Resource Assessment and Data Collection Initiatives in the Southeast

Summary Review of Research Efforts in Resource Assessment and Data Collection Pertaining to Wind Energy in the Southeast

Compiled by Nate Pedder
Southeastern Coastal Wind Coalition
Southeast Resource Assessment/Data Collection Workshop
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SOUTHEASTERN COASTAL WIND COALITION

Executive Summary

The Southeast holds one of the richest coastlines in terms of wind energy resources. Virginia, North Carolina, South Carolina, and Georgia hold 63% of the total East Coast offshore wind resource in 30 meter or less depths, and 82% if the same depths are considered at 12 miles or greater offshore. Estimates from NREL show that these four states have the potential to produce up to 583 gigawatts of wind energy, doubling the demand of the entire East Coast.

As the region works down the "roadmap" for the development of cost-competitive offshore wind energy, the next necessary step is exploring and coordinating wind energy resource assessment efforts. Already, individuals from academia, non-profits, government agencies, utilities, and private companies are working on initiatives to collect data and assess the wind energy resources in the Southeast. These initiatives are all critical for the advancement of offshore wind energy in the region.

This document provides a list of researchers and summaries of their work as they pertain to resource assessment and data collection for wind energy in the Southeast. The goal of this document is to enable you to identify opportunities for collaboration that will increase the value of complementary efforts. This list is as exhaustive as possible, but may contain omissions.

The identified researchers and projects are shown in the table below. They are broken into two categories, fundamental science and applied science. These categories are then broken down further into subcategories.

FUNDAMENTAL SCIENCE			
Institution	**Researcher**	**Category**	**Description**
Coastal Carolina University	Paul Gayes	Ocean atmosphere interactions	Met-ocean, geophysical, and interactively coupled systems initiatives
North Carolina State University	Ruoying He	Ocean-atmosphere interactions	An integrated ocean current, wave, marine weather prediction system for the South Atlantic Bight and Gulf of Mexico
Southeast Coastal Ocean Observing Regional Association	Debra Hernandez	Impacts on habitat	SECOORA is involved in environmental work along with the Governors' South Atlantic Alliance
NASA	Grady Koch	Characterizing atmospheric and oceanic physics	Long-range aircraft capable Doppler aerosol wind lidar
Savannah River National Laboratory	Ralph Nichols	Wave interactions with OSW structures	Characterization and simulation of met-ocean conditions to improve the design of foundations and structures

University of South Carolina	Dwayne Porter	Impacts on habitat	National Estuarine Research Reserve System-wide Monitoring Program
University of Miami	Lynn Shay	Characterizing atmospheric and oceanic physics	Attempting to map the mesoscale surface wind speeds from HF radars
University of South Carolina	George Voulgaris	Characterizing atmospheric and oceanic physics	HF radar with wind energy data tailoring capability

APPLIED SCIENCE			
Institution	**Researcher**	**Category**	**Description**
North Carolina State University	Anantha Aiyyer	Characterization of atmospheric conditions	Data collection using sodar and a WRF mesoscale model
North Carolina State University	Sukanta Basu	Characterization of atmospheric conditions	Data collection using sodar and a WRF mesoscale model
Department of Energy	Joel Cline	Characterization of atmospheric conditions / resource assessment	Supports efforts to accurately define, measure, and forecast the nation's land-based and offshore wind resources
University of Maryland Baltimore County	Ruben Delgado	Characterization of atmospheric conditions	Data collection using lidar and validation of lidar wind data
Coastal Carolina University	Paul Gayes	Characterization of atmospheric conditions/ weather forecasting	Met-ocean, geophysical, and interactively coupled systems initiatives
Virginia Polytechnic Institute	George Hagerman	Characterization of atmospheric conditions / met-ocean characterization	Estimated standards-based design parameters for extreme winds, waves, currents, and water levels for Mid-Atlantic offshore wind energy areas
Dominion	Robert Hare	Resource assessment / met-ocean characterization	Research studies and surveys to prepare for offshore wind farm development in Virginia
North Carolina State University	Ruoying He	Weather forecasting	An integrated ocean current, wave, marine weather prediction system for South Atlantic Bight and Gulf of Mexico

SECOORA	Debra Hernandez	Met-ocean characterization	SECOORA is the preeminent ocean-observing group in the Southeast
NOAA	Eric James	Characterization of atmospheric conditions	Long-term high-resolution wind dataset from a rapidly updating numerical weather prediction model
Santee Cooper	Elizabeth Kress	Resource assessment	Project development initiatives and exploration
North Carolina State University	Gary Lackmann	Weather forecasting	Understanding and predicting high-impact weather events using numerical models
James Madison University, Center for Wind Energy	Blaine Loos	Characterization of atmospheric conditions	Wind resource measurement projects through meteorological towers with additional towers yet to be installed
Portland State University	Chris Mooers	Weather forecasting	Real-time, mesoscale operational, multi-month forecast system for the Gulf of Mexico ocean circulation
Savannah River National Laboratory	Ralph Nichols	Design of offshore wind plants	Characterization and simulation of met-ocean conditions to improve resource assessment and the design of foundations and structures for offshore wind energy plants
NREL	Joseph Owen Roberts	Characterization of atmospheric conditions / resource assessment	Involved in a variety of resource assessment and data collection initiatives that seek to support the development of offshore wind
University of North Carolina	Harvey Seim	Characterization of atmospheric conditions	Analysis of wind profiles at various hub heights using historical data, SODAR, buoys, and a mesoscale atmospheric model
University of Florida	Peter Sheng	Weather forecasting / impact forecasting	Hurricane modeling and measurements, storm surge and coastal inundation forecasting, and estimating effects of climate change on weather events along the coast
University of Maryland Baltimore County	Lynn Sparling	Characterization of atmospheric conditions	Offshore wind energy/geophysical measurement campaign including ship-based wind lidar, aircraft wind lidar, bathymetric and other data
Weatherflow, Inc.	Jay Titlow	Characterization of atmospheric conditions / resource assessment	Private company with experience in coastal wind resource characterization

Timmons Group	Rick Thomas	Met-ocean characterization	Proof of concept for a commercial wide-area metocean and environmental monitoring program
University of South Florida	Robert Weisberg	Met-ocean characterization	Offshore met-ocean moorings used to collect data as part of Coastal Ocean Monitoring and Prediction System
NOAA	Allen White	Characterization of atmospheric conditions/ weather forecasting	Wind profiling radars and surface meteorology towers used to detect and monitor high-impact weather events

FUNDAMENTAL SCIENCE

Name: Paul Gayes
Category: Ocean-atmosphere interactions
Institution: Coastal Carolina University
Title: Professor, Director for Center for Marine and Wetlands Studies
Contact: ptgayes@coastal.edu, (843) 349-4015

Summary
The group at Coastal Carolina University (Pietrafesa, Gayes, Bao, Yan, Hackett, Gurka) have been involved in a number of wind energy related initiatives including:

1. The "Palmetto Wind" study resulting in a year of met-ocean data at six locations on two shore perpendicular transects off northern South Carolina and support of 3km to 300m scale ocean/atmospheric modeling of wind resources. This was undertaken with support from Santee Cooper and SC Energy Office (through DOE).
2. There is a great deal of focus at CCU on refinement and application of the now fully interactively coupled model system (WRF/ROMS/SWAN). This includes present applications:
    a. In partnership with Savannah River National Lab, NREL and MMI Engineering working on a DOE funded study providing 100's m scale characterizations of the coupled modeling system nested in Long Bay (CCU) to facilitate development and initialization of geophysical fluid dynamic models of potential wave forcing on future offshore with turbine towers (MMI) to help support improving design standards for offshore towers in the southeast.
    b. In partnership with MMI working on a DOI-BSEE study to establishment of Met-Ocean Data and Hazard Curves for Wind Energy Areas (WEAs) off the Atlantic Seaboard.
    c. Working to expand coastal observations (met-ocean buoy, SODAR and traditional tower) for assimilation into NOAA's MADIS system as part of the MesoUS program as well as focus on seeking to better characterize the coastal marine boundary layer (vertical structure / air sea interactions) to improve the coupled ocean/wave/atmosphere model system
3. The group also has an active area of research studying small-scale turbulent flows (laboratory PIV) with present applications from sediment transport to larval organisms navigation and site selection within the bottom boundary layer on regional hardbottom (reef) habitats.
4. Lastly, there is a considerable geophysical and coastal geological capacity here. Dr. Gayes' group just launched a new research vessel (54' aluminum catamaran style vessel) designed to support Coastal Carolina's geophysical survey system (multibeam sonar, side scan sonar, CHIRP sub-bottom profiler, Marine Electrical Resistivity (submarine groundwater discharge), magnetometer and a range of ground truthing capacities (bottom video etc.). These resources have been engaged in regional geologic framework and detailed bottom habitat studies and mapping related to avoidance of Essential Fish Habitat for regional ODMDS's, beach nourishment and expanding to soon-to-be defined WEA off South Carolina.

Name: Ruoying He
Category: Ocean-atmosphere interactions
Institution: North Carolina State University
Title: Professor of Oceanography
Contact: rhe@ncsu.edu, (919) 513-0249

Summary
Global Circulation Models (GCMs) are important tools for wind energy resource assessment and project wind power variability under different weather and climate scenarios. However, their abilities to resolve regional/local changes in marine environment are largely compromised by their coarse resolutions (typically 100-200 km) and lack of key local atmosphere and ocean dynamics. Regional downscaling is much needed so that detailed local marine resource assessment and projections can be derived. At NC State, Dr. He and his partners have developed a regional coupled atmosphere-ocean-wave model for the southeast U.S. coastal ocean and the Gulf of Mexico, utilizing sophisticated model coupling and parallel computing techniques. This three-dimensional, high-resolution (5-km), regional prediction system provides a nowcast and an 84 h forecast of wind (Figure 1), ocean waves, and currents. The system runs daily and supports a series of user-defined applications. Extensive model validations have been performed against in situ and satellite-observed ocean conditions, indicating a reliable capability of the system in providing offshore wind, ocean current and wave predictions. Long-term integration of this coupled model system can be used to effectively support regional wind resource assessment and data collection effort. More information on the modeling system is available online at: http://omgsrv1.meas.ncsu.edu:8080/ocean-circulation/.

Name: Debra Hernandez
Category: Impacts on habitats
Institution: Southeast Coastal Ocean Observing Regional Association (SECOORA)
Title: Executive Director
Contact: debra@secoora.org, 843-906-8686

Summary
SECOORA is actively collaborating with the Governors' South Atlantic Alliance (GSAA) on a data portal that meets the needs of coastal managers and other stakeholders. A team that included SECOORA, Duke, Georgia Tech, The Nature Conservancy, SC Department of Natural Resources, Point 97, and USC collaborated to design the GSAA Coast and Ocean Portal. The design of the portal was guided by the state resource managers actively engaged in the GSAA, and additions to the website are planned as funding becomes available. Over 140 data layers are included in the portal; many are existing data layers drawn from federal and state sources, but others are new biological data layers created as part of this project. The data in the Portal is organized in seven categories:

1. Boundaries, which contains marine jurisdictions, OCS lease blocks, shorelines and undersea feature names;
2. Coastal and Marine Habitat, which contains bathymetry, sand resources, hard bottom habitat, sediment type, etc.

3. Coastal and Marine Models, which includes a shoreline hazard vulnerability assessment and shorelines,
4. Designations and Restrictions, which has aquaculture, shellfish harvest areas, essential fish habitat Habitats of Particular Concern, marine protected areas, various fishing gear restriction areas, impaired waters in the four states, military areas, dredge material disposal sites, etc.
5. Marine Industry, which includes commercial fisheries information, principal ports, shipping and navigation data, on-shore transportation, and wind stipulation areas;
6. Marine Species, which includes birds and bird nests, deep water finfish, marine mammals, shallow water finfish and shrimp; and,
7. Recreational Activities, which has artificial reefs and boat ramps.

The GSAA and SECOORA are interested in expanding the Portal to address stakeholders needs for information, and there is a feedback tab on the website where users are encouraged to identify data gaps and provide other input. Visit the site at gsaaportal.org.

Name: Grady Koch
Category: Characterizing atmospheric and oceanic physics
Institution: NASA Langley Research Center
Title: Principle Investigator
Contact: grady.j.koch@nasa.gov, (757) 864-3850

Summary
NASA Langley Research Center operates a Doppler wind lidar that can be used for wind resource assessment. This lidar, called the Doppler Aerosol Wind lidar (or DAWN), is unique in its ability to reach long distances. Wind resource measurement capabilities for applications in wind energy have been demonstrated in several field tests. In 2011 the lidar was positioned on the shore in Virginia Beach to probe winds out into the Atlantic and Chesapeake Bay. Work in 2012 and 2013 involved installing the lidar instrument into an aircraft to show a new capability for 3-dimenional mapping of wind over potential offshore wind energy areas. Such wind maps were made of areas offshore of Virginia Beach and Ocean City, MD. Details of the lidar measurements can be found at http://remotesensing.spiedigitallibrary.org/article.aspx?articleid=1852153 and http://remotesensing.spiedigitallibrary.org/article.aspx?articleid=1358116.

Collaboration for future wind resource measurements is welcome. Upcoming research also includes a new technology for warning of oncoming severe wind events, allowing time for protective actions against strong gusts and wind shear.

Name: Ralph L. Nichols
Category: Wave interactions with OSW structures
Institution: Savannah River National Laboratory
Title: Sr. Fellow Engineer, Environmental Stewardship Directorate
Contact: ralph.nichols@srnl.doe.gov, (803) 725-5228

Summary
Ralph is currently conducting research related to characterization and simulation of met-ocean conditions to improve resource assessment and the design of foundations and structures for offshore wind energy plants. His research is focused on new tools to study the interaction between the ocean and atmosphere and its' effect on resulting waves and atmospheric boundary layer to improve the design basis of structures constructed on the Atlantic Outer Continental Shelf. The hydrodynamic forces from steep and breaking waves are likely to drive the design of foundations and structures for fixed foundation offshore wind turbines. New tools include improved use of AWACs for wave characterization, interactively coupled met-ocean models incorporating modules for ocean, atmosphere and sea state and integration of these results into simulation of hydrodynamic loads from steep and breaking waves using computational fluid dynamics.

Name: Dwayne Porter
Category: Impacts on habitat
Institution: NOAA/NERRS
Title: Associate Professor, Chair of the Department of Environmental Health Sciences
Contact: porter@sc.edu, (803) 777-4615

Summary
The National Estuarine Research Reserve System is a network of 28* areas representing different biogeographic regions of the United States that are protected for long-term research, water-quality monitoring, education and coastal stewardship. Established by the Coastal Zone Management Act of 1972, as amended, the NERRS is a partnership program between the National Oceanic and Atmospheric Administration and the coastal states. NOAA provides funding, national guidance and technical assistance. Each Reserve is managed on daily basis by a lead state agency or university, with input from local partners.

To better meet its public trust responsibilities, the NERRS has established a System-Wide Monitoring Program (SWMP) with a primary mission to:

> *Develop quantitative measurements of short-term variability and long-term changes in the water quality, biotic diversity, and land-use / land -cover characteristics of estuaries and estuarine ecosystems for the purposes of informing effective coastal zone management*.

SWMP is designed as a question driven monitoring program that uses the NERRS as a network of intensively studied coastal and estuarine reference sites for evaluating ecosystem function and change. Within these sites, long-term datasets with relevance to management issues of concern are collected using standard approaches with a high degree of spatial and temporal resolution. The NERRS has identified three core questions that these standard approaches should address:

1) How do environmental conditions vary through space/time within the network of sites?
2) How does ecosystem function within critical NERR habitats vary through space/time?
3) To what extent are changes within estuarine ecosystems represented by the NERRS attributable to natural variability versus anthropogenic activity?

The entire suite of standard approaches used by SWMP are collectively referred to as the SWMP Portfolio and individual protocols and procedures are referred to as elements within the portfolio. These elements have been grouped according to the nature of the parameter(s) they measure and products they produce into a number of toolkits: abiotic, biotic, mapping, data analysis and interpretation, and translation and education.

Data from every core element are assimilated, managed, and served by the NERRS Centralized Data Management Office (CDMO; cdmo.baruch.sc.edu) for a variety of audiences from academic researchers to coastal managers and the general public. The CDMO ensures that SWMP data are authoritative, of high quality, and easily accessible.

*In the Southeast (NC, SC, GA and FL), the Reserves are the North Carolina NERR, Winyah Bay/North Inlet NERR, ACE Basin NERR, Sapelo Island NERR, GTM NERR, Rookery Bay NERR and Apalachicola NERR

Name: Lynn Shay
Category: Characterizing atmospheric and oceanic physics
Institution: University of Miami
Title: Professor, Meteorology and Physical Oceanography Program
Contact: nshay@rsmas.miami.edu, (305) 421-4075

Summary
Using high frequency (HF) radars, the approach utilizes backscatter from surface waves of one-half the radar wavelength (i.e., Bragg wave) to form a Doppler Spectrum. While the first-order returns in this spectrum are associated with the frequency shift off of the Bragg frequency that are proportional to the radial surface current, the ratio of the first-order Bragg peaks in the spectrum of the advancing and receding waves is proportional to the wind direction. With two or more stations, the directional ambiguity in resolving the wind direction is removed. Techniques have been developed to attempt to map the mesoscale surface wind speeds from HF radars. By removal of the Bragg peaks of the spectrum, an expression relating wind speed to the frequency of the second-order peaks allows mapping of the 2-D wind field subject to some underlying assumptions. Such an approach needs to be implemented for real time mapping of the wind fields.

Name: George Voulgaris
Category: Characterizing atmospheric and oceanic physics
Institution: University of South Carolina
Title: Professor in Earth and Ocean Sciences
Contact: gvoulgaris@geol.sc.edu, (803) 777-2549

Summary

1. As part of the SECOORA / US IOOS, Dr. Voulgaris has been operating two HF radars over the Long Bay region that routinely provide surface current information over the Long Bay area (all the way to the Gulf Stream) every 30 minutes and with a spatial resolution every 3 km. Dr. One of these HF radar stations is in Caswell Beach, NC and the other is in Georgetown, SC.
2. Although the processed real-time data are available online for public use, Dr. Voulgaris's group has the capability to tailor the data for wind energy power through additional processing of the raw data. The raw data can provide additional information through the following approaches:
    a. Combination of HF radar data with atmospheric models to evaluate the ability of the latter to identify variability in small spatial (~3 km) and temporal scales. A good example of the latter will be the effect of the diurnal sea-breeze wind patterns on the overall wind energy budget, as this depends on distance from the shoreline and can vary considerable from place to place. In such analysis the various modes of the wind – driven surface currents are analyzed in terms of spatial and temporal variability and it is correlated with point-measured winds and with the results of a met model. If the met model is doing a good job to predict the wind resources then it should be doing a good job in identifying the variability observed by the HF radars.
    b. Spatial variability of wind direction over the domain as recorded by the HF Radars with a resolution of 3 km. This will require analysis of the peaks of the Doppler spectra collected by the radars, the strength of each peak depends on a high frequency wave that is directly related to the wind intensity above the sea surface. Different wind directions produce different peak energies over the negative and positive Doppler frequency Bragg lines. This is something also used in the NJ wind power studies.
    c. Identification of sub-mesoscale and/or mesoscale eddies in the area that might influence the placement/operation of wind power structures
    d. Wave conditions over large areas; these will require the deployment of a directional wave buoy within the domain for a short period for calibration of the electromagnetic coefficient used to couple the wave conditions with the electromagnetic signal of the HF radar
3. The radar operation will not cost anything to the project as it is covered by the SECOORA / US IOOS program, the only costs will be related to analysis of data for the specific project and to the possible directional wave rider deployment (see d).

APPLIED SCIENCE

Name: Sukanta Basu and Anantha Aiyyer
Category: Characterization of atmospheric conditions
Institution: North Carolina State University
Title: Associate Professor
Contact: sbasu5@ncsu.edu, aaiyyer@ncsu.edu

Summary
Dr. Basu and Dr. Aiyyer are doing field experiments near Beaufort, NC using a sodar (Scintec SFAS). They collected approximately 2 months of sodar data last year (June-July, 2013) and are using this data for model validation. They have plans to collect more data in the near future. Dr. Basu and Dr. Aiyyer would be happy to collaborate with folks if they require wind data collection using sodar.

They are also running a mesoscale model (WRF) with 6 km resolution. A few of these runs use 2 km resolution. Approximately 5 years of cases are covered in this database, which includes quite a few extreme wind events. The analyzed datasets (mean wind speed, AEP, Weibull distribution at multiple hub-heights) will be disseminated to the general public by the end of this year via an interactive website. As part of Dr. Basu's NSF-CAREER award, she is collaborating with two K-12 teachers who will be using this website for curriculum development.

Name: Joel Cline
Category: Characterization of atmospheric conditions / resource assessment
Institution: Department of Energy
Title: Project Manager, Meteorologist
Contact: joel.cline@ee.doe.gov

Summary
The Wind and Water Power Technologies Office (WWPTO) within the U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) supports efforts to accurately define, measure, and forecast the nation's land-based and offshore wind resources. More accurate predictions and measurement of wind speed and direction allow wind farm operators to more efficiently supply clean, renewable energy to utility customers at lower costs. One of the largest remaining opportunities for reducing the levelized cost of energy from wind (LCOE) will come from gaining a substantial understanding of the complex aerodynamics and atmospheric phenomena that occur within a wind farm. To address this, the Wind Program has prioritized improving data and modeling at the wind plant scale through a collaborative effort with the National Oceanic and Atmospheric Administration (NOAA), DOE's National Labs, private industry, and academia. One example of this research is the second round of the Wind Forecasting Improvement Project in Complex Terrain (WFIP 2.0), beginning in Fiscal Year 2015, that is aimed at improving the physical understanding of atmospheric processes that directly

impact wind industry forecasts in complex terrain, such as the western United States. This research will be carried out through a targeted field campaign that will incorporate new data and an improved understanding of atmospheric phenomena into the foundational weather forecasting models.

Name: Ruben Delgado
Category: Characterization of atmospheric conditions
Institution: University of Maryland Baltimore County
Title: Assistant Research Scientist
Contact: delgado@umbc.edu, (410) 455-1936

Summary
Dr. Delgado is an Assistant Research Scientist in the University of Maryland, Baltimore County (UMBC) Joint Center for Earth Systems Technology (JCET). He has participated in field campaigns for NASA and National Oceanic and Atmospheric Administration (NOAA) for validation of atmospheric remote sensing technology, satellite instruments and forecasting models over the past decade. Dr. Delgado's Atmospheric Lidar Group at UMBC is conducting the offshore and coastal wind resource assessment for the state of Maryland (MD), sponsored by the Maryland Energy Administration (MEA) using scanning Doppler wind lidar technology. During the MD Geophysical Survey (summer 2013) UMBC's ALG collected Doppler wind lidar data over Maryland's Wind Energy Area (WEA), allowing for the development of remote sensing sampling strategies and validation of motion correction algorithms to reduce uncertainties of wind lidar retrievals. Dr. Delgado's group is actively conducting validation of lidar sensors with radar wind profiler, rawinsondes and anemometers in rural, suburban, coastal and marine environments. These efforts allow Dr. Delgado's group to generate datasets that allow verification surface forcing and meteorological parameters in numerical weather prediction models that drive winds in the United States. In addition, Dr. Delgado is the UMBC campus PI for NOAA's Cooperative Remote Sensing Technology and Science Center (CREST). NOAA CREST is NOAA-CREST is a multidisciplinary center formed by five partner institutions: City College of New York, Hampton University, University of Puerto Rico-Mayaguez, California State University-Los Angeles, and UMBC, with vast expertise in remote sensing applied to earth, atmospheric, environmental, and marine sciences.

Name: Paul Gayes
Category: Characterization of atmospheric conditions/ weather forecasting
Institution: Coastal Carolina University
Title: Professor, Director for Center for Marine and Wetlands Studies
Contact: ptgayes@coastal.edu, (843) 349-4015

Summary
The group at Coastal Carolina University (Pietrafesa, Gayes, Bao, Yan, Hackett, Gurka) have been involved in a number of wind energy related initiatives including:

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2. There is a great deal of focus at CCU on refinement and application of the now fully interactively coupled model system (WRF/ROMS/SWAN). This includes present applications:
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Name: George Hagerman
Category: Characterization of atmospheric conditions / met-ocean characterization
Institution: Virginia Polytechnic Institute, Advanced Research Institute
Title: Senior Research Associate
Contact: hagerman@vt.edu, (757) 340-1921

Summary
A two-year study funded by the Technology Assessment and Research Program of the U.S. Bureau of Environmental Safety and Enforcement, which estimated standards-based design parameters for extreme winds, waves, currents, and water levels for Mid-Atlantic offshore wind energy areas from northeastern North Carolina to New York.

For both hurricanes and nor'easters, Dr. Hagerman's team estimated fundamental wind and wave parameters at 50- and 100-year return periods. The estimated fundamental wind parameter was the 10-minute average wind speed at the meteorological "surface" elevation of 10 meters above sea level (U10). The estimated fundamental wave parameter was the significant wave height (Hs) for an assumed 3-hour sea state duration.

From these fundamental wind and wave parameters, existing standards specify derived wind and wave conditions to be used in various Design Load Cases (DLCs). For example, the standards specify an "extreme" or "reduced" 3-second gust speeds to be derived from a "reference" 10-minute mean wind speed (Vref) at turbine hub height, which is derived from U10 and an assumed vertical profile of wind speed. Likewise, the standards specify various multipliers of Hs to derive estimates of "extreme," "severe" and "reduced" individual waves and the sea state as a whole.

Measured wind and wave data from a variety of platforms were used to validate the derivation multipliers published in existing standards. Where measurements depart from the standards-based multipliers, alternative multipliers were recommended.

Name: Robert Hare
Category: Resource assessment / met-ocean characterization / impacts on habitats
Institution: Dominion
Title: Senior Business Development Manager
Contact: robert.p.hare@dom.com, (804) 819-2963

Summary
Dominion is developing the Virginia Offshore Wind Technology Advancement Project (VOWTAP), a two turbine 12 MW project in federal waters adjacent to the Virginia Wind Energy Area (WEA). In May, Dominion was awarded $47 million by the U.S. Department of Energy (DOE) to continue VOWTAP development activities. In addition, Dominion won a commercial wind energy lease in September 2013 for a project in the WEA.

Environmental studies and surveys completed to support the VOWTAP Research Activities Plan (RAP) submitted to BOEM in December 2013 include:

- Geophysical and Shallow Geotechnical Surveys
- Benthic Surveys
- Wetlands and waterbody surveys.
- One-year Terrestrial and boat-based avian and bat surveys
- Visual Impact Assessment
- Marine and Terrestrial Archaeology Surveys
- Acoustic Analysis
- Air Emissions Analysis
- Aviation Assessment
- Navigational Risk Assessment
- Fisheries, Marine Mammal and Sea Turtle Assessments
- Sediment Transport Analysis

Dominion submitted the VOWTAP Site Assessment Plan (SAP) providing a description of meteorological monitoring equipment to BOEM in February 2014, which is being updated following the additional DOE award. A SAP was also submitted for the commercial offshore project in May 2014.

Dominion is considering/conducting the following select innovative research studies for VOWTAP:

- Geotechnical surveys at the turbine sites, cable route, and HDD area on- and off-shore
- Underwater Marine Mammal Acoustic Assessments;
- Unexploded Military Ordinance (UXO) Survey;
- Post-Construction Avian and Bat Monitoring

Name: Ruoying He
Category: Weather forecasting
Institution: North Carolina State University
Title: Professor of Oceanography
Contact: rhe@ncsu.edu, (919) 513-0249

Summary
Global Circulation Models (GCMs) are important tools for wind energy resource assessment and project wind power variability under different weather and climate scenarios. However, their abilities to resolve regional/local changes in marine environment are largely compromised by their coarse resolutions (typically 100-200 km) and lack of key local atmosphere and ocean dynamics. Regional downscaling is much needed so that detailed local marine resource assessment and projections can be derived. At NC State, Dr. He and his partners have developed a regional coupled atmosphere-ocean-wave model for the southeast U.S. coastal ocean and the Gulf of Mexico, utilizing sophisticated model coupling and parallel computing techniques. This three-dimensional, high-resolution (5-km), regional prediction system provides a nowcast and an 84 h forecast of wind (Figure 1), ocean waves, and currents. The system runs daily and supports a series of user-defined applications. Extensive model validations have been performed against in situ and satellite-observed ocean conditions, indicating a reliable capability of the system in providing offshore wind, ocean current and wave predictions. Long-term integration of this coupled model system can be used to effectively support regional wind resource assessment and data collection effort. More information on the modeling system is available online at: http://omgsrv1.meas.ncsu.edu:8080/ocean-circulation/.

Name: Debra Hernandez
Category: Met-ocean characterization
Institution: Southeast Coastal Ocean Observing Regional Association (SECOORA)
Title: Executive Director
Contact: debra@secoora.org, 843-906-8686

Summary
The Southeast Coastal Ocean Observing Regional Association (SECOORA) is one of the eleven coastal ocean observing regional associations established in partnership with the US Integrated Ocean Observing system (US IOOS®). The SECOORA footprint encompasses coastal estuarine and ocean waters of North and South Carolinas, Georgia and Florida. The U.S Southeast coastal region is vulnerable to hurricane hazards, potential impacts from oil spills and climate change. SECOORA is in the process of implementing an end-to-end Regional Coastal Ocean Observing System (RCOOS) that leverages and integrates existing observational, modeling, data management, scientific and outreach/educational activities within the region. The observing subsystem consists of a suite of coastal and offshore moored platforms, autonomous underwater gliders, satellite data receivers and high-frequency radar (HFR) surface current installations. Currently, SECOORA supports six buoys and six coastal stations along the west Florida shelf, seven moorings and one coastal station off the Carolinas coasts, and 14 high-frequency radars sites spread across five locations. See http://secoora.org/maps/ for locations of assets. SECOORA follows an optimal approach to advance the implementation of nowcast/forecast models from sub-regional to regional scales, including coupled atmosphere, surface wave, water quality, habitat and ocean circulation. SECOORA has established a data management and communications infrastructure, and has implemented the Open Geospatial Consortium (OGC) standards and technologies that promote aggregation, access, visualization, interoperability, utilization, archival and dissemination of coastal ocean observations and model data. SECOORA, in dialogue and collaboration with critical stakeholders such as NOAA National Weather Service (NWS) Weather Forecast Offices (WFOs), researchers, coastal zone resources and emergency managers, and commercial entities integrates data from a variety of sub- regional coastal ocean observing programs to deliver marine weather information and products via its web site and data portal. For more information about SECOORA and its on-going coastal ocean observing activities in the SE, please visit SECOORA's web site (http://secoora.org).

Name: Eric James
Category: Characterization of atmospheric conditions
Institution: NOAA Global Systems Division
Title: Associate
Contact: eric.james@noaa.gov, (303) 497-4278

Summary
The Global Systems Division (GSD) of the National Oceanic and Atmospheric Administration (NOAA) has developed a 3-km horizontal grid numerical weather prediction (NWP) model called the High-Resolution Rapid Refresh (HRRR), run every hour

and providing forecasts out to 15 hours. In January 2012, the GSD began accumulating the HRRR forecasts on disk for the purpose of examining long-term averages of the model forecasts. Two-hour forecasts from the HRRR are considered a good proxy for truth (limiting the model forecast error but also reducing spurious features associated with the data assimilation and the first hour of model spin-up). In this project, the GSD calculated long-term averages of 80-m wind speed, as well as the frequency of exceedance of several interesting 80-m wind speed thresholds, and several measures of variability, over the 2.5-year period, based upon two-hour forecasts from the HRRR.

The dataset highlights regions of high potential for wind energy development in the United States. Areas exhibiting strong average 80-m wind speeds include high mountain ranges in the West, subtly elevated terrain features throughout the Great Plains, the Pacific Ocean close to the west coast, the western Great Lakes, and the Atlantic Ocean near the east coast. Some of these regions display significant interannual variability, and all of them experience a large seasonal cycle in 80-m wind speed. Diurnal variability is influenced by such meteorological phenomena as low-level jets, land-sea interactions, and orographically forced flows. Average wind speed information from this dataset, combined with a measure of variability, can provide guidance for decision-makers seeking to locate promising areas for wind farms.

Name: Elizabeth Kress
Category: Resource Assessment
Institution: Santee Cooper
Title: Senior Engineer, Renewable Energy
Contact: eakress@santeecooper.com, (843) 761-8000 ext. 5014

Summary
Santee Cooper has been involved with wind mapping and other research pertaining to offshore wind as an option for renewable energy since 2005 when the first wind maps of the state were produced with funding from Santee Cooper, the SC Energy Office and DOE. These wind maps showed a significant wind resource offshore, although very little land-based wind resource.

- Santee Cooper and the South Carolina Inst for Energy Studies at Clemson (SCIES) collaborated on some coastal anemometry. A 50meter tower was installed at three sites, and monitored for various amounts of time. The sites were North Charleston on the former Navy base, Waites Island in NMB, and the Baruch Center near Georgetown. Shorter towers and data were obtained from Coastal Carolina Univ in Conway and Georgetown High School.

- The SC Energy Office was the lead coordinator using a DOE Coastal Clean Energy grant to accomplish three objectives over a 3-year period, as follows:
  1. Transmission Study - Co-Primary investigators were SCIES and Eco-Energy.
  2. Permitting Coordination - The SC Energy Office will hire a lead coordinator for this work.

3. The Offshore Wind/Wave/Tidal Energy Study - CCU will develop this data as lead coordinator.

- In July 2009, researchers for the Wind/Wave/Tidal Energy Study began gathering information from six weather buoys off the coast of North Myrtle Beach and off Winyah Bay. Research coordination was among Coastal Carolina University, North Carolina State University, Santee Cooper and the South Carolina Energy Office.

- Santee Cooper contracted with Ocean and Coastal Consultants, to investigate placement of an anemometer tower that would gather wind data at the Winyah Bay location. A preliminary design for the anemometry platform and tower including geotechnical surveys and site assessment was completed and is on file.

Other Offshore wind related research by Santee Cooper

- Early feasibility study by Clemson SCIES including high-level environmental checks.
- SCIES produced photo simulations of wind turbines offshore from South Carolina.
- Worked with SC Energy Office and Georgia and NC groups with DOE funding through a Wind-Powering America grant to overcome barriers to wind development.
- Permitting coordination planning through the Regulatory Task Force, a broad mix of stakeholders from industry,
- Transmission interconnection options and capacity by Clemson's CUEPRA
- Marine spatial planning and environmental study needs for offshore wind
- Cost of offshore wind generation including forecasting of trends related to increasing marine environmental knowledge, improving regulatory process, availability of construction equipment & vessels, and effect of installation learning curve.
- Conceptual design of a demonstration scale wind farm off the coast of Georgetown by Ocean and Coastal Consultants, coordinated and funded by Santee Cooper.
- Electric load seasonal and diurnal peak coincidence with offshore wind generation

Name: Gary Lackmann
Category: Weather forecasting
Institution: North Carolina State University
Title: Professor and Director of Graduate Programs, Department of Marine, Earth, and Atmospheric Sciences
Contact: gary@ncsu.edu, (919) 515-1439

Summary
His primary research focus is on improving understanding and prediction of high-impact weather events, including hurricanes, severe thunderstorms, and winter storms. His research utilizes numerical models both in weather prediction and as a research tool with

which to test hypotheses. Specific to the southeastern US, he has studied topographically flows such as Appalachian cold-air damming, tropical cyclones, and winter storms. His interest in tropical cyclones includes understanding their dynamics, the processes that control their size, and how they are affected by changes in the larger-scale environment (including climate change). He believes that the potential impact of tropical cyclones on wind farms should be an important concern for coastal wind energy developers.

Name: Blaine Loos
Category: Characterization of atmospheric conditions
Institution: James Madison University, Center for Wind Energy
Title: Project Facilitator
Contact: loosbe@jmu.edu, (540) 568-8754

Summary
The Center for Wind Energy at James Madison University in Harrisonburg, Virginia has been involved in resource assessment and data collection and analysis for over a decade. This began in 2001 with the creation of the Virginia State Based Anemometer Loan Program, which loans meteorological towers, free of charge, to Virginia residents, businesses, and other organizations. To date, the program has deployed systems at 43 sites throughout the state, primarily for small, distributed wind applications. The Center has also supported resource assessment for utility scale wind projects using some of the 15 meteorological towers in our possession, and our two SoDAR units.

The Center also operates the Small Wind Training and Testing Facility (SWTTF) at JMU, which at present supports a Bergey wind turbine and several wind monitoring systems for research purposes. This facility serves as Virginia's only site equipped for small wind installer training and testing of new and innovative small wind turbine designs. The Center has been involved in a variety of other data collection and research activities, including two Jobs and Economic Development Impact (JEDI) studies for offshore wind in the Southeast and Mid-Atlantic regions, and also educational initiatives including the Virginia Wind for Schools program which, to date, has deployed 5 meteorological towers and supports 20 small wind turbines operating at public schools throughout Virginia. The Center administered in collaboration with our state energy office small wind grant and rebate programs funded by ARRA that led to the installation of more than 30 wind turbines at homes and small businesses.

The Center has helped to grow Virginia's installed small wind capacity from 0 kW a decade ago to nearly 400 kW today and is now engaging in new efforts to advance distributed and community wind to bring megawatt-scale wind to Virginia.

Name: Chris Mooers
Category: Weather forecasting
Institution: Portland State University
Title: Affiliated Research Professor
Contact: mooers@pdx.edu, (503) 725-4283

Summary
In cooperation with the Naval Research Laboratory, Portland State University is completing a multi-year development and evaluation of a prototype real-time, mesoscale operational, multi-month forecast system for the Gulf of Mexico ocean circulation, which is predominately driven by the throughflow of the Gulf Stream (inflow as the Yucatan Current, outflow as the Florida Current), and called the Loop Current. Atmospheric forcing over the Gulf of Mexico and Caribbean Sea is of secondary but crucial importance. Hence, operational, numerical weather prediction surface fields of all the dynamical variables are needed on a grid of a few kilometers and a few hours. Also, skill assessment of the oceanic and atmospheric variables is needed at the limited number of grid points where time series of surface observations are available.

Name: Ralph L. Nichols
Category: Design of offshore wind plants
Institution: Savannah River National Laboratory
Title: Sr. Fellow Engineer, Environmental Stewardship Directorate
Contact: ralph.nichols@srnl.doe.gov, (803) 725-5228

Summary
Ralph is currently conducting research related to characterization and simulation of met-ocean conditions to improve resource assessment and the design of foundations and structures for offshore wind energy plants. His research is focused on new tools to study the interaction between the ocean and atmosphere and its' effect on resulting waves and atmospheric boundary layer to improve the design basis of structures constructed on the Atlantic Outer Continental Shelf. The hydrodynamic forces from steep and breaking waves are likely to drive the design of foundations and structures for fixed foundation offshore wind turbines. New tools include improved use of AWACs for wave characterization, interactively coupled met-ocean models incorporating modules for ocean, atmosphere and sea state and integration of these results into simulation of hydrodynamic loads from steep and breaking waves using computational fluid dynamics.

Name: Joseph Owen Roberts
Category: Characterization of atmospheric conditions / resource assessment
Institution: NREL
Title: Engineer, Wind Technology Department
Contact: joseph.roberts@nrel.gov, (303) 384-7151

Summary
NREL provides a wide range of support to the deployment of offshore wind along the East Coast. This includes mapping offshore wind resources at state and national levels; developing recommended practices for data collection from offshore turbines and remote wind sensing from fixed or floating platforms; characterizing the resources that are measured by these platforms; investigating design conditions in the offshore environment. Notable projects include a DOE-funded collaboration with Fishermen's Energy and Stevens Institute of Technology to characterize and validate a scanning lidar for resource assessment, as well as supporting most of the DOE's advanced Technology Demonstrator Projects. Together with PNNL, NREL has been leading investigations in to the repurposing of the Chesapeake Light Tower as a Reference Facility for Offshore Renewable Energy. NREL also supports a range of federal and other agencies in developing offshore wind, and recently completed an assessment of the wind energy allocations along the east coast for BOEM. NREL uses its extensive experience in many different fields to support ongoing standards development through IEA Wind and the International Electrotechnical Commission.

Name: Harvey Seim
Category: Characterization of atmospheric conditions
Institution: University of North Carolina
Title: Professor and Chair of Marine Sciences
Contact: harvey_seim@unc.edu, (919) 962-2083

Summary
Dr. Seim's work began in 2011 with support from the NC Department of Commerce (ultimately ARRA funding), Duke Energy and Progress Energy. Dr. Seim's research group has been pursuing 3 activities:

1. Ongoing analysis of historical data – this activity has focused largely on estimating hub height winds using a stability-based extrapolation scheme. Dr. Seim's research group has implemented a 1D stability-based extrapolation scheme with a combined dataset (ASCAT (daily satellite) winds, AVHRR-OI sea surface temperature, and atmospheric properties from the North American Regional Reanalysis, a NOAA weather product). A manuscript will be submitted by the end of summer on the results, building on a conference paper and a publication in Sea Technology.

2. Collection of new observations – they have collected wind profiler data at Billy Mitchell airport, near Cape Hatteras on the Outer Banks, since late 2011. This SODAR measures winds to 200m elevation and has worked reasonably well though there have been several

equipment failures and prolonged outages as a result. A tall tower in Stumpy Point, NC was instrumented at 3 elevations by Weatherflow, Inc, providing a second location with vertical wind profiles simultaneous with the Billy Mitchell observations. Buoys have been deployed in Raleigh and Hatteras Bay on the 30 m isobaths, roughly 20 miles offshore, to document winds in locations that appear to be prime for wind farms but which have no historical observations. The buoy deployments have been difficult to maintain and only began in May 2014 after a brief deployment in fall 2011.

3. A mesoscale atmospheric model (based on RAMS; nested, inner grid with 2km horizontal resolution, 10 vertical levels below 200m) has been run by Weatherflow, Inc. and is being analyzed by synoptic weather type to establish the primary wind regimes and their spatial structure off NC. The observation collection and model analysis will likely continue for one more year until June 30, 2015.

Name: Peter Sheng
Category: Weather forecasting / impact forecasting
Institution: University of Florida
Title: Professor
Contact: pete@coastal.ufl.edu, (352) 392-9537

Summary
At the University of Florida, Civil and Coastal Engineering Department, Dr. Sheng and his partners are conducting research related to coastal winds:

1. Florida Coastal Monitoring Program (FCMP), http://fcmp.ce.ufl.edu/, which measures hurricane wind during landfalls, is a unique joint venture focusing on full-scale experimental methods to quantify near-surface hurricane wind behavior and the resultant loads on residential structures. The aim is to provide the data necessary to identify methods to cost-effectively reduce hurricane wind damage to residential structures. This work is critical in a state where 85% of the rapidly increasing population resides on or near the 1200 miles of coastline vulnerable to hurricane strike. The Florida Department of Community Affairs sponsors this project, and participants include Clemson University and the University of Florida. The goals of the FCMP include the following:
    - Measuring ground level wind velocity
    - Measuring building envelope wind forces
    - Evaluating the effectiveness of wind-resistant structural retrofits
2. Real-time Storm Surge and Coastal Inundation Forecasting – Funded by South Eastern Coastal Ocean Observing Regional Association (SECOORA), http://secoora.org/ , the University of Florida has developed a 24/7 real-time high-resolution forecasting system of water level, currents, waves, and salinity for the entire Florida coast using the CH3D-SSMS (http://ch3d-ssms.coastal.ufl.edu/) which is a three-dimensional integrated storm surge modeling system including the effects of wind, tide, wave, precipitation, and river flow. The modeling system uses of the North Atlantic Mesoscale (NAM) wind forecasts provided by NOAA-NCEP using the WRF and HWRF model. Dr. Sheng and his group also use a parametric wind model to augment the wind

fields during hurricanes. The model uses the FCMP wind and any other available wind to validate the wind forecasts during historical storms.

3. Incorporating Climate Change Effects on Hurricanes, Sea Level Rise, and Coastal Inundation – Funded by NOAA Climate Program, the University of Florida is developing prediction of coastal inundation risks for Atlantic and Gulf coasts for future climates (2020-2040 and 2080-2100). Results indicate that future climate will generate stronger and most likely more frequent hurricanes.

Name: Lynn Sparling
Category: Characterization of atmospheric conditions
Institution: University of Maryland Baltimore County
Title: Associate Professor
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Summary
UMBC participated in an offshore wind energy/geophysical measurement campaign, summer 2013. The dataset includes ship-based wind lidar, aircraft wind lidar, bathymetric and other geophysical and ocean data. Processing and analysis and comparison with WRF model output is ongoing. Other research includes characterization of uncertainties in coastal and marine boundary layer winds from mesoscale models, low-level wind forcing mechanisms in the MidAtlantic, the use of wind lidar on moving marine platforms (theory, simulation and experiment) and statistical data analysis from satellite, marine and land-based platforms.

Name: James Titlow
Category: Characterization of atmospheric conditions
Institution: Weatherflow
Title: Senior Meteorologist
Contact: jtitlow@weatherflow.com

Summary
WeatherFlow has completed several wind energy research activities within the area of data collection and resource assessment. WeatherFlow has been collecting weather data with a strong accent on winds in the littoral zone for over 20 years. WeatherFlow's expansion occurred via a geographical broadening of Weatherflow's proprietary coastal mesonet (initially with stations on the northeast and mid-Atlantic coasts, now on all U.S. coasts and the Great Lakes), a diversifying client base which lead to the addition of new instrumentation (sonic anemometers, SODAR, LIDAR, etc.), and a dramatic increase in the total number of sites, now exceeding 400. With this data, WeatherFlow meteorologists have gained a wealth of expertise in coastal meteorology and use this to provide daily in-season forecasts tailored to water recreation enthusiasts.

WeatherFlow entered the wind energy arena by supplying archived data in support of the development projects in Vineyard Sound, Massachusetts and in the region around Block Island. The company's coastal meteorology expertise has also been used in ongoing

projects in North Carolina and Virginia. These projects involve wind resource characterization as a cumulative sum of contribution from several dominant synoptic and mesoscale patterns, identified by factors such as time of year, average wind speed, and wind speed variability.

Name: Rick Thomas
Category: Met-ocean characterization
Institution: Timmons Group
Title: Environmental and Energy Services
Contact: rick.thomas@timmons.com, (804) 200-6446

Summary

Proof of Concept for a Wide-area Metocean and Environmental Monitoring Program
Timmons Group and its team members were selected in March 2014 by the Virginia Department of Mines, Minerals and Energy to develop a proof of concept for a commercial wide-area metocean and environmental monitoring program. The main reason for the project is to integrate previously collected marine mammal and sea turtle data near the Virginia Wind Energy Area (WEA) and to lower the cost of energy from offshore wind.

Team members include the technical expertise and capabilities of AWS Truepower, AXYS Technologies, Northstar Marine, Cornell University, Versar-Geomarine, The Virginia Aquarium and Marine Science Center and the Center for Conservation Biology.

The proof of concept will demonstrate that this mobile, fully instrumented, self-elevating vessel and platform is capable of safely and cost-effectively providing the necessary structure and power to host multiple data collection tools. It will also demonstrate the accuracy and effectiveness of state-of-the-art remote sensing data collection tools, focusing on Lidar and radar technologies.

The current methods of data collection are insufficient due to budget constraints, weather conditions, and lack of visual coverage. Our team will evaluate the feasibility of a self-elevating fixed platform design to lower the cost of obtaining met ocean and environmental data for pre-construction site characterization. The project will also provide the first comprehensive blending and analysis of North Atlantic right whale data in their migratory corridor.

Virginia Offshore Wind Advanced Technology Demonstration Project
Timmons Group worked with James Madison University and the Virginia Department of Mines, Minerals and Energy to develop a work plan designed to further the mission of the Virginia Coastal Energy Research Consortium to advance the economic viability of offshore wind in Virginia.

The primary tasks completed under this project were test turbine site analysis, permitting, property control, and interconnection, regulatory permitting preparation, wind resource and met-ocean design environment characterization, outreach/relations to avian, marine

and other key stakeholders, and viewshed analysis and outreach to key stakeholders. In support of the prime contractor, James Madison University, Timmons Group played a major role in every aspect of these tasks, serving as lead consultant and primary author of the final deliverable to the Virginia Department of Mines, Minerals and Energy. Additionally, Timmons Group developed two data viewer web portals entitled Map and Data Viewer and Wind, Weather and Energy Viewer which combine state of the art geospatial, meteorological data modeling and mapping capabilities to provide real time and modeled energy production data throughout Virginia's coastal region.

Dominion, in partnership with Alstom Power, the National Renewable Energy Lab, Virginia Tech Advanced Research Institute and Kellogg, Brown and Root built from the work provided under this contract, and were successful in receiving a grant from the U.S. Department of Energy to develop this project within Federal waters off the coast of Virginia.

Name: Robert Weisberg
Category: Met-ocean characterization
Institution: University of South Florida
Title: Professor
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Summary
The Coastal Ocean Monitoring and Prediction System (COMPS), hosted by the College of Marine Science, University of South Florida, was initiated in 1998 to address societal relevant matters pertaining to the west Florida coastal ocean. As part of the Integrated Ocean Observing System (IOOS), coordinated through NOAA, and with support from the Southeast Atlantic Coastal Ocean Observing Regional Association (SECOORA), COMPS maintains and serves observations from offshore buoys, coastal stations, HF-radars and gliders and combines these observations with numerical ocean circulation model simulations to describe and understand the workings of the west Florida shelf, with applications including storm surge, harmful algae blooms, fisheries ecology, spilled substances and safe navigation.

The WFS COMPS moored array presently has three surface moorings, each with surface meteorological and in-water ocean measurements reporting in near real time (http://comps.marine.usf.edu). An application of COMPS observations to estimating the potential for power generation by mechanical (winds, waves and ocean currents) and solar means is given by *Weisberg et al.* (2012). A review of COMPS coastal ocean observations is provided by *Weisberg et al.* (2009), and a commentary on the role of coordinated coastal ocean observing/modeling systems in understanding the workings of the coastal ocean is provided by *Weisberg* (2011). Dr. Weisberg's group's intention is to maintain and grow the COMPS array, and recent engineering upgrades are being implemented to improve real time data reliability.

Name: Allen White
Category: Characterization of atmospheric conditions/ weather forecasting
Institution: NOAA Physical Sciences Division, Earth System Research Laboratory
Title: Research Meteorologist, Acting Chief of Water Cycle Branch
Contact: allen.b.white@noaa.gov, (303) 497-5155

Summary
With funding provided by the 2012 Disaster Relief Act (Sandy Supplemental), NOAA's Earth System Research Laboratory Physical Sciences Division has installed three Doppler wind profiling radars (wind profilers) and surface meteorology towers along the U.S. Gulf and Southeast coasts to help detect and monitor land-falling tropical storms and other high-impact weather events. These observing sites complement a fourth wind profiler deployed in coastal North Carolina as part of NOAA's Hydrometeorlogy Testbed Southeast Pilot Study (HMT-SEPS). The wind profile observations measured with these instruments have been used in other studies (e.g., the Wind Forecast Improvement Project jointly led by DOE and NOAA) to help improve wind energy forecasts. The data are also available for inclusion in LAPS, the data assimilation system that is used at local NWS Weather Forecast Offices to initialize local WRF model weather forecasts.