South Bay Coastal Ocean Observing System

California Clean Beaches Initiative

Quarterly Report
December 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 September 30, 2003 – December 31, 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:

- Continued operation of the nearshore currents and wave measurement system, archiving of data, and qa/qc of data streams.
- 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.
- Deployment of the nearshore water quality sampling station which allow real-time measurements of ocean water temperature, water salinity, and turbidity in the surfzone near the I.B. Pier.
- 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.
- Development of a Bight '03 data support page by SDCOOS to provide rapid, realtime access to relevant data products for this regional sampling program.

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, 2003 (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, 2003 (6.5 months)
1.3.3 install data cable / logging computers	January 15, 2003 (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, 2003 (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 as well as other interested parties including City of San Diego (for Bight 03 sampling), Parsons Engineering, Regional Board 9, IBWC, USCG, USN.

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. The reliablity has been greatly improved with the additional of an uninterruptible power supply (UPS),. In addition, staff from the Imperial Beach Safety Center have been trained to alert SDCOOS to power outages so that the system can be restarted. We began the transmission of real-time data on October 7, 2003 to the SDCOOS web site (http://www.sdcoos.ucsd.edu/data/current_data_IB.cfm) and (http://www.sdcoos.ucsd.edu/data/wave_data_IB.cfm).

Task 1.3 Surf-zone Currents and Water Quality Sampling System

This system remains deployed in a non-optimal state due to the rotation of the current meter by large waves. We anticipate moving the instrument within the next 6 months. The water quality sensor system which measures turbidity, temperature, and salinity was deployed November 24, 2003. The system was deployed on one of the pier pilings directly beneath the lifeguard tower. Prior to deployment, the piling was cleaned of barnacles and deployed by a team of both divers and top side personnel. Cabling from the instrumentation to the logging system was completed on December 2, 2003. Staff are presently involved in the QA/QC of the data to ensure the sensors are performing to specification. Once SDCOOS staff are confident the data is within manufacturers specifications, it will be displayed and archived in realtime on the SDCOOS web site.

Task 1.4 Water Column Stratification Measurement System

This system continues to operate near the wye of the South Bay Ocean Outfall. The real-time telemetry link that was established to connect the data stream to the Imperial Beach pier continues to operate. Data from the system is now live on the internet. In addition to data summaries of the water column stratification, realtime conditions of the stratification are updated once per hour on the SCCOOS web site to assess when the SBOO plume may be prone to surfacing. The battery life of this instrument is estimated to be 6 months, at which time the mooring will need to be turned around using a leased vessel.
Links to the data summaries are here:
http://www.sdcoos.ucsd.edu/data/SbooSummary.cfm
Realtime data are here:
http://www.sdcoos.ucsd.edu/data/SbooProfile.cfm

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. This includes the continued integration and archiving of County of San Diego Department of Environmental Health REC water sampling results.

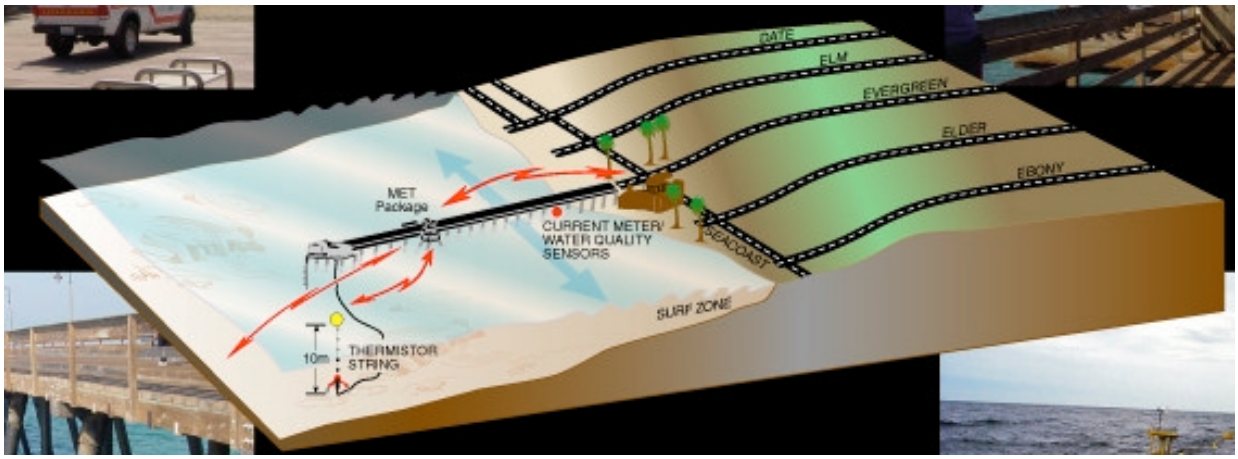


Figure 1. Overview of the monitoring equipment deployed on the Imperial Beach pier. The system cabled to the pier represents a vertical profiling current meter which allows measurement of ocean waves and currents. The measurement site is approximately 200' offshore the pier. Wave and currents at this location are now displayed in realtime on the SDCOOS web site.

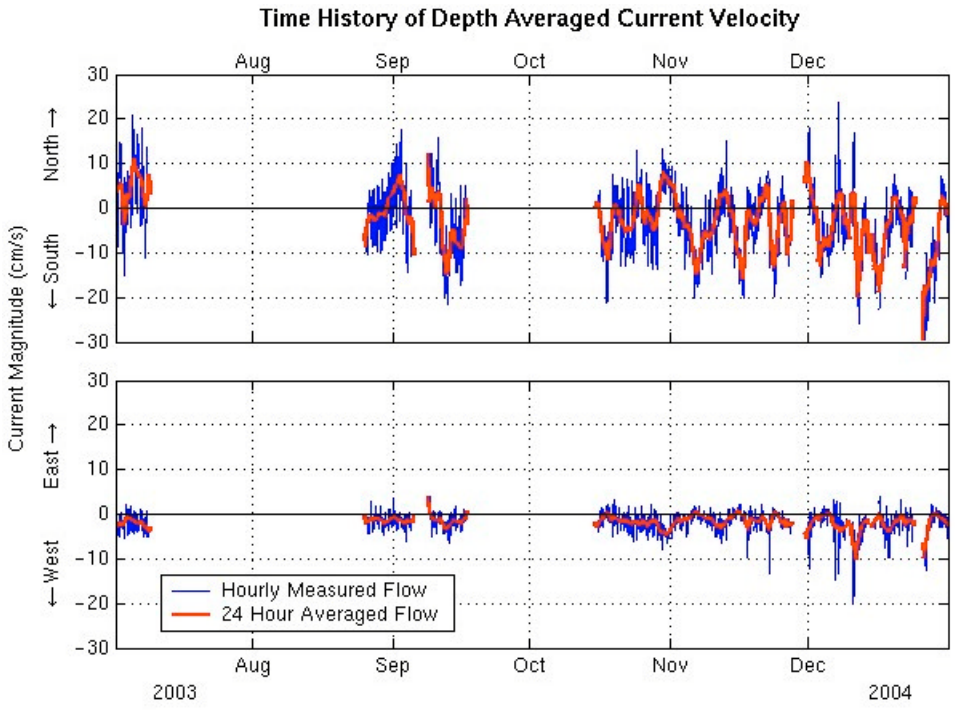


Figure 2. A summary of the depth averaged currents at the I.B. pier location measured to date by the Acoustic Doppler Current Profiler. The blue lines represent hourly data, and the red line is a sliding 24 hour average. Gaps in the time series at the beginning of the records are a result of bringing the system offline for QA/QC efforts. A comparison of the plots shows that the dominant current directions in this region are alongshore. In addition, the top graphs illustrates the temporal variability of the currents. Additional analysis efforts, and the creation of linkages of this data with the HF radar data and water quality data will undertaken and reported in subsequent reports.

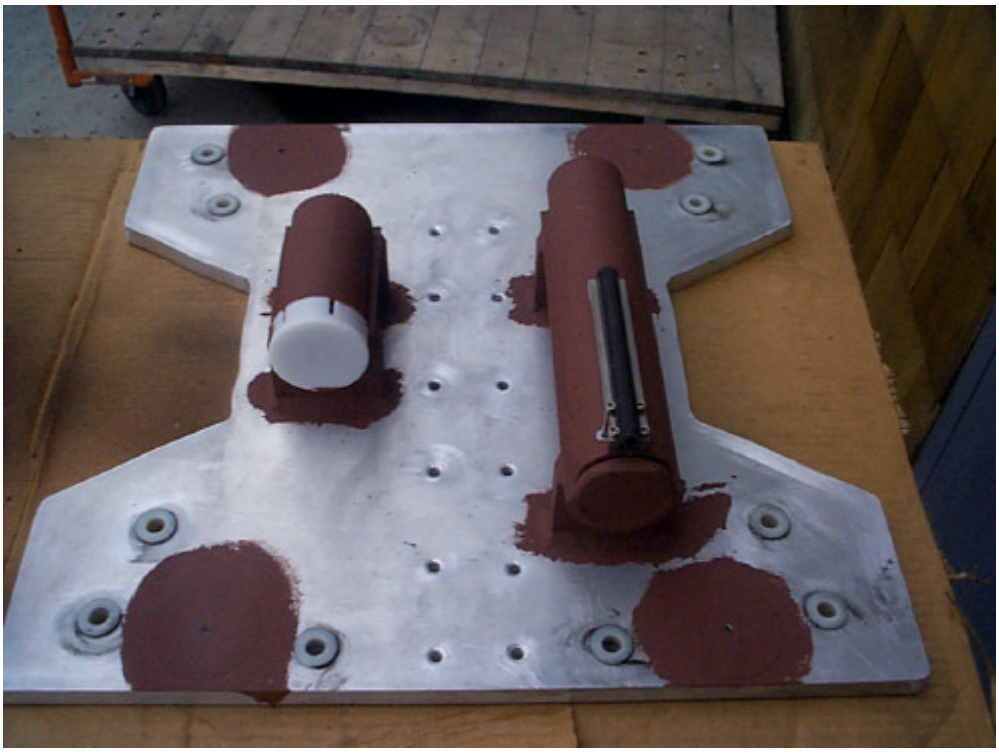


Figure 3. The oceanographic sensors which will be used for the pier mounted water quality system resting on their aluminum mounting plate. The sensor on the left is a Wetlabs FLNTUS optical sensor which measures turbidity and chlorophyll florescence. The sensor on the right is a Seabird Electronics Microcat which measures ocean temperature and conductivity. The conductivity measurement is used to compute the salinity of the water. In this photograph, the sensors have already been painted with an anti-fouling paint.

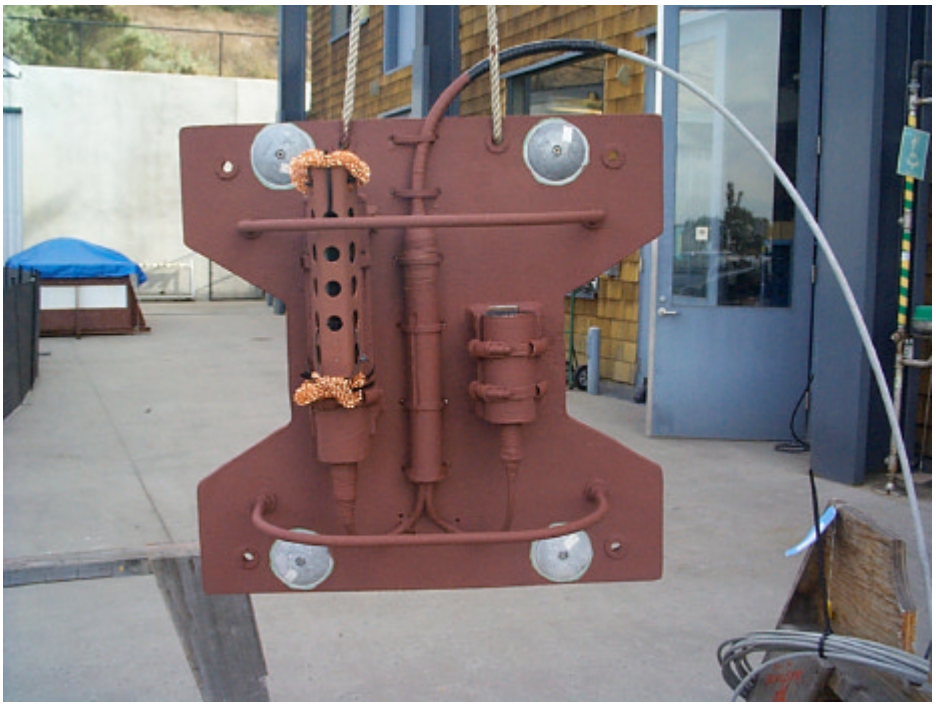


Figure 4. The sensor system ready to be deployed. Here the mounts have also been painted with anti-fouling paint. The copper 'brillo' pads are fixed to either end of the conductivity and temperature probe to provide additional anti-fouling protection. Also shown is the armored cable that provides power and communication to the system.

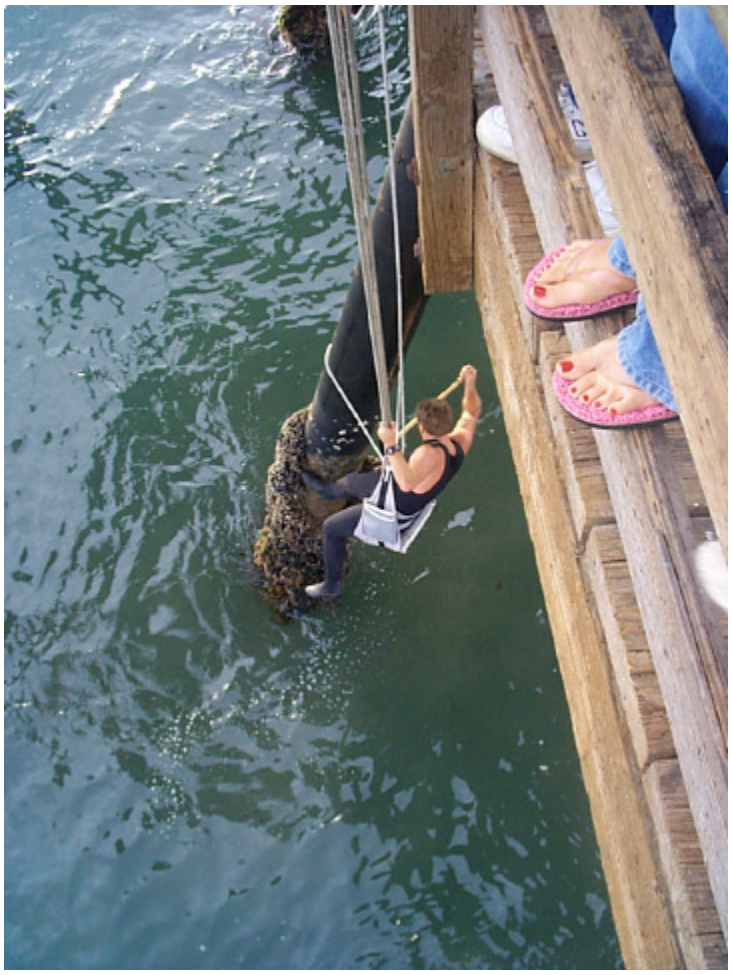


Figure 5. Prior to deploying the water quality sensor system on the Imperial Beach pier, a piling had to be cleaned of marine growth. While our original scope of work did not include the cleaning of pilings, SDCOOS undertook this effort to expedite the deployment of these sensors. Our original plan was to take advantage of pilings that the Port of San Diego cleaned for routine inspection. However, there were no inspections conducted in these regions that were deemed optimal for these measurements.

Figure 6. The data and power cable are connected to the computer logging system that is located on the bottom floor of the lifeguard tower.

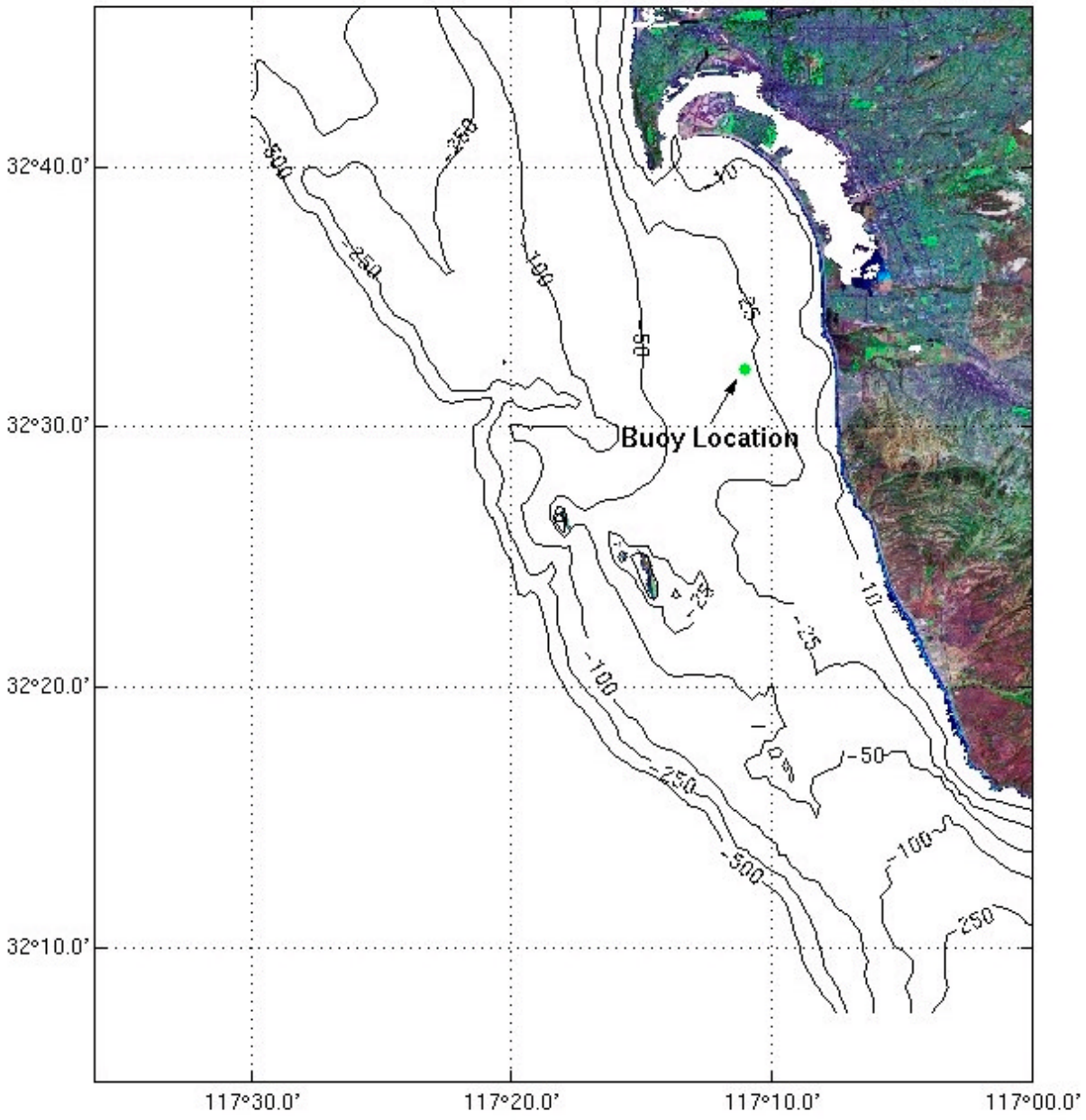
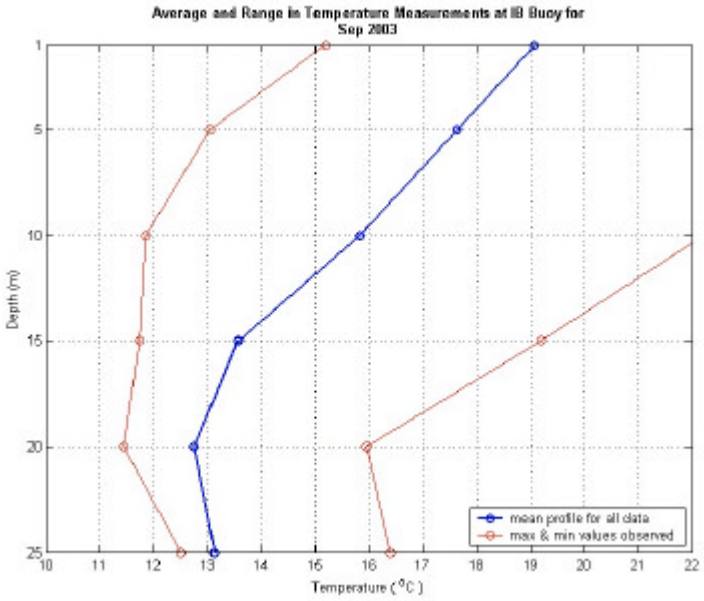
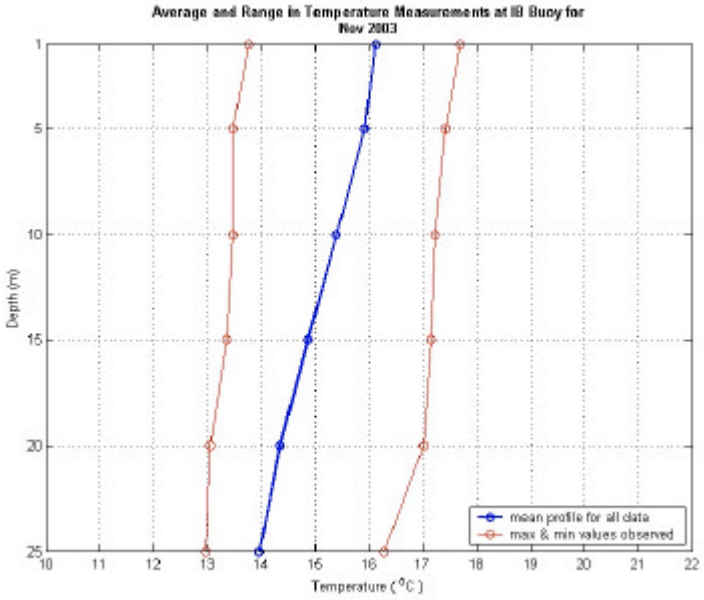


Figure 7. A map of the San Diego Southbay region showing bathymetry contours and the location of the SDCOOS buoy at the Southbay outfall. The buoy is located in 28m water depth near the center of the wye of the diffuser.





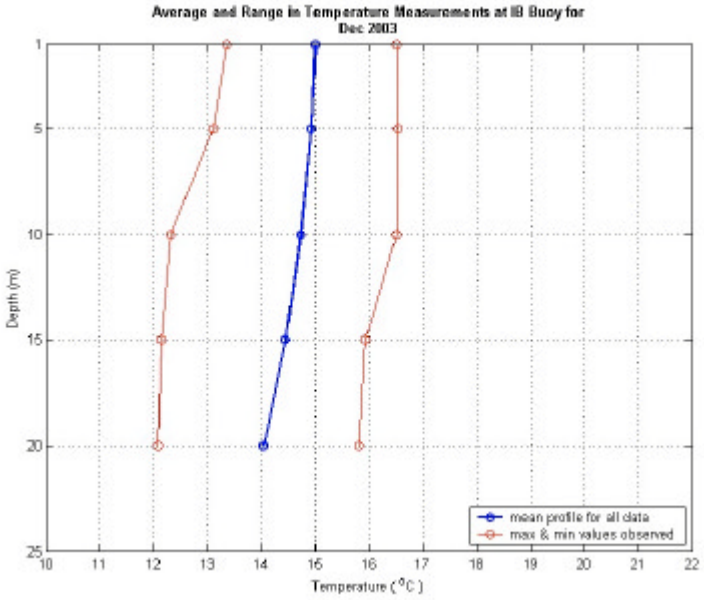
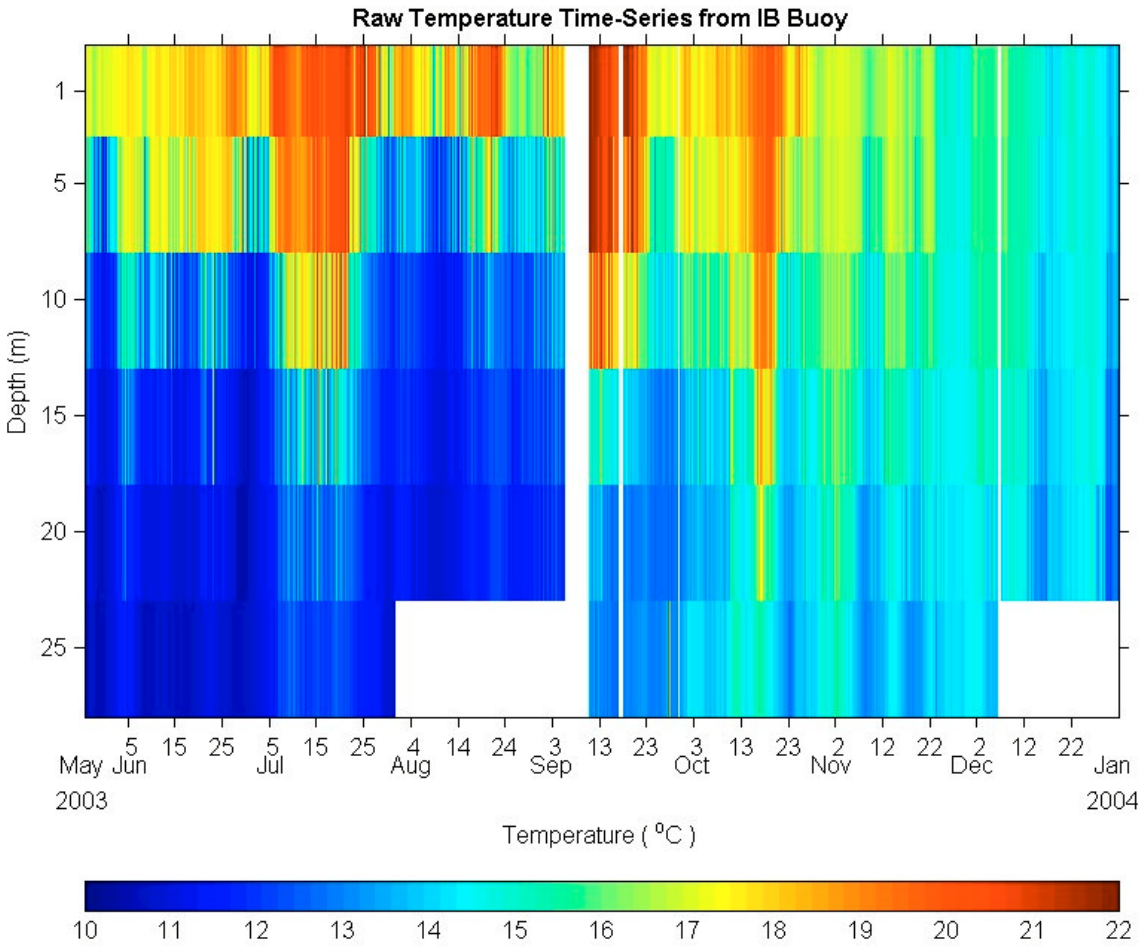


Figure 8. Monthly averages of the ocean temperature profiles at the South Bay Ocean Outfall for the months of September, November, and December. Shown are the monthly average (blue) as well as the maximum and minimum ocean temperatures observed at each depth. The show the breakdown of the thermocline and stratification as a result of increased vertical mixing during winter months. Temporal changes in ocean temperature are more apparent in the color contour figure of the water column temperatures in figure 9 (this report).



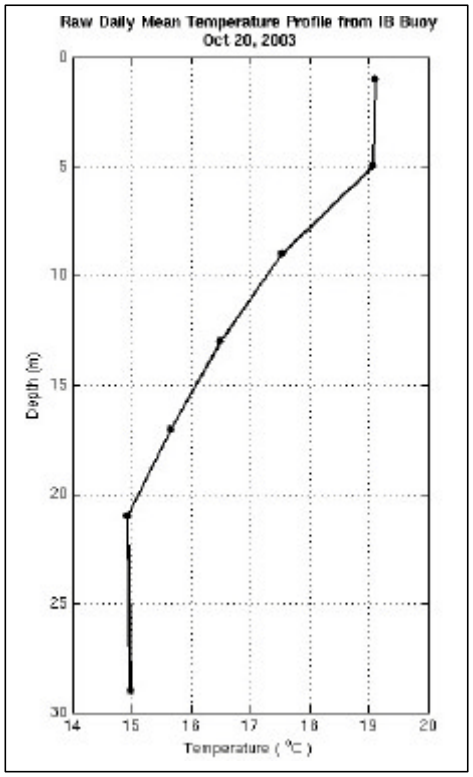


Figure 9. Above. Ocean temperatures measured at the wye of the Southbay Ocean Outfall using the SDCOOS water column stratification buoy. Shown are all data to date obtained during the CBI program. Rapid changes in temperature are more apparent in the above figure as compared to the monthly averages shown in figure 8. The left hand figure is an example daily average from October 20, 2003.

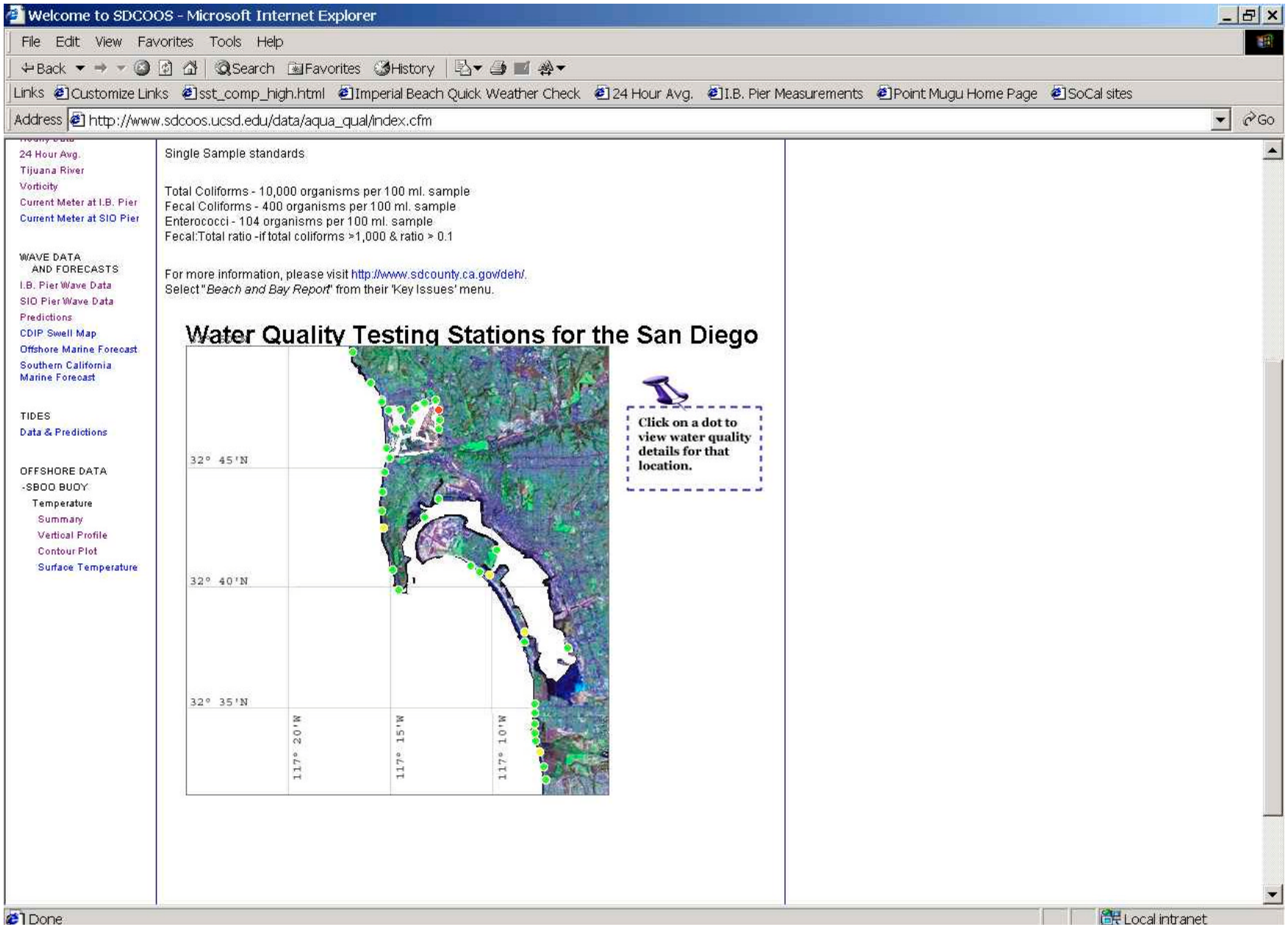


Figure 10. An example screen shot from the SDCOOS web site illustrating how the public can access water quality sampling results from the San Diego County DEH Rec water sampling program. Clicking on any of the dots on the map will bring the user to the most recently obtained data, as well as an option to view and graph results from either the last 180 days, or all measurements from the beginning of the program. Figure 11 is an example of this capability for the site ¾ mile north of the TJ river.

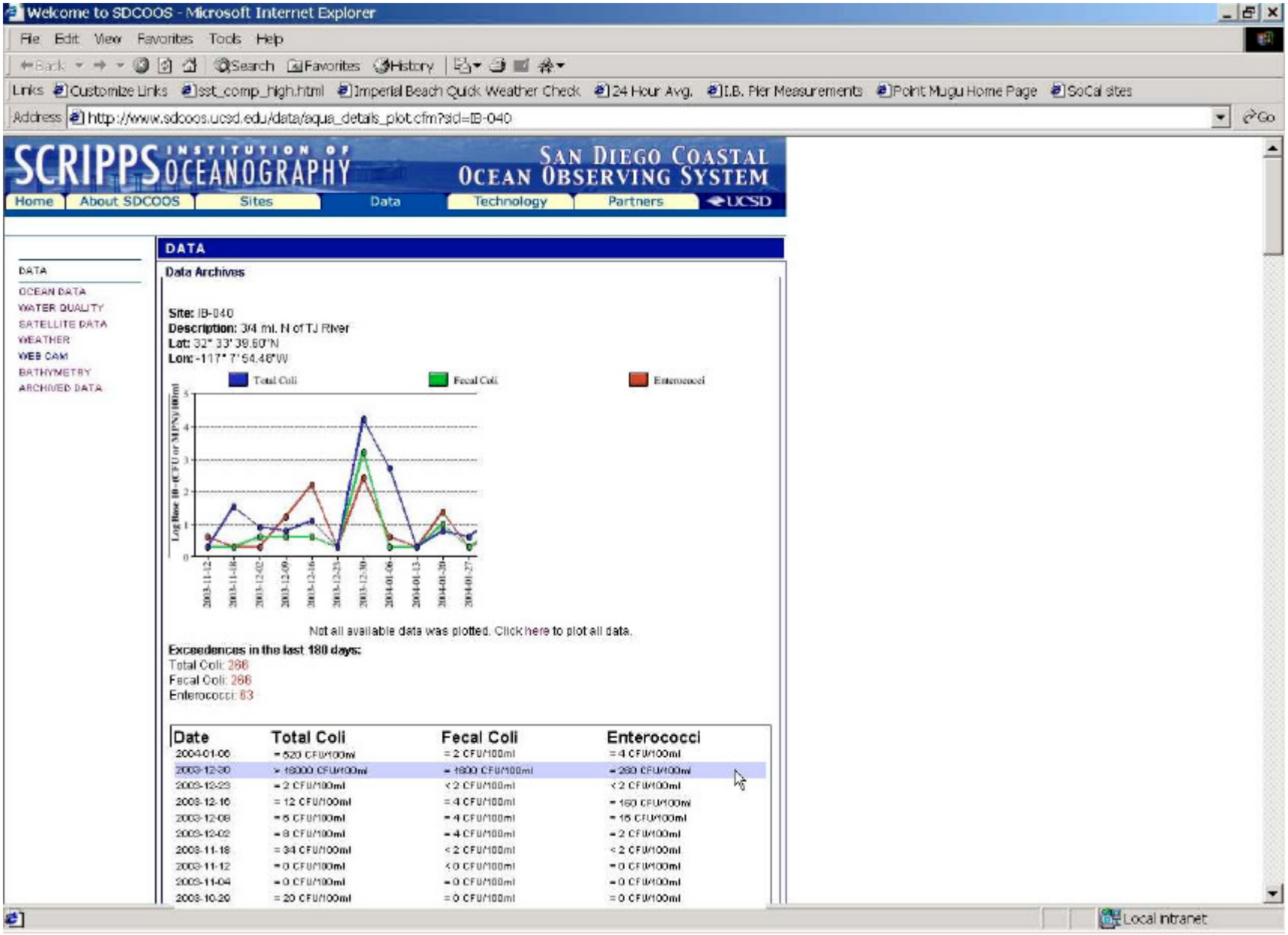


Figure 11. An example screen shot from the SDCCOOS web site illustrating how users can access statistics of water quality data. Available are both # of exceedances from the last 180 days, the qa/qc'd data, and a time series graph of total Coliform, Fecal Coliform, and Enterococci counts. A user can access the web site at http://www.sdcoos.ucsd.edu/data/aqua_qual/index.cfm. The time series graph plots the data as the logarithm of the CFU or MPN/100ml units to account for the broad range of values. For example, the spike in values observed on 12/30/03 have counts exceeding 10^4.

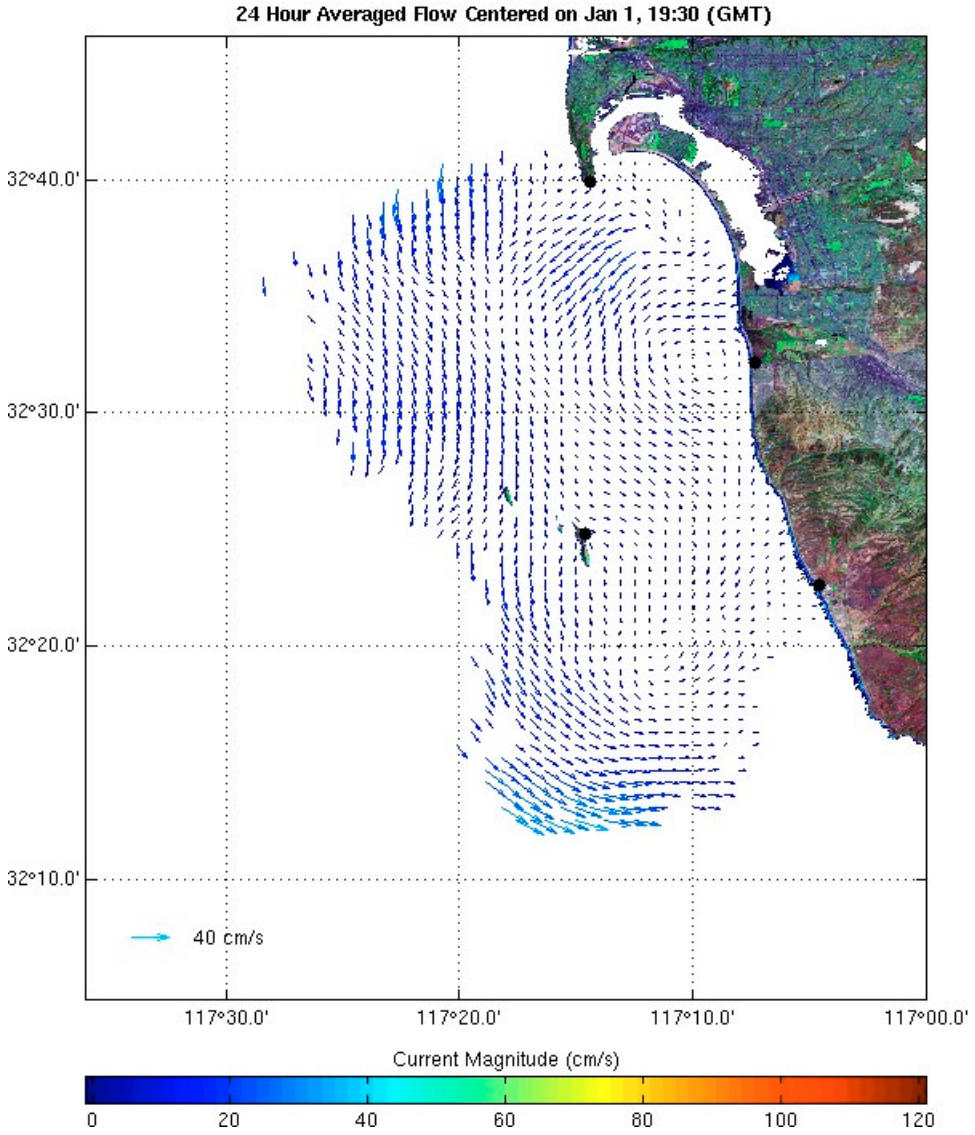


Figure 12. The 24 hour averaged currents measured by the SDCOOS HF radar system on January 1, 2004. This time period coincides closely with the values shown in figure 11.

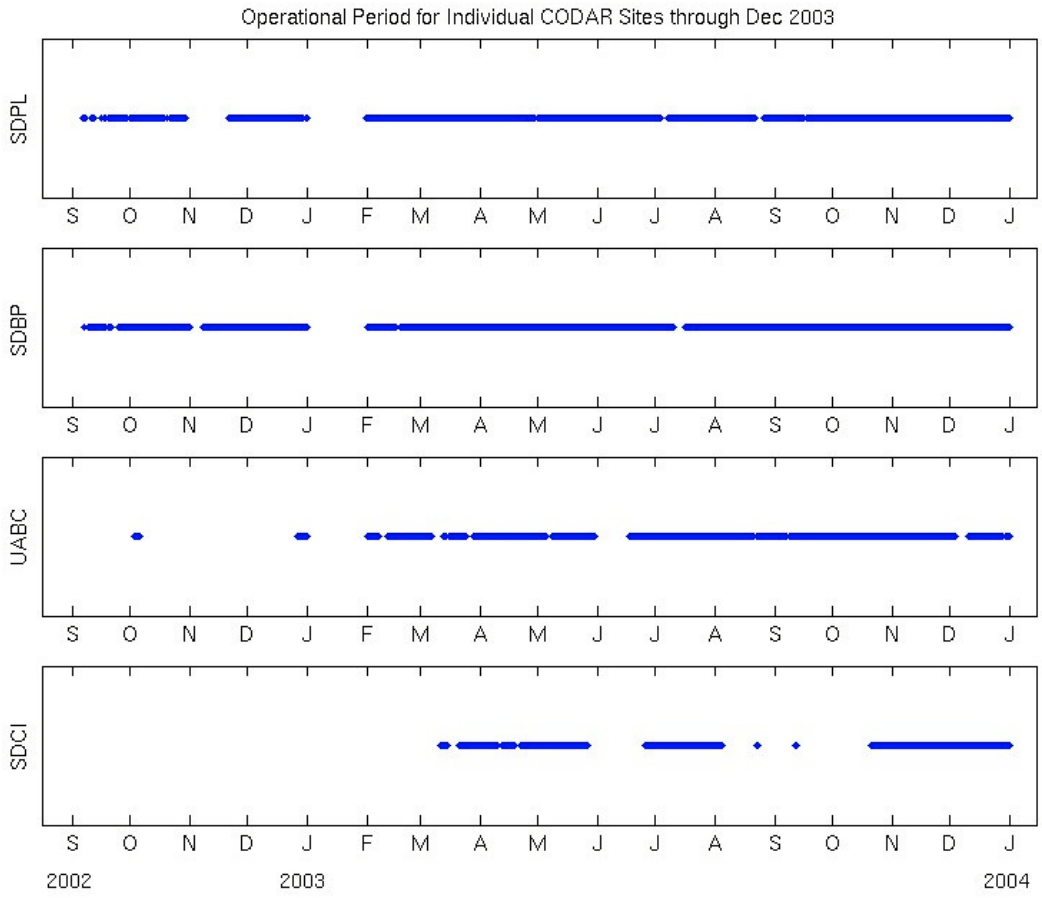


Figure 13. The operational statistics of the SDCOOS CODAR array. The graphs show when each individual site was operational on a daily basis. Shown are the statistics for the Coronado Islands (SDCI), the Pemex refinery site owned by CICESE/UABC (UABC), the Point Loma site (SDPL), and the site at Border Field State Park (SDBP). Outages shown in the graphs are indicative of the system down for software upgrades, system improvements, or component failures that required on-site servicing by SDCOOS personnel. Personnel also have the ability to remotely reset the system (or the system automatically resets) for common outages. As the system is maturing, our mean time between failures is significantly increasing.

NOTE – A SIMILAR FIGURE WAS PROVIDED IN LAST QUARTERS REPORT. HOWEVER, A BUG WAS FOUND IN THE ANALYSIS ALGORITHM USED TO GENERATE THE REPORT AND HAS SINCE BEEN CORRECTED. THE GRAPH ABOVE SUPERCEDES THE DATA SHOWN IN THAT REPORT.