

Integrated Ocean Observing System (IOOS[®]) Support to Hurricane Sandy

Before and during Hurricane Sandy, observations and models from the U.S. IOOS Regional Associations proved critical to National Weather Service Weather Forecast Offices along the Atlantic Coast, as well as partner Federal and State agencies and the public. Following are some examples:

Northeast Regional Association of Coastal and Ocean Observing Systems (NERACOOS):

- NERACOOS hardened its forecast system infrastructure so that it would have the best chance of surviving the hurricane.
- During the storm, NERACOOS made near real-time data available through its Real-Time Data Portal at <http://neracoos.org/>. These data included hourly updates of information developed for marine operations, such as wind, wave, visibility, air temperature, water temperature at various depths, and more, coastal high frequency radar data covering Long Island Sound to Maine, and coastal wave forecasts (at <http://www.neracoos.org/datatools/forecast/wave>). Web traffic for all three days of the storm jumped 300%, peaking at 800% on October 29. NERACOOS received more than 13,300 page views for the three-day period, with about 20% of viewers going to the real-time portal.
- Gray, ME, WFO noted the following specific areas of support:
 - NERACOOS assets were particularly helpful during this large storm, particularly the buoy wind and wave data. Very large waves and storm forces winds were observed on October 29th and 30th, allowing operational meteorologists to adjust our forecasts in real-time.
 - The Coastal Flood Nomogram was particularly valuable prior to andfall. Animations suggested that large, battering waves would approach the coast on October 29th (35 feet), causing erosion and splash-over problems in our more vulnerable exposed beaches (see attached wave picture, Camp Ellis, Maine). That did occur, and forecasters were able to adjust their conceptual model for potential hazards associated with "Sandy".
 - The Northeast Coastal Ocean Forecast System (NECOFS) model performed well and model verification was available during the storm. The wave and storm tide tracker information was then presented at the fall workshop at NWS Gray, Maine for training purposes.
- Taunton, ME, WFO reported the following:
 - The IOOS buoy data were invaluable for Sandy. We use a combination of wave amplitude and water level to ascertain the expected impact of coastal flooding along selected reaches of the coastline. The data helped us refine our near term forecasts and then allowed us to go back and adjust our coastal flood forecast impact procedures. We have subsequently refined our coastal flood tables that attempt to assign expected impact at selected locations as a function of total water level and wave height based in part on the wave data observed at the IOOS sites.
 - NERACOOS is one of the partners in the development of StormReporter and helped expand it from the initial project in Massachusetts to a region wide effort. StormReporter helped us assess the actual coastal storm impacts along the MA and RI coastline (our forecast area of responsibility). We used StormReporter to get an idea of extent of structural damage, extent of overwash, and severity of erosion. The uploaded images provided by StormReporter really helped to objectify the impact whether the impact was inundation, structural damage, and/or beach erosion. The StormReporter data will provide an archive for future studies on this event.

- NERACOOS helped by restoring the real-time telemetry for the Scituate tide gauge in time for the November 7 nor'easter. It helped confirm that this storm did have the capability to produce a 2 to 3 foot storm surge but during a period of especially low high astronomical tides.
- NERACOOS information was used to inform the 180 participants of the 2012 NEOSEC Ocean Summit in Narragansett, RI on the impact of Sandy. The Summit continued on November 1 and 2 with Dr. Kathy Sullivan giving the key note address just days after the superstorm.

Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS):

- Glider RU23 was deployed to monitor sea surface temperature and the mixing layer off the New Jersey coast, and its data were available at: <http://marine.rutgers.edu/cool/auvs/index.php?did=369&view=imagery>, until power was lost at the main communications hub in New Jersey. The glider, however, continued to provide information to the backup communications hub located at Teledyne Webb Research in Massachusetts. Coastal high frequency radar data from North Carolina to Massachusetts were available at <http://maracoos.org/> and at NDBC at hfradar.ndbc.noaa.gov/.
- Stevens Institute of Technology, a MARACOOS partner, provided storm surge forecasts at <http://hudson.dl.stevens-tech.edu/SSWS/>.
- Rutgers University, another MARACOOS member, maintained the blog that explained the accessible data at <http://maracoos.org/blogs/main/>.
- In addition, new state-of-the-art ocean observing equipment, deployed prior to the storm as part of the second leg of an extensive ocean observing technology demonstration project, battled Hurricane Sandy and continued to transmit real-time weather data through winds as strong as 70 knots and accelerating currents greater than 3 knots.
- Throughout the hurricane, a Liquid Robotics wave glider and two Sonardyne undersea nodes continued to transmit temperature and pressure data every ten minutes without failure. The collaboration effort includes Liquid Robotics, Sonardyne, Rutgers University, MARACOOS, and the national IOOS Program Office.

Southeast Coastal Ocean Observing Regional Association (SECOORA):

- SECOORA successfully packaged observations from the National Data Buoy Center (NDBC) and the Center for Operational Oceanographic Products and Services (CO-OPS) in such a way that they were immediately useful to forecasters and the general public on Google: <http://google.org/crisismap/sandy-2012>