LONG-TERM GOALS
The Southern California Coastal Ocean Observing System (SCCOOS) is one of eleven regions that contribute to the national U.S. Integrated Ocean Observing System (IOOS®). The regional observing systems work to collect, integrate, and deliver coastal and ocean observations in order to improve safety, enhance the economy, and protect the environment. 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.
OBJECTIVES
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.

- **Ecosystems and Climate**: to monitor ocean climate trends and environmental changes in the Southern California Bight by collecting physical, chemical, and biological variables.
- **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 provide accurate, validated inundation models and information with the long-term goal of improving coastal safety.

APPRAOCH AND WORK PLAN
1.) Scientific/Technical Approach
SCCOOS operates as a system of partnerships and projects that are facilitated by technical and programmatic staff. Organized by the four focus areas, the SCCOOS scientific and technical approach is based on a system of core ocean observing technologies and the delivery of useful data products and tools. System components include sub-surface ocean observations from underwater gliders, nearshore and coastal measurements, wave measurements and models, pier-based monitoring, satellite imagery, high frequency (HF) radar surface current mapping, and data assimilative ocean modeling. The projects described in this report represent the multidisciplinary and collaborative efforts of the research teams that contribute data and information to SCCOOS.

**Data Quality Requirements**
SCCOOS will continue to provide access to high-quality integrated data and support regional user needs while complying with the standards and protocols for sharing and archiving data that are developed nationally. SCCOOS actively participates in IOOS Data Management efforts such as the Thematic Real-Time Environmental Distributed Data Services (THREDDS). By leveraging the Coastal Data Information Program (CDIP) and the HF Radar National Network programs, SCCOOS will target THREDDS distribution for both wave and surface current data. SCCOOS participants also contribute to ongoing efforts to develop quality control standards for waves and HF radar-derived surface currents. Wave and current data have associated XML and FDGC compliant metadata.

2.) Partners
**California Polytechnic State University, San Luis Obispo**
Mark Moline manages the array of six HF radar sites for the central California coast and oversees the HAB water sampling program off the Cal Poly Pier in San Luis Obispo Bay.

**Farallon Institute for Advanced Ecosystem Research**
William Sydeman oversees shipboard observations of the distribution and abundance of marine birds and mammals, conducted three times yearly in conjunction with the California Cooperative
Oceanic Fisheries Investigations (CalCOFI) Long-Term Ecological Research (LTER) ship surveys.

**Scripps Institution of Oceanography (SIO), University of California, San Diego**
Spray underwater glider operations are conducted by Daniel Rudnick and Russ Davis of the Instrument Development Group. Ralf Goericke manages the nine stations that comprise the nearshore component of the CalCOFI Program. John McGowan and Melissa Carter collect and analyze water samples to monitor HABs at the Scripps Pier. Robert Guza and William O’Reilly conduct coastal hazards projects in order to develop validated, customized warnings of wave and tide-induced coastal inundation. Eric Terrill serves as Technical Director, with his team at the Coastal Observing Research and Development Center, operates and maintains the HF radar systems and automated shore stations as well as the data management component. Julie Thomas serves as SCCOOS Executive Director and provides wave data and models from the CDIP buoys in Southern California.

**University of California, Los Angeles (UCLA)**
Rebecca Shipe conducts the HAB monitoring program at Santa Monica Pier. Jim McWilliams, Oceanic Research Group, and Yi Chao, Jet Propulsion Laboratory, develop the Regional Oceanic Modeling System (ROMS).

**University of California, Santa Barbara (UCSB)**
Libe Washburn manages the operation of HF radar systems in the Santa Barbara region, and along with Mark Brzezinski, oversees the HAB monitoring program at Goleta Pier and Stearns Wharf.

**University of Southern California (USC)**
Burt Jones manages the HF radar systems and coastal glider operations for discharge plume tracking and HAB detection; he collaborates with David Caron to lead the HAB monitoring program in San Pedro Bay, specifically the collection of water samples at the Newport Beach Pier.

3.) Workplan
In FY2011, SCCOOS will continue its core observations and expand data products when possible within budget constraints. SCCOOS is also committed to contributing to larger ocean observing efforts regionally, nationally, and internationally.

**Ecosystems and Climate:**
- Underwater glider surveys collect offshore measurements of temperature, salinity, chlorophyll, and current velocity.
- As part of CalCOFI-LTER program, measure variables in nearshore region including temperature, salinity, zooplankton, phytoplankton, fish eggs and invertebrate larvae.
- Conduct shipboard observations three times yearly to count seabirds and marine mammals in conjunction with CalCOFI-LTER surveys.
- Meteorological stations provide wind speed and direction, air temperature, sea surface temperature, barometric pressure, humidity, and rainfall levels.
Water Quality:
- Monitor HABs at six pier stations by collecting weekly measurements of temperature, salinity, chlorophyll, nutrients, and toxic species; distribute data.
- Expand HABs website to include Central and Northern California.
- Continue automated sampling at four shore stations to measure temperature, salinity, chlorophyll, turbidity, and water level.
- Implement the 3-km California statewide ROMS ocean forecasting system for real-time operations and conduct a systematic validation of the model.
- Analyze pollution dispersal in finescale, nearshore, and shelf ROMS for the San Pedro and Santa Monica Bays.
- Provide HF radar-based trajectory tracking tool for Tijuana River Plume.

Marine Operations:
- Operate and maintain HF radar systems; display surface current maps and tools online.
- Provide Weather Research & Forecasting Model (WRF) wind and precipitation forecasts online from the UCLA Department of Atmospheric and Oceanic Sciences, Climate Sensitivity Research Lounge.
- Maintain integrated map displays for ports and harbors with multi-layered views of near real-time surface currents, wave nowcasts and forecasts, and nautical charts.
- Deliver ocean current data and surface wind analyses to aid oil spill and Search and Rescue (SAR) real-time recovery and post-analysis trajectories.

Coastal Hazards:
- Validate and refine inundation models based on surveys of beach sand and water levels.
- Expand online development and integration of inundation information.

WORK COMPLETED & RESULTS
U.S. IOOS regional awards were finalized by the National Oceanic and Atmospheric Administration (NOAA) in late August 2011, so work on this award is just beginning.

IMPACT AND APPLICATIONS
National Security
- Ocean conditions and surface currents measurements can be used to generate trajectories and inform search and rescue (SAR) operations and hazardous/oil spill response.
- Customized, interactive map displays of ocean conditions can improve navigation and safety for military regions and testing ranges.
- Ocean observing data can be used to inform and validate ocean models used by the military and federal agencies.

Economic Development
- Customized, interactive map displays of ocean conditions can improve navigation, safety, and efficiency for commercial vessels, harbor pilots, and port operations.
- Accurate forecasts and measurements of water quality, such as for coastal pollutants and harmful algal blooms, inform beach closures and warnings which can affect tourism revenue and the local economy.
- Coastal data and forecast models of erosion, flooding, and inundation levels can be used to protect and improve beaches, real estate, and highways.
Quality of Life

- Tracking impacted or polluted sources such as rivers and sewage outfalls can influence public health and ecosystem health (Areas of Special Biological Significance and marine protected areas).
- Long-term time series of physical, biological, and chemical ocean data are critical in monitoring climate trends and determining ecosystem health.
- Physical and ecological ocean patterns and processes constitute valuable information for Coastal and Marine Spatial Planning and marine protected areas monitoring. For example, surveys of marine birds are being used by California Audubon and Birdlife International to delineate marine Important Bird Areas (mIBA) in the sea.

Science Education and Communication

- SCCOOS ocean data can inform classroom curriculum and informal education programs.
- SCCOOS data visualizations can provide a larger, environmental context for aquariums, science centers, and coastal tourist locations.

TRANSITIONS
National Security

- Initial implementation of surface currents measured by the SCCOOS HF radar network are now accessible by U.S. Coast Guard for search and rescue (SAR) applications using their Environmental Data Server.
- The live feed of HF radar data is now available for oil and hazardous spill response in the Environmental Response Management Application® (ERMA) map viewer for the southwest region. Near real-time and archived surface current measurements have been used in the National Preparedness for Response Exercise Program (NPREP) drill scenarios led by the U.S. Coast Guard in San Diego, Los Angeles, and Ventura.
- Surface current measurements are integrated into the General NOAA Operational Modeling Environment ( GNOME) for oil spill trajectory analysis.
- Customized, interactive map displays of wave and surface currents were developed for Naval Air Systems Command (NAVAIR), Point Mugu.
- Glider data is provided to the Naval Oceanographic Office (NAVO) for assimilation into operational models.

Economic Development

- The customized, interactive map display of ocean conditions and forecasts for the Port of Los Angeles and Long Beach Harbor is used to improve navigation, safety, and efficiency for commercial vessels, harbor pilots, and port operations.
- CalCOFI incorporates measurements from the nine nearshore stations, supported by SCCOOS, into the long-term CalCOFI time series used to inform fisheries management.
- SCCOOS recently signed a Memorandum of Understanding with CeNCOOS and NANOOS to expand and strengthen coordination at the West Coast scale, which will enhance efforts to contribute ocean observing information to regional management efforts including coastal and marine spatial planning and the West Coast Governors’ Agreement on Ocean Health.
Quality of Life

- The SCCOOS HAB program contributes to the statewide HAB Monitoring and Alert Program (HABMAP) initiated by NOAA, the California Ocean Science Trust, and the Southern California Coastal Water Research Project (SCCWRP).
- HAB data and samples (plankton net tow and monthly mussel samples) are sent to the California Department Public Health Plankton Monitoring Program.
- The County of San Diego’s Department of Environmental Health uses the SCCOOS Tijuana River Plume Tracker to inform water quality warnings and beach closures.
- The YMCA Camp Surf in Imperial Beach uses the SCCOOS Tijuana River Plume tracker, HABs data, and CDIP swell model to help make decisions about the campers’ health and safety.
- SCCOOS is working closely with staff from the California Ocean Science Trust’s Marine Protected Area Monitoring Enterprise on the development and successful execution of a monitoring program for Southern California’s newly established network of marine protected areas.

Science Education and Communication

- SCCOOS surface currents are featured on an interactive touch-screen kiosk at the Birch Aquarium as part of "Boundless Energy," an exhibit on sources of renewable ocean energy.
- In partnership with SCCOOS PIs and staff members, the Centers for Ocean Sciences Education Excellence (COSEE)-West and University of Southern California Sea Grant educators conduct an education program for HABs, Ocean Observing Systems Institute for teachers, and multiple online workshops.
- Conducted by the Ocean Institute, the 5th grade “Weather and Water” school program is based on SCCOOS meteorological data and meets Earth Science Standards on the water cycle and weather.
- SCCOOS data is included in the Channel Islands National Marine Sanctuaries Interactive Touch Screen Kiosk Program.

RELATED PROJECTS
California Cooperative Oceanic Fisheries Investigations (CalCOFI): http://calcofi.org
Centers for Ocean Sciences Education Excellence (COSEE): http://www.cosee.net
Coastal Data Information Program (CDIP): http://cdip.ucsd.edu
Coastal Observing Research and Development Center (CORDC): http://cordc.ucsd.edu
Farallon Institute for Advanced Ecosystem Research: http://www.faralloninstitute.org
Figure 1. SCCOOS surface current measurements were included in the map for the National Preparedness for Response Exercise Program (NPREP) in San Diego, May 2011.
Figure 2. SCCOOS surface currents are featured on an interactive touch-screen kiosk at the Birch Aquarium as part of "Boundless Energy," an exhibit on sources of renewable ocean energy.

Figure 3. SCCOOS monitors harmful algal blooms (HABs) at six pier stations in Southern California. At the Scripps Pier, a “red tide” algal bloom of Lingulodinium polyedrum showed bright bioluminescence at night (Photo Credit: Christopher Wills, University of California, San Diego, September 2011).
改善生活和生计：加利福尼亚

概览：
数以千计的工具——从卫星到水下传感器——持续收集海洋和沿海数据。Integrated Ocean Observing System (IOOS) 正在扩展其数据网络，并使其更容易获取和使用。

两个 IOOS 区域涵盖了加利福尼亚的海洋和沿海数据需求——Central and Northern California Ocean Observing System (CeNCOOS) 和 Southern California Coastal Ocean Observing System (SCCOOS)。

随着我们国家的海洋和沿海水域的增加和多样化，对准确和及时的海洋信息的需求也在增加。在 850 英里的海岸线中，加利福尼亚的海滩与经济、环境和公共健康紧密相连。海洋观测系统提供了科学数据和信息，帮助更好地了解海洋和沿海环境的变化。物理、化学和生物数据，加利福尼亚的海洋观测系统迅速做出决策，进行沿海区域的长期评估。

石油泄漏和海岸污染：追踪危险泄漏和污染对管理沿海水域至关重要。加利福尼亚的海洋观测系统运营着一个州的高频率雷达网络，记录速度和方向的海面流，以及在实际时间通知应急响应人员、水质、健康和安全。

科学家将表层流数据纳入 NOAA 的官方模型，以便于对泄漏路径进行预测。降雨后，来自蒂华纳河的水可以沿海岸和附近海滩流动。水质官员、救生员和冲浪者使用轨迹图，每小时由高频雷达生成，预测何时何地可能出现的泄漏将会影响附近海滩。

“海洋观测系统是估计 exact where the river plume 正在对海滩水质产生影响的强大工具，”本杰明·麦凯，WILDCOAST。有害藻类爆发：你曾奇过布拉德利·赫奇斯对“鸟”的灵感来自哪里吗？由于有害藻类的中毒，数百只鸟类可能已经死亡。有害的藻类爆发不仅对鸟类产生了影响，而且可能对人类和沿海地区产生了影响。
blooms can impact shellfish, seabirds, marine mammals, and human health. CeNCOOS and SSCOOS monitor harmful blooms at pier sites along the coastline. Weekly water samples measure domoic acid, water temperature, salinity, chlorophyll and abundance of algal species. Abalone farmers use this information on ocean conditions and algal blooms to protect their shellfish stocks. The ocean observing systems are, “a very important component of the security for our business operations,” stated Art Seavey of the Monterey Abalone Company.

Safe, Better Marine Operations: Timely and accurate information about ocean conditions is critical to the safe passage of ships and efficient harbor navigation.

U.S. Coast Guard workers can now access surface currents measured by California’s high frequency radar network and use data for search and rescue applications through the agency’s Environmental Data Server. San Francisco Bar Pilots also need real-time information such as waves, winds and currents, to safely navigate large vessels through the bay and into port.

The San Francisco Bar buoy, “allows for safer transit, safer pilot boat operations, and efficiency for the shippers that call at San Francisco Bay,” Captain Bill Greig.

Tsunami Detection: After Japan’s March, 2011 tsunami, IOOS data supported the issuance of warnings to safeguard lives and property. CeNCOOS and SSCOOS experienced web traffic hikes as they captured the tsunami passage in real time from the deep ocean and near shore, displayed inflows and outflows via video cameras mounted on piers, and informed media and stakeholders.

Beach Erosion and Inundation: Coastal erosion and inundation can damage homes, cause highway closures and disrupt transportation.

With rising sea levels, storm surge, and El Niño winters, it is crucial that scientists develop a West Coast inundation model for future safety and protection of coastal communities.

The goal of the SSCOOS Coastal Hazards Project at Cardiff State Beach is to develop a field-validated, site-specific model for inundation and flooding.

The project included installation of ten buried pressure sensors to measure water levels along with surveys of beach sand levels.

Data will inform model validation and feed into real-time displays of wave and tidal inundation for the safety and protection of coastal communities.

For More Information:
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Figure 4. “IOOS In Action: California” flyer