

## **Annual Report: “Renewal of SABSOON”**

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### **LONG-TERM GOALS**

The South Atlantic Bight Synoptic Offshore Observational Network (SABSOON) is a real-time coastal ocean observing system on the continental shelf off Georgia developed at offshore towers maintained by the U.S. Navy for a flight training range. The long-term objective for SABSOON is to function both as component of a regional coastal ocean observing system, and as a coastal ocean observatory, providing distributed real-time observations and time series records of coastal ocean conditions, hosting specific projects and serving as a test bed for development of new sensor systems.

### **OBJECTIVES**

The renewal of SABSOON was funded under the NOPP FY01 BAA (Topic Area “Renewal of Existing NOPP Projects”). The renewal has supported maintenance of the system, further development and deployment of instrument packages, and contributed to an associated modeling program (separately funded by NOPP, Dan Lynch of Dartmouth College, Lead P.I.). Support for key technical support personnel has also been ensured during a transition period from an independent project to a component of developing regional and national coastal ocean observing systems, the Southeast Atlantic Coastal Ocean Observing System (SEA-COOS).

### **APPROACH**

Through partnership with the Naval Surface Warfare Center (NAVSEA, Corona CA), and its regional component, the Tactical Aircrew Training System (TACTS, based at the Marine Corps Air Station, Beaufort, SC), offshore platforms have been equipped with meteorological and oceanographic sensors and real-time, two-way communications have been established for SABSOON. The eight towers maintained by TACTS are located about 50-100 km offshore, at 25-45 m water depth (Fig. 1). As a no-cost partner in the original NOPP project (initiated in FY98), TACTS has actively supported the development of SABSOON. In addition to logistic support (shared helicopter transportation and technical advice), TACTS has provided SABSOON with power and access to its high bandwidth microwave communications network on three central “master” platforms. The Navy power and communications systems on the five somewhat smaller “remote” platforms are more limited. It was decided that installation of separate power and communications at the remote platforms was necessary to support the SABSOON observatory operations and to ensure that there would be no interference with the Navy systems. The basic approach for design of SABSOON systems has been to emphasize real-time data acquisition, flexibility for future additions or modifications of instrument packages, and,

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where possible, to make instrument packages serviceable from the platform (minimizing the need for weather-dependent ship and diving operations).



[Figure 1. The M2R6 platform. This “master” platform is located in 33 m water depth about 60 km offshore. Power on the three master platforms is generated by photovoltaic panels, wind generators and a diesel backup generator. A high-bandwidth microwave network is used for communications between master platforms and shore. Helicopter transportation of personnel is used for most servicing operations.]

## **WORK COMPLETED**

During the renewal period, SABSOON systems have been maintained at two of the larger master towers (R2, M2). At a third (smaller) remote platform (R8), power and communications systems were installed, followed by an initial instrument set (meteorological package, pressure sensor for waves and water level) and surface CT. Some challenges in the past year delayed planned system development (particularly at the R8 platform), and, at times, compromised data acquisition. In the late summer and early fall of 2001, problems with the Navy power systems interrupted real-time communications and

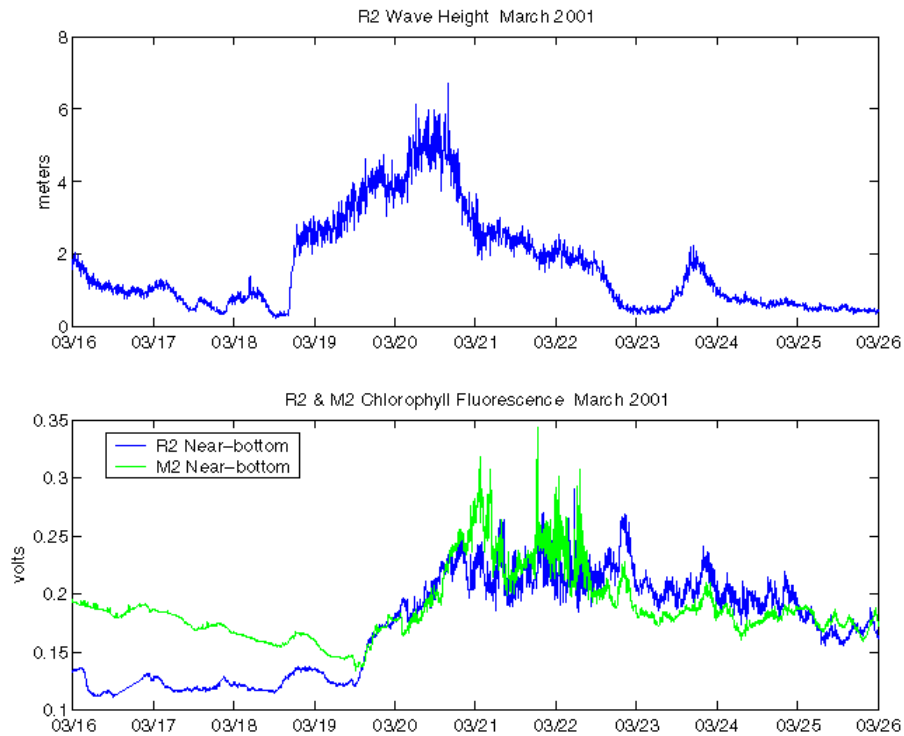
data acquisition at the R2 platform. From spring until early summer of 2002, helicopter service was not available and SABSOON maintenance and installation operations were limited. Helicopter service (contracted to a private company) was reestablished in the summer. Although causing some gaps in data acquisition, SABSOON will benefit from the ongoing maintenance and upgrade of the Navy systems by TACTS. The Navy installed new banks of batteries at R2 in September 2001, upgraded the microwave communications system and initiated structural refurbishment of the master platforms.

A new ADCP was also installed at the R2 tower (bottom-deployed frame about 200 m from the tower), with data acquisition beginning in late June, 2002. Automated data processing scripts are being updated and a GUI tool for data QC (with logging of outlier removal, etc.) has been implemented for CTD and ADCP data records. Divers from Skidaway (SABSOON project technicians) and from the Gray's Reef National Marine Sanctuary program (a SABSOON partner) also replaced the camera and cable for the UW fish video system designed by project partner Charlie Barans (SC DNR).

## **RESULTS**

Results of ADCP current records from the M2 tower (~33 m depth) analyzed by Harvey Seim and graduate students at UNC were presented at the 2002 Fall AGU (San Francisco). A revised manuscript is in preparation. Following an initial harmonic analysis, variability in the largest semi-diurnal constituent was considered. Stratification was found to cause significant shifts in vertical shear, ellipticity, tidal phase and ellipse orientation. Estimates of bed stress also vary in time and suggest that surface gravity waves are modulating the properties of the benthic boundary layer and impacting tidal current speed. Comparison of the observations during unstratified conditions with a one-dimensional model that includes a turbulence closure scheme confirms observational estimates of a roughness length of 2-10 cm, consistent with a strong influence of the surface gravity wave field on the benthic boundary layer.

Another analysis of the SABSOON time series is focusing on storm events on water column properties and implications for biogeochemical fluxes. A distinct increase in chlorophyll fluorescence (and in beam attenuation at M2) has been noted when large surface waves are generated in storms (Fig. 2). This is likely due to the suspension of benthic diatoms that are very abundant in the surface sediments of the SAB mid-to-outer shelf, (Nelson et al. 1999) and other fine particles. Comparison of pre- and post-storm SeaWiFS ocean color imagery showed that regional bio-optical properties can be strongly impacted by such storm events.



[Figure 2. Observations of wave height (at the R2 tower, 26 m depth) and chlorophyll fluorescence (R2 and M2 towers, raw output in volts) obtained during a late winter storm event (March, 2001). Winds were  $\sim 15 \text{ m s}^{-1}$  from NNE during the build-up of the waves. Regional SeaWiFS chlorophyll imagery showed a 2-3 fold post-storm increase over pre-storm levels, comparable to the increase in in-water chlorophyll fluorescence. Shipboard work suggests that the chlorophyll inventory in surface sediments (largely benthic diatoms) is sufficient to account for this signal if roughly half of the total in surface sediments were suspended during the storm.]

## IMPACT/ APPLICATIONS

Meteorological, wave and sea surface temperature data are transmitted hourly to the National Weather Service. Hourly updated observations and time series over intervals of 24 hrs, 7 days and 30 days are posted on the project web site ([http://www.skio.peachnet.edu/projects/sabsoon\\_web/index.html](http://www.skio.peachnet.edu/projects/sabsoon_web/index.html)). ADCP current and water level records from SABSOON provide input for a local-area, data assimilative circulation model. This is a separate NOPP project and involves collaboration between investigators at Dartmouth College, the University of North Carolina, the National Weather Service, Woods Hole Oceanographic Institution and Skidaway Institute.

## TRANSITIONS

SABSOON P.I.s have participated in a number of workshops, special sessions at scientific meetings, and steering committee meetings focused on the development of the U.S. coastal ocean observing system, including the OCEAN.US workshop in March 2002 for planning an Integrated Ocean Observing System. The recently initiated Southeast Atlantic Coastal Ocean Observing System program (SEA-COOS, *see* [www.sea-coos.org](http://www.sea-coos.org)) is supporting continued maintenance and development of SABSOON and associated model development. Through SEA-COOS, the project will be integrated within a larger regional framework for NC, GA, SC and FL partnering academic institutions with state and federal agencies. The SEA-COOS network will be built around observing, data management, modeling/data product, and outreach/education subsystems.

## RELATED PROJECTS

In addition to the NOPP modeling program described above, SABSOON data is being utilized to complement separate research projects on benthic biogeochemical processes on the shelf (NSF projects of Rick Jahnke), benthic primary production (NSF, Nelson), and application of ocean color imagery on the shelf (NASA, Nelson, Jahnke, Li). The development of an UW video system for fisheries studies, initiated in partnership with Charlie Barans (SC DNR) will continue under SEA-COOS. Further development of instrument/sensor test bed capabilities are being pursued in association with the Alliance for Coastal Technologies (ACT, <http://www.actonline.ws/>). An outreach/education effort was recently initiated through collaboration with Dr. Jim Demmers of the Georgia Tech Research Institute. Demmers has received an award from NSF to develop web-based, interactive educational units for K-12 students using the real-time and archived SABSOON data. A workshop for middle school teachers was held in April, 2003 at Skidaway to describe the Sea Maven project to the educators and engage them in the development process. Through the SE COSEE program (NSF, NOAA and ONR support) we are participating in a regional effort to link researchers and educators, and locally, linking SABSOON and related ship work with marine educator programs of the University of Georgia's Marine Education Center and Aquarium (located next to the Skidaway Institute).