All the observed values, except Guam and Yap, remained very close to the forecast ones. The deviations of Guam and Yap were considerably higher than the forecast values captured by CCA model simulation for prediction in JAS.

The relationship between the sea level and the SST time-series at each geographical grid-point has been investigated (figures are not reported here). Observations revealed, for example, the JAS sea level in Guam displays strong and positive correlations with the SSTs of the preceding and current season in the western Pacific. This positive correlation implies that warmer sea waters and more heat content with a deeper thermocline in the western North Pacific correspond to a higher sea level in Guam.

Table 2: Monthly observed sea level deviations in inches (year to year monthly std deviation in parentheses)

Tide Gauge	July.		August		September[3]	
	Dev.	SD	**Dev.**	SD	**Dev.**	SD
Guam	**+9.4**	(4.6)	**+10.9**	(4.6)	**N/A**	(4.6)
Saipan	**N/A**	(2.9)	**N/A**	(2.4)	**N/A**	(3.1)
Malakal	**0**	(4.4)	**+4.1**	(4.2)	**N/A**	(4.3)
Yap	**+9.2**	(4.6)	**+9.7**	(4.1)	**N/A**	(4.6)
Kwajalein	**+4.6**	(2.2)	**+3.5**	(2.0)	**N/A**	(2.7)
Majuro	**+1.1**	(2.2)	**+1.1**	(2.2)	**N/A**	(3.2)
Pohnpei	**+3.3**	(2.7)	**+0.9**	(2.7)	**N/A**	(3.7)
Kapingamar.	**+1.7**	(2.3)	**+2.2**	(2.5)	**N/A**	(2.6)
Pago Pago	**+1.7**	(3.1)	**+3.7**	(2.8)	**N/A**	(2.6)

Average observed/forecasted seasonal sea level deviation: Jul-Aug-Sep[3]

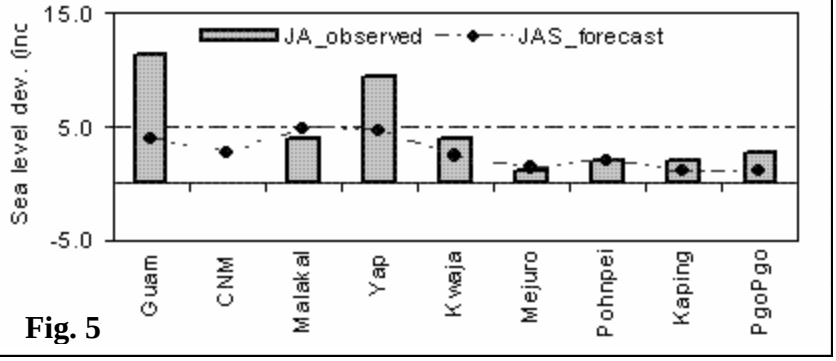


Fig. 5

Note: - indicates negative deviations (fall of sea level from the mean), and + indicates positive deviations (rise of sea level from the mean), N/A: data not available. **3.** September data is unavailable at print time.

The ENSO Cycle: El Niño, La Niña, and ENSO Neutral

The following text was taken from the Institute for International Research on Climate Prediction's " ENSO Basics" http://iri.columbia.edu/climate/ENSO/background/basics.html with figures provided by NOAA's Pacific Marine Environmental Laboratory <http://www.pmel.noaa.gov/tao/elnino/el-nino-story.html>.

What are El Niño and La Niña?

The term El Niño was first coined more than 100 years ago to describe the unusually warm waters that would occasionally form along the coast of Ecuador and Peru. This phenomenon typically occurred late in the calendar year near Christmas, hence the name El Niño (spanish for "the boy child", referring to the Christ child). Today the term El Niño is used to refer to a much broader scale phenomenon associated with unusually warm water that occasionally forms across much of the tropical eastern and central Pacific. The time between successive El Niño events is irregular but they typically tend to recur every 3 to 7 years.

La Niña is the counterpart to El Niño and is characterized by cooler than normal SSTs across much of the equatorial eastern and central Pacific. A La Niña event often, but not always, follows an El Niño and vice versa. Once developed, both El Niño and La Niña events tend to last for roughly a year although occasionally they may persist for 18 months or more. El Niño and La Niña are both a normal part of the earth's climate and there is recorded evidence of their having occurred for hundreds of years.

Although El Niño and La Niña events are characterized by warmer or cooler than average sea surface temperatures in the tropical Pacific, they are also associated with changes in wind, pressure, and rainfall patterns. In the tropics where El Niño and La Niña form, rainfall tends to occur over areas having the warmest sea surface temperature. [**Fig. 6** provides illustrations of the following ENSO conditions.]

- **Normal conditions [or ENSO Neutral]**. The warmest water is found in the western Pacific, as is the greatest rainfall. Winds near the ocean surface travel from east to west across the Pacific (these winds are called easterlies).
- **El Niño conditions**. The easterlies weaken, warmer than average sea surface temperatures cover the central and eastern tropical Pacific, and the region of heaviest rainfall moves eastward as well.
- **La Niña conditions**. Could be thought of as an enhancement of normal conditions. During these events, the easterlies strengthen, colder than average ocean water extends westward to the central Pacific, and the warmer than average sea-surface temperatures in the western Pacific are accompanied by heavier than usual rainfall.

What is ENSO?

While the tropical ocean affects the atmosphere above it, so too does the atmosphere influence the ocean below it. In fact, the interaction of the atmosphere and ocean is an essential part of El Niño and La Niña events (the term *coupled system* is often used to describe the mutual interaction between the ocean and atmosphere). During an El Niño, sea level pressure tends to be lower in the eastern Pacific and higher in the western Pacific while the opposite tends to occur during a La Niña. This see-saw in atmospheric pressure between the eastern and western tropical Pacific is called the *Southern Oscillation,* often abbreviated as simply the SO. A standard measure of the Southern Oscillation is the difference in sea level pressure between Tahiti and Darwin, Australia. Since El Niño and the Southern Oscillation are related, the two terms are often combined into a single phrase, the *El Niño-Southern Oscillation,* or *ENSO* for short. Often the term *ENSO Warm Phase* is used to describe El Niño and *ENSO Cold Phase* to describe La Niña.

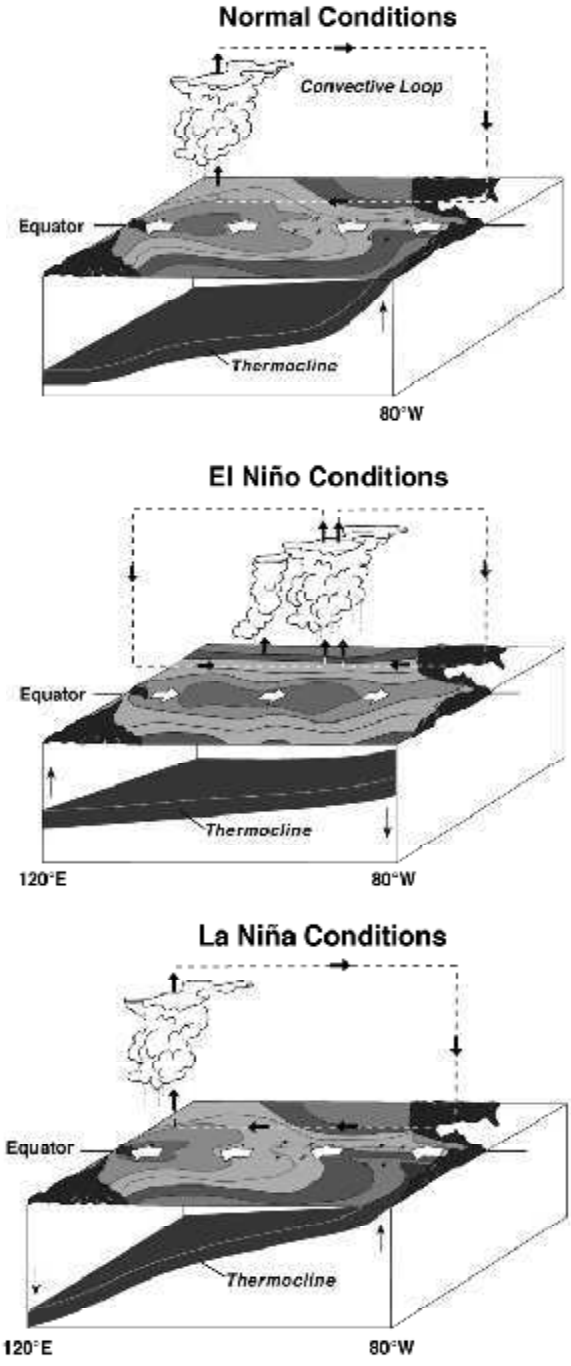


Figure 6. An illustration of typical rainfall, wind, sea surface temperatures and subsurface ocean temperature patterns in ENSO Neutral, El Nino, and La Nina conditions. *Illustration courtesy of PMEL/NOAA*

Pacific ENSO Update

Feedback Postcard Enclosed:

A stamped, preaddressed postcard is enclosed in all the newsletters mailed to the U.S. affiliated Pacific Islands. Please take the time to update your address and provide feedback. Your feedback is used to further improve PEAC's products and services. Thank you for your time. If you would like to comment further, please contact the PEAC ENSO Update Editor at nicole.colasacco@noaa.gov or at the address and phone number provided below.

ENSO FORECAST

Excerpt from PROGNOSTIC DISCUSSION FOR LONG-LEAD OUTLOOKS
NOAA NWS -Climate Prediction Center- Camp Springs, MD- 8:30 am EST Thursday October 20, 2005
http://www.cpc.ncep.noaa.gov/products/predictions/long_range/fxus05.html

Pacific SSTs along the equator were generally near the long-term average during late September and the first half of October - with the warmest SSTs and largest departures observed just to the west of the International Date Line. Equatorial subsurface ocean temperatures were slightly above average in the western Pacific and 1-2 degrees Celsius below average at depths of 50-100 m below the surface between 120W and 95W. Atmospheric indicators such as the low level winds and convection in the equatorial Pacific remain close to average and suggest together with the ocean state that neutral ENSO conditions will likely continue during the next 6-9 months…

The consensus of several models used at CPC shows seasonal mean Niño 3.4 SST anomalies remaining very close to zero through the winter and the spring. Spread among the individual tools has decreased in recent months with more than 80 percent of the forecasts falling in the neutral range [-0.5C to +0.5C]. Thus there is increased confidence that SSTs across the tropical Pacific will remain near average through early 2006.

Excerpt from EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION
issued by NOAA NWS Climate Prediction Center-October 6, 2005
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/

***Synopsis**: ENSO-neutral conditions are expected during the next 3-6 months.*

By the end of September, equatorial SST anomalies greater than +0.5ºC were found between 160ºE and 170ºE, while negative anomalies less than –0.5ºC were observed at most locations between 130ºW and the South American coast. The SST departures in the Niño 3, and Niño 1+2 regions were negative, while weak positive departures were observed in the Niño 4 and Niño 3.4 regions. During the last three months surface and subsurface temperature anomalies decreased, especially in the eastern equatorial Pacific, while atmospheric conditions (low-level winds, convection and sea level pressure) remained near average over most of the tropical Pacific.

The large spread of the most recent statistical and coupled model forecasts (weak La Niña to weak El Niño) indicates considerable uncertainty. However, current conditions and recent observed trends support a continuation of ENSO-neutral conditions for the next 3-6 months.

ACKNOWLEDGEMENTS and FURTHER INFORMATION:

PACIFIC ENSO APPLICATIONS CENTER:
HIG #350, 2525 Correa Road, Honolulu, Hawaii 96822
Contact Nicole Colasacco at 808-956-2324 for more information on the *Pacific ENSO Update* and ENSO-related climate data for the Pacific Islands.
Contact Dr. R. Chowdhury at 808-956-2324 for more information on ENSO and sea level variability in the USAPI.

University of Guam (UOG)
WATER AND ENERGY RESEARCH INSTITUTE (WERI):
UOG Station, Mangilao, Guam 96923
Contact Dr. M. Lander at 671-735-2685 for information on tropical cyclones and climate in the Pacific Islands.

NOAA National Weather Service-Pacific Region
WEATHER SERVICE FORECAST OFFICE (WSFO)
3232 Hueneme Road, Barrigada, Guam, 96913
Contact C. Guard at 671-472-0900 for further information on tropical cyclones and climate in the Pacific Islands.

University of Hawaii (UH) School of Ocean and Earth Science and Technology (SOEST)
DEPARTMENT OF METEOROLOGY:
HIG #350, 2525 Correa Road, Honolulu, Hawaii 96822
Contact Dr. T. Schroeder at 808-956-7476 for more information on hurricanes and climate in Hawaii.