

DIEM CENTER OF EXCELLENCE: COASTAL HAZARD MODELING

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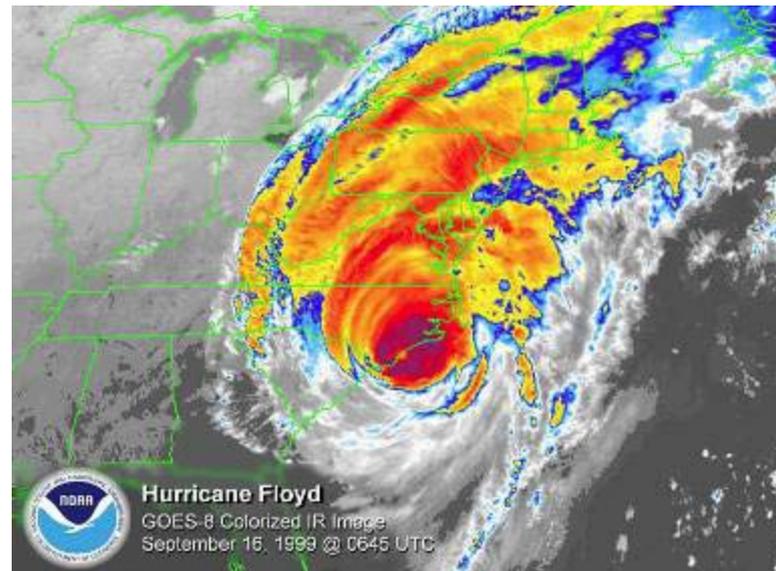
NOAA National Severe Storms Lab, National Weather Center

OUTLINE

Coastal Hazard Modeling – 3 Interrelated Projects

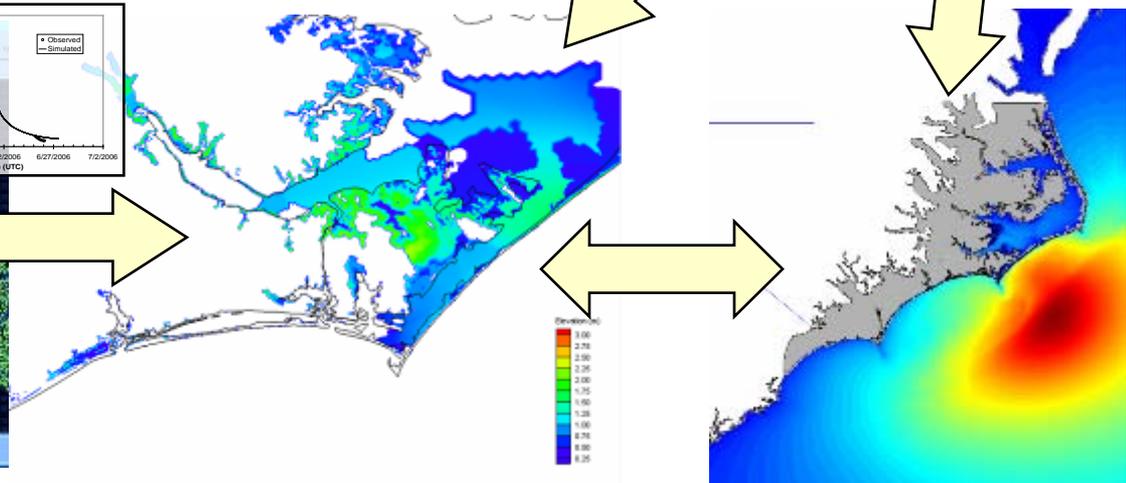
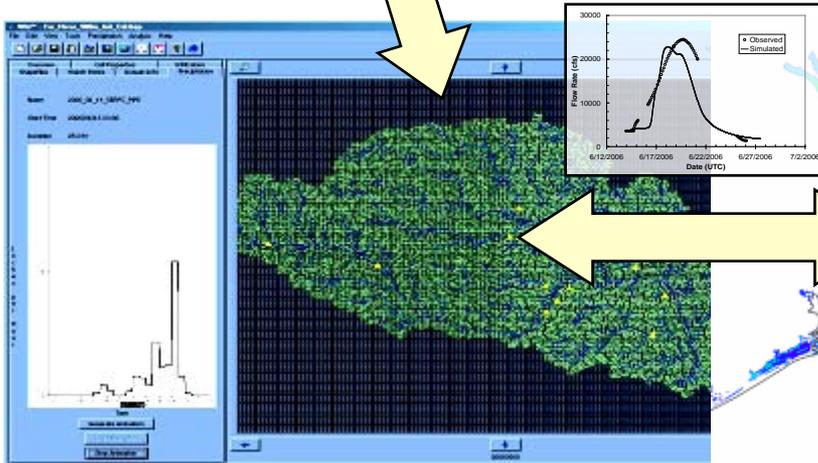
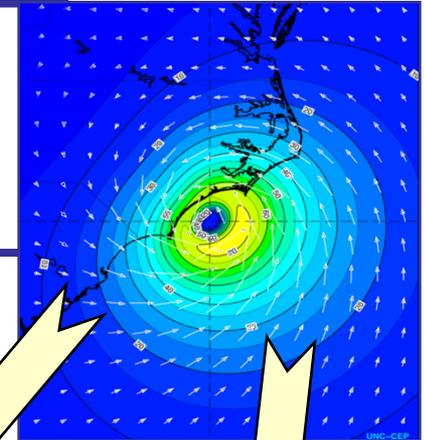
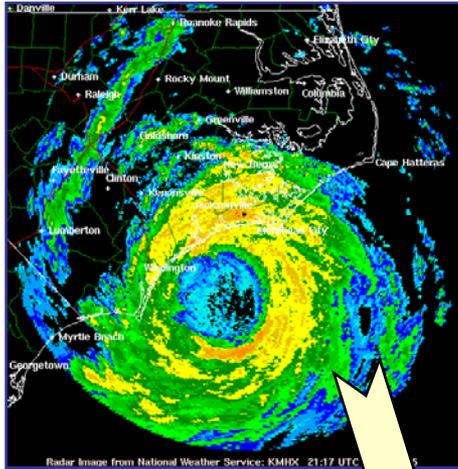
1. Modeling the coastal ocean response to coastal hazards
2. Predicting intensity and structure of tropical cyclones
3. A hydrologic modeling system for coastal environments

Model coupling for
each component



COASTAL HAZARD MODELING

Intensity and Structure of Tropical Cyclones (Fitzpatrick)

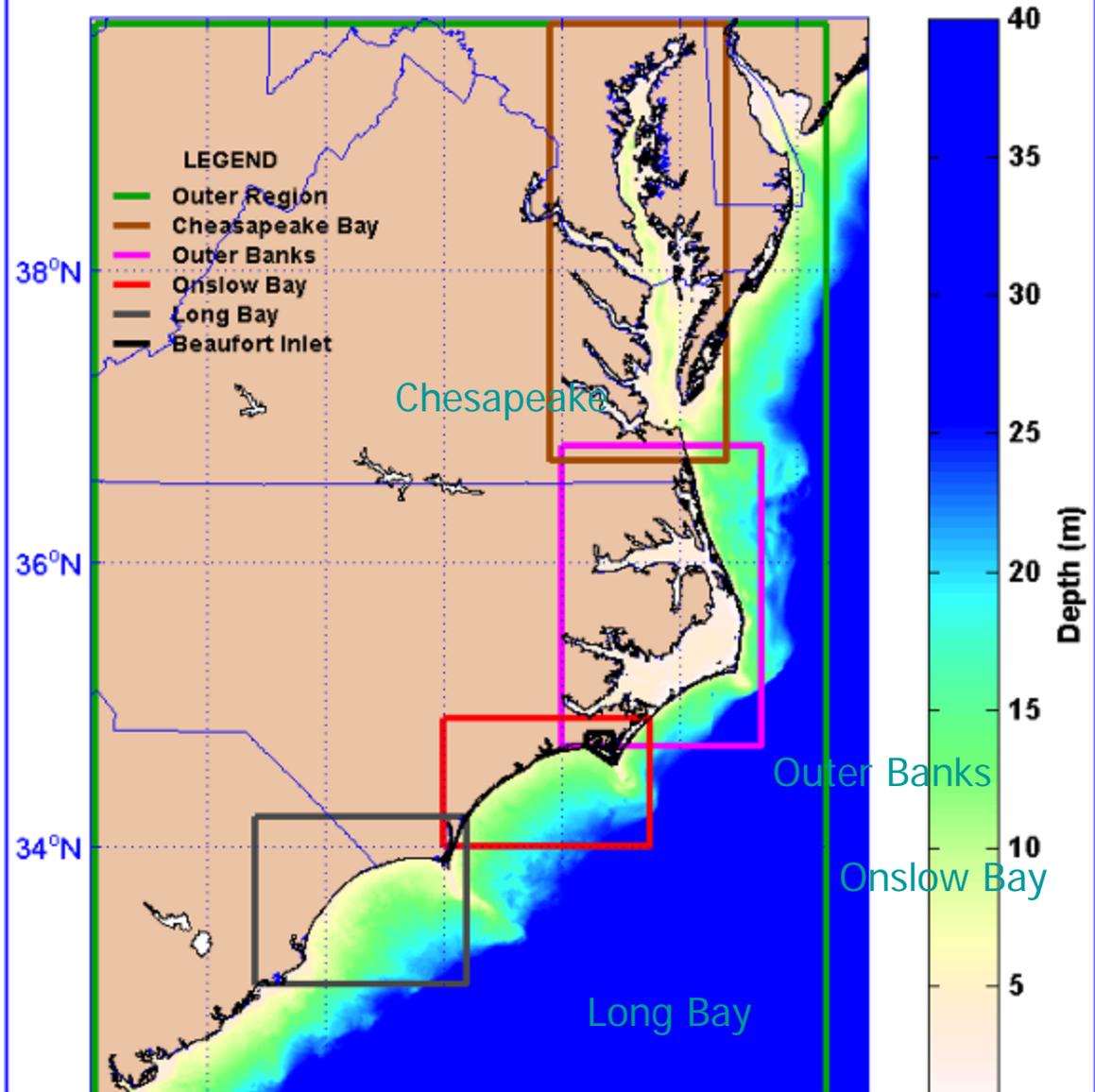


Hydrologic Modeling in Coastal Systems (Vieux, Kolar, Hong, Gourley, Kelleher, Van Cooten)

Coastal Ocean Response

(Luetjeh/Hanson)

Model Domains Map



SWAN WAVE MODEL

Operational Update:

4xday

Computational Grid:

1000 km (inner grids)

Output Fields:

Wind Speed/Direction

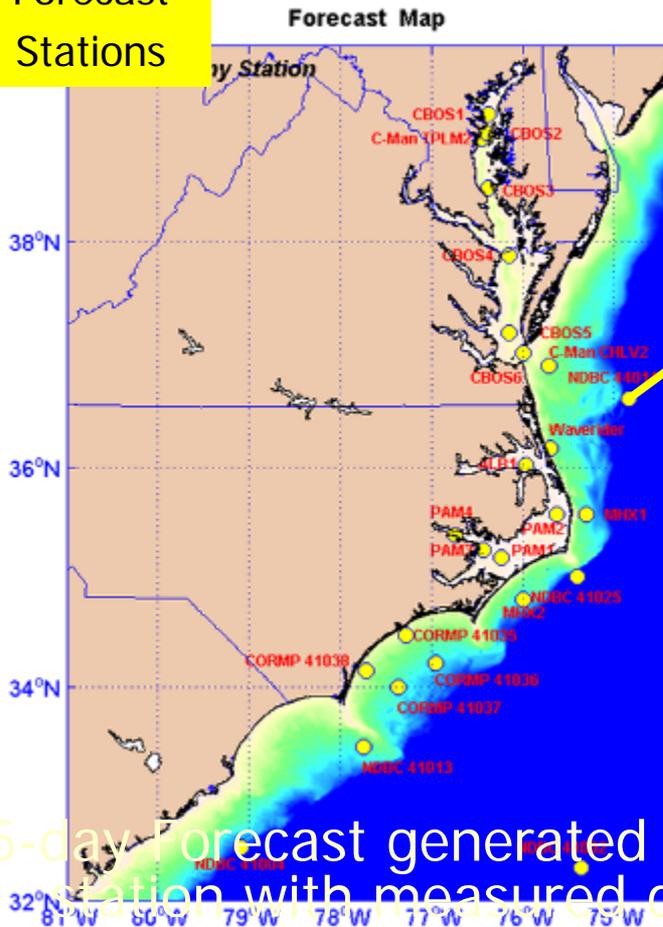
Wave Height

Wave Period

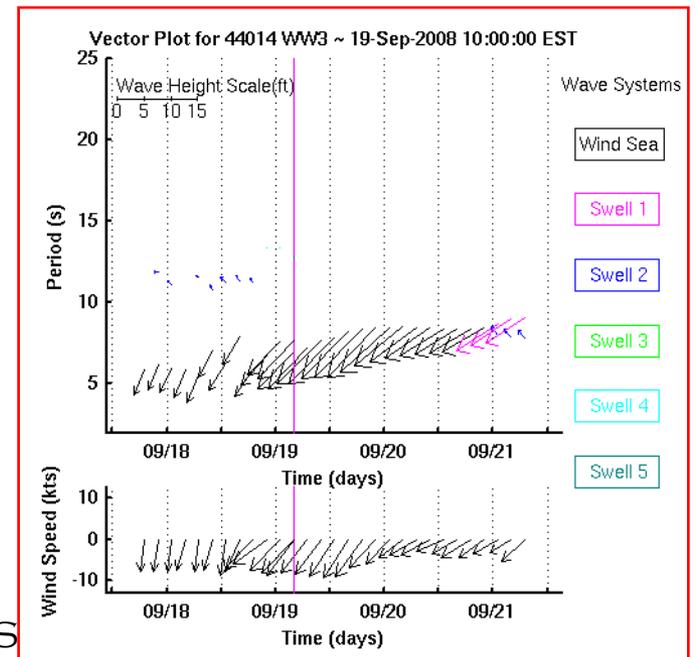
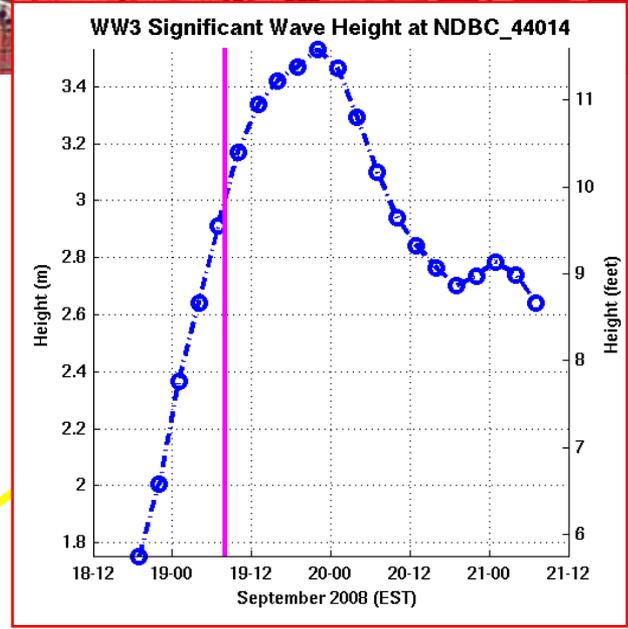
Wave Direction

WAVE PRODUCTS

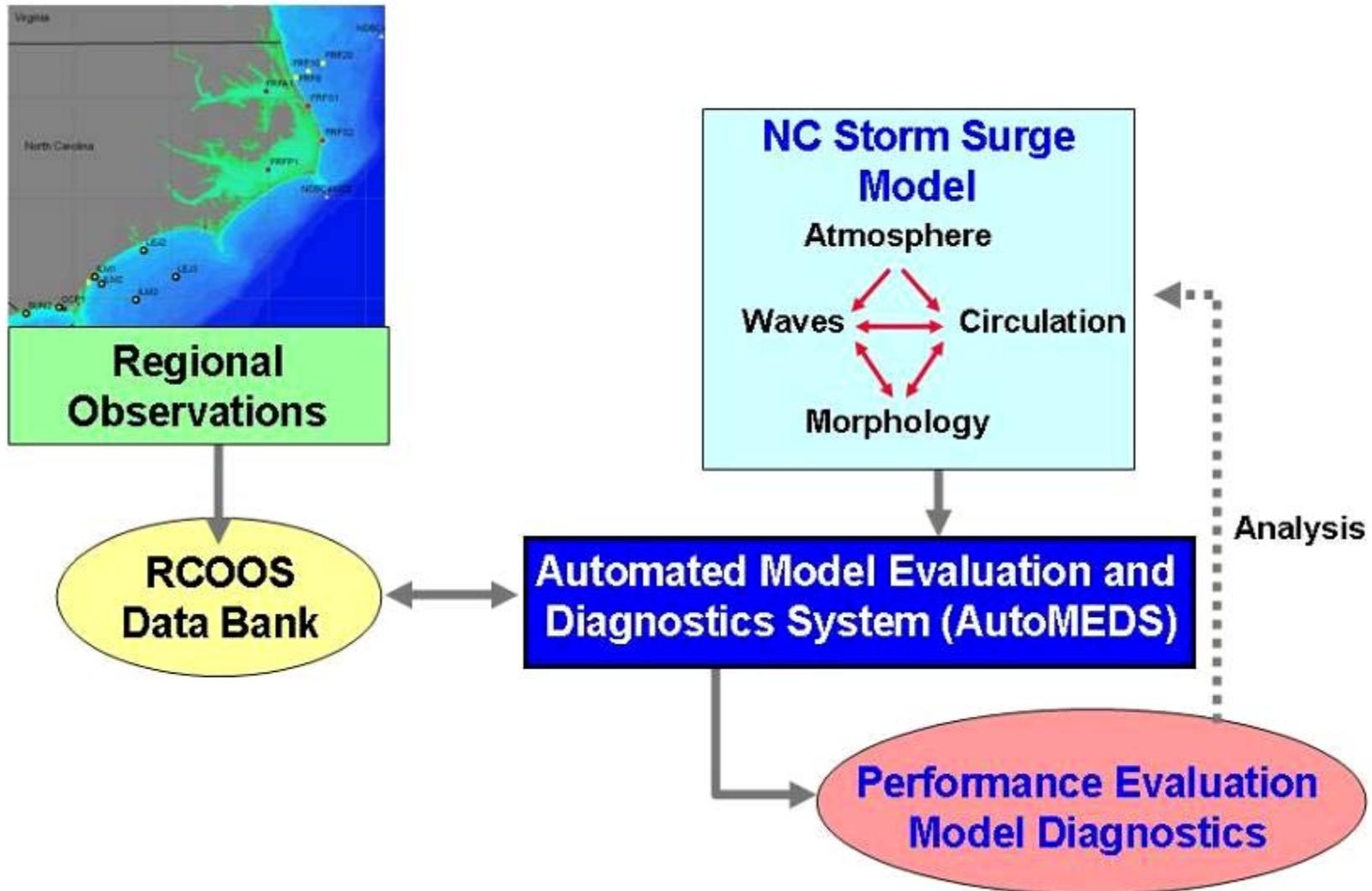
Forecast Stations



2.5-day Forecast generated at each station with measured data

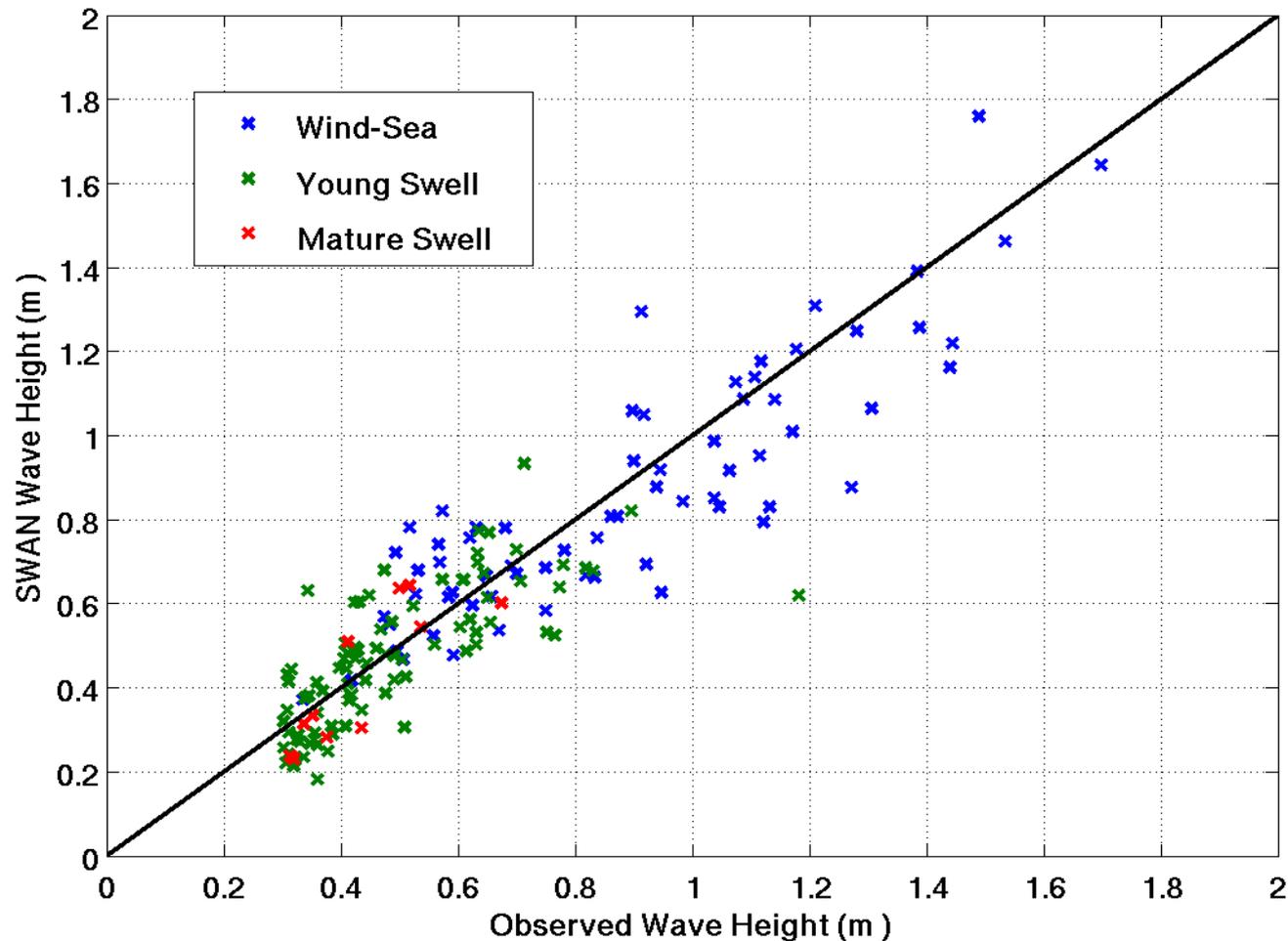


AUTOMATED MODEL EVALUATION & DIAGNOSTICS SYSTEM (AUTOMEDS)

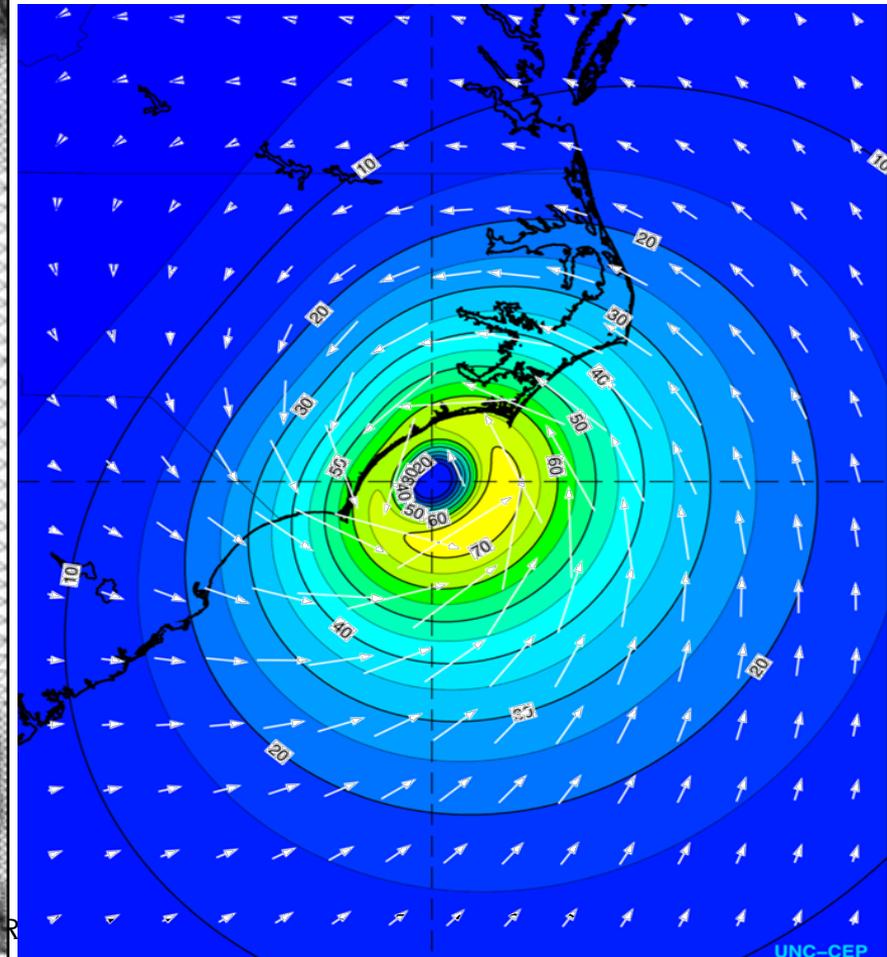
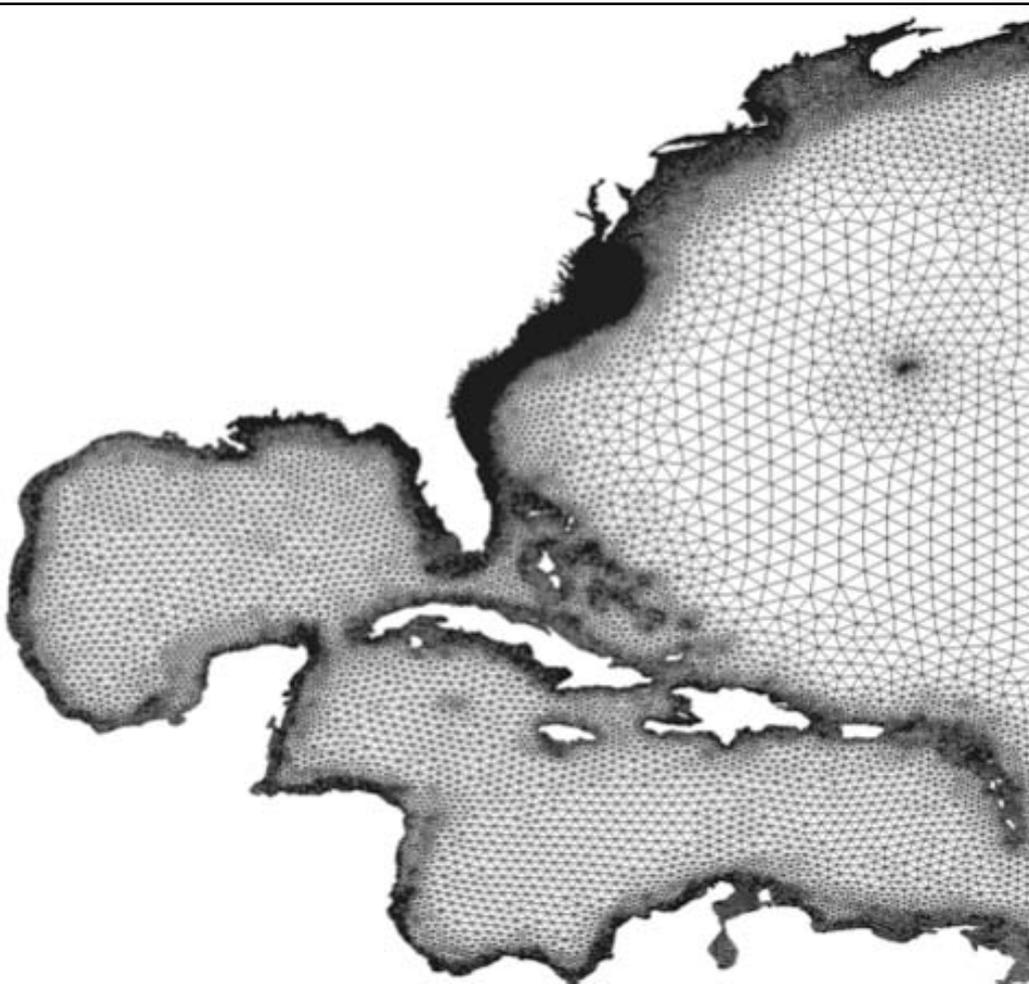


AUTOMEDS RESULTS: EXAMPLE MONTHLY SCATTER PLOT

Wave Height SWAN Scatter Plot for Station 41035M

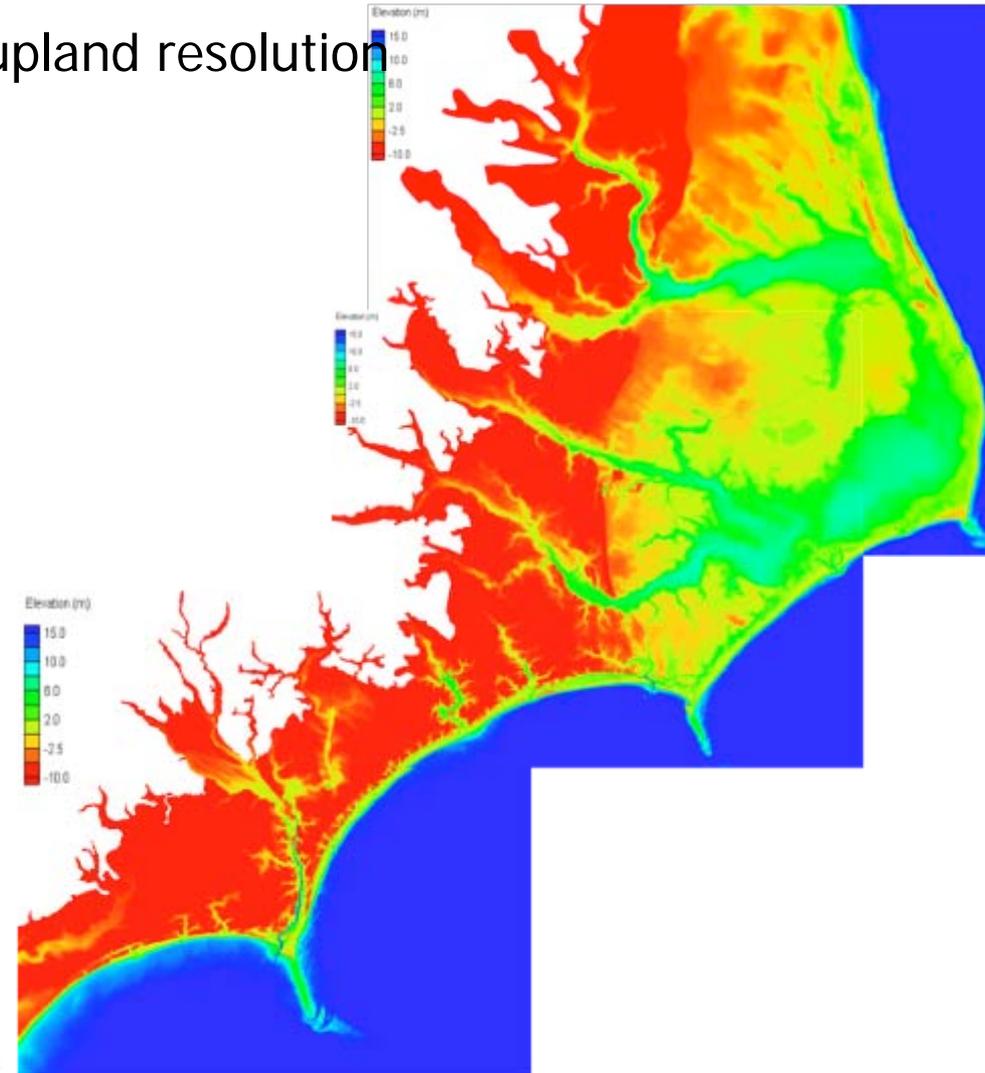
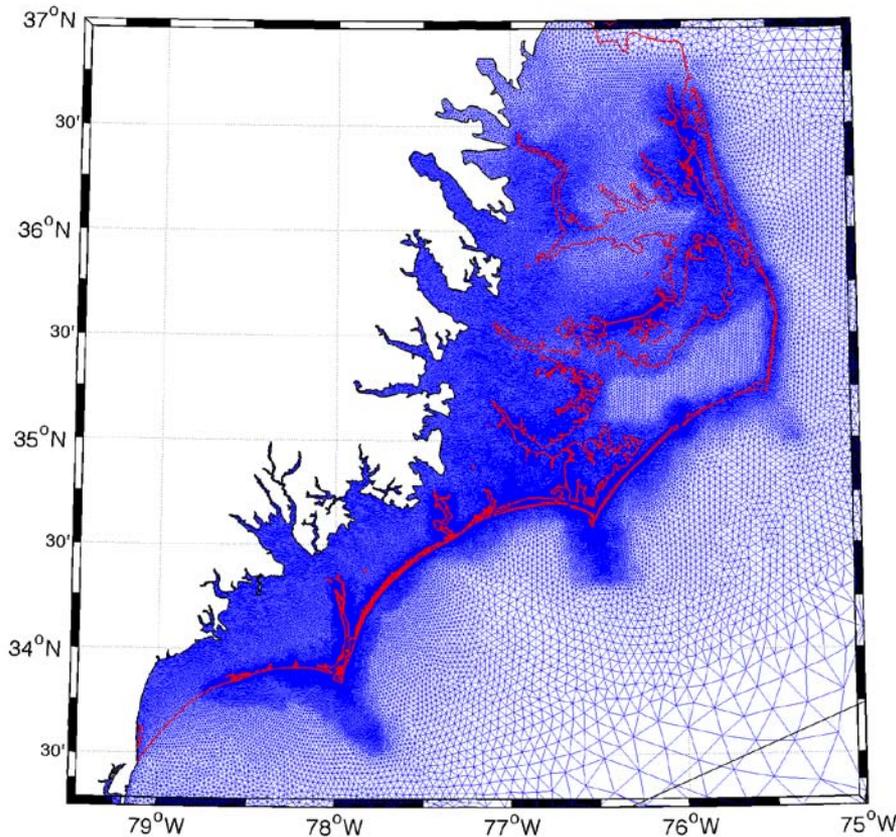


ADCIRC SURGE/INUNDATION MODEL

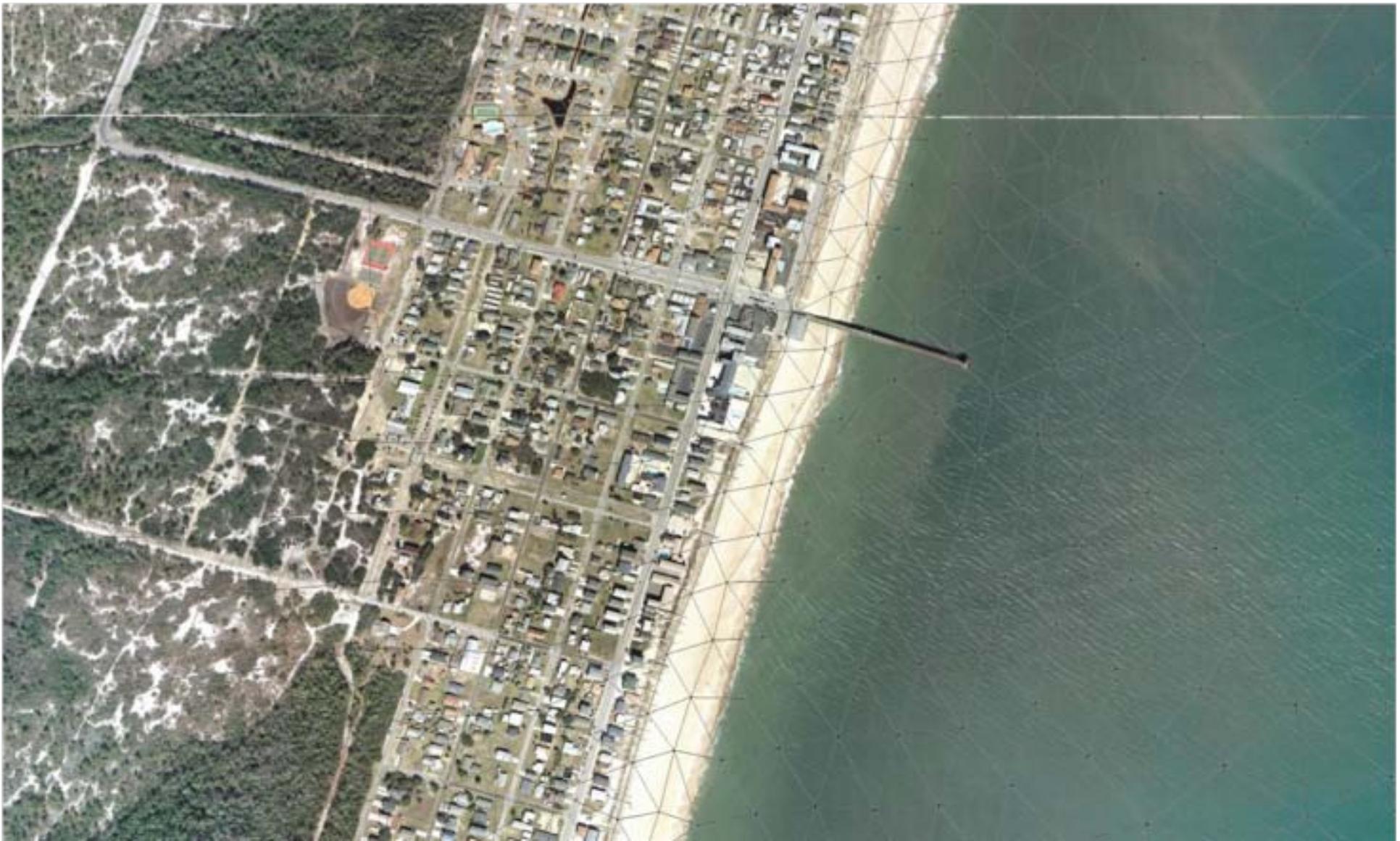


ADCIRC GRID FOR COASTAL NC

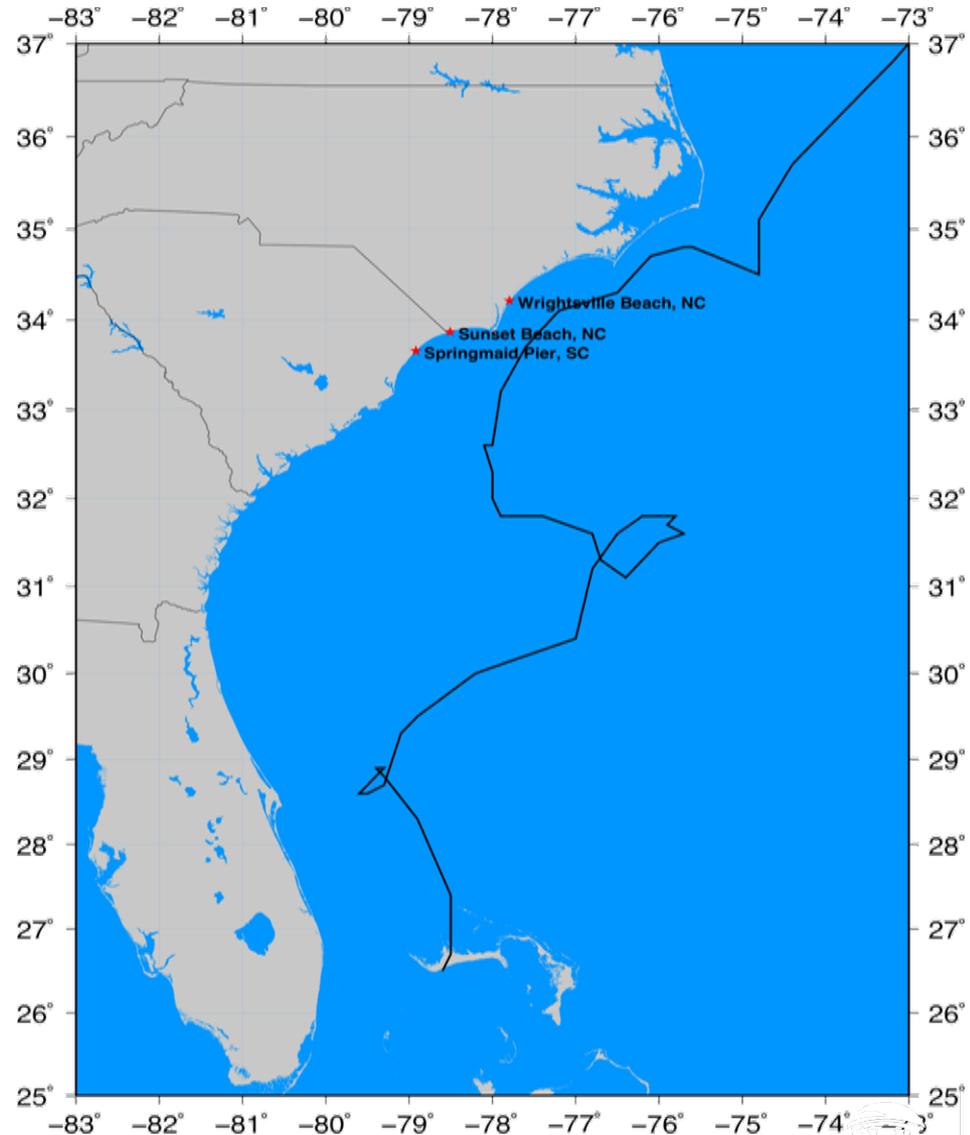
350K nodes, 10-20 meter nearshore, upland resolution
Cover up to 15m topographic contour



ADCIRC MODEL DETAIL WRIGHTSVILLE BEACH AREA

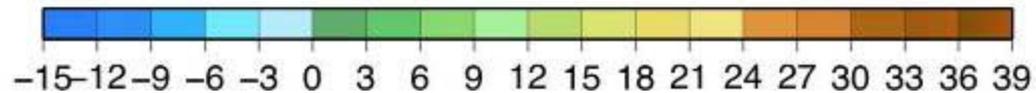
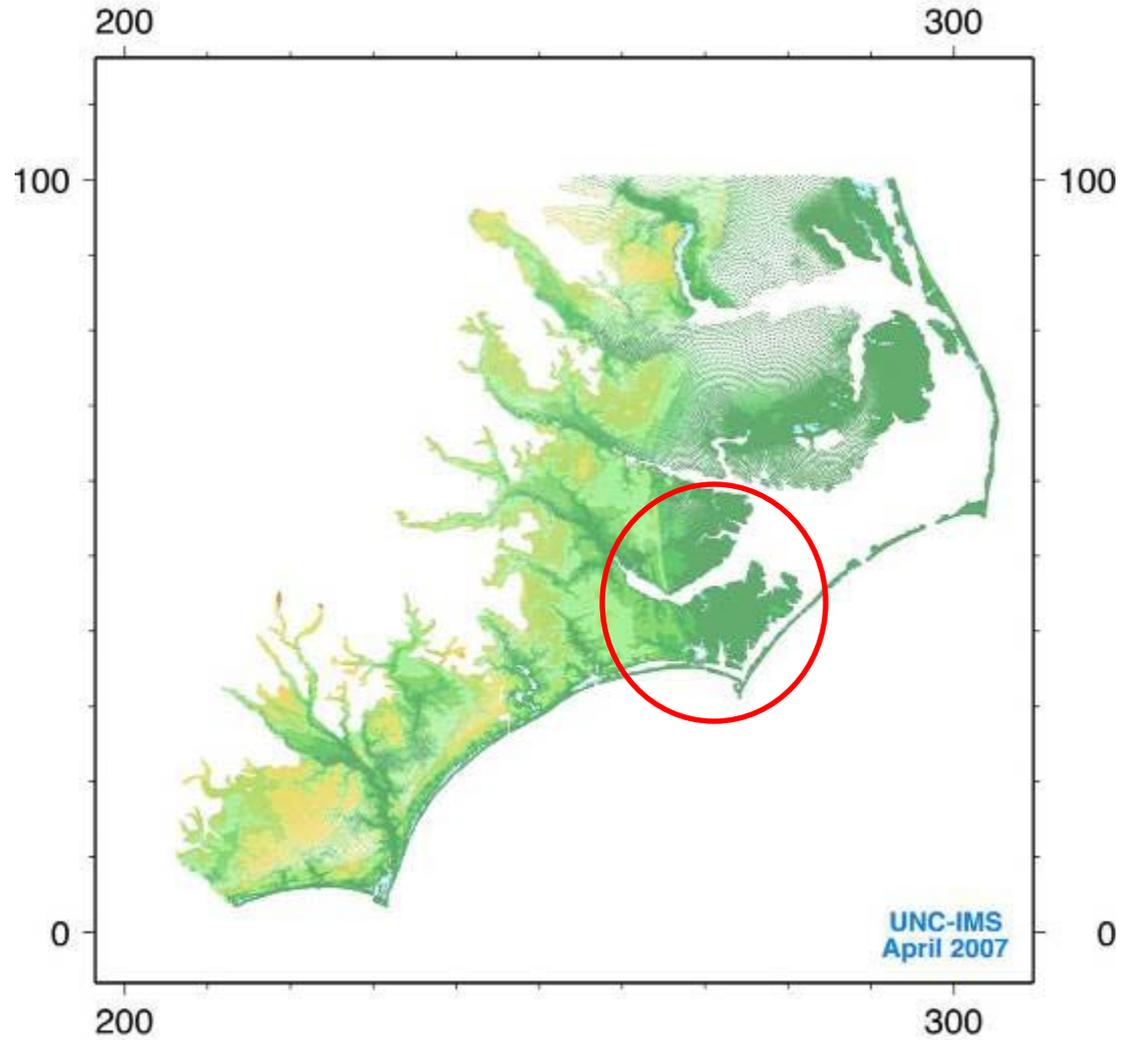


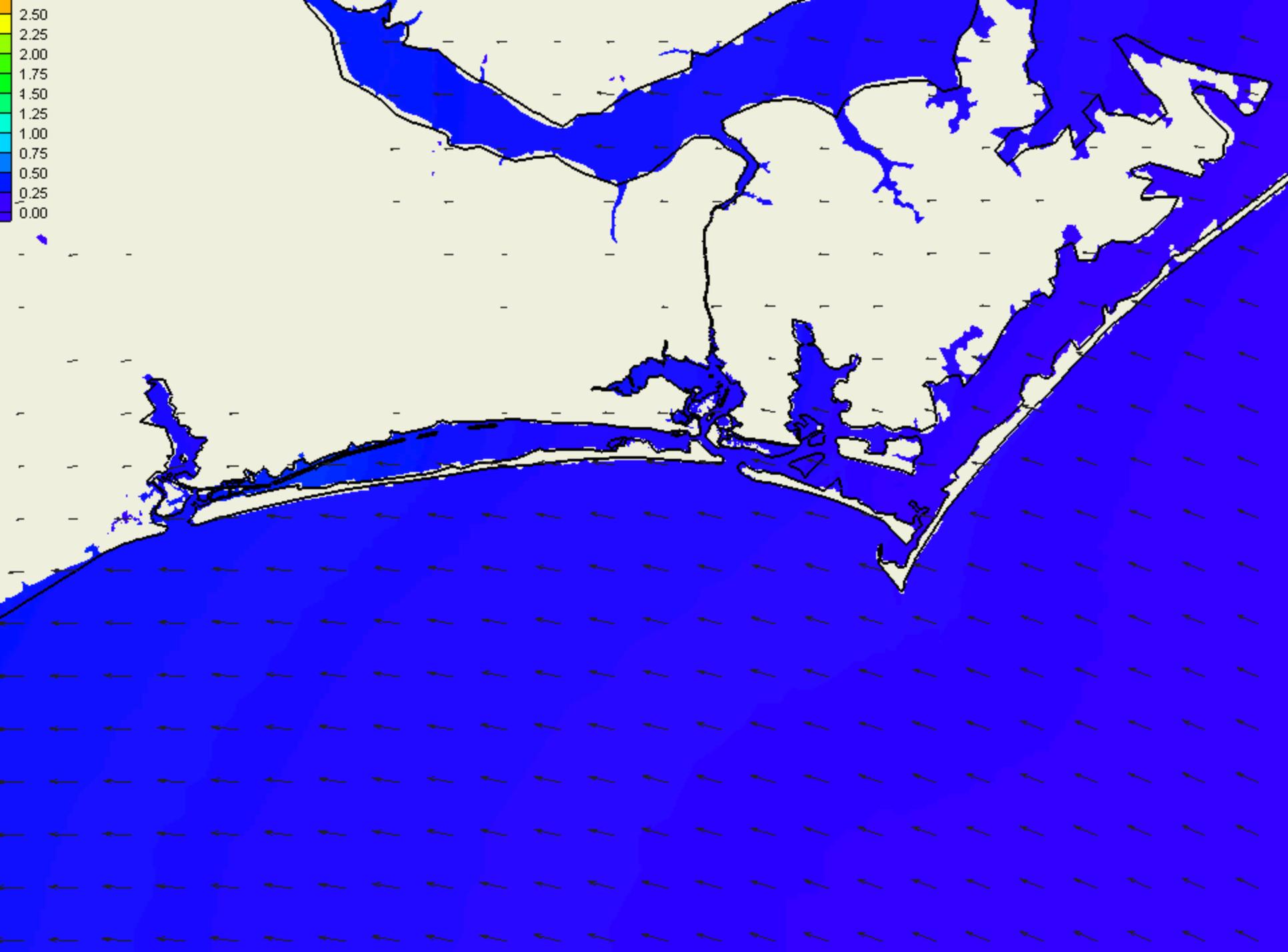
HURRICANE OPHELIA TRACK 2005





OPHELIA INUNDATION AREA





HYDROLOGIC MODELING ISSUES

Complexity

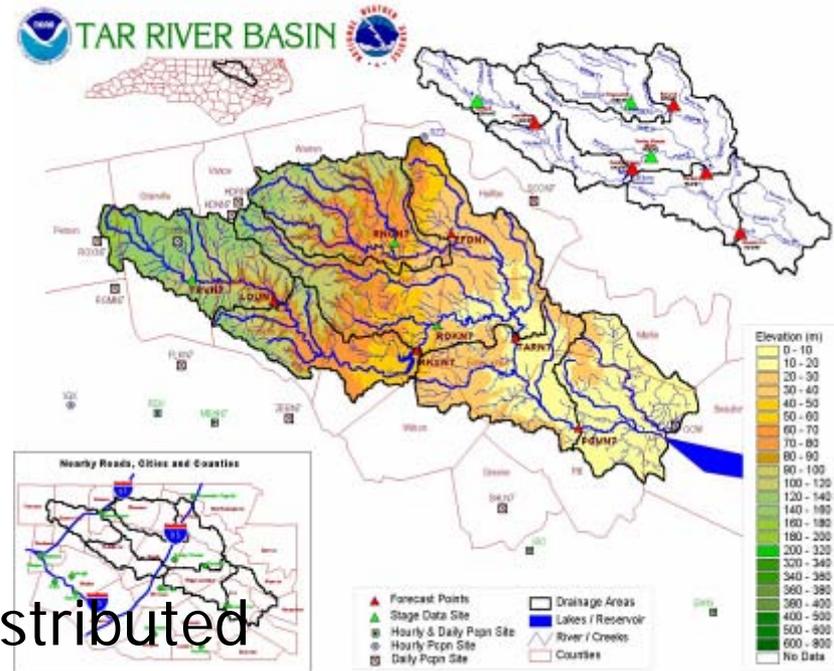
- Topography
- Soil profile
- Stream network
- Land use

Model types

- Lumped parameter vs. distributed
- Empirical vs. physics-based

Model Coupling

- 1-way vs. 2-way (dynamic)
- Optimal handoff, River → ADCIRC
- Software superstructure: ESMF or MCEL

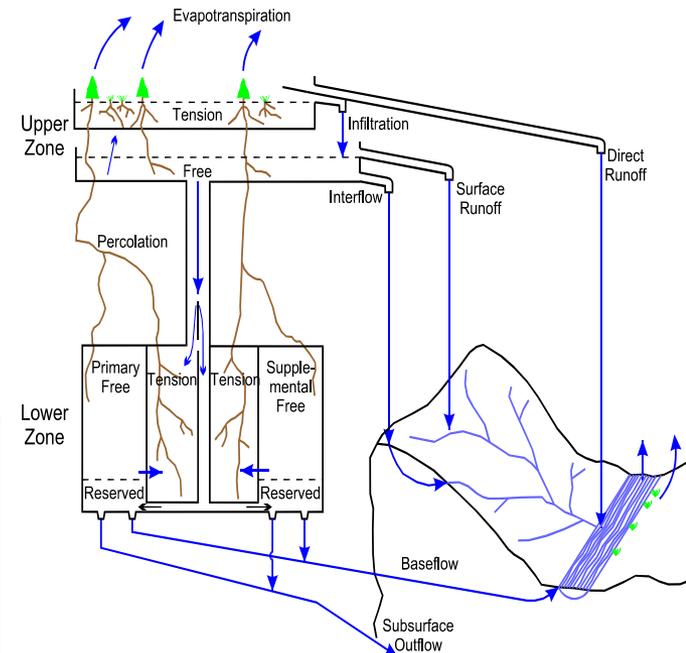
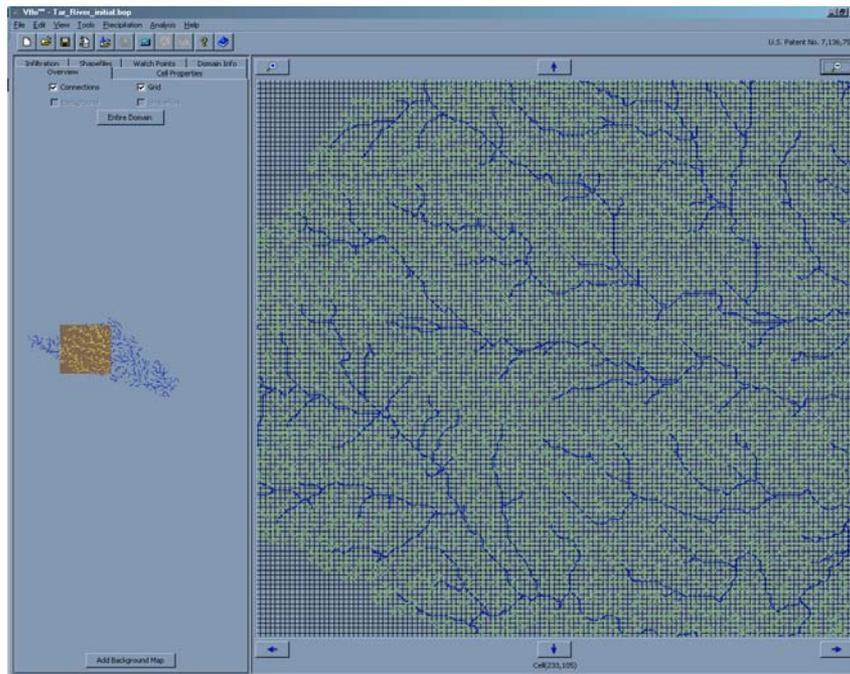


MODEL SELECTION

Ensemble modeling framework

Two prototypes chosen

- HL-RDHM
- Vflo



VFLO MODEL INPUTS

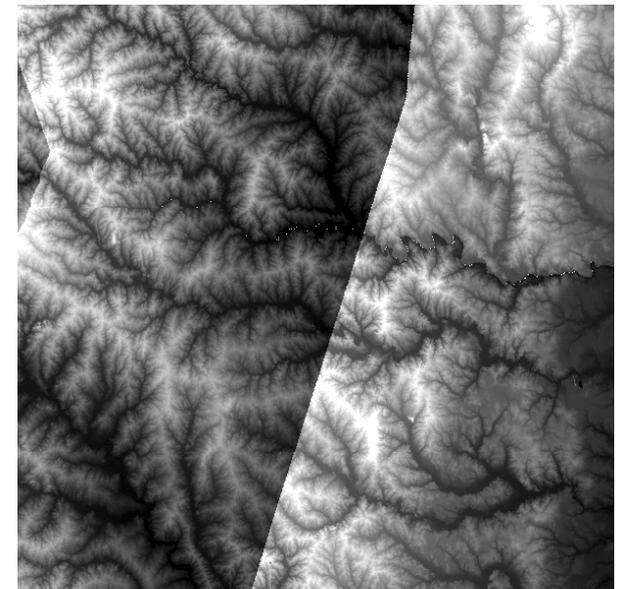
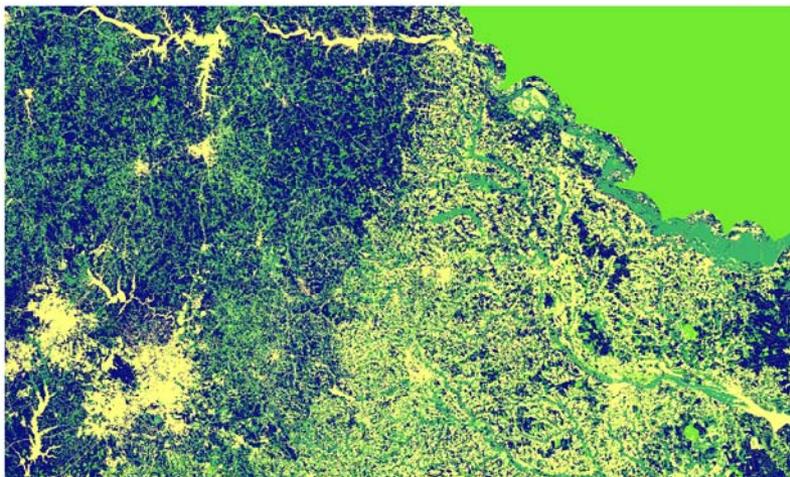
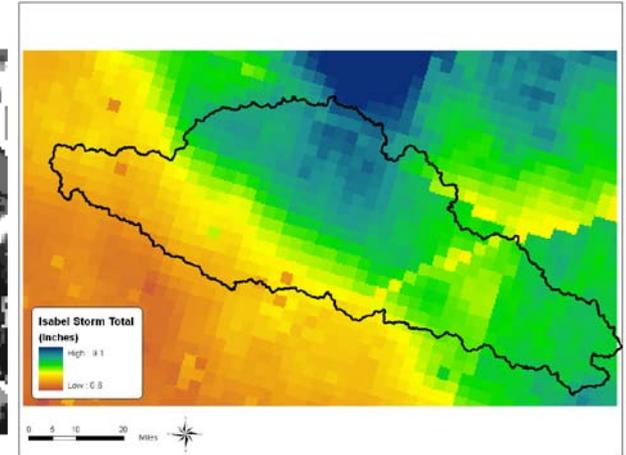
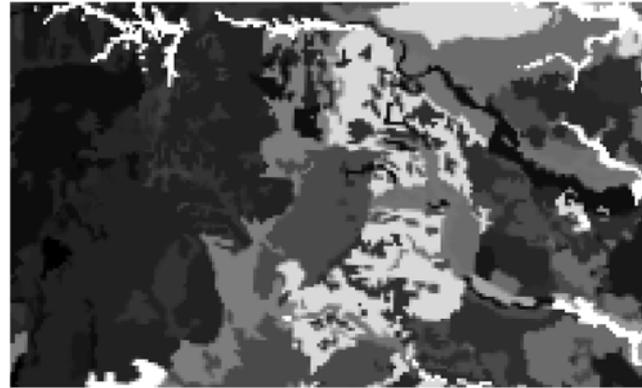
Land Use

Soil types

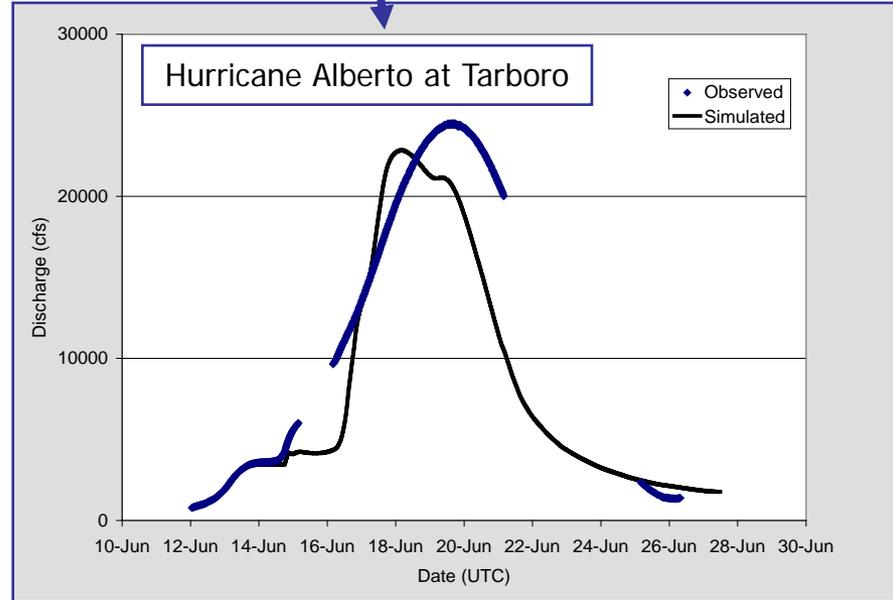
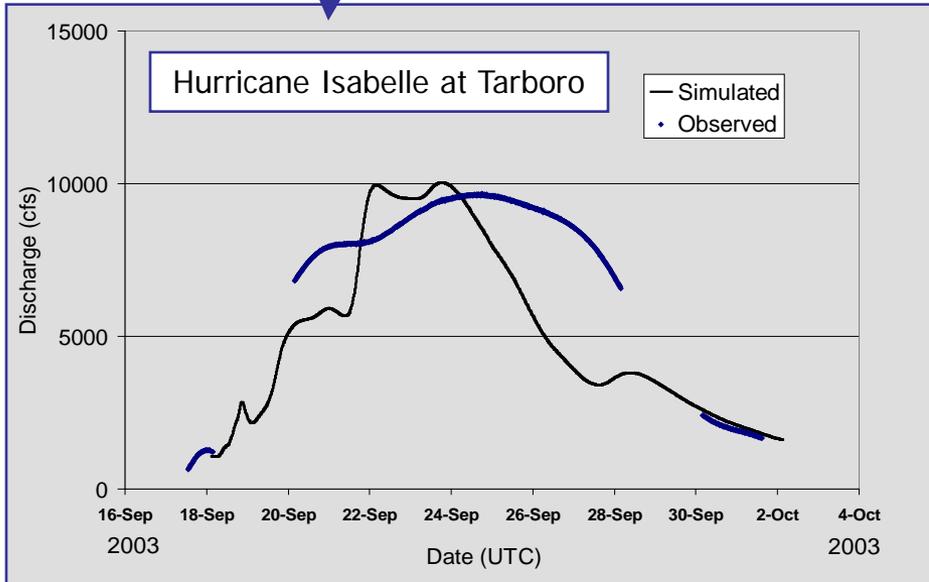
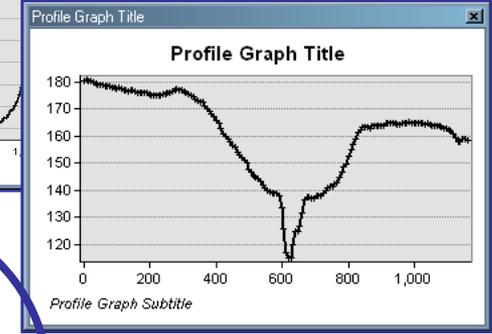
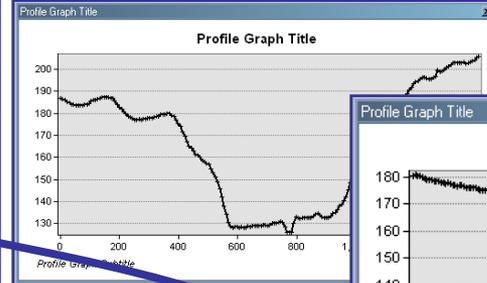
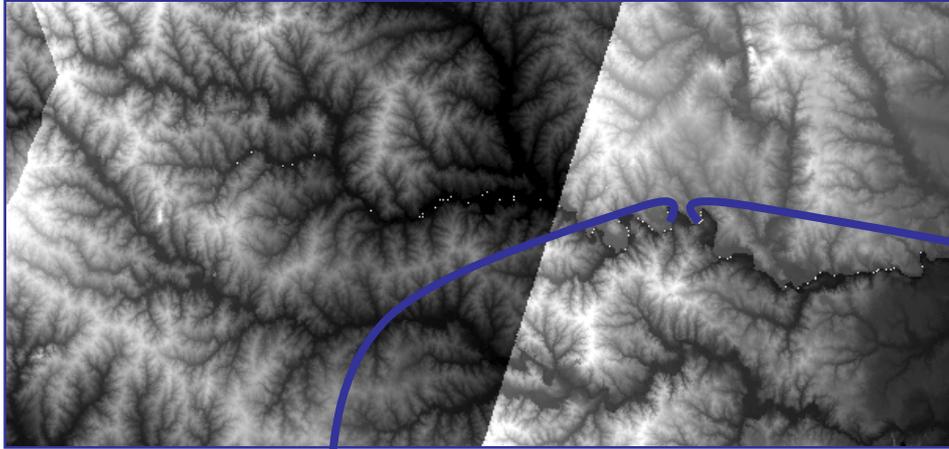
Topography

Precipitation

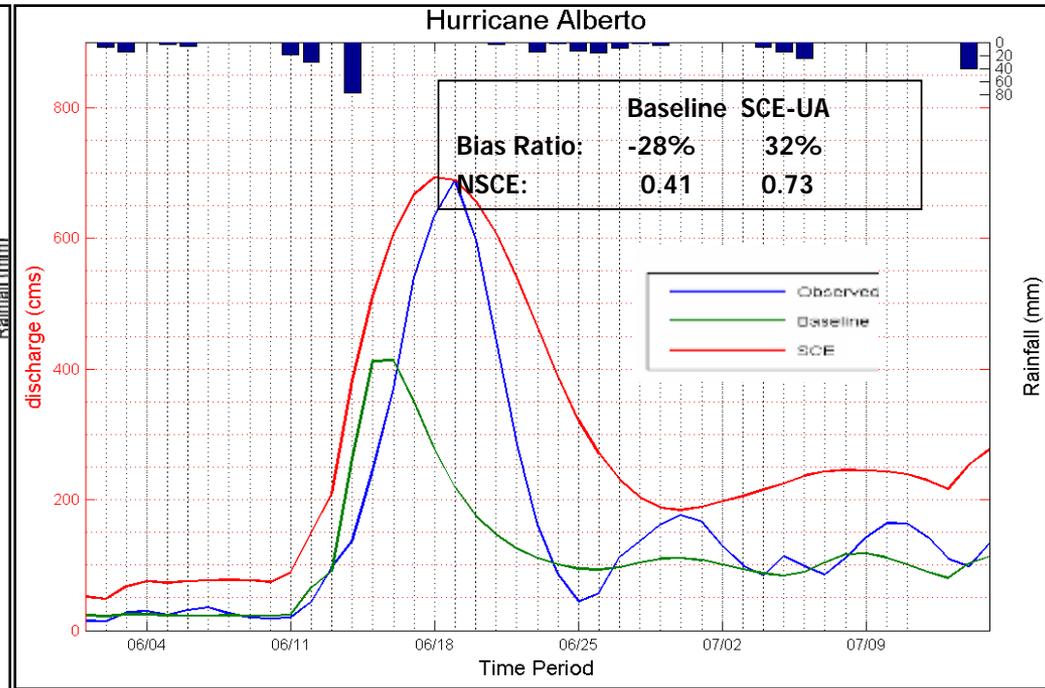
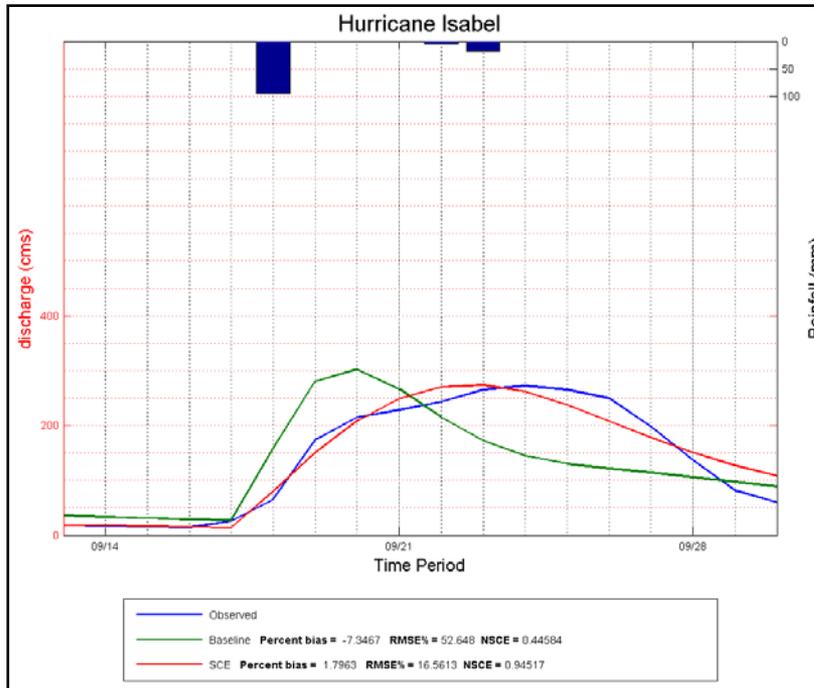
Stream network



CURRENT VFLO STATUS



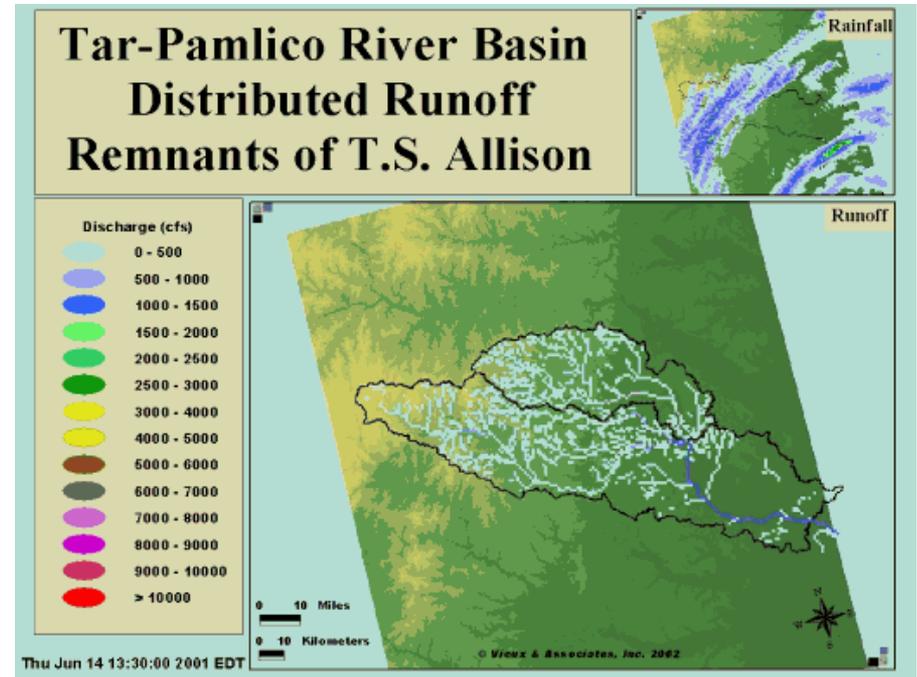
AUTOMATED OPTIMIZATION USING SCE-UA



HL-RDHM

COASTAL AND INLAND RUNOFF PREDICTION

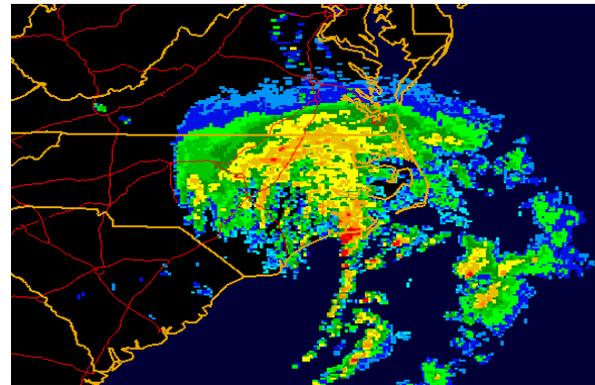
Coupling ADCIRC and an ensemble of watershed models takes into account watershed runoff, river discharge/stage, and storm surge for flood risk forecasting.



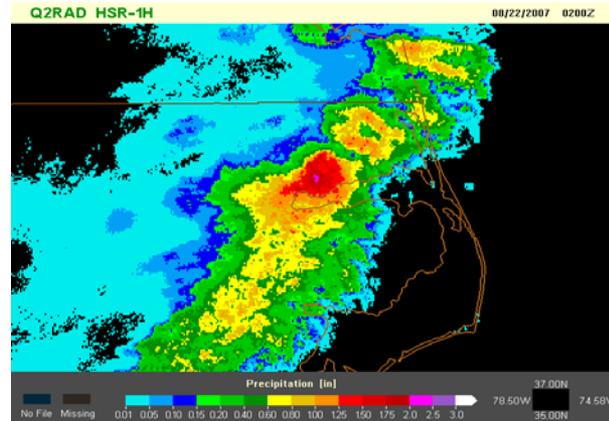
LEVERAGING NSSL WORK



(Coastal Inland Flood Observation and Warning)



The Power of Partnerships... Linking Scientists to Citizens



www.nssl.noaa.gov/ciflow

POSSIBLE COLLABORATIONS

National Center for Island, Maritime and Extreme Environment Security (CIMES) –

University of Hawaii in Honolulu for maritime and island security
and Stevens Institute of Technology in Hoboken, N.J.

Specific Collaboration-

Tsunami, storm surge, and inundation modeling

Coastal and inland infrastructure resilience

Natural hazards risk assessment associated with flooding