

*pacific*

# ENSO

*update*

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

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

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## CURRENT CONDITIONS

La Niña became strong in the latter months of 2010, and continued to dominate the weather and climate of the Pacific basin through April 2011. There are signs (particularly in the subsurface ocean) that the current La Niña is fading. The Climate Prediction Center anticipates a return to ENSO-neutral by July of 2011 (see CPC statement to the right). While the first half of 2010 was generally dry throughout the USAPI, as is typical in the year that follows El Niño, it has been very wet at many islands during the first three months of 2011 (see Figures 1a and Figure 1b). The most notable exception to recent wet conditions occurred at islands along the equator where colder-than-normal SSTs accompanied exceptionally dry conditions. One such affected location was the island of Kapingamarangi, where extended dry conditions likely caused harm to water supplies, vegetation and crops. The following description appeared in a drought information statement issued by the Guam Weather Forecast Office (WFO) on 21 April 2011 (and in several earlier such statements): “Damage to food crops has likely occurred on Kapingamarangi atoll and the other drought stricken areas. The health of food crops should be closely monitored...and food assistance may be necessary if damage to plants and fruits is irreversible. Catchments should still be monitored in the coming weeks.”

It should be noted that rainfall amounts on Kapingamarangi have recently seen a substantial increase, and extremely dry conditions should subside as La Niña continues to fade.

Other islands affected by the equatorial cold tongue of water and its accompanying lack of rainfall include Nukuoro, Kosrae, Nauru, and the atolls of Kiribati. Rainfall at Nauru and throughout Kiribati was likely as severely reduced as at Kapingamarangi. Further north, at Nukuoro and at Kosrae, rainfall was low during several months, but was not as drastically reduced as at other islands closer to the equator. As a general rule, rainfall was more abundant further from the equator and further west. At islands that are well away from the equator, and that are normally in their dry season during the first three months of the year (e.g. Guam, the CNMI, and the northern RMI), rainfall was unusually abundant. Many locations in the state of Hawaii and in American Samoa were also wetter than normal during the first quarter of 2011, with the exception of the Big Island. Computer forecasts available to the PEAC Center largely anticipated this abundant rainfall, and most of the PEAC Center’s outlooks have reflected this.

The final quarter in 2010 and the first quarter of 2011 were generally wet for most of the islands in the state of Hawaii with the exception of the Big Island (see local summary for more information). This is a very welcome change to the drought conditions present during the second half of 2010 on all the islands. In fact, all drought conditions have been eliminated on Oahu and Kauai. Also, heavy rainfall this winter has diminished drought conditions across the central Hawaiian Islands, which is typical for a La Niña winter.

The following comments from the 07 April 2011 **EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION** were posted on the U.S. Climate Prediction Center web site:

**“ENSO Alert System Status: La Niña Advisory.**

**Synopsis:** A transition to ENSO-neutral conditions is expected by June 2011.

La Niña weakened for the third consecutive month, as reflected by increasing surface and subsurface ocean temperatures across the equatorial Pacific Ocean. All four Niño indices ranged between  $-0.3^{\circ}\text{C}$  and  $-0.8^{\circ}\text{C}$  at the end of March 2011. Subsurface oceanic heat content anomalies (average temperatures in the upper 300m of the ocean) became weakly positive in response to the continued eastward progression of a strong oceanic Kelvin wave, which has begun to shoal in the eastern Pacific. However, the basin wide extent of negative SST anomalies remained considerable throughout the month. Also, La Niña impacts on the atmospheric circulation remained strong over the tropical and subtropical Pacific. Convection remained enhanced over much of Indonesia and suppressed over the western and central equatorial Pacific. Also, anomalous low-level easterly and upper-level westerly winds have persisted in this region. Collectively, these oceanic and atmospheric anomalies reflect a weakening La Niña, but with ongoing global impacts. ...

La Niña will continue to have global impacts even as the episode weakens through the Northern Hemisphere spring. Expected La Niña impacts during AMJ 2011 include suppressed convection over the west-central tropical Pacific Ocean, and enhanced convection over Indonesia. ...

The next ENSO Diagnostics Discussion is scheduled for 5 May 2011. To receive an e-mail notification when the monthly ENSO Diagnostic Discussions are released, please send an e-mail message to: [ncep.list.ens0-update@noaa.gov](mailto:ncep.list.ens0-update@noaa.gov).”

SEA SURFACE TEMPERATURES

SOUTHERN OSCILLATION INDEX

La Niña has weakened for the third consecutive month, as reflected by increasing surface and subsurface ocean temperatures across the equatorial Pacific Ocean. Subsurface oceanic heat content anomalies became weakly positive in response to the continued eastward progression of a strong oceanic Kelvin wave, which has begun to shoal in the eastern Pacific. However, the basin wide extent of negative SST anomalies remained considerable throughout the month. La Niña impacts on the atmospheric circulation remained strong over the Pacific. Anomalous low-level easterly and upper-level westerly winds have persisted in this region. Collectively, these oceanic and atmospheric anomalies reflect a weakening La Niña, but with ongoing global impacts.

The 3-month average of the Southern Oscillation Index for the 1st Quarter of 2011 was 2.5, with monthly values of 2.3, 2.7 and 2.5 for the months of January, February, and March 2011, respectively. These recent positive SOI values coincide with abnormally cold ocean waters across the eastern tropical Pacific typical of a La Niña episode.

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

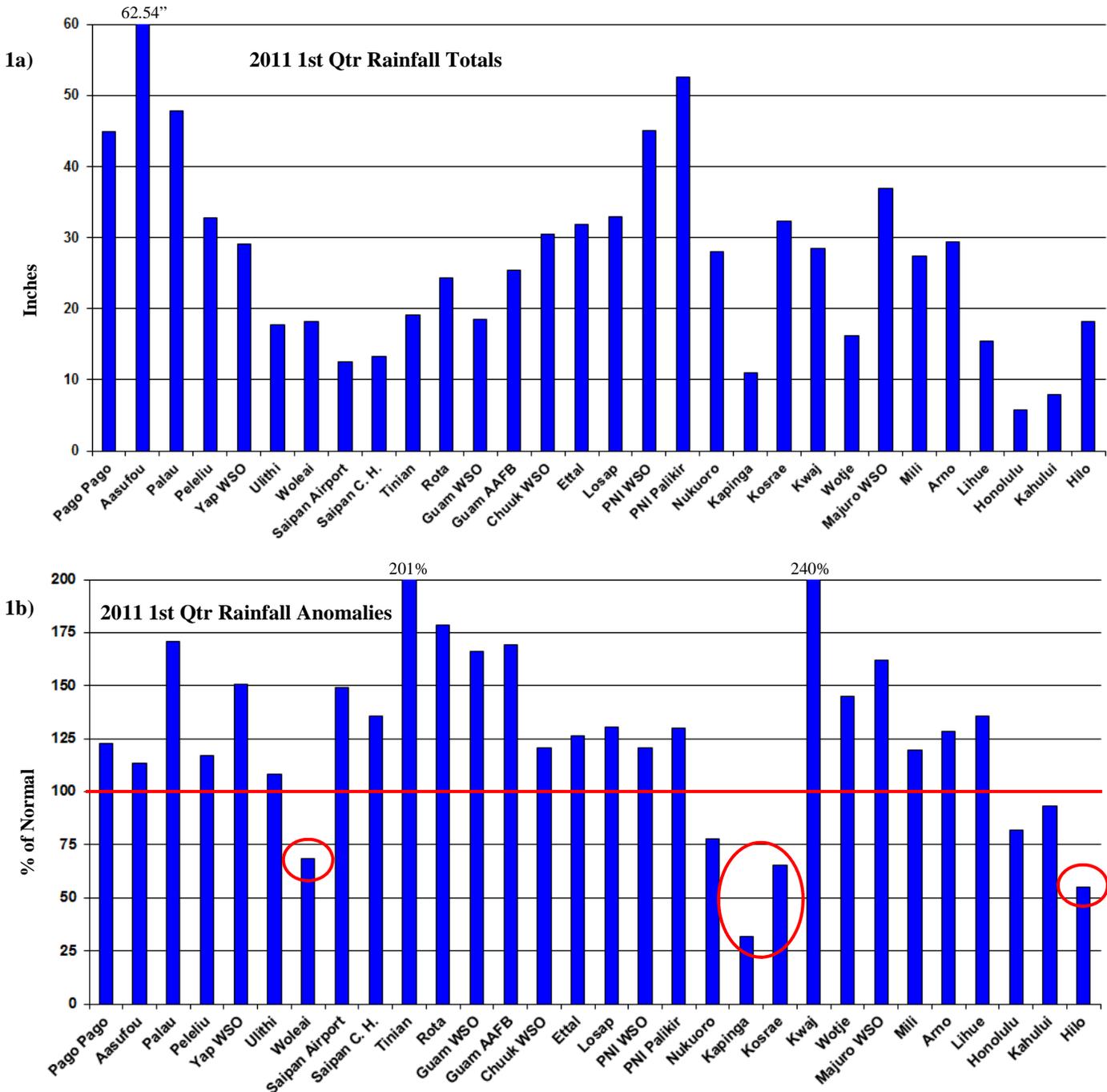


Figure 1, above. 2011 1st Quarter rainfall totals (a) in inches and (b) anomalies (expressed as % of normal). In 1b, solid line indicates normal rainfall (100%) and circles indicate rainfall less than 75% of normal.

2nd Quarter, 2011

## TROPICAL CYCLONE

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

**Tropical Cyclone Summary**

Tropical cyclone activity in the western North Pacific during 2011 is expected to rebound from the record-setting inactivity experienced during 2010. From January 2011 through mid-April of 2011, there have been some episodes of westerly winds along the equator extending eastward to near 150°E accompanied by the formation of large areas of disturbed weather. During the progress of one such episode of westerly winds along the equator in early April, the JTWC numbered two tropical depressions: TD 01W, which formed in the South China Sea and later dissipated there; and TD 02W, which emerged from a low-latitude monsoon depression centered near Palau. TD 02W slowly consolidated northeast of Palau, and then tracked to the northeast on a path taking it to the north of Guam and Saipan. Surface winds on Guam and Saipan became westerly for a few days as TD 02W passed to the north. The only adverse weather noted during the passage of TD 02W through Micronesia was some high surf on western shores noted particularly at Yap and Palau. TD 01W and TD 02W were not named by the JMA, so the basin still stands with no named TCs through mid-April.

The Southern Hemisphere cyclone season of 2010-2011 has been below average, particularly in the South Indian Ocean. Most of the southern Hemisphere TC activity has been in the Australian regions of the South Pacific and South Indian Ocean. This is consistent with La Niña, and was anticipated in earlier PEAC forecasts, and forecasts made by the Australian Bureau of Meteorology. TC activity east of the International Date Line has been reduced overall, with one notable storm occurrence: Tropical Cyclone Wilma (TC 08P). TC Wilma passed very near to Pago Pago on 24 January 2011 as a minimal hurricane with little impact in the region. The total of 21 TCs numbered by the JTWC in the Southern Hemisphere from July 2010 through mid-April 2011 is below normal. In fact, through 21 April 2011, the Southern Hemisphere Accumulated Cyclone Energy (ACE) (see <http://www.coaps.fsu.edu/~maue/tropical/>) was sitting at 140.4 versus a normal for the season to date of 210, or 67%. ACE is a measure of tropical cyclone activity that takes into account the intensity and duration of storms. No further TC activity is anticipated for American Samoa through June 2011 to finish out the current cyclone season.

**PEAC Center Tropical Cyclone Outlook**

Based on available guidance<sup>1</sup> and the forecast behavior of ENSO, the PEAC tropical cyclone outlook for the upcoming western North Pacific typhoon season of 2011 is for near normal activity, notwithstanding the recent widespread trend toward reduced numbers of TCs. There may be a notable westward shift of TC activity in the first half of 2011 as the waning La Niña still exerts some influence on the weather of Micronesia. By fall of 2011, under a scenario of ENSO-neutral conditions, the TC activity in the western North Pacific (and in Micronesia) should be close to normal for cyclone numbers and cyclone formation locations and tracks (see island summaries for further details).

On March 8, 2011, the Tropical Storm Risk (TSR) Research Group (<http://www.tropicalstormrisk.com/>) issued the following assessment of tropical cyclone activity for the western North Pacific basin: "The TSR extended range forecast for Northwest Pacific typhoon activity in 2011 anticipates a season with activity close to normal. Based on current and projected climate signals, Northwest Pacific typhoon activity in 2011 is forecast to be double that seen in 2010 (which recorded the fewest number of tropical storms and typhoons since reliable records began in the mid 1960's). The forecast spans the period from 1st of January to 31st of December 2011 (95% of typhoons occur historically after the 1st of May). ... Updated forecasts will be issued in early May, early July, and early August."

	<b>Intense Typhoons*</b>	<b>Typhoons</b>	<b>TS + TY</b>
2011	7.8 (+ 2.7)	17.5 (+ 3.3)	27.8 (+ 4.2)
46yr Climate Norm	8.5 (+ 3.0)	16.4 (+ 3.8)	26.3 (+ 4.6)

**Note:** (mean + SD); \* One-Minute Sustained Wind > 95 kts

As of mid-April 2011, experimental forecasts for the annual total of western North Pacific TC activity issued by Paul Stanko (Senior forecaster, Guam WFO) indicate that the most likely category of 2011 TC activity is "normal," (among seven groupings ranging from "record high" to "record low.") These forecasts are based only on year-to-date activity, and are not very skillful this early in the season. The latest TC outlooks and forecast updates from Paul Stanko, the TSR, and the City University of Hong Kong Laboratory for Atmospheric research will be provided in the 3rd Quarter Newsletter due in mid-July.

<sup>1</sup>The PEAC tropical cyclone forecasts for 2010 are provisional. The PEAC considers input from three seasonal outlooks for tropical cyclone activity in the western North Pacific basin: (1) The City University of Hong Kong Laboratory for Atmospheric Research, under the direction of Dr. J. C-L. Chan; (2) The Benfield Hazard Research Centre, University College London, Tropical Storm Risk (TSR) research group, UK, led by Dr. Adam Lea and Professor Mark Saunders (<http://www.tropicalstormrisk.com/>); and, (3) an experimental typhoon outlook produced by Paul Stanko (forecaster at the Guam WFO).

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**American Samoa:** Hurricane Wilma passed directly over American Samoa at the end of January 2011. It appears that Wilma was of severe tropical storm intensity when it passed; peak measured winds were 50 kt with gusts to 70 kt. Coastal inundation was experienced on the North Shore of Tutuila, with some damage to roads and bridges. There was also some loss of sheet metal roofs in locations of greater exposure, such as at higher elevations, in valleys where winds were funneled, or where down-slope winds accelerated. Wilma intensified after passing American Samoa, and became a very powerful 115 kt (Saffir-Simpson Category 4) hurricane two-and-one-half days later when it was located well to the south of the Fiji Islands. The months of December 2010 and January 2011 were very wet at Pago Pago with 28.30 and 25.72 inches, respectively. An extreme amount (44.12 inches) of rainfall was seen at Aasufou during the month of January, which was the third-highest monthly total seen there in its climate record (previous extremes include 47.86 inches in January 2005 and 44.89 inches during February 2006). This higher elevation station on the island of Tutuila often gets far more rain than stations along the coastal perimeter of the island. In contrast, the 4.99 inches of rainfall in February was a very dry value for this site (a record February minimum, but not an all-time low), and was attributed by local observers to be a result of a substantial change of wind and weather patterns between the two months. After the unusually wet months of December and January, the SPCZ shifted to the west to lie across the region from Vanuatu through Fiji, and conditions became much drier in February and March.

American Samoa Rainfall Summary 1st Qtr 2011						
Station		Jan.	Feb.	Mar.	1st Qtr	Predicted <sup>1</sup>
Pago Pago WSO	Inches	25.72	13.39	5.77	44.88	43.93
	% Norm	204%	105%	51%	123%	120%
Aasufou	Inches	44.12	4.99	13.43	62.54	N/A
	% Norm	238%	26%	76%	113%	N/A

<sup>1</sup> Predictions made in 4th Quarter 2010 newsletter.

**Climate Outlook:** Computer forecasts and a consensus of outlooks from several regional meteorological centers indicate that rainfall in American Samoa is likely to be slightly below normal for the next few months as the next rainy season wanes and the dry season becomes established. Normal monthly rainfall is typically below 10 inches per month for the period May through September at Pago Pago. Thereafter for the remainder of 2011 and early 2012, the rainfall and tropical cyclone activity in American Samoa will depend on the evolution of ENSO. If the climate system is ENSO-neutral or moving toward El Niño in latter half of 2011, the rainfall and tropical cyclone activity in American Samoa should be normal to above normal. If La Niña returns, the rainfall and tropical cyclone activity should be near normal to below normal.

LOCAL SUMMARY AND FORECAST

Predicted rainfall for American Samoa from April 2011 through March 2012 is:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>2</sup>
April - June 2011 (Onset of Dry Season)	90% (24.78 inches - Pago Pago)
July - September 2011 (Heart of Dry Season)	95%
October - December 2011 (Onset of next Rainy Season)	100%
January - March 2012 (Heart of next Rainy Season)	100%

<sup>2</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.



**Guam/CNMI:** With the exception of the El Niño year of 2009, the past several years have seen no strong episodes of the SW monsoon, a sharp reduction of tropical cyclone activity, and few notable extremes of rainfall throughout Guam and the CNMI. During the El Niño year of 2009, the northern islands of the CNMI were affected by two intense typhoons: Melor and Choi-Wan, and intense Typhoon Nida passed between Guam and Yap. During 2010, very quiet conditions resumed. Relatively tranquil conditions continued in the 1st Quarter of 2011, but there were hints of change in continuing the quiet character of the climate and weather. For the first time in a long time, it was quite wet at most locations. The rainfall during January 2011 was nearly double (200%) the normal value at all locations – an odd uniformity for rainfall of showery convective origin. During the three-month period January through March, there were some episodes of 2 or 3 inches of rainfall in 24 hours. Distant lightning was observed several times in offshore convective cloud systems. Tropical Depression 02W passed to the north of Guam and the CNMI on April 04 bringing brisk westerly winds to island waters.

Guam and CNMI Rainfall Summary 1st Qtr 2011						
CNMI						
Station		Jan.	Feb.	Mar.	1st Qtr	Predicted <sup>1</sup>
Saipan Intl. Airport	Inches	6.81	2.80	2.85	12.46	8.36
	% Norm	193%	106%	143%	149%	100%
Capitol Hill	Inches	7.17	3.18	2.86	13.21	9.75
	% Norm	179%	106%	104%	135%	100%
Tinian Airport	Inches	11.79	2.65	4.62	19.06	9.50
	% Norm	295%	88%	185%	201%	100%
Rota Airport	Inches	11.85	7.06	5.44	24.35	13.64
	% Norm	224%	151%	147%	179%	100%

<sup>1</sup> Predictions made in 4th Quarter 2010 newsletter.

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Guam and CNMI Rainfall Summary 1st Qtr 2011						
Station		Jan.	Feb.	Mar.	1st Qtr	Predicted <sup>1</sup>
<b>Guam</b>						
<b>GIA (WFO)</b>	<b>Inches</b>	8.23	6.21	4.12	<b>18.56</b>	<b>11.17</b>
	<b>% Norm</b>	185%	166%	138%	<b>166%</b>	<b>100%</b>
<b>AAFB</b>	<b>Inches</b>	10.55	7.45	7.43	<b>25.43</b>	<b>15.01</b>
	<b>% Norm</b>	185%	143%	182%	<b>169%</b>	<b>100%</b>
<b>University of Guam</b>	<b>Inches</b>	10.79	5.53	4.08	<b>20.40</b>	<b>11.15</b>
	<b>% Norm</b>	242%	148%	137%	<b>183%</b>	<b>100%</b>
<b>Ugum Watershed</b>	<b>Inches</b>	11.91	6.56	7.23	<b>25.70</b>	<b>15.21</b>
	<b>% Norm</b>	209%	126%	162%	<b>169%</b>	<b>100%</b>
<b>Ypapao (Dededo)</b>	<b>Inches</b>	10.08	8.28	5.10	<b>23.46</b>	<b>15.04</b>
	<b>% Norm</b>	177%	159%	125%	<b>156%</b>	<b>100%</b>
<b>Sinajaña</b>	<b>Inches</b>	10.01	5.43	3.57	<b>19.01</b>	<b>11.18</b>
	<b>% Norm</b>	225%	145%	120%	<b>170%</b>	<b>100%</b>

<sup>1</sup> Predictions made in 4th Quarter 2010 newsletter.

**Climate Outlook:** The evolution of ENSO from La Niña to ENSO-neutral usually brings wetter weather to Guam and the CNMI. This shift of the status of ENSO, coupled with observed increase in extreme rain events and other indicators of greater instability in the regional atmosphere during the 1st Quarter of 2011 portend a more active rainy season than has been seen in the past few years. This could mean the occurrence of a few moderate or strong episodes of the southwest monsoon during the upcoming rainy season, an increase in extremes of rainfall (e.g., 4 in or more during a 24-hour period), and an increase in tropical cyclone activity in regional waters. The anticipated increase of tropical cyclone activity will bring the risk of a typhoon to near normal (a 15 to 20% risk of gales or higher from a nearby TC passage) for Guam and the CNMI, which may seem quite active with respect to the several recent very quiet years. The highest risk of a typhoon in the region occurs during El Niño, when the risk of gales in regional waters increases to 25-35%, or three times the odds for non-El Niño years (1-in-10).

Predicted rainfall for the Mariana Islands from April 2011 through March 2012 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>2</sup>	
	Guam/Rota	Saipan/Tinian
April - June 2011 (2nd Half of Dry Season)	<b>120%</b> <b>(19.71 inches)</b>	<b>120%</b> <b>(10.30 inches)</b>
July - September 2011 (Heart of Next Rainy Season)	<b>120%</b>	<b>120%</b>
October - December 2011 (End of Next Rainy Season)	<b>110%</b>	<b>110%</b>
January - March 2012 (Onset of Next Dry Season)	<b>110%</b>	<b>110%</b>

<sup>2</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

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Federated States of Micronesia

**Yap State:** Rainfall during the first three months of 2011 was above normal throughout most of Yap State. Yap Island was wettest with roughly 30 inches of rain during the 1st quarter, or 150% of normal. At some of the atolls of Yap State it was drier. Ulithi's 17.73 inches of rain during the 1st Quarter was 108% of normal, and the 3-month total of 18.17 inches at Woleai was only 69% of normal. In a La Niña weather pattern, the heavy rainfall of the tropical western North Pacific shifts to the west (or at least is not reduced in the western portion of the basin). Located in the western portion of Micronesia, there has been an abundance of convective cloud clusters and tropical disturbances providing heavy rainfall in Yap State. At the end of March, a large monsoon depression formed near Yap and Palau. This monsoon depression evolved into Tropical Depression 02W. The monsoon depression and the numbered tropical depression that it spawned, stayed in the region of Yap State for over a week. Abundant rains, a period of westerly wind, and some high surf on the western shores were their affects in Yap State.

Yap State Rainfall Summary 1st Qtr 2011						
Station		Jan.	Feb.	Mar.	1st Qtr	Predicted <sup>1</sup>
<b>Yap Island</b>						
<b>Yap WSO</b>	<b>Inches</b>	11.80	6.71	10.50	<b>29.01</b>	<b>19.27</b>
	<b>% Norm</b>	161%	112%	176%	<b>151%</b>	<b>100%</b>
<b>Dugor</b>	<b>Inches</b>	10.75	9.94	11.90	<b>32.59</b>	<b>19.27</b>
	<b>% WSO</b>	147%	166%	200%	<b>169%</b>	<b>100%</b>
<b>Gilman</b>	<b>Inches</b>	14.75	5.94	11.02	<b>31.72</b>	<b>19.27</b>
	<b>% WSO</b>	201%	99%	185%	<b>165%</b>	<b>100%</b>
<b>Luweech</b>	<b>Inches</b>	13.36	4.34	10.86	<b>28.56</b>	<b>19.27</b>
	<b>% WSO</b>	182%	73%	182%	<b>148%</b>	<b>100%</b>
<b>Maap</b>	<b>Inches</b>	11.32	7.40	9.10	<b>27.82</b>	<b>19.27</b>
	<b>% WSO</b>	154%	124%	153%	<b>144%</b>	<b>100%</b>
<b>North Fanif</b>	<b>Inches</b>	13.67	9.88	10.17	<b>33.72</b>	<b>19.27</b>
	<b>% WSO</b>	186%	165%	171%	<b>175%</b>	<b>100%</b>
<b>Rumung</b>	<b>Inches</b>	11.04	9.87	8.80	<b>29.71</b>	<b>19.27</b>
	<b>% WSO</b>	151%	165%	148%	<b>154%</b>	<b>100%</b>
<b>Tamil</b>	<b>Inches</b>	14.45	8.88	9.08	<b>32.41</b>	<b>19.27</b>
	<b>% WSO</b>	197%	148%	152%	<b>168%</b>	<b>100%</b>
<b>Outer Islands</b>						
<b>Ulithi</b>	<b>Inches</b>	5.30	4.98	7.45	<b>17.73</b>	<b>16.38</b>
	<b>% Norm</b>	85%	98%	147%	<b>108%</b>	<b>100%</b>
<b>Woleai</b>	<b>Inches</b>	3.25	6.91	8.01	<b>18.17</b>	<b>26.48</b>
	<b>% Norm</b>	30%	92%	97%	<b>69%</b>	<b>100%</b>

<sup>1</sup> Predictions made in 4th Quarter 2010 newsletter.

**Climate Outlook:** Computer forecasts and a consensus of outlooks from several regional meteorological centers indicate that rainfall throughout Yap State is likely to be slightly above normal for at least the next few months as the rainy season becomes established. Normal monthly rainfall on Yap Island begins to top 10 inches starting in June, but it is likely that April

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and May will each exceed 10 inches in the current weather pattern. Abundant rainfall is anticipated to occur throughout Yap State for the foreseeable future.

There is a normal risk (roughly a 10-15% chance – that is, once in 7 to 10 years) of a damaging tropical cyclone in Yap State or its outer atolls during 2011. Most tropical cyclones affecting Yap State form near Chuuk or Guam and pass to the north of Yap Island. The northern atolls of Yap State (e.g., Ulithi and Fais) are probably most vulnerable to typhoons, but two recent typhoons (Mitag – March 2002, and Sudal – April 2004) made direct hits on Yap Island.

Predicted rainfall for Yap State from April 2011 through March 2012 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>2</sup>	
	Yap and Ulithi	Woleai
April – June 2011 (Onset of Rainy Season)	120% (32.63 inches)	100% (36.26 inches)
July – September 2011 (Heart of Rainy Season)	100%	100%
October – December 2011 (End of Rainy Season)	120%	100%
January – March 2012 (Onset of next Dry Season)	110%	100%

<sup>2</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

**Chuuk State:** Rainfall was abundant throughout Chuuk State during the 1st Quarter of 2011, with some large month-to-month and island-to-island variations. There was a north-south gradient of rainfall across Chuuk State, with islands located further south (e.g., the southern Mortlocks) receiving the most rainfall (upwards of 40 inches) during the 3-month period, and islands further to the north (e.g., Fananu) receiving the least (just over 25 inches). During March, some locations (e.g., Nama and Ta) received over 20 inches of rain. At this time of year, 20 inches of rain in one month is unusual. In the time series of rainfall at Chuuk WSO extending from 1956 to 2007, there were only two occurrences of 20 inches or more of monthly rainfall during any January, February or March. In addition, there were only 12 occurrences of monthly rainfall over 15 inches, or 7.5% of all 1st Quarter months in the period 1956 to 2007. At its latitude, most of the islands of Chuuk State have a short dry season, with the average monthly rainfall during February and March falling below 10 inches. During the years that follow El Niño, the short dry season in Chuuk State is prolonged and much drier. During times of waning La Niña (the current scenario), or during the onset of El Niño, it tends to be wet throughout Chuuk State.

Chuuk State Rainfall Summary 1st Qtr 2011						
Station		Jan.	Feb.	Mar.	1st Qtr	Predicted <sup>1</sup>
<b>Western Atolls</b>						
Polowat	Inches	2.75	1.95	2.37	7.07	15.91
	% Norm	41%	36%	42%	40%	90%

<sup>1</sup> Predictions made in 4th Quarter 2010 newsletter.

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Chuuk State Rainfall Summary 1st Qtr 2011						
Station		Jan.	Feb.	Mar.	1st Qtr	Predicted <sup>1</sup>
<b>Northern Atolls</b>						
Fananu	Inches	6.60	9.00	11.05	26.65	22.69
	% WSO	62%	146%	132%	106%	90%
Onoun	Inches	13.53	16.43	7.77	37.73	22.69
	% WSO	127%	266%	93%	150%	90%
<b>Northern Mortlocks</b>						
Losap	Inches	10.35	12.68	9.87	32.90	25.21
	% WSO	97%	205%	118%	131%	100%
Nama	Inches	7.60	10.63	22.22	40.45	25.21
	% WSO	71%	172%	266%	160%	100%
<b>Chuuk Lagoon</b>						
Chuuk WSO	Inches	8.08	8.42	13.97	30.47	25.21
	% Norm	76%	136%	168%	121%	100%
Piis Panew*	Inches	4.85	5.05	8.38	18.28	25.21
	% WSO	45%	82%	100%	73%	100%
<b>Southern Mortlocks</b>						
Station		Jan.	Feb.	Mar.	1st Qtr	Predicted <sup>1</sup>
Lukunor	Inches	14.38	8.93	14.97	38.28	30.60
	% Norm	163%	110%	125%	125%	100%
Ettal	Inches	10.41	6.59	14.79	31.79	25.21
	% WSO	97%	107%	177%	126%	100%
Ta	Inches	9.48	7.33	23.70	40.51	25.21
	% WSO	89%	119%	284%	161%	100%
Namoluk	Inches	12.93	8.58	19.58	41.09	25.21
	% WSO	121%	139%	235%	163%	100%

<sup>1</sup> Predictions made in 4th Quarter 2010 newsletter.

\* Values for Piis Panew are estimated.

**Climate Outlook:** Conditions at Chuuk State are anticipated to continue to be wetter than normal. This is supported by long-range computer forecasts, and the known typical behavior of the weather and climate of Chuuk State when La Niña wanes during the spring and becomes ENSO-neutral by the summer.

For the next five months (April 2011 through August 2011), there is a low risk chance (1-in-15, or 7%) of a tropical storm within the boundaries of Chuuk State. It is more likely that the depression stages of developing tropical cyclones will form in Chuuk State (bringing abundant rain), and then pass to the north-west before becoming numbered or named cyclones. Later in

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the year (September through December), the risk of a tropical storm or typhoon occurring within the boundaries of Chuuk State will be higher (possibly 10-15%). In any case, these named cyclones, or their precursors, will bring at least one or two episodes of heavy rain and gusty westerly winds across Chuuk State from September through December.

Predictions for Chuuk State from April 2011 through March 2012 are as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>2</sup>			
	Chuuk Lagoon, Losap, and Nama	Polowat	Northern Atolls	Southern Mortlocks
Apr – Jun 2011	120% (42.65 inches)	90% (32.00 in)	100% (35.55 in)	120% (42.65 in)
Jul – Sep 2011	100%	90%	120%	100%
Oct – Dec 2011	120%	100%	120%	100%
Jan – Mar 2012	100%	95%	100%	100%

<sup>2</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

**Pohnpei State:** The 2011 1st Quarter rainfall was above normal on Pohnpei Island. On the atolls of Pohnpei State, there was a variety of rainfall conditions with Nukuoro below normal, Pingelap near normal, and Mwoakilloa above normal. Close to the equator, at Kapingamarangi, it was very dry. Because La Niña produced colder than normal sea surface temperatures along the equator for several months beginning in the latter part of 2010, the atolls of Pohnpei State located at low latitudes (e.g., Kapingamarangi at 1°N and Nukuoro at 4°N) had reduced rainfall in recent months. The reduction of rainfall was most pronounced at Kapingamarangi where the monthly rainfall during September 2010 through February 2011 was 0.72 inches, 1.10 inches, 2.07 inches, 0.76 inches, 2.27 inches, and 0.20 inches. This level of dryness (only 15% of the normal rainfall total during the 6-month period) prompted the WFO Guam in coordination with the WSO Pohnpei to issue weekly drought advisories for Kapingamarangi, which continued through late April 2011. Much needed rainfall occurred at Kapingamarangi in March 2011. As noted in the drought advisories, damage to vegetation and crops probably occurred during this prolonged dry spell.

Pohnpei State Rainfall Summary 1st Qtr 2011						
Station		Jan.	Feb.	Mar.	1st Qtr	Predicted <sup>1</sup>
<b>Pohnpei Island</b>						
Pohnpei WSO	Inches	12.24	12.25	20.60	45.09	35.54
	% Norm	94%	113%	152%	121%	95%
Palikir	Inches	11.66	18.59	22.33	52.58	38.41
	% Norm	83%	159%	153%	130%	95%
Kolonia Airport	Inches	8.30	11.66	20.75	40.71	29.08
	% Norm	77%	131%	187%	133%	95%

<sup>1</sup> Predictions made in 4th Quarter 2010 newsletter.

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Pohnpei State Rainfall Summary 1st Qtr 2011						
Station		Jan.	Feb.	Mar.	1st Qtr	Predicted <sup>1</sup>
<b>Atolls of Pohnpei State</b>						
Nukuoro	Inches	4.34	6.66	16.96	27.96	34.11
	% Norm	40%	63%	125%	78%	95%
Pingelap	Inches	12.79	14.22	13.23	40.24	37.05
	% Norm	103%	116%	91%	103%	95%
Mwoakilloa	Inches	15.35	13.85	16.04	45.24	37.05
	% Norm	124%	113%	111%	116%	95%
Kapingamarangi	Inches	2.27	0.20	8.46	10.93	25.95
	% Norm	22%	2%	61%	32%	75%

<sup>1</sup> Predictions made in 4th Quarter 2010 newsletter.

**Climate Outlook:** The dry conditions at Kapingamarangi should soon end. A welcome increase of rainfall occurred during March 2011, and rainfall amounts should gradually recover to near normal over the next 3 to 6 months.

Pohnpei Island usually experiences its heaviest monthly rainfall during April through June. It may be quite wet on Pohnpei Island during April through June of 2011, with 25-30 inches of rain possible in one of those months at the WSO or at Palikir.

A direct strike of any Pohnpei State location by a tropical storm or typhoon is not anticipated in the foreseeable future.

Predicted rainfall for Pohnpei State from April 2011 through March 2012 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>2</sup>		
	Pohnpei Island	Atolls	Kapingamarangi
Apr - Jun 2011	120% (64.09 inches)	120% ( 64.09 inches)	75% (23.46 inches)
Jul - Sep 2011	100%	100%	85%
Oct - Dec 2011	100%	100%	90%
Jan - Mar 2012	100%	100%	90%

<sup>2</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

**Kosrae State:** The tongue of colder-than-normal sea surface temperature (which was responsible for the prolonged substantial reduction of rainfall at Kapingamarangi and a short term reduction of rainfall on Nukuoro) likely had a perceptible impact on the rainfall on Kosrae. Located at just under 6°N, the island of Kosrae was at times, in a dry easterly wind flow, with heavier rainfall passing to the north in the convergence zone. Rainfall across Kosrae has been persistently drier than normal for many months. The rainfall amounts during the 1st Quarter of 2011 continued this trend, with a 3-month 2011 1st Quarter total at the airport of 32.37 inches, which was only 66% of normal. Other locations on Kosrae were wetter than at the airport, with Tofol being the wettest. A monthly rainfall total below 10 inches is relatively rare on Kosrae, comprising only about 20% of all months during the 1st Quarter of the year, and 15% of all months regardless of quarter.

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Kosrae State Rainfall Summary 1st Qtr 2011						
Station		Jan.	Feb.	Mar.	1st Qtr	Predicted <sup>1</sup>
Airport (SAWRS)	Inches	11.81	10.96	9.60	32.37	46.94
	% Norm	82%	67%	51%	66%	95%
Utwa	Inches	9.73	9.82	16.39	35.94	46.94
	% WSO	68%	60%	88%	73%	95%
Nautilus Hotel	Inches	12.91	12.30	11.30	36.51	46.94
	% WSO	90%	75%	61%	74%	95%
Tofol	Inches	14.45	9.50	16.74	40.69	46.94
	% WSO	100%	58%	90%	82%	95%

<sup>1</sup> Predictions made in 4th Quarter 2010 newsletter.

**Climate Outlook:** April, May, and June are normally the wettest months of the year at Kosrae. Computer forecasts are indicating normal or above normal rainfall for Kosrae during the upcoming period of April through June, but given the recent unexpected dryness there, the rainfall might only recover to near normal. Even normal rainfall in the next three months would be quite a bit wetter than it has been on Kosrae in recent months.

Predicted rainfall for Kosrae State from April 2011 through March 2012 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>2</sup>
April – June 2011	100% (59.46 inches)
July – September 2011	100%
October – December 2011	100%
January – March 2012	95%

<sup>2</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.



**Republic of Palau:** Rainfall during the first three months of 2011 was above normal throughout most of the Republic of Palau. The Koror

Weather Service Office (WSO) was wettest with roughly 47.87 inches of rain during the 1st Quarter, or 171% of normal. This 3-month total at Koror WSO was the second highest 1st Quarter total observed in Micronesia, and was second only to the 52.58 inches observed at Palikir, Pohnpei Island. Other locations in the Republic of Palau reported lesser amounts than at the WSO, but all recording sites were above normal. In a La Niña weather pattern, the heavy rainfall of the tropical western North Pacific shifts to the west (or at least is not reduced in the western portion of the basin). Thus, there has been an abundance of convective cloud clusters and tropical disturbances providing heavy rainfall in the Republic of Palau which is located in the far western portion of Micronesia. At the end of March, a large monsoon depression formed south of Palau. This monsoon depression evolved into Tropical Depression 02W. The monsoon depression and the numbered tropical depression that it spawned stayed in the region of Palau for over a week producing abundant rains, a period of westerly wind, and some high surf on the western shores of the islands.

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Republic of Palau Rainfall Summary 1st Qtr 2011						
Station		Jan.	Feb.	Mar.	1st Qtr	Predicted <sup>1</sup>
WSO Koror	Inches	18.62	13.95	15.30	47.87	28.02
	% Norm	174%	153%	187%	171%	100%
Nekken	Inches	10.80	8.97	13.38	32.43	28.02
	% WSO	94%	98%	163%	116%	100%
Intl. Airport	Inches	13.59	14.52	12.61	40.72	28.02
	% WSO	127%	159%	154%	145%	100%
Peleliu	Inches	10.41	17.30	4.99	32.70	27.90
	% Norm	97%	190%	61%	117%	100%

<sup>1</sup> Predictions made in 4th Quarter 2010 newsletter.

**Climate Outlook:** With La Niña conditions slowly abating and the climate system of the Pacific trending towards ENSO-neutral, Palau should have above normal rainfall for the foreseeable future. This typical response to this particular evolution of ENSO is also supported by long-range computer forecasts that show normal to above-normal rainfall for the next 3 months.

There is only a slight risk (5-10% – which is normal) of a damaging tropical cyclone in the Republic of Palau during all of 2011, with greatest threat late in the year. It is most likely that one of the western North Pacific basin's final typhoons of 2011 will move to the north or northeast of Palau to bring a few days of gusty westerly winds, high surf on the western shores, and some heavy showers.

Predicted rainfall for Palau from April 2011 through March 2012 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>2</sup>
April – June 2011 (Onset of Rainy Season)	120% (45.91 inches)
July – September 2011 (Heart of Rainy Season)	100%
October – December 2011 (End of Rainy Season)	120%
January – March 2012 (Next Dry Season)	100%

<sup>2</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.



**Republic of the Marshall Islands (RMI):**

Until recently, the RMI has been drier than normal. In fact, the long-term time series of rainfall at Kwajalein and at Majuro (which extend back into the 1950's) show a statistically significant trend of decreasing rainfall at both islands. With this as a background, the recent wet conditions in the RMI are all the more unusual. During the first three months of the year, the RMI enters its normal dry season. During the 1st Quarter of 2011, there was as much rain in each of the dry season months as in a wet month of the rainy season. At Kwajalein, the 3-month total of 31.34 inches was 240% of normal, and the 36.98 inches of rainfall at Majuro was 162% of the normal 1st

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quarter rainfall. Unusual deep convection was continually noted, with unusual occurrences of lightning. A large portion of the high monthly rainfall in the RMI came in extreme 24-hour events of 2 or more inches. During April, the wet pattern seemed to break, and dry trade winds prevailed.

RMI Rainfall Summary 1st Qtr 2011						
Station		Jan.	Feb.	Mar.	1st Qtr	Predicted <sup>1</sup>
RMI Central and Southern Atolls						
Majuro WSO	Inches	8.10	13.05	15.83	36.98	22.86
	% Norm	96%	212%	191%	162%	100%
Laura	Inches	4.77	13.37	12.49	30.63	22.86
	% WSO	57%	217%	151%	134%	100%
Aling-laplap	Inches	11.21	18.92	14.84	44.97	17.36
	% Norm	172%	403%	240%	259%	100%
Arno	Inches	8.13	13.25	21.24	42.62	22.86
	% WSO	96%	215%	257%	186%	100%
Jaluit	Inches	8.98	6.75	15.61	31.34	22.86
	% WSO	107%	110%	189%	137%	100%
Mili	Inches	8.68	10.64	8.02	27.34	22.86
	% WSO	103%	173%	97%	120%	100%
RMI Northern Atolls						
Kwajalein	Inches	6.11	11.79	10.61	28.51	11.88
	% Norm	134%	365%	259%	240%	95%
Wotje	Inches	0.83	7.24	8.08	16.15	11.14
	% Norm	19%	249%	207%	145%	95%
Utirik	Inches	1.32	4.88	4.03	10.23	10.13
	% Norm	34%	177%	115%	101%	95%

<sup>1</sup> Predictions made in 4th Quarter 2010 newsletter.

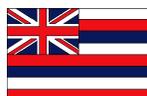
**Climate Outlook:** The rainy season in the RMI slowly builds from April through June, then extends through the final quarter of the year. Abundant rainfall should continue in the RMI for the foreseeable future, but perhaps not so far above normal as during the past several months. Computer forecasts and the typical behavior of the climate when La Niña fades suggest that 2011 will have at least near normal rainfall. Since the cause of the long-term decline of rainfall in the RMI is not known, we can not know how to factor this trend into future rainfall forecasts.

Predicted rainfall for the RMI from April 2011 through March 2012 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>2</sup>		
	Jaluit and Mili	Majuro	Northern Atolls
April – June 2011 (Onset of rainy Season)	100% (33.92 inches)	110% (37.31 in)	110% (27.62 in)
July – Sept 2011 (Heart of Rainy Season)	100%	100%	100%
Oct – Dec 2011 (End of Rainy Season)	100%	110%	110%
Jan – Mar 2012 (Dry Season)	100%	100%	100%

<sup>2</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

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**Hawai'i:** The final quarter in 2010 and the first quarter of 2011 were generally wet for most of the islands in the state of Hawaii. This is a very welcome change to the drought conditions present during the second half of 2010 on all the islands. In fact, all drought conditions have been eliminated on Oahu and Kauai. Also, heavy rainfall this winter has diminished drought conditions across the central Hawaiian Islands, which is typical for a La Niña winter.

On the islands of Molokai, Maui, and Lanai, heavy rains have greatly improved drought conditions. Kahului recorded 93% of normal rainfall for the quarter, while Lihue reported 136% of normal. On both islands, as well as on Molokai, pastures and vegetation continue to recover. Reservoir levels have remained steady or even increased on these islands.

Although progress has been seen on many of the islands, some areas on the Big Island of Hawaii remain in a moderate to extreme drought state. In each month of the 1st Quarter of 2011, the trade wind showers would reach the state of Hawaii, but then would weaken or move away before reaching the Big Island. The rain that did reach the Big Island was insufficient and well below normal (see Hilo rainfall summary below). Drought conditions on the leeward side of the Big Island still include deteriorating pastures and ranchers hauling water to support livestock. These drought state conditions may persist in the coming season (see climate outlook below).

State of Hawaii Rainfall Summary 1st Qtr 2011					
Station		Jan.	Feb.	Mar.	1st Qtr
Lihue Airport	Inches	4.11	4.65	6.73	15.49
	% Norm	90%	143%	188%	136%
Honolulu Airport	Inches	2.87	1.85	0.98	5.70
	% Norm	105%	79%	52%	82%
Kahului Airport	Inches	4.31	2.85	0.71	7.87
	% Norm	115%	121%	30%	93%
Hilo Airport	Inches	3.69	4.14	10.32	18.15
	% Norm	38%	47%	72%	55%

**Climate Outlook:** The following comments are from the U.S. Climate Prediction Center's Hawaiian Seasonal Outlook Discussion: "NCEP models predict a tendency for above normal temperatures for Hawaii for MJJ 2011. Above median precipitation for Hawaii is forecast for MJJ 2011 based on the NCEP forecast tools."

For the MJJ forecast period on the Big Island, it is becoming less likely that the western sides of the Islands will see substantial improvement in drought conditions, as trade winds become more dominant heading toward the warm season.

**For more information on weather and climate in Hawai'i go to:**  
[www.cpc.noaa.gov/products/predictions/long\\_range/fxhw40.html](http://www.cpc.noaa.gov/products/predictions/long_range/fxhw40.html)

## Seasonal Sea-Level Outlook for the US-Affiliated Pacific Islands

The following sections describe: (i) the *Canonical Correlation Analysis (CCA)*-based forecasts of sea-level deviations for forthcoming seasons AMJ, MJJ, and JJA of 2011, (ii) the observed monthly mean and maximum sea-level deviations for the season OND 2010, (iii) forecast verifications (observed/forecast values) for OND 2010, and (iv) a Synopsis of ENSO and seasonal sea-level variability. *Note that the deviations are defined 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’.* Also note that the CCA-forecasting technique adapted here does not account for sea-level deviations created by other atmospheric or geological factors such as tropical cyclones, storm surges or tsunamis.

(i) **Seasonal sea level forecast** (*deviations with respect to climatology*) for AMJ, MJJ, and JJA of 2011

Forecasts of the sea-level deviations in the USAPI ((see <http://www.prh.noaa.gov/peac/map.php> for location of stations) are presented using CCA statistical model Based on the independent SST values in JFM 2011, the resulting CCA model has been used to forecast the sea-level of three consecutive months: AMJ, MJJ, and JJA (see Table 1: left panel shows values for seasonal mean while the right panel shows the seasonal maxima). The forecast values of sea-level for AMJ, MJJ, and JJA displays a positive deviation in the vicinity of north and south Pacific Islands, except one station in Majuro (for JJA) and two stations in Hawaii (for AMJ) where a negative deviation is also visible. All the tide gauge stations (at 0 to 2-months lead time) show skillful forecasts for these three consecutive seasons (Table 1: bottom panel). Consistent with the on-going La Niña event, the sea level in these islands are higher than normal.

**Table 1: Forecasts of sea-level deviation (in inches) for April-May-June, May-June-July, and June-July-August 2011.**

Tide Gauge Station	Seasonal Mean Deviations <sup>1</sup>				Seasonal Max Deviations <sup>2</sup>					
	AMJ	MJJ	JJA	Forecast Quality <sup>3</sup>	AMJ	MJJ	JJA	Forecast Quality <sup>3</sup>	Return Period <sup>4</sup> for AMJ Season	
Lead Time <sup>5</sup>	0	1M	2M		0	1M	2M		20 year	100 year
Marianas, Guam	+7	+7	+7	Good	+22	+23	+22	Good	5.6	6.7
Malakal, Palau	+3	+3	+4	Good	+37	+37	+38	Good	9.6	14.3
Yap, FSM	+5	+5	+5	Good	+32	+32	+30	Good	16.7	33.0
Chuuk, FSM**	+5	+5	+5	N/A	+31	+32	+32	N/A	N/A	N/A
Pohnpei, FSM	+4	+2	+1	V. Good	+33	+32	+30	Good	5.8	7.1
Kapingamarangi, FSM	+3	+2	+2	Good	+29	+29	+28	Good	7.4	9.4
Majuro, RMI	+1	0	-1	Fair	+40	+38	+39	Fair	4.1	5.1
Kwajalein, RMI	+4	+3	+2	Good	+40	+39	+39	Fair	4.5	5.9
Pago Pago, AS	+5	+5	+4	V. Good	+28	+28	+27	Good	3.9	5.4
Honolulu, Hawai'i	-1	0	+1	Fair	+20	+21	+21	Fair	4.1	5.9
Hilo, Hawai'i	-1	0	+1	Fair	+21	+24	+24	Fair	7.9	11.4

**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 from -1 to +1 inch are considered negligible, and deviations from -2 to +2 inches are unlikely to cause any adverse climatic impact. Forecasts for Chuuk (\*\*) are estimated subjectively based on information from WSO Chuuk and observations from neighboring stations of Pohnpei and Yap. See [http://www.prh.noaa.gov/peac/peu/2011\\_2nd/sea\\_level.php#footnote](http://www.prh.noaa.gov/peac/peu/2011_2nd/sea_level.php#footnote) for explanations of footnotes 1 through 5.

**Remarks:** The forecasts values of sea level for AMJ, MJJ, and JJA seasons (Table 1, above) indicate that sea levels for most of the stations are likely to fall in the months to come. However, currently most of these stations show about 3-6 inches higher than normal sea level in the forthcoming seasons. As compared to other stations, Guam shows a higher rise of 6-7 inches while Majuro shows a lower rise 0-1 inches, or even fall in JJA season.

Despite an elevated sea level for about 3-6 inches higher than normal in the forthcoming seasons, the forecasts clearly indicate a fall in the same time horizon. This falling trend is supportive to on-going La Niña condition. According to CPC, a transition to ENSO-neutral conditions is expected by June 2011. La Niña weakened for the third consecutive month, as reflected by increasing surface and subsurface ocean temperatures across the equatorial Pacific Ocean. However, as observed, the atmospheric component is weakening slowly and, as a result, enhanced low-level easterly trade winds and anomalous upper-level westerly winds are still active over the equatorial Pacific. Collectively, these oceanic and atmospheric anomalies reflect a weakening La Niña.

Receive Pacific ENSO Update notifications by email:

Visit <http://www.prh.noaa.gov/peac/subscribe.php>

Seasonal Sea-Level Outlook for the US-Affiliated Pacific Islands

(ii) Observed Monthly Sea-Level Deviation in the January-February-March (JFM) 2011 Season

The monthly time series (January - March 2011) 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](http://ilikai.soest.hawaii.edu/islp/slpp/deviations). Locations of these stations can be found at: <http://www.prh.noaa.gov/peac/map.php>.

Table 2: Monthly observed max/mean sea-level deviations in inches (year to year standard deviation in parentheses)

Tide Gauge Station	Monthly Mean Deviations <sup>1</sup>				Monthly Max Deviations <sup>2</sup>			
	Jan.	Feb.	Mar.	Standard Deviations	Jan.	Feb.	Mar.	Standard Deviations
Marianas, Guam	+5.6	*	*	(+4.2)	+21	*	*	(+3.8)
Malakal, Palau	+7.0	+8.1	+10.6	(+4.8)	+42	+46	+49	(+4.8)
Yap, FSM	+6.1	+5.5	+4.6	(+4.0)	+34	+34	+33	(+4.4)
Chuuk, FSM**	*	*	*	(*)	*	*	*	(*)
Pohnpei, FSM	+8.1	+6.5	*	(+2.6)	+41	+35	*	(+3.2)
Kapingamarangi, FSM	*	*	*	(+2.4)	*	*	*	(+4.1)
Majuro, RMI	+6.8	+9.5	*	(+3.3)	+47	+54	*	(+2.5)
Kwajalein, RMI	+3.0	+3.8	+5.3	(+3.7)	+44	+45	+42	(+2.8)
Pago Pago, American Samoa	+10.0	+10.3	*	(+2.8)	+37	+35	*	(+3.0)
Honolulu, Hawai'i	+1.0	-1.0	-2.0	(+1.7)	+21	+17	+13	(+2.6)
Hilo, Hawai'i	+2.1	0.0	0.0	(+2.1)	+27	+22	+18	(+3.0)

\* Data currently unavailable; <sup>1</sup> Difference between the mean sea level for the given month and the 1975 through 1995 mean sea level value at each station; <sup>2</sup> Same as <sup>1</sup> except for maxima; SD stands for standard deviations.

**Remarks:** As compared to February 2011, the monthly mean sea-level in March 2011 recorded rise in Palau and Kwajalein, and recorded fall in Yap and Honolulu. There are several missing data; data for Guam is again unavailable now. Based on February data, it may be mentioned that Pohnpei recorded fall, Majuro recorded considerable rise, and Pago Pago remained stationary. The monthly maxima also displayed similar trends. Recent report by Hans (WSO, Pago Pago) stated that after the Tsunami of March 11, readings from the tide gauge indicates resonance for more than a day long. Resonance were also seen in CNMI, FSM.

(iii) Forecast Verification (Seasonal Mean) for JFM 2011

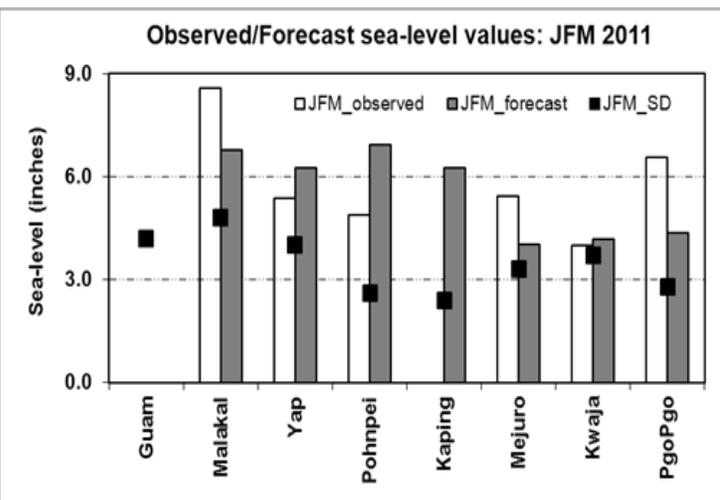


Figure 3: The observed and forecasted values for the previous season JFM are presented above. Because of missing data, we are not reporting for Guam in this issue of the newsletter. Forecasts were generally skillful. Pago Pago was slightly under forecasted.

(iv) ENSO and Seasonal Sea Level Variability: A Synopsis

Table 3: Sea-Level Deviation in Current and Major ENSO Years

Seasons	Seasonal Mean Deviations: Observed rise/fall (inches)			
	JFM 11 (La Nina)	JFM 10 (La Nina)	JFM 09 (El Nino)	JFM 08 (La Nina)
Marianas, Guam	+5.6*	+8.2	+2.0	+7.8
Malakal, Palau	+8.6	+4.0	-5.5	+5.6
Yap, FSM	+5.4	+5.6	-4.2	+4.1
Pohnpei, FSM	+7.3	+6.2	0.0	+6.2
Majuro, RMI	+8.2	+4.5	+2.8	+2.7
Kwajalein, RMI	+4.0	*	*	+4.0
Pago Pago	+10.1	+4.0	+2.0	+2.0

**Remarks:** The sea level in 2011 is much higher than that of previous years. It is possible that the recent trend of enhanced trade winds west of the dateline are partly responsible for this rise. Other factors, like snow-melt, and climate-induced changes in water storage, may also be responsible here. (\* Missing data)

# Pacific ENSO Update

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## Excerpts from El Niño/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

Issued by NOAA NWS Climate Prediction Center - 7 April 2011

[http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/enso\\_advisory/ensodisc.html](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.html)

### ENSO Alert System Status: [La Niña Advisory](#)

**Synopsis: A transition to ENSO-neutral conditions is expected by June 2011.**

La Niña weakened for the third consecutive month, as reflected by increasing surface and subsurface ocean temperatures across the equatorial Pacific Ocean. All four Niño indices ranged between  $-0.3^{\circ}\text{C}$  and  $-0.8^{\circ}\text{C}$  at the end of March 2011. Subsurface oceanic heat content anomalies (average temperatures in the upper 300m of the ocean) became weakly positive in response to the continued eastward progression of a strong oceanic Kelvin wave, which has begun to shoal in the eastern Pacific. However, the basin wide extent of negative SST anomalies remained considerable throughout the month. Also, La Niña impacts on the atmospheric circulation remained strong over the tropical and subtropical Pacific. Convection remained enhanced over much of Indonesia and suppressed over the western and central equatorial Pacific. Also, anomalous low-level easterly and upper-level westerly winds have persisted in this region. Collectively, these oceanic and atmospheric anomalies reflect a weakening La Niña, but with ongoing global impacts.

Nearly all of the ENSO models predict La Niña to continue weakening in the coming months, and the majority of models indicate a return to ENSO-neutral by May-June-July 2011 (three month average in the Niño-3.4 index between  $-0.5^{\circ}\text{C}$  and  $+0.5^{\circ}\text{C}$ ). While there is confidence in ENSO-neutral conditions by June 2011, the forecasts for the late summer and beyond remain highly uncertain. At this time, all of the multi-model forecasts suggest ENSO-neutral conditions will persist from June through the rest of the year. However, the spread of individual model forecasts and overall model skill at these lead times leaves the door open for either El Niño or La Niña conditions by the end of 2011.

La Niña will continue to have global impacts even as the episode weakens through the Northern Hemisphere spring. Expected La Niña impacts during April-June 2011 include suppressed convection over the west-central tropical Pacific Ocean, and enhanced convection over Indonesia. Potential impacts in the United States include an enhanced chance for below-average precipitation across much of the South, while above-average precipitation is favored for the northern Plains. An increased chance of below-average temperatures is predicted across the northern tier of the country (excluding New England). A higher possibility of above-average temperatures is favored for much of the southern half of the contiguous U.S. (see 3-month seasonal outlook released on March 17th, 2011).

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

The Pacific ENSO Update is produced quarterly both online and in hard copy, with additional special reports on important changes in ENSO conditions as needed. For more information about this issue please contact the editor, LTJG Charlene Felkley, at [peac@noaa.gov](mailto:peac@noaa.gov) or at the address listed below.

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