DATA MANAGEMENT
SUMMARY DETAILS

SCCOOS continues to integrate a broad suite of observations including: surface currents, satellite imagery, wave conditions and forecasts, meteorological conditions and forecasts, water quality, bathymetry, ocean temperature, salinity, chlorophyll, and density in the form of data products and raw data. This effort provides scientists, decision makers, and the public access to products and data services that will facilitate a scientific basis for research and management of the Southern California ocean environment. SCCOOS has implemented a broad range of value-added efforts that leverage both the growing end user structure and the California investment in observing system infrastructure. Technical activities within SCCOOS have focused on the collection and synthesis of accurate and comprehensive observations and the management and early delivery of those data into useful data products and decision support tools.

SCCOOS as a regional association has received national attention for product display and data dissemination. Products are easily navigated by either region of interest or product type and are available online: **www.sccoos.org/interactive-map**.

AUTOMATED & MANUAL SHORE STATIONS

The manual shore station data collection of water temperature and salinity provides a historical time series data, with some sites dating back to 1916. Continuing integration of the SCCOOS automated shore stations with other shore station networks in Southern California including the County of Los Angeles sponsored Watch the Water (**www.watchthewater.org**) program as well as the historical shore station program provides data for much needed long term trend analysis. SCCOOS scientists have worked with Watch the Water organization in providing both sensor specification and IT support. Maintaining data integra-

tion for both the manual and automated shore stations requires periodic hardware upgrades and communication and code maintenance as well as continual interaction with volunteers.
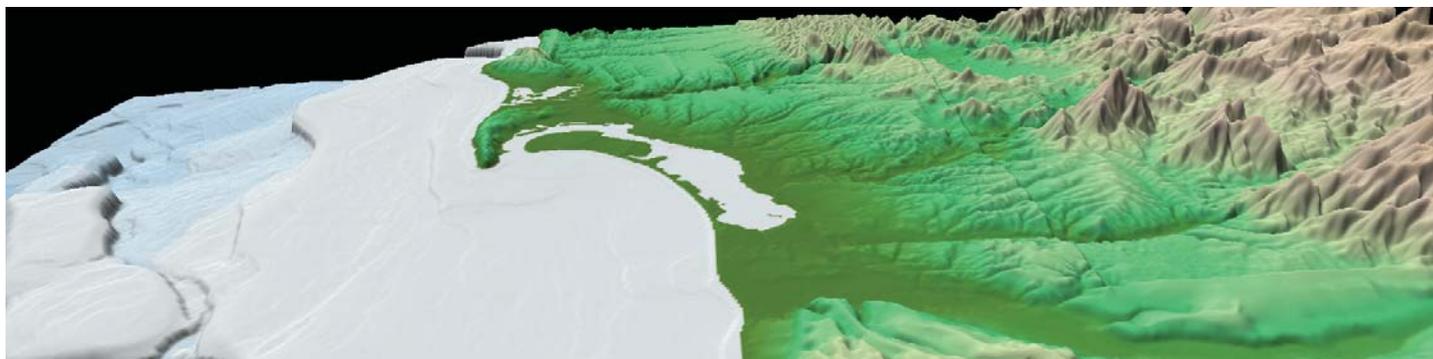
BATHYMETRY MAPS

SCCOOS provides online access to Southern California bathymetry maps provided by the National Geophysical Data Center (NGDC). These maps provide a backdrop for many users' research and personal information. SCCOOS data managers consult with users on data downloads and orientation.

HAB & HAB-RELATED DATA

Monitoring of HAB species has been conducted from the Oceanside and Scripps Pier in an effort to develop methodologies for a Bight-wide HAB monitoring effort. The monitoring of chlorophyll, nitrates, and silicates are conducted 2x a week to develop appropriate methodologies for monitoring large-scale areas to examine the relationship between local biological productivity and nutrient inputs. Understanding these processes is fundamental in understanding what forces algal blooms. SCCOOS maintains access to this data for download.

HYDROGRAPHIC CAST DATA ACCESS INCLUDING DATA FROM GLIDERS

Agencies operating publicly operated treatment works that maintain monitoring stations for their NPDES permits continue to provide SCCOOS their hydrographic data. SCCOOS integrates the NPDES monitoring data and shoreline water quality data into its regional data system. Both ship-based sampling of the ocean (CTD) data and indicator bacteria data are being provided to the

*Screen capture of a Bathymetry map rendered in Fledermaus.*

SCCOOS data management system for planned integration with other observations. Coordination between the various participating organizations, including the Orange County, City of Los Angeles, County of Los Angeles, and Ventura/Oxnard Sanitation Districts, has resulted in a standardized grid that is sampled by the different agencies on a quarterly basis. Data are typically provided 60 days after collection to allow for QA/QC. NPDES permit holders are using the SCCOOS data management system to assess long term, regional trends. These hydrographic data will be the initialization and constraint of area ocean models.

SCCOOS programmers have worked toward integrating glider data into the system. The glider data is complex, consisting of several different file formats and data types. The interface will include the flexibility to interactively plot glider tracks using polylines versus images for Google Maps glider track displays allowing for faster browser load capability.

METEOROLOGICAL DATA INTERFACE

SCCOOS aggregates, integrates, and manages data generated at approximately 400 coastal meteorological stations from multiple networks deployed in Southern California. Data are made publicly available via a Google Maps interface. A public outreach effort to users of the product shows overwhelming support for continued operation.

Observing system products developed to meet California 5th grade science standards and used in educational outreach SCCOOS programmers are working with Ocean Institute staff to develop a basic mapping display web portal for visitors to view data. This activity will foster community outreach and provide an interactive utility for the Ocean Institute. The Ocean Institute plans to use this modified portal for education and outreach activities.
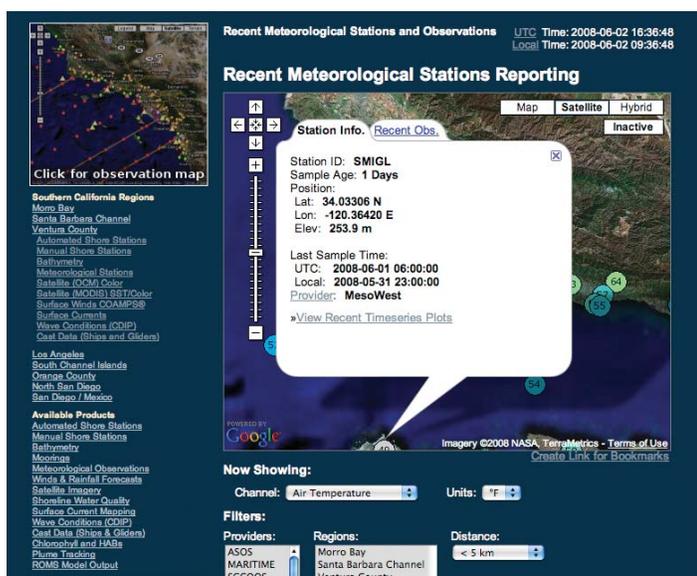
Interactive graphical display of meteorological station reporting

SCCOOS initiated a targeted outreach effort to the maritime safety community. SCCOOS personnel hosted a boot and presented on 12 April 2007 at the California Surf Lifesaving Association Board of Directors meeting in Redondo Beach. The marine safety offices in attendance were encouraged to engage in SCCOOS data sharing and data development efforts that will serve their mission of public safety. Interest by Huntington Beach lifeguards in SCCOOS observations and products was raised during the HB06 field demonstration. This outreach effort will build on that experience, bringing a more directed opportunity for the lifeguard community to provide input into SCCOOS data product development.

OCEAN MODEL NOWCASTS/FORECASTS

An HF-Radar Network Node was sent to JPL in May 2006 for dissemination of measurements made by HF-Radar systems throughout California. These data are processed to produce surface current velocities at variable resolution (nominally 1, 2 and 6km) along the West Coast of the United States and are assimilated into the Regional Ocean Modeling System (ROMS-DAS) in near-real time at JPL.

SCCOOS designed an interactive display of JPL's Regional Ocean Modeling System (ROMS) output of temperature, currents, and salinity overlaid on bathymetry. Users will be able to not only select a depth profile, but also choose any cross-sectional area of the Southern California Bight and produce a gradient along that path. This display will enhance online data usability.

The modeling interface for the ROMS Nowcasts reads the Nowcast NetCDF files directly and can return on-demand cross-sections at any given time. A secondary interface emulates "virtual moorings," allowing a user to view a time-series of ROMS modeled output at a specific location over long time ranges. ROMS, Nowcasts are data sets at a specific time. By aggregating multiple nowcasts, data managers have been able to build a time-series (4th dimension) component into the visualization process. Stepping through multiple Nowcasts on-the-fly can be significantly resource intensive. SCCOOS programmers have hand-selected targeted areas for these "virtual moorings" located at the ocean outfalls along the coast. This allows time series to be pre-generated and speeds the access time.

REMOTE SENSING DATA ACCESS

Near-real time Level-2 products for Southern California and the west coast, in multiple formats, have been developed including:

- QUIKSCAT: wind vectors
- JASON: sea surface elevation
- MODIS SEA SURFACE TEMPERATURE

- MODIS COLOR PRODUCTS: chlorophyll, total suspended matter
- SAR WIND SPEED PRODUCTS - demonstration product, not near-real time

Additional SAR/ASTER acquisitions were provided during the Hyperion diversion event to identify surface plume location and extent.

Rolling 7-day near-real time browse data are being provided for multiple sub-regions including:

- OCEAN COLOR MONITOR: chlorophyll, total suspended sediment
- MODIS SEA SURFACE TEMPERATURE
- MODIS COLOR PRODUCTS: chlorophyll, total suspended matter

Optimally interpolated sea surface temperature (GHRSST) - recent addition

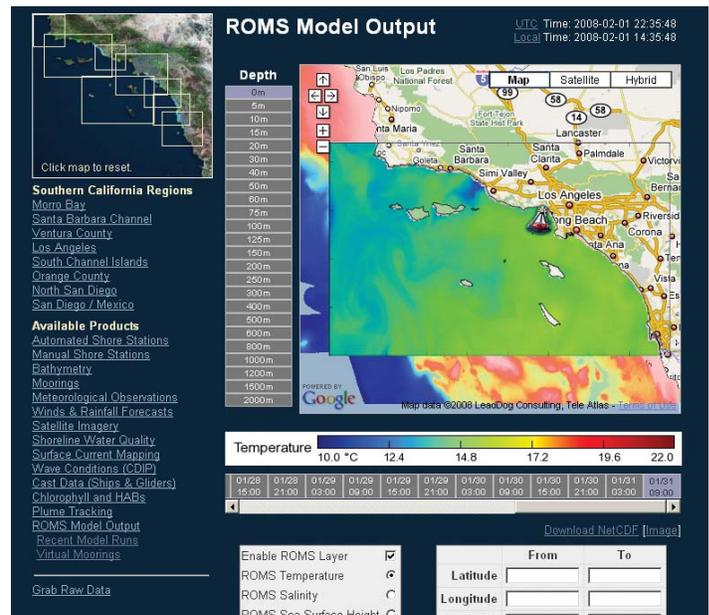*Interactive graphical display of ROMS Model output.*

SHORELINE WATER QUALITY DATA

SCCOOS continues to collect and integrate AB411 shoreline water quality data sent from collaborating counties to access, integrate, and display the data alongside other observing system data streams to facilitate the development of decision-making tools. Five counties in the region already provide data to the SCCOOS data management system on a weekly basis and GIS-based tools are in development. The data delivery system is now in use by both agencies and general public.

SURFACE CURRENTS AT 1KM AND 6 KM RESOLUTION AVAILABLE HOURLY AND WITH DE-TIDED 25 HOUR AVERAGES

Planned data collection and dissemination efforts continue within the SCCOOS program. As the network of HF radar systems grows within California, programmers update and incorporate new data streams into the mapping system.

SIO SCCOOS programmers have developed a useful, interactive site management tool for Surface Current Mapping antenna systems: **www.sccoos.org/SoCal**. The site can be used for planning purposes having California Coastline, google maps, and Topozone links based on GPS location. Users are able to view available geographic information for the site location, and upload images taken at the site location for discussion and review. The site hosts publicly displayed data such as site name, affiliation, owner information, location, images, and public notes or files, as well as login required information such as maintenance notes, and privately maintained images and contributed files. This management tool has been replicated for CeNCOOS: **www.sccoos.org/CeNCOOS** providing statewide consistency and compatibility.

SIO SCCOOS programmers have developed detailed system diagnostic utilities from the available metadata allowing for a quick look at data transfer latencies, system health, data reliability, and error estimates. Programmers continually interact with vendor representatives in an effort to expand and improve diagnostic, and have made numerous recommendations, which in turn have been implemented in subsequent software releases.

Scripps Institution of Oceanography co-hosted a meeting with NOAA on 6 April 2007 to develop recommendations for Standard Operating Practices for surface current mapping HF radar systems. SCCOOS and CeNCOOS staff and PIs and HF radar experts from around the country attended the meeting. Following the meeting, representatives from the SCCOOS have collaborated on a draft document. This document details best practices for HF radar related tasks such as: locating a site, power requirements, communications, enclosure specifications, supporting equipment (UPS, backup drives, etc.), antenna tuning, antenna pattern measurement, software configuration, site maintenance, data management, and quality control. This working document will be iterated upon throughout the community and will provide and outline of management practices learned through experience.

Operation of HF radar requires an experimental license to be issued from the FCC. Due to the large number of units proposed for deployment, additional paperwork and justification was required. The FCC partially granted an experimental site request on February 10, 2006 for 17 of the 18 locations. The request covers frequencies, on a not to interfere basis, within the three main operational bands for surface current mapping antenna systems 5MHz, 12MHz, and 25MHz. SCCOOS has submitted a license

renewal on May 18, 2007. We are also in discussion with NOAA, who has independently received blanket approval of several bands with the caveat of operations are to be on a not-to-interfere basis.

A workshop conducted 10-13 September 2007 at Scripps Institution of Oceanography brought together representatives of the HF radar technical community from around the nation. The workshop included representatives from the Radiowave Operators Working Group (ROWG). The main goal of the workshop was to garner input from participants into the draft Standard Operating Practices ("Best Practices") document highlighting the many aspects of HF radar operation, including siting requirements, communications, supporting equipment, software settings, data management, and quality assurance/quality control. The workshop was supported through IOOS funding as part of an effort to bring the HF Radar technical community together for discussions on field installations, radar operation, software programming, and site integration.

Through continued collaboration with other program participants, HFR data is currently being shared for the generation of data products benefiting the public. SCCOOS continues in its implementation of the COCMP HF radar data exchange for all of California and has made significant advances in building HF radar data transport for the region. SCCOOS programmers also continued development on HF radar metadata and implementation of a network Common Data Format (netCDF) for data dissemination of statewide HF radar surface current maps. Currently data access is available through near real-time online google map graphical displays. SCCOOS data management includes continuing development at the radial data level focusing on schema development and metadata extraction for further diagnostic information and quality control.

A total of 10 new HFR sites were added to the near-real time data acquisition and processing system for a total of 45 sites within California. An additional data acquisition computer (Portal) was deployed at University of California, Santa Cruz (UCSC) (07/25/2007). There are now five operational portals deployed in California and one that is ready for integration at the University of Southern California. The previous deployed portals are operational at University of California at Santa Barbara (UCSB) (2006/01/30), San Francisco State University (SFSU) (2006/04/11), California Polytechnic State University (Cal Poly) (2006/11/15), and Scripps Institution of Oceanography (SIO). The UCSC High Frequency Radar Network (HFR-Net) Portal was brought on-line to serve data from UCSC/NPS HFR sites on 5 December 2007. The installment of this Portal lightens the load on the SFSU Portal providing a larger buffer for each system. This larger buffer effectively enables the system

to tolerate longer network outages. The SFSU portal remains in operation and continues to serve data from SFSU and BML HFR sites. Future HFRNet development includes deployment of a data repository computer (node) at UCSC and enabling access to total vector data.

SIO SCCOOS programmers have developed detailed system diagnostic utilities from the available metadata allowing for a quick look at data transfer latencies, system health, data reliability, and error estimates. SCCOOS staff have drafted a working document: *Deployment & Setup of a High-Frequency Radar for Ocean Surface Current Mapping: Best Practices.*

WIND AND PRECIPITATION FORECAST INTERFACE

SCCOOS programmers upgraded the transitory COAMPS wind display, set up only as a test for SIO, to a Fleet Numerical Meteorology and Oceanography Center (FNMOC) supported observational output.

Recently, both maritime individuals and representatives of boating associations region wide, provided feedback to SCCOOS on the usability of the wind forecasts and their growing dependence on the data.

WAVE CONDITIONS (CDIP)

Regional maps of wave height and direction are provided by the Coastal Data Information Program through SCCOOS. SCCOOS and CDIP programmers have worked together to provide a seamless user experience for accessing regional wave data. This relationship has extended into the rapid response projects that SCCOOS supported collaborating and integrating data products in support of the Huntington Beach 2006 experiment, and OCSD and Hyperion Outfall diversions.

PROJECTS

SCCOOS provided rapid response data support in May when the Orange County Sanitation District requested data and product support during ocean outfall repairs. Repairs took place in the early morning during low flows, and OCSD diverted and stored incoming and treated wastewater within the delivery and treatment systems during the one-day repair. SCCOOS provided local views of modeled surf zone waves and currents, near real-time meteorological observations, and surface currents for use by OCSD and the Orange County Health Care Agency. Programmers also initiated a plume tracking simulation at the inshore location for tracking surfacing discharge in the event that longer-term diversion was necessary.

SCCOOS provided near real-time weather data in support of the 2007 Southern California wildfires.

SYSTEM DEVELOPMENT

SCCOOS representatives provided feedback into the newly created IOOS Observation Registry following a request for input from Regional Associations. SCCOOS programmers provided an XML document designed to conform to meet minimum FGDC required fields (CSDGM core requirements), while meeting the IOOS registry requirements as best as possible still conforming to the FGDC metadata standard. Programmers also detailed a best fit 1-to-1 relationship between the IOOS registry specification and the FGDC specification.

In April 2007, SCCOOS completed the registration of its regional observation activities in the IOOS Regional Observations Registry, a national database that defines the operational status and distribution of in situ ocean observation activity among the non-federal participants in IOOS. SCCOOS's contribution to the registry was made possible by data management support in NOAA's Coastal Observing Technology System (COTS) program. SCCOOS representatives provided feedback into the newly created IOOS Observation Registry following a request for input from Regional Associations.

Included in SCCOOS's registration were all the radars in operation for California's Coastal Ocean Current Monitoring Program (COCMP). The primary purpose of the registry is to support strategic planning and to facilitate the discovery and use of observation data. In addition to HF radar sites under COCMP, observational activities registered by SCCOOS included 136 regional observations aggregated by SCCOOS, as well as all CDIP buoys presently reporting. The IOOS registry map can be viewed at **oceanobs.org/wc**.

The SCCOOS data management team configured an interactive Federal Geographic Data Committee (FGDC) compliant metadata engine. Programming this system required a significant amount of research into various metadata standards and cataloging software. Many of the available tools were either not fully compliant or relied on vendor supported databases. Although the SCCOOS programmers used existing community accepted standards, new code was needed for the backend system. Future work will include populating the database for a full FGDC compliant metadata catalog of SCCOOS data. Programmers also began work on implementing the common application programming interface (api) for ease of access to existing metadata, as well as contributing to NOAA's Regional Observations Registry.

Product development continues to advance as SCCOOS programmers were able to improve the data management administrative interface to databases by adding a summary page for collections of measurements displaying some statistics, a plot of surface data, and a small map. This interactive administrative interface allows for quick data looks and statistical summaries. Optimization of the data system for fast retrieval continues to require time and constant updating as the near real-time system grows.

SCCOOS programmers began planning to restructure the real-time data storage system. As the data system continues to increase in size, data queries and data serving can become sluggish to the user. Efforts are underway to reorganize the database schema and storage methods. Individual data streams require a dedicated database with a shared metadata catalog. Parsing the SCCOOS database causes more complex relationships between parameters for querying across multiple datasets, but significantly improves access and storage requirements by a limiting single bloated system. This activity will require significant effort and will extend through 2008.
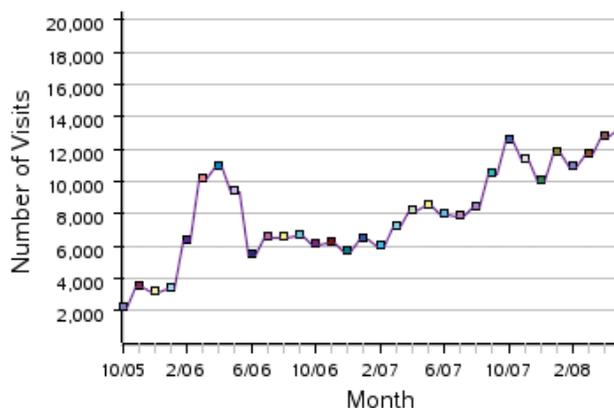
Tracking of SCCOOS website visits as of 2 June 2008.