



PACIFIC



UPDATE

A Quarterly Bulletin of the Pacific El Niño-Southern Oscillation Applications Climate

(PEAC) Center

3rd Quarter, 2018 Vol. 24, No. 3

ISSUED: September 3, 2018

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

<http://www.weather.gov/peac>

CURRENT CONDITIONS

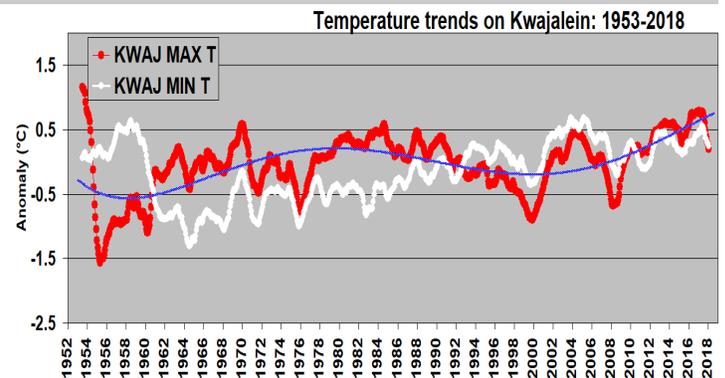
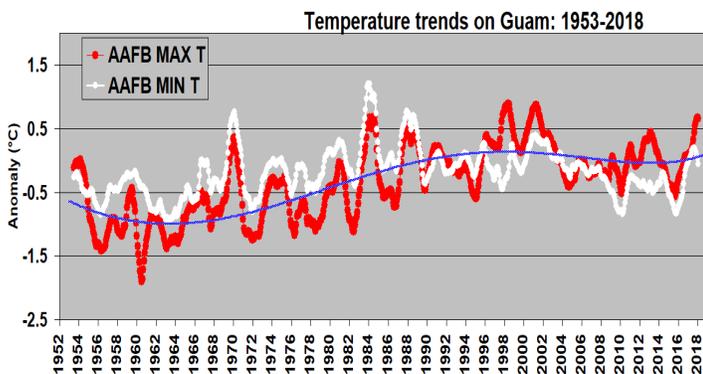
Weather conditions across Micronesia during the 1st half of 2018 were split about evenly above and below average at locations from Chuuk and westward (see Figures 3 and 4 on page 16). From Pohnpei and eastward, conditions were mostly wetter than average, with rainfall amounts at some of the atolls of the RMI (e.g., Kwajalein and Majuro) surging to new historical highs! (see the Local Variability Summaries for more details).

Breaking news:

During July and August, the pattern of abundant rainfall in the east (e.g., the RMI), with persistent dryness in the far west (e.g., Palau) continued. High rainfall in August, to-date, has already pushed multi-month totals at Majuro and Kwajalein to ever higher record magnitudes, exceeding prior high marks by wide margins.

Temperature

The temperatures across Micronesia in during the 1st Half of 2018 were mostly above average, especially in the regions of lowest rainfall (e.g., Guam) (see Figure CC-1), but were closer to (but still above) average at islands of eastern Micronesia (e.g., Kwajalein) where rainfall was heavy. During El Niño, temperatures tend to be lower across Micronesia, likely the result of cloudy, wet and windy weather. Note the persistent increase of temperature at Guam and Kwajalein from a pronounced coolness during 2015 to warmer conditions during 2016 and 2017.



Sea Level

During the 1st Quarter of 2018, the trade winds began to weaken. The sea level across most of Micronesia was above average during the 1st Quarter of 2018, but underwent a sudden fall during April 2018, with Palau dropping all the way from a stand at +6 inches above average to 0. The recent fall of sea level may be explained as a lagged response to the easing of trade-wind forcing (Figure CC-2). The response is lagged because it takes about 2-months for wind-forced mounds or depressions of sea surface topography to propagate across the Pacific basin.

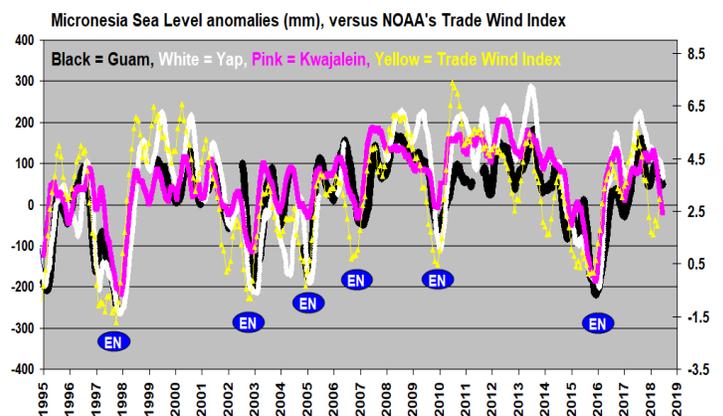


Figure CC-1. A post-WWII time series of maximum and minimum temperatures at Andersen Air Force Base (AAFB) on Guam (top panel) and on Kwajalein (top-right). Values plotted are a 12-month moving average of the monthly anomalies of temperature. Note a general warming trend, with some obvious non-linear inter-annual and inter-decadal variability. The inter-decadal variability is highlighted by the smooth non-linear trend lines. Very warm MAX and MIN temperatures at Kwajalein during the 1950s are probably an artifact of station location and exposure.

Figure CC-2. Sea level recorded at Yap (white), Guam (black) and Kwajalein (pink). Also plotted is NOAA's Trade Wind Index (5N-5S ; 135E-180) (yellow) 1985 to present. During El Niño, there is a sharp drop in sea level at most locations followed by a steep rise thereafter (blue circles inscribed with "EN" show CPC-declared El Niño events). The sea level across all of Micronesia closely tracks the trade wind forcing. Recent weakening of the trade winds corresponds with a net fall of sea level of about 4-6 inches from early 2018 to now (see the sea level discussion for more details).

CURRENT CONDITIONS

ENSO Evolution

La Niña-like weather patterns persisted through the 4th Quarter of 2017 into the 1st Quarter of 2018, as the climate system continued to be within the SST bounds of La Niña (see Fig. CC-3). During March and April, the Oceanic Niño Index (ONI) warmed to the threshold of ENSO-neutral, and with the anticipation of further warming, the CPC's latest ENSO diagnostic discussion (appended below) establishes an El Niño Watch. Some weather features more typical of El Niño have recently occurred, including a very wet eastern Micronesia, several early season tropical disturbances in eastern Micronesia and some unusual westerly winds in eastern Micronesia (see the LVS section for more details).

CURRENT STATE OF ENSO

ENSO Alert System Status: *El Niño Watch*

Synopsis: *There is ~60% chance of El Niño in the Northern Hemisphere fall 2018 (September-November), increasing to ~70% during winter 2018-19.*

El Niño Diagnostic Discussion¹

CLIMATE PREDICTION CENTER/NCEP/NWS

and the International Research Institute for Climate and Society

9 August 2018

Synopsis: There is ~60% chance of El Niño in the Northern Hemisphere fall 2018 (September-November), increasing to ~70% during winter 2018-19. "ENSO-neutral continued during July, as indicated by near-average sea surface temperatures (SSTs) across the central and eastern equatorial Pacific at the end of the month. The latest weekly Niño indices were 0.0°C for the Niño-3 index, +0.1°C for the Niño-3.4 and Niño1+2 indices, and +0.4°C for the Niño-4 index. Positive subsurface temperature anomalies (averaged across 180°-100°W) continued over the past month, and the volume of anomalous warmth extended to the surface in the eastern part of the basin. Convection remained suppressed near the Date Line and over western Indonesia. Low-level winds were near average across most of the equatorial Pacific Ocean, while upper-level wind anomalies were westerly over the eastern Pacific and near the International Date Line. Overall, the oceanic and atmospheric conditions reflected ENSO-neutral."

"The majority of models in the IRI/CPC plume predict ENSO-neutral to continue during the remainder of the Northern Hemisphere summer 2018, with El Niño most likely thereafter. Model predictions for El Niño have not wavered despite the recent decrease in the positive SST anomalies in portions of the eastern Pacific. Because of the consistency of forecasts and the expected eventual resurgence in the low-level westerly wind anomalies, the forecasters still favor the onset of El Niño in the coming months. In summary, there is ~60% chance of El Niño in the Northern Hemisphere fall 2018 (September-November), increasing to ~70% during winter 2018-19 (click CPC/IRI consensus forecast for the chance of each outcome for each 3-month period):

http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/?enso_tab=enso-cpc_plume."

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

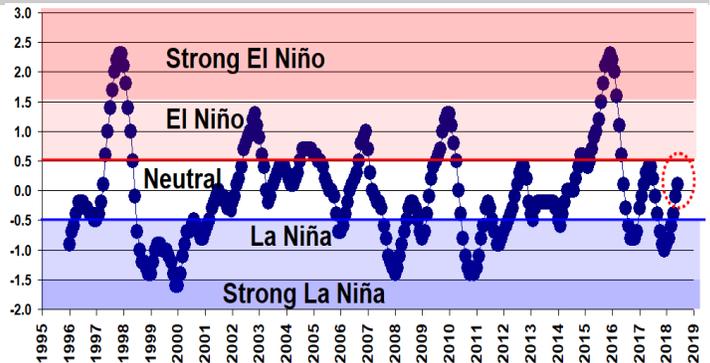


Figure CC-3. A plot of the CPC's Oceanic Niño Index (ONI) for the past two decades. Note that it made a run toward El Niño early in 2017, but then reversed and entered the La Niña category at mid-2017. During the first half of 2018, the ONI began a move through ENSO-neutral and toward El Niño. The move closer to (and possible into) El Niño is expected to continue for the next few months. Thus, the CPC issued its final La Niña advisory (text above) on 10 May 2018, and established an El Niño Watch in its latest advisories.

TROPICAL CYCLONE ACTIVITY

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

Western North Pacific

Western North Pacific tropical cyclone activity during the 1st Half of 2018 was about average, but saw a quicker pace of TC formation during July and August. The 25 TCs numbered by the JTWC during January through August of 2018 are well above average. The JMA named 21 of these, which is far above their average of 13 named storms through the same time period (see Table CC-1 for a summary of Northern Hemisphere TC activity to-date, by basin and for the Northern Hemisphere). Although the number of TCs in the western North Pacific basin was well above average, many of the storms were weaker systems that formed in subtropical latitudes and interacted with a strong and persistent monsoon system displaced to the north and west of the usual location of the monsoon trough. Thus, while the count of numbered systems was high, the count of WNP typhoons was near average. Because of the displaced location of the monsoonal low-pressure area, the tracks of the 2018 western North Pacific TCs were also displaced to the north and west (see Figure CC-4), with many exhibiting a more north-oriented track, as individual TCs were steered on cyclonically curving pathways (i.e., initially on a northerly heading, with a subsequent direction change to a more westerly heading) around the monsoon low-pressure area. A chart of the January to August tracks of the TCs of 2015 is also

TROPICAL CYCLONE ACTIVITY

Basin	Named Storms	Named Storm Days	Hurricanes/Typhoons	Hurricane Days	Major ³ Hurricanes	Major Hurricane Days	ACE
<i>NAtl</i>	5 (4.6)	18.25 (17.2)	2 (1.9)	3.25 (5.2)	0 (0.6)	0.00 (1.1)	17.5 (25.2)
<i>ENP</i>	14 (9.6)	59.25 (41.0)	6 (4.9)	29.0 (16.1)	4 (2.4)	17.25 (4.6)	147.6 (72.0)
<i>WNP</i>	21 (13.2)	84.50 (61.1)	9 (7.7)	27.5 (26.3)	4 (3.4)	9.00 (8.4)	139.2 (119.2)
<i>NIO</i>	2 (1.8)	7.25 (5.7)	1 (0.6)	2.75 (1.4)	1 (0.4)	0.50 (0.6)	11.5 (8.2)
<i>SPac</i> <i>>135°E</i>	42 (29.2)	169.25 (125.0)	18 (15.1)	62.5 (49.0)	9 (6.8)	26.75 (14.7)	315.8 (224.6)

Table CC-1. Northern Hemisphere Tropical Cyclone Activity for 2018 (through August 2018), by basin and Northern Hemisphere totals (<http://tropical.atmos.colostate.edu/Reality/>). Numbers in parentheses are long-term averages.

³ A major hurricane/typhoon has an intensity of CAT 3, or higher, on the Saffir-Simpson Hurricane Damage Potential Scale (i.e., maximum sustained winds greater than 110 mph).

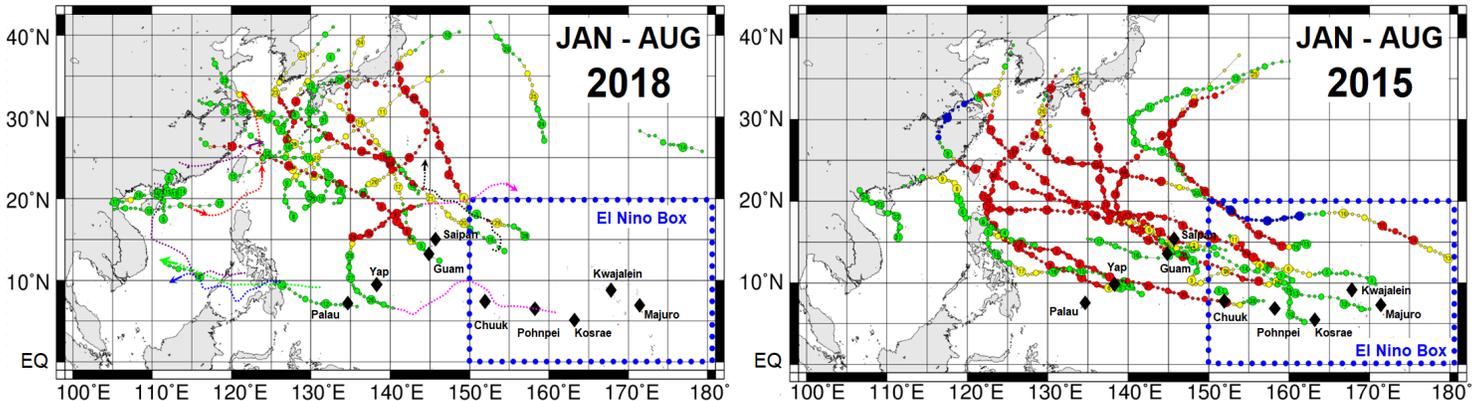


Figure CC-4. Tropical cyclone tracks during JAN-AUG 2018 (Left) and JAN-AUG 2015 (an El Niño year) (Right). Dotted lines on the 2018 chart show disturbance stages tracked by the JTWC in the pre- and post-storm stages and some TCs that were numbered by the JTWC but not named by the JMA. Large-dot box encloses the region where TCs occur almost exclusively during El Niño. Charts adapted from the “digital typhoon” web site: <http://agora.ex.nii.ac.jp/digital-typhoon/year/wnp/>

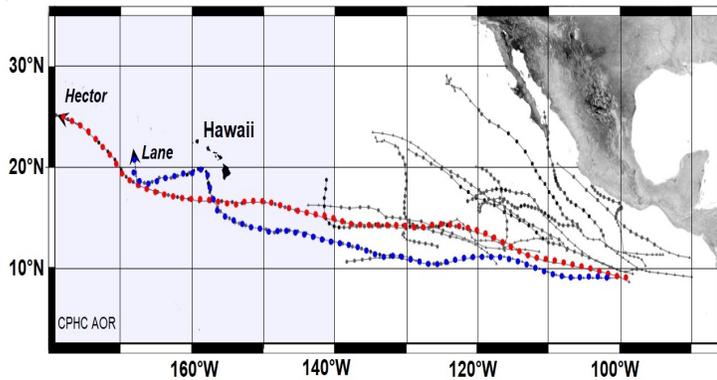


Figure CC-5. Tropical disturbances and hurricane Lane and Hector tracks. Dotted lines on chart show disturbances and larger dots are hurricanes Lane and Hector.

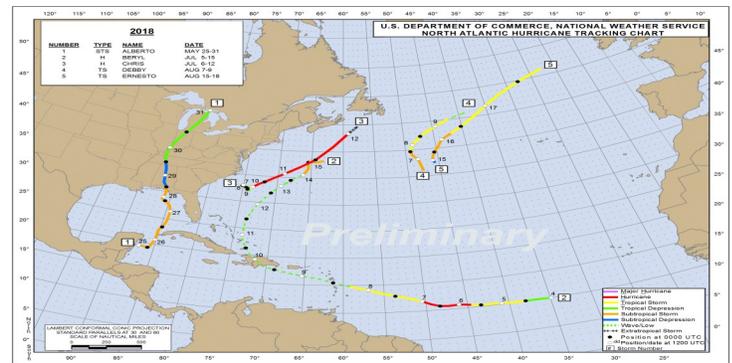


Figure CC-6. Preliminary Atlantic Tropical cyclone tracks from May to August 2018.

included in Figure CC-4 to illustrate the large differences that occur during an El Niño year.

In Table CC-1, it can be seen that the eastern North Pacific is the real stand-out basin this year, with a high number of named TCs and a high number of intense TCs. The Atlantic is the suppressed basin this year, with low numbers in most of the TC statistical categories (e.g. number of TCs, number of hurricanes and total Accumulated Cyclone Energy (ACE)). The abundance of Pacific TCs also has pushed the TC statistics of the Northern Hemisphere well above their typical values.

EastPac

Only one tropical cyclone formed in the Eastern Pacific basin in May, but did not strengthen into a named storm (see Figure CC-5). June was an extremely active month for tropical cyclone activity in the eastern Pacific basin. Six tropical cyclones formed, five of which became named storms with two of the cyclones strengthening into major hurricanes during the month. The six tropical cyclone formations are the most on record for June, and the five named storm formations in the month ties the June record set in 1985. TC activity in July was below average. Only two named storms (Fabio and Gilma) formed during the month, with Fabio becoming a hurricane. Two tropical depressions also formed during the month. Even though Tropical Depression Ten-E formed at the end of July, it strengthened into Tropical Storm Hector on August 1. August was well above average. Seven named storms formed during the month, with five becoming hurricanes, including three major hurricanes. Based on a 30-year (1981-2010) climatology, three to four named storms typically form during August, with two of those becoming a hurricane and one of those reaching major hurricane intensity. Accumulated Cyclone Energy (ACE) activity in the basin thus far in 2018 has been above average.

TROPICAL CYCLONE ACTIVITY

Atlantic

The 2018 Atlantic hurricane season (see Figure CC-6) had an early start with the formation of Subtropical Storm Alberto in May. No tropical cyclones formed in the basin in June. Based on a 30-year climatology (1981-2010), about one named storm forms in the basin by the end of June every other year. July was an active month for the Atlantic basin with two hurricane formations. Based on a 30-year climatology (1981-2010), one named storm typically forms in the basin in July, with a hurricane forming once every other year. August was below-average for the Atlantic basin with only two weak, high-latitude tropical storms and one tropical depression forming during the month. Based on a 30-year climatology (1981-2010), three named storms typically form in the basin in August, with one or two becoming hurricanes, and one major hurricane. This is the first August since 1997 to have zero tropical storm formations in the Atlantic basin south of 30N. Accumulated Cyclone Energy (ACE) activity in the Atlantic basin thus far in 2018 has been below normal.

Southern Hemisphere

The 2017-18 Southern Hemisphere (SH) TC season ended on 30 June 2018. Overall it was relatively quiet; both in the Australia region and in the south Pacific. Despite the low activity, one long-lasting and very intense cyclone (Gita) meandered across the South Pacific with serious impacts occurring throughout the region from American Samoa through Tonga, Fiji and on southward to New Zealand. It is too early yet to make a confident assessment of the character of the upcoming 2018-19 SH TC season, except to say that during El Niño, the genesis region is displaced farther to the east than at other time, resulting in above average numbers of TCs in the South Pacific to the east of 180°.

PEAC tropical cyclone assessment

Western North Pacific and American Samoa: Two organizations routinely provide forecasts of western North Pacific typhoon activity: (1) The Guy Carpenter Asia-Pacific Climate Impact Centre (GCACIC) at the School of Energy and Environment, City University of Hong Kong; and, (2) Tropical Storm Risk (TSR), Dr Adam Lea and Professor Mark Saunders, Department of Space and Climate Physics, UCL (University College London). On 11 May 2018, the TSR issued its outlook for the western North Pacific typhoon season; it then issued an update to its outlook on 7 August 2018.

GCACIC (June 2018): The Guy Carpenter Asia-Pacific Climate Impact Centre's (GCACIC's) 2018 predictions for tropical cyclone formations in East Asia are near-to below-normal; consequently, the number of tropical cyclone landfalls is also expected to be near-to below-normal in all regions of East Asia.

TSR (May 2018 with August 2018 update): In its May outlook, the TSR foresaw slightly above average TC activity during the 2018 western North Pacific typhoon season (with respect to a 1965-2017 baseline). The August update was relatively unchanged, as seen below:

NW Pacific ACE Index and System Numbers in 2018 (Table CC-2. August update in italics):

Table CC-2.	ACE Index	Intense Typhoons	Typhoons	Tropical Storms
TSR Forecast (±FE) 2018	307 (±87) <i>319</i>	9 (±3) <i>9</i>	17 (±3) <i>17</i>	27 (±4) <i>27</i>
53yr Climate Norm (±SD) 1965-2017	294 (±101)	9 (±3)	16 (±4)	26 (±4)
Forecast Skill at this Lead 1965-2017	26% <i>50%</i>	24% <i>52%</i>	14% <i>25%</i>	6% <i>11%</i>

PEAC (an active fall ahead in Micronesia):

Given the very high activity of the western North Pacific to-date, it is likely that the TSR estimate of total storms (27) is low. But also given the over abundance of weaker storms and near average number of typhoons and intense typhoons to-date, the TSR forecasts for the statistics of these may be accurate. Taking into account outside guidance, and considering current weather patterns and the evolution of ENSO, the PEAC will adopt the press-release forecast by the WFO Guam (Mr. Charles P. Guard and collaborators) for the 2018 typhoon season for Guam and the CNMI, wherein the odds for a severe tropical storm at each location is given as 50% (about average); the odds of a CAT 1 typhoon is set at 25% (above average); and the odds for a major typhoon (CAT 3 or higher) is set at 15% (slightly above average). Elsewhere in Micronesia, the odds for damaging TC strikes are set to slightly above average (for example, the average annual number of named tropical cyclones passing within 180 n mi of Yap or Palau is four, with a 10-15% chance of a damaging strike). Eastward of Chuuk State, the risk of a tropical storm or typhoon is much lower than at locations farther to the west, except during strong or some moderate El Niño events. During 2016 and 2017, the PEAC set very low odds (< 10%) for TC activity eastward of Chuuk State. This year, the PEAC anticipates an enhancement of TC development at locations to the east of Chuuk State, with the odds of some damaging effects from a TC (high surf; gale-force or stronger wind; and extreme rainfall > 10 inches in 24 hours) set at 25% (1-in-4) for all locations. This is an above average risk and is well above the level of activity seen throughout Micronesia in both 2016 and 2017.

The 2017-18 South Pacific cyclone season ended on June 30, 2018, with no TC activity (< 10% risk of damaging impacts) anticipated to occur near American Samoa through September. It is early yet for a confident assessment of the character of the upcoming 2018-19 South Pacific TC season (See the American Samoa LVS for more details).

SEASONAL SEA LEVEL OUTLOOK FOR THE US-AFFILIATED PACIFIC ISLANDS

As being in the El Niño transition state, the sea level throughout Micronesia started to fall from April of 2018. In general, sea level records a significant fall in an moderate-to-strong El Niño year and, consistent to the on-going El Niño event, sea level recorded considerable fall across most of Micronesian Islands. Palau registered significant fall and currently showing negative anomaly. This is a typical picture in any El Niño year as *Palau tracks ENSO so well that it makes a good ENSO index in its own right!*

The following sections describe: (i) the Canonical Correlation Analysis (CCA) forecasts for seasonal (mean and maxima) sea level anomalies (seasonal cycle removed) for the forthcoming seasons August-September-October (ASO) of 2018 to November-December-January (NDJ) of 2018-19, (ii) ASO-return values at 20 and 100-yr period, (iii) the observed monthly mean and maximum sea-level anomalies for the previous season April to July (AMJJ) of 2018, and (iv) synopsis of last 2-years Sea Level variability and forecasts. *Note that, seasonal cycles have been removed for the data anomalies that are defined as 'deviations or departures from the normal' using the 1983 through 2001 mean sea level value computed at each station. Also note that CCA-forecasting technique adopted here does not account for sea level deviations created by other atmospheric or geological factors.*

Seasonal Sea Level Forecast (anomalies with respect to climatology) for ASO, SON, OND, and NDJ of 2018

Forecasts of the sea-level anomalies in the USAPI are presented using CCA statistical model (see Chowdhury M. R., Chu P-S, and Guard C. (2014): *An Improved Sea Level Forecasting Scheme for Hazards Management in the U.S.-Affiliated Pacific Islands. Int. Journal of Climatology* 6, 2320-2329). Based on the independent SST and zonal wind (U) (SST-U) values in MJJ of 2018, the resulting CCA model has been used to forecast the sea level of four consecutive seasons: ASO, SON, OND, and NDJ (see Table 1: left panel shows values for seasonal mean while the right panel shows the seasonal maxima). All the tide gauge stations (at 0 to 3-months lead time) provided skillful forecasts for these three consecutive seasons.

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

Tide Gauge Station	Seasonal Mean Deviations ¹					Seasonal Max Deviations ²					
	ASO	SON	OND	NDJ	Seasonal Outlook ³	ASO	SON	OND	NDJ	ASO: Return Period ⁴	
Lead Time ⁵	0-M	1M	2M	3M	Seasonal Outlook ³	0-M	1M	2M	3M	20-YR	100-YR
Marianas, Guam	+1	0	0	0	Normal	+16	+16	+17	+17	6.5	9.1
Malakal, Palau	-2	-1	-1	-1	Below	+35	+36	+36	+35	6.1	6.4
Yap, FSM	0	-1	0	0	Below	+27	+27	+29	+29	8.2	11.0
Chuuk, FSM**	+1	+1	0	0	Normal	+28	+28	+29	+29	n/a	n/a
Pohnpei, FSM	+1	0	0	0	Normal	+28	+28	+30	+32	9.1	11.8
Majuro, RMI	+1	+1	+1	+1	Normal	+40	+40	+40	+42	5.7	6.4
Kwajalein, RMI	+1	0	0	0	Normal	+38	+37	+38	+39	6.6	8.4
Pago Pago, Am. Samoa***	+6 (+11)	+5 (+11)	+5 (+11)	+5 (+11)	Above	+30 (+25)	+30 (+25)	+30 (+25)	+31 (+26)	4.9	6.1
Honolulu, Hawaii	+1	+1	+1	+1	Normal	+20	+20	+21	+22	3.0	3.7
Hilo, Hawaii	+1	+1	+1	+1	Normal	+22	+22	+24	+26	3.2	5.2

Table 1 and Supporting Statistics: (-) indicate negative anomalies (fall of sea level from the mean), and (+) indicate positive anomalies (rise of sea level from the mean), n/a: data not available. Anomalies from -1 to +1 inches are considered negligible and anomalies from -2 to +2 inches are unlikely to cause any adverse climatic impact. Forecasts for Chuuk (***) are estimated subjectively based on information from WSO Chuuk and observations from neighboring stations of Pohnpei and Yap. *** There was a level shift (approximately 5 inches) in American Samoa at the time of September 2009 earthquake. So, -5 inches needs to adjust to the current tide-gauge values of Pago Pago. See PEAC website for the explanations of footnote (1 to 5). Also note that all information is based upon the 1983-2001 epoch.

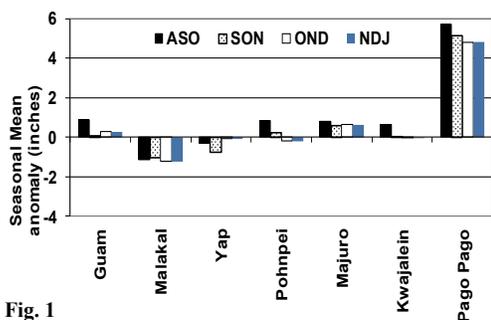


Fig. 1

The current sea level forecasts (Fig. 1) indicate that most of north Pacific stations are likely to be normal to marginally below-normal (normal and average are synonymously used throughout the sea level section) in the forthcoming ASO-NDJ seasons. If El Niño develops as per projections, then the lowest anomalies of sea level may likely to occur at the later part of 2018. In Hawaii, both Honolulu and Hilo are likely to be slightly elevated, but still close to normal. The fall is somewhat expected and it corresponds very well with the current developing phase of ENSO-neutral condition and/or developing phase of El Niño. Note that the south Pacific station (i.e., Pago Pago) maintains a 4-6 months' time-lag to change fall/rise when compared to north Pacific stations (i.e., Guam and the Marshalls).

SEASONAL SEA LEVEL OUTLOOK FOR THE US-AFFILIATED PACIFIC ISLANDS

Observed Monthly Mean Sea Level Anomalies (with respect to climatology) for Jan-Feb-Mar-Apr (JFMA) of 2018

Current Conditions: Consistent to El Niño, most of the north Pacific stations displayed considerable fall in June. ONLY Pohnpei and Kapingamarangi recorded slight rise. Some of the stations may still remain marginally elevated (e.g., Guam, Kapingamarangi) in June-July, but likely to fall below normal in August or September 2018. Hawaii sea levels also returned to normal, but Hilo recorded rise and currently stays elevated. Note that the south Pacific station (i.e., Pago Pago) is elevated (+7). This station maintains 4-6 months' time-lag w.r.t north Pacific stations (i.e., Guam and the Marshalls).

Impacts: While the MSL is falling, tides have been very high with high waves for some of the islands (e.g., Majuro, Pago Pago). There might have been minor-to-moderate inundations in low-lying atolls and Pohnpei, Kosrae, and Chuuk reported road damage during this quarter.

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

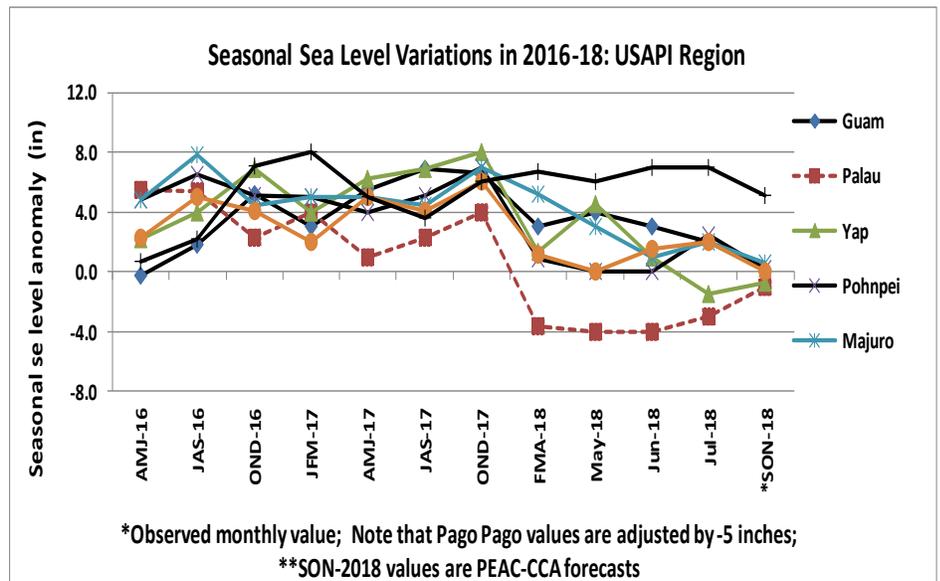
Tide Gauge Station	Monthly Mean Deviations ¹					Monthly Max Deviations ²				
	Apr	May	Jun	Jul	Standard Deviations	Apr	May	Jun	Jul	Sea level Trend
Marianas, Guam	+6	+4	+3	+2	3.5	+20	+18	+19	+20	Above-Stable
Malakal, Palau	0	-4	-4	-3	4.4	+37	+31	+31	+31	Below-Stable
Yap, FSM	+6	+4.5	+1	-1.5	3.7	+32	+29	+29	+27	Below-Stable
Chuuk, FSM*	+3	+1	0	+1	**	**				Above-Stable
Pohnpei, FSM	+6	0	0	+2.5	3.0	+32	+29	+30	+35	Above-Stable
Majuro, RMI	+5	+3	+1	+2	2.3	+43	+40	+43	+43	Above-Stable
Kwajalein, RMI	+2	0	+1.5	+2	2.8	+36	+36	+37	+29	Above-Stable
Pago Pago, American Samoa***	+10.5 [6.5]	+11 [+6]	+12 [+7]	+12 [+7]	3.7	+31	+31	+37	+37	Above-Stable
Honolulu, Hawaii	+2	+1.5	+3	+3	1.8	+16	+20	+25	+25	Above-Stable
Hilo, Hawaii	+3.5	+5	+5	+4	2.1	+23	+26	+28	+30	Above-Stable

Table 2. +/- indicate positive anomaly (rise) and negative anomaly (fall) respectively. Note that any changes between (0~±1) inch is considered to be negligible. Also note that changes within the range of (+/-) 2 inches are unlikely to cause any adverse climatic impact. *** Guesstimated values, ** Data currently unavailable; Figures in parenthesis are year-to-year seasonal anomaly. 1: Difference between the mean sea level for the given month and the 1983 through 2001 mean sea level value at each station (seasonal cycle removed); 2: Same as 1 except for maxima; SD stands for standard deviations. Red: Falling trend, Black: Stable SL, and Blue: Rising trend. * In Pago Pago, there was a level shift (approximately 2-4 inches) at the time of September 2009 earthquake. Data Source: University of Hawaii Sea Level Center (UHSLC). [ftp://ilikai.soest.hawaii.edu/islp/slpp.anomalies](http://ilikai.soest.hawaii.edu/islp/slpp.anomalies).

Synopsis of 2-years Sea Level Variability and Forecasts

Starting from AMJ of 2016, a comparative perspective of two years of seasonal sea level variations is given below (Fig. 2). The sea level in the western Pacific started to rise from AMJ of 2016 and stayed elevated until OND of 2017. It started to fall from March 2018 and currently showing a falling trend. The current forecast for SON of 2018 also signals further fall.

Figure 2. A comparative perspective of Island-wise seasonal sea level variations (ASO 2016 to MJJ 2018) (*Note that Pago Pago data needs correction because of level shift after 2009 earthquake. There was a level shift (approximately 2-4 inches) at that time which has not been adjusted).



LOCAL SUMMARY AND FORECAST



American Samoa:

Rainfall at WSO Pago Pago, American Samoa during 2017 and continuing into 2018 has been characterized by overall wet conditions with high month-to-month variability (Figure AS-1). When summed over the 2017 calendar year, the 2018 1st and 2nd Quarters, and the 1st half of 2018, very high rainfall in some of the wet months (notably May 2017, October 2017, February 2018, and April 2018) has more than compensated for deficits accrued during any of the below-average months (Figure AS-2). February 2018 was notable for extreme rainfall and damaging wind accompanying Cyclone Gita (see the Cyclone Gita Sidebar report in the 2018 2nd Quarter ENSO Newsletter). Rainfall amounts at the two high-ground remote stations (Siufaga Ridge and Toa Ridge), while typically receiving more rainfall than the WSO, had lower 1st-half 2018 rainfall totals than the WSO station situated at the coastal lowland airport location on the south side of the island.

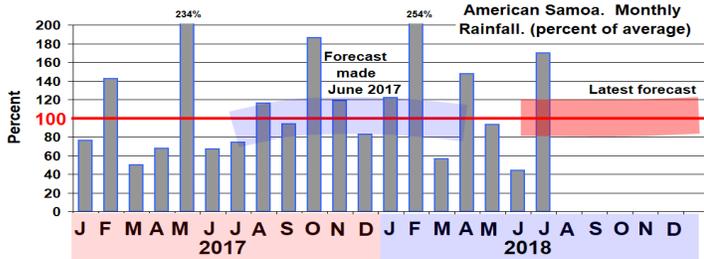


Figure AS-1. A time series of the monthly rainfall at Pago Pago from January 2017 through July of 2018. Note the high month-to-month variability, which overall yielded above average rainfall when summed over time periods of 6-12 months. An earlier rainfall forecast made by the PEAC in June 2017 is shown in light blue, and a new forecast for the next several months of 2018 is shown in light red. Note that the earlier forecast did not capture the high variability, but did fall within the range of the difference between above and below average monthly totals. The latest forecast calls for near-average rainfall for the next several months, in agreement with the most recent statistical and dynamic forecasts.

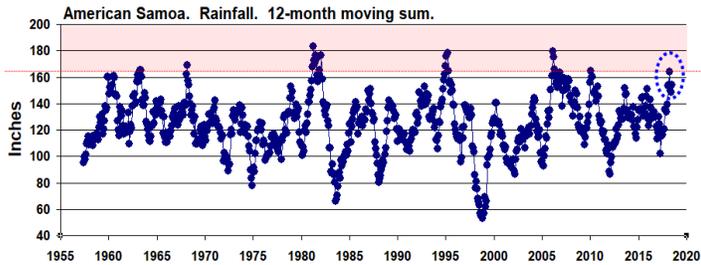


Figure AS-2. A 12-month moving sum of the monthly rainfall at Pago Pago. Note that the data for the last few points (AMJJ 2018) (inside the dotted blue circle) indicate a relatively high value of rainfall that has been exceeded only during 6 episodes over the historical record. The light red shading indicates 12-month rainfall sums that are at-or-above the reading of April 2018.

Some wet weather statistics include:

- (1) February 2018 was the 2nd wettest February, and 2nd wettest of any month;
- (2) April 2018 was the 10th wettest April in the Pago Pago post-WWII historical record;
- (3) The 4-month period January to April 2018 was 2nd wettest such period;
- (4) The 163.89 inch 12-month sum of rainfall ending April 2018 was the 4th highest such total in the 53-year WSO Pago Pago climate record;
- (5) The July 2018 total of 10.68 inches was the 5th wettest July rainfall total.

Apart from damage from the extreme rains and high winds of

LOCAL SUMMARY AND FORECAST

Cyclone Gita, there were no other major weather-related problems at American Samoa during the 1st half of 2018. During early July 2018, there were two reported events of flooding, resulting in nuisance damage but no reported injuries.

Pago Pago Sea Level

While the sea level across Micronesia has fallen over the past few months (and is now near average at many locations), the sea level at Pago Pago remains elevated above its long-term average, even after accounting for the approximately 10-cm shift of the datum during the 2009 earthquake/tsunami event (Figure AS-3).

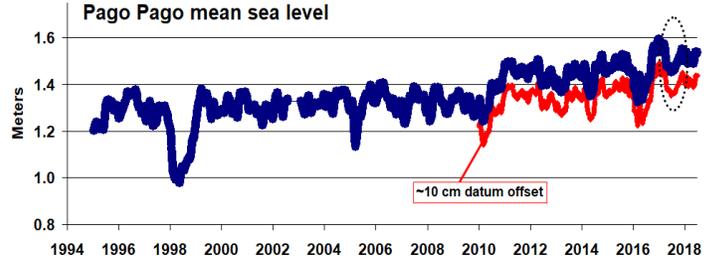


Figure AS-3. A 12-month moving average of the mean sea level at Pago Pago (dark blue time series). A sudden jump in 2009 was the result of a datum change (a land subsidence) that occurred during the large earthquake/tsunami event of 29 September 2009. The red line shows the time series with the 10-cm land movement removed.

American Samoa Rainfall Summary: 2nd Quarter 2018 and 2018 1st Half total.

Station		Apr	May	Jun	2 nd QTR	1 st Half
Pago Pago WSO	Rain (in)	17.76	9.26	3.24	30.26	84.46
	% Avg.	148%	93%	44%	103%	128%
Siufaga Ridge*	Rain (in)	15.73	12.60	5.76	34.09	79.54
	% Avg.	121%	115%	64%	103%	103%
Toa Ridge	Rain (in)	11.86	9.51	2.79	24.16	63.95
	% Avg.	91%	86%	31%	73%	83%

Climate Outlook:

Statistical and computer dynamic model forecasts now indicate average rainfall over the next three months at Pago Pago, and the PEAC concurs with these projections.

The 2017-2018 South Pacific hurricane season is over (official end was June 30). Overall, the 2017-2018 TC season in the South Pacific was below average (see the TC discussion in the Current Conditions Section). Although the season was below average in TC count, American Samoa was nevertheless heavily impacted by Cyclone Gita. It is too early to provide any sense of the character of the next TC season of 2018-2019. Details on the next TC season will be provided as they become available later in the year.

Predicted rainfall for American Samoa from July 2018 through June 2019is:

Inclusive Period	% of long-term average / Forecast rainfall (inches) ¹
Jul - Sep 2018 (Heart of Next Dry Season)	100%
Oct - Dec 2018 (Onset of Next Rainy Season)	105%
Jan - Mar 2019 (Heart of Next Rainy Season)	115%
Apr - Jun 2019 (Onset of Next Dry Season)	110%

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

LOCAL SUMMARY AND FORECAST



Guam/CNMI:

Rainfall totals on Guam were generally below average for the first half of 2018, with early very dry conditions offset, to some extent, by heavier rains in the later months. In an unusual reversal of the typical large-scale north-south rainfall gradient, Saipan and other recording locations of the CNMI had even higher rainfall than at Guam (especially in April, May and June), resulting in above average 1st-half rainfall (particularly across Saipan). The monthly distribution of the rainfall in the CNMI, however, was similar to that on Guam, with the first three months of the year having below average rainfall, followed by much above average rainfall in the latter 3 months.

Impacts of dry conditions emerged by late December 2017 across Guam and the CNMI, with an uptick of wildfires in both jurisdictions. Guam and the islands of the CNMI were moved into the drought categories of D0 (abnormally dry) and D1 (moderate drought) on the U.S. drought monitor (author: Mr. Richard Heim) as impacts intensified. By late March of 2018, both Guam and Saipan were moved into the D2 (severe drought) category. Some large wildfires occurred on Saipan in late March that burned over 400 acres of brush and grasslands on the sloping terrain on the east side of Wireless Ridge. During April, beneficial but heavy rainfall occurred on Guam, Tinian, Saipan and Rota. The April rainfall was heavy enough to alleviate drought conditions: all islands transitioned from the D2 drought category to the D0 drought category. Abundant rainfall in subsequent months eased all drought impacts: the islands turned green, wildfires abated and water resource managers saw no reason to impose any water restrictions.

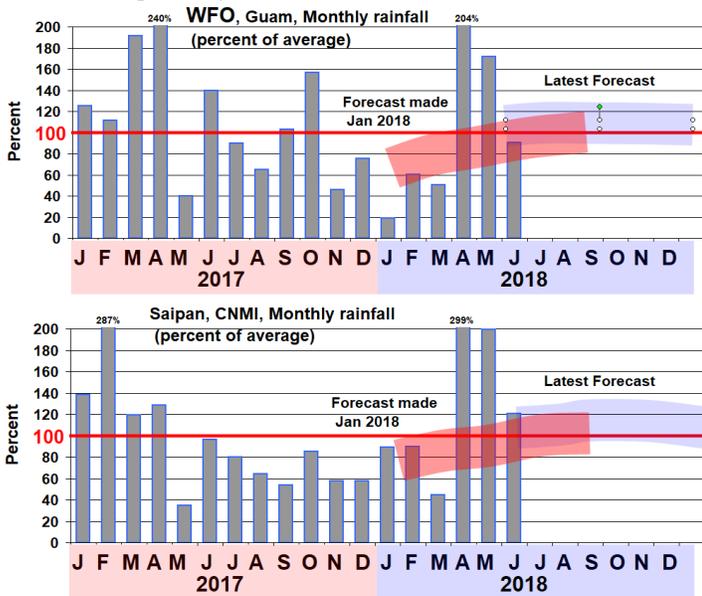


Figure G1. Top: A time series of monthly rainfall percentages at the Guam WFO. Bottom: Same as the top panel, but for monthly rainfall percentages at the Saipan International Airport. Prior forecasts of rainfall made in January 2018 by the PEAC (just for illustration) are indicated by light red bands. The forecast rainfall going forward from June 2018 is indicated by the light blue bands. Note that prior to April the rainfall on Guam and Saipan was much drier than forecast, with a particularly long-lasting shortfall at Saipan. The April and May rainfall was much wetter than forecast.

Newsletter Update:

Abundant rainfall in July and August

During July and into August 2018, abundant rainfall occurred across Guam and in the CNMI. The summer monsoon became

LOCAL SUMMARY AND FORECAST

well established in the western North Pacific Basin, but in a location to the north and west of average (see the TC track graphic in the Current Conditions Section to see the impact of this on the basin's TC tracks!). More details on the unfolding rainy season on Guam and in the CNMI will be contained in the 4th Quarter Newsletter issued in the fall of 2018.

Tropical Storm/Typhoon Maria, 2-6 July 2018

On the night of 04 July into the morning of 05 July, Tropical Storm Maria passed near, or over, Guam while moving along a typical northwesterly track. This TC was in its developmental stages, and reached tropical storm intensity just as it made its way across Guam. Rapid intensification ensued at or about the time of its Guam passage that saw it increase from a minimal tropical storm to a major typhoon (CAT 3) in the 24 hours subsequent to its passage over Guam.

While passing over Guam, a very remarkable event occurred: a mesovortex orbited along the inner edge of the primary band of convection in the TC's core (Fig. G2). On radar, it is clear that the mesovortex was in orbit about the larger vortex circulation, appearing at first to move rapidly northward from a location to the southeast of Guam, then swing sharply to the left to pass near or over the very northern-most few miles of Guam, even as the larger parent circulation probably passed near or over southern Guam (see NULLSCHOOL image below with possible mesovortex track shown by the black dotted line).

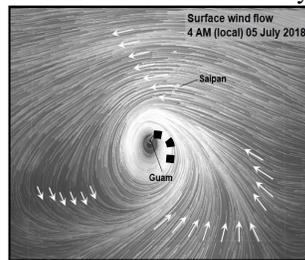


Figure G2. GFS model output stream-line depiction of Maria's surface wind flow (courtesy of NULLSCHOOL website) showing vortex light wind center passing just south of Guam. The track of an intense meso-vortex that brought typhoon-force winds to parts of northern Guam is shown by the black dotted line.

Whereas the winds at the WFO and at AAFB had gradually increased through the night and began to have repeated gusts in the range of 45 to 50 kt during the two-hour period of 1 AM to 3 AM on the 5th, there was a sudden spike of wind at the AAFB that saw gusts over 60 kt for about 15 minutes with a peak of 83 kt shortly after 3:30 AM. This wind spike accompanied the downward sharp dip of 10 hPa in the sea level pressure.

A survey of the damage caused by Maria revealed a remarkable pattern of inferred wind speed that was generally consistent with two combined causes: the 50-55 kt wind gusts associated with the core of Maria coupled with the 70-80 kt wind gusts associated with the mesovortex. Across most of central Guam northward to near AAFB, the tree damage was relatively light, and consistent with the TS A category. The most extreme damage occurred on the very northern-most coast of Guam at the U.S. Fish and Wildlife preserve at Ritidian Point. Ritidian Point was near the likely exit point of the meso-vortex circulation. The extensive tree damage here was in excess of TS CAT B damage. The numerous downed trees, crushed beach shrubbery, and large downed limbs were consistent with wind gusts in excess of minimal typhoon force, likely in the range of 90-100 mph. The UOG investigator would classify this damage in the definitive range of TY CAT 1. The WFO Guam investigator classified a small pocket of damage as strong CAT 1 or weak CAT 2 wind. Based on tree damages, sustained winds were well above 65 kt but below 100 kt. Winds appeared to be of the straight-line variety, and there were no reports of west winds anywhere on Guam. The final track of Maria near Guam is still being assessed by the Joint Typhoon Warning Center.

LOCAL SUMMARY AND FORECAST						
Guam and CNMI Rainfall Summary: 2 nd Quarter 2018 and 2018 1 st Half total.						
Station		Apr	May	Jun	2 nd QTR	1 st Half
GUAM						
GIA (WFO)	Inches	7.99	8.15	5.42	21.56	26.62
	% Avg	204%	135%	84%	131%	96%
AAFB	Inches	4.68	4.50	5.81	14.99	19.07
	% Avg	96%	68%	92%	84%	58%
Southern Mountain	Inches	10.09	9.29	.	.	.
	% Avg	207%	141%	%	%	%
CNMI						
Saipan Intl. Airport	Inches	8.72	9.14	5.83	23.69	29.84
	% Avg	311%	208%	125%	200%	153%
Capitol Hill	Inches	8.58	8.79	8.02	25.39	32.53
	% Avg	245%	160%	138%	181%	134%
Tinian Airport	Inches	9.65	3.05	9.68	22.38	29.90
	% Avg	276%	55%	167%	151%	123%
Rota Airport	Inches	7.92	5.72	11.77	25.41	31.59
	% Avg	175%	90%	190%	149%	103%

Climate Outlook:

The state of the Pacific climate has moved into ENSO-neutral, with some signs of an impending El Niño. The Climate Prediction Center (CPC) has issued an El Niño watch, with the possibility of the development of El Niño over the next few months given as over 50%. In general, any movement of the climate system in the direction of El Niño (whether from La Niña to ENSO-neutral, or La Niña to El Niño or ENSO-neutral to El Niño) tends to be wetter than average. It is thus not surprising that computer model forecasts for the past several months have aggressively forecast above-average rainfall across Guam, the CNMI, and, indeed, across most of the rest of Micronesia. The latest suite of computer models (for the 3-months ASO) continues to indicate above average rainfall. Now, after a wet spring, an abundant start to the rainy season, and with signs of the climate system moving in the direction of El Niño, the PEAC team concurs with forecasts of average to above-average rainfall for at least the next three months. Thereafter, the long-term rainfall forecast (late fall 2018 into winter 2018-2019) is contingent upon the evolution of ENSO, with a stronger and earlier transition into El Niño bringing about the best chances for wetter than average conditions and enhanced TC activity.

The threats of impacts in the region from a TC during the remainder of 2018 are summarized in two separate official predictions prepared in June by the WFO Guam (Charles P. Guard) in coordination with the UOG PEAC scientist (Mark A. Lander), one for Guam and one for the CNMI. Both documents are still in effect. Excerpts from these documents include:

“During an ENSO-neutral state, which is the transition state between El Niño and La Niña, the chance of getting a direct hit by a tropical storm or a typhoon is much better than during La Niña, but not as good as during El Niño.”

“... most models are [now] in agreement that we will remain in an ENSO-neutral state through summer, with a trend toward

LOCAL SUMMARY AND FORECAST

a continued ENSO-neutral state or a weak El Niño state by late summer or fall. In this scenario, we don’t get many early season tropical cyclones.”

“We expect more tropical cyclone activity than in 2016 and 2017, about the same activity as in 2015 for Guam (Typhoon Dolphin), but not quite as busy as 2015 for the CNMI (Typhoons Soudelor and Dolphin [and tropical storms Bavi and Champi]).”

Guam

Specific excerpts from the Guam document includes:

“For the remainder of the year, there is a 50% chance of getting a strong tropical storm (sustained winds 50-73 mph) and a 25% chance of getting a Category 1 typhoon (sustained winds 74-95 mph). The chance of getting a Category 2 typhoon (sustained winds 96-110 mph) is about 15%, while the chance of getting a Category 3 typhoon (sustained winds 111-129 mph) is around 10%. Chances of getting a Category 4 typhoon (sustained winds 130-155 mph) is around 3%, and finally, the chances of getting a Category 5 (sustained winds 156-195 mph) is less than 1%. These percentages will likely need to be fine-tuned as the season evolves. Tropical cyclone activity for Guam could begin a little late, toward mid-summer, but keep in mind that the weather patterns can change quite rapidly. Remember, we are in the only basin that can get a typhoon any month of the year.”

CNMI

Specific excerpts from the CNMI document includes:

“The Northern Islands could get a tropical storm or weak typhoon in late July or early August into September.”

“Saipan and Tinian could see a nearby tropical storm in July, but could be impacted by a typhoon in October, November, or December.”

“Rota could see a nearby tropical storm or typhoon in July, but could be impacted by a typhoon in late October, November, December, and/or early January [2019].”

“For the remainder of the year, there is a 50% chance of getting a strong tropical storm (sustained winds 50-73 mph) and a 25% chance of getting a Category 1 typhoon (sustained winds 74-95 mph). The chance of getting a Category 3 typhoon (sustained winds 111-129 mph) or stronger is around 15% or less. Tropical cyclone activity could begin a little late, toward early summer. These percentages will be fine-tuned as the season evolves.”

Predicted rainfall for the Mariana Islands from July 2018 through June 2019 :

Inclusive Period	% of long-term average / Forecast rainfall (inches) ¹	
	Guam/Rota	Saipan/Tinian
Jul-Sep 2018 (Onset of next rainy season)	120%	120%
Oct-Dec 2018 (End of next rainy season)	120%*	120%*
Jan-Mar 2019 (1st half of next dry season)	100%**	100%**
Apr-Jun 2019 (2nd half of next dry season)	110%	110%

¹ Heavy rainfall at this time of the year is contingent on TC activity, and a direct strike by a typhoon could yield at least 20 inches of rainfall in a day.

** The evolution of ENSO is the key to rainfall at this time of the year. An El Niño onset would lead to the most rainfall, and a continuation of ENSO neutral conditions or a return to La Niña (however unlikely that appears at this time) would favor average or below-average rainfall.

LOCAL SUMMARY AND FORECAST



Federated States of Micronesia
Yap State:

Over the past 18 months, rainfall at Yap Island underwent two prolonged wet spells and two prolonged dry spells (events “1”, “2”, “3” and “4” on Fig. Y1). Heavy rainfall in October 2017 signaled the onset of a prolonged period of wet weather throughout much of Yap State that continued through March of 2018; then, during April, May and June, conditions became dry again. Overall, the 1st Quarter wetness outweighed the 2nd Quarter dryness at Yap Island to yield an above-average total for the first half of the year. This was not the case at Ulithi or Woleai where the total rainfall during the first half of 2018 was slightly below average (see rainfall table).

No reports were received by the PEAC concerning problems with water supply anywhere in Yap State during the first half of 2018. During the 1st Quarter of the year the PEAC received an anecdotal report from a resident of Yap Island indicating that the typical dry season this year was unusually wet, and that temperatures were uncomfortably cool at times (by Yap standards).

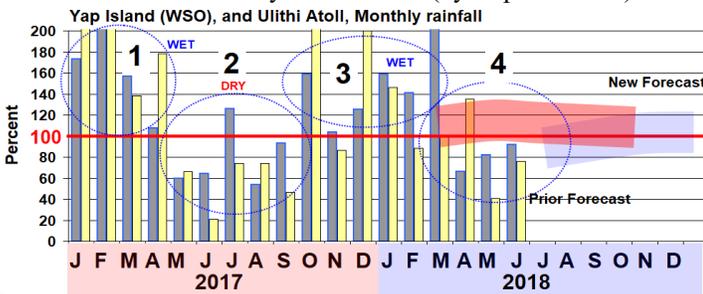


Figure Y1. Time series of monthly rainfall at the Yap Island WSO (gray bars) and Ulithi Atoll (yellow bars) for all of 2016 through June 2017. The continuous dryness at the end of 2015 through July of 2016 set a new historical record for low rainfall. Heavy rainfall in October 2016 began a 7-month run of persistent above-average rainfall, to be followed by an abrupt dry spell in May and June of 2017. Though recently dry, the rainfall across Yap State should rise to at-or-slightly above average through the remaining months of 2017. Note that Ulithi data from 24 through 29 June was missing. Rainfall at Ulithi during that period was likely at least 1.00 inch based on satellite data and data at Yap. This would place the rainfall at a more realistic 31% of normal.

Yap State Rainfall Summary: 2nd Quarter 2018 and 2018 1st Half total.

Station		Apr	May	Jun	2 nd QTR	1 st Half
Yap State						
Yap WSO	Inches	3.80	7.41	11.67	22.88	55.25
	% Norm	66%	82%	92%	83%	118%
Ulithi	Inches	6.63	3.14	8.21	17.98	36.66
	% Norm	135%	41%	76%	77%	92%
Woleai	Inches	10.36	10.49	17.14	37.99	61.48
	% Norm	94%	86%	132%	105%	98%

Climate Outlook:

Computer model forecasts continually indicated wet conditions for Yap State for all of the monthly forecast cycles for 2017 and continued to do so for each monthly step of the 3-month forecast cycle for 2018; that is, until the most recent 3-month forecast for JAS, which trended lower to average-to-below average rainfall amounts over those months. The PEAC concurs with these model forecasts for the next three months,

3rd Quarter, 2018

LOCAL SUMMARY AND FORECAST

but sets the rainfall forecasts beyond September to average to above average.

With the long-range evolution of ENSO now moving in the direction of El Niño, and with some climatic signals indicating a possible enhancement to typhoon activity in Micronesia (see the TC section of the Current Conditions section), the PEAC anticipates an elevated risk of impacts to Yap State by the near passages of tropical storms and/or typhoons, particularly in the fall. The following statements in a risk assessment of typhoon impacts to Guam during 2018 made by the WFO Guam in coordination with PEAC are valid for Yap State as well:

“During an ENSO-neutral state, which is the transition state between El Niño and La Niña, the chance of getting a direct hit by a tropical storm or a typhoon is much better than during La Niña, but not as good as during El Niño.”

“... most models are [now] in agreement that we will remain in an ENSO-neutral state through summer, with a trend toward a continued ENSO-neutral state or a weak El Niño state by late summer or fall. In this scenario, we don’t get many early season tropical cyclones.”

“We expect more tropical cyclone activity than in 2016 and 2017...”

The greatest risk is anticipated to be later in the year (September through December), with at least a 50% chance of a severe tropical storm affecting Yap Island, and other atolls of Yap State (e.g., Ngulu, Ulithi and Fais). The risk of a direct hit by a typhoon on any individual island is deemed to be above average at 20% (1-in-5) with the average value being 15% (1-in-7).

Predicted rainfall for Yap State from July 2018 through June 2019 is:

Inclusive Period	% of long-term average / Forecast rainfall (inches) ¹	
	Woleai	Yap & Ulithi
July-September 2018 (Heart of next Dry Season)	95%	95%
October-December 2018 (End of next Rainy Season)	100%	110%
January-March 2019 (Onset of next Dry Season)	100%*	110%*
April-June 2019 (End of next Dry Season)	95%*	105%*

Chuuk State:

During the calendar year 2017 and continuing into the 2nd Quarter of 2018 there was high seasonal variability of rainfall throughout Chuuk State. The following anomalies are apparent on the time series of monthly rainfall at the Chuuk WSO, Weno Island, Chuuk Lagoon, and Lukunoch in the Mortlock Island group (Figure CH-1):

- (1) A period of high rainfall during the 6-month period OND (2016) – JFM (2017);
- (2) A period of persistent dryness during the 5-month period AMJJA (2017);
- (3) A prolonged period of abundant rainfall to finish 2017 (SOND), with a continuation of above average rainfall through March 2018 (particularly in the Chuuk lagoon);
- (4) Some dryness was evident in March through June 2018 in the northern atolls;
- (5) April was dry at the WSO Chuuk; and,
- (5) Lukunoch had its driest 2nd Quarter (AMJ) rainfall total in its 31 year historical record.

Some of the northern atolls (e.g., Fananu and Onoun) and some of the atolls in the southern Mortlock Island group (e.g.,

LOCAL SUMMARY AND FORECAST

Lukunoch, Ettal and Ta) were actually quite dry during various months of 2018, with the northern atolls of Fananu and Onoun appearing for a time on the Drought Information Statement issued by the WFO, Guam. The dry months at these atolls yielded overall below-average totals for all splits of the integrated 2018 rainfall (e.g., 1st Quarter, 2nd Quarter and 2018 1st half). Over June and July, however, adequate rainfall occurred. In recent PEAC teleconferences, the weather in Chuuk has been described by WSO Chuuk staff as: “warm, but not too bad” and “plenty wet”. Municipal water supplies and rain catchment have been adequate. There have been no excessive rainfall events, and there were no reports of any recent significant sea inundation.

With the recent demise of La Niña, the regional sea level fell across nearly all major island groups of Micronesia. Although there is no operational tide gauge now sited at Chuuk, it is likely that the mean sea level throughout Chuuk State has been falling over the past few months from about 6 inches above average to 2 or 3 inches above average (see the sea level section for details).

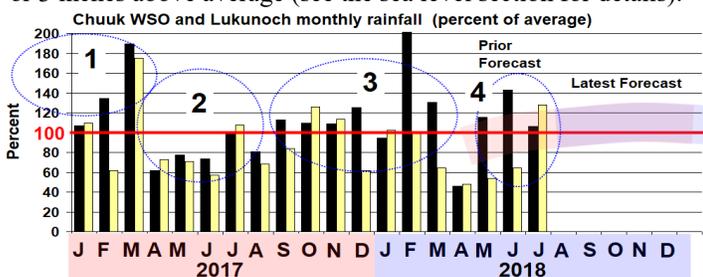


Figure CH-1. A time series of the monthly rainfall at the WSO Chuuk (black bars) and at Lukunoch (yellow bars) during 2017 and continuing into 2018. The light blue band is the latest rainfall prediction for the next several months. The light red band is the rainfall forecast made in April. Numbered blue circles indicate prolonged wet periods (“1”, “3” and “4”) and prolonged dry period (“2”).

Chuuk State Rainfall Summary: 2 nd Quarter 2018 and 2018 1 st Half total.						
Station		Apr	May	Jun	2 nd QTR	1 st Half
Chuuk Lagoon						
Chuuk WSO	Inches	5.60	14.01	16.67	36.28	69.85
	% Avg	45%	115%	142%	100%	114%
Southern Mortlocks						
Lukunoch	Inches	6.28	7.14	7.83	21.25	49.34
	% Avg	48%	54%	64%	55%	70%
Northern Mortlocks						
Losap	Inches	3.41	16.49	6.50	26.40	55.38
	% Avg	28%	135%	55%	73%	90%
Northern and Northwestern Atolls						
Fananu	Inches	3.00	12.54	8.42	23.96	42.87
	% Avg	24%	24%	72%	66%	70%
Ounoun	Inches	2.96	2.96	11.86	23.08	36.87
	% Avg	24%	24%	101%	64%	60%
Western Atolls						
Polowat	Inches	3.45*	4.64	6.80	14.89	33.23
	% Avg	58%	52%	54%	54%	69%

* It is possible that persistent dryness at Polowat is exaggerated by an exposure problem with the rain gauge; although February and March appeared reasonable.

Climate Outlook:

Computer model forecasts continually indicated wet conditions for WSO Chuuk for nearly all of the monthly forecast cycles for 2017 and have continued to do so for all of 2018 to-date.

LOCAL SUMMARY AND FORECAST

The latest 3-month forecast (ASO 2018) again suggests above average rainfall across Chuuk State. The PEAC team decided to let the computer forecasts stand; that is, the tercile probabilities for below average/near average/above average rainfall are 25%/35%/40%. From this, the PEAC has predicted average to above average rainfall for the island state for at least the next three months.

With the long-range evolution of ENSO moving in the direction of El Niño, and with some climatic signals indicating a possible enhancement to typhoon activity in Micronesia (see the TC section of the Current Conditions section), the PEAC anticipates an elevation of the risk of impacts in Chuuk State by the near passages of tropical storms or typhoons. The PEAC assesses the risk of potentially damaging effects from a passing TC at 15% (a 1-in-7 chance), through September 2018. This level of risk is a little above average. The risk is anticipated to rise in the final months of the year (OND) to 25% chance (to 1-in-3) for the at least the occurrence of large TC-related waves (> 15 feet), gales (35 kt or greater) or very heavy rainfall (> 10 inches in 24 hours).

Predicted rainfall for Chuuk State from July 2018 through June 2019 is

Inclusive Period	% of long-term average / Forecast rainfall (inches) ¹			
	Chuuk Lagoon, Losap, & Nama	Polowat	Northern Is.	Southern Mortlocks
Jul - Sep 2018	110%	90%	100%	110%
Oct - Dec 2018	115%	95%	110%	110%
Jan - Mar 2019	110%	90%	95%	110%
Apr - Jun 2019	110%	90%	100%	110%

¹ If the climate system becomes El Niño late in 2018 or during the first few months of 2019, Chuuk could experience an early season (FMAM) typhoon.

Pohnpei State:

“Plenty wet!” Assessment of the recent climate at Pohnpei Island provided by WSO Pohnpei Island station chief, Eden Skilling.

The 1st Half of 2018 was wet throughout most of Pohnpei State (Figure PN-1 and tabular rainfall summaries). The big story of the 1st Half of 2018 was the enormous amount of rainfall on Pohnpei Island and some of the outer atolls during March 2018. The March monthly total of 57.93 inches at the WSO Pohnpei was that station’s highest March rainfall total, its highest total for any month, and the highest monthly total for any month at any station across Micronesia! (see Table 1). The 150.18 inches of rainfall at the WSO Pohnpei during the 1st half of 2018 was, by far, the highest such total in that station’s 62-year historical record. In the framework of a 12-month moving sum of rainfall, the WSO’s 12-month sum of 246.83 inches during May 2017 to April 2018 falls into the number 2 slot behind the 256.16-inch total that occurred during Nov 1975 to Oct 1976 (Figure PN-2)

The high rainfall of March 2018 on Pohnpei Island included some very high 24-hour rainfall amounts. During the two-day period of 16 and 17 March, a total of 21.15 inches of rain (12.21 inches on the 16th plus 8.94 inches on the 17th) was recorded at the WSO Pohnpei (Figure PN-2). This heavy short-term rainfall caused significant damage, and there was one fatality and one injury in a single mudslide. There were 24 identified mudslides. Many homes, and 11 bridges and culverts were damaged. During the course of this event, WSO Pohnpei issued a mudslide warning and 6 flood statements. Including the heavy rainfall on the 16th and 17th, there were 16 days in March 2018 with over 1 inch of rainfall.

LOCAL SUMMARY AND FORECAST

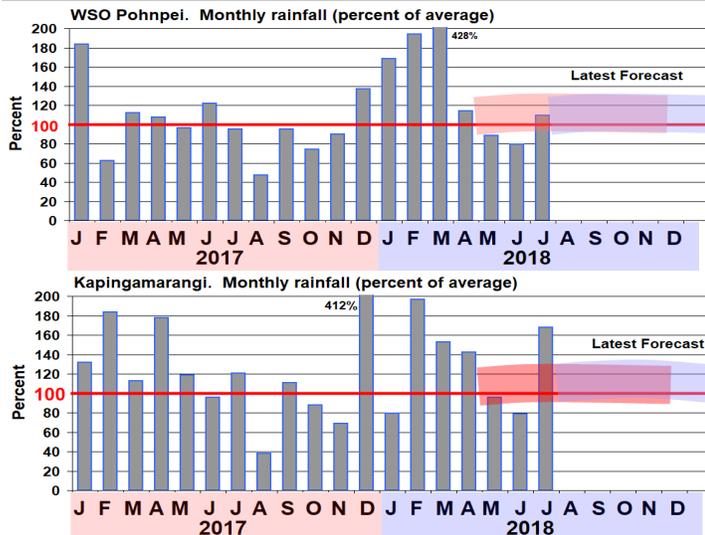


Figure PN-1. A bar chart of the monthly rainfall at WSO Pohnpei (top) and at Kapingamarangi Atoll (bottom) during the calendar-year 2017 through April 2018. The heavy December 2017 rainfall at Kapingamarangi and the heavy rainfall at the WSO Pohnpei in March 2018 are extreme values that would seem impossible to anticipate. The latest forecast (light blue band) now indicates an expectation for average to above-average rainfall throughout Pohnpei State. The light-red band is the PEAC forecast made in April 2018.

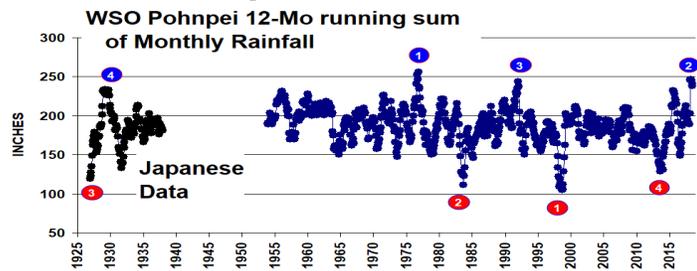


Figure PN-2. A time series of a 12-month moving sum of monthly rainfall at WSO Pohnpei. Numbers in the red and blue circles indicate the relative rankings of the extremes in each of the wet and dry categories.

Climate Outlook:

Computer model forecasts continually indicated wet conditions for Pohnpei Island and nearby atolls for all of the monthly forecast cycles for 2017, and have continued to do so for all of 2018 (including the latest 3-month forecast made for ASO). High rainfall during the 1st Quarter of 2018 was successfully anticipated by the models and, for the most part, by the consensus PEAC forecasts (although the extreme magnitude of the rainfall in March was not foreseen). Dryness for all of Pohnpei State in May and June of the 2nd Quarter was not forecast by the models, and was not anticipated by the PEAC. The PEAC concurs with the latest model forecasts for average to above average rainfall over the next few months.

LOCAL SUMMARY AND FORECAST

Pohnpei State Rainfall Summary 2 nd Quarter 2018 and 2018 1 st Half total.						
Station		Apr	May	Jun	2 nd QTR	1 st Half
Pohnpei WSO	Rain (Inches)	18.80	16.91	13.58	49.29	150.18
	% of Average	114%	88%	79%	94%	167%
PNI Airport	Rain (Inches)	15.37	14.98	8.30	38.65	120.68
	% of Average	114%	95%	59%	89%	163%
Atolls of Phonpei State						
Station		Apr	May	Jun	2 nd QTR	1 st Half
Nukuoro	Rain (Inches)	10.07	8.69	6.86	25.62	67.97
	% of Average	67%	59%	56%	61%	87%
Mwoakil	Rain (Inches)	10.73	10.11	9.01	29.85	99.58
	% of Average	79%	64%	64%	69%	135%
Kapinga	Rain (Inches)	17.39	11.08	9.17	37.64	86.54
	% of Average	143%	96%	79%	106%	124%

With the long-range evolution of ENSO now moving in the direction of El Niño, and with some climatic signals indicating a possible enhancement to typhoon activity in Micronesia (see the TC section of the Current Conditions section), the PEAC anticipates an elevation of the risk of impacts to Pohnpei Island and atolls by the near passages of tropical storms and perhaps typhoons in the remaining months of 2018. The statements extracted from a risk assessment of typhoon impacts to Guam during 2018 made by the WFO Guam in coordination with PEAC are valid for Pohnpei State as well. (See Guam and CNMI summary)

The greatest risk is anticipated to rise in the final months of the year (OND) to 30% chance (to 1-in-9) for at least the occurrence of large TC-related waves (> 15 feet), gales (35 kt or greater) or very heavy rainfall (> 10 inches in 24 hours).

Lastly, because of recent weakening of the Pacific trade wind system as the climate transitioned to ENSO-neutral, the sea level in Pohnpei State fell away from its earlier stand of approximately 6-8 inches above the long term average to about 2.5 inches above average in July, (see the sea level section for details).

Predicted rainfall for Pohnpei State from July 2018 through June 2019:

Inclusive Period	% of long-term average	
	Pohnpei Island/ atolls	Kapingamarangi
Jul – Sep 2018	110%	110%
Oct – Dec 2018	110%	115%
Jan – Mar 2019	100%	110%
Apr – Jun 2019	110%	105%

Pohnpei	57.92 Mar 2018	43.65 May 2015	38.81 Sep 1991	38.65 Apr 959	38.43 May 1980	37.20 Jul 1965	36.31 Jul 1972	35.30 Mar 1991
Kosrae	53.19 Apr 1960	43.95 May 1958	42.57 Dec 2001	40.88 Dec 1959	38.67 Feb 1959	37.75 Jun 1958	37.51 Jan 1962	35.64 Dec 1963
Palau	34.82 Jul 1962	34.82 Jul 1962	33.83 Jul 1990	30.57 Jul 1965				
Guam	40.13 May 1976	38.49 Aug 1997	38.13 Aug 1992	38.03 Jun 2004	37.32 Aug 2004	32.25 Sep 2013		
American Samoa	32.66 Feb 1968	32.47 Feb 2018	30.87 Apr 2016	30.25 Apr 1982				

Table 1. The top monthly rainfall totals of 30 inches, or more, in the historical record at the indicated locations. Color coding depicts categories as shown by the key below the table. Cells are colored gray if there are fewer than eight months at-or-above 30 inches in any location's record.

	> 50 inches
	> 40 inches
	> 35 inches
	> 30 inches

LOCAL SUMMARY AND FORECAST

Kosrae State:

More than half of the past 18 months (10 of 18) have been wetter than average at the Kosrae Airport Supplemental Aviation Weather Reporting Station (SAWRS) and at the Nautilus Hotel (Figure KS-1). This represents a substantial and prolonged recovery from the dry conditions experienced in 2016 (Figure KS-2). The 9-month (September 2017 to May 2018) total of 187.99 inches at Kosrae SAWRS was the 3rd highest such total since this station was established at the airport in 1986. The March total of 29.00 inches at SAWRS was the highest March total in the airport record (1986-present), although there were three March readings that were higher than this in the 24-years of record (1954-1977) when the rainfall was recorded at Lelu. No reports were received by the PEAC of any major problems with mud-slides or flooding in recent months.

Kosrae is one of the wettest locations in Micronesia. At 206 inches per year, the annual rainfall at Kosrae SAWRS is roughly equivalent to that at Palikir, Pohnpei Island (204 inches per year). Only at some unusual locations, such as the summit of Pohnpei's highest mountain (Nahna Laud), are found higher values. A UOG project, in association with the Conservation Society of Pohnpei, measured 330 inches of rain per year on the summit of Nahna Laud! At Aasufou (a USGS rain gauge that was located at an elevation of 1,340 feet in the mountains of American Samoa), an annual average of 203.31 inches was observed. Hawaii holds the US-API record, where the annual rainfall at Waialeale (a rain gauge located in the mountains of Kauai) averages 452 inches per year in a record that goes back to 1912.

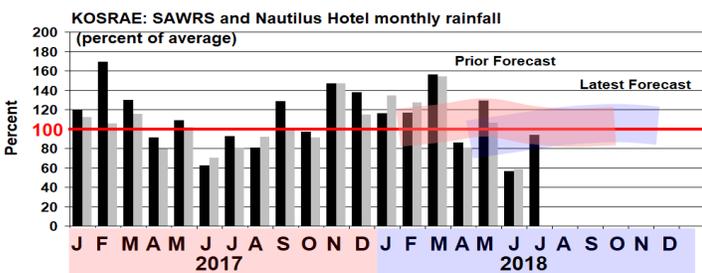


Figure KS-1. A time series of the monthly rainfall at Kosrae Supplemental Aviation Weather Reporting Station (SAWRS) (black bars) and the Nautilus Hotel (gray bars) for the period January 2017 through April 2018. The PEAC rainfall forecast made in January 2018 (light red band) was accurate through the 1st Quarter of 2018, but missed the dry April and dry June. The light blue band shows the latest PEAC forecast for the next several months. The SAWRS is located on the northwest side of the island, while the Nautilus Hotel is located on the east-northeast.

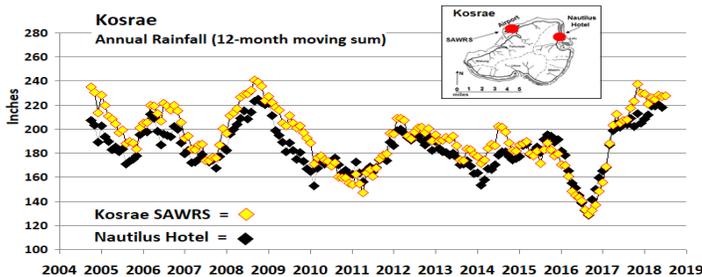


Figure KS-2. A plot of the 12-month moving sum of rainfall at the Kosrae Supplemental Aviation Weather Reporting Station (SAWRS) and at the Nautilus Hotel (locations indicated by the red dots in the inset). Rainfall across the relatively small island seems to be coherent. Note the big dip of rainfall amounts in response to the 2015-2016 El Niño, with the subsequent rapid recovery to wet conditions during 2017 and 2018 to-date.

LOCAL SUMMARY AND FORECAST

Kosrae State Rainfall Summary: 2 nd Quarter 2018 and 2018 1 st Half total.						
Station		Apr	May	Jun	2 nd QTR	1 st Half
Airport (SAWRS)	Rain (Inches)	18.45	24.16	10.58	53.19	117.84
	% of Average	85%	129%	56%	89%	108%
Nautilus Hotel	Rain (Inches)	17.48	19.96	11.08	48.52	117.46
	% of Average	81%	106%	58%	82%	108%

Climate Outlook:

For many months, computer models have favored above average rainfall at Kosrae. These same models are now mixed: some high, some near average. The PEAC team decided to let the computer forecasts stand; that is, the tercile probabilities for below average/near average/above average rainfall are 30%/35%/35%. From this, the PEAC has predicted average to above average rainfall for the island state for at least the next three months.

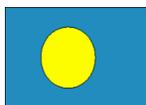
Damaging TCs are rare at Kosrae, and those rare storms that do occasionally strike Kosrae do so primarily during strong El Niño events. Thus, the risk of a damaging TC on Kosrae during the first half of 2018 was considered to be typically low (less than 1-in-10 chance). But, depending on a move toward El Niño conditions beyond the summer months, the risk of a late-season tropical storm tracking near but north of Kosrae could be enhanced. The PEAC is now leaning toward an expectation of a higher than average risk of TC impacts for Kosrae (high waves, heavy rainfall and rough seas) in the fall months (OND).

Lastly, because of the easing of the Pacific trade wind system during the recent transition to ENSO-neutral, the sea level at Kosrae, which likely has been above average by several inches, should have declined a few inches (see the sea level section for details).

Predicted rainfall for Kosrae State from July 2018 through June 2019 is:

Inclusive Period (Kosrae)	% of long-term average / Forecast rainfall (inches) ¹
Jul – Sep 2018	105%
Oct – Dec 2018	110%
Jan – Mar 2019	105%
Apr – Jun 2019	100%

* If the climate system becomes El Niño late in 2018 or during the first few months of 2019, Kosrae could be wetter than indicated.



Republic of Palau:

Palau experienced a record-breaking drought during the course of the epic 2015-2016 El Niño event. By August 2016, a prolonged period of monthly rainfall deficits had accumulated to an integrated shortfall of 85.13 inches (see Figure PL-1). This amount is equivalent to well over half-a-year's average rainfall of approximately 148 inches. With the return of some above-average monthly totals during 2017, the long-term deficit had recovered to -49.24 inches by the end of December 2017. Recent dryness, however (Fig. PL-2 and Fig. PL-3), has led to a renewed increase in the long-term accumulated loss of rainfall, which stood at -57.52 inches in April, and increased farther to -66.12 inches as of July 2018.

LOCAL SUMMARY AND FORECAST

Through the 2015-2016 drought there were serious problems with the municipal water supply on Palau. Whereas, during the course of the extreme El Niño drought, water problems were clearly related to lack of rainfall, the problems now are also exacerbated by increased demand. On March 24, 2018, the Palau government implemented a plan of water rationing to the Palau states of Koror and Airai after the water levels in system reservoirs fell to rationing thresholds. On 2 May 2018, the National Emergency Committee of Palau released another Public Advisory to establish new water hours. Excerpts from this latest advisory include:

*“Public Advisory: New Water Hours (Tues, May 2, 2018)
The National Emergency Committee
May 2, 2018*

PUBLIC ADVISORY

PLEASE CONSERVE WATER

WATER SHORTAGE WARNING and MANDATORY WATER RATIONING to CONTINUE

WATER OFF: 12AM TO 5AM (5 HOURS) for all of Koror and Airai

The National Emergency Committee (NEC) continues to place the Republic of Palau under “Water Shortage WARNING –STAGE 2” and informs the general public that Mandatory Water Rationing for all of Koror and Airai will continue daily with NEW rationing hours – WATER OFF: 12AM TO 5AM (5 HOURS). Mandatory Water Rationing will continue daily during the same times until further notice from the National Emergency Committee.

Ngerimel Dam has had positive impacts to its water level since being shut down on April 5 and has reached as high as 15 feet over the past week compared to 7 feet 11 inches on April 5. Our water conservation efforts with the efficiency and productivity of Ngerikiil Dam have proven positive over the past week with substantial amounts of water being utilized to serve Koror and Airai. These positive results will allow PPUC to further shorten mandatory water rationing hours by one hour as of May 2 and begin turning the water OFF at 12AM and back on 5AM for Koror and Airai. PPUC will continue to monitor water levels and results of this action and work towards shorter water rationing hours for Koror and Airai.”

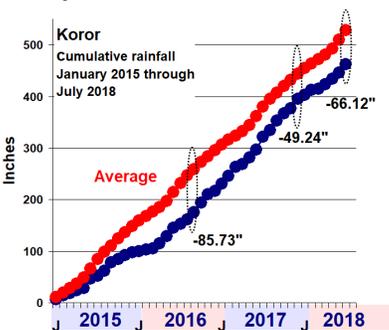


Figure PL-1. Over three years of cumulative rainfall at Koror. Red line shows the normal expected accumulated rainfall from JAN 2015 through JUL 2018, and the dark blue line shows the observed accumulated rainfall over the same time period. The accumulated deficit reached its extreme value of -85.73 inches in August 2016. Abundant rainfall in late 2016 and through 2017 erased 36

inches of the deficit which stood at -49.24 inches in December 2017. Recent dryness has once again increased the long-term deficit by about 17 inches to its July stand at -66.12 inches.

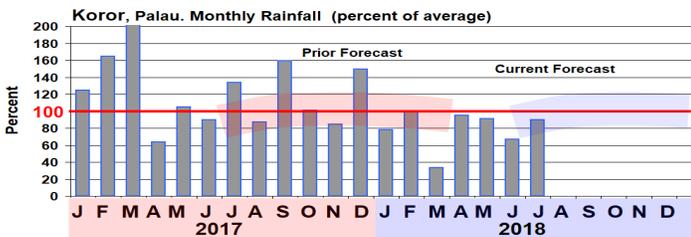


Figure PL-2. A bar chart of observed monthly rainfall (percent of average) at the Koror WSO during 2017 and 2018 through July. The forecast presented in the June 2017 Newsletter for the rest of 2017 is shown by the light-red band. As an average, it appears to have been accurate, although large month-to-month variability is not captured. The current long-range rainfall forecast is shown by the light blue band. Note that the magnitude of dryness in the first half of 2018 was not fully anticipated.

LOCAL SUMMARY AND FORECAST

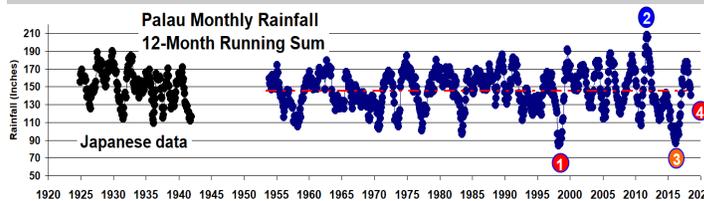


Figure PL-3. A 12-month running sum of the rainfall at Koror, Palau (Japanese period of record included). Notable events over the past 20 years include: (1) the extreme dryness during the 1997-98 El Niño event; (2) very wet conditions that peaked in 2011; (3) extreme dryness during the 2015-16 El Niño event; and, (4) recent dryness that, coupled with increased demand, has exacerbated problems with the municipal water supply.

Republic of Palau Rainfall summary: 2nd Quarter 2018 and 2018 1st Half total.

Station		Apr	May	Jun	2 nd QTR	1 st Half
Koror WSO	Rain (Inches)	8.25	10.91	11.60	30.76	50.92
	% of avg.	101%	87%	64%	79%	75%
Intl. Airport	Rain (Inches)	7.61	15.15	10.86	33.62	58.59
	% of avg.	84%	110%	55%	79%	79%
Melekeok	Rain (Inches)	5.21	8.43	8.65	22.29	40.62
	% of avg.	64%*	67%*	48%*	58%*	60%*
Peleliu	Rain (Inches)	4.26	8.22	8.01	20.49	37.58
	% of avg.	62%	68%	59%	63%	63%

* This is a new station; % of average uses one half of (AVG Koror + AVG Intl. Airport).

Climate Outlook:

Computer model forecasts continually indicated wet conditions for the Republic of Palau for nearly all of the monthly forecast cycles for 2017 and continued to do so for all of 2018, until the most recent forecast cycle made in July indicated average to below-average rainfall for the next three months (ASO). Observed low rainfall throughout most of the 1st half of 2018 was unsuccessfully anticipated by the models, but aggressive forecasts for above-average rainfall were tempered in the right direction by the PEAC team. The most recent computer projections have lowered their rainfall projections from earlier forecast cycles. The PEAC concurs with these lowered forecasts and anticipates that the rainfall throughout Palau should be average to below-average through October, with a recovery to average to above average in the final months of the year.

With the long-range evolution of ENSO now moving in the direction of El Niño, and with some climatic signals indicating a possible enhancement to typhoon activity in Micronesia (see the TC section of the Current Conditions section), the PEAC anticipates an elevation of the risk of impacts to Palau by the near passages of tropical storms and typhoons later in the year (OND). The PEAC earlier assessed the risk of potentially damaging effects from a passing TC at 10% (a 1-in-10 chance), through June 2018. That level of risk was near average, and indeed, no serious effects from passing TCs occurred. The risk of damaging effects from TCs is anticipated to rise in the final months of the year (OND) to a 25% chance (to 1-in-4) for the occurrence of large TC-related waves (> 15 feet), gales (35 kt or greater) or very heavy rainfall (> 10 inches in 24 hours).

LOCAL SUMMARY AND FORECAST

Lastly, with the recent demise of La Niña the regional sea level fell quite dramatically from 6 inches above normal in March to 3 inches below average in July (see the sea level section for details).

Predicted rainfall for Palau from July 2018 through June 2019 is:

Palau Inclusive Period	% of long-term average / Forecast rainfall (inches) ¹
Jul-Sep 2018	90%
Oct-Dec 2018	110%
Jan-Mar 2019	100%
Apr-Jun 2019	90%

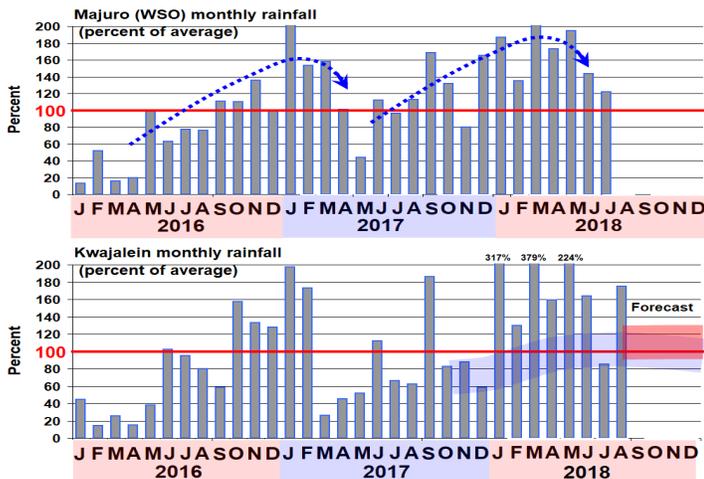
¹ Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.



Republic of the Marshall Islands

(RMI): Over the past two years (2016, 2017 and to-date in 2018) the RMI has undergone substantial variations of rainfall (Figure RMI-1 top and bottom panels). The pattern of rainfall variation was very similar during both 2016 and 2017, with both years beginning very dry and then ending very wet. For two years in a row, drought conditions were experienced in the northern-most atolls (e.g., at or north of Kwajalein). During early 2016, drought conditions were part of widespread dryness associated with El Niño. Then, in early 2017, there was another period of dryness that was most pronounced in the northern atolls. Once again in early 2018, some of the northern atolls (e.g., Utirik and Wotje) became dry. A drought statement was issued by the WFO Guam, but was short-lived as high rainfall occurred in the northern RMI in both March and April. No impacts from dryness were reported. Then, the story turned to one of very high rainfall, with both Majuro and Kwajalein experiencing new historical records for high rainfall. March and April 2018 were particularly wet, with over 20 inches of rain in each of these months at Majuro, and over 20 inches of rain at Kwajalein during April. Summed over periods of 6 or 12 months (see Figures RMI-2 and RMI-3), new historical records emerge. The high rainfall didn't just edge-out previous highs; it crushed the old high marks by large margins!

Very heavy rainfall in the RMI early in the year is often associated with El Niño onset; however, a wet spring has also occurred during other phases of ENSO, thus limiting the usefulness of this phenomenon as a predictor of El Niño. The heavy 2018 spring rains in the RMI are being treated as a red flag that the status of ENSO may soon shift to El Niño, and it was (and still is) a factor in the forecast of enhanced TC activity throughout Micronesia during the 2nd half of 2018.



LOCAL SUMMARY AND FORECAST

Figure RMI-1. (Top panel) A time series of rainfall at the WSO Majuro (gray bars) during 2016 through July 2018. Note two repeated dramatic rises from dry conditions early in the year to the return of abundant rainfall in the both fall of 2016 and the fall of 2017. (Bottom panel) A time series of rainfall at Kwajalein (gray bars) during 2016 through mid-2018 (note: a partial sum for August 1-27 is included). Long-term fluctuations at Kwajalein are similar to those seen at Majuro in the top panel. Amounts of rainfall in January, March and May exceed the upper bound of the scale.

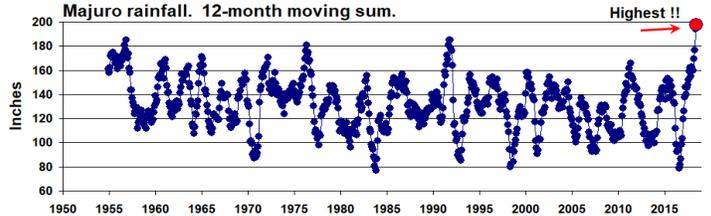


Figure RMI-2. A 12-month moving sum of rainfall at Majuro Atoll. Note that by July 2018 the sum had risen to its highest value in the historical record (red dot).

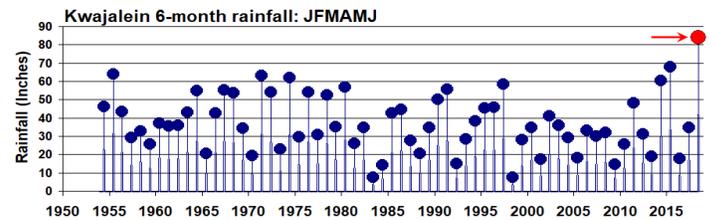


Figure RMI-3. A time series of 6-month sums (1st-half annual totals: JFMAMJ) of rainfall at Kwajalein Atoll. The rainfall total in the first six months of 2018 (large red dot) is a new historical record, and exceeds all others in the time series by a large margin!

RMI Rainfall Summary: 2 nd Quarter 2018 and 2018 1 st Half total.						
Station		Apr	May	Jun	2 nd QTR	1 st Half
RMI Central and Southern Atolls						
Majuro WSO	Inches	17.79	21.81	16.62	56.22	102.81
	% Avg	173%	195%	143%	170%	184%
Laura	Inches	10.64	21.54	16.87	49.05	96.33
	% Avg	104%	193%	146%	148%	172%
Jaluit	Inches	6.48	12.50	3.46	22.44	49.45*
	% Avg	63%	112%	30%	68%	88%
Mili	Inches	20.16	11.01	18.98	50.15	84.22
	% Avg	196%	98%	164%	152%	151%
RMI Northern Atolls						
Kwajalein	Inches	12.05	22.33	15.75	50.13	84.34
	% Avg	160%	224%	164%	185%	216%
Wotje	Inches	15.92	4.51	15.00**	35.43	52.41
	% Avg	408%	98%	288%	259%	252%
Utirik	Inches	7.43	15.50	16.41	39.34	52.01
	% Avg	206%	364%	341%	310%	270%

* The dryness at Jaluit may be due to some missing days. ** Estimated value.

Climate Outlook:

Recent computer model forecasts are still projecting average to above-average rainfall for at least the next three months at Kwajalein and at Majuro. The PEAC team, in coordination with RMI partners, accepts these projections.

The reason for the extraordinarily high rainfall totals at some stations of the RMI during the first half of 2018 could be because of. The tradewind convergence zone appears to have expanded and shifted north for a few months. The amounts exceed by far the previous record high values.

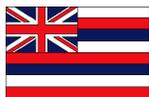
LOCAL SUMMARY AND FORECAST

Damaging TCs are rare in the RMI, and those rare storms that pass through the RMI do so primarily during strong El Niño events. Depending on the evolution of ENSO beyond the summer months, the risk of a late-season tropical storm tracking through the RMI could be enhanced; indeed, some of the basin's TCs have already originated from disturbances that emerged and moved westward from the RMI. In any case, the PEAC is now leaning toward an expectation of a higher-than-average risk of TC impacts (high waves, heavy rainfall and rough seas) in the fall months (SOND). The TC risk has two main scenarios: (1) a Central Pacific TC forms and is named to the south of Hawaii and then moves westward into or just north of the RMI; and (2) The western North Pacific monsoon trough undergoes an episodic extension into the RMI accompanied by the *in-situ* development of a monsoon depressions. Both these scenarios could be in-play late in 2018.

Lastly, because of the easing of the Pacific trade wind system during the current transition to ENSO-neutral, the sea levels at Kwajalein and Majuro have fallen, substantially at Kwajalein (+7 inches in February to +1.7 inches in April, and now at +2.0 inches in July (see the sea level section for details).

Predicted rainfall for the atolls of the RMI from July 2018 through June 2019:

Inclusive Period	% of long-term average		
	South of 6°N	6°N to 8°N	North of 8°N*
Jul-Sep 2018	110%	120%	120%
Oct-Dec 2018	120%	120%	120%
Jan-Mar 2019	120%	115%	110%
Apr-Jun 2019	110%	120%	110%



Hawaii:

Part of the following information was taken from the NWS Honolulu Office August 2018 Precipitation Summary (<http://www.prh.noaa.gov/hnl/pages/hydrology.php>) and different news articles.

The entire month of July consisted of large scale trade wind conditions near the surface. An unusual aspect of the weather was that most of the heavy rain events were associated with the Fissure 8 eruption in the Lower East Rift Zone of Kilauea Volcano. On several instances, an unstable and anomalously moist trade wind air mass combined with the heat and moisture inputs from Fissure 8 to produce persistent, localized heavy rainfall over the Leilani Estates and surrounding areas.

Elsewhere across the state, many of the windward areas received near to above average rainfall but leeward areas had drier than average conditions. As a result, drought impacts returned to Maui County by mid-July, then Oahu and the Big Island in the latter half of the month. Kauai County has had adequate rainfall and remained drought-free so far this summer.

Seasonal Drought Outlook for Hawaii:

Drought conditions have expanded across Hawaii over the past 30 days. Dynamical guidance indicates an enhanced and northward displaced Pacific ITCZ which may bring periods of above-normal precipitation to Hawaii, particularly the Big Island. The primary wet season, however, begins beyond the SON outlook period. Therefore, no additional drought development is

LOCAL SUMMARY AND FORECAST

indicated in this outlook, but substantial drought reduction is not anticipated. *Forecast confidence is low to moderate for Hawaii.*

Hurricane Lane Outlook: Hawaii was spared a direct hit from a major hurricane as Hurricane Lane diminished to a tropical storm as it approached and then drifted west, further from land during August 23-26. Hurricane Lane may have passed by the island chain over the weekend, but Hawaii is still feeling the storm's aftereffects as residents recover from days of heavy rain and remain on the lookout for even more showers and storms. Hawaii has received more than 50 inches of rain from Lane. The possibility for higher amount can not be ruled out. While the start was slow for C Pac season, it is very active and crowded now. We didn't have any in July but conveyor belt going strong now. PEAC will provide a complete perspective on hurricane Lane in the next issue of newsletter.

Rainfall Outlook: The tropical base state is currently transitioning towards El Niño conditions, with increasing SSTs and a breakdown of the Pacific trade winds regime. Historical El Niño composites favor increased odds for dry conditions for Hawaii in winter, which is consistent with the forecast from the CA tool. Therefore, the middle leads (DJF, MAM) reflect dry conditions. The later portions (MAM) reflects the uncertainty and equal probabilities of below, average or above average rainfall.

Predicted rainfall for Hawaii State from September 2018 through August 2019 is:

Inclusive Period	Station			
	Hilo	Honolulu	Kahului	Lihue
Sep -Nov 2018	40% chance of Above Median rainfall			
Dec -Feb 2019	65% chance of Below Median rainfall			
Mar -May 2019	50% chance of Below Median rainfall	50% chance of Below Median rainfall	50% chance of Below Median rainfall	60% chance of Below Median rainfall
Jun -Aug 2019	Equal probabilities of below, average or above average rainfall	Equal probabilities of below, average or above average rainfall	Equal probabilities of below, average or above average rainfall	Equal probabilities of below, average or above average rainfall

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SEASONAL RAINFALL OUTLOOK FOR THE US-AFFILIATED PACIFIC ISLANDS

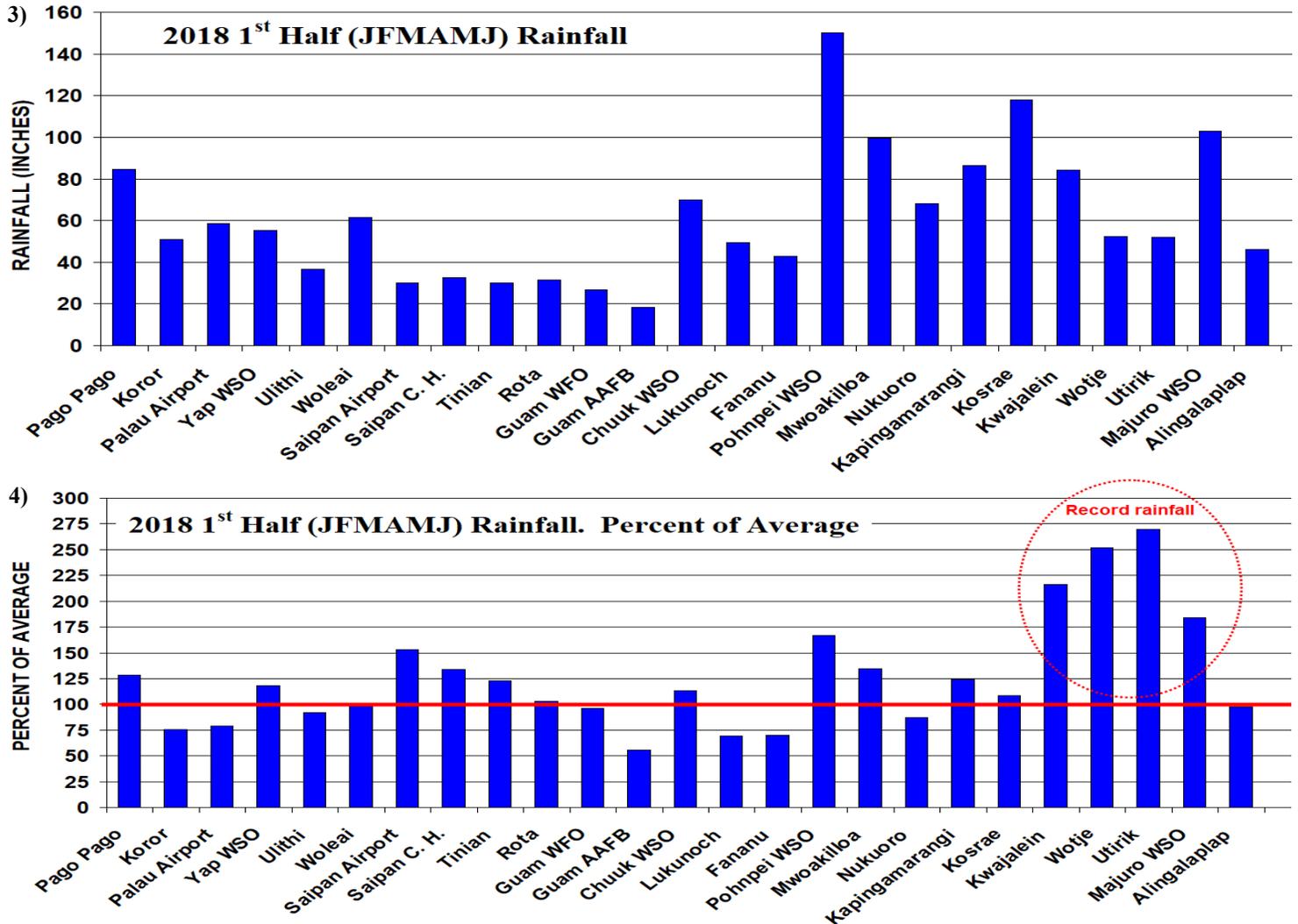


Figure 3: 2018 First Half (JFMAMJ) rainfall amounts in inches at the indicated locations.

Figure 4: 2018 First Half rainfall as a percent-of-average at the indicated locations. Note the strong pattern of dry-west, wet-east across Micronesia. The northern RMI atolls of Utirik and Wotje recovered nicely from dry conditions earlier in the year. Rainfall at some of the atolls of the RMI set new historical record high values.

ACKNOWLEDGEMENTS AND FURTHER INFORMATION

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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 PEAC Center at peac@noaa.gov or at the address listed below.

PEAC is part of the Weather Forecast Office (WFO) Honolulu's mission and roles/responsibilities. All oversight and direction for PEAC is provided by the Weather Forecast Office Honolulu in collaboration with the Joint Institute for Marine and Atmospheric Research (JIMAR) at the University of Hawaii. Publication of the Pacific ENSO Update is supported by the National Oceanic and Atmospheric Administration (NOAA), National Weather Service-Pacific Region Climate Services. The views expressed herein are those of the authors and do not necessarily reflect the views of NOAA, any of its sub-agencies, or cooperating organizations.