Supporting the Blue Economy - SECOORA 2018 Annual Meeting

SECOORA Principal Investigator Abstracts

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Enhancing deep-water estuarine monitoring in the SECOORA region through expansion and integration of the National Estuarine Research Reserve System's System-Wide Monitoring Program in the Charleston Harbor

Denise M. Sanger, ACE Basin National Estuarine and Research Reserve, South Carolina Department of Natural Resources

Charleston Harbor is the busiest port in the state of South Carolina. In particular, the deepening of Charleston Harbor to accommodate larger vessels may alter salinity regimes and circulation patterns within the harbor. Water quality data before and after this project will be of great value in assessing the project impacts. In Year 2, SC Department of Natural Resources (SCDNR) and the ACE Basin National Estuarine Research Reserve (NERR) worked with partners, Army Corps of Engineers - Charleston District (ACOE-CD), US Coast Guard (USCG), Charleston Port, and SECOORA, to establish the Charleston Harbor water quality monitoring station. The site was chosen such that it would be co-located with an ACOE-CD wave monitoring site. The site, installed in November 2017, is located adjacent to the shipping channel. The water quality monitoring station is configured to be consistent with NERR System-Wide Monitoring Plan protocols and operations. The site monitors water temperature, conductivity/salinity, dissolved oxygen, pH, turbidity, chlorophyll fluorescence, and water depth. The request to the NERR Data Management Committee for consideration of the site as a secondary NERR water quality monitoring location was approved. This allowed SCDNR to acquire the telemetry equipment needed to provide real-time data from this station. All data are available on the SECOORA data portal and the NERR Centralized Data Management Office.

Operate and Maintain Gray's Reef Ocean Acidification Buoy

Scott Noakes, The University of Georgia

Operation of the Grays Reef time-series mooring has been a multi-organization effort, which has successfully collected high-resolution data since 2006. The mooring is located in the South Atlantic Bight (SAB) offshore Georgia, USA and within the boundaries of Gray's Reef National Marine Sanctuary (GRNMS). It sits along the divide between the inner and middle shelf with water depths of 20 m. Water chemistry is primarily controlled by the middle shelf oceanic dynamics, but during heavy rain events, it can be affected by freshwater plumes coming from the numerous rivers along the Georgia and South Carolina coast. Temperature, salinity and biological activity also play a major role in the pCO_2 variability with seasonal changes being apparent. During summer months, GRNMS acts as a CO_2 source to the atmosphere while during winter months it is a CO_2 sink. The benthic community at GRNMS has proven to be hardy enduring large seasonal swings of seawater CO_2 and pH. At this point, it is unclear at what point the benthic community will experience detrimental effects of the decreasing seawater pH. It is clear that for the ten-year monitoring effort, the atmospheric and seawater CO_2 has been increasing annually causing the seawater pH to decrease. Research planned for the sanctuary will be aimed at determining how these organisms cope with the seasonal changes and how they will adapt to rising seawater CO_2 over time.

All data transmitted from the buoy is sent to the Pacific Marine Laboratory, NOAA, Seattle WA for quality assurance monitoring. Real-time data can be graphically viewed at https://www.pmel.noaa.gov/co2/story/Grays+Reef. Additionally, data that has been processed through the quality control and assurance process can be accessed through the website.

During Year 3, a Georgia Southern University graduate student will be engaged to apply the GRNMS ocean acidification data in a research project relating oculina coral growth to carbon dioxide concentrations. The project is in the early stages of development and depending on funding will take place starting July 2018.

Operate and Maintain UNCW Moored Stations as part of SECOORA

Lynn Leonard, University of North Carolina Center for Marine Science

As part of the larger SECOORA coastal observing enterprise, and in cooperation with partner that include US Army Corps of Engineers (USACE) and UCSD Coastal Data Information Program (CDIP), UNCW's Coastal Ocean Research and Monitoring Program (CORMP) operates nine real-time coastal and offshore moorings in NC and SC. These systems provide hourly reports of core meteorological and oceanographic parameters. In Year 2, UNCW added acoustic receivers to 4 moorings in Onslow Bay, NC; 3 on real-time moorings and 1 on a subsurface, non real-time station. Additionally, UNCW and Skidaway Institute of Oceanography (SkIO) entered into an MOU whereby the UNCW Pelagia glider was loaned to SkIO through 2021 to support the SECOORA glider observatory. In Year 2, CORMP hosted two UNCW undergraduate interns and three high school interns from the New Hanover County Schools' Marine Science Academy. In addition, CORMP mentored 11 undergraduate student research projects and two graduate student theses. The CORMP staff were also instrumental in the development a new "underwater technologies course" that served 8 BS Oceanography and 10 MS Geosciences/Marine Science students in Spring 2018.

CORMP implements QARTOD for real-time data QA/QC and, in partnership with Second Creek Consulting, developed an interactive QA/QC report that provides daily alerts when data are "suspect" or "failed". CORMP provides all data to SECOORA, including QARTOD roll-up flags, and archives the data on UNCW servers. Real-time mooring data are ingested for use in existing products and applications by local, state, and federal agencies and industry partners (e.g. University of South Carolina, SECOORA, NWS, USACE, Roffer's Ocean Fishing Forecasting Service, SaltwaterCentral.com). Currently, supported applications include: 1) data verification points to support hind-casting and real time applications (USACE Wave Information Study, USCG Search and Rescue, Voulgaris HF Radar surface current velocity study); 2) daily validation of the Coastal Waters Forecast and rip current forecasts produced by NOAA NWS offices; 3) meteorological and physical oceanographic data for data poor areas of Onslow Bay and Long Bay; 4) observational data to support continued operation and enhancement of ongoing and proposed SECOORA products such as the Marine Weather Portal and How's the Beach; and, 5) long-term data records for assessment of environmental change. By providing observations in the Carolinas portion of the SECOORA footprint, the data provided by UNCW fills what would

otherwise be large gaps in coastal oceanographic observations, including areas not covered by existing HF Radar or federal assets in the region. The UNCW observing program supports SECOORA goals in the areas of Marine Operations; Coastal Hazards; and Living Marine Ecosystems.

Maintain and Operate Priority USF COMPS Inshore Coastal Stations

Mark E. Luther, PI, Jeff Scudder and Clifford Merz, Co-Investigators, University of South Florida College of Marine Science

University of South Florida College of Marine Science continues to maintain five COMPS in-shore Coastal Stations to the extent possible with the resources available. Data from three of these sites are sent to SECOORA and the NOAA National Data Buoy Center (NDBC) and to the Global Telecommunication System (GTS) via NDBC. The project team is in the process of re-establishing the Big Carlos Pass station as an NDBC reporting station. Data from all five stations are also sent to the GCOOS portal.

Sites collecting water level and surface meteorological parameters at Big Carlos Pass, Clam Bayou, Fred Howard Park, Aripeka, and Shell Point have remained operational with minimal down time. Additionally, the Clam Bayou site collects a suite of water quality parameters and the Big Carlos Pass site collects water temperature/salinity and fish acoustic data in collaboration with Jim Locascio at Mote Marine Lab.

Data from the inshore coastal sites and from the Tampa Bay PORTS sites during the passage of Hurricane Irma showed maximum wind gusts of over 100 knots at the Big Carlos Pass site and a negative storm surge of 6.14 ft below predicted tide at the Port of Tampa (MacKay Bay) water level gauge.

M. Luther, S. Meyers, and J. Scudder are working with St. Petersburg and Pinellas County water management staff to develop predictive tools based on short-term climate forecasts to help mitigate future wastewater releases into Tampa Bay and surrounding waters. Data from the water quality station on Clam Bayou have been very useful for assessing the impacts of the recent wastewater releases on dissolved oxygen, chlorophyll, and turbidity. We are working with city staff from St. Petersburg and from Gulfport to quantify the occurrence of low DO events and to distinguish naturally occurring from wastewater related events.

M. Luther makes quarterly updates to the Tampa Bay Harbor Safety and Security Committee and to the Vessel Movement committee on the status of real-time ocean observations in support of maritime transportation.

M. Luther and S. Meyers are working with the Tampa Bay Estuary Program, the US

Fish and Wildlife Service, and the Tampa Port Authority to analyze Automatic Identification System (AIS; see https://www.navcen.uscg.gov/?pageName=AISworks) vessel tracking data to estimate the impacts of ship wakes on critical marine habitat in Tampa Bay. They are mining the AIS data for other Maritime Domain Awareness applications, such as identification of optimal vessel transit windows and automated anomaly detection, in collaboration with the port authority, the Tampa Bay Pilots, and ARES Security (http://aressecuritycorp.com/news/florida-ports). Real-time products being developed will be incorporated into the CommandBridge vessel traffic system.

A Coordinated Observing and Modeling System for the West Florida Continental Shelf as part of SECOORA

Robert H. Weisberg and Yonggang Liu, College of Marine Science, University of South Florida

This award partially supports three real-time ocean-atmosphere buoys (C10, C12, C13) on the west Florida shelf (WFS), a west Florida coastal ocean circulation model (WFCOM) that downscales from the deep-ocean, across the shelf and into the estuaries, and satellite altimetry and surface geostrophic currents analyses. Two subsurface moorings are also maintained. Both real time observations and modeled nowcast/forecasts are served at http://ocgweb.marine.usf.edu and supplied to SECOORA. These are also distributed through NOAA.

All of the real-time moorings were damaged by Hurricane Irma. C10 and C12 being closest and with damage to power system and some sensors were quickly back on line. C13, more remote and more severely damaged remains to be fixed. The recent receipt of a National Academy of Science Gulf Research Program (NASEM-GRP) Irma damage award has now enabled us to accomplish this though the purchase of necessary replacements and the funding of ship time. A new C13 system is scheduled for deployment in June 2018. We have reason to believe that the internally recording and separately powered C13 ADCP continues to function as it did transmit up until the buoy telemetry power system eventually failed a few days after the storm passage.

Along with the SECOORA funded buoys, we also made significant progress on our RESTORE Act funded real-time waves/currents/met station deployed offshore of St. Pete Beach, FL. This funding was leveraged through a competitive grant from Pinellas County and will be included as part of the SECOORA and USF College of Marine Science funded Coastal Ocean Monitoring and Prediction System as long as funding remains available. The meteorological station portion of the system was deployed in January 2018. Adverse weather at that time kept us from completing the system, and ship support has been unavailable since then. As presently scheduled this C21 site will be completed at the end of May 2018.

We also completed a very high resolution model for the Tampa Bay vicinity with a competitive Pinellas County RESTORE Act award. This Tampa Bay Coastal Ocean Model (TBCOM), with resolution as fine as 20m, includes Tampa Bay, Sarasota Bay,

the Intra-Coastal Waterway, and all of the inlets connecting these with each other and with the Gulf of Mexico. TBCOM provides automated, daily nowcast/forecasts available to the public at: http://ocgweb.marine.usf.edu/~tbm/index.html. By nesting in WFCOM, TBCOM we have a seamless transition from the deep ocean across the WFS and into Tampa Bay, which allowed us to accurately model the response to Tampa Bay to Hurricane Irma.

It is only through the coordination of observations and model simulations that we can continually advance our understanding on how the WFS works, thereby providing useful information to stakeholders. Two recent accomplishments of note are a new hypothesis on the WFS control of the Loop Current penetration into the Gulf of Mexico and an explanation on the origin and transport of sediments to the south Florida reef track during Hurricane Irma. Both of these may lead to new leveraging opportunities.

Recent papers include:

Chen, J., R.H. Weisberg, Y. Liu, L. Zheng (2018), The Tampa Bay Coastal Ocean Model (TBCOM) Performance for Hurricane Irma, *Marine Technology Society Journal*, in press for Vembu special issue.

Liu, Y., R.H. Weisberg, J. Law, B. Huang (2018) Evaluation of Satellite-Derived SST Products in Identifying the Rapid Temperature Drop on the West Florida Shelf Associated with Hurricane Irma, *Marine Technology Society Journal*, in press for Vembu special issue.

Weisberg, R.H., L. Zheng, and Y. Liu (2017), On the Movement of Deepwater Horizon Oil to Northern Gulf Beaches, Ocean Modelling, 111, 81-97, doi:10.1016/j.ocemod.2017.02.002.

Weisberg, R.H. and Y. Liu (2017), On the Loop current penetration into the Gulf of Mexico, Journal of Geophysical Research: Oceans, 122, 9679-9694, doi:10.1002/2017JC013330, https://doi.org/10.1002/2017JC013330.

Operate and Maintain University of South Florida IOOS Priority High Frequency Radars in SECOORA

Robert H. Weisberg and Clifford R. Merz, College of Marine Science, University of South Florida

USF continues to operate and maintain three US IOOS/SECOORA identified priority CODAR system HFR sites (Naples, Venice and Redington Shores), along with two WERA HFR sites (Venice and Ft. DeSoto Park), overlooking our instrumented mooring array. Data are sent to SECOORA, NOAA NDBC, and the IOOS National HFR CORDC Network (HFRNet) for integration, display and dissemination. The data are also being posted on the USF College of Marine Science COMPS Ocean Circulation Group web site (http://ocgweb.marine.usf.edu). We continue to work with other SECOORA region HFR operators to standardize operations, data delivery, display and dissemination, maintain data integrity and provenance, provide accuracy estimates of surface currents and develop common data products for stakeholders. The average CORDC up-time for HFR data received from Dec 1, 2017 to May 7, 2018 by all five USF HFR sites was 92.5%.

Hurricane Irma passed directly over the entire USF HF Radar array. Although the 5 sites suffered no direct storm related damage, several of the sites experienced reductions in real-time up-times because of prolonged power outages. Specifically: Redington Shores CODAR – down approximately 2.5 days; Ft DeSoto WERA – down approximately 7 days; and Naples CODAR – down approximately 10.5 days. The Venice CODAR and WERA sites did not lose power and operated continuously throughout the storm's passage without any data loss to provide a valuable and unique data record incorporated in: Liu, Y., R.H. Weisberg, C.R. Merz, J. Law, L. Zheng, and J. Chen: West Florida Shelf response to hurricane Irma, Ocean Sciences Meeting, Portland Oregon, Feb 2018.

Recent papers include:

Liu Y., Merz C.R., Weisberg R.H., O'Loughlin B.K., Subramanian V. (2018) Data Return Aspects of CODAR and WERA High-Frequency Radars in Mapping Currents. Chapter 11 In: Venkatesan R., Tandon A., D'Asaro E., Atmanand M. (eds) Observing the Oceans in Real Time. Springer Oceanography. Springer, Cham, 333 pp. DOI: 10.1007/978-3-319-66493-4. On-line publish date: November 20, 2017.

SECOORA High Frequency Radar Sensing of the Florida Current in South Florida

Lynn K. (Nick) Shay, Department of Ocean Sciences, RSMAS, University of Miami

The University of Miami operates three WERA sites (Virginia Key, Crandon Park, and Dania Beach). The goal is to provide 24/7 surface current coverage across the Florida Straits. Each site provides hourly radial current data at 2.2 km resolution to SECOORA data portal and the US National Network archive hosted by Scripps Institution of Oceanography. In Year 2, all three sites were damaged during the passage of Hurricane Irma, causing extensive damage to Dania Beach and complete destruction of the Virginia Key and Crandon Park sites. In March 2018, the HFR installation at Dania Beach was brought back on-line. Supplemental funding is required to bring Virginia Key and Crandon Park HFR back on-line. We are working on hold harmless agreements at Virginia Key (VK) and Crandon Park prior to redeploying HF radar instrumentation (unclear when funds will arrive). In addition, Dade County Water and Sewage Department (DWASD) requests a fence be installed around the facility housing the radar and computer as part of our agreement. Once supplemental funding is available, the HFR team will purchase two new HF radar/computer units from Helzel as well as new cabling from Talley to begin the installations. In addition, we are submitting an application to the Florida Department of Environmental Protection (DEP) for an HF radar site in Northern Key Largo. This fourth site will support WERA in a direction-finding mode. Once the permit is approved, a copy will be forwarded to SECOORA.

In the northern part of the domain at Dania Beach, we recently conducted a week experiment with the US Naval South Florida Test Facility to measure significant wave heights for their operations. Comparisons were directly made between the WERA and buoy derived wave heights. With the exception of one day of measurements when the buoy was located on the fringe of the radar domain, comparisons were quite good. More recently, a manuscript was accepted (subject to a revision) in Geophysical Research Letters on comparing the Florida Current to the East Australian Current.

In addition, higher resolution surface current measurements close to Port Everglades are being made available to the planned Army Corp of Engineers sponsored dredging pilot study administered through Florida Institute of Technology via a South Florida-Caribbean Cooperative Ecosystems Studies Unit (CESU). The CESU program (http://sfc-cesu.com/events/) is a consortium of the National Park Service, Southeast Marine Fisheries, Army Corps of Engineers, Fish and Wildlife, Coast and Geodetic

Survey, Bureau of Indian Affairs, San Juan Historical Society, and the University of Miami. Finally, our HF radar data are beginning to be used to assess sea level rise along Miami Beach since several years of radial and vector current measurements have been acquired as part of SECOORA, including sea level measurements and high resolution, space-based sea surface height anomaly measurements from satellite missions. Thus, there is interest in our HFR measurements of currents and waves since 2003 as the measurements have direct societal relevance.

Sustaining & Enhancing Coastal Ocean Observing for Regional Applications – HF-RADAR

Dana K. Savidge, Skidaway Institute of Oceanography

Two high-frequency, shore-based WERA radar systems are installed on St. Catherine's and Jekyll Islands, along the coast of Georgia. The WERA provide surface velocity measurements over a shelf area extending approximately 100 miles along the coast and 100 miles out to sea. A dense grid of measurements at ~3.5mile spacing are updated every half hour, and are used for model verification (R. He, NCSU) and continuing scientific analysis of shelf circulation and Gulf Stream variability. The St. Catherine's HFR continues to operate well and tropical systems along the Atlantic coast have not dramatically impacted this station. However, in Year 1, Hurricane Matthew caused significant damage to the Jekyll Island antenna arrays. They sustained considerable physical damage, including dislodging and burial of approximately half the pole/coil/cable assemblages. Because of the nature of the beam-forming equipment, it was possible to restore operation at somewhat reduced range and spatial resolution after several months outage. In Year 2, Hurricanes Irma and Maria destroyed the remaining external components (antennas and cables) of the Jekyll system, and exacerbated ongoing erosion at the Jekyll site. To restore operation of the Jekyll system, SkIO worked with the Jekyll Island Authority to identify a new, less erosion prone site on the island for WERA redeployment. In April 2018, Savidge and Matthais began the permitting process with GA Department of Natural Resources. Once the permits are approved, Matthais will oversee the redeployment of the Jekyll array.

Finally, four additional WERA radars (funded by NSF) were installed by Savidge and Matthais on the Outer Banks of North Carolina in spring 2017. These 13MHz medium range systems provide data every 20 minutes, to approximately 75mile range at 0.5mile spatial resolution. In addition to serving the science goals of the NSF project, reduced temporal (hourly) and spatial resolution (5 mile) quality-controlled data are being provided to Hugh Roarty at Rutgers for inclusion in the Mid-Atlantic Regional Coastal Ocean Observing System (MARCOOS) current mapping.

HF Radar Operation and Maintenance in Long Bay, SC

George Voulgaris, University of South Carolina

University of South Carolina has been responsible for the operation and maintenance of the US IOOS/SECOORA identified priority WERA system radar sites located at Georgetown, SC (GTN) and Fort Caswell, NC (CSW).

The two sites have been operational for the current funding period providing surface current data for over 95% of the time. Surface currents are measured every 30 min and the data are available to the national HF radar network within 45 min of data collections. Hurricane Irma made landfall on September 11, 2017 and, although there was no damage that resulted in downtime, a few emergency cable repairs were necessary at the GTN site. Storm surge and overwash placed the cables underwater for a significant period of time but repairs were conducted in a timely manner. Data delivery continuous to be exceeding 94% of the time for both stations and we continue to update our climatology data on a monthly basis.

In addition, in collaboration with the University of North Carolina at Wilmington, we have embarked on an in-situ evaluation of the HF radar aiming at (i) evaluating the accuracy of the velocities and (ii) examining the ability of the systems to provide spectral information regarding ocean waves. For this purpose, an ADCP has been deployed in the footprint of the HF radar systems. Analysis suggests that the differences between the ADCP and HF radar measured velocities are mainly due to Stokes' drift not accounted by the HF radars and not due to vertical current shear (Cahl et al., 2018). A method was developed that allows the correction of HF radar derived radial velocities to truly Lagrangian using waves from wave models or measurements (Kumar et al., 2017).

Additionally, recent work by the USC group has shown that combining traditional WERA beamforming analysis with the MUSIC algorithm, used by beamforming systems, can be used to identify inaccuracies in radial velocity measurements (Cahl et al., in prep 2018).

The challenges of the project are related to coastal erosion around the HF radar deployment stations, leading to multiple instances of HF radar antenna relocation. In addition, during Spring – Summer the Georgetown station is in a marine turtle nesting area. Permanent installation of the antennas is not allowed as we are unable to alter the

natural environment. Thus, as coastal erosion continues the antenna arrays are found closer to the beach, the area of turtle nesting. We are in continuous communication with the SC Department of Natural Resources in taking measures to avoid interference with the turtle nesting. This is achieved through continuous monitoring and changes of the installation. Although manageable at present, it creates additional costs in modifications and in personnel expenditures. In the long term, if there is not a reversal of the erosional patterns, relocation or decommission of the station might be inevitable.

Operate and Maintain University of North Carolina – Chapel Hill IOOS Priority High Frequency Radars in SECOORA

Harvey Seim, University of North Carolina at Chapel Hill

The three high frequency radar installations along the North Carolina coast have operated well over the last year, providing observations over 93% of the time, over ranges of, on average, 175 km or more. Maintenance on the installations during Year 1 replaced failing components and cabling at several sites; and, working with the National Park Service, removal of sand from the access road to the HATY site at Buxton, necessary to replace the fuel tank for the backup generator. Each site faces challenges – the CORE site is remote and accessible only by boat; the HATY site has seen severe coastal erosion and overwash; and the DUCK site has also experienced significant erosion. In Year 2, HATY and CORE experienced outages related to Hurricane Maria. The HATY site suffered significant erosion as a result of the storm and the receive antenna fell into the surf. The receive antenna was repaired, but significant fluctuations in loop 1 and 2 phases and increasing noise floor levels lead us to replace the antenna board in the receive antenna. Since then, the system has been operating well. Duck sustained a lightning strike in early May that damaged receiver, transmit, and transmit antenna units operated there in collaboration with John's Hopkins University. The strike lead to a weeklong outage. The radar was returned to operation after the UNC transmit and receive units were re-installed at the site.

The installations also support a National Science Foundation study of Processes driving Exchange At Cape Hatteras (PEACH). The NC radars provide surface current information over a large fraction of the PEACH domain. The PEACH project has deployed a large array of in-water equipment and added 4 WERA higher-resolution/ high frequency radar systems within the NC codar network. Gliders are also being operated on the shelf, along the shelf slope, and in the Gulf Stream. The nested radars provide combined radial vectors from both types of systems and fill in coverage in Raleigh Bay that was previously unavailable from the codar systems. The surface currents provide the PEACH project with essential information about the convergence of shelf waters off Hatteras, and the influence of the Gulf Stream on the cross shelf transport that results. The radar network also informs PEACH glider operations. Ten in-water current sensors will provide a rich source of validation data for the radar network when they are recovered in November, 2018.

SECOORA Regional Glider Observatory

Catherine R. Edwards, Skidaway Institute of Oceanography, University of Georgia
Chad Lembke, University of South Florida; Ruoying He, North Carolina State University; Harvey Seim, University of North Carolina at Chapel Hill; Fumin Zhang, Georgia Tech

The SECOORA regional glider observatory was established in July 2016 as a cooperative effort among five institutions (SkIO/UGA, USF, UNC, NCSU, GIT) to use autonomous underwater vehicles called gliders to provide regional 4-D information about temperature, salinity and density structure, dissolved oxygen, chlorophyll concentration, and fisheries data to SECOORA stakeholders and partners. Field and shore-based responsibilities are pooled among the participants, taking to advantage of complementary assets.

Deployments in year 2 focused on basin-scale surveys to maximize the geographic range, with SECOORA mapping missions deployed from Cape Canaveral and a shake-down deployment for an older glider made available by UNCW for observatory use. The gliders were outfitted with acoustic telemetry and passive acoustic receivers provided by the Ocean Tracking Network and NOAA-NCCOS. The Kennedy Space Center Ecological Program and Gray's Reef National Marine Sanctuary provided vessel support at no cost, and the missions were coordinated with the Florida Atlantic Cooperative Telemetry. Students from UNC, UGA, and Georgia Tech have contributed to glider observatory efforts, and one journal paper and four conference papers have been published or are in press based on glider observations and path planning algorithms developed to optimize navigation.

SkIO and UNC also have developed and automated data visualization products to aid piloting. The codes detect which gliders are operational, automatically convert binary data into ASCII, make plots of engineering and science data, publish them to a website, and update a Google Maps-based app within minutes of glider data transmission. These codes have been modified to accept data from local and remote dockservers, including Webb's new Slocum Fleet Management Control software.

Year 2 marked an active hurricane season in the southeast. Deployed gliders are usually safe in-water during hurricane conditions, but Hurricane Irma caused significant power and network outages for the glider observatory's dockserver operations centers (SkIO and USF). In advance of Irma's landfall, the SECOORA glider observatory

discovered a new way to redirect the glider's calls and data transfer from the primary dockserver to another institution in real time and at no cost beyond normal satellite time. Texas A&M scientist Steve DiMarco and TAMU technician Karen Dreger provided invaluable assistance in making their resources available to the SECOORA guest pilots. The process of transferring calls within a provider network is new to the glider community and is a valuable tool for disaster planning at the intra-RA level. GCOOS and SECOORA have promoted this success story to IOOS and shared this success in the story of the day to all NOAA employees in October 2017. The process was documented and shared among UG2 glider community through a webinar in January 2018, through forum posts, and documentation with the manufacturers.

Supporting Resilient Ecosystems, Communities and Economies -- A Coupled Marine Environmental Assessment and Prediction System for the Southeastern U.S. Coastal Ocean in Support of Effective Marine Ecosystem-Based Management, Efficient Marine Operations, and Resilient Coastal Communities

Dr. Ruoying He, Department of Marine, Earth and Atmospheric Sciences, North Carolina State University

In the southeastern U.S., the Loop Current/Florida Current/Gulf Stream system unites shelf seas from Louisiana to Florida in the Gulf of Mexico and from Florida to North Carolina along the east coast. This strong, deep ocean feature flows along the continental shelf in the entire SECOORA footprint, strongly affecting circulation on adjacent continental shelves and providing a conduit for transport of nutrients, heat and marine organisms between the sub-regions of the coastal southeastern United States. The development of a regional coastal observatory in the service of societal goals elaborated in the national plans therefore requires a *regional-scale* approach, and a combination of modeling, observations, and data management.

The primary goal of this effort is to support all four of the SECOORA theme areas, as the ability to model and predict regional marine environmental conditions, transport of heat, organisms, nutrients and pollutants bears materially upon climate change, coastal hazards, safe and efficient marine operations, water quality and living marine resource management.

To contribute to the efforts of building a regional observatory, we have implemented an advanced regional marine environment assessment and prediction capability for SECOORA by using *a suite of fully coupled ocean-atmosphere-wave-marine ecosystem prediction models informed and updated continuously though data assimilation*. This system will predict coastal ocean conditions over the entire SECOORA footprint with a high degree of scientific accuracy, and update and transmit such information to stakeholders in a timely and clear fashion.

Benefits include the ability to inform coastal managers of the paths and intensities of storms and the resulting wave and water level buildup along the coast, when and where polluted water could move across the shelf into our coastal areas, define likely receipt zones for harmful algal blooms, define habitat interconnectivity for commercially important fish or crustacean species, and help determine physical processes affecting

the lifecycles of those species.

Stakeholder groups include U.S. Coast Guard, NOAA National Marine Fisheries Service, NOAA Office of Response and Restoration, Bureau of Ocean Energy Management, NC Department of Environmental Quality, SC DNR, GA DNR, Florida Fish and Wildlife Conservation Commission, and the South Atlantic Fishery Management Council.

Integrated Decision Support and Management Tools for Adaptive Public Health Practices: An Early Warning System for Swimming Beach and Shellfish Harvesting Waters

Dwayne E. Porter, PhD, Geoff I. Scott, PhD, Matthew Neet, PhD and Dan Ramage, Dept. of Environmental Health Sciences Arnold School of Public Health, University of South Carolina; H. Kelsey, PhD, Center for Environmental Science, University of Maryland

Bacterial pollution of coastal waters has important public health, economic, and social implications, particularly for tourism and shellfish industries. Bacterial pollution is a major cause of water quality impairments, resulting in a loss of ecosystem services. These losses impact the recreational and commercial fishing and shellfish industries, tourism, and also contribute to public health concerns related to primary contact with bacterial-laden waters and consumption of contaminated shellfish.

This project builds on the PIs existing collaborative community-based research efforts with local and regional decision makers to develop and implement a robust decision-making support system to advance the overarching goals of the Integrated Coastal Ocean Observing Act of 2009 and specifically addresses the SECOORA priority theme areas of: Ecosystems, Living Marine Resources, and Water Quality; Coastal Hazards; and, Climate Change. Members of the project team work with resource managers and public health officials in the FDA, EPA, ISSC and in MD, NC, SC and FL to develop and implement decision support tools which incorporate rainfall, water temperature, wind, and salinity data for beach recreational contact management of SC and FL beaches, and prototype tools for SC and MD shellfish harvest area management.

This project leverages resources, data, and skill sets available from the University of South Carolina, University of Maryland Center for Environmental Science, SECOORA, state and local resource management and public health agencies, and NOAA's National Weather Service (NWS), Center for Coastal Environmental Health and Biomolecular Research, National Integrated Drought Information System, and Office for Coastal Management / National Estuarine Research Reserve System.

User groups, including resource managers, public health officials and representatives of potentially vulnerable populations (e.g. Ad Hoc Water Quality Modeling Work Group, Charleston Waterkeeper, Lowcountry Alliance for Model Communities), are being

convened to provide guidance, input, and review in support of tool development. The anticipated products include nowcast tools that use precipitation, water temperature, wind, and salinity data (provided by the NWS, ocean observing systems, and state management agencies) and historic measures of bacteria concentrations to predict Enteroccocus, fecal coliform and/or Vibrio levels as well as new forecasting products derived by coupling the nowcasting tools and climate change model scenarios.

We continue to maintain the mobile app howsthebeach.org and provide public access to daily estimates of swimming beach bacteria levels for the Myrtle Beach, SC, Sarasota, FL, and now, Charleston, SC. These sites are located at http://howsthebeach.org/ and more specifically: http://howsthebeach.org/myrtlebeach; http://howsthebeach.org/sarasota; and http://howsthebeach.org/charleston. In addition, detailed daily reports are provided to interested beach managers and public health officials in SC and FL. We also worked with the Charleston Waterkeeper to develop a newsletter for distribution via their established communication network.

Extending the work done for the beach water quality projects, our research team provided the app for http://howsmyscriver.org. This came about from the Saluda River Monitoring Coalition, which was formed to monitor sections of the Saluda and Congaree rivers. This project monitors fecal coliform along eleven (11) sampling sites weekly during the recreation season, May to September.

The project team expanded the beach water quality monitoring efforts to include a section of the NC Outer Banks. This location has been identified as critical for water quality monitoring by the Division of Coastal Management, NC Department of Environmental Quality. The project team has begun collecting available historical and real-time water quality data for the Kill Devil Hills beach areas in NC. The team is starting to process data and run MLR models on this area. Due to lack of long-term historical salinity in the area, the project is using modeled salinity data from three models: HYCOM, Rutgers, and Copernicus. We are unable to use any regional models due to lack of easily accessed long-term historical data. Having a THREDDS server with long term, high resolution, local models would be very useful for the modeling process.

Marine Weather Portal: Upgrades and Stakeholder Requested Enhancements

Jennifer Dorton, Southeast Coastal Ocean Observing Regional Association

Regional coastal ocean observing systems, as part of the IOOS initiative, provide opportunities for increased access to meteorological and oceanographic data over and beyond the data that NOAA and other federal agencies have been able to provide. One of the challenges faced by IOOS-funded organizations is how to aggregate data from multiple sources in a meaningful way for stakeholders. SECOORA members have worked together since 2007 to develop and continuously improve the Marine Weather Portal (MWP), hosted on the SECOORA website. The MWP aggregates data provided by the NOAA National Data Buoy Center, National Weather Service (NWS), National Estuarine Research Reserves, IOOS Regional Associations, and other sources into a map-based product specifically developed for the marine community.

The goals of the Marine Weather Portal (MWP) are to: 1) provide 24/7 access to critical marine weather information for the commercial and recreational marine communities in the southeast US and Gulf coast regions; 2) make NOAA and other provider data more widely accessible on one website; and, 3) provide the site in a customizable format which the NWS offices can use for their Marine landing page. The MWP allows users to access standardized map-based marine weather pages, color coded active hazards, marine observations, point-and-click coastal waters forecasts, and detailed five-day marine forecasts, among other features.

The MWP was developed by meteorologists, web designers, data managers, and outreach personnel with SECOORA, University of North Carolina Wilmington, University of South Carolina, Second Creek Consulting LLC, and NWS offices in coastal states across the Southeast and Gulf of Mexico. The MWP is currently used to disseminate standardized, consolidated marine information for the SECOORA and Gulf of Mexico Ocean Observing System regions: http://mwp.secoora.org. During Year 2 of the project, the MWP team added newly developed NWS hurricane products to the site; NWS Active Hurricane Threats and Impacts; and, NWS Potential Storm Surge Flooding. Additonally, PIs Dorton and Galvarion presented the MWP at the NWS office in Tampa, FL and to the NWS office and Gulf of Mexico Disaster Response Center in Mobile, AL. Finally, PI Dorton presented at the 2017 Coastal and Esturine Research Federation (CERF) conference.

Southeast Ocean and Coastal Acidification Network (SOCAN)

Leslie Wickes, Thrive Blue LLC http://www.socan.secoora.org

Formed in February 2015, the Southeast Ocean and Coastal Acidification Network (SOCAN) is an interdisciplinary network of scientists, resource managers, and industry, non-profit, and government representatives dedicated to supporting and encouraging discussions on ocean and coastal acidification in the Southeast. SOCAN is supported by the National Ocean and Atmospheric Administration's Ocean Acidification Program and the Southeast Coastal Ocean Observing Regional Association.

Since its foundation, SOCAN has synthesized Southeast acidification research, established regional OA monitoring and research priorities, and developed partnerships with regional stakeholders. State-specific stakeholder workshops are currently underway; the first was held in North Carolina in October 2017 and the second is a joint Georgia/South Carolina Stakeholder Workshop scheduled for July 2018. SOCAN seeks to facilitate discussion with stakeholders about how acidification is linked to other coastal water quality issues, such as eutrophication and consequences of land-use change. Current efforts are focused on capacity building to expand funding resources for SOCAN and facilitating collaborative research and monitoring activities with stakeholders.

Southeast Disaster Recovery Partnership

Amanda Martin

The Southeast coastal region is vulnerable to a variety of disasters that can impact the vitality and long-term viability of its coastal communities. Planning for the disaster recovery process provides an opportunity to build resilience to future hurricanes, flooding, and other hazards. The Southeast Disaster Recovery Partnership (SDRP) was established to strengthen the ability of the Southeast's coastal economy and environment to recover from the next coastal storm. This Partnership connects disaster recovery stakeholders with the training, resources, information, and industry support that coastal communities need to effectively bounce back.

SECOORA coordinates the Partnership, which is currently funded by a NOAA Regional Coastal Resilience award. Under this grant, the Partnership's work has three components. First, it supports projects in the states of North Carolina, South Carolina, Georgia and Florida that provide critical information, training, and resources to coastal communities to implement the National Disaster Recovery Framework or build disaster recovery capacity more broadly. Second, the Partnership builds the capacity of the public and private sectors to work together in implementation of the Economic Recovery Support Function of the NDRF. Third, the partnership builds a regional network of disaster recovery stakeholders that exchange knowledge across federal, state, and local governments and with non-governmental partners (academia, private sector, non-profits, etc.).

Web Camera Applications Testbed (WebCAT)

Debra Hernandez, SECOORA and Mark Willis, Surfline

Web cameras are transforming how environmental monitoring is conducted. SECOORA and Surfline are deploying webcams to develop a Web Camera Applications Testbed (WebCAT) to confirm the use of video data for applications related to transportation and commerce, preparedness and risk reduction, and stewardship of coastal resources. In support of this project, webcams are being deployed in five locations within the SECOORA domain: Cape Hatteras, NC; Myrtle Beach, SC; St. Augustine, FL; Miami, FL; and near Tampa Bay, FL. The intended use cases for these cameras include: measuring wave run-up (U.S. Geological Survey); rip currents monitoring and model validation (NOAA's National Weather Service and National Ocean Service); counting whales (NERRS); and, assisting in beach safety and water quality efforts (University of South Carolina). In addition, the project team has engaged with local NOAA National Weather Service offices (NWS) on the camera deployments as they relate to operational protection of life and property. For example, the NWS office in Newport/Morehead City, NC plans to use the recently installed Cape Hatteras video camera to assist in their coastal flood warning operations.

Outcomes from this project will include a community workshop focused on sharing lessons learned, the development and analysis of data standards and algorithms by project partners so that methods for consistent video footage analysis can be evaluated across NOAA line offices and with other stakeholders, and an archive of video data for future use. In addition, this project will allow SECOORA stakeholders and the general public to monitor real time ocean conditions and hazards. The project will also allow for cost-savings by eliminating potential redundant/duplicative efforts by different programs to manage video data.

Project partners include: SECOORA, NOAA Integrated Ocean Observing System (IOOS), Surfline, NOAA Center for Operational Oceanographic Products and Services (CO-OPS), NOAA Office for Coastal Management National Estuarine Research Reserves, NOAA National Weather Service offices, University of South Carolina and Axiom Data Science.

Porting a prototype operational ocean prediction system to a cloud-computing infrastructure

Ruoying He, Fathom Science, LLC

The effort supports NOAA's Total Water Initiative, which calls for a boundary-spanning partnership across multiple sectors to predict and deliver water information to meet the needs of the 21st century. The project team, comprised of RPS/ASA, NOAA National Ocean Service (NOS) water team, and NOS leadership, is working to port a prototype operational ocean prediction system to Amazon Web Services' (AWS) cloud computing infrastructure.

Specific project goals include:

1) Hosting a project team meeting with NOS and RPS/ASA to discuss expectations for cross-NOS collaboration and reporting (completed on September 13-14, 2017).
2) Collaborating with the cyber infrastructure team at RPS/ASA to explore the utility of AWS cloud-computing infrastructure in coastal ocean modeling (ongoing).
3) Documenting procedures and lessons learned in porting a prototype operational ocean prediction system to AWS cloud-computing infrastructure (ongoing).