

**Performance Progress Report  
Developing the Pacific Islands Ocean Observing System (PacIOOS)  
Cooperative Agreement # NA16NOS0120024  
Performance Period: December 1, 2018 through May 31, 2019**

**Submitted June 2019 by:  
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This report covers activities conducted during the sixth six 6-month performance period of this award. PacIOOS' estimated operating budget for the fiscal year was \$2,659,836.

## **1.0 Progress and Accomplishments**

### **REGIONAL GOVERNANCE AND MANAGEMENT SYSTEM**

#### **Finalize Subaward for Filling the Gaps; Original completion date: November 2018**

*Status: Complete. Due to the delay in funding from NOAA, this task was delayed, but the subaward was finalized in January 2019 as part of our FY18 filling the gaps effort.*

#### **Plan and Conduct Capacity Building Workshops for the Insular Pacific; Original completion date: May 2019**

*Status: Begun, but implementation delayed. While some of the delay is due to the delay in funding for FY18 funding, the delay is also strategic. PacIOOS has offered to host the 4<sup>th</sup> Pacific Islands Data Buoy Cooperation Panel (DBCP) capacity development workshop in Honolulu prior to OceanObs'19 in September 2019. While PacIOOS will sponsor some of the workshop, most of the funding will come from other NOAA funding and the DBCP. In this sense, we will be able to reach more trainees, as we will also conduct additional workshops and trainings after the September workshop.*

*In addition, we have begun capacity building with a local non-governmental organization (NGO) in Pohnpei called the Conservation Society of Pohnpei. More details are included below in the Observing Subsystem section of this report. We have also identified another focal site for enhanced capacity building in our region: Majuro. This site has been chosen due to the overwhelming interest of Marshallese government agencies to have more responsibility of the instruments deployed in their country. Initial planning discussions have begun for the training in Majuro.*

#### **Convene Governing Council Executive Committee meeting; Original completion date: May 2019**

*Status: Complete. April 2019. Members of the PacIOOS Governing Council Executive Committee (ExCom) gathered on the University of Hawai'i Mānoa campus and the Hawai'i Institute of Marine Biology for the annual meeting. The IOOS Program Office participated, PacIOOS shared programmatic updates and internal evaluation results. The ExCom also engaged in valuable discussions on regional capacity building, international partnerships, and PacIOOS' short- and long-term priorities. ExCom members from across the region represent various sectors and provide valuable feedback to help guide the future of the program. <http://www.pacioos.hawaii.edu/pacioos-updates/2019-executive-committee-meeting/>*

#### **Internal PacIOOS Evaluation; Original completion date: February 2019**

*Status: Complete. March 2019. The internal PacIOOS evaluation is used to provide an objective review of what is going well and what needs more attention within the program. The results were presented to the PacIOOS Governing Council Executive Committee in April 2019, and were one of the key drivers of*

the FY20 budget discussion with the committee. Overall, PacIOOS system effectiveness improved.

**Additional activities for regional governance and management** that highlight regional observing system successes and occurred during this reporting period include the following:

- *PacIOOS secured funding from DOI Office of Insular Affairs to enhance public safety through improved atmospheric and wave forecasts for the Pacific Island territories. During this three-year project, PacIOOS will improve and validate the existing suite of atmospheric forecasts for the three territories, and also develop new high-resolution wave forecasts for Saipan, Tinian, and Rota in the CNMI and for the Manu'a Islands in American Samoa.*
- *PacIOOS participated in IOOS Spring Meeting in Washington, D.C. (March 2019) and conducted outreach with congressional staffers both in D.C. (March 2019) and in Honolulu (May 2019).*

## OUTREACH, STAKEHOLDER ENGAGEMENT AND EDUCATION SUBSYSTEM

**Outreach with stakeholders on Hawai'i Island about location for former Kiholo WQ Buoy; Original completion date: May 2019**

**Status:** *In progress. Co-Investigator Colbert conducted a survey of locations to determine optimal oceanographic locations where the buoy is suitable and connected with various stakeholders to discuss opportunities and potential challenges with regard to community support for the buoy in their coastal waters. Kailua Bay is one area of interest rising to the top. In addition to being the type of environment suited to the buoy design, it is an area with a wide array of ocean users and stakeholders.*

**Lead OceanObs'19 community white paper efforts; Submit papers; Original completion date: November 2018**

**Status:** *Complete. PacIOOS management (in **underlined bold**) led or collaborated on three different community white papers for OceanObs'19, all of which have been published with *Frontiers in Marine Science*. PacIOOS co-investigators, researchers, students, and staff (in **bold**) were involved in additional community white papers as well.*

***Iwamoto MM**, Dorton J, Newton J, Yerta M, Gibeaut J, Shyka T, Kirkpatrick B and Currier R (2019) Meeting Regional, Coastal and Ocean User Needs With Tailored Data Products: A Stakeholder-Driven Process. *Front. Mar. Sci.* 6:290. doi: 10.3389/fmars.2019.00290*

*Ostrander CE, **Iwamoto MM** and **Langenberger F** (2019) An Innovative Approach to Design and Evaluate a Regional Coastal Ocean Observing System. *Front. Mar. Sci.* 6:111. doi: 10.3389/fmars.2019.00111*

***Guiles M**, **Azouri A**, **Roeber V**, **Iwamoto MM**, **Langenberger F** and **Luther DS** (2019) Forecasts of Wave-Induced Coastal Hazards in the United States Pacific Islands: Past, Present, and the Future. *Front. Mar. Sci.* 6:170. doi: 10.3389/fmars.2019.00170*

*Bailey K, Steinberg C, Davies C, Galibert G, Hidas M, **McManus MA**, Murphy T, Newton J, Roughan M and Schaeffer A (2019) Coastal Mooring Observing Networks and Their Data Products: Recommendations for the Next Decade. *Front. Mar. Sci.* 6:180. doi: 10.3389/fmars.2019.00180*

***Holland KN**, Anderson JM, **Coffey DM**, Holmes BJ, **Meyer CG** and Royer MA (2019) A Perspective on Future Tiger Shark Research. *Front. Mar. Sci.* 6:37. doi: 10.3389/fmars.2019.00037*

*Vance TC, Wengren M, Burger E, Hernandez D, Kearns T, Medina-Lopez E, Merati N, O'Brien K, O'Neil J, **Potemra JT**, Signell RP and Wilcox K (2019) From the Oceans to the Cloud: Opportunities and*

**Collaborate with IOOS Program Office and IOOS Association to provide on-the-ground support for OceanObs'19 and determine next steps; Original Completion Date: September 2019**

**Status:** *In progress. The PacIOOS management team is heavily involved with several planning efforts involving U.S. IOOS during OceanObs'19, including the 20<sup>th</sup> anniversary celebration, a Women in Ocean Science official side-event, the 2019 IOOS Fall meeting and field trip for participants. Next steps will require additional support from PacIOOS.*

**Ongoing outreach and engagement with stakeholders and partners to ensure meeting ocean data needs; Original completion date: Ongoing**

**Status:** *Ongoing. Outreach and stakeholder engagement with partners is ongoing via e-mail, phone calls, and meetings; stakeholder and community outreach and education efforts are conducted as appropriate. Specific activities during this reporting period are listed below.*

**Outreach Efforts**

- *PacIOOS continues to publish and distribute monthly e-newsletters; more than 100 new contacts were added to the newsletter mailing list, the majority of which signed up through the subscription form on the PacIOOS website. A total of 1983 recipients receive monthly updates.*
- *Increased public awareness and interest throughout PacIOOS region with targeted news releases for redeployment of PacIOOS wave buoy in Saipan after U.S. Coast Guard recovered asset 800 NM offshore; joint news release with NOAA for deployment of Ocean Acidification buoy in American Samoa.*
- *Increased number of web stories that are easy to share on social media, to provide PacIOOS updates, announce new tools and data sets. Coverage included water quality sensor partnership in Pohnpei; wave observations during winter storm in Hawai'i; publication of evaluation framework; and citizen scientists training sessions on Maui.*
- *During this reporting period, the PacIOOS website was visited by over 63K users and had more than 186K sessions.*
- *PacIOOS continues its presence on social media, in particular on Facebook and Twitter. PacIOOS' Facebook page has more than 1,465 likes; Twitter following increased to over 440 followers.*
- *Popular posts included deployment of the Ocean Acidification buoy in American Samoa; record-breaking waves in Hawai'i in February; U.S. Coast Guard wave buoy recovery; coral colony growth on wave buoy mooring line; capacity building in Pohnpei; announcement of citizen scientists workshops on Maui.*

**Stakeholder Engagement**

- *Met with stakeholders from various sectors, including industry partners (e.g., Liquid Robotics), agency partners (e.g., Division of Aquatic Resources, Department of Transportation, Department of Health Clean Water Branch, U.S. Army Corps of Engineers, NOAA), and non-profit organizations (e.g., Malama Maunalua, KUA, YachtAid Global)*

**Collaborative Efforts, Events and Conferences**

- *Participated in outreach and educational events, including Wilson Elementary Career Day, Hanauma Bay Lecture Series, Stevenson Middle School STEM fair.*
- *Presentations: Hawai'i Survey & Mapping Conference; Infragravity Workshop; Waterpower Week.*
- *Water quality team mentors undergraduate college students and high school students to support sensor and buoy program.*
- *Integration of PacIOOS data in UH Hilo Marine Science undergraduate projects.*

- Participate on the NOAA Pacific Island Regional Team (PIRT), NOAA Sentinel Site Program Review, NOAA Pacific Regional Outreach Group (PROG), NOAA Habitat Blueprint Program, State of Hawai‘i Ocean Resources Management Plan (ORMP) Working Group, and Hawai‘i Ocean Council.

**Additional activities** not mentioned above that highlight regional observing system successes and occurred during this reporting period include the following:

- Combined page views of the PacIOOS website and PacIOOS wave buoy pages from CDIP total over 1.3 million.

## **OBSERVING SUBSYSTEM**

### **Waverider buoy operating in the Hawaiian Islands, Mariana Islands, American Samoa, and the Marshall Islands; Original completion date: Ongoing**

*Status: Ongoing. Keeping all the wave buoys managed by PacIOOS operational continued to be challenging this reporting period, but PacIOOS partners continue to be amazingly supportive and wonderful assets. Notably this reporting period, the USCG rescued our Tanapag wave buoy in early December 2018. Super Typhoon Yutu broke the Tanapag mooring off Saipan in October 2018. Due to dangerous ocean conditions, we were unable to retrieve the buoy immediately, and it drifted 800 nm—halfway to Taiwan after more than 6 weeks. The largest individual wave measured by the Saipan wave buoy during this storm was 14.66m (48 ft.) peak-to-trough, 10.2 second wave period, on October 25, 2018. The buoy was redeployed May 2019. <http://www.pacioos.hawaii.edu/pacioos-updates/tanapag-wave-buoy-redeployment-2019/>*

*A strong low-pressure system with an exceptionally close approach to the Hawaiian Islands chain, caused record-breaking wave heights on February 10, 2019. The PacIOOS wave buoy off Hanalei, Kaua‘i, measured 38 ft. in significant wave height and the largest wave recorded (Hmax) measured 63ft. The Waimea wave buoy also broke its 15-year record and climbed to a significant wave height of 29 ft., and the largest wave measured 48 ft. Both buoys are located approximately 4 miles offshore and moored in depths of 200-240m. <https://www.pacioos.hawaii.edu/pacioos-updates/winter-storm-hawaii/>*

*The Majuro wave buoy broke from its mooring in February 2019, and was fortunately recovered the next day. It will be redeployed during the next reporting period.*

### **Swap Ipan wave buoy; Original completion date: February 2019**

*Status: Complete. November 2018.*

### **Swap Hilo and Ritidian wave buoys; Swap WETS mooring and wave buoy; Original completion date: May 2019**

*Status: Complete. Hilo Bay wave buoy was successfully redeployed February 2019. Ritidian was redeployed November 2018 (after going adrift in September), and the old mooring and acoustic release were recovered January 2019. WETS buoy and mooring were swapped in April 2019.*

### **Real-time wave data and associated products online; Original completion date: Ongoing**

*Status: Ongoing. <http://www.pacioos.hawaii.edu/waves-category/buoy/>*

### **Nearshore sensors operating and data online; Original completion date: Ongoing**

*Status: Ongoing. PacIOOS currently has five near shore sensors operational in Hawai‘i (four on O‘ahu and one on Maui), and four operational in the Insular Pacific (American Samoa, the Federated States of Micronesia, the Republic of the Marshall Islands, and Guam). Partners on the islands other than O‘ahu are key to keeping these sensors operational, and data flowing. New modems for some stations have been*

*purchased and deployed. The team is working through issues with a couple of the modems used for data telemetry for the sensors, possibly due to carriers working on the cellular network towers in the area.*

*The Guam sensor was relocated slightly to keep it from getting inundated with sediment. Initial location is in the archive, and the new site is in the active sensor pages. <http://www.pacioos.hawaii.edu/water-category/sensor/>*

**Expand Water Quality Sensor Partnership Program; Original completion date: Ongoing**

***Status:** Ongoing. The PacIOOS Water Quality Sensor Partnership Program (WQSPP) continues to be popular with partners and the PacIOOS Governing Council. The program currently has three sensors deployed, with another one on order with FY18 Fill the Gaps funding.*

*In early May, the WQSPP project in Kewalo Basin, O‘ahu, HI wrapped up. This sensor was utilized to help a local non-profit organization monitor water quality conditions before and during a construction project in Kewalo Basin Harbor conducted by another entity hired by the commercial harbor. Results showed that the turbidity data was correlated with wave action and rainfall during the time frame the sensor was deployed.*

*All WQSPP data of completed projects are now available on the PacIOOS website under archival sites: <http://www.pacioos.hawaii.edu/water/sensor-archive/>*

*A new MOU with the Ebiil Society in Palau was signed for a new WQSPP site. The sensor will be use to monitor water quality downstream of a terrestrial/forest restoration site on Balbeldaob, Palau. Five additional partners and stakeholders have contacted us with interest in the WQSPP, and we have begun discussions with them.*

**Implement Pohnpei water quality monitoring with local partners; Original Completion date: May 2019/ongoing.**

***Status:** A water quality Seabird sensor was purchased and deployed in December 2018, with associated training for the Conservation Society of Pohnpei (CSP; a local NGO) staff. The sensor was retrieved in May 2019, and data downloaded before being re-deployed. Rain gauges were ordered and received in May 2019, and CSP staff were trained how to use the rain gauges. CSP will deploy the rain gauges in June 2019. A river flow meter was ordered and received by PacIOOS staff in Pohnpei. River survey training and monitoring will begin in July 2019. Data will be collated with the sensor in the Nanpil River itself, rainfall data, and other coral and fish monitoring being conducted by CSP. Information derived will show how much sediment is reaching the lagoon and is expected to guide decision-making on development clearing in the Nanpil River basin. <http://www.pacioos.hawaii.edu/pacioos-updates/monitoring-sedimentation-dausokele-estuary-pohnpei/>*

**Pelekane Bay water quality buoy operational & data online; Ongoing**

***Status:** Ongoing. The buoy is in the water, reporting, and data are online. PacIOOS co-investigator Steven Colbert from the University of Hawaii at Hilo and his team fixed hardware issues caused by storm waves last month. The buoy measures physical water parameters, including water temperature, salinity, turbidity, chlorophyll, and oxygen in 15-min intervals. Autonomous, real-time water quality measurements support monitoring efforts and provide baseline data for Pelekane Bay, which often experiences high levels of turbidity. <http://www.pacioos.hawaii.edu/water/wqbuoy-pelekane/>*

**Replace Hilo Bay Water Quality Buoy and telemetry system & data online; Original completion date: May 2019.**

***Status:** In progress. The replacement buoy, sensor and telemetry system has been purchased and received. The previous buoy at this location was lost during Hurricane Lane last summer. Fill the Gaps*

*and other PacIOOS funding supported the replacement purchase. There were some delays in the order due to new regulations related to anything transmitting “data” and the related paperwork procedures. The buoy has been painted and will be deployed during the following reporting period.*

**Real-time and Logged water quality data and products online; Original completion date: Ongoing**

*Status: Ongoing. Dynamic graphs and map viewers on the PacIOOS website provide a quick way to check the latest observations. <http://www.pacioos.hawaii.edu/water-category/sensor/>, <http://www.pacioos.hawaii.edu/water/wqbuoy-pelekane/>*

**Real-time surface currents available online for west and south shores of O‘ahu and Hilo Bay; Original completion date: Ongoing**

*Status: Ongoing. Focus continues to be on operations and maintenance of 7 HFR stations on O‘ahu and Hawai‘i Island. Mongoose damaged cables at the Kalaeloa station; the team has requested assistance from the SOEST Facilities to pull new cables. In the meantime the radar operates at reduced range, and this site continues to require major maintenance work.*

*We are experiencing some issues with access to the HFR sites at Ka‘ena, Kapolei, and Kokohead due to changing staff and ownership. Kokohead needs work on the transmitting antennae down the cliff in order to bring the range back to full. Access and staff time are challenges.*

*Many of the other outdoor equipment (cables, antennas) at the HFR sites are aging and will soon require repairs/recapitalization. The UH-designed radar electronics, however, has proven to be rock-solid, with not a single electronics failure since they were installed to replace the failing WERAs in 2012.*

**Repair PacIOOS SeaGlider; Original completion date: November 2018**

*Status: Delayed. Because the funding for other equipment costs were tied up with the same internal budget for the SeaGlider, we could not proceed with the purchase order for the repairs until November 2018. The PacIOOS SeaGlider was sent to Kongsberg for servicing and repair at the end of 2018. We were initially told to expect the repaired glider during the spring of 2019, but as of the end of this reporting period, it is still at Kongsberg due to delays on their end.*

**Two 3-month glider run to inform ROMS; Original completion date: May 2019.**

*Status: Delayed. See above delays to the repair of the PacIOOS SeaGlider.*

**Validation samples for NOAA-ON Ocean Acidification effort; submit data to NCEI every 6 months; Original completion date: Ongoing**

*Status: Ongoing. Eric DeCarlo and Christopher Sabine continue efforts to support the OAP at the Class III station. The recent reclassification of the CRIMP-2 buoy as the Class III station and reclassification of the Kāne‘ohe buoy as a Class II station means that they have largely shifted efforts to the new location over the most recent project period. Thus, they continue to collect and analyze validation samples for DIC and TA at a frequency of every two weeks at CRIMP-2. They do, however, continue to also collect such samples at the Kāne‘ohe buoy, weather permitting, under the auspices of NOAA/Sea Grant College Program funding.*

*The latest data submission was assigned NCEI Accession Number 0176671. Additional samples collected since the last submission are currently being run and undergoing QA/QC checks. The new data will be submitted to NCEI before the end of the year. The CRIMP-2 systems were recently serviced and are operational. The Kāne‘ohe buoy broke its bungee in March and is currently out of the water. Analysis of the broken bungee by UH and PMEL suggested a problem in the mooring design. A new design has been developed and they are waiting for all of the equipment to arrive from PMEL.*

**Deploy benthic instruments from PMEL on OA buoy(s); validation samples; submit data to NCEI every 6 months; Original completion date: Ongoing**

*Status: Delayed. No activities to report at this time. DeCarlo and Sabine are awaiting receipt of instruments from PMEL for a new deployment.*

**Additional activities** not mentioned above that highlight regional observing system successes and occurred during this reporting period include the following:

- *Partnered with numerous NOAA and American Samoa partners to deploy a new MAPCO2 buoy in Fagatele bay within the National Marine Sanctuary of American Samoa to measure carbon dioxide and other important seawater characteristics within the bay's vibrant tropical coral reef ecosystem. This site in the Southern Hemisphere complements two similar existing coral reef monitoring sites within the U.S. Pacific Islands (Kāne'ohe Bay and on the South Shore of O'ahu, Hawai'i), and is part of a national buoy array to better understand changes in ocean chemistry. The buoy measures carbon dioxide in the atmosphere as well as seawater measurements of carbon dioxide, temperature, salinity, pH, dissolved oxygen, turbidity, and chlorophyll. All data can be viewed online on the PMEL and PacIOOS websites. <http://www.pacioos.hawaii.edu/latest-news/new-ocean-acidification-monitoring-station-american-samoa/>*
- *Partnered with Hawai'i Pilots Association to deploy a new weather station at the entrance of Honolulu Harbor in order to address their data needs for wind data at the location to inform their piloting of a new cruise ship into harbor. Ovation of the Seas is the 4<sup>th</sup> largest cruise ship in the world, and double the size of anything piloted into Honolulu Harbor prior to its first port here in May. <http://www.pacioos.hawaii.edu/weather/obs-honolulu/>*

#### **DATA MANAGEMENT SUBSYSTEM**

The data management milestones that directly relate to specific observing, modeling, or other subsystem components are listed and described with those components.

**Purchase and set up server for Hawai'i Undersea Research Laboratory (HURL); Original completion date: February 2019**

*Status: Complete. A new server has been purchased and installed. All the HURL archives (except the videos, which require more processing time) have been transferred to the new server to enable public access to the data.*

**HURL data publicly available; Original completion date: May 2019**

*Status: In progress. A separate website has been created and is almost set for public release. With the release, decades worth of NOAA-funded deep sea biological data will be publically accessible.*

**Additional activities for the data management subsystem** that are not mentioned within the other subsystems but that highlight regional observing system success and occurred during this reporting period include the following:

- *During this performance period, over 35,000 unique visitors (via direct external access to our servers) accessed more than 10.2 million pages in our servers (TDS, ERDDAP, and LAS) and transferred over 2.3 TB of data.*
- *Customized a data collection web app for the West Maui Wave Run-up project. The web app includes a map interface to view all photos collected in a user-friendly fashion.*
- *PacIOOS was the first Regional Association to work on providing biological data via standard data services. This was accomplished in collaboration with the local NOAA Fisheries Science Center and their reef fish population data. Through the project, a new biological schema was developed and adopted. The reef fish data were then published via the PacIOOS ERDDAP server. During this reporting period, PacIOOS began updating the data with more recent observations. The data are*

collected through routine assessments by towed-diver and fixed-view surveys by NOAA, the National Park Service and the Papahānaumokuākea National Marine Monument. This project aims to: 1) collect new data (since the original project in 2015); 2) ensure the data conform to Darwin Core standards; 3) update the existing PacIOOS data set; 4) publish the new collection via the PacIOOS ERDDAP server. We are currently in task two and are developing a merged record that follows the IOOS Biological Data Standard Schema when possible, with extension based on Darwin Core when necessary. PacIOOS has been working closely with the NOAA/PIFSC personnel to ensure the integrity of the data and to fill in any missing metadata.

- During the past two reporting periods, DMAC staff have been migrating PacIOOS servers from a single server to a Virtual Machine (VM) stack of servers. The plan is to take advantage of VM management and parse different services to different VM's, thus eliminating single points of failure.
- Worked with NDBC to obtain WMO no. for all remaining PacIOOS and PacIOOS-supported assets.
- Discussions on how to QC and visualize WaveGlider environmental assessment data with Liquid Robotics, Inc.

## MODELING, ANALYSIS, AND PRODUCT DEVELOPMENT SUBSYSTEM

**High-water level forecasts upgraded based on feedback/new inputs, forecasts available online;**

**Original completion date: Ongoing**

*Status:* Ongoing. Continuously refining forecasts with user feedback and collaborating with partners to obtain on-the-ground validation during predicted events. <http://www.pacioos.hawaii.edu/shoreline-category/highsea/>

**Harbor surge forecast upgraded based on feedback/new inputs, forecast available online; Original completion date: Ongoing**

*Status:* Ongoing. Work ongoing to refine harbor surge forecast and obtain non-IOOS funding to expand locations. The February strong low-pressure system with an exceptionally close approach to the Hawaiian Islands described above, created strong surges in the Haleiwa Harbor. Stakeholders reported using the PacIOOS Harbor Surge Forecast to inform their decisions to move their boats out of the harbor before the impacts. The users were pleased with the performance of the forecast and thankful for the service it provided. <http://www.pacioos.hawaii.edu/shoreline-category/harborsurge/>

The U.S. Army Corps of Engineers (USACE) organized a two-day Infragravity Waves (IG) workshop at the Scripps Institution of Oceanography in San Diego to discuss the latest IG wave research, and improve USACE's understanding and prediction of IG waves and their associated effects. Assaf Azouri, PacIOOS researcher under the supervision of co-investigator Professor Douglas Luther, was one of the invited experts to present on observational data and numerical modeling of IG waves for the complex and variable coastlines along the North Shore of O'ahu and West Maui. Workshop participants developed strategic plans with one, three, and five-year goals to guide future development and research needs.

**Obtain necessary permits for collecting data to develop a Harbor Surge Forecast for Kahului Harbor, Maui, HI; Original completion date: May 2019.**

*Status:* Delayed. The West Maui Coastal Resilience project (described below) is requiring additional PacIOOS staff resources, pushing back plans to work on the permitting for deployments in Kahului Harbor. The team plans to revisit this milestone during the upcoming descope phase for Year 4 (FY19) of this award.

**Wave run-up forecasts upgraded based on feedback/new input, forecasts available online; Original completion date: Ongoing**

*Status:* Ongoing. PacIOOS continues to refine forecasts with user feedback and collaborating with partners to obtain on-the-ground validation during predicted events. The work being conducted for the



*PacIOOS Coastal Resilience Grant project for West Maui will also provide a significant addition and upgrade to our published PacIOOS run-up forecasts. <http://www.pacioos.hawaii.edu/shoreline-category/runup/>*

*Some of the 24 instruments deployed along the West Maui shoreline during the last reporting period were retrieved and redeployed during this reporting period. The data are proving to be extremely valuable for the modeling effort and forecast development. Data from pressure sensors, current and wave meters will provide valuable insights into wave dynamics along West Maui and serve as validation for the high-resolution wave run-up forecast that is currently in development for this stretch of shoreline. Funding for the extensive data collection is provided by the UH Sea Grant College Program, the Joint Institute for Marine and Atmospheric Research, and PacIOOS. Numerous local partners on Maui are making this effort possible. <http://www.pacioos.hawaii.edu/pacioos-updates/data-collection-wave-dynamics-west-maui/>*

**Continuously upgrade ROMS circulation model in operation for Hawai‘i, Mariana Islands, and Samoan Islands; Original completion date: Ongoing**

***Status:** Ongoing. All data can be accessed online on the PacIOOS website and on PacIOOS Voyager. PacIOOS ROMS is available for various areas and grid sizes in Hawai‘i, the Mariana Islands, and Samoa. During this reporting period, we experienced issues with the Global HYCOM data and had to work with the data manually.*

*Research work on developing an operational coupled physical and biogeochemical forecast for the Hawaiian Islands has made significant progress. Using the PacIOOS ROMS configuration coupled with the GFDL developed COBALT model, we have integrated several years of fully coupled models based on the reanalysis described above. This work is being validated and calibrated. The goal is to eventually have a full forecasting system that includes the geochemistry and base foodweb for the PacIOOS regions. PacIOOS staff presented the work in a seminar for the UHM Oceanography Seminar.*

*In a recent study published in the Journal Geoscientific Model Development and authored by Dale Partridge, Tobias Friedrich, and PacIOOS co-investigator Professor Brian Powell, researchers used advanced techniques to reanalyze 10-years worth of ocean circulation data around Hawai‘i. Observational information, such as surface current observations, satellite, sea gliders, ARGO floats, and other data, play a vital role to improve modeled forecasting capacities. This reanalysis provides a consistent dataset for further studies of the ocean dynamics around Hawai‘i and demonstrates the interplay, value, and need of observational and forecasting data.*

**Model data and products (including Ala Wai Plume Forecast) online; Original completion date: Ongoing**

***Status:** Ongoing. All forecasts and data output are available via the PacIOOS website. <http://www.pacioos.hawaii.edu/currents-category/model/>, <http://www.pacioos.hawaii.edu/water/model-plume-alawai/>*

## RESEARCH AND DEVELOPMENT SUBSYSTEM

**Transmitting tags deployed on pelagics (sharks) throughout the year; Original completion date: Ongoing**

***Status:** Ongoing. During the reporting period, we continue to work with and wait on the ATN DAC to ingest and serve our oceanographic profile data collected from satellite tags on sharks. We are delaying the deployment of additional oceanographic profiling satellite tags on sharks until the ATN DAC is ready to ingest and serve the data collected from these tags. Tracks from previous tagging efforts can be viewed on PacIOOS' shark tracking pages and PacIOOS Voyager. <http://www.pacioos.hawaii.edu/projects/sharks/>*

*Co-Investigator Holland presented his work, including collaborations with PacIOOS at the annual Tuna Conference in CA near the end of the reporting period. He also presented his work to Wildlife Computers while on the mainland.*

**Service land-based receivers for shark tags throughout the year; Original completion date:**

**Ongoing**

**Status:** *Ongoing. Currently 3 land-based receivers are deployed on O'ahu, and 2 are deployed on Maui.*

## **2.0 Scope of Work**

No changes to the project scope of work are anticipated.

## **3.0 Personnel and Organizational Structure**

PacIOOS advertised and filled a new position: PacIOOS Operations Coordinator. Mr. Chip Young was hired for this position as of March 1, 2019. The PacIOOS Operations Coordinator will be responsible for the coordination and management of the day-to-day operations of PacIOOS; will provide field and technical support for PacIOOS components as needed; and will help us identify and facilitate the realization of opportunities to increase the ability of PacIOOS to address stakeholder needs. PacIOOS partner, UH Sea Grant College Program, also hired Max Sudnovsky as the new Marshall Islands Coastal Management Extension Faculty. Max is partially supported by PacIOOS to liaise with partners and stakeholders on the ground, maintain the PacIOOS near shore sensor in Majuro, help with the maintenance and recovery of the PacIOOS wave buoy, and validate the PacIOOS wave run-up forecast.

## **4.0 Budget Analysis**

Spending for this award is on track with projected program expenditures. The University of Hawai'i Office of Research Services submitted a semi-annual financial report for the period ending April 30, 2019, through Grants Online. That report showed total receipts of \$5,926,238.96.

As of May 31, 2019, internal budget tracking shows expenditures of \$6,327,681.42 representing a draw down of 81.6% of the Federal funding for this award. Once it was apparent that the funding for Year 4 (FY19) would be delayed, PacIOOS Management asked the co-investigators to spend conservatively in order to ensure that we can operate through the gap in funding.