

Preparing for the Storm: NOS Predictions of Extreme High and Low Water Levels

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Development Laboratory

Extreme Water Levels Severely Impact Marine Transportation



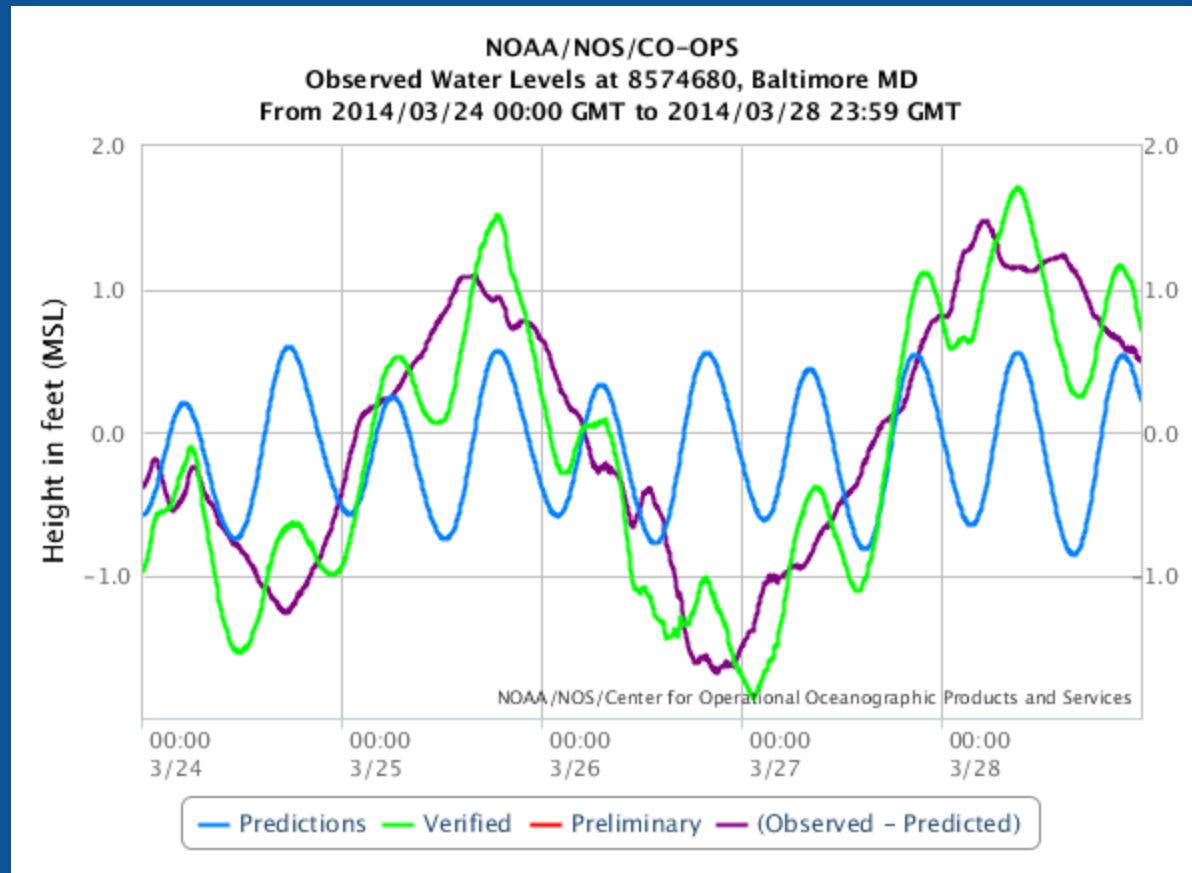
Strong wind events can drive a set-down that reduces under keel clearance



Storm surge flooding can cause havoc to assets along the coast

Margin for Error is Small

With small tolerances for underkeel clearances, water drops of a few feet can restrict commerce and affect safety



Operational Modeling to Predict Water Level

Tidal Prediction

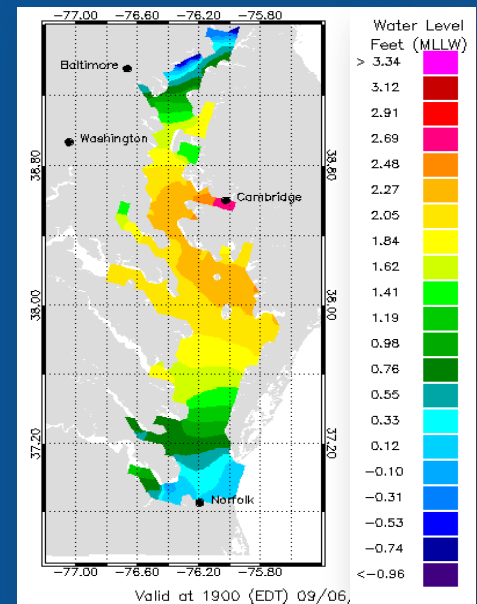
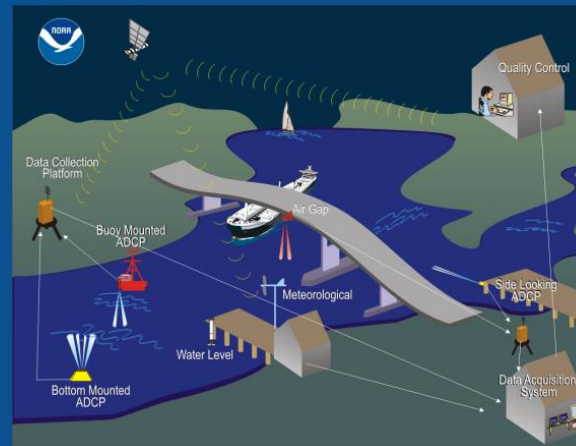
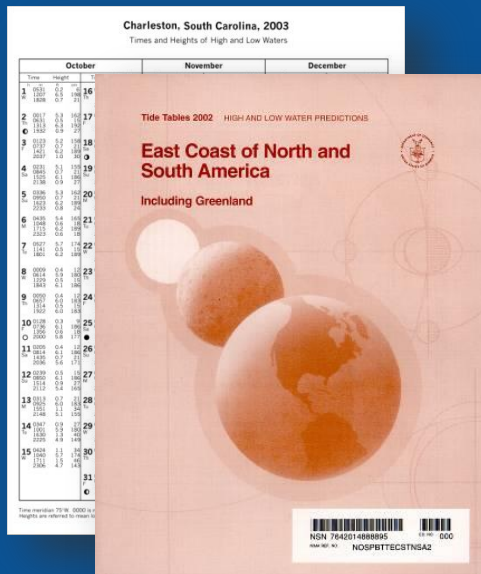
Tables provide only *astronomical* tide & tidal current predictions. Wind, river, and density effects are not included.

Real-time Data

Wind, river, and density effects included in the data but information is only for the time and location of measurement.

Operational Forecast Systems

Spatially distributed water levels & currents going out into the near future.



NOAA Partnership for Coastal OFS Projects

Concept of Operations (CONOPS)

NOS/CO-OPS

- System Transition to Operations, Maintenance and Routine Update
- Product Generation and Service Delivery

NOS/OCS

- OFS Development and Testing

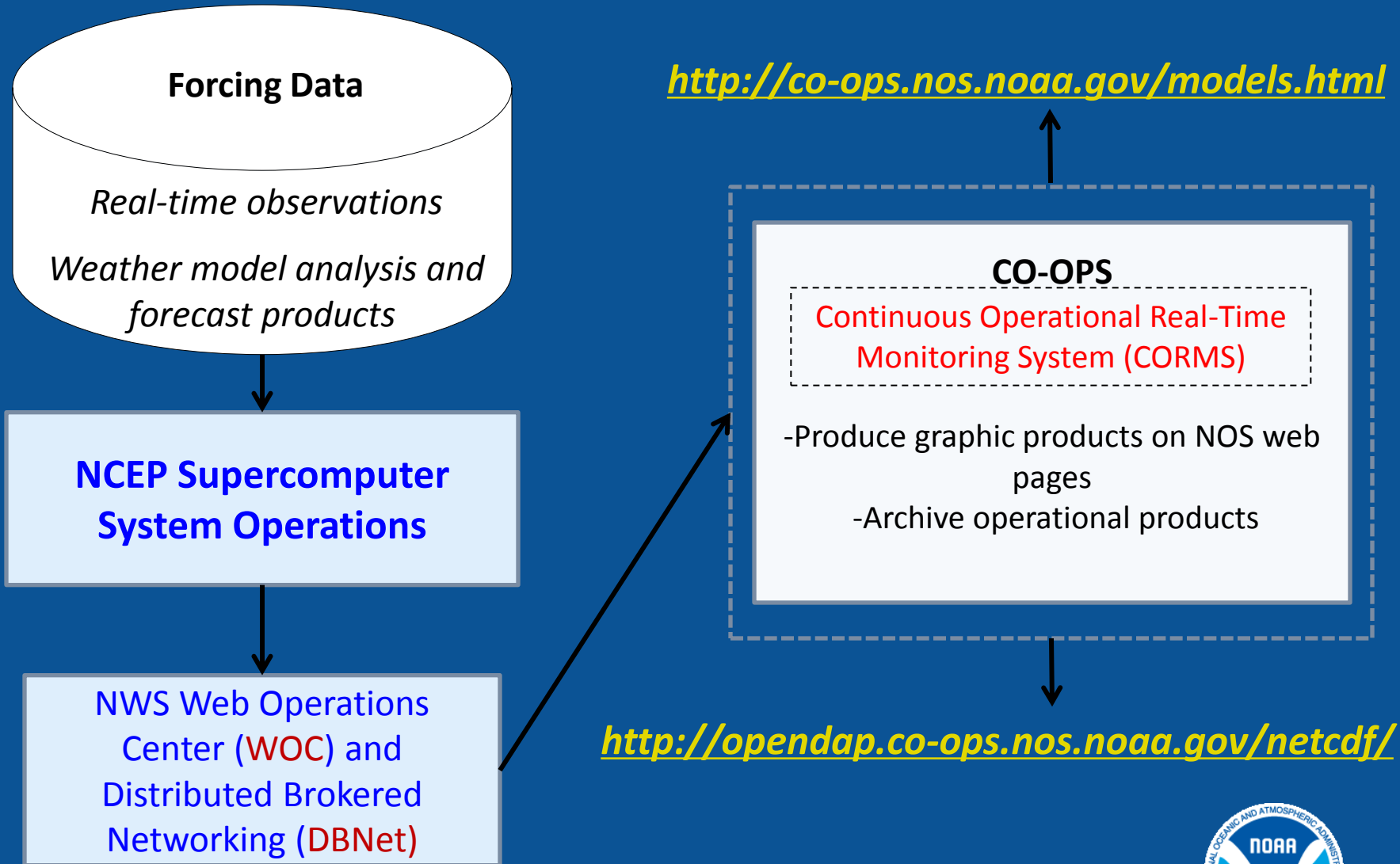
NWS/NCEP

- Operate NOAA's Computer System
- Output Delivery

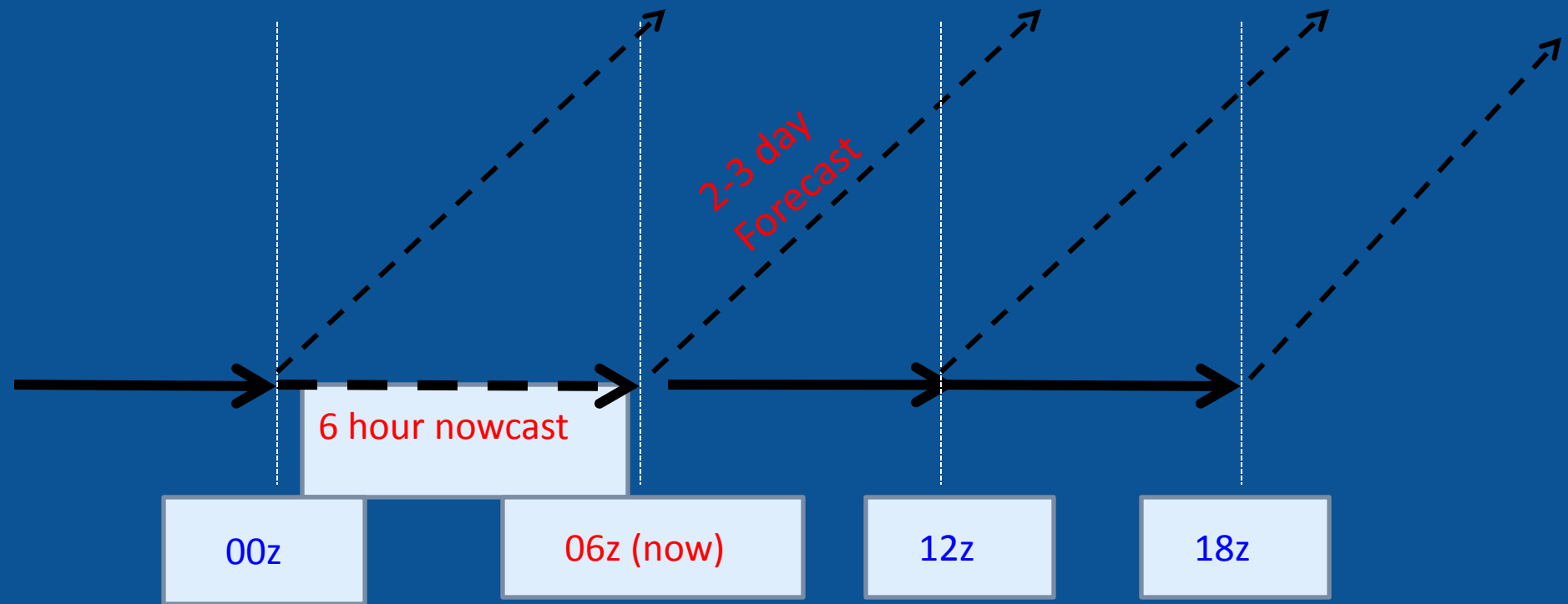
NOAA Weather and Climate Operational Supercomputing System



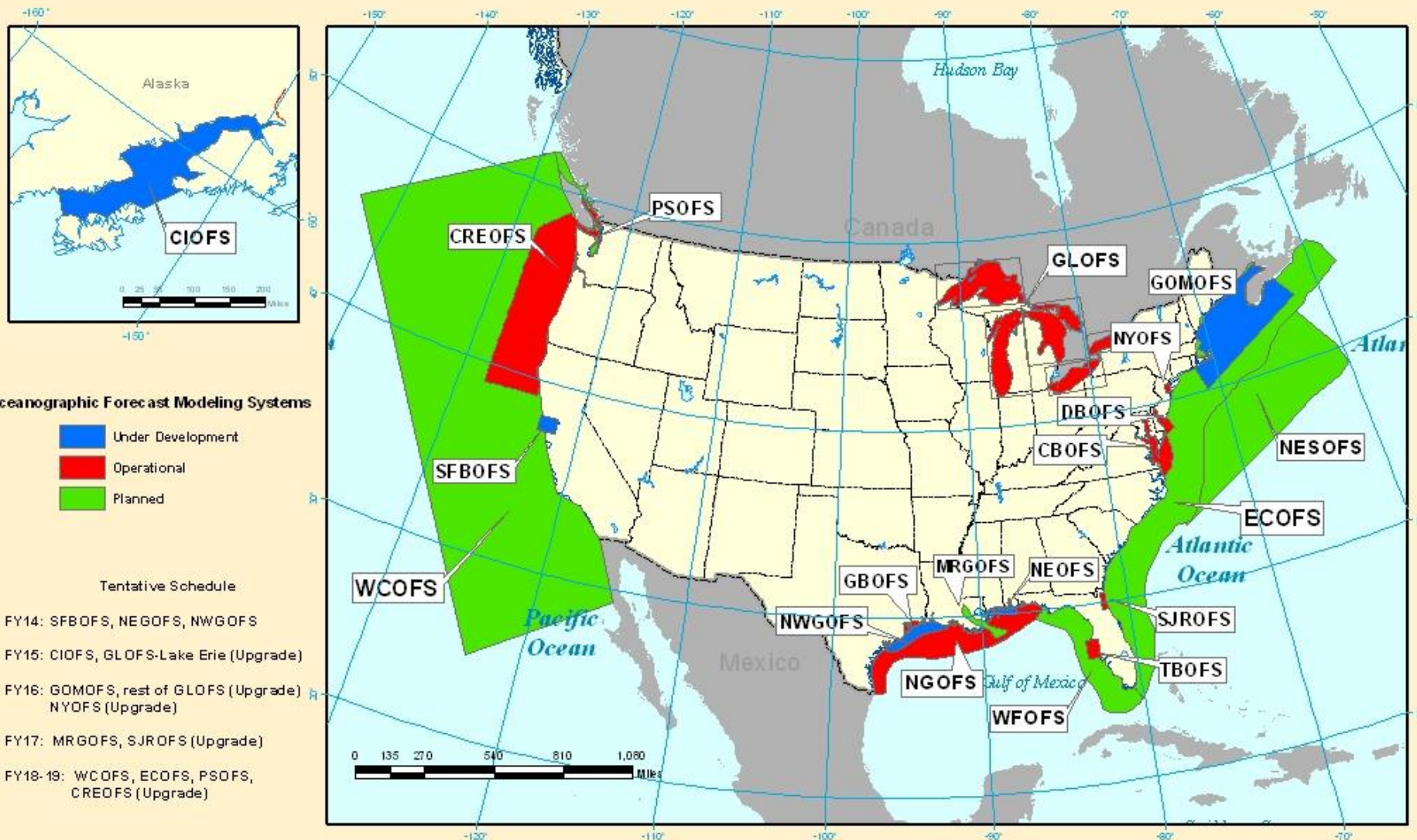
OFS Operational Data Flow



Typical OFS Nowcast/Forecast Schedule

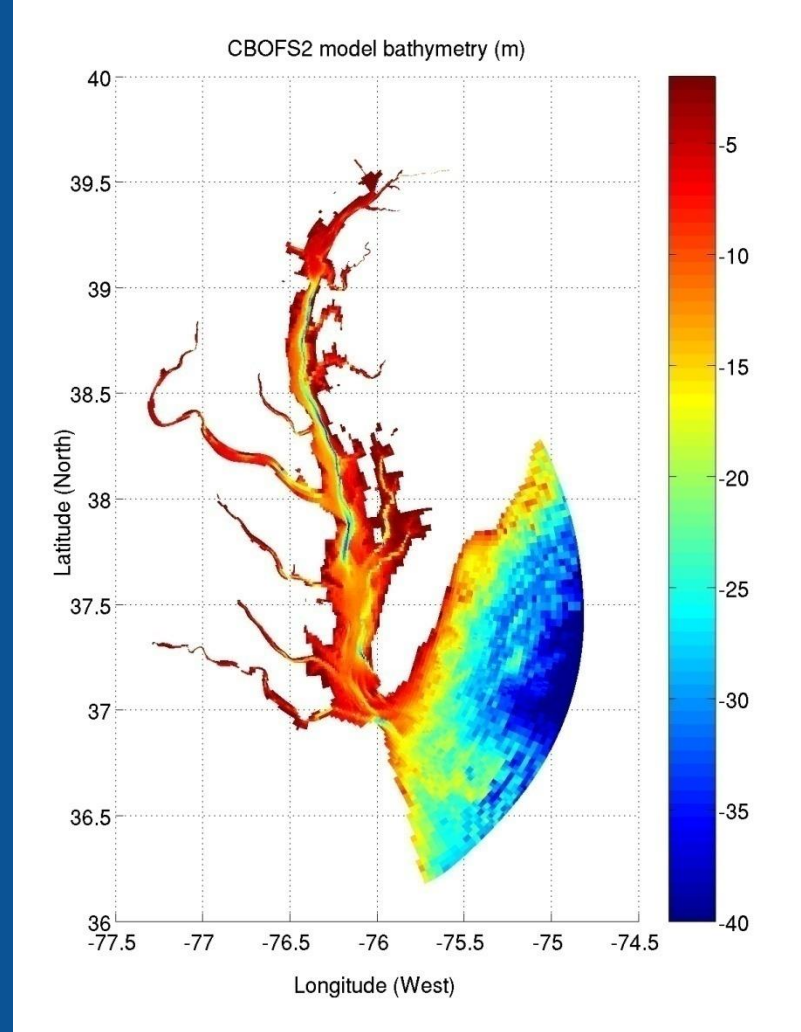
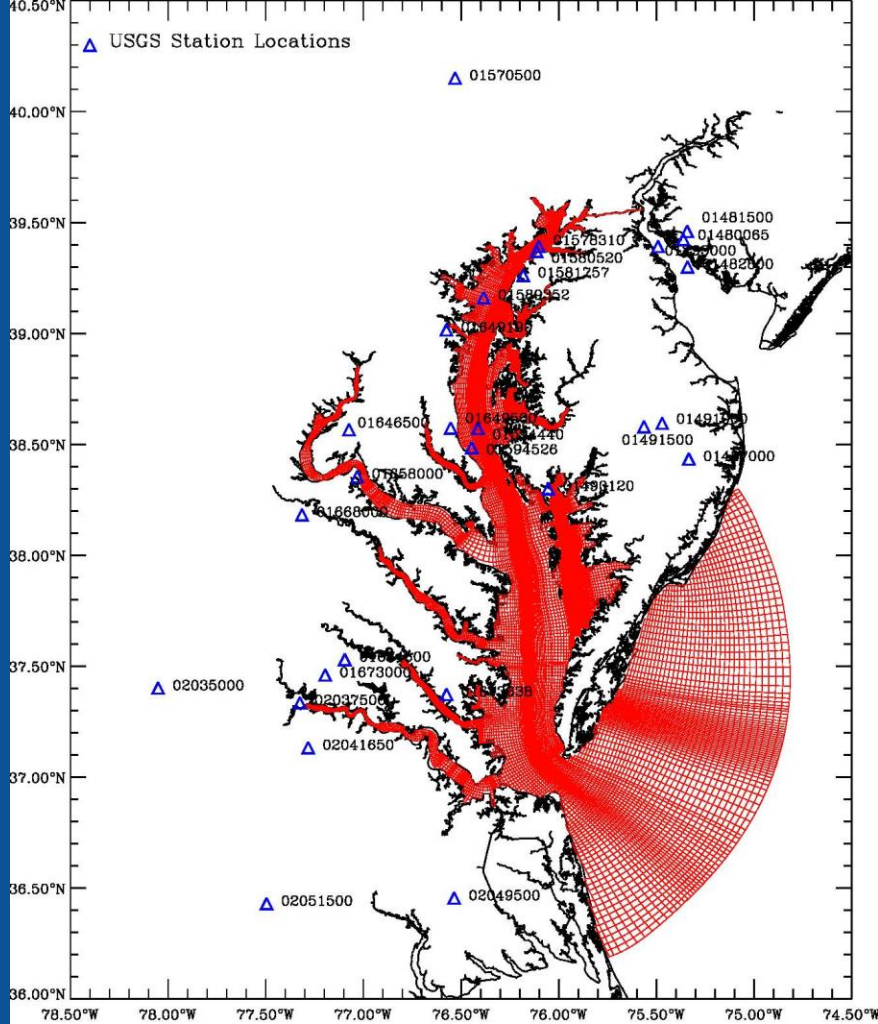


2-3 day forecast updated 4 times per day



NOAA/National Ocean Service Operational Coastal Modeling Implementation Strategy

*Subject to Revision by NOS Management Based Upon Stakeholder Needs & Budget Opportunities.
January 15, 2013*



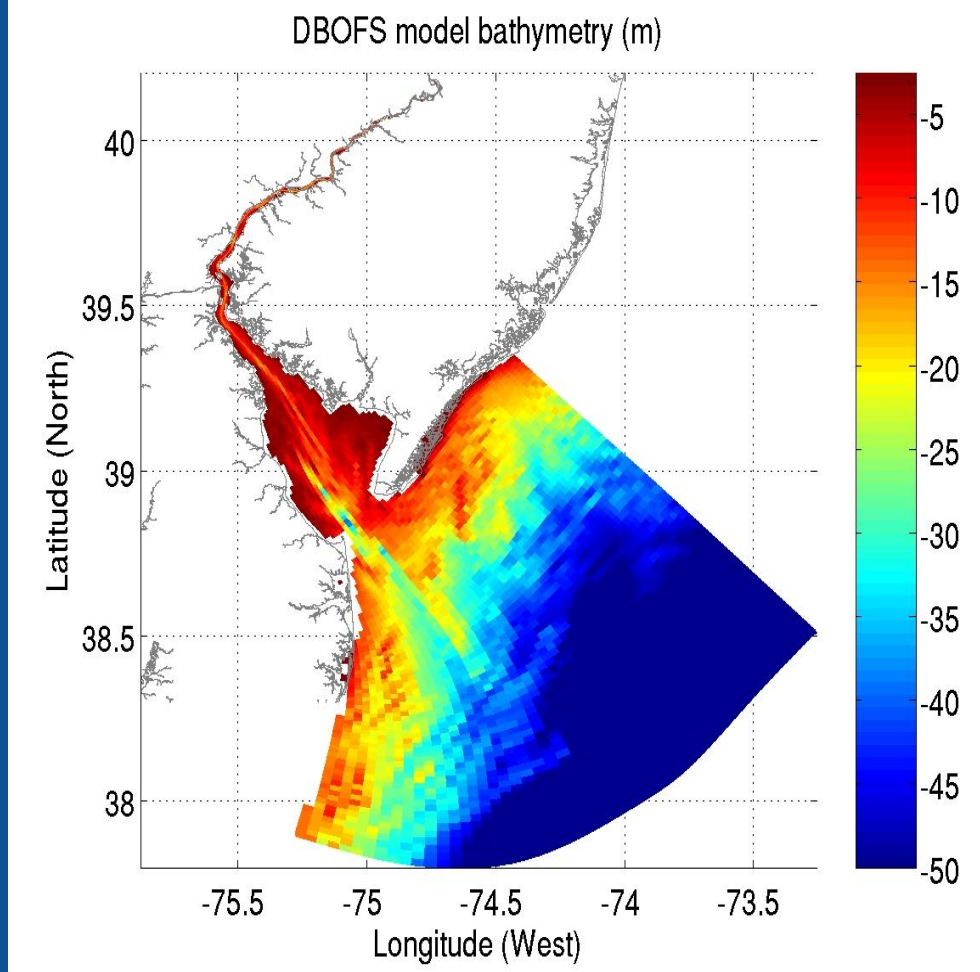
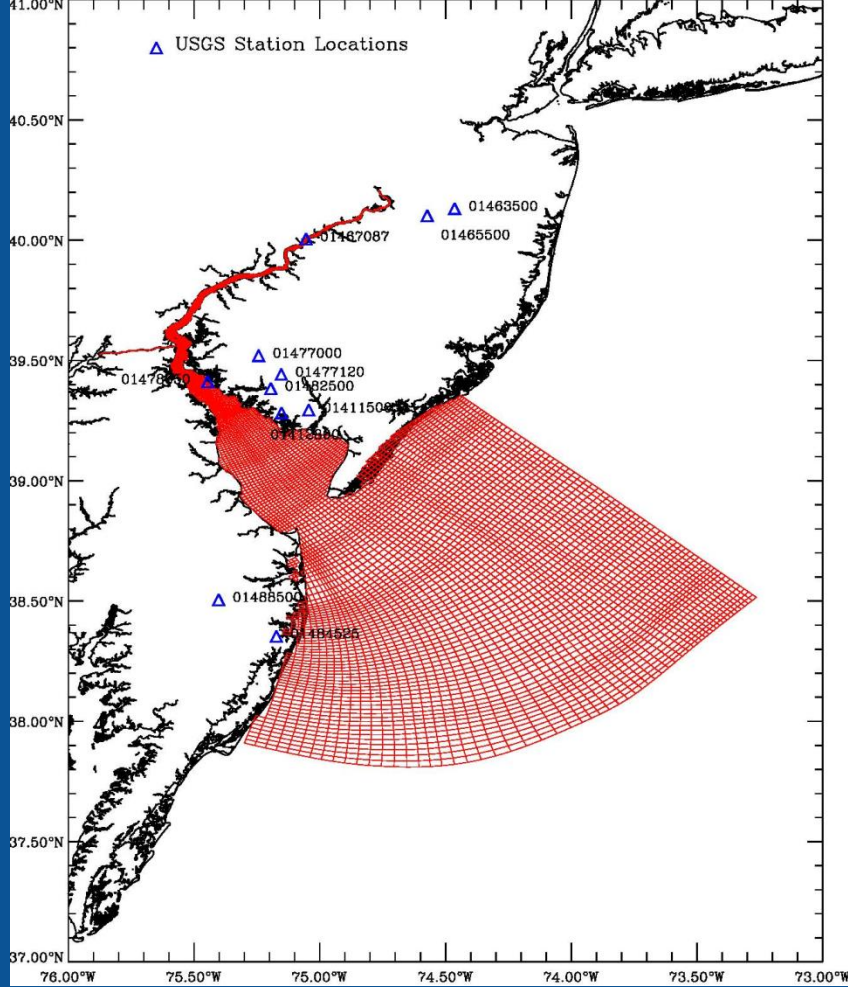
Chesapeake Bay Operational Forecast System (CBOFS)

Dimensions: 291 x 332 x 20
Res. 50 m – 5 km

- 48 hour forecasts of water levels, currents, T & S
- ROMS model implementation

Office of Coast Survey





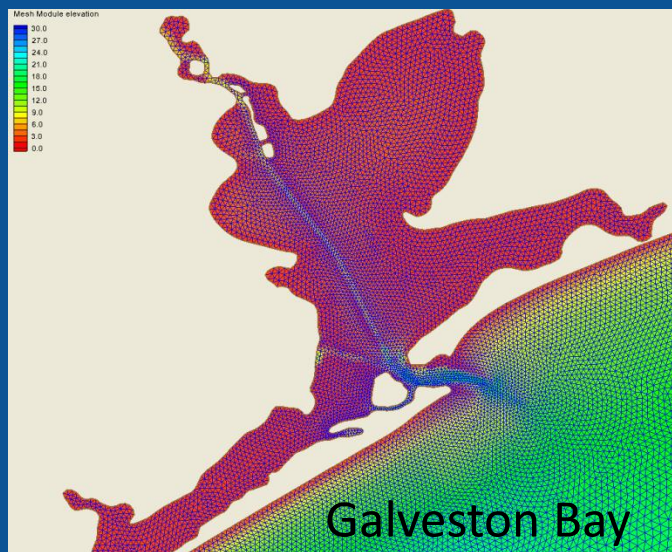
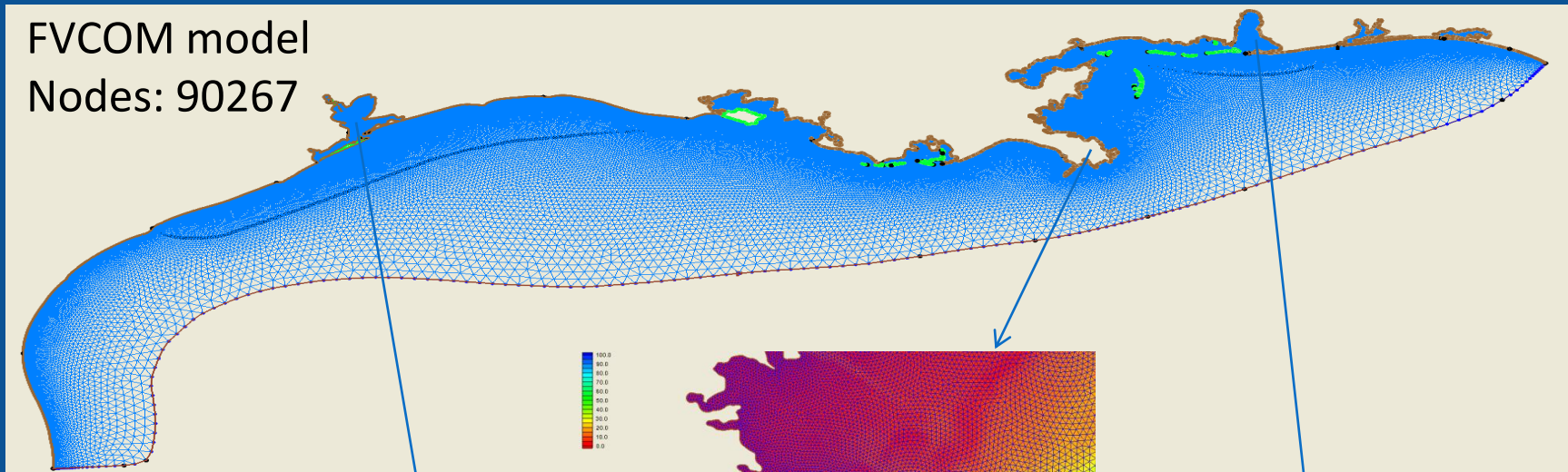
Delaware Bay Operational Forecast System (DBOFS)

Dimensions: 119 x 732 x 10
Res. 100 m – 3 km

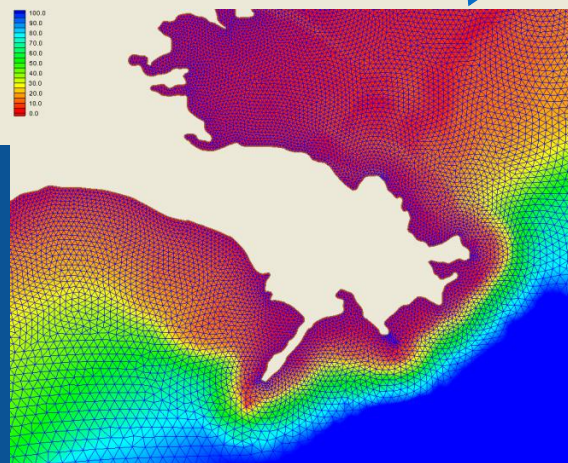
- 48 hour forecasts of water levels, currents, T & S
- ROMS model implementation

Northern Gulf of Mexico Operational Forecast System (NGOFS)

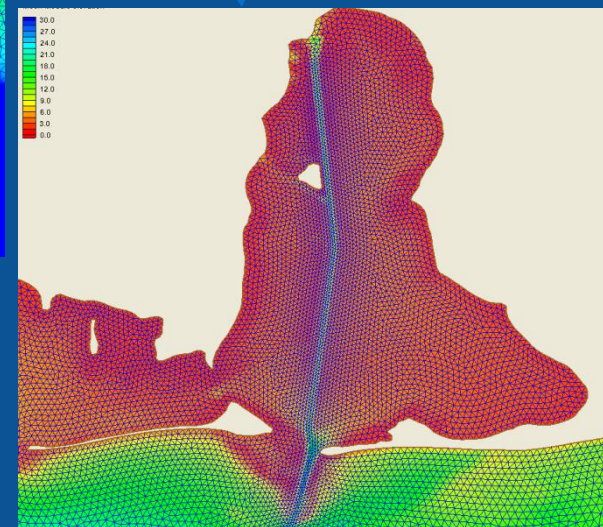
FVCOM model
Nodes: 90267



Galveston Bay



Mississippi Delta



Mobile Bay

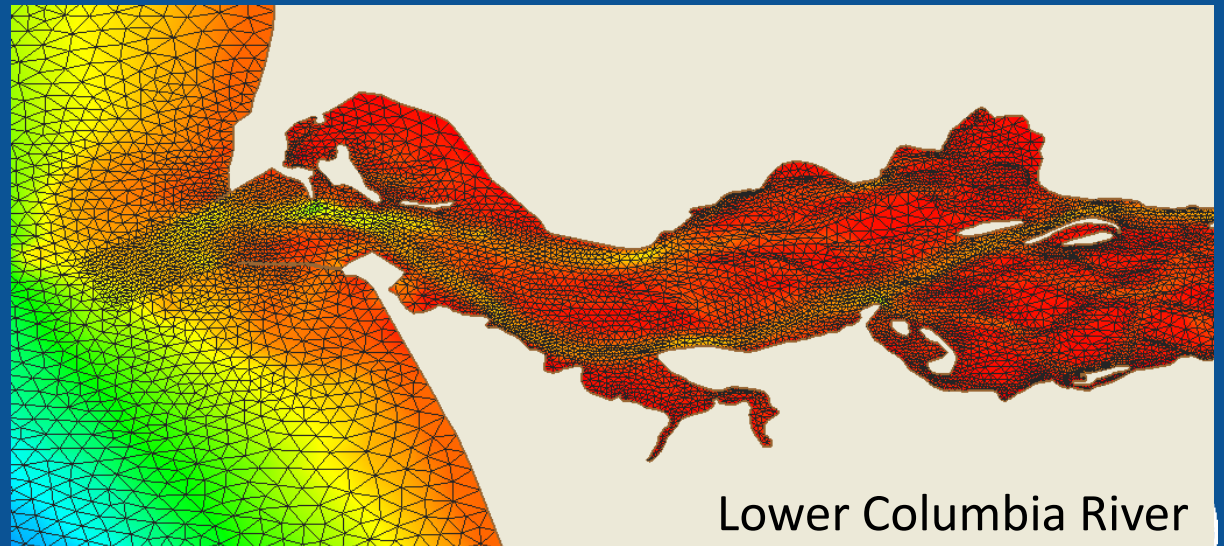
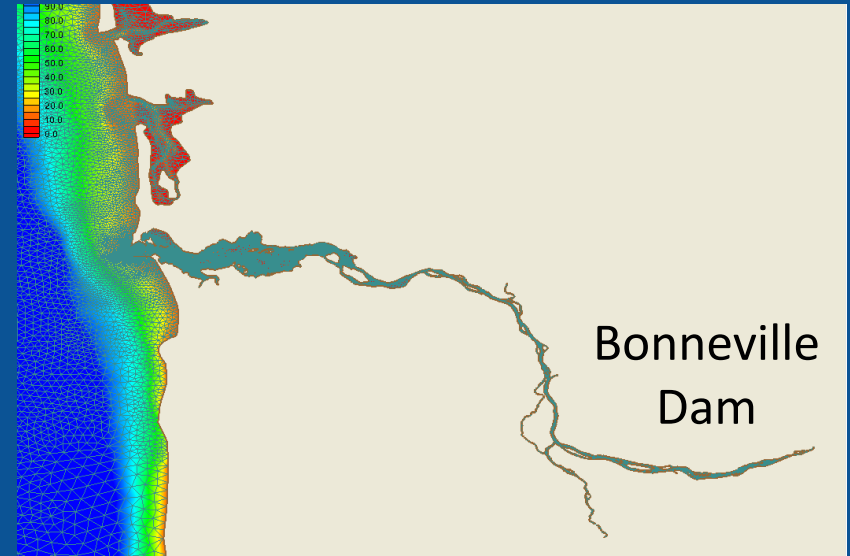
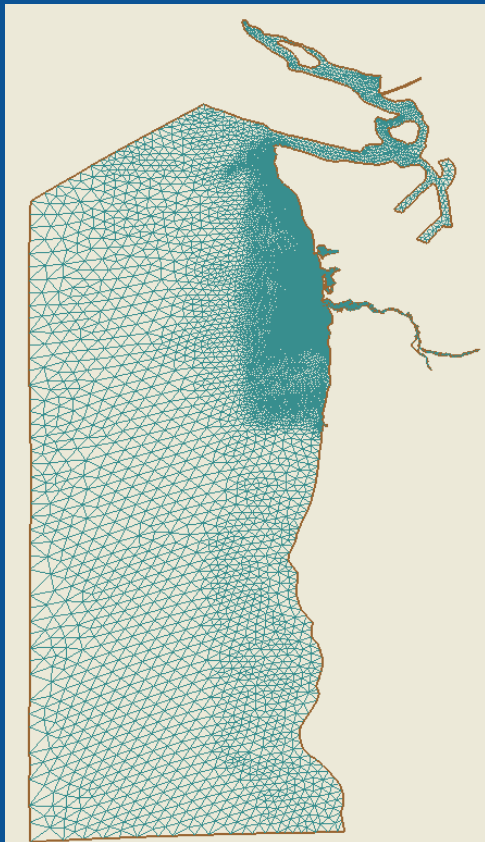
Columbia River and Estuarine Operational Forecast System (CREOFS)

SELFE model

Transitioned from academia

Nodes: 74061

Elements: 142684

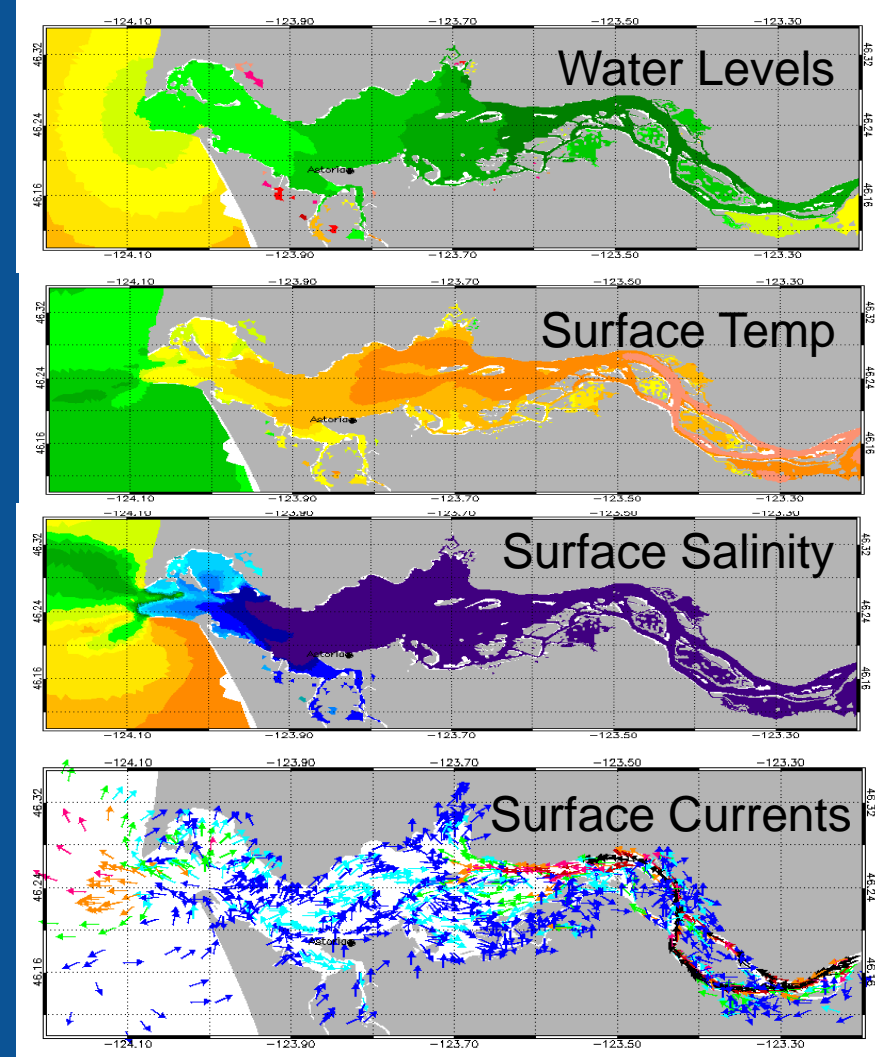
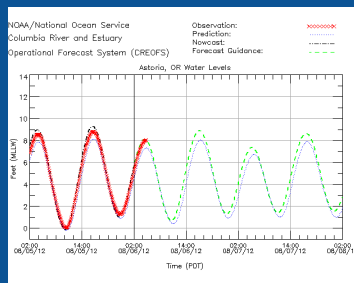


Operational Forecast System Output

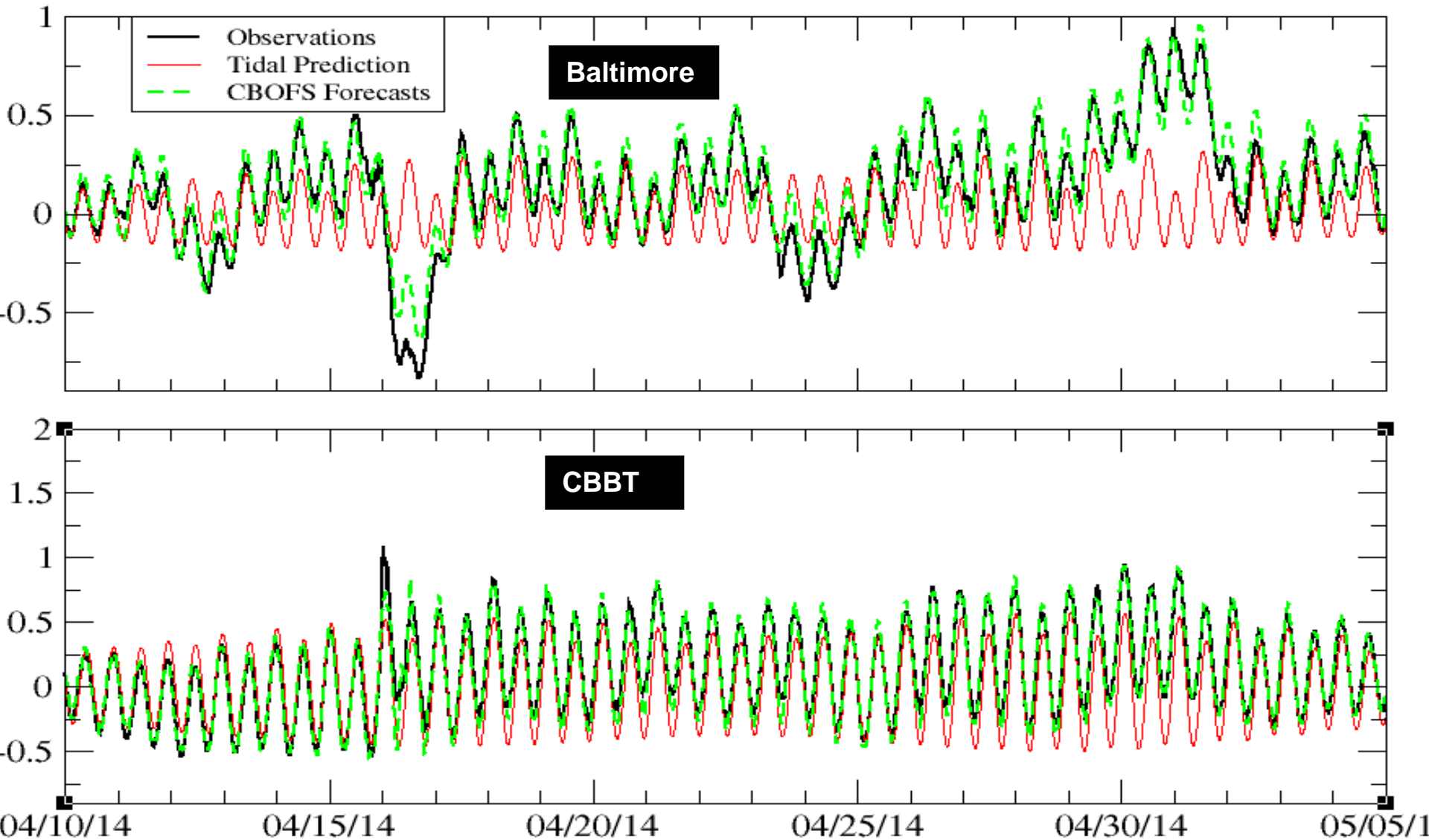


National Weather Service

“Receiving accurate model output for the Columbia River Bar and Tillamook River Bar is central to WFO Portland’s effort to improving forecasts for these areas”



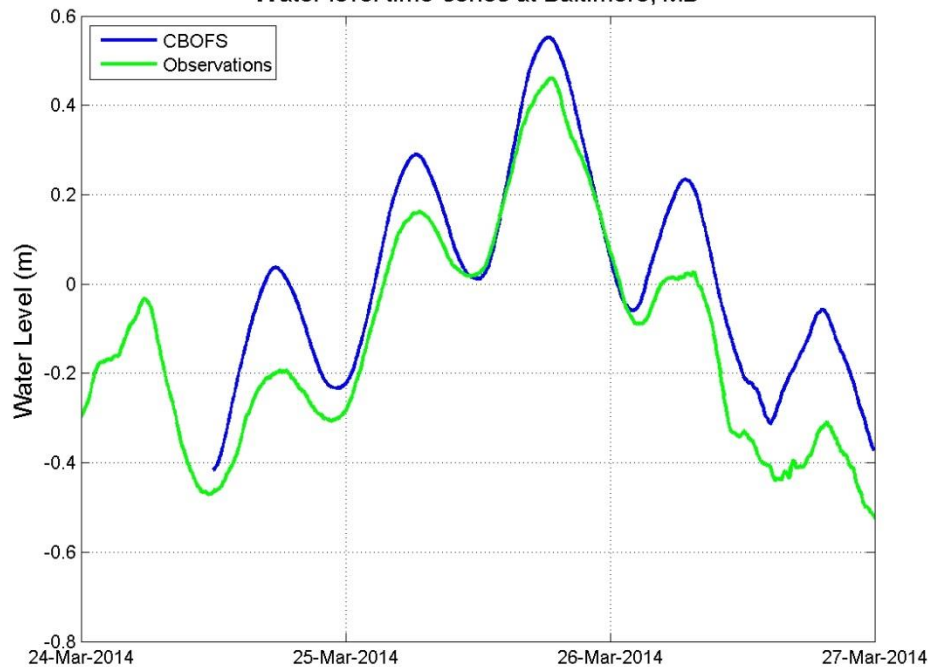
OFS Water Levels: Chesapeake Bay (m MSL)



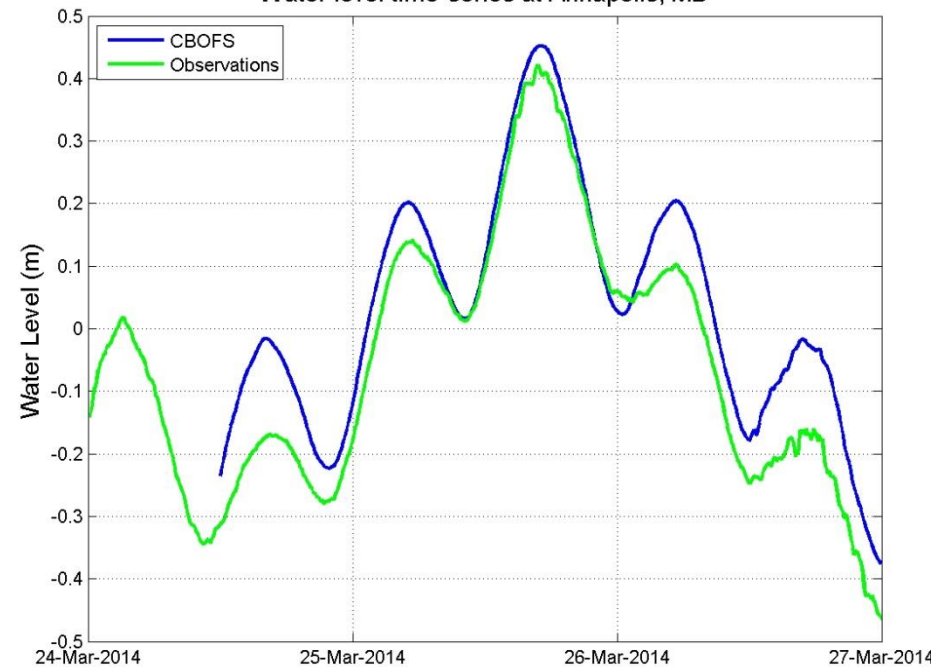
OFS Models Predict High and Low Water Events

NOAA/NOS/CO-OPS

Water level time-series at Baltimore, MD

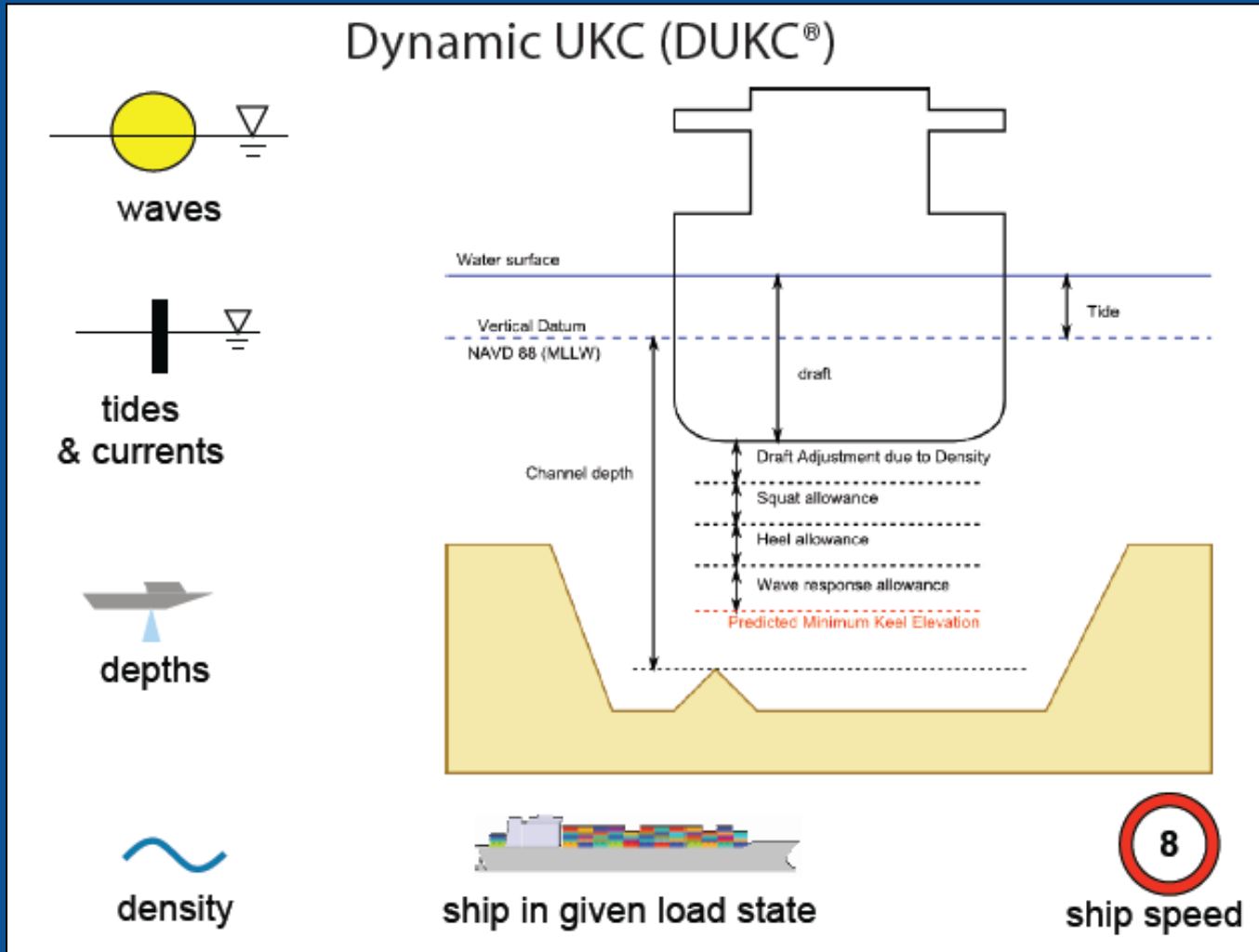


Water level time-series at Annapolis, MD



— Predictions — Validated — Preliminary — (Observed Predicted)

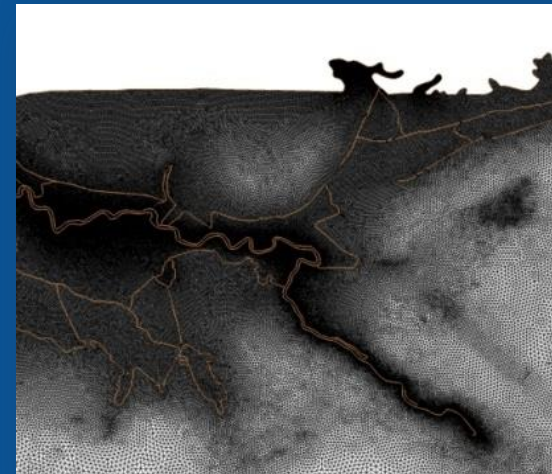
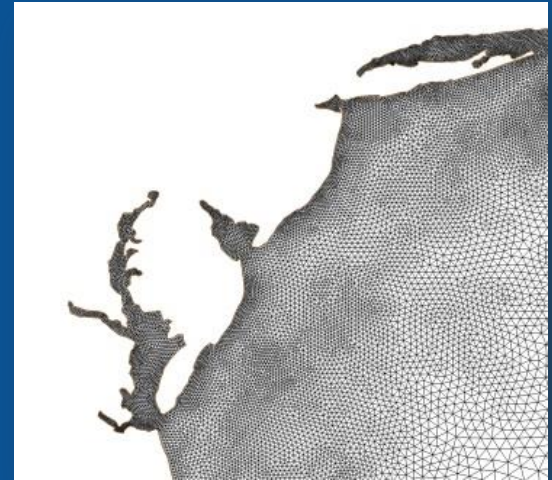
Looking forward: Under Keel Clearance



Courtesy G. Lesser, OMC Intl. and CAPT D. Jordan, Columbia River Bar Pilots

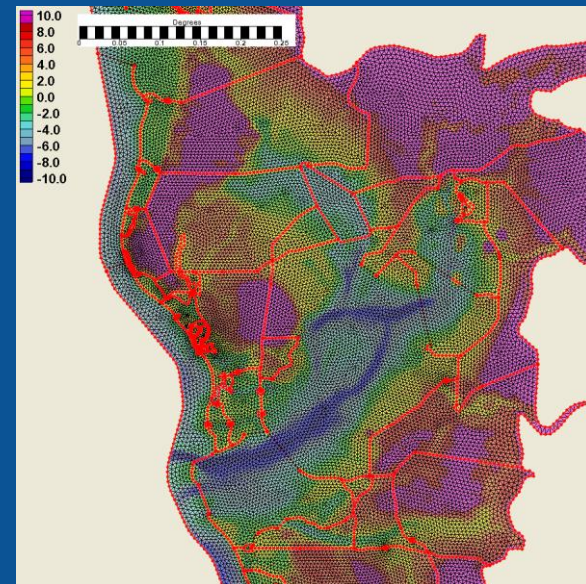
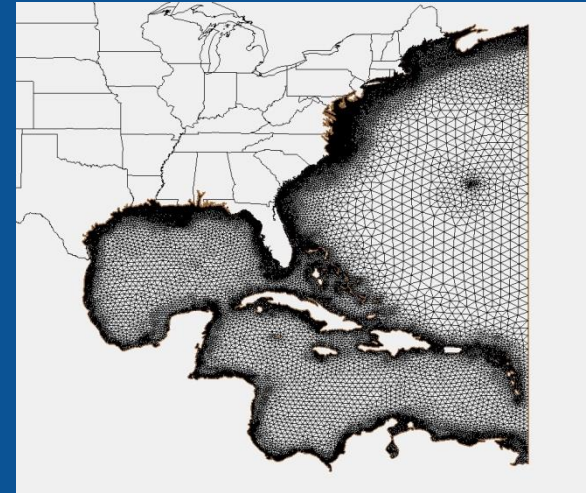
Storm Surge Modeling

- Using unstructured grid model ADCRIC for extratropical (e.g., nor'easter) and tropical (e.g., hurricane) storms
 - Efficient unstructured triangular grids with high localized resolution
 - Combines effects of surge and tides
 - Extratropical surge and tide model predicts coastal water levels year round
 - High res tropical surge predictions being developed to run for landfalling storms
- Inform ports and harbors to prepare

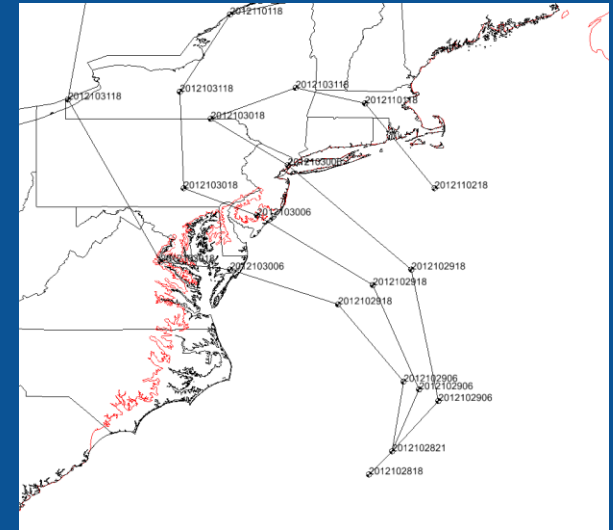
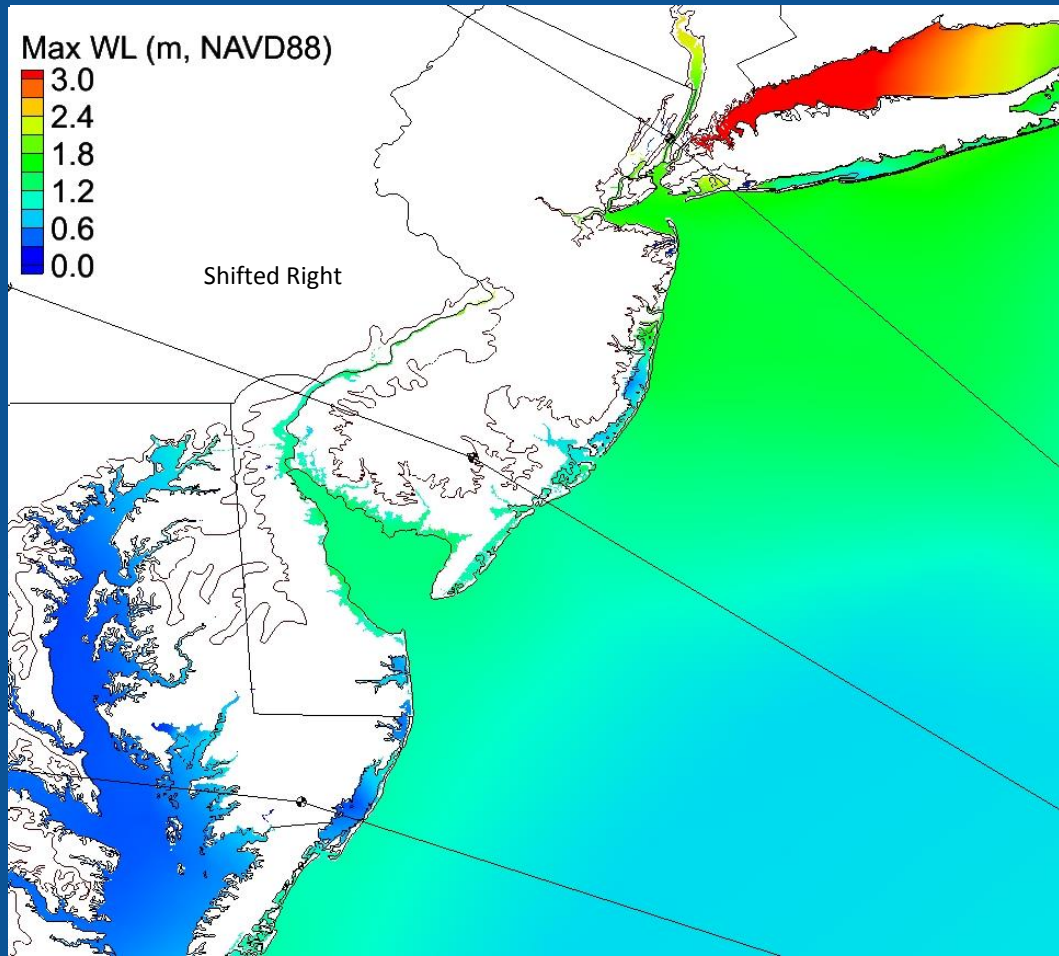


Next Generation Surge Modeling

- NOS model within NOAA ensemble
 - 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
 - Sandy Supplemental: a 500 meter grid will be operational in 2015

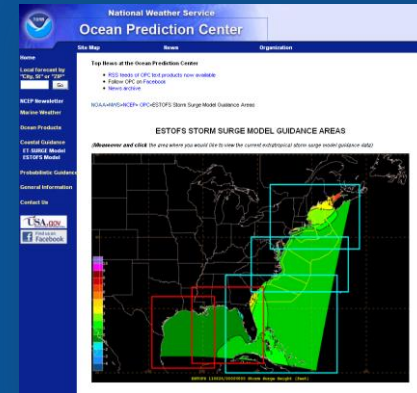
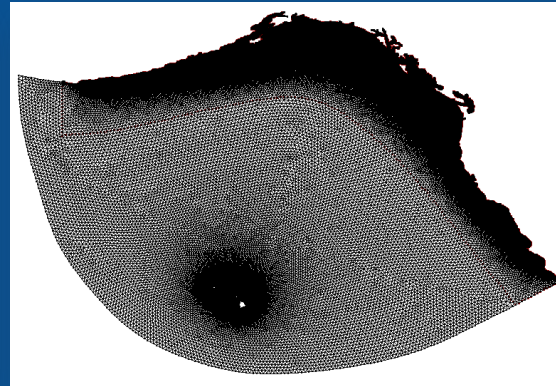
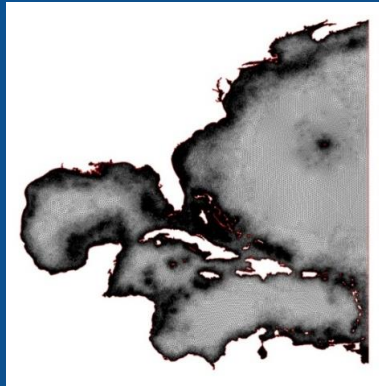


Ensemble Prediction of Sandy's Surge



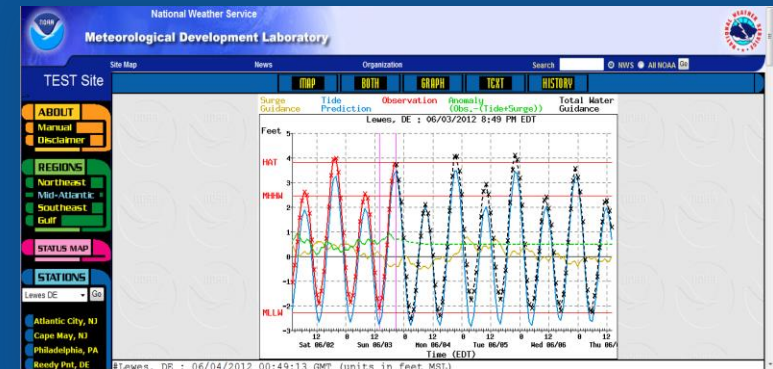
Experimental predictions of Sandy for 5 ensemble members

Extratropical Surge and Tide Operational Forecast System (ESTOFS)



- Computes surge with tides along coast for forecasting and coupling to NWS' operational WAVEWATCHIII® wave model
- Atlantic and Pacific models
- Coarser resolution than port OFS, but better coverage
- 180 hr forecast 4 times per day

http://www.opc.ncep.noaa.gov/estofs/estofs_surge_info.shtml



http://slosh.nws.noaa.gov/etsurge_ESTOFS/

Potential Storm Surge Flooding Map

- New experimental NHC product based on extensive studies
- Requires NOS expertise on social science, topobathy data, vertical datums, and tide modeling
- 2015: new storm surge warning

