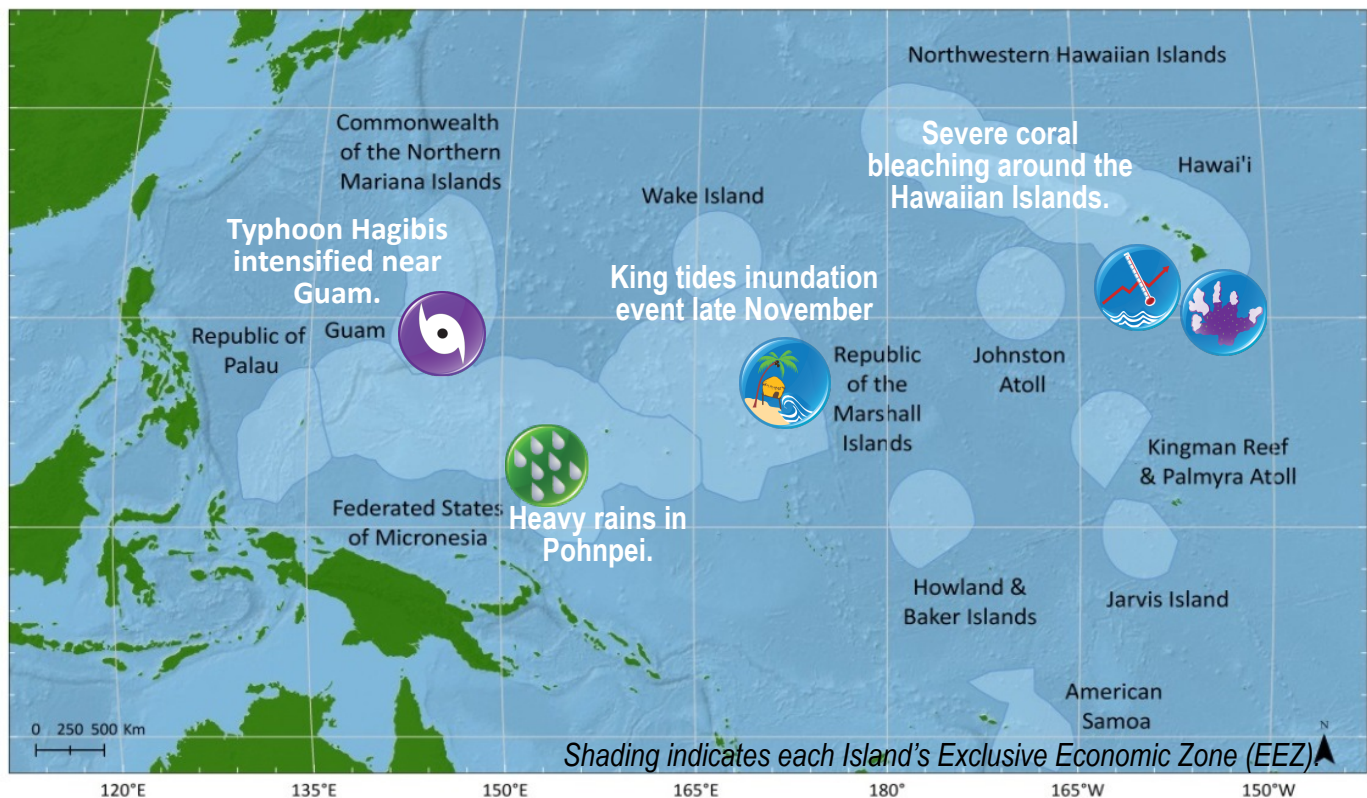


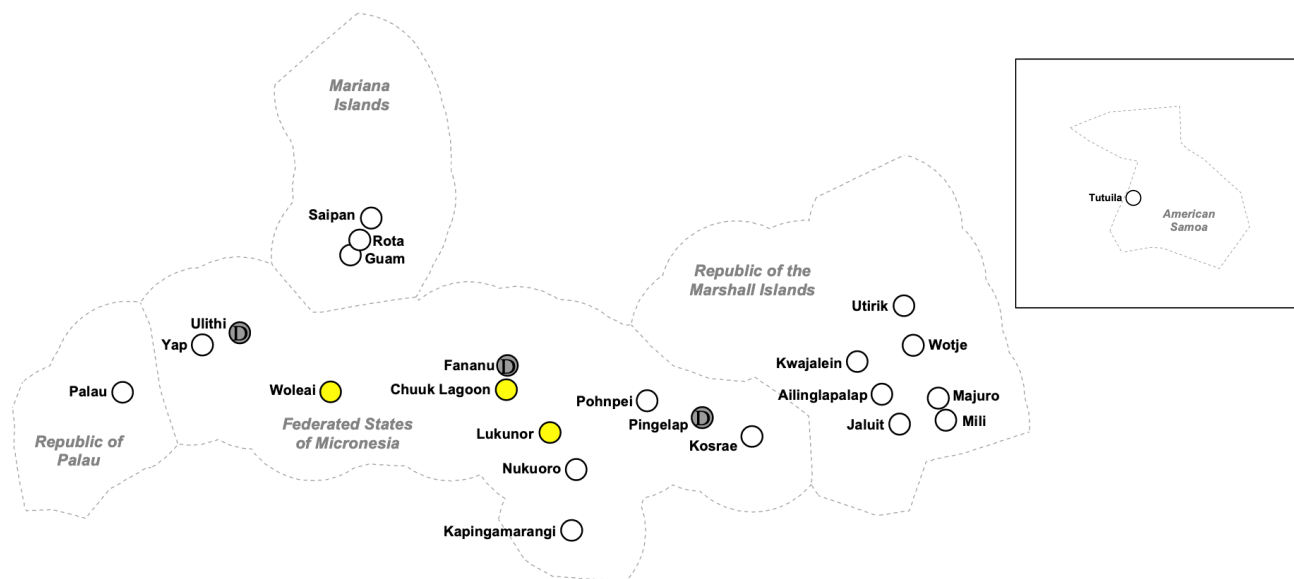


Significant Events – For September – November 2019



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

- Typhoon Hagibis passed near Guam and the Commonwealth of the Northern Mariana Islands. Heavy rainfall was the primary impact.
- Near normal rainfall was observed across American Samoa and the Republic of Palau.
- Significant King Tide inundation events in the Republic of the Marshall Islands in October and November.
- Heavy rains fell in Pohnpei within the Federated States of Micronesia while drought conditions worsened in the Hawaiian Islands.
- Sea-levels in parts of the Federated States of Micronesia, Yap, and Guam have risen dramatically in the last few months. Several islands continue to report salt water inundation on account of the rebounding sea levels.
- Coral bleaching was observed near the Marshall Islands and the Hawaiian Islands during the month of October.



The 2 December Niño 3.4 region anomaly was $+0.4^{\circ}\text{C}$, and the overall coupled ocean-atmosphere system reflects ENSO neutral conditions.

Sea-surface temperatures are above normal across most of the Pacific with $+1.0^{\circ}\text{C}$ anomalies over FSM and RMI. Waters around American Samoa are $+0.25^{\circ}\text{C}$ warmer than average. Additionally, **warm anomalies $>1^{\circ}\text{C}$ continue to surround the Hawaiian Islands** and a mass of anomalously warm water ($3\text{--}4^{\circ}\text{C}$ above average) persists in the far north Pacific. Meanwhile, a shrinking area of cold anomalies (between -1 and -2°C) resides along the equator to South America east of 120°W .

Above-normal sea levels in the western and central Pacific have moderated since last month near and north of the equator. Sea levels in the central South Pacific are steady near or above normal. Eastern Pacific sea levels are near or below normal. Hawaii remains at the western edge of a broad region of above-normal sea levels.

Drought conditions have worsened across Hawaii but largely improved over the U.S. Affiliated Pacific Islands. As of 27 November, the Hawaiian Islands of Maui and Hawaii were depicted with severe to extreme drought, while moderate drought persists on Kauai and Ohau. *Rainfall* from September through November was quite varied: Honolulu (118%), Lihue (130%), Kahului (17%), and Hilo (92%). Elsewhere, Saipan was above normal at 171% and Guam was above normal (135%). In Kwajalein and Majuro in the RMI, rainfall was near to above normal, with 98% and 108% of average respectively. In the FSM, rainfall from September through November was distributed as follows: Chuuk (87%), Kosrae (80%), and Pohnpei (145%). Further west, Yap was 76% of normal and Palau was 94%. In American Samoa, rainfall was below normal for the quarter (78%).

Tropical Cyclone (TC) activity in the western North Pacific basin was near normal with 14 named storms. Most activity has been north of Guam and west of the Mariana islands. The period from August-October is climatologically the quietest part of the entire year with a historical total of only 5 storms from 1981-2010 (1 in September and 4 in October), of which only three were at named strength. TC Rita formed in November and briefly attained Australian Category 3 status.



Flooded areas of Majuro, Marshall Islands in November. Photo courtesy of Nover Juria, NOAA.

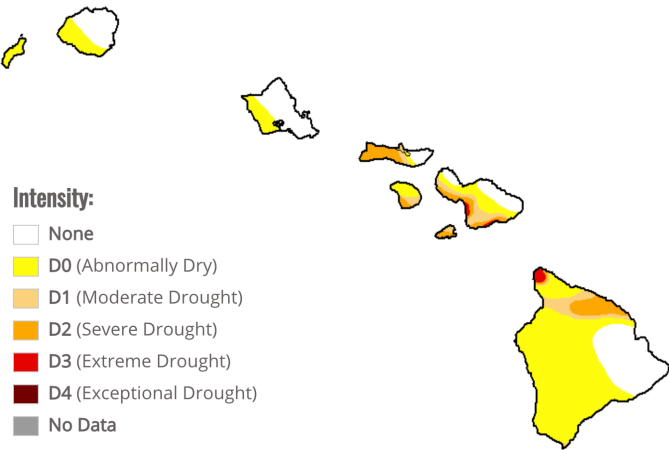


Inundation event Majuro. Photo courtesy of Radio New Zealand.

Facilities and Infrastructure – About 200 people evacuated their homes in the capital of the Marshall Islands on November 25 after big waves caused ocean inundation around the low-lying atoll. From Radio NZ, "The key driver of this current inundation appears to be a large swell which has arrived from a more northerly direction than the typical trade wind swell." Heavy rainfall over leeward Oahu in the early morning hours of October 11 produced flash flooding and deep ponding of roads in the Waianae area. Later that day, a burst of intense rainfall over central and north Kauai produced a flash flood in Hanalei River. The rapid rise in water level inundated and closed Kuhio Highway near the Hanalei Bridge for several hours.

Water Resources – As of November 10th the Reservoirs level in Majuro, Marshall Islands, had decreased to 28 million gallons about 82% full but no immediate impacts or water shortages were noted.

Natural Resources – On Hawaii Island, the areas most affected by the coral bleaching were along the Kona coast with 40% live coral bleached in many survey locations. Over 50% of live corals were bleached on the windward shores of Oahu. In American Samoa, monitoring continues of the outbreak of *Valonia* sp. algae in Ofu-Olosega, as well as a disease (cyanobacteria) that is affecting some massive *Porites* in Ofu.

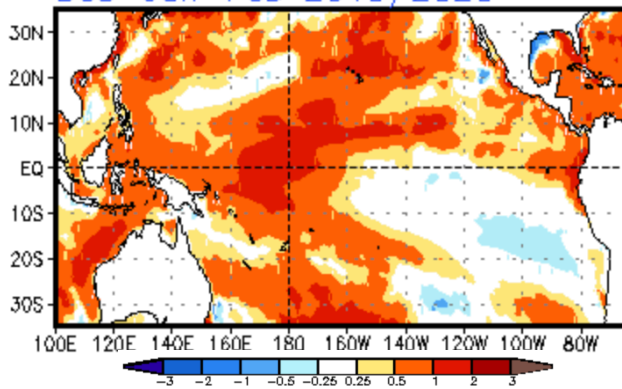


Current drought status for Hawaii, valid 27 November 2019. Source: www.drought.gov



Bleached corals around the Hawaiian Islands. Source: <https://dlnr.hawaii.gov/>

Dec-Jan-Feb 2019/2020



Sea-Surface Temperature Outlook, Dec through Feb 2020. Source:

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

According to ENSO prediction models, **there is a 70% chance of ENSO neutral conditions continuing through March 2020.**

The SST anomaly outlook indicates +0.5° to 2.0° C anomalies continuing and spreading across much of the Western Pacific, including American Samoa. Cool anomalies to -0.5° C are projected for the far eastern equatorial Pacific. **NOAA's Coral Reef Watch 4-month bleaching outlook** projects high heat stress (Alert Level 2) will continue in the western Pacific Ocean around Nauru and the Gilbert Islands for the next 3 months, and expand southward and eastward (at Alert Level 1) toward Tuvalu, American Samoa, and French Polynesia in January and February 2020.

Over the next six months, dynamical models suggest mostly above-normal sea levels in the western half of the Pacific. The area around Guam is an exception where near or below-normal sea levels are forecast. Around Hawaii, the models are predicting slightly above-normal sea level. The predicted increasing sea level around Hawaii is consistent with warmer-than-normal ocean temperatures in the region.

During the period December through February, rainfall is projected to be near normal in Yap, Palau, most of FSM, northern RMI, Guam, and CNMI. Below normal rainfall is projected for southern RMI and far southern FSM. Above normal rainfall is projected for both Hawaii and American Samoa.

Tropical cyclone (TC) activity in the western North Pacific expected to be near normal as we enter the quiet period of the basin. In the southwest Pacific, the early part of the season from Nov-Jan, should be close to normal with perhaps at least one named TC around the dateline. Activity in general is expected to increase during the late season beginning in February where indications are for an increased risk of storms occurring near Samoa, American Samoa, Tonga, Niue, the Southern Cook Islands and the Austral Islands.

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 (APDRC) -

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