Progress on the Choptank MTM

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Modeling Workgroup Quarterly Review

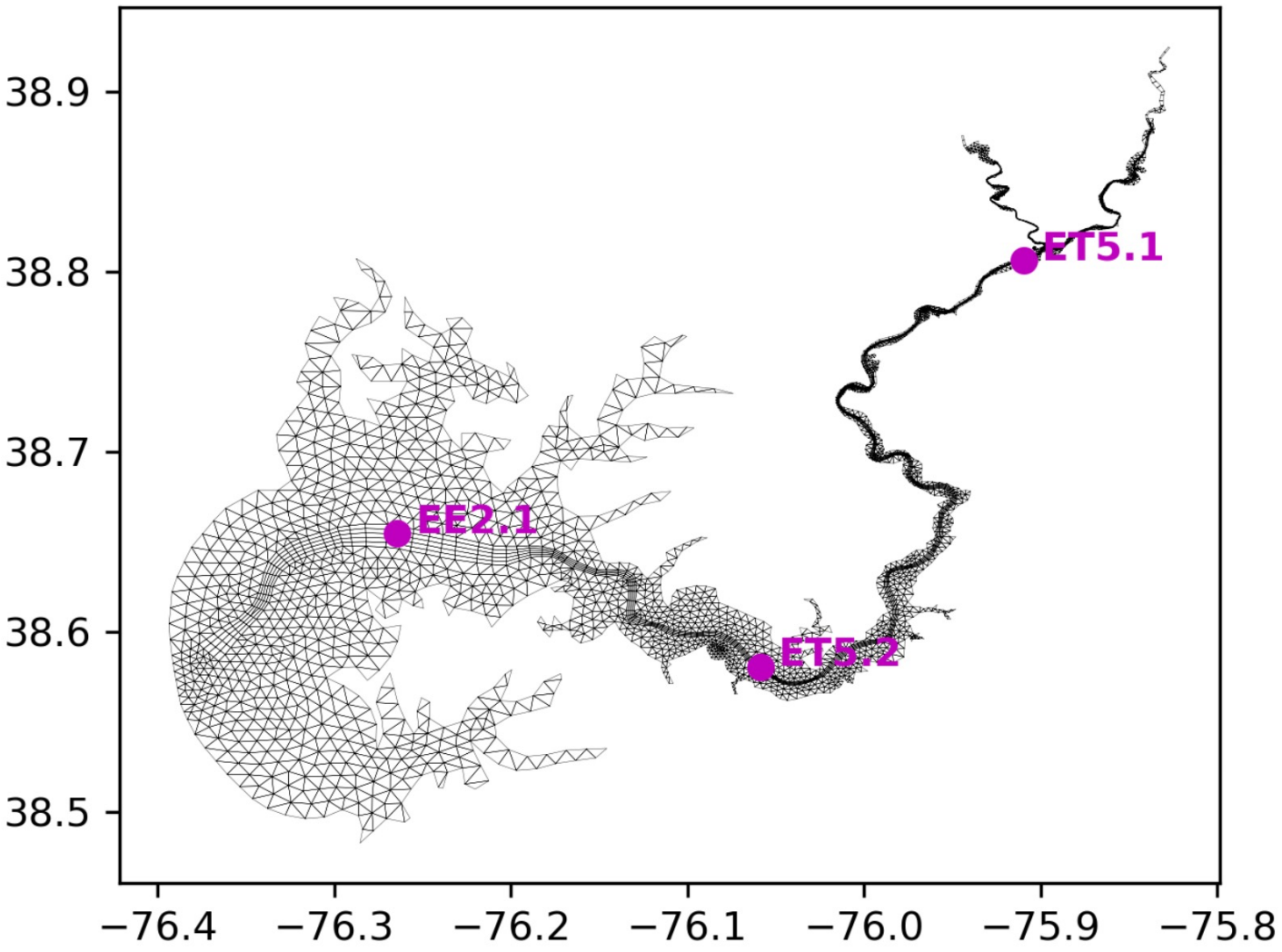
January 2025

Outline

- Sensitivity tests to resolve underestimated salt intrusion in upper estuary.

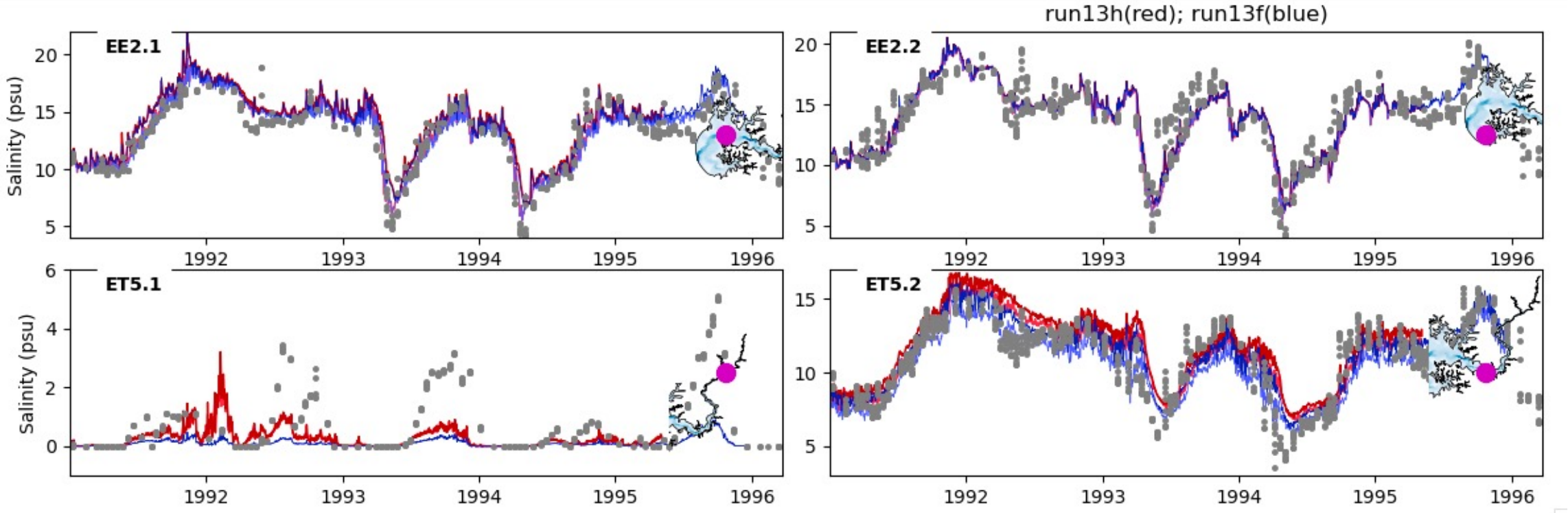
- ICM modeling results

CBP monitoring stations



Water quality data available at three stations

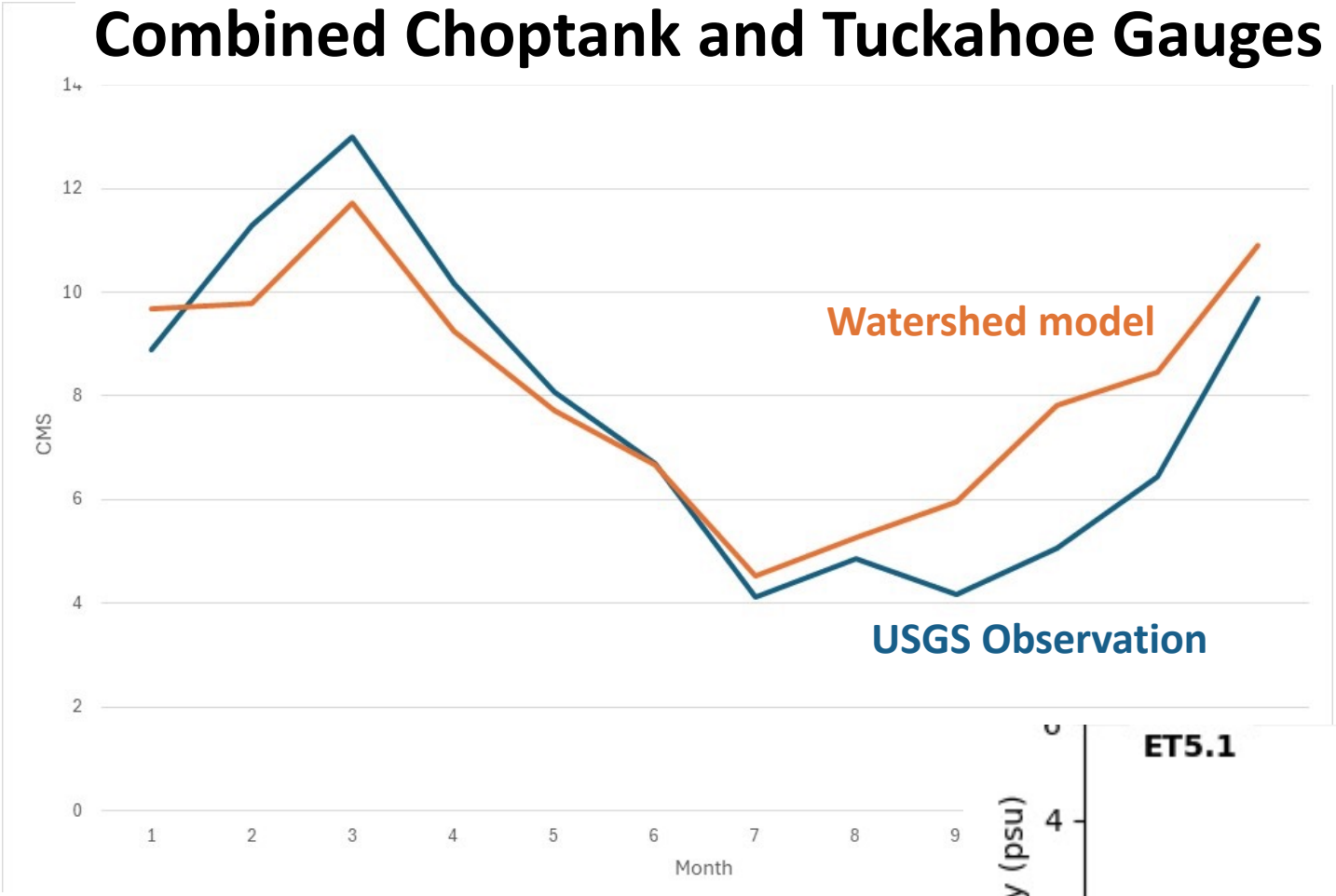
Run13h: all triangle grids, no quads, to take advantage of higher-order transport scheme (WENO), slightly increase of computational cost. Better salt intrusion at upper estuaries station.



Other sensitivity tests conducted

- Increase number of vertical layer from minimum 10 to 20 (No difference)
- Include more small water bodies (No difference)
- Extend grid to more upstream (No difference)

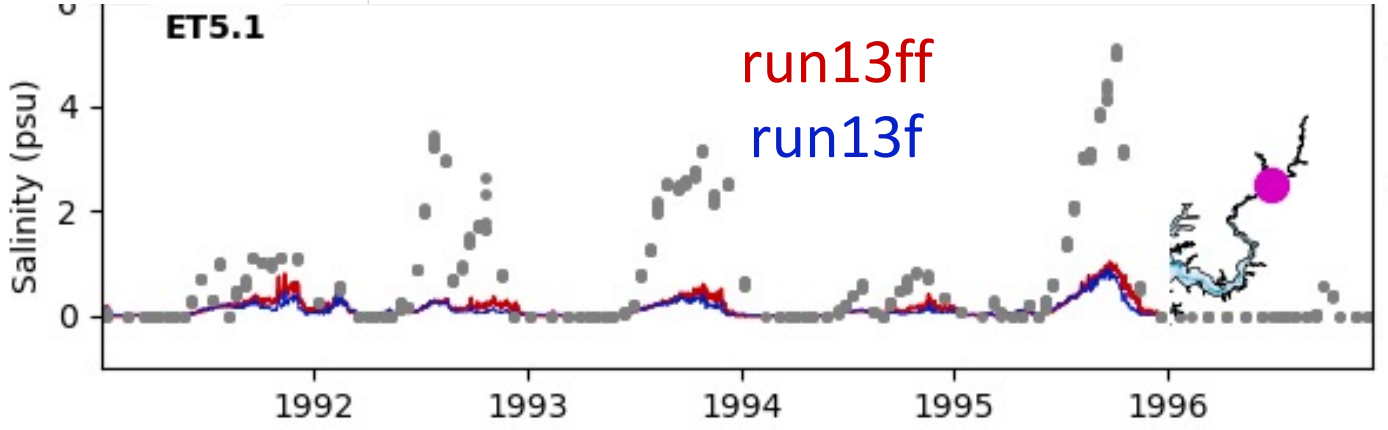
Combined Choptank and Tuckahoe Gauges



From watershed modeling team

We modified the freshwater input to match the observed seasonality (run13ff).

However, there is little difference in model results.



Possible reasons for the salt intrusion underestimation:

- Grid (unlikely)
- Transport scheme (unlikely)
- River flow (maybe)
- Bathymetry (maybe)
- Wind (maybe)

We will continue carrying out numerical tests when necessary.

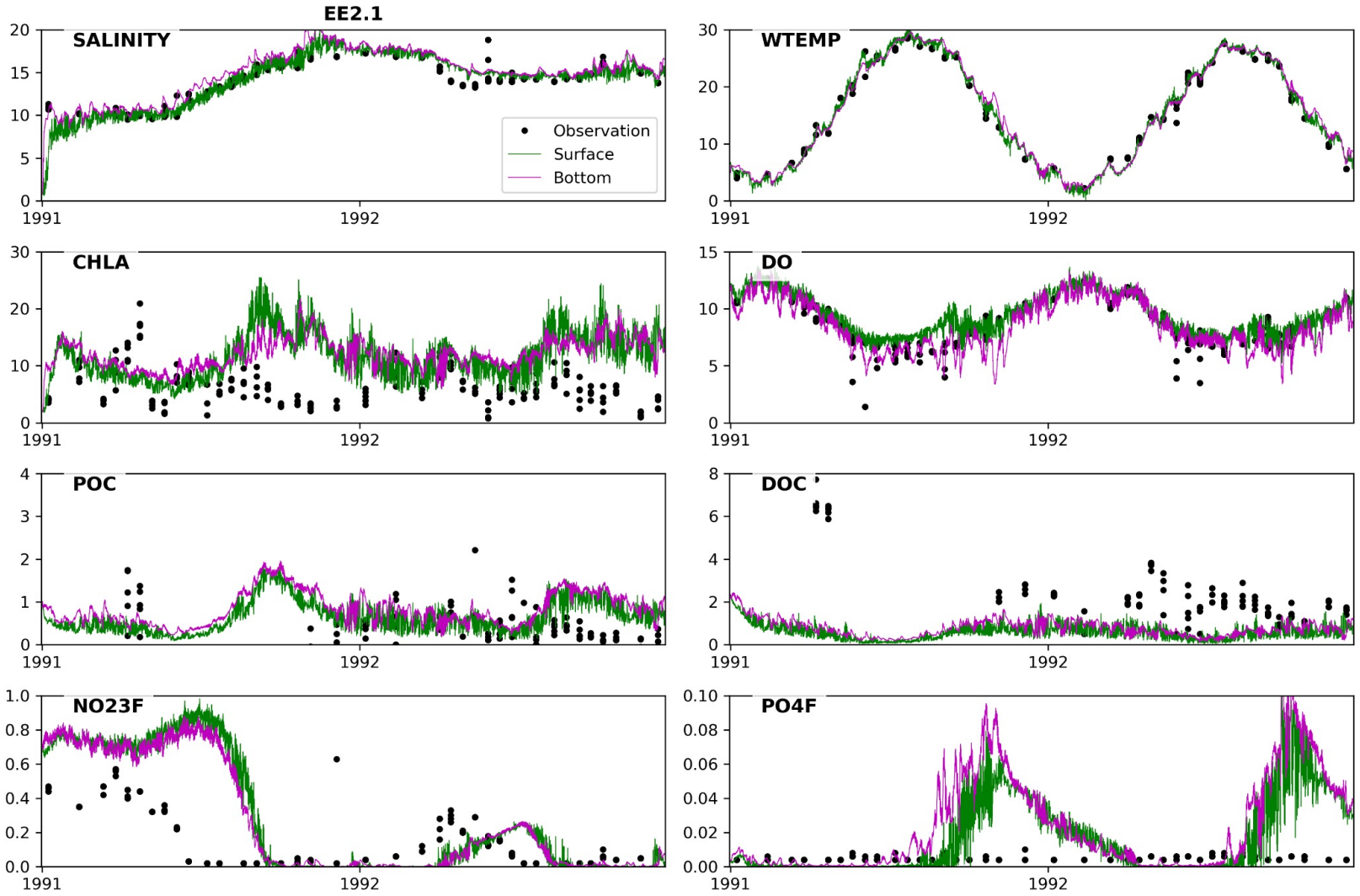
Meanwhile, we want to move on with the water quality modeling.

BGC simulation

- Nutrient load from watershed model
- Open boundary from main bay model
- Fully coupled hydro+ICM
- Efficiency: using 72 cpus (27 for IO) at TAMU HPC, it takes 11hr for one-year simulation
- Efficiency should be better if running in standalone mode

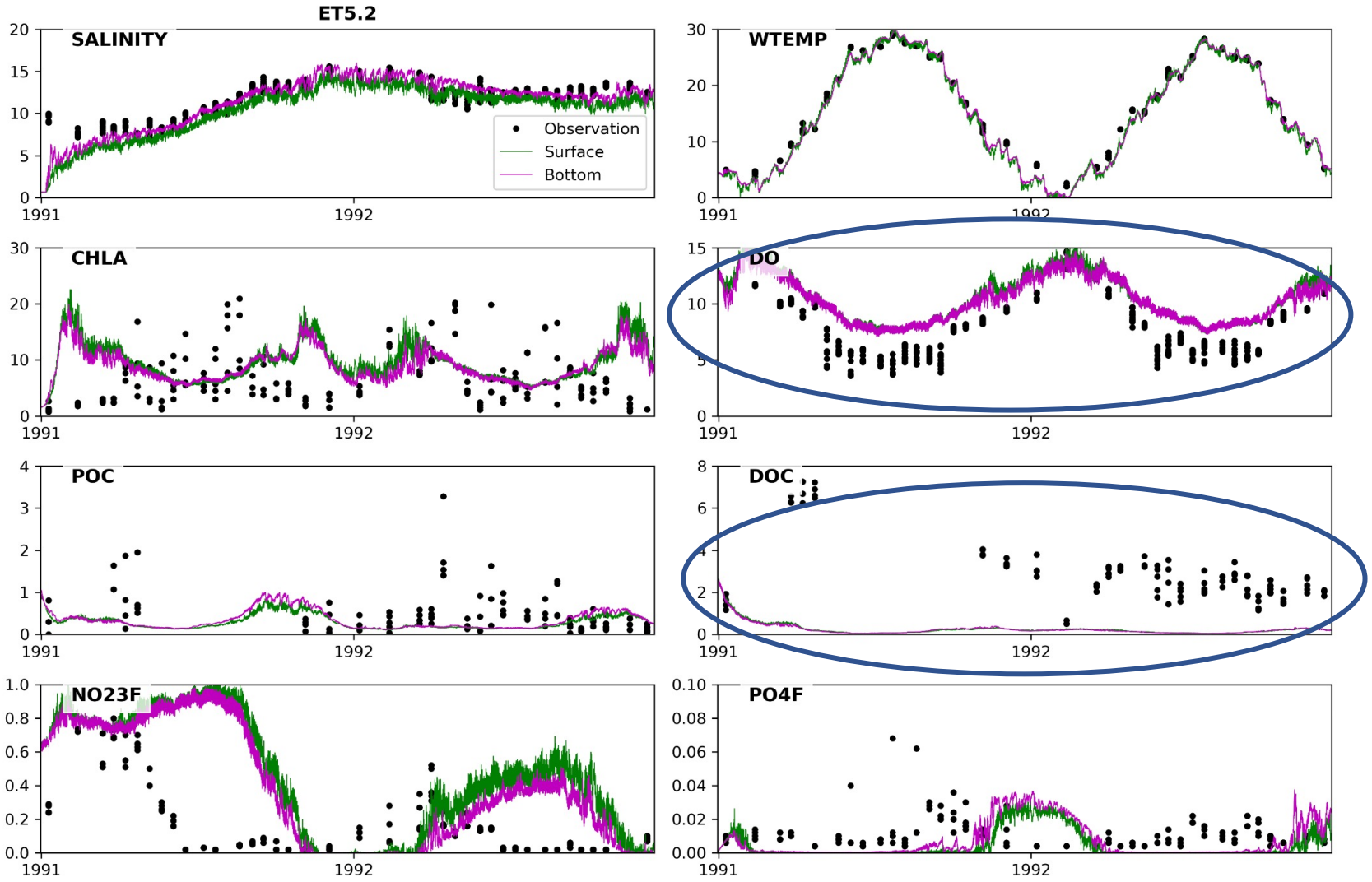
BGC simulation

run10f:
Use grid V1.0 (less grid node, with quads)
Sediment flux model not turned on



- Near open boundary
- More controlled by open boundary conditions
- With erroneous open boundaries, it is hard to determine the source of error in middle and upper river stations.
- We will make correction on the open boundary condition.

BGC simulation



Middle estuary station
A key station for calibration.

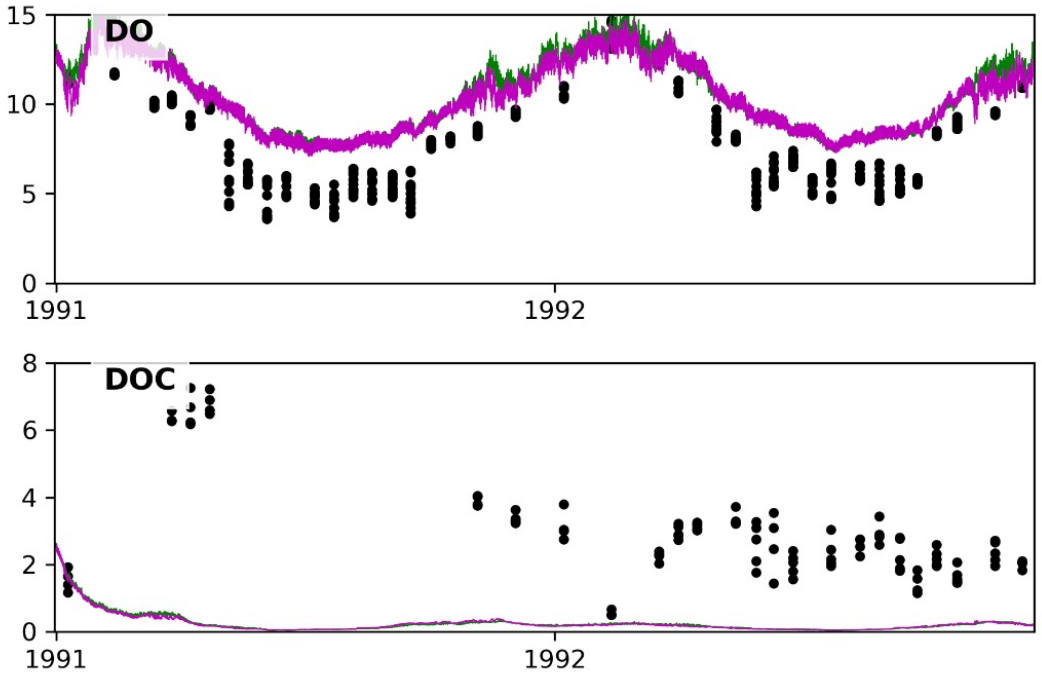
While the model captures the magnitude of major nutrient, DO and chla, there are some notable issues to be resolved.

- Overestimation of DO during summer – **need to use latest code**
- Underestimation of DOC
- Wrong seasonality in chla and NO23

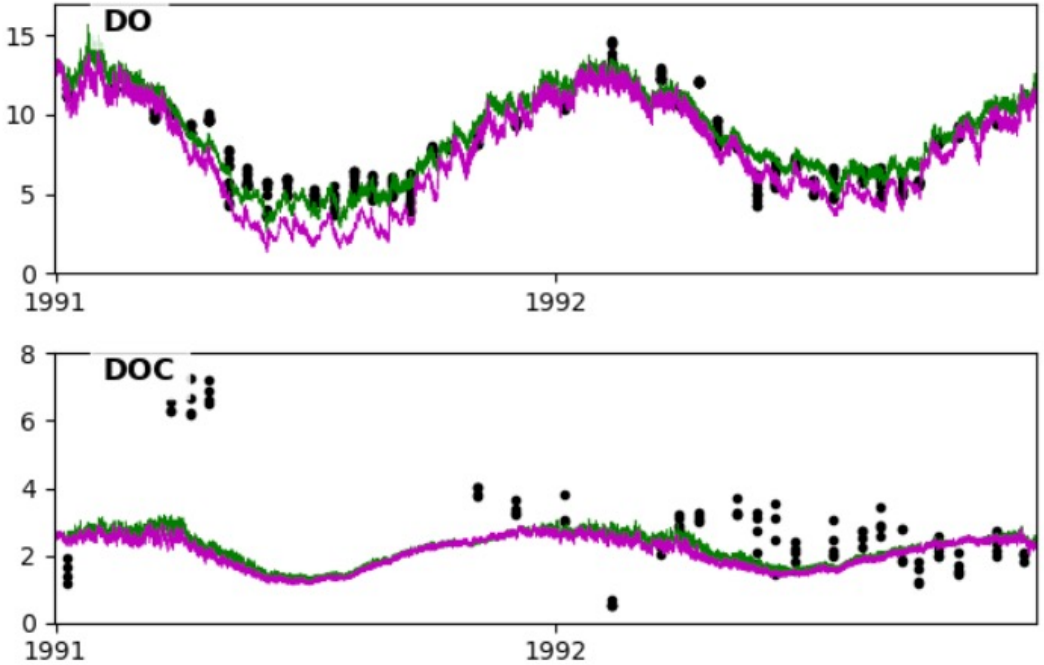
The sediment flux model was not turned on.

BGC simulation

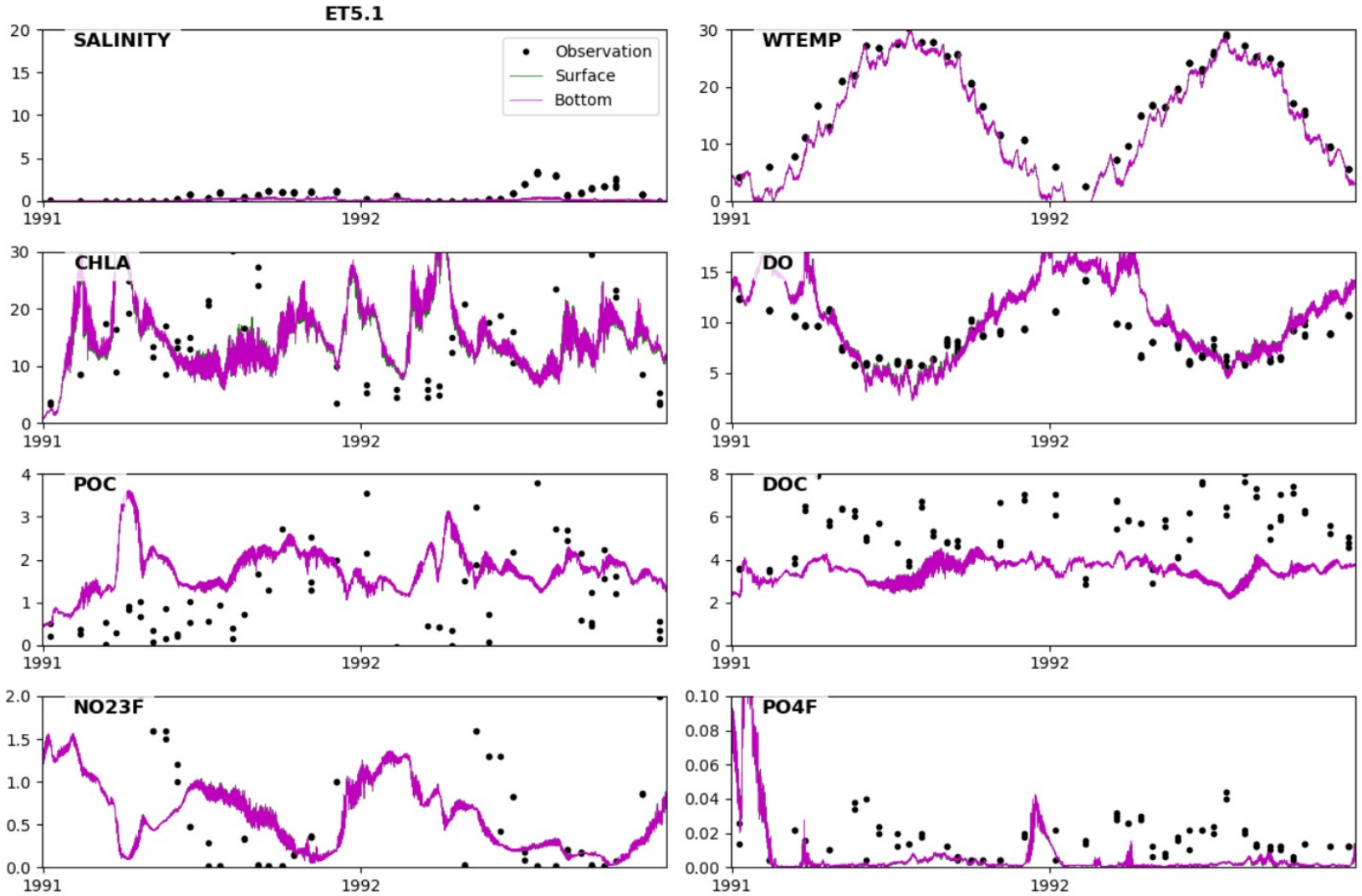
From **run10f**
Without sediment flux module
Smaller phytoplankton metabolism rate



From **run10fc** (same icm parameters as in main bay model RUN09k)
With sediment flux module
Larger phytoplankton metabolism rate



BGC simulation



From run10fc

Upstream station
More controlled by watershed inputs

Next steps

- Correction at open boundary condition.
- Standalone simulations, instead of using coupling mode
- Sensitivity test on
  - Sediment flux module
  - Half saturation concentration for major nutrients
  - Phytoplankton growth rate.

- Goal: capture the magnitude and seasonality of major BGC variables