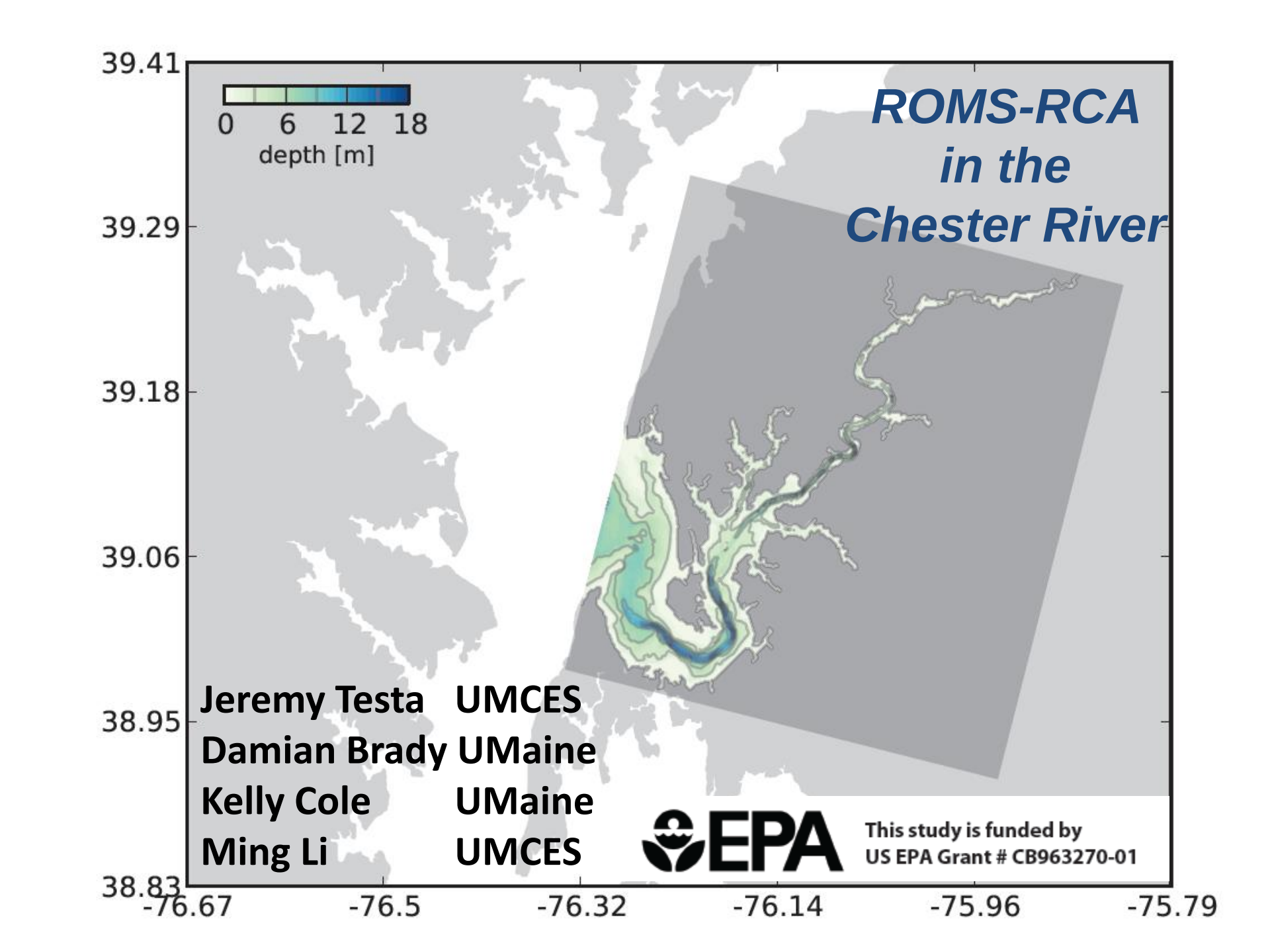

39.41
39.29
39.18
39.06
38.95
38.83
-76.67
-76.5
-76.32
-76.14
-75.96
-75.79
0 6 12 18
depth [m]
ROMS-RCA in the Chester River
Jeremy Testa UMCES
Damian Brady UMaine
Kelly Cole UMaine
Ming Li UMCES
EPA
This study is funded by US EPA Grant # CB963270-01

ROMS-RCA in the Chester River estuary

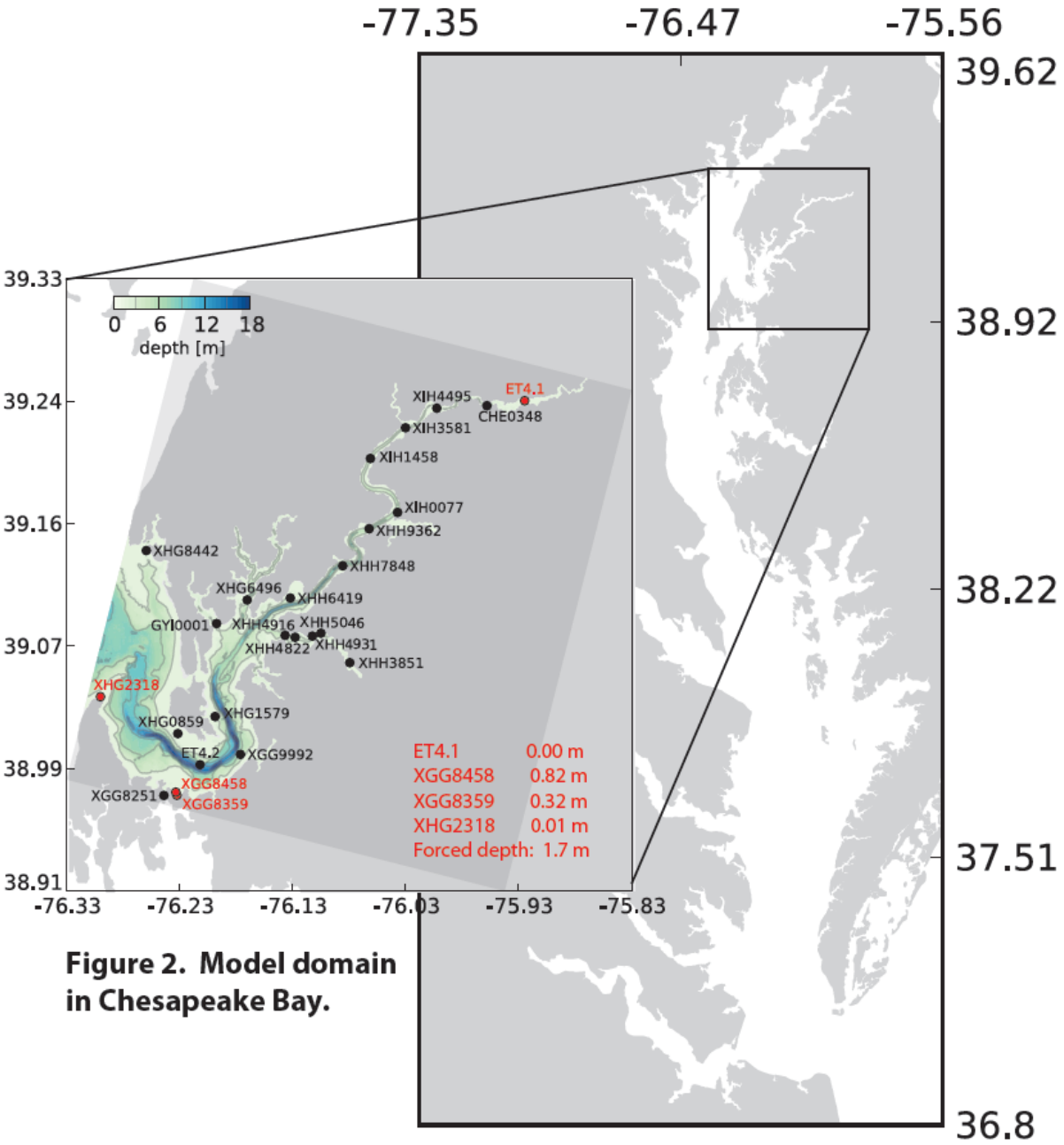
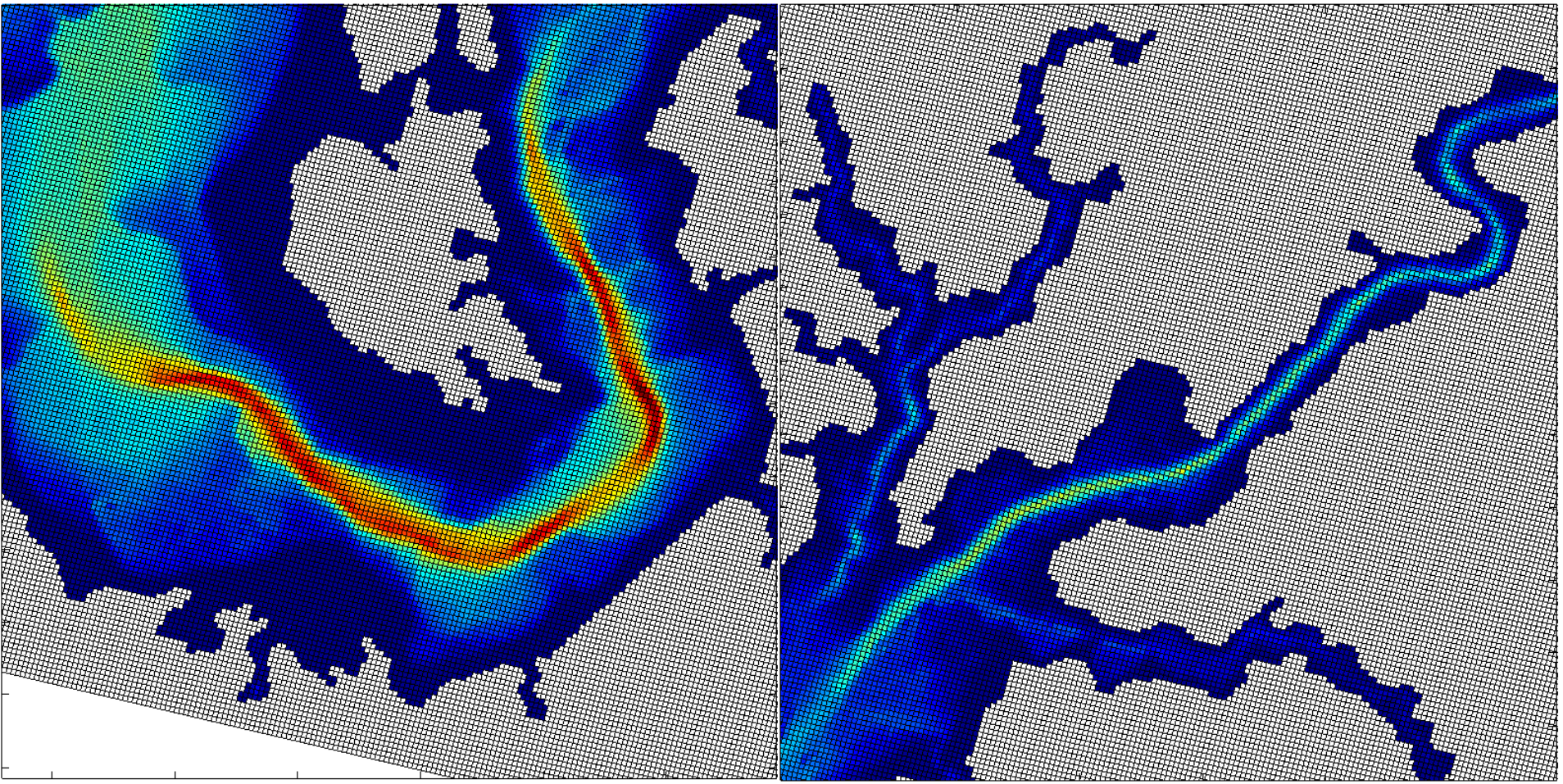


Figure 2. Model domain in Chesapeake Bay.

- 70 m horizontal resolution
- 10 vertical layers
- Forced by 1 FW source
- dt = 20s
- Initial t/s from CH3D
- Min depth = 1.7 m
- Max depth = 18 m
- NDBC, NARR air-sea fluxes
- 38,500 cells

ROMS-RCA Grid Resolution



ROMS-RCA Hydrodynamics

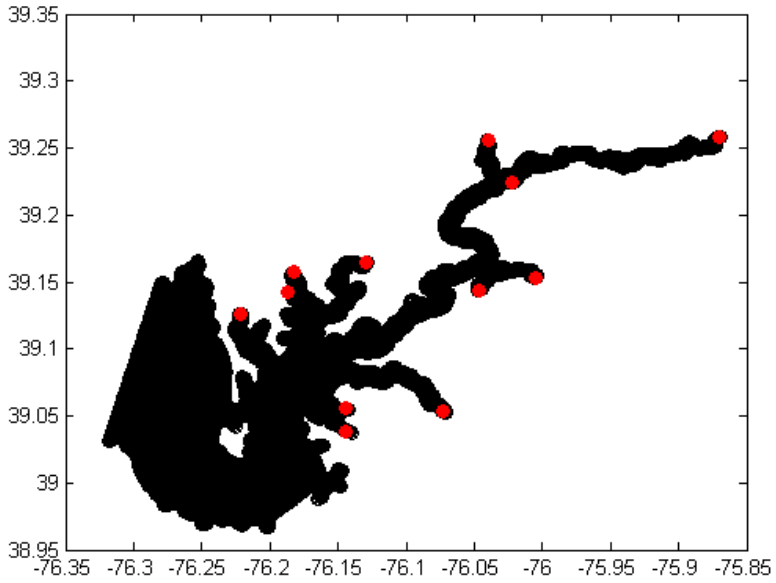
Initial run: 1 FW source at upstream boundary, no atmospheric forcing, 2003 only

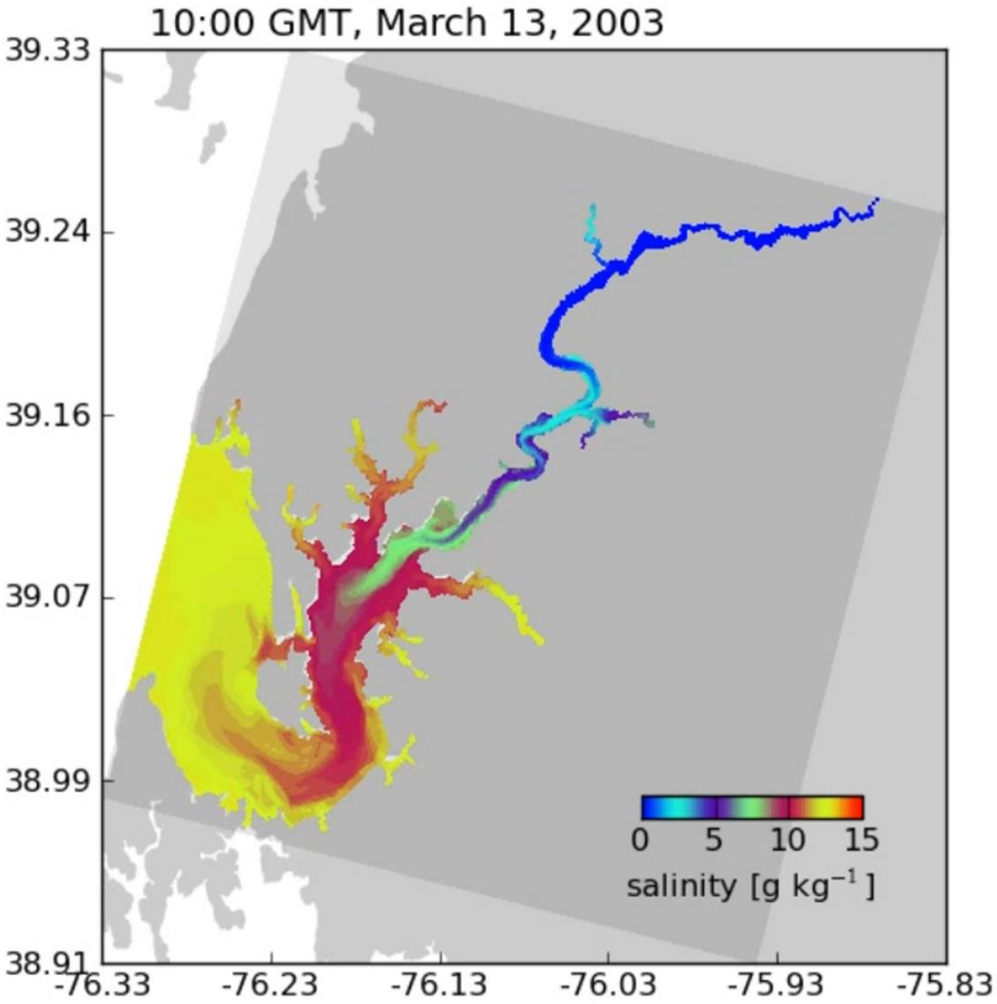
Runs in progress:

12 FW Sources (below)

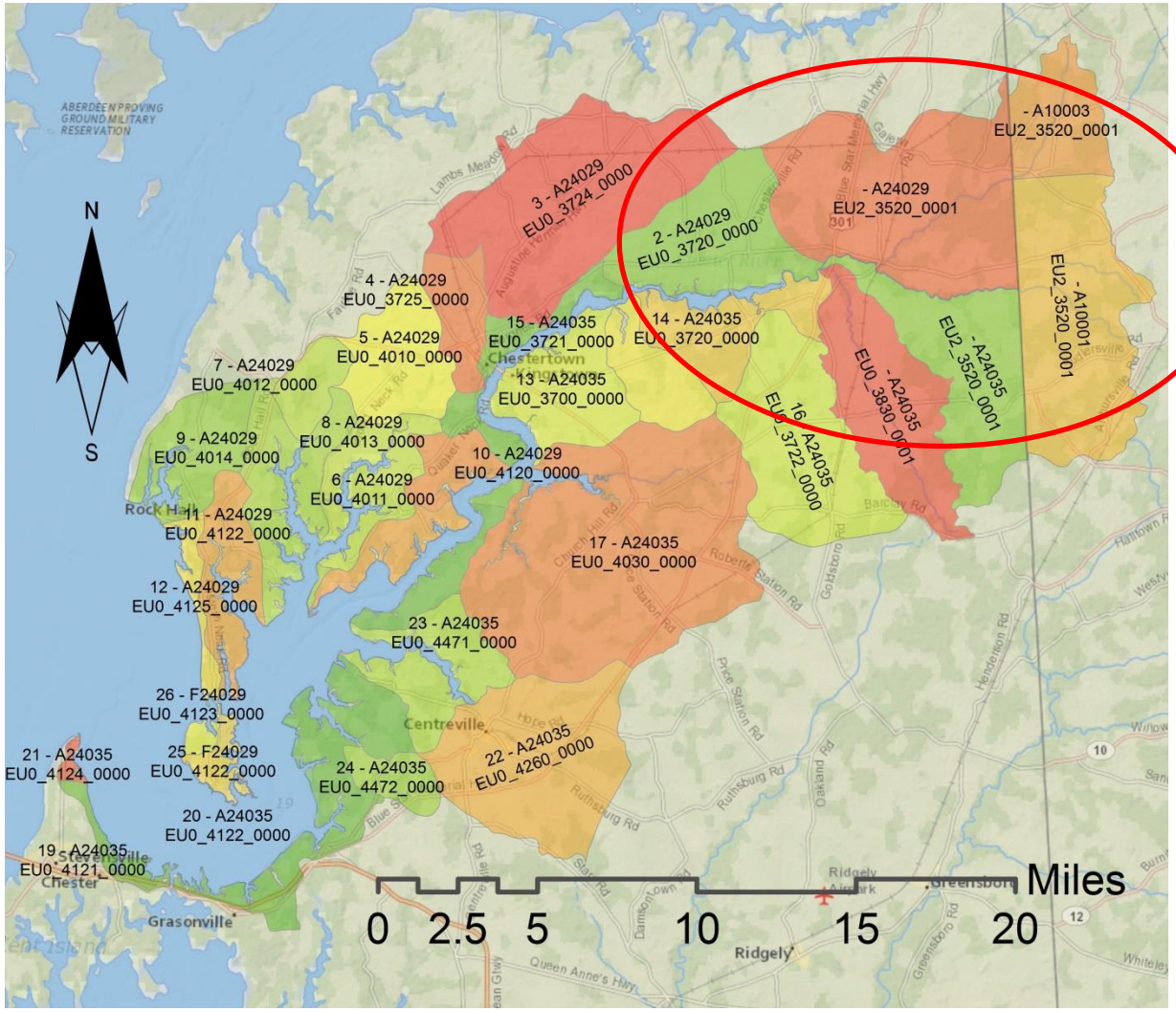
atmospheric Forcing

2003-2011



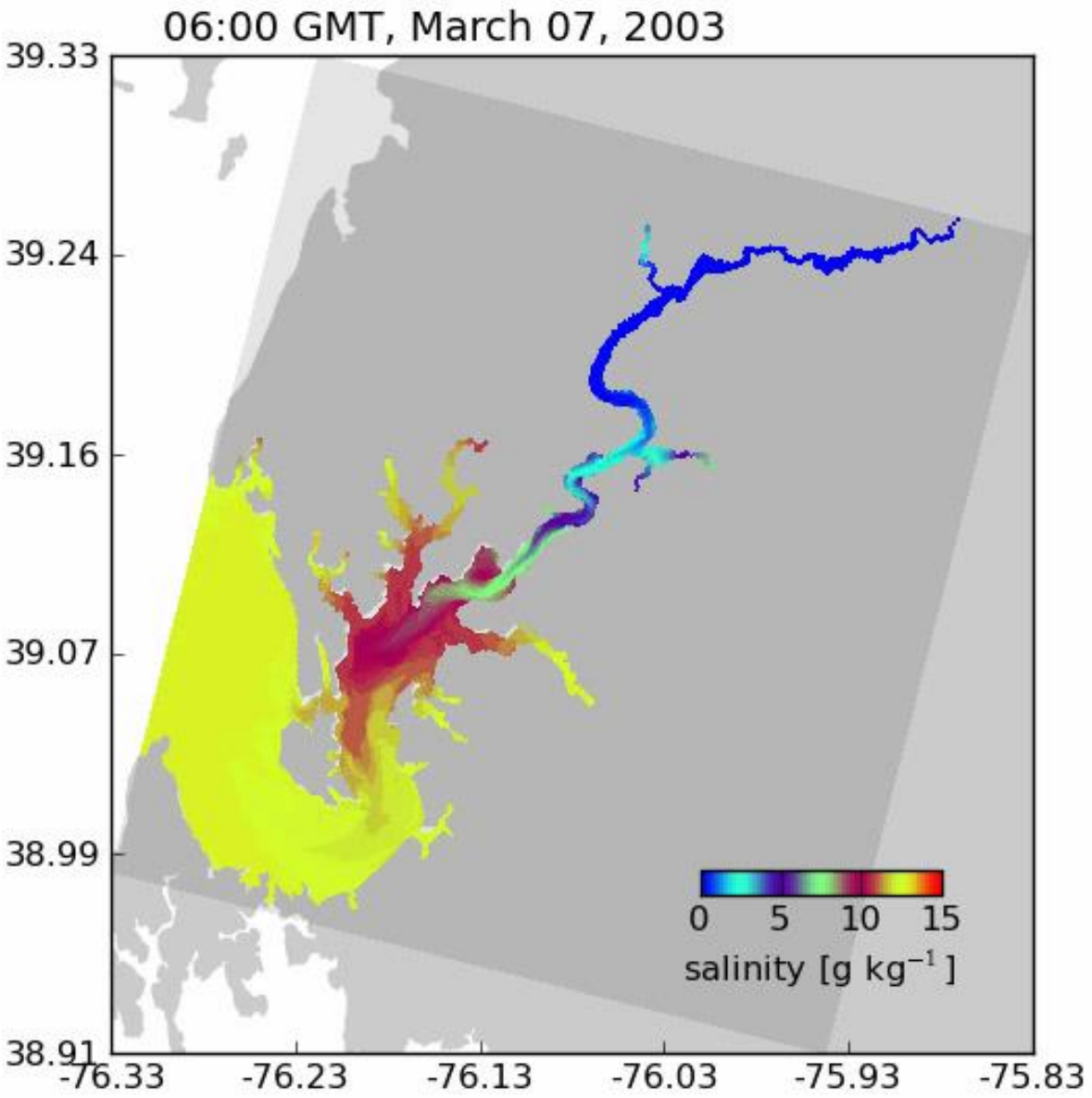


Freshwater Inputs to the Chester ROMS

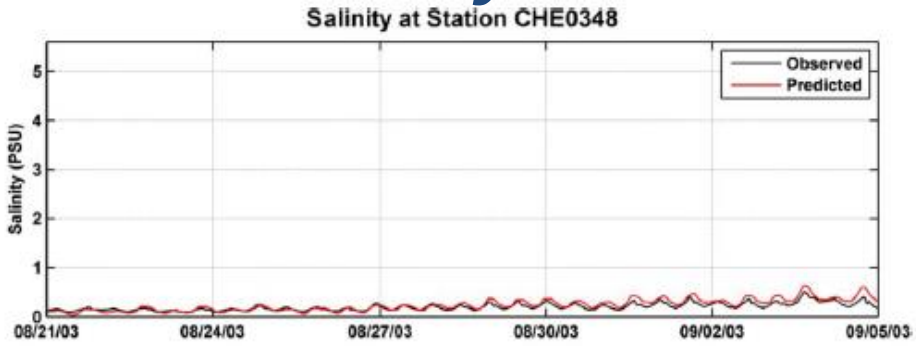


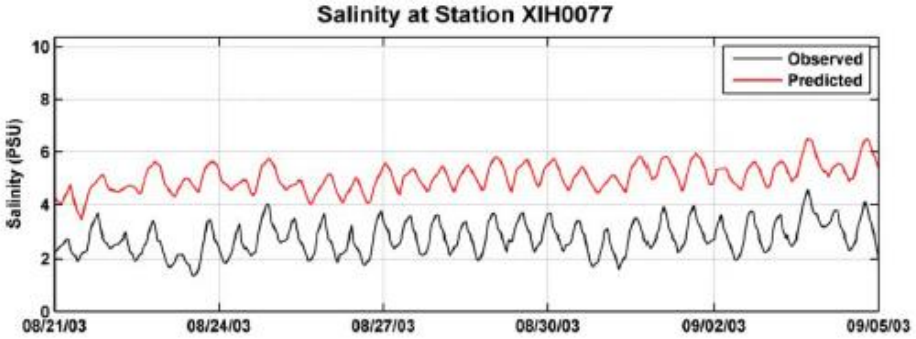
- Initial Runs forced with FW to 1 upstream cell that Represents 8 watershed units ~41% of total watershed flow
- Realistic t/s in FW flow

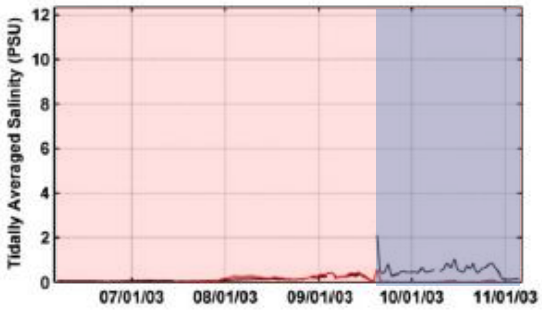
Temporal Dynamics of Chester Salinity

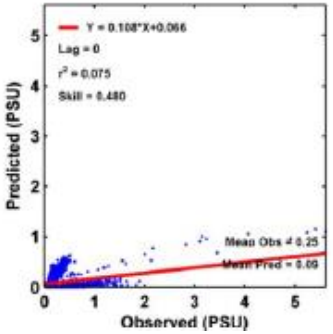


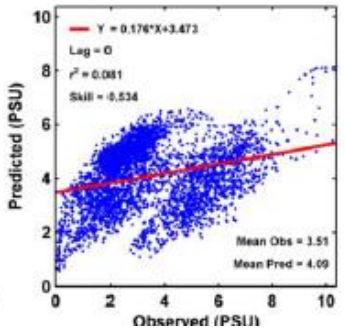
Salinity Simulations in Chester ROMS

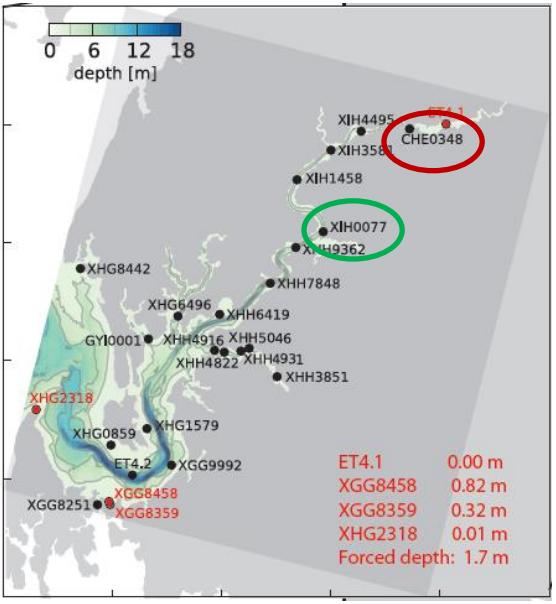


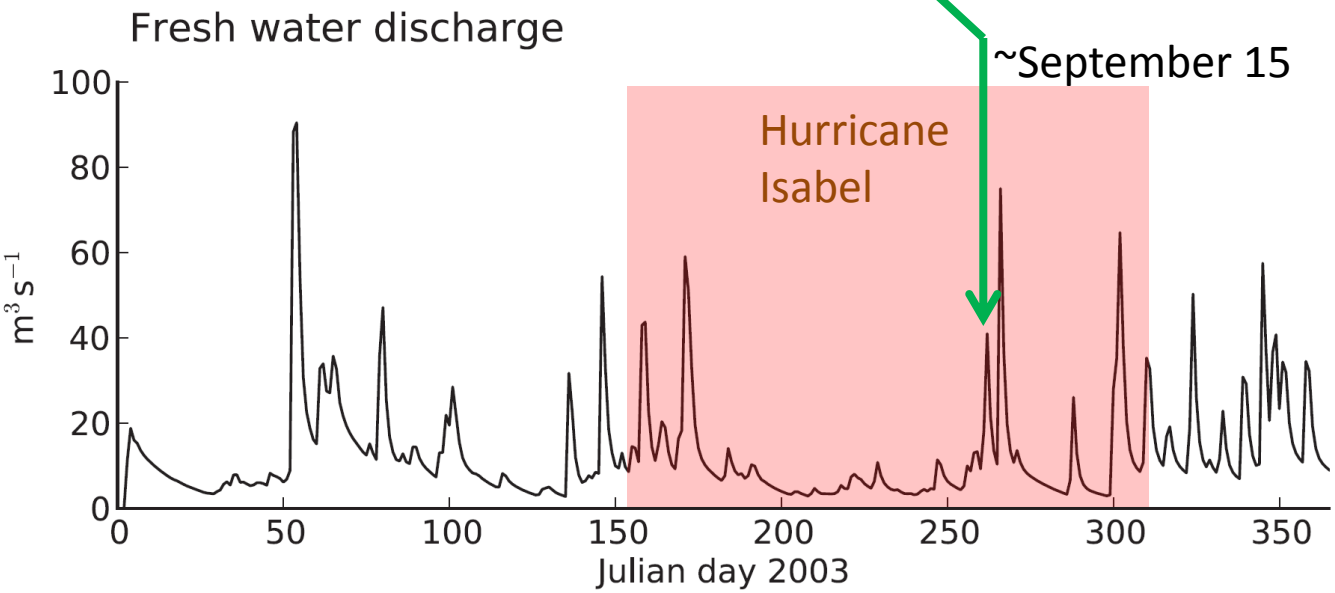




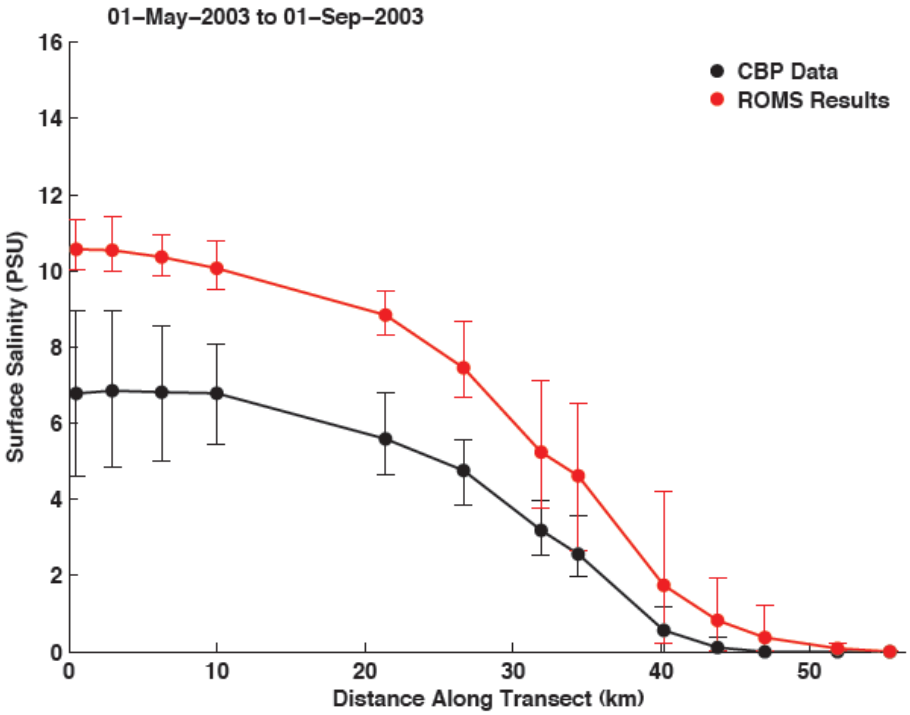


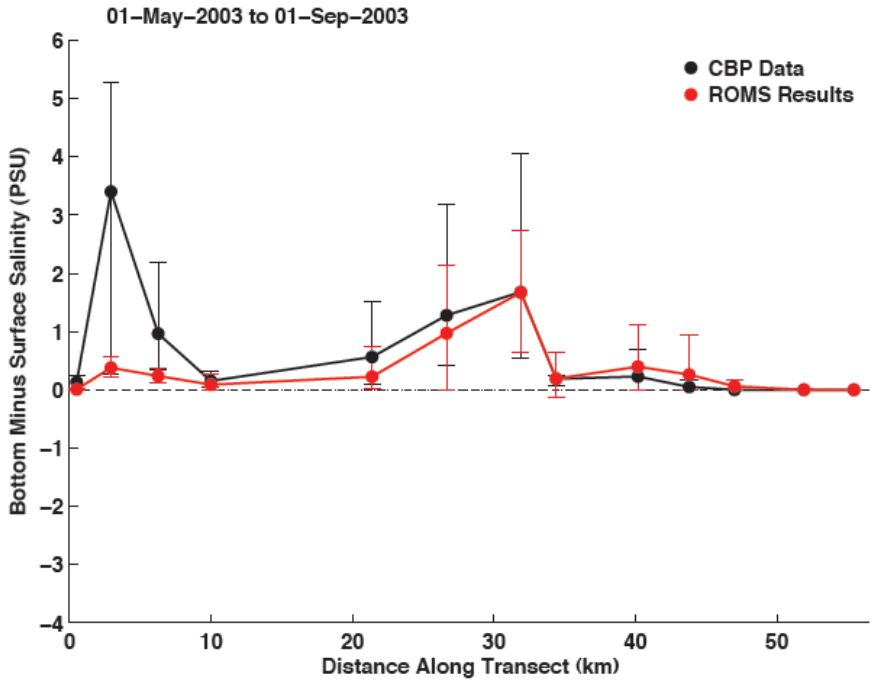




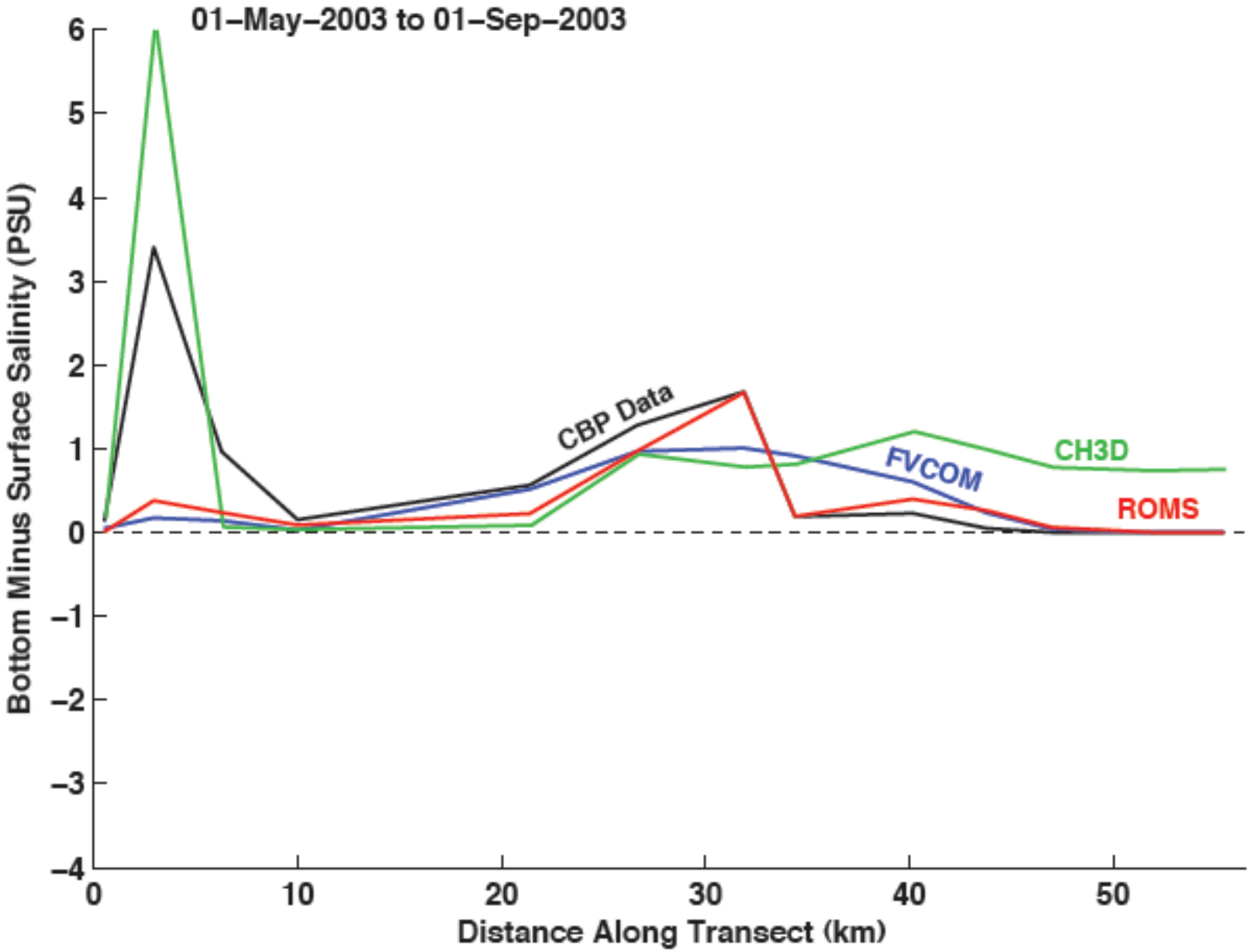


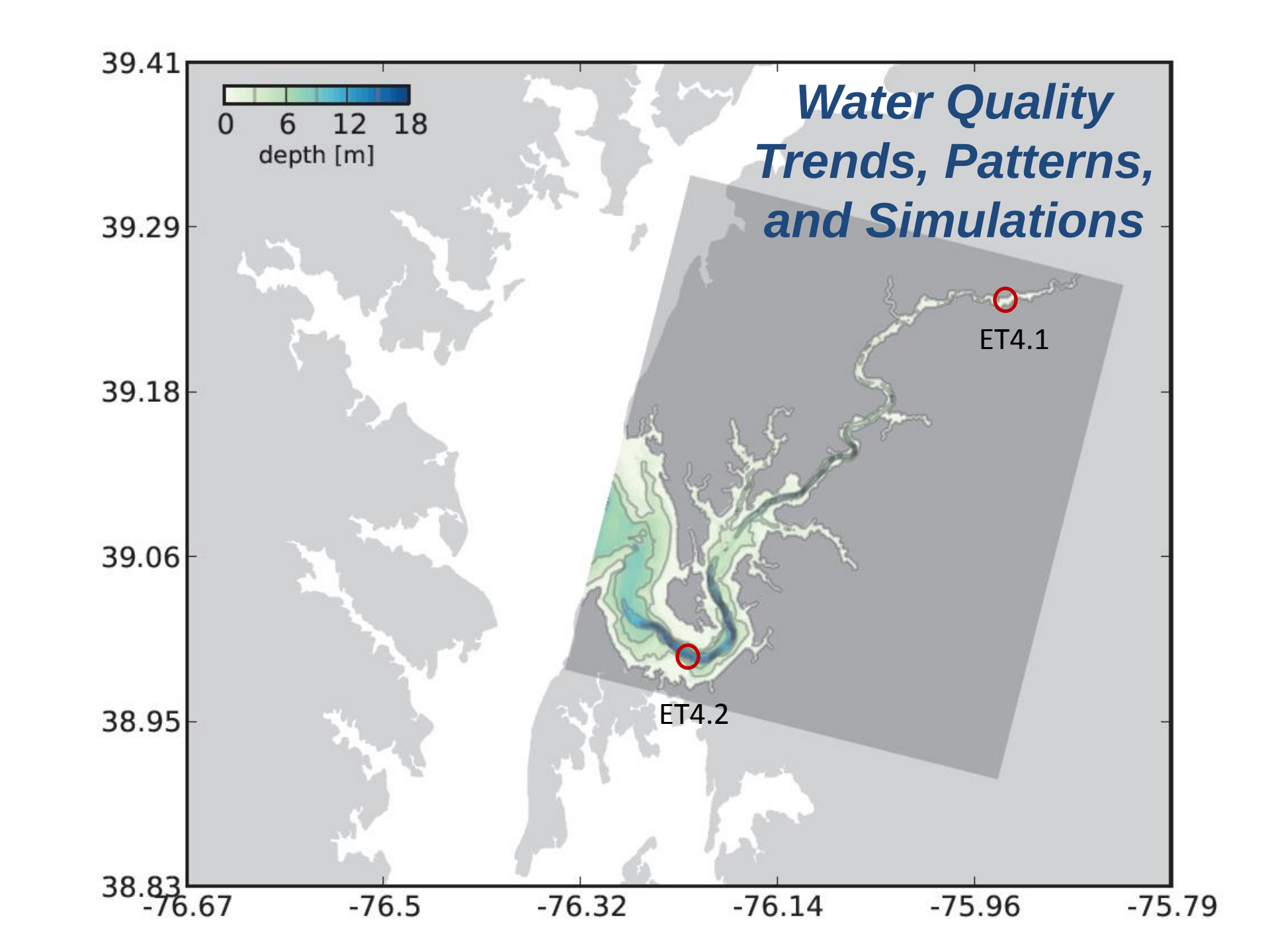
Stratification Weak, but Present

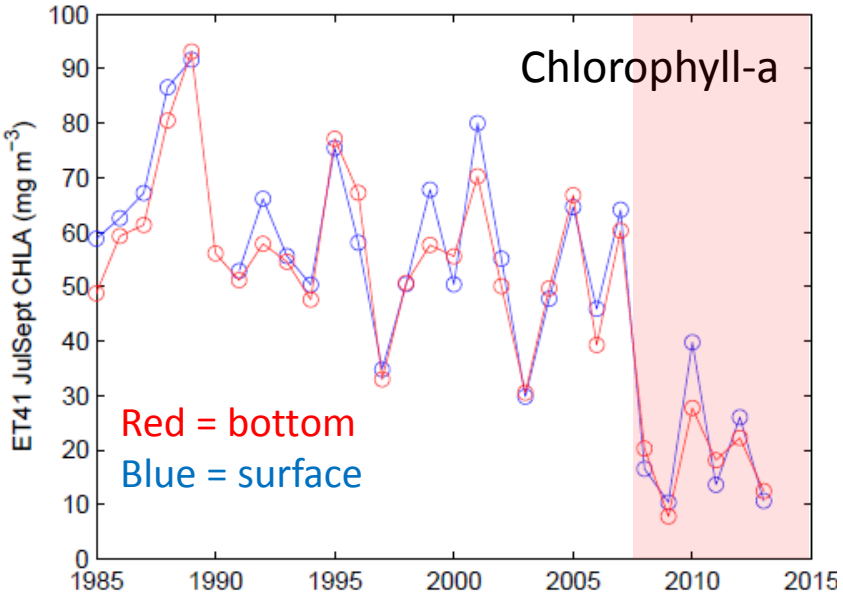


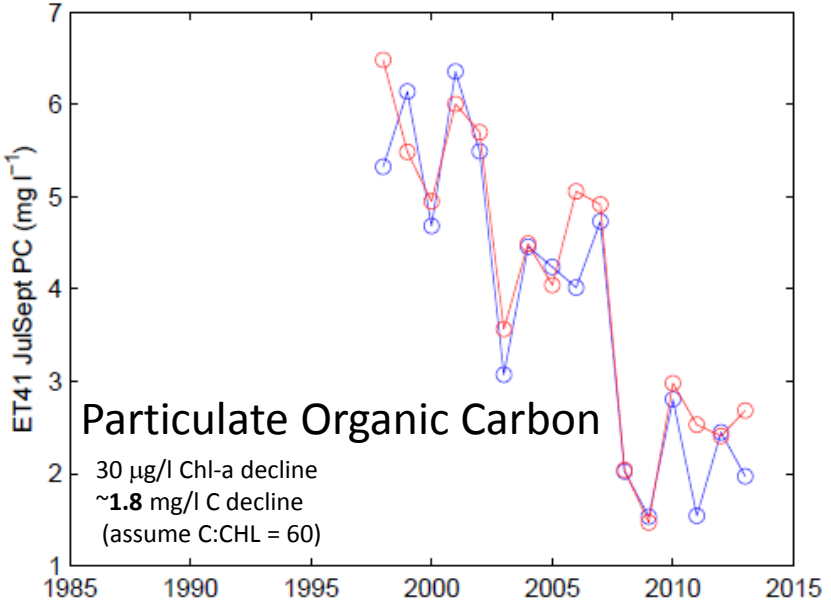


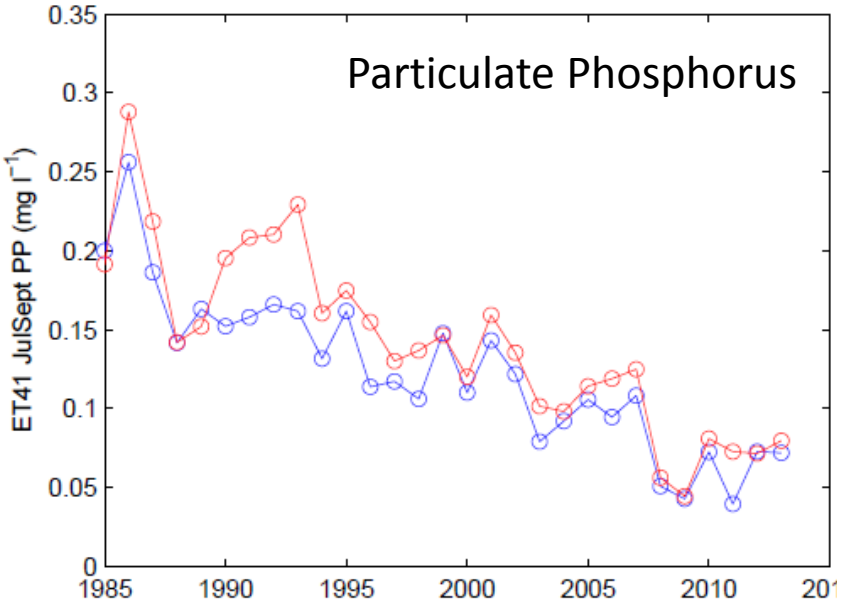
- Despite single FW injection at upstream boundary, ROMS captures stratification
- Signals importance of spatial resolution
- Currently, no salt forcing at boundary

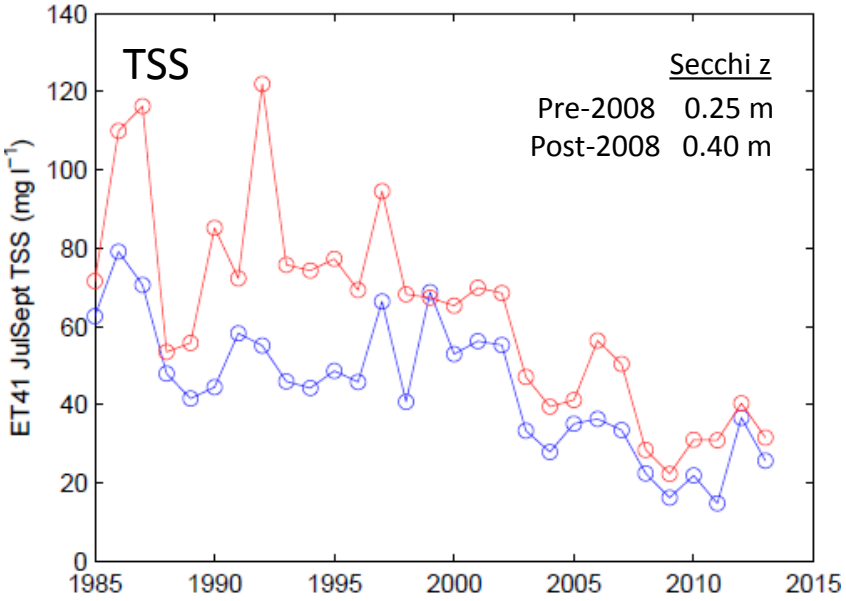

01–May–2003 to 01–Sep–2003
Bottom Minus Surface Salinity (PSU)
Distance Along Transect (km)
CBP Data
CH3D
FVCOM
ROMS
6
5
4
3
2
1
0
−1
−2
−3
−4
0
10
20
30
40
50


Water Quality Trends, Patterns, and Simulations
0 6 12 18
depth [m]
ET4.1
ET4.2
39.41
39.29
39.18
39.06
38.95
38.83
-76.67
-76.5
-76.32
-76.14
-75.96
-75.79

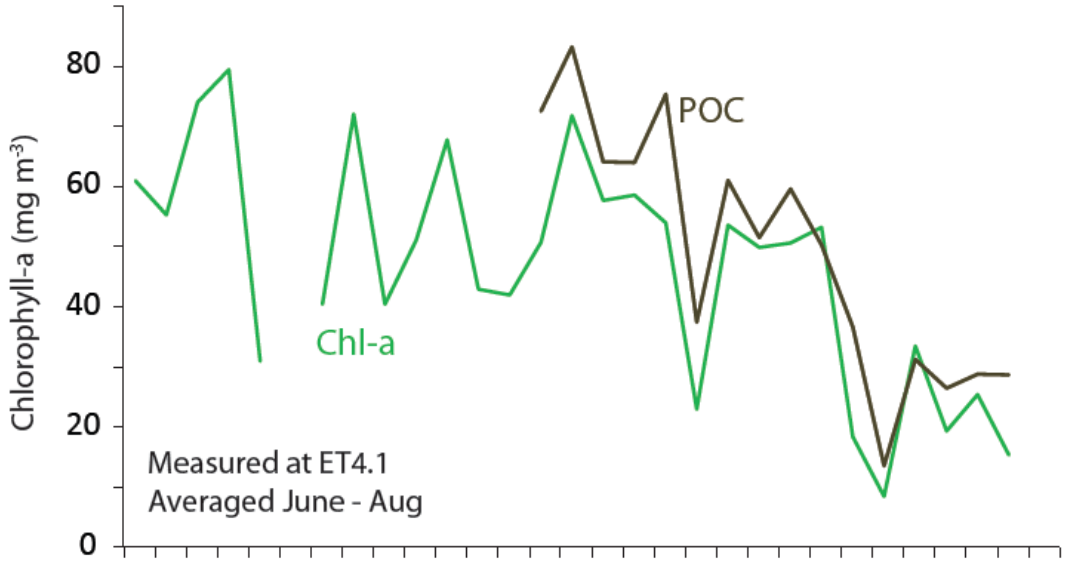

Chlorophyll-a
ET41 JulSept CHLA (mg m^{-3})
Red = bottom
Blue = surface

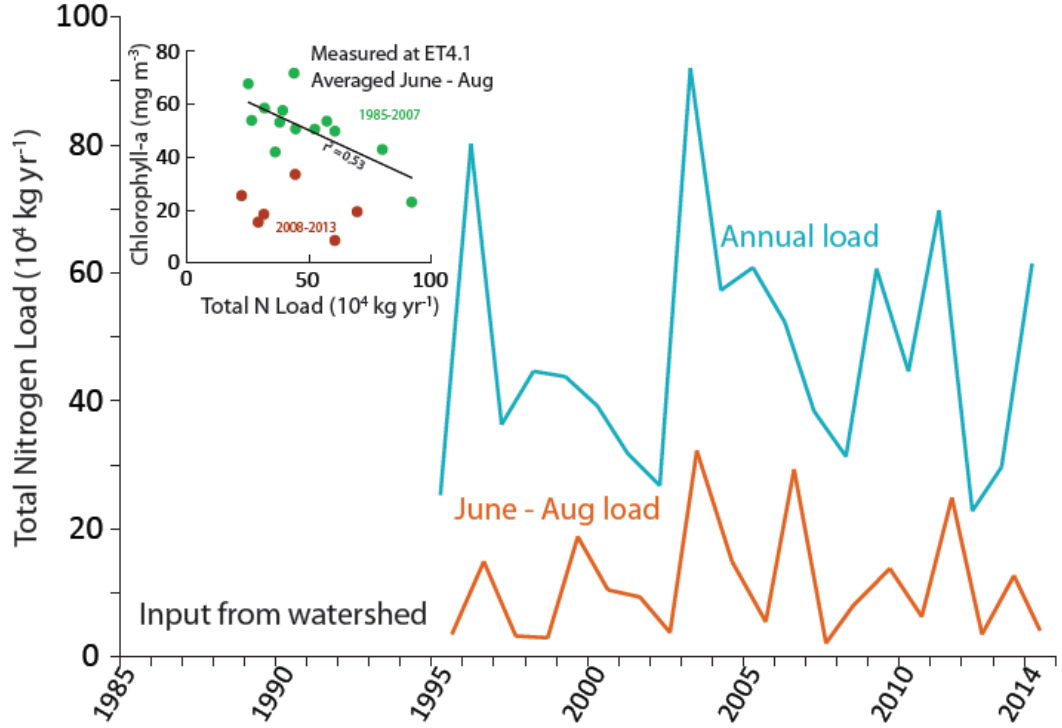

Particulate Organic Carbon
ET41 JulSept PC (mg l^{-1})
30 µg/l Chl-a decline
~**1.8** mg/l C decline
(assume C:CHL = 60)

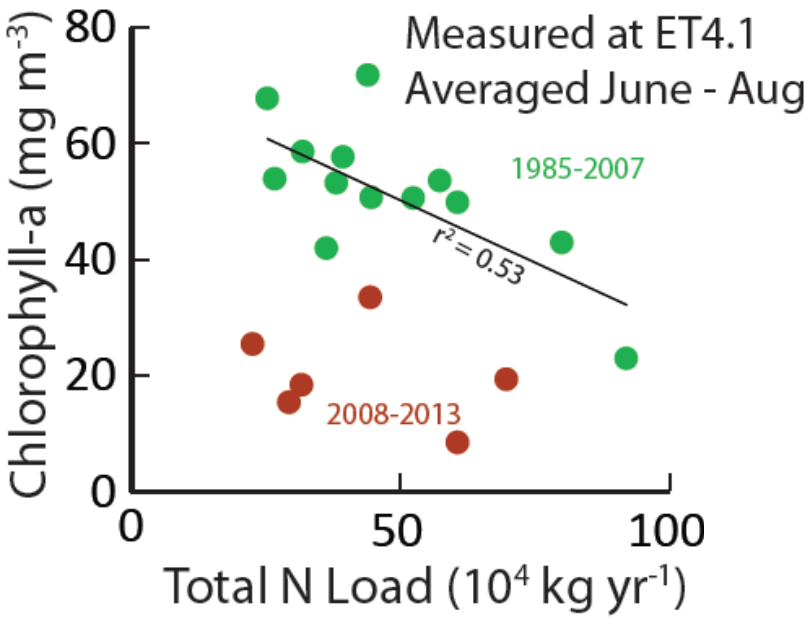

Particulate Phosphorus
ET41 JulSept PP (mg l^{-1})


TSS
ET41 JulSept TSS (mg l^{-1})
Secchi z
Pre-2008 0.25 m
Post-2008 0.40 m

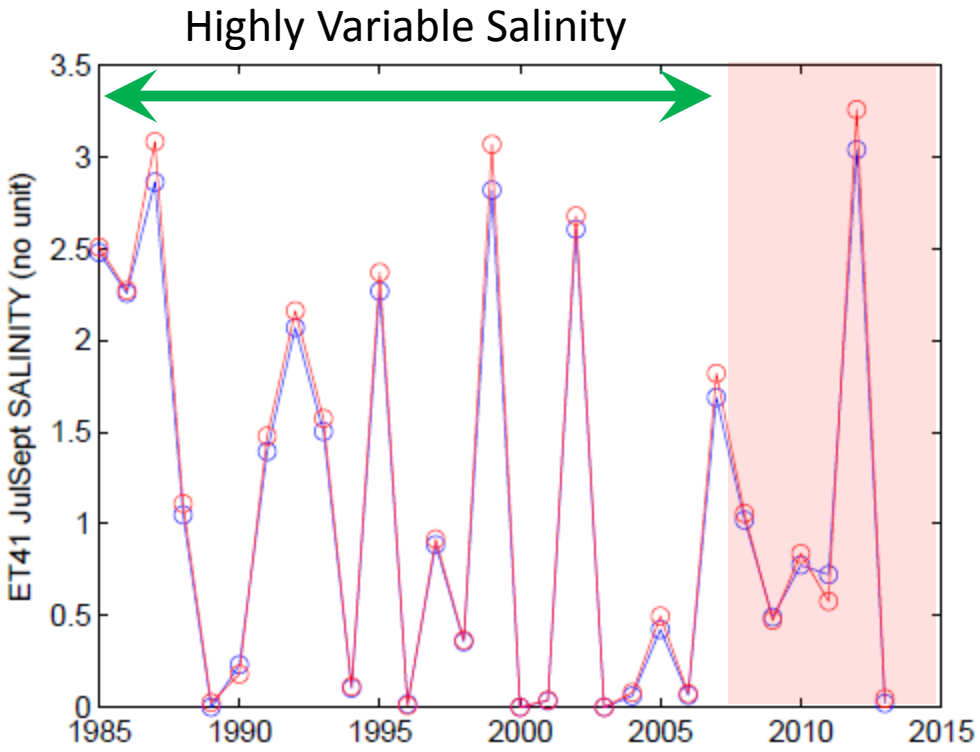
Chlorophyll-a, Nutrient Load, and Flushing





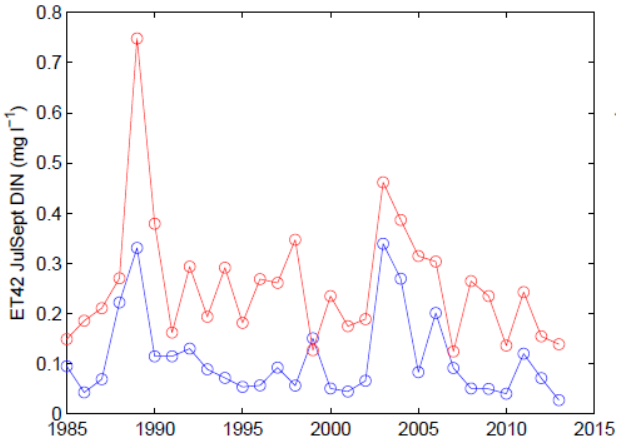


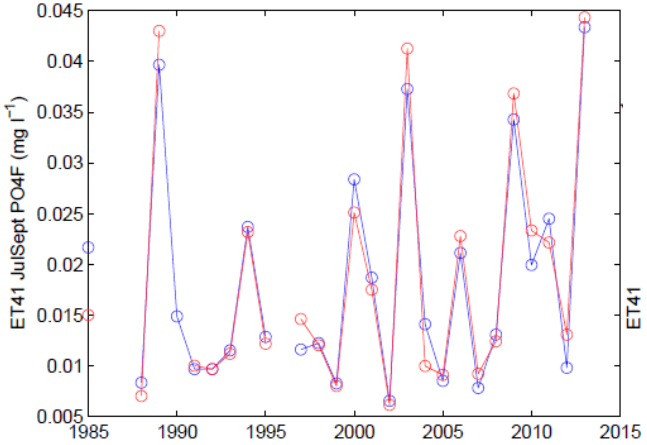
Drivers of Chlorophyll-a Decline?



*Salinity highly variable from 1986-2002

*Consistently low 2003-2006, consistently high 2007-2012





*DIN likely not limiting (>>0.01 mg l^{-1})

*DIP likely not limiting (>0.003 mg l^{-1})

Modeling Benthic Algae

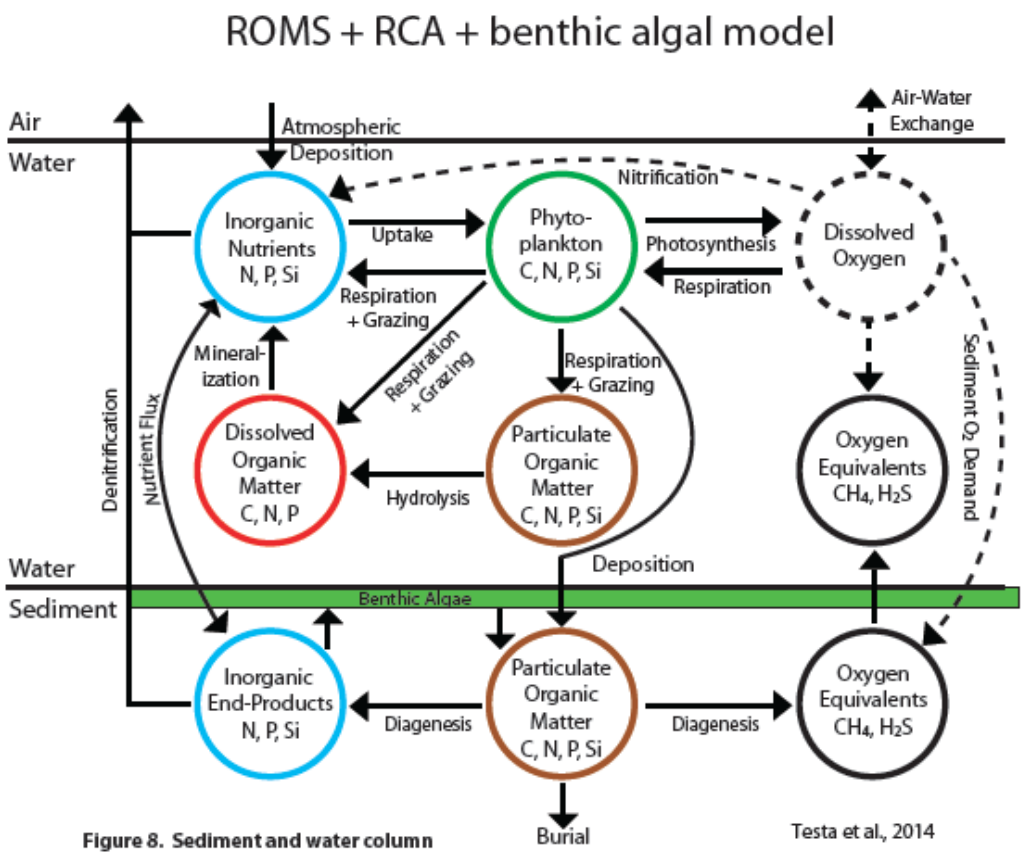
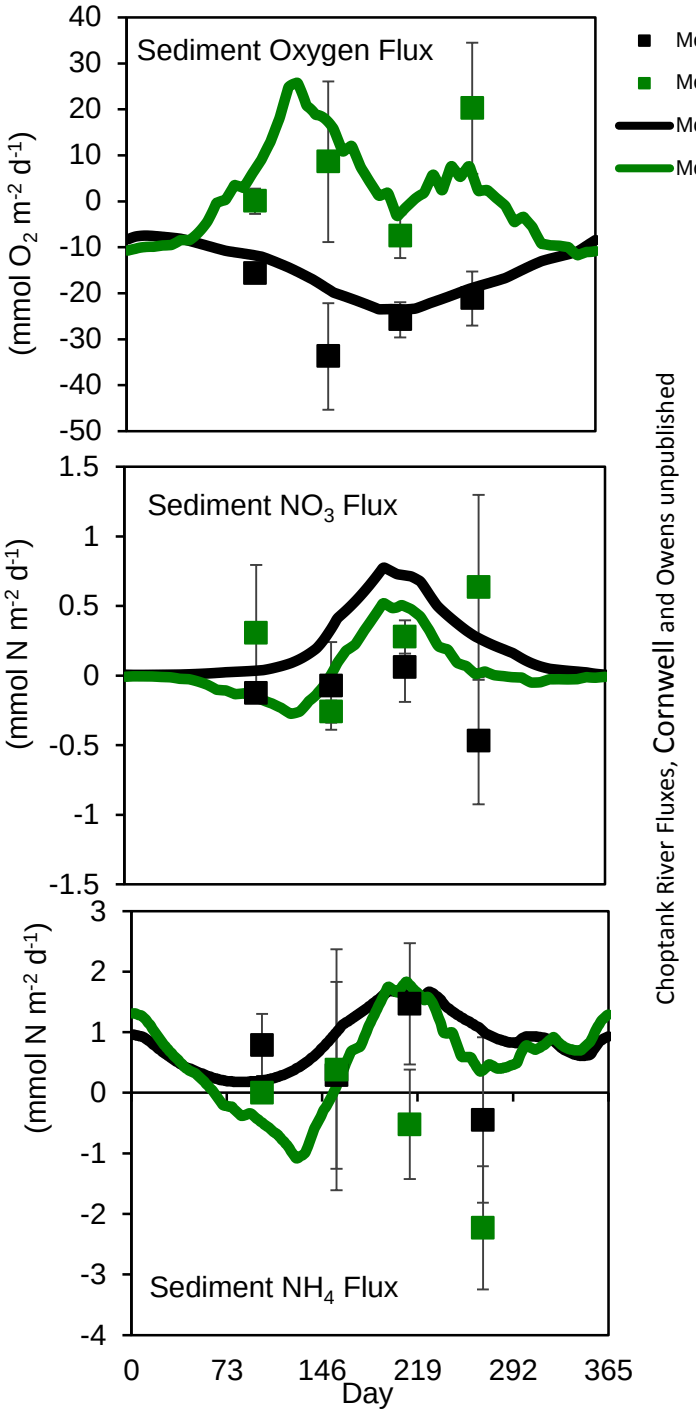


Figure 8. Sediment and water column processes in RCA with added benthic algal model.

*Additions:

(1) aerobic respiration to SFM

(2) benthic algal layer



Summary

- ROMS-RCA in progress for hydrodynamic simulation in the Chester
- Initial simulations, although they have their limitations, reproduced stratification reasonably, and even better than others
- This latter fact likely due to better spatial resolution in RCA, but excessive resolution?
- Large decline in upper Chester chl-*a* and particulates does not appear to be related to nutrients (“bottom-up”) – is it top-down?