Progress on the Choptank MTM

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Modeling Quarterly Review

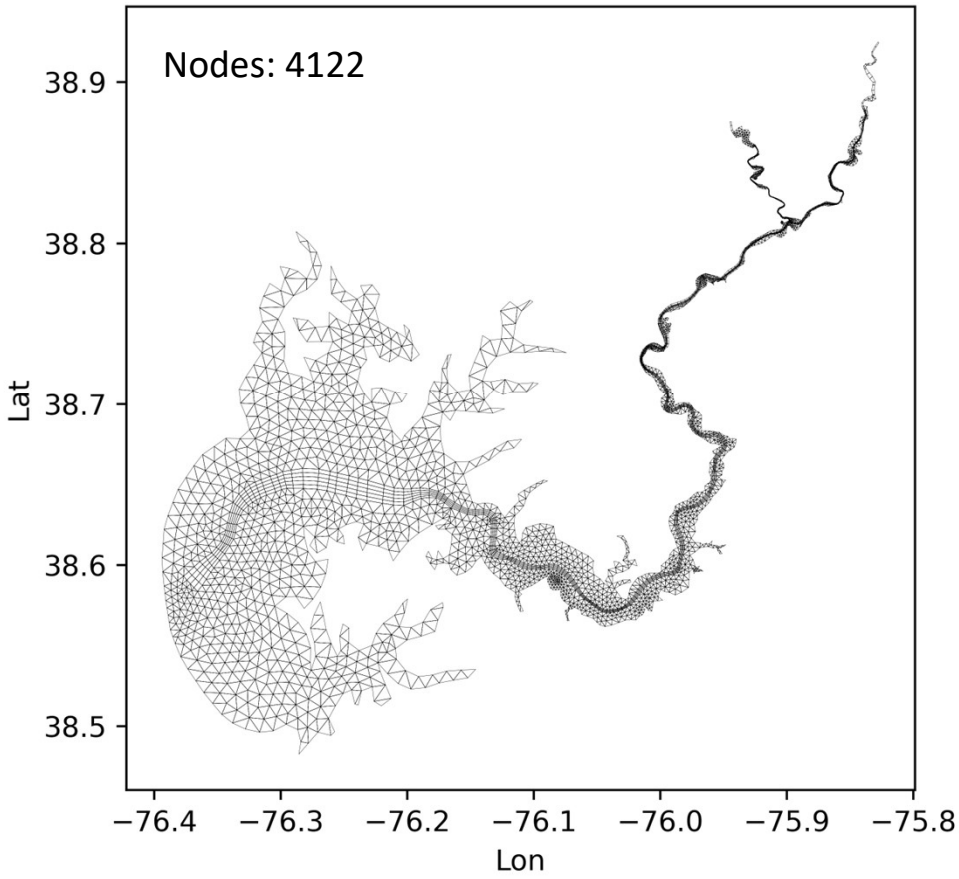
April 3 2024

Outline

- Choptank model setup
- Preliminary results for hydrodynamic simulation (1991-2000)
- Issues and next step

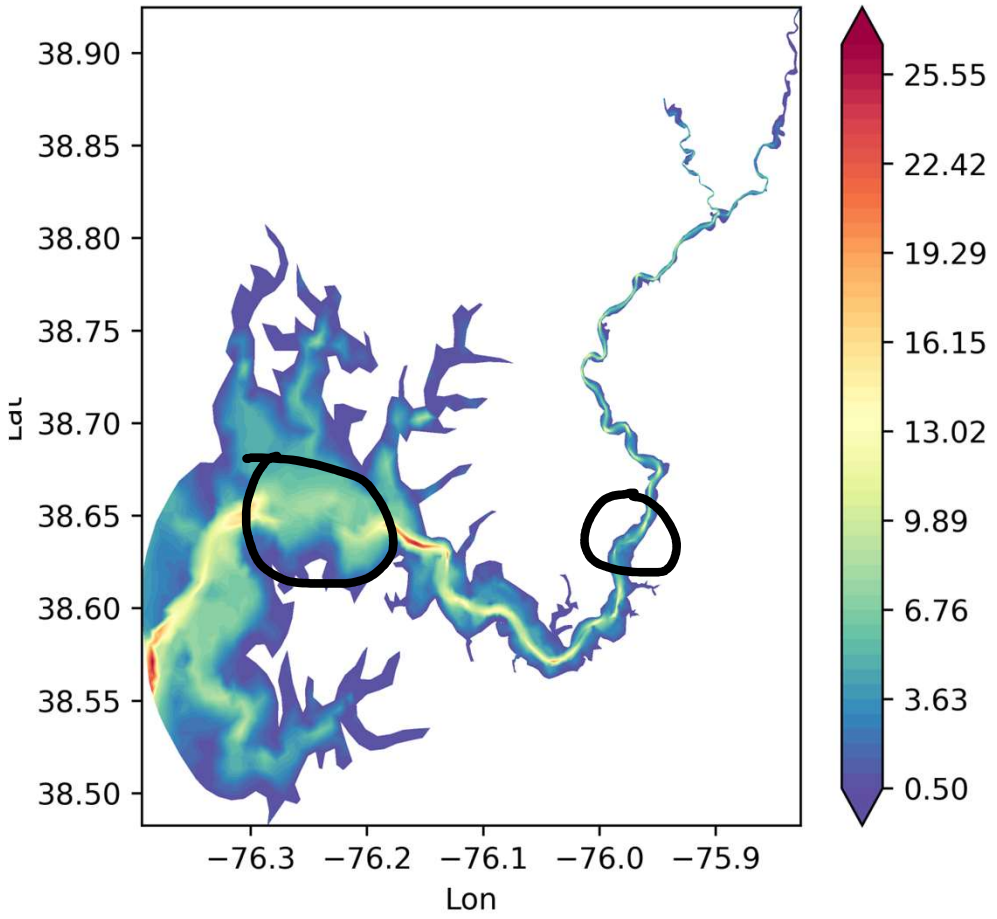
Model Grid

- Number of grid nodes: 4122
- Grids along the river channel are refined.
- The same bathymetry used in MBM.
- Same vertical grid (LSC^2) is applied, with maximum layer of 32 (Maximum layer in MBM is 52).



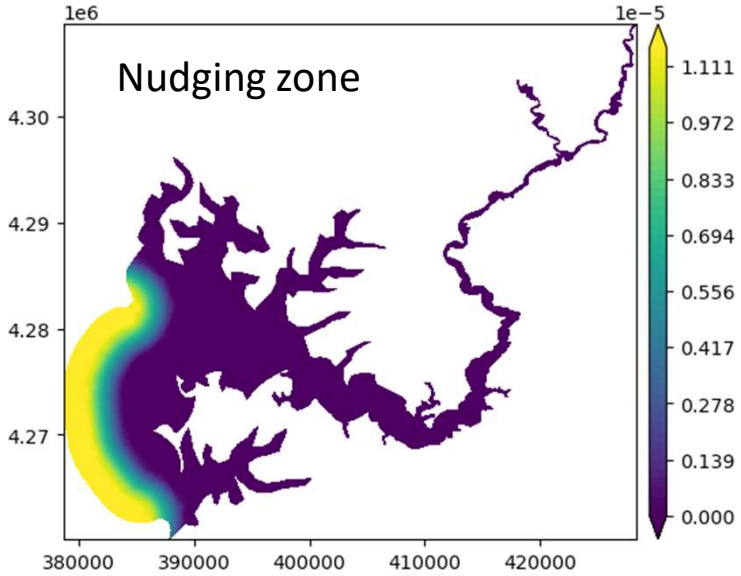
Bathymetry

- The same bathymetry data used in MBM is applied.
- The deeper channel is broken at some places.



How to couple with MBM?

- Open boundary: salinity, temperature, velocity, and surface elevation interpolate from MBM outputs (run07b). (extractions based on Zhengui's pylib package)
- MBM output frequency: 30-minute
- A 5km nudging zone (383 grid nodes)



Other configurations for the choptank model

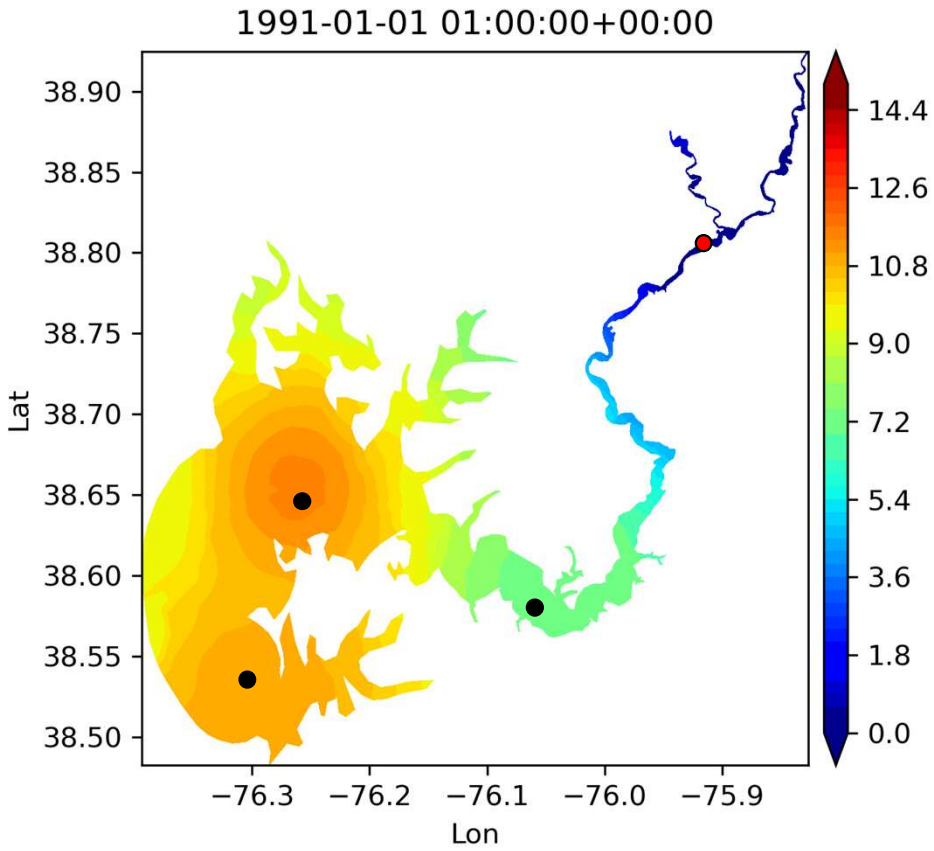
Initial states: MBM outputs.

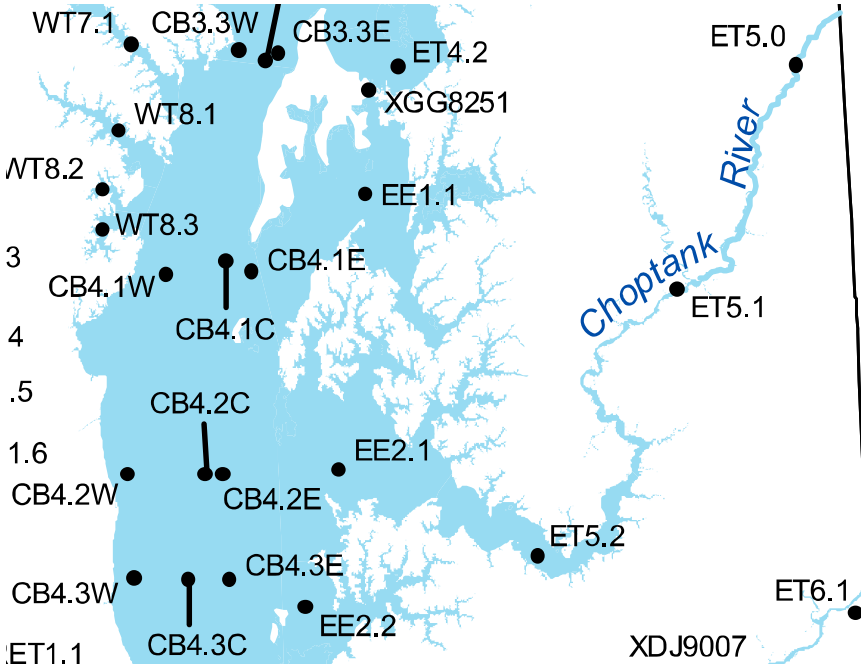
Watersheds for the Choptank River grid.

Parameters, forcings and other inputs follow the MBM setup.

Hydrodynamic simulation for 1991 – 2000.

Animation of surface salinity

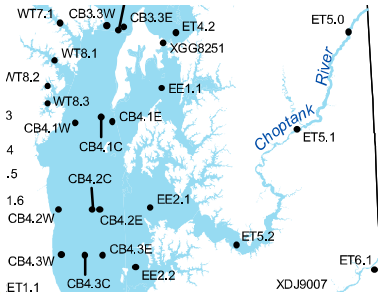




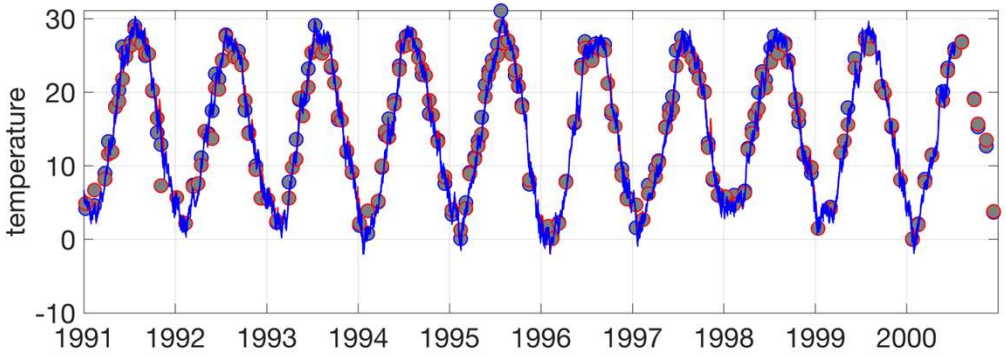
Temperature Validation

Seasonal cycle is reproduced.

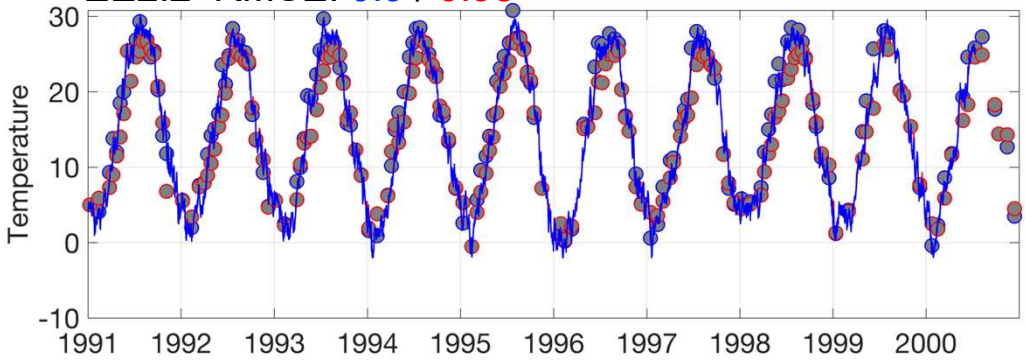
Underestimated stratification.



EE2.1 RMSE: 0.8 / 0.92

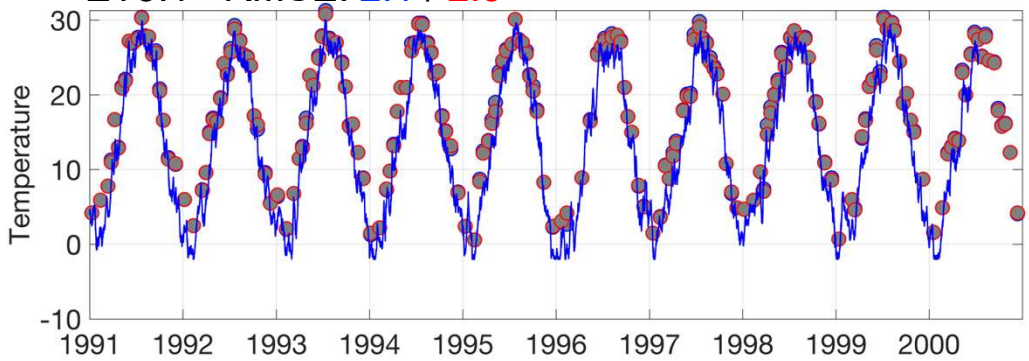


EE2.2 RMSE: 0.9 / 0.98

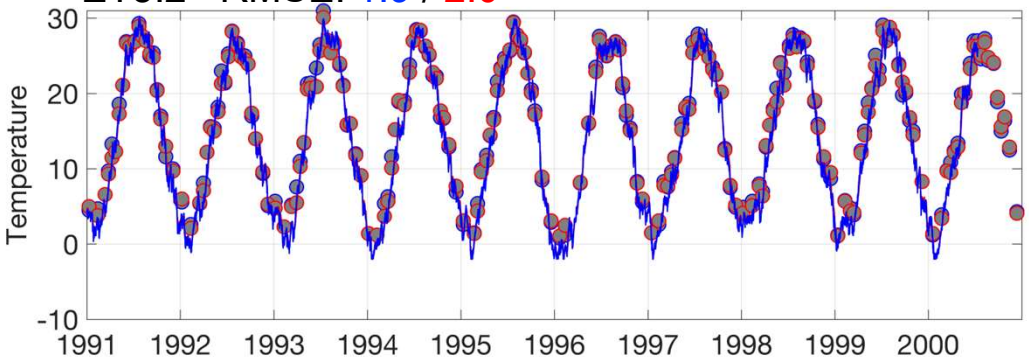


Surface/ Bottom

ET5.1 RMSE: 2.1 / 2.3

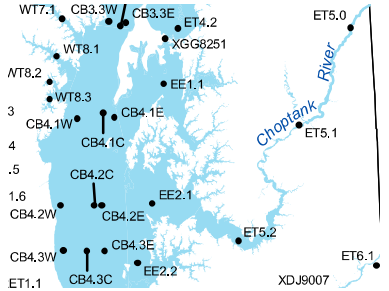


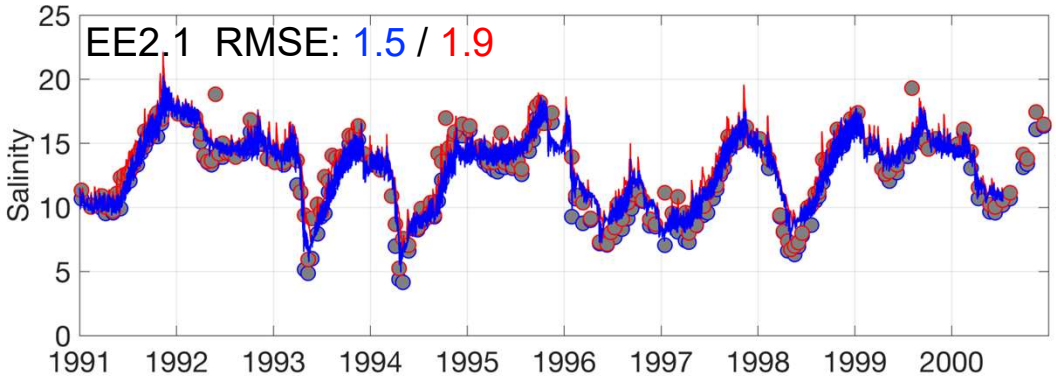
ET5.2 RMSE: 1.9 / 2.0

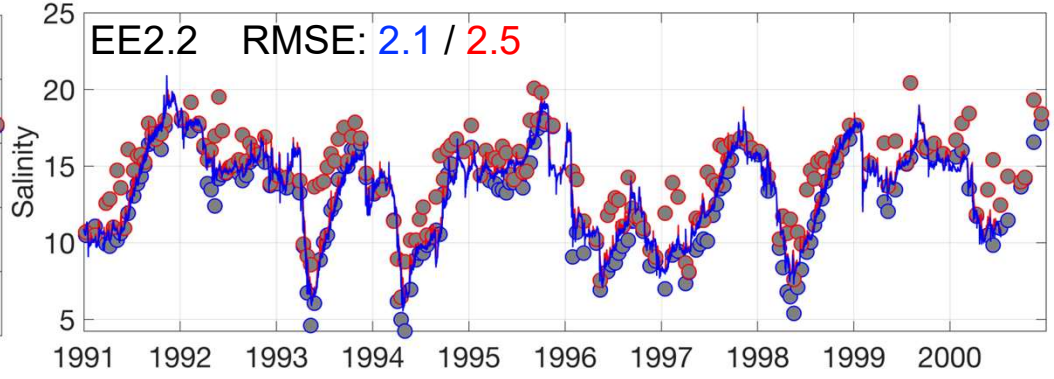


Salinity Validation

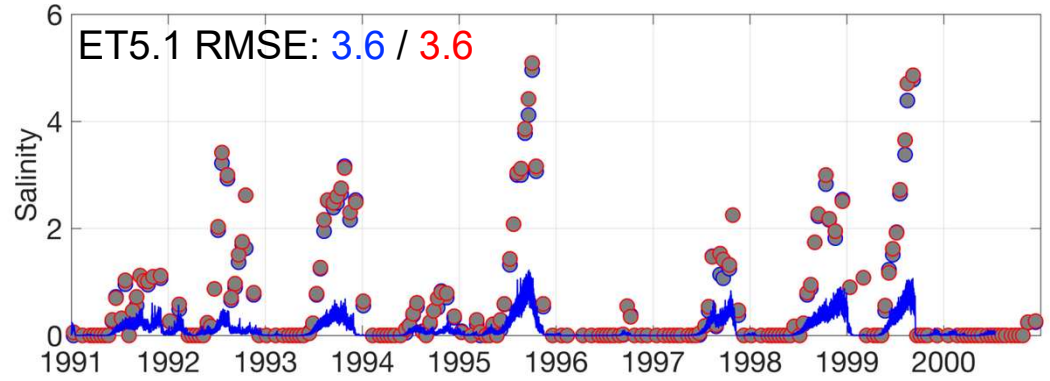
Further improvement: stratification and salt intrusion.

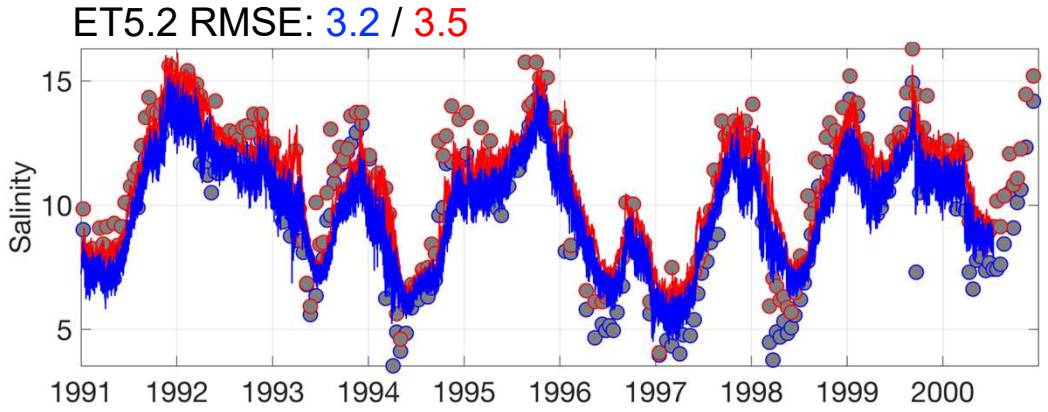






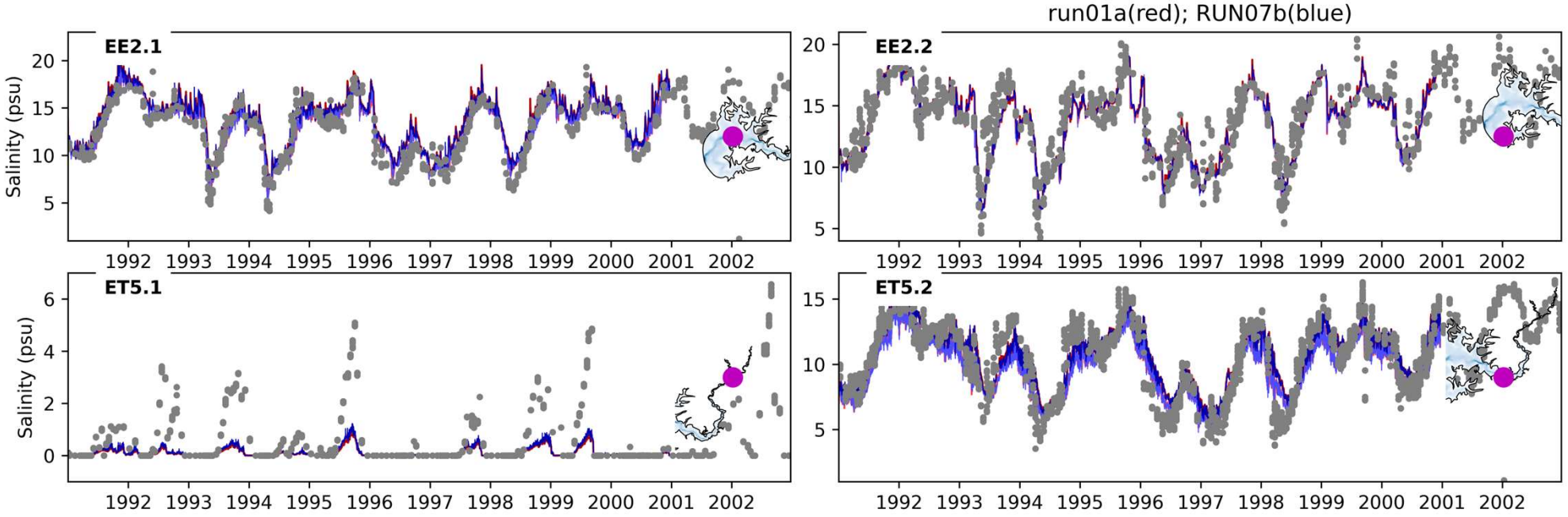
Surface / Bottom





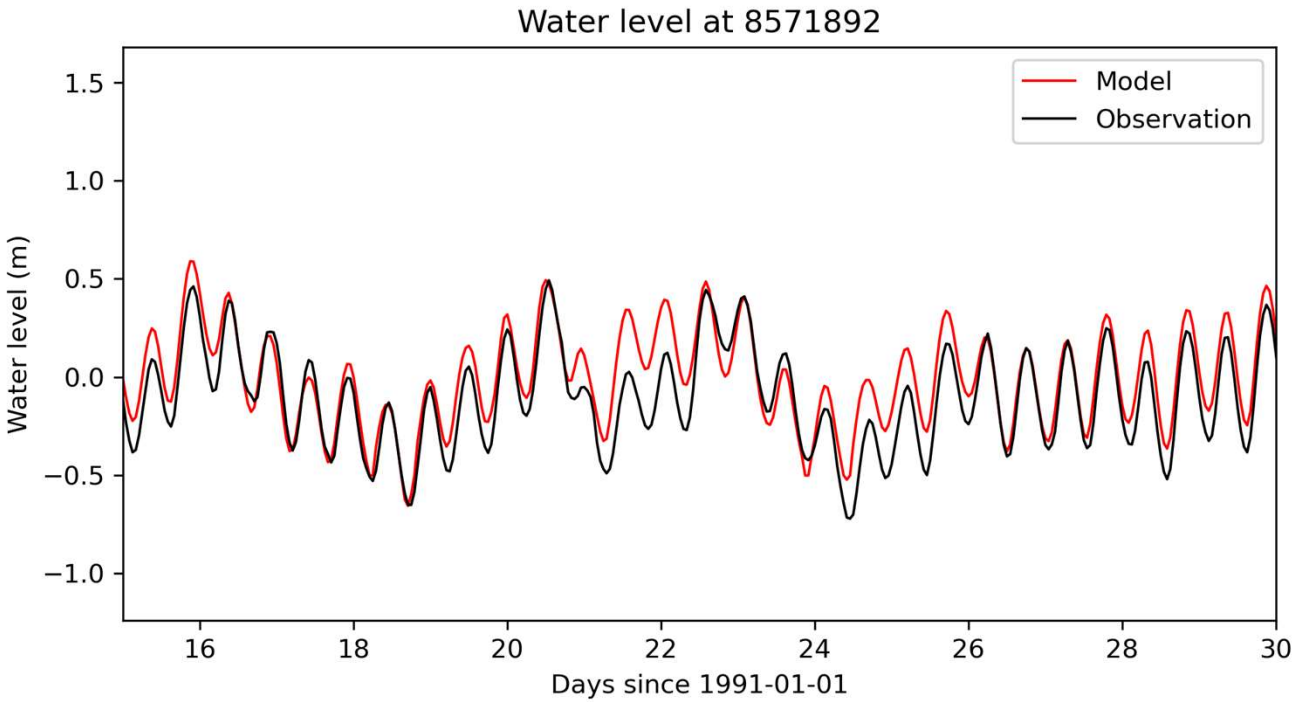
Comparison with MBM results

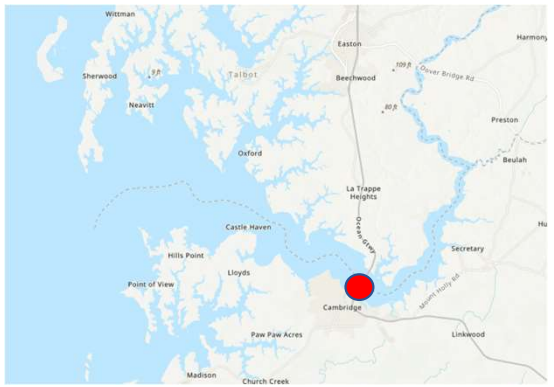
- blue lines: MBM results (run07b); red lines: our tributary model.
- MBM and tributary model produce similar results.



Water level at tide gauge station

Some mismatch is expected due to open boundary condition and limited resolution of wind field.
The mismatch is same as in MBM model.



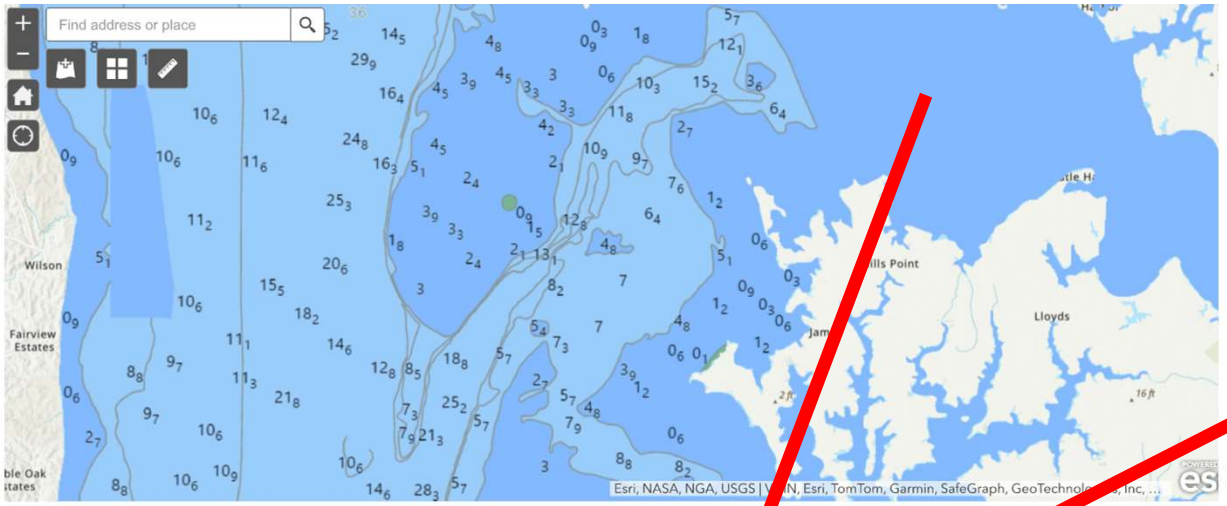


Potential solution:
Some adjustment on surface elevation at the boundary. However, we cannot make corresponding adjustments on velocity.
Any thoughts?

Issues to be resolved and potential solutions

- Underestimated stratification and salt intrusion
  - Grid refinement
  - Bathymetry data examination
  - Hydrodynamic model parameters (e.g., diffusivity min/max)
  - River flow

- Surface elevation problem
  - Adjustment on surface elevation and velocity at the open boundary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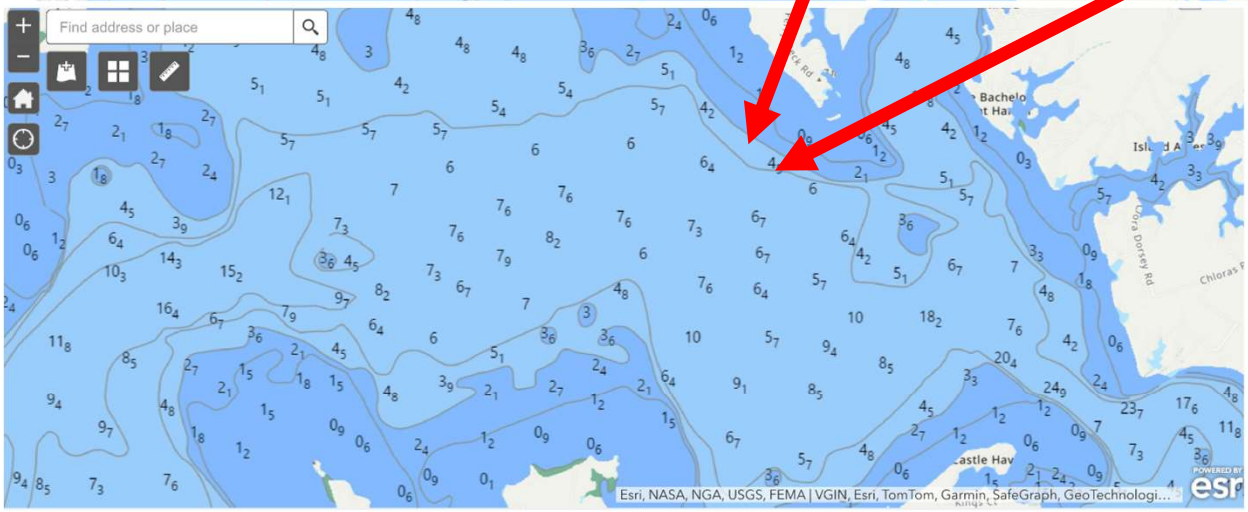
Fairview Estates
Lloyds
Esri, NASA, NGA, USGS | VGIN, Esri, TomTom, Garmin, SafeGraph, GeoTechnol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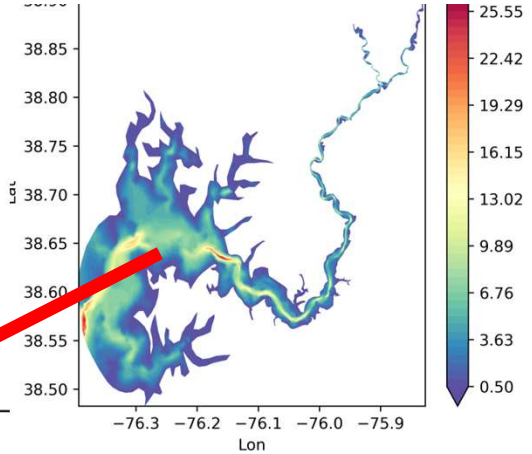
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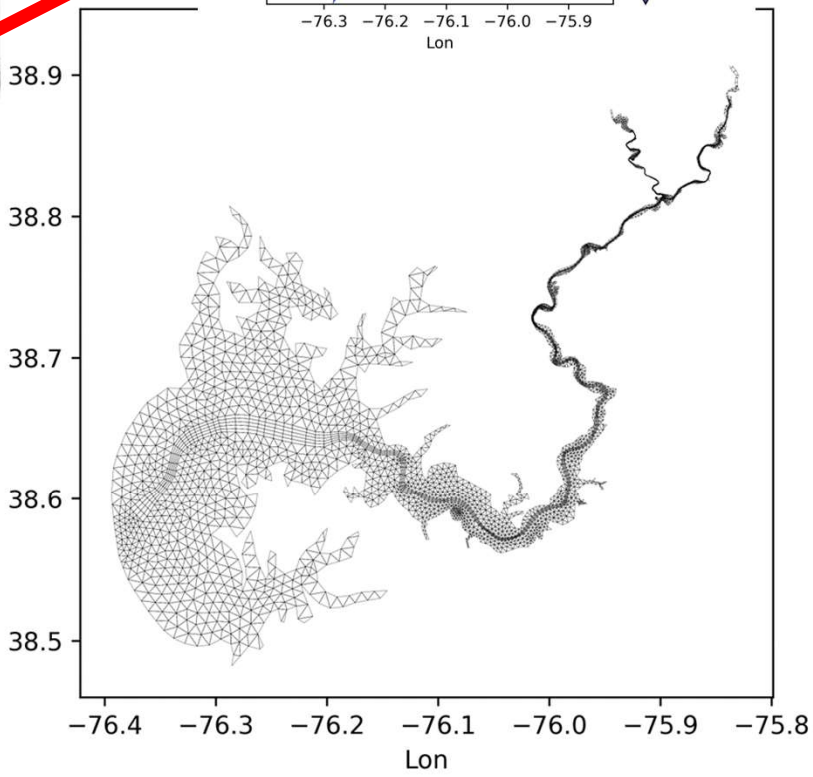
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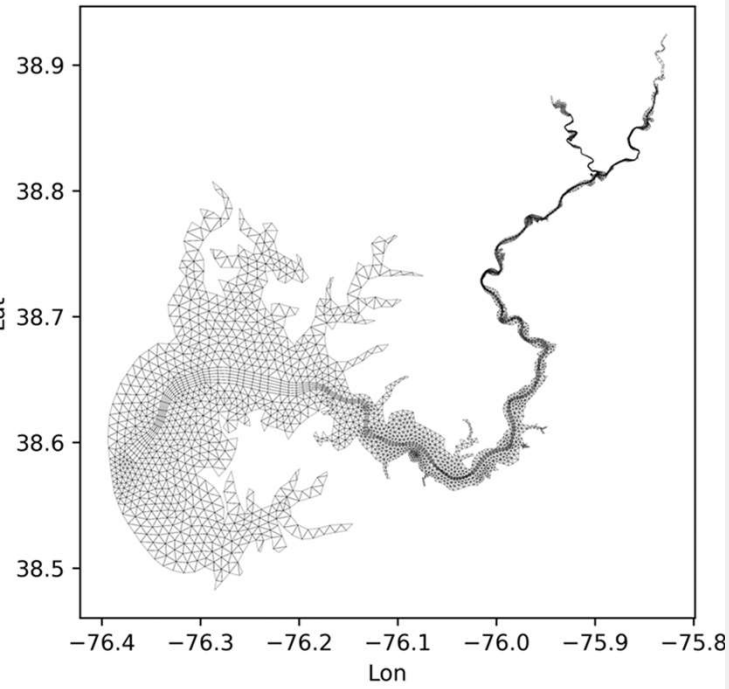
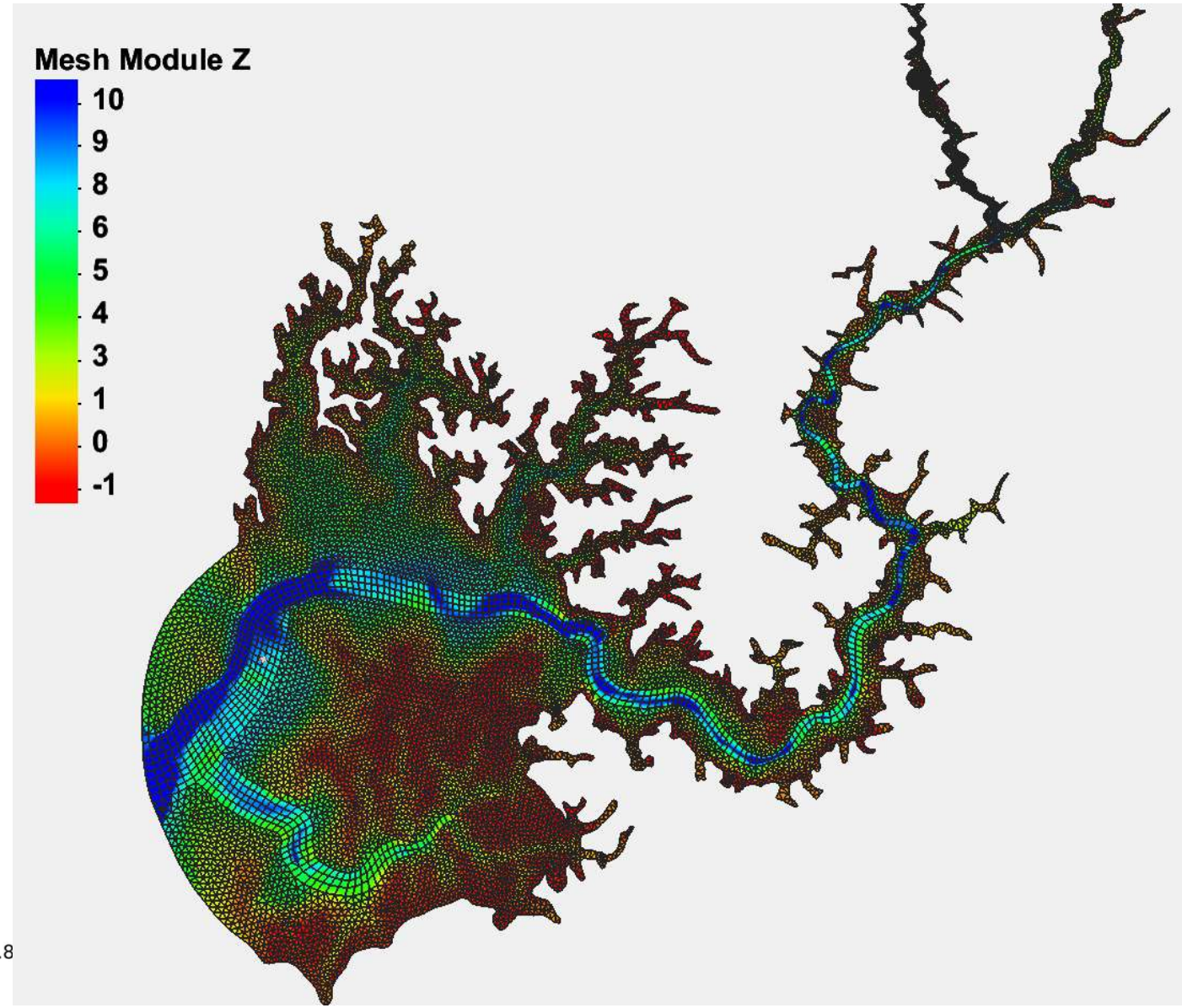
Lon

Different Grid from Richard Tian

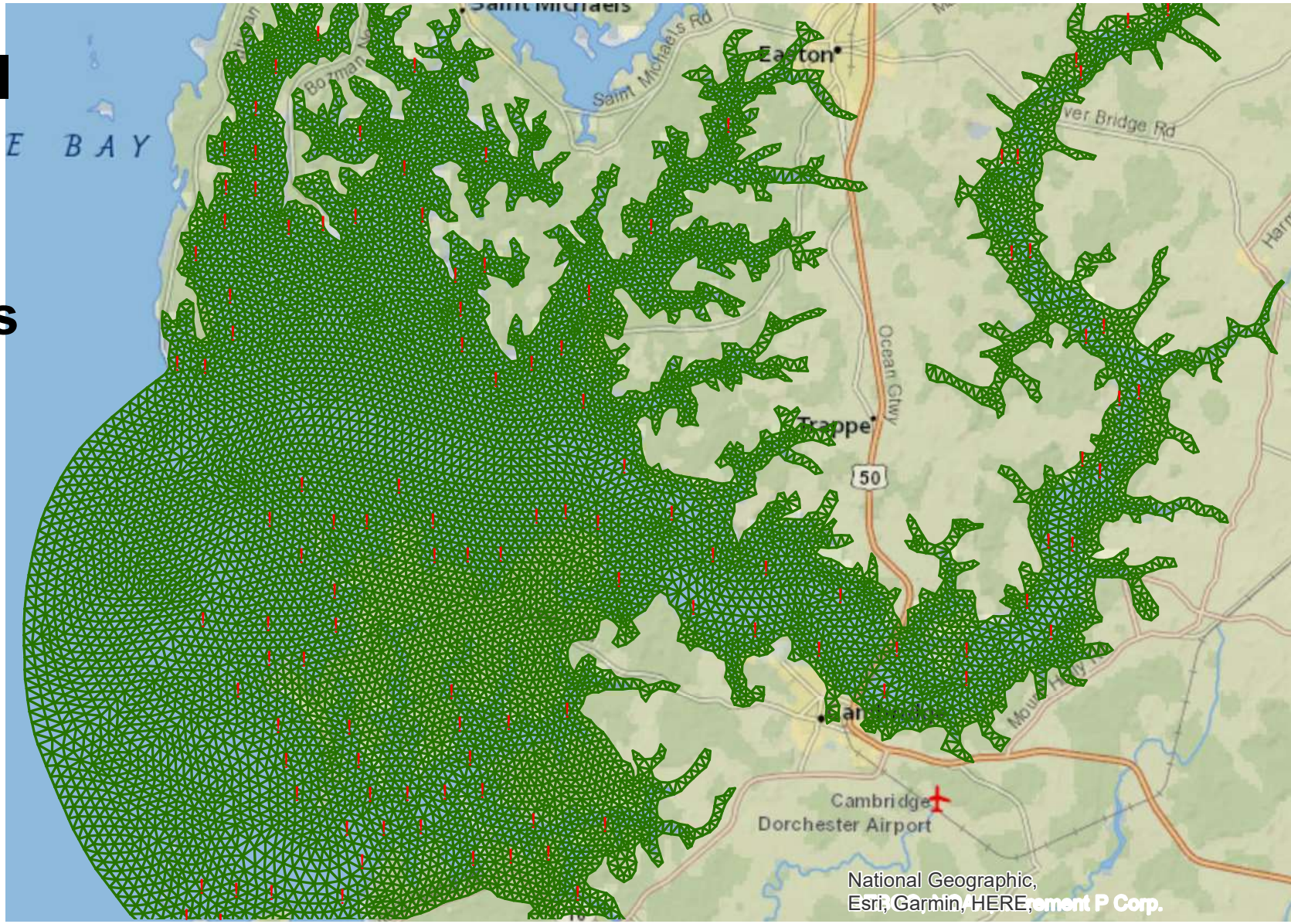
Simulation grid



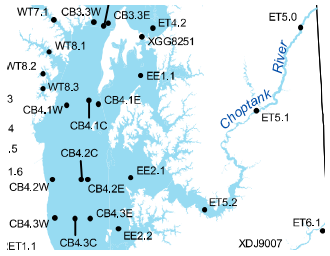


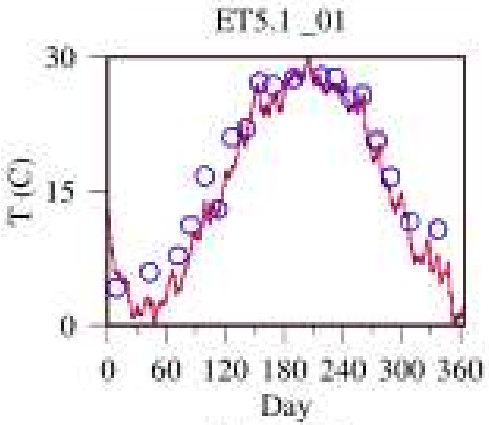
Operational grid

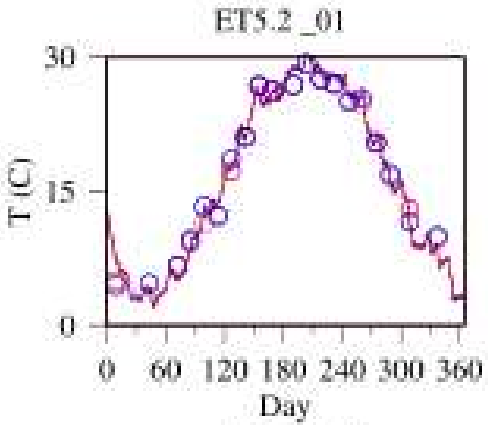
- 20429 cells
- 11690 nodes
- 27 layers

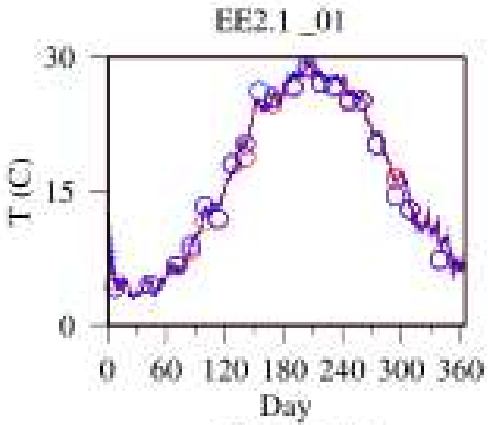


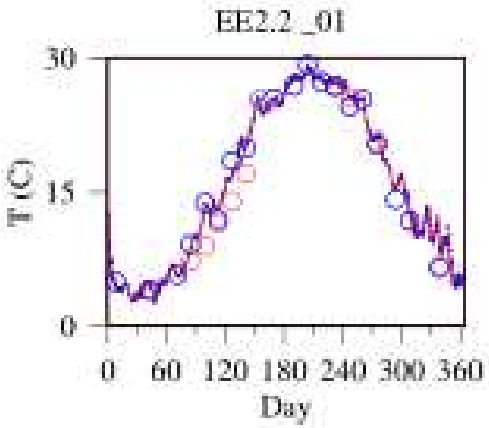
Preliminary results of temperature simulation 1991

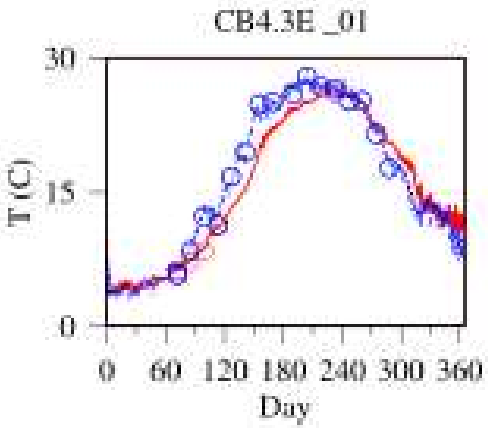


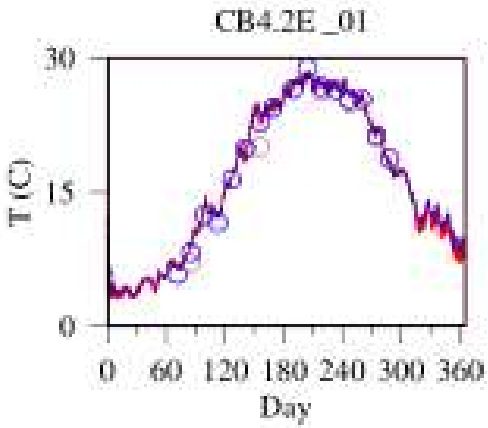




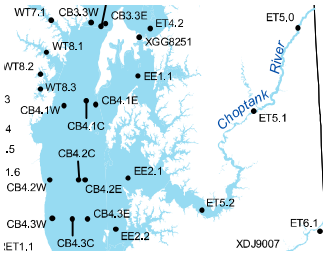


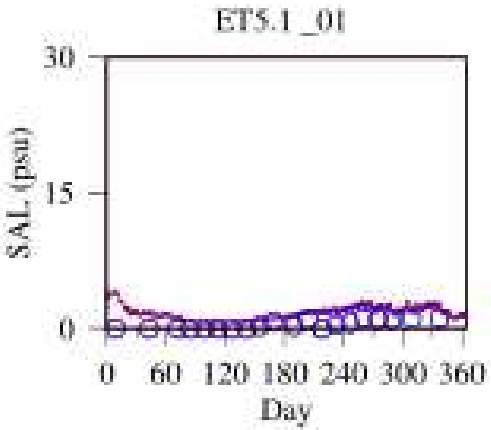


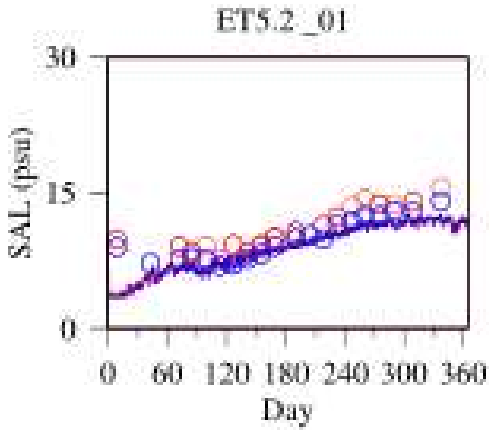


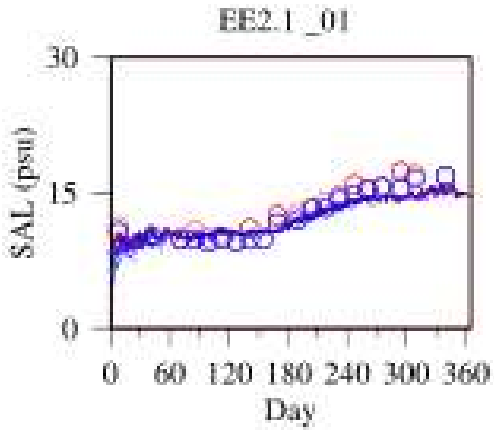


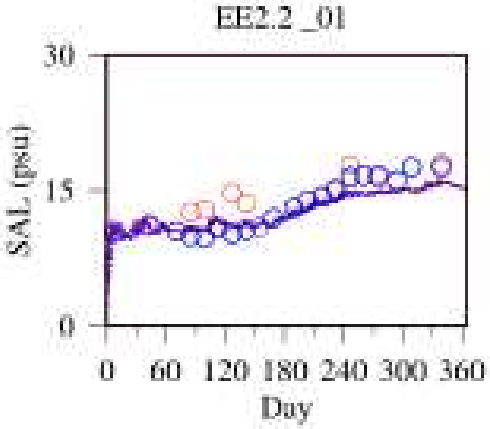
Preliminary results of salinity simulation 1991

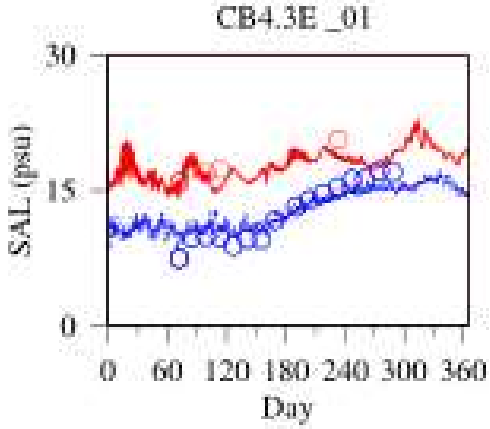


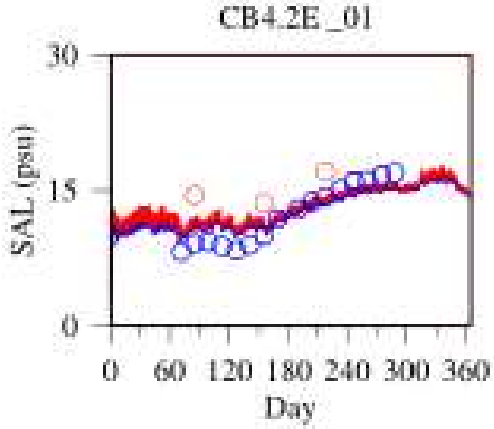












Questions ?

Supplemental:

Water level from MBM