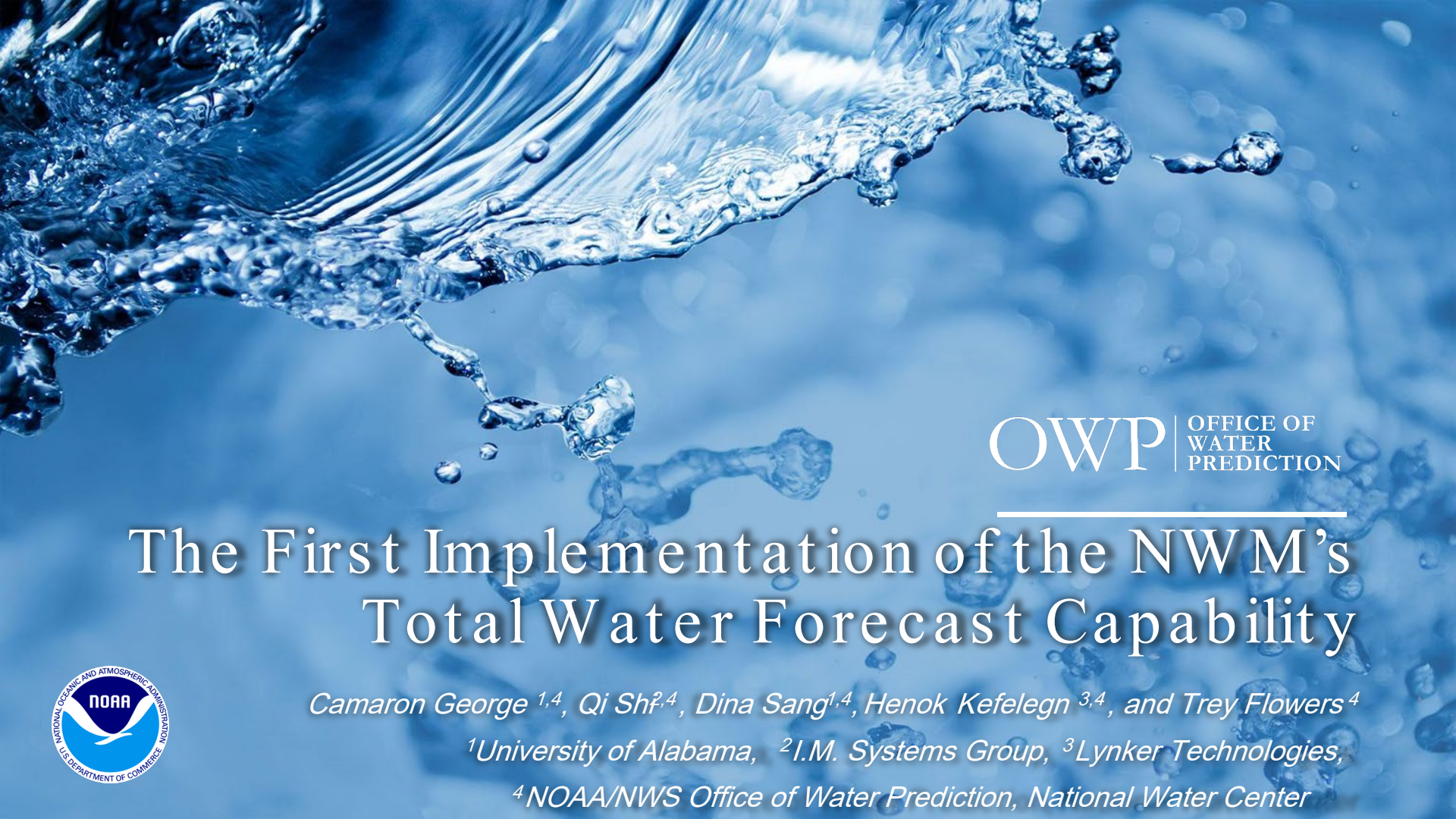

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The First Implementation of the NWM's Total Water Forecast Capability

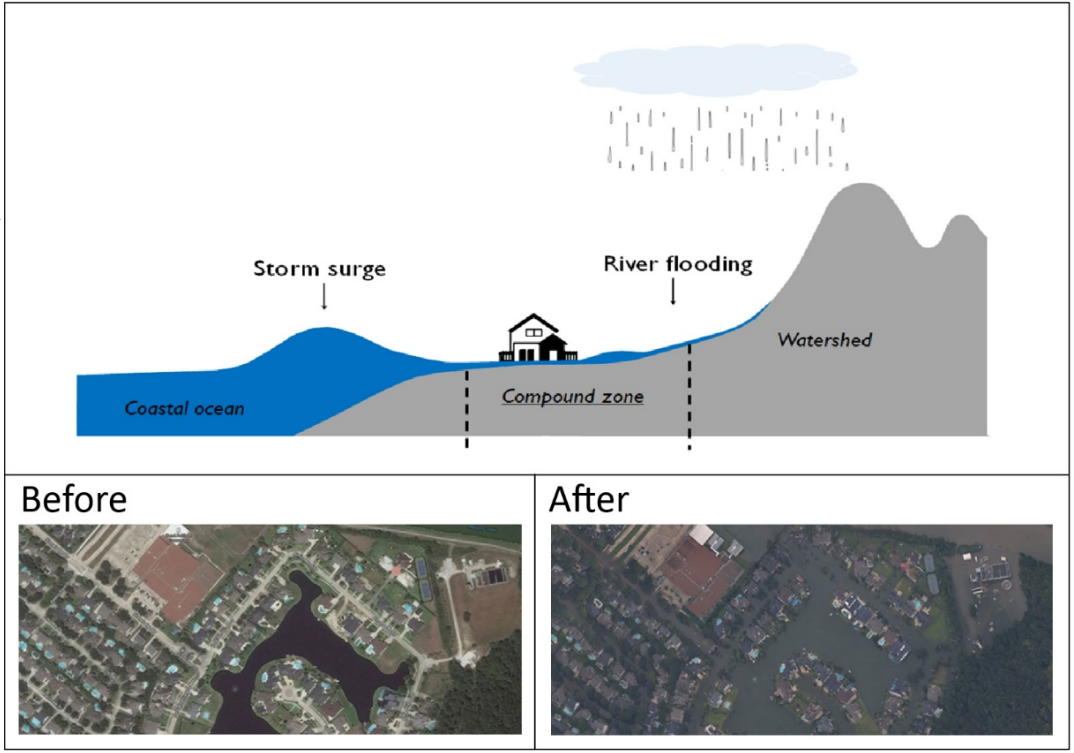
Camaron George [1,4], Qi Shi[2,4], Dina Sang[1,4], Henok Kefelegn [3,4], and Trey Flowers [4]

[1]University of Alabama, [2]I.M. Systems Group, [3]Lynker Technologies,

[4]NOAA/NWS Office of Water Prediction, National Water Center

Coastal Flooding

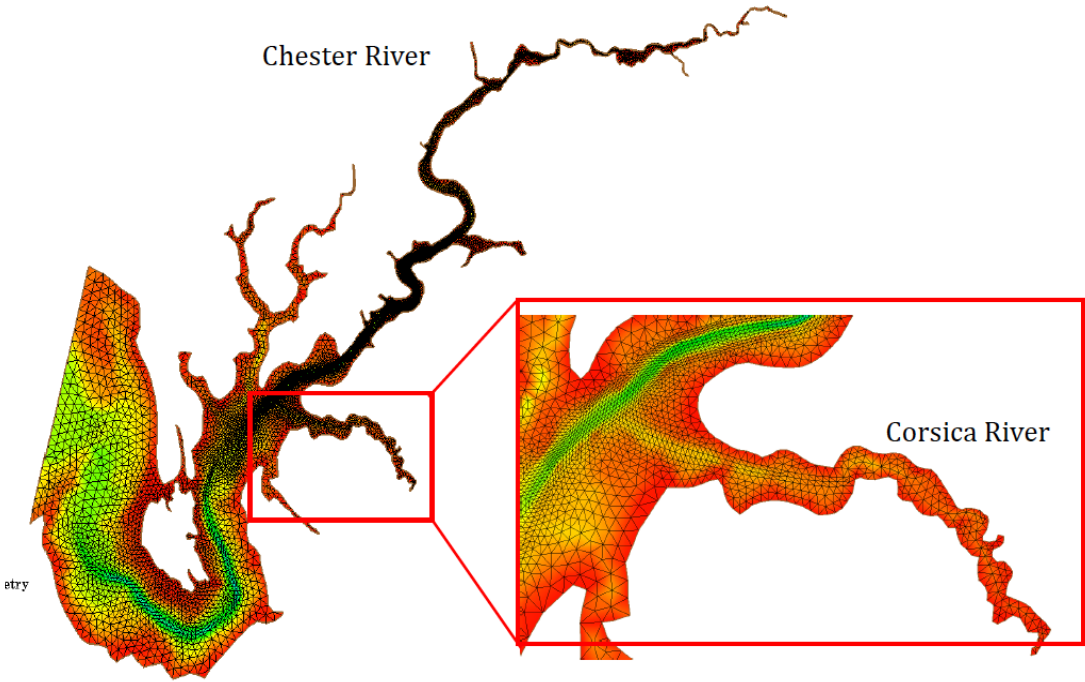
- Coastal flooding posts increasing risks to the coastal community:
  - Sea level rise – more frequent tidal flooding
  - Stronger storms – compound flooding
- Goal: Produce a coupled modeling strategy that will provide total water level prediction for the Nation Water Model (NWM), which will:
  - improve the accuracy of NWM-based flood inundation mapping along the coast
  - provide enhanced guidance to emergency responders



Credit: NOAA Remote Sensing Division

Semi-implicit Cross-scale Hydroscience Integrated System Model (SCHISM)

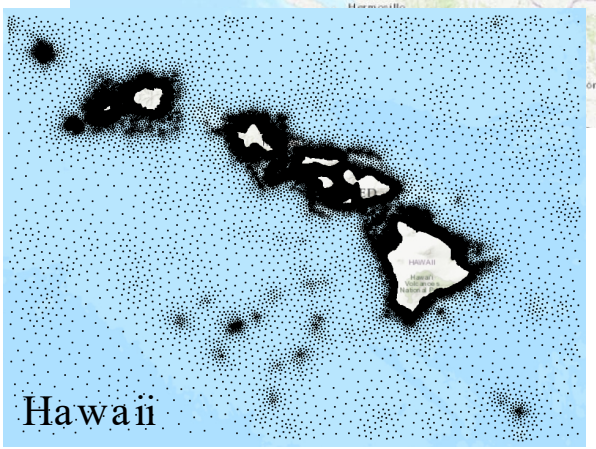
- SCHISM acts as a “middleware” to link oceanic processes to upstream rivers/creeks using polymorphism technique
- Unstructured mesh provides flexibility of local refinement, boundary resolving, and feature capturing
- Accurate, yet efficient, by using implicit solvers
- Open source with active community participation



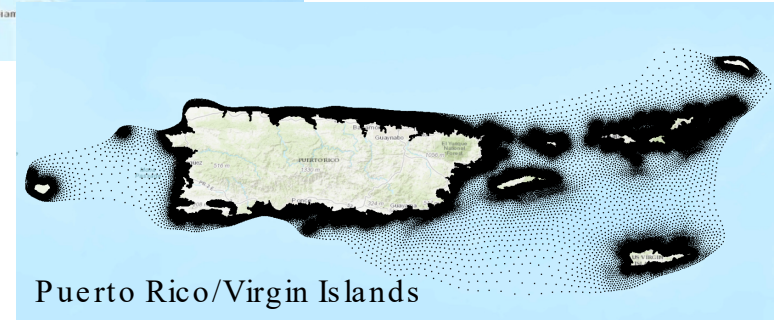
Friedrichs et al (2015)

Model Domains

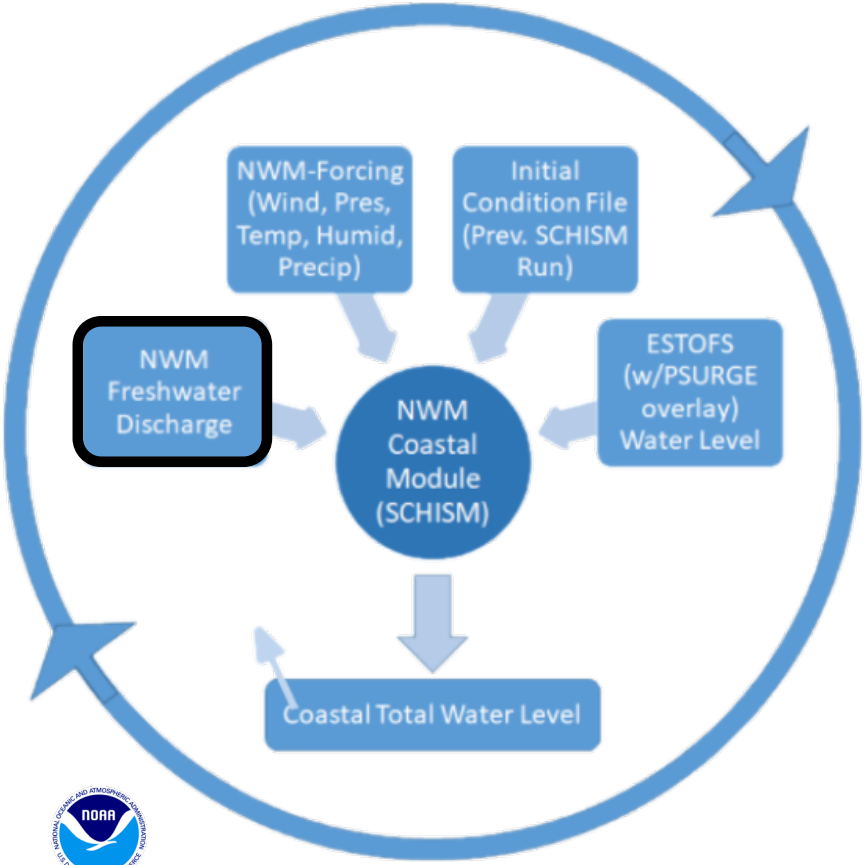
Unstructured mesh generated using a sizing function (paper 4.1 by Henok Kefelegn et al.)

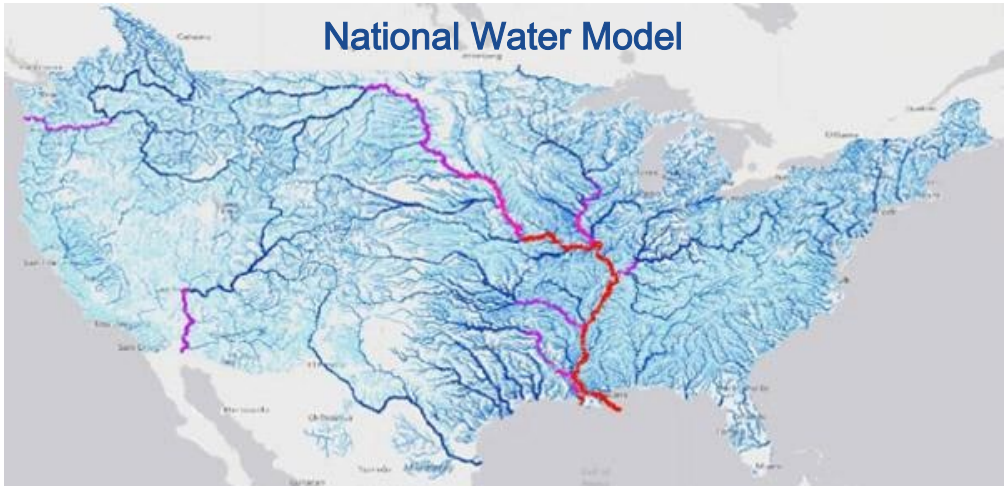


Resolution:
30 m near rivers
70 – 100 m away from rivers



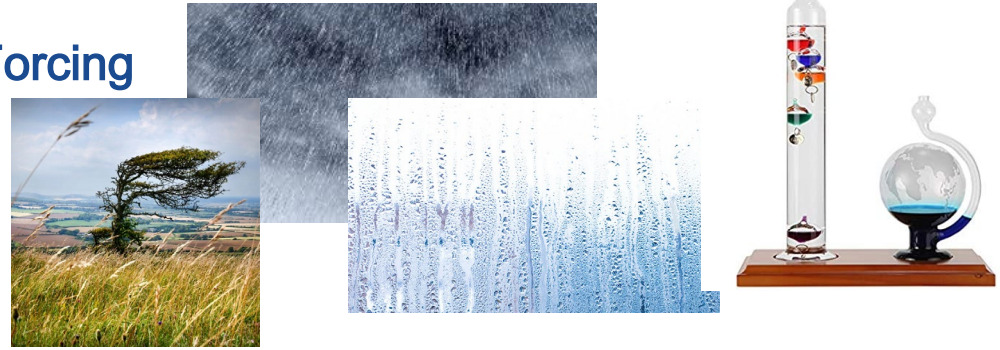
Coupling framework – Freshwater Forcing

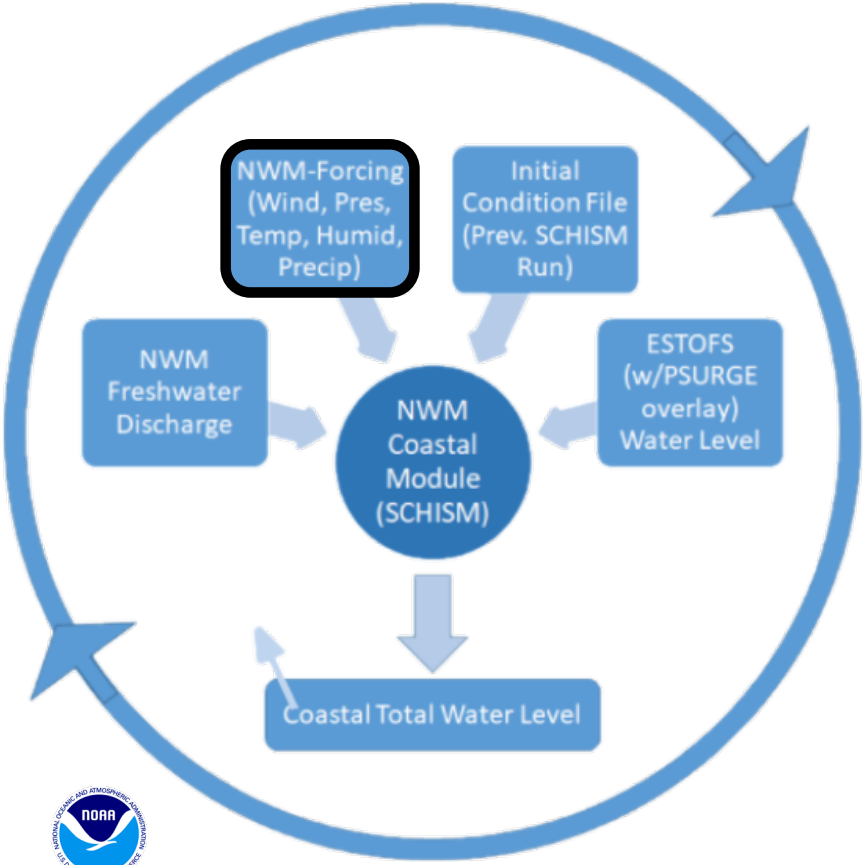




Streamflow from the NWM forecast is injected into the SCHISM domain as point sources/sinks at the intersections between NWM segments and SCHISM land boundary.

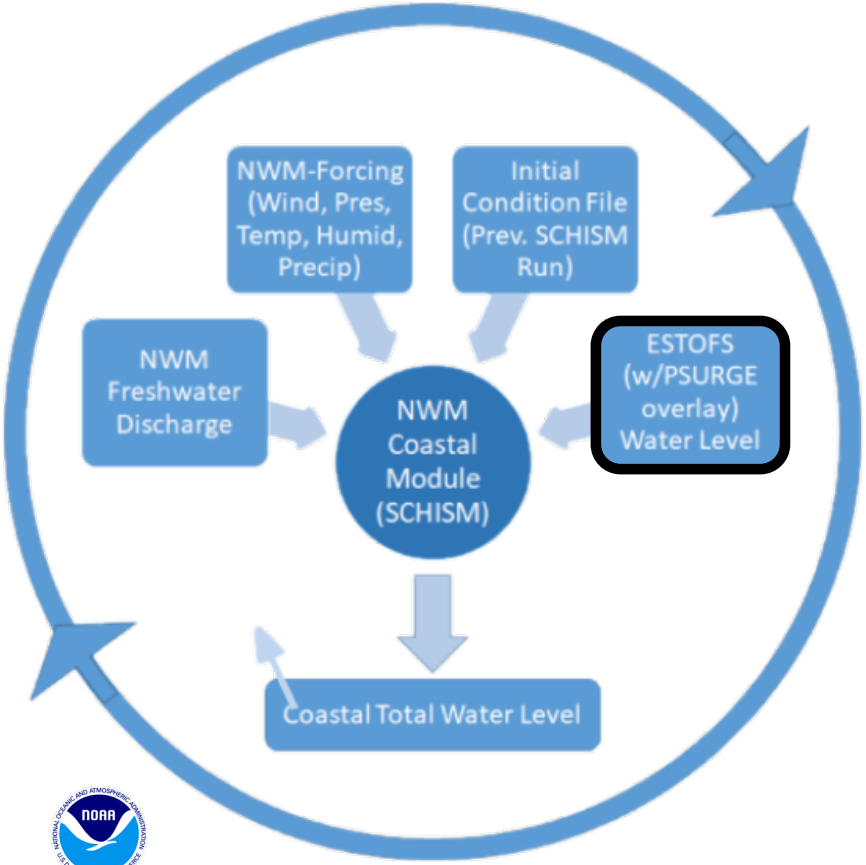
Coupling framework – Atmospheric Forcing

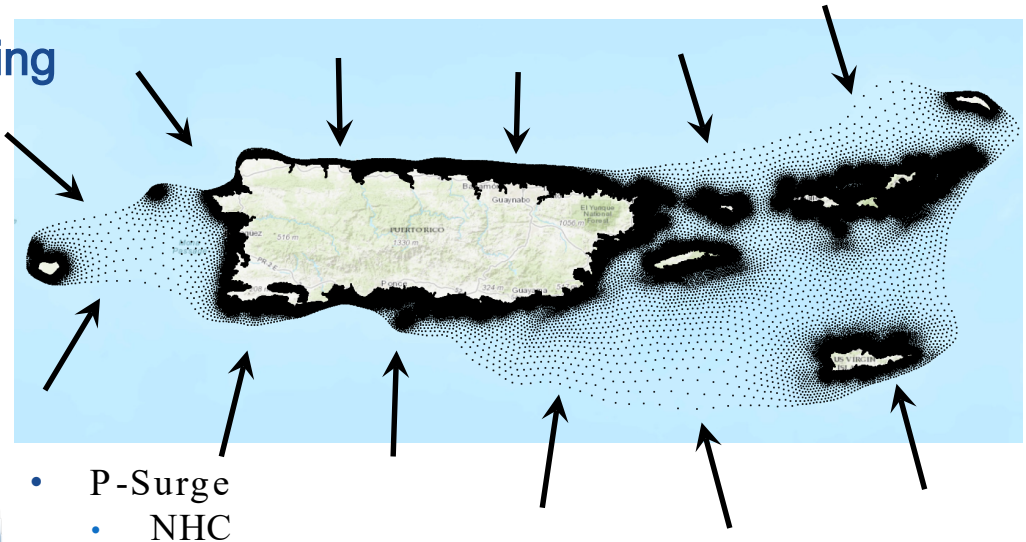




- Surface wind speed, temperature, sea level pressure, and humidity from the NWM is sent to SCHISM as 2-dimensional fluxes
  - Short-range forecast: High-Resolution Rapid Refresh (HRRR)
  - Medium-range forecast: Global Forecast System (GFS)
- Similar to the NWM streamflow, the precipitation is injected into the model domain as point sources.

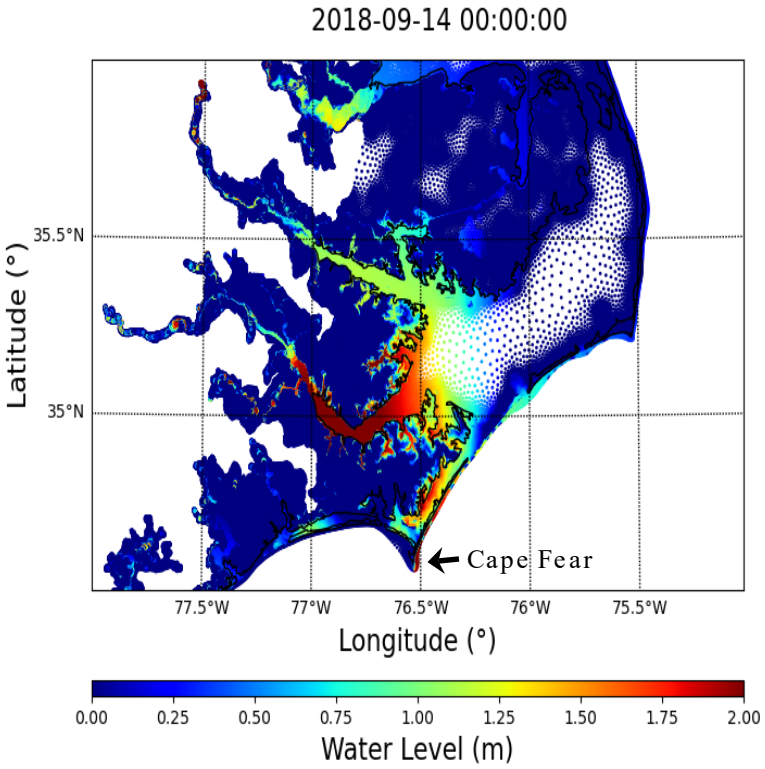
Coupling framework – Oceanic Forcing





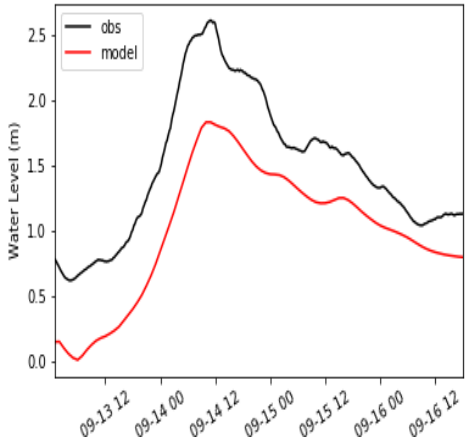
- P-Surge
  - NHC
  - Forecast Range: 0-102 hrs
  - Horizontal Resolution ~1 km
  - Domain Coverage: Basin based
  - Available when there is a storm approaching the east and/or gulf coast(s)
- ESTOFS
  - NOS/NCEP
  - Forecast Range: 0-180 hrs
  - Horizontal Resolution: up to 200 m
  - Domain Coverage: Global

Hurricane Florence (2018)

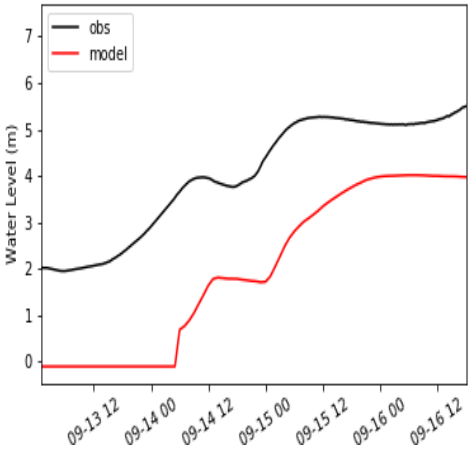


- Forecast Start Date/Time:
  - 09/13/18 at 00z
- Validation Tools:
  - NOAA Tide Gauges
  - USGS River Gauges
  - High water marks
  - Peak stage reports

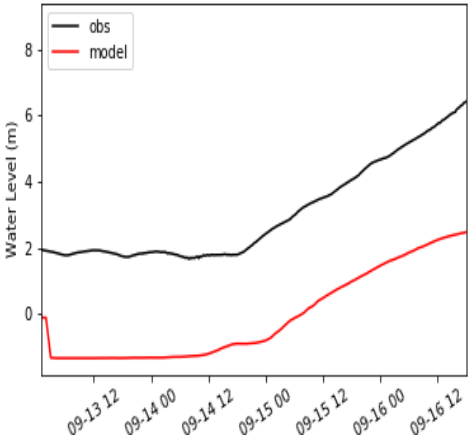
Pamlico River



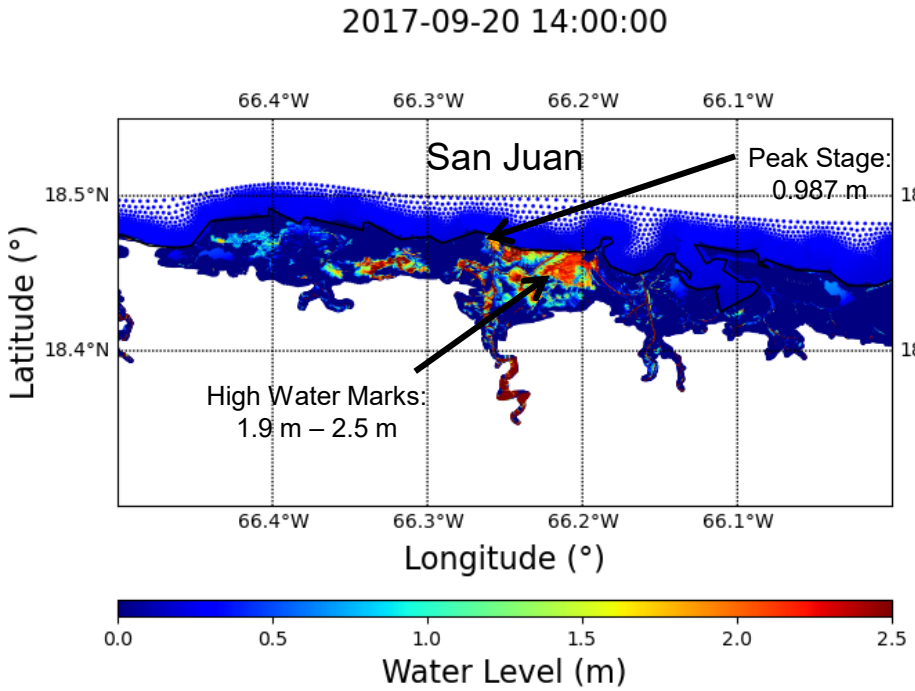
Pollocksville



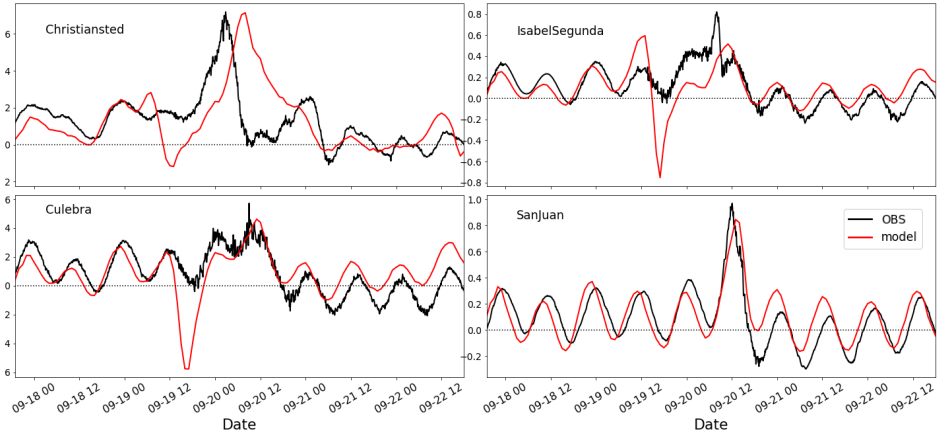
Northeast Cape Fear



Hurricane Maria (2017)



Model vs. NOAA Gauge Obs.



- Forecast Start Date/Time: 08/26/20 at 00z
- Validation Tools:
  - NOAA Tide Gauges
  - High water marks
  - Peak stage reports

Summary

- Addressing a critical forecasting gap, NWM v3.0 will feature the first implementation of a TWL forecast capability
- SCHISM, which resolves processes across multiple spatial and temporal scales, will operate along the East, Gulf and Pacific coasts, in PR/VI, and in HI
- Currently working on improving the accuracy of the results and two-way coupling between the inland and coastal modules

Thank You!

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https://water.noaa.gov

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