NERACOOS Provides Critical Information During Superstorm Sandy

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NERACOOS
NORTHEASTERN REGIONAL ASSOCIATION of COASTAL OCEAN OBSERVING SYSTEMS

Superstorm Sandy

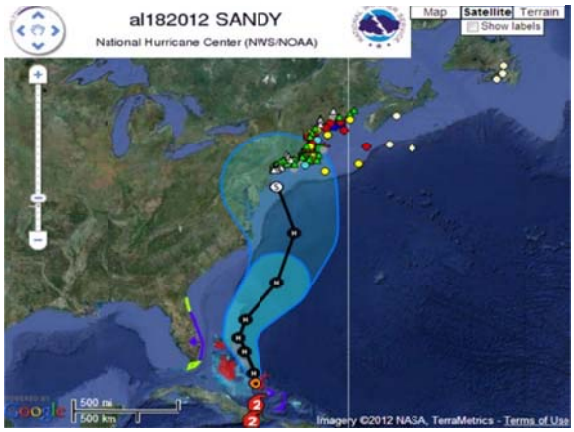
On the 29th of October 2012, Hurricane Sandy combined with a cold front and developed into Superstorm Sandy. The storm came ashore in New Jersey where the wind, wave, and flooding caused extensive damage and power outages in many communities along the east coast. The National Hurricane Center reported that Sandy's tropical force winds extended 820 miles out and that the pure kinetic energy of the storm surge and wave "destruction potential" reached the highest recording ever measured. Sandy caused the deaths of at least 125 people and current estimates suggest that the storm resulted in up to $62 billion in damages, making it the second most costly storm in U.S. history.

Integrated Ocean Observing System (IOOS®) Provides Support

IOOS® INTEGRATED OCEAN OBSERVING SYSTEM

Before and during Hurricane Sandy, observations and models from the U.S. IOOS Regional Associations proved critical to the National Weather Service Weather Forecast Offices along the Atlantic Coast, partner Federal and State agencies, and the public. In addition, critical data and tools were provided by the Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS), the Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS), and the Southeast Coastal Ocean Observing Regional Association (SECOORA).

NERACOOS Delivers Critical Information Throughout Sandy



The delivery tools and information on the NERACOOS website proved to be a critical and reliable resource for responders, forecasters, and citizens in the northeast. As hurricane Sandy churned in the Caribbean, the National Hurricane Center issued its 5-day forecast tracks indicating that Sandy would impact the Northeast. NERACOOS posted these forecast tracks on the real-time data portal to help communicate information about the storm and its potential path to mariners and other stakeholders in the region.

Web traffic to NERACOOS.org increased significantly for all three days of the storm (10/28 to 10/30) and was typically up 300% with a peak of 800% on 10/29. There were over 13,300 page views for the three days with over 50% of the traffic going to the real-time portal and real-time data products.

In the northeast, NERACOOS provides over half the continuous near real-time at-sea assets in the region from Long Island sound to Canada. In Long Island Sound alone, NERACOOS provides all of the at-sea near real-time assets. Throughout Sandy, weather observations from NERACOOS assets were delivered to the National Weather Service and helped feed the models that forecasted Sandy. All buoys were operational during the storm with those in the Gulf of Maine reporting for the duration of the storm. Long Island Sound buoys went offline due to power outages on land. Damage was sustained to one High Frequency Radar (HFR) antenna that measures surface currents from the UCONN group. Data from the UMaine HFR from the national data feed at Rutgers University was down, but was rerouted to the University of California San Diego (UCSD). Coastal High Frequency Radars (HFR) sea surface currents, coastal wave forecasts, and coastal inundation forecasts were all available before the storm impacted the modeling facility.

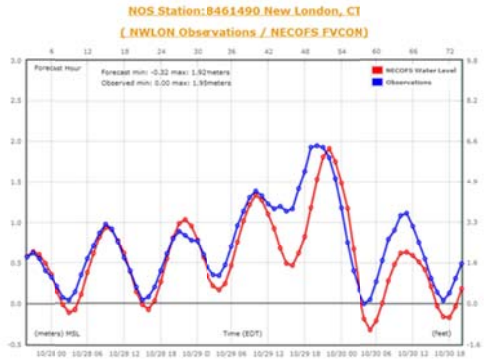
The National Weather Service Weather Forecast Offices in the northeast used NERACOOS information throughout the storm. John Cannon from the Gray, Maine office reported that "the close relationship that NERACOOS and a front line office such as NWS GYX has was really important. I received quick responses in real-time for data requests during the storm, making the support from NERACOOS and others terrific!" John Cannon also noted that the wind and wave data from NERACOOS buoys were particularly helpful during this large storm and allowed operational meteorologists to adjust their forecasts in real-time.

The NERACOOS Coastal Flood Nomogram, a predictive coastal flooding tool, also proved to be particularly valuable to forecasters prior to Sandy's landfall. Animations from the tool suggested that large, battering waves (35 feet) would approach the coast on October 29th, causing erosion and splash-over problems in our more vulnerable exposed beaches (see picture to the right of Camp Ellis, Maine). Indeed that occurred and forecasters were able to adjust their conceptual model for potential hazards associated with Sandy.

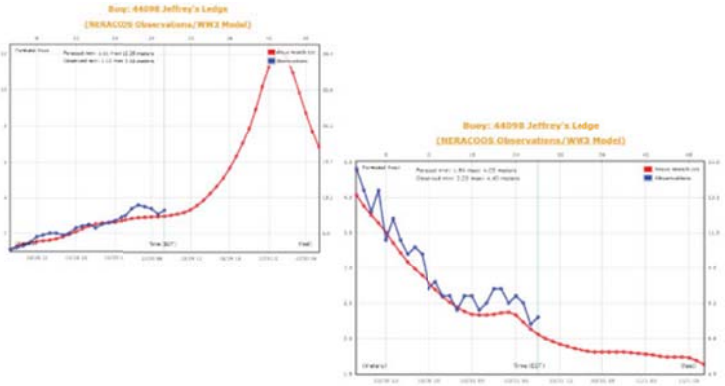
NERACOOS forecast models performed well during the storm. Wave Watch Three (WW3) model was operational during storm but the Northeast Coastal Ocean Forecast System (NECOFS) was offline for a couple of days. Both models showed good agreement with observations. The forecasts performed well in predicting magnitude if not timing. Hardening the forecast system infrastructure so that it does not go down during these events and protecting the hindcasts remains a priority.

Bob Thompson from the Taunton, Massachusetts office noted that "the IOOS buoy data were invaluable for Sandy," and explained further. "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 with refinement of our near term forecasts and then allowed us to go back and adjust our coastal flood forecast impact procedures. We have subsequent to Sandy 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."

In 2011, NERACOOS helped develop the StormReporter into an expanded tool for the region from the initial project in Massachusetts. Bob Thompson explained that the "StormReporter helped us to assess the actual coastal storm impacts along the MA and RI coastline (our forecast area of responsibility). Over 350 StormReporter entries were received from Massachusetts alone! 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."



This storm created flooding and very large waves around the shores of Long Island Sound. Early analysis suggests that the areas flooded were larger than expected based on the FEMA flood zones. NERACOOS supports three buoys with meteorological sensors and wave sensors in the Sound and another overwater station on a lighthouse. These sensors operated successfully throughout the storm in conditions never observed before. Storm surges in Long Island Sound and Rhode Island were between 8-12 feet, which were greater than forecasted by the Northeast Coastal Ocean Forecast System (NECOFS). Highest sustained winds were observed near 70 mph at the CMAN station in Buzzards Bay. Many buoys reported wave heights around 30 feet. The figure below shows how the NERACOOS Model Forecast/Observation Viewer displayed the predicted and observed waves at Jeffery's Ledge. The CDIP wave buoy array includes two buoys in the NERACOOS region (Block Island, ACOE, and Jeffrey's Ledge, UNH), which tracked the storm as it moved up the eastern seaboard (Seymour, Olfe, and Thomas, 2012). The growth of Sandy during its northern travel resulted in peaks in the wave height measured in the Gulf of Mexico (St. Petersburg on 29 October) and the eastern Caribbean (Rincon on 30 October) that occur on or after the date of the wave energy peak in New England (Jeffrey's Ledge on 29 October). The largest single wave that was recorded by this array of buoys was at the Block Island, RI site, and was equivalent to the height of a five-story building. [Seymour RJ, Olfe CB, and Thomas JO, 2012. CDIP wave observations in Superstorm Sandy, Shore & Beach, Vol. 80, No. 4]



Information for Future Planning and Response

As the second most costly storm in U.S. history, Superstorm Sandy proved it essential that weather information and observations continue to be provided for emergency responders and decision makers. Better information means better decisions and preparedness for the next extreme event, resulting in less lives loss and less damage. The NERACOOS data, along with NOAA and USGS, will help improve forecasting and provides critical information to guide future planning for coastal infrastructure protection.