Project Name:

Coastal Ocean Monitoring and Prediction System (COMPS): Publically assessable, real time wind, waves and currents from Pass-a-Grill Channel, Pinellas County.

Contact Information:

Dr. Robert Weisberg, University of South Florida (USF), 727-553-1568, weisberg@usf.edu;

Project Location:

The entry marker to Pass-a-Grill Channel, St. Pete Beach (Pinellas County), FL.

Project Description:

This project will solidify one COMPS observational site at the entrance to Pass-a-Grill Channel (St. Pete Beach) in Pinellas County, FL. Real time observations of winds, waves, currents and temperature will be provided to the general public via the internet, thereby facilitating safe navigation for recreational and commercial boaters and environmental data for tourists and beachgoers. Real time salinity measurements will also be added. Measurements of salinity, an important variable that tends to correlate with beach water quality, are generally lacking in near shore waters.

The College of Marine Science (CMS), University of South Florida (USF) initiated a Coastal Ocean Monitoring and Prediction System (COMPS) in 1998 to observe and predict coastal ocean phenomena of societal importance. COMPS observations are of surface meteorology, ocean currents, waves, temperature and salinity using moored buoys, HF-radar and robotic gliders, all supporting predictive models. Applications include hurricane storm surge and waves, harmful algal blooms, fish larvae recruitment and tracking of Deepwater Horizon oil both at the surface and below. Real time observations are served to the public via the internet and are made available to federal agencies and private sector users. Automated nowcast/forecast ocean models updated daily are also provided to the public via the internet. A few recent accomplishments include: 1) Explaining how Deepwater Horizon hydrocarbons impacted fish along Florida's west coast from the Big Bend to the Florida Keys despite oil not being seen on the surface, 2) Explaining why there was no red tide in 2010 and then successfully predicting that there would not be a red tide in 2013 and that there would be one in 2014, 3) Explaining how gag grouper larvae transit for offshore spawning to onshore settlement and hence what constitutes a good recruitment year. In all, some 90 COMPS-related papers are published in refereed professional journals and numerous invited public presentations continue to be made on hurricane storm surge risk to the Tampa Bay region and elsewhere along Florida's west coast. COMPS observations and models are also what facilitated our response to the Deepwater Horizon oil spill, for which our forecasts were regularly used by the Incident Command in their daily briefings. Such forecasts are presently available to the USCG for search and rescue and to the FWRI in the event of another harmful substance spill.

Ironically, despite its demonstrated value, COMPS is now critically under-funded. The prospect of Deepwater Horizon penalty monies (as already distributed to the National Fish and Wildlife Federation and the National Academy of Sciences and promised through the RESTORE Act) ended the availability of other funds, leaving systems like COMPS foundering. With both NFWS and NAS uninterested in long-term observing and modeling systems, the only viable source of increased funding for COMPS is the RESTORE Act and hence the reason for our proposal.

Estimated Project Cost:

The estimate provided is based on a 5-year project duration. The first year includes equipment purchases to supplement what we already have in reserve and to replace waves sensors that are no longer functional. The remaining 4 years will support site maintenance and data dissemination, including necessary ship support. The project costs over 5 years total $415,910, with year 1 being $169,117 and subsequent years ranging between about 56K to 65K, depending

on equipment servicing. No support is requested for the PI or the lead mooring technician, as this is provided by USF. A detailed budget is provided under additional materials

Other Funding:

The COMPS site at Pass-a-Grill is presently unfunded and has been so for a number of years. Limited funding for COMPS overall is currently provided by the Southeast Coastal Ocean Regional Association (SECOORA) as part of NOAA IOOS. Partial funding is provided for three HF radar stations and two moorings. We were able to initiate the Pass-a-Grill site using spare equipment, but the present level of funding makes this non-sustainable. Other funds come from shorter duration competitive grants that vary from year to year, plus some technician support provided by the University of South Florida. While we anticipate continuing with such competitive proposal submittals there is a need for sustained funding at a level sufficient to maintain reliability and support the naturally occurring depreciation of assets. It is anticipated that US IOOS funding will ramp up to provide sustaining funds beyond the 5-year interval proposed here.

Technical Feasibility:

The monitoring station at Pass-a-Grill is in place but without a functioning waves sensor. A modified tower platform was constructed and installed in 2009 to house the meteorological sensors and surface telemetry. The inventory, infrastructure and expertise necessary to properly assemble, deploy and maintain the proposed atmosphere and ocean observations at Pass-a-Grill Channel are already in place at USF.

COMPS has been a functioning asset to science and to the coastal community at large for nearly two decades, albeit in a presently diminished capacity. Measurements on the WFS by the University of South Florida, College of Marine Science, Ocean Circulation Group (under the direction of Dr. Robert Weisberg) began in 1993. Real time observations of both atmosphere (wind, atm. pressure, relative humidity, air and sea surface temperatures and short and long wave radiation) and ocean (currents and temperature/salinity) began in 1998. Modeling evolved in conjunction with the moored array beginning in 1998. We subsequently added HF-radar for surface currents and gliders/profilers for water column temperature/salinity bio-optics, oxygen and (in some instances) bio-acoustics. The site is also capable of adding nutrient and other sensors as robust versions become available. COMPS data and nowcast/forecast models are all publically available on the internet.

Recognizing that our technology was vintage 1998 we invested funds through our Center for Ocean Technology to redesign and build new telemetry and data loggers. The transition period began over the past year and the results are satisfying. Outages that we may now be experiencing from time to time entail antenna failures or power lapses due to sea bird droppings on solar panels. In other words, our proposed observing system is robust and reliable, and we are ready to perform.

Conflicts or Complements to Existing Efforts:

The COMPS program contributes information to both the Southeast Atlantic Coastal Ocean Observing Regional Association (SECOORA) and the Gulf of Mexico Coastal Ocean Observing System (GCOOS), both of which have assets deployed in the Gulf of Mexico. SECOORA and GCOOS, in turn, are two of eleven regional associations that are part of the U.S. Integrated Ocean Observing System (IOOS). The proposed Pass-a-Grill observing site will complement and be a part of these other data sources.

Additionally, COMPS data are served in real-time to the National Data Buoy Center, Global Telecommunications System and National Weather Service (NWS) as well as being posted along with model products to our own public website at http://comps.marine.usf.edu. This access is of great benefit to NWS forecasters, and additional data will lead to improved coastal ocean weather forecasts. The US Coast Guard (USCG) also has data access for their use in Search and Rescue Operations (SAROPS) and survivability models, a capability that is being expanded through a graduate fellowship

awarded to an active duty USCG officer working directly with Dr. Weisberg. COMPS data are also utilized in an ongoing partnership with the Florida Wildlife Commission to predict and track Harmful Algal Blooms (HABs). Finally, COMPS data are freely available to private sector providers of fisheries and ocean weather information.

Complies with Federal, State, Local and Tribal Laws/Regulations:

There are no conflicts with regulations. This project sustains and expands present assets that comply with all federal, state, local and tribal laws and regulations.

Readiness for Implementation:

The Coastal Ocean Monitoring and Prediction System is already implemented, albeit in a diminished capacity. Thus, the technical expertise is already in place and needs only sustained support. The project can begin immediately.

Environmental Benefits:

Ocean water properties are determined by physical, biological and chemical connections that occur across space, time and trophic levels. Coastal ocean environmental stewardship is predicated on understanding this complex system functionality and applying that understanding toward prediction in a quantitative, scientifically defensible manner. Only in this way can forecasts be made regarding the consequences of either human or natural occurrences. Understanding the coastal ocean ecosystem begins with understanding the coastal ocean circulation because it sets the background state for all else. Five recent examples of this are: 1) our emergent ability to forecast the occurrence (2014) or lack of occurrence (2010 and 2013) of WFS HABs, 2) our explanation of gag grouper recruitment success, 3) our explanation of WFS fish lesions and liver chemistry anomalies subsequent to the Deepwater Horizon oil spill, 4) the use of our model trajectory forecasts by NOAA during the Deepwater Horizon event itself and 5) our numerous briefings to emergency management and private citizen groups on hurricane storm surge and wave risks. With observations and understanding comes predictive capabilities that enable circulation and the evolution of water properties to be modeled and forecast. But models must be continually veracity tested, requiring continued observations. With sustained observations, coordinated with models, we steadily increase our ability to predict coastal ocean processes and their environmental consequence. The environmental benefit is thus improved, scientifically defensible environmental stewardship of value to county, state and federal agencies and the general public.

Economic and Social Benefits:

As a peninsula nearly surrounded by water there is little of the Florida economy that is not influenced by the ocean. Even inland agriculture is influenced by land-sea breeze and the ensuing rainfall. Tourism, in particular, is related in large measure to the attraction of the sea and Florida's bountiful living marine resources. The understanding of such ecosystem services begins with the data collection proposed and the use of data in conjunction with predictive models. For instance, matters of real property and personal safety under extreme conditions require the ability to track storm systems, forecast storm surge and waves and provide information for use by emergency managers, activities enhanced by ocean observations. Direct near real time observations of winds, waves and currents, along with the associated model forecasts are also of immediate application for recreational and commercial boaters and fishers to inform safe and successful outings. Employment of skilled technical and scientific staff for operations and related science provides another benefit. Further employment will derive through improved tourist attraction as a consequence of better environmental stewardship. These data and model simulations will also serve the present and next generation of students through outreach and education.

Community Resilience:

COMPS observations and models can be further tailored as effective community resilience tools. COMPS was shown to be effective in a time of crisis for tracking surface and subsurface oil, and this utility would apply to any future hazardous

material spill. A present demonstration of utility is via the HAB prediction and tracking tool in partnership with FWC and the availability of real time data and model to the USCG for SAROPS. Non-real time applications include scenario studies on the severity and location of storm surge and waves for a multitude of extreme weather events, thus providing a valuable tool for emergency management planning. They can be expanded for assessing and anticipating changes in living resource distributions as demonstrated in the aforementioned gag grouper larval recruitment study. These examples are all tangential benefits to the primary function of providing baseline information about the complex coastal ocean ecosystem in order to better assess damages and carry out effective restoration.

Public Acceptance:

We know from the calls and emails received when a COMPS buoy goes down that our real time data are regularly used by the general boating public. While unheralded, the buoys graphically shown by local weather reporters are COMPS buoys, and the data provided to the agencies via the GTS are used in local weather forecasts. COMPS provides real time data to beachgoers, sailors and fishers making their outings safer and more enjoyable. Pass-a-Grille is a particularly important location for Pinellas County, given its point of access to the greater Gulf of Mexico for so many boaters. The coastal ocean is where society meets the sea, and we are committed to contributing our scientific expertise to the benefit of society.

Additional Information

Tables and Figures:

1. Table 1. 5 Year Budget.
    - https://drive.google.com/a/mail.usf.edu/file/d/0B5PGt0arj3QZUXBMdE5uSG5jb0E/view?usp=sharing
2. Figure 1. COMPS moorings, monthly glider tracks and model domains. Shows existing assets and phased implementation of new moorings and glider deployments.
    - https://drive.google.com/a/mail.usf.edu/file/d/0B5PGt0arj3QZdW5fQnFtZ2NVYlk/view?usp=sharing

Online Data and Product Sources, and tracking tools:

1. C21 (Pass-a-Grill) Station Page:
    - http://comps.marine.usf.edu/index?view=station&id=C21
2. COMPS program homepage. All real-time sites shown on interactive map for simple, clickable access to current ocean-atmosphere observations.
    - http://comps.marine.usf.edu/
3. Ocean Circulation Group homepage. Interactive website displaying OCG monitoring and modeling efforts.
    - http://ocgweb.marine.usf.edu/
4. SECOORA regional association homepage. COMPS data is displayed in real-time.
    - http://secoora.org/

Relevant Publications:

1. Weisberg, R. H. (2011). Coast Ocean Pollution, Water Quality, and Ecology. MTS Journ., 45(2), pp. 35-42.
    - https://docs.google.com/a/mail.usf.edu/file/d/0B5PGt0arj3QZVzlMOExld1JjVXM/edit
2. Weisberg, R. H., Boicourt, W., Jochens, A. E., Virmani, J. I. A Vision for Coastal Ocean IOOS for the next Decade.
    - https://docs.google.com/file/d/0BwW7dLnWT2C0UW8tc2hxMEhHQXM/edit
3. Weisberg, R. H. , Zheng, L., Liu, Y., Lembke, C., Lenes, J. M., Walsh, J. J. (2014). Why no red tide was observed on the West Florida Continental Shelf in 2010. J. Harmful Algae, 38 (2014), pp. 119-126.
    - http://www.sciencedirect.com/science/article/pii/S1568988314000572

4. Weisberg, R. H., Zheng, L., Peebles, P. (2014). Gag grouper larvae pathways on the West Florida Shelf. Cont. Shelf Res., 88 (2014), pp. 11-23.
    - http://www.sciencedirect.com/science/article/pii/S0278434314002027
5. Weisberg, R. H., Zheng, L., Liu, Y., Murawski, S., Hu, C., Paul, J. (2014). Did Deepwater Horizon hydrocarbons transit to the west Florida continental shelf? Deep Sea Res. Part II: Top. Studies in Oceangr., In Press.
    - http://www.sciencedirect.com/science/article/pii/S0967064514000356
6. Huang, Y., Weisberg, R. H., Zheng, L. (2010). Coupling of surge and waves for an Ivan-like hurricane impacting the Tampa Bay, Florida region. J. Geophys. Res., 115, C12009, doi:10.1029/2009JC006090.
    - https://docs.google.com/a/mail.usf.edu/file/d/0B5PGt0arj3QZVXFzcXpUNk1lbG8/edit)