IOOS Regional Associations
Collaborations with NOAA's National Weather Service

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Most of the 11 IOOS Regional Associations work with the NWS field offices. These collaborations include providing data and model output for use in forecasts, the delivery of buoy data through NBDC and the joint development of products and services. The following is a sampling of the kinds of activities currently underway in the regions.

In Alaska, AOOS (Alaska Ocean Observing System) has been working closely with the NWS both to provide data to NWS forecasters and display NWS data through the AOOS web portal. AOOS streams data through its Real Time Sensor map from over 400 NWS sensors, including weather stations, stream gauges, and NDBC buoys. AOOS also displays visualized model output from 38 parameters modeled by the NWS through NCEP or NDFD.

AOOS has collaborated with the NWS to conduct a user survey about how mariners get their weather. In addition, AOOS has facilitated a modeling working group to help transfer wind model input from an AOOS-funded WRF model to NWS forecasters.

AOOS is able to provide weather data to the NWS at lower cost and with quicker maintenance. When the AOOS wave buoy in Cook Inlet, which provides data to NDBC, became dislodged in October, AOOS partners were able to retrieve the buoy in less than 12 hours. The buoy will soon be redeployed. AOOS also is funding eight Snotel weather stations in Prince William Sound that stream data to the NDBC at low cost.

This year, AOOS is funding a project that will use NWS sea ice charts and other resources to produce a historical sea ice atlas for Alaska waters that will be useful to sea ice forecasters, scientists, policy makers, industry, and other stakeholders.
**In the Northeast, NERACOOS** (Northeastern Regional Association of Coastal Ocean Observing Systems) provides real-time observations from its buoy arrays providing half the surface ocean measurements in the region. In addition to meteorological data, the arrays provide the only wave observations in Long Island Sound and the only ocean visibility observations in the Gulf of Maine, observations that local WFOs describe as critical. Pilot projects with the Gray, ME and Taunton Weather Forecast Offices (WFOs) in Saco, ME and Scituate, MA are underway to inform coastal inundation and provide near street-level forecasts with the Northeast Coastal Ocean Forecast System (NECOFS). John Cannon of the WFO in Gray, ME worked with NERACOOS to develop a coastal erosion and splash over tool that combines model and buoy observations for forecasting damage potential (see attached flyer for more information). The Northeast Coastal Ocean Forecast System information is routinely made available to the region’s WFOs and is used to investigate new forecast products such as ship icing potential before transition to operations.

**Bob Thompson, NWS BOX**

**John Cannon, NWS Gray, ME**

In the Mid Atlantic, MARACOOS (Mid-Atlantic Regional Association Coastal Ocean Observing System). The National Weather Service (NWS) has had informal ties to products and services from MARACOOS members for over a decade, and more recently the IOOS concept of bringing together the government, academic, and private sectors to share resources, exchanges ideas, and tackling common research and operational goals has brought additional, more formal benefits to the NWS. Many Weather Service Forecast Offices including Taunton, MA, Upton, NY, Mt. Holly, NJ, Wakefield, VA, and Sterling, VA have had access to WeatherFlow coastal marine observations for several years. Other marine observations collected via academic institutions, such as the University of Connecticut (MySound) and Stevens Institute of Technology are accessed by NWS offices to aid in nowcasting operations. In addition to simple data access, NWS offices have teamed up with MARACOOS members on several projects. For example, NWS offices in Sterling and Wakefield, VA participated in a research and operations project focused on improved inundation forecasts for the Chesapeake Bay, called CIPS (Chesapeake Bay Inundation Prediction System). The three-year project used multiple inundation models in combination with NWS and WeatherFlow atmospheric models to successfully predict levels of flooding in tropical systems and Nor’easters. The system was run in a semi-operational mode during the Veteran’s Day storm in 2009 and yielded inundation estimates within inches of actual water levels from the storm.

**In the Southeast, SECOORA** (Southeast Coastal Ocean Observing Regional Association) member University of North Carolina Wilmington worked with regional NWS offices to develop the Marine Weather Portal (MWP) that consolidated marine information in a single, easily accessible site with the same look and feel across offices (see [http://forecast.weather.gov/mwp/](http://forecast.weather.gov/mwp/)). The project team is
now working with NWS to transition the portal to incorporate OpenLayers software in an effort to enhance the map based products available on the MWP.

Information collected and delivered through the SECOORA funded buoys aid NWS in making marine forecasts and determining when to issue Special Marine Advisories. For example, during March 2007, the network of buoys off the Cape Fear coast indicated the passage of a cold front much earlier than models predicted. As a result, the NWS was able to adjust the start time for a Small Craft Advisory that gave mariners extra time to prepare for the stronger winds in the wake of the front.

The NWS office at National Hurricane Center has been using wave information (significant wave height) from the WERA HF Radar maintained and operated with SECOORA funds at the University of Miami to help evaluate marine forecasts across the Florida Current.

A University of North Carolina at Chapel Hill graduate student with partial funding from SECOORA has been working on rip current forecasting on the Outer Banks with the Newport, NC WFO and the Ocean Rescue staff in Kill Devil Hills. The work included 2 summers of data collection along a 7 km stretch of beach and development of a forecast model using logistic regression. His dissertation includes a comparison of the new model with the existing NWS model and the new model shows a considerable improvement in forecast skill. The WFO is currently considering a test implementation and evaluation.

In the Gulf of Mexico, GCOOS (Gulf of Mexico Coastal Ocean Observing System) has worked with 8 local data providers to help them deliver their real-time data into the NDBC system, which puts their data out onto the GTS where it is available to NWS. Below are the non-federal local data nodes:

- Dauphin Island Sea Lab
- Louisiana State University/Wave-Current-Surge Information System for Coastal Louisiana
- Louisiana Universities Marine Consortium
- Mote Marine Laboratory
- Sanibel-Captiva Conservation Foundation
- Texas Automated Buoy System
- Texas Coastal Ocean Observation Network
- University of South Florida/Coastal Ocean Monitoring and Prediction System
In the Caribbean, Caribbean Regional Association for Coastal Ocean Observing (CaRA) has installed 4 coastal data buoys, and a coastal weather mesonet consisting of 12 meteorological stations (in collaboration with WeatherFlow, Inc.). The mesonet was designed in close consultation with the NWS San Juan WFO. The observations, particularly of wind speed and direction, provide unique coverage of the region by increasing the number of reliable high quality wind data stations with the new additions located at optimal sites for supporting coastal weather reporting and forecasting. The coastal data buoys provide unprecedented information on currents and waves plus full meteorology. CaRA also provides NWS-SJ-WFO with the technical support necessary for the implementation, validation and optimization of a high-resolution weather model (weather research forecasting model or “WRF”) and a high resolution wave model (SWAN: Simulating Waves Near Shore). WRF was originally implemented by CaRA in 2007 at the request of the WFO. In 2009, CaRA funded the implementation of the SWAN modeling, which has been validated through instrumental field observations. SWAN output is now regularly posted on the CaRA web pages. Coincidentally, NWS has recently requested their WFO to implement these same two (WRF & SWAN) high-resolution regional models and incorporate their output to the suite of data/simulations supporting their forecast. The CaRA modeling will be providing support for this effort as well as providing “backup” runs. Two former CaRA interns are now employed in the San Juan WFO where their expertise in ocean weather is particularly valuable. A memorandum of agreement between CaRA and the NWS is being negotiated in order to formalize these multiple collaborations.

In the Great Lakes, GLOS (Great Lakes Observing System) coastal buoys in Lake Superior and Lake Michigan are used by NWS to improve nearshore forecasting. The buoys provide data in faster report cycles than NDBC which is valuable because conditions along the coastline change very rapidly and are different than at the central lake positions of the NDBC buoys. This data is useful for a variety of applications, particularly public health and safety, because the Great Lakes is the primary source for drinking water in the region and several GLOS buoys are located near water intakes.

GLOS coastal buoys are playing a major role in NWS efforts for rip current forecasting. Specifically, directional wave spectra from the buoys will contribute to new predictive capability for a set of rip current experiments planned for summer 2012. This project is funded by the Michigan Department
of Environmental Quality (MDEQ) in cooperation with several NWS forecast offices in the region and NOAA/GLERL.

GLOS has also funded a project with NOAA-NWS, Northern Michigan University, Michigan Sea Grant, and the City of Marquette, MI to implement a Channel Current Monitoring and Alert System to respond to the need for improved monitoring of currents and communication of safety conditions at Marquette’s Picnic Rock beach where dangerous currents that have attributed to numerous drowning accidents in the area. Data collected from a current meter and profiler was used to develop a warning system that can be used to notify the Marquette Fire Department, City Offices, NOAA-NWS, and potentially the public in Marquette when swimming conditions are dangerous. This data is also used by NOAA-NWS to improve nearshore forecasts and will be the basis for development of new surf forecasts with the longer-term goal of developing surf warnings similar to the other weather warnings NWS provides.

In California, SCCOOS (Southern California Coastal Ocean Observing System) and CeNCOOS (Central and Northern California Ocean Observing System) are working with NWS on several projects. SCCOOS, in conjunction with its sister program CDIP (Coastal Data Information Program), operates a number of wave buoys along the coast as well as a wave model. Data from the wave buoys are being used for weather forecasts. For example, a wave buoy placed on the San Francisco Bar at the entrance of San Francisco Bay provides wave data for the NWS forecasts.

The wave model provides forecasts out to three days. SCCOOS sends automated messages to the NWS offices and city officials when the model predicts threshold levels are to be exceeded. For example, for the City of Encinitas, automated messages are sent to NWS and the City when the model predicts waves of 4.2 meters are likely to occur. Waves of this height over run Highway 101. This early notice provides managers with the time to prepare for such an event.

In Southern California, SCCOOS provides current and wave information is provided in the San Pedro Channel where coastal islands confuse waves. NWS is providing SCOOS with wind data to improve surface current forecasts.

CeNCOOS has worked with NWS on a number of data delivery products including:

- Integrating NWS data, at their request, in the CeNCOOS Data Portal, where you can visualize and download data: [http://204.115.180.244/CeNCOOS/DataPortal.html](http://204.115.180.244/CeNCOOS/DataPortal.html)
- Creating better visualizations and representations of NWS tide data: [http://www.cencoos.org/sections/conditions/tides.shtml](http://www.cencoos.org/sections/conditions/tides.shtml)

NWS and CENCOOS work together on a variety of collaborative projects as well.
• Supplying data and a cohesive message to emergency responders in the Monterey Bay area. The areas include the Pajaro River and the Carmel River where flooding and severe erosion can occur in certain storm events.
• Working as a team, along with other NOAA agencies, to create a cohesive message to the Americas Cup Race Management Team in San Francisco.
• Bringing science to the San Francisco Exploratorium planning and exhibits.

In the Northwest, NANOOS (Northwest Association of Networked Ocean Observing Systems), supports the work of NWS and benefits directly from its products.

NANOOS members and partners provide in-situ meteorological and oceanographic near-real-time observations to the National Data Buoy Center (NDBC) for direct use by NWS forecasting, in addition to a wide range of users. Data for the Columbia Estuary, Puget Sound and the Strait of Juan de Fuca, and the Oregon and Washington Shelves are provided by the following NANOOS RCOOS partners: the Center for Coastal Margin Observation and Prediction (CMOP), Oregon State University (OSU), the University of Washington (UW) and Intellicheck-Mobilisa (ICM).

The NANOOS Visualization System (NVS) provides integrated, consistent and user-friendly access to a comprehensive set of near-real-time observational and model data for the Pacific Northwest coastal and marine environments. Data from regional (as well as federal and Canadian) assets may be accessed via the online user interface, smartphone apps, or directly through simple web services. NVS provides an important service to government agencies and the public through its dissemination of NWS-NCEP NAM and WAVEWATCH III model forecasts in highly accessible forms, including map overlays, animations, and time series plots at the location of in-situ platforms that present live, integrated comparisons of observations and forecasts.

NANOOS members are also directly engaged with regional NWS offices in partnerships that support the NWS mission. CMOP provides these services:
• Daily forecasts of the water velocities at the mouth of the Columbia River are provided to the Portland WFO, who incorporates the information into their short wave forecasts for the Columbia River bar.
• Tidal forcings in the lower Columbia River estuary to the Northwest River Forecast Center (NWRFC) for use as a boundary conditions for NWS discharge and stage forecasts.
• The circulation forecasting model for the Columbia River are being transferred to NOS for evaluation and operational use. Once in operational use, these models will be run in NWS NCEP computers.

OSU has implemented the NWS WAVEWATCH III model at high resolution for the entire Oregon coast and southwest Washington coast, complementing NWS NCEP coarser resolution forecasts; model forecasts are made available through NVS.

The UW and NANOOS Data Management And Communications (DMAC) staff have been engaged with the NWS Seattle office to facilitate direct access to regional buoy data, including recently
deployed assets; extensive instructions have been provided for direct access to the NVS recent-data store via its simple web services. In addition, NANOOS is implementing a request from NWS Seattle to develop NVS “situational awareness” map visualizations of integrated weather and marine observations.

*In the Pacific, PacIOOS* (Pacific Islands Ocean Observing System) works very closely with the NWS in the Pacific through regular consultations with the local weather forecast offices (WFO) in the region for input on new observations and models the RA should develop to serve their operational capabilities. This interaction is at all levels within the NWS, from their regional lead (Jeff LaDouce) down to individual forecasters. NWS was offered a seat on the PacIOOS Governing Council, but deferred to NMFS for the time being as there is only 1 NOAA seat on our Council.

PacIOOS operates the WRF Hawaiian Region and the NWS uses it in their operational weather forecast. They also operate all of the wave buoys in the region which NWS uses for their marine forecast statements. Two new buoys (in Guam and CNMI) are going out in direct response to a NWS request for our assistance. In fact, the buoy in the Marshall Islands is migrating over to the local NWS office for maintenance and servicing.

The School of Ocean and Earth Science and Technology (SOEST), where PacIOOS is located, also houses the Hawaii WFO, and the Meteorology department regularly graduates students into NWS jobs, as forecasters, meteorologists, and technicians in all of the parts of the Pacific region.

Finally, PacIOOS is working with the NWS to integrate high water level and inundation forecasts (8 locations in the region) into the Coastal Flood Warning Tool within the NWS. They often don’t use it out here, but with the integration of IOOS data they might be able to release warnings and watches of slow, coastal flooding and wave inundation.
For more information
Contact Josie Quintrell, Director of NFRA, the National Federation of Regional Associations for Coastal and Ocean Observing at jquintrell@comcast.net, any of the Regional Associations or the IOOS Program Office.

IOOS Program Office
www.ioos.gov

AOOS Alaska Ocean Observing System
www.aoos.org

CaRA Caribbean Regional Association
www.cara.uprm.edu

CeNCOOS Central and Northern California Ocean Observing System
www.cencoos.org

GCOOS Gulf of Mexico Coastal Ocean Observing System
www.gcoos.tamu.edu

GLOS Great Lakes Observing System
www.glos.org

MARACOOS Mid-Atlantic Regional Association Coastal Ocean Observing System
www.maracoos.org

NANOOS Northwest Association of Networked Ocean Observing Systems
www.nanoos.org

PacIOOS Pacific Island Ocean Observing System
www.soest.hawaii.edu/pacioos

SCCOOS Southern California Coastal Ocean Observing System
www.sccoos.org

SECOORA Southeast Coastal Ocean Observing Regional Association
www.secoora.org