MEMBER REPORT

United States of America

Pacific Region

ESCAP/WMO Typhoon Committee
18th Integrated Workshop
ESCAP - UN Conference Center, Bangkok, Thailand
28 November – 1 December 2023

CONTENTS

I. Overview of tropical cyclones which have affected/impacted Member's area since the last Committee Session

The Pacific Region of the United States of America (USA) National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) encompasses both the western North Pacific Islands in Micronesia (except Kiribati) and the Central Pacific areas. In Micronesia, the USA tropical cyclone activities involve the NWS Pacific Region and the Department of Defense Joint Typhoon Warning Center (JTWC) located at Pearl Harbor, Hawaii. The NWS Weather Forecast Office (WFO) on Guam provides weather forecasts, advisories, watches, and warnings within its Area of Responsibility (AOR). The WFO Guam AOR roughly extends from 130 Degrees East Longitude eastward to the International Date Line, covers an ocean area of more than 4 million square miles (about 10.4 million square kilometers) and includes more than 2000 Micronesian islands. This AOR includes the Commonwealth of the Northern Mariana Islands (CNMI), Republic of Palau, Federated States of Micronesia (FSM), Republic of the Marshall Islands, and the U.S. Territory of Guam. The FSM is composed of the States of Yap, Chuuk, Pohnpei, and Kosrae.

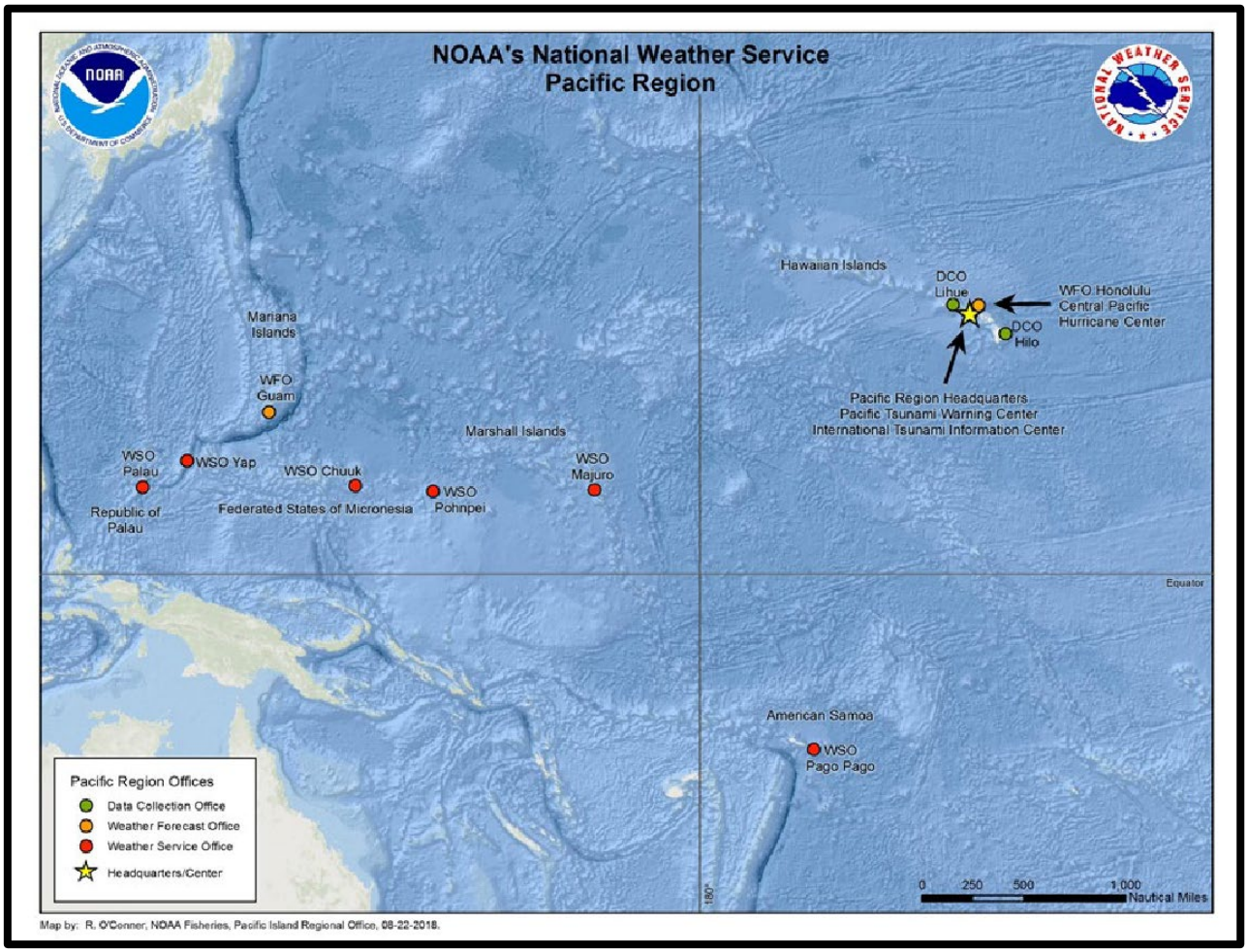


Figure 1: Map of the NOAA National Weather Service Pacific Region

When tropical cyclones occur within the Guam AOR, WFO Guam issues watches and warnings for the U.S. Affiliated Islands of Micronesia. WFO Guam uses the track, intensity and wind distribution information provided by JTWC to produce plain-language and graphical forecast and warning products informing the general public and governmental agencies of impending severe weather.

The Central Pacific Hurricane Center (CPHC) is co-located with the NWS Honolulu Forecast Office (HFO). The NWS Honolulu Forecast Office activates the CPHC when tropical cyclones form in, or

move into, the Central Pacific region from 140 Degrees West Longitude westward to the International Date Line. CPHC is also the World Meteorological Organization (WMO) Regional Specialized Meteorological Center (RSMC) for tropical cyclones in this region and in this capacity is known as RSMC Honolulu. The NWS Forecast Office in Honolulu's AOR covers around 5 million square miles (about 13 million square kilometers) from the Equator to 30N between 140W and 160E.

1. Meteorological Assessment (highlighting forecasting issues/impacts)

Central North Pacific (140W to 180, North of the Equator) Overview

The 2023 tropical cyclone season featured near normal activity across the RSMC Honolulu AOR. There were four tropical cyclones which entered the central North Pacific during the period from 1 January through 15 November 2023. The monthly TC distribution was 1 in July, 2 in August and 1 in September. This aligned well with the climatological peak of activity for this basin in mid-August.

Tropical Storm Calvin moved into the RSMC AOR from RSMC Miami AOR on July 17 and slowly weakened as it skirted just south of the Big Island (Hawaii Island) by 19 July. Calvin then dissipated to a remnant trough.

Hurricane Dora brought distant but significant impacts to portions of the Hawaiian Islands as it moved east to west across the entire AOR. Dora entered the AOR on 6 August and exited to the RSMC Tokyo AOR on 12 August. Dora spent nearly the entire basin crossing as a major hurricane with winds 110 knots or greater, only weakening to 95 knots as it reached the Dateline and crossed the boundary to Tokyo's TC AOR. Dora' preliminary peak intensity was 125 knots on 6 August and again on 9 August. The most significant indirect impact from Dora was a disastrous wildfire which occurred during a period of very strong winds as Dora passed far to the south of the Hawaiian Islands.

Tropical Storm Greg entered the RSMC Honolulu AOR on 14 August and slowly weakened as it moved westward along the 11 degree north latitude. Greg dissipated on 17 August. No impacts to land or marine areas were noted.

Tropical Depression 12-E crossed into RSMC Honolulu on 17 September and quickly dissipated that same day.

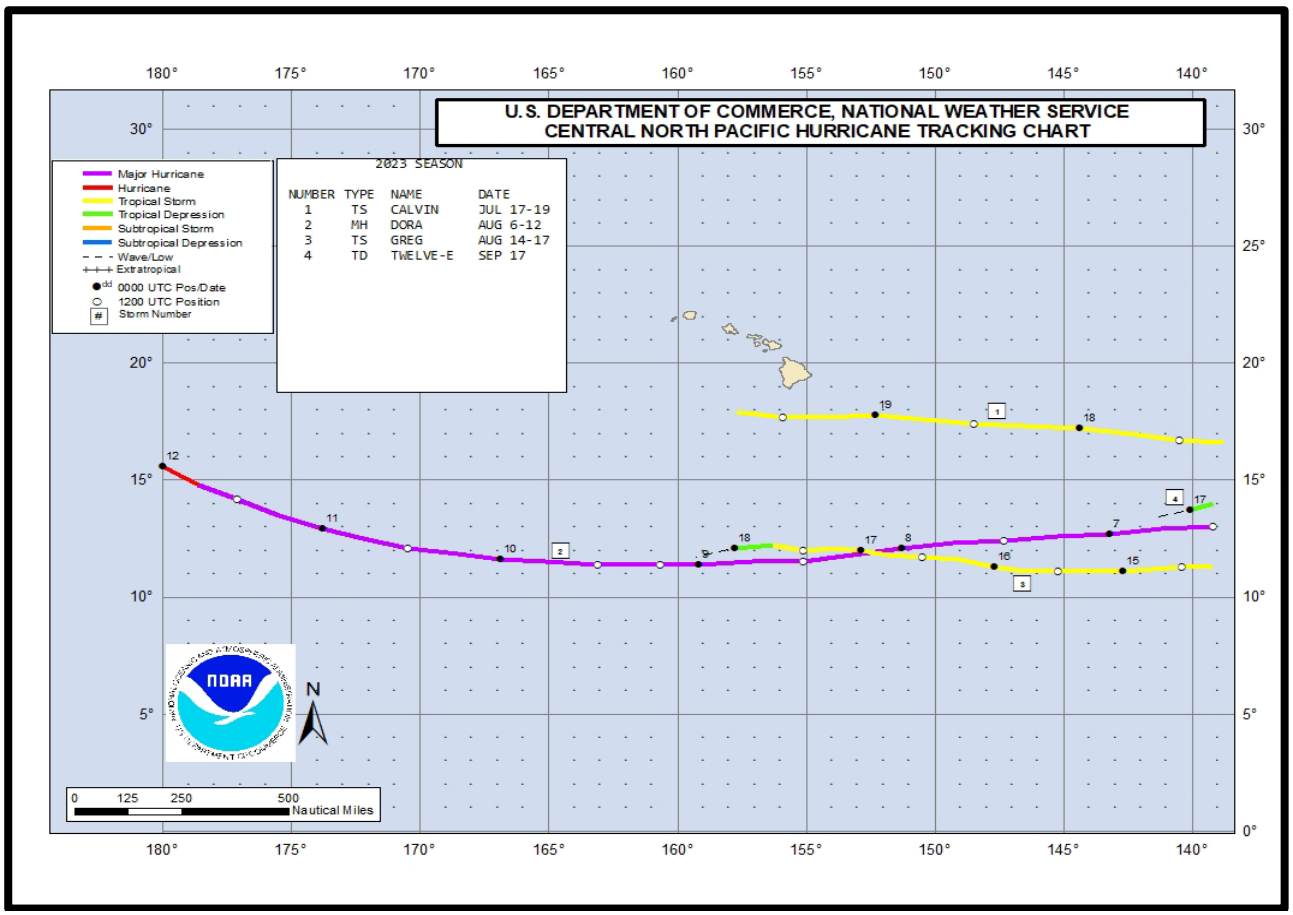


Figure 2: Preliminary central North Pacific tropical cyclone and invest tracks from 1 January 2023 to 15 November 2023

Western North Pacific (130E to 180, north of the equator) Overview

In 2023, below normal tropical cyclone activity was observed across the broader western North Pacific basin; however, compared to the 2020-2022 seasons, tropical activity did shift farther east into the Guam Area of Responsibility (AOR) that spans from the Equator to 25N between 130E and the International Date Line due to 2023's El Niño. However, despite the El Niño status for 2023, tropical cyclone activity was notably lower than expected. While several multi-week patterns saw westerly flow along the equator, sometimes extending as far east as 170E, and a substantial number of tropical disturbances passed through the region, many failed to materialize into bona fide tropical cyclones due either to lackluster duration of stronger equatorial westerly wind bursts (WWBs), increased upper-level shear north of 7N to 10N, or long periods of dry, subsident mid- and upper-atmospheric conditions. A look at the Joint Typhoon Warning Center (JTWC) storm tracks for the period of 1 November 2022, through 18 November 2023, reveals 20 western North Pacific (WNP) TCs, 13 of which formed within the Guam AOR and only 5 that reached typhoon intensity in the same region. A fourteenth tropical cyclone in the Guam AOR crossed the international date line from the Central Pacific – Hurricane Dora, which formed in the East Pacific. Despite this notable increase in tropical cyclone activity in the Guam AOR, only 4 had notable direct impacts to islands in the region: Tropical Storm (TS) Banyan (27W), November 2022; Tropical Storm Sanvu (01W), April 2023; Super Typhoon (STY) Mawar (02W), May 2023; and STY Bolaven (15W), October 2023. A fourth storm, Tropical Depression (TD) 17W, November 2023, developed east of Palau and Yap and resulted in the issuance of TS watches for islands in both jurisdictions. TD 17W eventually dissipated without either intensifying or reaching any of the nearby islands.

In April 2023, Sanvu (01W) formed south-southeast of Pohnpei island and slowly moved north-northwest over island. A diurnal convective flare-up occurred as Sanvu passed over Pohnpei, causing

some minor damage on the windward side of the island. Once north of Pohnpei, Sanvu intensified to a tropical storm, which it maintained for a couple of days before succumbing to increasing vertical wind shear.

In May 2023, Mawar (02W) formed southwest of Chuuk and slowly lifted northward toward the Marianas as it steadily intensified. Initially anticipated to pass through the Marianas as a category 2 typhoon (83-95 kt 1-minute sustained winds), a slower storm motion provided ample time for Mawar to rapidly intensify into a strong, high-end category 4 super typhoon southeast of Guam. STY Mawar weakened as it approached the north tip of Guam due to a timely eyewall replacement cycle (ERC), but still delivered much devastation and flooding to central and northern Guam. Once to the west of the island, the ERC completed and a second round of rapid intensification took place.

In October 2023, Bolaven (15W) formed in northern Chuuk State and slowly intensified as it moved northwest toward the Marianas. Bolaven passed between the islands of Rota and Tinian as a category 1 typhoon (64-82 kt 1-minute sustained winds). Despite having a clearly-defined eye in both radar reflectivity data and satellite microwave imagery, a well-defined eye was not visible in infrared satellite imagery until Bolaven was west of the Marianas and undergoing rapid intensification. Damage across Rota and Tinian was minimal due to the fortunate passage of Bolaven directly between the two islands which sit 50 miles (80 km) apart. Observations from Saipan indicated tropical storm force winds (34-63 kt) despite Bolaven having passed only about 45 miles (72 km) to the south-southwest.

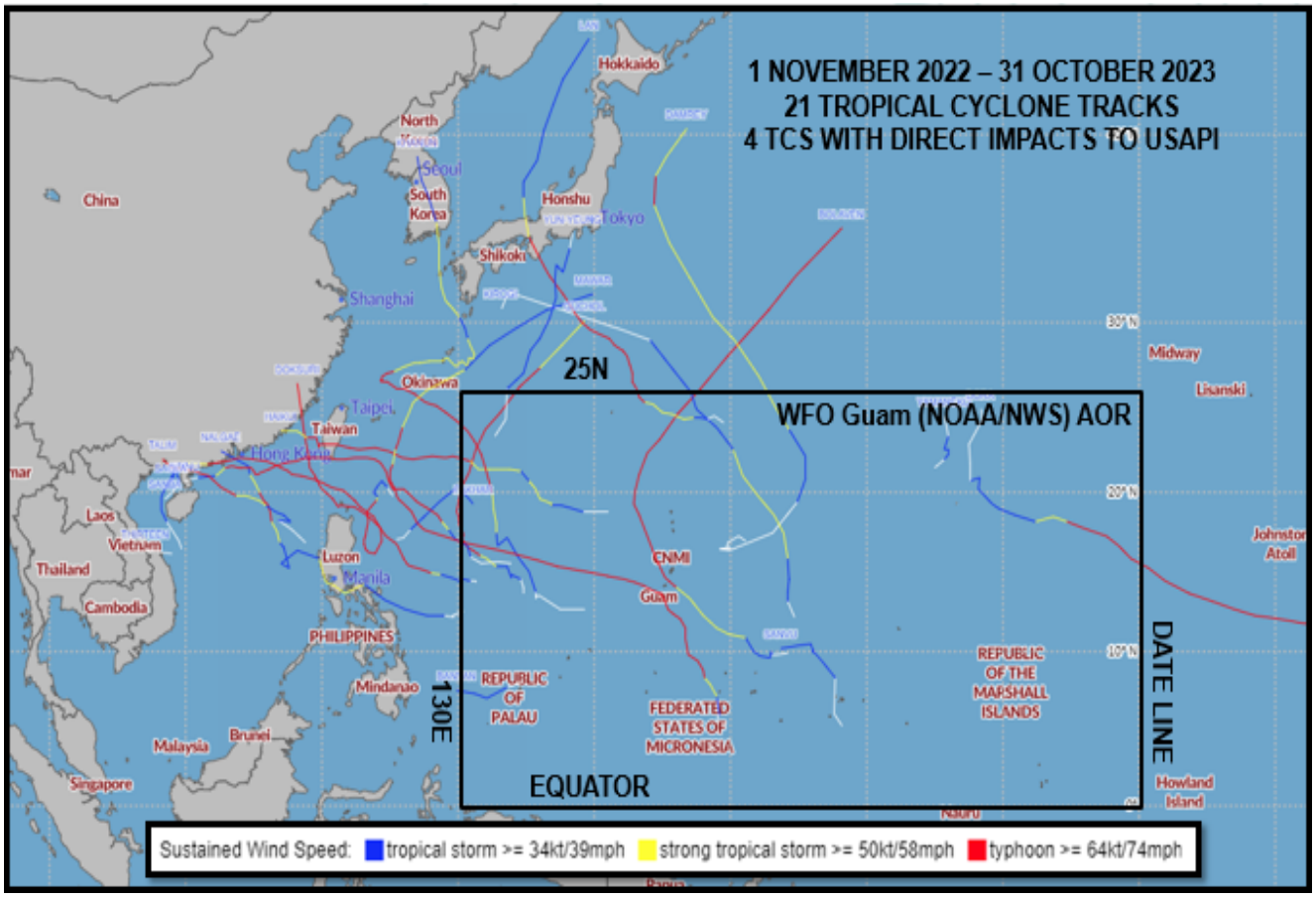


Figure 3: Preliminary western North Pacific tropical cyclone tracks from 1 November 2022 to 18 November 2023

2. Hydrological Assessment (highlighting water-related issues/impact)

Central North Pacific (140W to 180, North of the Equator) Overview
This region has experienced below normal rainfall and worsening drought conditions throughout the 2023 year so far. At the end of the year, the drought has reached severe to extreme levels for over 80 percent of the land areas.

The tropical cyclone activity in the RSMC Honolulu AOR generally stayed far enough of away from land areas, such that no areas of enhanced rainfall were observed in the Hawaiian Islands. With little to no relief provided by the summer tropical season of 2023 to those areas, and less persistent trade wind showers, the drought is expected to be worsening into early 2024. Inferring from seasonal OLR anomalies, the one area in the AOR that had beneficial rains was along and south of 10 degrees North latitude impacting the islands and atolls of Kiribati.

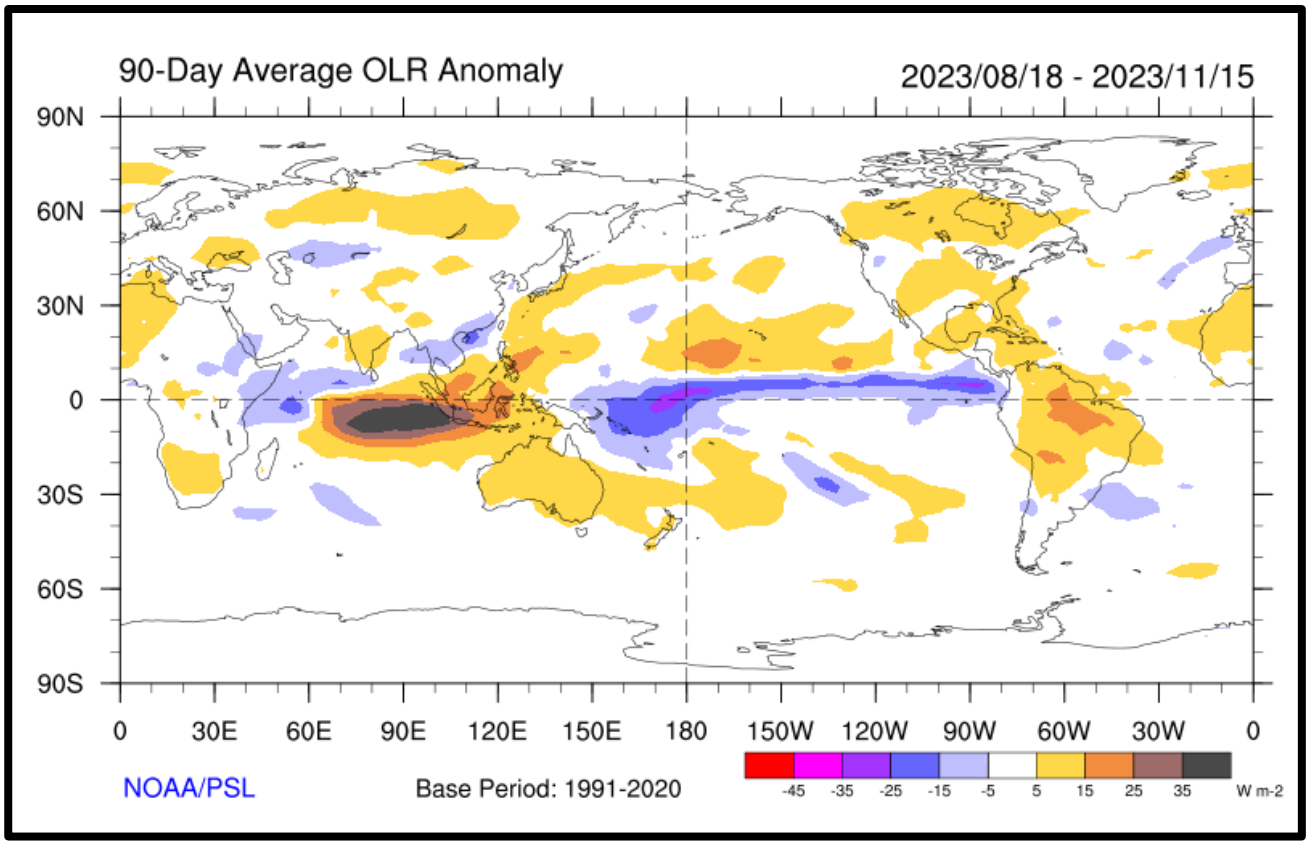


Figure 4: 90-day Average OLR Anomaly ending on 15 November 2023

Western North Pacific (130E to 180, north of the equator) Overview
The end of 2022 throughout 2023 saw above to well above normal rainfall across the Marianas and Micronesia. Rainfall amounts from 1 January through 31 October 2023 for islands across the Micronesia region are listed in the Table 1, below. So far this year, there are no problems with drought, nor low water levels across the region.

Location	Rainfall (Inches)	Rainfall (mm)	% Normal	% Yearly Normal
Majuro, RMI	107.13	2721	101	82
Kosrae, FSM	184.04	4675	117	94
Pohnpei, FSM	223.68	5682	147	122
Chuuk, FSM	141.10	3584	120	99
Yap, FSM	118.58	3012	114	96

Palau	144.12	3661		
Guam	128.34	3260	152	131
Rota	92.71	2355	116	100
Tinian	72.23	1835		
Saipan	67.42	1713	111	97

Table 1: Rainfall totals for 1 January 2023 to 31 October 2023 for select islands of the western North Pacific

An El Niño neutral pattern transitioned into a weak El Niño early in 2023 and is now strong. The result of this pattern is the above normal rainfall across Micronesia and the Marianas. So far, only a few tropical cyclones have affected the region through the end of October 2023. The strongest of these was Super Typhoon Mawar. Tropical Storm Sanvu and Super Typhoon Bolaven.

The hydrologic impacts from these three tropical cyclones were as follows:

- Tropical Storm Sanvu – 19 to 21 April 2023; Sanvu was very short-lived and only affected a couple of three islands in Pohnpei State. No warnings were issued for Sanvu and only a Tropical Storm Watch was issued for Pohnpei, Sapwaufik and Pakin in Pohnpei State. This system did produce much need rainfall across these islands during the dry season months of 2022.
- Super Typhoon Mawar – 20 May to 3 June 2023
  - Mawar resulted in tropical storm warnings being issued across western Chuuk State for Ulul and Polowat and 1 in eastern Yap State for Satawal. These islands received tropical storm force winds along with periods of heavy rainfall.
  - As Mawar approached the Marianas, typhoon warnings were issued for Guam and Rota and a tropical storm warnings for Tinian and Saipan.
  - Extreme rainfall occurred as Super Typhoon Mawar moved through the Marianas. Guam took the brunt of the storm, which produced rainfall amounts of as high as 28.12 inches (714 mm) over a 72 hour period. Much lower rainfall occurred across the CNMI.
  - This rainfall resulted in extensive flash flooding across Guam.
- Super Typhoon Bolaven – 7 to 14 October 2023
  - A tropical storm warning was issued for Guam and Rota, a typhoon warning was issued for Tinian and Saipan, and a tropical storm watch was issued for the northern CNMI islands.
  - Rainfall amounts of up to 7.39 inches (188 mm) were reported across Guam and the CNMI. This resulted in localized flooding and flash flooding.

Additional hydrologic events across the Mariana Islands resulted in urban and small stream flood events in which some streets and streams were briefly flooded during heavy showers. Several of these rain events resulted in flash flooding which briefly flooded major thoroughfares, and several homes. There have been no reports of injury or loss of life due to floods, but several residents with received support from the American Red Cross due to water in the homes.

3. Socio-Economic Assessment (highlighting socio-economic and DRR issues/impacts)

Central North Pacific (140W to 180, North of the Equator) Overview

Significant impacts were noted on the Hawaiian island of Maui during the distant passage of Major Hurricane Dora on 8 August 2023. During that time period, existing and new wildfires raged out of control on the island of Maui due to strong winds which developed between Dora and an unseasonably strong high pressure area north of the region. These winds destroyed trees and power lines during the day, but as winds became stronger a wildfire developed outside of Lahaina town and raced into the city. The speed of the fire overtook many residents who could not evacuate in time and there were 99 fatalities and hundreds of people injured. Many people took refuge in the ocean as flames

reached the coastline. The wildfire destroyed over 2000 structures including homes and businesses that day. Total economic damages are estimated at between 4 and 6 billion USD. Recovery of the area continues many months after, with RSMC Honolulu having provided hundreds of forecasts and briefings in support of the recovery crews in the area.

RSMC Honolulu conducted dozens of tropical cyclone related outreach events, over 100 broadcast and print media interviews, and many formal emergency manager briefings during the course of the 2023 hurricane season.

Western North Pacific (130E to 180, north of the equator) Overview

WFO Guam conducted formal presentations for and held meetings with territorial officials (Governors and Lt. Governors), emergency managers, military leaders and the Federal Emergency Management Agency (FEMA). WFO Guam staff also traveled to the Republic of Palau, the Federated States of Micronesia and the Republic of the Marshall Islands to conduct meetings and workshops for, decision makers, state, and national leaders. The WFO completed hundreds of broadcast, radio and print media interviews, and participated in dozens of outreach events, both virtual and in person. WFO Guam hosted its first World Meteorological Day Open House on March 23, with nearly 1500 guests in a 5-hour event.

Since 1 November 2022, three tropical cyclones had significant socio-economic impacts in the WFO Guam AOR: Tropical Storm Banyan (27W) in early November 2022, Super Typhoon Mawar (02W) in May 2023, and Super Typhoon Bolaven (15W) in October 2023.

Tropical Storm Banyan approached Yap Proper and the Republic of Palau (ROP) as a tropical disturbance and was upgraded to a tropical depression just prior to passage over the ROP. Banyan was upgraded to a tropical storm by the JTWC 6 hours later, just after passing over the ROP. Much of Palau experienced near-tropical storm force conditions with wide-spread wind damage, flooding and several mudslides. The sudden and brief onslaught of inclement weather conditions caught many in the republic by surprise.

Super Typhoon Mawar, originating in the Federated States of Micronesia attained super typhoon status a day prior to its passage near Guam. It weakened just prior to approach and passed over far northern Guam as a Category-4 typhoon with maximum sustained winds of 140 mph (120 kt). Up to 28 inches (711 mm) of rain fell over parts of central and northern Guam in a 24-hr period, with wind damage ranging from severe tropical storm force over southern Guam to near-super typhoon force in far northwestern Guam. Damage across the northern third of Guam was extensive to many structures, and catastrophic to most wood and tin structures (anything not reinforced concrete).

Super Typhoon Bolaven approached the Marianas as a tropical storm and attained typhoon status just prior to passage between Rota and Tinian islands in the Commonwealth of the Northern Mariana Islands (CNMI). Its passage between the two islands spared both locations the strongest, typhoon-force winds, with severe tropical storm force damage indicated across the CNMI.

There have been no direct fatalities resulting from tropical cyclones in the WFO Guam AOR. Following the passage of Tropical Storm Banyan (Palau) in 2022, WFO Guam took significant steps to bolster its early warnings and significant weather communications. These efforts have succeeded in mitigating the risk of tropical cyclones to a diverse and vulnerable community across the western North Pacific.

WFO Guam is the only official local weather source in the region. Unlike cities and states in the continental U.S. where broadcasters communicate weather information to the public, residents in the region rely on WFO Guam and its partners to communicate weather information. In an effort to

increase weather communications, WFO Guam is in its third year of a partnership with a local Guam TV station to provide weekly weather outlooks (since July 2020) and its partnership with a local newspaper to produce bi-weekly weather columns (since September 2021). During the passage of Super Typhoons Mawar and Bolaven, WFO Guam used Facebook Live extensively to broadcast pre- and during-storm event information. Its broadcasts were live-streamed in regional Emergency Operations Centers and sought cooperation with regional Emergency Managers and Public Information Officers to aid in conversation and Q&A (Question and Answer) with the public. WFO Guam also began issued a weekly Regional Weather Outlook to provide early warning and weather information to decision makers across the region. Originally distributed to 30 contacts, the distribution list now includes nearly 250 regional and national decision makers, island leaders and NGOs.

Additionally, WFO Guam has partnered with the U.S. Department of Defense to initiate region wide virtual weather briefings ahead of significant weather threats to provide early hazards and warnings to military, state and national leaders in the AOR to promote preparedness and risk reduction.

4. Regional Cooperation (highlighting regional cooperation and related activities)

In 2023, Hurricane Dora was the first tropical cyclone to cross between RSMC Honolulu and RSMC Tokyo AOR boundary since 2018. This handoff went very smoothly with no issues reported during the transfer of responsibility between the two RSMCs.

Continued collaboration with respect to TC Sigmets following the agreements between MWO Honolulu and the Badan Meteorologi, Klimatologi, dan Geofisika (BMKG), Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), and Honolulu and Japan Meteorological Agency (JMA) using the JMA collaboration portal.

Initiative to increase visibility and sharing of Dvorak tropical cyclone analysis issued by various NMS through GTS in support for improved tropical cyclone strength and center position estimates, which feeds into increased numerical model and operational forecasting skill. Will need to continue to emphasize this initiative for more widespread regional adoption.

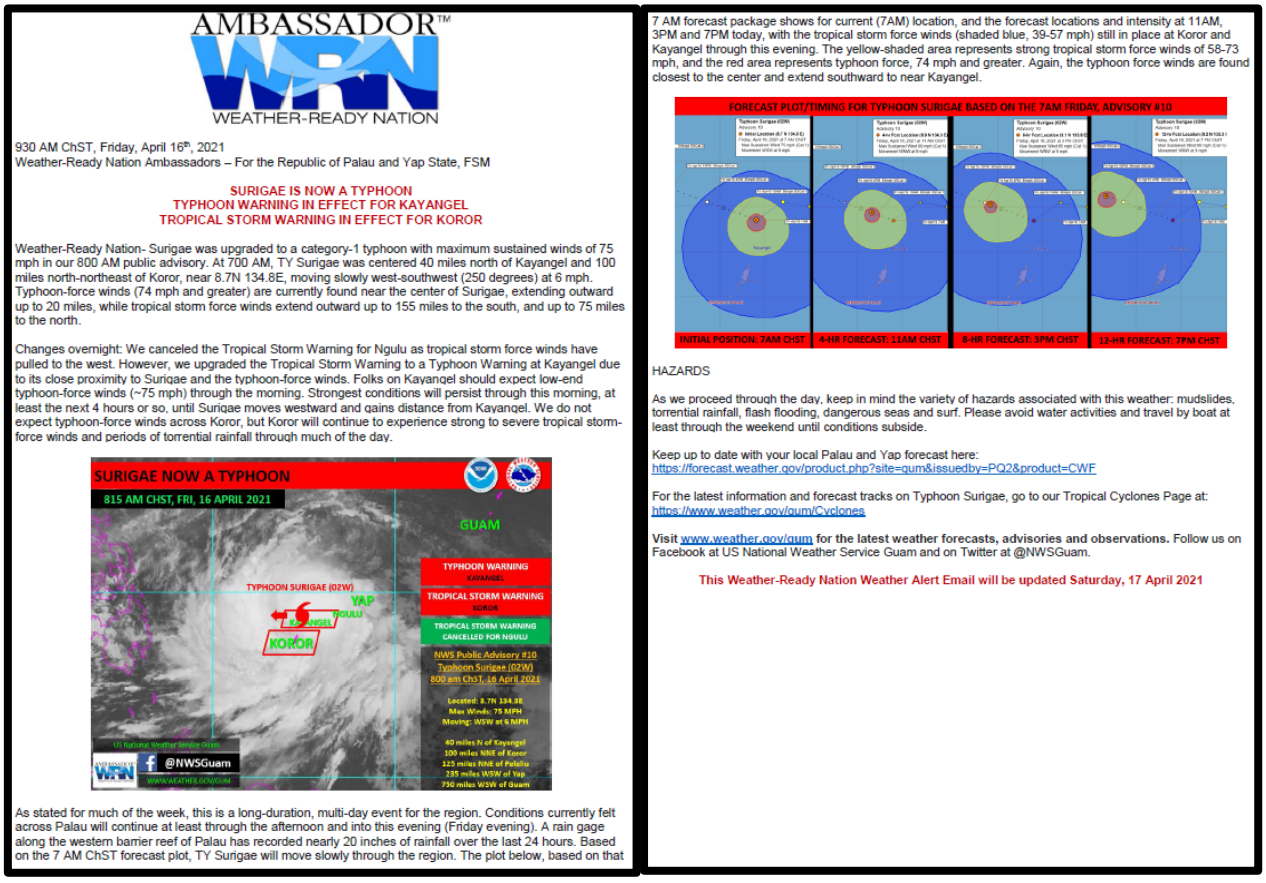
When Typhoon Mawar approached the most populated islands in Micronesia, the Marianas, the collaboration between WFO Guam, NWS Pacific Region Headquarters, and WFO Honolulu increased. WFO Honolulu seamlessly augmented the WFO Guam operations.

II. Summary of Progress in Priorities supporting Key Result Areas

1. Weather Ready Nation Ambassador Program

Main text:
Striving for community resilience at a national scale is a major goal for the NOAA National Weather Service. Since embarking on the Weather Ready Nation (WRN) program and expanding it to include the Ambassador Initiative in 2014, NOAA and its partners are moving to make the country weather-resilient.

As a WRN Ambassador, partners commit to working with NOAA and other Ambassadors to strengthen national resilience against extreme weather. Throughout 2022, the WRN Ambassador initiative helped and continues to help unify the efforts across government, non-profits, academia, and private industry toward making the nation more ready, responsive, and resilient against extreme environmental hazards.


AMBASSADOR™
WRN
WEATHER-READY NATION

930 AM ChST, Friday, April 16th, 2021
Weather-Ready Nation Ambassadors – For the Republic of Palau and Yap State, FSM

SURIGAE IS NOW A TYPHOON
TYPHOON WARNING IN EFFECT FOR KAYANGEL
TROPICAL STORM WARNING IN EFFECT FOR KOROR

Weather-Ready Nation- Surigae was upgraded to a category-1 typhoon with maximum sustained winds of 75 mph in our 800 AM public advisory. At 700 AM, TY Surigae was centered 40 miles north of Kayangel and 100 miles north-northeast of Koror, near 8.7N 134.8E, moving slowly west-southwest (250 degrees) at 6 mph. Typhoon-force winds (74 mph and greater) are currently found near the center of Surigae, extending outward up to 20 miles, while tropical storm force winds extend outward up to 155 miles to the south, and up to 75 miles to the north.

Changes overnight: We canceled the Tropical Storm Warning for Ngulu as tropical storm force winds have pulled to the west. However, we upgraded the Tropical Storm Warning to a Typhoon Warning at Kayangel due to its close proximity to Surigae and the typhoon-force winds. Folks on Kayangel should expect low-end typhoon-force winds (~75 mph) through the morning. Strongest conditions will persist through this morning, at least the next 4 hours or so, until Surigae moves westward and gains distance from Kayangel. We do not expect typhoon-force winds across Koror, but Koror will continue to experience strong to severe tropical storm-force winds and periods of torrential rainfall through much of the day.

As stated for much of the week, this is a long-duration, multi-day event for the region. Conditions currently felt across Palau will continue at least through the afternoon and into this evening (Friday evening). A rain gage along the western barrier reef of Palau has recorded nearly 20 inches of rainfall over the last 24 hours. Based on the 7 AM ChST forecast plot, TY Surigae will move slowly through the region. The plot below, based on that 7 AM forecast package shows for current (7AM) location, and the forecast locations and intensity at 11AM, 3PM and 7PM today, with the tropical storm force winds (shaded blue, 39-57 mph) still in place at Koror and Kayangel through this evening. The yellow-shaded area represents strong tropical storm force winds of 58-73 mph, and the red area represents typhoon force, 74 mph and greater. Again, the typhoon force winds are found closest to the center and extend southward to near Kayangel.

HAZARDS

As we proceed through the day, keep in mind the variety of hazards associated with this weather: mudslides, torrential rainfall, flash flooding, dangerous seas and surf. Please avoid water activities and travel by boat at least through the weekend until conditions subside.

Keep up to date with your local Palau and Yap forecast here:
https://forecast.weather.gov/product.php?site=gum&issuedby=PQ2&product=CWF

For the latest information and forecast tracks on Typhoon Surigae, go to our Tropical Cyclones Page at:
https://www.weather.gov/gum/Cyclones

Visit www.weather.gov/gum for the latest weather forecasts, advisories and observations. Follow us on Facebook at US National Weather Service Guam and on Twitter at @NWSGuam.

This Weather-Ready Nation Weather Alert Email will be updated Saturday, 17 April 2021

Figure 5: Sample of WRN Ambassador bulletin

For more on the National Weather Service's Weather-Ready Nation Ambassador Program, visit https://www.weather.gov/wrn/

Identified opportunities/challenges, if any, for further development or collaboration:
NWS will continue to use the opportunity to engage in multilateral forums and engage with partners in international agreements to help infuse the global weather enterprise with our new weather and climate information, new science, and innovative technology and seek opportunities to learn best practices from other countries to improve our technology and service delivery. We will continue to

expand our partnerships to help improve and sustain observing and communications networks essential for early warnings.

Priority Areas Addressed:

Integrated

- Strengthen the cooperation between TRCG, WGM, WGH, and WGDRR to develop impact-based forecasts, decision-support and risk-based warning.

DRR:

- Enhance Members' disaster risk reduction techniques and management strategies.
- Share experience and knowhow of DRR activities including legal and policy framework, community-based DRR activities, methodology to collect disaster-related information.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	✓
Detection, observation, monitoring, analysis, and forecasting	
Warning dissemination and communication	✓
Preparedness and response capabilities	✓

Contact Information:
Member: USA - Guam
Name of contact for this item: Marcus Aydlett
Telephone: +1 671-472-0946
Email: marcus.aydlett@noaa.gov

2. Annual Tropical Cyclone Exercises

Main text:
Annual tropical cyclone exercises were conducted by the Government of Guam, Government of the CNMI, the Republic of Palau and the State of Hawaii with participation by NWS Offices at Honolulu and Guam and the U.S. FEMA in order to maintain a level of skill and situational awareness when dealing with tropical cyclones.

Annual tropical cyclone exercises were conducted by the State of Hawaii with participation by US National Weather Service Office at Honolulu and the US Coast Guard in order to maintain a level of skill and situational awareness when dealing with tropical cyclones.

RSMC Honolulu supported the annual Makani Pahili hurricane exercise with a Hawaii State Emergency Operations Center activation functional exercise on 4 to 5 May, 2023. The exercise simulated EOC operations during two timelines: 48 hours pre-impact on 4 May and 24 hours post-impact on 5 May. RSMC Honolulu prepared a scenario featuring a major hurricane impact to the Main Hawaiian Islands. They provided a briefing for the simulated hurricane on 4 May and a briefing for the current weather on 5 May as players proceeded through the recovery phase of a catastrophic hurricane impact. In addition, RSMC Honolulu provided additional virtual briefings on 2 and 3 May to set the stage in advance of the exercise.

The United States Coast Guard District 14 also conducted their annual Hurricane Exercise during the same week as Makani Pahili. Weather briefings were given during the Coast Guard Cutter (CGC) Surface Action Group Hurricane Evasion coordination calls, providing a scenario update and answering questions from ship commanders as they determined where to go to avoid hurricane impacts.

Identified opportunities/challenges, if any, for further development or collaboration:
Staff turnover at partner agencies continued at high levels and many key decision makers are new and lack experience. Combined with limited in-person interactions due to the pandemic, exercise participation was crucial to build those skills and relationships ahead of a real disaster.

Priority Areas Addressed:

DRR:

- Enhance Members' disaster risk reduction techniques and management strategies.
- Share experience and knowhow of DRR activities including legal and policy framework, community-based DRR activities, methodology to collect disaster-related information.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	✓
Detection, observation, monitoring, analysis, and forecasting	
Warning dissemination and communication	✓
Preparedness and response capabilities	✓

Contact Information:
Member: USA – Guam, USA - Hawaii
Name of contact for this item: Marcus Aydlett, John Bravender
Telephone: +1 671-472-0946, +1 (808) 973-5275
Email: marcus.aydlett@noaa.gov john.bravender@noaa.gov

3. StormReady® and TsunamiReady®

Main Text
StormReady® is a program designed by the National Weather Service to help communities and counties implement procedures and supplemental programs to reduce the potential for disastrous, weather-related consequences. StormReady® helps communities evaluate their current levels of preparedness for and response to extreme weather-related events. These communities demonstrate a strong commitment to saving lives and protecting property when hazardous weather strikes. By participating in StormReady®, local agencies can earn recognition for their jurisdiction by meeting guidelines established by the NWS in partnership with federal, state and local emergency management professionals. TsunamiReady® is a similar program that expands preparedness and response of coastal communities to tsunami threats. After the initial recognition, communities can reapply every 4 years.

RSMC Honolulu assisted the needs of the 18 StormReady and TsunamiReady communities across the State of Hawaii in 2023.

Identified opportunities/challenges, if any, for further development or collaboration:
As of 2 November 2023, there were 3,385 StormReady® and/or TsunamiReady® communities in the United States. All of the locations in the Pacific Region, including WFO Guam and RSMC Honolulu AOR are both StormReady® and TsunamiReady®.

Priority Areas Addressed:

DRR:

- Enhance Members' disaster risk reduction techniques and management strategies.
- Share experience and knowhow of DRR activities including legal and policy framework, community-based DRR activities, methodology to collect disaster-related information.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	✓
Detection, observation, monitoring, analysis, and forecasting	
Warning dissemination and communication	✓
Preparedness and response capabilities	✓

Contact Information:
Member: USA – Guam, USA - Hawaii
Name of contact for this item: Marcus Aydlett, John Bravender
Telephone: +1 671-472-0946, +1 (808) 973-5275
Email: marcus.aydlett@noaa.gov john.bravender@noaa.gov

4. Outreach and Education Activities

Main text: Numerous outreach and education activities conducted in 2023 include:

Expanded Pacific Hydrology Discussions. Both WFO Guam and RSMC Honolulu provide input into the Climate Prediction Center's Monthly *ENSO Diagnostics Discussion* and employs the use of more comprehensive and targeted products--the *Hydrologic Outlook* product for extreme rainfall events and the *Drought Information Statement* for drought events.

RSMC Press Conferences. RSMC Honolulu hosted three press conferences in 2023: Announce the 2023 Central Pacific Hurricane Season Outlook on 24 May; Announce the commencement of Hurricane Preparedness Week; and Update the hydrological prediction for the coming Hawaii wet season.

RSMC Honolulu media interfaces. RSMC Honolulu conducted hundreds of media interviews in preparation for hurricane season as well as event-specific interviews and briefings during tropical cyclone watches and warnings from T.C. Calvin as well as the indirect impacts from Hurricane Dora in the Hawaiian Islands.

RSMC Honolulu hosted in-person training workshops for emergency managers. RSMC Honolulu hosted a week-long workshop covering Central Pacific Hurricane Center products, for emergency managers.

University Course Enhancement. RSMC Honolulu hosts twice weekly weather discussions involving students and professors of the University of Hawaii (UH) Department of Meteorology, which engages the students in operational weather application focusing on societal impacts. These discussions are hybrid with on-site and virtual participation by employees, students and faculty.

WFO Guam media interfaces. WFO Guam conducted dozens of media interviews in advance of and during Typhoons Mawar and Bolaven. Following these events, more than a dozen interviews were conducted with global news outlets. Several press conferences were held with WFO Guam personnel at the Emergency Operations Center and at WFO Guam prior to storms passing.

World Met Day Open House. WFO Guam hosted its first Open House event to commemorate the World Meteorological Day. Several government dignitaries, including the Governor of Guam, visited the WFO, which featured 14 agency booths set up on the campus. More than 1000 schoolchildren visited and learned a great deal about weather and the National Weather Service.

Figure 6: Mr. Kenneth Kleeschulte presenting to schoolchildren at Open House.

Figure 7: Mr. Marcus Aydlett demonstrating the balloon launch at Open House

Identified opportunities/challenges, if any, for further development or collaboration:
Outreach and education events are fundamental in training specialists and emergency responders as well as the general population in disaster preparedness that eventually leads to a more resilient population.

Priority Areas Addressed:

DRR:

- Enhance Members' disaster risk reduction techniques and management strategies.
- Share experience and knowhow of DRR activities including legal and policy framework, community-based DRR activities, methodology to collect disaster-related information.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	✓
Detection, observation, monitoring, analysis, and forecasting	
Warning dissemination and communication	✓
Preparedness and response capabilities	✓

Contact Information:
Member: USA – Guam, USA - Hawaii
Name of contact for this item: Marcus Aydlett, John Bravender
Telephone: +1 671-472-0946, +1 (808) 973-5275
Email: marcus.aydlett@noaa.gov john.bravender@noaa.gov

5. Pacific International Training Desk

Main text:
The Pacific International Training Desk (PITD) was established on the campus of the University of Hawaii at Manoa in 2001 by the US NOAA/NWS at the WFO Honolulu. It is one of NOAA's contributions to the WMO Voluntary Cooperation Program (VCP). The Pacific Desk began by offering two-month training internships to visiting students from the Regional Association V (RA V) of the WMO in March 2001 and later expanded the training opportunity briefly to developing countries from WMO RA II nations in east and Southeast Asia, who were also members of the ESCAP/WMO Typhoon Committee. Up until 2016, all the PITD training were conducted at the RSMC Honolulu. In 2016, the PITD training reached out to include the Weather Service Offices in Micronesia and was conducted at the WFO Guam. In 2021, the Honolulu training resumed in a virtual capacity due to the global pandemic. The PITD welcomed 28 participants from six countries in five cohorts for 2023. Weather forecasters and observers from Fiji, Papua New Guinea, Samoa, Solomon Islands, Tuvalu, and Vanuatu took part in training at the Honolulu Forecast Office on the campus of the University of Hawaii (UH)-Manoa.

Figure 8: Year 2023 Cohorts from Pacific Island Nations participating in the PITD

The PITD curriculum includes introductory and intermediate weather analysis and forecasting topics, as well as communications systems training. The PITD piloted a hybrid training format this year in addition to the standard in-person training. The PITD programs include partners such as NOAA National Weather Service-Pacific Region, City and County of Honolulu Emergency Management, Joint Typhoon Warning Center, UH School of Ocean and Earth Science and Technology, and a local media outlet (KHON2). The PITD also hosted 2 webinars on special topics such as space weather and tsunami detection

Identified opportunities/challenges, if any, for further development or collaboration:
The open webinars allow students from the Micronesia Weather Service Offices and from other Pacific Island Nations Meteorological Services to continue their development in the field of Meteorology, Hydrology and Disaster Preparedness. It also offers an insight into other Pacific Island nations' Meteorological services and their operations.

Priority Areas Addressed:

Meteorology

- Enhance the capacity to monitor and forecast typhoon activities particularly in genesis, intensity and structure change.

DRR

- Enhance Members' disaster risk reduction techniques and management strategies.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	✓
Detection, observation, monitoring, analysis, and forecasting	✓
Warning dissemination and communication	
Preparedness and response capabilities	✓

Contact Information:
Member: USA – Guam, USA - Hawaii
Name of contact for this item: Genevieve Miller, Christopher Brenchley
Telephone: +1 (671) 472-0944, +1 (808) 973-5273
Email: genevieve.miller@noaa.gov, christopher.brenchley@noaa.gov

6. Resource Mobilization during Extreme Events

Main text:
RSMC Honolulu conducted many Emergency Management Briefings during 2023 hurricane season through video teleconferencing. These briefings included personnel at Emergency Operations Centers from the State level to the local level with the State Governor and County Mayors participating at times.

WFO Guam provided numerous virtual and onsite decision support services by way of Heavy Weather Briefs to the Guam Homeland Security/Office of Civil Defense, CNMI Homeland Security Emergency Management and to the governors of both Guam and the CNMI prior to and during the passage of Typhoons Mawar and Bolaven. WFO Guam's Warning Coordination Meteorologist consults with both agency's Joint Information Centers to provide explanation and clarity in government press releases. These particular heavy weather briefings are primarily catered for the island leadership and military decision makers on potential tropical cyclone threats. WFO Guam began providing similar support in 2023 to state and national leaders in the Federated States of Micronesia and the Republic of Palau, including to the U.S. Embassies in the U.S. Affiliated Islands in the Pacific.

Identified opportunities/challenges, if any, for further development or collaboration:
Impact-based decision support services are made available to local decision makers especially in locations that lack meteorological support and knowledge. Social media platforms have made these interagency interactions possible and allowed the sharing of information. US NWS continues to look for ways to optimize our use of these tools.

Priority Areas Addressed:

DRR:

- Enhance Members' disaster risk reduction techniques and management strategies.
- Share experience and knowhow of DRR activities including legal and policy framework, community-based DRR activities, methodology to collect disaster-related information.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	✓
Detection, observation, monitoring, analysis, and forecasting	
Warning dissemination and communication	✓
Preparedness and response capabilities	✓

Contact Information:
Member: USA – Guam, USA - Hawaii
Name of contact for this item: Marcus Aydlett, John Bravender
Telephone: +1 671-472-0946, +1 (808) 973-5275
Email: marcus.aydlett@noaa.gov john.bravender@noaa.gov

7. Improved Typhoon-related Disaster Risk Management in Various Sectors

Main text:
Tropical Weather Outlook graphic. During the tropical cyclone season, RSMC Honolulu prepares and transmits both a text and a graphical *Tropical Weather Outlook* that illustrates the probability of tropical cyclone development in the next 48 hours and 7 days respectively.

Time of Arrival/Departure graphics. When there is an active tropical cyclone in the AOR, RSMC Honolulu and WFO Guam issues graphical products for both "Most Likely Time of Arrival" and "Earliest Reasonable Time of Arrival" to assist government officials and public in their critical decision-making process as they prepare for potential weather impacts. A time of departure graphic is also being developed for experimental use in future seasons.

Hawaii Emergency Preparedness Executive Consortium (HEPEC). RSMC Honolulu is a member of the Hawaii Emergency Preparedness Executive Consortium (HEPEC). HEPEC is comprised of emergency managers and disaster mitigation personnel from local, state, and federal agencies. HEPEC meets quarterly to provide updates on current and outstanding threats, both natural and manmade, to the State of Hawaii. RSMC Honolulu Personnel provided several hurricane presentations to this group during the Feb 2023 and October 2023 meetings.

Software improvements for Emergency Managers. Hurrevac or HVX (an online application for emergency managers to gather critical hurricane forecast information) continues to evolve and introduce improvements to the software annually, and includes additional information from storm surge modeling in Hawaii.

Pacific Risk Management Ohana (PRiMO) Conference. NWS Pacific Region representatives along with other Pacific agencies gathered at the Honolulu Convention Center to celebrate 20 years of the pacific Risk Management 'Ohana. The theme for the year was "Equity and Resilience in a Changing World". The event was an opportunity time to meet with community, state and federal partners; and those with a shared vision of a resilient future to address questions of equity and inclusion, consider pathways to adapt to the changing climate through deepened discussions on science and technology, and solutions.

Figure 9: Members of NOAA and PITD participating in PRiMO

Priority Areas Addressed:

DRR:

- Enhance Members' disaster risk reduction techniques and management strategies.
- Share experience and knowhow of DRR activities including legal and policy framework, community-based DRR activities, methodology to collect disaster-related information.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	✓
Detection, observation, monitoring, analysis, and forecasting	
Warning dissemination and communication	✓
Preparedness and response capabilities	✓

Contact Information:
Member: USA – Guam, USA - Hawaii
Name of contact for this item: Marcus Aydlett, John Bravender
Telephone: +1 671-472-0946, +1 (808) 973-5275
Email: marcus.aydlett@noaa.gov **john.bravender@noaa.gov**

8. Technological Improvements

Main text:

Next generation geostationary satellites - GOES and Himawari

- RSMC Honolulu and WFO Guam have been utilizing high resolution imagery available from JMA's Himawari-9. Both offices also have satellite receive systems to obtain HimawariCast.
- GOES-18 was declared the operational satellite and used for tropical cyclone surveillance across the central and eastern Pacific areas in 2023.

In addition, data continues to be received, analyzed, and evaluated from the multiple sensors and displays coming from a large number of polar orbiting satellite instruments. One of those sensors is onboard the Suomi NPP and JPSS 1 satellite and it continues to play a critical role in locating positions of tropical cyclones. The Visible Infrared Imaging Radiometer Suite (VIIRS) is able to produce a day-night band allowing forecasters to receive visible images at night. VIIRS will also be available on the Joint Polar Satellite Systems 2 (JPSS2) which was launched successfully on November 10.

Continued evaluation and application of ocean surface wind vector scatterometer instruments (ASCAT, RSCAT and Windsat) and ocean wave height altimetry (JASON2, JASON3). While these instruments are subject to the attenuation effects of heavy rainfall and are somewhat limited under very light and very strong wind conditions, they continue to greatly improve our capability to monitor tropical cyclone development and to observe the structure and intensity of tropical cyclones in the AOR.

Continued use of the Synthetic Aperture Radar (SAR) data that are available over and around Guam. These data are available at this NOAA/NESDIS website (https://www.star.nesdis.noaa.gov/socd/mecb/sar/AKDEMO_products/APL_winds/wind_images_nic/sarwinds_calendar_now.html).

WFO Guam has been trending toward using probabilistic graphics and has been testing experimental graphics for nearly a year. This new method puts the WFO Guam in line with the rest of the Hurricane Centers and Weather Forecast Offices in the United States. It will also wean the general public about honing in on the deterministic graphics and help them anticipate the probable dangers associated with an impending tropical cyclone.

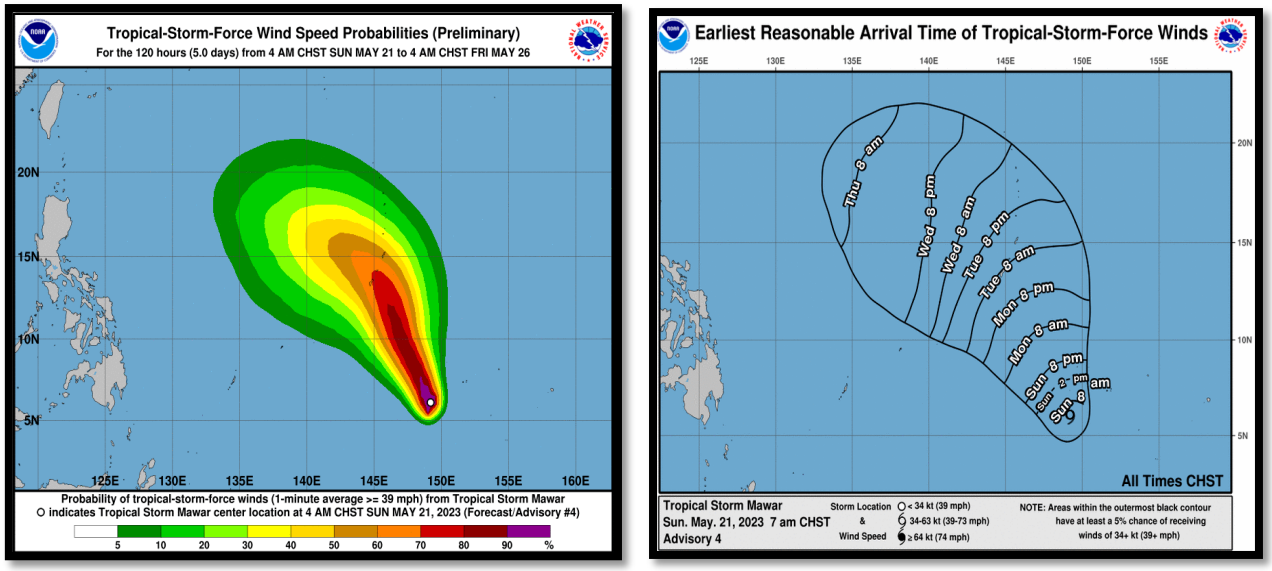


Figure 10: Examples of probabilistic graphics during Mawar

Priority Areas Addressed:

Meteorology:

- Enhance the capacity to monitor and forecast typhoon activities particularly in genesis, intensity and structure change.
- Develop and enhance typhoon analysis and forecast techniques from nowcast to medium-range, and seasonal to long-range prediction.
- Enhance and provide typhoon forecast guidance based on NWP including ensembles, weather radar and satellite related products, such as QPE/QPF.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	✓
Detection, observation, monitoring, analysis, and forecasting	✓
Warning dissemination and communication	✓
Preparedness and response capabilities	✓

Contact Information:

Member: USA – Guam, US – Hawaii
Name of contact for this item: William Aydlett, Robert Ballard
Telephone: +1 (671) 472-0948, +1 (808) 973-5274
Email: William.aydlett@noaa.gov robert.ballard@noaa.gov

9. Leveraging Additional Communications for EW4ALL

Main text:

Weekly Regional Weather Outlook. As a means to provide routine weather information direct to government and core partners, WFO Guam began providing a Weekly Regional Weather Outlook in January 2023. The weekly outlook is produced weekly on Tuesdays and sent directly to users by email. Initially delivered to regional Homeland Security, FEMA and Weather Service Office personnel, the distribution list has grown to over 250 users across the western North Pacific. This weekly outlook aims to provide early weather communications on significant weather features and concerns to islands across the region and early warnings on emerging weather and water threats. The Regional Weather Outlook is produced daily during significant weather events.

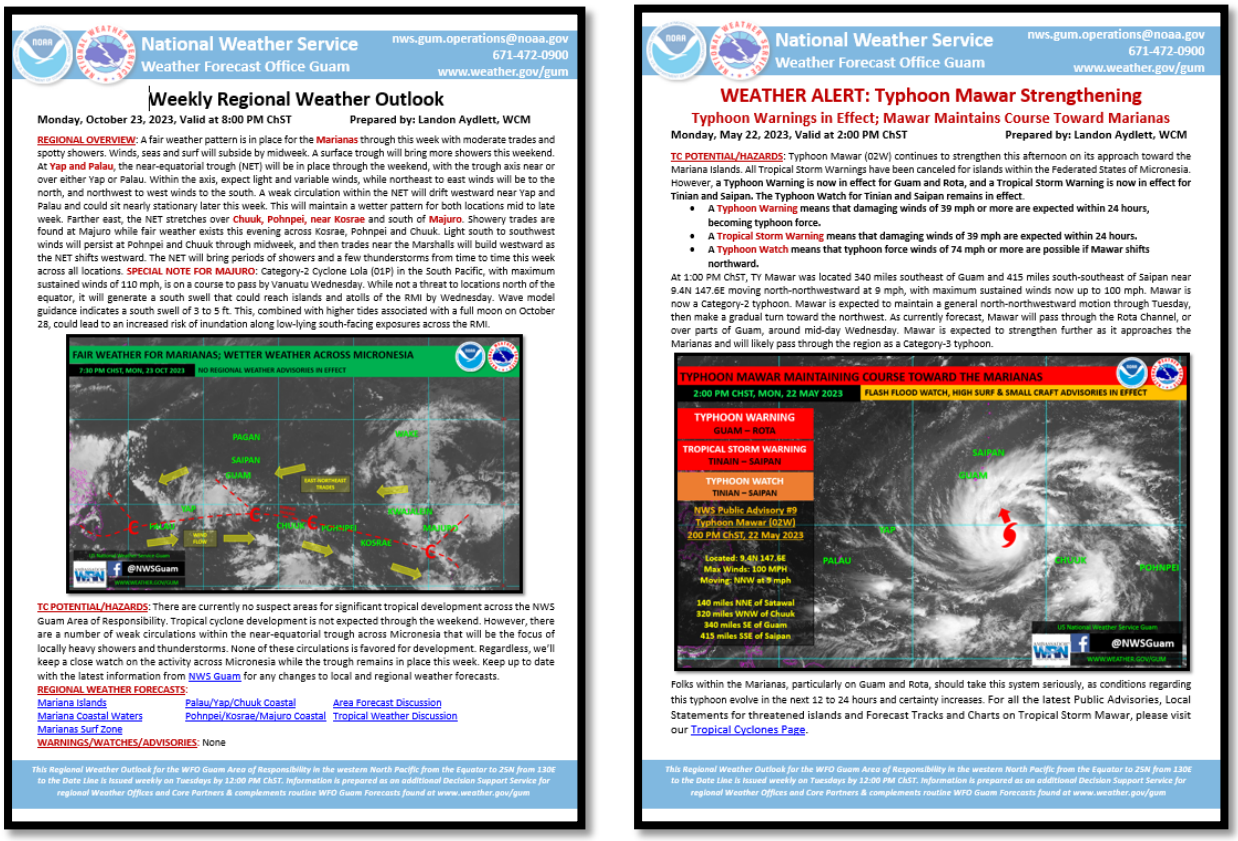


Figure 11: Example of Weekly Regional Weather Outlook

Facebook Live Broadcasts. WFO Guam anticipated the need to communicate preparedness and warning information in as many ways as possible prior to Typhoon Mawar's approach to Guam. WFO Guam began utilizing Facebook Live extensively to broadcast detailed weather forecast and warning information to Guam and the CNMI. Broadcasts often reached up to 30 minutes in length, with multiple forecasters providing discussion on specific areas of the region. Regional emergency management partners began active participation by providing official answers and comments to viewer questions and comments.

Priority Areas Addressed:

DRR:

- Enhance Members' disaster risk reduction techniques and management strategies.
- Share experience and knowhow of DRR activities including legal and policy framework, community-based DRR activities, methodology to collect disaster-related information.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	✓
Detection, observation, monitoring, analysis, and forecasting	✓
Warning dissemination and communication	✓
Preparedness and response capabilities	✓

Contact Information:
Member: USA – Guam, USA - Hawaii
Name of contact for this item: Marcus Aydlett
Telephone: +1 671-472-0946
Email: marcus.aydlett@noaa.gov

Appendix I - Priority Areas of Working Groups for the Strategic Plan 2022-2026

WG	Priorities
Integrated	1. Strengthen the cooperation between TRCG, WGM, WGH, and WGDRR to develop impact-based forecasts, decision-support and risk-based warning.
	2. Strengthen cross-cutting activities among working groups in the Committee.
	3. Enhance collaborative activities with other regional/international frameworks/organizations, including technical cooperation between TC/AP-TCRC and TC/PTC cooperation mechanism.
Meteorology	4. Enhance the capacity to monitor and forecast typhoon activities particularly in genesis, intensity and structure change.
	5. Develop and enhance typhoon analysis and forecast techniques from nowcast to medium-range, and seasonal to long-range prediction.
	6. Enhance and provide typhoon forecast guidance based on NWP including ensembles, weather radar and satellite related products, such as QPE/QPF.
	7. Promote communication among typhoon operational forecast and research communities in Typhoon Committee region.
	8. Enhance training activities with TRCG, WGH, and WGDRR in accordance with Typhoon Committee forecast competency, knowledge sharing, and exchange of latest development and new techniques.
	9. Enhance RSMC capacity to provide regional guidance including storm surge, in response to Member's needs.
Hydrology	10. Improve typhoon-related flood (including riverine flood, flash flood, urban flood, and coastal flood) monitoring, data collection and archiving, quality control, transmission, processing, and sharing framework.
	11. Enhance capacity in typhoon-related flood risk management (including land-use management, dam operation, etc.) and integrated water resources management and flood-water utilization.
	12. Strengthen capacity in effective flood forecasting and impact-based early warning, including hazard mapping and anticipated risk based on methodological and hydrological modelling, and operation system development.
	13. Develop capacity in projecting the impacts of climate change, urbanization and other human activities on typhoon-related flood disaster vulnerability and water resource availability.
	14. Increase capacity in utilization of advanced science and technology for typhoon-related flood forecasting, early warning, and management.
DRR	15. Provide reliable statistics of mortality and direct disaster economic loss caused by typhoon-related disasters for monitoring the targets of the Typhoon Committee.
	16. Enhance Members' disaster risk reduction techniques and management strategies.
	17. Evaluate socio-economic benefits of disaster risk reduction for typhoon-related disasters.
	18. Promote international cooperation of DRR implementation project.
	19. Share experience/knowhow of DRR activities including legal and policy framework, community-based DRR activities, methodology to collect disaster-related information.