Progress on MTMs in the Potomac and Choptank Rivers – Initiation in the Tidal Potomac River

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Progress of MTM development

ICM equations and code

- Review and comparisons
- Incorporations of CH3D 2017 version

Domain and Grid

- Main Bay Model
- The linkage between the main stem and tributaries
- Shallow tidal waters

Chesapeake Bay Estuary Model

- Sub-BGC modules (SAV, marsh etc.)
- Sediment transport
- Wind wave

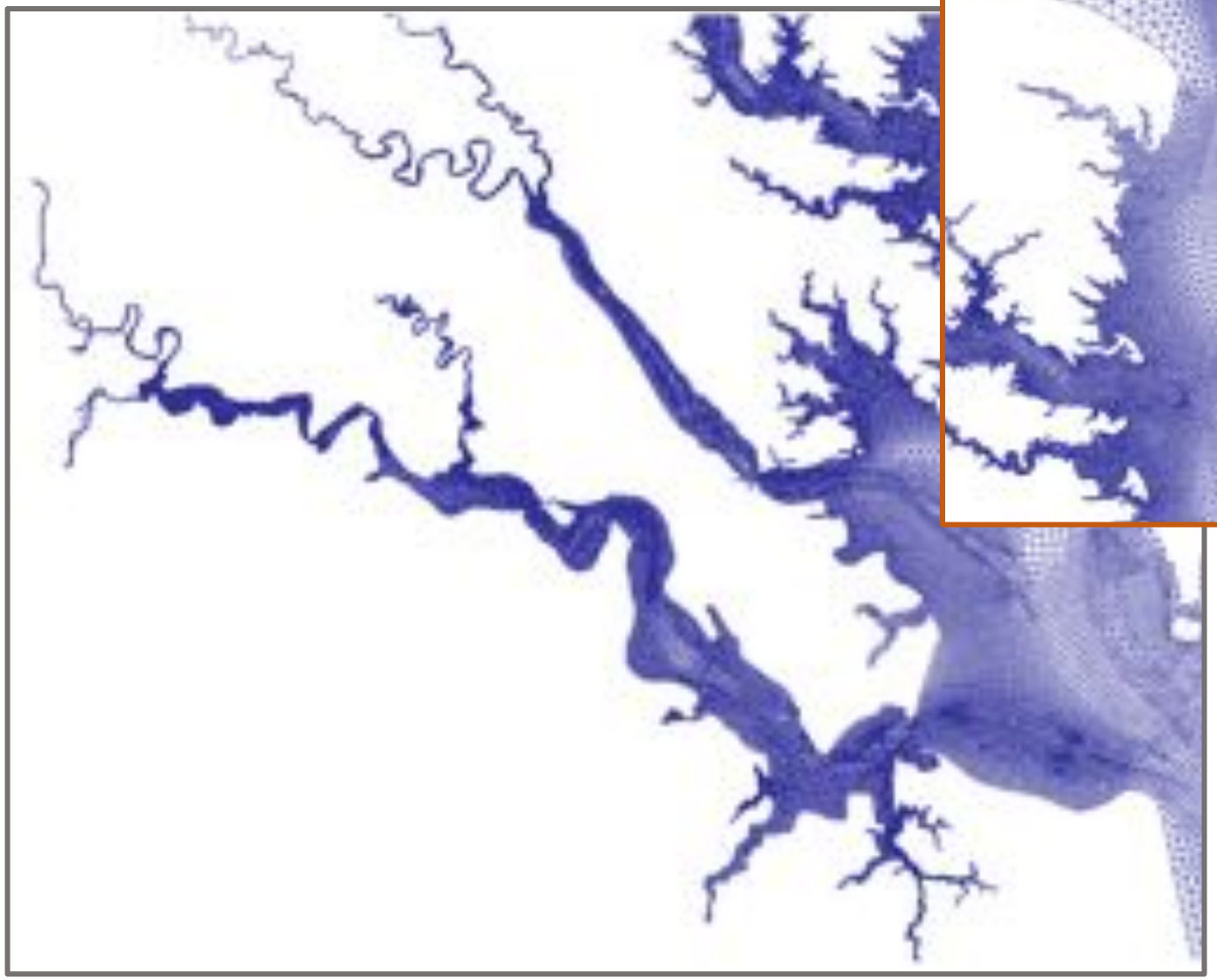
Modules and linkage

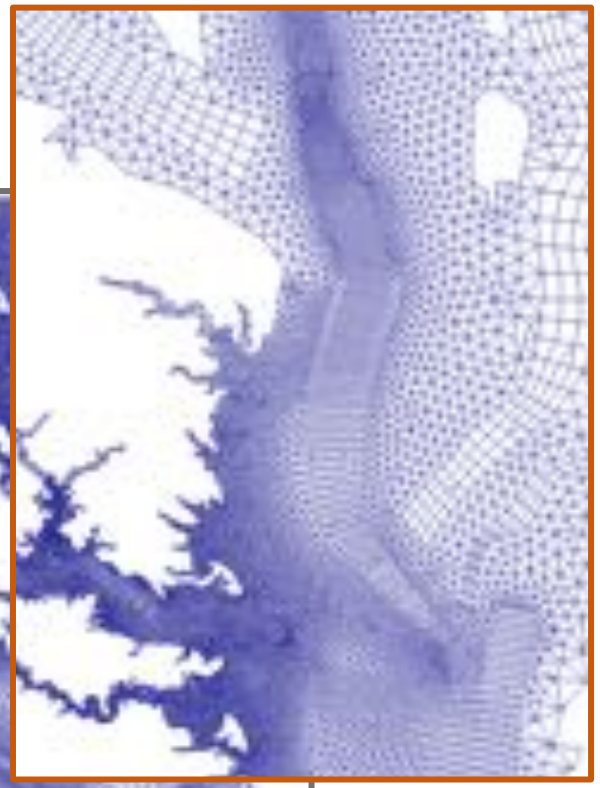
- Watershed
- Airshed
- Open boundary

Forcings

Progress of MTM development

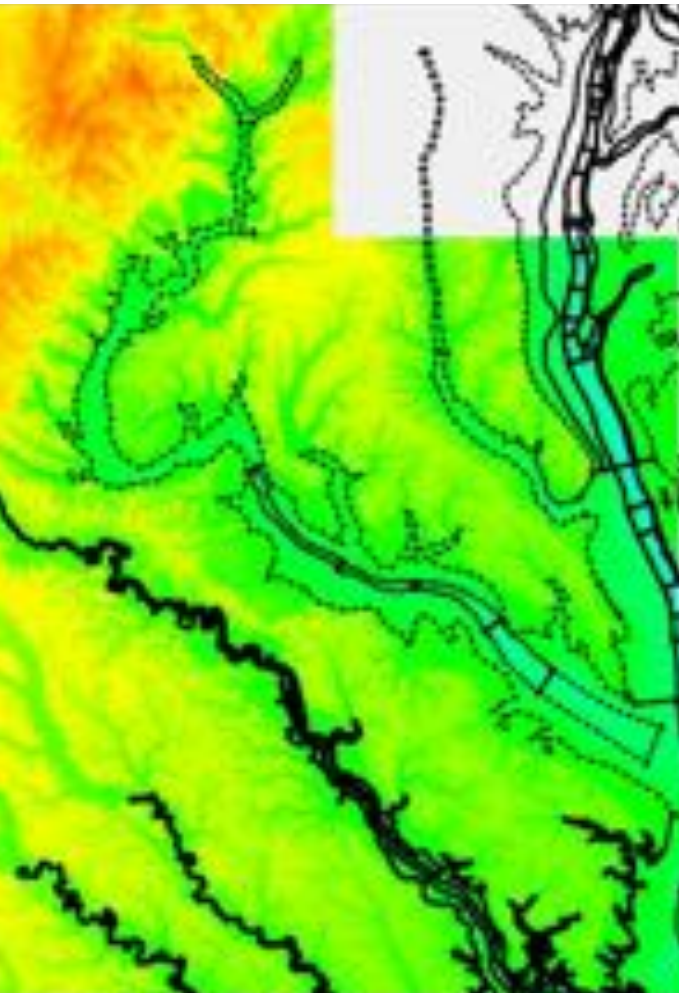
Tidal James and York Rivers





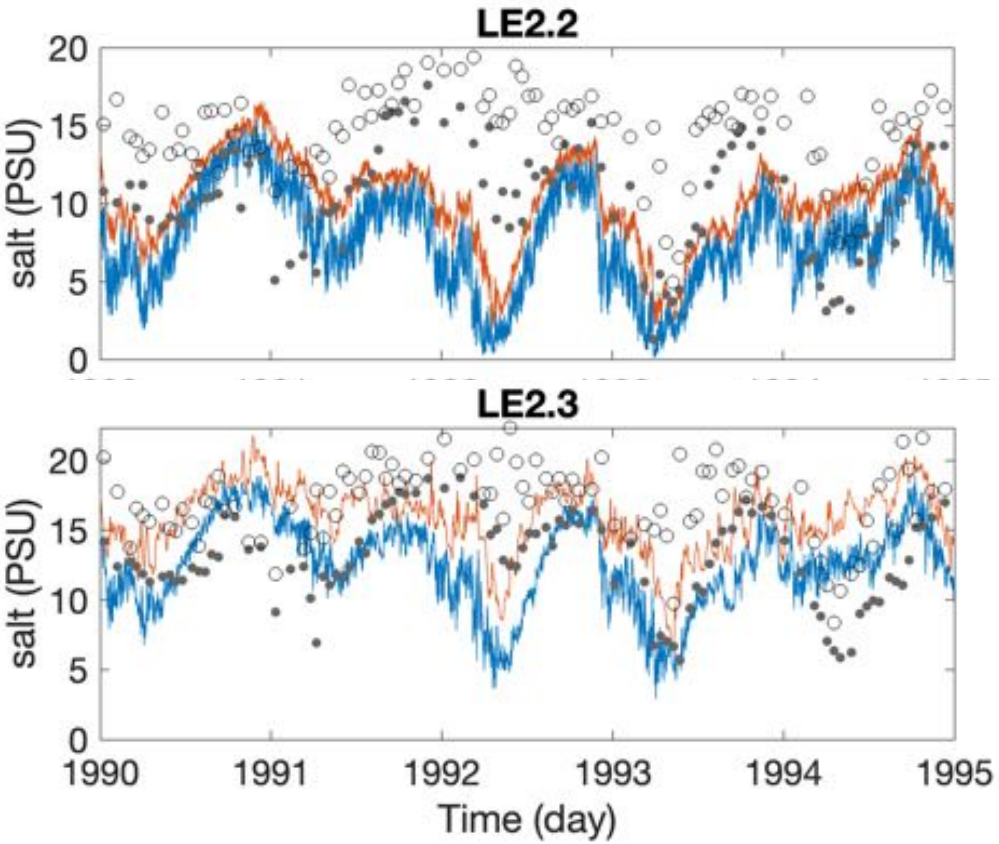
Going upwards for the linkage between the MBM and MTM

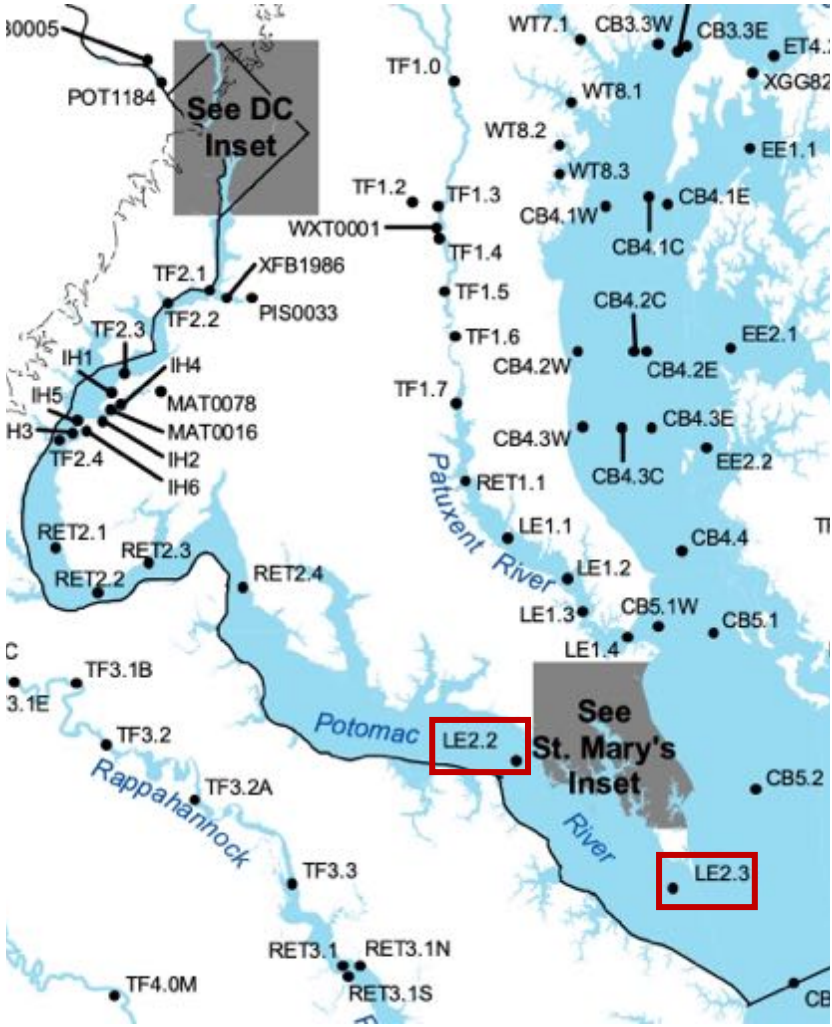
Condition of old Potomac grid



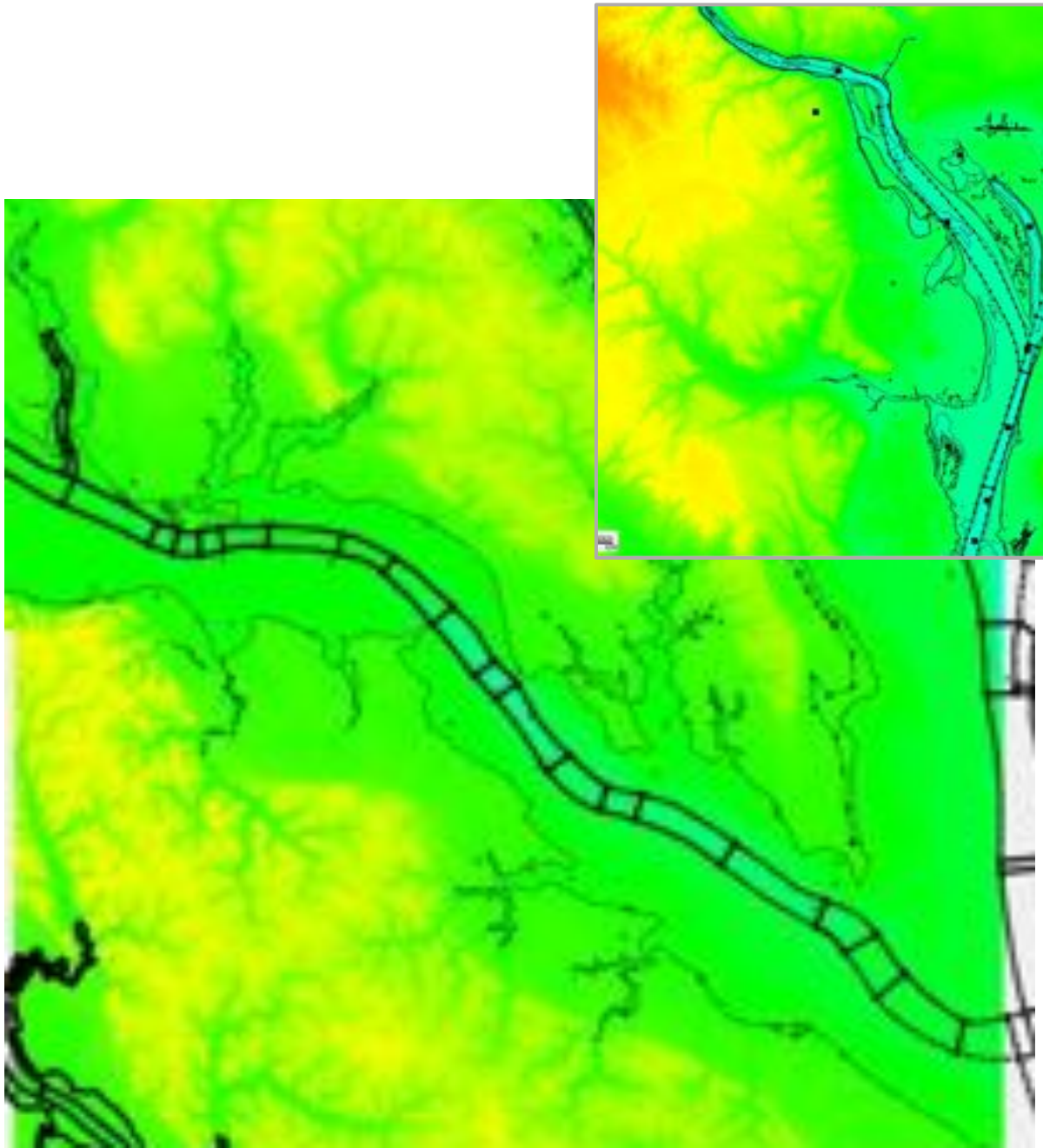
Resolution: about 1 km

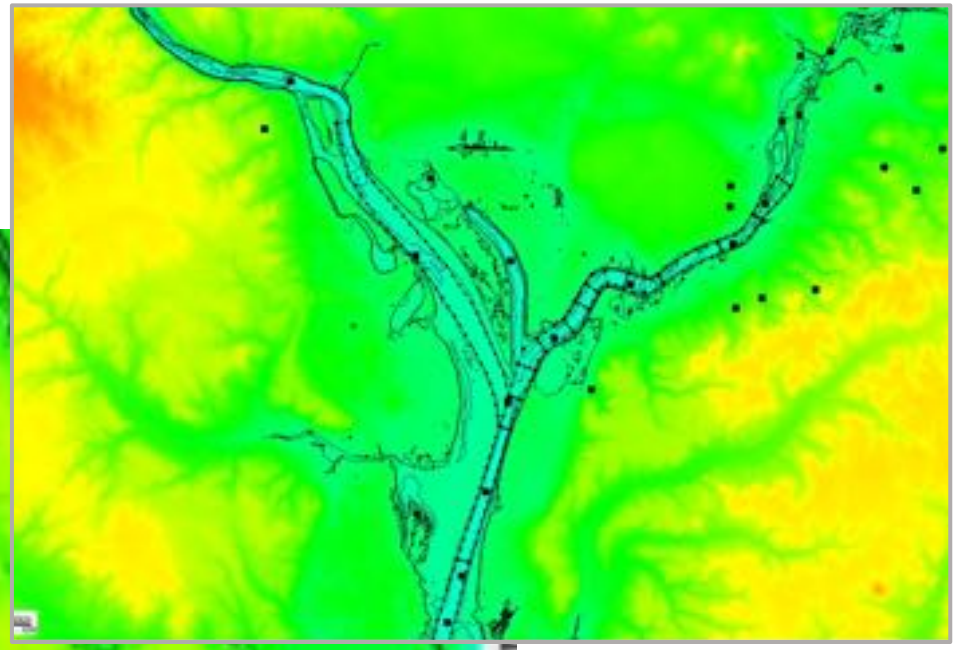
Overall insufficient stratification from the mouth





Grid construction screenshots

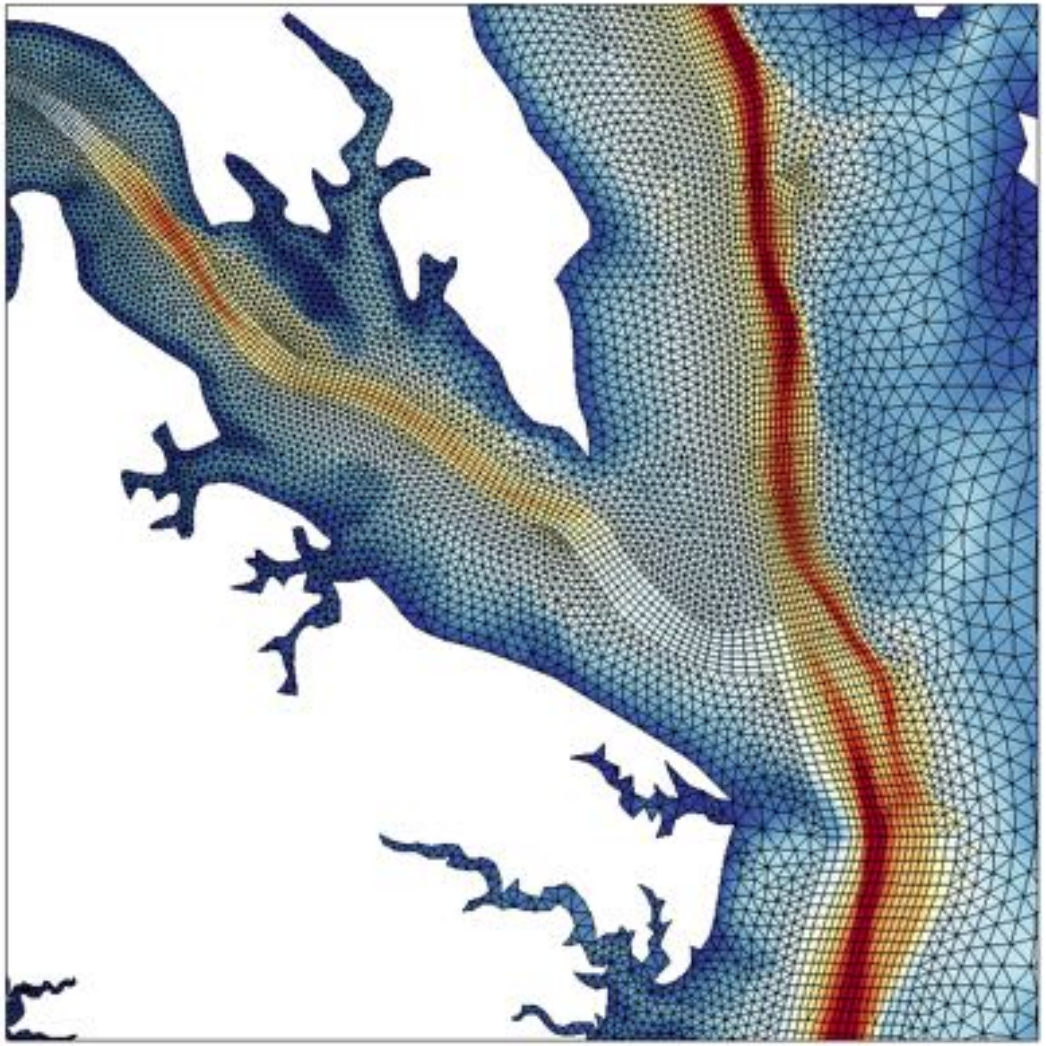




- Head of the Potomac connected to the Anacostia River
- In rectangular mesh

Lower Potomac connected the main stem of the Chesapeake Bay

Potomac horizontal grid



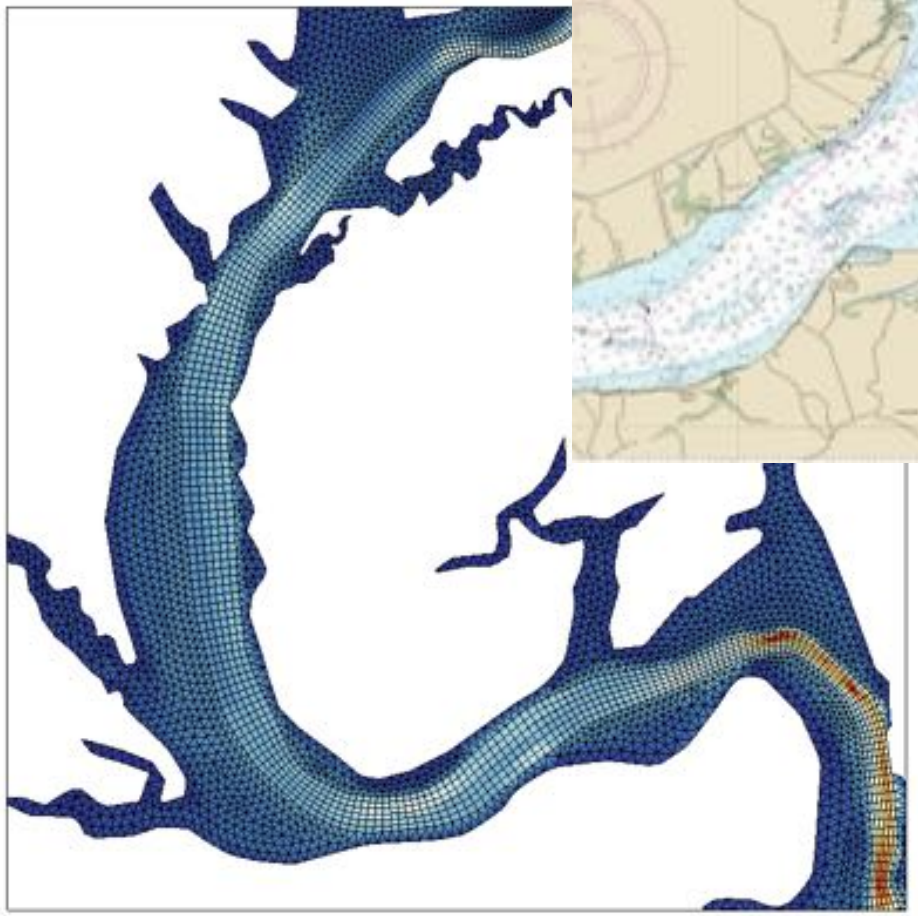
Potomac mouth

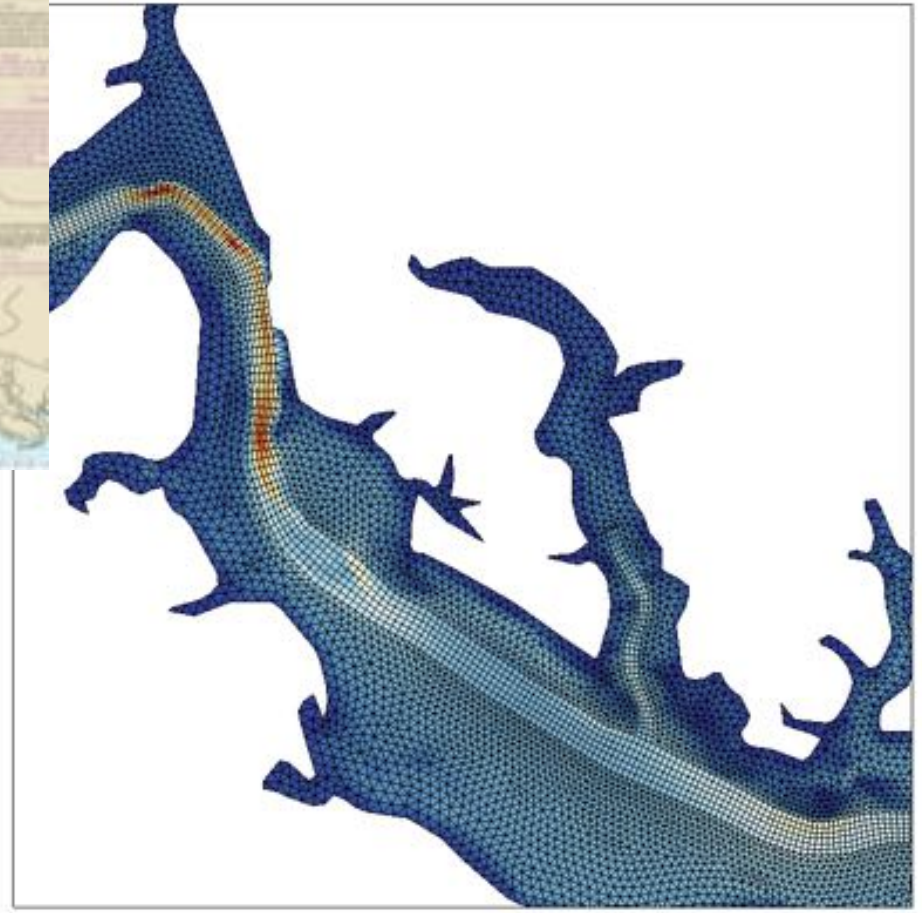
Potomac head

Potomac horizontal grid

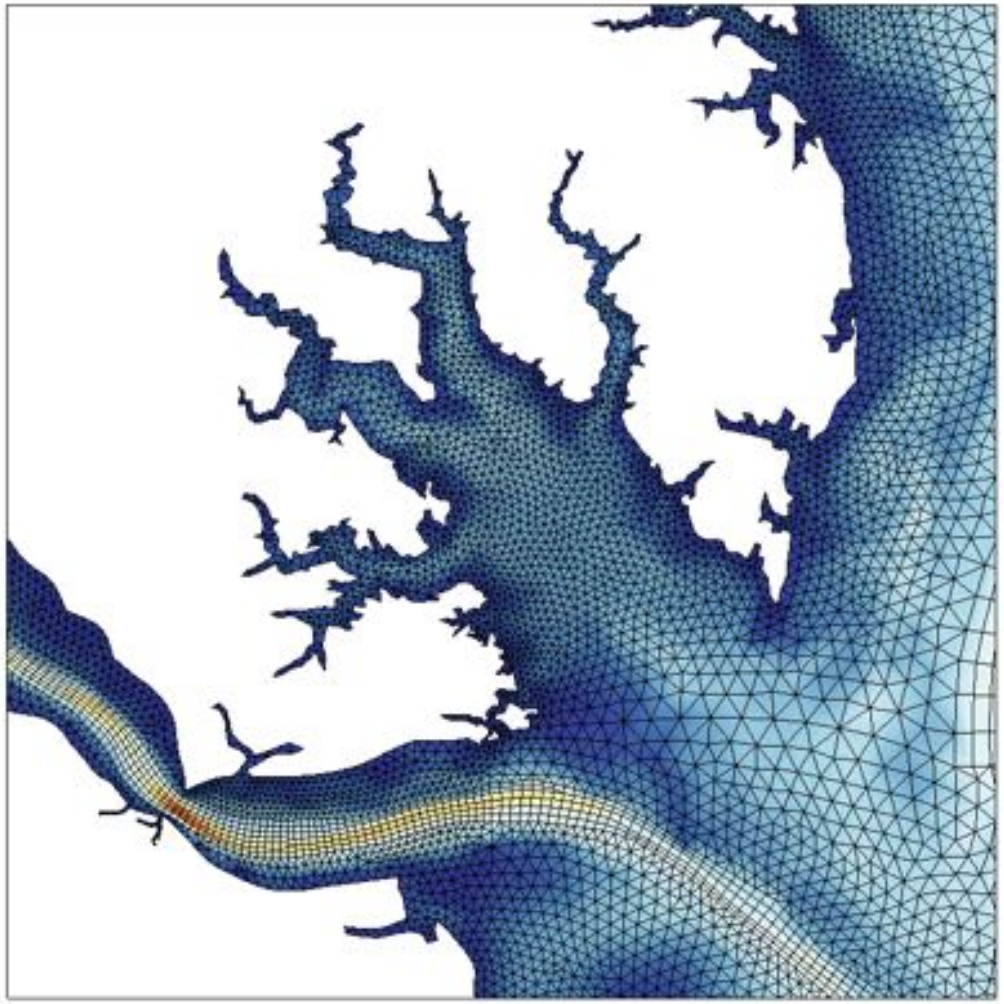
NOAA nautical chart (2021)

Mid Potomac R.

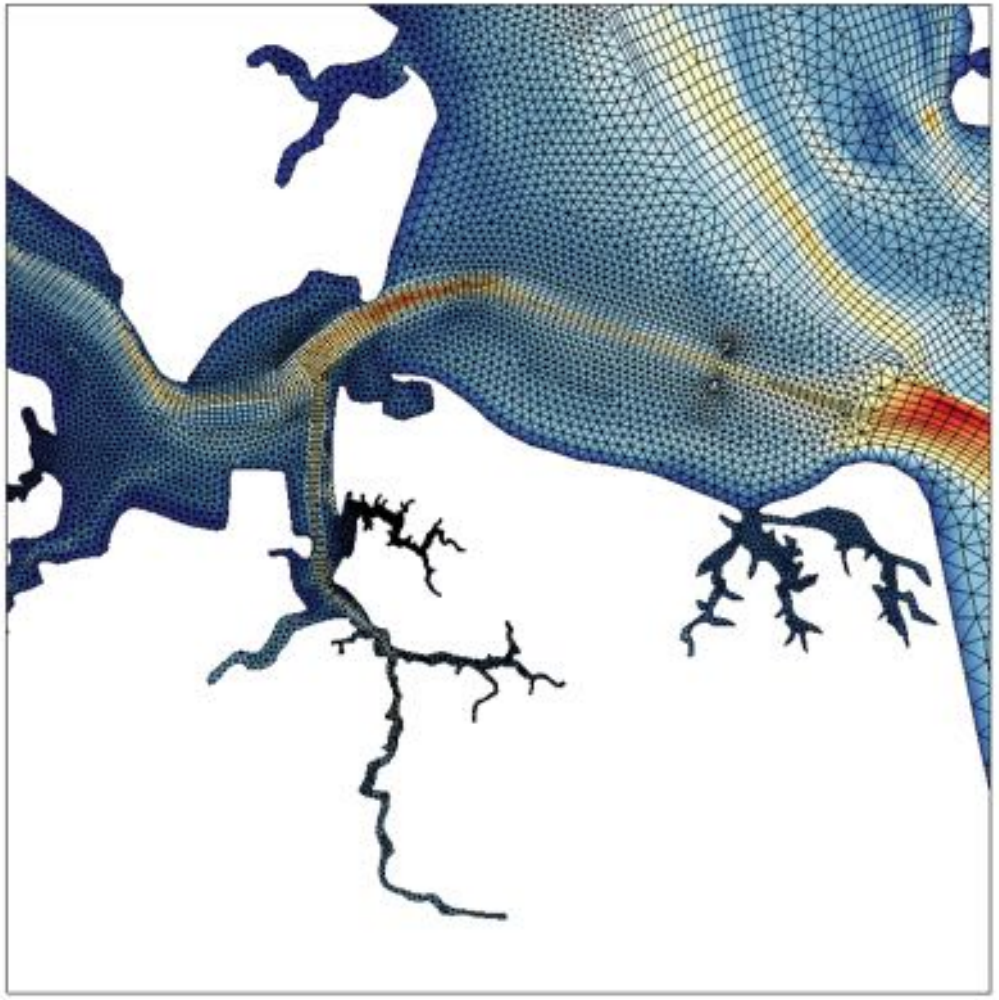




Expanded coverage



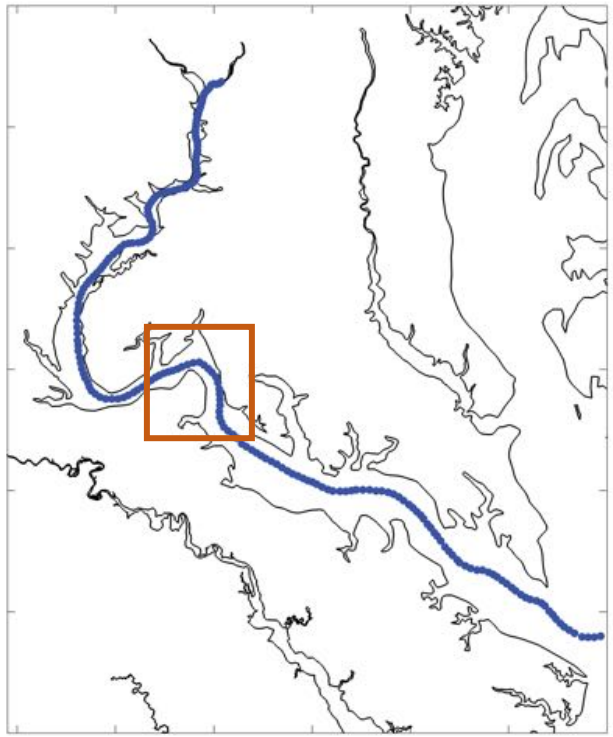
Mobjack Bay

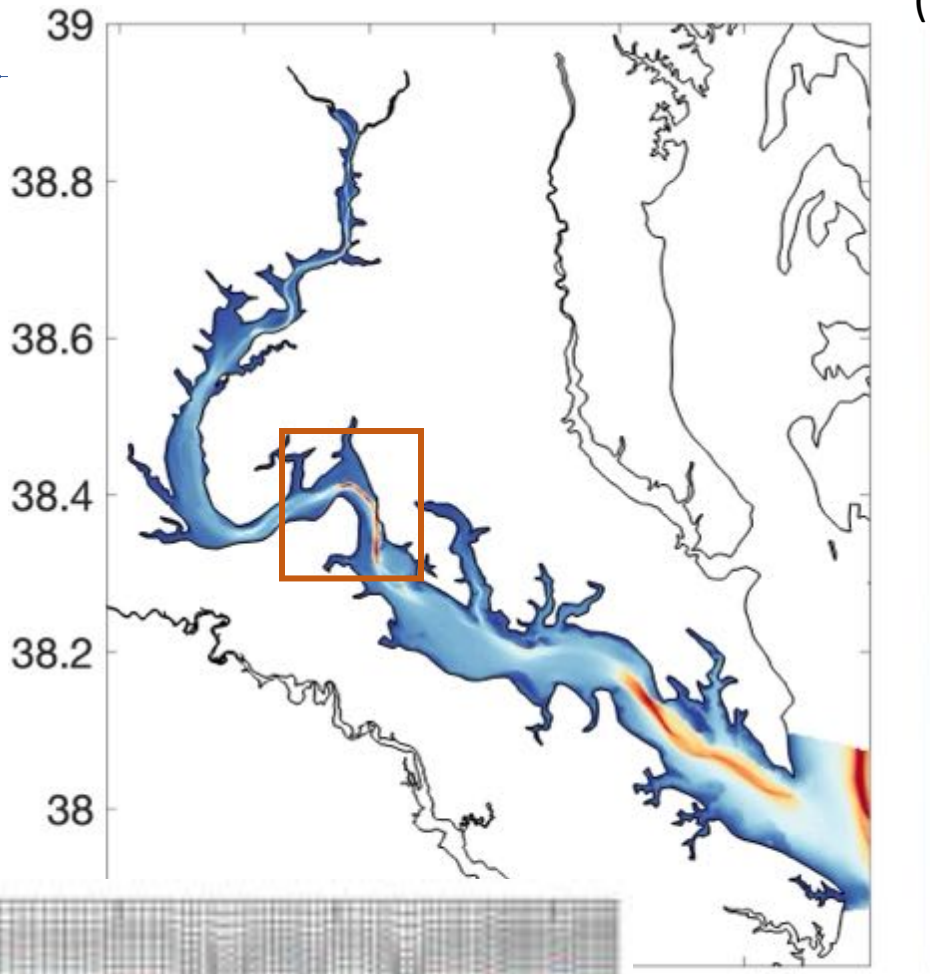


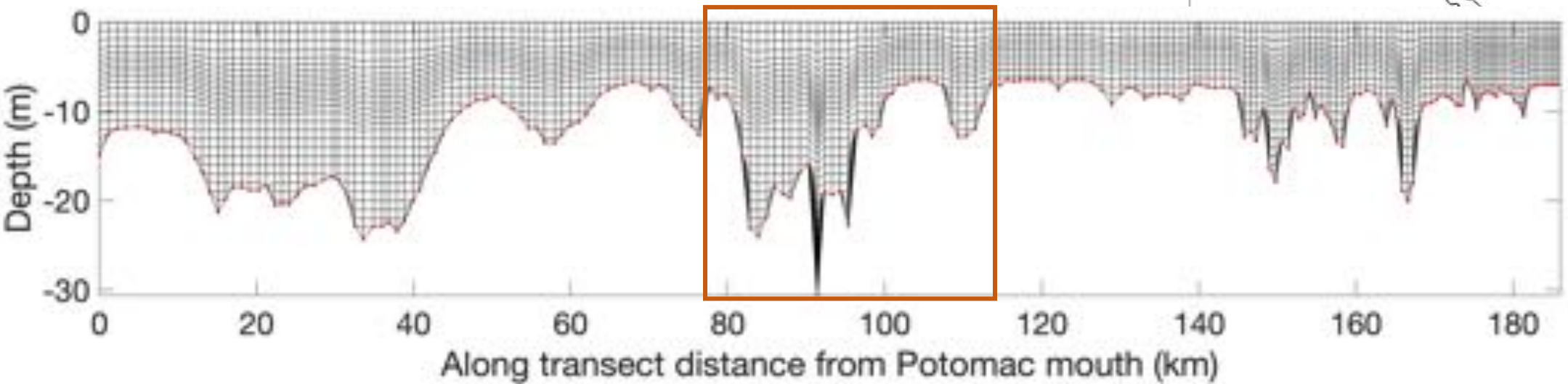
Lynnhaven Bay

Vertical grid and bathymetry

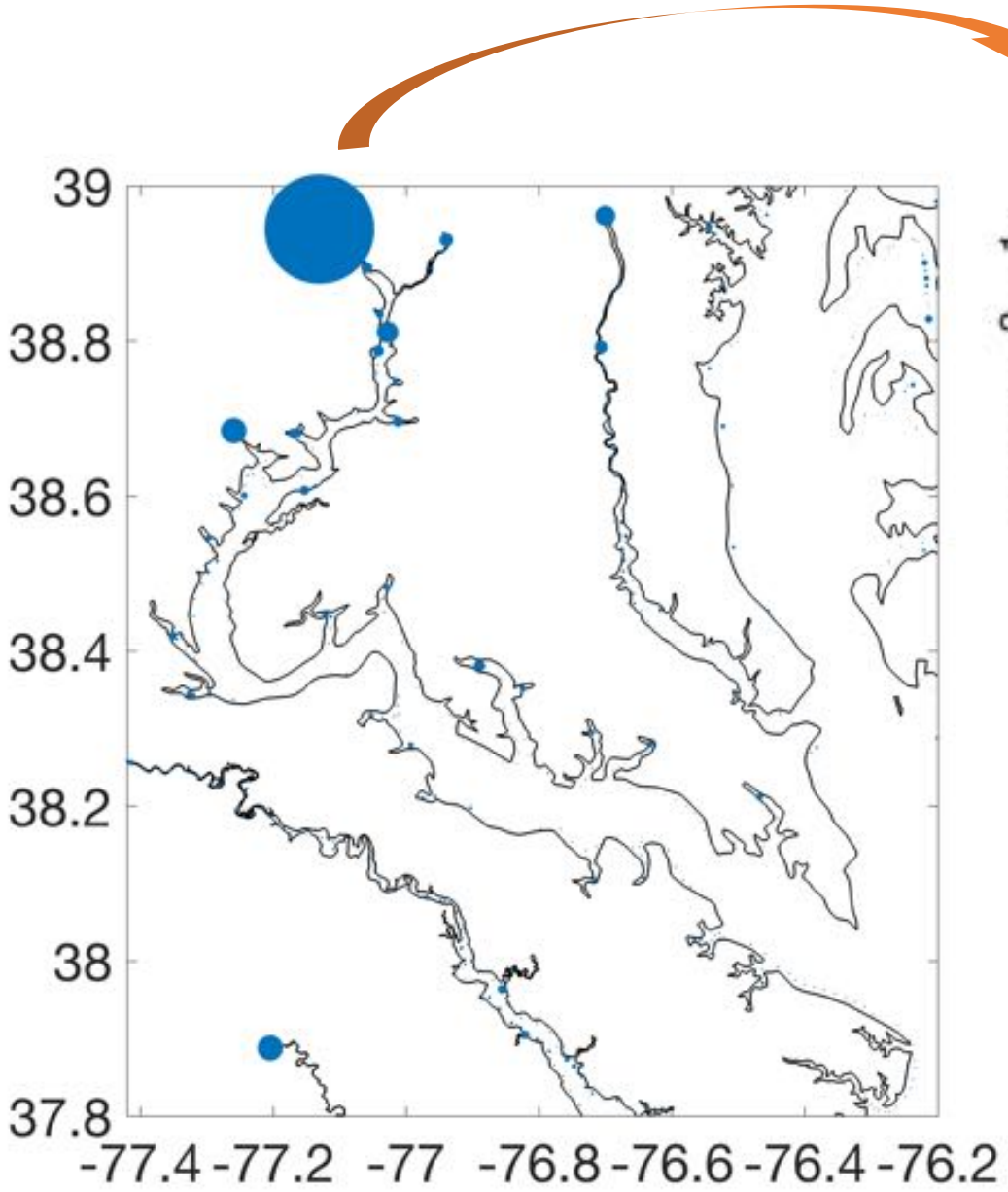
- Generally consistent with NOAA nautical chart (2021)
- Overall deeper and wider channel than other tributaries
- Limited amount of bathymetry jump along the channel

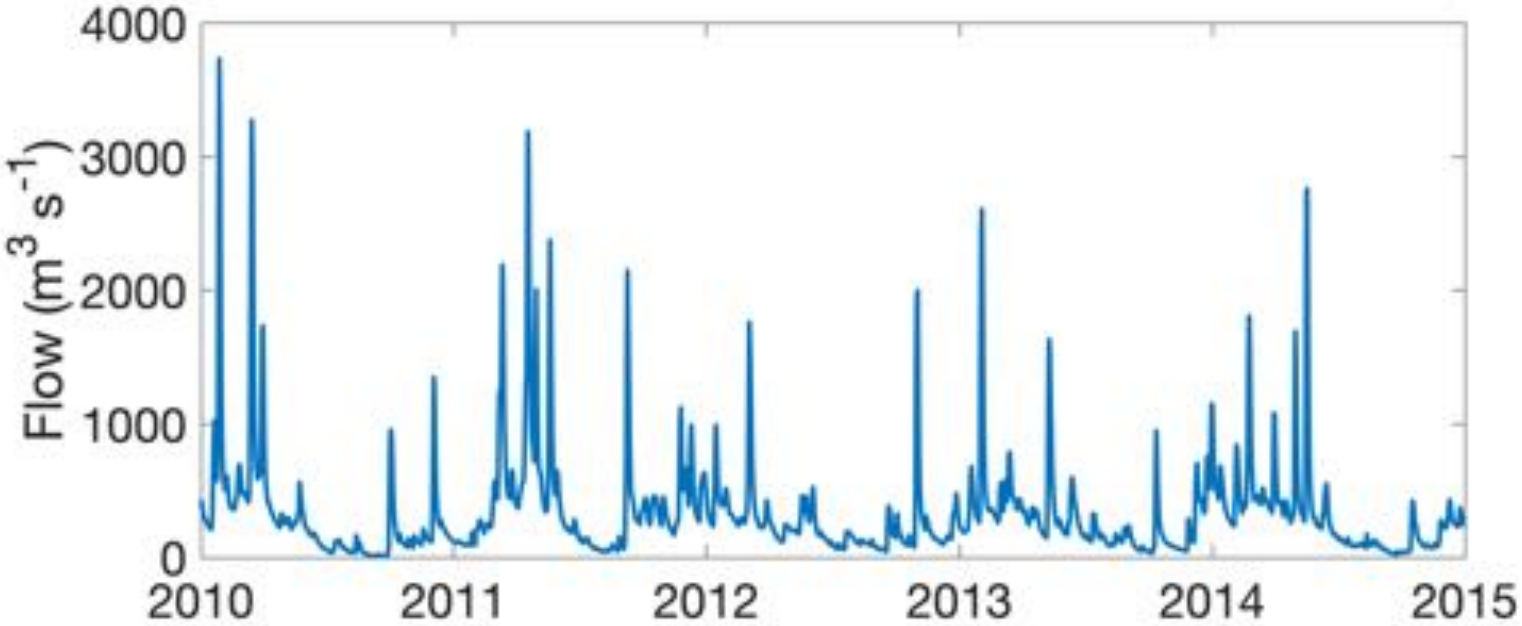






Loadings – P6 watershed

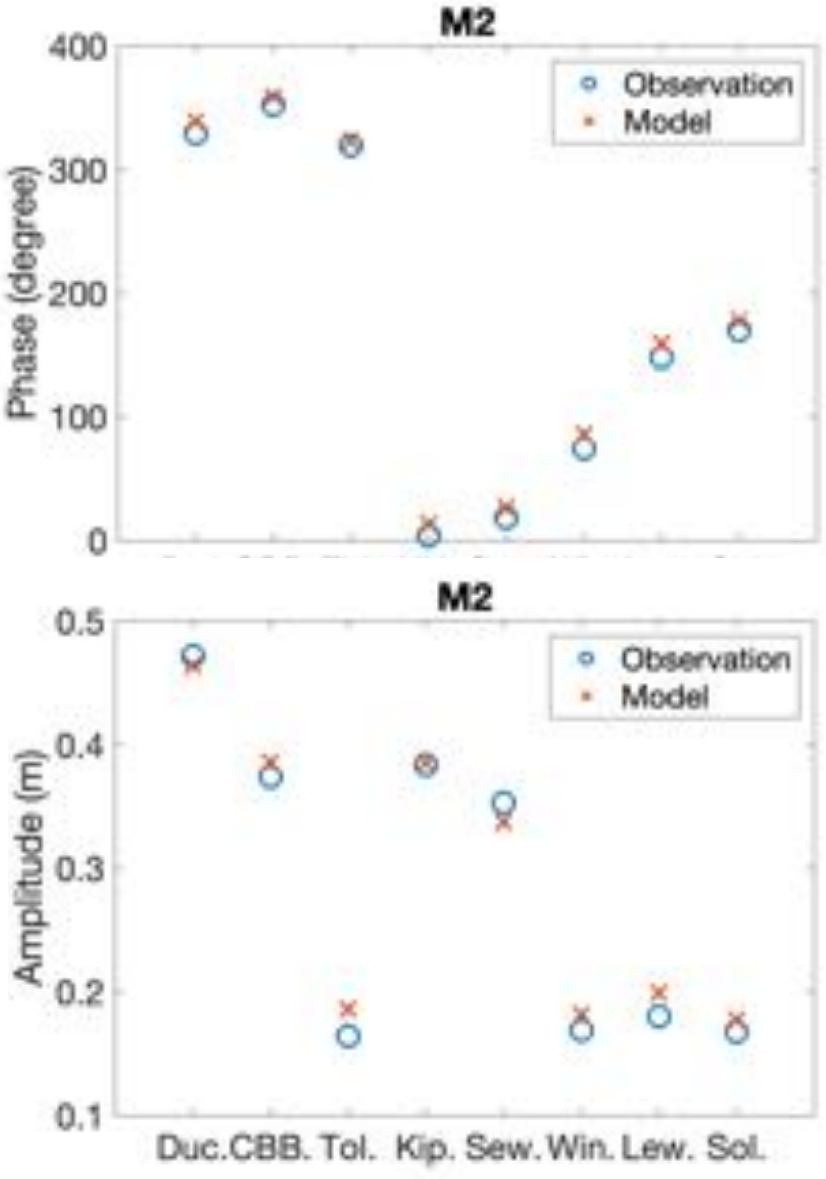




Preliminary results evaluation

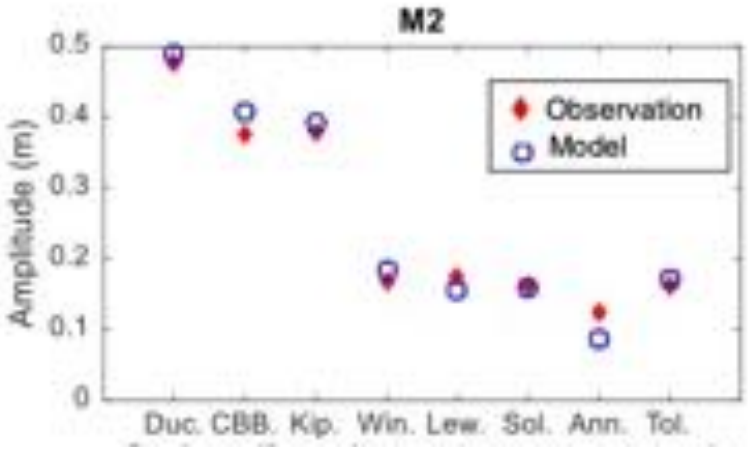
-- Main stem Chesapeake Bay

Elevation and tide

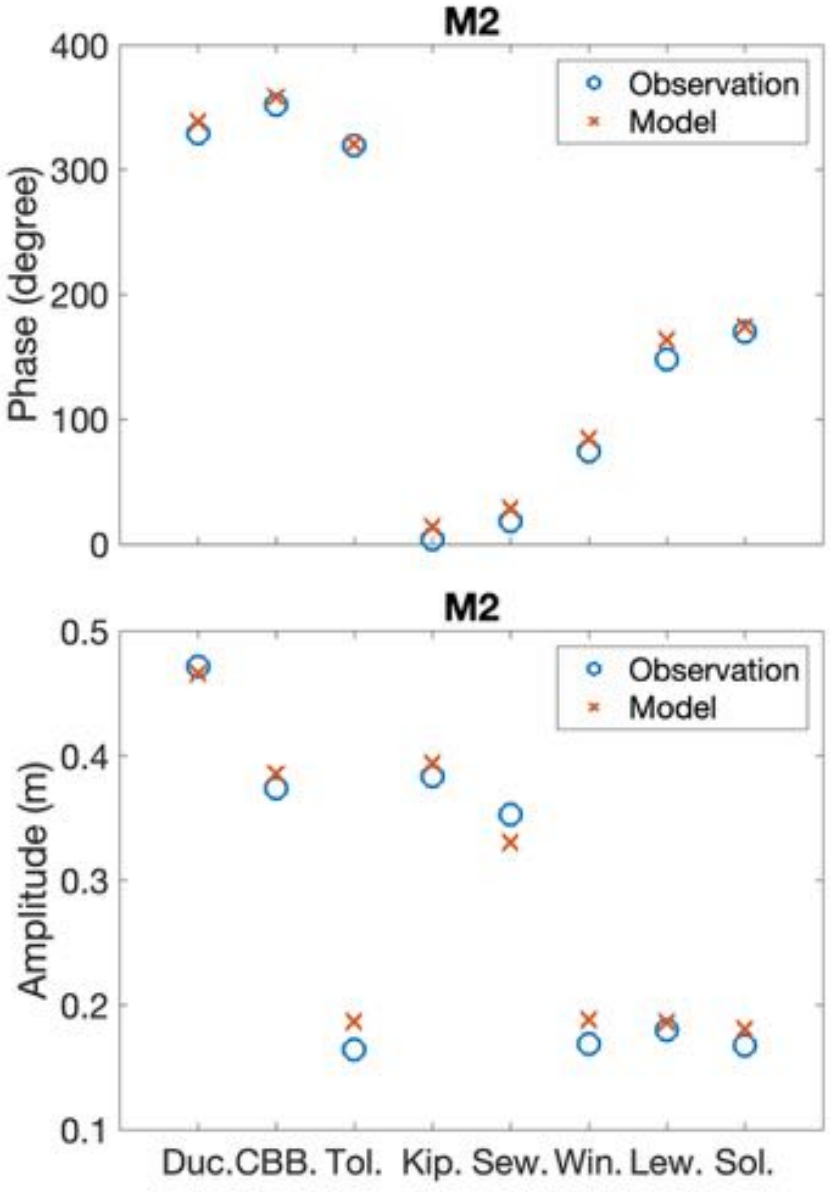


This study for years 2010 to 2015

Comparable to past models



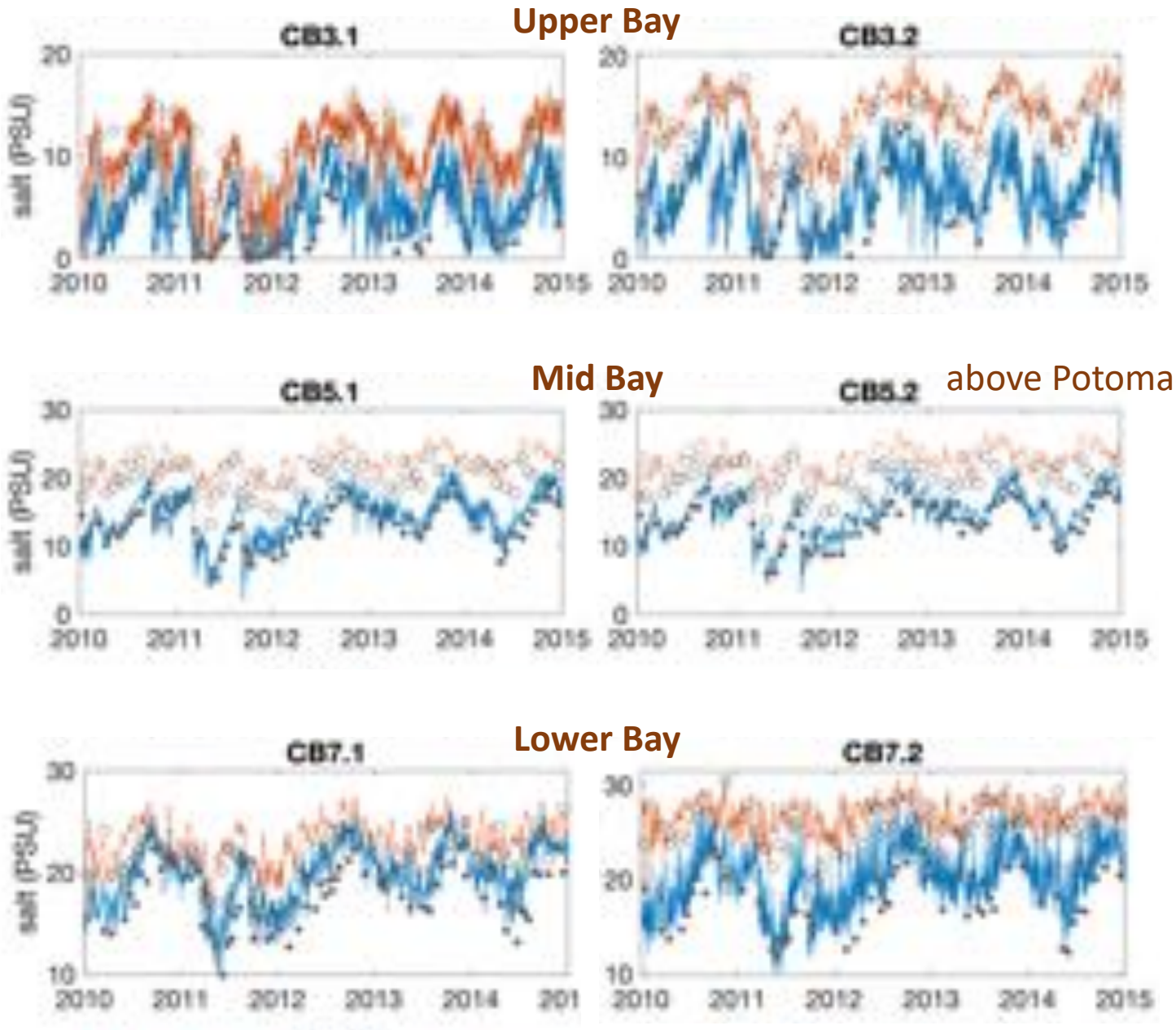
Ye et al. (2018) for years 2011 to 2014



Cai et al. (2022) for year 2010

Salinity

Overall reproduction of benchmarks in Ye el al. (2018) and Cai et al. (2020 and 2022)

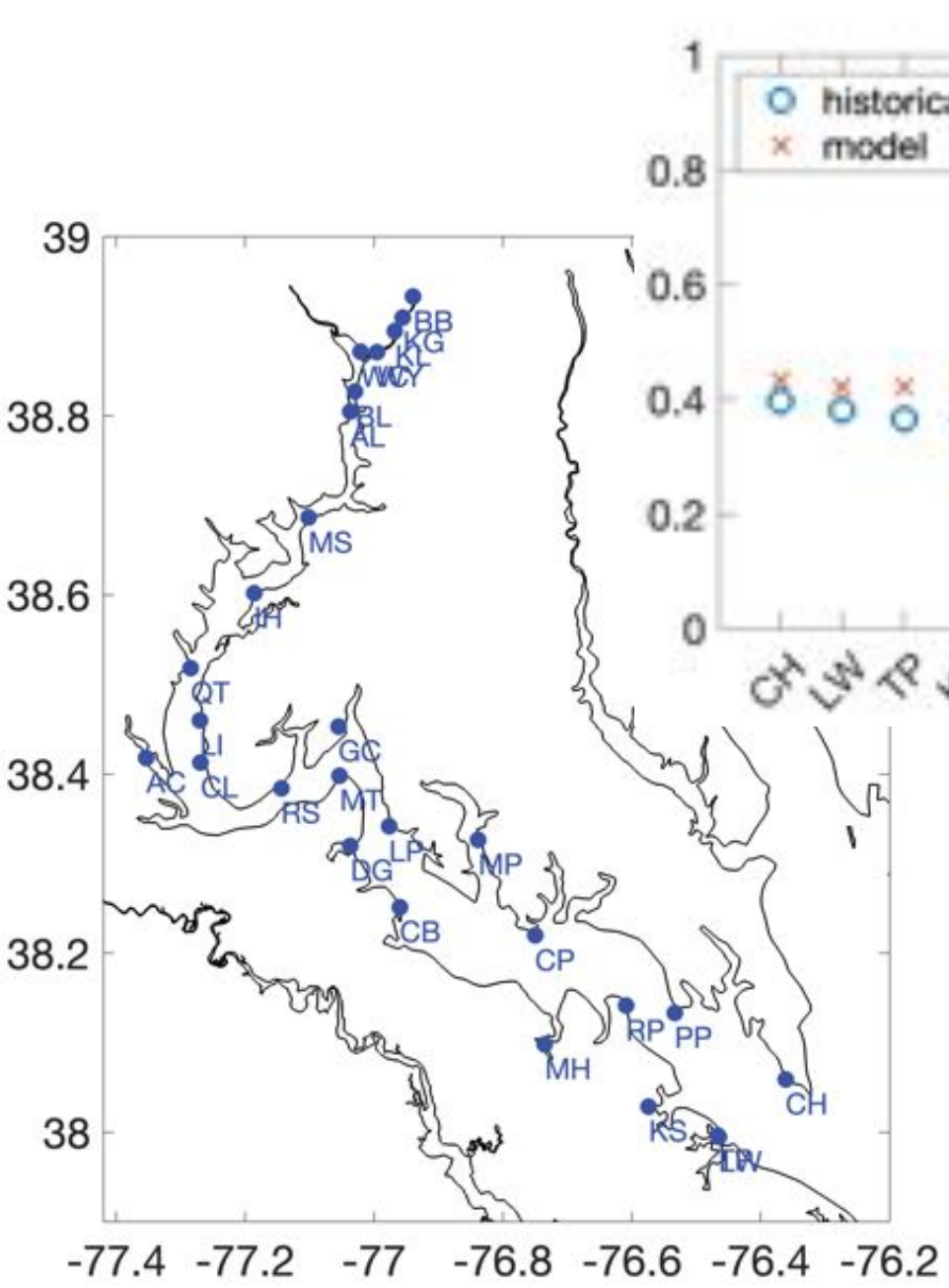


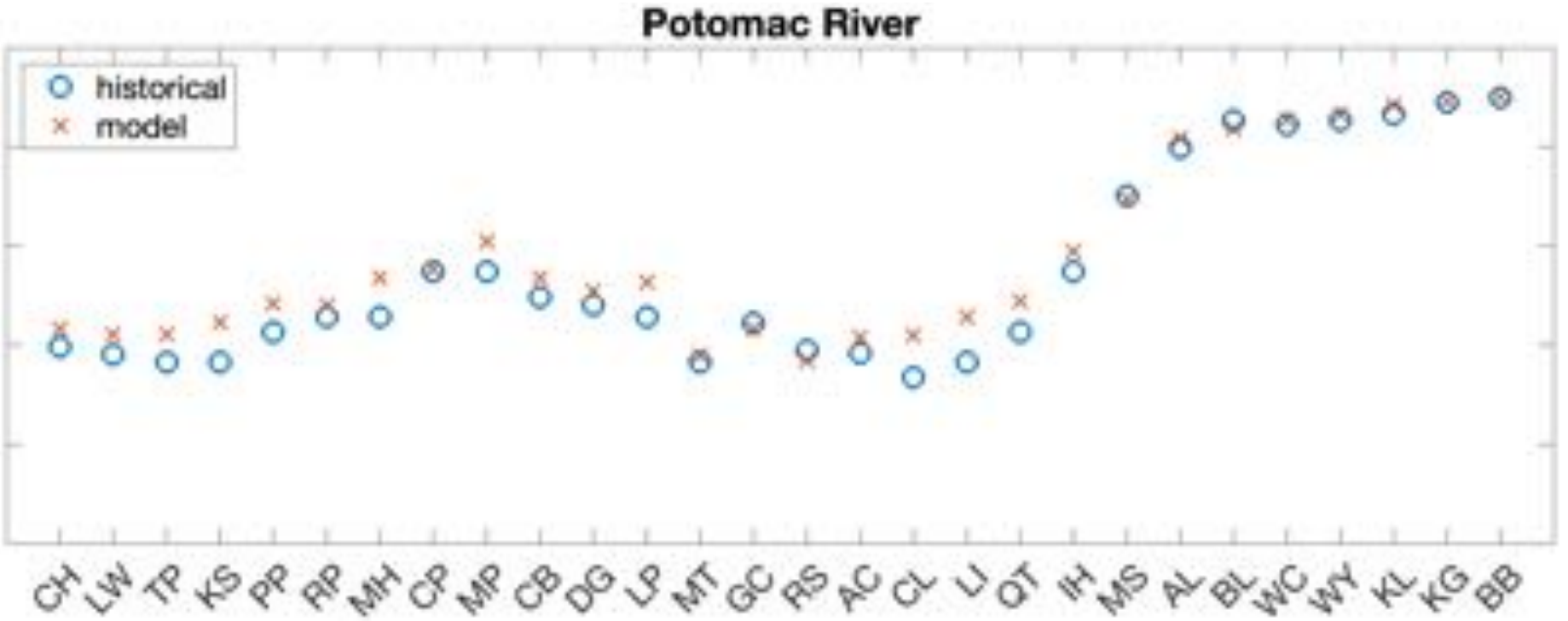
above Potomac R.

Preliminary results evaluation

-- Potomac River

Tidal range





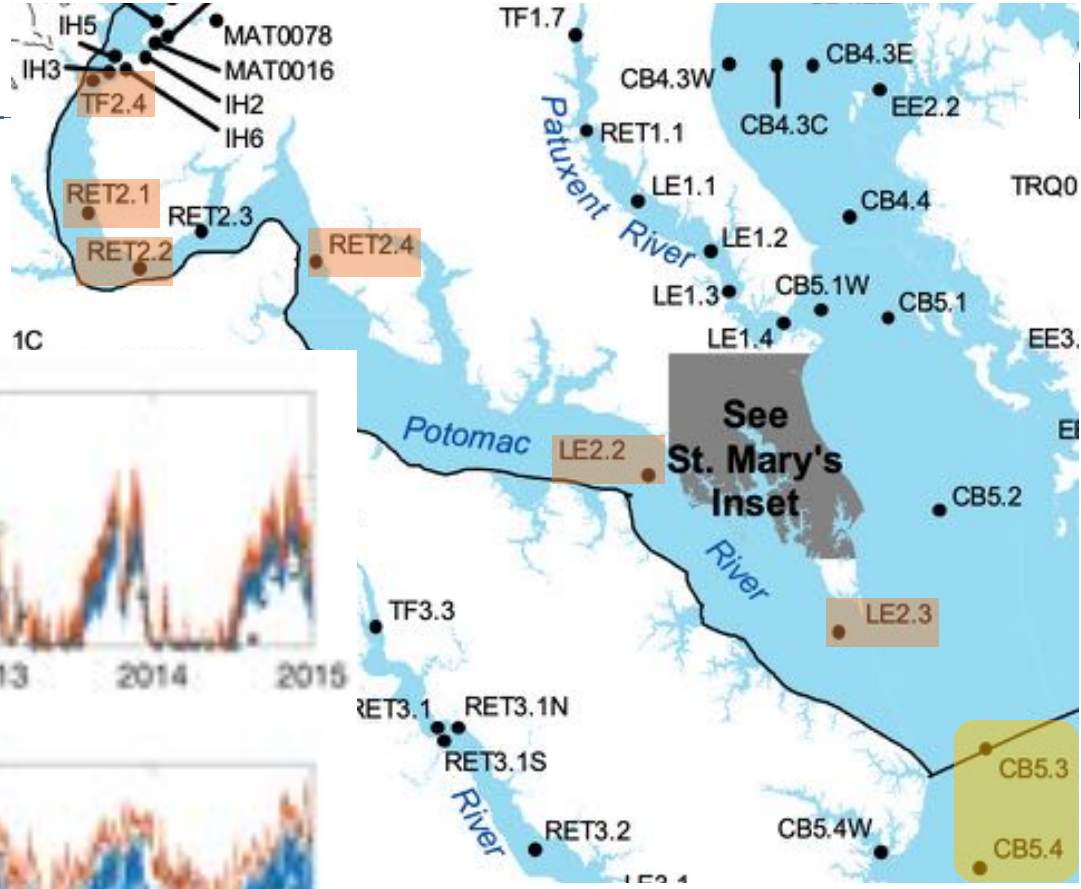
Potomac mouth → **Potomac head**

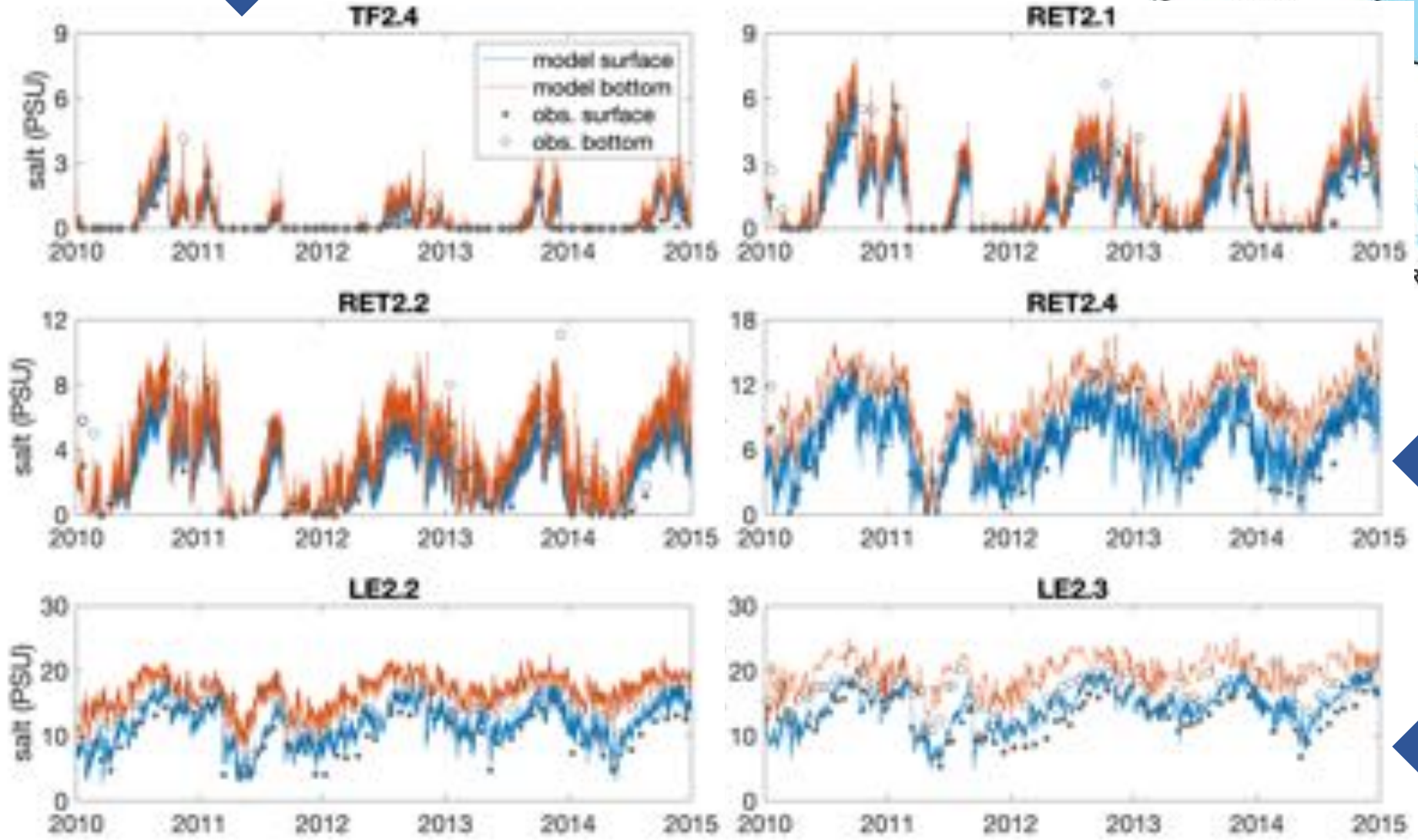
Well-capture of the trend and magnitude

- Sufficient and accurate bathymetry data
- Stable shoal line

Salinity

Well capture of saltwater intrusion distance

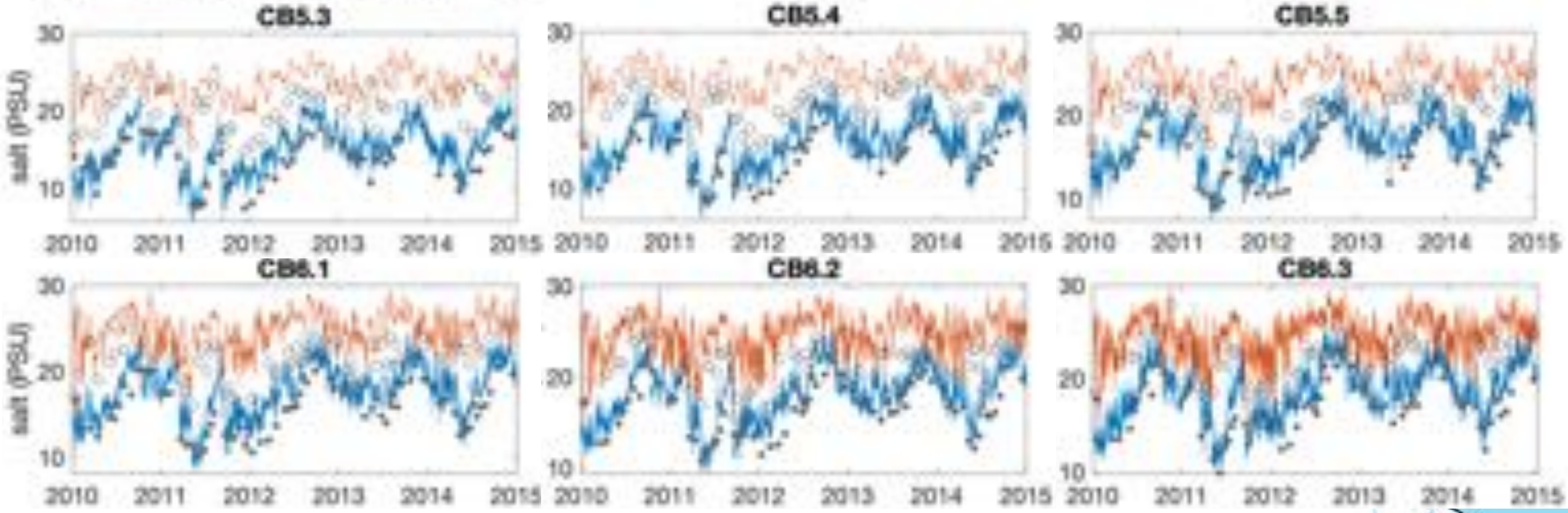




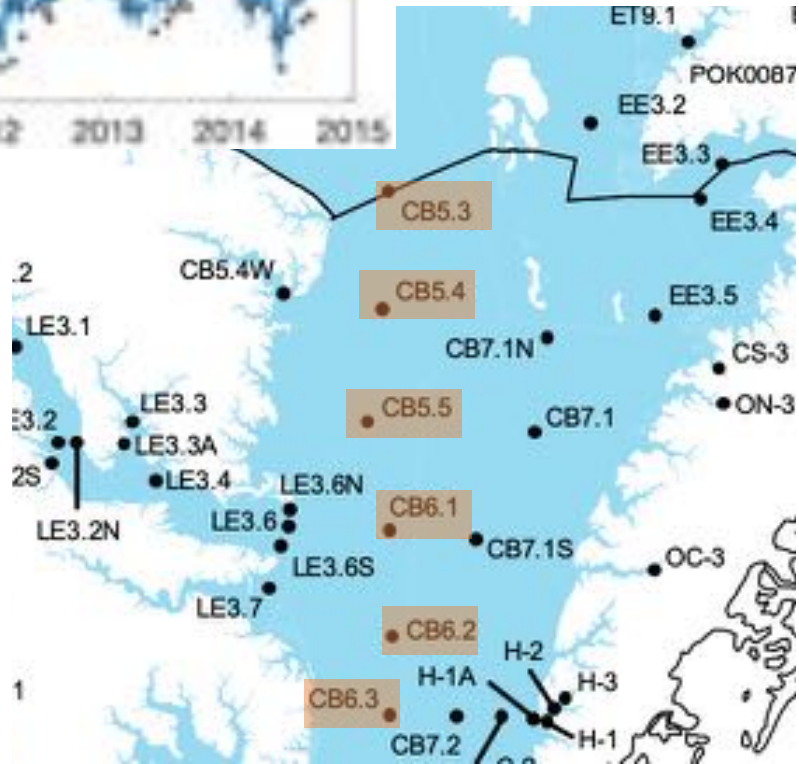
Reasonable capture of mid-Potomac stratification

- Overestimation of stratification at the mouth
- Particularly year 2012

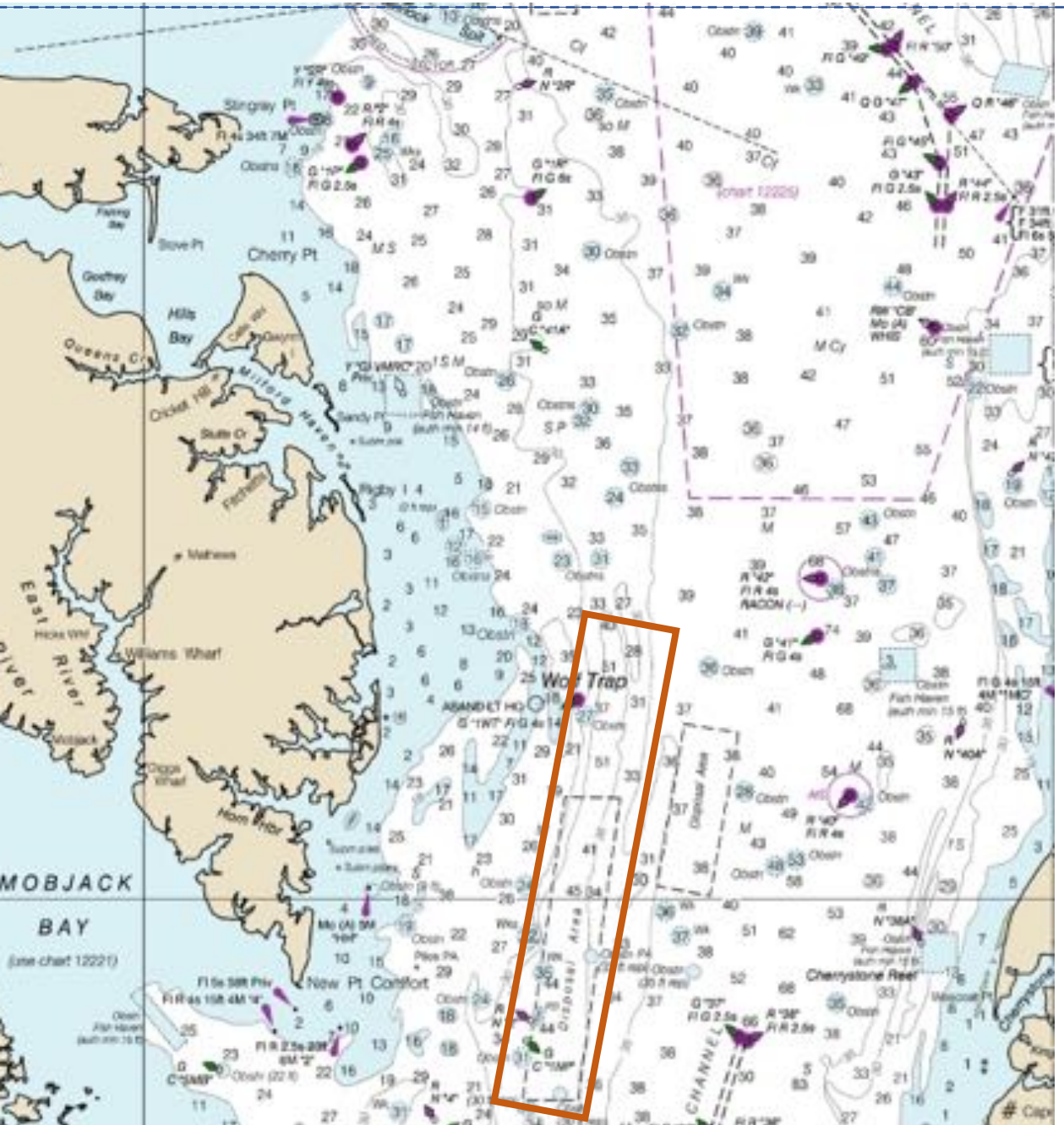
Improvement to be made over Rappahannock Shoal

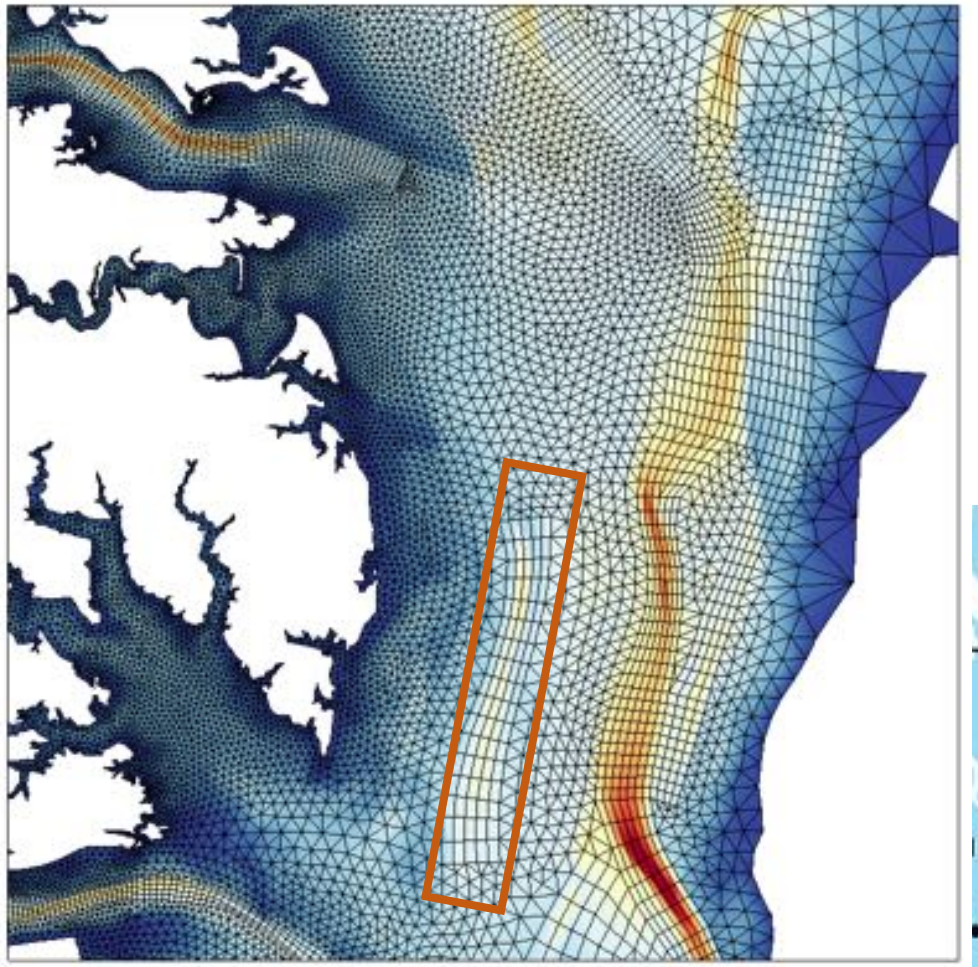


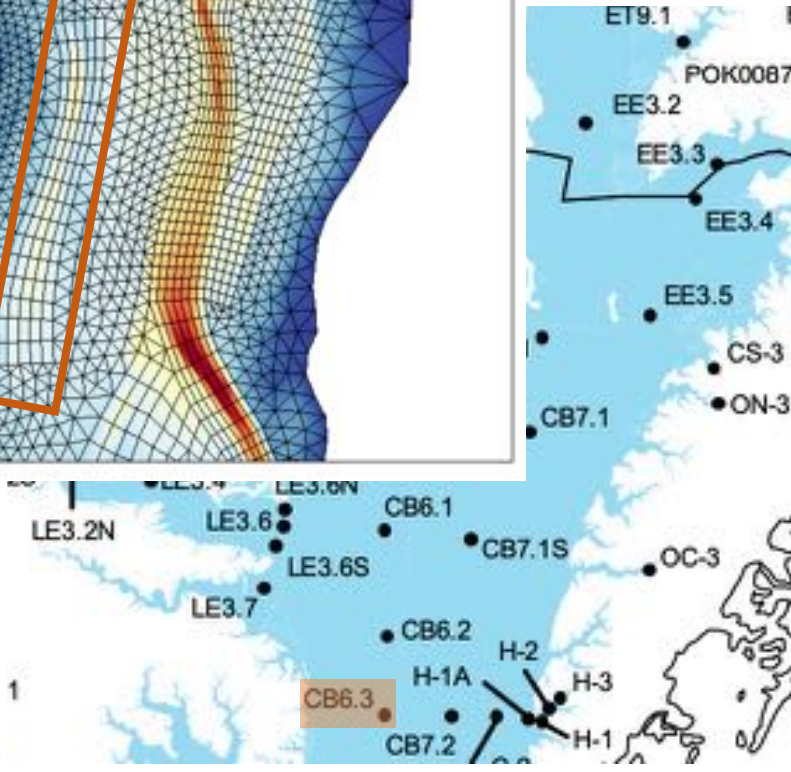
Overall over-estimation of intrusion through the Rappahannock Shoal region



Improvement to be made over Rappahannock Shoal







Summary

- Expanded coverage
  - Regions of interest (e.g., Mobjack Bay, Lynnhaven Bay)
  - The linkage between the MBM and MTM

- Initiation of the Potomac Tributary Model
  - Significant improvement in simulating the physical environment
  - Space to improve concerning the simulation of the mid-Chesapeake Bay

Suggestions??

To be continued …

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