

UNSTRUCTURED MODELING OF COASTAL WAVES

Need



Surface gravity waves near the coast drive nearshore circulation, wave setup, and sediment transport. Wave forces along with resulting hydrodynamics and sediment transport are critical to coastal engineering design, operation and maintenance of shore protection structures, beach restoration, harbors, and channels. Resolving these processes requires high wave model accuracy, resolution, and efficiency, as well as tight coupling with circulation and sediment transport models through the Coastal Storm Modeling System (CSTORM). Large regional studies focused on flood and coastal storm risk reduction in particular require flexible wave model gridding to resolve complex shorelines efficiently.

Approach



This R&D project is upgrading the community phase-averaged wave model WAVEWATCH III (WW3). The approach includes:

- Model improvements: unstructured grid, implicit solution, domain decomposition, and improved memory management
- Validation for nearshore application
- Coupling to circulation and sediment transport models in CSTORM
- Documentation and technology transfer

Validation of WW3 in the nearshore has applied data collected at the Field Research Facility, focused on both hurricane (Irene and Sandy) and extratropical events. Model development and validation has included close collaboration with NOAA National Centers for Environmental Prediction. Model development is consistent with the CHL numerical modernization plan.

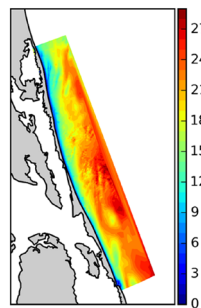
Outcomes



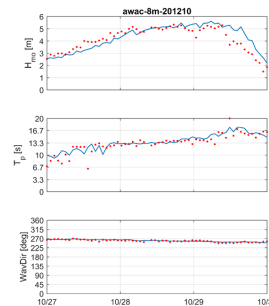
The WW3 upgrades provide improvements in state-of-the-art wave modeling technology that will be accessible to District users (through SMS and CSTORM), but also benefit the larger international WW3 user community. The model provides flexibility in gridding, state-of-the-art physics, and application efficiency. Improvements to WW3 will benefit District flood risk management, navigation and ecosystem restoration projects that require modeling of the nearshore waves to estimate flood risk, sediment transport or navigability, as well as the Wave Information Studies, CSTORM, and the Coastal Hazards System.



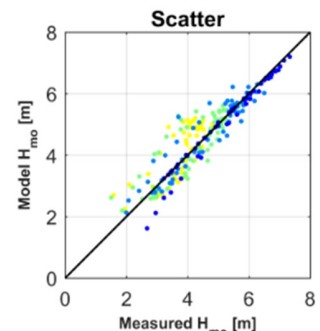
Hurricane Sandy Track



Nearshore grid, Duck, NC



Sandy Validation
results at 8 m depth



Sandy Validation at
all FRF gauges

More Information

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For more information on FRM R&D, see the ERDC FRM wiki:
https://wiki.erdc.dren.mil/Flood_and_Coastal_Storm_Damage_Reduction_Research_Program