



# FY2013: U.S. Integrated Ocean Observing System (IOOS®) Development

U.S. IOOS is an operational system and a network of partners responsible for regional observations, data management, modeling and analysis, education and outreach, and research and development. The overarching purpose of U.S. IOOS is to address regional and national needs for ocean data and information. NOAA continued providing merit-based funding in 2013 to further development of U.S. IOOS, which included funding to the Alliance for Coastal Technologies for the activities outlined below.

## ALLIANCE FOR COASTAL TECHNOLOGIES (ACT)

ACT is a partnership of research institutions, resource managers, and private sector companies dedicated to fostering the development and adoption of effective and reliable sensors and platforms for use in coastal, freshwater and ocean environments. NOAA established ACT in 2001. NOAA continues to support ACT through the U.S. IOOS Program – to bring about fundamental changes to technology transitioning and adoption practices in coastal and ocean monitoring.



### NOAA Funding:

- FY 2013 - \$1,000,000
- FY 2012 - \$996,350
- FY 2011 - \$975,000
- FY 2010 - \$3,439,500
- FY 2009 - \$1,200,000
- FY 2008 - \$1,200,000
- FY 2007 - \$1,100,000



### Project Priorities:

The public and private sectors have an increasing demand for accurate and reliable environmental observations, which allow for a better basic science understanding, forecasting abilities, and informed management decisions. To meet this demand, the federal government: (1) has established operational systems and services, which provide the basis for production and dissemination of official assessments, predictions, and warnings, and (2) supports technology and systems development to improve operational observation capabilities, such as higher quality data through the introduction of new or enhanced environmental sensors. By fostering the development and adoption of effective and reliable instrumentation for coastal, freshwater and ocean science, monitoring, and long-term environmental stewardship, ACT is a critical link between these two national priorities.

ACT's goals are to: (a) rapidly and effectively transition emerging technologies to operational use; (b) maintain a dialogue among technology users, developers, and providers; (c) identify technology needs and novel tools and approaches to meet those needs; (d) document technology performance and potential; and (e) provide U.S. IOOS with information required for the deployment of reliable and effective networks.

ACT has made advancements in support of NOAA's efforts to validate and exploit new ocean observing approaches by serving as:

1. A third-party testbed for quantitatively evaluating the performance of new and existing coastal technologies, both in the laboratory and under diverse environmental conditions;
2. A forum for capacity-building through technology-specific workshops that review the current state of instrumentation, build consensus on identification of future trends, and enhance communications between users and developers; and;
3. An information clearinghouse, provided through a searchable, online database of environmental technologies and community discussion boards.

In FY2013, ACT will sustain its core technical functions while addressing instrumentation needs related to monitoring and understanding ocean acidification and its impacts on coastal waters. Funded activities include field testing of pH sensors, training and hand-on demonstrations for users of in situ pH sensors, and development of an ocean acidification monitoring strategy for the Chesapeake Bay in partnership with NOAA's Ocean Acidification Program, NOAA's Chesapeake Bay Office, and the Smithsonian Environmental Research Center.

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# FY2013: Regional Integrated Ocean Observing System (IOOS®) Development

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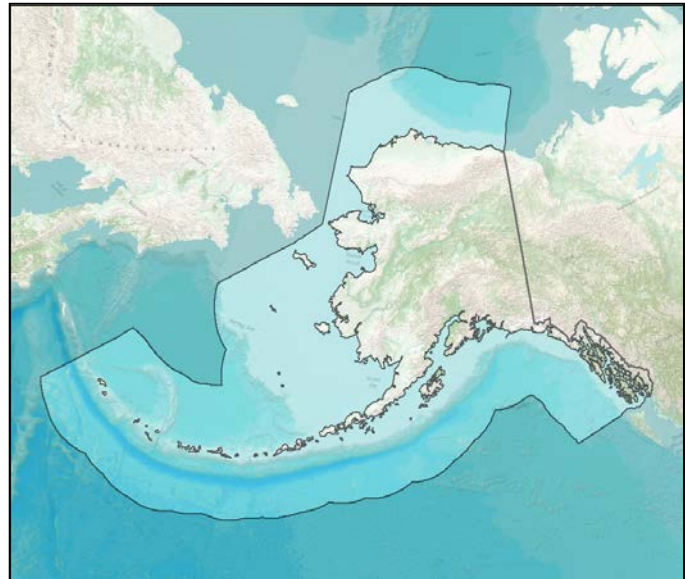
## ALASKA REGION

The Alaska Ocean Observing System (AOOS) is the regional association for the statewide coastal and ocean observing system and three regional observing systems (Gulf of Alaska, Bering Sea/Aleutian Islands, and Arctic) that are being developed for the Alaska region as part of U.S. IOOS. The mission of AOOS is to address regional and national needs for ocean information, gather specific data on key coastal and ocean variables, and ensure timely and sustained dissemination and availability of these data.

### NOAA Funding:

Prior to FY 2011, IOOS regional partners received two awards – one for development of the Regional Coastal Ocean Observing System (RCOOS), and one for planning and stakeholder engagement by a Regional Association (RA). Starting in FY 2011, IOOS made a single award to each region for management of these activities. Funds awarded by NOAA since establishment of the U.S. IOOS Program Office are as follows:

FY 2013 - \$2,180,037  
FY 2012 - \$2,014,766  
FY 2011 - \$1,775,000  
FY 2010 - \$1,400,000 RCOOS, \$399,985 RA  
FY 2009 - \$1,000,000 RCOOS, \$399,969 RA  
FY 2008 - \$1,000,000 RCOOS, \$399,976 RA



### Regional Priorities:

AOOS works to support marine commerce; navigation safety; weather, climate, and marine forecasting; energy siting and production; economic development; ecosystem-based marine and coastal resource management; public safety; and public outreach training and education in the region.

Based on stakeholder input, AOOS priorities include:

1. Increasing access to existing coastal and ocean data;
2. Packaging information and data in useful ways to meet the needs of stakeholders; and

3. Increasing observing and forecasting capacity in all regions of the state, with a priority on the Arctic and the northern Gulf of Alaska.

Activities that AOOS will undertake in FY 2013 include:

- Providing funding to maintain the most critical SnoTel stations in Prince William Sound and Cook Inlet providing real-time web accessible data
- Partnering with the Marine Exchange of Alaska to equip two Automatic Identification System transmitters to disseminate real-time weather data, buoy data, and weather forecasts to vessels
- Increasing public access to real-time data through user-friendly tools, including a real-time sensor map, web cam maps, and smart phone applications using emerging communications technologies
- Continuing to monitor development of the Alaska Harbor Observation Network pilot projects in Seward and Kodiak
- Maintaining the WaveRider buoy installed in Cook Inlet as part of implementing the IOOS National Operational Waves Observation Plan in Alaska
- Partnering with the Alaska Center for Climate Assessment and Policy to produce an atlas consisting of digitally stored sea ice concentration data covering all Alaska coastal waters to a distance of approximately 300 nautical miles from shore
- Partnering with others to maintain long time series:
  - Sampling along the Seward Line, the longest multidisciplinary time series in Alaska
  - Observing the through-flow of water between the northern Bering Sea and the interior Arctic
  - Ocean acidification sampling in the northern Gulf of Alaska, Chukchi Sea, and Bering Sea
  - Sentinel monitoring in Prince William Sound and Cook Inlet
- Funding mooring turnovers for biological monitoring by the Ocean Tracking Network and Pacific Ocean Shelf Tracking network
- Developing data integration and visualization tools for the Arctic in anticipation of potential commercial fishery development
- Ingesting prioritized datasets, warehouse, archive and provide access through query and mapping tools
- Partnering with the Alaska Department of Fish and Game Division of Commercial Fisheries to establish a data-serving node feeding into the AOOS system
- Expanding the AOOS Model Explorer
- Supporting Operations & Maintenance costs for High Frequency radar sites along the Chukchi Sea
- Collaborating to support a glider line in the Chukchi Sea, taking oceanographic measurements
- Collaborating to support the Distributed Biological Observatory (DBO) sampling in the Chukchi Sea
- Supporting the development of an ocean acidification forecast model for the Gulf of Alaska

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**U.S. IOOS Program Office Contact:**

Dave Easter, Regional Coordinator ([Dave.Easter@noaa.gov](mailto:Dave.Easter@noaa.gov))



# FY2013: Regional Integrated Ocean Observing System (IOOS<sup>®</sup>) Development

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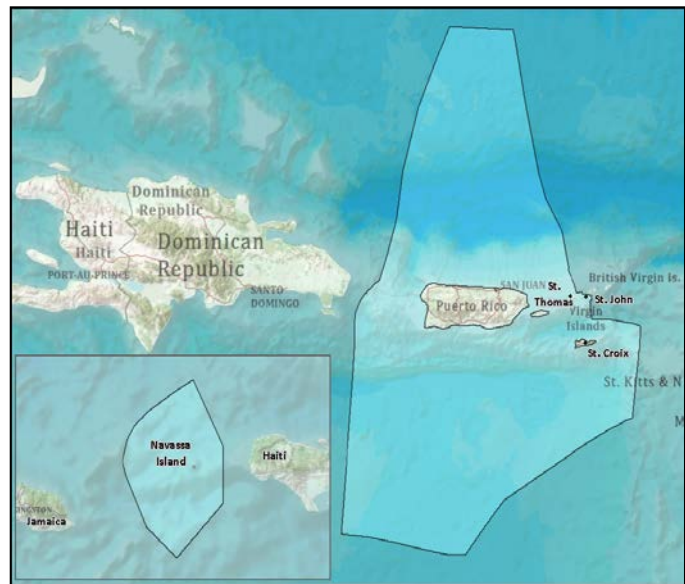
## CARIBBEAN REGION

The Caribbean Regional Association (CaRA) is the regional association driving the implementation of the Caribbean Coastal Ocean Observing System (CariCOOS) for Puerto Rico and the U.S. Virgin Islands. CariCOOS is focused on meeting identified stakeholder needs for improved real time data products and forecasts of coastal weather (winds, waves and currents), water quality and hurricane-driven inundation for the U.S. Caribbean Exclusive Economic Zone (EEZ).

### NOAA Funding:

Prior to FY 2011, IOOS regional partners received two awards – one for development of the Regional Coastal Ocean Observing System (RCOOS), and one for planning and stakeholder engagement by a Regional Association (RA). Starting in FY 2011, IOOS has made a single award to each region for management of these activities. Funds awarded by NOAA since establishment of the U.S. IOOS Program Office are as follows:

FY 2013 - \$1,644,149  
FY 2012 - \$1,409,730  
FY 2011 - \$1,347,000  
FY 2010 - \$1,000,000 RCOOS, \$399,824 RA  
FY 2009 - \$527,016 RCOOS, \$399,826 RA  
FY 2008 - \$499,999 RCOOS, \$399,699 RA



### Regional Priorities:

CaRA has engaged stakeholders from the marine tourism and recreation, maritime transportation, security, and human and ecosystem health and management sectors, who require coastal seas and weather information for their decision-making. To meet both stakeholder needs and national program requirements, CariCOOS is focused on the following activities:

- Enhancement or installation of essential in situ (in the water) observational assets
- Operational implementation of modeling tools
- Partnering with NOAA and other entities to produce regionally-focused water quality products

- Ensuring IOOS-compliant data processing and archiving
- Disseminating data and products to agencies and stakeholders to ensure a user-responsive, operational regional observing system
- Continued stakeholder engagement towards identification of data needs, enhancing awareness of CariCOOS products and training in their use and interpretation

Activities that CariCOOS will undertake in FY 2013 include, among other things:

- Operational implementation of numerical inshore high resolution wind, wave and circulation models for critical coastal sites and integration with direct observations into user-focused products (harbor operations support product, beach and surf-zone warning system)
- Sustained operation and maintenance of all observational assets (CariCOOS Data Buoy network, high frequency radars in the Mona Passage, and coastal weather [MESONET](#)) and regional model implementations, and sustained dissemination of data streams and data products
- Water quality product development, monitoring and dissemination (remotely sensed turbidity and suspended sediments and microbial beach contamination)
- Updating regional storm surge inundation atlas with revised bathymetry and computational meshes
- Bi-weekly sampling at, and annual refurbishing of, NOAA's Ocean Acidification Program MAPCO2 buoy at La Parguera

CariCOOS will also receive supplemental funds from NOAA's Coral Reef Conservation Program to continue providing support for hydrodynamic modeling in the Northeast Corridor Reserve.

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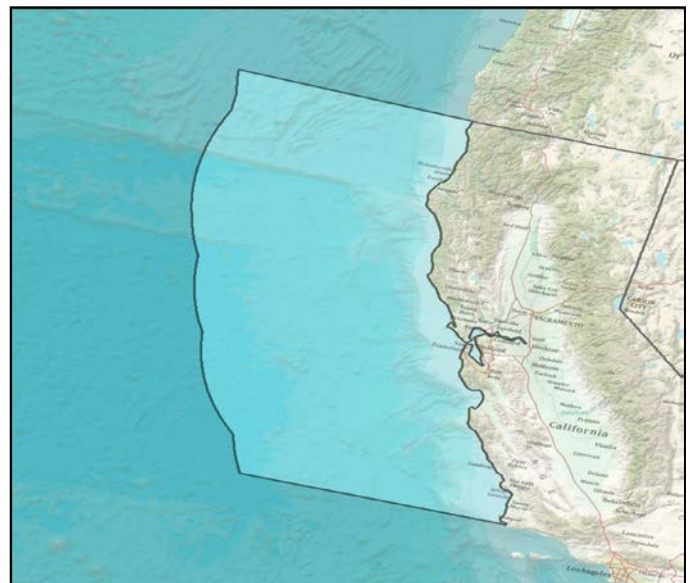
## CENTRAL & NORTHERN CALIFORNIA REGION

The Central and Northern California Ocean Observing System (CeNCOOS) spans the coastal ocean from the California/Oregon border south to Point Conception, CA. The CeNCOOS approach is to develop long-term monitoring and prediction of water quality, surface currents, and other oceanographic conditions in support of natural resource management, marine operations, coastal hazard mitigation and response, and climate change planning in central and northern California.

### NOAA Funding:

Prior to FY 2011, IOOS regional partners received two awards – one for development of the Regional Coastal Ocean Observing System (RCOOS), and one for planning and stakeholder engagement by a Regional Association (RA). Starting in FY 2011, IOOS made a single multi-year award to each region for management of these activities. Funds awarded by NOAA since establishment of the U.S. IOOS Program Office are as follows:

FY 2013 - \$2,323,054  
FY 2012 - \$2,089,916  
FY 2011 - \$1,739,000  
FY 2010 - \$1,402,000 RCOOS, \$399,619 RA  
FY 2009 - \$1,281,529 RCOOS, \$397,308 RA  
FY 2008 - \$1,000,000 RCOOS, \$395,763 RA



### Regional Priorities:

For the period 2011-2016, CeNCOOS has established a multi-purpose observational scheme to collectively address user needs in the general categories of climate and ecosystem health, water quality, marine operations, and coastal hazards. A sampling of CeNCOOS products to address these issues includes:

- Long-time series of temperature and coastal sea level data to address global warming and sea level rise
- Sustained observations of carbon variables (e.g. pH) to monitor ocean acidification
- Observations to monitor and help predict the occurrence of harmful algal blooms (HABs)
- Real-time measurements and model forecasts of surface currents for search and rescue and tracking of spills
- Water quality data to support mariculture operations

- Real-time measured and modeled winds for marine recreation and other uses

The core observation suite used to address these issues includes automated water quality shore stations, coastal buoys, the High Frequency (HF) radar surface current mapping network, and autonomous profiling gliders. The data from these systems are collected and distributed in near real-time by the CeNCOOS Data Management and Communications (DMAC) system. Atmospheric and ocean models produce estimates of present and future conditions in and over the ocean in the CeNCOOS region.

The CeNCOOS work plan for 2013 will focus on the following activities:

- Maintain automated coastal shore stations and one near-shore mooring for: water quality, long term trends in temperature, salinity, sea level, chlorophyll fluorescence, ocean acidification and HABs monitoring and forecasting.
- Operate a cross-shore glider transect on a 24/7 basis to monitor temperature, salinity, chlorophyll fluorescence, dissolved oxygen, currents, and acoustic properties. These data will be used to track El Niño events and climate change, and to feed ocean observations into ocean circulation models. Short-term glider deployments to support instrument development will also be made.
- Maintain and operate the HF radar surface current mapping network used to support search and rescue, marine operations, oil spill response, and ecosystem forecasting.
- Operate an atmospheric model covering the CeNCOOS region, and both state-wide and west coast-wide numerical ocean models to forecast currents, oceanographic variables, and eventually ecosystem variables.
- Enhance the DMAC system to facilitate easy data access and use by researchers, modelers, product developers, managers, and the general public. Expand the DMAC system to integrate other data types together with fixed point time series.
- Implement a tool for users to access high-resolution bathymetric data for just their area of interest from California's Seafloor Mapping Project.
- Work with the Tagging of Pacific Predators (TOPP) program and the national IOOS office to establish a portal for broad access to and use of satellite animal telemetry data as part of the larger U.S. IOOS strategy to establish a national Animal Telemetry Network.

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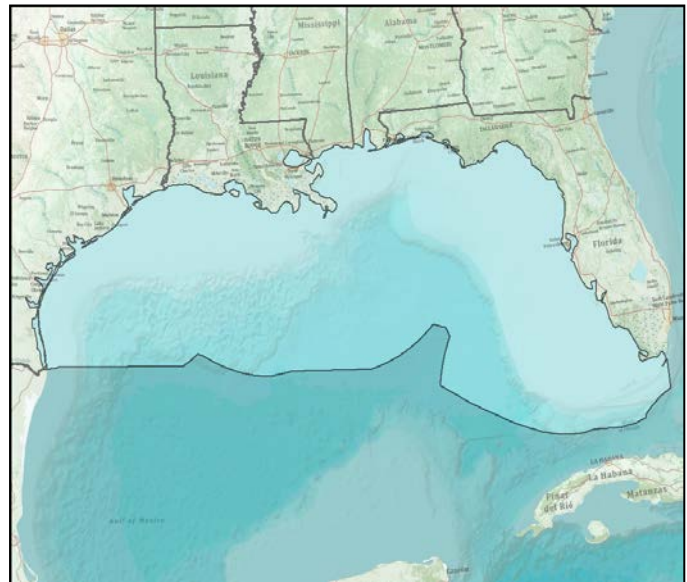
## GULF OF MEXICO REGION

The Gulf of Mexico Coastal Ocean Observing System Regional Association (GCOOS-RA), established in January 2005, is building a sustained, integrated, operational observing system through a partnership of many organizations—from federal, state, and local governments to industry to non-governmental organizations to academia to educators—to provide data, information, and products on the marine, coastal, and estuarine systems of the Gulf of Mexico to a wide range of users. The region covers the entire U.S. Gulf of Mexico, extending from the Florida Keys westward to the southern tip of Texas and encompassing over 17,000 miles of tidal shoreline in five U.S. states—Texas, Louisiana, Mississippi, Alabama, and Florida. It includes the coastal zone that extends inland to the end of tidal effects in estuaries, bays, and rivers, and offshore to the boundaries of the U.S. Exclusive Economic Zone (EEZ) of the Gulf of Mexico.

### NOAA Funding:

Prior to FY 2011, IOOS regional partners received two awards – including separate funding for development of the Regional Coastal Ocean Observing System (RCOOS) and for planning and stakeholder engagement by a Regional Association (RA). Starting in FY 2011, IOOS made a single award to each region for management of these activities. Funds awarded by NOAA since establishment of the U.S. IOOS Program Office are as follows:

FY 2013 - \$1,534,234  
FY 2012 - \$1,440,586  
FY 2011 - \$1,400,000  
FY 2010 - \$1,000,000 RCOOS, \$399,960 RA  
FY 2009 - \$573,085 RCOOS, \$399,998 RA  
FY 2008 - \$573,085 RCOOS, \$399,986 RA



### Regional Priorities:

The Gulf of Mexico region provides our Nation with many valuable resources: energy from oil, gas, wind and waves; abundant fish and shellfish resources; major transportation waterways and ports; beautiful beaches and extraordinary recreational activities; vibrant coastal communities; and a complex and diverse ecosystem with many unique habitats

supporting a rich array of sea life. It has endured both natural and manmade catastrophes, including Hurricane Katrina in 2005 and the Deepwater Horizon Macondo well blowout in 2010. Being a region of vital economic importance to our nation, a thriving Gulf Coast economy is critical for humans. However, if urban development and human growth and activities are not balanced by excellent environmental stewardship, the health of ecosystems, the quality of the water, and the effectiveness of the natural ecosystem functions will be compromised.

To empower people, communities, and businesses to improve decision making about their lives, work, and play along the Nation's Gulf Coast requires access to science-based information, including biological, chemical, physical, and geological data. It also requires tools to generate forecasts, graphics and products to inform the impacted stakeholder community. The GCOOS-RA worked over the past decade to identify the needs of the stakeholders for data, information, and products about the Gulf of Mexico, its resources, and its ecosystem. These results were used to identify the key elements to make up the observing system, the GCOOS. Ranging from vulnerability of community infrastructure to risks to life, property, and ecosystems, the major societal priorities of the GCOOS-RA are:

- Safe and Efficient Marine Operations,
- Mitigation of Effects of Coastal Hazards,
- Public Health and Safety, and
- Healthy Ecosystems and Water Quality

All include impacts from *Climate Change* as sea level rises and land subsides in the Gulf. The GCOOS is being developed to integrate the measurements already being made by the GCOOS-RA partners, to identify and fill gaps in observations where necessary to meet regional, as well as national, requirements, and to serve freely shared and easily accessed data, information, and products needed by Gulf communities and our Nation's people.

The efforts of the GCOOS-RA have had two major results. First is a growing partnership of interests in the Gulf of Mexico that focuses on jointly meeting regional challenges to the benefit of all. Second is the development of the GCOOS Data Portal that integrates resources to improve decision-making by partners and the public. For FY 2013, the GCOOS-RA will work to:

- Maintain RA governance and stakeholder engagement, including interactions with IOOS partners, the Gulf of Mexico Alliance, and the Mexico/U.S. Gulf of Mexico Large Marine Ecosystem project;
- Maintain data management and data/products portal capability;
- Maintain outreach and education capability;
- Maintain the flow of real-time data, currently being provided by non-Federal entities (local data nodes) into the IOOS data stream;
- Add new, non-Federal real-time data providers willing to provide their data and provide support to help them meet IOOS standards;
- Provide support for key regional real-time observation systems, including the High-Frequency radar network, Harmful Algal Bloom Integrated Observing System, and Hypoxia Monitoring System;
- Develop ecosystem modeling project on nutrients to support marine resource decision-makers
- Support to maintain the capability of three satellite processing centers to serve their products in an IOOS DMAC-compliant way.

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## GREAT LAKES REGION

The Great Lakes Observing System (GLOS) provides coverage for the coastal zone within the states of New York, Pennsylvania, Ohio, Indiana, Illinois, Wisconsin, Minnesota, and Michigan, bordering on the Great Lakes and St. Lawrence River.

### NOAA Funding:

Prior to FY 2011, IOOS regional partners received two awards – one for development of the Regional Coastal Ocean Observing System (RCOOS), and one for planning and stakeholder engagement by a Regional Association (RA). Starting in FY 2011, IOOS made a single award to each region for management of these activities. Funds awarded by NOAA since establishment of the U.S. IOOS Program Office are as follows:

FY 2013 - \$1,602,848

FY 2012 - \$1,726,000

FY 2011 - \$1,400,000

FY 2010 - \$1,080,815 RCOOS, \$400,000 RA

*(In FY 2010, the Environmental Protection Agency provided a total of \$3,000,000 for GLOS observing and modeling activities in support of the Great Lakes Restoration Initiative. Of this total, \$730,815 was included in the RCOOS award.)*

FY 2009 - \$350,000 RCOOS, \$400,000 RA

FY 2008 - \$350,000 RCOOS, \$400,000 RA



### Regional Priorities:

The only freshwater region of IOOS, the Great Lakes is home to more than 40 million U.S. and Canadian citizens, many tribal groups, eight states and two provinces. The region's coastline totals nearly 11,000 miles, and the Great Lakes and their connecting channels form the largest fresh surface water system on Earth, holding nine-tenths of the U.S. fresh surface water supply. GLOS was formed to coordinate the regional observing network that plays a critical role in the management of these valuable resources.

In addition to addressing issues similar to other IOOS regions (e.g., spill response, search and rescue, beach quality, and beach hazards such as rip and channel currents), GLOS is also positioned to address unique regional issues resulting from its freshwater composition and geography. These issues include source water protection; providing baseline data to managers of Great Lakes Areas of Concern (AOCs) and Lakewide Management Plans (LaMPs); identifying, collecting and integrating key fishery and associated environmental (physical, chemical and biological) observations to support state and provincial fishery managers; understanding the impacts of climate change upon net basin water supplies; assisting municipal/regional planners in adapting to climate change; and prioritizing maintenance funds for key port and harbor infrastructure.

In 2013 GLOS will continue:

- Deployment and operation of observing system platforms, including buoys, autonomous underwater vehicles, gliders, and vessels of opportunity across all five Great Lakes;
- Working with NOAA's Coastal Storms Program to coordinate, in partnership with NWS, the purchase and deployment of at least one buoy in the Great Lakes during the 2014-2015 recreation seasons;
- Program management and partner coordination, including participation in Canadian-American Group on Earth Observations Great Lakes Testbed activities and the development of a regional Adaptive Management process;
- Data Management and Communication activities, to include identifying baseline information for measuring progress, continuing integration of existing priority data sets, and identifying priority opportunities for data standards, quality management system, and protocol development;
- Expanding the development of data management and decision support tools consistent with the recommendations of the 2011 GLOS Enterprise Architecture Design Report;
- Refining and enhancing existing tools as needed and identifying emerging opportunities for model and tool development;
- Serving as secretariat and facilitator of the Lake Michigan Ecosystem Modeling and Forecasting Modeling Framework Working Group;
- Growing the content of the Great Lakes Model Inventory;
- Outreach and education efforts including identifying priority targets for GLOS membership, evaluation of existing tools, and sustaining promotion and engagement activities;
- Working with the Great Lakes Sea Grant Network and a competitively selected contractor to convene municipal/regional planners and other infrastructure planners to provide input to DMAC, observations, tools and modeling sub-systems based on an initial evaluation of existing needs assessment activities relative to climate change; and
- Supporting Michigan Sea Grant to coordinate efforts among project partners in the region to promote the use/awareness of the *Teaching with Great Lakes Data* website that includes Great Lakes data, lessons and information about monitoring systems.

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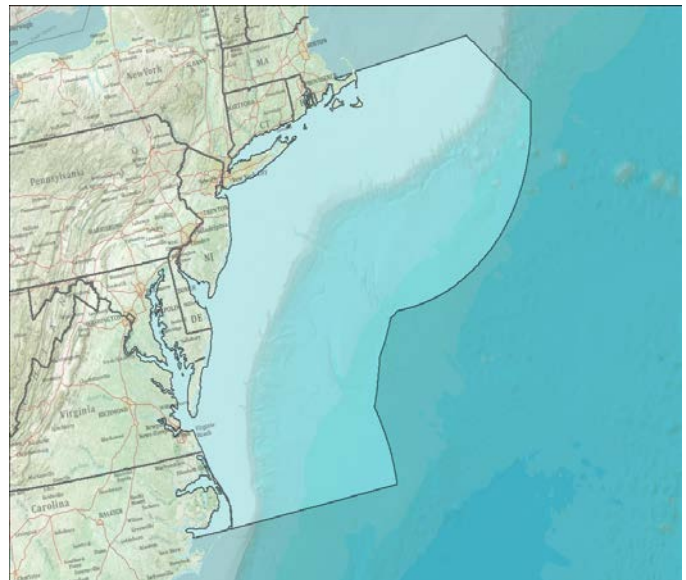
## MID-ATLANTIC REGION

The Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS) extends 1,000 km alongshore from Cape Cod to Cape Hatteras. It comprises ten states, five major urban ports and estuaries, and a wide continental shelf cut by multiple deep shelf-break canyons. The region supports one quarter of the U.S. population, one quarter of U.S. Maritime commerce, and both commercial and recreational fisheries. A century of industrialization and a growing coastal population impact water quality. Damage from tropical storms and nor'easters are year-round threats. Climatic-scale warming trends are altering fish and shellfish habitats. Population density, reliable winds and shallow coastal zones combine to support the nation's first offshore wind development projects in response to the nation's most congested electrical power grid.

### NOAA Funding:

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- FY 2013 - \$3,030,848
- FY 2012 - \$2,456,472
- FY 2011 - \$2,070,000
- FY 2010 - \$1,700,000 RCOOS, \$400,000 RA
- FY 2009 - \$1,700,000 RCOOS, \$400,000 RA
- FY 2008 - \$1,700,000 RCOOS, \$400,000 RA
- FY 2007 - \$1,700,000 RCOOS, \$400,000 RA



### Regional Priorities:

MARACOOS seeks to discover and apply new knowledge and understanding of our coastal ocean to help save lives and livelihoods, and maintain the quality of life in the Mid-Atlantic Region. To accomplish this, MARACOOS membership has identified five high-priority regional themes: Maritime Safety, Ecological Decision Support, Water Quality, Coastal Inundation, and Energy.

A fundamental MARACOOS asset is the diverse expertise of its approximately 1/3 academic, 1/3 industry, and 1/3 non-profit/government membership. MARACOOS has developed a collaborative network of scientific, business, non-profit and government leaders who are dedicated to applying their combined expertise to address priority regional needs. Multiple federal agencies have recognized the combination of expertise, operational capabilities, and opportunities in the Mid-Atlantic with their investments in this region including NOAA, Department of Defense, National Science Foundation, Department of Homeland Security (including U.S. Coast Guard), NASA, and the Environmental Protection Agency.

To address the primary regional themes, the MARACOOS implementation plan first prioritized and then established six primary real-time observing and forecasting assets:

- An array of High-Frequency (HF) Surface Current Radars covering the entire Mid-Atlantic Bight (MAB),
- A fleet of underwater gliders able to adaptively sample the entire MAB,
- A network of hardened meteorological stations distributed throughout the MAB,
- Five satellite ground stations acquiring imagery of the ocean, atmosphere and land,
- Coast Guard drifters used for SAR operations and to evaluate the skill of the forecasting systems, and
- An ensemble of both statistical and dynamical ocean forecast models that (a) assimilate spatial data from the satellites, the HF Radar network, and the fleet of autonomous ocean gliders, and (b) are forced by an ensemble of atmospheric models validated with the meteorological network.

Initial MARACOOS successes have already been demonstrated and communicated. Regional HF Radar-derived surface current data, and the resulting short-term statistical forecasts, are now an operational component of the Coast Guard's Search and Rescue Optimal Planning System (SAROPS) and through MARACOOS, are helping to save lives at sea. Collaboration with NOAA Fisheries has developed observatory based habitat models for critical species distributed throughout the MAB. Water quality efforts have demonstrated new products for floatables (oil, trash) and rainwater, and have developed regional plans for dissolved oxygen. Coastal inundation demonstration projects have been conducted in the region's bays. State support has enhanced regional activities to inform offshore wind energy development.

The 5-year future vision for MARACOOS includes sustained operations of the regional network consisting of the Observing, Data Management, and Modeling & Analysis Subsystems, and expanding the Education & Outreach Subsystem activities to include extension to new users. Specifically, MARACOOS is focusing on two primary goals:

1. Maintain and gap-fill the existing observing, data management and forecasting subsystems focused on the transition from data-generated products to model-generated ensemble forecast products that can be repurposed for multiple users.
2. Expand end-to-end operations across all five regional themes through: (a) broadening IOOS support and leveraging of non-IOOS activities, (b) enhancing the extension components of MARACOOS, and (c) developing and applying IOOS-endorsed metrics to measure and demonstrate success.

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#### **U.S. IOOS Program Office Contact:**

Gabrielle Canonico, Regional Coordinator ([Gabrielle.Canonico@noaa.gov](mailto:Gabrielle.Canonico@noaa.gov))



# FY2013: Regional Integrated Ocean Observing System (IOOS<sup>®</sup>) Development

U.S. IOOS is an operational system and a network of regional partners responsible for regional observations, data management, modeling and analysis, education and outreach, and research and development. The overarching purpose of U.S. IOOS is to address regional and national needs for ocean data and information. NOAA continued to provide merit-based funding in 2013 to further develop the IOOS regional network. IOOS regional partners provide coordination with regional stakeholders while contributing data and other outputs to the national system – supporting regional priorities while advancing national objectives.

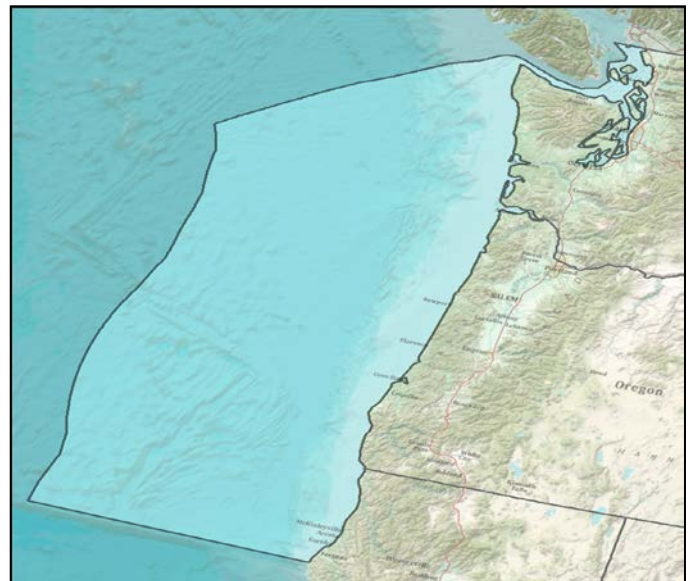
## PACIFIC NORTHWEST REGION

The Northwest Association of Networked Ocean Observing Systems (NANOOS) provides coverage for the Pacific Northwest (PNW), primarily Washington and Oregon. NANOOS has strong ties with other west coast observing systems, particularly the Alaska Ocean Observing System (AOOS), the Central and Northern California Ocean Observing System (CeNCOOS), the Southern California Coastal Ocean Observing System, and observing programs in British Columbia (e.g., the Victoria Experimental Network Under the Sea, or VENUS) through common purpose and the occasional overlap of data and products.

### NOAA Funding:

Prior to FY 2011, IOOS regional partners received two awards – one for development of the Regional Coastal Ocean Observing System (RCOOS), and one for planning and stakeholder engagement by a Regional Association (RA). Starting in FY 2011, IOOS made a single multi-year award to each region for management of these activities. Funds awarded by NOAA since establishment of the U.S. IOOS Program Office are as follows:

FY 2013 - \$3,089,477  
FY 2012 - \$2,428,291  
FY 2011 - \$2,070,000  
FY 2010 - \$1,700,000 RCOOS, \$400,000 RA.  
FY 2009 - \$1,500,000 RCOOS, \$400,000 RA  
FY 2008 - \$1,500,000 RCOOS, \$400,000 RA  
FY 2007 - \$1,500,000 RCOOS, \$400,000 RA



### Regional Priorities:

NANOOS is a partnership of more than 40 entities, including industry, state agencies, local governments, tribes, non-government organizations, and educational institutions. Established in 2003, NANOOS has used results of nearly three years of NOAA-funded planning efforts and ongoing regional contributions to build partnerships in the Pacific Northwest (PNW) and to identify high priority user needs and requirements.



To progress on the NANOOS regional priorities of maritime operations, fisheries, ecosystem impacts, climate, and coastal hazards, this project will continue to develop the essential subcomponents of the Pacific Northwest RCOOS: observing systems, modeling and products, data management and communications (DMAC), and education and outreach. The work will be applied in four observational domains: coastal ocean shelf, coastal ocean surface currents, estuaries, and shorelines.

NANOOS key activities for the FY13 project period are:

- Maintain surface current and wave mapping capability providing a portion of the critical national capacity.
- Sustain existing buoys and gliders in the Pacific Northwest (PNW) coastal ocean, in coordination with national programs. Maintain these essential assets providing regional observations, with focus on hypoxia, harmful algal blooms (HABs), ocean acidification (OA), climate change detection, and modeling input.
- Maintain observation capabilities in PNW estuaries, in coordination with local and regional programs to aid sustainable resource management, water quality assessment and sub-regional climate change evaluation.
- Maintain core elements of beach and shoreline observing programs and contribute to hazard mitigation by providing essential observations and better decision support tools for coastal managers, planners and engineers.
- Maintain NANOOS' Data Management and Communications (DMAC) system for routine operational distribution of data and information, including the NANOOS Visualization System (NVS) which provides dynamic and distributed data access and visualization for IOOS.
- Contribute to the operation of a community of complementary numerical PNW regional models, and the tools and products they support.
- Deliver existing user-defined products and services for PNW stakeholders.
- Foster ocean literacy and facilitate use of NANOOS products for IOOS objectives, the core task for which the entire NANOOS RCOOS is constructed, via existing approaches for engaging users.
- Support NOAA's Ocean Acidification Program by providing observational data from the La Push, Washington mooring.
- Provide technical support to U.S. IOOS' efforts with Microsoft and the European Environmental Agency to provide U.S. IOOS data and information to the Eye on Earth Application.

NANOOS places a priority on sustaining the leveraged coastal observations that it has integrated and on developing the most informative and useful products for regional users, as advised by its Governing Council and its active Standing Committees (DMAC, User Products, Education & Outreach) that prioritize work efforts.

In late 2009, NANOOS launched its online system-wide data viewing and access tool, known as the NANOOS Visualization System (NVS). NVS, available at <http://www.nanoos.org/nvs>, allows easy access to ocean observing data in the Pacific Northwest. NVS gathers data across a wide range of sources (federal and non-federal) including buoys, shore and land-based stations throughout the NANOOS region. NVS is continually being improved and refined as new data streams are brought in and as the NVS development team receives feedback from users. Today's NVS 2.6 includes features such as places, markers, a tsunami evacuation zones product, access to surface currents from high frequency radars, temperature and ocean color from satellites. Users can also find data from research cruises and forecast information on water levels and waves for many locations.

NANOOS developed a wide variety of user products and educational materials centered on its regional priorities. Examples include forecast information products developed for commercial and recreational albacore tuna fishers, real-time water quality information optimized for shellfish growers, blended tide, current, weather conditions forecasts for mariners, and on-line "theme pages" for issues of regional interest, such as ocean acidification and

hypoxia, with direct links to data, educational content, and regional activities. A variety of lesson plans, some using real-time data, and learning resources are available and being used and evaluated by teachers at various levels.

**Regional Contact Information:**

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Jenifer Rhoades, Regional Coordinator ([Jenifer.Rhoades@noaa.gov](mailto:Jenifer.Rhoades@noaa.gov))



# FY2013: Regional Integrated Ocean Observing System (IOOS®) Development

U.S. IOOS is an operational system and a network of regional partners responsible for regional observations, data management, modeling and analysis, education and outreach, and research and development. The overarching purpose of U.S. IOOS is to address regional and national needs for ocean data and information. NOAA continued to provide merit-based funding in 2013 to further develop the IOOS regional network. IOOS regional partners provide coordination with regional stakeholders while contributing data and other outputs to the national system – supporting regional priorities while advancing national objectives.

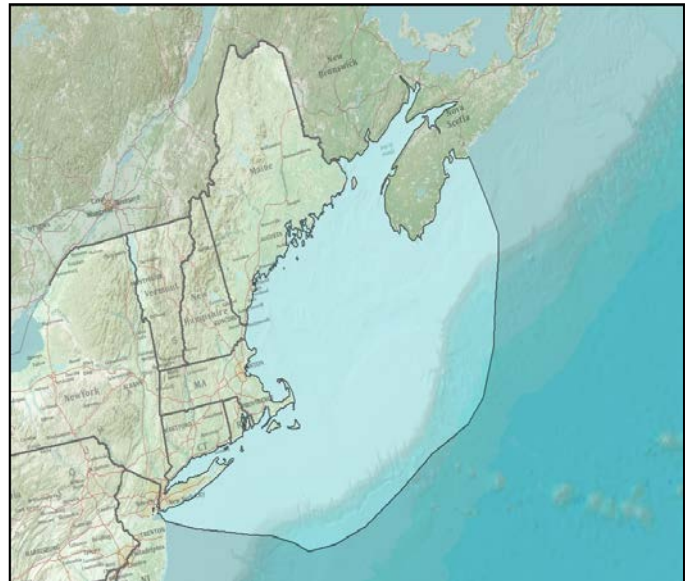
## NORTHEAST ATLANTIC REGION

The Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS) spans coastal waters from the Canadian Maritime Provinces to the New York Bight. NERACOOS provides weather and ocean data to fishers and commercial vessel operators for use in determining if conditions are safe for passage and to emergency managers issuing storm warnings. NERACOOS is also advancing efforts to use these data for water quality and ocean acidification monitoring, harmful algal bloom predictions and warnings, and coastal flooding and erosion forecasting systems.

### NOAA Funding:

Prior to FY 2011, IOOS regional partners received two awards – one for development of the Regional Coastal Ocean Observing System (RCOOS), and one for planning and stakeholder engagement by a Regional Association (RA). Starting in FY 2011, IOOS made a single award to each region for management of these activities. Funds awarded by NOAA since establishment of the U.S. IOOS Program Office are as follows:

- FY 2013 - \$2,444,161
- FY 2012 - \$2,080,618
- FY 2011 - \$1,770,000
- FY 2010 - \$1,400,000 RCOOS (plus \$49,000 for High Frequency Radar support); \$400,000 RA.
- FY 2009 - \$1,324,787 RCOOS, \$400,000 RA
- FY 2008 - \$1,200,000 RCOOS, \$400,000 RA
- FY 2007 - \$1,200,000 RCOOS, \$400,000 RA



### Regional Priorities:

The Northeast region is geographically complex, with five states and two Canadian provinces, coastal waters and watersheds of the Scotian Shelf, Gulf of Maine, Southern New England Bight, and Long Island Sound. Regional user requirements identified inundation, harmful algal blooms, water quality, and living marine resources as specific concerns in the Northeastern Region.

In 2013, NERACOOS will continue the improvement and integration of the coastal ocean observing system through close collaboration with regional organizations, especially the Northeast Regional Ocean Council (NROC). The NROC is a state-federal partnership that provides a forum for tackling and prioritizing regional scale problems. This collaboration helps to ensure that NERACOOS directly addresses pressing regional scale issues of societal benefit. To that end, NERACOOS adopted four NROC priority theme areas and formalized the collaboration with a Memorandum of Understanding. NERACOOS and NROC merged committees and working groups in 2012 to form joint committees for Ocean and Coastal Ecosystem Health and Coastal Hazards Resiliency. In addition, NERACOOS will advance regional ocean planning and enable the ocean data portal to be incorporated into regulatory and management decisions by directly supporting activities of the Northeast Regional Planning Body under the National Ocean Policy.

In FY13 NERACOOS, in close coordination with these regional bodies, will continue activities in support of the following themes:

- **Maritime Operations** – NERACOOS will provide real-time observations and forecasts directly for maritime operational safety, inform US and Canadian Coast Guard Search and Rescue Operations, and introduce new and enhance existing weather forecast products.
- **Ocean and Coastal Ecosystem Health** – NERACOOS will expand harmful algal bloom forecasting, facilitate the development of a regional sentinel monitoring program to monitor climate and ecosystem variability, monitor ocean acidification and support the development of an ocean acidification monitoring network, enhance integration of water quality information, and enable ecosystem based fisheries management and marine spatial planning.
- **Ocean Energy Planning and Management** – NERACOOS will provide the necessary oceanographic information to facilitate the renewable energy sector to support a regional approach to facilities siting.
- **Coastal Hazards Resiliency** – NERACOOS will enhance and evaluate street-level inundation forecasting, expand forecasts for coastal flooding and erosion, and support emergency spill response.

With funding from the U.S. IOOS Marine Sensor Innovation Program, NERACOOS will expand upon existing efforts, funded by NOAA's Monitoring and Event Response for Harmful Algal Blooms (MERHAB) program, to deploy the Environmental Sample Processor (ESP) for harmful algal bloom detection. This is a major step towards establishing the ESP array envisioned as a future element of the NERACOOS regional observing system and an integral part of state and federal biotoxin monitoring programs.

Finally, continued development and implementation of a Data Management and Communication system is central to the delivery of information and products to users of the system; performance and evaluation metrics will enable tracking the return on investment; and education and outreach will engage NERACOOS users to ensure information and products meet their needs.

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# FY2013: Regional Integrated Ocean Observing System (IOOS®) Development

U.S. IOOS is an operational system and a network of regional partners responsible for regional observations, data management, modeling and analysis, education and outreach, and research and development. The overarching purpose of U.S. IOOS is to address regional and national needs for ocean data and information. NOAA continued to provide merit-based funding in 2013 to further develop the IOOS regional network. IOOS regional partners provide coordination with regional stakeholders while contributing data and other outputs to the national system – supporting regional priorities while advancing national objectives.

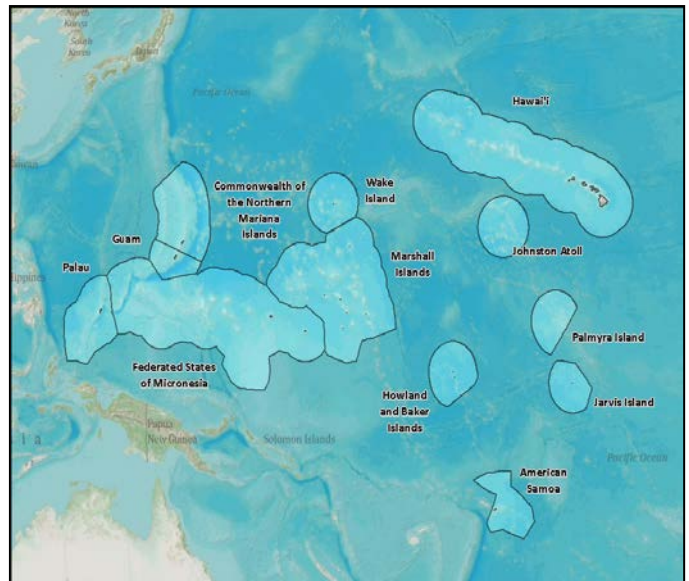
## PACIFIC ISLANDS REGION

The Pacific Islands (PacIOOS) region is defined as the State of Hawaii, the Commonwealth and Territories of the United States in the Pacific, the U.S. Pacific Remote Island Areas, and the Freely Associated States in the Pacific. PacIOOS is a partnership of data providers and users working together to enhance ocean observations and develop, disseminate, evaluate and apply ocean data and information products designed to address the needs of stakeholders who call the Pacific Islands home.

### NOAA Funding:

Prior to FY 2011, IOOS regional partners received two awards – one for development of the Regional Coastal Ocean Observing System (RCOOS), and one for planning and stakeholder engagement by a Regional Association (RA). Starting in FY 2011, IOOS made a single multi-year award to each region for management of these activities. Funds awarded by NOAA since establishment of the U.S. IOOS Program Office are as follows:

- FY 2013 - \$2,197,836
- FY 2012 - \$2,485,505
- FY 2011 - \$2,065,000
- FY 2010 - \$1,700,000 RCOOS, \$399,973 RA
- FY 2009 - \$1,869,134 RCOOS, \$398,802 RA
- FY 2008 - \$1,700,000 RCOOS, \$397,909 RA
- FY 2007 - \$1,700,000 RCOOS



### Regional Priorities and Objectives:

PACIOOS implements regional modeling, sensor deployment, data and information services, and outreach and education in four key product areas: Water Quality, Marine Operations; Ecosystems and Living Marine Resources; and Coastal Hazards.

PACIOOS key activities for the FY13 project period are:

- Supplying real-time observations of biological, chemical, and physical water parameters to improve the understanding of ocean acidification, more effectively protect healthy coastal marine ecosystems, and enhance the response to marine events that impact human health.
  - Providing predictions of high water level and inundation events in coastal areas, developing maps of coastline change and identifying areas of vulnerability, and providing beach condition forecasts to users and lifeguards to promote public safety and community resilience.
  - Supporting NOAA's Coastal Services Center by producing a series of sea level rise and coastal flooding inundation maps for the islands of Hawaii, Guam, Commonwealth of the Northern Marianas Islands (CNMI), and American Samoa. These maps were recently incorporated into the CSC Sea Level Rise and Coastal Flooding Impacts Viewer ([www.csc.noaa.gov/slr](http://www.csc.noaa.gov/slr)) for visualization. Additionally, PacIOOS will release an interactive tool that will allow users to examine shoreline erosion and inundation along various coastlines.
  - Providing timely, reliable, real-time, and forecast information on harbor conditions, coastal and open ocean currents, waves, and weather to improve search-and-rescue operations, spill response, optimize shipping routes, and develop better severe weather and event predictions.
  - Continue integrating information for effective ocean, coastal and marine planning including measuring and modeling parameters necessary for the development of climate change mitigation and adaptation plans and collecting and serving necessary information for renewable energy development.
  - Promoting the understanding and stewardship of the Hawaiian and insular Pacific's coastal waters and building capacity for the continued expansion of ocean observations and informational products.
  - Maintain and expand the network of directional wave buoys in Hawaii and the insular Pacific Ocean in partnership with the Coastal Data Information Program and to provide information and services to the National Weather Service, coastal engineers, planners, managers, mariners, and researchers.
  - Enhance the data management and communications (DMAC) system to facilitate easy data access and use by researchers, modelers, product developers, managers, and the general public. An interoperable data system, both within the regional association and across RAs, is an integral and important part of the national IOOS process.
  - Expand coverage and enhance wave (WWIII), ocean circulation (ROMS), and weather (WRF) models and forecasts.
  - Expand coverage and enhance HFR capabilities on Oahu and the Island of Hawai'i.
  - Advance animal tagging research by adding O2 sensor to tags.

Initial PacIOOS observing efforts focused on the development of an end-to-end observational system confined to the island of Oahu, Hawaii. This focused pilot-project explored the operability of various observational systems in an island setting to help determine the ideal design for a full PacIOOS observational network.

The success of this pilot project allowed for data system development, modeling, education and outreach, and stakeholder engagement through a collaborative governance framework that is focused not only on the Hawaiian Islands, but on each of the PacIOOS jurisdictions through the Pacific. Targeted deployment of instrumentation to address local stakeholder continues in all Pacific jurisdictions with deployments to expand under future funding cooperative agreements.

#### **Regional Contact Information:**

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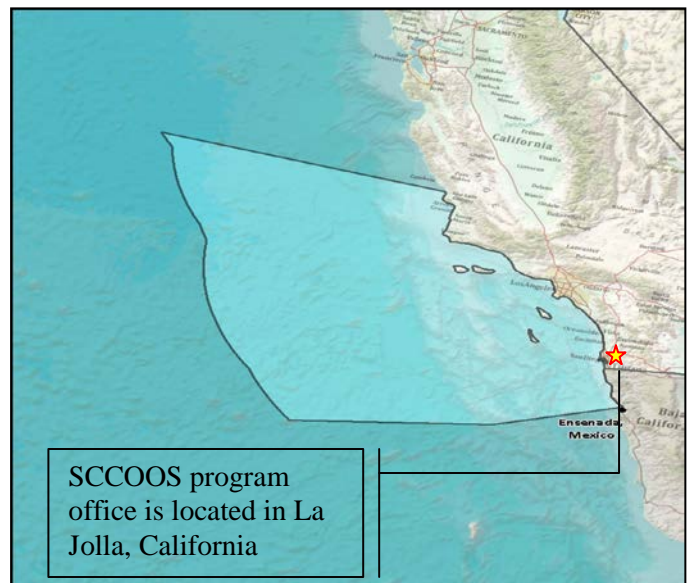
## SOUTHERN CALIFORNIA REGION

The Southern California Coastal Ocean Observing System (SCCOOS) provides coastal observations for the Southern California Bight. The primary goal of SCCOOS is to provide the scientific data and information needed to inform decision-making and better understand the changing conditions of the coastal ocean in Southern California. SCCOOS has aligned its priorities and objectives with the focus areas designated by U.S. Integrated Ocean Observing System (IOOS®), as identified by users and stakeholders throughout the nation.

### NOAA Funding:

Prior to FY 2011, IOOS regional partners received two awards – one for development of the Regional Coastal Ocean Observing System (RCOOS), and one for planning and stakeholder engagement by a Regional Association (RA). Starting in FY 2011, IOOS made a single multi-year award to each region for management of these activities. Funds awarded by NOAA since establishment of the U.S. IOOS Program Office are as follows:

FY 2013 - \$2,276,758  
FY 2012 - \$2,157,214  
FY 2011 - \$1,768,000  
FY 2010 - \$1,400,000 RCOOS - \$395,210 RA  
FY 2009 - \$1,341,466 RCOOS - \$393,093 RA  
FY 2008 - \$500,000 RCOOS - \$353,785 RA



### Regional Priorities:

As the regional ocean observing system for Southern California, SCCOOS has developed the capabilities to support short-term decision-making and long-term assessment by implementing and leveraging biological, chemical, and physical observations, many of which are available in near real-time.

SCCOOS has aligned its organizational priorities and objectives with the focus areas designated by the IOOS Association for Coastal and Ocean Observing:

- **Ecosystems and Climate Trends:** To monitor climate trends and environmental effects on the Southern California Bight by collecting physical, chemical, and biological time series.



- **Water Quality:** To provide monitoring, tracking, and prediction tools for harmful algal blooms, outfall and storm water plumes, and surf zone contaminants.
- **Marine Operations:** To advance integrated, customized products that are critical for safe and efficient navigation, search and rescue, and oil spill response.
- **Coastal Hazards:** To promote safe recreational use of beaches and provide warnings of wave and tide-induced coastal inundation.

SCCOOS continues its work with local, state, and federal agencies, resource managers, industry, policy-makers, educators, scientists, non-governmental organizations, and the public to make ocean and coastal information more widely available in a variety of formats. These efforts will ensure that products are useful and easy to access, while preserving the necessary detail to support the scientific and education communities. SCCOOS continues to explore new visualizations and technologies to make data products more comprehensible and widely available.

In order to achieve an effective outreach strategy that fully engages a wide range of audiences, SCCOOS focuses on developing projects through partnerships on the local, regional, and national levels. SCCOOS collaborates with the Central and Northern California Ocean Observing System (CeNCOOS) on statewide issues and formed a Joint Strategic Advisory Committee, of users and stakeholders across the state, to create a unified and coordinated approach to ocean observing in California.

The U.S. West Coast OOSes (Ocean Observing Systems - SCCOOS, CeNCOOS, and NANOOS – Northwest Association of Networked Ocean Observing Systems) aim to promote clean coastal waters and beaches, healthy ocean and coastal habitats, effective ecosystem-based management, reduced impacts of offshore development, increased ocean awareness and literacy among the region's citizens, sustainable economic development of coastal communities, and expanded ocean and coastal scientific information, research, and monitoring.

Two recent examples on how these goals have been carried out are:

- SCCOOS, CeNCOOS, and NANOOS have formally signed a Memorandum of Understanding to work cooperatively with governmental and non-governmental entities in identifying and providing ocean and coastal information products that inform a broad range of scientific, economic and management activities in fisheries and water quality, climate variability and change, coastal hazards, marine commerce and safety, and other priorities identified by regional management groups.
- The West Coast Governors Alliance on Ocean Health (WCGA) and the West Coast OOSes signed a two-year agreement in October of 2012 to advance effective management of coastal and ocean resources for the benefit of current and future generations, with a specific focus on using ocean observing systems to help address harmful algal blooms and ocean acidification as well as advancing surface current mapping and a regional data framework.

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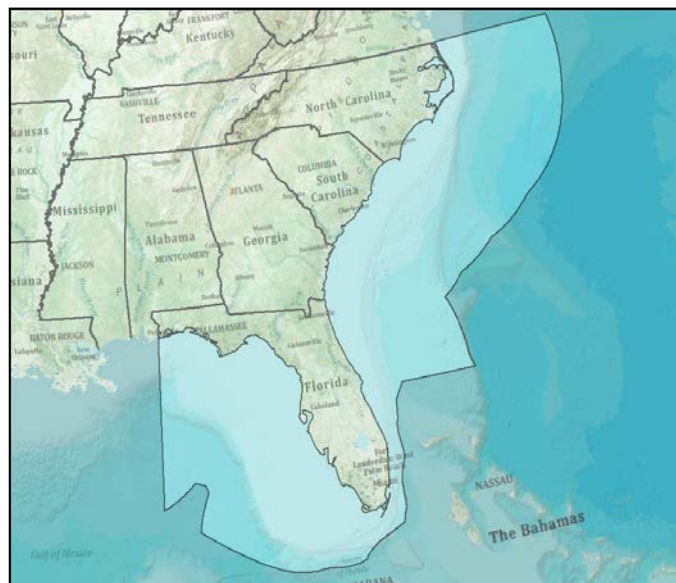
## SOUTHEAST ATLANTIC REGION

The region serviced by the Southeast Coastal Ocean Observing Regional Association (SECOORA) encompasses four states, over 42 million people and spans the coastal ocean from North Carolina to the west Coast of Florida. The region is vulnerable to hurricane hazards, potential impacts from oil drilling off Cuba and neighboring regions, and climate change because of low-lying coastal land and corals and other habitats that will be the first indicators of significant ecological impact. A regional observing system is critical to understanding risks and reducing impacts, as well as supporting the economy of the southeastern United States. SECOORA supports the need of the region for real-time, or near real-time, marine information on coastal and ocean conditions that protects our people, environment and economy.

### NOAA Funding:

Prior to FY 2011, IOOS regional partners received two awards – one for development of the Regional Coastal Ocean Observing System (RCOOS), and one for planning and stakeholder engagement by a Regional Association (RA). Starting in FY 2011, IOOS made a single award to each region for management of these activities. Funds awarded by NOAA since establishment of the U.S. IOOS Program Office are as follows:

- FY 2013 - \$2,439,688
- FY 2012 - \$2,297,724
- FY 2011 - \$2,015,000
- FY 2010 - \$1,680,000, \$399,670 RA
- FY 2009 - \$500,000 RCOOS (plus 3 additional implementation awards totaling \$2,444,150), \$391,991 RA
- FY 2008 - \$400,000 RCOOS, \$384,535 RA



### Regional Priorities:

The ocean and coastal waters of the southeastern United States support ecologically and economically significant ecosystems; provide tourism, boating, and other recreational opportunities; and generate over \$675 billion annually in economic impact within our region. SECOORA is working to integrate and augment existing observational,

modeling, data management and education assets to provide lasting benefits in these areas and for the people, communities, and natural resources that make the Southeast unique, including:

- Protection of people and communities through quantitative improvements in the forecast of potentially destructive winds, waves, and storm surges;
- Improved coastal and marine use decision-making through enhanced and more comprehensive characterization of the coastal and marine environment;
- Improvements to public safety through more timely and site-specific health advisories, storm surge and rip current warnings;
- Safer and more efficient marine operations and emergency response through enhanced coastal and marine situational awareness;
- Better-informed decision-making regarding commercial and recreational fisheries, and shoreline and climate change impacts.

Fisheries, coastal development and erosion, storms and coastal hazards, and water quality are all critical concerns that require informed management policy and strong science. Towards that end, starting in FY 2011 and for the following five years, SECOORA will work to achieve the following objectives:

- Ensure stakeholder needs are met through assessment and governance mechanisms that effectively prioritize the distribution of Regional Coastal Ocean Observing System (RCOOS)-related funding and other resources that are required to meet critical regional needs.
- Coordinate and begin to execute the build out plan for a fully instrumented RCOOS in the Southeast with defined service levels, commensurate with funding, that provides coordinated monitoring, assessment and prediction.
- Maintain an observing subsystem that includes moored and coastal stations, high frequency radars (HFR), gliders and storm event monitoring subcomponents.
- Support a multi-scale, multi-resolution modeling framework that includes shelf and estuarine circulation and surge/inundation prediction, and uses the observing subsystem for verification, assimilation, and operation.
- Build upon the Data Management and Communication (DMAC) infrastructure to optimize existing operations, facilitate technology evolution / transfer, and address structural / project management complexities.
- Support an education and outreach (E&O) program partnered with other RAs and other marine education organizations including SE Sea Grant offices and COSEE-Southeast that engages diverse education and stakeholder audiences to understand the benefits of ocean observing to society.

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