

# **CeNCOOS: Integrating Marine Operations for Decision Makers and the General Public**

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## **LONG-TERM GOALS**

CeNCOOS is one of the eleven Regional Associations (RAs) comprising the national Integrated Ocean Observing System (IOOS). IOOS finds its legal basis in the Omnibus Public Land Management Act of 2009, which was signed into law by President Barack Obama on March 30, 2009. The task of the RAs is to “coordinate State, Federal, local, and private interests at a regional level with the responsibility of engaging the private and public sectors in designing, operating, and improving regional coastal and ocean observing systems in order to ensure the provision of data and information that meet the needs of user groups from the respective regions.” A major emphasis is on producing unique, specific products that meet the needs of end-users in four focus areas: Ecosystems and Climate, Water Quality, Marine Operations, and Coastal Hazards.

## **OBJECTIVES**

CeNCOOS strives to maintain a sustained observational presence in the coastal ocean in order to: a) provide baseline information by which to quantify change; b) capture large, transient, unpredictable, and important events; and c) facilitate breakthroughs in knowledge not possible without these long-term observations. The primary objective of the CeNCOOS data management effort is to facilitate easy data access and use by researchers, modelers, product developers, managers, and the general public. Furthermore, CeNCOOS fosters solid working relationships between scientists and end-users in order to produce ocean information products of societal relevance in the four theme areas cited above.

## **APPROACH AND WORK PLAN**

The CeNCOOS PIs are organized into teams around the four primary focus areas of climate and ecosystems, water quality, marine operations, and coastal hazards. The CeNCOOS philosophy is that quality control is best left in the hands of the data collector. This has led to the web-services based DMAC approach such that the most recent version of the data is always being accessed.

CeNCOOS is organized around institutions, rather than individuals, who can carry out a needed task and are committed to maintaining the continuity of the observing system over a period of many years. A listing of the institutions grouped by task follows.

1. All CeNCOOS activities are coordinated by the CeNCOOS program office located at MBARI. This office administers the CeNCOOS region including strategic planning, program governance, fiscal

oversight, education and outreach, development and maintenance of the web site, and product creation for end users. *MBARI*

2. Maintain automated coastal shore stations for water quality, long term trends in temperature, salinity, sea level, chlorophyll fluorescence, and ocean acidification; Harmful Algal Bloom monitoring, forecasting, and mitigation. *Humboldt State University, UC Davis – Bodega Marine Lab, San Francisco State – Romberg Tiburon Center, UC Santa Cruz, Moss Landing Marine Laboratories (MLML), California Polytechnic State University (CalPoly), Sonoma State University.*

3. Continuously operate across-shore glider transects 24/7 to monitor temperature, salinity, chlorophyll fluorescence, dissolved oxygen, and the carbon variables. These transects will be used to track ENSO events and climate change, and to feed data assimilating ocean circulation models. *Monterey Bay Aquarium Research Institute, California Polytechnic State University*

4. Harden the HF radar surface current mapping (SCM) network to reduce down time, improve accuracy, and produce products. The SCM network is used in virtually all of our products for search and rescue, marine operations, and ecosystem forecasting. *Humboldt State University, UC Davis – Bodega Marine Lab, San Francisco State – Romberg Tiburon Center, The Naval Postgraduate School, California Polytechnic State University*

5. Run state-wide data assimilating ocean circulation models to forecast currents, state variables, and ecosystem parameters. Expanding into ecosystem modeling is a large task but the aim is to get started under the present grant. *The Naval Research Laboratory – Monterey, CA, JPL/UC Los Angeles, UC Santa Cruz*

6. Implement a 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. *Science Applications International Corporation*

## **WORK COMPLETED**

We have only had funding under this grant for 3 months. During that time CeNCOOS has hired a new Program Director, distributed monies to all subcontractors (except two federal labs who receive their funding directly), and continued operation of shore stations, glider line, HF radars, and regional meteorological and oceanographic circulation models. In addition, a new shore station, at the Santa Cruz wharf, with enhanced capabilities for harmful algal bloom (HAB) detection, has been brought on line. CeNCOOS is working with partners in the Sonoma coast region to identify the cause of an unusual large die-off of abalone and other marine invertebrates that occurred during the fall of 2011. An iPhone app for access to real-time data has been implemented and is being upgraded. A 10-year build-out plan, required by IOOS, has been submitted. The CeNCOOS wind product, one of our longest running products, is in the process of being transitioned from JPL to the CeNCOOS program office. In addition, CeNCOOS is leading the data/tool and industry discussion for the California Current Acidification Network (CCAN).

## **RESULTS**

As part of its collaborative efforts with other regional oceanographic projects, CeNCOOS assisted with glider operations for an NSF-sponsored project and were able to clearly identify nepheloid layers on the southern shelf of Monterey Bay. These features are a critical part of the sediment budget.

Technical achievements accomplished in the last three months include an upgrade of the data portal, and launching of the iPhone app, which should make access to CeNCOOS data easier and more immediate. The addition of the Santa Cruz wharf HABs station covers a gap in the West Coast efforts to create a HAB data/web tool for the CA initiative, HAB Monitoring and Alert Program (HABMAP).

## **IMPACT AND APPLICATIONS**

### **National Security**

HF radars have the potential to be used for tracking unidentified vessels. This is not a current CeNCOOS capability, but could potentially be developed in the future.

### **Economic Development**

The potential impacts on economic development are numerous and include: improving safety and efficiency of shipping; enhancement of tourism through information provided to beach goers and marine recreational users; increased sustainability of fisheries; improved aquaculture operations, and assessment of wave energy as a renewable energy source.

### **Quality of Life**

CeNCOOS is working with the State of California in assessing the efficacy of marine protected areas, is heavily involved in detecting (and in the future hopefully forecasting) harmful algal blooms, and is a primary resource for long-term ocean time series used to assess ocean conditions in the context of climate change.

### **Science Education and Communication**

CeNCOOS engages across numerous disciplines and audiences to increase ocean awareness, ocean literacy, and inform stakeholders of the value of ocean observing through well-designed, user-friendly products. Whether focusing on K-12 classroom activities, building displays for local venues, creating reports/flyers for policy makers, or training experts in using surface current information for search and rescue, CeNCOOS strives to make science available, digestible and useful.

## **TRANSITIONS**

### **Economic Development**

Local city and county planners are using CeNCOOS-generated data and long-term trends for rapid response and future planning regarding inundation and flooding at the Pajaro River mouth and the Carmel River mouth – two areas that are very susceptible to flooding and erosion in big wave and precipitation events.

Decisions regarding time of transit, whether to hold a cargo ship offshore due to dangerous wave conditions, how heavily to load a ship, and the actual route of a vessel, all greatly impact the cost of

maritime operations. Maritime operators, especially those in the busy ports of SF Bay, use CeNCOOS generated products to inform decisions such as these. These products are also used in search and rescue, and overall recreational and commercial safety. CeNCOOS is working to build a SF Bay Harbor Page that integrates many useful data layers, similar to the successful Southern California Coastal Ocean Observing System (SCCOOS) LA/Long Beach Harbor Page.

### **Quality of Life**

CeNCOOS is working with the California Marine Protected Area Monitoring Enterprise to develop a plan to evaluate the effectiveness after five years of MPAs in central and northern California. The CeNCOOS wind page is being used by surfers and other recreational users on a daily basis to plan their activities. CeNCOOS is collaborating with the SCCOOS to provide training to the CA State Water Resources Control Board on using our web tools and products for addressing water quality issues in CA. CeNCOOS is sharing outreach and web expertise with SCCOOS, the Southern California Water Resources Program, and HAB experts in CA to develop a program that provides monitoring and alerts for rapid response and preparation to HABs. The resulting products will be used by wildlife and human health officials as well as scientists to better understand HAB development and trends.

### **Science Education and Communication**

Faculty at San Jose State University are using materials generated by CeNCOOS, and available on the website, to create an online exercise on ocean observing within the context of CeNCOOS research by California State University (CSU) for use in courses within the CSU system. The online exercises will address technology, applications, societal impacts, discussions among CSU faculty regarding the value of observations, and an exercise using real-time and archived data from the CeNCOOS website. CeNCOOS is partnering with NOAA and the San Francisco Exploratorium to share science related to the development of exhibits and scientific data collection at the Exploratorium's new venue along the Embarcadero in SF Bay. In partnership with the Center for Ocean Solutions, and other organizations, CeNCOOS products and web expertise are being utilized for an upcoming workshop, "Preparing for the Future: Climate Change and the Monterey Bay Shoreline", to be held in December 2011.

### **RELATED PROJECTS**

This CeNCOOS project is closely related to literally dozens of other federally, state, and privately funded projects – too many to be listed individually here. Every one of our PIs has closely related projects. These include a NASA-funded study entitled Utilizing Ecosystem Information to Improve the Decision Support System for Central California Salmon, and HABs projects funded by NOAA and the California Ocean Protection Council.

### **PUBLICATIONS**

Lipa, B., D. Barrick, S.-I. Saitoh, Y. Ishikawa, T. Awaji, J. Largier, and N. Garfield, Japan Tsunami Current Flows Observed by HF Radars on Two Continents, *Remote Sens.* **2011**, 3, 1663-1679; doi:10.3390/rs3081663.

### **OUTREACH MATERIALS**

Our greatest outreach tools include the website: [www.cencoos.org](http://www.cencoos.org) , the CeNCOOS Data Portal: <http://204.115.180.244/CeNCOOS/DataPortal.html> and the wide array of Data Products available on the website: <http://www.cencoos.org/sections/products/index.html>. We have many outreach materials

developed in earlier years of this project, including the SCCOOS, CeNCOOS and COSEE collaboration: <http://www.youtube.com/watch?v=zZr8NIByB7I>. Outreach materials developed during the last three months include our most recent newsletter ([http://www.cencoos.org/sections/news/Summer\\_Fall\\_Newsletter\\_2011.shtml](http://www.cencoos.org/sections/news/Summer_Fall_Newsletter_2011.shtml), and attached here as a pdf file) and the CeNCOOS regional fact sheet for the IOOS website (<http://www.ioos.gov/regions/cencoos.html>).