Summary of the current MTMs and the US East Coast model

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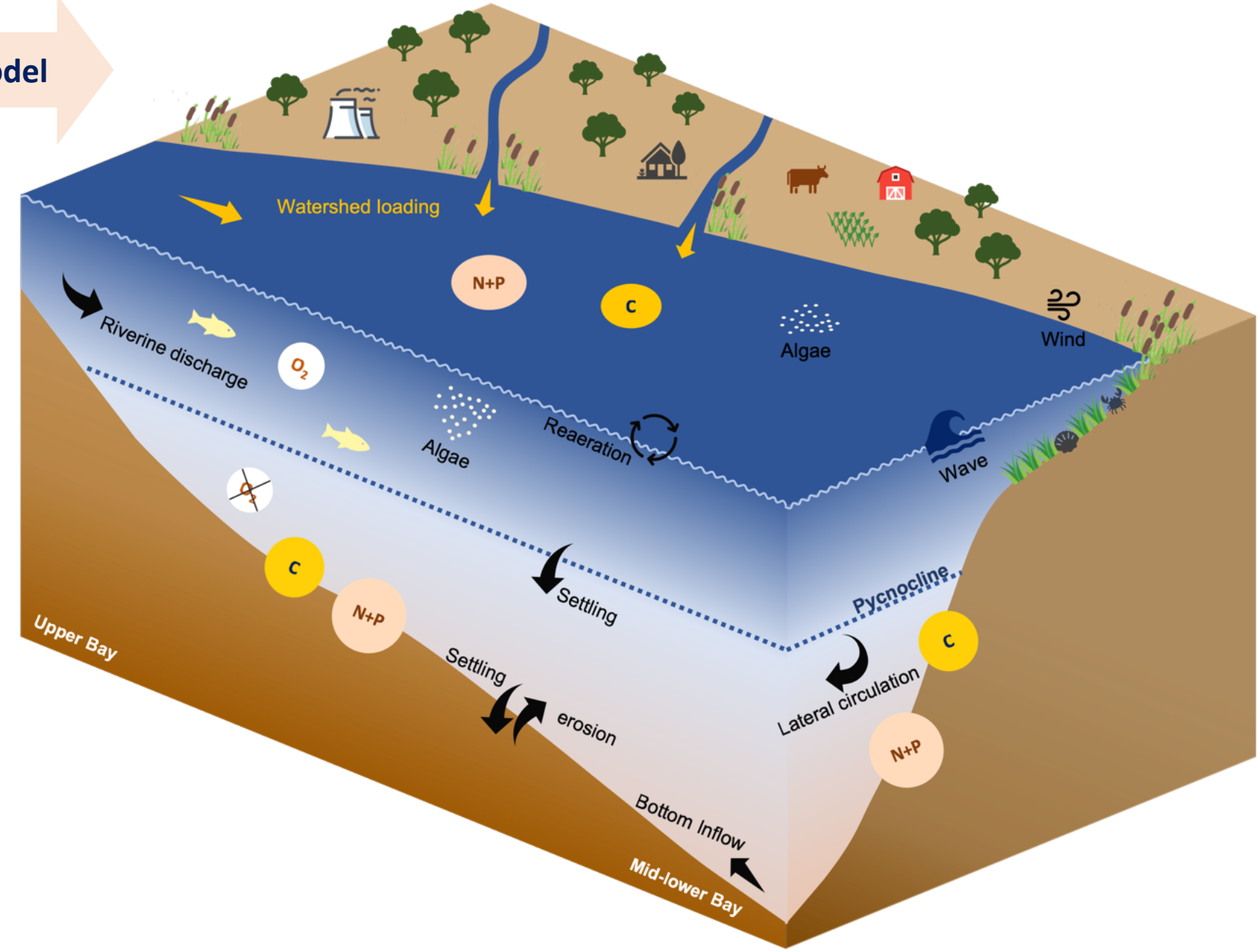
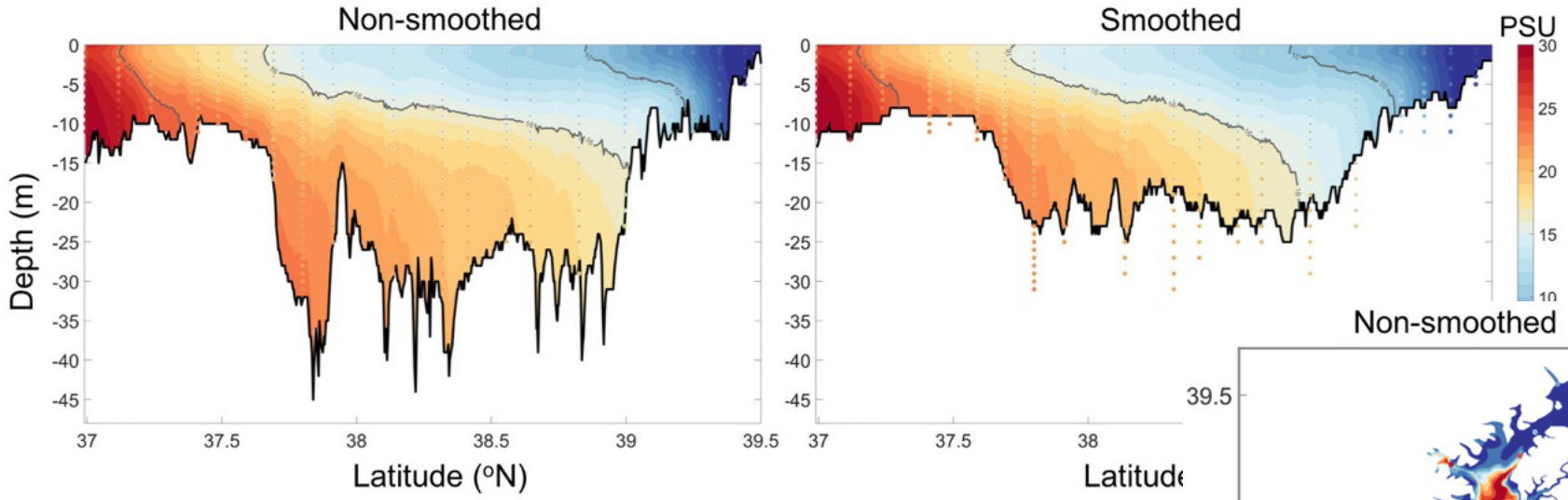
Overview

Next-generation Bay Model



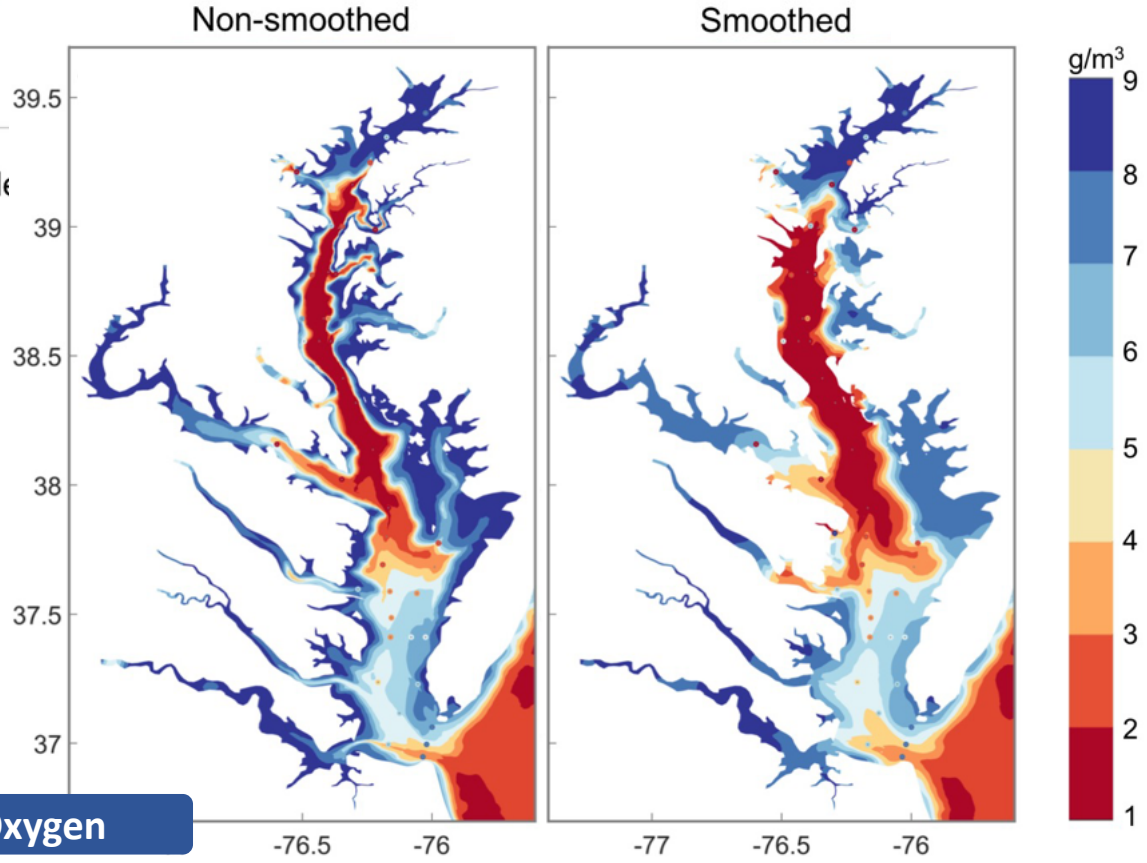
Importance of an accurate representation of bathymetry

Salinity



Cai et al. (2020)

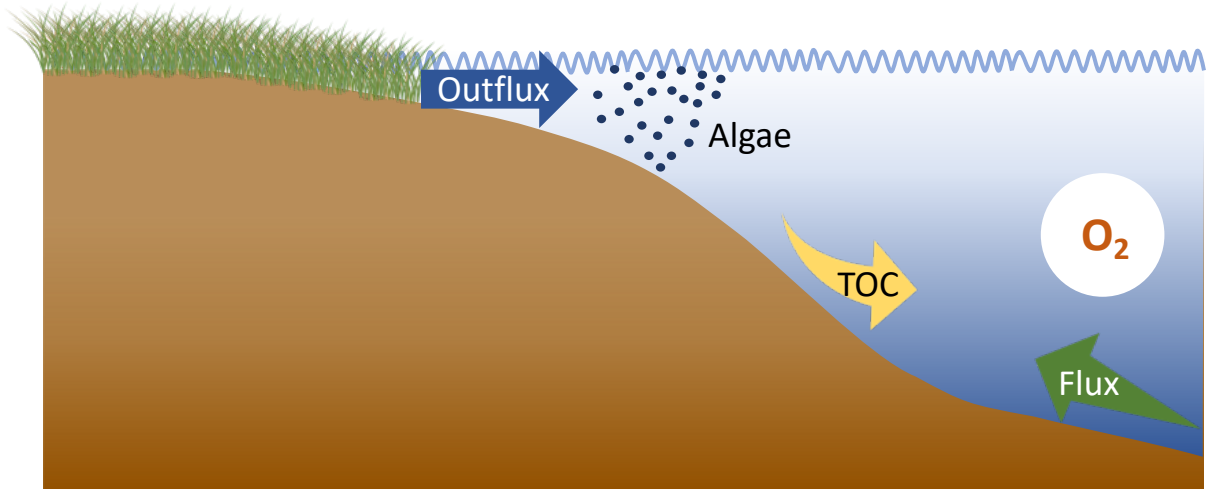
Dissolved Oxygen



Motivations towards the shallow waters using unstructured grids

Shallow waters

- Over 24% area is less than 2 m in depth
- More degradation of water quality
- Early responses to management actions
- Larger impacts from climate change
  - Relative larger change on local bathymetry
  - Evolution of coastal lines



Unstructured grids

Complex linkages between land and shoreline, shallows regions, and open Bay waters

EFDC

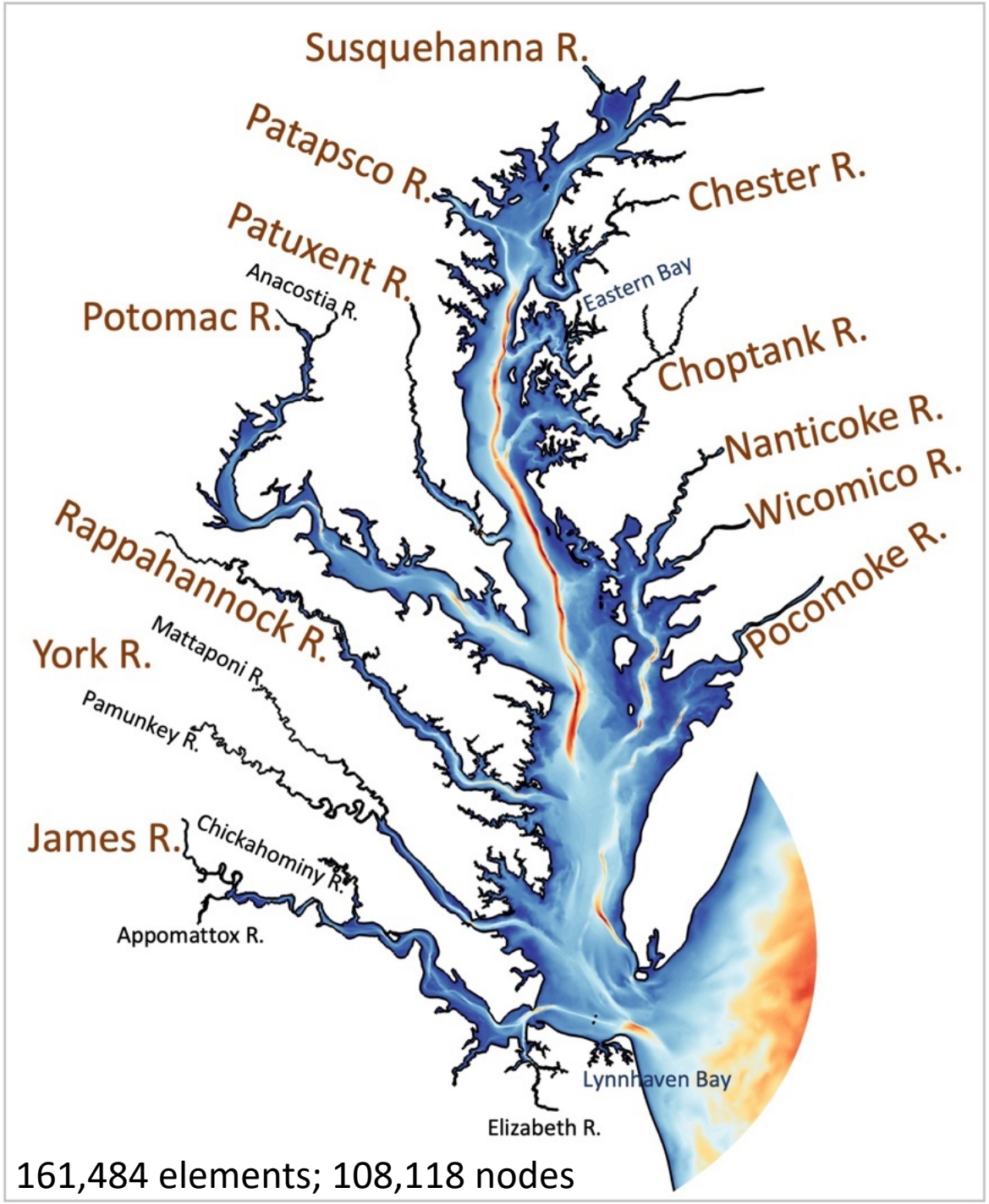
Chickahominy River

Combined MTMs

- Parallel to the revamping of SCHISM-ICM
- Accompany the development of MBM
- A test to exclude grid-induced errors or hidden transport issues

Motivation

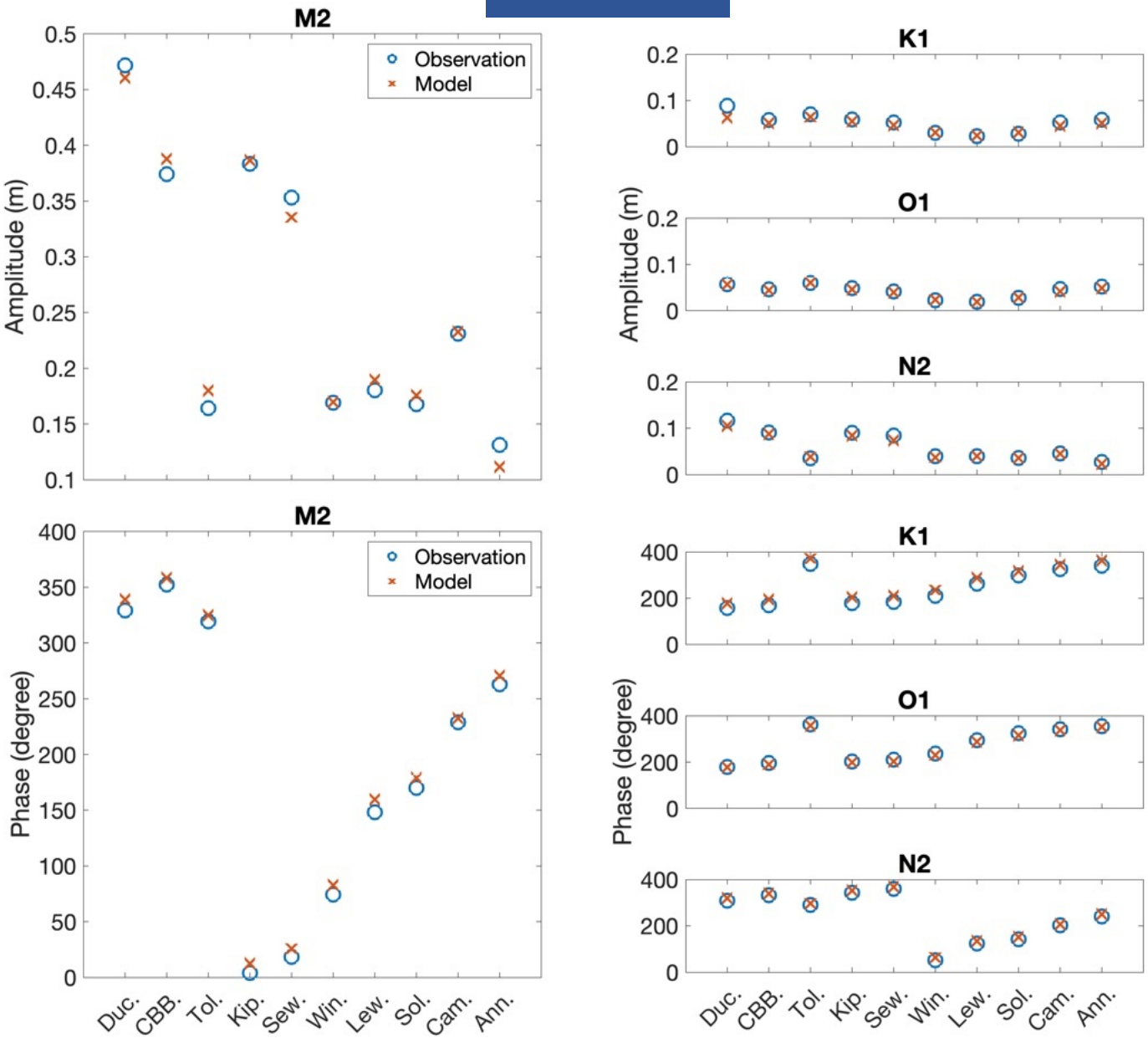
- First time to have a fine grid covering all the tributaries and shallow regions
- Quantitatively synthesize the interactions between each sub-tributaries



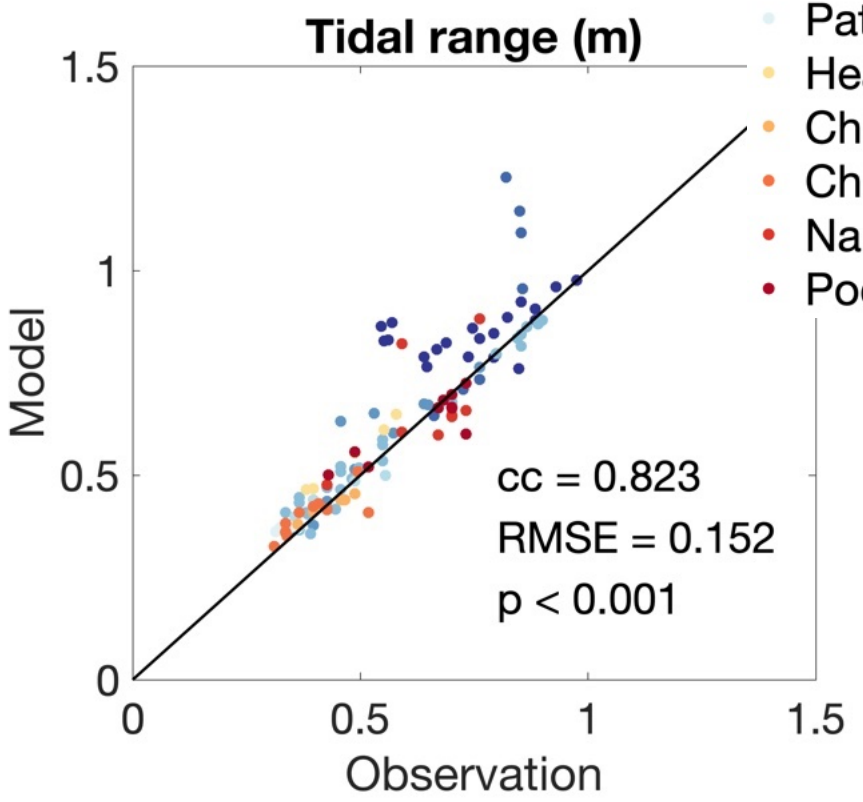
161,484 elements; 108,118 nodes

Elevation and tide

Main stem

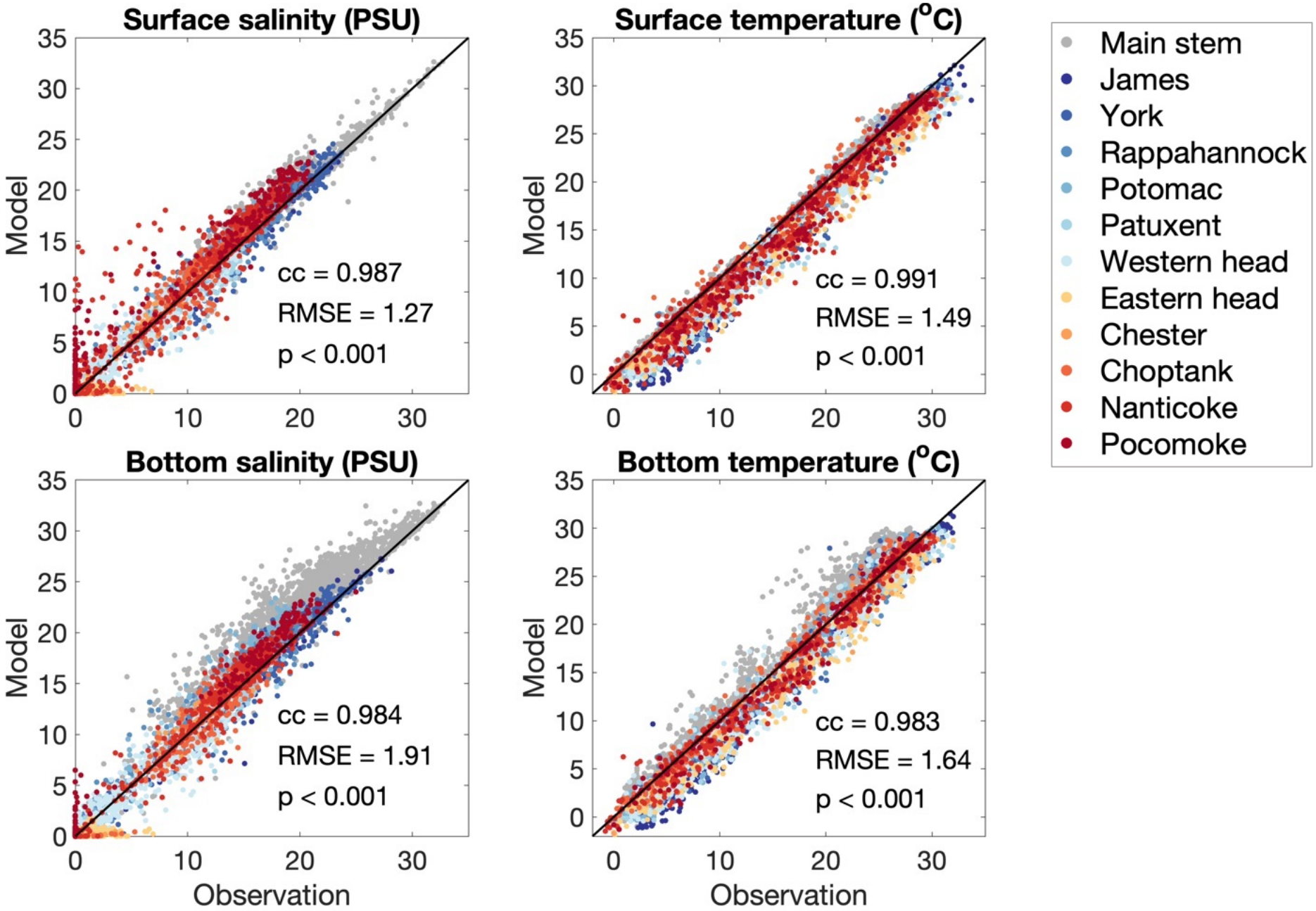


Tributaries

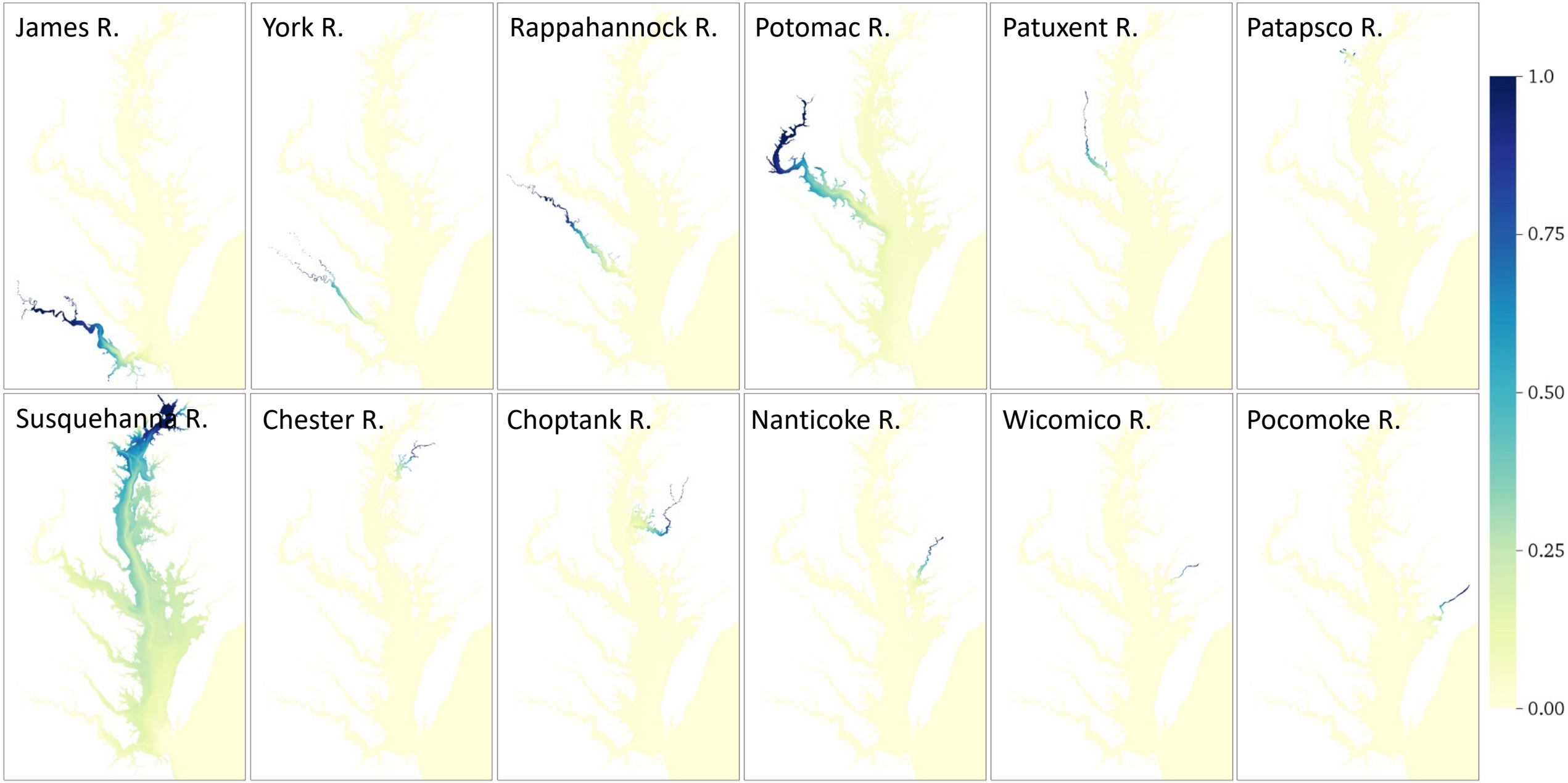


- James
- York
- Rappahannock
- Potomac
- Patuxent
- Patapsco
- Head
- Chester
- Choptank
- Nanticoke
- Pocomoke

Salinity and temperature



Generic tracer application and distribution



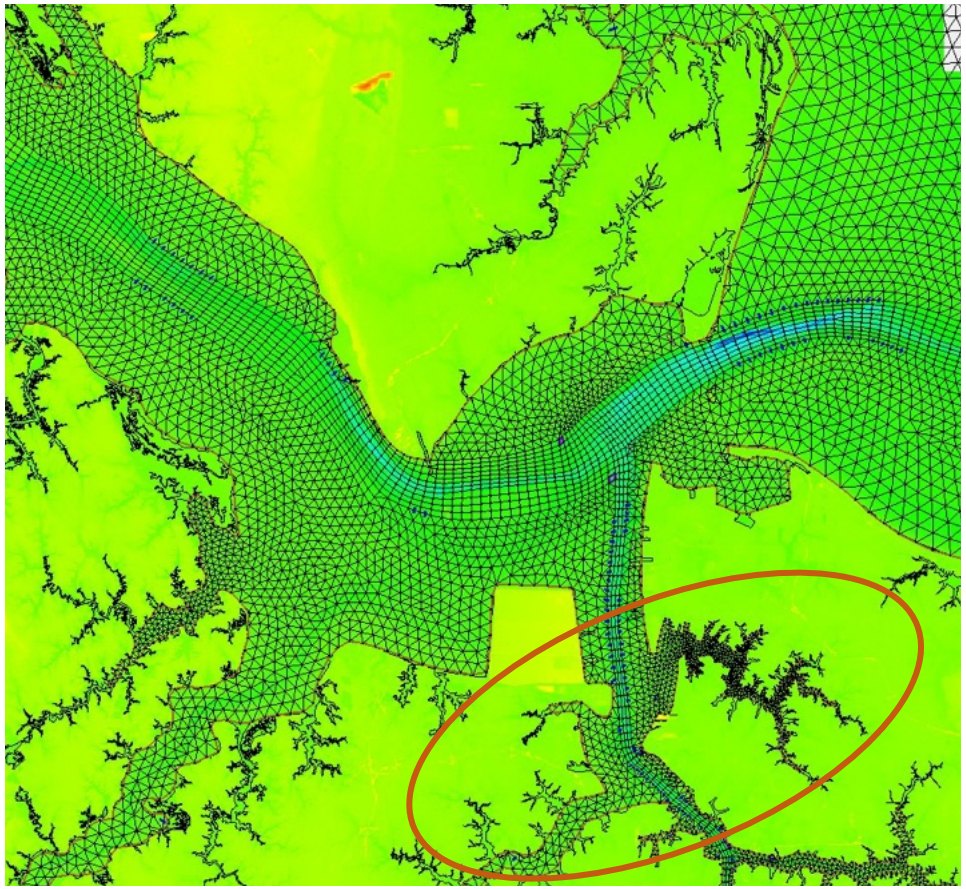
James River

Local refinements in the James River

- Along counters (e.g., 9 m and 6 m) to have arcs capture the major channels all the way from the shipping channel to the fall line.
- Construct sufficient quals to capture major sub-tributaries (e.g., Elizabeth R.)
- Refine **cross-channel** and along-channel resolutions

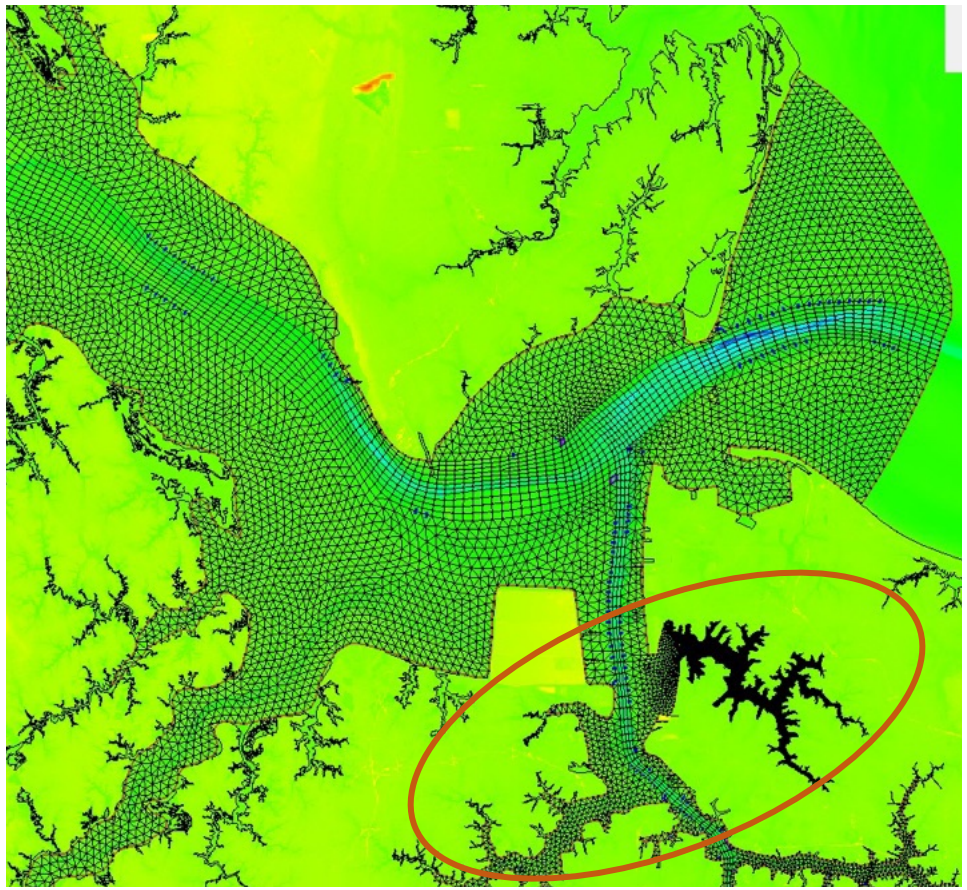
Cut-off from the MBM

James River connected to the whole Bay grid



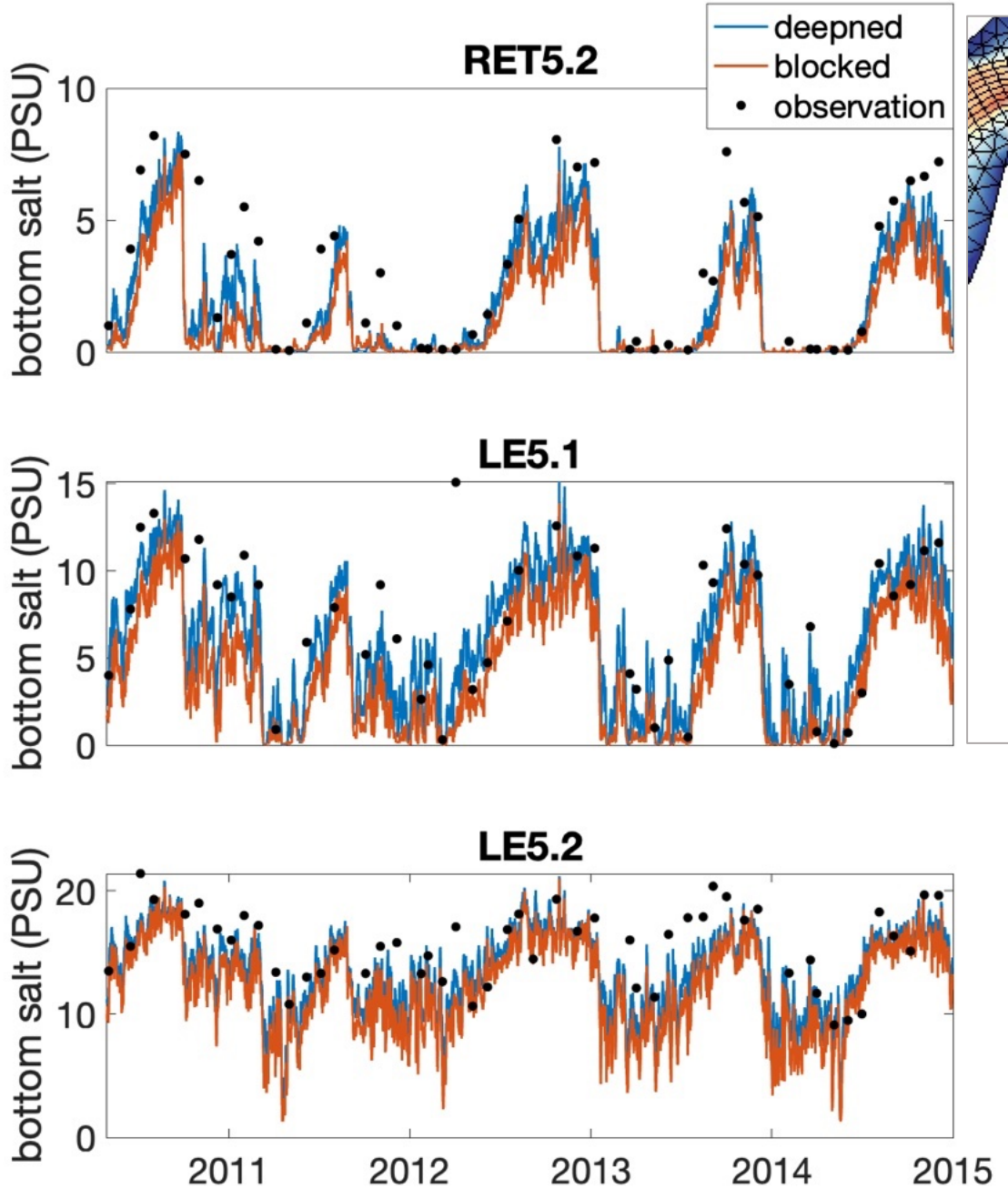
- Unchanged channel arc's
- Refined shoals and sub-tributaries
- #63 boundary nodes

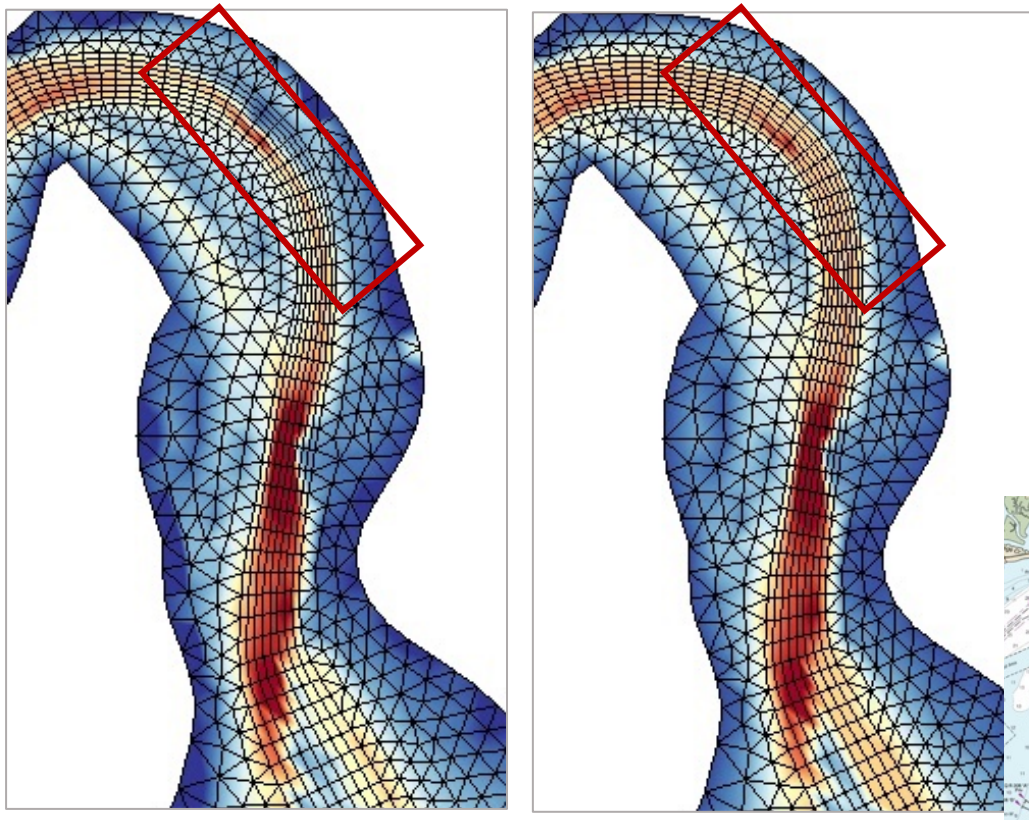
single James River grid



- #17,305 nodes, #25955 elements (32% of phase I)
- Maximum #32 vertical layers (62% of phase I)

Sensitivity tests: w/ vs. w/o maintaining shipping channel depths



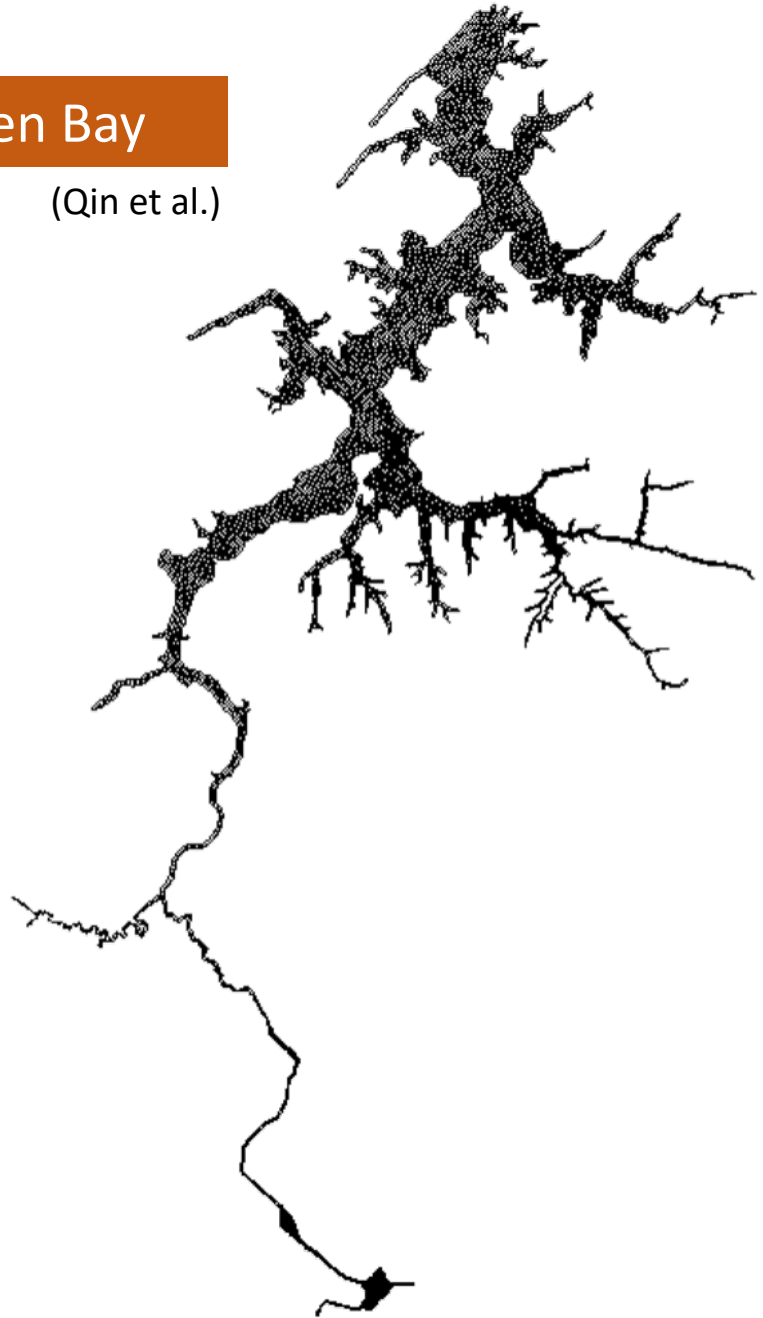


Deepened channel with standard minimum depth helps to get the intrusion upwards.

Examples of grid domains in the places of specific interest

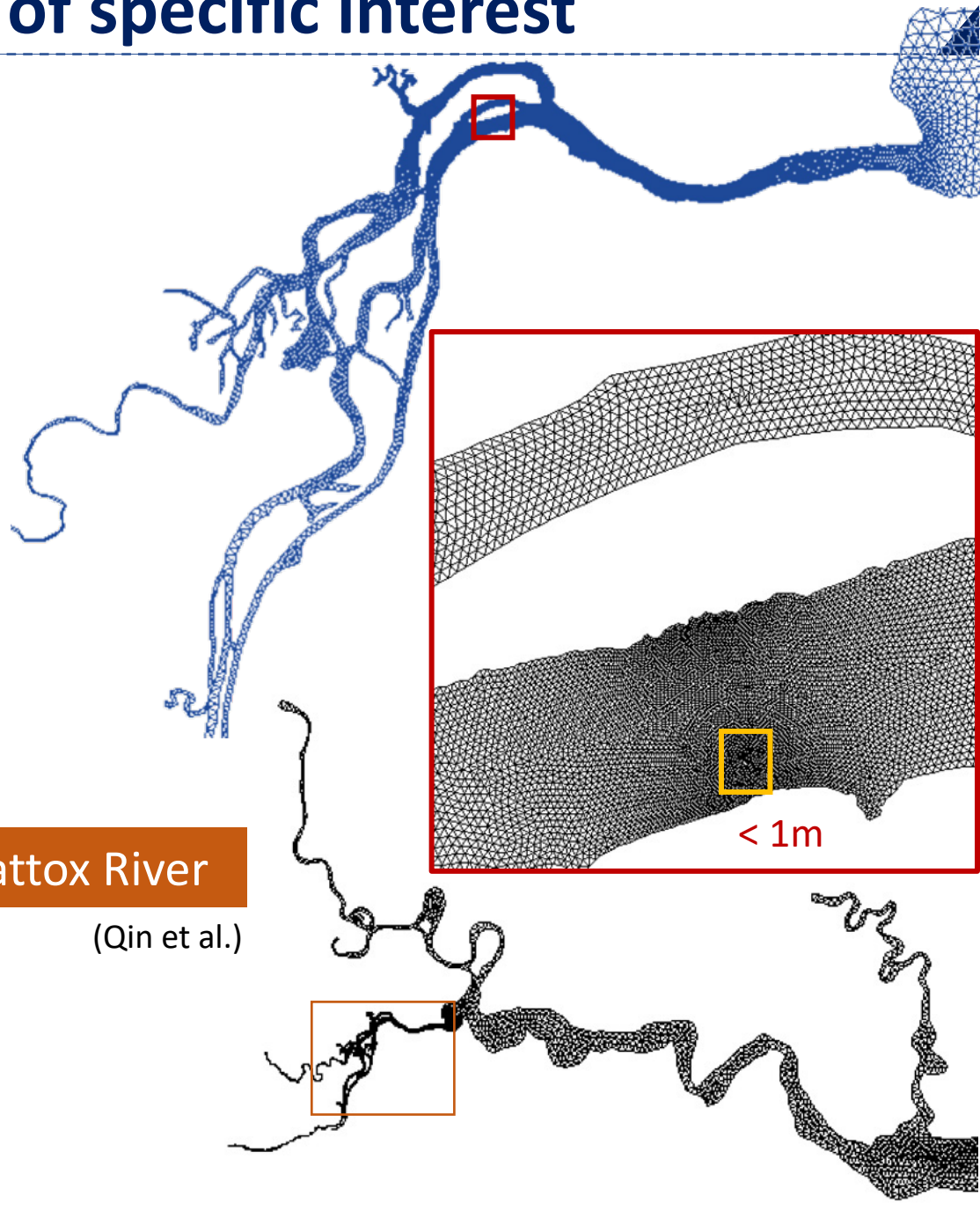
Lynnhaven Bay

(Qin et al.)



Appomattox River

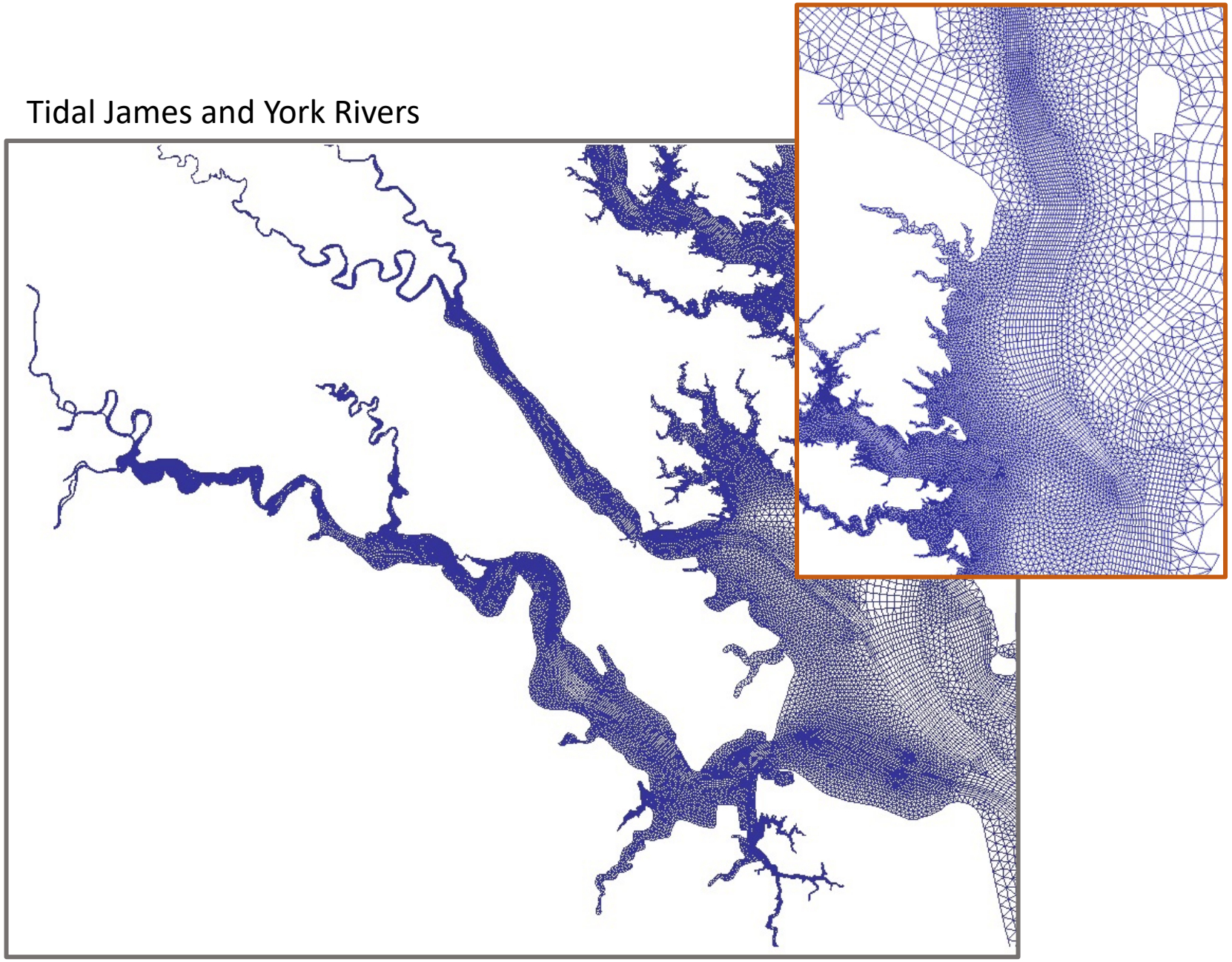
(Qin et al.)



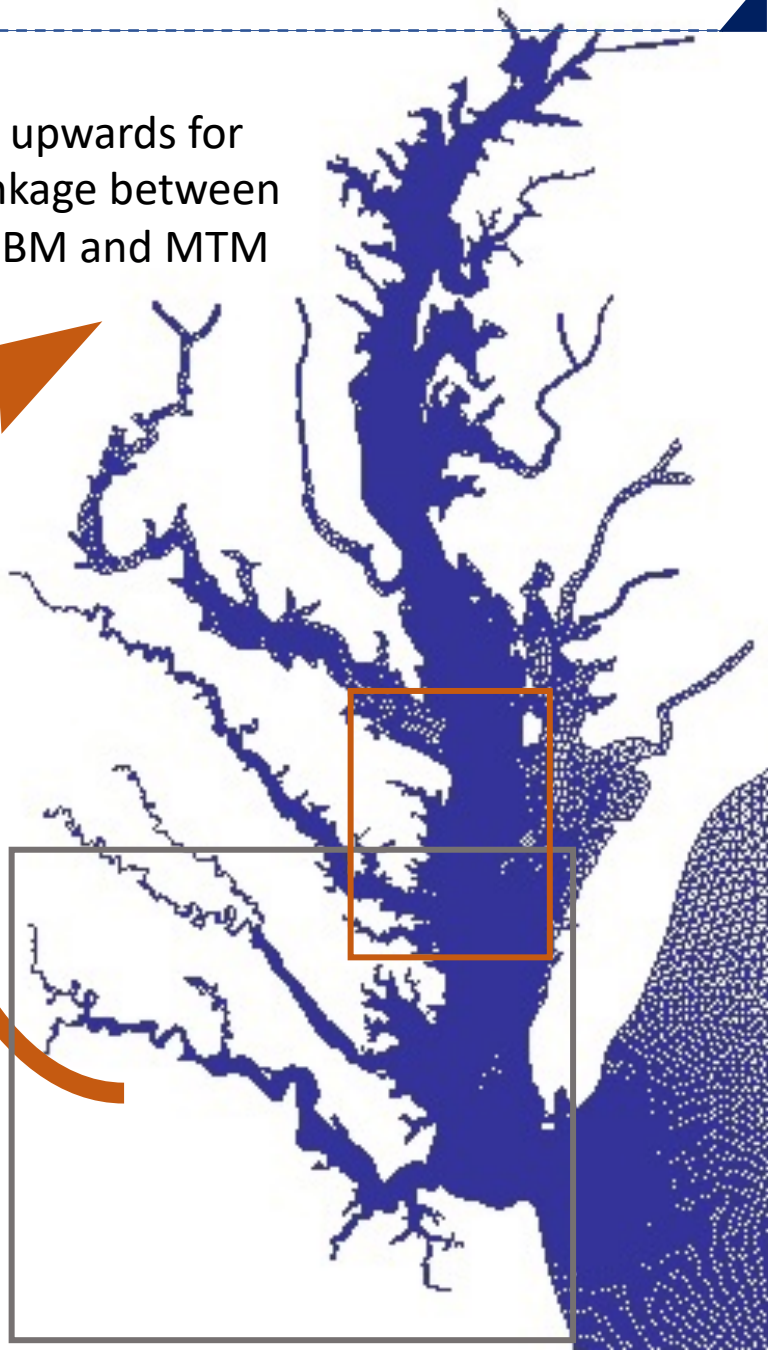
Potomac River

Progress of MTM development

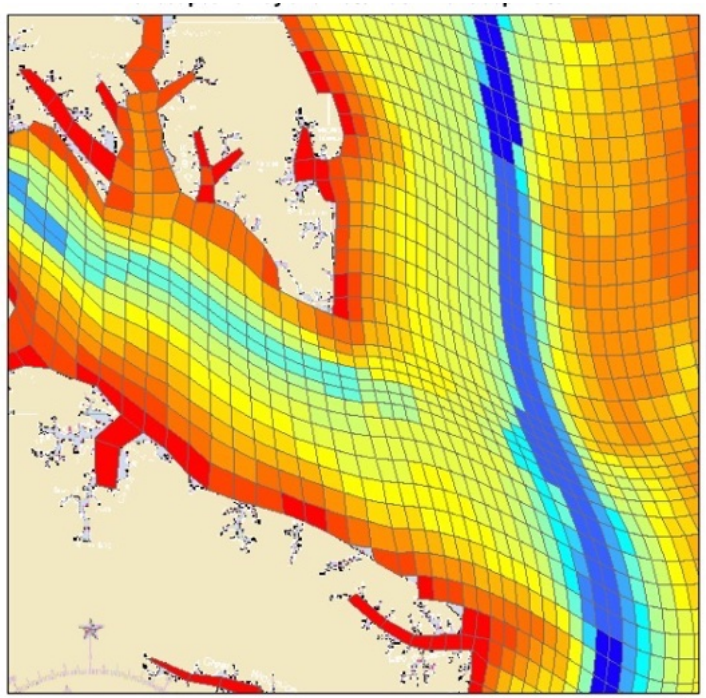
Tidal James and York Rivers



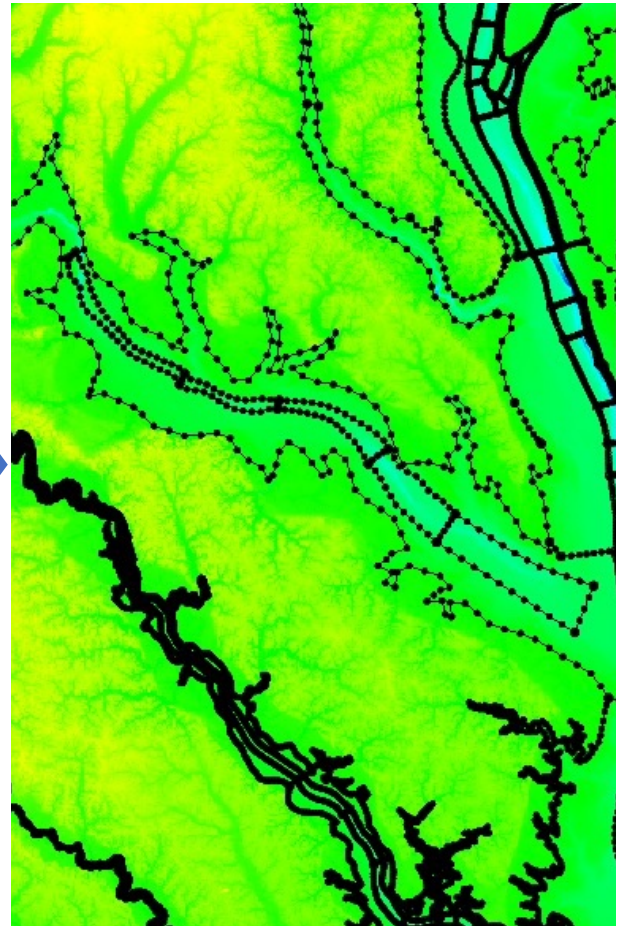
Going upwards for the linkage between the MBM and MTM



Grid construction screenshots

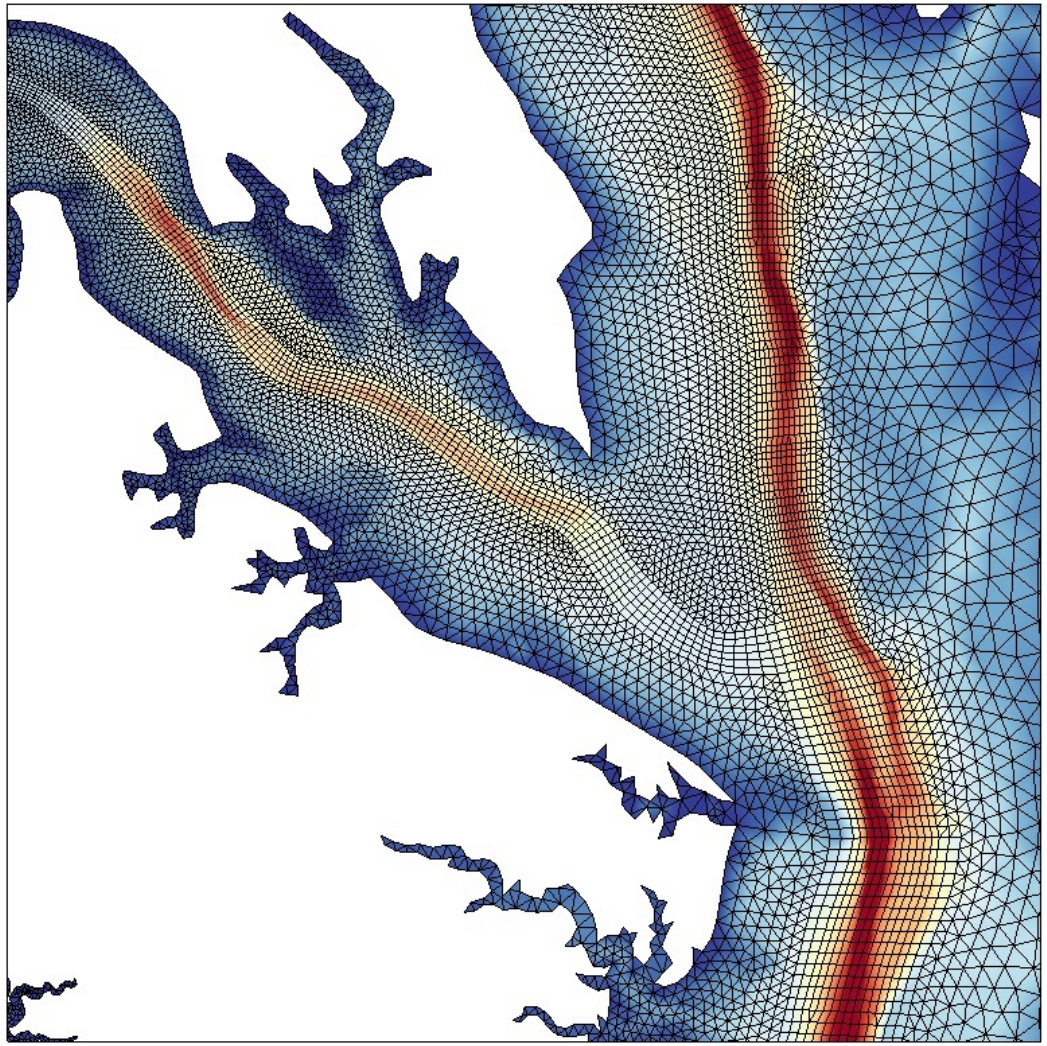


CH3D

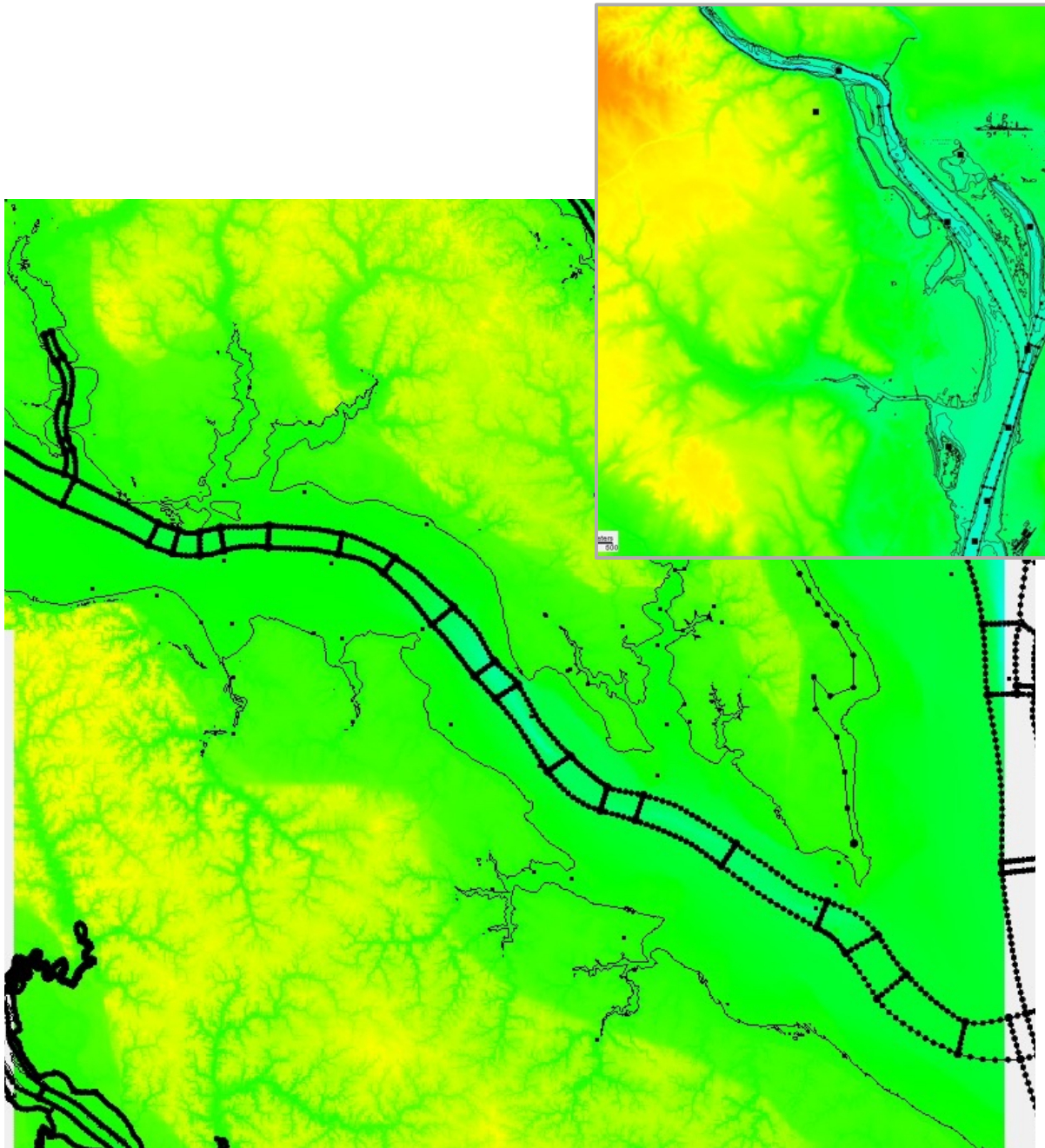


Old MBM

Lower Potomac connected the main stem of the Chesapeake Bay



Grid construction screenshots

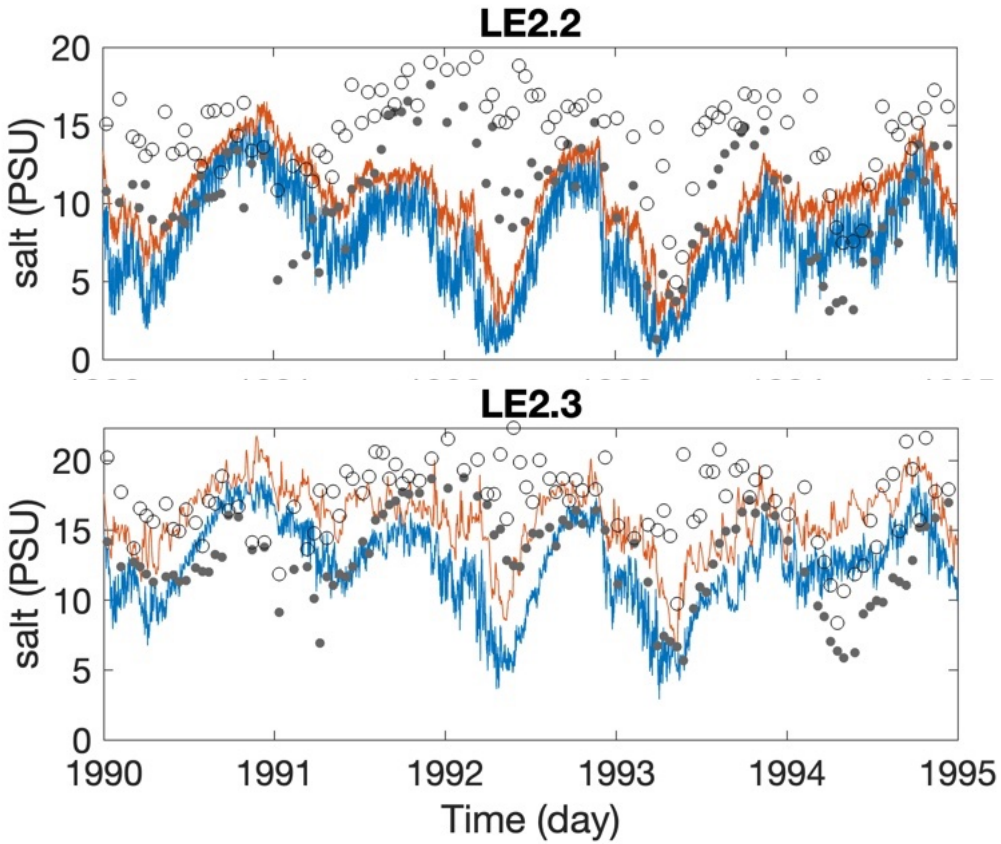


- Head of the Potomac connected to the Anacostia River
- In rectangular mesh

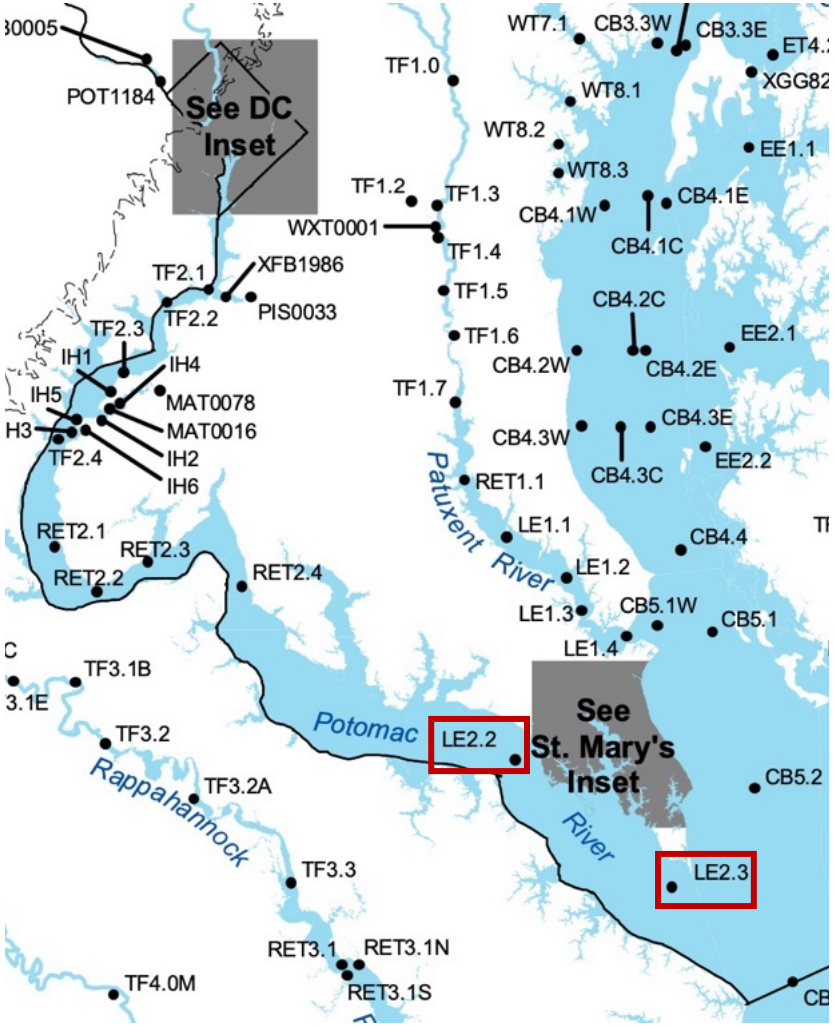
Lower Potomac connected the main stem of the Chesapeake Bay

Improvement from grid refinements

Overall insufficient stratification from the mouth

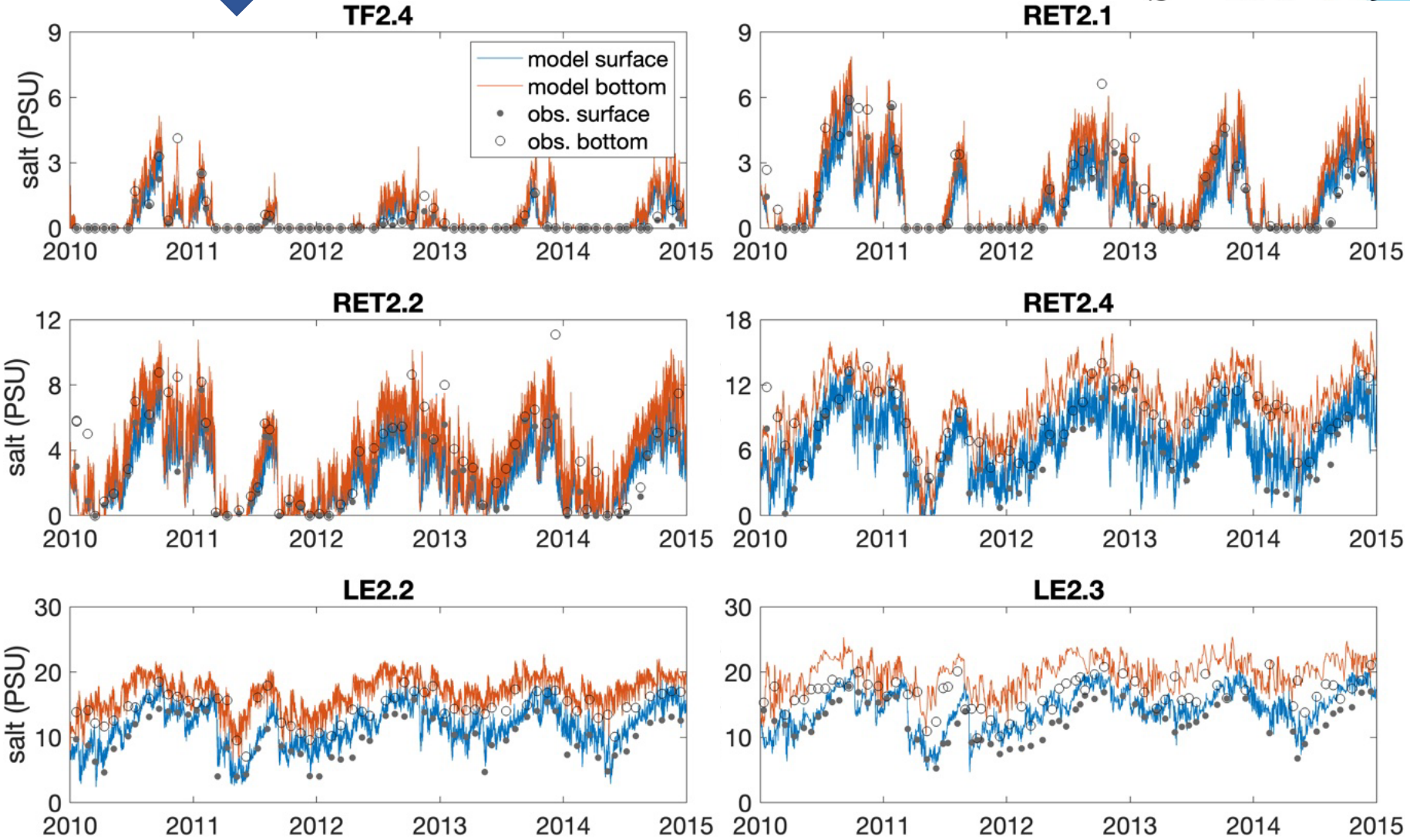


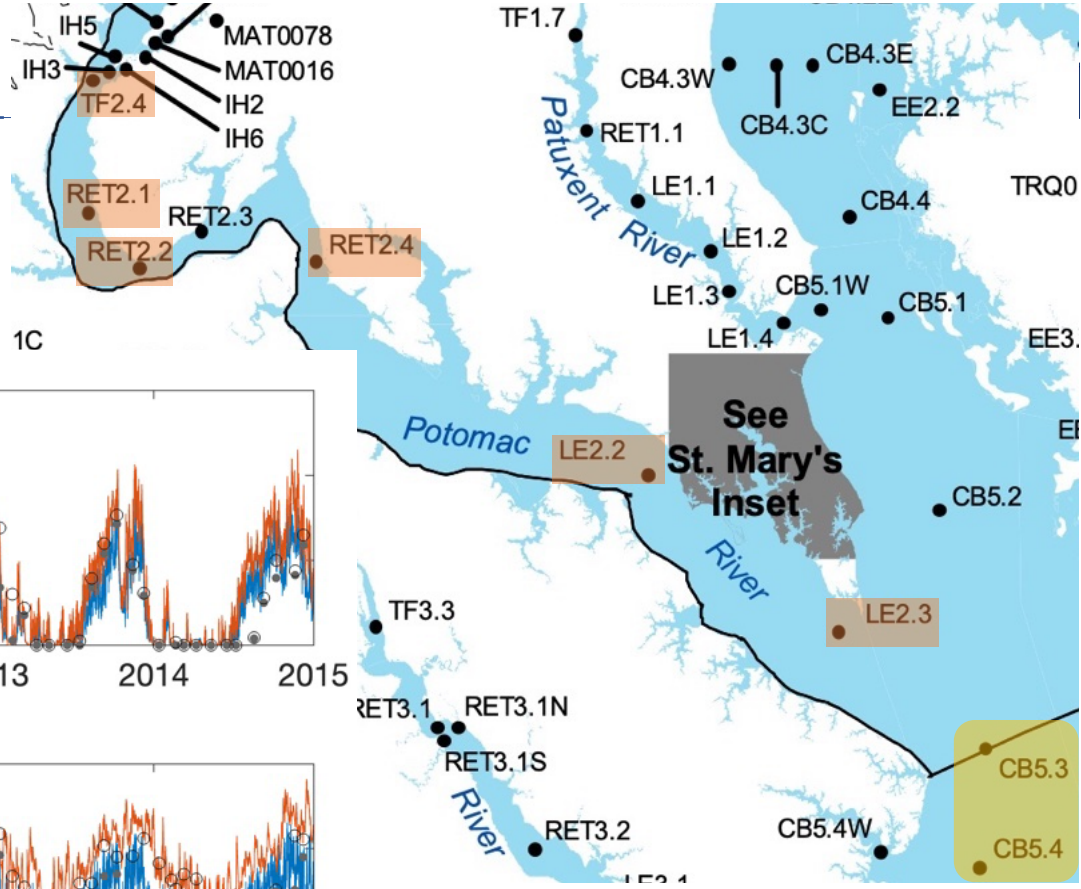
Before grid refinements



Salinity

Well capture of saltwater intrusion distance





Reasonable capture of mid-Potomac stratification

USEC model

Recent updates on grids

165,390 nodes
272,427 elements

Version 0

346,591 nodes
632,217 elements

Version 1

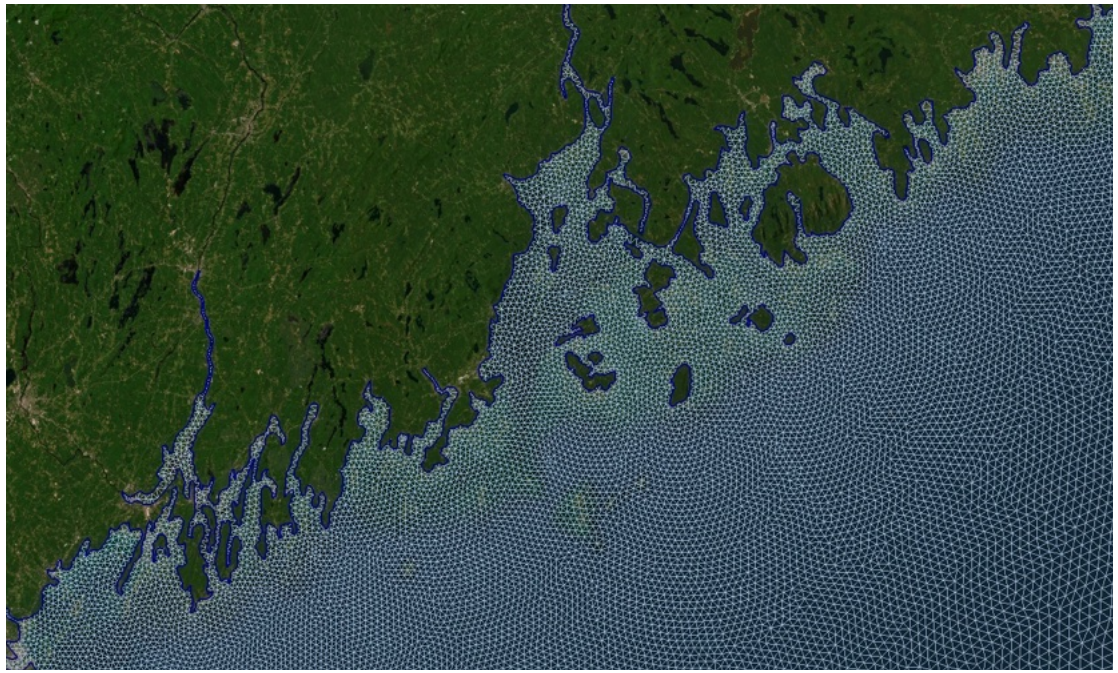
260,244 nodes
452,350 elements

Version 2

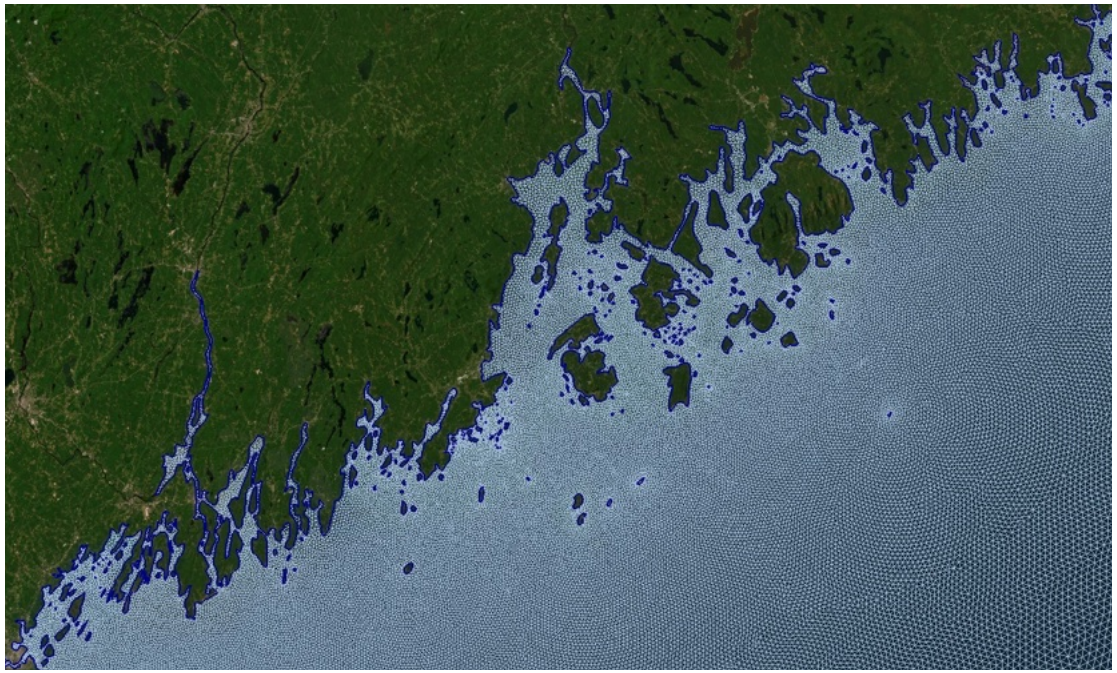
540,895 nodes
983,607 elements

Version 3

Maine Coast



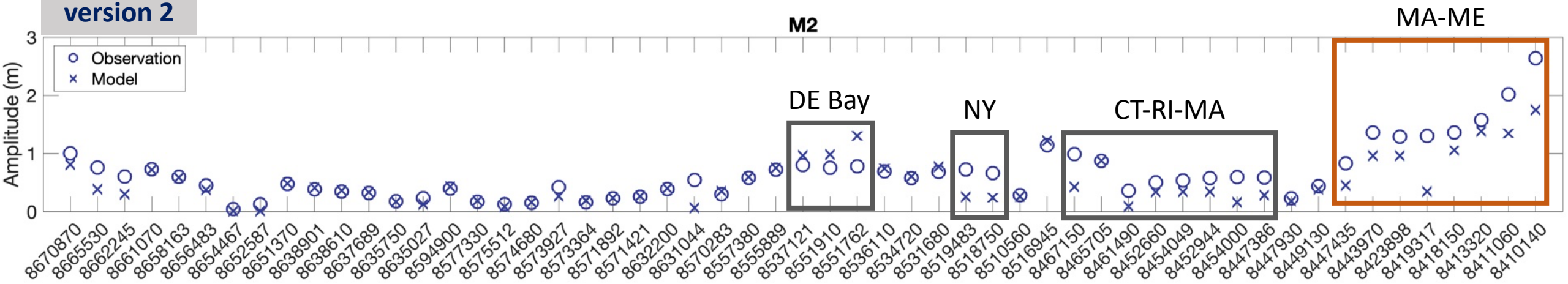
Version 2



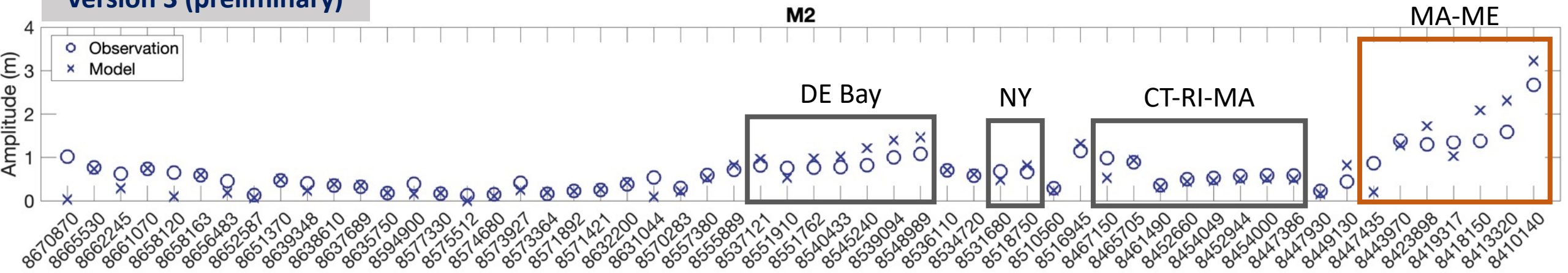
Version 3

Assessments of tide simulations (version 2 vs. version 3)

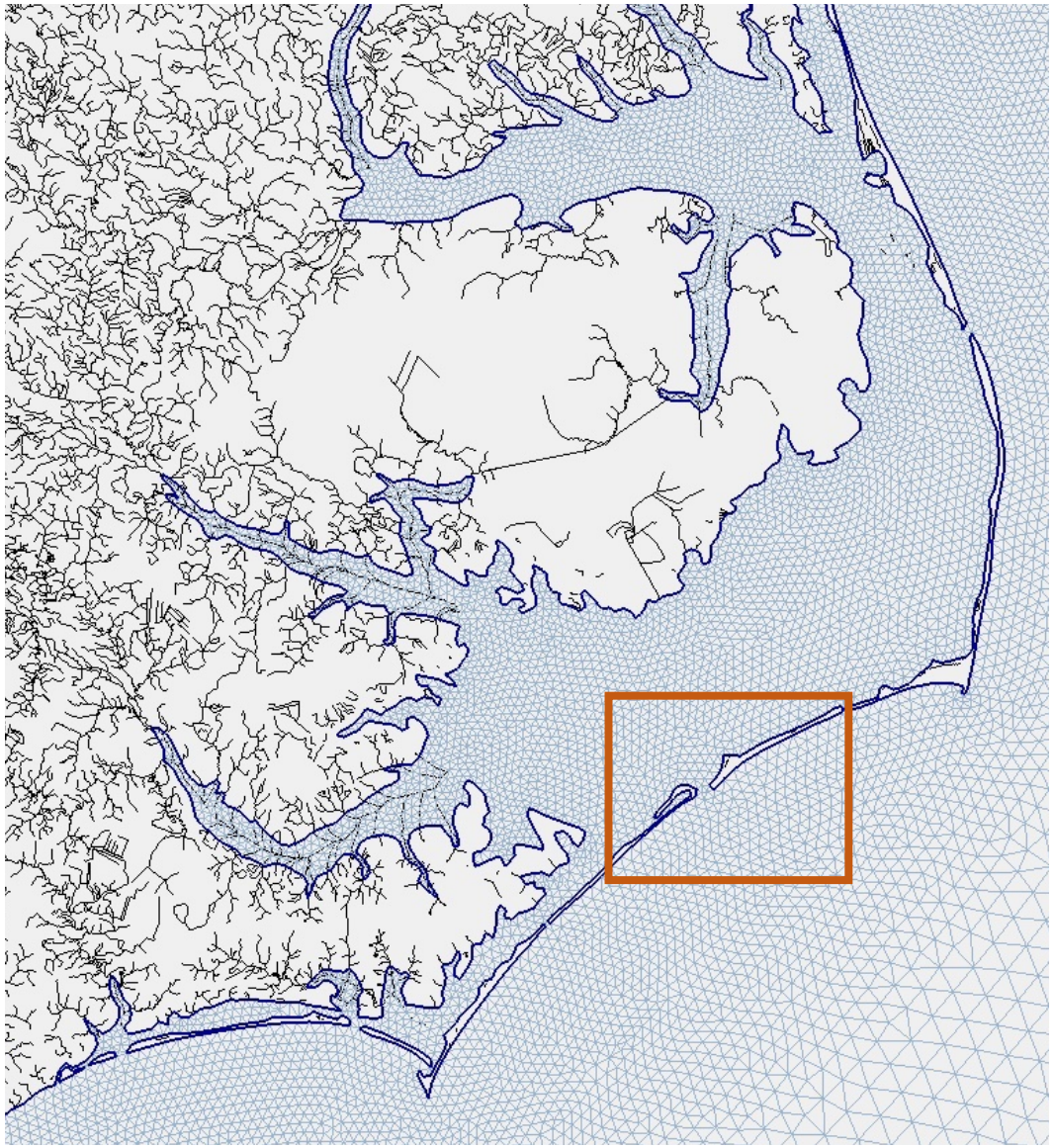
version 2



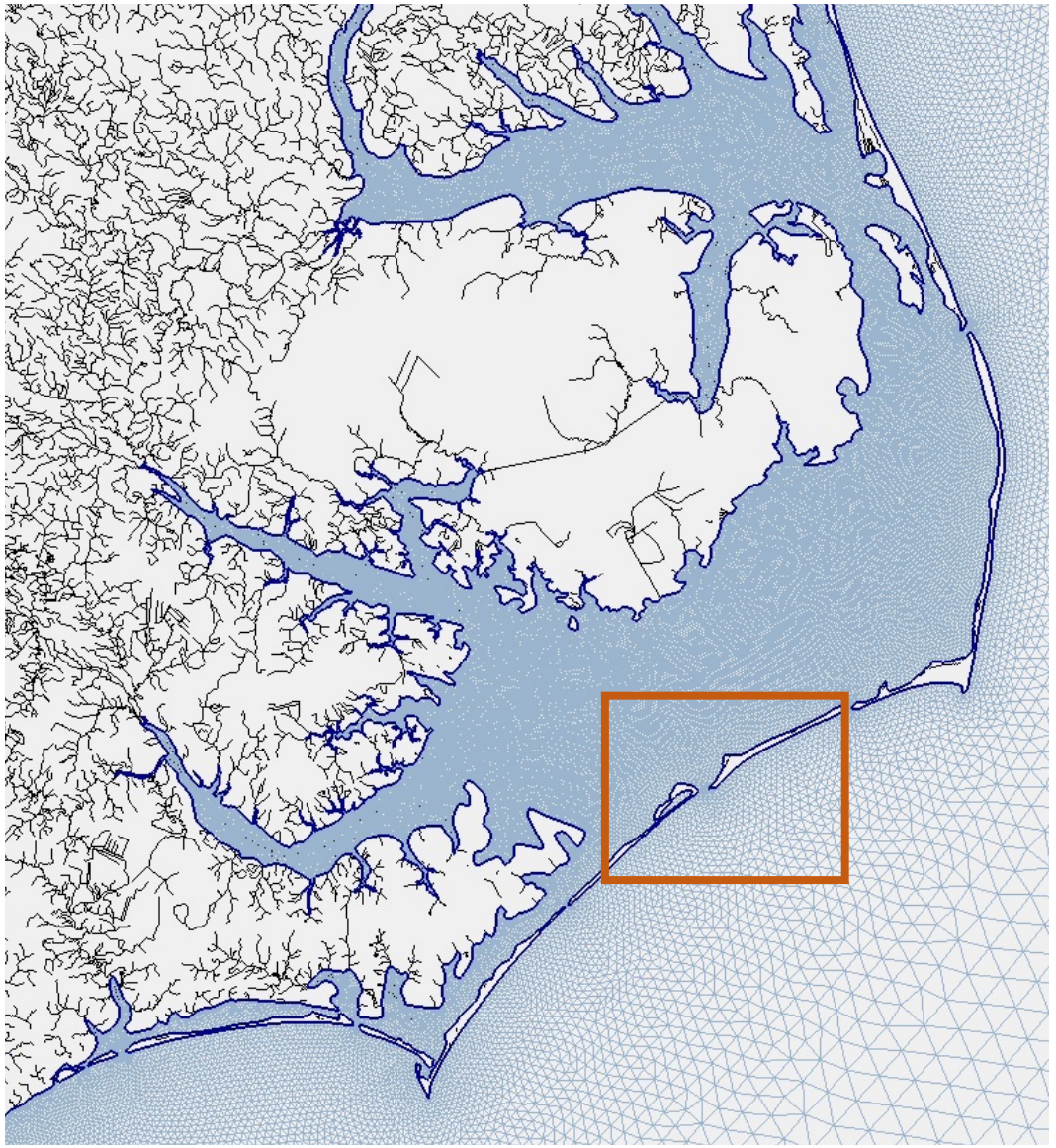
version 3 (preliminary)



Albemarle-Pamlica Sound Estuary

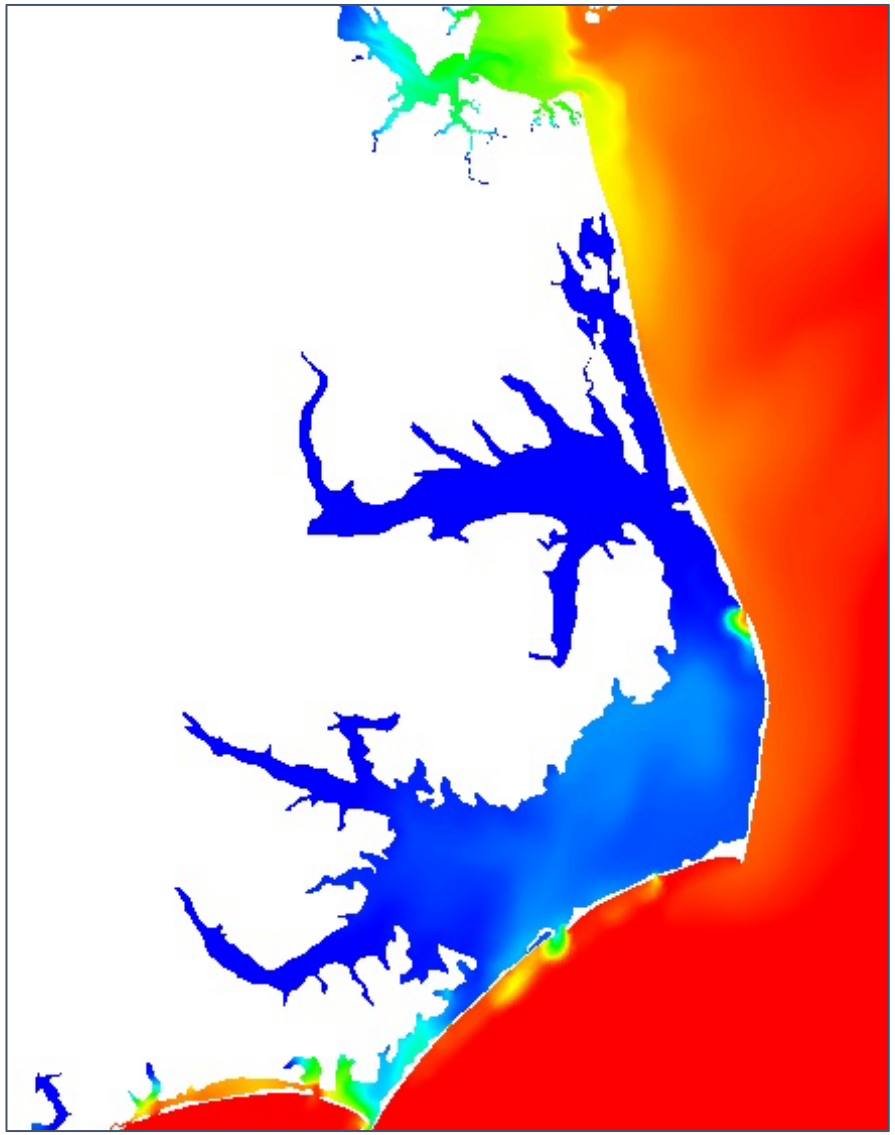


Version 2

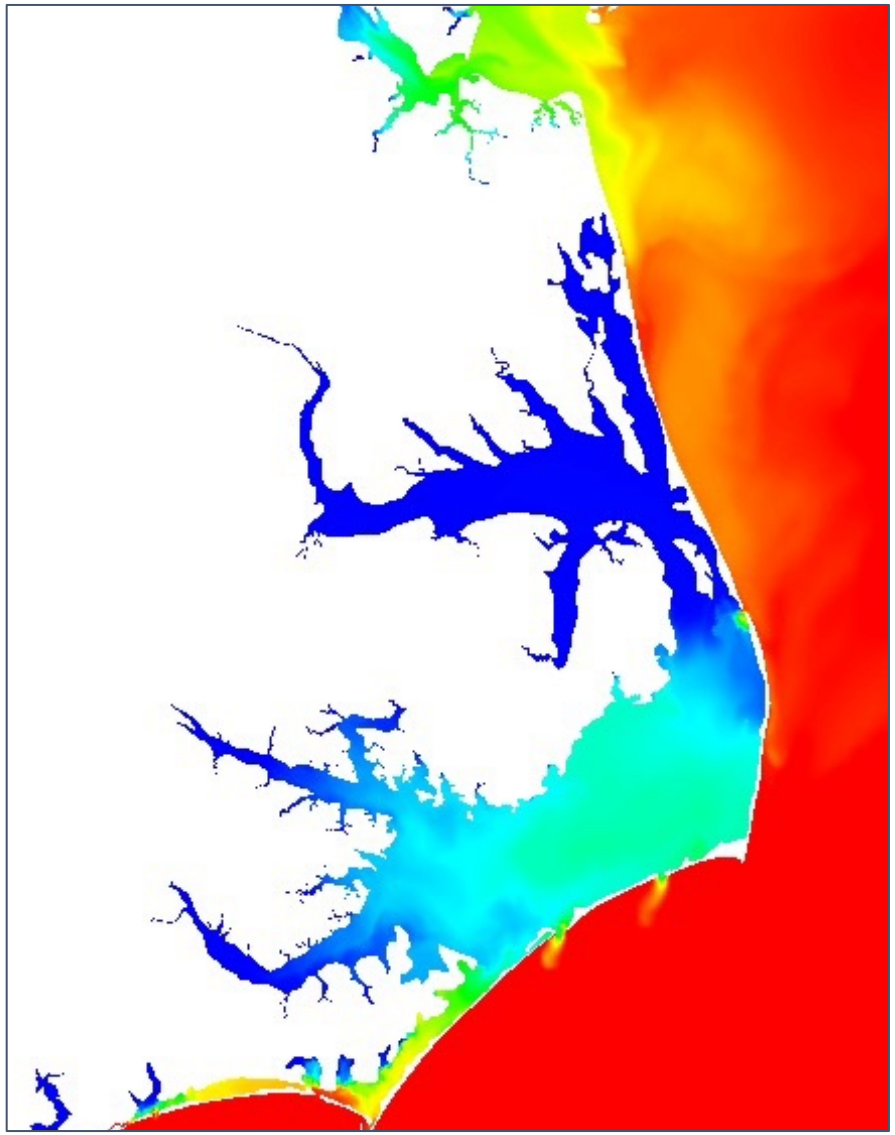


Version 3

Salinity simulations



Version 2



Version 3