

Real-Time Flood Forecasting

Opportunities and Challenges for Automating Flood Models

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Model Development

- GMU: 2D Coastal Flood Modeling
 - ADCIRC Sensitivity Analyses
 - Friction
 - Storm Characteristics
 - Mesh design
- Dewberry: 1D & 2D Riverine Flood Modeling
 - FEMA Floodplain Studies: Flood Maps
 - HMS: Precipitation 1% Annual Event
 - HEC-RAS: Steady Flow, 1% Annual Event
- Results:
 - Flood Maps & Statistics
 - Repeat

Model Re-Development

Coastal Flood Models:

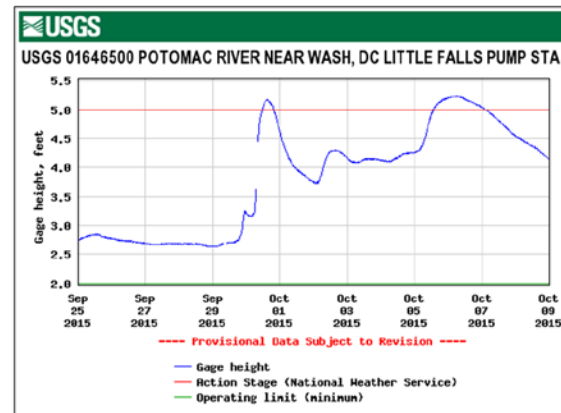
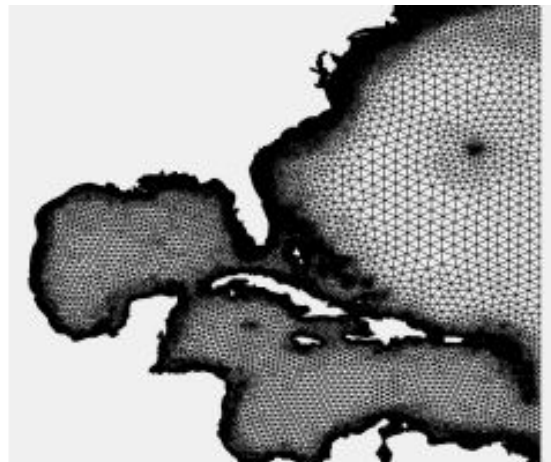
- Adaptation for Forecasting
 - Mesh Refinement
 - HPS Allocation & the Queue

Riverine Flood Models:

- Adaptation for Forecasting
 - HEC-HMS: Gridded Data
 - HEC-RAS: Unsteady Flow

Input/Output:

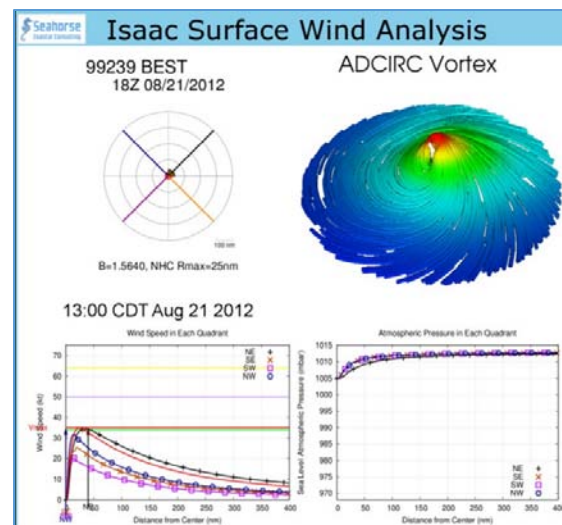
- Scripting
- Flood Maps



Forecast Model: Input

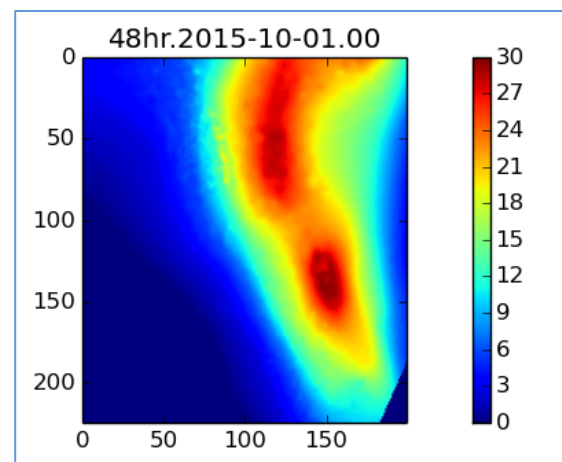
Coastal Flood Models:

- National Hurricane Center: HURDAT2
- Adcirc Surge Guidance System: ASGS



Riverine Flood Models:

- National Weather Service
- Mid Atlantic River Center



Forecast Model: Automation

- USACE: CWMS (RTS)
 - Reservoir Management
 - Dewberry

- Deltares: FEWS
 - CHPS
 - Potomac River Basin

- Bash, Python & the Cloud
 - Event Based Scenarios
 - George Mason Campus

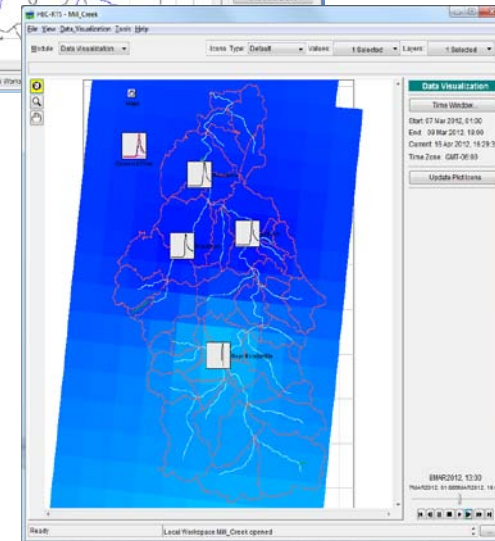
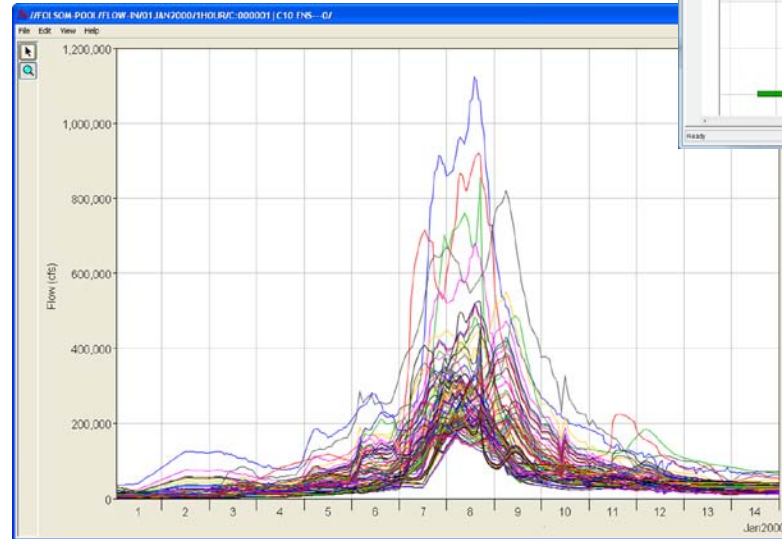
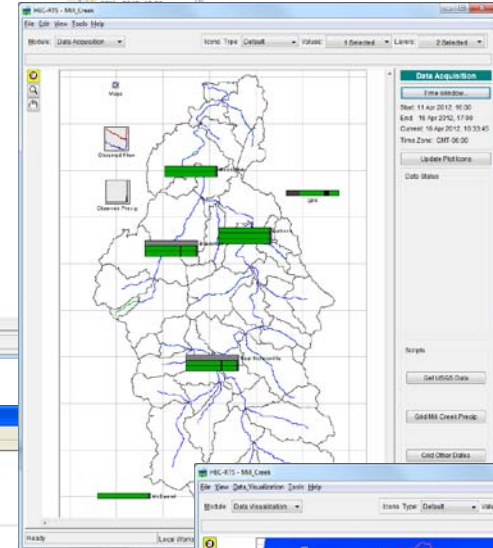
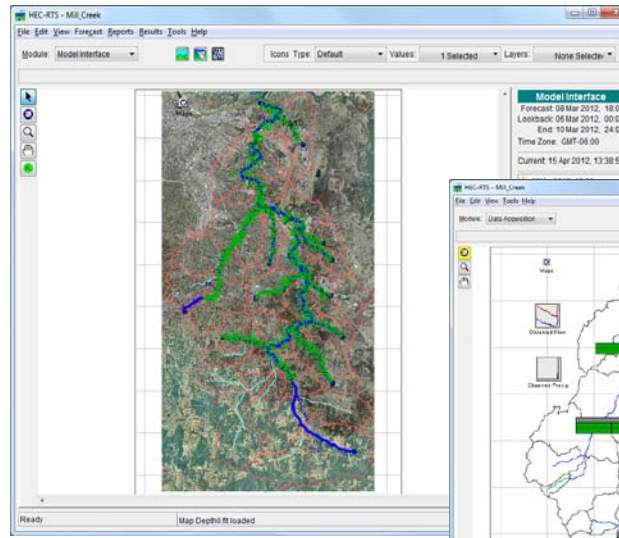
USACE

- Corps Water Management System (CWMS)

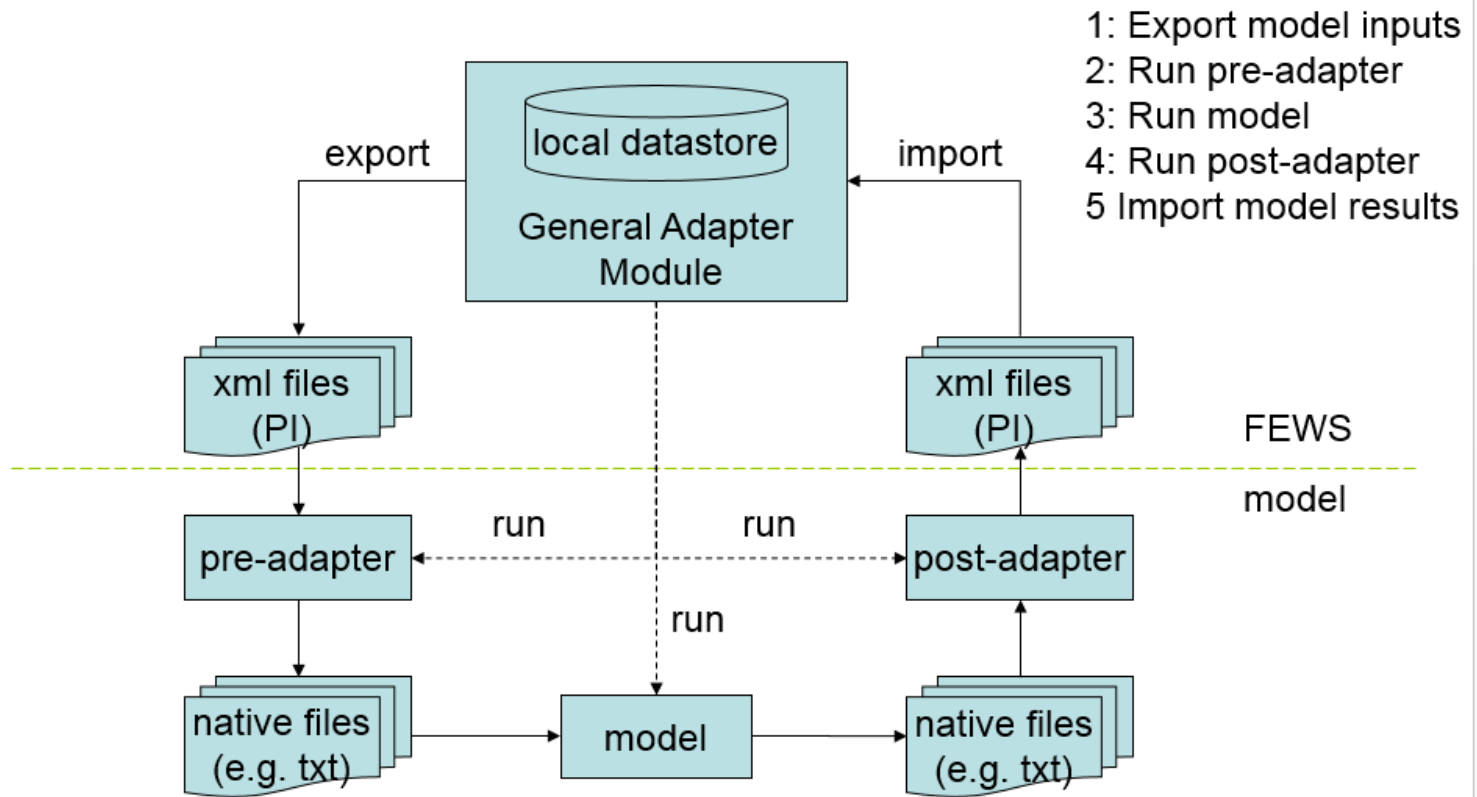
- HEC Products
- Oracle Database
- Unix Operating System
- Data Retrieval Client Based

- Real Time Simulation (RTS)

- HEC Products
- HEC-DSS
- Windows PC
- Scripting Capability



Deltares



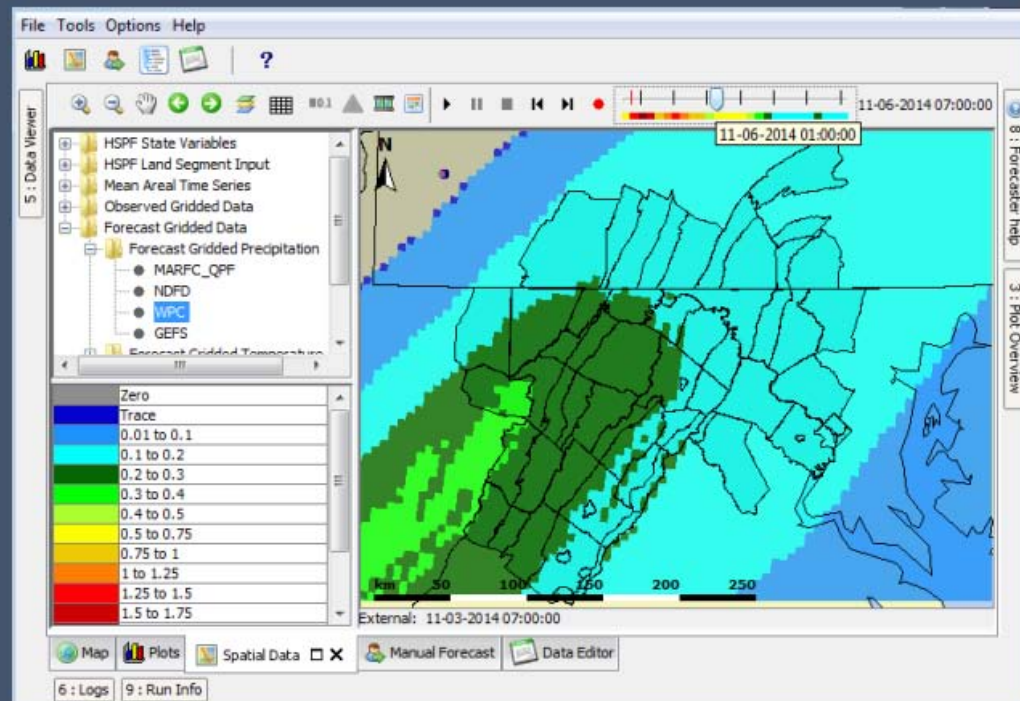
Deltares USA

FEWS: ICPRB

LFFS

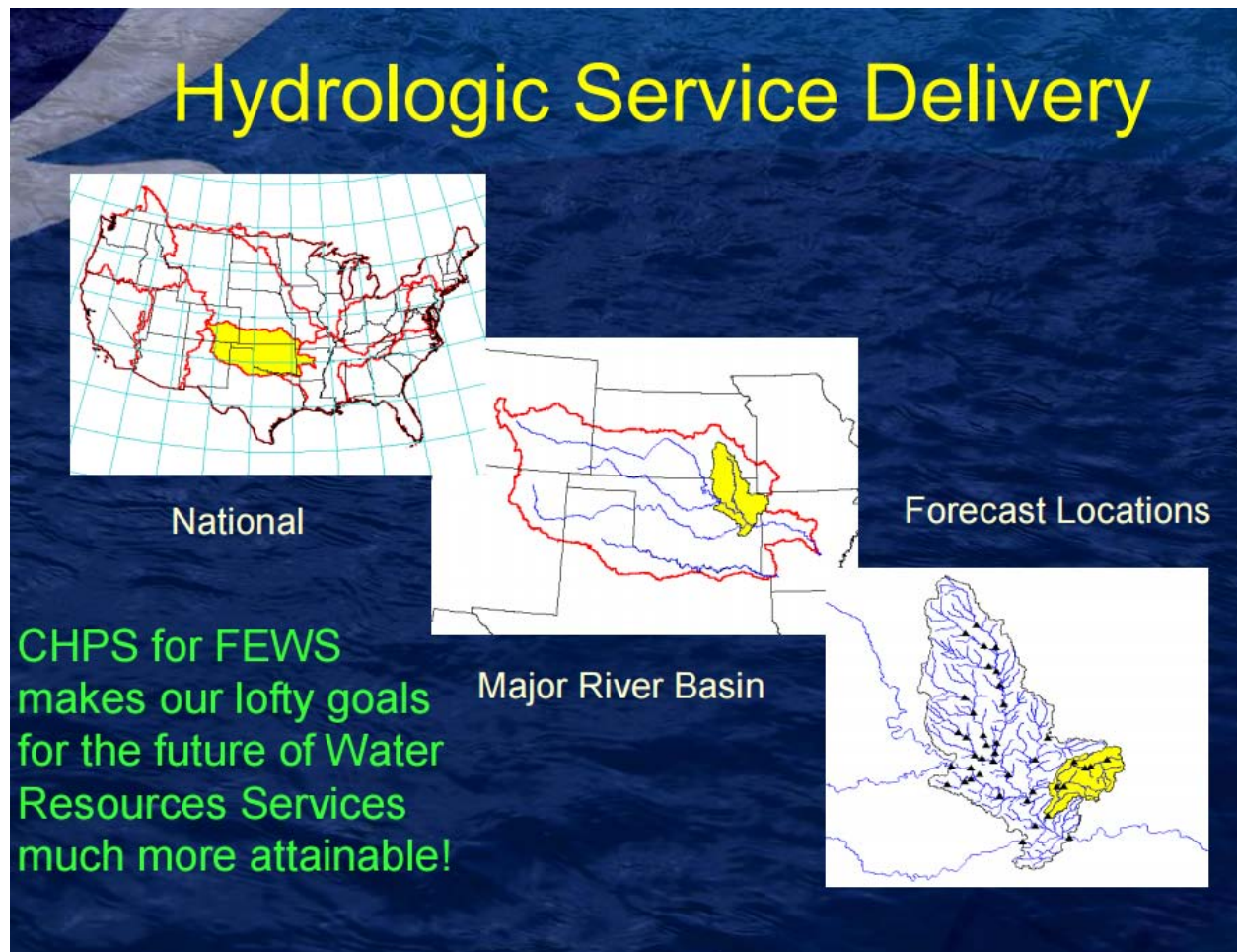
Forecasted Meteorological Data

- ▶ MARFC's 3-day quantitative precipitation forecasts (QPFs)
- ▶ National Digital Forecast Database (NDFD) 3-day QPFs
- ▶ Weather Prediction Center (WPC) 7-day QPFs
- ▶ Global Ensemble Forecast System (GEFS) 15-day forecasts



FEWS: National Weather Service

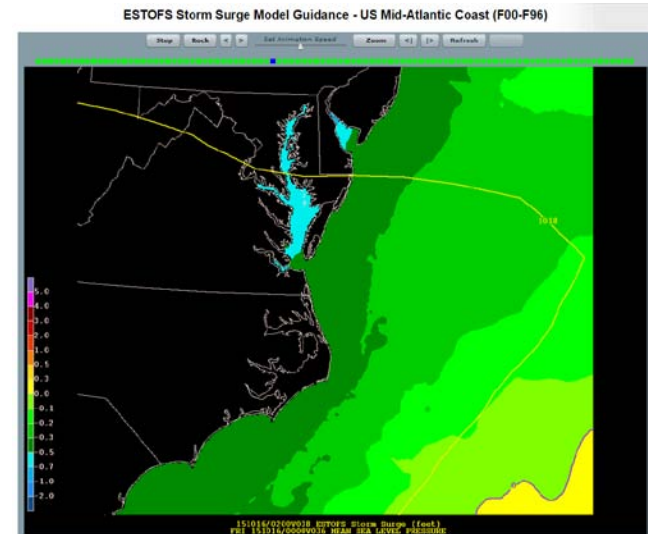
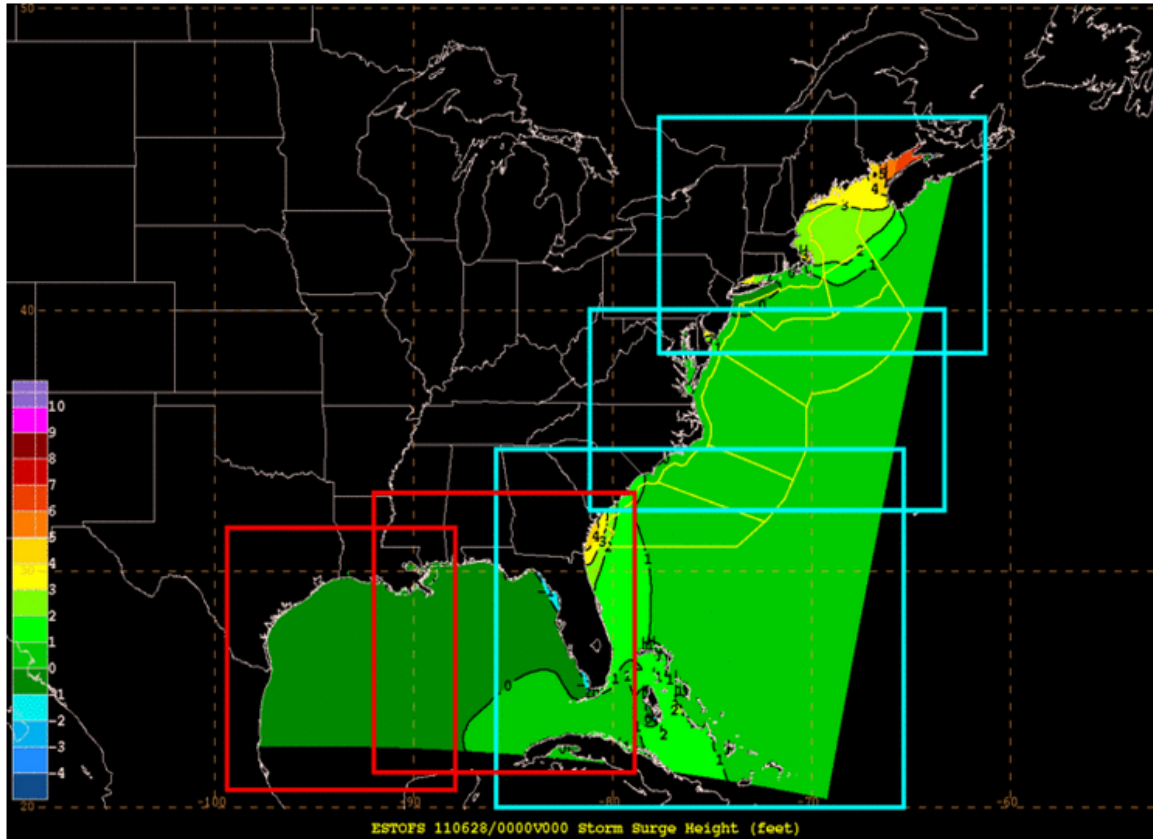
- Community Hydrologic Prediction System/Flood Emergency Warning System



ESTOFS Storm Surge Model Guidance (0-96 Hour Forecasts)

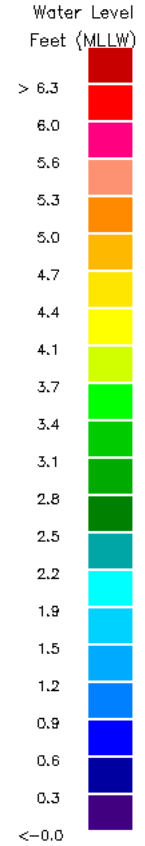
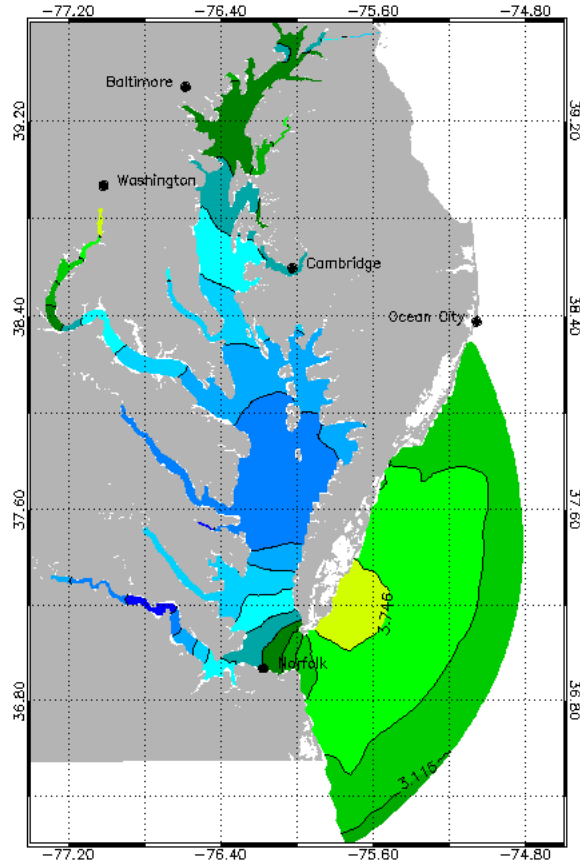
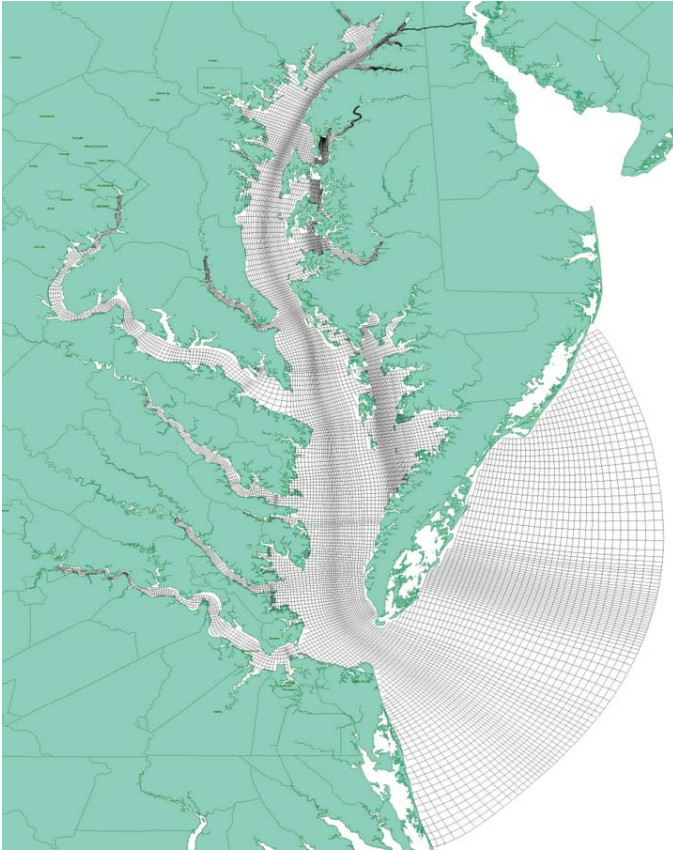
[Go to 0-96 hour forecasts](#) – [Go to 97-180 hour forecasts](#) – [Go to Total Water Level \(including tides\) forecasts](#)

(Mouseover and click the area where you would like to view the current extratropical storm surge model guidance data)



Chesapeake Bay OFS Water Level Nowcast

All model nowcast and forecast information is based on a hydrodynamic model and should be considered as computer-generated nowcast and forecast guidance.

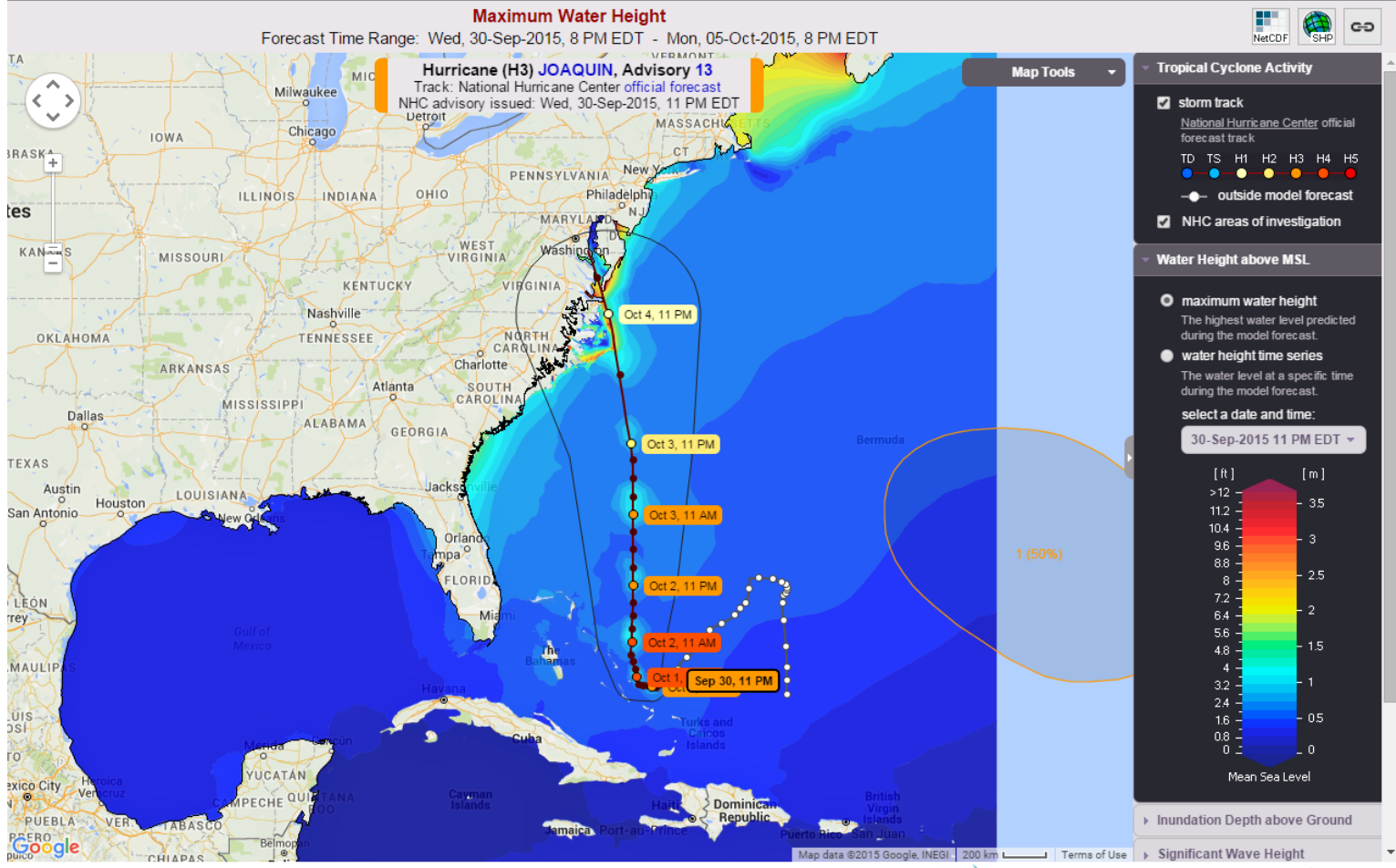


Valid at 1900 (EDT) 10/13/15

CERA

Coastal Emergency Risks Assessment Storm Surge and Wave Guidance for the Atlantic Coast
 ADCIRC Coastal Circulation and Storm Surge Model + SWAN Wave Model

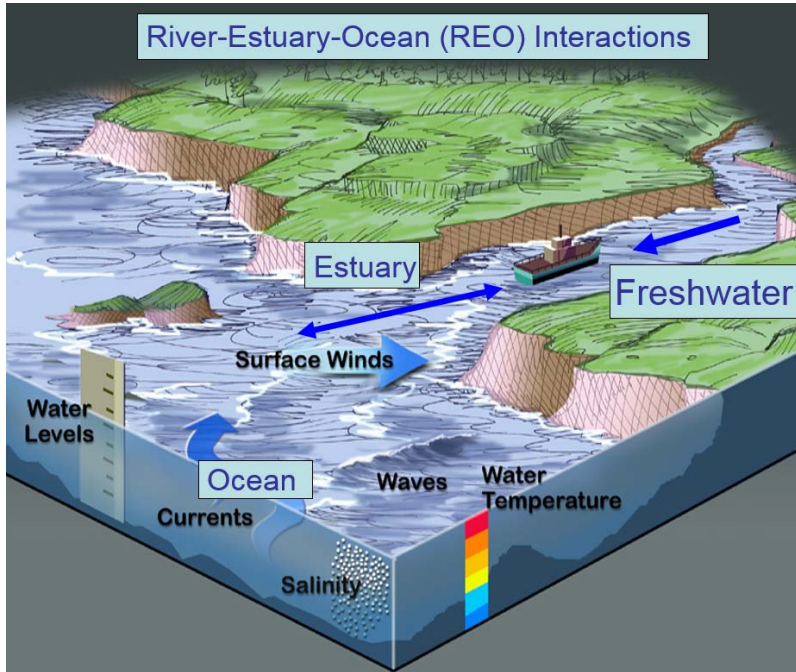
Select by: **Day** **Storm** | Storm: 2015 - JOAQUIN | Advisory/Track: 13 - NHC forecast | Best For: North Carolina



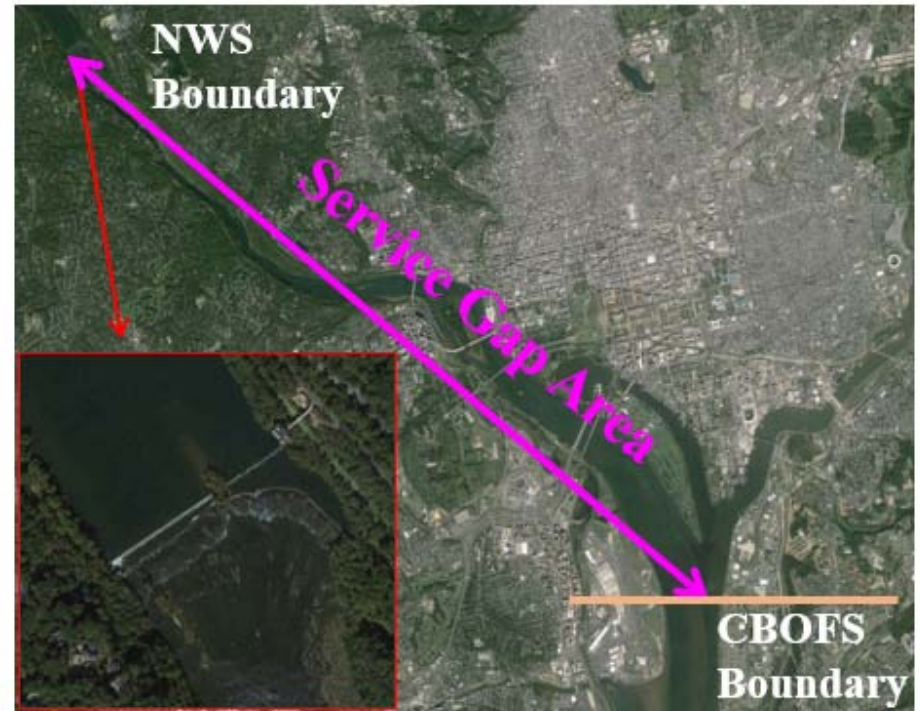
Contact us: [email](#) [tutorial](#)

Sea Grant | IGOOS | COASTAL HAZARDS CENTER | renci | LSU | ADCIRC | UNC | Seahorse

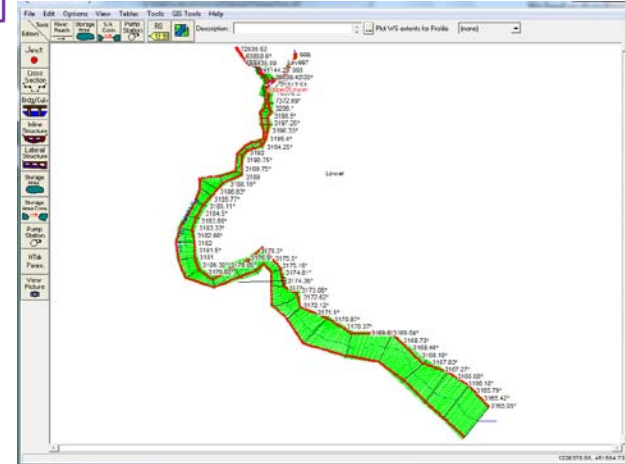
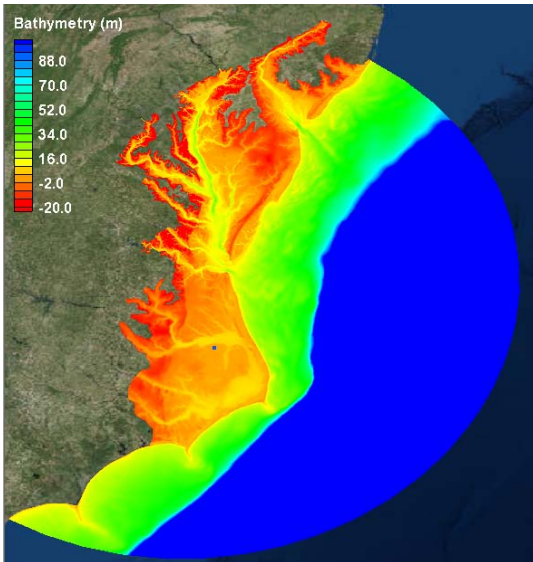
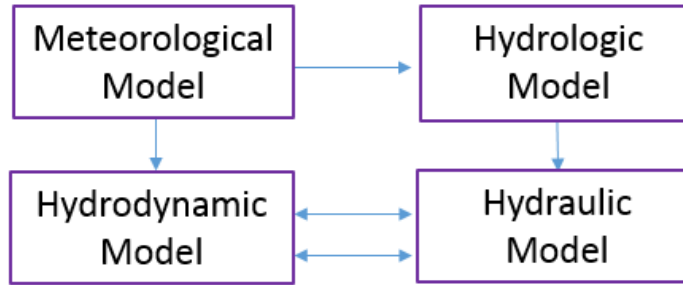
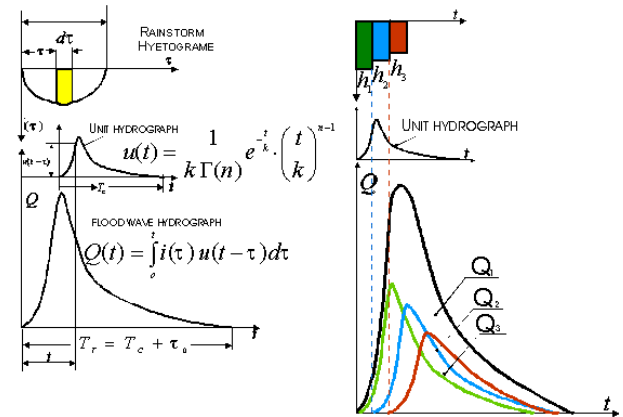
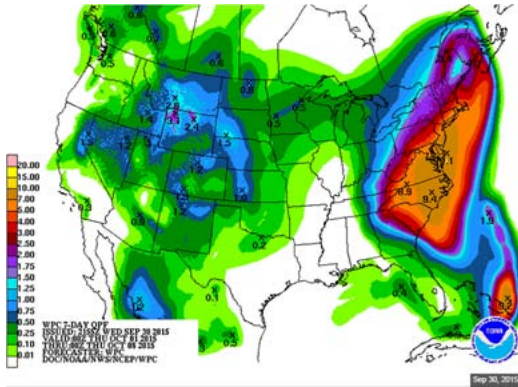
Gap Areas & Transition Zones



Potomac River at Washington DC

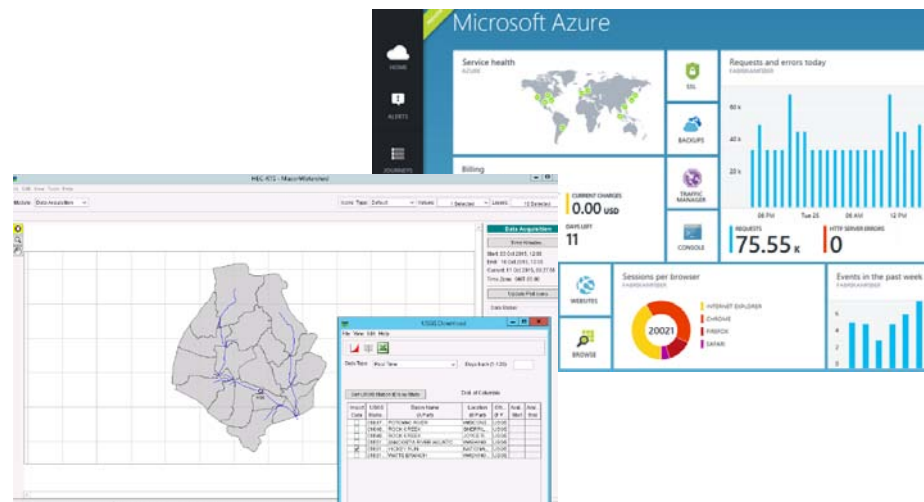


Forecasting in Transition Zones

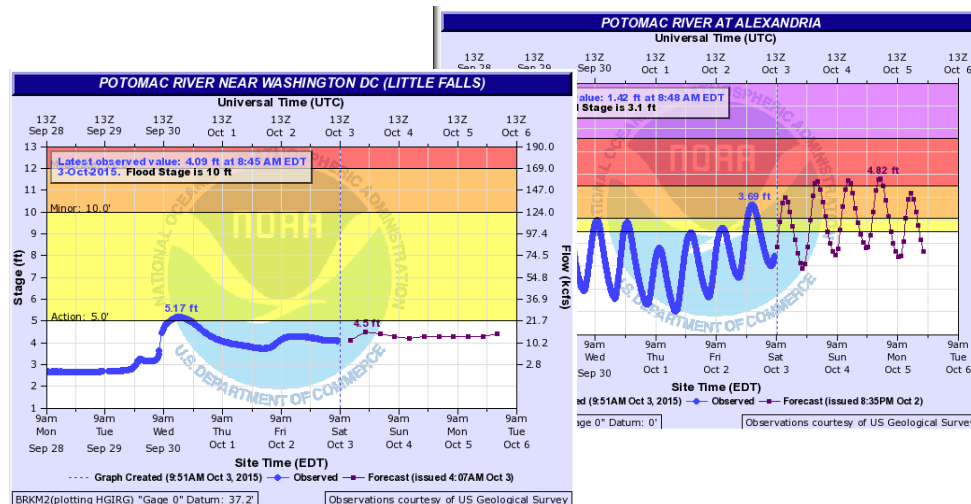


Unstructured Alternatives

- George Mason Campus
 - Microsoft Azure & Amazon EC2 Cloud Computing
 - SQL Database
 - Linux/Windows Platforms
 - Bash Scripting



- Hurricane Joaquin
 - HEC-RAS on Azure
 - ADCIRC on ARGO
 - Python Scripting



Summary & Conclusions

- In many cases, existing models can be refitted for forecasting
- Tools are readily available for transforming to an operational forecast capacity
- Forecast can be done at regional and local levels to augment national operations
- Water Resources Engineers need to become more familiar with the data types and data tools in use by meteorologist
- Flood Alerts: Operational forecast maps

Questions?

Graphical References

Models and Modeling in FEWS, Part I: Micha Werner, Deltares & UNESCO

http://www.nws.noaa.gov/oh/hrl/hsmb/docs/hydraulics/presentations/Mashriqui_etal_OHD_25August2010.pdf

<http://www.weather.com/news/news/stunning-meteorological-images-october-2015-flooding>

https://www.youtube.com/channel/UCd6e2OI2RF6brhy_Fo22wiA

http://oss.deltares.nl/c/document_library/get_file?uuid=6274405d-8f92-42b4-a9f3-09a4516448dc&groupId=145641

<http://seahorsecoastal.com/ASGSIsaac>

<http://adcirc.org/products/grids/>

<http://nc-cera.renci.org/>

http://www.usace.army.mil/Missions/CivilWorks/ProjectPlanning/CivilWorksReviewBoard/mill_creek.aspx

<http://tidesandcurrents.noaa.gov/ofs/cbofs/cbofs.html>

<http://planetprinceton.com/2015/09/30/tropical-storm-joaquin-could-reach-new-jersey-by-sunday/>

<http://blogs.microsoft.com/blog/2014/04/03/microsoft-announces-new-cloud-experience-and-tools-to-deliver-the-cloud-without-complexity/>

http://www.awra.org/meetings/Annual2014/doc/pdfs/ANL_S63_Schultz_Cherie.pdf

http://waterdata.usgs.gov/md/nwis/uv?site_no=01646500

<http://water.weather.gov/ahps2/hydrograph.php?gage=axtv2&wfo=lxw>

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