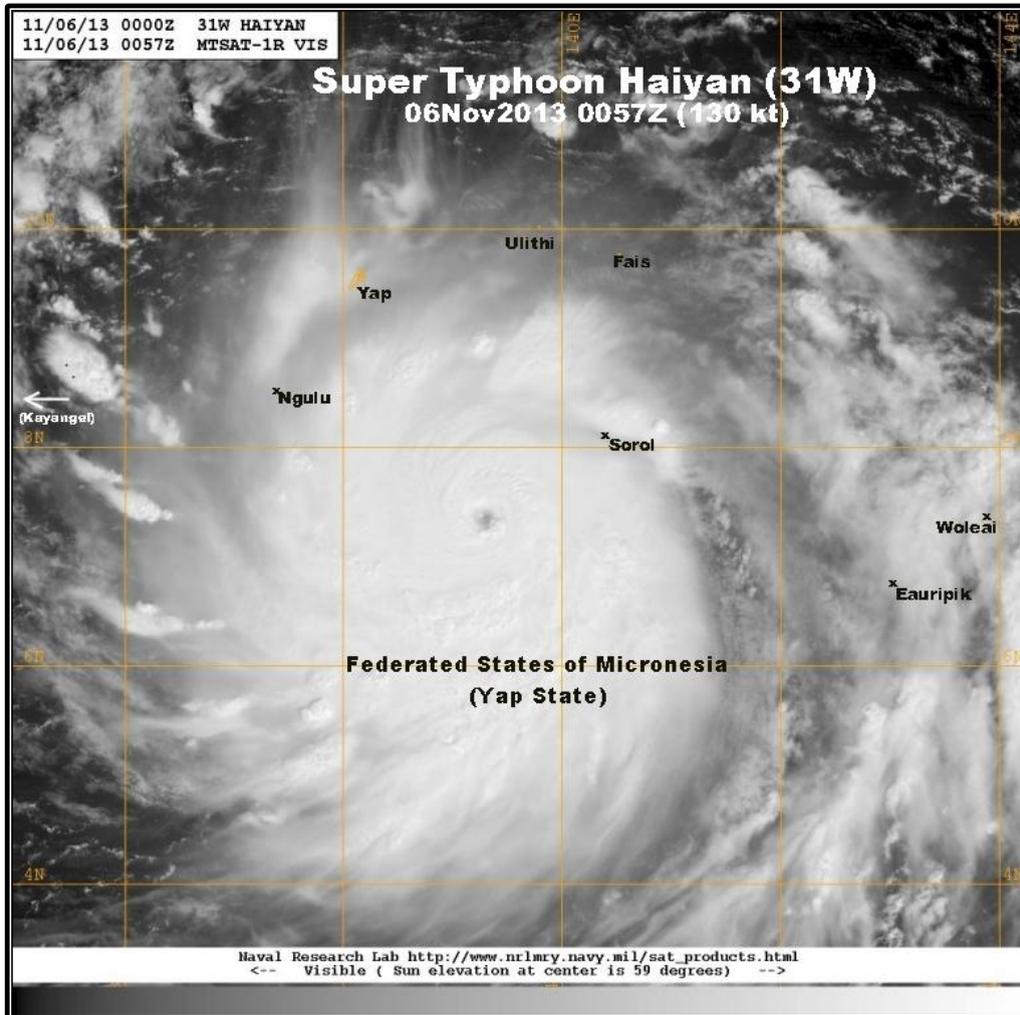


MEMBER REPORT

ESCAP/WMO Typhoon Committee
8th Integrated Workshop/2nd TRCG Forum



United States of America Pacific Region

Macao, China
2 - 6 December 2013

Cover caption: MTSAT visual image of the intensifying Super Typhoon Haiyan (31W) (named “Yolanda” in the Philippines) moving through Yap State in the Federated States of Micronesia on 6 November 2013 prior to passing over the small island of Kayangel in the Republic of Palau and on towards the Philippines. The 130-knot wind speed is a 1-minute average wind and is based on the Dvorak wind estimation technique.

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I. Overview of tropical cyclones which have affected/impacted Member's area in 2013

1. Meteorological Assessment (highlighting forecasting issues/impacts)

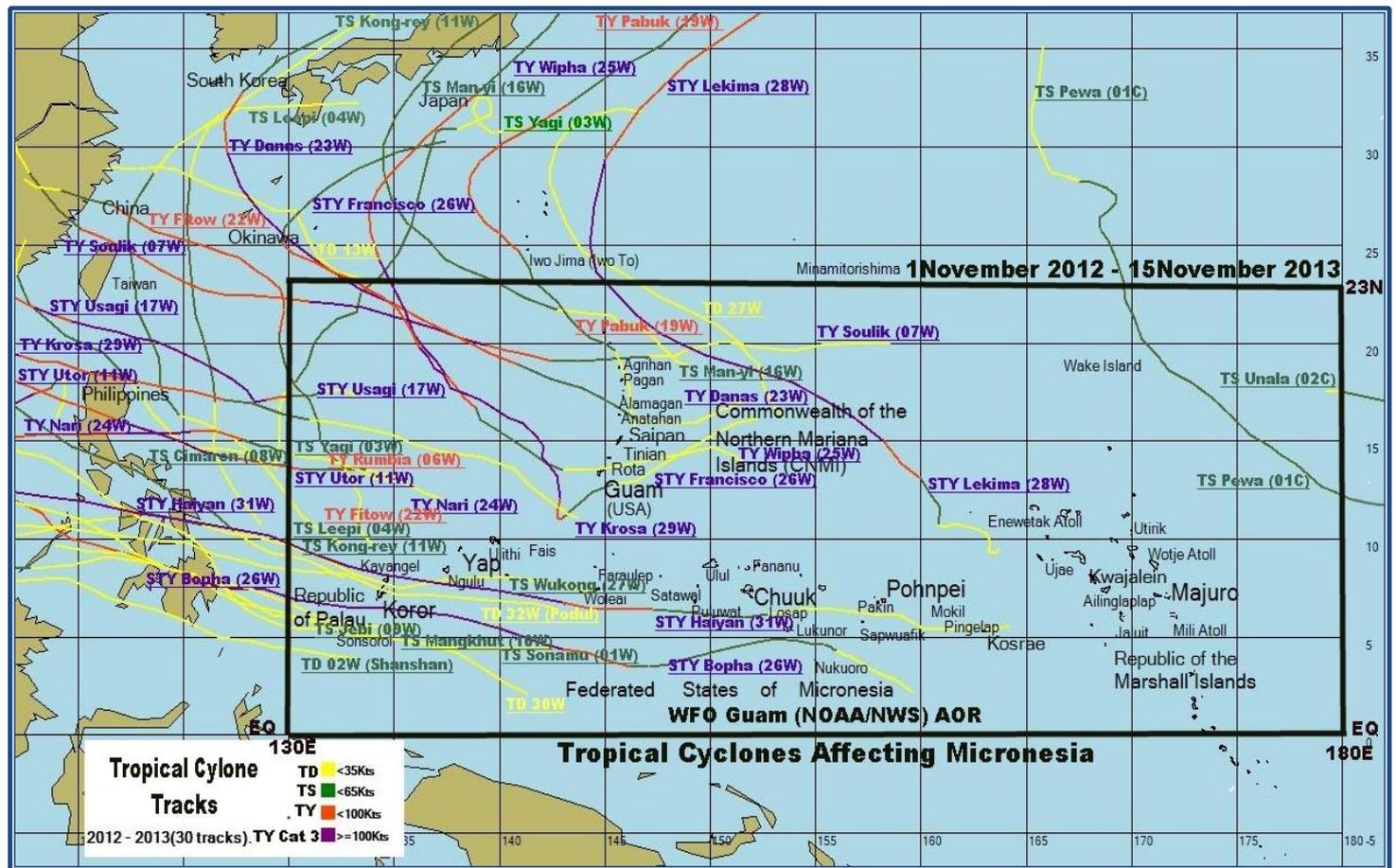


Figure 1: Tropical Cyclones affecting Micronesia 1 November 2012 through 15 November 2013

Tropical Cyclone activity in the Micronesian portion (area between the Equator and 25N from 130E to 180, not including Kiribati) of the western North Pacific from 1 November 2012 through 15 November 2013 was up from the past several years of low activity. Through 15 November, 28 tropical cyclones either developed within or were initiated within the US National Weather Service (NWS) Weather Forecast Office (WFO) Guam's Area of Responsibility (AOR). In addition, two weak tropical storms moved into the AOR from the Central Pacific. While Micronesia was still dominated by tropical cyclones forming in the western half of the AOR, storms did form a little more east this year, and thus had an effect on more inhabited islands. This past year, included six super typhoons (130 knot, 1-minute sustained) and five additional major typhoons (Category 3, >100 knot,

1-minute sustained). Two of the super typhoons, Bopha and Haiyan occurred almost one year apart with one affecting the southern half of the Republic of Palau (ROP) and the other affecting the northern half. Haiyan, in particular, went directly over the small northern island of Kayangel in the ROP, with an estimated 140-knot maximum sustained wind. It brought massive damage to the island’s vegetation and buildings but no deaths or serious injuries occurred. Sixteen tropical cyclones warranted Public Advisories from WFO Guam in its AOR, slightly below the average of 19 tropical cyclones per year. The WFO also issued Typhoon Warnings and Tropical Storm Warnings for several islands because of four cyclones. The Typhoon Warnings issued for Bopha at the end of November 2012 were the first such warnings issued in Micronesia since 2009. In addition, three distinct periods of persistent monsoon flow occurred in September and October of 2013, and they affected all islands west of Kosrae and Pohnpei. In one such instance, a 2.5 day event over Guam brought over 22 inches (559 mm) of rain and a peak wind of 52 knots. In another event, 6.84 inches (174 mm) fell over Pohnpei from 13 to 15 September. And in still another occurrence, a gust of over 45 knots occurred in heavy rainfall over the island of Saipan. Each of these cases occurred with no organized tropical cyclone in the area. Farther to the east, rainfall and organized tropical activity were still slightly below normal, which is consistent with the El Niño-Southern Oscillation (ENSO)-neutral pattern.

Type	Definition
Tropical Storm watch	Tropical storm-force winds (34-63 knots, 1-minute average sustained) are possible within the next 48 hours
Tropical Storm warning	Tropical storm-force winds (34-63 knots, 1-minute average sustained) are expected within the next 24 hours or are occurring
Typhoon watch	Typhoon conditions (64 knots or more, 1-minute average sustained) are possible within the next 48 hours
Typhoon warning	Typhoon conditions (64 knots or more, 1-minute average sustained) are expected within the next 24 hours or are occurring.

Figure 2: Definitions of WFO Guam watches and warnings

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

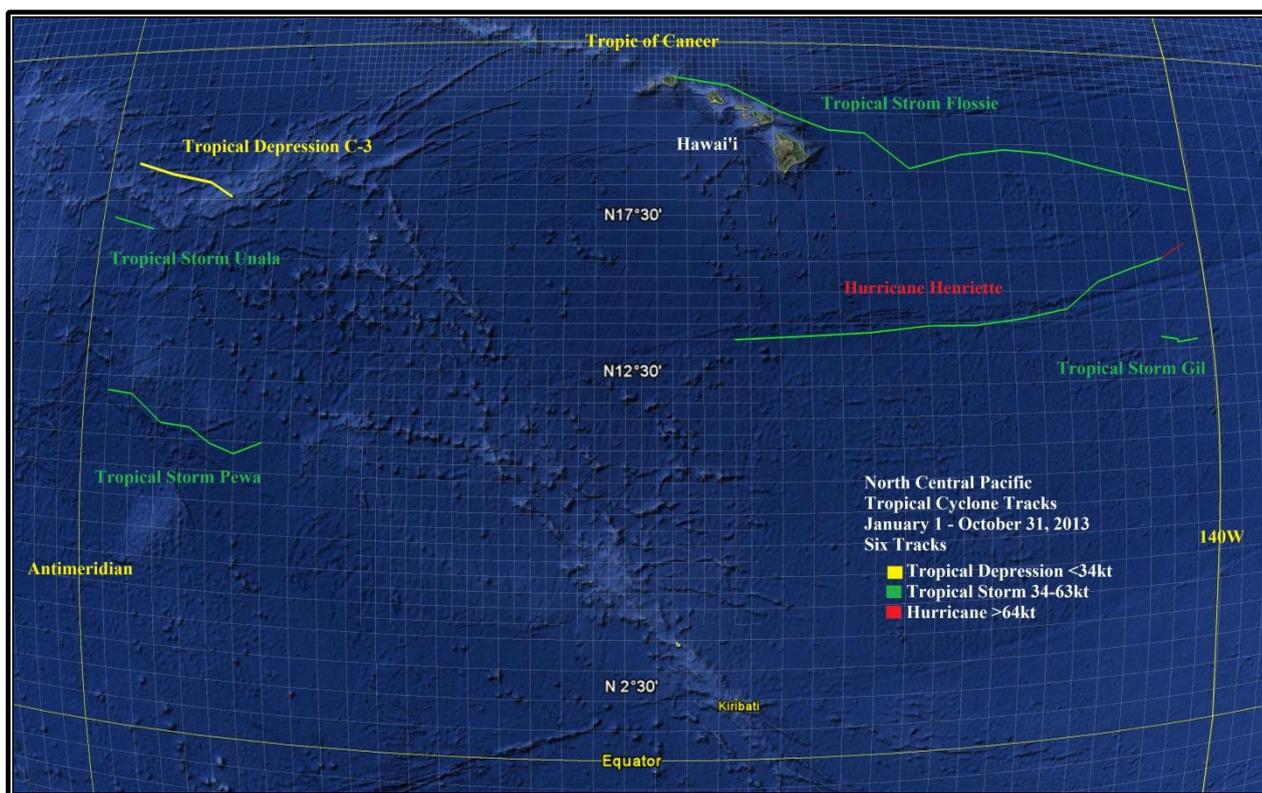


Figure 3: Tropical cyclones affecting the central North Pacific January 1 through October 31, 2013

Six tropical cyclones entered into, or were generated in, the central North Pacific during the 2013 hurricane season. The tropical cyclone with the most significant impact was Tropical Storm Flossie, which moved just north of the main Hawaiian Islands from early on 29 July through early on 30 July. A key piece of data that helped the confidence of the forecasters in shifting the forecast track to the north just before it impacted the “Big Island” of Hawaii came from a unique sensor onboard the Suomi NPP satellite. The Visible Infrared Imaging Radiometer Suite (VIIRS) day-night band allowed forecasters to see a visible image over Flossie at night, just before the 05 UTC advisory on 29 July. Because of these data, preparedness and response activities for the impacts of Tropical Storm Flossie were shifted to Maui County. The main impacts were to the islands of Maui and Molokai, both in Maui County, where power outages, some wind damage and even one lightning-induced death

occurred. The other tropical cyclones in the area remained far away from populated areas with only one hurricane entering the area. Hurricane Henriette was decreasing in intensity as it crossed 140°W into Regional Specialized Meteorological Center (RSMC) Honolulu's AOR. The other tropical cyclones remained at or below tropical storm strength.

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

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

There was plenty of tropical cyclone activity since 2012 and hydrologic events ranged from a massive drought during the first half of the year in eastern Micronesia, to large, record setting rainfall episodes in western Micronesia during the second half of the year. WFO Guam issued several hydrologic products, including numerous multi-page Drought Information Statements, a newly introduced Hydrologic Outlook Statement and several *Urban and Small Stream Flood Advisories, Flash Flood Warnings* and *Special Weather Statements* to address these situations. Again, the monsoon trough emerged as a major rainmaker, and starting in September, the trough generated several tropical cyclones. As the transition from La Nina in the first half of the year to ENSO-neutral conditions, rainfall was normal to above normal west of 155E longitude and below normal east of 155E longitude.

In September, Typhoons Man-Yi and Pabuk were initiated with the monsoon flow over the Marianas but did not warrant any typhoon watches or warning for any of our warning points. That monsoon flow caused extensive periods of rain on both Saipan and Guam. September rainfall amounts were 14.73 inches (374 mm) for Saipan International Airport and 32.25 inches (813 mm) for Guam International Airport. Rainfall for Guam broke the previous September precipitation record of 27.13 inches (689 mm) from 1982, which occurred under similar monsoon circumstances. While more than 100 people were displaced, there were no deaths or injuries.

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

With the exception of the Big Island, the main Hawaiian Islands experienced near to above normal rainfall during the hurricane season. The Big Island received below average rainfall keeping most of the island under some level of drought. The most extreme drought conditions remained over the interior, leeward areas of the island.

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

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

Drought conditions in the early part of the year appeared to be the result of a combination of La Niña and a multi-decadal trend for less rainfall for the Micronesian Islands east of

155E. This drought heavily affected the northern islands of the Republic of the Marshall Islands (RMI). The National Weather Service provided decision support services to the RMI government and to several international agencies that were providing relief to the affected islands.

WFO Guam conducted outreach to several of the main islands of Micronesia. The outreach included a multi-faceted Tropical Cyclone Workshop that addressed all aspects of tropical cyclone characteristics and preparedness/response, and also a multitude of other topics.

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

RSMC Honolulu conducted over 50 tropical cyclone-related outreach events in 2013. The highlight of these outreach events was the Central Pacific Hurricane Center (CPHC)/Federal Emergency Management Agency (FEMA) course entitled "Hurricane Preparedness for Decision Makers". This course was attended by emergency managers, police department, fire department, homeland security, and other decision makers from across the State of Hawaii on April 16-18, 2013. For all events, RSMC Honolulu emphasized that even though there was a likelihood of ENSO-neutral conditions and below normal tropical cyclone activity, it only takes one hurricane hitting Hawaii to produce major damage and impacts.

4. Regional Cooperation Assessment (highlighting regional cooperation successes and challenges)
Nil.

II. Summary of progress in Key Result Areas

Title of item:

Annual Tropical Cyclone, Disaster Preparedness and Climate Workshops

A primary WFO Guam outreach event during the year at the major Micronesia islands is the Annual Tropical Cyclone, Disaster Preparedness and Climate Workshop. These two-day, 18-module Workshops are tailored for each location 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/states; and WFO Guam website products. Adding to this list are topics on general climate familiarity, climate variability and climate change; El Niño /La Niña and their effects, impacts and status. In addition, other subjects requested for inclusion are tsunamis and volcanoes; rip currents, currents, and tides; and earthquakes. In 2013, WFO Guam conducted workshops in Yap Island, FSM; Majuro, RMI; Saipan, CNMI; and on Guam. Scheduling difficulties and travel restrictions prevented the WFO Guam staff from achieving total visitation to all eleven annual sites.

In addition to conducting the workshops, WFO Guam also provides seminars at the local colleges, training at the meteorological service offices, and specifically requested training to disaster managers.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil.

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology							
DRR				X	X		
Training and research							
Resource mobilization or regional collaboration							

Member:	USA	Name of contact for this item:	Chip Guard
Telephone:	+671-472-0946	Email:	chip.guard@noaa.gov

Title of item:

National Weather Service StormReady/TsunamiReady Program

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.

WFO Guam assisted the Island of Saipan, CNMI in renewing its second 6-year period of StormReady and TsunamiReady recognition. The island, led by local Emergency Management Office, underwent a comprehensive evaluation and was recognized by NWS in August as earning StormReady and TsunamiReady status.

RSMC Honolulu assisted the community of Ewa Beach on the island of Oahu in their successful campaign to be designated as a StormReady and TsunamiReady Community. RSMC Honolulu ensured the community had disaster action plans in place and held outreach events to convey a preparedness message.

As of November 2013, there were 2148 StormReady Communities in the United States. Of which, sixteen are in the Pacific Region.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil.

KRA =	1	2	3	4	5	6	7
Meteorology					X		
Hydrology							
DRR	X						
Training and research							
Resource mobilization or regional collaboration							

Member:	<u>USA</u>	Name of contact for this item:	<u>Chip Guard/Michael Cantin</u>
Telephone:	<u>+671-472-0946</u> <u>+808-973-5275</u>	Email:	<u>chip.guard@noaa.gov</u> <u>michael.cantin@noaa.gov</u>

Title of item:

Annual Tropical Cyclone Exercises

It is always important to have procedures in place for dealing with tropical cyclones. Even more important is the opportunity to test and evaluate these programs. In 2013, both WFO Guam and RSMC Honolulu participated in annual tropical cyclone exercises.

On Guam, the annual Typhoon Preparedness Exercise called Exercise Pakyo was held from 15 to 19 June. Pakyo is the native word in Chamorro (language of the Marianas Islands) for strong winds. WFO Guam participated in several planning meetings spearheaded by the Guam Homeland Security Office of Civil Defense and the US military. The live exercise was a 5-day event beginning with a developing system southeast of the island chain heading northwestward and developing into a supertyphoon as it reached Guam and the southern CNMI. Major agencies involved in the exercise included the Government of Guam, the Joint Region Marianas (military), and the Government of the CNMI.

During the interagency exercise, the WFO Guam provided daily briefings at the Office of Civil Defense (OCD) for the Guam Governor and his staff. WFO Guam had 15 objectives for this exercise.

RSMC Honolulu participated in a statewide annual tropical cyclone drill in Hawaii. The annual hurricane exercise, coordinated by Hawaii State Civil Defense (SCD) in partnership with the NWS Forecast Office in Honolulu was held in June.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil.

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology							
DRR				X	X		
Training and research							
Resource mobilization or regional collaboration							

Member: USA Name of contact Thomas Evans/Genevieve Miller
for this item: _____

Telephone: +808-973-5272/ +671-472-0944 Email: tom.evans@noaa.gov/genevieve.miller@noaa.gov

Title of item:

International Cooperation Efforts

Opportunities for international cooperation presented themselves in 2013.

RSMC Honolulu hosted the Director, Deputy Director and two researchers from the Korean Meteorological Administration on 11-14 March. The delegates visited the Joint Typhoon Warning Center and RSMC Honolulu, as well as, the Hawaii State Civil Defense. Discussions revolved around tropical cyclone forecast operations at the different centers and how important it is for effective interaction with decision makers (emergency management). The varied uses of satellite data, including Dvorak tropical cyclone intensity estimation technique were also discussed.

RSMC Honolulu hosted two forecasters from the Japanese Meteorological Agency on 4-5 April. The delegates visited with personnel from RSMC Honolulu and the Joint Typhoon Warning Center to discuss TC analysis and forecasting techniques, and to continue close cooperation with neighboring RSMCs.

WFO Guam and the Pacific Region Headquarters in Honolulu assisted with the regional planning and logistics for the Japan Agency for Marine-Earth Science and Technology's (JAMSTEC) Tropical Cyclone Genesis Experiment. This experiment was conducted in a triangular area that included Palau, ROP and Yap, FSM on the base and a Japanese research ship at the apex. WFO Guam launched a daily supplemental rawinsonde during the month of June as part of the experiment while the WSOs Yap and Palau launched two daily supplemental rawinsondes for the experiment for a longer period.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil.

KRA =	1	2	3	4	5	6	7
Meteorology							X
Hydrology							
DRR							
Training and research							
Resource mobilization or regional collaboration							

Member: USA Name of contact: Thomas Evans/Genevieve Miller
 for this item: _____
 Telephone: +808-973-5272/ +671-472-0944 Email: tom.evans@noaa.gov/genevieve.miller@noaa.gov

Title of item:

Technological Improvements

- *Continued use of the Indian Meteorological Office Ocean Scatterometer (OSCAT).* The European Space Agency (ESA) and the NOAA/NESDIS continue to provide near-real time ocean surface wind vector data from the OSCAT instrument. These data in conjunction with the ESA Advanced Scatterometer(ASCAT) instrument have combined to cover more than 90% of the tropical ocean surface with estimated surface wind vectors. Although these instruments are still subject to evaluation from the effects of strong rainfall rates and under very light and strong wind conditions, they have greatly improved the capability of tropical weather offices around the world to monitor for tropical development and to observe the structure and initial intensities of tropical cyclones in their AOR.
- *GOES-R project.* RMSC Honolulu has been participating in the GOES-R project by receiving, analyzing, and evaluating possible sensors and displays of data from polar orbiting satellite imagery. One of those sensors is onboard the Suomi NPP satellite and it played a critical role in locating the position of TS Flossie during the nighttime hours just before the center of TS Flossie was expected to move across the Big Island of Hawaii. The Visible Infrared Imaging Radiometer Suite (VIIRS) is able to produce a day-night band allowing forecasters to receive a visible image at night. The images the forecasters had available for the 29 July 05 UTC advisory provided confidence to their forecast in shifting the forecast track of TS Flossie to the north lessening the impacts to the Big Island and providing enhanced warnings for Maui County.
- *Dual Polarization radar upgrade.* All NWS radars were upgraded by April 2013 to using Dual Polarization (dual-pol) technology. This technology added an additional 14 products to the suite of data already available to NWS forecasters. These tools will assist forecasters in the warning and forecast process. The benefits of Dual-Pol are many including a better estimation of total precipitation and of the size distribution of hydrometeors, improved identification of the melting layer and differentiation of hydrometeors and insects/birds; and new severe thunderstorm signatures. The full benefit of dual-pol radar, however, will not be fully realized until NWS forecasters and research meteorologists develop additional real-time expertise.
- *Wave buoys in Marianas.* During October 2012, the Pacific Islands Ocean Observing System (PacIOOS) wave buoy team deployed two new wave buoys (Datawell Mark II Waverider buoy) in the Mariana Islands. Real-time information from Ritidian Point off of Guam's northwest coast and from Tanapag off of Saipan's west coast in the Northern Mariana Islands, have provided the WFO

Guam with vital information that have been used to fine-tune surf forecasts and to issue advisories and warnings for coastal inundation events.

- *HOKEN replacements.* The replacement of the old Hydrogen Generator (HOKEN) at all five rawinsonde stations in Micronesia began in early 2013. These new HOKEN40 Series II systems replaced the HOKEN 40 series 1 which had exceeded their life expectancy. The replacement greatly improved the reliability of the hydrogen generators and decreased the number of missing soundings due to ground equipment failures.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil.

KRA =	1	2	3	4	5	6	7
Meteorology						X	
Hydrology							
DRR							
Training and research							
Resource mobilization or regional collaboration							

Member:	USA	Name of contact for this item:	Roger Edson/Robert Ballard
Telephone:	+671-472-0948/ +808-973-5274	Email:	roger.edson@noaa.gov bob.ballard@noaa.gov

Title of item:

Outreach/Education Activities

- *Expanded Pacific Hydrology Discussions.* WFO Guam suspended its one-page monthly written discussion on the status of the ENSO and its effects on Micronesia in favor of incorporating the material into some new and existing products. WFO Guam expanded its input into the quarterly *Pacific ENSO Update* newsletter produced by the Pacific ENSO Applications Climate Center, which will now issue additional Special Updates, if warranted. WFO Guam also provides input to the Climate Prediction Center's Monthly *ENSO Diagnostics Discussion*, and employs greater use of the *Hydrologic Outlook* product for extreme rainfall events and *Drought Information Statement* for drought events. Finally, WFO Guam and WFO Honolulu both assist in preparing a popular new monthly 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 to announce the 2013 Central Pacific Hurricane Season Outlook on 22 May.
- *RSMC Honolulu media interfaces.* RSMC Honolulu conducted numerous media interviews, teleconferences and press briefings during Tropical Storm Flossie from 28 to 30 July in order to provide decision makers with useful and timely information about developing hazards.
- *National Disaster Preparedness Month.* September was National Disaster Preparedness Month for 2013. The Emergency Management Offices on Guam and in the CNMI took the leads and arranged the events. On Guam, several events and numerous activities such as school presentations and a Grand Finale event at a major shopping center showcased the Preparedness Month. WFO Guam participated in the proclamation signing by the Governor of Guam, several awareness activities and the Grand Finale Display at the local Shopping Center. WFO Guam also took its stand-alone display to Saipan, CNMI and participated in radio and television spots/interviews for the CNMI's Disaster Preparedness Month Grand Finale.
- *University of Guam lectures.* Environmental Biology classes at the University of Guam participated in a field trip and lecture series at the WFO Guam during the spring and fall semesters. Depending on the instructor's desires, WFO Guam conducted 1 to 2-hour presentations, which covered basic weather concepts, climate and climate change, or specific weather and ocean hazards, such as tropical cyclones, volcanic eruptions, and tsunamis.
- *Guam Emergency Plan.* WFO Guam participated in a 3-day Workshop to transition the 7-volume Government of Guam Emergency Response Plan into a newly-

directed single-volume Guam Comprehensive Emergency Management Plan. The WFO Guam representative wrote the general natural hazards section and major portions of the specific tropical cyclone, tsunami, and communications sections

Identified opportunities/challenges, if any, for further development or collaboration:

Nil.

KRA =	1	2	3	4	5	6	7
Meteorology					X		
Hydrology							
DRR					X		
Training and research							
Resource mobilization or regional collaboration							

Member:	<u>USA</u>	Name of contact for this item:	<u>Chip Guard/Michael Cantin</u>
Telephone:	<u>+671-472-0946/ +808-973-5275</u>	Email:	<u>chip.guard@noaa.gov michael.cantin@noaa.gov</u>

Title of item:

Improved Typhoon-related Disaster Risk Management in Various Sectors

- *Tropical Weather Outlook graphic.* During the tropical cyclone season, RSMC Honolulu prepares and transmits a text and graphical *Tropical Weather Outlook* that illustrates the probability of tropical cyclone development in the next 48 hours.
- *Hawaii State Hazard Mitigation Forum.* The Hawaii State Hazard Mitigation Forum, of which RSMC Honolulu is a member, is tasked with maintaining and updating the Hawaii State Hazard Mitigation Plan. Forum members met regularly to discuss hazard threat, risk assessment, and actions which can be taken to mitigate the hazard risk to protect lives and property from loss and destruction during a natural hazard.
- *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. The RSMC Honolulu Director provided a hurricane presentation to the group during the June 2013 meeting.
- *RSMC Coordination.* RSMC Honolulu and RSMC Tokyo coordinated seamless transitions of three tropical cyclones as they crossed the International Date Line into RSMC Tokyo's area of responsibility.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil.

KRA =	1	2	3	4	5	6	7
Meteorology				X			
Hydrology							
DRR				X			
Training and research							
Resource mobilization or regional collaboration							

Member:	USA	Name of contact for this item:	Thomas Evans
Telephone:	+808-973-5272	Email:	tom.evans@noaa.gov

Title of item:

Pacific International Desk

The Pacific International Desk (PITD), funded by the USA National Weather Service as part of the US contribution to the WMO Voluntary Cooperation Program (VCP), is now restarted and is being expanded in scope. The PITD postponed operations for much of the past two years to allow for a broad ranging program evaluation and decisions on how to improve the Desk. The PITD will be managed by the University of Hawaii, Telecommunications and Social Informatics Research Program (TASI). The new Desk has 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 on-site training program carried out at the US Weather Forecast Office in Honolulu; 3) training on use of communications equipment, also to be funded by the VCP; and 4) in-Island workshops on severe weather event topics. The Desk is now hiring for the Instructor position; the Instructor will help design curricula as well as deliver courses. A more formal and detailed description of the Desk will be distributed to WMO and the ESCAP/Typhoon Committee Members in early 2014.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil.

KRA =	1	2	3	4	5	6	7
Meteorology						X	X
Hydrology							
DRR							
Training and research							
Resource mobilization or regional collaboration							

Member:	USA	Name of contact for this item:	Dan Beardsley
Telephone:	+301-713-0645 ext 134	Email:	dan.beardsley@noaa.gov

Title of item:

Resource Mobilization

RSMC Honolulu assisted Hawaii State Civil Defense during Tropical Storm (TS) Flossie through video teleconferencing and even placed an Emergency Response Specialist in their Emergency Operations Center during the critical impact time.

The WFO Guam Warning Coordination Meteorologist spent numerous hours in Guam's Emergency Operations Center providing direct input and options to the Governor and his staff during Typhoon Francisco in October 2013.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil.

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology							
DRR							
Training and research							
Resource mobilization or regional collaboration				X	X		

Member:	USA	Name of contact for this item:	Thomas Evans/Genevieve Miller
Telephone:	+808-973-5272 +671-472-0944	Email:	tom.evans@noaa.gov genevieve.miller@noaa.gov