

pacific

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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

Tranquil weather conditions prevailed throughout Micronesia and the USAPI during the first half of 2005, and continued into the months of July and August. Through the first half of 2005, most islands have had near normal rainfall. Other than very dry conditions throughout most of Micronesia in February, and a spate of South Pacific hurricanes near American Samoa (also in February), there were no other noteworthy monthly anomalies, and very few noteworthy short-term extreme events. Nearly 11 inches of rain in 24 hours at the WSO Pohnpei on April 30 stands out as one of the most extreme rain events in Micronesia so far this year. Strong trade winds prevailed during the first few months of 2005, and high surf was unusually persistent at many locations. The number of tropical cyclones in the western North Pacific basin was lower than average, and tropical cyclone formation was north and west of normal, keeping most of the tropical storms and typhoons away from Micronesia.

According to the U.S. Climate Prediction Center (CPC), the **climate of the tropical Pacific is now in ENSO Neutral**. The weak El Niño that began in the second half of 2004 ended in early 2005. The islands of Micronesia are typically drier than normal in the first few months during the year that follows an El Niño, and for the whole year after El Niño, the month-to-month variability of rainfall is less than during El Niño (primarily a result of the westward shift of tropical cyclone development during the year that follows an El Niño event).

For the first half of 2005, most of the islands of Micronesia had near normal rainfall (**Fig. 1a, 1b**). Only the northernmost islands, such as Guam, the CNMI, and Kwajalein, experienced persistent dryness that was considerably less than normal. January through June rainfall totals below 80%

Correction: In the last issue, incorrect rainfall values were given for several stations on Yap. The correct values are included in p. 5 of this newsletter. The editor apologizes for any confusion this may have caused.

CURRENT CONDITIONS

were experienced on Peleliu, Saipan, Tinian, Rota, Kwajalein and Utirik. January through June rainfall totals in excess of 120% of normal were experienced at WSO Chuuk and at Polowat. American Samoa was wetter than normal during the first six months of 2005. The highest official rainfall total recorded in Micronesia for the first six months of 2005 was the 107.47 inches at the Nautilus Hotel on Kosrae. The UOG/CSP experimental rain gage on top of Nahna Laud (Pohnpei Island's highest mountain) recorded 182.07 inches of rain during the first six months of 2005. The lowest recorded six month rainfall total during the first half of 2005 was the 14.05 inches of rain at Capitol Hill, Saipan. Near normal rainfall is anticipated throughout much of Micronesia and American Samoa for the next three to six months. Tropical cyclone activity, which has been very quiet in Micronesia so far in 2005, should return to near normal

CURRENT CONDITIONS

in the latter half of 2005 (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 three to six months**. For more information, see the CPC EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION for August on p. 12.

SEA SURFACE TEMPERATURE (SST)

Sea surface temperature anomalies decreased throughout the eastern equatorial Pacific during July. By early August, equatorial SSTs were near average in most areas between 180°W and the South American coast, while positive anomalies persisted between Indonesia and 180°W. By the end of July the patterns of tropical convection, atmospheric circulation, SST and subsurface ocean temperatures were near average,

indicating ENSO Neutral conditions. Subsurface temperatures were near normal to depths of 500 meters across the equatorial strip of the tropical Pacific, with a few small patches of water approximately 1° C warmer than normal at depths of 50 to 100 meters. **With ENSO Neutral conditions, equatorial SST should be near normal.**

SEA LEVEL

See Experimental Sea Level Forecasts p. 9-10 for forecasts and 1st Quarter observed sea levels.

SOUTHERN OSCILLATION INDEX (SOI)

The SOI rose to near normal near the middle of June after a weakly negative April and May. Overall, it has remained near zero since, though recent high pressures at Darwin coupled with low pressures at Tahiti, resulted in a small decrease in late July. The official monthly SOI for July was zero. From January through July, the monthly values of the SOI were + 0.3, - 4.1, -0.2, - 1.0, -1.2, +0.1, and 0.0. The 5-month running mean centered on May was approximately - 0.5. With the climate expected to continue remain 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.

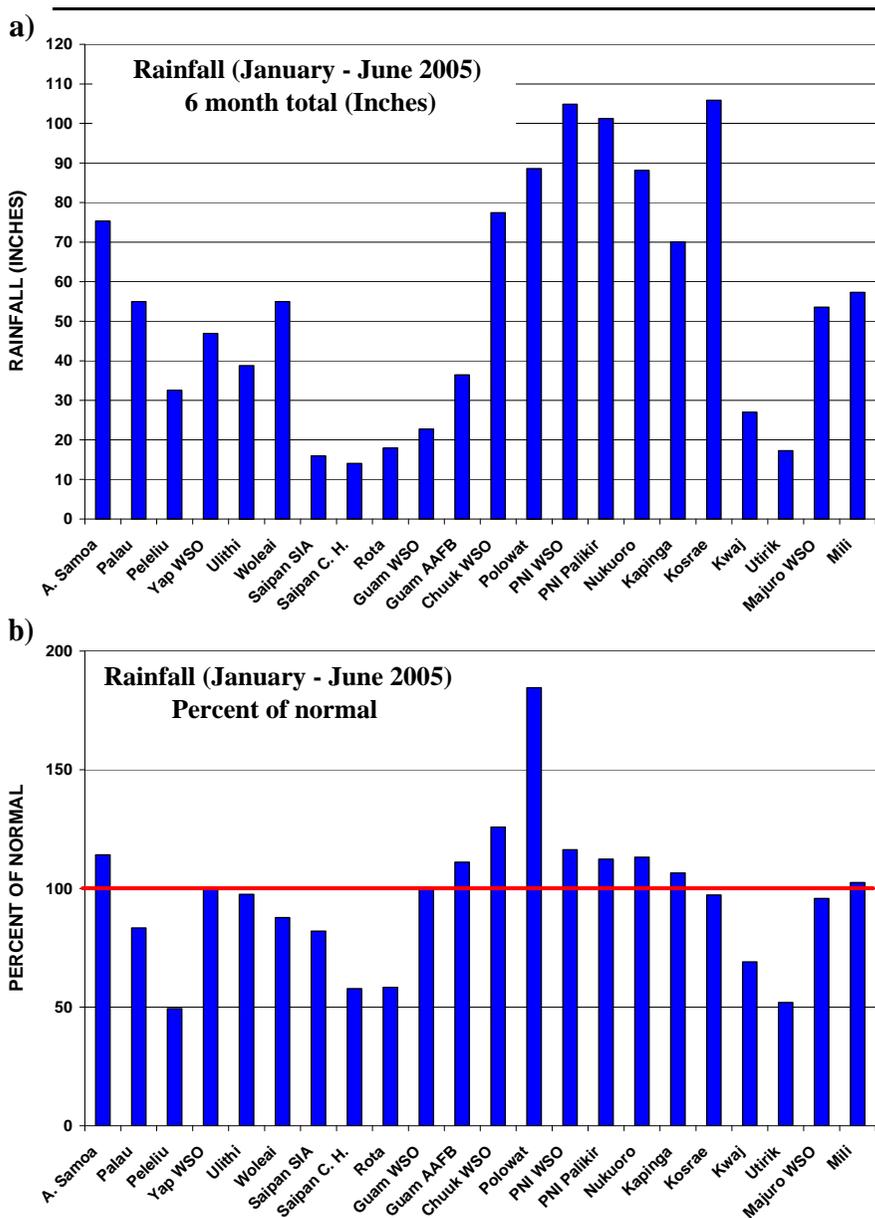


Figure 1. (a) Rainfall totals (in inches) and (b) anomaly (expressed as percent of normal) at the indicated islands for the 1st half of 2005.

TROPICAL CYCLONE

TROPICAL CYCLONE OUTLOOK

In the last Newsletter, the PEAC outlook for tropical cyclones in the western North Pacific basin during 2005 was “no above-normal activity should be expected in any category (e.g., number of typhoons and number of intense typhoons)”. Through August 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 (especially during October through December), we anticipate an eastward expansion of the region of tropical cyclone formation into the eastern Caroline Islands, so that some of the tropical cyclones in the basin 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 and typhoons. The number of such tropical cyclones will be near normal, and the threat of a tropical storm or typhoon will be greatest in the western and northwestern islands (Guam, the CNMI, Yap, and Palau) during the last four months of the year (September through December). No typhoons or tropical storms are anticipated for Pohnpei, Kosrae, or the RMI.

TROPICAL CYCLONE ACTIVITY (1ST QUARTER 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) 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 Japanese Meteorology Agency (JMA), which is the World Meteorological Organization’s Regional Specialized Meteorological Center (RSMC) for the basin. 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 one-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 when appropriate.

During January through June 2005, the JTWC numbered only four tropical cyclones in the western North Pacific: TC 01W (January), TC 02W (March), TC 03W (April), and TC 04W (May). The JMA named them Kulap, Roke,

TROPICAL CYCLONE

Sonca, and Nesat respectively. Normally there are approximately six numbered tropical cyclones in the western North Pacific basin during the first six months of the year, and seventeen through August. By the end of August, the western North Pacific basin had experienced fourteen numbered tropical cyclones, continuing the below-normal activity noted in the first half of 2005. While in their formative stages, about half of the tropical cyclones of the western North Pacific occurring through August 2005 brought some rainfall to the islands in the northwestern portions of Micronesia: Guam, Yap, and Palau. After a burst of tropical cyclone activity in the South Pacific during the February and March of 2005, activity ended in April when cyclone Ingrid moved westward across northern Australia and tropical storm Sheila (not numbered by the JTWC, but named by the Fiji RSMC) passed near Niue as a weak tropical storm.

LOCAL SUMMARY AND FORECAST



American Samoa: The total rainfall of 75.32 inches in American Samoa during the first half of 2005 was wetter than normal (114%). Abundant rainfall in April, May, and June (the start of the dry season) accounted for most of the surplus.

American Samoa Rainfall Summary 2nd Quarter 2005

Station		Apr.	May	Jun.	Total	Six month
Pago Pago WSO	Rainfall (inches)	14.50	10.78	13.31	38.59	75.32
	% of Normal	130%	103%	224%	152%	114%

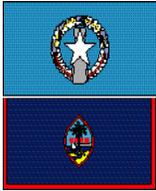
Climate Outlook:

Computer forecasts and a consensus of outlooks from several regional meteorological centers indicate that **rainfall in American Samoa is likely to be near normal through the winter dry season**. Long-range computer rainfall forecasts, however, have only limited skill in the tropical Pacific islands.

Predicted rainfall for American Samoa from September 2005 through August 2006 is:

<u>Inclusive Period</u>	<u>% of long-term average</u>
Sep - Oct 2005 (Dry Season)	105%
Nov -Dec 2005 (Onset of Rainy Season)	100%
Jan - May 2006 (Heart of Next Rainy Season)	110%
Apr - Aug 2006 (Next Dry Season)	100%

LOCAL SUMMARY AND OUTLOOK



Guam/CNMI: Rainfall on Guam during the first half of 2005 was moderately drier than normal during all months except for June at most locations. The six month total of 22.68 inches at the Guam International Airport (GIA) was normal at 100% (thanks mostly to a wet June).

In stark contrast to enormous island-wide rainfall on several days in 2004, there have been very few island-wide heavy rain events to date in 2005. At the GIA, there have been only two days (through mid-August) with 24-hour rainfall in excess of 2 inches.

Most of the CNMI rainfall stations reported less rainfall than on Guam (both in inches and as a percent of normal) during the each of the months of the first half of 2005. During July 2005, however, it was wetter at both Tinian and Rota than it was at the

Guam and CNMI Rainfall Summary 2nd Quarter 2005

Station		Apr.	May	Jun.	Total	6 month
Guam Inter. Airport	Rainfall (inches)	2.50	2.40	8.59	13.49	22.68
	% of Normal	64%	40%	133%	82%	100%
Anderson Air Force Base	Rainfall (inches)	2.06	3.11	6.85	12.02	36.45
	% of Normal	42%	47%	108%	67%	111%
Univ. of Guam*	Rainfall (inches)	1.98	2.92	7.32	12.22	20.43
Saipan Inter. Airport	Rainfall (inches)	3.04	2.30	3.51	8.85	15.95
	% of Normal	109%	52%	75%	75%	82%
Capital Hill	Rainfall (inches)	2.48	1.29	3.44	7.21	14.05
	% of Normal	71%	23%	59%	49%	58%
Tinian Airport	Rainfall (inches)	2.62	1.43	2.69	6.72	12.27
	% of Normal	75%	26%	46%	45%	50%
Rota Airport	Rainfall (inches)	2.73	2.91	3.41	9.05	17.92
	% of Normal	60%	46%	55%	55%	58%

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

GIA. During the first six months of 2005, the Saipan International Airport (SIA) and Capitol Hill experienced 82% of normal and 58% of normal, respectively. Rota was also quite dry with a six month total of only 17.92 inches, or 58% of normal. The 12.27 inches recorded at Tinian during the first half of 2005 was the lowest amount at any recording station in Micronesia.

LOCAL SUMMARY AND FORECAST

Eruptions of Anatahan volcano, located about 90 miles north of Saipan and 200 miles north of Guam, continue to send episodes of hazy volcanic smog (vog), fumes, and volcanic ash southward to Guam and to many of the islands of the CNMI. More information on these events and current volcanic activity is available through a USGS and Hawaiian Volcano Observatory website, <<http://hvo.wr.usgs.gov/cnmi/>>.

Climate Outlook:

The tropical cyclone distribution in the western North Pacific basin through August 2005 is typical for a year after an El Niño. The numbers have been below normal and the formation region has been west and north of normal. During the months of September through December 2005, 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 the remaining months of the year.** Thus, two or three tropical storms and one or two typhoons should pass within 200 miles of any Guam and CNMI location. The months of greatest threat will be October and November. The odds of typhoon force winds (or greater) at any location on Guam or in the CNMI during any given year (status of ENSO not considered) are approximately one in seven. During El Niño years, the odds of typhoon force winds on Guam or on any individual island in the CNMI rise to about one in three. During non-El Niño years the odds fall back to around one in ten. Dangerous surf from a typhoon does not require that the typhoon pass close to any location, so it is certain that 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 through the the summer rainy season, and then be slightly drier than normal in the next dry season.**

Predicted rainfall for the Mariana Islands from September 2005 through August 2006 is as follows:

Inclusive Period	% of long-term average	
	Guam/Rota	Saipan/Tinian
Sep-Oct 2005 (Heart of Rainy Season)	100%	90%
Nov 2005- May 2006 (Next Dry Season)	90%	85%
Jun - Aug 2006 (Next Rainy Season)	110%	100%



Federated States of Micronesia

Yap State: For the first six months of 2005, the total rainfall at most recording locations in Yap Island was near normal, with all stations reporting between 40 and 50 inches of rain. During July 2005, rainfall was heavy with approximately 20 inches at all stations on

LOCAL SUMMARY AND FORECAST

Yap Island. Farther south at Woleai Atoll, the total rainfall during the first half of 2005 was greater than Yap Island or Ulithi. The six month total rainfall of 38.76 inches at Ulithi was the lowest recorded in Yap State for that period. At the Yap WSO the total rainfall for the first half of 2005 was 46.91 inches (100% of normal).

Yap State Rainfall Summary 2nd Quarter 2005

Station		Apr.	May	Jun.	Total	6 month
Yap WSO	Rainfall (inches)	12.84	5.37	13.75	31.96	46.91
	% of Normal	223%	59%	108%	116%	100%
Dugor*	Rainfall (inches)	10.86	7.36	11.00	29.22	44.66
Gilman*	Rainfall (inches)	17.61	7.12	12.34	29.22	49.62
Luweech*	Rainfall (inches)	11.37	7.83	16.04	35.24	50.59
Maap*	Rainfall (inches)	9.39	7.70	11.65	28.74	40.02
North Fanif*	Rainfall (inches)	11.04	8.87	10.89	30.80	40.82
Tamil*	Rainfall (inches)	11.33	8.54	14.76	34.63	48.52
Rumung*	Rainfall (inches)	10.97	8.73	13.61	33.31	47.61
Ulithi	Rainfall (inches)	7.76	3.98	7.61	19.35	38.76
	% of Normal	158%	52%	71%	83%	97%
Woleai	Rainfall (inches)	10.13	7.35	10.65	28.13	54.97
	% of Normal	92%	60%	82%	78%	88%

* Long term normal is not established for these sites.

Climate Outlook:

The **tropical cyclone threat** for the remaining months of 2005 should be **near normal**. During the months of September through December 2005, approximately two or three 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 of any island or atoll of Yap State in the remainder of 2005, residents should always be prepared for the possibility.

Predicted rainfall for Yap State from September 2005 through August 2006 is as follows:

LOCAL SUMMARY AND FORECAST

Inclusive Period	% of long-term average	
	Yap and Ulithi	Woleai
Sep – Dec 2005 (Rest of Rainy Season)	100%	110%
Jan – May 2006 (Next Dry Season)	95%	100%
Jun 2006 – Aug 2006 (Next Rainy Season)	90%	90%

Editor's Note: In the last issue, incorrect rainfall values were given for several stations on Yap. The correct values are printed below. The editor apologizes for any confusion this may have caused.

Corrected Yap Rainfall Summary 1st Quarter 2005

Station		Jan.	Feb.	Mar.	Total
Luweech*	Rainfall (inches)	7.30	2.01	6.04	15.35
Maap*	Rainfall (inches)	4.58	1.37	5.33	11.28
North Fanif*	Rainfall (inches)	4.29	1.42	4.31	10.02
Tamil*	Rainfall (inches)	7.99	1.42	4.48	13.89
Ulithi	Rainfall (inches)	12.68	1.92	4.81	19.41
	% of Normal	204%	38%	95%	78%
Woleai	Rainfall (inches)	17.75	2.16	6.93	26.84
	% of Normal	166%	29%	83%	101%

* Long term normal is not established for these sites.

Chuuk State: Rainfall was abundant throughout most of Chuuk State during the first half of 2005. January 2005 monthly rainfall totals were very high, with reports in excess of 20 inches at some locations. February was very dry, with rainfall totals of two inches or less at most locations. Polowat was the wettest location in Chuuk State during the first half of 2005 with 86.57 inches. This was 185% of normal, which was the highest percent of normal at any location in Micronesia during the first half 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

LOCAL SUMMARY AND FORECAST

Chuuk Rainfall Summary 2nd Quarter 2005

Station		Apr.	May	Jun.	Total	6 month
Chuuk Lagoon						
Chuuk WSO	Rainfall (inches)	14.89	9.34	11.72	35.95	77.42
	% of Normal	121%	76%	125%	107%	126%
Piis Panew*	Rainfall (inches)	11.15	14.46	11.08	36.69	55.93
Xavier High School*	Rainfall (inches)	15.15	10.10	13.31	38.56	N/A
Mortlocks						
Lukunoch*	Rainfall (inches)	15.38	5.19	10.49	31.06	67.90
Ettal*	Rainfall (inches)	14.39	6.54	21.91	43.35	72.78
Ta*	Rainfall (inches)	17.40	6.59	15.37	39.36	69.40
Hall Islands						
Fananu*	Rainfall (inches)	12.97	14.79	8.69	36.45	57.04
Eastern Atolls						
Losap*	Rainfall (inches)	11.54	16.98	8.82	37.04	74.36
Nama*	Rainfall (inches)	14.70	12.33	14.76	41.79	80.91
Western Atolls						
Polowat	Rainfall (inches)	20.40	6.98	17.27	44.65	86.57
	% of Normal	340%	78%	138%	162%	185%

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

than normal in the spring when the trade-wind trough becomes established in the region.

Predictions for Chuuk State from September 2005 through August 2006 are as follows:

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

Pohnpei State: Apart from an extremely dry February, the rainfall at most Pohnpei locations was abundant during the first half of 2005, with an extreme event of 11 inches of rain in 24 hours occurring at the WSO Pohnpei on the 30th of April. The rainfall total for the first half of 2005 at

LOCAL SUMMARY AND FORECAST

the Pohnpei WSO (on the north side of Pohnpei Island) was 104.83 inches. This value exceeded only by the 105.84 inches recorded at Kosrae SAWRS during the same time period. The experimental UOG/CSP rain gage network in the mountainous interior of Pohnpei island indicated that the top of Nahna Laud (Pohnpei Island's highest mountain) received a whopping 182 inches in the first half of 2005, with 57.40 inches in the month of May. Elsewhere on Pohnpei Island , the rainfall totals during the first half of 2005 were similar to those at the WSO. The six month total at Palikir (on the northwest side of the island) was 101.21 inches. On the atolls of Pohnpei State, the rainfall pattern in the first quarter of 2005 was similar to that at the WSO on Pohnpei island.

Pohnpei Rainfall Summary 2nd Quarter 2005

Station		Apr.	May	Jun.	Total	6 month
Pohnpei Island						
Pohnpei WSO	Rainfall (inches)	26.11	23.95	15.64	65.70	104.83
	% of Normal	154%	123%	91%	125%	116%
Palikir*	Rainfall (inches)	22.86	22.14	16.38	61.38	101.21
Song Kroun*	Rainfall (inches)	28.98	26.16	N/A	N/A	N/A
Atolls of Pohnpei State						
Nukuoro	Rainfall (inches)	21.93	12.25	16.37	50.55	88.10
	% of Normal	146%	83%	134%	121%	113%
Pingelap	Rainfall (inches)	15.68	19.89	19.52	55.09	99.27
	% of Normal	91%	117%	120%	109%	111%
Mwokilloa *	Rainfall (inches)	10.26	18.86	16.92	46.04	82.95
Kapingamarangi	Rainfall (inches)	14.64	13.44	10.54	38.62	70.04
	% of Normal	108%	130%	145%	124%	106%

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

Climate Outlook:

During 2005, the tropical cyclones of the western North Pacific have been forming to the west and north of normal. The region of formation is expected to expand eastward into the Caroline Islands by October. It is expected at this time that Pohnpei will only experience rain from tropical disturbances, some of which may later become tropical storms and typhoons after they have moved to the west and northwest away from Pohnpei. Thus, a direct strike by a tropical storm

LOCAL SUMMARY AND FORECAST

or a typhoon is unlikely at any island in Pohnpei State for the remainder of 2005 and into the spring of 2006.

Based on the continuation of ENSO Neutral conditions for the remainder of 2005 and early 2006, **rainfall at Pohnpei Island and at Pohnpei's atolls should be near normal for the next 3 to 6 months**, and then potentially wetter than normal on Pohnpei Island and atolls to the east and west when the trade-wind trough becomes established in the region by April 2006. Kapingamarangi has been wetter than normal for a long time, but the rainfall on this island should return to normal for the duration of this forecast period.

Predicted rainfall for Pohnpei State from September 2005 through August 2006 is as follows:

Inclusive Period	% of long-term average	
	Pohnpei Islands/ Atolls	Kapingamarangi
Sep- Dec 2005	100%	95%
Jan - Mar 2006	95%	100%
Apr- Jun 2006	110%	95%
Jul - Aug 2006	100%	90%

Kosrae State: During the first half of 2005, rainfall totals on Kosrae were just over 100 inches at all recording locations. The 6-month rainfall total of 107.47 inches at the Nautilus Hotel was the highest recorded official rainfall in Micronesia during this time period (excluding the extreme rainfall of over 180 inches recorded by the UOG/CSP rain gage network on top of Nahna Laud on Pohnpei Island). Although the rainfall values recorded on Kosrae were the heaviest in Micronesia, they were actually near normal. The 6-month total of 105.84 inches at Kosrae Supplemental Aviation Weather Reporting Station (SAWRS) (located at the airport on the north side of the island) was 97% of normal .

Kosrae State Rainfall Summary 2nd Quarter 2005

Station		Jan.	Feb.	Mar.	Total	6 month
Kosrae Airport (SAWRS)	Rainfall (inches)	21.92	16.23	22.01	60.16	105.84
	% of Normal	101%	86%	116%	101%	97%
Utwa*	Rainfall (inches)	24.84	20.00	20.57	65.41	106.30
Nautilus*	Rainfall (inches)	22.81	22.47	20.66	65.94	107.47

* Long term normal is not established for these sites.

Climate Outlook:

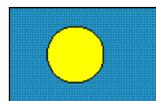
The tropical cyclone distribution during 2005 is shifted to the west of normal, and therefore, no tropical storms or typhoons should adversely affect Kosrae. Kosrae is located close enough to the equator so that a direct strike by a strong tropical storm or a typhoon is usually very unlikely in any case, although it did occur 100 years ago! During the El Niño

LOCAL SUMMARY AND FORECAST

year of 1905, an intense typhoon hit Kosrae, and went on to strike Pohnpei also. 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 September 2005 through August 2006 is as follows:

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



Republic of Palau: Along with other island groups in the north and western portions of Micronesia, Palau was drier than normal during the first half of 2005. Some of the tropical cyclones that have formed so far in 2005 have passed to north of Palau, and contributed some rainfall. Palau is one of only a few islands of Micronesia to experience the southwest winds of the Asian monsoon, which have remained well to the west of normal. The rainfall total for the first half of 2005 at Koror was 54.97 inches, or 83% of normal.

Rep. of Palau State Rainfall Summary 2nd Quarter 2005

Station		Apr.	May	Jun.	Total	6 month
Koror WSO	Rainfall (inches)	8.56	19.51	7.24	35.31	54.97
	% of Normal	99%	163%	42%	93%	83%
Nekken*	Rainfall (inches)	6.08	20.41	N/A	N/A	N/A
Inter. Airport*	Rainfall (inches)	N/A	N/A	N/A	N/A	N/A
Peleliu*	Rainfall (inches)	1.78	8.33	7.19	17.30	32.55

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

Climate Outlook:

Dry conditions in Palau during the first half of 2005 were consistent with the end of El Niño conditions during early 2005. The year after an El Niño event tends to be drier than normal throughout Micronesia, and especially at island locations in the western and northern portions of Micronesia (for example: Guam, Yap, and the CNMI). Because the monsoon will affect Palau for the remainder of 2005, rainfall is expected to average near normal with some large month-to-month variations.

A direct strike by a typhoon is not likely to occur in Palau during 2005. However, the tropical cyclone distribution in the western North Pacific basin has shifted to the west; westerly gales may occur two or three times in response to typhoons

LOCAL SUMMARY AND FORECAST

passing to the north of Palau from September through early December.

Predicted rainfall for Palau from September 2005 through August 2006 is as follows:

Inclusive Period	% of long-term average
Sep - Dec 2005	110%
Jan 2006- May 2006	95%
Jun - Aug 2006	100%



Republic of the Marshall Islands (RMI): The northern atolls of the RMI (Kwajalein, Utirik and Wotje) were among the driest of locations in Micronesia during the first half of 2005. Only some locations in the CNMI were drier. Islands further south had more rainfall, which was closer to the normal amount expected. Kwajalein has been particularly dry with four of the first six months of 2005 seeing less than 50% of normal rainfall. The most rainfall recorded in the RMI during the first half of 2005 was at Mili with 57.29 inches (102%).

RMI Rainfall Summary 2nd Quarter 2005

Station		Apr.	May	Jun.	Total	6 month
RMI Central and Southern Atolls						
Majuro WSO	Rainfall (inches)	13.85	6.84	8.02	28.71	53.53
	% of Normal	123%	59%	72%	87%	96%
Laura*	Rainfall (inches)	N/A	7.70	8.99	N/A	N/A
Arno*	Rainfall (inches)	6.24	5.83	8.42	20.49	46.63
Aling-laplap*	Rainfall (inches)	5.35	N/A	6.37	N/A	N/A
Mili*	Rainfall (inches)	10.88	12.61	9.05	32.54	57.29
RMI Northern Atolls						
Kwajalein	Rainfall (inches)	3.12	2.68	6.49	12.29	26.95
	% of Normal	41%	27%	67%	45%	69%
Utirik	Rainfall (inches)	4.31	2.76	2.18	9.25	17.26
	% of Normal	67%	33%	27%	40%	52%
Wotje	Rainfall (inches)	4.38	2.13	3.73	10.24	15.76
	% of Normal	61%	22%	41%	41%	46%

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

LOCAL SUMMARY AND FORECAST

Climate Outlook:

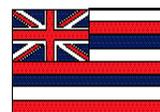
In the year following an El Niño event, the islands in the western and northern portions of Micronesia are typically dry. This was true for Palau, Yap, Guam and the CNMI, and it was also true for the northern islands of the RMI. At 69%, 52%, and 46% of normal for the first six months of 2005, Kwajalein, Utirik, and Wotje, respectively, were among the driest of the islands. 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 early 2006. Usually the RMI is wettest in the latter half of the year, as the monsoon works its way east, and tropical disturbances that later move west and become tropical cyclones affect the RMI. The remainder of 2005 should be very tranquil, and it is unlikely that any extreme rain events will take place.

Based on the continuation of ENSO Neutral conditions for the remainder of 2005 and early 2006, **rainfall should continue to average below normal in the northern islands, and near normal in the central and southern islands** with only moderate month-to-month variation.

Predicted rainfall for the RMI from September 2005 through August 2006 is as follows:

Inclusive Period	% of long-term average		
	S. of 6°N	6°N to 8°N	N. of 8°N
Sep - Dec 2005	100%	95%	90%
Jan - Apr 2006	100%	95%	85%
May - Aug 2006	95%	100%	90%

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



SECOND QUARTER 2005
 MONTHLY PRECIPITATION
 STATE OF HAWAII SUMMARY

April: Trade winds prevailed through most of April at mainly moderate levels. Trade shower activity during the first two weeks of the month brought daily rainfall to the east-facing slopes of the islands, though totals were mostly less than an inch and no significant flooding problems occurred. The airmass over the island chain stabilized for the period from April 15 to 25 with many sites reporting little or no rainfall. The trades broke down on April 26 as a weak, late-season cold front moved slowly across the state on April 27 and 28 before dissipating near the Big Island and Maui on April 29. Most rain gages recorded less than a quarter of an inch during the frontal passage.

May: Trade winds prevailed through most of May though at lighter than normal levels. A weak, out-of-season shear line moved across the island chain on May 18 and 19 bringing needed rains to the windward slopes. Its remains lingered

HAWAII LOCAL SUMMARY

near the Big Island on May 20 before returning westward over Maui County and Oahu in the trade winds. Enough rain fell over windward Oahu from Kailua to Hauula to produce elevated stream levels and minor flooding. Upper level troughs near the state produced sufficient instability to generate heavy afternoon showers over the leeward and interior sections of the islands on May 9 and May 22 through 24. The rainfall over Upcountry Maui proved to be heavy enough to warrant advisory issuances for minor flooding on May 9 and 24.

June: Moderate trade winds dominated the weather pattern over the Hawaiian Islands during most of June. A short period of fresh to strong trade winds prompted the issuance of a wind advisory for central Maui, south Big Island, and the summits of Mauna Kea, Mauna Loa, and Haleakala on June 9 to 11. Shower areas embedded within the trades brought much needed rains to the east facing slopes of the Big Island and Maui. Drier than normal conditions during April and May over

HAWAII LOCAL SUMMARY

the east half of the state have been stressing water supplies, especially those on catchment systems and growers of non-irrigated crops. No significant flood events occurred during the month though brief heavy rains over Kailua-Kona produced minor street flooding during the night of June 4. An out of season shear line on June 19 and 20 followed by an upper level trough on June 21 through 24 produced enhanced shower activity but no associated flooding problems.

**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>>.

**NEW – Experimental Sea level Forecasts
(deviations w. r. t. climatology) for the U.S-affiliated Pacific Islands**

In our last issue of this newsletter, we introduced an operational **forecasting technique** using a Canonical Correlation Analysis (CCA) model. This statistical sea level forecast is based on the teleconnections, or air-sea interactions over great distances, between tropical SST and sea level in the USAPI. Hereafter, we will continue to report results on observed and forecasts values of sea level deviations in the ‘Experimental Sea Level Forecasts’ section. The following sections describe: the observed monthly sea level deviations, and the CCA-based forecasts for sea level deviations for the forthcoming season. This forecast technique does not account for sea level changes created by other atmospheric or geologic conditions such as tropical cyclones, storm surges or tsunamis.

Note that, as per user feedback, the units of the whole sea level values have been converted to inches in this issue.

Observed monthly sea level deviation in JFM, 2005

The monthly time series (April to June) for sea level deviations have been taken from the UH Sea Level Center. The full time series is available at: <<http://ilikai.soest.hawaii.edu/uhslc/woce.html>>. Deviations are defined here as the difference between the mean sea level for the given month and the 1993 to 2001 mean sea level at that station. Locations of all these station are shown in **Fig. 2**.

Table 1 provides the monthly observed sea level deviations (in inches). In the 2nd quarter, Guam continued to show sharp rise in this quarter. The months of April, May, and June displayed 9.4, 10.9, and 12.0 inches of rise from the mean respectively (see **Table 1** for monthly values of each of the stations and **Fig. 3** for average values of AMJ). Other than Malakal (Palau), the sea level in the northwestern Pacific Island stations (Guam, Yap, and Pohnpei) tended to show positive deviations. Malakal initially recorded lower than mean sea level in April; however, for May and June, no considerable variations were observed. Similarly, the low latitude Pacific Island station (Kapingamarangi) and the central Pacific Island stations (Majuro and Kwajalein) had positive deviations during the same time period. The sea level of the lone south Pacific Island station, Pago Pago (American Samoa) displayed a slight rise during the same time period.

In the 1st quarter (JFM) of 2005, the average sea level deviations in most of the northwestern Pacific Island stations displayed negative deviations, the 2nd quarter provides a tendency towards more positive deviations (**Table 1; Fig. 3**). This agrees with the AMJ forecast in the last newsletter (**Fig. 3 dotted line**). Both the low latitude station (Kapingamarangi) and the central Pacific Island stations (Kwajalein and Majuro) continued to show rising trends in this quarter. On the contrary, the South Pacific Island station (Pago Pago), which displayed negative deviation in the last quarter, tended to show a positive deviation in this quarter. This is somewhat expected pattern for American Samoa. Following a weak El Niño year, American Samoa has been found not to experience any pronounced variation in sea level from July to December (see *Pacific ENSO Update*, 4th Quarter 2004, Vol. 10, No. 4).

Tide Gauge Stations

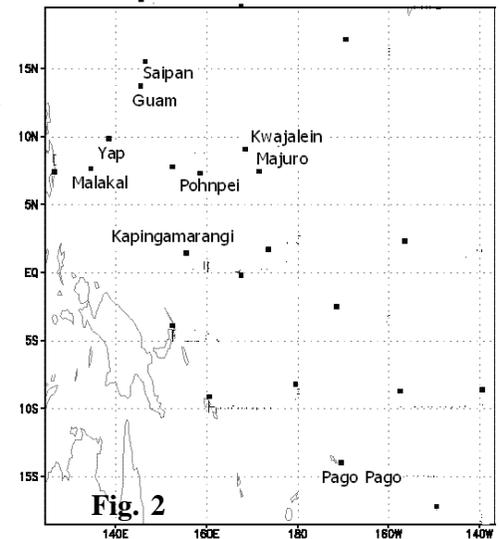


Fig. 2

NEW – Experimental Sea level Forecasts (con't)

Table 1: Monthly observed sea level deviations in inches (std deviation in parentheses)

Tide Gauge	Apr.	May	Jun.	Average observed/forecasted seasonal sea level deviation: Apr-May-Jun
Marianas, Guam	+9.4 (3.7)	+10.9 (10)	+12.0 (3.6)	
Saipan, CNMI	N/A (3.2)	N/A (2.9)	N/A (2.8)	
Malakal, R. Palau	-2.7 (4.6)	-0.3 (4.6)	0 (4.2)	
Yap, FSM	-1.7 (3.9)	+3.9 (3.4)	+5.9 (4.1)	
Pohnpei, FSM	+4.5 (2.0)	+4.4 (2.4)	+4.4 (2.8)	
Kapingamari, FSM	+3.2 (3.0)	+1.4 (2.9)	+0.2 (2.6)	
Majuro, Marshalls	+2.0 (2.0)	+3.0 (2.0)	+0.7 (2.1)	
Kwajalein, Marshalls	+3.9 (2.0)	+5.7 (2.5)	+3.8 (2.2)	
Pago-Pago, A Samoa	-1.6 (3.6)	+0.0 (4.2)	+2.1 (3.6)	

Fig. 3

Note: - indicate negative deviations (fall of sea-level from the mean), and + indicate positive deviations (rise of sea-level from the mean), n/a: data not available, Figures in parenthesis are year-to-year SD (standard deviations) for the month.

Seasonal Sea Level Forecast for JAS, ASO, and SON 2005

Forecasts of the sea level anomalies in the USAPI are presented here using CCA statistical model. Based on the independent SST values in JFM 2005, the resulting CCA model was used to forecast the sea level of moving-average season of three consecutive months: Jul-Aug-Sep (JAS), Aug-Sep-Oct (ASO), and Oct-Nov-Dec (OND) (Table 2). 1-season ahead of CCA cross-validation forecast skills (cross-validation is conducted to evaluate the overall forecasting skill of the CCA model) are also presented (Fig. 4). A short summary of qualitative forecast quality is presented (Table 2).

The forecast skill for most of the tide gauge stations varies from moderate-to-good (Table 2). Pohnpei provided high skill while CNMI at Saipan displayed fair skills (Fig. 3). Other than CNMI, the cross-validation correlation skills for the 3-moving seasons (at 1-season lead time) are reasonably well predicted with a mean skill greater than 0.40 for all the tide gauge stations.

The sea level forecast in JAS, which is based on spring SSTs (AMJ), is slightly less skillful than previous seasons. Climatologists refer to this period as the spring barrier because of the difficulty in predicting SST during the spring. As the year advances, the skill gradually increases until the next spring. For rainfall prediction, this spring barrier has a pronounced effect; however it appears to be a relatively weaker obstacle for SST based sea level predictions. As a result this season has slightly weaker yet still useful skill values for the upcoming seasons (Fig. 3).

Table 2: Forecasts of sea level deviation in inches (JAS: Jul-Aug-Sep, ASO: Aug-Sep-Oct, and SON: Sep-Oct-Nov)

Tide Gauge Station	AMJ	MJJ	JJA	*Forcst. quality	* Forecast quality is a measure of expected CCA cross-validation 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 0.5 are thought to be good, while skill levels greater than 0.6 are thought to be high.
Guam	+4	+3	+2	Good	
Saipan	+3	+3	**	Fair	
Malakal	+5	+5	+4	Good	
Yap	+5	+4	+3	Good	
Pohnpei	+2	+2	+3	High	
Kapingamaringa	**	**	+2	Moderate	
Majuro	+1	+2	+3	Moderate	
Kwajalein	+2	+2	+2	Moderate	
Pago Pago	**	+1	+1	Good	

Fig. 4

Note: For +/-, see notes in Table 1. Any deviations between (0~ ±1) in. is considered as negligible and denoted by ** Deviations of ±2 in. are unlikely to cause any adverse impact. To put in a historical perspective, during JAS 1997 Yap recorded deviations of -6 in. in JAS 1997 and +7 in. during JAS 1998. Pago Pago recorded deviations of +2.4 in. and - 7 inches during that same time period.

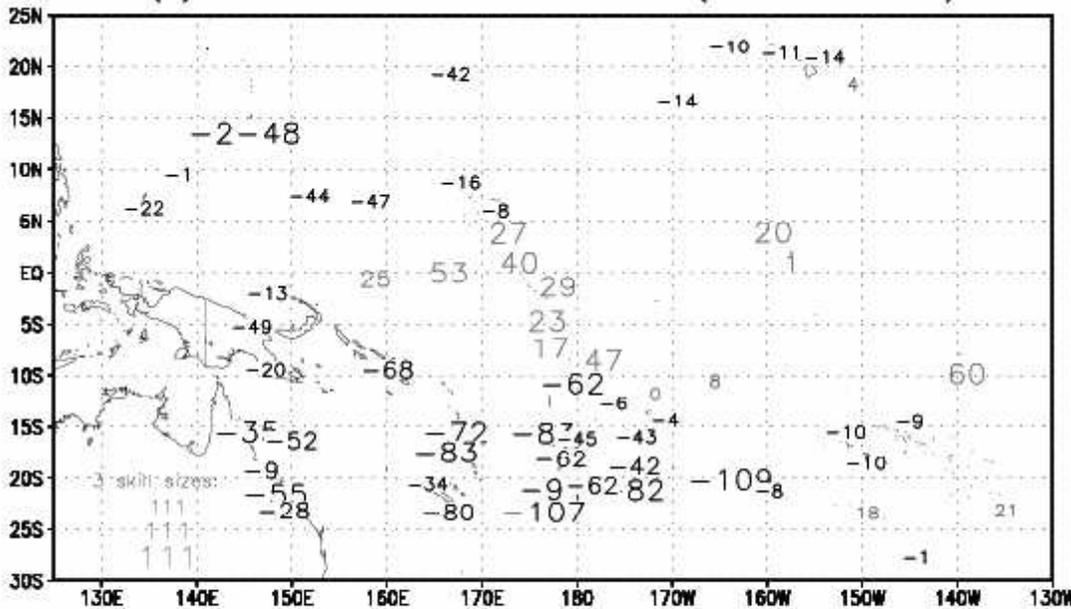
Experimental Forecasts for Pacific Island Rainfall

The latest results from the CPC statistical model for all predicted locations are shown below. This map-like presentation applies only to two particular seasons (Sep - Nov 2005 and Dec - Feb 2005) of the 13 three month periods out to a year in advance that are available from the model. The full time series in graphs and tables are updated monthly on the internet at: <http://www.cpc.ncep.noaa.gov/pacdir/CCA11.html>.

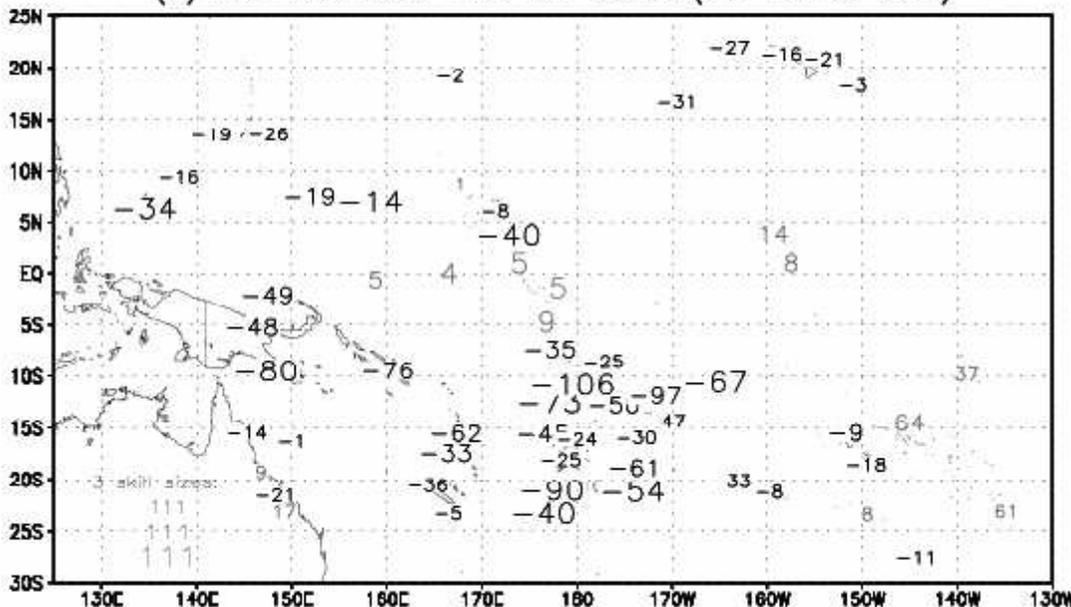
Negative numbers are forecasts for less than normal rainfall while positive numbers are forecasts for greater than normal rainfall. The size of the number (not the value of the number) indicates how accurate the forecast is expected to be, on the average, for the station at the given time of year and the forecast lead time. There are three sizes: the smallest size indicates low skill, the medium size indicates moderate skill, and the largest size indicates a relatively high skill. The value of the numbers tell how large a deviation from normal is expected. These values are in standardized units that

indicate how typical (or atypical) the rainfall conditions are expected to be relative to the station's normal climatology. For example, numbers from 0 to 25 (or 0 to -25) are small deviations, indicating conditions that would be considered typical of the climate for the station and the time of year. Deviations from 25 to 60 (or -25 to -60) are moderate deviations, indicating somewhat wetter (or drier) conditions than would be expected for the station and the time of year. Deviations of over 60 (or less than -60) are large deviations, indicating much wetter (or drier) conditions than normal for that location and time of year.

(1) CCA FORECAST FOR SON 2005 (0.5 month lead)



(2) CCA FORECAST FOR DJF 2006 (3.5 month lead)



Sites Covered

(list not complete, selected sites only)

1. Hilo, Hawaii
2. Kahului, Hawaii
3. Honolulu, Hawaii
4. Lihue, Hawaii
5. Anderson AFB Guam
6. Guam WSMO
7. Johnston Island
8. Koror WSO, Palau
9. Kwajalein Atoll
10. Majuro WSO, RMI
11. Pohnpei WSO, FSM
12. Wake Island
13. Yap WSO, FSM
14. Chuuk WSO, FSM

Pacific ENSO Update

ENSO FORECAST

PROGNOSTIC DISCUSSION FOR LONG-LEAD OUTLOOKS

NOAA NWS - Climate Prediction Center - Camp Springs MD- 8:30 am EST Thursday May 19, 2005

Excerpt from Summary of the Outlook For Non-Technical Users

http://www.cpc.ncep.noaa.gov/products/predictions/long_range/fxus05.html

Sea surface temperatures (SSTs) in the equatorial Pacific are close to normal across the entire basin. Subsurface ocean temperatures in the upper layers of the eastern Pacific are also quite close to normal indicating that neutral ENSO conditions will likely persist for the next few months. There is a modest consensus among both statistical and dynamical ENSO prediction models for neutral conditions to prevail through early 2006...The outlooks for SON 2005 through FMA 2006 are based on a wide array of dynamical and statistical tools. Outlooks for MAM 2006 and beyond are based mainly on trends with some input from other statistical tools with ENSO expected to be in its neutral phase through at least spring 2006...

Excerpt from EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION issued by NOAA NWS Climate Prediction Center-May 5, 2005

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/

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

Sea surface temperature (SST) anomalies decreased throughout the eastern equatorial Pacific during July. By early August, equatorial SSTs were near average in most areas between 180°W and the South American coast, while positive anomalies persisted between Indonesia and 180°W. The decrease in SST anomalies in the eastern equatorial Pacific during July was reflected by a decrease in the SST departures in the Niño 3, Niño 3.4, and Niño 4 regions. By the end of July the patterns of tropical convection, atmospheric circulation, SST and subsurface ocean temperatures were near average, indicating ENSO-neutral conditions.

The large range (weak La Niña to weak El Niño) in the statistical and coupled model forecasts indicates considerable uncertainty. However, current conditions and recent trends support the 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

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NOAA National Weather Service-Pacific Region

WEATHER SERVICE FORECAST OFFICE (WSFO)

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University of Hawaii (UH) School of Ocean and Earth Science and Technology (SOEST)

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