Offshore Wind Farms & The Role Of SeaSonde Data- Saving Money for Utilities and New Jersey Rate Payers

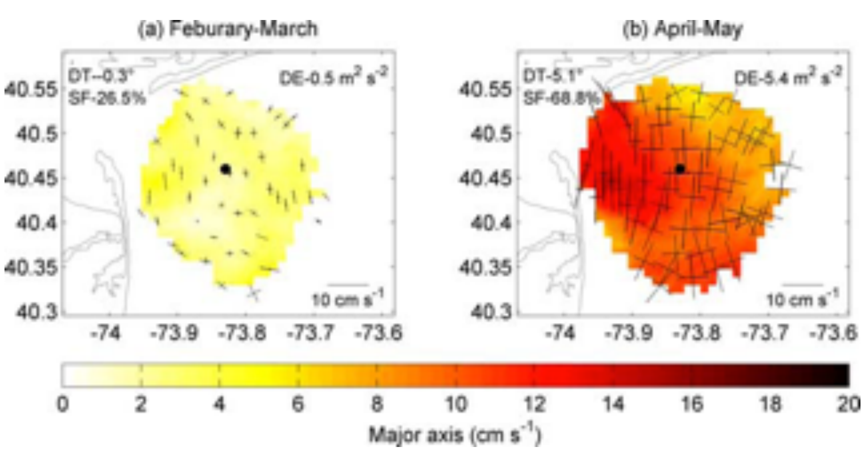
President Obama wants 20% of United States power coming from green energy by 2030. While this sounds like an aptly ambitious goal, it pales in comparison to that set by the state of New Jersey: source 30% of its electricity from green energy by 2020. Last summer the state celebrated its 4000th solar installation, proving it is rising to the challenge. But to fully achieve this lofty goal, New Jersey cannot rely on land-based equipment and must move to the water, capturing offshore wind power.

The New Jersey Board of Pubic Utilities (NJ BPU) is funding the development of offshore wind farms and along the way aims to save money for the utilities and NJ rate payers by optimal harnessing of such "green power". Once installed, the daily operating cost of running a wind turbine is relatively uniform, regardless of actual power produced any given day. Utilities sell power by bidding certain quantities on spot energy market for prices that are set 24 hours in advance. If the utility can predict accurately how much wind energy they will create and have available the following day (to sell) then they can bid a larger quantity of power produced from the wind (that comes at no additional cost to the utility), and maximize their profit. New Jersey rate payers also benefit because a percentage of any such profits gets refunded to the them. However, if the utility estimates poorly and oversells energy based on expected wind output then they need to derive that energy from another source (e.g. coal) -- as a result the utility can lose money and rate payers see no savings in their utility bills.

Image above shows the future location of NJ's 350 MW offshore wind park, set for construction to start in 2012. Program led by NRG Bluewater Wind.

NJ BPU has contracted scientists at Rutgers University to improve the atmospheric forecasts that utilities use in estimating potential green energy production. Rutgers' very high resolution atmospheric forecast model, RU-WRF, is running with a 1 km resolution that is fine enough to resolve the physics of the critical sea breeze off the New Jersey coast. RU-WRF outputs information that NJ BPU can share with all utility companies. Rutgers is running an operational version used to provide information to weather service and also a research version they can use to experiment and tweak over time. The SeaSonde data outputs will be a critical tool used to validate the WRF model. Rutgers manages a SeaSonde network in the New York- New Jersey area providing 2-D current maps with both 1 km and 6 km resolution settings. Wind turbines will be positioned near center of 1 km grid coverage areas.

For the modeling and forecasting effort, the biggest variability near shore during peak power times is the diurnal sea breeze. The sea breeze is a wind field that moves across the coastal zone towards land, affected significantly by differences between the warm land surface temperature and the cool sea surface temperature. You can see its leading onshore edge using microwave radars, as this front side contains plenty of dust and particulate matter acting as an ideal scatter wall for the microwave signals. However, that's all the microwave radar can see. The HF radar picks up from there by helping show the extent of the sea breeze and quantifying the spatial and temporal variability across the breeze field, that has until now been the critical missing information.



"Maps showing diurnal variance ellipses (black crosses) and the major axis (color) of diurnal variability calculated from the HF radar system for (a) February–March 2005 and (b) April–May 2005."

This figure and above description are published in Hunter, E., R. Chant, L. Bowers, S. Glenn, and J. Kohut (2007), Spatial and temporal variability of diurnal wind forcing in the coastal ocean, Geophys. Res. Lett., 34, L03607, doi: 10.1029/2006GL028945.

How does the HF radar do this? Not giving away the recipe in this short article, in summary: Rutgers applies a series of post-processing techniques to the SeaSonde 2-D surface current maps that filter out specific influences on the surface currents, such as the tidal constituents, eventually isolating the wind-induced component of current at each 1 km grid point in the radar field. The intensity of the wind-induced surface current is very well correlated with what the winds above are doing spatially.

Additional Uses For RU-WRF Model & SeaSonde Outputs:

Wind Farm Design and Engineering

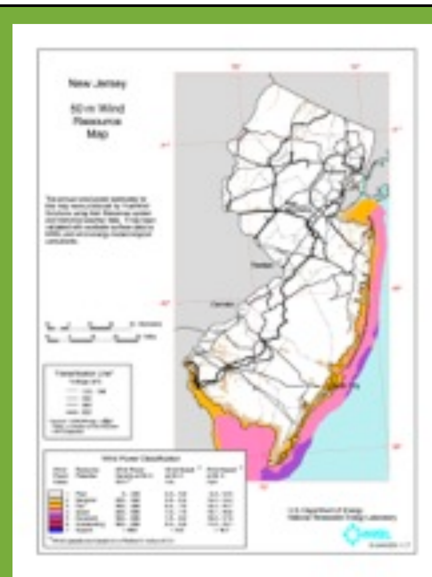
Typically the technology engineers utilize what are called “Wind Resource Maps” (WRM) to design equipment, determine its ideal placement offshore and estimate energy production. The resource maps are rather crude, in the form of annual average maps. One task of the Rutgers team is using the model outputs and SeaSonde data in creating more sophisticated WRMs-- for each month, with data averaged for 3 hour segment across the day, to better match demand periods.

Verifying Performance

The WRF model and SeaSonde data can also be used to confirm that the wind turbines are working and delivering the power they’re supposed to over a range of various wind speeds and durations, and afterwards gauge the power harnessing effectiveness of that equipment.

Assisting Routine & Emergency Ocean Operations

In addition to SeaSonde data being used to validate the model outputs, this same data can also be used to assist with field operations: during installation, routine O&M and any emergency responses that may be required. For these activities it’s good to know in real-time what the ocean current and wave conditions are for the area.



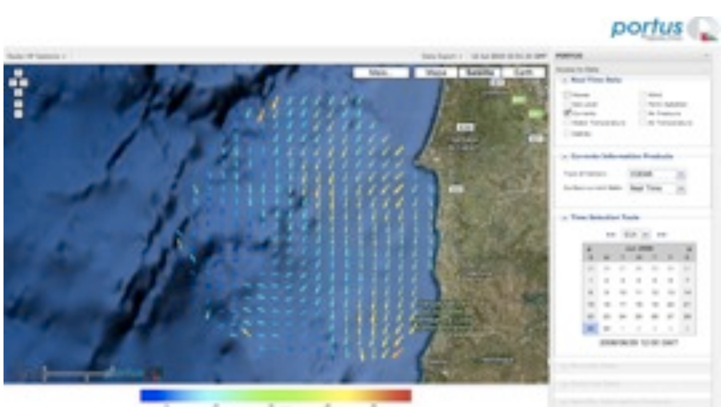
Example of annual Wind Resource Map for New Jersey area.

Portugal Starts Operational HF Radar Observing

The deployment of two SeaSonde® HF Radars in the Sines area by the INSTITUTO HIDROGRÁFICO (IH) has been awarded to the engineering company QUALITAS. This system is part of the SIMOC project (www.hidrografico.pt/simoc.php), which has also the support of Sines Harbor Administration, and will monitor surface currents and waves in the southwest coast of Portugal.

The IH (Portuguese Hydrographic Office) is a state research laboratory, part of the Portuguese Navy, and is the main operational oceanographic institution in Portugal. Amongst its responsibilities is the establishment and maintenance of the national operational ocean observing network, which gives support to all Portuguese interests along the its EEZ such as search and rescue activities, safe navigation and harbour operation.

The Sines area, positioned halfway between Lisbon and Algarve, was chosen as the first permanent HF Radar deployment area since it is one of the most sensible locations of the portuguese coast, having a major petrochemical harbor and right on the south a natural reserve (Natural Park of the Southwest of Alentejo). Environmental monitoring by means of HF radar is understood as a preventive action to improve safety along one of the heaviest ship traffic corridors in the world. The radar network will complement the wave buoy deployed near the Sines Harbor (part of the national buoy network) as fixed monitoring systems, and allow the deeper knowledge of the circulation in this area. The radars will be operating from the Sines Harbor and Cape Sardão, being these the first two sites of the planned national network as foreseen in MONIZEE, the portuguese coast monitoring plan.



SeaSonde currents showed inside display screen of PORTUS BY QUALITAS oceanographic information system.

Data retrieved by the system will be integrated in the PORTUS BY QUALITAS® oceanographic information system.

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