Numerical Modeling to Assess the Changing Coastal Risks from Nor'easters with Sea Level Rise in New England

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Nor'easters generate extreme winds, waves and storm surges that threaten the natural and built environment as well as public safety in coastal regions. Sea level rise will change these processes, which will in turn change the associated impacts such as coastal flooding. Furthermore, without mitigation or sufficient adaptation, the rising sea levels alone will increase the frequency and severity of coastal flooding from tides. These evolving threats pose challenges to DHS that are twofold, (1) understanding the vulnerability of their own facilities, infrastructure and populations and (2) understanding the broader range of impacts such that FEMA can continue to effectively understand, plan, prepare and respond to these threats. Therefore, it is imperative to understand these coastal hazards and their corresponding impacts for present and future conditions.

Coastal Resilience Center (CRC) researchers from the University of Rhode Island Graduate School of Oceanography (URI-GSO) are supporting DHS by studying coastal processes using numerical models. A coupled ADCIRC/SWAN model application is used for simulations. The application integrates a refined grid with high resolution in the New England coastal regions. The present analysis is focused on the northeast of Cape Cod, where the landform is a narrow hook shaped peninsula with unique vulnerabilities due to its storm exposure and relatively great shoreline to land ratio. Hindcast simulations of the high impact January 2nd- 6th 2018 nor'easter are performed for present sea level and with 1.0 meter (3.3 feet) of sea level rise added to the mean sea level. The model predicts the total water level, currents and wave heights. The inundation footprints and associated depths over land are mapped using the bottom topography and model predicted water levels for each scenario. A comparative analysis is performed to quantify the impact of sea level rise on total water level and wave heights at specific locations.