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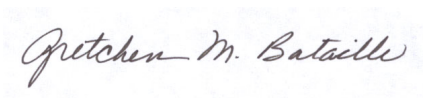

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SEACOOS Members
(parties to the SEACOOS Master Agreement and Articles of Collaboration):

- University of South Florida (USF)
- University of Miami (UM)
- Skidaway Institute of Oceanography (SkIO)
- University of South Carolina (USC)
- University of North Carolina at Chapel Hill (UNC-CH)
- South Carolina Dept. Natural Resources (SCDNR)
- Florida Sea Grant (FSG)
- Georgia Sea Grant (GSG)
- South Carolina Sea Grant Consortium (SCSGC)
- North Carolina Sea Grant (NCSG)

SEACOOS Affiliate Members

- Beaufort TACTS/Naval Surface Warfare Center/USN
- Center for Operational Oceanographic Products and Services/NOS/NOAA
- Naval Atlantic Meteorology and Oceanography Center/USN
- National Data Buoy Center/NWS/NOAA
- Marine Modeling and Analysis/EC/NCEP/NWS/NOAA
- Florida Keys National Marine Sanctuary/NOS/NOAA (FKNMS)
- National Coastal Data Distribution Center/NESDIS/NOAA
- Miami FL Weather Forecast Office/NWS/NOAA
- Southeast Fisheries Science Center/NMFS/NOAA (SEFSC)

SEACOOS Affiliate Member Nominees

- Atlantic Oceanographic and Meteorological Laboratory/OAR/NOAA (AOML)
- Jacksonville FL Weather Forecast Office/NWS/NOAA
- Field Research Facility/US Army Corps of Engineers
- Coastal Services Center/NOS/NOAA
- Beaufort Marine Laboratory/NOS and NMFS/NOAA (BML)
- South Atlantic Fisheries Management Council (SAFMC)
- Florida Marine Research Institute (FMRI)
- Coastal Services Center/NOS/NOAA
- Gray's Reef National Marine Sanctuary/NOS/NOAA (GRNMS)
- Florida Space Port
- Camp LeJuene Integrated Observing Network/USMarines
- SeaKeys

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PROJECT SUMMARY

The SouthEast Atlantic Coastal Ocean Observing System (SEACOOS) is a regional partnership that has initiated creation of an integrated coastal ocean observing system for a four-state region of the southeast coastal U.S. The long-term intent of SEACOOS is to support the establishment of a regional coastal ocean observing system for North Carolina, South Carolina, Georgia and Florida that will be part of the coastal component of the national Integrated Ocean Observing System (IOOS) envisioned by OceanUS. SEACOOS is accomplishing a major element of the national IOOS program by developing and implementing the mechanisms for integration of disparate and distributed observations and information products. This third-year effort builds on the first two years of activities, continuing to develop an information system for the coastal ocean inclusive of state territorial waters. The four major components of SEACOOS are the observing subsystem, the modeling and products subsystem, the data management subsystem, and the outreach and education subsystem. As part of the observing subsystem, the partners will maintain real-time reporting ocean/atmosphere measurement platforms, continue pilot studies of the long-term stability and accuracy of coastal HF radar for surface currents in the region, collaborate with regional remote sensing groups, test nearshore directional wave measurement techniques, and explore various moving observing platforms. The modeling and products subsystem will continue development of hindcast and nowcast/forecast models for subregions of the SEACOOS domain, focusing on coupling to basin scale modeling. The data management subsystem will continue to integrate observations from the new platforms with existing observations using data exchange tools advocated by OceanUS, further advances in standards and QA/QC protocols, and continue development of portals to observations, model output, and more refined data products, available through the SEACOOS portal (www.seacoos.org). The outreach effort with the regional Sea Grant offices will continue a dialog with a broad range of users to identify their information needs and the preferred formats and modes of information delivery. A K-12 education effort initiated through collaboration and funding of the NSF Centers of Ocean Science Education Excellence in the southeast (NC, SC, GA) and Florida will continue. Evolution of a system of governance for the southeast will continue in collaboration with SERA-COOS, our nascent regional association.

INTRODUCTION

This third year proposal of the Southeast Atlantic Coastal Ocean Observing System (SEACOOS) provides a statement of overall goals, Year 3 objectives, and details of recent progress and proposed activities in the four organizational units of the program. This overview of SEACOOS is followed by budget matrices, work statements and budget justifications for all participating institutions, and is followed by curriculum vitae and current and pending support records for all principal investigators.

The SEACOOS Mission: To significantly increase the quantity and quality of environmental information from the coastal ocean of the SE U.S. and make this readily available for a range of societal, scientific and educational applications.

Among the core objectives of SEACOOS are:

Deploy and evaluate state-of-the-art *in situ* measurement and remote sensing systems for the southeastern coastal ocean region;

Utilize and evaluate emerging observational technologies in field operations;

Implement and evaluate state-of-the-art numerical modeling systems for the SE coastal ocean for operational and research hindcasting and forecasting applications;

Generate, distribute, and evaluate information products in near real-time that combine observational data and model output and are based on up-to-date oceanographic and meteorological knowledge;

Develop and evaluate a regional information management system to access, distribute and archive data, metadata, and visualization products, and to ensure data formats and delivery systems are coordinated, interoperable, and compliant with national and international systems and standards;

Coordinate with governmental agencies and the private sector to enhance the development and efficiency of the observing system and to expand the economic opportunities and environmental management that it provides;

Promote and foster the use of coastal information by decision-makers, educators and the general public through outreach and education activities;

Develop a regional governance structure (via SERA-COOS) to ensure an efficient and productive collaboration among the partner institutions, regional and national affiliate organizations, and the national IOOS.

SEACOOS Year 3 Objectives. We have chosen to focus on the following objectives in Year 3:

1) *Continued development of a system to observe and predict the coastal ocean response to synoptic scale atmospheric forcing*. This topic is central to any observing system and is chosen to provide a scientific context in which to evaluate the components pieces. It is our main goal, and the majority of the present budget is dedicated to this objective. It is also an important step toward the goal of estimating physical (advective and turbulent) Lagrangian transports and physical environments/habitats. In terms of variables, this topic includes the evolving fields of winds, water level, currents, temperature, salinity, and heat and precipitation flux from the atmosphere, the principal physical variables required to address most ocean-related issues.

The following objectives are considered secondary efforts. This acknowledges their importance in the overall observing system but recognizes our limited resources to pursue them aggressively at present. In all cases we will use Year 3 to develop plans for further development in out years.

2) *Surface waves*. We will continue this effort, initiated in Year 2, but can not afford major growth in the area. The observational program will maintain existing assets and possibly deploy some test systems at the shelfbreak and in the beam-forming high-frequency radar (WERA) footprint, but we will review existing systems and plans, including modeling efforts, to develop a longer-term plan of action that can be initiated in year 4.

3) *Fisheries*. This area is of great interest to a number of our members and affiliate members (e.g. SCDNR, FKMNS, SEFSC, GRNMS, BML, SAFMC, FMRI). The topic provides an opportunity to explore how the existing observing system that focuses on physical processes can complement biological studies. Information merger is a unifying theme under this topic. Validated model fields of ocean state (from objective 1) are needed by those groups focused on measurement of fisheries stocks, and we will develop tools to facilitate exchange of these fields. There is also a need to merge habitat information (see 5 below). Lastly, innovative measurement systems (UWTV, passive acoustics) will also receive support. There is also a number of smaller initiatives being pursued by partner institutions that fit in this category. An inventory of these activities will be undertaken.

4) *Ecosystem relevant observations*. A new focus for SEACOOS will be assembly of available measurements needed to support ecosystem assessment and modeling. This will take advantage of existing satellite remote sensing capabilities and existing in-situ bio-optics and autonomous chemical measurement programs. An inventory of capabilities is anticipated to reveal major gaps in knowledge as well as sensors and observing system coverage.

5) *GIS coastal databases*. Assembly of these databases supports efforts to model storm surge, surface wave, fisheries and coastal ecosystems. The recent push to become compliant with OpenGIS Consortium protocols is viewed as an ideal mechanism for exchange of mapping information with federal and state agencies and will be pursued.

BACKGROUND

The Southeast Atlantic Coastal Ocean Observing System (SEACOOS) is a prototype regional coastal ocean observing system (RCOOS) (Seim et al., 2003). It is being developed with the intent that it become one of the systems that will surround the continental U.S. to form the coastal component of the Integrated Ocean Observing System (IOOS) (OceanUS, 2002). In this third year effort we propose to largely maintain existing observing systems, further refine data management capabilities, continue development and testing of assimilative model products, expand outreach and education efforts, and involve the private industry sector where appropriate. Because these components are required by all coastal observing networks, advances made within this program will benefit the development of the national system.

Creating a fully functional regional observing system that engages broad sections of the coastal and maritime communities and delivers tailored products to users will require major advances in ocean *in situ* sensor systems, data transmission, data management, assimilative modeling techniques, user engagement and educating a work force to support the operational system. Our

efforts to date have begun this process, concentrating on development of capabilities in the coastal ocean surrounding the states of Florida, Georgia, South Carolina and North Carolina. We will continue this development, and its growth into inshore waters, in Year 3.

The spatial domain of SEACOOS is consistent with that suggested by the U.S GOOS Steering Committee (Frosch Report, 2000) and OCEANUS (OceanUS, 2002). The four states participating in this effort have similar coastal ecosystems, are linked by the Loop Current/Florida Current/Gulf Stream system, and share a common weather and climate system, biogeography and socioeconomic profile. As such, this is a natural regional scale that will maintain flexibility needed to address issues of local importance, while providing effective larger-scale coordination of activities to address issues of regional-scale impact. It is recognized that seamless communications and information flow between adjacent regions is vital to the success of IOOS. SEACOOS therefore maintains overlap regions with the Gulf of Mexico (and its nascent regional association, GCOOS) and the Mid-Atlantic Bight (for which MARA is the regional association), and is actively involved with promoting an observing system for the Intra-Americas Sea (IOCARIBE-GOOS).

A vital but challenging aspect of developing a coastal ocean observing system for the nation is the establishment of a governance framework for identification of priorities, implementation tasks by players, responsibilities of partners, and terms of membership. Our first-year effort developed a model of governance suitable for the academic partnership that initiated SEACOOS, and all parties agreed to and signed the Articles of Collaboration (http://intranet.northcarolina.edu/docs/aa/research/initiatives/SEACOS_Collaboration.pdf). The Articles define the organizational structure of SEACOOS which coordinates activities within each of four main components of observing, information management, modeling and products, and outreach and education. The chairs of these working groups form an executive committee. Further evolution of a governance structure for the southeast that includes broad coastal community involvement is underway through interactions and participation of SEACOOS principal investigators in the Southeast Regional Association for Coastal Ocean Observations (SERA-COOS), the nascent regional association effort being led by Mr. M. R. DeVoe, director of the South Carolina Sea Grant Consortium.

Developing an integrated information system must begin with the operational (i.e., routine, real-time, robust, QA/QC'd) reporting of key variables using proven technologies, while providing the basis for rigorously testing new technologies that can eventually become operational. The SEACOOS system is concentrating on measuring and modeling the physical characteristics of the coastal ocean and atmosphere that dominate the list of identified variables that can be observed operationally (e.g. OceanUS, 2002). At the same time, SEACOOS is including pilot measurements of chemical and biological ocean properties that hold the promise of becoming operational and which will broaden the scope of issues that can be addressed.

SEACOOS supplements the existing federal observing system ("national backbone") in the SE region (Figure 1). Designing SEACOOS will be an iterative process because a configuration of the system that is adequate to address one issue may not be adequate to address others. Because the assessment of such adequacy is a topic of scientific investigation, we chose a scientific

problem to focus our initial design effort. In particular, we have targeted the regional response of the coastal ocean to synoptic scale atmospheric forcing ("weather") and will continue this effort in Year 3. This selection is consistent with the variables that can be observed operationally, relates to a large number of societal and scientifically relevant issues, and is of common interest to all observing system initiatives in our region. We will also pursue a number of other objectives, including a surface wave effort, engagement of the fisheries management community, aggregation of existing real-time observations relevant to ecosystem assessment (but we are not yet in a position to implement a complete observing system for these topics), and development of links to private industry. After briefly touching on the dynamics affecting ocean state estimation, the remainder of this one-year proposal describes the existing status and plans for system implementation in the next year for each of the major subsystems.

Ocean state estimation: what are we attempting to achieve and why?

The starting point for discussion is the goal of improved coastal ocean state variable specification (description and prediction) through a combination of measurements and models. These state variables at a minimum include the meteorological variables necessary to specify the surface momentum ($\sim W^2$), heat (Q), and fresh water (R) fluxes (including river inflows) that drive the underlying coastal ocean circulation, and the currents (V), temperature (T), salinity (S), and sea level (η) responses to the atmosphere and other forcing. Other state variables of societal importance include surface gravity waves, the full suite of nutrients, plus oxygen and organic matter that fuel the primary productivity of coastal ocean ecosystems, including harmful algal blooms. Beyond primary productivity we must also be concerned with higher trophic level productivity, fisheries ecology, and the potential threats to natural ecosystems from hazardous materials of anthropogenic origin. The variable list is an extensive one (see, e.g. OceanUS, 2002), but one that has its origins in the basic and most readily accessible physical variables of W/Q/R/V/T/S/η. These often control the spatial distributions of other variables through advection and mixing.

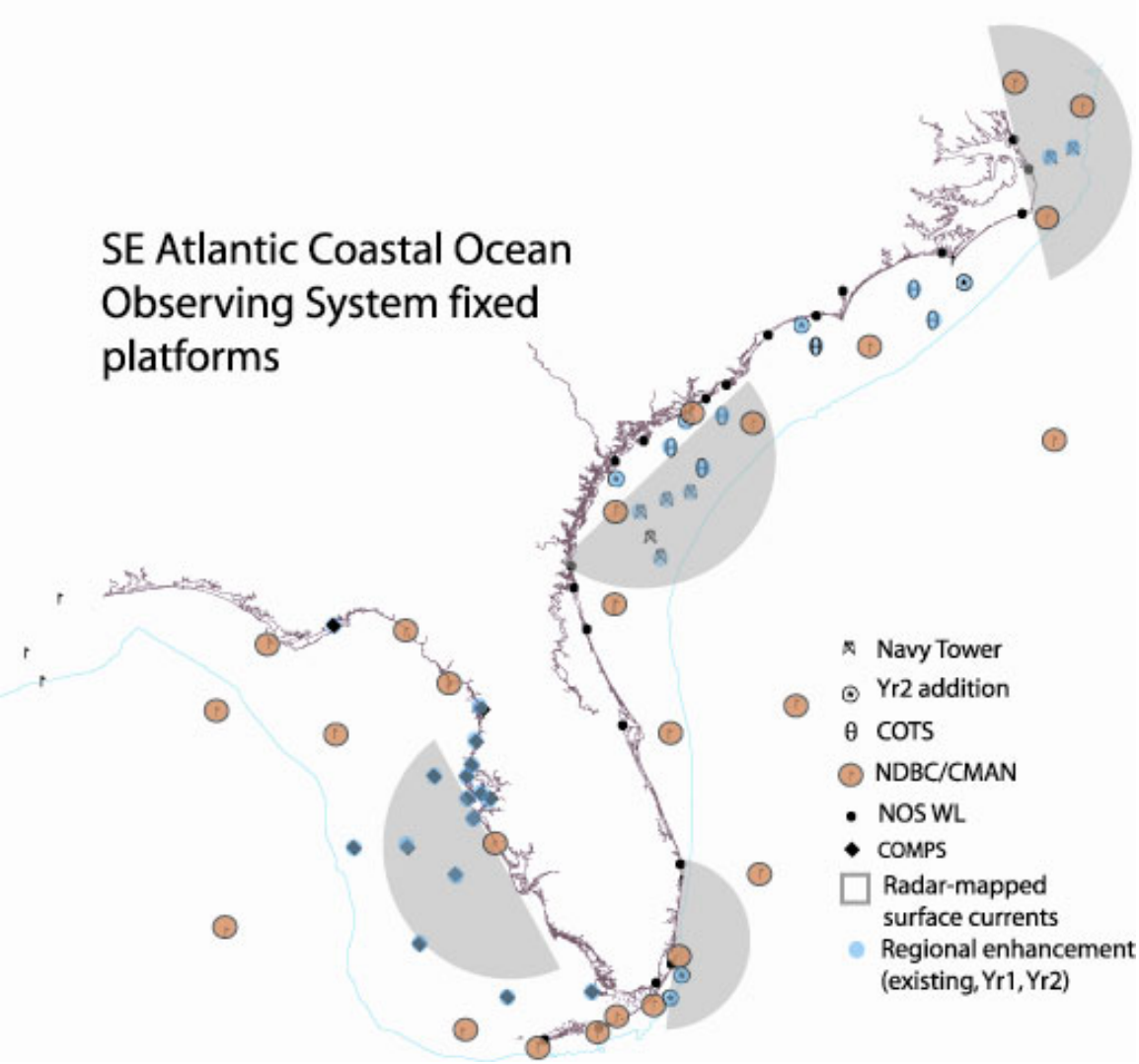

Figure 1 - Distribution of national backbone fixed platform elements (black, orange) and regional enhancements (blue) in the Southeast. Grey shading shows areas covered or to be covered by high-frequency radar.

Societal benefits from coastal ocean state variable specification are: improved marine weather forecasting, benefiting the maritime industry, including recreational and commercial fishermen; improved understanding of the coupled physical-biological interactions, providing a quantitative basis for ecosystem management; improved understanding of storm surge and surf zone responses for better emergency management, shoreline development, and beach erosion mitigation; and improved search and rescue and hazardous material tracking tools that may be life-saving. Achieving these goals requires a mix of sensing systems, thoughtful positioning of resources, and a suite of modeling systems.

From an ecosystem perspective the coastal ocean receives nutrients from land, from atmospheric deposition, and from deep ocean sources. Land drainage enters primarily through the estuaries, although GA and parts of FL have distributed inflows from multiple inlets or springs.

Atmospheric deposition of nutrients may exceed considerably that due to land drainage, but the temporal and spatial variability of its input is poorly known. Where present, the continental shelf can inhibit deep ocean contributions because they must first broach the shelf break before entering the coastal ocean, making it difficult to upwell nutrient rich water across the shelf break. To do so requires either shelf slope interactions by adjacent boundary currents, the LC/FC/GS complex, or anomalously strong and persistent upwelling favorable winds. Across-shelf transport tends to be carried by boundary layers or eddies. The boundary layers of particular interest are the surface and bottom Ekman layers activated by winds and interior flow, respectively, and where and how these frictional layers interact defines the region of the inner shelf. Eddies, caused by instability or vortices past abrupt topography, are also important. Such eddies, identified near shore as undulations of salinity fronts, at the shelf break as boundary current spin-offs, or anywhere on the shelf where topographic irregularities exist, may also transport materials across the shelf.

The environmental sampling problem is therefore a complex one, requiring a mixture of different instruments, each with attributes for specific situations. It is also clear that measurement emphasis must be given to the near shore, the shelf break, and the surface and bottom Ekman layers in a fully three dimensional, multi-scale, and time dependent manner, and that long time series are needed to describe the variability that occurs from super-tidal to inter-annual time scales.

Even the most intense synoptic measurement of these variables over the SEACOOS domain will result in spatial gaps and limited forecasting ability. Numerical models play critical role in the integration of observations, thus providing a more complete 3-D description of the state of the coastal ocean, as well as providing estimates of the evolution of the observed state into the future. Models in SEACOOS span the region from the inner shelf/near shore to the shelf break and are forced by atmospheric winds and heat fluxes, buoyant freshwater discharges, tides, as well as offshore (remote) signals through coupling to basin scale models. Forcing by forecast variables of meteorological and basin scale models, and assimilation of real-time observed data allows 48-72 hours forecasts of the ocean state, providing information relevant to commercial ship traffic, recreational activities and search and rescue, among others. Integration of physical and biogeochemical variables provides a sustained and quantitative description of the coastal ocean that enables fisheries managers to include information of larval transport in the design of Marine Protected Areas, follow the formation and fate of blooms, and estimate the exchange of suspended and dissolved matter between land and the open ocean. Examining model solutions over long time periods provides a measure of seasonal and eventually interannual variability of these variables, enabling the estimation of long-term secular changes associated with climate induced changes.

WORKGROUP SUMMARIES

OBSERVATIONS

SEACOOS Observing Working Group (OWG) activities derive from both the first two years of programmatic funding and the groundwork developed from prior sub-regional efforts. In particular, the SABSOON and COMPS programs, respectively in the South Atlantic Bight (SAB) and west Florida shelf (WFS), and Explorer of the Seas, a volunteer observing ship, helped to shape these activities. Thus, SEACOOS may be thought of as a coordinated set of sub-regional programs, each with its own distinctive flavor by virtue of programmatic origin, but each evolving with a commonality necessary for a truly integrated and sustained coastal ocean observing system. Common to all of the sub-regions is the development of a broad suite of sensors and delivery platforms for the purposes of observing, describing, and predicting coastal ocean state variables of societal importance. We have organized our efforts along several fronts, including in-situ measurements, remote measurements by sonar and radar, and remote measurements by satellite. We recognize that no single measurement system (sensor suite or delivery system) is sufficient to accomplish COOS goals so we are diversifying accordingly. We provide a synopsis of progress to date and a summary of activities planned for Year 3.

Progress

The national backbone of NDBC buoys and CMAN stations and the NOS NWLON network, providing coastal and offshore wind measurements and coastal sea level data, provides a backdrop for the OWG expansion. Excepting regions of special local interest and some large gaps along the east Florida shelf (EFS), sea level is reasonably well sampled, but unlike the coast the national backbone stations at sea are sparse, and generally with only meteorological, near-surface temperature and scalar wave measurements.

Over the first two years we set to out build upon the national backbone through a combination of in-situ measurements, remote measurements by HF-radar, and remote measurements by satellite, following the aforementioned rationale and with the initial focus on the variables: W/Q/R/V/T/S/η. The in-situ measurements are largely composed of instruments placed on moored buoys or fixed structures, taking advantage of existing and complementary programs. Figure 1 shows the resources that are, or will be, deployed in the SEACOOS region. These platforms generally sample water column currents and T/S, along with surface winds. Most contain a full suite of meteorological sensors for the purpose of estimating surface heat flux. The data are intended for real time availability, using various types of communications systems ranging from satellite telemetry via GOES, Iridium, and Orbcomm to line of sight radio and Navy microwave communications. Many of the technical problems encountered this year are associated with telemetry, and we are placing considerable emphasis into improving the data delivery reliability. Telemetered data are available to the NBDC for rebroadcast along with the national backbone data. This serves two purposes. First, it includes SEACOOS data as part of the national system and makes these available to government agency and private sector users.

Second, it affords SEACOOS a level of quality assurance through the eyes of NOAA watch-standers.

Newly developed and to become operational on the EFS in Year 2 is a moored profiler system (SWAMP) that will sample currents with a bottom mounted ADCP and T/S with a reelable float, telemetering data to shore when the float surfaces.

Along with moorings and towers that SEACOOS has added to the coastal network in FL, GA, SC and NC in-situ measurements are also being made by unattended profilers and shipboard measurements. The profilers include floats (developed under separate funding) that tend to hold station by parking on the bottom between profiles and gliders that can cruise over larger domains. Both of these systems are part of the Year 2 plans, and once facile with these technologies we will devise strategies for combining the float and glider attributes for mapping internal water property fields and assimilating these into models. Shipboard surveys are on an opportunistic basis with the exception of the Explorer of the Seas Program, which regularly collects a broad suite of ocean and atmosphere data while transiting between Miami and the Caribbean. Finally, the in-situ measurements include directional surface waves in limited regions off of SC and GA, and we are visually recording fish behaviors at some GA artificial reefs.

Remote sensing of surface currents by HF-radars forms our second OWG emphasis. During Year 2 we are implementing HF-radar systems of the WFS, EFS, and the northern part of NC. We chose to use two different types of systems, the direction finding long-range Seasonde by CODAR (off NC and WFS) and the beam forming WERA (that can also be used in direction finding mode) on the EFS. The WERA was also initially deployed on the WFS for two months for a comparison with the array of moored buoys there. Initial results of the test are excellent, and further analyses are underway. Our goal by the end of Year 2 is to have vector surface velocity fields over the WFS from Naples in the south to St. Petersburg in the north, over the EFS from the northern Florida Keys to Miami and reaching across to the Bahamas, and over the northern NC coast, covering the detachment of the Gulf Stream from the shelfbreak (Stearns et al, 2004), and linking up with the mid-Atlantic states array to the north. We anticipate that determining the relative utility of the CODAR and WERA systems for boarder-based COOS applications will be an important SEACOOS contribution.

Newly added in Year 2 is an emphasis on satellite remote sensing. A subcommittee of the OWG was formed that builds on established satellite remote sensing programs at USF and UM. In addition to the SST imagery from AVHRR and MODIS sensors, the initial operational products include a daily, cloud-free SST analysis, using optimal interpolation to blend SST products from various data sources. In collaboration with SEA-COOS Information Management personnel, web interfaces are being developed that allow users to select products, spatial domains, and time frames of interest for mapped displays, generate contoured displays, and compare selected imagery to regional climatology. Additional development efforts include ocean color products (chlorophyll, water clarity, true color imagery with high resolution for selected locales), static imagery for coral reef distributions and land use patterns, and altimetry and scatterometer products (near-real time data for the latter two systems is being acquired through collaboration

with the NASA PO DAAC). Overlays of various satellite products will be combined with other in-situ data and model products.

Third year activities

Year 3 activities are being directed toward solidifying existing stations, improving upon reliability, and systematically adding to these in a manner consistent with the design considerations discussed above. Each sub-regional P.I. group may be guided by local considerations, but these are being balanced by considerations of dynamics so that programmatic coherence is achieved in a scientifically defensible manner.

One such programmatic decision is to advance the HF-radar coverage to the coastal region of GA and SC. A long range CODAR will be installed providing coverage over several areas of interest including the Charleston Bump. This was done en lieu of expanding any of the other existing HF-radar networks. SEACOOS will now have four regions with HF-radar coverage, which we will attempt to fill in during subsequent years, as we all develop and share expertise in operating the systems and using the data. One attribute of the surface current fields from HR-radar is the ability to perform Lagrangian trajectory analyses from the space and time dependence of the velocity. As each of the regional systems becomes fully functional (i.e., with two or more stations needed for computing velocity vectors) emphasis will be given to Lagrangian trajectory mapping.

Mooring activities will focus on maintaining the existing arrays and improving upon telemetry system reliability, by correcting known deficiencies and by acquiring spares to allow for more regular turnarounds. The new SWAMP moorings on the EFS, being tested in Year 2, will provide in-situ data comparisons (along with the Explorer of the Seas transects) for the EFS radar test bed. In-situ instrument placements are also planned for towers on the northern NC coast integral to the radar domain located there. Added emphasis will also be given to water column T/S through a combination of fixed sensors, profiling floats, and gliders.

Surface gravity wave measurements will be expanded. With the phased array WERA system capable, in principle, of sampling directional waves, a directional wave buoy will be deployed in the EFS as a point of comparison. Directional wave information will also be collected in GA and SC to evaluate existing wave models and for use in sediment transport studies.

Not covered by the long range CODAR on a gently sloping shelf is the near shore transition region where CODAR resonant waves change from deep to shallow water, thereby degrading the current estimation algorithm. This region also coincides with the high salinity gradient region of estuarine influence. A near shore station will be designed for water column currents, T, S, and surface meteorology to fill this important gap. Depending on anticipated industry developments such stations may also be equipped to measure directional waves.

Finally, the SEACOOS measurements (in-situ, remote by HR-radar, and remote by satellite) will be coordinated with modeling, and we will continue to develop new products with attention placed on fields of data for description, practical multidisciplinary applications, and assimilation.

INFORMATION MANAGEMENT

There are three primary components to the Information Management activities within SEACOOS: (1) development and implementation of the infrastructure (hardware, software, personnel) for accessing, organizing, aggregating, integrating, distributing, and archiving data streams providing by the SEACOOS observing and modeling subsystems, (2) production of computer-based products utilizing data from SEACOOS partners, such as mapped-based visualizations of regional conditions, and (3) development and enhancement of a web-based interface for the dissemination of SEACOOS data, data products, and information on activities, partners, and programs. A major challenge for progress in these areas has been the need to coordinate and integrate activities, data, and information from multiple partners, which had existing and developing programs with different modes of operation and specific programmatic objectives. Thus, a major underlying theme of the Information Management effort has been to design a system that is flexible to accommodate differences and expandable to accommodate additional objectives, programs, and partners, and yet provides a common infrastructure to enable the aggregation of information for specific products and needs.

Progress to Date

An important element of effective problem solving has been networking both within and outside the SEACOOS community. The networking and problem-solving activities of the Data Management Coordinating Committee (DMCC) have grown over the past year, and constructive linkages with additional data management activities have been established, such as those with GoMOOS and SURA/SCOOP. Interactions with the federal sector (e.g. NOAA National Data Buoy Center, National Coastal Data Development Center) were also established, which lays the groundwork for enhanced protocol and data sharing. A general technology document has been posted outlining several technology components that are currently contributing to the SEACOOS efforts (http://caro-coops.org/bb/viewtopic.php?t=249). Other documents are available on Celoxis, an internal project management software tool, detailing many of the data aggregation efforts and issues.

To explore the most effective means for data transfer and visualization, the Distributed Oceanographic Data System (DODS), Open-source Project for a Network Data Access Protocol (OPeNDAP), and Live Access Server (LAS) functions have been tested by exchange of information among the partner institutions. SEACOOS in-situ and model data are available via DODS/OPeNDAP netCDF. DODS/OPeNDAP is not utilized, however, for the current SEACOOS data merger efforts due to the small file sizes transmitted (the data are representative of the most recent conditions). It is faster to retrieve the whole file directly from a data provider via HTTP rather than adding the additional complexity and overhead of utilizing the DODS/OPeNDAP interface. LAS was installed and reviewed at USC. It was determined that, while LAS is a useful tool for many in the scientific community, SEACOOS would utilize MapServer GIS to achieve the same goals of integrated data discovery and display. The MapServer GIS is an open source platform, which supports additional features such as multiple data layer overlays for visual comparison and is better supported technically from the larger GIS community from which it draws. A full review of DODS/OPeNDAP and LAS is available as part of the Celoxis documentation.

OPeNDAP is also being evaluated for non-gridded datasets. Historically OPeNDAP is better suited to supporting gridded data, but efforts are being made to better support in-situ datasets which may have data and metadata collected in Relational Database Management Systems (RDBMS) utilizing commercial systems such as Oracle and SQL Server, and open source systems such as mySQL and PostgreSQL. Use of DODS DRDS (DODS Relational Database Server) to serve the aggregated wind product and sea surface temperature datasets and other future database tables, which are collected centrally on the PostgreSQL relational database via the DODS interface, is being tested.

Efforts have and are continuing to be made to establish consistency among vocabularies where needed. A data dictionary has been defined and is part of the Celoxis documentation. This data dictionary will be helpful in defining the core variables and immediate products which SEACOOS may want to pursue. This data dictionary will also help in performing variable lookups and cross-references on queries against the SEACOOS datasets.

A high priority for SEACOOS is the development of the Web portal for dissemination of a variety of information for a wide range of users. This will involve the maintenance and further development of the SEACOOS portal (**www.SEACOOS.org**), as well as linkages and clarification of relationships among the various related Web locations. Particular attention will be paid to communication with various user communities. Community bulletin boards have been established at several sites (**www.carocoops.org/bb**, **http://redington.me3.com/php/gomoos/phpbb/index.php**), which cross-reference discussion and documentation as it affects data management issues within the community. These discussion threads are keyword searchable within the bulletin board and also searchable by popular search engines such as 'Google'. A second PostgreSQL database is planned which will shadow the data on the existing aggregated database as well as keeping an ongoing archive of the data. This database would be open for SQL queries by SEACOOS parties initially and others perhaps as credits, disclaimers, liability and additional metadata needs are resolved. A query, download and graphing component is also being developed which will run against the SEACOOS aggregated datasets.

An increasingly important objective for SEACOOS Information Management will be the development of geospatially-referenced, web-based products from data streams and model outputs, which include information and overlays. Development of initial GIS interfaces and data workflows for in-situ observations, merged model output and remote sensing observations have been completed. SEACOOS is organizing committees representative of outreach and research efforts, which will gather requirements to better focus product development. SEACOOS has participated in the IOOS integration efforts by supplying map images of in-situ wind speed and direction and sea surface temperature via the OpenGIS Consortium (OGC) Web Mapping Service (WMS) protocol. These in-situ measurements are aggregated from a variety of federal and non-federal sources. The SEACOOS GIS interface has been enhanced with additional raster (image) querying capabilities as well as additional visualization elements such as refined color legends. Initially, the in-situ, modeling and remote sensing developments are being treated as separate entities, but once each entity has resolved presentation and work flow issues the next step will be towards integration of the products.

To support data integration and the development of these map-based products, there has been considerable development of data integration software and processes. For example, to facilitate metadata documentation, Federal Geographic Data Committee (FGDC) metadata were generated to enable data discovery via the FGDC Clearinghouse. Metadata documentation is primarily focused on the overall themes and data procedures of the SEACOOS program.

Steps have also been taken to provide access to external data streams to support modeling and outreach efforts. Within the IOOS effort, SEACOOS has provided semantic templates that others have used as well as MapServer-specific code. With the help of USF, color schemes were established for all remote-sensing and in-situ IOOS participants to follow. SEACOOS also assimilated UC Santa Cruz' in-situ SST data by providing them with the SEACOOS netCDF in-situ SST format and subsequently pushed their data to the interpoerability portal via the WMS.

Third year activities

Emphasis will be placed on the refinement and development of geospatially-referenced, web-based products. We will continue to develop GIS interfaces and data workflows for in-situ observations, merged model output, and remote sensing observations. This will include continued participation in the IOOS interoperability effort, integration of data from other IOOS systems and federal sources, enhanced querying capabilities, additional visualizations, and integration of multiple parameters.

Data integration software and processes will be further developed in two primary areas. First, QA/QC libraries will be established, and QA/QC code will be developed, that is modular and reusable by different data providers. The aim is to reduce duplication of effort within SEACOOS and encourage a well understood and widely implemented library of routines throughout the ocean observing community. Our initial focus will be the implementation of the NOAA National Data Buoy Center handbook processes as applicable to the in situ datasets in SEACOOS. The procedural languages will initially be Java and Perl. Second, processes and protocols for aggregated data streams from SEACOOS partners will continue to be refined and enhanced to accommodate additional types and sources of data.

An essential step in the documentation and archiving of data is the development of appropriate metadata. To streamline and standardize metadata documentation, USC has been developing within the Caro-COOPS program an online metadata entry product based on the Cast-Net tool, which has greatly enhanced capabilities and reliability. This tool, called Meta-door, will be incorporated into the SEACOOS program to facilitate metadata generation by all partners. For Meta-door development, USC has been identifying XML schemas, in addition to FGDC and including SensorML and MarineXML, that should help meet IOOS goals. These efforts will enable consistent shared vocabularies among ocean observing systems that will facilitate data discovery and dissemination of SEACOOS data and products.

There is also the need to maintain and enhance operational hardware and software within the SEACOOS institutions. Computer platforms will be upgraded and replicated to ensure performance and security. Scripts and programs will continue to be developed to automate the

processes of converting, calibrating, and aggregating data as they are received from remote sites and pushed to data servers for Internet access. This activity is being expanded to include not just SEACOOS, but also additional IOOS participants. In addition, metadata for all SEACOOS data streams will be developed and documented. This will include tools to facilitate metadata entry and the identification of standards for metadata documentation.

An essential activity for the near-term will be the documentation of essential and innovative data management processes. This will include the development of internal and external (suitable for peer-reviewed publication) documents.

MODELING

Progress to Date

Analysis of merged model fields. Using the central OpenDAP server and in collaboration with the Information Management WG, we have completed the steps required to merge the present near-real-time barotropic nowcast and forecast fields (e.g., sea surface height and depth-averaged currents, etc.) from UNC, USF, and UM (see Figure 2). The product is available on www.seacoos.org. We are quantifying the difference fields in overlap zones to assess uniformity in the three models' input or internal parameters.

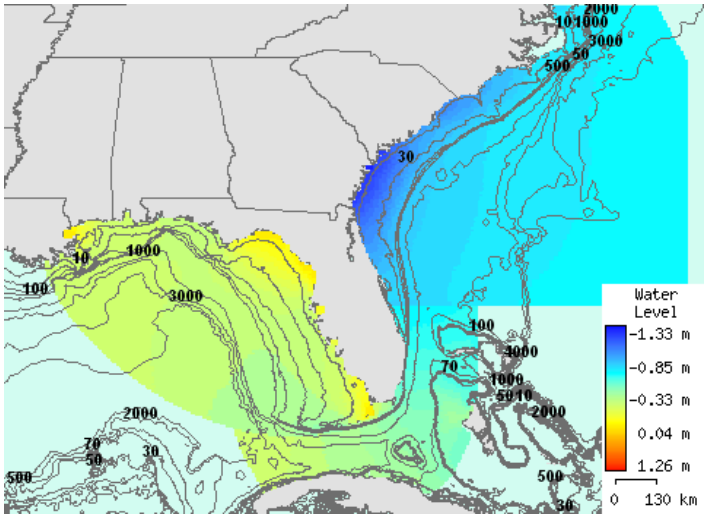

Figure 2. Sea surface elevation at an instant in time obtained by overlaying the USF, UM and UNC model solutions. Bottom depth contours in meters.

Daily execution of model runs. The required support methods have been implemented by each group. This support includes scripts to retrieve numerical weather prediction (NWP) files, manage the execution of the hydrodynamic models, post-process the output, and make available the output files (in a standardized netCDF formatted file) via local OpenDAP servers. A draft technical document on the implementation of the modeling sub-regions is available. This document "Implementation of the SEACOOS Nowcast/Forecast (SNFS) Model System" describes details of the SNFS, and will form the basis for a journal article.

Barotropic skill. Using sea-level gauges, ADCP velocity data and drifters, quantitative measures of model skill of the barotropic (no water column stratification) model solutions are being conducted. The skill analyses include both tidal and sub-tidal (weather-band) assessments. The coastal sea level (CSL) is the most immediate skill observable, as the data sources available for

comparison span the entire SEACOOS coastal region. Velocity observations, while not as available, provide guidance on the need to enhance model physics or the specification of the forcing. Sub-tidal skill varies by sub-region, as the processes that affect this frequency band vary throughout the SEACOOS region and are not generally restricted to barotropic mechanisms.

Hindcast studies. Analyses for the March 2001 period, during which two strong extra-tropical storms produced significant shelf responses at the beginning (March 5-7) and the end (March 21-22) of the month, are underway. Historical data for these events (CSL, currents, hydrography, as well as atmospheric forcing) have been acquired for comparison with barotropic hindcasts and a manuscript is in preparation. Strategies for the inclusion of baroclinic component, e.g., hydrographic initialization, are being quantified. In addition to the March 2001 period, we have begun the study of the "cool summer of 2003". Atmospheric, CSL and surface temperature data have been acquired and preliminary model runs have been conducted.

Baroclinic studies. We have begun studying the response of imposing heat fluxes and river discharge on the nowcast/forecast system. In the SAB this has allowed the study of the formation of tidal fronts during summer, the cooling of nearshore waters and associated water-mass subduction during cold-air outbreaks, as well as the formation of low salinity fronts during wet seasons. The baroclinic version of EFS-POM has been used for process and model testing studies in a strictly simulation mode so far. Results for simulations of frontal eddies on the EFS were validated against observed values reported in the literature (Fiechter and Mooers, 2003). On the WFS three different models are being used depending on application. The primary vehicle POM (Blumberg and Mellor, 1987) has been used for baroclinic hindcasts and for barotropic nowcast/forecasts. This is the basis for examining model limitations and improvements (e.g., He et al., 2004) in advance of data assimilation. Also being used are the ROMS (Arango, pers. comm.) and a Finite Volume Coastal Ocean Model (FVCOM; Chen, pers. comm.) for comparative studies and for linking the estuaries with the shelf (Weisberg and Zheng, 2003 and Zheng and Weisberg, 2004).

Global and Basin-scale Ocean Model Products. Global and basin-scale model products will be provided by GODAE and NCDDC. Collaborations have been established with these efforts (USF and UNC are funded partners of the HYCOM/GODAE consortium; UM is working with NRL, NAVO, and NCDDC on Global-NCOM and IAS-NCOM). Several teams are currently acquiring the 1/12 deg quasi-operational HYCOM/GODAE North Atlantic model output and developing methods to map these model products into their model domains. The frequency of availability of this basin scale product is 1 week. The 1/8 deg operational Global-NCOM will be acquired shortly and later the 1/24 deg IAS-NCOM on a daily basis. These products will provide best available estimates of the regional hydrography and currents as well as offshore barotropic elevations due to the proximity of the western boundary current to the SEACOOS continental shelf region.

Applications. On the SAB, we are collaborating with Dr. Jon Hare (NMFS) to study and quantify the transport of fish larvae (of selected species). This effort considers the model flow fields in relation to the design of Marine Protected Areas (MPAs). On the EFS, exploratory studies have been carried out extending model solutions to include a NPZD ecosystem model

that has been partially validated through comparison of simulated phytoplankton fields to MODIS color imagery, representing chlorophyll-*a* concentrations, depicting the influence of Florida Current frontal eddies on enhanced primary and secondary production (Fiechter and Mooers, 2004). On the WFS, we are collaborating with FMRI on shrimp fisheries concerns, and with J. Walsh through coupled physical/biological models of primary productivity on the WFS (e.g., Weisberg and He, 2003 and Walsh et al. 2003). We are also engaged in FVCOM applications with direct outreach implications involving hurricane storm surge simulations and an application to the Pinellas Co. Inter-Coastal Waterway.

Third year activities

Enhancement of nowcast/forecast system.

- Inclusion of density components to the nowcast/forecast system will include river discharge and atmospheric heat fluxes obtained from the NCEP's NWP analysis and forecast fields (the same source as the momentum fluxes currently being used by all three models). The background density fields, onto which these baroclinic forcings will be imposed, will initially be limited to climatological initial conditions of temperature and salinity. The availability of basin-scale ocean model forecasts of temperature and salinity structure will provide synoptic estimations for the SEACOOS domain (see below).
- A daily, cloud free SST product for the WFS (He et al, 2003a) is operational for the SEACOOS domain. We will use it to facilitate baroclinic nowcast/forecasts.
- A surface wind product that blends EDAS winds offshore with coastal and buoy winds implemented for the WFS will be made available for use over the entire SEACOOS region. This product quantitatively improves WFS hindcasts (He et al. 2004) and we expect similar improvements for other SEACOOS subdomains.
- A routine and useful description of the along- and across-shelf model solutions is achieved through the Lagrangian characterization of the flow. We will embed this approach in our standard analyses as these are of interest to a broad range of users (e.g., fisheries).
- We will explore capabilities of numerical models for surface gravity waves. Coupling of these wave models to our circulation models may enable a better forecast of wind stress and bottom stress and thus more quantitative statements on upper layer mixing and sediment transport processes, respectively.
- Baroclinic enhancements. We are using optimal interpolation (O/I) techniques to 1) composite SST fields from different satellites to produce operationally cloud-free daily images and to 2) composite surface wind fields from EDAS (model) and buoy and coastal observations for improved surface momentum flux forcing. The ocean model results from these O/I fields are demonstrably better than from the nominal EDAS fields alone. This quantitative finding underscores the importance of coastal ocean observing systems. These O/I techniques are incremental steps toward data assimilation.

Data assimilation. We will examine the possibility of routine data assimilation into the

SEACOOS modeling subdomains. We anticipate that CSL and ADCP data may be reliably available regionally for assimilation during the coming year, and we will also consider assimilation of surface current data from HF radar and internal T/S data from profilers, floats, gliders, and ship surveys into our sub-sub-domains. The latter is an open research topic requiring development of formal methods and forms part of a community-wide effort. Moreover, it must start with a cross-validation phase between model output, radar-derived surface currents, and, hopefully, independent observations.

SEACOOS domain models. For purposes of improving the open boundary condition specifications for the SEACOOS regional models we will consider implementing larger SEACOOS domain grids. Initial experiments will include climatological forcing. Coupling of the regional coastal ocean models with larger scale deep-ocean models will continue (see Progress Report) with other modeling groups (NRL NCOM and HYCOM users).

Ensemble model solutions. We will consider approaches where the three teams (UNC, UM, USF) use SEACOOS-wide models and work on the developing statistical measures of "forecasts" based on the three, now domain-wide, models. The ensemble three-model SEACOOS-wide domain approach may be advantageous in that:

- the difficult problem of dynamically linking all three sub-regions may be diminished;
- yet we will continue to be able to focus/zoom in on our own subdomains as needed through grid refinement and be responsive to the needs of the subdomain constituencies (e.g., the SAB estuaries, the Port Everglades-Port of Miami-Upper Keys Radar Testbed, the Lower Keys-Dry Tortugas complex, and the Tampa Bay/Charlotte Harbor sites); and,
- the "redundancy" of three model runs yields protections against failure of any one system, i.e., we will be more likely to provide continued forecast information to the SEA-COOS user community.

Ocean-atmosphere coupling. We will beta-test a coupled ROMS-WRF model that was developed by a collaboration between Rutgers University and PMEL in Seattle. We will work with Pat Welsh, JAX-WFO and others for implementation to eventually include the SEA-COOS wide domain.

State-of-the-Southeast USA Coastal Ocean Report. We will work towards developing routine ocean weather maps for hourly posting and for state of the SEA-COOS coastal ocean report. Continuous analysis of the daily model solutions will provide daily to seasonal descriptions of the state of the SEA-COOS domain and in the longer term, we will develop a database that will enable interannual comparisons.

Scientific publications. Peer-reviewed publications will be written and will provide an objective measure of the quality of our findings.

OUTREACH & EDUCATION

The "outreach" goal is to promote and facilitate two-way flow of information between user groups and the research community -- user groups need to receive useful science-based information and in turn academic researchers are provided feedback on the emerging issues that may warrant further investigation. The term "education" refers to formal education, K-16 situations and free-choice institutions. The Outreach and Education (O&E) workgroup has made progress, with help from all of the other workgroups, in creating increased awareness of ocean observing in general and SEACOOS in particular. This has been accomplished through development of O&E products, presenting information at regional and national meetings, working with user groups, site-specific demonstration projects, and coordinating efforts between states and projects.

Progress to Date

Products. As of March 2003, products that are designed to create an awareness of the potential for ocean observing information include a PowerPoint slide presentation ("SEACOOS 101") to familiarize stakeholders with the SEACOOS efforts and a draft Outreach web page interface for the SEACOOS web site. Nearing completion is a user community profile, accomplished through interviews to develop an assessment of stakeholder interests and needs in the COOS arena. Other products nearing completion include a tri-fold color brochure that showcases SEACOOS, produced by the management team with input from O&E workgroup members. An eight-page color publication will serve as a awareness product and annual report Year 2 progress. An electronic newsletter for educators, located on the SouthEast COSEE's website was loaded January 2004 and is available and the second issue is scheduled for May 2004.

Two O&E products that include primary research on SEACOOS impacts and user needs are in process. We have partnered with The Coastal States Organization on a national survey to assess ocean observing information needs of coastal managers. Another research report that assesses the regional economic and social impacts of coastal observing for the southeast is under contract.

Workshops, Meetings and Awareness Presentations. The development of working relationships with end users, educators and state and federal partners is essential to SEACOOS success. Our SouthEast COSEE education partner co-hosted a national workshop in March 2004 to develop a national network of COOS educators, resulting in shared initiatives and ideas. We are in discussions with OceanUS, NOAA's Coastal Service Center and others on a national workshop on outreach methods for regional ocean observing projects.

Poster display and fact sheets were made available for the Florida Association of Extension Professionals (FAEP) annual meeting, the International Boat Builders Exposition (IBEX), held in Miami, Florida (September 2003), the 2004 Miami Boat Show, held in Miami, Florida (February 2004), the American Boat Builders and Boat Repairers Association's (ABBRA) and Marine Environmental Education Foundation's annual meeting, held in Ft. Lauderdale, Florida (February 2004). A planning meeting was held for Florida Sea Grant county faculty on SEACOOS in Gainesville, Florida (August 2003). A presentation on Coastal Storm Initiative

(CSI) and SEACOOS was presented at the CSI work group meeting, held in Astoria, OR (October 2003).

Programs for formal educators will include a week long summer physical science workshop showcasing SEACOOS scheduled for June 7-June 11. Another program for educators are the 12 SEPORTs (South East Portals to Ocean Sciences for Teachers) workshops that will be completed by summer 2004.

Demonstration Projects. A successful outreach program includes real-world practical projects that bring researchers and end-users together to design, implement and evaluate products. This helps to insure the development of products that have practical value and enhances the public's ownership in the project and the overall observing system. These projects will be documented and the lessons learned as well as the successful practices will be shared with the rest of the ocean observing community.

The O&E group is working in North Carolina to determine offshore boaters needs and preferences for HF-radar information. Product review committees of commercial fishermen and offshore recreational anglers are being formed and in February 2004 the current HF-radar prototype products were displayed along with other SEACOOS information at the North Carolina Fishermen's Association annual meetings. Another demonstration project focuses on the design and installation of a North Carolina buoy/mooring for ocean and weather measurements. Working with the observing workgroup and local boaters we are determining the information needs and delivery methods of a real-time wind and wave monitoring system that would improve the safety for recreational boaters, anglers, commercial fishermen, commercial and recreational underwater divers, and wind powered sailors in the central NC coastal region.

Staffing. After a national search, Dr. Christina Simoniello was hired by Florida Sea Grant as SEACOOS Regional Outreach Coordinator. She is based at the University of South Florida. Her duties include the design, development, implementation and evaluation of regional outreach programs. Chris is working closely with Sandy Enslinger, the SERA-COOS Coordinator who is based in South Carolina, on projects that complement their activities.

Year 3 activities

Year 3 activities include a combination of products, presentations, working with user groups, site-specific demonstration projects, and coordinating efforts between states and projects. The Regional Outreach Coordinator, based at USF, provides oversight for the individual projects in the region and is the lead contact for outreach to user groups. She will oversee the development, implementation and evaluation of regional outreach programs.

Several prominent user-groups have been targeted for outreach effort in Year 3: we will determine information needs, potential products and services, and application to Florida's boating community, engage key user groups in the identification and development of SEACOOS coastal climate and hazards environmental information products and work intensively with marine fisheries managers. Two demonstration projects will determine the information needs and delivery methods for offshore boaters.

An innovative project involving will design and install a SEACOOS kiosk exhibit for Explorer of the Seas and upgrade graphical explanatory signage. In addition, we will develop an evaluation instrument that will determine the success of Explorer of the Seas **e**ducational programs.

For formal educators, we will develop ocean awareness professional development workshops that focus on SEACOOS. Also, a SEACOOS poster for educators, a DVD of the SEACOOS physical science workshop and a teaching-learning module designed for use in teacher education programs will be designed and produced. Finally, an electronic newsletter, a national set of oceanographic lessons, a poster focusing on wave parameters, and a physical science workshop for teachers will be undertaken.

MANAGEMENT

The fiscal management of SEACOOS will remain the responsibility of the University of North Carolina. Dr. Russ Lea, Vice President of Research, will act as project coordinator, and Prof. Harvey Seim with the Department of Marine Sciences at UNC-CH, will serve as Chief Operating Officer; together they will provide day-to-day oversight of the program. Dr. Jim Sanders, Director of the Skidaway Institute of Oceanography, was named Chairman of the Board of Directors in November 2003 and will serve in that capacity in Year 3.

Responsibilities of the program office include support of a program manager (Ms. Claire Eager), travel for Board meetings, and support of semi-annual workshops. At present, plans are to hold an internal review workshop in the fall of 2004, small scale external evaluation in early 2005, and an open workshop for the region in spring 2005. These events have proved popular and provide an excellent forum for information exchange and interaction will affiliate members.

SUMMARY

In Year 3 SEACOOS will strive to establish a pre-operational status for elements of the regional observing system associated with the physical ocean state by enhancing the robustness of observing components and further refinement of modeling systems. Within information management, continued development of standards and QA/QC protocols will lead to a greater number of available products. In this way, outreach and education will grow in scope as additional material is available for distribution and testing with users from many parts of the coastal community in the southeast.

Secondary efforts will strive to develop elements of broad interest in the region, in recognition of the economic importance of nearshore processes (e.g. coastal erosion, sediment transport) and salt-water fisheries. Given that a large number of regional state and federal agencies are focused on these topics, they provide a venue for greater interaction with these communities.

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WORK STATEMENTS AND BUDGET JUSTIFICATIONS

OBSERVATIONS

UNIVERSITY OF SOUTH FLORIDA

Observational subprogram – P.I. and Workgroup Chair Robert Weisberg (West Florida Shelf), co-P.I. Mark Luther (Coast and Tampa Bay), USF

WORK STATEMENTS

- **Moored Array**: Continue to maintain the offshore array, providing real-time data to the general public via the COMPS and SEACOOS Internet sites and providing these data to NCEP via the NDBC (Internet site and GTS). COMPS will also maintain a set of coastal stations.

- **HF Radar**: A long-range CODAR array will be completed (acquired in Year 2) and maintained for real time surface currents and as a radar test bed over a broad, gently sloping shelf with in-situ measurements for comparison. Three antennae sets will be positioned from Naples to St. Petersburg, and we will collaborate with Rutgers/Mote on a fourth. Joint analyses comparing WERA and WFS in-situ data will be completed with N. Shay.

- **Profilers***:* BSOP (profiling float) developments are progressing under separate funding. Our first extended (16 days), unattended deployments were conducted in November 2003, and limited operational deployments are planned. Near real time profiles will be served on the Internet.

- **Data analyses***:* Analyses will be aimed at understanding the synoptic, seasonal and inter-annual variations on the WFS, both for the ocean circulation and ocean-atmosphere interactions and for the biological ramifications of these.

- **Construct a replacement SEACOOS buoy** (1 of our 6 SEACOOS/COMPS surface moorings): This will help facilitate a regular servicing interval and improve reliability.

- **Design and construct a near shore station:** Measurements (met., currents & T/S are needed in the region of estuarine influence not covered by the long-range CODAR (within a few km of the beach). We anticipate using a fixed platform with acoustic telemetry to transmit data from a bottom mounted ADCP (possibly with waves). This may lead to matching support and will provide for outreach.

Budget Justification: Partial support is requested for the P.I. (Weisberg, 2mm), a computer manager/analyst (Donovan, 2mm), two sea-going technicians (Cole, 3mm and Law, 6mm), a radar technician (Tilbury, 6mm), engineer support (Russell, 4mm), a graduate student (12mm), and a sea pay allowance. Fringe is at 16.5% (1% on graduate students), plus 590/mo. insurance. Indirect costs are at 45% of MTDC (TDC minus tuition, equipment, and ship time).

Equipment includes costs for a replacement mooring, the near shore station, a field grade laptop pc for instrument set up at sea, and an analysis pc.

Travel is for field work and workshops. Materials/supplies are for field hardware and expendable such as batteries and for computer supplies for graphics and data storage/backup. Other costs include ship time (six days on SUNCOASTER), G.S. tuition, computer maintenance, HF-radar communications, ARGOS buoy location services, publication, instrument calibration, and freight.

USF Satellite Remote Sensing -- co-P.I. Frank Muller-Karger, USF (This is part of the Observational subprogram, but as a new addition in Year 3 it is being listed separately).

The remote sensing effort will be led by the University of South Florida (USF) and the University of Miami (UM), each with complementary capabilities. In broad terms, USF will generate the real-time coverages and UM will hold the corresponding historical archives and products served to SEACOOS and SERA. Of interest is the availability of various low-level, synoptic calibrated satellite data to be accessed through common mechanisms. This activity will focus specifically on developing and implementing a strategy to process and deliver basic, non value-added, real-time and historical oceanographic satellite data products. Value-added products are explicitly seen as an opportunity for industry engagement.

WORK STATEMENTS

- Produce high temporal and spatial resolution sea surface temperature fields from MODIS and AVHRR to be served by SEACOOS;
- Produce ocean color data from MODIS and SeaWiFS (the latter one in a protected mode available to researchers and educators) in a format compatible for SEACOOS access and in a manner similar to that for the SST products;
- Plan for delivery mechanisms of other relevant satellite data including altimetry and scatterometer observations (sea surface height and winds, respectively)

Budget Justification: Partial support is budgeted for the P.I. (Muller-Karger, 0.5mm), a research associate scientist (C. Hu, 2mm), two data managers (B. Murch, 3mm and J. Taylor, 2mm) and for one graduate student. Fringe is at 16.5% (1% on graduate students), plus 590/mo. insurance. Indirect costs are at 45% of MTDC (TDC minus tuition).

Travel is for SEACOOS and working group meetings. Other costs are for computer hardware and software maintenance, publications, and tuition.

UNIVERSITY OF SOUTH CAROLINA

SC Near shore Monitoring Stations – P.I. George Voulgaris, USC

WORK STATEMENTS

- Continue to operate and maintain two established near shore monitoring stations.
- Generate the near shore directional wave climate for the coast of South Carolina for the two stations.
- Continue to provide real-time information to assess coastal circulation to be used for the design and execution of coastal nourishment projects and for boating. This information can also be used as a prognostic tool for the forecasting of near shore circulation and mixing that control the transport and diffusion of colloid bacteria loading in the Myrtle Beach area as a result of storm rainwater runoff.

Budget Justification: Salary for one Research Associate (12mm; 33,000) is requested to have primary responsibility for maintaining the USC SEACOOS Near shore Monitoring systems addressing near shore wave and circulation dynamics, as it relates to coastal erosion. The work is primarily directed by Dr. Voulgaris, who is requesting 2mm of summer salary support. One year salary (12mm; 17,000) is requested for a Graduate Research Assistant (Ph.D. level), who will be trained in operational oceanography and will help in the interpretation of near shore dynamics to coastal erosion parameters for use by the end-users and the relationship of near shore sea state and atmospheric eddy covariance. Fringe benefits are calculated at 19.55% of salary for faculty and staff, plus $222/month health insurance. For the graduate student, fringe is calculated at 0.8%

Travel funds are requested to cover costs of (1) servicing and maintenance of monitoring station equipment ($6,000), (2) participation of PI and personnel in SEACOOS fall and spring workshops ($2,000), and (3) participation of P.I. and Ph.D. student in one national conference ($2,000).

Equipment funds are requested for a spare system compatible to those established in year 1, consisting of (1) WH Monitor 1200 kHz DR ADCP with 512 memory card; (2) WH ADCP Directional Wave Gauge Upgrade (includes 20 m pressure sensor firmware/software), (3) external battery case and cable 200 m rated, and (4) interface to Seabird MicroCAT CDT with interface cable.

Materials and supplies costs include equipment items with a value less than $5,000 per item and other supplies required for the maintenance of nearshore stations. Items include magnetic media ($600), a CTD ($4,120), MSI Diver serviceable bottom mount for ADCP ($4,250), underwater cable ($1,000), Tektronic Oscilloscope for field and lab testing ($1,800), MATLAB Software

($1,000), underwater anchors and stainless steel fastenings ($2,000), marine supplies, underwater connectors ($2,690), and field PC computer for testing ($4,200).

Other costs include contractual services for divers' services ($10,960), I.P. address monthly fee for 2 sites for 1 year (at $299/month = $7,440), freight services ($1,500), hiring assistance for cable installation and maintenance ($5,500), boat time ($12,000), long distance telephone and fax expenses ($750), and printing and photocopying ($500). Graduate student tuition is included at $3,175 per semester ($6,350).

Indirect costs are calculated at 19.55% of all direct costs, except for equipment and student tuition. The base is $146,605, and total IDC is $66,705.

OBSERVATIONS (CONT.)

HF Radar – P.I., Richard Styles, USC

WORK STATEMENTS

- Deploy a long-range HF Radar (CODAR) system in coordination with SKIO partners in the central South Atlantic Bight. Antenna locations will be selected based on site surveys, permitting considerations, and radial overlap options determined in Year 2.

Budget Justification: Salary is requested for Dr. Styles (1mm; 6,000), who will devote 2 months (1 summer, 1 academic) to this project. He will oversee a fulltime technician and coordinate HF-radar installation with other SEACOOS PIs (Nick Shay, Jim Nelson, Harvey Seim, and Bob Weisberg). Partial support for a fulltime technician is requested to install and maintain the HF-radar system (10mm; $47,667). The initial installation will be labor intensive. After the system is up and running, the technician will be responsible for acquiring and developing the software to maintain a near-real time feed to the internet and to display surface current maps on the SEACOOS web page.

A major fraction of the supply budget ($11,453) is associated with the installation of the HF-radar system and includes the purchase of a shack to house the electronics, software licensing fees, monthly service charges for phone and internet service to transfer HF-radar data and miscellaneous items (brackets, wires, waterproof seal, etc.) needed during installation.

Equipment costs are to purchase 1 long-range CODAR HF-radar antenna and central receiving station ($175,000). These costs are based on experience gained in SEACOOS Year 2 Radar Test-Bed programs.

Travel funds are requested for several trips to the South Carolina and Georgia coasts to search for potential installation sites as well as to provide routine servicing throughout the year ($3,000).

Indirect costs are calculated at 45.5% of direct costs, excluding equipment. The basis is $73,659, and calculated IDC are $33,515.

SKIDAWAY INSTITUTE OF OCEANOGRAPHY

P.I. and Workgroup Co-Chair Jim Nelson, and P.I.s Rick Jahnke, Dana Savidge

WORK STATEMENTS

- Maintain the SABSOON observing system on the Georgia continental shelf (mechanical systems, power, communications, instrument packages).
- Deploy a long-rang HF Radar (CODAR) system in coordination with USC partners in the central South Atlantic Bight. Antenna locations will be selected based on site surveys, permitting considerations, and radial overlap options determined in Year 2.
- Obtain surface wave information through deployment and maintenance of a directional wave buoy system with partner Paul Work (Georgia Institute of Technology, Savannah campus). The deployment location will be based on evaluation of initial results from Year 2.
- Continue incremental upgrades of instrument packages, power monitoring and control, data acquisition hardware and software, and communications components.
- Continue prototype development for a profiling CTD/optical package for tower deployment.
- Plan logistic support for a deployment of an air-sea gas exchange measurement system at one of the Navy towers (a separately funded project of Wade McGillis, Columbia University, LDGO)

Budget Justification: Engineering and technical support personnel: Project participants who are primarily involved in observing system efforts are Travis McKissack (4mm), Don Wagner (12mm), Charles Robertson (1mm) and Mary Richards (1mm).

McKissack (Project Engineer) has primary responsibility for the SABSOON engineering and management of operational systems. About 75% of his time is devoted to the SEACOOS project (with the majority of his time supported by SkIO). In Year 3, McKissack will be in charge of the technical aspects of HF Radar deployment and operation (his prior experience at Lockheed included work on radar systems). Wagner (Engineering Technician) has primary responsibility for maintenance of the SABSOON field equipment deployed on the offshore towers, service and calibration records and instrument inventories, and assists in the fabrication and testing of electronic components. Robertson and Richards are experienced members of the SkIO research

support staff (primarily supported through other projects of Nelson and Jahnke). One month time for each is requested to assist Wagner in field maintenance. Richards is also a member of the SkIO dive team for SABSOON.

Equipment: Year 3 equipment expenditure ($150,000) will be for HF Radar (Codar, Long-Range SeaSonde). Installation costs are included in Materials and Supplies.

Maintenance of the Observing System (Materials and Supplies, Transportation costs): At start of Year 3, we anticipate having three offshore towers fully instrumented with SkIO systems (Met, in-water CTD/bio-optical, bottom-mounted ADCP, pressure/waves) providing mid-to-outer shelf coverage (26, 33 and 44 m depths) and one (SE platform, R4) with a "self-contained" UNC system. Standard servicing of tower instruments uses helicopter transportation between SkIO and the offshore platforms at 4-6 week intervals. Helicopter costs are $1100-1250 per hour flight time (depending on the air frame used). Routine maintenance of 3-4 towers will require 4-5 hours flight time per month, while additional time is required for non-routine repairs and troubleshooting ($75,000 total for Year 3). Modification of instrument packages in Year 2 should reduce the time required for servicing, and may extend the interval required between servicing visits. Ship and smaller vessel transportation of personnel is also for servicing on occasion, such as when diving operations are required, and when it is cost-effective (e.g., when other ship operations are conducted near the towers). Ten days of ship time on the R/V Savannah are requested (at ~$5,000/day, $50,000 total). Some of the ship time will likely be re-allocated to smaller vessel operations if lifting capabilities for the 41 foot utility boat can be upgraded (presently being considered). Basic materials and supply costs for maintenance are ~$3,500 per platform per year. For the most part, the current instrument inventory will provide spare instruments, but we can anticipate the need to repair or replace some instruments and safety equipment over the course of the year.

Subcontract to GIT ($75,000 total): Paul Work (GIT) will continue observations and analyses of surface directional waves initiated in Year 2. Associated personnel costs ($42,600 combined salary, fringe, indirect) are for Work (1mm), Randy Abler (0.5mm, communications engineering), and a graduate student (12mm). Other subcontract expenses are for travel, deployment hardware, telemetry, student tuition, and GIT indirect costs. Ship/small vessel time for deployment and recovery of Work's buoy are included in the SkIO budget.

Other expenses: Other expenses include: travel ($18,000 for P.I.s and staff to attend various SEACOOS and COOS-related meetings); support of the SkIO computer network ($8,000, services include server/processor for SABSOON data stream, RAID array backup system, Matlab licenses, video conference support); telecommunications ($12,000 per year, includes a T1 link for SABSOON data to SkIO and a satellite phone used to ensure communications with personnel on offshore platforms).

UNIVERSITY OF MIAMI, RSMAS

Radar Test Bed for the East Florida Shelf (EFS) with Waverider Buoy - P.I., Lynn K. Shay MPO, RSMAS

WORK STATEMENTS

- Complete analysis of radar-derived surface currents and compare these data to moored ADCP data over the West Florida Shelf from the ~2-month deployment in August and September 03
- Maintain three surface current radar sites along the EFS thereby establishing a radar testbed (RTB) in a regime with large gradients that occur over short-time scale and compare to ADCP transect data from the Explorer of the Seas
- Provide hourly estimates of surface current maps via the Web
- Deploy a waverider buoy in the WERA domain for real-time measurements of the two-dimensional wave spectra for comparison to wave spectra derived from WERA

Budget Justification: Salary support is requested for Drs. L.K. Shay (2.7 months) and B. Haus (4.8 months), Tom Cook (9 months), Jorge Martinez (12 months), and M. Robozo (0.5 month). Shay will oversee and direct the project, play a leading role in the analysis of the WFS analyses, and procure the hardware. Haus and Cook will be responsible for field operations on the EFS, and Haus and Rebozo will be responsible for the deployment and processing of the Waverider buoy in the WERA domain. Cook is responsible for processing the data from WERA and will assist Haus in the wave comparisons. Martinez and Cook will maintain the HF radar sites. All personnel will be involved in the HF-radar operations on the EFS. The cost function used here is based on three earlier Dania Beach, FL deployments. The approximate deployment cost per month, including salary support (with indirect cost recovery), was approximately $23.5K. Direct costs include telephone lines and electricity at the sites, travel to and from the sites, expendable supplies; such as, disks/CDs to store data, computing services (i.e., Internet connections at the sites such as DSL, cell phone technology). The cost of the Waverider buoy, receiving station with computer, and mooring hardware is ~$65 K based on an exchange rate of $1.3 US to one Euro, and with ship time the total is $75K.

Real-time Oceanographic Profiling Stations Along the East Florida Shelf, P.I. Bill Johns, MPO/RSMAS

WORK STATEMENTS

- Two SWAMP (Shallow Water Autonomous Profiler) systems will be maintained on the EFS within the HF radar domain. Housed in a bottom platform, these contain a fixed ADCP and a buoyant CTD, periodically released to the surface and winched back to the bottom. They will provide real time profiles of velocity and T/S from shallow environments (<100 m) without the need for surface buoys.

- Deployments will be off Carysfort Reef and northern end of Elliott Key, both in 30-35 m depth at the outer edge of the reef tract. Anticipated are hourly current and 6-hourly CTD profiles transmitted every 6 hours. The data will be transmitted by Iridium and incorporated in the EFS radar test-bed and the SEACOOS data streams

Budget Justification: The estimated budget includes salary for the P.I. (Johns, 1 month @ $15k), and two technicians (Graham for 3 months @ $14.8k and Jones for 3 months @ $11.8k) to perform the SWAMP (Shallow Water Autonomous Profiler) deployments and handle the data retrieval (hourly current profiles and 6-hourly CTD profiles transmitted every 6 hours). Equipment costs include miscellaneous hardware supplies required for tests and multiple deployments at sea ($13k) and the capital acquisition of several Iridium transceivers and a substantial amount of batteries for the automated system (total $20k). Travel ($4k) is included for the P.I to participate in SEA-COOS meetings and workshops. Shiptime (6 days) is NOT included in this budget.

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

NC Observingt, Harvey Seim, PI

WORK STATEMENTS

- ***Fixed platforms***: deploy/maintain/harden 2 tower deployments off Oregon Inlet and a buoy off Cape Lookout. Test lithium batteries for these. Acquire spares and build additional systems. Conduct outreach and assess additional needs.

- **Moving platforms**: focus on shipboard and autonomous T and S mapping. Ship time is necessary for acrobat and glider experimentation in SABSOON, and to support the NE and central NC operations.

- ***HF-radar***: Operate and evaluate existing HF radar and develop ties to other NEOS and SEACOOS HF-radar networks. Plan for an additional site near Cape Lookout to cover the Gulf Stream as it leaves the shelfbreak. Also consider higher resolution systems for the near-shore region.

Budget justification: includes salary support for Seim (3 months), Mulgia (6 months), Stearns (9 months), Haines (3 months), and a technician at IMS (4 months). Will also provide partial support for a graduate student (Catherine Edwards, Royer scholar at UNC-CH). An ADCP with waves will be purchased for one of the fixed platforms. Supplies include a set of meteorological sensors (air temp/humidty, visibility, barometric pressure, long and shortwave radiation, anemometers), SBE microcats, cabling ($7500) and connectors ($10,000).

Transportation support includes 5 hours of helicopter time ($6500), 2 days on the R/V Hatteras ($22,000), 12 days on the R/V Capricorn ($8000) and 10 days on the R/V Savannah ($52,000), as well as $10,000 for vessel charter out of Manteo. Miscellaneous charges of $10,000 include electronics and shop charges, and computer supplies.

Travel is budgeted at $15,000 for all involved. Communications includes funds for cable modems and DSL for the radar installation at Buxton, NC ($5000). Tuition of $1506 is also requested.

UNIVERSITY OF SOUTH CAROLINA

Information management and communications – P.I. and Workgroup Chair Madilyn Fletcher, P.I. Dwayne Porter

WORK STATEMENTS

- Mapping products. USC will continue to provide the interface for continuing and newly developed geospatially-referenced, web-based products. We will coordinate with other SEACOOS partners to receive their data and their input on map product design and function.
- QA/QC libraries. QA/QC code will be developed, e.g. for establishment of range limits and time continuities.
- Maintenance and enhancement of operational hardware. A second server has been acquired and will be utilized to support existing production oriented processes as well as host a duplicate aggregated archival database which will allow query by partners and potentially the public. This server will also support computational needs by other groups. The necessary software is currently being installed on this server to support these processes.
- Maintenance and enhancement of operational software. USC will continue to contribute to the development of scripts and programs for automated input and aggregation of SEACOOS data streams. We will also continue to provide Caro-COOPS data to the SEACOOS platform.
- Incorporation of Meta-door components (i.e. metadata generation) in to SEACOOS framework. Metadata will be documented by all partners for SEACOOS observation data.
- Documentation. Processes and protocols that will be documented a data dictionary, descriptions of processes and protocols, and a record of the approaches required for the multi-institutional data integration effort.

Budget Justification: Salary support is requested for Drs. Fletcher (1 month; $11,146)) and Porter (0.75 month; $4,902)), who are responsible for overall program development, management, and implementation, and for C. Purvis (12 months; $69,010), who is responsible for development of GIS tools and coordination of data and data protocols among the Data Management Coordination Committee. Support is also requested for two Programmer/Developer

positions (one 12-month [$46,000[, one 6-month [$23,000]), who are necessary for the development of software related to QA/QC and metadata, as well as providing support for the development of GIS-based tools and applications. Fringe benefits are calculated at 19.55% of salaries, plus $222 per month, except for Dr. Porter's summer salary.

Travel ($9,000) includes airfare, ground travel, hotel and per diem, and incidental expenses related to Information Management coordination and project coordination meetings. Air travel also includes air travel by Drs. Fletcher and Porter to attend national meetings related to SEACOOS Information Management coordination within the IOOS framework.

Supplies includes computer hardware and software ($5,000), software licenses ($3,000), and supplies (cartridges, paper, etc.; $265). Funds ($1,000) are requested to cover USC computer system support costs.

Indirect costs are calculated at 45.5% of all direct costs except equipment. The basis is $209,323, and IDC are $95,242.

INFORMATION MANAGEMENT (CONT.)

SKIDAWAY INSTITUTE OF OCEANOGRAPHY

P.I. and Workgroup Co-Chair Jim Nelson, and P.I.s Rick Jahnke, Dana Savidge

WORK STATEMENTS

- Provide near-real time data to the SEACOOS modeling group and web site, and to the NWS and NDBC. Provide public access to recent data and graphics through the local SABSOON web site (updated hourly).
- Coordinate with DMCC for SEACOOS data formatting and exchange procedures, and implementation of SEACOOS QA/QC standards.
- Update data processing scripts in collaboration with UNC partners, and implement improvements to the SABSOON historical database and metadata records (following up from work initiated in Year 2).

Budget Justification: SkIO faculty: Salary support for SkIO faculty is requested for Jim Nelson (3 months), Rick Jahnke (1 months) and Dana Savidge (2 months). Nelson will be responsible for project oversight, coordination with SEACOOS partners and coordination with SE TACTS (for the SABSOON access to the Navy towers). Nelson will also participate in some field deployment and servicing operations, and will coordinate shipboard survey measurements that augment the time series observations (much of the ship time supported by other projects), and work with ocean color imagery for the South Atlantic Bight. Jahnke will be involved in a number of oversight and coordination roles for SEACOOS within Georgia and is a key liaison for SEACOOS with a number of national programs. He will also work with biogeochemical

applications of the observations and modeling products. Savidge will be involved in the GA/SC HF Radar deployment and analysis of the surface current data. Savidge will also help oversee the SABSOON data processing scripts and time series analyses of the SABSOON data set.

Engineering and technical support personnel: Personnel primarily involved in data processing and analysis, communications and database management roles are Trent Moore (9 months, 6 for data management, 3 for observations), Mimi Tzeng (6 months), and a Year 2 hire for database/metadata management, UNIX support and programming (8 months).

Moore (Research Coordinator) has the primary responsibility for maintaining SABSOON data processing, data communications (DODS server and ftp scripts for transfer to NDBC and NWS) and local web products. Moore also coordinates all diving operations associated with the project, and is involved in many of the field operations (ship surveys, smaller vessel work and diving). Tzeng (Research Technician) will have a primary role in processing ocean color imagery for the SAB shelf and working up ship survey data (CTD/bio-optical), and will assist in maintenance of the SABSOON data stream and database/metadata entries. A new hire is anticipated to start in Year 2 (Database Specialist) who will provide database and UNIX system skills. This person will have primary responsibility for upgrading the SABSOON database and metadata structure, updating PERL and C-scripts for automated processing and web displays, and implementing automated QA/QC procedures.

Other expenses: Other expenses include support for the SkIO computer network (services include server/processor for SABSOON data stream, RAID array backup system, Matlab licenses, video conference support) and telecommunications.

INFORMATION MANAGEMENT (CONT.)

UNIVERSITY OF MIAMI

Observations from the Explorer of the Seas and Associated Data Systems - P.I., Edward Kearns, MPO/RSMAS

Budget Justification: Base support is provided for the daily Explorer observations as well as the shore-side data management and distribution system activities. The largest portion of these expenditures is salary (6 months each) for 24/7 at-sea tech support (Maxwell/Cucchiara), with some support allotted to cover on-board living expenses ($5.5k) and miscellaneous laboratory supplies at sea ($2k). Other lesser salary expenditures are targeted mainly on the shore-side data management activities of the data/outreach manager (Williams, 6 months), P.I. (Kearns, 3 months), ship and database support personnel (Baringer, 2 months and McKinney, 2 months), oversight of shipboard and technical operations (Findley 0.7 months) and Program Management including scheduling and coordination of visiting scientists (Turbe, 6 months). Modest funds for the necessary supplies and hardware to calibrate the large array of instruments ($7k, including manufacturer costs and a supply of standard seawater) and maintain the on-board data network are budgeted ($2.5k), as are funds for some additional hardware (disk arrays @ $6.5k and network equipment @ $3k) in support of the data management system. Funds ($17.88k) are allocated for constructing an Outreach and Education kiosk for the Explorer of the Seas. Other

support is requested for software licenses ($2k) and travel ($3k) to Observations, Data Management, and Outreach workshops or scientific meetings. Funds are also requested to support publication costs ($500).

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

Subcontract to Office of Arts and Sciences Information Services, UNC-CH

WORK STATEMENTS

- **New server hardware** for modest increases in reliability and performance for the website (www.seacoos.org). Support for www.seacoos.org will continue to be available Monday through Friday, from 8am to 5pm.

- A one-time subcontract will be used to fulfill the requirements of a RFP to **redesign the website** (www.seacoos.org). The production of the RFP will be facilitated by OASIS and the SEACOOS Project Manager, utilizing input from SEACOOS members and external evaluations obtained by the Outreach Work Group. Significant emphasis will be placed on a new look and feel (design) for the website.

- **Minimal ongoing changes to functionality and content of www.seacoos.org**. Following fulfillment of the subcontract, occasional changes to the website can be made depending on available resources as apportioned by the SEACOOS COO. Principle responsibility for new content will rest with individuals' use of the Content Management System, which allows for distributed content additions and revisions.

- Ongoing **support of Celoxis** will include documentation, version upgrades, and new server hardware. Support for Celoxis will continue to be available Monday through Friday, from 8am to 5pm.

- **Programming & technical inquiry** will be provided by OASIS staff to enhance existing and research developing technologies in support of the SEACOOS website. Additional support may be available for task-specific programming and research activities for ancillary projects (e.g., Year 2 efforts for the UNC tower SBC, NDBC data marine encoder). Number and size of projects completed in Year 3 will be determined by assignment of resources by the SEACOOS COO.

- **Data support of www.seacoos.org** and Celoxis will include regular backups and system monitoring.

Budget Justification: Requested funds include salary support for a web developer (12 months), technical inquiry (1.8 months), system administrator (2.4 months), server administrator (1

month), and programmers (2 at 2.15 months each). Travel budget ($6,300) is for all persons supported.

P.I. Harvey Seim, UNC-CH

WORK STATEMENTS

- *Continued Data Integration*: Collaboration with SEACOOS data management personnel to implement processes to aggregate internal and external data streams for modeling and outreach products. External data streams are from federal data providers such as NBDC, NWS, and USGS.

- *Data Quality and Control*: We will implement QA/QC practices as identified by SEACOOS partners. This includes procedures for near, real-time observational data, as well as, after-the-fact.

- *Establish metadata and data structure for NC observations*: We will assist in identifying SEACOOS minimums for data structure and metadata needs for HF radar and in-situ measurements. These will be made available in a manner that are consistent with those throughout SEACOOS

- *Operational data streams*: Scripts and programs will be developed to automate the processes of converting, calibrating, and aggregating data as they are received from remote sites and pushed to data servers for Internet access. These automated processes will need to be sensitive to when sensors and equipment are brought online and offline or when there is a telemetry failure. Also, these scripts will need to access information about changes in calibrations and maintenance.

- *Design relational equipment database*: A relational database will be designed to hold information about field equipment and sensors, history of maintenance, calibration data and threshold standards. This will improve the communication of very detailed and pertinent information between the field personnel and data management personnel. This database will be updated by field personnel and used by operational scripts and programs—a crucial step towards operational function.

- *Continued development of nccoos website*: to work out coordination of display with central site. Com

Budget justification: includes salary support for Haines (9 months) and Stearns (3 months). Travel expenses are covered at $8000, and $2000 for computer supplies is requested. To support the NCCOOS server and other computers we require $5000 for computer services and contracts, and include $2250 to cover the costs of cable modems for involved staff to enable round the clock and weekend access to networks.

UNIVERSITY OF SOUTH FLORIDA

USF Data management-P.I. Mark Luther, USF

WORK STATEMENTS

- We are participating in all areas of data management integrating efforts with colleagues at USC, UNC and RSMAS. Data are being served at the COMPS, NDBC, and SEACOOS websites. Opendap access to data has been implemented and will be maintained.

Budget Justification: Partial support is budgeted for two data managers (Donovan and Subramanian) and for a web assistant (Smith).

MODELING

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

P.I. and Modeling Working Group Chair, Francisco Werner, UNC-CH

WORK STATEMENTS

- **Baroclinic circulation.** To include hydrography, atmospheric fluxes, and river discharge. Blending of climatology and recent observations will be used to initialize the hydrography.
- **Coupling with HYCOM**. To include bathymetry matching, examine accuracy/compatibility of mass field and momentum fluxes, and exploration of techniques for merging fields
- **Data assimilation**. Explore implementation of techniques developed under SABLAM for assimilation of ADCP and sea level observations, and examine methods for HR radar data assimilation
- **Quantitative assessment of generated fields & skill assessment**. Will include all modeled fields for which observations are available
- **Quantification of transport (along- and cross-shelf).** To include Lagrangian characterization of SAB, fisheries/MPA applications, and biogeochemical flux considerations.
- **Preparation of ocean weather maps**, for daily posting and for state of the SEA-COOS coastal ocean domain report.
- **Ensemble SEA-COOS domain modeling –** explore the use of SEA-COOS wide domain models with USF and UM, including the development of quantitative model ensemble forecasts/hindcasts.
- **Examine the capabilities of the ocean-atmos coupled models with ROMS-WRF.** We will beta-test a coupled ROMS-WRF model that was developed by Dale Haigvogel of Rutgers University and Chris Moore of PMEL in Seattle.
- **Write papers on the above for scientific publication**. Peer-reviewed publications will be written and will provide an objective measure of the quality of our findings.

Budget Justification: includes salary support for Werner (3 months) and Blanton (7 months), and and full-time (12-month) student support for each K. Edwards and A. Aretxabaleta. Travel expenses are covered at $10,000 and an additional $10,000 are requested for supplies. To

support on campus computing we request a $15,000 subcontract to academic technology and networking (ATN), who maintain a Blade cluster and IBM p690 and multi-Terabyte storage facility for running and storing computer models. We also require $4,000 for local computer services and contracts. Other costs include $3,012 for tuition remission $1,000 for communications, and $2,850 to cover the costs of cable modems for involved staff to enable round the clock and weekend access to networks.

MODELING (CONT.)

UNIVERSITY OF MIAMI, RSMAS

East Florida Shelf Information System (EFSIS), P.I. Christopher N. K. Mooers, OPEL/RSMAS/UM.

The main efforts planned for YR3 are to:

WORK STATEMENTS

- **Complete the barotropic EFSIS** comparisons and participate in MODPROD Working Group publications;
- **Implement and test the baroclinic EFSIS** within the nowcast/forecast system;
- **Establish a high-resolution, nested subdomain model** corresponding to the WERA testbed, conduct model validation studies with WERA data, and explore data assimilation there;
- **Import Global-NCOM (and possibly IAS-NCOM) fields from NCDDC** for use as open boundary and initial conditions and evaluate their realism;
- **Follow-up studies with the NPZD model,** the **Dry Tortugas** nested subdomain, and **Lagrangian simulation** studies;
- **Initiate an exploratory effort with surface gravity wave models** (e.g., WAVEWATCH III and SWAN);
- Significant involvement is planned in **developing the annual State-of –the-Southeast USA Coastal Ocean Report**.

Budget Justification: The budget provides for 5.5 mos support for the P.I., 6 mos for the Co-PI (Dr. I. Bang), and 12 mos for the PhD student (Mr. Jerome Fiechter). It includes upgrades for the OPEL computer system to facilitate handling the Global-NCOM fields for SEACOOS ($41.8k), as well as increased computational efficiency for EFS-POM and EFSIS ($5k). Funds are also allocated for publication costs ($3k). It also seeks travel funds to support participation in SEACOOS related activities ($15k domestic, $7k foreign).

UNIVERSITY OF SOUTH FLORIDA,CMS

West Florida Shelf Modeling Subprogram- P.I. Robert Weisberg,CMS/USF

WORK STATEMENTS

- **Baroclinic hindcasts and forecasts** – Continue the development Optimal Interpolation methods to composite SST and wind fields and use these for model intercomparisons between POM, ROMS, and FVCOM..

- **Nowcast/forecast** – Complete barotropic nowcast/forecast skill using EDAS nowcast/forecast for the WFS POM, inclusive of tidal forcing at the open boundary, and implement baroclinic nowcast/forecasts.

- **SEACOOS domain model** - Explore the coupling of regional coastal ocean models with larger scale deep-ocean models in collaboration with SEACOOS colleagues and other modeling groups (NRL NCOM, HYCOM, and NOAA ROFS) and plan for data assimilation implementations.

- **Estuarine applications** - Use the FVCOM for the Charlotte Harbor and Tampa Bay estuaries.

- **Linking the estuaries with the shelf** – Use the FVCOM for linking the Tampa Bay and Charlotte Harbor estuaries with the WFS.

Budget Justification. Half time support (six months each) is requested for 2 post-doctoral Research Associates. The remaining support for the Research Associates is from related projects (the new HYCOM initiative and COMPS). Additional partial salary support is for the P.I. (Weisberg, 1 month) and data manager (Donovan, 1 month). Dr. R. He, presently a post-doctoral fellow at WHOI, continues to work part time on SEACOOS. His involvement will be funded through the consultant line with the caveat that "consultant" may be changed to a subcontract depending on the institutional preference. We intend to advance on all of the items listed above (as individual tasks) and to begin more formal data assimilation activities.

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SC SEA GRANT

South Carolina Sea Grant Outreach – P.I. and Workgroup Chair, Robert Bacon, SCSGC

WORK STATEMENT

- **SC SEACOOS Coordinator:** The coordinator will assume all SEACOOS outreach responsibilities for SC Sea Grant. Specifically the coordinator will be responsible for helping to identify and develop a strong constituent base for SEACOOS products. The coordinator will be responsible for identifying appropriate users for participation in product development, review, and evaluation and conducting such reviews as appropriate

- **Coastal Climate and Hazards Program:** (see project description in GA SEA Grant section)

- **Establish Dialogue on Ecosystem-based Fisheries Management**: interact with regional fishery management councils to increase their awareness of SEACOOS and begin to develop linkages between fishery management users and SEACOOS PIs. Will include a presentation to the South Atlantic Fishery Management Council Science and Statistics and/or Ecosystem-Based Management Committees to discuss applications for SEACOOS data.

SOUTH CAROLINA SEA GRANK/SOUTHEAST COSEE

Lundie Spence, SCSG

WORK STATEMENT

- **SEPORT** (South East Portal to Ocean Research for Teachers) will offer leadership opportunities for the teachers/participants of the 2004 SECOSEE Ocean Sciences Leadership Institute, and extend ocean sciences information to new groups of educators in partnership with "free choice" institutions. In these 6-hour ocean awareness sessions, information about SEACOOS and other ocean sciences will be distributed and taught.

- **Passport to the Sea** is an electronic newsletter partially supported by SECOSEE and partially by SEACOOS, Articles focus on SEACOOS projects, products and researchers.

- **Project Maury** is a national set of oceanographic lessons provided by the American Meteorological Society, US Naval Academy and master educators. Dr. David Smith from the US Naval Academy and Terri Hathaway, NC Sea Grant Marine Education Specialist will develop extensions of specific lessons to include SEACOOS coastal ocean observing data.

- **SEACOOS Poster web support** to increase awareness of SEACOOS products and their application in the K-16 system. A web component will be built to complement the waves poster done in Year 2.

- **SECOSEE Physical Science Workshop for middle school teachers.** A second physical science workshop for teachers will be conducted to demonstrate how SEACOOS coastal ocean data and information can be used in inquiry-based examples for physical science concepts.

Budget Justification: Salary support is requested for the PI (Bacon, 2 mos), and Sandy Eslinger (6 mos). Fringe is $6,500. Materials and supplies, including publications, total $5,700. Travel is requested in the amount of $19,300 and includes invitational travel for workshop participants. Other costs ($27,500) include $1,320 for telecommunications, a subcontract ($5,000) in support of the O&E Workgroup section of the SEACOOS website, a subcontract ($18,000) for the hazards/emergency workshops in coordination with GA Sea Grant. Per established policy, SC Sea Grant charges no indirect costs.

UNIVERSITY OF MIAMI

P.I., Ed Kearns RSMAS

- **Univ. of Miami Explorer of the Seas OOS Outreach and Informal Education:** We will design and install a touch screen OOS/SEACOOS kiosk exhibit for the exhibit gallery area on Explorer of the Seas and upgrade the graphical explanatory signage of the exhibit galleries to focus on long-term monitoring basics and purposes. The new exhibit will focus on the plans and implementation of a coastal observing system. The exhibit content will be developed by the UM and the O&E Working Group.

Budget Justification: Funds in the amount of $17,880 are requested for materials and contracted services. F&A is $9,120.

FL SEA GRANT

Florida Sea Grant Outreach – P.I.s Mike Spranger and Jim Cato (FLSG)

WORK STATEMENT

- **SEACOOS Regional Outreach Coordinator** – A full-time (12 month) education coordinator, based in Florida, has been hired to assist in the design, development, implementation and evaluation of regional education and outreach programs. This individual will assist the outreach specialists and researchers in the identification of constituent needs and in the development of useful and relevant coastal ocean observation products and services.

- **Recreational Boater Demonstration Project** - This project will determine needs, potential products and services, and application to Florida's boating community. FSG staff will regularly attend the Clean Boating Partnership, a coalition of Florida's marine industries that is focusing on Florida's marinas and boatyards. Their information needs, potential products and services will be determined and useful ocean obs products developed.

- **Explorer of the Seas Exhibit Evaluation** – This project will be conducted in conjunction with the Explorer Exhibit project and will develop and implement evaluation instruments that will measure the successfulness of these educational programs. These evaluation instruments may be formal and/or non-obtrusive. The Gulf of Mexico COSEE Educator will assist in the development of these evaluation tools.

- **SEPORT** (South East Portal to Ocean Research for Teachers) **–** The Florida Sea Grant Program, through its Gulf of Mexico –COSEE Project will coordinate this SEPORT project, which involves developing 6-hour ocean awareness professional development workshops on SEACOOS and ocean sciences.

FL COSEE

Florida Sea Grant Education – Barbara Spector (USF)

WORK STATEMENTS

- **Poster:** A SEACOOS poster focusing on hurricanes and observing will be designed and printed.

- **DVD:** A DVD will be developed for use in teacher education throughout the SEACOOS states and other states. The subject of the DVD will be the SEACOOS physical science workshop being pilot tested in the summer of 2004 by Florida COSEE. The Gulf of Mexico COSEE will assist with the project.

- **Technology Module involving Center for Ocean Technology:** A teaching-learning module designed for use in teacher education programs will be developed. This module will enhance pre-service teacher understanding of SEACOOS science and give them opportunities to develop skills and abilities to share SEACOOS science with their students through real world applications.

Budget Justificatino for FL Sea Grant and FL COSEE: Requested funds include salary support for the Educational Coordinator (12 mos) and FSG faculty (2.4 mos). Fringe amount is $14,179. Materials and supplies total $7,000. Travel is requested in the amount of $29,500. Other direct costs are requested for copying, library, duplication, rentals and teacher stipend expenses in the amount of $6,506 for SEACOOS coordinator, $3,700 for Recreational Boater End-User Project and $12,000 for SEPORT project, and $1,500 for Explorer Evaluation Project. A subcontract in the amount of $39,300 will be awarded to the University of South Florida who will carry out the FL-COSEE duties associated with this project. Total other costs requested total $ 63,006. Total indirect cost is ($170,288 x 0.20) $34,058

GA SEA GRANT

Georgia Sea Grant Outreach – P.I. David Stooksbury

WORK STATEMENT

- **Coastal Climate and Hazards Collaboration and Workshop**: Georgia Sea Grant and South Carolina Sea Grant will engage key user groups in the identification and development of SEACOOS coastal climate and hazards environmental information products. Emphasis will be placed on key users who have significant requirements for incorporating near real-time and archived products into their hazards planning and response operations. A national workshop forum will be convened, and, based on the results of the workshop, a white paper will be developed which will serve as a blueprint for future SEACOOS product development.

- Development of a **user-inspired prototype coastal climatology**. The results from the 2003 Coastal Climatology Workshop will be used to develop a more detailed and sector specific understanding of major users needs.

Budget Justification: Salary support is requested for David Stooksbury, Mac Rawson, and other professionals. Fringe totals $6,032. Domestic travel support is requested in the amount of $16,200. F&A totals $16,356.

NC SEA GRANT

North Carolina Sea Grant Outreach – Jack Thigpen, NCSG

WORK STATEMENT

- **Offshore Boating product development – CODAR:** we will work with recreational and commercial fishermen and power and sail boaters to identify useful products and methods of delivery CODAR information and products This will be accomplished through a combination of personal interviews and formal focus groups.

- **Offshore Boating product development – Cape Lookout:** we will develop an information delivery scheme for the Cape Lookout buoy measurement system. We will determine the information needs and delivery methods of a real-time wind and wave monitoring system that will improve the safety for recreational boaters in the region.

- **SEACOOS DVD:** As a companion product to the SEACOOS 101 PowerPoint presentation and the SEACOOS brochure, a DVD product will be developed. This interactive tool will be used to generate awareness and understanding about SEACOOS products and researchers with the general public and information-users.

Budget Justification: Salary support is requested for one graduate student ($15,000). Fringe is $1,320. Travel funds are requested in the amount of $9,375. Other direct costs include $20,000 for the development and production of the DVD and tuition for the graduate student ($3,165). F&A (26%) totals $11,881.

MANAGEMENT

UNIVERSITY OF NORTH CAROLINA SYSTEM

UNC Office of the President, Dr. Russ Lea, Managing PI

Grants Manager Sarah Smith

WORK STATEMENT

- *Financial and Administrative Oversight.* UNC will provide financial and administrative oversight for the project including compliance monitoring, budget management, and project coordination for governance. UNC will work closely with Dr. Seim and the SEACOOS Board of Directors on development of the budget along programmatic lines as well as the annual review of carry over funds. The Contracts and Grants Manager will follow-up on the administrative site visits conducted in Year 2, to ensure "best practices" are being followed for the administration of grant funds and compliance.

- *Biannual SEACOOS PI Conference Support.* UNC will coordinate SEACOOS support for the Biannual SEACOOS PI Conferences. As host sites are identified, UNC will provide discrete funding for these activities. The Fall Conference will be hosted by South Carolina Sea Grant Consortium in Charleston, SC. The Spring 2005 conference location will be determined at the fall SEACOOS Board meeting.

- *Program Evaluation.* UNC will coordinate a SEACOOS program evaluation component, scheduled for early spring 2005. The evaluation activity will provide independent and objective review of SEACOOS progress toward iterated goals and alignment of goals for the coming program year. The evaluation team will consist of non-SEACOOS personnel with relevant experience in ocean observing, oceanography, formal and informal education and large-scale projects.

Budget Justification: Dr. Lea and the Contracts and Grants Manager will each commit 15% annual FTE to SEACOOS ($38,334). Fringe benefits are calculated at 23% ($8,819). Travel funds support the Biannual SEACOOS PI Conferences and SEACOOS Board Travel ($34,000). Other direct costs support the SEACOOS Evaluation ($10,000) and communication/printing/supply costs ($2,000). F&A is calculated at 13.5% of salaries and fringe benefits ($6,371).

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

Subcontract to Office of Arts and Sciences Information Services (OASIS), Director, Rick Peterson

WORK STATEMENTS

- **Project Manager**: duties include expediting project-level goals and specific tasks; handling day-to-day management details for the SEACOOS COO; coordinating conferences and meetings; facilitating partner communications; gathering information and creating status reports; Celoxis training and functional assistance; and managing day-to-day office tasks (filing, answering/making calls, etc.).

- The Project Manager will continue to provide Celoxis training for individuals and groups within SEACOOS as needed. Existing training materials will be updated to reflect changes in version upgrades. Additional training materials may be produce as resources allow.

Budget Justification: Salary support includes 12 months for the Project Manager. Travel support is $6,300.