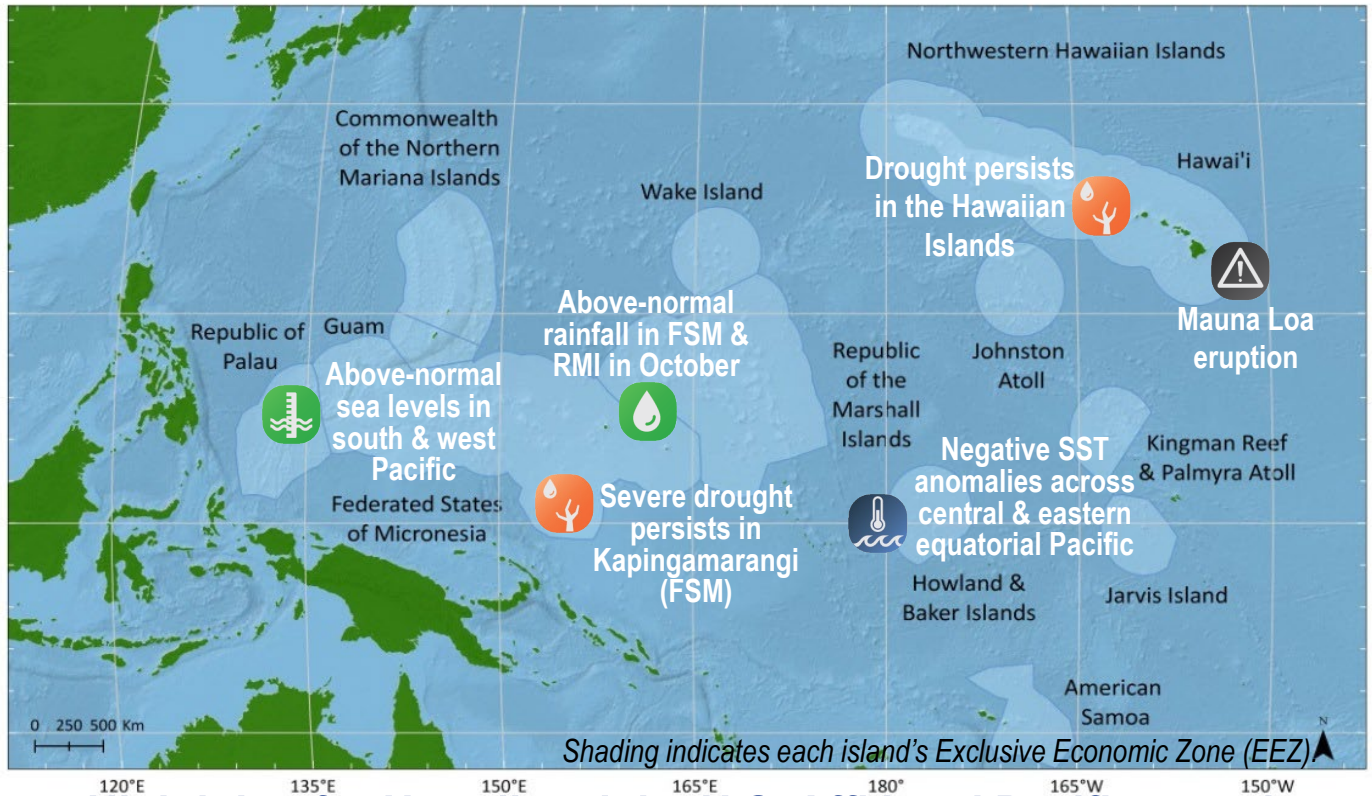




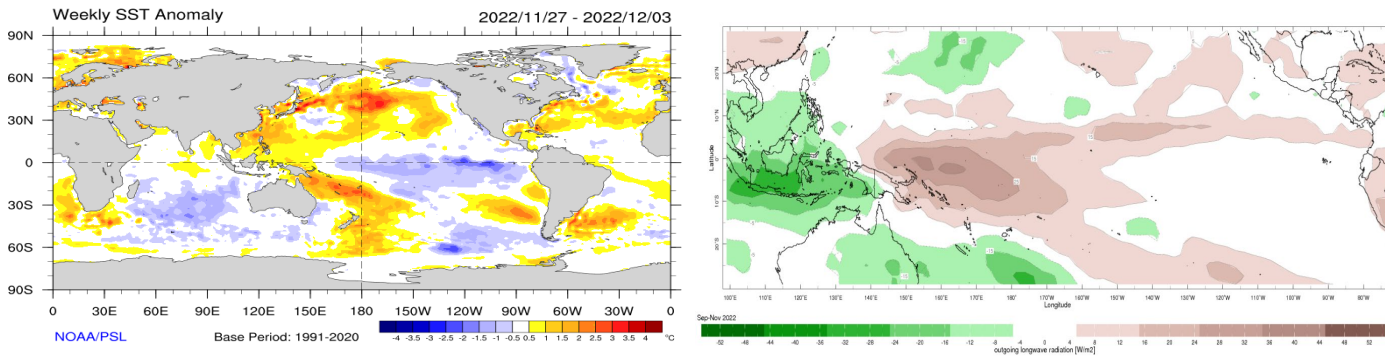
Significant Events – For September 2022–November 2022



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

- La Niña Advisory was in effect (Dec 12) with below-normal sea surface temperatures (SSTs) observed across the central and eastern Pacific Ocean. La Niña is expected to continue in the winter, with equal chances of La Niña and ENSO-neutral conditions during January-March 2023, according to NOAA Climate Prediction Center.
- For the Sept-Nov (SON) period, the U.S. Affiliated Pacific Islands (USAPI) were largely drought-free, with exception of Severe Drought (D2) conditions in the Federated States of Micronesia (FSM) in Kapingamarangi where both short and long-term precipitation deficits have been observed (driest Jan-Nov period on record).
- For the SON period, precipitation was near-to-above normal in Palau, Guam, Saipan, American Samoa, and areas of both FSM (Chuuk, Kosrae, Pohnpei) and the Republic of the Marshall Islands (RMI; Kwajalein, Majuro). Conversely, below-normal rainfall was observed in areas of the central and southern FSM (Lukunor, Kapingamarangi) as well as across much of the Hawaiian Islands.
- Satellite analysis (November) showed above-normal sea levels occurring across the tropical western Pacific and along a narrow band in the far western portions of the tropical central Pacific, while near-normal to below-normal sea levels were observed across most of the tropical central and eastern Pacific.
- Mauna Loa volcano began erupting (Nov. 27) in the Moku'āweoweo Caldera and migrated to the Northeast Rift Zone where fissures fed several lava flows, according to the USGS Hawaiian Volcano Observatory.

Climate Overview – For September 2022–November 2022



Weekly sea surface temperature anomaly map for 11/27/22 to 12/03/22 (left) and seasonal outgoing long-wave radiation anomalies for Sept–Nov 2022 (right). Areas with more rain/clouds than normal are depicted in **green**, while areas with fewer clouds/less rain are depicted in **brown** (right). Sources: NOAA PSL, NOAA NCEP Climate Prediction Center, IRI.

Across most of the equatorial Pacific Ocean (east of 160°E), sea surface temperatures (SSTs) were below normal with La Niña conditions present. All four Niño regions registered negative SST anomalies on the NOAA CPC update (12/12/22) at the end of the SON period: Niño 3.4 region at -1.0°C ; Niño 3 at -1.1°C ; Niño 1+2 at -0.7°C ; and Niño 4 at -0.8°C .

During SON, **above-normal sea levels were observed across much of the equatorial western Pacific, while near-normal to below-normal levels were observed across much of the tropical central and eastern Pacific, with a basin-wide sea level pattern consistent with the prolonged La Niña event.** In the Hawaiian Islands, near-normal to slightly-above-normal sea levels (monthly means) were observed during September (Oct–Nov 2022 station data not available). In the western Pacific, monthly mean sea levels were above normal (5–15 cm) throughout SON, with numerous daily extreme-high sea level records broken during September (Oct–Nov data not available) including in Palau (9/11–13), Guam (9/9, 11–13, 22–25, 28–29), Saipan (9/8–10), Pohnpei, (9/8–11, 14, 23–25, 28–29), Kapingamarangi (9/9–10, 30), and Kwajalein (9/10–11), according to the University of Hawai‘i Sea Level Center.

During the SON period, **most of the U.S. Affiliated Pacific Islands (USAPI) were drought-free** except for Severe (D2) drought observed in southern FSM at Kapingamarangi and Moderate (D1) drought in Lukunor (FSM) during October, according to the U. S. Drought Monitor. **Median precipitation for the SON period ranged from 69% to 127% of normal across USAPI.** Of note, September and November were drier than normal across much of USAPI, while **October saw well-above-normal rainfall across much of the region.** For SON, Airai (Palau) recorded 43.75 in. (121% of normal). In FSM, Yap observed 40.23 in. (112% of normal), Kapingamarangi 12.12 in. (38% of normal, 8th driest), Pohnpei 51.81 in. (117% of normal), Lukunor 22.95 in. (69% of normal, 7th driest), Kosrae 52.38 in. (136% of normal), and Chuuk 38.25 in. (106% of normal). In the Mariana Islands, Saipan observed 26.38 in. (94% of normal, 14th driest) and Guam 36.52 in. (108% of normal). In the RMI, Majuro observed 48.69 in. (108% of normal, 11th wettest) for SON, while Kwajalein logged 34.45 in. (108% of normal). In American Samoa, precipitation was slightly above normal (29.67 in., 102% of normal) at Pago Pago. **Across most of the Hawaiian Islands, below-normal rainfall was observed during SON, with drought persisting across areas of the island chain.** For the SON period, Lihue observed 3.86 in. (41% of normal), Honolulu 1.37 in. (29% of normal), Molokai 5.33 in. (102% of normal), Kahului 1.98 in. (64% of normal), Kailua Kona 0.75 in. (33% of normal), and Hilo 28.01 in. (84% of normal).

In the Northeast Pacific (east of 180°), tropical cyclone (TC) activity was **below normal** for the 2022 season, with 19 named storms with an Accumulated Cyclone Energy (ACE) Index of 116.5 (normal 132.6) by 11/30/22. In the Northwest Pacific, TC activity for the typhoon season was **below normal** with an ACE Index of 162.1 (normal 285.8) and 12 named storms by the end of November, according to the Colorado State University, Department of Atmospheric Science, Tropical Meteorology Project.

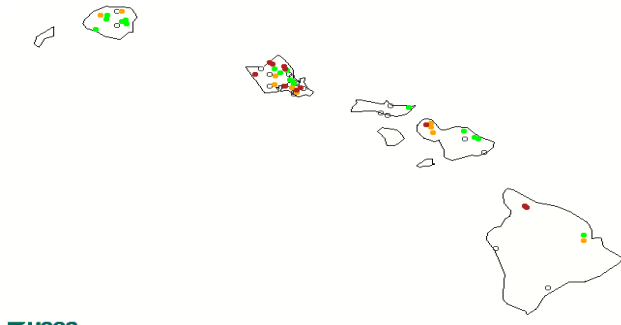


Surfer in Hilo, Hawaii during the large northeast swell event on 11/27/22. Photo credit: Hawaii News Now.

Agriculture – In Maui, the prolonged drought has continued to cause issues associated with axis deer encroachments onto farmlands, resulting in severe damage to crops, pastures, and losses for local producers. On 11/18/22, Governor Ige issued a fifth proclamation regarding the axis deer crisis, extending the disaster emergency relief period through 1/17/23.

Facilities and Infrastructure – On 11/27/22, a large northeast swell produced warning-level surf that caused some road closures, localized minor flooding, and closure of local parks and beaches around the Hilo area and other east-facing locations including Hanauma Bay State Park (Oahu).

Water Resources – On the Big Island, Maui, and Oahu, U.S. Geological Survey (USGS) stream gages were reporting 14-day average flows well below normal (<10th percentile) in response to recent rainfall shortfalls. In Majuro (RMI), reservoir storage reached 99% of total capacity (currently 28,200,000 million gallons) on 12/1/22.



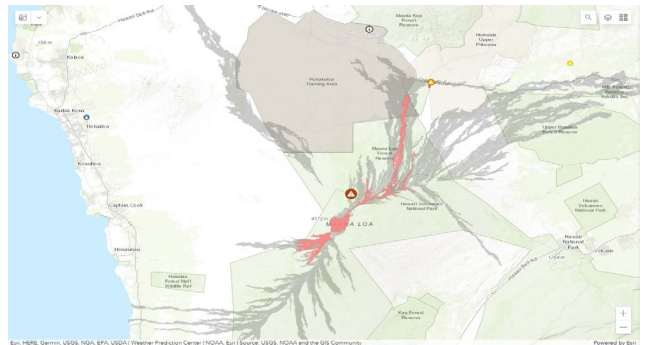
Search USGS streamgage

Choose a data retrieval option and select a location on the map
 List of all stations Single station Nearest stations

Explanation - Percentile classes							
Low	<10	10-24	25-75	76-90	>90	High	Not-ranked
	Much below normal	Below normal	Normal	Above normal	Much above normal		

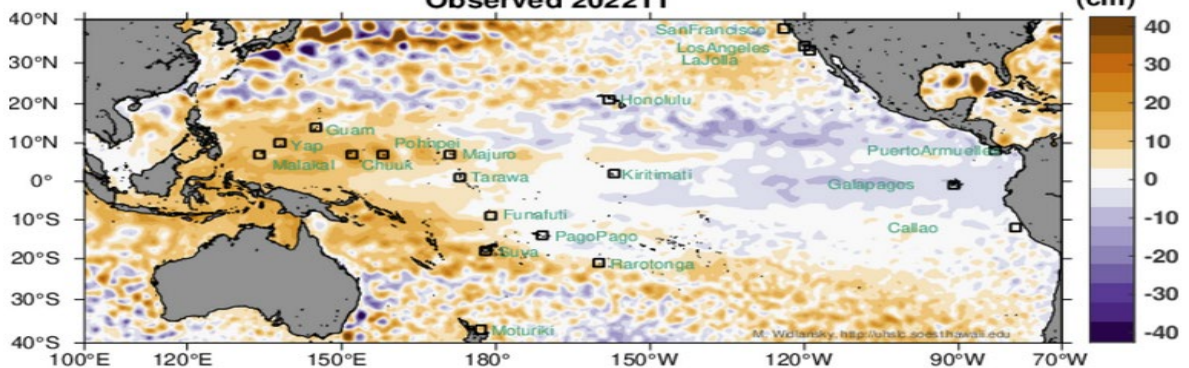
Map of 14-day average streamflow compared to historical streamflow for the day of the year, according to the USGS on 12/13/22. **Warm colors** represent below-normal streamflows.

Map credit: USGS; <https://waterwatch.usgs.gov/>

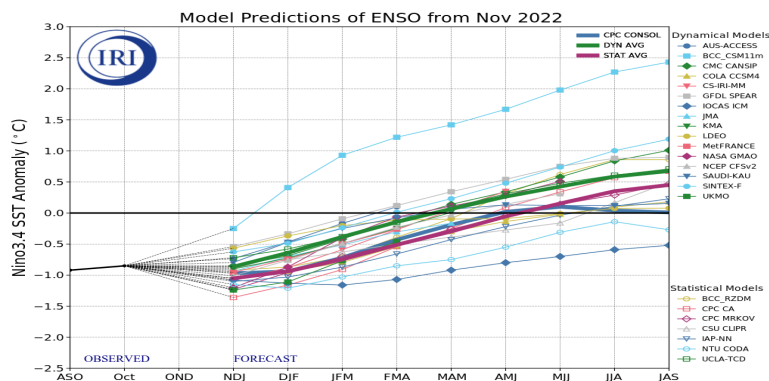


Map depicting the current status (Dec. 12) of the Mauna Loa eruption and lava flow activity (red). Map credit: County of Hawaii Hazard Impact Map, ESRI.

Satellite analysis (CMEMS) Observed 202211



Satellite analysis of observed sea level height anomalies for November 2022. **Warm colors** represent above-normal sea levels and **cool colors** represent below-normal sea levels. Source: University of Hawaii Sea Level Center.



ENSO forecast model predictions – November 2022

Source: IRI/CPC. <https://iri.columbia.edu/our-expertise/climate/forecasts/ens0/current/>

According to the majority of ENSO prediction models (see IRI/CPC forecast above), **La Niña** conditions are expected to continue into the Northern Hemisphere winter, with equal chances of La Niña and ENSO-neutral in the January-March 2023 period. For February-April 2023, there is a 71% chance of ENSO-neutral conditions, according to the latest ENSO status update by NOAA CPC (Dec 12).

NOAA's Coral Reef Watch four-month (Dec 2022–Mar 2023) coral bleaching heat stress outlook calls for a bleaching **Watch** for areas of USAPI including Palau, FSM, and American Samoa.

During the period of December 2022 through February 2023, **above-normal precipitation** is forecasted for USAPI, including areas of Palau, FSM (Kosrae, Pohnpei), RMI (Kwajalein, Majuro), and American Samoa. Normal precipitation levels are expected in central and western FSM in Chuuk and Yap and in the Mariana Islands (Guam and Saipan). Conversely, **below-normal precipitation** is forecasted for the Hawaiian Islands, according to the NOAA Pacific ENSO Applications Climate (PEAC) Center.

For the next 3 to 6 months, dynamical models (NOAA CFSv2, ACCESS-S2 [Australia]) suggest continuation of **above-normal sea level anomalies** for many of the South Pacific Islands and areas west of 180° in the tropical Pacific. The forecast of high seasonal sea levels, combined with long-term sea level rise, may raise high tide water levels by up to 15 cm above tide calendar predictions for some locations in the South Pacific region. Conversely, **below-normal sea level anomalies** are forecasted across much of the tropical central and eastern Pacific Ocean—consistent with the continuing La Niña event, according to model data from the University of Hawaii Sea Level Center.

NOAA Coral Reef Watch:
<https://coralreefwatch.noaa.gov/>

NOAA National Centers for Environmental Information:
<http://www.ncei.noaa.gov/>

NOAA NMFS Pacific Island Fisheries Science Center:
<https://www.fisheries.noaa.gov/region/pacific-islands#science>

NOAA NWS Weather Forecast Office Honolulu & Guam:
<https://www.weather.gov/hfo/>
<https://www.weather.gov/gum/>

NOAA OceanWatch - Central Pacific:
<https://oceanwatch.pifsc.noaa.gov/>

NPS Pacific Island Inventory & Monitoring Network:
<https://www.nps.gov/im/pacn/index.htm>

University of Guam - Water and Environmental Research Institute:
<https://weri.uog.edu/>

University of Hawaii Asia Pacific Data Research Center (APDRC):
<http://apdrc.soest.hawaii.edu/index.php>

University of Hawaii - Joint Institute of Marine and Atmospheric Research:
<https://www.soest.hawaii.edu/jimar/>

University of Hawaii Sea Level Center:
<https://uhslc.soest.hawaii.edu/>

USGS Science Center – Pacific Coastal and Marine Science Center:
<https://www.usgs.gov/centers/pcmssc>

USGS Pacific Islands Water Science Center:
<https://www.usgs.gov/centers/piwsc>

Western Regional Climate Center:
<https://wrcc.dri.edu/>