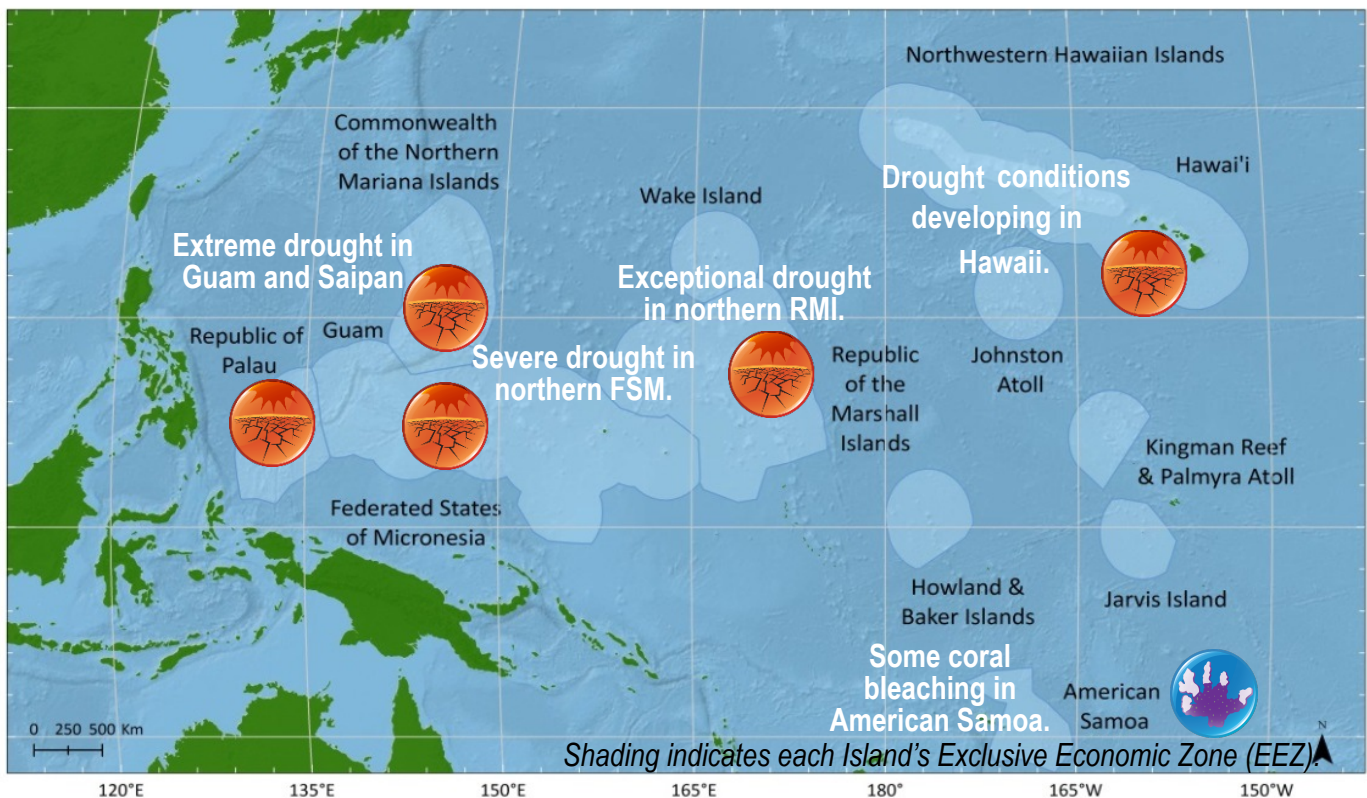




Significant Events – For March – May 2019

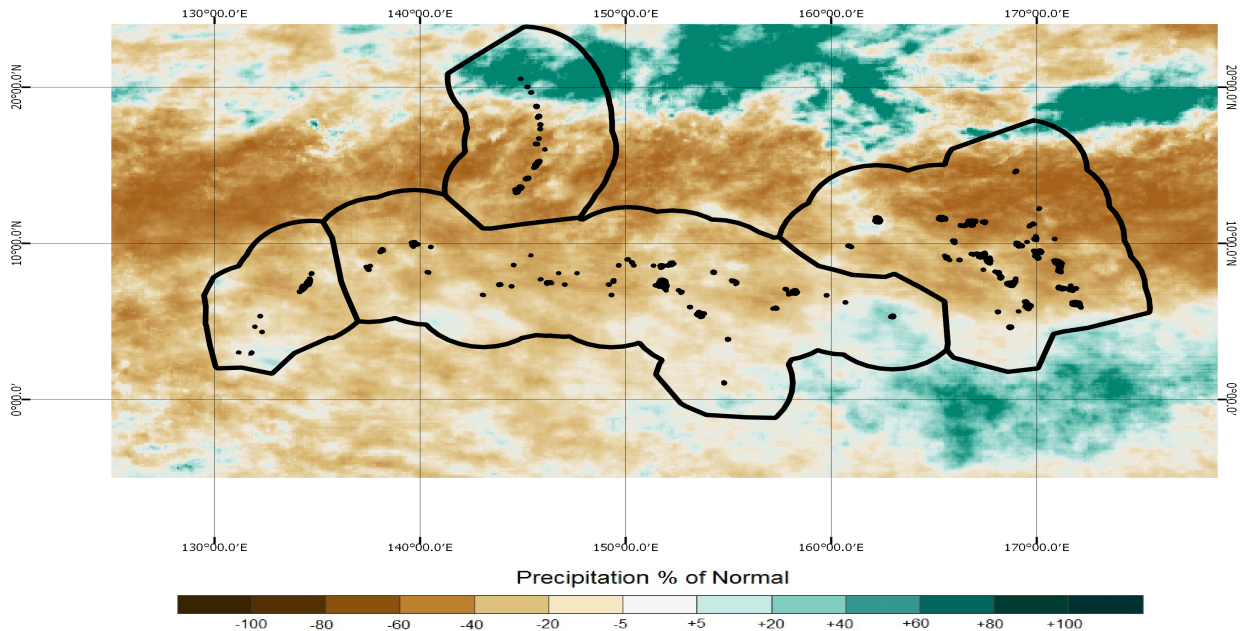


El Niño Advisory in Effect

Highlights for Hawaii and the U.S. Affiliated Pacific Islands

- Drought conditions have worsened across the northern Republic of the Marshall Islands, much of Yap State and Palau, and northern islands of the Federated States of Micronesia. Strict water conservation measures are in place across many areas.
- Well-above average coastal flooding occurred in March along the north shores of Oahu. The flooding coincided with spring tides, high surf, and strong onshore winds.
- Sea-levels in parts of the Federated States of Micronesia, Yap, and Guam have remained below normal due to the ongoing weak El Niño conditions. Coral reefs in these areas are beginning to show signs of stress.
- Abundant rainfall and some flooding have occurred in American Samoa. Sporadic coral bleaching and coral diseases were found in park waters from about 30 to 80 ft deep.

March-May 2019 GPM Precipitation Anomaly



The 1 June Niño 3.4 region anomaly was $+0.8^{\circ}$ C, and the overall coupled ocean-atmosphere system reflects ongoing El Niño conditions.

Sea-surface temperatures are above normal across much of the Pacific with $+1.0^{\circ}$ C anomalies across the Hawaiian Islands, and $+0.5^{\circ}$ C anomalies over Yap, Palau, Guam, and FSM. Waters around American Samoa are $+0.75^{\circ}$ C warmer than average. Positive *sub-surface water temperature* anomalies up to 1° C are evident to a depth of 100m between 160° E and 140° W longitude. Cooler than average sub-surface water temperatures are located 120° W to 90° W.

Satellite and model analyses show above normal sea levels continuing in the tropical Central Pacific, which is consistent with weak El Niño conditions. Tide gauges are recording above-normal sea levels on the equator across the basin as well as in parts of the southwestern Pacific. Sea levels in northern Micronesia are rising but remain below normal, for example around Yap (-25 cm versus -15 cm for March and April). Hawaii sea levels are near normal.

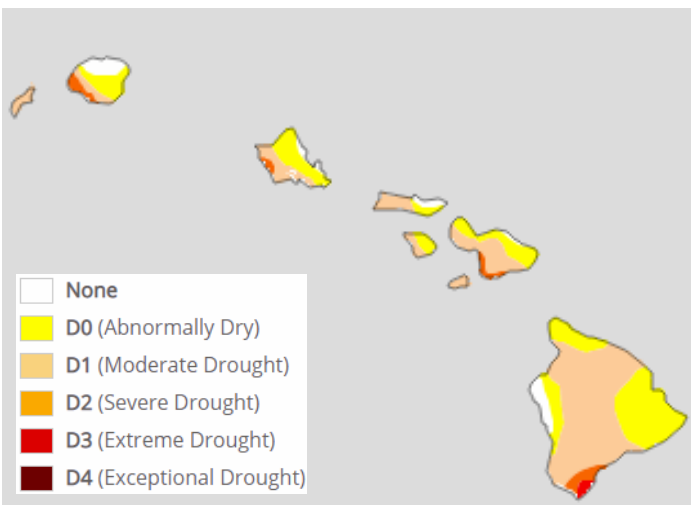
Drought conditions have intensified across the region during the period. Extreme drought is ongoing in Guam, Rota, and Saipan and across the northern Marshall Islands, while severe drought continues in Palau, Fananu, and Woleai. Drought has also expanded across the Hawaiian Islands with severe drought depicted on Kauai, Oahu, Maui, and the Big Island. *Rainfall* from March through May was much below normal: Honolulu (18%), Lihue (56%), Kahului (38%), and Hilo (67%). Elsewhere, Saipan was below normal at 88% and Guam was much below normal (43%). In Kwajalein and Majuro in the RMI, rainfall was below normal, with 70% and 93% of average respectively. In the FSM, rainfall from March through May was distributed as follows: Chuuk (63%), Kosrae (130%), and Pohnpei (80%) of normal. Further west, rainfall amounts were below normal; Yap was 76% of normal and Palau was 69%. In American Samoa, rainfall was above normal for the quarter (128%).

Tropical Cyclone (TC) activity in the western North Pacific basin was normal with no storms. In the southwest Pacific, the TC season formally ended on 30-April, however, this period was extremely quiet with only 4 TCs occurring and a total of 5 TCs when the month of May is factored in. Of those 5 TCs, four were major with TC Trevor attaining near Category 5 status in March.



Majuro Atoll Waste Company staff try to contain a fire at the dump. Photo courtesy of the Marshall Islands Journal.

Facilities and Infrastructure – Discarded cigarettes have caused some fires on Majuro, RMI, and one large fire occurred in March at the Majuro dump; both events were compounded by the ongoing severe drought in the region. In Kosrae, there were a few high surf warning issued in the month of March, and there was some minor flooding on the roads. During April in Pohnpei, there were some reports of lightning storms with high surf and minor inundations along the northeast side of the island, but no damage was reported.



30 May 2019 Drought Map for the State of Hawaii

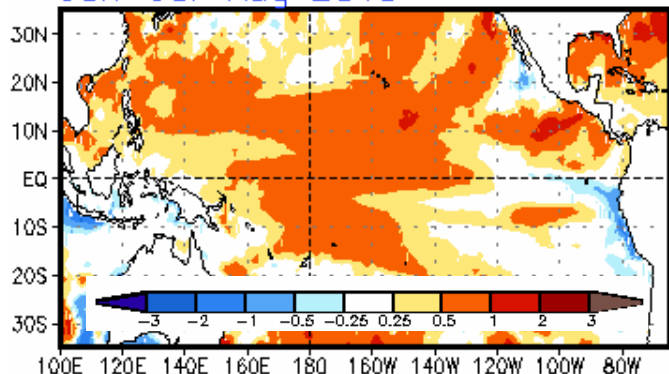
Water Resources – Since December 2018, the northern RMI have received much less rainfall than normal. Residents here are continuing strict water conservation measures. Health issues related to water problems have been reported in the northern RMI. In Guam and Saipan, extreme drought has dried out many fine fuels, including leftover debris from last year’s Typhoon Yutu, and wildfire danger is elevated. As of the end of May, the water reservoir at Majuro is at 81% capacity.

Natural Resources – Regular spring tides have caused taimasa (stinky low tide) in American Samoa and the shallow backreef was exposed. As a result, minor bleaching at Ofu in Ofu village and Toaga beach amongst bolder Porities and encrusting Montipora and moderate bleaching at Asaga. Palau and the Federated States of Micronesia (FSM) in the western Pacific have seen an increase in coral reef HotSpots since May. Severe bleaching (~25% at 6-10m depth) was first reported in Malaysia at Pulau Redang (an island off the Terengganu coast) on May 21, when the region had been under a Bleaching Warning for 5 weeks. Bleaching was again recorded at both Pulau Redang and Pulau Bidong during the last week in May, with observations of 10-15% of bleaching on shallow coral reefs and some bleaching at deeper sites (~16m).



Photo of bleached coral from the far western Pacific. Image courtesy of Mark Eakin, Coral Reef Watch.

Jun-Jul-Aug 2019



Sea-Surface Temperature Anomalies for July through August 2019.

Source: <http://www.cpc.ncep.noaa.gov/>

According to ENSO prediction models, **there is a 70% chance of El Niño conditions continuing through August 2019.**

The SST anomaly outlook indicates at least +0.5° C anomalies continuing and spreading across much of the Pacific, including American Samoa. NOAA's Coral Reef Watch 4-month bleaching outlook projects heat stress in the equatorial Pacific Ocean to increase (Alert Levels 1 and 2) around the Phoenix Islands, Kiribati, the Northern Line Islands, and the Gilbert Islands by July 2019 and then diminish. Waters surrounding the Marshall Islands and the Main Hawaiian Islands are expected to reach Alert Level 1 by September and possibly Alert Level 2 by October. Similarly, waters surrounding Guam and the Eastern FSM are expected to reach Alert Level 1 during this time.

Over the next six months, dynamical forecast models suggest rising sea levels in the northwestern Pacific (becoming above normal around Guam and Yap), steady sea levels in the southwestern Pacific (mostly above normal), and near-normal sea levels in the equatorial eastern Pacific. Around Hawaii, only small changes in sea level are projected during the next six months.

During the period June through August, under the continued influence of a weak El Niño, rainfall is projected to be near to below normal in Koror and Yap. In Hawaii, leeward areas are forecast to have below normal rainfall with existing areas of moderate and severe drought development likely to expand. **Well below normal rainfall is projected for the RMI, Guam and Saipan.** Near to above normal rainfall is indicated for American Samoa and Kosrae.

Tropical cyclone (TC) activity in the western North Pacific is expected to be above normal from Micronesia toward Guam. In the southwest Pacific, the outlook period June-August is expected to be a quiet period as climatologically there are only 0.1 TCs on average during this time.

NOAA NWS Weather Forecast Office Honolulu:

<http://www.prh.noaa.gov/pr/hnl/>

NOAA NWS Weather Forecast Office Guam:

<http://www.prh.noaa.gov/pr/guam/>

NOAA National Centers for Environmental Information:

<http://www.ncei.noaa.gov/>

NOAA NMFS Pacific Island Fisheries Science Center:

<http://www.pifsc.noaa.gov/>

NOAA OceanWatch - Central Pacific:

<http://oceanwatch.pifsc.noaa.gov/>

NOAA Coral Reef Watch:

<http://coralreefwatch.noaa.gov/>

USGS Pacific Islands Water Science Center: <http://hi.water.usgs.gov/>

USGS Science Center – Pacific Coastal and Marine Science Center:

<http://walrus.wr.usgs.gov/>

University of Hawaii - Joint Institute of Marine and Atmospheric Research:

<http://www.soest.hawaii.edu/jimar/>

University of Guam - Water and Environmental Research Institute:

<http://www.weriguam.org/>

University of Hawaii Sea Level Center:

<https://uhslc.soest.hawaii.edu/>

University of Hawaii Asia Pacific Data Research Center (APDR) -

<http://apdr.soest.hawaii.edu/index.php>