

Improving NOAA's Capacity to Address Coastal Inundation Events

Collaborating via NOAA's Storm Surge Roadmap

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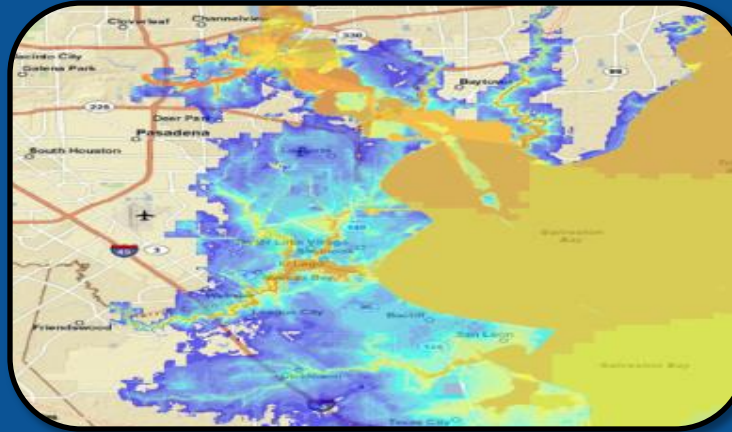
Storm Surge Roadmap Portfolio Manager

NOS/Office of Coast Survey/Development Laboratory

Office of Coast Survey



The Vision



Modeling's role is
to provide
information to
those who assess
and communicate
risk...

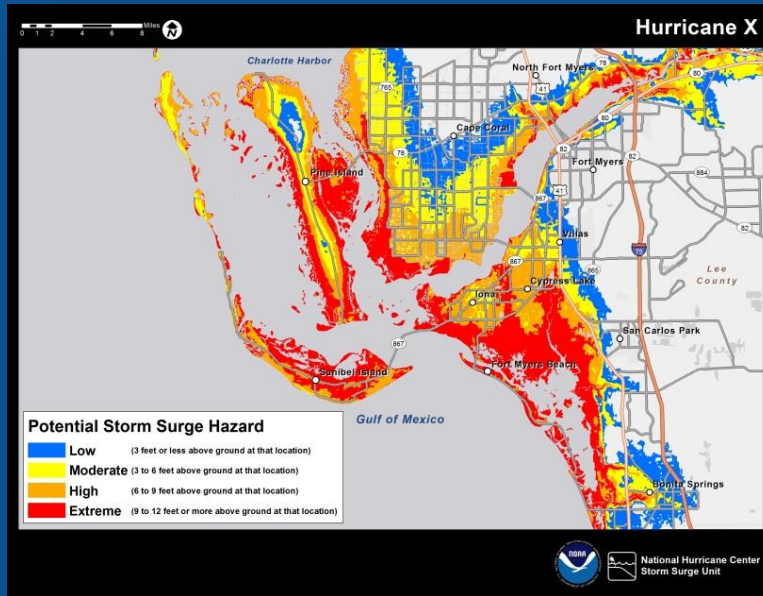
Highly accurate, relevant, and timely information

CLEARLY COMMUNICATED

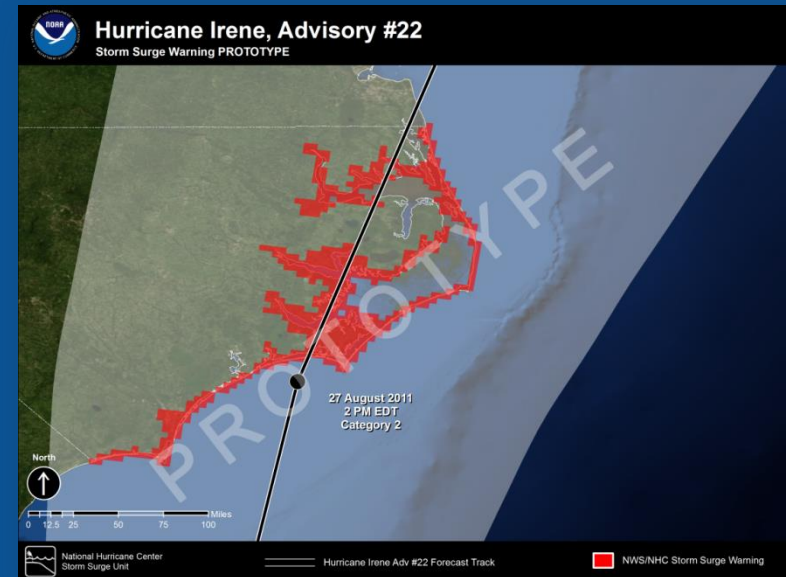
Operational
products

which results in reductions in loss of life and
ensures communities are resilient

New Operational Products Emerging



TC inundation map will
be experimental in 2014



TC storm surge warning will
be experimental in 2015

Products will later be expanded to ET storms

Operational Modeling Requirements

- Emergency managers and decision makers rely on official NWS forecasts to support tough decision-making during crisis events
 - Take care not duplicate or conflict with official forecasts; user confusion can lead to inaction or poor decision-making
- NWS forecasters rely heavily on operational model guidance within AWIPS system
 - Accessing external data can be challenging, confusing, and time consuming, particularly in event
 - Confidence may be low due to unfamiliarity



Model Advancements Prioritized by NOAA's Storm Surge Roadmap

- Storm surge model predictions that are:
 - Ensembled and/or probabilistic
 - High resolution
 - Able to capture dynamics of large scale storms
 - Model total water level of flooding event: surge, tides, waves, and river inflow
 - Community-based to leverage multi-agency investments



Improving Operational Predictions

- NOS and NWS are developing and operating multi-model ensembles of tropical and extratropical surge
 - NOAA is leveraging extensive federal investment in the SLOSH and ADCIRC storm surge models
 - SLOSH uses simplified physics and an efficient numerical scheme to run extremely quickly, enabling a large number of ensemble runs to generate probabilistic predictions
 - ADCIRC uses advanced physics and a complex numerical scheme to provide high resolution, high fidelity predictions which are costly to compute, minimizing ensemble members

Transitioning Models to Operations

- NWS operational system prioritizes robustness
 - 99.9% uptime using well-vetted and tested models within hands-off robust computing system
 - Standardized model skill assessment and testing before transition to operations
- Development “pipeline” to operations



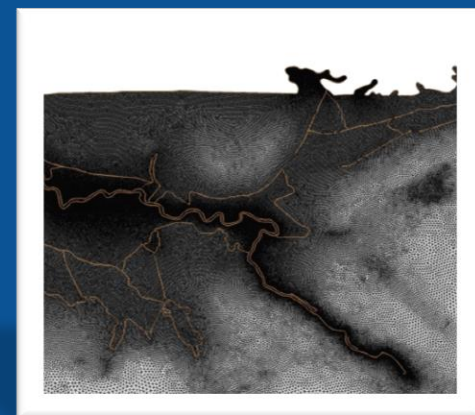
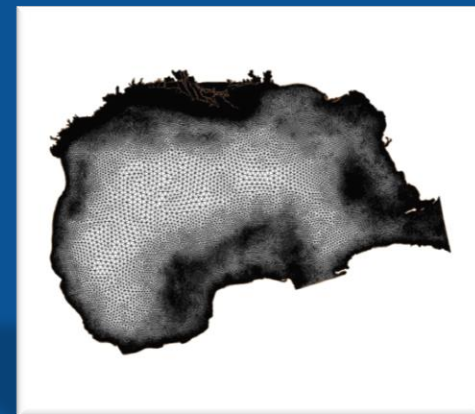
Contributions from IOOS RAs

- RAs provide access to advanced science and a focus on local issues (e.g., local resolution)
- Can consider federal modeling transition groups an important customer
 - Understand operational requirements and consider them during planning
- Use of community-based models, standards and frameworks shortens transition to operations
 - Common data format and dissemination can speed use before operations



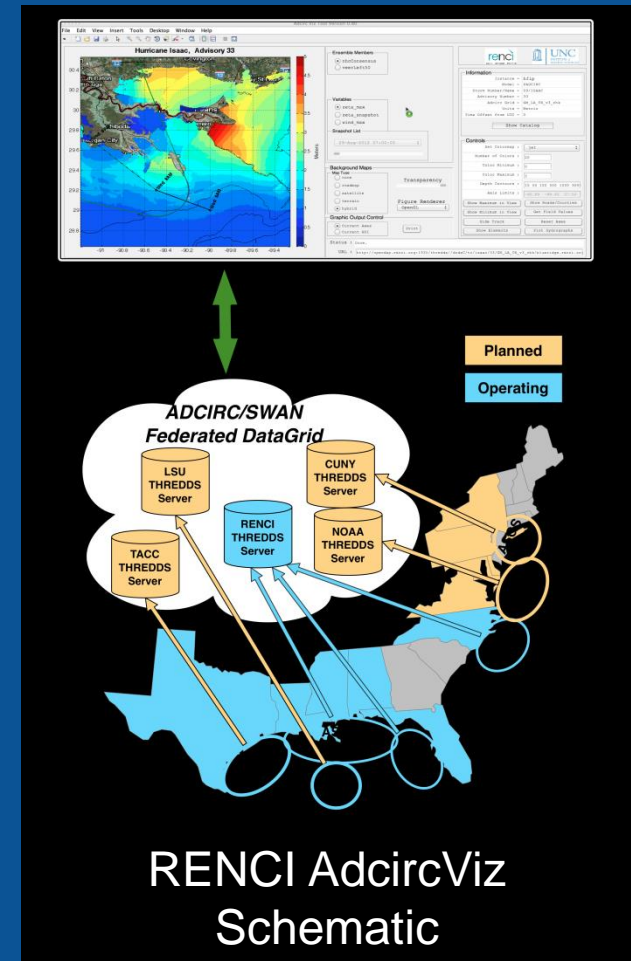
Experimental High Res Surge Ensemble

- ADCIRC Surge Guidance System
 - Automated system for ADCIRC surge predictions
 - Forced by NAM or NHC advisories
 - Utilizes community library of ADCIRC grids
 - Supported from USACE and DHS; maintained by researchers at UNC-CH
- Perturbs official NHC forecast
 - Official forecast track, wind speed increase, veer halfway/fully to edges of cone, slower forward speed, change in R_{max}

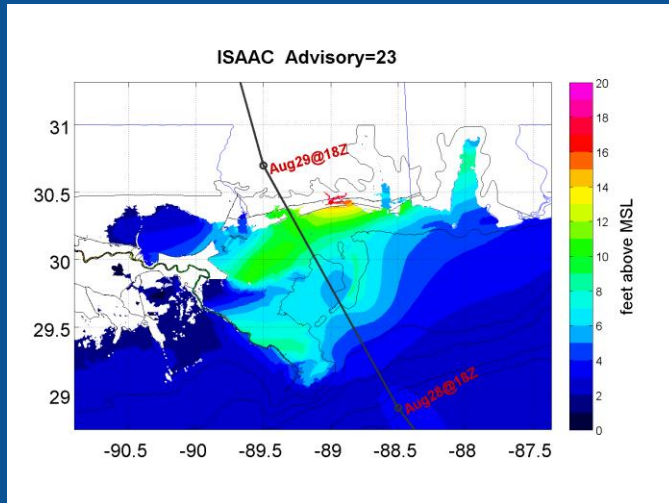


Dissemination of Surge Predictions

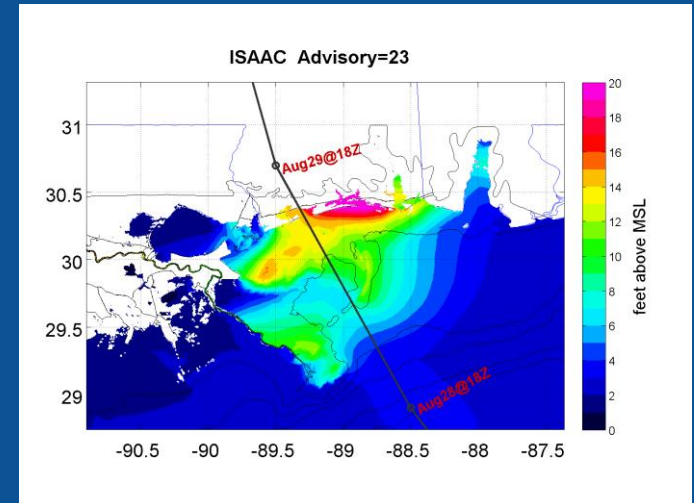
- RENCI has developed MATLAB-based tool “ADCIRCViz” to display NetCDF results
- Accesses runs from NOAA and elsewhere via THREDDS servers
- Supported by Joint Hurricane Testbed for testing at NHC in FY14-15



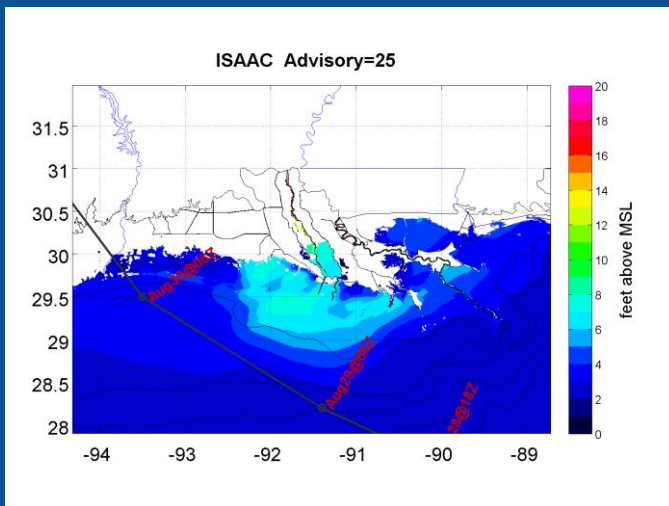
Ensemble Forecast to Address Track Uncertainty



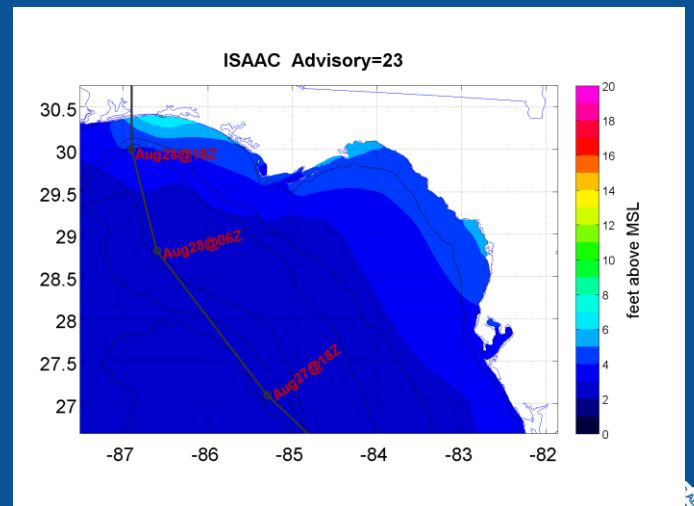
Official Track



20% More Intense



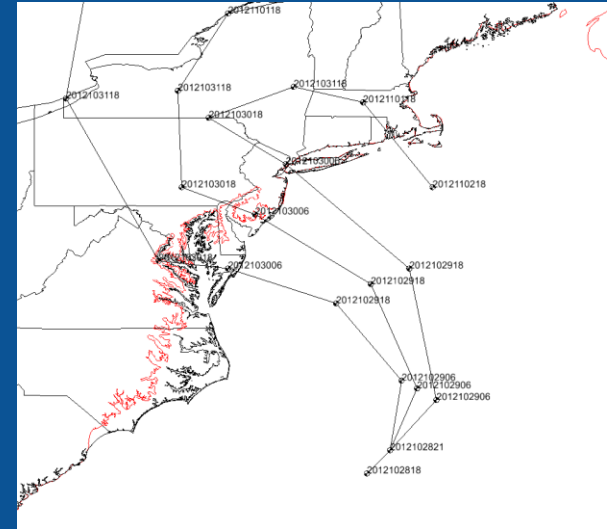
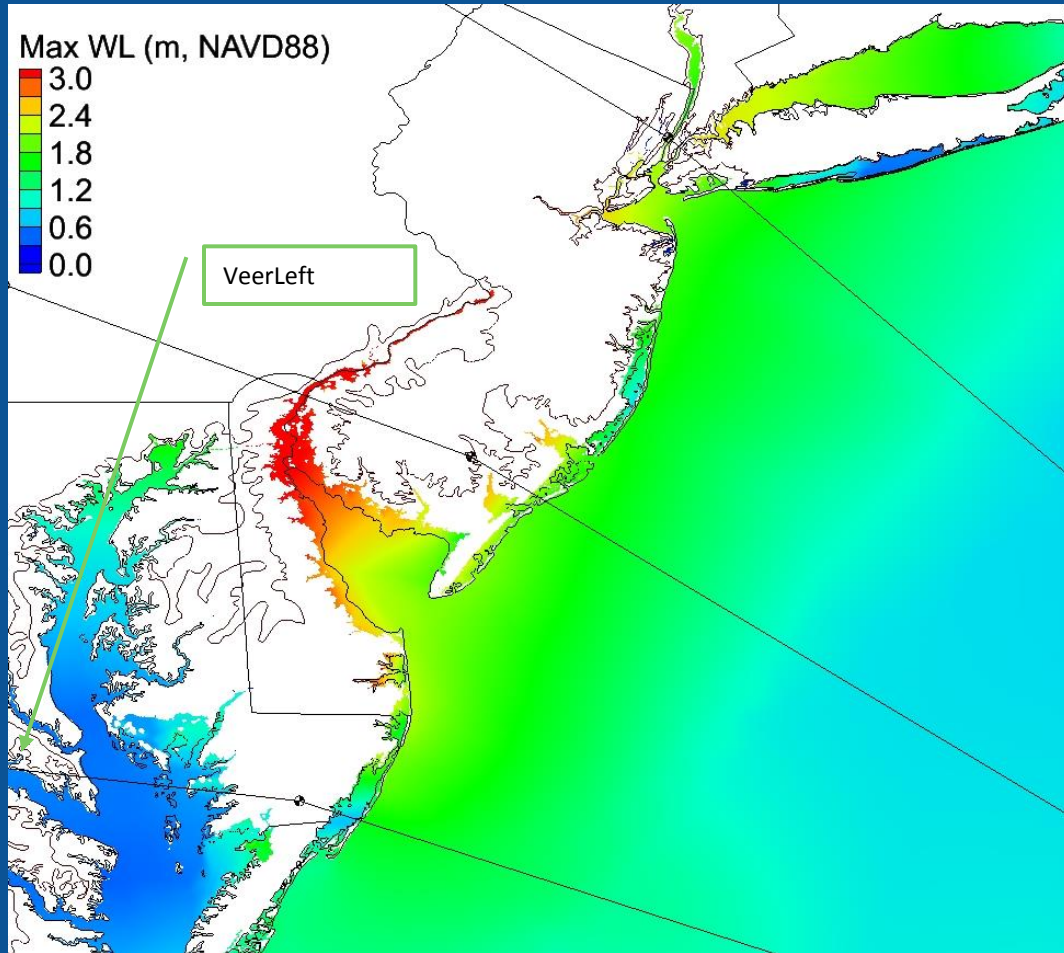
Left shift



Right Shift

Testing Simulation of Sandy's Surge

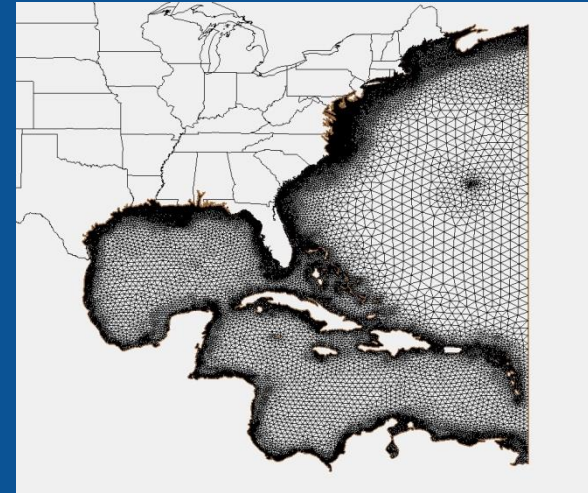
Advisory 26 (10/28/2012 18Z)



Experimental
predictions of
Hurricane/Post-
Tropical Storm
Sandy for 5
ensemble members

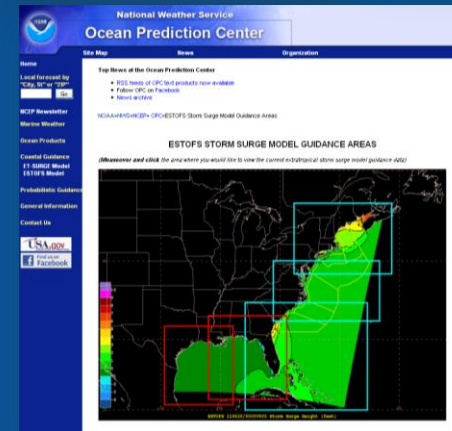
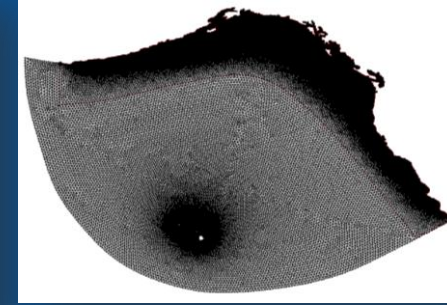
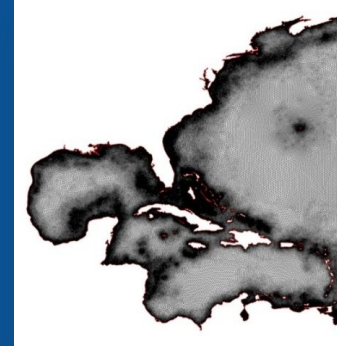
Improvements to Operational Models

- **NOS operational modeling upgrades**
 - ADCIRC unstructured grids capture large storms like Sandy while providing local coastal resolution
 - Combine effects of surge and tide
 - An ensemble of 5 to 10 members is used to address forecast uncertainty
 - With Sandy Supplemental funding a 500 m resolution grid will become operational in FY15



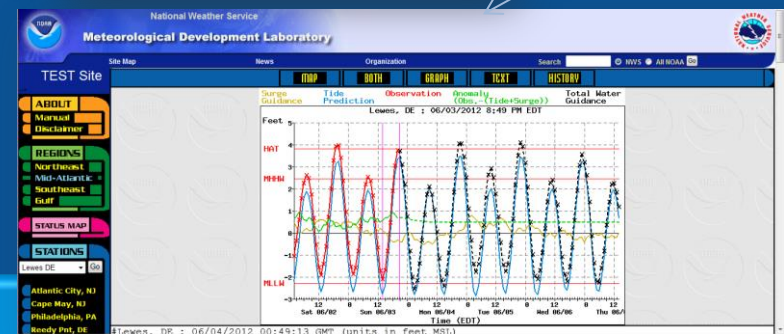
Extratropical Surge and Tide Prediction

- Extratropical Surge+Tide Operational Forecast System (ESTOFS)
 - Atlantic operational in 2012; Pacific in 2014
 - Uses ADCIRC to provide surge, tide, and combined water level 4 times per day out to 180 hours using GFS wind and sea level pressure forcing
 - Provides coastal water levels for forecasting and for coupling to nearshore wave prediction system
 - Basin scale with coastal resolution around 3 km means not designed for local estuaries



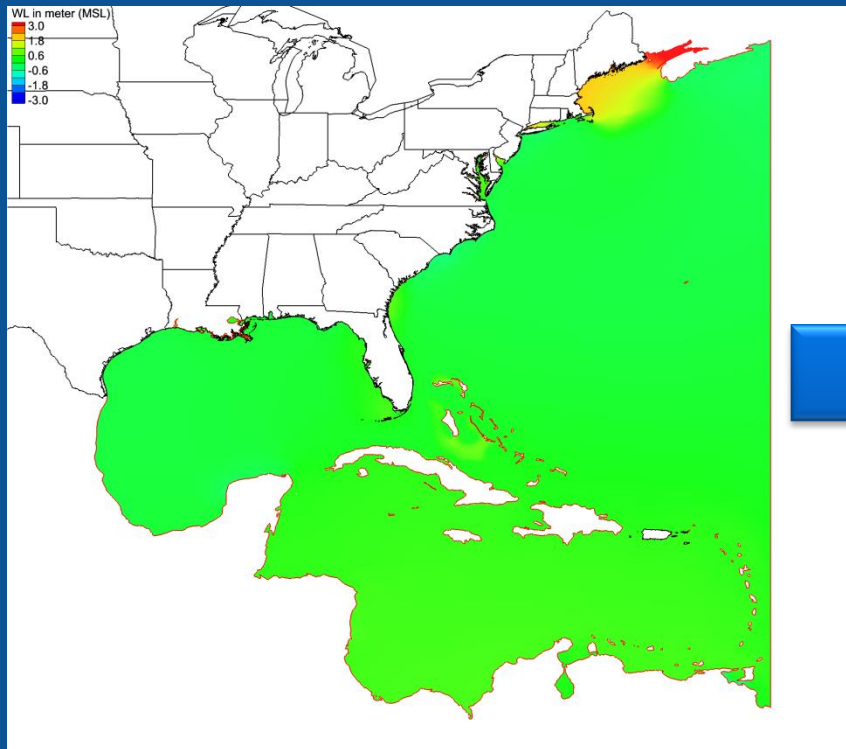
animations

hydrographs

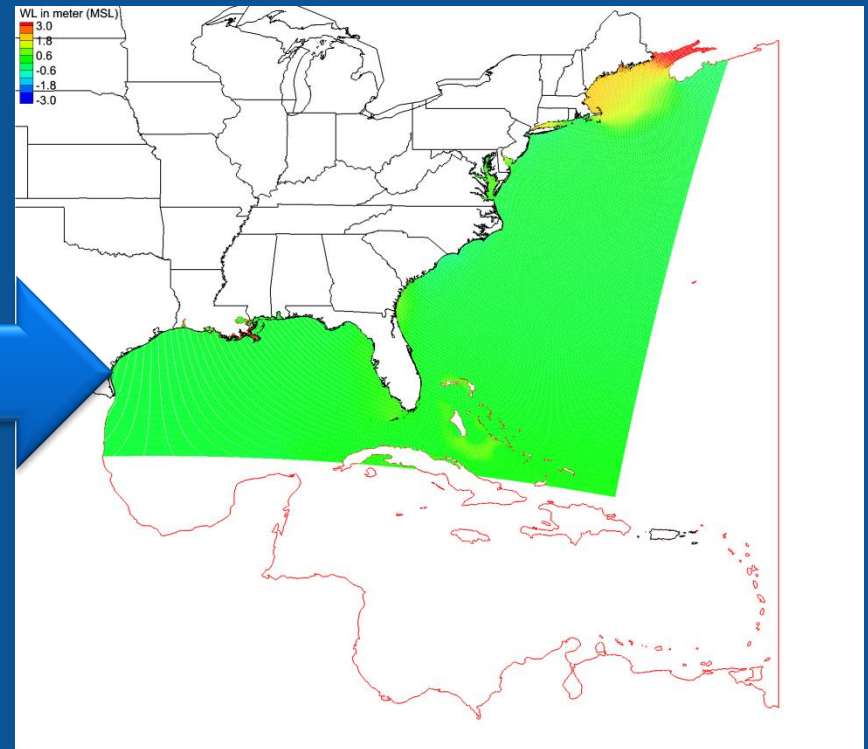


Interpolating Water Level Fields to AWIPS-friendly Formats

EC2001 grid (NetCDF)



NDFD 2.5 km CONUS grid (GRIB2)



IOOS Testbed: using Community-Based Models to Improve Operations

- Provides shared, systematic methodology for evaluating benefits of research models for transition to operations
- Coastal inundation subgroup
 - First phase provided SLOSH coupled to SWAN wave model, ADCIRC surge guidance system
 - Now in Puerto Rico to study steep sloped wave-driven inundation: ADCIRC+SWAN, SLOSH+SWAN, ADCIRC+WW3



