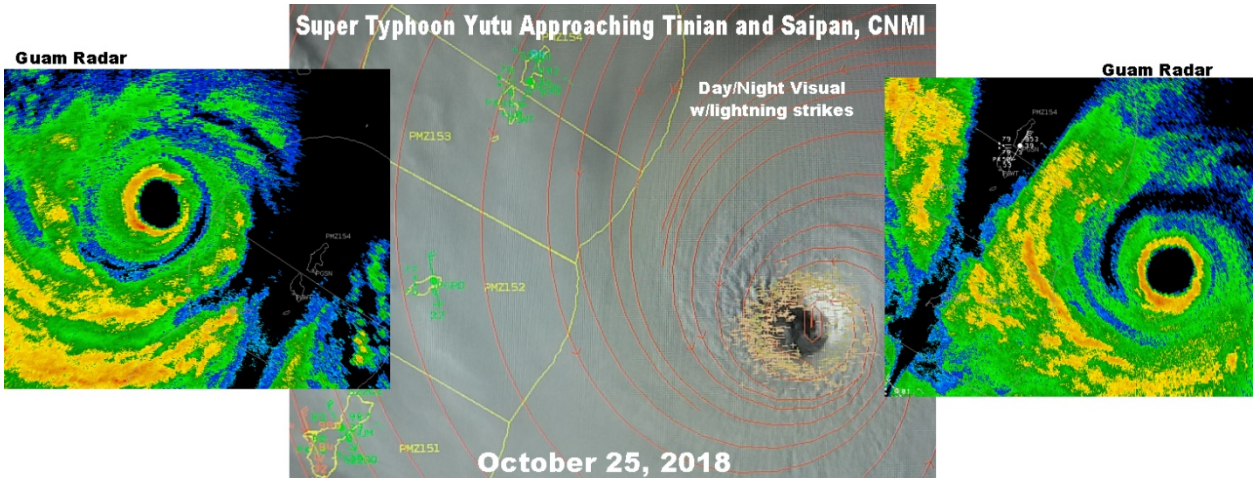
MEMBER REPORT
United States of America
Pacific Region



ESCAP/WMO Typhoon Committee
14th Integrated Workshop
Tumon, Guam
4 to 7 November 2019

Cover caption: Super Typhoon Yutu (31W) is the first tropical cyclone of the reporting period and the strongest tropical cyclone to make a direct hit on one of the more populated islands in Micronesia in many years. As a catastrophic Category 5, tropical cyclone winds were estimated to peak at 155 knots (178 mph) just prior to making a direct passage over Tinian and southern Saipan. (Extensive lightning could be seen occurring in the eyewall, a good sign for rapid intensification.)

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, watches, warnings and advisories within its area of responsibility (AOR). The WFO Guam AOR roughly expands from 130 Degrees East Longitude to the International Date Line and covers an ocean area of more than 4 million square miles (about 10.4 million square kilometers) and more than 2000 Micronesian islands. This 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 Chuuk, Yap, Pohnpei, and Kosrae. When tropical cyclones occur, WFO Guam provides the warnings for the U.S. Affiliated Islands of Micronesia. The WFO Guam uses the track, intensity and wind distribution information provided by JTWC to produce plain language 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 Forecast Office in Honolulu. The NWS Forecast Office in Honolulu activates the CPHC when tropical cyclones form in, or move into, the Central Pacific region from 140 Degrees West Longitude to the International Date Line. CPHC is also the 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) generally from the Equator to 30N between 140W and 160E.

1. Meteorological Assessment (highlighting forecasting issues/impacts)

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

A near normal total of nineteen tropical cyclones entered or formed in the WFO Guam AOR from 1 October 2018 until 15 October 2019. This is quite a bit less than the 30 that formed within the AOR during the same period from the previous year.

Starting as a weak El-Nino and turning into ENSO-neutral conditions, the five tracks shown in Figure 1, were initially long, westward moving, showed persistence but had little intensification. In one case, Typhoon Usagi (33W) tracked in November 2018 from east of the dateline for almost three weeks as a tropical depression before intensifying in the South China Sea just prior to reaching Vietnam. The remaining fourteen cyclone tracks for the period are shown in Figure 2. Except for Super Typhoon Yutu (31W), the strongest tropical cyclone of the period at 155 knots (178 mph), which moved mostly westward from east of 170E and passing through both the CNMI and the Philippines, all other tracks showed similar northwest motions, but with different starting points. In general, about half of these formed east of 160E while the other half formed

west of 150E with perhaps tropical cyclones in the latter portion of the season starting farther to the east than those forming earlier in the season. As noted above for Usagi, two tropical cyclones formed east of the dateline and moved into the AOR. There were only four Super Typhoons (winds greater than or equal to 130 knots, 150 mph) during this period: Yutu, Wutip, Lekima and Hagibis. Yutu was the strongest, a catastrophic Category 5 tropical cyclone, which had a devastating effect on the infrastructure of the islands of Tinian and Saipan in the CNMI (but with only one fatality). This typhoon was one of the strongest tropical cyclones to make a direct hit on one of the populated islands in Micronesia in the past 50 years. Another tropical cyclone of interest was Super Typhoon Wutip (02W) which at 140 knots (160 mph) may have been the strongest tropical cyclone on record for the northern hemisphere for the month of February. After Wutip, tropical cyclone activity waned until later in the season in August and September.

Although Tropical Cyclone Advisories were issued for all tropical cyclones that JTWC issued warnings within the WFO Guam AOR, only six cyclones required either a tropical/typhoon watch or warning for islands in its AOR during this reporting period: STY Yutu (31W), TY Man-Yi (34), Tropical Depressions One (1) and Three (3), STY Wutip (02W) and STY Hagibis (20W).

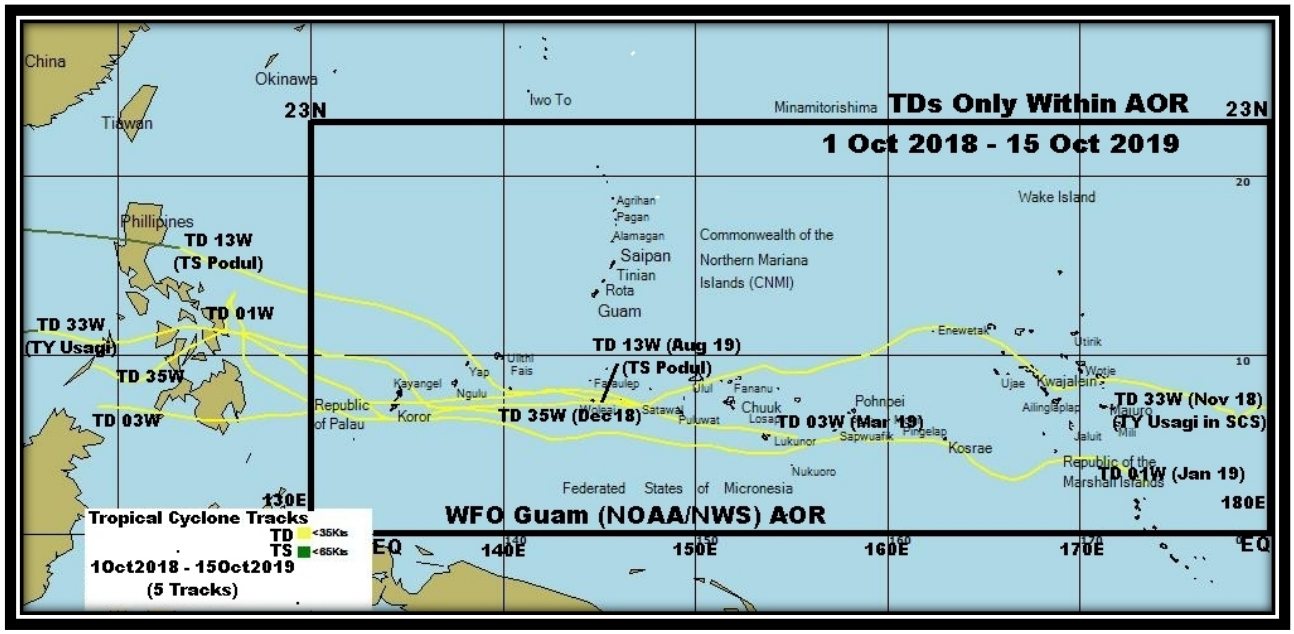


Figure 1: Tropical Depressions affecting Micronesia from October 1, 2018 to October 15, 2019

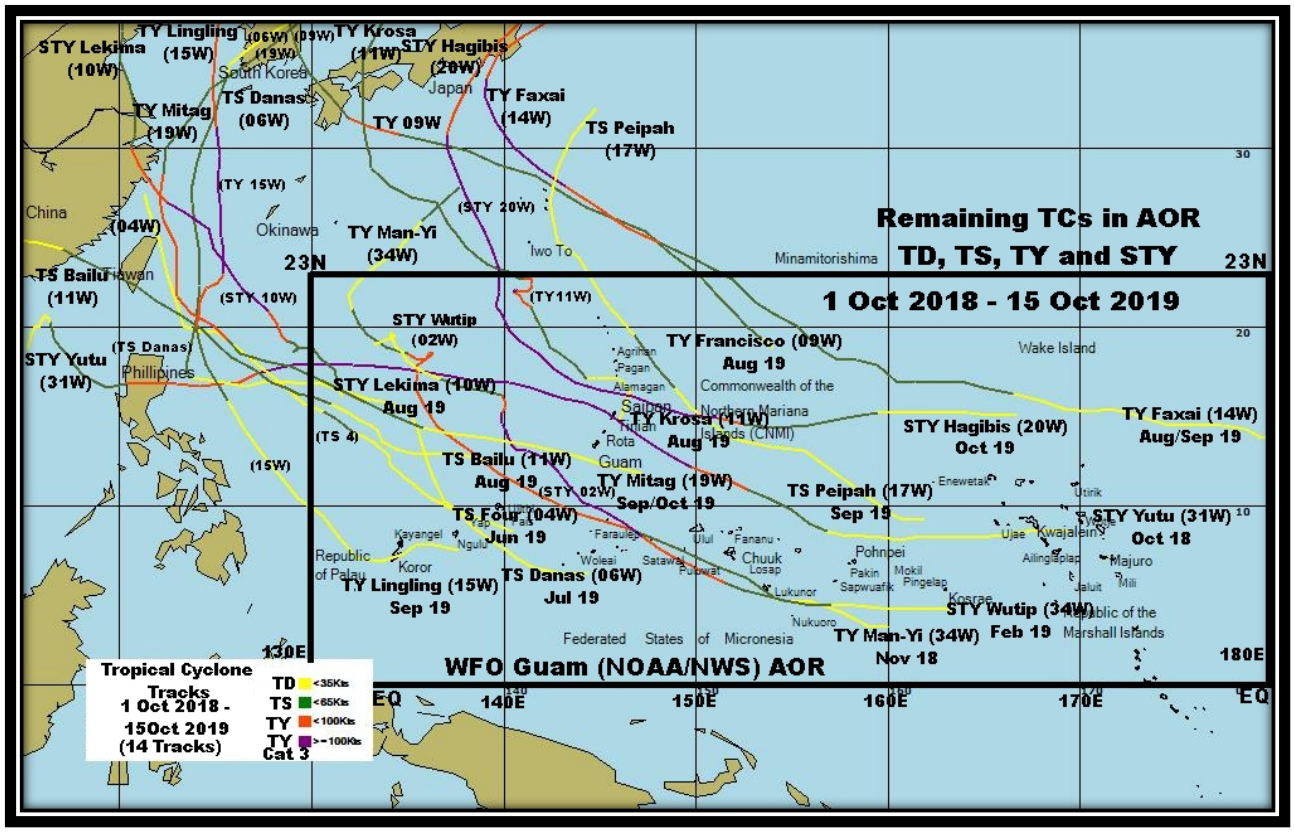


Figure 2: Tropical Cyclones greater than 34 knot affecting Micronesia from October 1 2018 to October 25, 2019.

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

Five tropical cyclones entered into, or were generated in, the central North Pacific during the period from January 1 through October 28, 2019. These were: Hurricane Erick, Tropical Storm Flossie, Tropical Storm Akoni, Tropical Depression Kiko, and Tropical Storm Ema.

Hurricane Erick developed in the Eastern Pacific basin and moved into the Central Pacific basin near 11N (140W) on July 29 as a 65 knot hurricane. Erick moved west-northwestward as it strengthened to 115 knots, then passing south of the Big Island, as a weakening tropical storm. Erick became classified as post tropical on August 4 and dissipated shortly thereafter near 20N 172W. Erick brought elevated surf to east facing shores of the Hawaiian Islands, along with moisture that contributed to heavy rainfall which resulted in damaging flash flooding to Kauai on August 4th.

Tropical Storm Flossie developed as a hurricane in the Eastern Pacific basin and moved into the Central Pacific as a weakening tropical storm on August 2. Flossie continued to weaken slowly as it moved northwestward to just east of the Big Island as a remnant post tropical low. Flossie brought elevated surf to the east facing shores as well as locally heavy rainfall to portions of west Maui, and central Oahu.

Tropical Storm Akoni developed along the far eastern edge of the Central Pacific, near 13N (140W) on September 4, and remained a weak tropical storm peaking at 40 knots intensity for a few days as it moved slowly westward near 12N. Akoni became post tropical on September 6.

Tropical Depression Kiko began as a hurricane in the Eastern Pacific, but had weakened to 30 knot intensity as it crossed into the Central Pacific on September 24. Kiko dissipated later that day.

Tropical Storm Ema developed in the Central Pacific basin on October 12 about 300 miles west-southwest of Lihue, Kauai. Ema reached a peak intensity of 45 knots as it moved northwest later that day. Ema quickly weakened on October 13 and 14, becoming a post tropical low on October 14 about 600 miles west-northwest of Kauai.

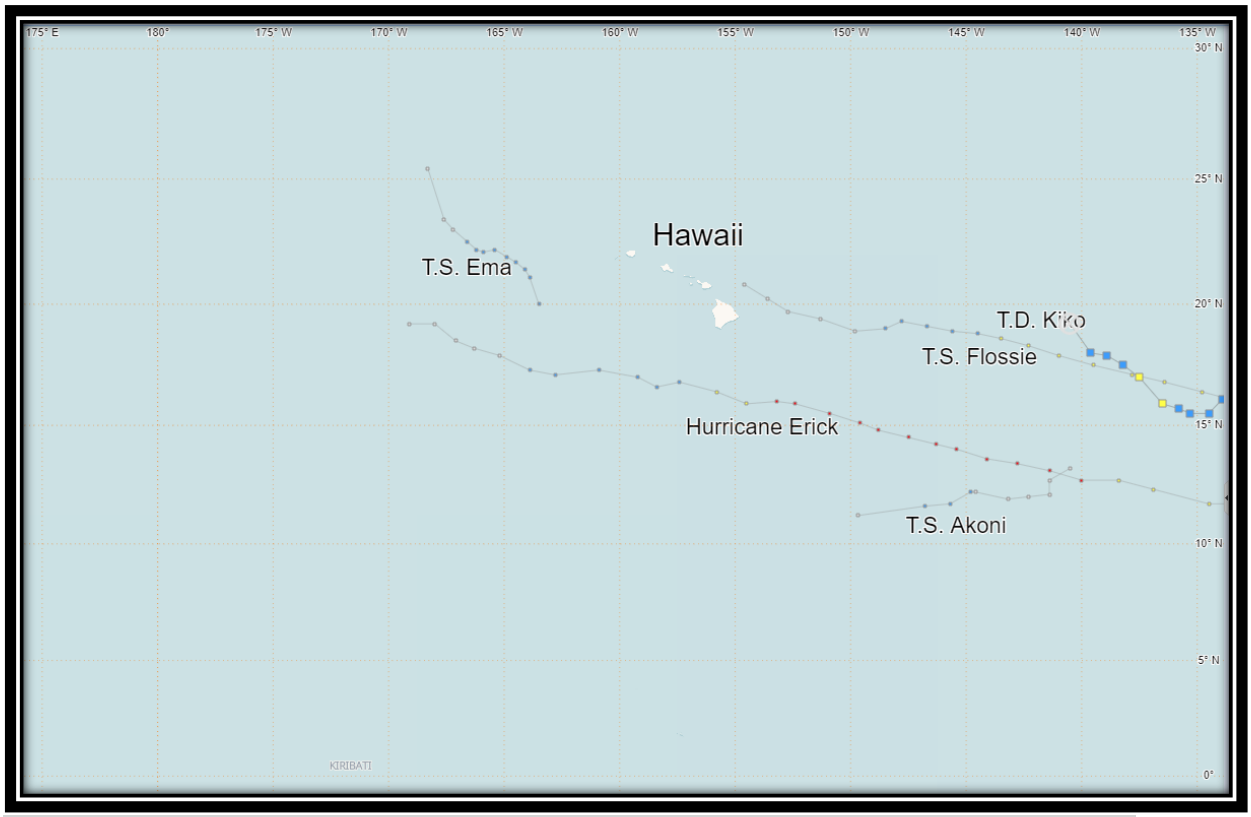


Figure 3: Central North Pacific Tropical Cyclone tracks: January 1, 2019 to October 28, 2019.

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

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

By the end of September 2019, below normal rainfall occurred across the Marianas and Micronesia as only one major tropical system affected Kosrae, Pohnpei and Chuuk States in the Federated States of Micronesia. A few more systems affected the Mariana Islands, mainly the northern CNMI. A few other systems moved through the region north of the Micronesian islands as Tropical Disturbances before developing into Tropical Depressions, Tropical Storms or Typhoons north and west of the islands. The latter three months of 2018 through mid-2019 saw a weak El Nino-like pattern affecting the western North Pacific. El Nino reverted to ENSO-neutral by September 2019 and is expected to continue through spring of 2020. Dry conditions developed over the northern Marshall Islands and the Mariana Islands from the middle of February and continued for most of Micronesia through late June. Dry conditions continued

through late July for the Marianas and the northern Marshall Islands, when beneficial rains finally eased the water shortage. Comprehensive Drought Information Statements, summarizing detailed rainfall status and predictions, were provided by the WFO Guam on a twice monthly basis from February 2019 until the final statement was issued, ending the drought on August 22nd. A total of 15 Drought Information Statements were issued during this period.

Several tropical systems affected the western Pacific from October 2018 through the end of September 2019, beginning with Super Typhoon Kong-rey, which initially formed in late September 2018. The most notable of these storms, however, were Super Typhoon Yutu (31W) in late October 2018 and Super Typhoon Wutip (02W) in February 2019. Super Typhoon Yutu brought massive devastation to the islands of Tinian and Saipan in the CNMI, along with heavy rainfall. Rainfall amounts are estimated due to the loss of rain gauges during the storm. Rainfall estimates were in excess of 10 inches (~255 mm) for both Tinian and Saipan, while less than 2 inches occurred on Rota and Guam. Super Typhoon Wutip began as a tropical disturbance south of Kosrae around February 16. This storm moved south of Kosrae, Pohnpei and Chuuk Lagoon, bringing heavy rains to most of the islands along with tropical storm to low-end typhoon force winds to a few of the islands of western Chuuk State. The storm slowed and rapidly intensified to a super typhoon, but fortunately lingered to the southwest of Guam on a slow northward track, keeping only tropical storm conditions over the island, but for an extended period of time along with heavy rainfall in excess of 6 inches (~150 mm) over 36 hours. Tropical Depression 17W formed east of the Mariana Islands in mid-September. This system moved toward the north-northwest, eventually becoming Tropical Storm Peipah. Peipah brought heavy rain to the islands, with a new daily rainfall record of 8.20 inches (~209 mm) in less than 24 hours for Guam and amounts in excess of 6 inches (~150 mm) for the remainder of the Marianas. For this event, WFO Guam issued a Flash Flood Warning for Guam and Urban and Small Stream Flood Advisories for the CNMI.

Aside from these more significant storm systems, a few weak disturbances brought short periods of beneficial rains to many of the smaller islands experiencing drought conditions.

Central North Pacific (140W to 180, North of the Equator) Overview
Overall the impacts of heavy rainfall were felt in early August due to tropical moisture associated with Erick and Flossie. Specifically, damaging flash flooding affected homes and bridges on the island of Kauai. Otherwise, rainfall was spotty and rather limited during the tropical cyclone season across the Central North Pacific.

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

Western North Pacific (130E to 180, north of the equator) Overview
WFO Guam conducted formal presentations for National Leaders (Governors and Presidents), emergency managers, military decision makers, and for representatives from the Federal Emergency Management Agency (FEMA) and the United States Agency for International Development (USAID), the two key US agencies for emergency recovery, relief, and mitigation program assistance. The WFO also conducted more than one-hundred-fifty radio and television interviews, 174 outreach educational events that at least in-part addressed tropical cyclones, and 37 operational Tropical Cyclone briefings to Emergency Managers. WFO Guam also utilized

social media to greatly increase its reach to the general public. In fact, tropical cyclone information was accessed four times as often through Facebook as through the WFO Guam website. For Typhoon Wutip, there were 1.1 million Facebook views of 37 posts and for Typhoon Hagibis, there were 1.4 million Facebook views for 29 posts.

WFO Guam also provided specially tailored, comprehensive 16-module, 2-day Tropical Cyclone, Disaster preparedness and Climate Workshops at three different locations in the first nine months of 2019. These locations included Guam (110 attendees each day), and Saipan (65 attendees each day) and Tinian (30 attendees each day) in the CNMI. Twelve of the modules addressed tropical cyclones or some aspect of tropical cyclone support. More limited training was provided in Chuuk following the formal dedication of the State's new US-funded Weather Service Office. WFO Guam also assisted Guam in updating its Comprehensive Hazard Mitigation Plan and in assisting Saipan in achieving its recognition of being StormReady for another 3-year period.

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

Regional Specialized Meteorological Center (RSMC) Honolulu conducted dozens of tropical cyclone related outreach events, over 100 broadcast and print media interviews, many formal emergency manager briefings. New in 2019, media training was presented to staff and partners, hurricane messaging training was presented to forecast staff, and a Hurricane Awareness Tour was presented in collaboration with hurricane hunters and public and media tours were arranged to kick off the seasonal awareness campaign. A joint outreach tour with the U.S. Coast Guard was also engaged in the various Hawaiian Islands in the spring of 2019.

Also in 2019, RSMC Honolulu presented onsite Hurricane Preparedness for Decision Makers training at the various federal, state and county emergency management agencies in coordination with U.S. Federal Emergency Management Agency (FEMA). This approach resulted in a larger outreach to the various emergency management functions in each agency. For all events, RSMC Honolulu emphasized that a direct landfall is not necessary to produce major damage and impacts, as well as new products and services.

4. Regional Cooperation Assessment (highlighting regional cooperation success and challenges.

None.

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 program and expanding it to include the Ambassador Initiative in 2014, NOAA and its partners are continually working 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 2019, 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. Guam ranks second in the nation for the number of WRN Ambassadors.

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

Priority Areas Addressed:
Strengthen typhoon-related disaster risk reduction activities in various sectors, including increased community-based resiliency with better response, communication, and information sharing capability.

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2. Annual Tropical Cyclone Exercises

Main text:
Annual tropical cyclone exercises were conducted by the Government of Guam, Government of the CNMI, Federated States of Micronesia and the State of Hawaii with participation by US National Weather Service Offices at Honolulu and Guam and the US FEMA in order to maintain a level of skill and situational awareness when dealing with tropical cyclones.

WFO Guam participated in the island-wide typhoon exercises for Guam and for the CNMI in June and for Chuuk FSM in September. RSMC Honolulu participated in two statewide annual tropical cyclone exercise in Hawaii. Both annual hurricane exercises, one coordinated by Hawaii Emergency Management Agency (HEMA) in partnership with the NWS Forecast Office in Honolulu, the other by the Hawaii National Guard, were held in June.

RSMC Honolulu hosted internal tropical cyclone exercises in training sessions before the season, as well as in coordination with the inaugural effective hurricane messaging course. An annual hurricane exercise coordinated by the Hawaii Emergency Management Agency (HIEMA) was held in the early summer.

Identified opportunities/challenges, if any, for further development or collaboration:
With staff turnovers affecting every agency, it is important to maintain these exercises such that all persons remain skilled and ready in the event of a real disaster.

Priority Areas Addressed:
Enhance capacity to generate and provide accurate, timely and understandable information using multi-hazard impact-based forecasts and risk-based warnings, watches, and advisories.
Strengthen typhoon-related disaster risk reduction activities in various sectors, including increased community-based resiliency with better response, communication, and information sharing capability.

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3. Tropical Cyclone Workshops

In the western North Pacific, WFO Guam conducts their Annual Tropical Cyclone, Disaster Preparedness and Climate Workshop. These two-day workshops are tailored for each island and designed for decision makers in the local, state, and national governments and agencies.

The Workshops cover a plethora of topics such as:

- tropical cyclone behavior, structure, and hazards;
- the WFO Guam tropical cyclone program, products, and timing of products;
- tropical cyclone plotting and speed-distance-time computations;
- typhoon risk and vulnerability; a scale that relates tropical cyclone wind speed to damage and storm surge;
- tropical cyclone decision making for individual islands and states; and
- WFO Guam website products.
- In addition, topics on general climate familiarity, climate variability, and climate change; El Niño /La Niña and their effects, impacts and status are covered. Other subjects addressed were tsunamis and volcanoes; rip currents, currents, and tides; and earthquakes upon the request of the participants.

In 2019, WFO Guam conducted workshops in Tinian and Saipan, CNMI, Guam, and Chuuk in the FSM. Scheduling difficulties and travel restrictions prevented the WFO Guam staff from achieving total visitation to all of Micronesia.

Identified opportunities/challenges, if any, for further development or collaboration:
Primary means of educating decision makers of all agencies and ensuring that the information continually updated.

Priority Areas Addressed:
Enhance capacity to generate and provide accurate, timely and understandable information using multi-hazard impact-based forecasts and risk-based warnings, watches, and advisories.
Strengthen typhoon-related disaster risk reduction activities in various sectors, including increased community-based resiliency with better response, communication, and information sharing capability.

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4. StormReady® and TsunamiReady®

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 3 years.

In August 2019, the island of Saipan, CNMI was recognized for another three years as a StormReady® and TsunamiReady® location. This designation was tested when Typhoon Yutu affecting the Northern Marianas. Yutu tracked just south of Saipan, crossing over Tinian as a Super Typhoon. Tinian, Saipan and Rota Emergency Management offices went into action and adequately warned their populace, preventing what could have been a catastrophic disaster.

RSMC Honolulu assisted the needs of the 19 StormReady and TsunamiReady communities across the State of Hawaii in 2019. This included ensuring each community had disaster action plans in place and held outreach events to convey a preparedness message.

Identified opportunities/challenges, if any, for further development or collaboration:
As of October 31, 2019, there were 2985 StormReady® and/or sites in the United States, of which, 21 of each are in the Pacific Region. All of the locations under the WFO Guam AOR are both StormReady® and TsunamiReady®.

Priority Areas Addressed:
Strengthen typhoon-related disaster risk reduction activities in various sectors, including increased community-based resiliency with better response, communication, and information sharing capability.

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5. Outreach and Education Activities

Main text: Numerous outreach and education activities conducted in 2019 include:

- *Expanded Pacific Hydrology Discussions.* Both WFO Guam and RSMC Honolulu provide input into the quarterly *Pacific ENSO Update* newsletter produced by the Pacific ENSO Applications Climate Center, which issues Special Updates, if warranted. WFO Guam also provides input to 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. Finally, WFO Guam and RSMC Honolulu assist in preparing a popular quarterly two-page color product called the *Hawaii and U.S. Pacific Islands Climate Impacts and Outlook*.

- *RSMC Press Conference.* RSMC Honolulu hosted a press conference with high ranking government officials to announce the 2019 Central Pacific Hurricane Season Outlook on 22 May.

- *RSMC Honolulu media interfaces.* RSMC Honolulu conducted in the neighborhood of one hundred media interviews, teleconferences and press briefings throughout the season as several of the tropical cyclones had impacts to the Hawaiian Islands in order to provide decision makers with useful and timely information about developing hazards.

- *National Disaster Preparedness Month.*
  September 2019 was declared National Preparedness Month in the USA. On Guam, staff from the WFO Guam conducted outreach training at several local elementary schools reaching up to 300 children. Several schools also paid visits to the WFO Guam office to learn more about weather and disaster preparedness. Specialized presentations were given at the Rotary Club, a community organization for bettering society, and at the Guam Hotel and Restaurant Association. Lastly, the WFO Guam joined the Guam Homeland Security Office of Emergency Management at the local shopping center wrapping up the month of preparedness activities.

- *University Course Enhancement.* WFO Guam hosted the University of Guam Environmental Biology and Physical Geography classes providing facility tours and seminars on tropical cyclones, ENSO, and Climate Change. This provided education to nearly 200 students majoring in such topics as nursing, education, criminal justice, and biological sciences. 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. At least two forecast personnel and management have been invited as guest instructors at university classes at UH and Leeward Community College.

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

Priority Areas Addressed:
Strengthen typhoon-related disaster risk reduction activities in various sectors, including increased community-based resiliency with better response, communication, and information sharing capability.

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6. 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 Weather Forecast Office (WFO) Honolulu. The Pacific Desk is one of NOAA's contributions to the World Meteorological Organization (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. In 2019 at both WFO Guam and RSMC Honolulu for a total of 23 students.

The training itself consists of four components: 1) basic forecaster training, to be implemented through use of e-learning modules that will be readily available to anyone; 2) a month long, instructor led onsite training program carried out at RSMC Honolulu and/or WFO Guam; 3) training on use of communications equipment, also to be funded by the VCP: and 4) in-Island workshops on severe weather event topics.

Identified opportunities/challenges, if any, for further development or collaboration:
Regarding the Micronesia Weather Service Offices, all personnel will have completed the training by early 2019. After which the second phase of the PITD in Micronesia will gradually progress into more detailed topics and forecasting techniques for their jurisdictions.

Priority Areas Addressed:
Enhance capacity to generate and provide accurate, timely and understandable information using multi-hazard impact-based forecasts and risk-based warnings.
Enhance Typhoon Committee's Regional and International collaboration mechanism.

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7. Resource Mobilization During Extreme Events

Main text:
RSMC Honolulu conducted several Emergency Management Briefings during 2019 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 onsite decision support services deployed to the Guam Homeland Security/Civil Defense Joint Information Center during Typhoons Yutu, Wutip, and Hagibis. These particular heavy weather briefings are primarily catered for the island leadership and military decision makers on potential tropical cyclone threats. For locations outside of Guam, WFO Guam also prepared tailored briefing slides for the CNMI leadership and the Emergency Management Office, and then provided an accompanying telephonic briefing on those slides.

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.

Priority Areas Addressed:
Enhance capacity to generate and provide accurate, timely and understandable information using multi-hazard impact-based forecasts and risk-based warnings
Strengthen typhoon-related disaster risk reduction activities in various sectors, including increased community-based resiliency with better response, communication, and information sharing capability.
Enhance Typhoon Committee's Regional and International collaboration mechanism.

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8. 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 5 days respectively.

- *Time of Arrival graphics.* When there is an active tropical cyclone in the AOR, RSMC Honolulu 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.

- *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 May 2019 and September 2019 meetings.

- *Software improvements for Emergency Managers.* Hurrevac (software for emergency managers to gather critical hurricane forecast information) improvements were implemented in 2019. The primary operational version is online, called HVX. The software download version is still also supported.

- *10th Conference on Island Sustainability.* The 10th annual Island Conference on Island Sustainability on Guam was held on April 2019 with the objective to inspire change, facilitate action, and provide a venue for sharing, networking, and collaboration of sustainability issues related to the economic, social/cultural, educational, and environmental or energy solutions. WFO Guam Warning Coordination Meteorologist provided a presentation on extreme events in the Pacific concentrating on droughts, typhoons and El Nino and provided an evaluation on downscaled products.

Priority Areas Addressed:

Enhance capacity to generate and provide accurate, timely and understandable information using multi-hazard impact-based forecasts and risk-based warnings

Strengthen typhoon-related disaster risk reduction activities in various sectors, including increased community-based resiliency with better response, communication, and information sharing capability.

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9. Technological Improvements

Main text:

- *GOES-17 and Himawari Satellite.* RSMC Honolulu and WFO Guam have been utilizing the new high resolution data available from the new Japanese Himawari geostationary satellite and mesoscale sector requests in operational forecasting. RSMC Honolulu is now using GOES-17 high resolution satellite data including mesoscale sectors, which became available at the beginning of 2019. 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 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.

- *Continued evaluation and application of ocean surface wind vector scatterometer instruments (ASCAT, SCATSAT and Windsat).* SCATSAT data plus the two ASCAT instruments and the Windsat sensor are made available in near real-time to the operational forecasters by the European Space Agency (ESA), NOAA/NESDIS and the US Naval Research Laboratory (NRL). Coriolis satellite also provides surface wind data through its Windsat via its 37GHz microwave instrument. 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.

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10. Synergized Standard Operating Procedure (SSOP) Phase II

Main Text.

Mr. Tom Evans, National Weather Service (NWS) Pacific Region Deputy Director was selected as the Project Manager of the Synergized Standard Operating Procedures (SSOP) Phase II in 2017. The goal of the SSOP-II is to "…promote the capacity on establishment of the SOP at national-level to coastal multi-hazards through extending the achievement of SSOP-I (Guidelines and Quick Reference of SSOPs) in the Typhoon Committee and the Panel on Tropical Cyclones regions by conducting training course and workshops on the "mechanics" of preparing and implementing synergized standard operating procedures for coastal multi-hazards early warning system in beneficiary countries." At the same time, Mr. Ken Kleeschulte of the NWS Weather Forecast Office Guam was one of the experts tasked to assist with the training of the Member countries.

Nearly two years later, Mr. Evans provided the summary of the SSOP as stated in the following:

All three of the major activities of the SSOP Phase II: Implementation of Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System (EWS) project have been completed. The first activity was conducting the October 22-24, 2017 Training Workshop for the beneficiary countries at the Regional Training Center in Nanjing, China. The second activity was sending Panel on Tropical Cyclone (PTC) and Typhoon Committee (TC) members to each other's attachment training for tropical cyclone forecasters. Regional Specialized Meteorological Centre (RSMC) Tokyo conducted their attachment training in December 2017, which was attended by participants from Bangladesh, Maldives and Myanmar. RSMC New Delhi conducted their attachment training in July 2018, which was attended by participants from Cambodia, Lao PDR, Philippines, Thailand and Viet Nam. The third activity was conducting the in-country Consultation Workshops for up to six of the beneficiary countries. Five consultation workshops were realized in Myanmar, Thailand, Sri Lanka, Viet Nam and Lao PDR.

The project had two expected outcomes. First, extending the knowledge on the "mechanics" of preparing and implementing SSOPs in TC and PTC regions using the knowledge from the workshops and attachment training. Second, the cooperation mechanism between TC and PTC will be put into practice via RSMC cooperation on the annual RSMC Tokyo-New Delhi attachment training every year. At the Nanjing Training Workshop the participants indicated they received the most value from group discussions; going through the nine-step process of creating and maintaining an SSOP; understanding the key concepts, basic principles, and standards; collaborating through the scenarios; learning how to improve cooperation and integration at all levels of SOPs; and cultural exchanges. Extending the knowledge received at the Nanjing Training Workshop, the in-country consultation workshops looked at specific topics to train on the mechanics for improving and updating SOPs to become better synergized. Five in-country consultation workshops were conducted: Myanmar, November 2018; Thailand, July 2019; Sri Lanka, September 2019; Viet Nam, September 2019; and Lao PDR, October 2019. The results of these consultation workshops will lead toward developing new SSOPs, improving current SOPs to become better synergized, developing and

improving Memorandums of Understanding, involving local communities, and pursuing impact based EWSs.

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