South Bay Coastal Ocean Observing System

California Clean Beaches Initiative

Quarterly Report
September 2003

to
City of Imperial Beach

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Executive Summary

This quarterly reports reflects efforts conducted under a contract between Scripps Institution of Oceanography and the City of Imperial Beach under California's Clean Beaches Initiative for the period between July 1 2003 – September 30, 2003. Resources provided under this contract are to be used to establish a Coastal Observing System in the San Diego Southbay region to provide real-time time measurements of key oceanographic parameters that are relevant to understanding the complex coastal transport mechanisms present in this region and their relevance to local water quality issues.

Efforts conducted during this time period are as follows:

- Development of real-time display capabilities for accessing real-time data from the nearshore currents and wave measurement system. QA/QC efforts are underway to examine the data to evaluate whether sensors are performing as expected and whether changes need to be implemented.
- Continued maintenance and implementation of network upgrades for the 3 CODAR systems that were installed for SDCOOS. This effort has included the installation of software upgrades and data archiving. In addition, we have continued the integration of data from a fourth CODAR system located in Rosarito Beach, MX that is owned by colleagues at CICESE/UABC.
- Fabrication of the nearshore water quality sampling station which allow real-time measurements of ocean water temperature, water salinity, and turbidity. All sensors have been delivered, underwater cables fabricated, and corrosion resistant mounts were built. We anticipate deploying the system early next quarter so we can begin evaluating their performance in the rigors of the surfzone.
- Continued operation and maintenance of an ocean buoy located near the South Bay Ocean Outfall. The buoy presently has a vertical array of temperature sensors to allow the measurement of water column stratification in the region. Real-time data is telemetered to a receiving station that was installed on the Imperial Beach pier.
- Continued integration of County of San Diego Department of Environmental Health monitoring data into the SDCOOS web site. Web pages have been developed which allow the viewing of recent monitoring results in a GIS format. Database tools have been developed which allow web users to plot multi-year time series of the County's data for all coastal sites in San Diego.
- An expanding archive section is now present on the SDCOOS web site using database tools designed at the San Diego Supercomputer Center. Data sets now available to the user include CODAR hourly and daily averages of ocean surface currents, water quality data, and 300m resolution satellite imagery. Users may access this data repository from http://www.sdcoos.ucsd.edu/data/srb_access.cfm.
- SDCOOS has met with representatives from the Southern California Coastal Water Research Project and its member agencies outlining the strengths of a coastal observing for water quality monitoring. SDCOOS will be supporting the Bight '03 regional monitoring program and will showcase its capabilities in support of multi-agency program designed to understanding the fate and transport of storm water runoff from the Tijuana River (see an earlier report which discussed results from runoff events in February 2003). A Bight '03 data support page will be developed by SDCOOS for this effort.

Project Timeline – Schedule update

TASK ITEM	Schedule completion date based on a July 1, 2002 start
1.1. *Coastal Ocean Dynamics Application Radar*	
1.1.1 – 1.1.3 site planning, array design, order system	September 15, 2002 (2.5 months)
1.1.4 – 1.1.6 system installation	January 31, 2002 (6.5 months)
1.1.5 – 1.1.8 system calibrations and optimization	September 15, 2003 (14.5 months)
1.1.9 data integration	continuous effort through June 30, 2004 (24 months)
1.2. *Nearshore Currents and Water Type Sampling*	
1.2.1 – 1.2.2 system fabrication, site planning	December 15, 2002 (5.5 months)
1.2.3 – 1.2.4 system installation	January 15, 2003 (6.5 months)
1.2.5 – 1.2.6 data integration	continuous effort through June 30, 2004 (24 months)
1.3. *Surf-zone Currents and Water Quality Sampling System*	
1.3.1 fabricate system	December 15, 2002 (5.5 months)
1.3.2 install system	January 15, 2002 (6.5 months)
1.3.3 install data cable / logging computers	January 15, 2002 (6.5 months)
1.3.4 data integration	continuous effort through June 30, 2004 (24 months)
1.4. *Water Column Stratification Measurement System*	
1.4.1 – 1.4.2 system fabrication and installation	January 1, 2002 (6 months)
1.4.3 data integration	continuous effort through June 30, 2004 (24 months)
1.5. *Central Data Acquisition and Real-Time Data Distribution System*	
1.5.1 – 1.5.3 database development, data merger, online access tool development	continuous effort through June 30, 2004 (24 months)
1.6. *Data Integration and Interpretation*	continuous effort through June 30, 2004 (24 months)
1.7. *Reporting*	
1.7.1-1.7.3 progress reports of activities, milestones, data summaries, and interpretation efforts	continuous effort through June 30, 2004 (24 months)

Activities undertaken for the above timeline during the time period of this report:

Tasks 1.1 – Coastal Ocean Dynamics Application Radar

All CODAR sites have been installed and are currently operating. Real-time data is streamed to the http:www.sdcoos.ucsd.edu web site. Routine maintenance including software upgrades and data archiving is conducted at each site on an as needed basis. We continue to provide support to the San Diego County Department of Environmental Health and the Imperial Beach Safety Center.

Task 1.2 Nearshore Currents and Water Type Sampling System

The nearshore current sampling system continues to operate at a location approximately 200' from the end of the Imperial Beach Pier. A number of network and data outages occurred in the first months of operation as a result of intermittent power outages on the City's pier. Unfortunately, many of these outages were not reported to SDCOOS staff which delayed troubleshooting activities when the system was down. Several steps have been taken to make the system more stable including the deployment of an uninterruptible power supply (UPS) for the control computer and the development of more robust software better able to recover from unplanned shutdowns. Software has also been developed for allowing the real-time display of the wave and current information on the SDCOOS web site, however we have held off on deploying the software live on the web until this system becomes more stable. We anticipate going live with the data in mid November.

Task 1.3 Surf-zone Currents and Water Quality Sampling System

Data from the current meter continues to be evaluated for QA/QC purposes and all data since installation has been archived. Analysis efforts indicate that the current meter may have been rotated by large waves present in an earlier storm. We have determined that a maintenance dive needs to be scheduled to potentially move the current meter so that it is better positioned to monitor the currents. We anticipating moving the instrument within the next 6 months as conditions permit so that is fully operational for the next swimming season.

Task 1.4 Water Column Stratification Measurement System

This system continues to operate near the wye of the South Bay Ocean Outfall. Data has been offloaded and is currently being compared with CTD data from the SBOO monitoring program. A real-time telemetry link has been established with a receiving station installed on the Imperial Beach pier and real-time display software for the internet has been developed. Data summaries of water column stratification are also now availabe at the SDCOOS web site.

Task 1.5 Central Data Acquisition and Real-Time Data Distribution System

Development and maintenance efforts for the SDCOOS real-time data distribution system continues.

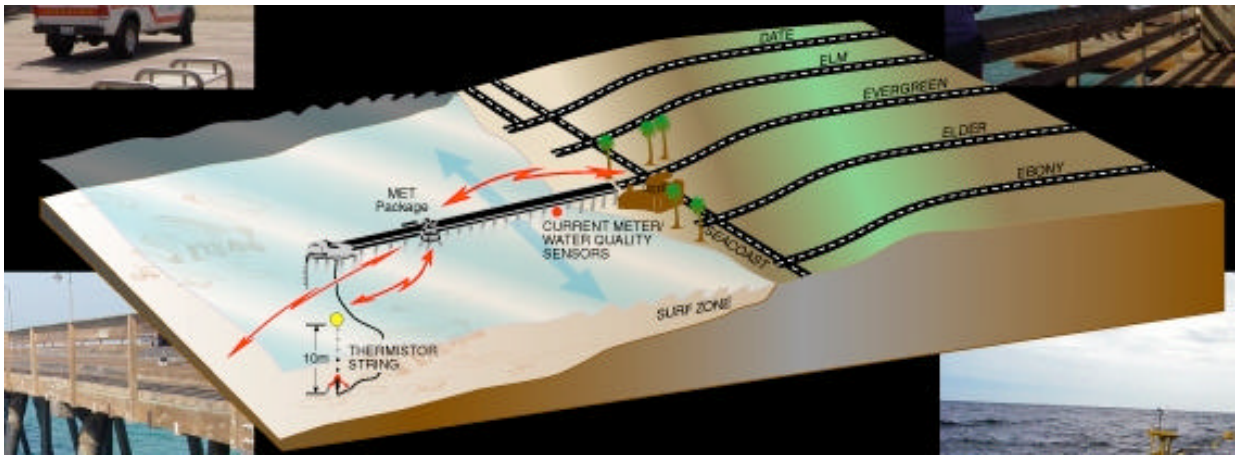

Figure 1. Overview of the monitoring equipment deployed on the Imperial Beach pier. The system cabled to the pier represents a vertical profiling current meter which allows measurement of ocean waves and currents. The measurement site is approximately 200' offshore the pier.

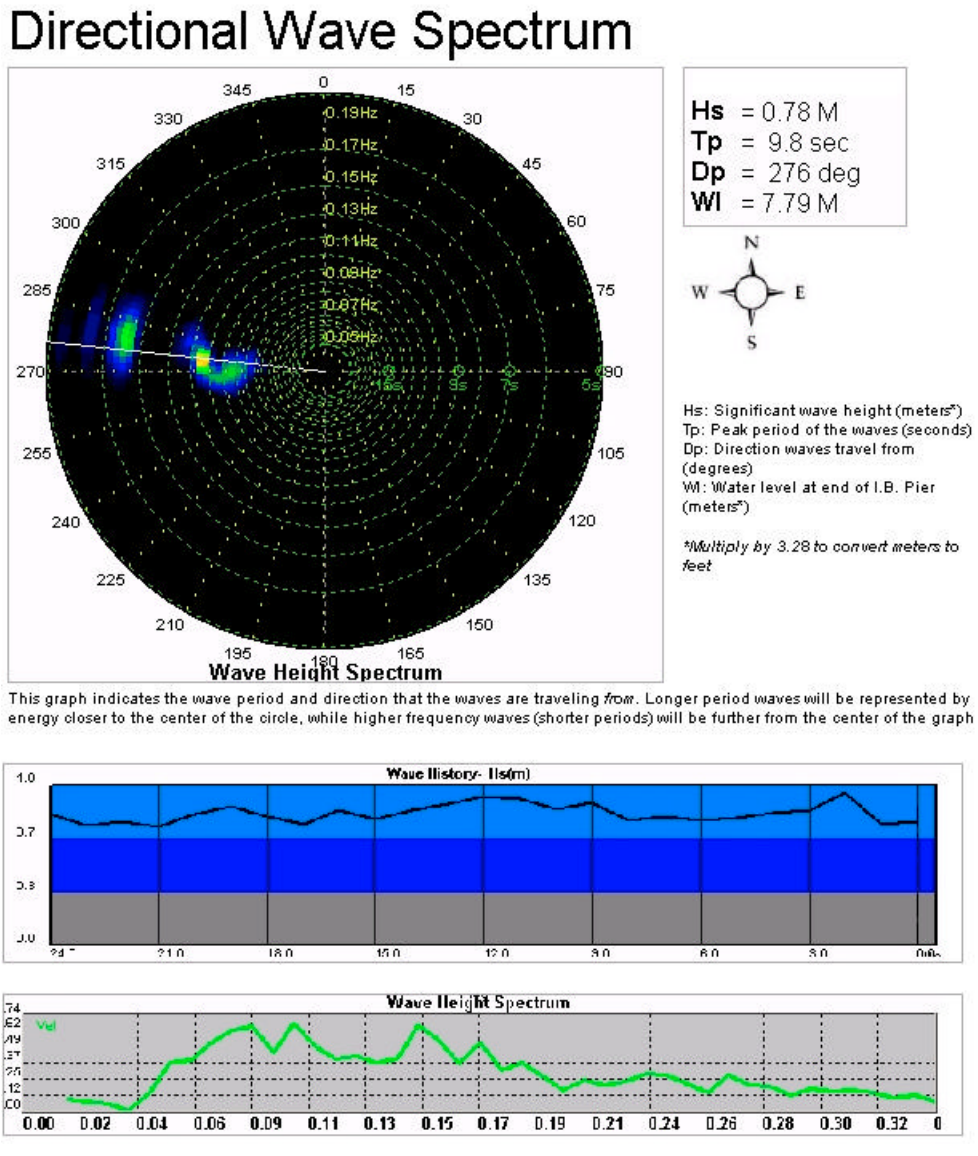

Figure 2. The display screen of wave heights measured at the Imperial Beach Pier. This screen will be updated hourly and be available to the public at http://www.sdcoos.ucsd.edu/data/wave_data_IB.cfm.

The compass plot represent the direction that the wave energy is coming from and over what wave periods this wave energy is distributed. The box in the upper right gives the significant wave height of the ocean (Hs = 0.78 m), the peak period of the waves (Tp = 9.8 seconds), the direction of the waves (Dp = 276 degrees), and the water level at the measurement site (Wl = 7.79m). Of direct interest to SDCOOS is the direction of the waves since long period swell from the south may be responsible for northward surfzone transport of contaminated water.

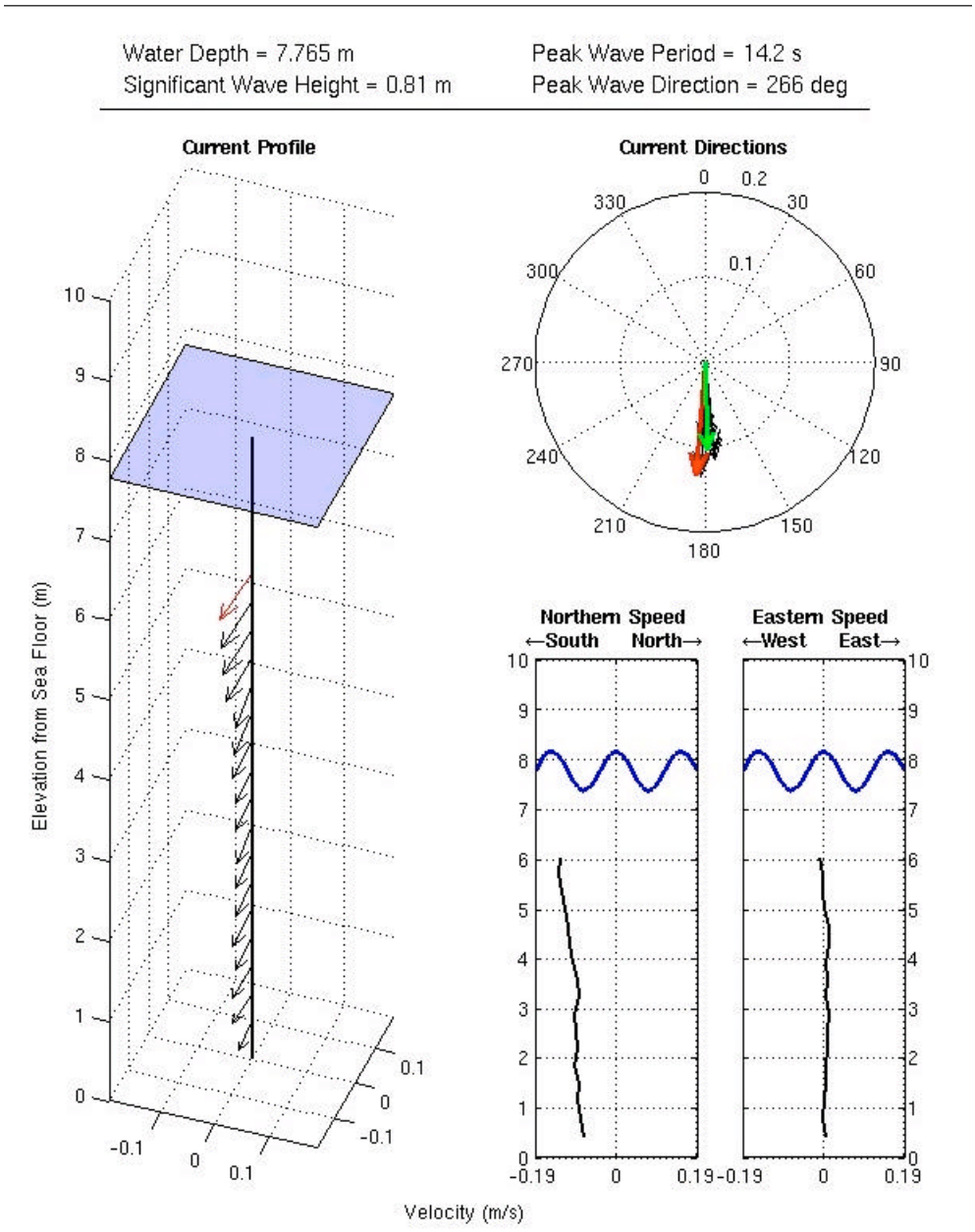

Figure 3. The online display developed for the vertical current meter deployed at the end of the Imperial Beach Pier. All data shown will be based upon hourly averages of sampling. The red vector in the current profile & current directions plots represent the current velocity measured closest to the surface. The green vector in the current directions plot represents the depth averaged velocity. The blue plane in the current profile plot indicates the water level. The blue lines in the northern & eastern speed plots represent the water level and significant wave height. Users will be available to view this data at http://www.sdcoos.ucsd.edu/data/current_data_IB.cfm.

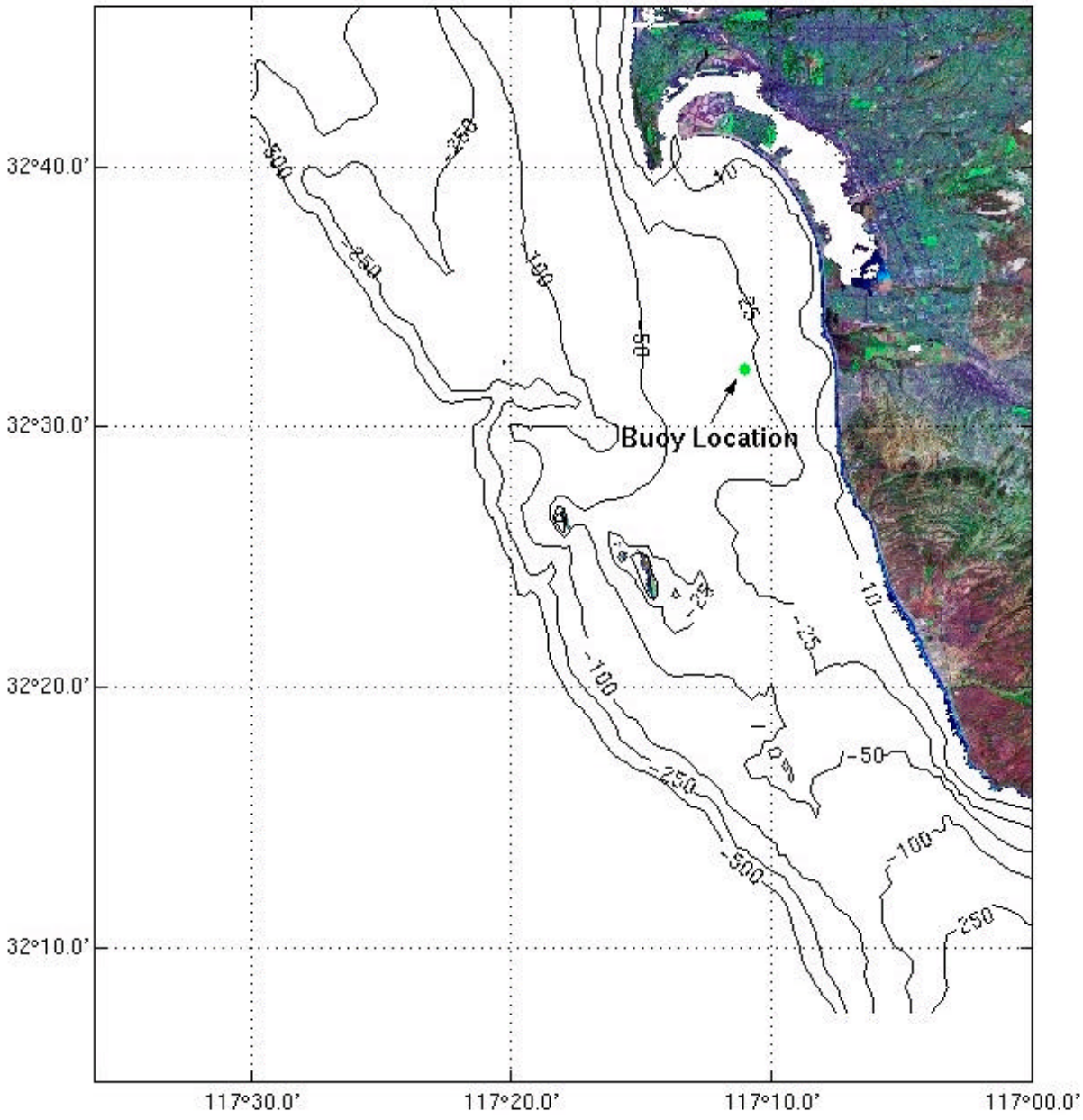

Figure 4. A map of the San Diego Southbay region showing bathymetry contours and the location of the SDCOOS buoy at the Southbay outfall. The buoy is located in 28m water depth near the center of the wye of the diffuser.

Figure 5. The SDCOOS buoy and mooring prior to deployment near the Southbay outfall. The workboat Sammy G was used for deployment of the mooring and its 2000 pound anchor. The mooring also serves as a platform for a current profiler that was provided for with funds outside of the CBI program.

Figure 6. The SDCOOS buoy deployed at its mooring location. The buoy was designed to have minimal structural components to prevent vessels from tying off to the buoy and to protect instruments from vandalism. A radar reflector (the wide plastic object) and a solar powered flashing light notifies vessels of its presence in the water. In addition, a Notice to Mariners was filed with the U.S. Coast Guard to identify the SDCOOS buoy in nautical charts of the region. The black antenna at the top of the buoy allows data to be telemetered to shore.

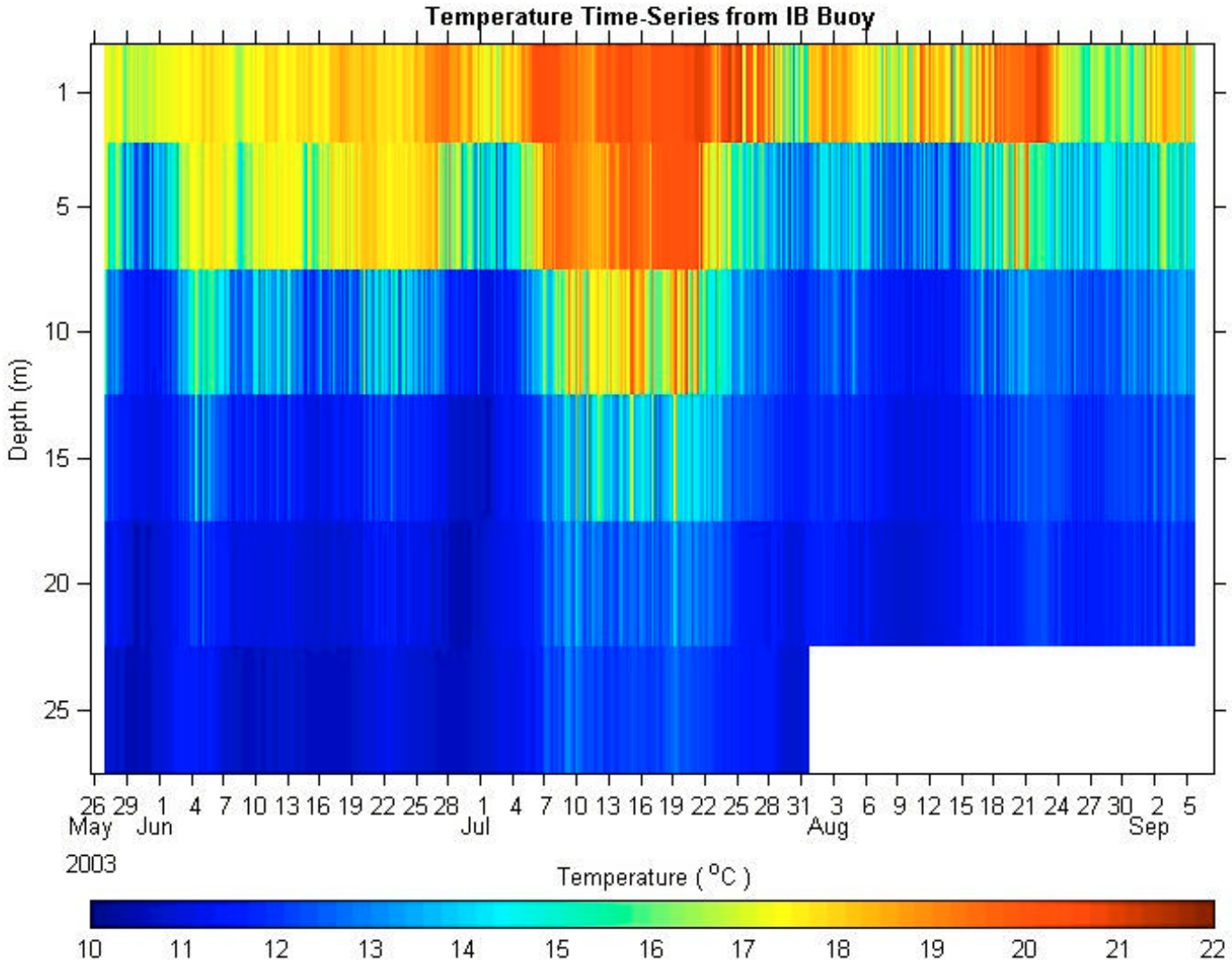

Figure 7. Time series of ocean temperatures measured as a function of water column depth by the SDCOOS mooring from when it was deployed (May) through this report. In this plot, the ocean temperatures are mapped to colors, with blue representing cooler water. Use of this data allows SDCOOS to measure water column stratification which is relevant to understanding whether the effluent plume is trapped beneath the thermocline. When the stratification is weak, the plume is able to surface and can be potentially transported by surface currents. A surprising observation is the intermittent breakdown in stratification that appears to occur for short time periods. An example is the presence of cool water near the surface at the end of July/early August and again around August 27-30.

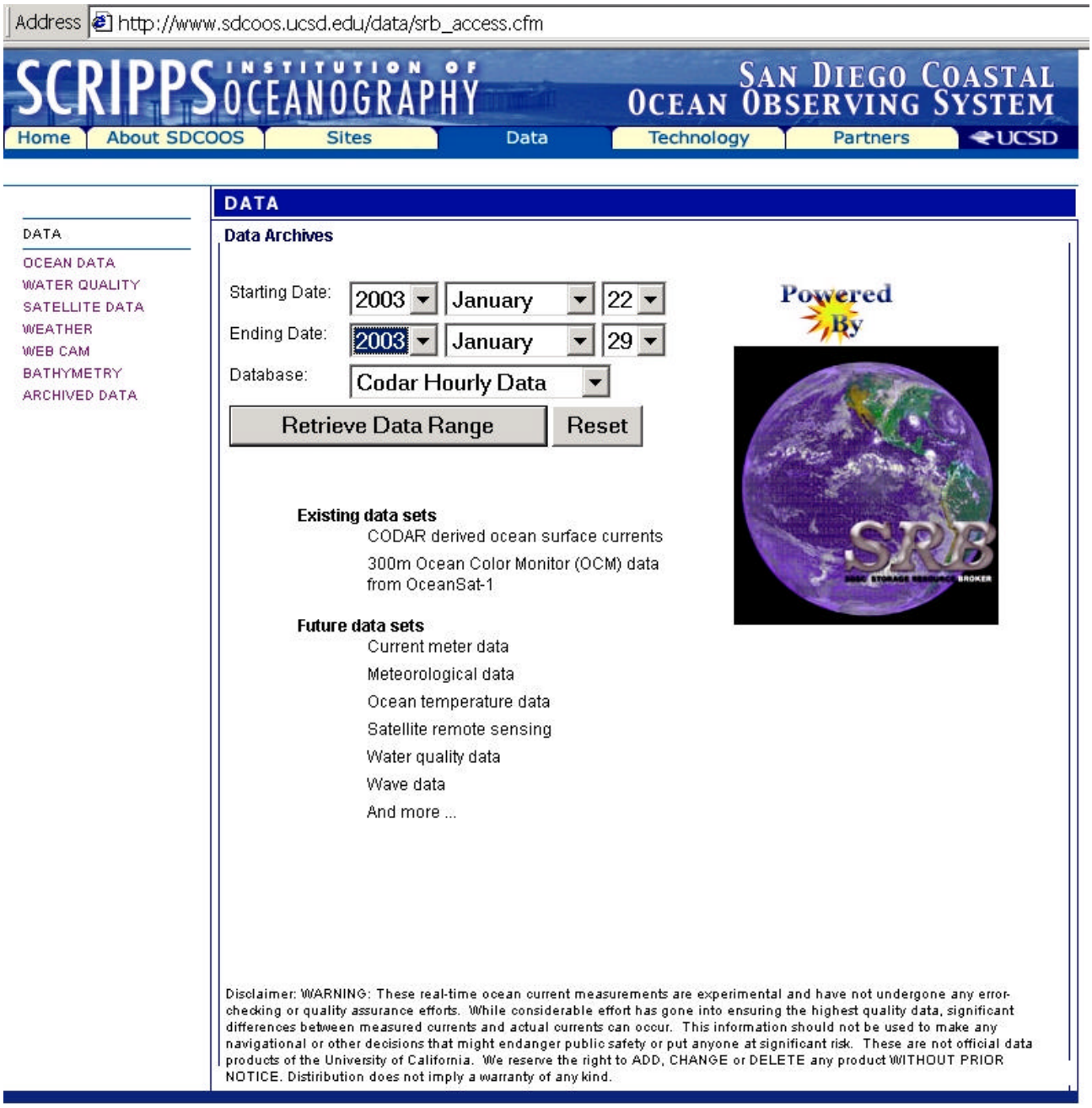

Figure 8. A data archive has been developed for SDCOOS which users can access from the internet. Based upon information technology developed at the San Diego Supercomputer Center (SDSC), the Storage Resource Broker allows the storage of heterogenous data types and has virtually no limits to the quantity of data that can be stored. Shown above is the online interface which allows users to access CODAR hourly and daily averaged data, satellite data, and water quality data from the San Diego Department of Environmental Health recreational water program..

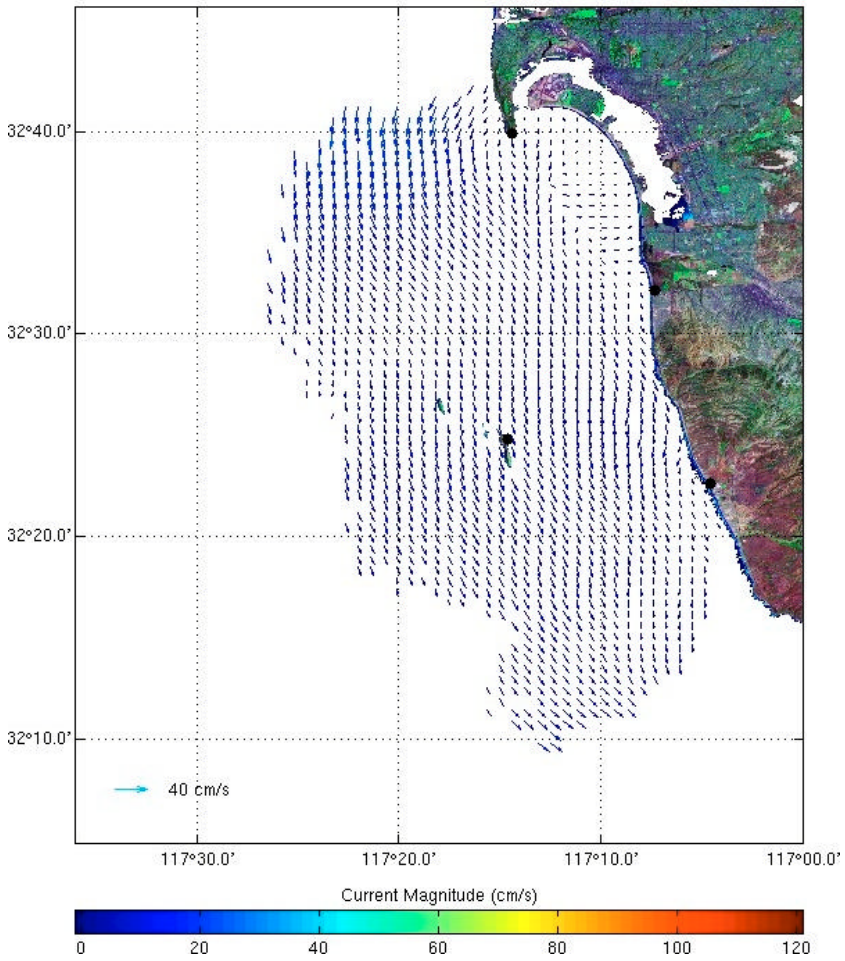

Figure 9. The average currents measured by the CODAR array between July 1 and September 30, 2003 (time period of this report). Note that the average flow during this time period is southward.

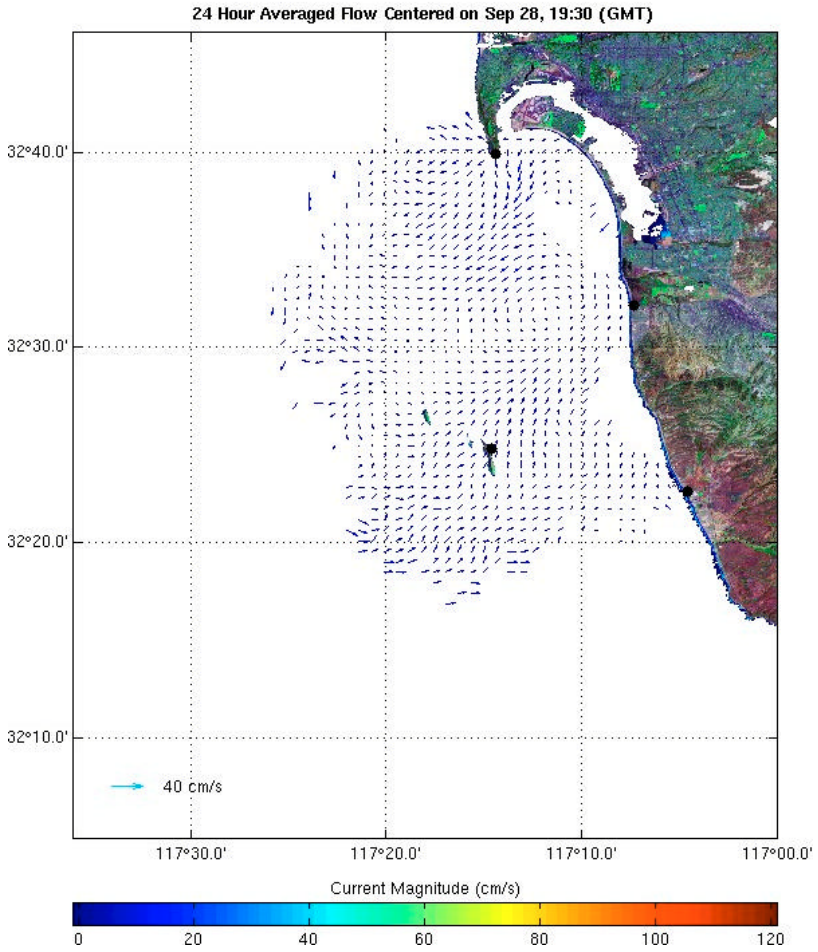

Figure 10. While the currents averaged over this quarter are dominated by southward flow, that average field does provide any insight on the variability of the currents. Shown above is a 24 hour averaged current map for a time period during the quarter (September 28) which shows the presence of a large eddy and northward flow along the coast. SDCOOS was designed to measured and understand the variability of these intermittent events and their impact on local water quality.

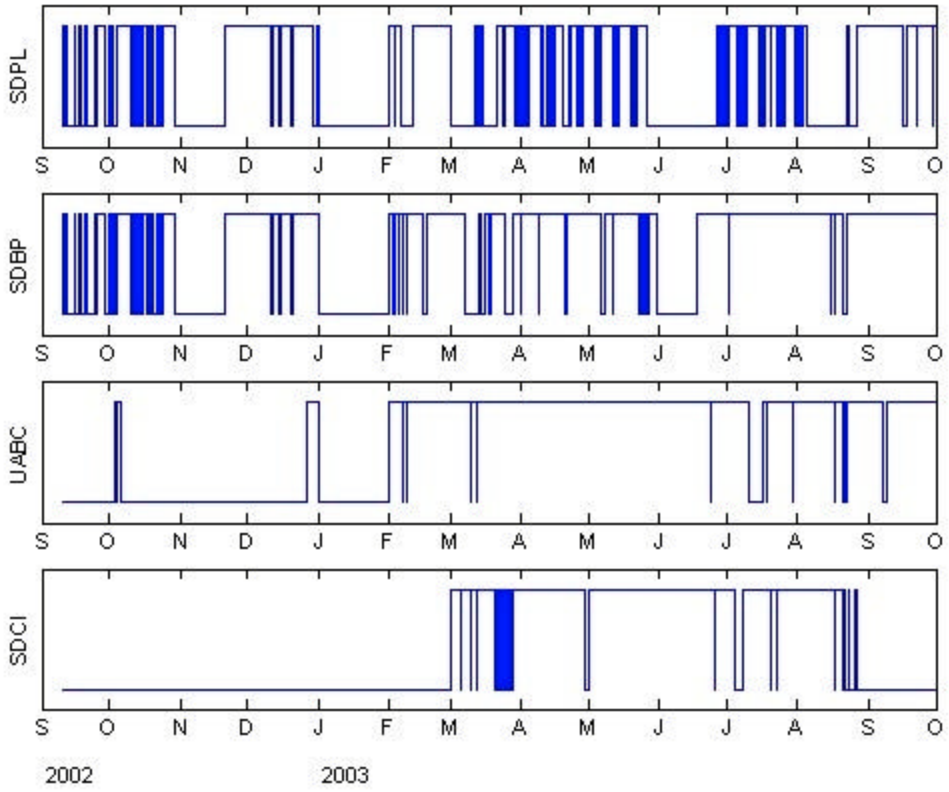

Figure 11. The operational statistics of the SDCOOS CODAR array. The graphs show when each individual site was operational (higher value). Shown are the statistics for the Coronado Islands (SDCI), the Pemex refinery site owned by CICESE/UABC (UABC), the Point Loma site (SDPL), and the site at Border Field State Park (SDBP). The short outages (many times 1-2 hours) shown in the graphs are indicative of the system down for software upgrades or for system improvements. However, some of the installations also represent software glitches or power outages. SDCOOS personnel have the ability to remotely reset the system (or the system automatically resets) for common outages. However, many of the glitches have required personnel to go onsite to troubleshoot the system. As the system is maturing, our mean time between failures is significantly increasing.