U.S. Integrated Ocean Observing System (IOOS) Implementation
Southern California Coastal Ocean Observing System (SCCOOS)
National Oceanographic Partnership Program Report:
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1) PROJECT SUMMARY

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 principal goal of the Southern California Coastal Ocean Observing System (SCCOOS) is to provide observations and products to a diverse stakeholder community of managers and planners, operational decision makers, scientists, and the general public. As the regional 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 and models, many of which are available in near real-time. SCCOOS priorities and objectives are aligned with the seven societal goals as outlined in the IOOS Summit Report[i]. The focus themes, as designated by IOOS, highlight these priorities and are designed to improve safety, enhance the economy, and protect our environment.

- **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.

- **Science Education and Communication:** to provide a way for the public to learn, educate, and promote scientific research using data obtained from SCCOOS.

2) PROGRESS AND ACCOMPLISHMENTS

SCCOOS continues to achieve its milestones by providing 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 targets THREDDS distribution for wave, surface currents and most recently, shore station data. SCCOOS also continues to implement QARTOD data quality control standards. Wave and surface current data have associated XML and FDGC compliant metadata.

The following goals/milestones have been met.

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 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 Harmful Algal Blooms (HABs) at five pier stations by collecting weekly measurements of temperature, salinity, chlorophyll, nutrients, and toxic species; distribute data and expand HABs website to include Central and Northern California.
- Continue automated sampling at three shore stations to measure temperature, salinity, chlorophyll, turbidity and water level.
- Display the 3-km California statewide Regional Ocean Modeling System (ROMS) for real-time operations and conduct a systematic validation of the model. 3-km California state-wide ROMS model with data assimilation and real-time forecasting capabilities have been running continuously. This state-wide ROMS model is assimilating both the HF radar surface current data and the vertical profiles of temperature and salinity from four Spray gliders as well as other available observational data sets including satellite sea surface temperature and vertical profiles of temperature and salinity from moorings, ships and floats. On the daily basis, we are making on the order of 20 ensemble model forecast in order to quantify errors. Six hourly nowcasts and 72-hour forecast files are available via OpenDAP/THREDDS.
- 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:
- The live feed of HF radar data are now available on the national HFR network 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.
- Customized and expanded interactive map displays of wave and surface currents with multi-layered views of observations, nowcasts, and forecasts were developed for Naval Air Systems Command (NAVAIR), at Point Mugu.
- 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.
- NOAA CO-OPS integrated High Frequency Radar surface currents into their Tides & Currents Product.
- Surface current measurements and surface wind analyses are integrated into the General NOAA Operational Modeling Environment (GNOME) for oil spill trajectory analysis.

Coastal Hazards:
- Develop Shoreline inundation forecast, validation, and dissemination of warnings.
- Display inundation development and integration information online.
- Expand development and integration of inundation web site.

Science Education and Communication
- SCCOOS science education and communication were uploaded to the IOOS Cloud entitled Education/Outreach and Training Inventory.

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 still ongoing.

Ecosystems and Climate
- 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. Under the auspices of SCCOOS, the California Current Ecosystem Long Term Ecological Research (CCE_LTER) program, and in conjunction with the California Cooperative Ocean Fisheries Investigation (CalCOFI), the distribution and abundance of seabirds during 3 seasonal surveys were studied.
- Conduct shipboard observations three times yearly to count seabirds and marine mammals in conjunction with CalCOFI-LTER surveys. Data, products and modeling page display results on the SCCOOS website.
- Operate, support, and maintain one glider lines to collect measurements of temperature, salinity, chlorophyll, current velocity, and acoustic backscatter; deliver data to SCCOOS website and push to modeling centers.
- The automated shore stations program now operate and maintain 3 stations (Scripps Pier, Newport Pier and Santa Barbara Pier) and provide real-time continuous data at 1-4 minute intervals with limited interruptions. Real-time coastal measurements of temperature, salinity and fluorescence. The automated shore station data are one of the most requested data sets provided through SCCOOS. These data are used by the public and local state and research agencies to assess local conditions related to water quality, nearshore processes, population dynamics of coastal species and harmful algal blooms. Data collected at these stations includes temperature, salinity, fluorescence, and pressure. Calibration samples have been collected during cleaning and service dives, however incorporation of these data quality checks is not feasible at the current funding level.

Water Quality
- SCCOOS continues to provide HF radar-based trajectory tracking tool for Tijuana River Plume which is accessed on a daily basis by users such as lifeguards, Department of Environmental Health, and local surfers/beach goers. Tracking impacted or polluted sources such as rivers and sewage outfalls can influence public health and ecosystem health (For example, areas of special biological significance and marine protected areas).
- Conduct a systematic validation of the 3-km California statewide ROMS ocean forecasting system for real-time operations. A systematic effort has been carried out to validate the 3-km state-wide ROMS model. A manuscript describing this validation effort is in progress and expected to be submitted early 2016. Three validation products have been developed and are being tested on the [PI's web site](). On the daily basis, there are on the order of 100,000 satellite SST data that are assimilated into ROMS. The RMS difference between the ROMS nowcast and the original satellite SST data is slightly less than 1°C, comparable to the 0.5^{o}C-1°C errors specified for the satellite retrieved SST data.
- 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). The HAB program generates a baseline time-series of ocean properties to monitor ocean conditions and harmful algal blooms in the very near shore zone of the Southern California Bight. These measurements are used to inform the public and statewide agencies of current harmful algal blooms (HABs) that can impact human health, marine life, and recreational beach use. Furthermore, regional observations increase our knowledge of the sign, frequency, and magnitude of variation of temperature, salinity, density, nutrients, and harmful algal blooms.
- Boat sampling *Pseudo-nitzscha* blooms that produce domoic acid are being monitored. The Caron lab is responsible for the analysis of domoic acid from the 5 SCCOOS HAB monitoring sites.
- Primary inorganic nutrients samples will be analyzed by Brzezinski's group at the Analytical Laboratory at the Marine Science Institute at the University of California, Santa Barbara for the 5 SCCOOS HAB monitoring sites.
- At UCLA analyses are ongoing for the nested fine-scale simulations with ROMS for waste-water effluent dispersal and dilution during Fall 2006 and for more general material dispersal throughout the Southern California Bight shelves during 2007-2008 (in collaboration with UCSB). The former study includes both the Hyperion Treatment Plant outfall in Santa Monica Bay and the Orange County Sanitation District outfall in San Pedro Bay, and it also includes alternative near-shore outfalls used when repairs are necessary (as happened in Fall, 2012, in Orange County and will happen soon for Santa Monica Bay). The dominant transport and mixing rates are controlled by mesoscale and submesoscale eddies. In all these effluent situations, the material stays mainly on the continental shelf and slope beneath the surface, and for the near-shore outfall the material stays at the surface and close to the coast. Validation analyses are underway with USC glider measurements. Manuscripts have been submitted for publication (Uchiyama et al., 2013; Romero et al., 2013). A new study is being made of the space-time structure of shelf currents in the Bight in these simulations.

Marine Operations
- Ocean observing data can be used to inform and validate ocean models used by the military and federal agencies.
- SCCOOS continues to operate and maintain the network of short, medium, and long range HF radar systems and deliver data streams to the National HFR Network.
    1. Cal Poly HFR Operations and Maintenance update: Replaced housing enclosures at AGL1 and ARG1. Installed new TX and RX antenna along with cables at PTC1. Installed updated RX antenna and TX/RX cables at DCLR. Installed mac minis at all sites along with Ethernet power controller's to allow for remote restarts to decrease site downtime and travel time. Replaced all GPS antenna's at 9 Cal Poly sites. General maintenance of sites has been kept up.
- Customized, interactive map displays of ocean conditions with multilayer views of observations, nowcasts, and forecasts can improve navigation and safety for military regions and testing ranges.

- Customized, interactive map displays of ocean conditions can improve navigation, safety, and efficiency for commercial vessels, harbor pilots, and port operations.
- Implementation of ocean conditions, surface currents measured by the national HF radar network, and surface wind analyses can be used to aid in spill response operations and are also accessible by U.S. Coast Guard for search and rescue (SAR) applications using their Environmental Data Server.
- Glider data are provided to the Naval Oceanographic Office (NAVO) for assimilation into operational models.
- Currently an HF radar quality assurance/quality control(QAQC) Development Project is underway with the goals to:
    1. Provide real-time baseline comparisons of radial HF radar velocities;
    2. Provide other real-time comparisons of radial HF radar velocities;
    3. Provide real-time validation of elliptical HF radar velocities.

  All three aspects are in progress. Software developed for 1) is operational in beta mode for UC, Santa Barbara, and USC sites. Software for 2) has also been developed and is operational, with preliminary visualizations for University of California System, USC and California Polytechnic State University - San Luis Obispo sites. Work is currently focused on improving the efficiency of the computations, managing data and improving visualizations. A donation of server hardware was obtained and used upgrade the server that is running computations, increasing its memory capacity and expanding its single hard drive to a 1Tb RAID array. Regarding 3), we've been in contact with Codar Ocean Sensors about obtaining software for producing elliptical data on HF radar site computers, and about obtaining any real-time elliptical data for use in development. Finally, we've been developing an international collaboration with researchers from Tianjin University, who sent a student to visit for 5 weeks. This group is using data from Chinese built HF radars and are interested in our validation techniques.

Coastal Hazards
- Expand development and integration of inundation web site.
- Develop Shoreline inundation forecast, validation, and dissemination of warnings.
- Develop and distribute information about wave and tide-induced coastal inundation and erosion in southern California.
- Use surveys of sand levels on beaches and monitor storm inundations at selected locations to validate and refine coastal data and forecast models of erosion, flooding, and inundation levels can be used to protect and improve beaches, real estate, and highways.

Science Education and Communication
- 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.
- Weekly reports of HAB species and related water quality measurements and are provided to the California Department of Public Health; and the HAB Monitoring and Alert Program Group.
- Annually provide training to first responders of maritime incidences in the use of SCCOOS products.
- SCCOOS has started a citizen science project and webpage called storm photo to get the help of the general public to document flooding events from Imperial Beach in San Diego County to Point Conception via emailed cell phone pictures.
- SCCOOS collaborates with Scripps Institution of Oceanography Center for Marine Biodiversity and Conservation (CMBC) on their graduate student projects. CMBC promotes interdisciplinary research and educational approaches to maintain the integrity of ocean ecosystems and manage their use in the face of rapid and inevitable global change.

3) SCOPE OF WORK
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 multi-disciplinary and collaborative efforts of the research teams that contribute data and information to SCCOOS.

4) PERSONNEL AND ORGANIZATION STRUCTURE
- SCCOOS has increased membership to our Joint Strategic Advisory Committee.
    1. Tom Ford, Executive Director – Santa Monica Bay Restoration Commission

5) BUDGET ANALYSIS
In FY 2016, SCCOOS received an increased allocation of directed funding which required a decrease in base funds from FY15. The decrease in base funding ($78,491) will come out of the data management and communication subsystem. SCCOOS Executive Steering Committee approved the decrease of data management funds on March 16, 2016.

SCCOOS funding provides a valuable investment in important assets and will strengthen regional partnerships and national program planning. 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. Expenditures are progressing as expected, with no major discrepancies between actuals and budgeted on both the main award and the subawards.

6) ANNUAL SUPPLEMENTALS
Regional Ocean Governance Organization Activities
- SCCOOS developed and a new networking group within SCCOOS called the Los Angeles Engagement. We host periodic phone calls with Los Angeles Waterkeeper, Santa Monica Bay Restoration Commission, Heal the Bay, University of Southern California Sea Grant and the City of Los Angeles in order to stay current on funding opportunities or synergistic projects in the greater Los Angeles area.
- SCCOOS participates in the Southern California Coastal Water Research Project Bight Regional Monitoring. The working groups that participate in for the Bight '13 Monitoring are:
    1. Marine Protected Areas
    2. Nutrients
- SCCOOS participates in the San Diego Harbor Safety Meetings for the ports of San Diego, Long Beach and Los Angeles throughout the year.
- SCOOS participates in the Southern California Beach Water Quality Workgroup meetings throughout the year.
- Throughout the year SCCOOS participates in the Tijuana River Valley Recovery Team meetings, the U.S. International Boundary Water Commission citizen's forum meetings, the West Coast National Marine Sanctuary Education and Outreach meetings, Marine Protected Areas Collaborative Meetings, and Maritime Alliance networking/informational meetings.
- Over the past year SCCOOS has participated in many discussions regarding supplementing research with ocean observations to save time, money, and to streamline strategic efforts. Examples of working groups are NOAA fisheries, NOAA Marine Mammals, Modeling, Harmful Algal Blooms forecasting, Ecological forecasting, Aquafarm collaboration, Oil Spill meetings and Acoustic Tagging Network activities.
- SCCOOS (alongside CeNCOOS and NANOOS) is participating in webinars, conference calls, and workshops to continue participation and further collaboration with the WCGA on Ocean Acidification and Marine Debris.

Efforts to Leverage IOOS Funding
Each fiscal year SCCOOS uses its' award to support leveraged and collaborative programs. An explanation of these programs are;

- Maintain and validate the pCO_2-DIC system (Burkolator). Train a representative at the Carlsbad Aquafarm to operate and maintain the prototype instrument. Begin development of data management and communication for data collection, quality control, quality assurance, and data archive. Initiate the IOOS marine sensor program with the long-term goal of creating a sustainable and coordinated U.S. West Coast wide ocean acidification effort.

- Several efforts are in place in California that strive to have citizens using photographs to document the tidal level, king tides, storm surge, flooding hazards, and other conditions concerning the boundary of the ocean and coastline. These photos can be used to calibrate sea-level rise and flood models, as well as provide unique detailed information on coastal resources that are currently or will be impacted by flooding. SCCOOS collaborates with many organizations in Southern California (California King Tides Project, University of Southern California Urban Tides Initiative, The Nature Conservancy and Scripps Institution of Oceanography) to leverage our efforts of designing a robust photo archive system that can be uploaded in science communications.

- Collaboration with the Orange County Sanitation District (OCSD) to improve data quality at Newport Beach Pier Automated Shore Station. Real-time measurements of temperature, salinity and fluorescence provide current resources for evaluating coastal conditions of water quality and potential harmful algal blooms. Over the last year, data quality has improved by funding additional service dives to clean sensors and the purchase of new fluorimeters.

- SCCOOS supports Dan Rudnick's glider effort out of Scripps institution of Oceanography (SIO), where he maintains three continuous glider lines off the California coast since 2008 (http://www.sccoos.org/data/spray/?r=0). Through a cooperative agreement with U.S. IOOS, SCCOOS funds one continuous transect, and the other two are funded by the NOAA Ocean Climate Observation Program through the Consortium on the Ocean's role in Climate.

  Profiling gliders are rapidly becoming essential instruments for operational observing of the nation's coastal oceans and Great Lakes. Dan's gliders have contributed 14,797 of the 25,722 glider days (2008-2012) that contribute to the U.S. IOOS sustained subsurface observations. He plays a pivotal role as a steering committee member in the U.S. IOOS National Glider Network goal to expand program-level dialog on glider deployment and operation, community standards for data access and organization, as well as what the expansion paths toward a national capacity and availability.

  This dataset lead to the development of the SCCOOS SoCal Niño index. Using glider-measured temperatures at 50m along California Cooperative Oceanic Fisheries Investigations (CalCOFI) line 90 (line 90 is off Dana Point, California). The data is compared to NOAA's sea surface temperatures in their El Niño 3.4 region (http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/). The climate prediction Center and the National Centers for Environmental Prediction (NCEP) prepares and updates regarding the El Niño Southern Oscillation (ENSO) Cycle. The two indices are remarkably correlated.

- SCCOOS funds 9 nearshore sampling stations (http://sccoos.ucsd.edu/data/cast/calcofi/) of California Cooperative Oceanic Fisheries Investigations (CalCOFI) 66 sampling stations. The focus of this study is the management of the marine environment off the coast of California, and its living resources monitoring the indicators of El Nino and climate change. Quarterly cruises are conducted off southern & central California, collecting a suite of hydrographic and biological data on station and underway.

- CalCOFI research is supported by contributions from the participating agencies: The California State Department of Fish and Game, NOAA, National Marine Fisheries Service, Southwest Fisheries Science Center, and the University of California, Integrative Oceanography Division at the Scripps Institution of Oceanography, UCSD.

- SCCOOS Leverages both CalCOFI and Seabird Surveys as sentinels of marine climate change via the Farallon Institute. Due to their existence at the boundary layers of the atmosphere and the ocean, seabirds are the most conspicuous of all marine organisms which rely on surface and near-surface ocean habitats. Seabirds also are less exploited than other upper level predators such as fish and mammals. Owing to these and other characteristics, seabirds have been put forth as reliable ecological indicators of coupled physical-ecological change. In this project we are investigating changes in the abundance, distribution, and spatial organization of seabirds in the California Current. In this study FI biologists make counts of seabirds from fisheries research vessels.

    The seabird data is valuable for several reasons:
    1. Information on seabird/mammal distribution and abundance provides an upper trophic level perspective which complements the hydrographic and lower trophic-level (plankton) data collected by others.
    2. Estimates of seabird/mammal distribution and abundance contributes to understanding the spatial ecology of these regions.
    3. By extending our existing records (May 1987-present off southern CA; May 1996-present off central-northern CA), these data contribute to understanding the effects of natural and anthropogenic climate variability on the southern and central sectors of the California Current ecosystem.

- SCCOOS leverages the national HF radar network (HFRNet) that provide surface currents in near real-time (http://www.sccoos.org/data/hfrnet/). This network is made up of more than 150 radars from 31 different institutions. They contribute their data to the HFRNet data management system, which is funded by U.S. IOOS and managed by CODRC (Eric Terrill's Lab) at Scripps institution of Oceanography (SIO) with aggregation nodes at SIO, the National Data Buoy Center (NDBC) and Rutgers University.

    The National HF Radar Network supports a number of applications such as coastal search and rescue, oil spill response, water quality monitoring, and safe and efficient marine navigation. The data is used in operational applications within organizations such as the U.S. Coast Guard, NOAA Office of Restoration and Response, and CA Office of Spill Prevention and Response.

- SCCOOS leverages the California Data and Information program (CDIP) mission is to monitor and predict nearshore waves and shoreline change (http://www.sccoos.org/data/waves/?r=0). The program has deployed over 130 wave stations, has archived over 100GB of wave data, and disseminates these data in near real time via the CDIP website, National Data Buoy Center, and the National Weather Service radio broadcasts.

    CDIP is primarily funded by the U.S. Army Corps of Engineers in support of planning and design of structures and beach nourishment projects and considers this funding their main contribution to the U.S. IOOS. This resource is accessed by over 6,000 sites daily by the Navy, Marines, Coast Guard, coastal planners and managers, maritime pilots, commercial fisherman, recreational boaters, and beach-goers.

- SCCOOS received directed funding from the IOOS office to support Uwe Send's "Del Mar" mooring. It is a multi-disciplinary real-time mooring covering the full water column on the 100m isobath off Del Mar. It has now collected a 9-year long record of physical and biogeochemical variables, soon allowing construction of a climatology; it is one of very few existing moorings that telemeter near-bottom (and water column) oxygen and pH conditions; it is located next to a rocky reef with abundant species, including rock fish, and carries acoustic backscatter sensors for fish and zooplankton detections; it recently got a fish tag receiver added also telemetering its data; the MBARI genomic ESP sampler will be tested on the mooring this fall. The mooring complements similar moorings on the 80-100m isobaths off Oregon and Washington (NANOOS). Before SCCOOS received directed funding from the IOOS

office for this mooring it was funded by ship time which is provided via UC ship funds since the mooring is also used for teaching purposes.

The Del Mar mooring has become a cornerstone and reference site for a variety of process studies and even laboratory experiments, is recognized by NOAA as an important element in the west coast ocean acidification observing system, and has attracted participation in/usage of the platform by a variety of researchers (T.Martz/SIO, D.Demer/SWFSC, B.Simmens/SIO, C.Scholin/MBARI, D.Chadwell/SIO, J.Jaffe/SIO). The City of San Diego Public Utilities Department considers the Del Mar mooring data and capability useful enough that they have asked for two duplicate moorings off Pt. Loma and South Bay. The data from the mooring have been requested and used by:

1. E.Bockmon, C.Frieder, and M.Navarro to set parameters of biological lab experiments (Bockmon et al 2013, Navarro et al 2014, Frieder et al 2014)
2. SPAWAR (A.Wiggington) for model-data comparisons
3. Ron Johnson (local fisherman)
4. A.Kurapov (OSU) for validation of the NOAA West Coast Ocean Forecast System (WCOFS)
5. Southern California Coastal Water Research Project (M.Sutula) - local scientists (E.Parnell, D.Lucas, A.Nosal, D.Demer, etc).

The Del Mar mooring data have further led to insight into the effect of La Nina on the oxygen conditions on the shelf (Nam et al, 2011), into the effect of upwelling relaxations on oxygen concentration (Send and Nam, 2012), and into sea/land breeze causing resonant oscillations (Nam and Send, 2013).

- SCCOOS leverages the Marine Mammal Center by displaying their marine mammal health map on the SCCOOS site (http://sccoos.org/projects/mmhealth/). The goal of this project is to develop a national marine mammal health tracking program that is web-based and readily accessible to scientists, managers and the general public. This will allow detection of spatial and temporal changes in marine mammal health that will enable early prioritization of management and conservation efforts to mitigate mortality and identify potential public health risks. In addition, this project will potentially contribute to the detection of climate change impacts on marine mammal health.

- SCCOOS visualizes AIS ship tracking by leveraging the Southern California Marine Exchange and NOAA Office of Coast Survey.

- SCCOOS visualizes meteorological observations by leveraging National Oceanic and Atmospheric Administration (NOAA) Research (Oceanic and Atmospheric Research) Earth System Research Laboratory (ESRL) Global Systems Division (GSD) developed the Meteorological Assimilation Data Ingest System (MADIS) to collect, integrate, quality control (QC), and distribute observations from NOAA and non-NOAA organizations.

- SCCOOS visualizes satellite ocean data by leveraging NASA jet propulsion laboratory.

- SCCOOS visualizes modelled wind and rain nowcasts and forecasts by leveraging The COAMPS® model is a product of NRL: The Naval Research Laboratory's Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS®). COAMPS® is produced by NRL Monterey and accessed through the US Global Ocean Data Assimilation Experiment (USGODAE).

- SCCOOS visualizes west coast Ocean Acidification by leveraging the west coast shellfish industry, AOOS, NANOOS and CeNCOOS.

Updates to RA Governance Board Membership

Region	Type of Governance	Distribution of Governance Board Membership							Foreign (all sectors)	Total Number of Governance Committee Members
		Government				Non-Government				
		State	Local	Tribal	Federal	Research Institute	Industry	NGO		
SCCOOS	MOU	7	9	0	12	11	0	3	1	43

Governance Activities and Accomplishments

- SCCOOS hosts a weekly conference call between SCCOOS program staff, Executive Steering Committee chair and Board of Governors chair.
- SCCOOS has facilitated and participated many governance meetings over the last 6 months;
    1. SCCOOS Board of Governors meeting – December 3, 2015
    2. CeNCOOS Winter meeting – February 11-12, 2016
    3. IOOS Spring Meeting – March 1-3, 2016
    4. Executive Steering Committee call – March 16, 2016
    5. Board Executive Committee call – April 8, 2016

Education and Outreach Activities

- SCCOOS participates in education and outreach activities throughout the year. The list of activities are, https://docs.google.com/a/noaa.gov/spreadsheet/ccc?key=0Ar1oUzIQ8DBVdHFQTXk2RThlWFVsdkVIYW5qWUUwNkE&usp=sharing

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[i] IOOS Summit Report, 2012. http://www.iooc.us/wp-content/uploads/2013/01/U.S.-IOOS-Summit-Report.pdf