

Progress Report
Developing the Pacific Islands Ocean Observing System (PacIOOS)
Cooperative Agreement # NA11NOS0120039
Performance Period: December 1, 2014 through May 31, 2015

Submitted by:
Chris Ostrander
School of Ocean and Earth Science and Technology
University of Hawaii at Manoa
June 2015

1.0 Project Summary

The Pacific Islands Ocean Observing System (PacIOOS) is the Regional Association (RA) for Hawaii and the Insular Pacific region being developed as part of the national Integrated Ocean Observing System (IOOS). The primary goal of the work proposed under this award is to continue the development of an operational ocean monitoring and forecasting system that provides integrated, customized, and timely products that enable an ocean-literate and well-informed public and policy makers in the Pacific Islands. PacIOOS is being planned and implemented through the collective efforts of a consortium of users, signatories to the Memorandum of Agreement, and 17-member Governing Council. PacIOOS has focused initial development on ocean-state and forecasting, prediction of coastal hazards, water quality sensing, the provision of marine ecosystem information, and the development of integrated data visualization capabilities to inform marine spatial planning, operations, commerce, and recreation. Through the efforts proposed under this award, PacIOOS has enhanced development of observing and product suites in each of the aforementioned focus areas and continues to engage users, stakeholders, and system partners in the use, extension, education, and outreach of technical capacity, data visualization, and ocean information.

This report covers activities conducted during the last six 6-month performance period of Year 4 of a 5-year award. PacIOOS' operating budget for Year 4 was \$2,272,846.

2.0 Progress and Accomplishments

2.1 User Needs, Stakeholder Input and Partnerships

User Needs/Stakeholder Input

- Continued significant engagement with stakeholders throughout PacIOOS region to inform the 2016-2021 proposal to IOOS. This included travel to Guam, Saipan, Majuro, Hilo, American Samoa, and Palau. Regional Coordinator in Pohnpei sought input from FSM partners and stakeholders. Other inter-island Hawaii stakeholders were reached via phone, email, and at large meetings/conferences held on Oahu.
- Guam – University of Guam Marine Lab, University of Guam Sea Grant, Bureau of Planning and Statistics, CZM Program, NOAA OCM, NOAA NWS WFO, Office of the Governor, USCG, and The Nature Conservancy.

- Saipan – Office of the Governor, Congressman Sablan’s Office, Bureau of Environmental Coastal Quality, Coastal Resources Management, Northern Mariana Collage, Department of Land and Natural Resources, and Mariana Islands Nature Alliance.
- Majuro – US Embassy, College of the Marshall Islands, UH Sea Grant, Joint National Advisory Panel, Mico Beach Yacht Club, Red Cross, Jenrok Early Warning Action Team, EPA, Ports Authority, Marshall Islands Marine Resources Authority, and NOAA NWS WSO.
- Hawaii Island - NOAA Mokupapapa Ocean Center, University of Hawaii at Hilo, Kohala Center, UH Sea Grant, Kampache Farm, Forever Oceans, Liquid Robotics, Western Pacific Fisheries Management Council, and County Planning Office.
- American Samoa – Dept. of Marine and Wildlife Resources, EPA, Coral Reef Advisory Group, Ports Authority, CZM Program, UH Sea Grant, Coalition of Reef Lovers, American Samoa Community College, NOAA NWS WFO, NOAA PIRO, and USCG.
- FSM – Pohnpei Surf Club, Micronesian Challenge Trust, College of Micronesia, Conservation Society of Pohnpei, etc.
- Palau – Palau International Coral Reef Center, Office of the President, Palau Conservation Society, NOAA NWS, The Nature Conservancy, Bureau of Marine Resources, Environmental Quality Control Board, and Palau Community College.
- Maui – Maui Ocean Center, UH Maui College, Marine Option Program, County Planning Office, Office of the Mayor, Coral Reef Alliance, Pacific Disaster Center, etc.
- Kauai – County Planning Office, Hanalei Community Stewardship Group, etc.
- Oahu – The Nature Conservancy, State Planning Office, Hawaii CZM Program, State of Hawaii Departments of Land and Natural Resources, Health, Transportation (Harbors), and Agriculture, NOAA OCM, NMFS, PIRO, HIHWNMS, Conservation International, Malama Maunalua, USCG, US Navy, USACE, Hawaii Pilots Association, Waikiki Aquarium, City and County of Honolulu (CCH) Planning Department, Western Pacific Fisheries Management Council, CCH Environmental Services Division, etc.

Partnerships

- New Signatories to the MOA:
 - Mico Beach Yacht Club
 - Forever Oceans, Inc.
 - Mariana Islands Nature Alliance (MINA)
 - Conservation International Hawaii
- Renewed an existing partnership with City and County of Honolulu. CCH is providing PacIOOS \$50,000 for the year to provide data management of specific CCH environmental data and reports.
- Formal partnership with Young Brothers, Ltd. to assist PacIOOS in vessel transport for wave buoy operations and maintenance within Hawaii.
- Participated on the NOAA Pacific Island Regional Team (PIRT), NOAA Sentinel Site Program, NOAA Pacific Regional Outreach Group (PROG), NOAA Offshore

Aquaculture Group, one NOAA American Samoa, NOAA Habitat Blueprint Program, and State of Hawaii Ocean Resources Management Plan (ORMP) Working Group.

- PacIOOS and the NOAA NWS continue to explore options to move PacIOOS forecasts into an experimental guidance product with hopes to transition them to operational capacity within AWIPS.
- Partnering with NOAA Habitat Blueprint team for West Hawaii to develop project page to inform the public on the efforts in the priority area and to enable access to related data.
- Discussions with Pacific Islands Regional Planning Body on potential partnership with PacIOOS supporting data management component of the RPB.

2.2 Governance and Administrative Structure

- PacIOOS hosted an Executive Committee meeting in March/April in Majuro, Republic of the Marshall Islands to 1) to strengthen relations with stakeholders and partners; 2) to identify areas of potential collaboration and synergy; 3) to discuss program updates and budgets; 4) to strategize specific aspects of the future direction of PacIOOS; and 5) to increase the understanding of the challenges and opportunities of atoll living in the Insular Pacific.
- Continued engagement with Co-PIs and all recipients of IOOS funding through the PacIOOS cooperative agreement.
- Participated in IOOS activities that provide direction on the development of PacIOOS.
- Increased engagement with PacIOOS MOA partners and PacIOOS Governing Council.
- Conducted staff evaluations and submitted to RCUH.

2.3 Business/Operations Plan

- Submitted RICE Certification application to IOOS Program Office.
- PacIOOS 5-year Strategic Operational Plan continues to inform program efforts.
- Revised PacIOOS internal evaluation process of program components; conducted evaluation, and presented results to Executive Committee.
- Revised PacIOOS Performance Metrics; presented to Executive Committee for approval.
- Identified and strengthened partnerships on neighbor islands to assist with operations and maintenance of nearshore water quality stations and offshore wave buoys.
- Continued to leverage funding and partnership opportunities with NOAA CSC, NOAA Coastal Storms Program (CSP), City and County of Honolulu, State of Hawaii, US Army Corps of Engineers, EPSCoR, US Navy, UH Sea Grant, and NOAA PMEL.
- Closed out services contract with Dewberry/Day1 Solutions for NOAA Flash Flood Tool.
- Closed out services contract with Palau International Coral Reef Center for sensor maintenance and outreach.
- Extended services contract with University of Guam Sea Grant for sensor maintenance and outreach.
- Entered services contract with Hibiscus for website redesign and development.
- Leveraged IOOS funds to receive additional funding from UH Coastal Geology Group/State of Hawaii Office of Coastal and Conservation Lands to develop a pilot data viewer for the Hawaii Intergovernmental Climate Adaptation Committee.

- Drafted budget and early stages of next 5-year proposal.
- Began implementing consultant suggestions for improved communications.

2.4 Observing System Implementation

Ocean-State

- Combined page views of PacIOOS wave buoy pages from NDBC, CDIP, and PacIOOS websites total over 1.25 million during this reporting period. PacIOOS wave buoys accounted for over 2.7 million data requests and almost 23 million RSS requests from NDBC during this reporting period.
- Continued to maintain an array of 13 wave buoys across the system. Recovered, redeployed, or swapped the following wave buoys: Hanalei, Waimea, Lanai, Barbers Point, Ritidian, Ipan, Hilo, Kaneohe, and Mokuauia.
- Seeking funding beyond IOOS to purchase a new wave buoy for Majuro.
- Received permit approval from USCG for Pepekeo HFR; installation complete. Data to be provided to the public and the HFR DAC at the beginning of next reporting period. Funding for both Hilo HFR stations provided by NOAA Coastal Storms Program (CSP).
- Continue to maintain HFR stations on Oahu (4) and Hilo (2).
- Received all necessary permits and agreements for Chevron HFR installation. HFR installation in progress.

Forecasting

- Modeling servers moved to UH IT Center for 24/7 support.
- Transition to new Oceanographic Modeler (under Dr. Brian Powell). Former modeler accepted faculty position at CICESE in Ensenada, Mexico.
- Ran 1 PacIOOS glider mission for data assimilation into ROMS model.
- Coupled waves from PacIOOS SWAN model to Waikiki Ocean Model.
- Updated existing WRF runs for Hawaii, American Samoa, CNMI/Guam early this year with WRF 3.6.1 and the new GFS output from NCEP.
- Captured Typhoon Dolphin in daily WRF runs for CNMI/Guam during May14-17, 2015.
- Currently assessing impact of data assimilation with GPS RO soundings (<http://www.cosmic.ucar.edu/projects.html>) in the Hawaiian WRF domain.
- Adjusted WW3 domain for the NWHI to improve stability of the forecast model system.
- Upgraded SWAN and WaveWatchIII to the latest version 41.11A and 4.18, respectively.
- Optimized the pre-processing system to improve efficiency of the wave forecast. PacIOOS wave forecasts validated daily with measurements from NDBC buoys.

Coastal Hazards

- Completed PacIOOS inundation forecast for the most populated segments of Kwajalein Atoll. The forecast machinery is based on empirical formulas derived from observations at Kwajalein by Merrifield et al. (2014). Inputs used for the forecast include the following: (i) sea level at the NOS/Co-Ops tide gauge at Echo Pier, within Kwajalein Atoll; and, (ii) the NOAA Wave Watch III global spectral forecast model output at two

locations offshore of Kwajalein Atoll. The forecast will go live on the PacIOOS website during the next reporting period.

- Upgraded the PacIOOS inundation forecast for Majuro in three ways (now live website):
 - forecast machinery is now based on empirical formulas derived from observations at Majuro by Merrifield et al. (2014); previously, the empirical formulas were based on observations from a fringing reef environment on Oahu similar to Majuro's fringing reefs;
 - forecast plot itself was changed to be more visually intuitive; and,
 - inundation heights for four historical events that produced a range of flooding were determined with hindcasts, using the same machinery as for the forecasts (with appropriate inputs). These historical heights are plotted with the forecast to provide a practical reference for residents.
- Continued re-analysis of PacIOOS Wave Run-Up Forecasts along the North Shore of Oahu in order to improve forecast process for multiple locations along the coast.
- Maintenance of existing products included the following efforts:
 - Tidal analyses updated for the Kwajalein and Majuro "Six-Day High Sea Level Forecasts" in preparation for establishing the new Kwajalein and updated Majuro inundation forecasts, which employ the "Six-Day High Sea-Level Forecasts."
 - Significant modification to the code for the inundation forecasts for Waikiki and the North Shore to take advantage of two independent swell forecasts in their input streams.
 - Fixed code to accommodate the move of the PacIOOS serve to the UH IT Center. Other operation coding issues also solved during this reporting period.
- Continued field validation of inundation forecasts by PacIOOS liaisons and volunteer observers. This highly useful information, including photos, is being used to build up a validation archive and to fine-tune the inundation forecast.

Water Quality

- Continual service and maintenance of all 13 water quality sensors (NSS) and 2 buoys (WQB) throughout PacIOOS region.
- Meetings with stakeholders throughout the region to evaluate efficacy of NSS throughout Insular Pacific and potential development of an NSS instrument pool for project support.
- Continued discussions with Kiholo Bay community over concerns of WQB in seascape. Agreement reached with community to deploy again for a pre-determined time frame. Deployment expected during next reporting period.
- US Army Corps of Engineers permit for the Kawaihae Buoy was approved. Team strengthening relationships with the folks that work in the area.
- Maintained and operated the Hilo Bay Buoy, which included several undergraduate student projects, some of which are ongoing. Projects included an examination of the biofouling organisms that grow on the buoy, using a scanning electron microscopy to make taxonomic time series that complemented the Chlorophyll-a fluorescence time series from the buoy, and ground-truthing the Chlorophyll fluorescence readings with standard laboratory Chlorophyll-a measurements.

Ecosystems and Living Marine Resources

- Successful deployment and recovery of the first oxygen sensing pop-up tags allowed “next generation” development of fin-mounted tags with oxygen sensors and uplink software based on the data obtained from the pop-up tags.
- Two fin-mounted oxygen tags on tiger sharks were deployed and continue to regularly transmit oceanographic profiles.
- Additional near real-time shark tagging conducted around Oahu, leveraging funds from State of Hawaii for tags off Maui. Data available on PacIOOS website.
- Data analysis of tiger shark movements was initiated and continues.
- Continued participation in IOOS ATN Initiative with acoustic receivers.

2.5 Data Management and Communications (DMAC)

The PacIOOS data management group (DMG) is tasked with ensuring the data collected by PacIOOS are stored and accessible to users via standard services. In addition, the DMG develops tools and products based on the collected data. Accomplishments by the DMG during this reporting period include the following:

- 26,025 unique visitors (either via direct access to our servers, via our website, or via Voyager) accessed 4,205,291 pages in our servers and transferred 850GB of data.
- Re-located main PacIOOS servers (for website and modeling) to new UH IT Center for an improved uptime (goal is 24/7).
- Maintaining the system and addressing issues as they arise- including challenges initially encountered as a result of co-locating our servers in the UH IT Center.
- Completed project page for the City and County of Honolulu’s Mamala Bay Study.
- Completed a beta version of a project page with an interactive map viewer on the estimated coral cover in Hawaii in partnership with Hawaii Institute of Marine Biology.
- Completed a project page on Ocean Acidification with an interactive map viewer in partnership with NOAA PMEL.
- Completed a project page with an interactive map viewer on predicted shorelines based on erosion rates and sea level rise in partnership with the UH Coastal Geology Group and the State of Hawaii Office for Coastal and Conservation Lands for the Hawaii Intergovernmental Climate Adaptation Committee.
- Continued enhancement of PacIOOS Voyager functionalities and interface, including a new format for coordinates, based on user feedback and requests.
- Improved the initial loading time of Voyager by 3 fold, responding to user feedback.
- New data holdings added to the PacIOOS Servers and Voyager include:
 - Aloha Cabled Observatory live acoustic and video feeds;
 - Plots of the latest ALOHA station data (temperature, salinity, oxygen, and currents);
 - Expansion of underwater cables data set;
 - New biology-related satellite data sets derived from the MODIS:
 - Chromophoric (colored) dissolved organic matter (CDOM),
 - Particulate organic carbon (POC), and

- Particulate inorganic carbon (PIC);
 - Liquid Robotics wave glider data;
 - NOAA Sea Level Rise data sets;
 - High Resolution Global 1-km Sea Surface Temperature (GISST) daily composite produced by NASA JPL;
 - Coastlines of islands in PacIOOS region;
- Continuously work with data and technical staff in each of the focus areas to improve user experiences and access to products and data.
- All of DMG continues to work toward meeting all of the IOOS goals and requirements.
- Continued participation/support of new Kilo Nalo underwater, cabled observatory.
- Revised the DMS plan to address requirements for certification application.

2.6 Education, Outreach and Public Awareness

PacIOOS Website/Brand Development

- During this reporting period, the PacIOOS website was visited by over 110,000 users and had more than 630,000 page views. Shark tracking and wave buoy pages continue to be the most visited pages on the website.
- To provide web users with a modern and more user-friendly website, PacIOOS initiated a website redesign. During this reporting period, the emphasis was on the design phase:
 - Content will be reorganized for intuitive navigation.
 - A content management system will be installed to allow for more efficient and timely updates.
 - Responsive design will accommodate users from various devices (desktop, mobile, tablet).
- Developed new brand identity for PacIOOS, which will be revealed with website launch.

PacIOOS Social Media

- Enhanced presence on social media, especially Facebook, Twitter and Instagram, with increased frequency of posts to continuously engage audience.
- PacIOOS experienced an increase to more than 1,100 total page “Likes” on Facebook.

PacIOOS Communications

- Continue to publish and distribute monthly e-newsletters.
- Over 100 new contacts added to newsletter mailing list, for a total of 1,300 recipients.
- Presentations for numerous organizations, groups, and events, including NOAA Geospatial partner group, Waikiki Aquarium, Taiwan Central Weather Bureau, and Pacific Islands Training Workshop on Ocean Observations and Data Applications.
- Continue to produce updated and relevant flyers and materials for workshops, conferences, partner meetings, and general outreach.
- Collected/published success stories illustrating value of PacIOOS data and services.
- Increased public awareness and interest in PacIOOS with targeted, engaging press releases including:

- ‘Ocean Users asked to keep distance from PacIOOS wave buoy in Hilo Bay’, UH Media
- PacIOOS Invites Everyone to Listen for Marine Wildlife, ECO – environment coastal & offshore

Collaborative Efforts/Events

- Continue to run kiosks in collaboration with COSEE Island Earth at University of Guam, College of Marshall Islands, Windward Community College Library, Hawaii State Art Museum, Kailua Sailboards & Kayaks, Maui Ocean Center, Whalers Village (Lahaina, Maui), UH Maui College, Dolphin Quest (Kohala Coast, Big Island), and Mokupapapa Discovery Center (Hilo).
- Continued collaboration with UH Maui College to develop classroom activities using data available on PacIOOS Voyager, focusing on data relevant to student experiences and real-world decision-making.
- Initiated partnerships with high schools on Oahu - Punahou, Iolani, and Kamehameha Schools to access and use real-time water quality data on Voyager.
- Continued partnership with C-MORE Scholars to mentor undergraduate students to help maintain PacIOOS water quality sensors and complete a project using the sensor data.
- Exhibits and partner support at multiple events, including Hawaii State Science Fair, Holiday Tech Fair, Mauka to Makai Earth Day at Waikiki Aquarium, PRiMO meeting.

2.7 National and International Collaborations

- PacIOOS continues to participate in all IOOS and IOOS Association calls and meetings.
- Melissa Iwamoto served on the Finance Committee of the IOOS Association Board.
- Chris Ostrander also remains a member of the board.
- Chris Ostrander continues to serve on the IOOS Federal Advisory Committee.
- Chris Ostrander continues to serve on the Indo-Pacific Oceanography Reference Group (UNESCO-IOC).
- Chris Ostrander and Jim Potemra continue as members of the Advisory Committee for the Pacific Islands Global Ocean Observing System (PI-GOOS).
- Jim Potemra participates in all monthly DMAC conference calls, as well as the marine portal forum. Jim attended the IOOS DMAC and Product Development workshop in Silver Spring, MD in May.
- Melissa Iwamoto and Chris Ostrander represented PacIOOS at the annual IOOS meetings in March in Silver Spring, MD, and met with PacIOOS congressionals while in DC.
- PacIOOS collaborated with NANOOS for the development of the IOOS Pacific Region Ocean Acidification Data Portal.
- PacIOOS collaborated with SCCOOS, CENCOOS, NANOOS, AOOS, IOOS Program Office, and NOAA OCO on the First Pacific Anomalies workshop held in San Diego.
- PacIOOS collaborated and participated in First Pacific Islands Training Workshop on Ocean Observations and Data Applications in Palau. Co-sponsors/collaborators included Republic of Palau, Office of the President, PI-GOOS, SPREP, Tropical Pacific Observing System (TPOS), and NOAA Office of Climate Observation (OCO).

3.0 SCOPE of WORK

3.1 User Needs, Stakeholder Input and Partnerships

- Continue to work with partners to identify user needs and areas of synergy/collaboration.
- Visit interisland stakeholders within Hawaii (e.g., Maui and Kona, Hawaii Island).
- Visits planned to Palau, Guam, and Saipan planned for next reporting period.
- Increase engagement with PacIOOS MOA partners.
- Continue to explore options to move PacIOOS forecasts into NOAA NWS AWIPS.
- Continue to strategically increase signatories to the MOA.

3.2 Governance and Administration

- Elections are scheduled for June 2015 for 6 seats on the PacIOOS Governing Council
- Host Governing Council meeting in Honolulu in October 2015.
- Continue to participate in national IOOS activities that provide direction on the development of PacIOOS.
- Continue to meet frequently with PacIOOS PIs and focus area groups.
- Conduct PacIOOS administration and effectively staff the program.

3.3 Business/Operations Plan

- Finalize and submit 5-year proposal to IOOS program office.
- Present executive committee-approved performance metrics to Governing Council.
- Continue to identify and leverage funding and partnership opportunities with partners.
- Revise RICE certification to address comments and concerns received from reviewers.
- Update DMAC Plan.

3.4 Observing System Implementation Activities

Ocean-State

- Maintain array of 13 wave buoys throughout PacIOOS region.
- Recovery of moorings planned for Ipan, Ritidian, Tanapag, and Majuro.
- Wave buoy redeployments planned for Ritidian, Tanapag.
- Marshall Islands redeployment is pending funding.
- Examine options to strengthen moorings throughout region to minimize runaway buoys.
- Make data stream from 2 Hilo Bay HFR live on PacIOOS Voyager.
- Finalize installation and calibration of Chevron HFR station; make data live.
- Improve data streaming from Kaena HFR.

Forecasting

- GOES-R will be launched in 2016. In collaboration with NWS, PacIOOS will conduct applications of satellite data for model initialization and verification to improve weather forecasting in Hawaii.
- Launch one PacIOOS glider run.
- Begin to work with ATN to assimilate oceanographic data from animal tags into ROMS.

Coastal Hazards

- Maintenance of existing products.
- Go live with new Kwajalein inundation forecast.
- Continue re-analysis of PacIOOS Wave Run-Up Forecasts along the North Shore of Oahu in order to improve forecast process for multiple locations along the coast.
- Continued field validation of the inundation forecasts to fine-tune the inundation forecast.

Water Quality

- Continue service and maintenance of all 13 water quality sensors (NSS) and 2 buoys (WQB) throughout PacIOOS region.
- Stakeholder outreach to solicit project proposals for PacIOOS Water Quality Partnership Program; initial phases of instrument pool implementation.
- Finalize discussions with Kiholo Bay community and deploy WQB.
- Deploy Kawaihae WQ Buoy (Pelekane Bay).
- Maintain and operate the Hilo Bay WQB.
- Continue student projects associated with Hilo Bay WQB.

Ecosystems and Living Marine Resources

- Continue participation in IOOS ATN Initiative with acoustic receivers.
- Continue to provide near real-time shark tracks on PacIOOS website.
- Initiate the deployment of an operational system for acquiring and disseminating oceanographic and behavioral data telemetered from tagged sharks around the main Hawaiian Islands.

3.5 Data Management and Communications Subsystem (DMAC)

- Continue to maintain the system and address data management issues as they arise.
- Continue close collaboration with PacIOOS management and communications.
- Continue to create relevant Project Pages for partners.
- Continue expansion and addition of data into PacIOOS Voyager and Voyager mobile.
- Continue improvement of utility and map styles for Voyager.
- Continue meeting IOOS DMAC protocols.
- Continue participation in NOAA PMEL ocean acidification efforts, including hosting of data on Voyager.
- Continue participation in new Kilo Nalo underwater, cabled observatory process.

3.6 Education, Outreach and Public Awareness

PacIOOS Website/Brand Development

- Finalize redesign of PacIOOS website to enhance user-friendly access to available observation and forecasting tools and data.
- Incorporate new PacIOOS branding into outreach and communications materials.

PacIOOS Social Media

- Continue to engage stakeholders through regular social media posts.

PacIOOS Communications

- Continue to provide and create electronic and printed outreach materials (newsletters, flyers, fact sheets, videos etc.).
- Continue to publish and distribute press releases on compelling aspects of PacIOOS.
- Continue to identify and publish PacIOOS success stories.
- Target specific user groups to conduct more outreach (e.g. fishing clubs).

Collaborative Events/Efforts

- Continue to present and participate in local events (Waikiki Aquarium, Hawaii Conservation Conference, SOEST Open House).
- Continue working with COSEE to deploy kiosk on Kauai and improve overall usage.
- Refine classroom activities using PacIOOS Voyager to raise awareness and enthusiasm for ocean data in secondary and undergraduate classrooms.
- Continue to work with high schools on Oahu - Punahou, Iolani, and Kamehameha Schools - to access and use real-time water quality data on Voyager.
- Continue to partner with C-MORE Scholars to mentor undergraduate students to maintain PacIOOS water quality sensors and complete projects using sensor data.
- Collaborate with UH Hilo and Mokupapapa Discovery Center to develop curriculum based on the Hilo HFR data.

3.7 National and International Collaborations

- RA Directors Meeting and IOOS Association Board Meeting in FL, September 2015.
- Continue participation in IOOS Association, IOOS FAC.
- Continue participation with the WMO/IOC Data Buoy Collaboration Panel (DBCP) efforts to build capacity for observations and data applications in the Pacific Islands.

4) Personnel and Organizational Structure

No changes in key scientific or management personnel occurred during this reporting period.

5) Budget Analysis

Spending is on track with projected program expenditures, with full draw down of funds anticipated by the conclusion of this 5-year funding agreement.

The University of Hawaii Office of Research Services submitted a semi-annual financial report for the period ending 3/31/2015, through Grants Online. That report showed total receipts of \$8,797,672.77.

As of April 31, 2015 internal budget tracking shows receipts of \$9,058,746.37, representing a draw down of 96% of the Federal funding for this award near the end of the performance period.

Semi-Annual Supplemental Information (from June 1, 2014-May 31, 2015)

1.0 Regional Ocean Governance Organization

The Regional Ocean Governance structure within the PacIOOS region is the Pacific Regional Ocean Partnership (PROP). The U.S. Pacific Islands Region Governors of American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI), Guam, and Hawaii established PROP in August 2012. Appointed members of the PROP have met only a few times and are in a relatively elementary stage compared to other regional ocean governance structures around the nation.

We are in continued contact with the PROP Secretaries regarding possible contributions PacIOOS can make toward PROP initiatives and for identifying areas of collaboration. To date there has been very limited opportunity for PacIOOS, and other partners outside the Governor's offices, to contribute or participate in PROP.

In addition to the PROP, there is a Pacific Islands Regional Planning Body (RBP) focused on CMSP. The Pacific Islands RPB most recently met in November 2014, in Honolulu to review and approve their stakeholder engagement plan, discuss possibilities for CMSP workshop training in Honolulu (which was subsequently offered in early 2015), and options for a CMSP data portal. PacIOOS was listed as one of the options during the discussion, and members of the RPB have since contacted PacIOOS to talk about this more. They are interested in starting a pilot project with PacIOOS for American Samoa, but many details and questions remain unanswered at this stage. To date, there is no expected start date on such a pilot, and no funding available. The next RPB meeting is tentatively scheduled for October 2015 in American Samoa, funding dependent.

2.0 Efforts to leverage IOOS funding

- City and County of Honolulu provide PacIOOS with \$50,000 to manage and serve their oceanographic data, leveraging our data servers and viewers.
- Conservation International Hawaii provided \$10,000 to the PacIOOS Near Shore Water Quality group to continue the work of our partnership on Lanai focused on understanding watershed dynamics and reef impacts, leveraging our near shore water quality program expertise and staff time.
- UH Sea Grant provided PacIOOS \$7,850 to develop a project page on sea level inundation risk for Honolulu based on modeling paid for by NOAA CSP, leveraging previous work on data viewers.
- UH Coastal Geology Group and the State of Hawaii Office for Coastal and Conservation Lands provided PacIOOS with \$10,650 to develop a project page to display data related to the estimated impacts of climate change to shorelines in sample sites within the main Hawaiian Islands. The purpose of the initial pilot page is for decision making of the Hawaii Interagency Climate Adaptation Committee formed by the State of Hawaii Legislature in 2014 per Act 23.

- Student interns from Virginia State University are in Hilo for the summer (2015) to continue a project started by leveraging the PacIOOS water quality buoy in Hilo with funding from a UH Hilo Research Council SEED grant. The project involves examining the phytoplankton growing at the Hilo WQB using scanning electron microscopy to make a taxonomic time series that complemented the Chlorophyll-a fluorescence time series from the buoy. The interns will also ground-truth the Chlorophyll-a fluorescence readings with standard laboratory Chlorophyll-a measurements.
- In early 2014, PacIOOS established a formal agreement with Young Brothers, Limited through a community support program. Young Brothers continued this partnership with PacIOOS in January 2015, to assist PacIOOS in operations and maintenance of Hawaii-based wave buoys by providing vessel support. During the past year, as part of this partnership, Young Brothers has provided boat and material transfers, donated 6,000 lbs of chain (for moorings), and provided a cost savings to PacIOOS of about \$7,000.
- The wave buoy program in the Pacific is a collaborative effort made possible by funds from PacIOOS, the University of Hawaii (UH), the Coastal Data Information Program (CDIP), and the US Army Corps of Engineers. The CDIP partnership alleviates our staff from managing the wave buoy data, saving both time and money.
- Partner programs purchased a number of the buoys we operate and maintain; for example, the Kona and Hilo water quality buoys (NSF-EPSCOR) and the Kaneohe buoys (Department of Energy). Two new wave buoys are targeted for Kaneohe Bay. The assets help with NSF related projects on the Big Island and wave energy experiments in Oahu. We host the data, and our users benefit.
- PacIOOS is working in partnership with community stewardship groups to maintain the two Maui near shore water quality sensors.
- PacIOOS pays \$40K per glider expedition. The gliders we operate are part of a larger glider pool at UH, which is comprised of ten systems purchased by various programs. Data from each glider mission is available to all partners, meaning that PacIOOS has access to data from ~10 missions per year, while paying for only one.
- All HFR operations are a results of collaborative efforts between CIMES, PacIOOS, and UH. CIMES and UH provided much of the initial investment into the development of the HFR systems used in Hawaii. PacIOOS funds operations and maintenance.
- Installation of HFR at all of our sites is a result of collaborations with property owners. Depending on the site, we use space, electrical, and internet access to operate the systems effectively. Example partners/sites include Kapiolani Community College, US Air Force, UH Medical facilities, and Chevron.
- The majority of data in our Voyager and Explorer tools are provided by partner agencies. This enables PacIOOS to provide valuable information to stakeholders without performing additional ocean surveys and observational work. Our partners help us meet our stakeholder needs.

3.0 Update to RA Governance board membership

The online RA Governance board membership is updated. PacIOOS is in the process of running 2015 elections to fill 6 seats on the PacIOOS Governing Council. The total number of MOA Signatories is now 51.

4.0 Governance Activities and Accomplishments

PacIOOS held a Governing Council meeting in October 2015 in Honolulu to discuss program priorities, evaluation, and to begin discussions for the next 5-year proposal.

PacIOOS held an Executive Committee meeting in March/April in Majuro, Republic of the Marshall Islands to 1) to strengthen relations with stakeholders and partners; 2) to identify areas of potential collaboration and synergy; 3) to discuss program updates and budgets; 4) to strategize specific aspects of the future direction of PacIOOS; and 5) to increase the understanding of the challenges and opportunities of atoll living in the Insular Pacific.

PacIOOS gained 7 new MOA Signatories since June 2014. Rather than numbers, we are now focusing on acquiring new strategic MOA partners.

5.0 Education and Outreach Activities

PacIOOS held or participated in a number of outreach activities (presentations, live demos, webinars, hands-on activities etc.).

Many can be found here: <http://pacioos.org/outreach/events/events.php>

- State of Hawaii Office of Planning Data Exchange (June 2014)
- Hawaii Community Development Agency Board Meeting (June 2014)
- 2014 North Shore Ocean Fest (June 2014)
- 8th Annual Kewalo Basin Park Clean up (June 2014)
- Turtle Bay Biathlon (August 2014)
- Hawaii Fishpond Caretakers (August 2014)
- NOAA Kona IEA (September 2014)
- PacIOOS Governing Council Meeting (October 2014)
- Waikiki Aquarium 110th Anniversary lecture (November 2014)
- 15th Annual Holiday Tech Fair (December 2014)
- NOAA Geospatial information sharing for regional partners (January 2015)
- Wilson Elementary School Career Day (February 2015)
- Hawaii State Science Fair (February 2015)
- PRiMO – Pacific Risk Management Ohana (March 2015)
- 8th Annual Mauka to Makai Earth Day event at Waikiki Aquarium (April 2015)
- PacIOOS Governing Council Executive Committee meeting and Partner Reception in Majuro, Marshall Islands (March 2015)
- Taiwan Central Weather Bureau (April 2015)
- Pacific Islands Workshop on Ocean Observations and Data Applications (May 2015)
- Hawaii Ocean Resources Management Plan Working Group
- Meetings in Guam, CNMI, Marshall Islands, American Samoa, Palau and Hawaii

PacIOOS focused mainly on the ongoing redesign of the PacIOOS website, and participated in priority outreach events. With regards to education, PacIOOS continues to work with the University of Hawaii Maui College to develop classroom activities using data available on

PacIOOS Voyager, focusing on data relevant to student experiences and real-world decision-making. UH Maui continues to run these activities in the Introduction to Oceanography lab. PacIOOS is also working with high schools on Oahu - Punahou, Iolani, and Kamehameha Schools - to access and use real-time water quality data on Voyager.

5.1 Update information contained in the Education and Outreach Tool

Completed. Please see google shared inventory for responses.