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NorthEast Coastal Ocean Forecast System (NECOFS)

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NorthEast Coastal Ocean Forecast System (NECOFS)

Abstract

NECOFS is a regional forecast model system for the atmosphere, ocean, and surface waves. It includes: 1) the Weather Research and Forecasting (WRF) model for atmospheric predictions; 2) the Finite Volume Community Ocean Model (FVCOM) with the NECOFSv2 grid for ocean states; 3) the FVCOM-SWAVE (FVCOM surface wave model) for wave dynamics; 4) the Massachusetts Coastal FVCOM with the inclusion of estuaries, inlets, harbors and intertidal wetlands; and 5) four subdomain wave-current coupled FVCOM inundation forecast systems in Scituate and Boston Harbor in MA, Saco Bay in ME, and Hampton Harbor in NH.

BOOC Keywords

ocean forecast, ocean modeling, flood forecasting, inundation, offshore wind, coastal resilience, FVCOM, IOOS, NERACOOS

1. Sources and type of data and information used

The regional WRF model is driven by the Global Forecast System (GFS) dataset to provide atmospheric forcing. Ocean boundary conditions are provided by global FVCOM simulations, and wave forcing is obtained from the Global Wave Watch III model. Hydrologic forcing comes from the National Water Model and Water Balance Model. Satellite-derived sea surface temperature and sea surface height data, along with buoy observations of temperature, salinity, and velocity are assimilated into the model. Bottom temperature observations from the Environmental Monitors on Lobster Traps and Large Trawlers (eMOLT) program are also assimilated to improve bottom temperature simulations. The four subdomain inundation models are dynamically nested within NECOFS to provide high-resolution coastal flood forecasts for those regions.

2. Transformation into an actionable information service

NECOFS provides hourly 3-to 5-day forecasts and up to 3-day hindcasts for oceanic, atmospheric, and wave fields. These include ocean temperature, salinity, sea surface elevation, currents, and coastal inundation; wind, precipitation, air temperature, humidity, and pressure; and significant wave height. Forecasts are available for download through a THREDDS server and are visualized on the IOOS Model Viewer.

Links:
https://www.fvcom.org/?p=20
http://134.88.228.119:8080/fvcomwms/

3. Describing the Benefits

Users include: NWS, emergency managers, coastal resource managers, resilience planners, underserved and frontline communities, water quality managers and monitoring systems, oyster growers, the wild harvest shell fishing industry; bath iron works used for sea level rise; Bureau of Ocean Energy Management (offshore wind).

Benefits cover the following areas: Delaware Shelf to the eastern end of the Scotian Shelf.

Specific use case #1: Bureau of Ocean Energy Management (BOEM) used the hindcasting and forecasting capabilities of NECOFS to provide

comprehensive temporal and spatial simulations of wind energy impacts on proposed areas of offshore wind energy development. Additionally, a sub-domain of FVCOM that included proposed wind turbines with a boundary connected to NECOFS was developed.

Specific use case #2: General Dynamics Bath Iron Works (BIW), located on Kennebec River Estuary, ME, faces significant flooding risks due to sea level rise, particularly affecting critical infrastructure along the waterfront. To support their operations, they required an improved short term (2-4 day) water level forecast system to anticipate extreme water levels during storm events.

Specific use case #3: NECOFS provided real-time predictions of wind, air pressure, significant wave height, and water elevation during the Super Nor'Easter PI event on March 14-15, 2017. These forecasts supported multiple operational and planning activities.

The U.S. Coast Guard used NECOFS predictions to assess the potential impacts of extreme weather on offshore wind farm monopiles, informing the navigational safety and emergency response planning for Coast Guard assets during a storm. In addition, NOAA and NERACOOS utilized NECOFS outputs, including a newly developed inland river/ocean coupled model, to study the risks of compound coastal and riverine flooding. These predictions helped inform coastal flood advisories and supported emergency management decisions aimed at reducing flood risk in vulnerable coastal communities.

Through these collaborations, NECOFS predictions contributed to improved situational awareness, proactive risk assessment, and more informed response actions during the event.