

The Development of the Mid-Atlantic, Chesapeake Bay, and Delaware Bay Regional Ocean Modeling System (MACROMS) and Its (preliminary) Hydrodynamics Validation

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Outline

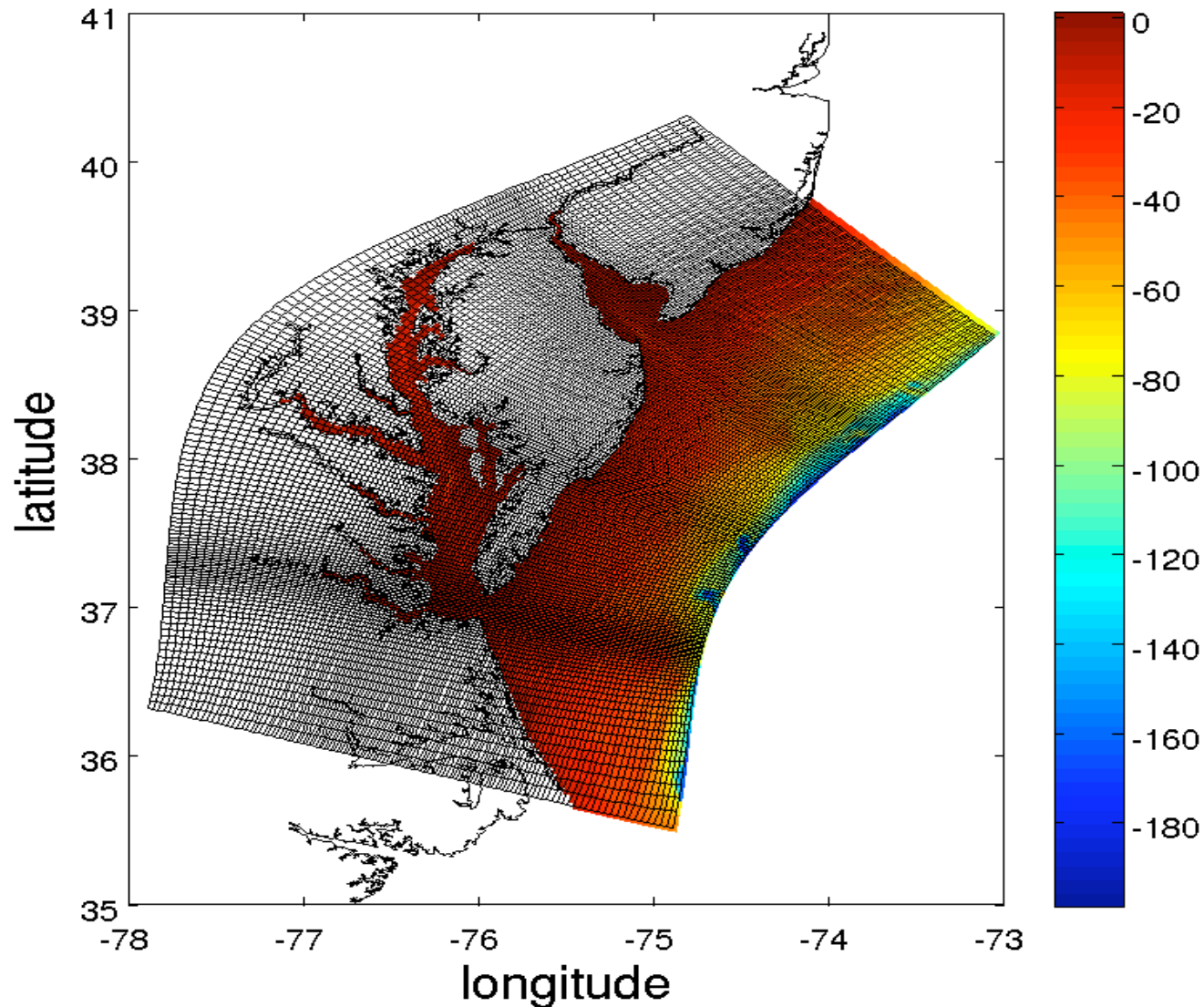
- Project Introduction
- Grid System
- Forcing System
- Initial Test Setup: 2005-2006
- Temperature Prediction -2005
- Water Level Prediction -2005
- Salinity Prediction -2005
- Concurrent Work and Future Plans (LTRANS, Comparison to CTD data, CnD effect)

Project Introduction

- MACROMS is a software to model the coastal ocean circulation and fish larvae transport for the USA Mid-Atlantic region, which covers estuaries and continental shelves of NYC, NJ, DE, MD, PA, VA and NC. Rutgers ROMS model is applied for this study or google MACROMS
- Built on ROMS3.0, OpenSource
- Nested within MABGOM or HYCOM

Grid System

MACROMS grids and bathymetry (m)
grid dimension:300x250
grid size: 0.42267-7.9406km



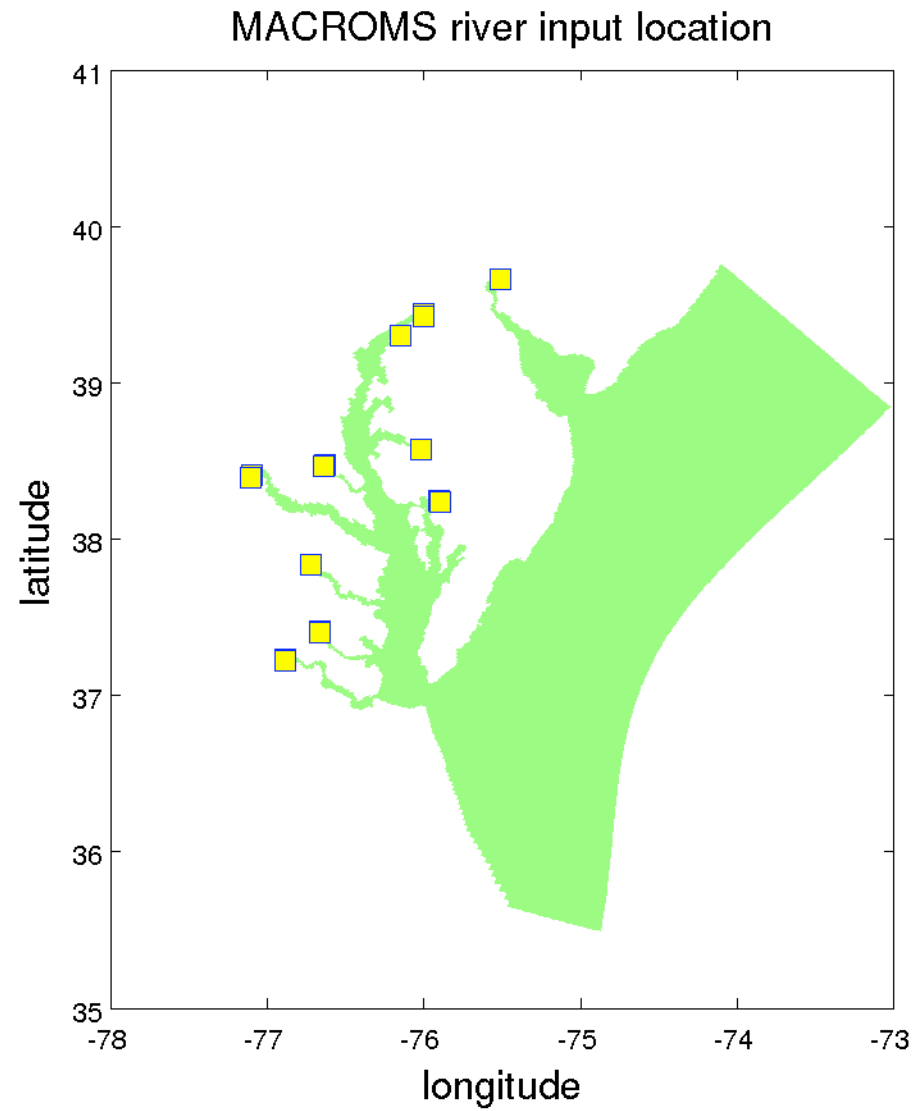
Forcing System

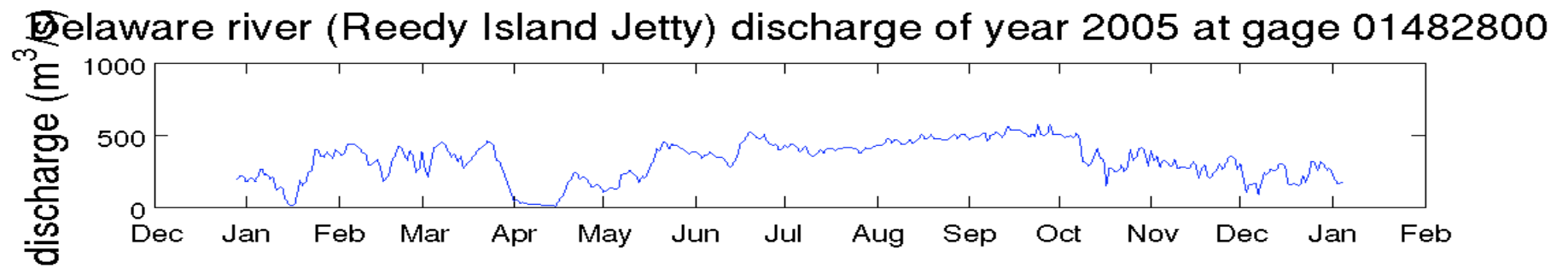
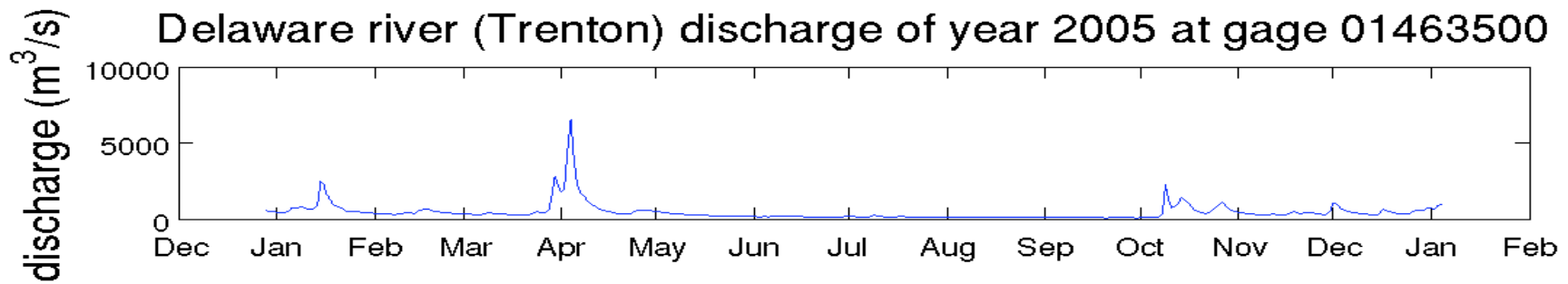
- Tides
- Rivers
- OBC
- Surface
- Initial Condition

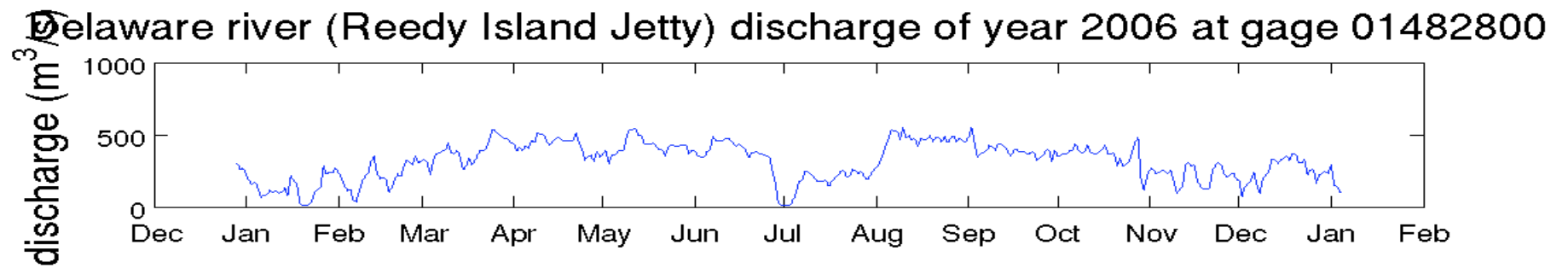
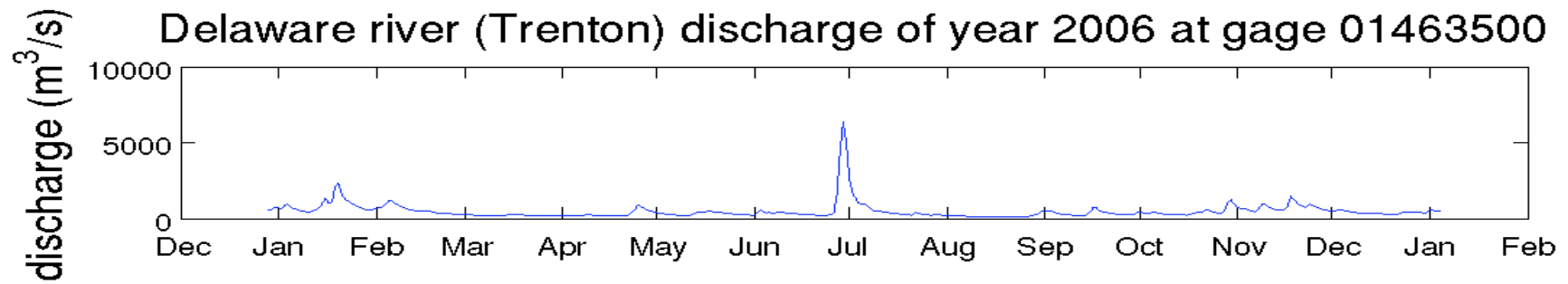
Tides

- ADCIRC East Coast 2001 Tidal Database is used to prescribe tides at the OBC
- 9 constituents are used: M2, N2,S2, K1,K2, M4, M6,O1,Q1,

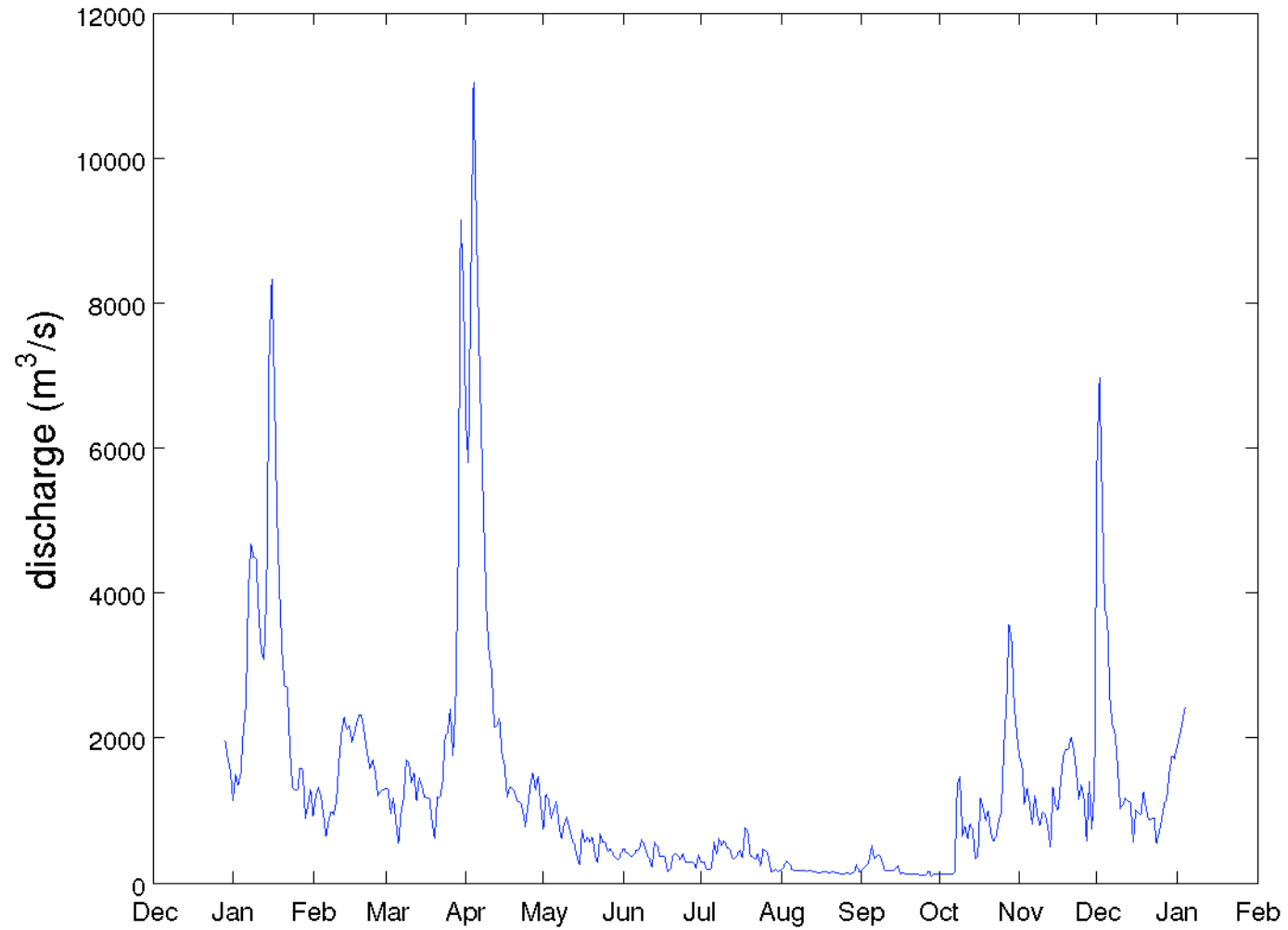
Rivers



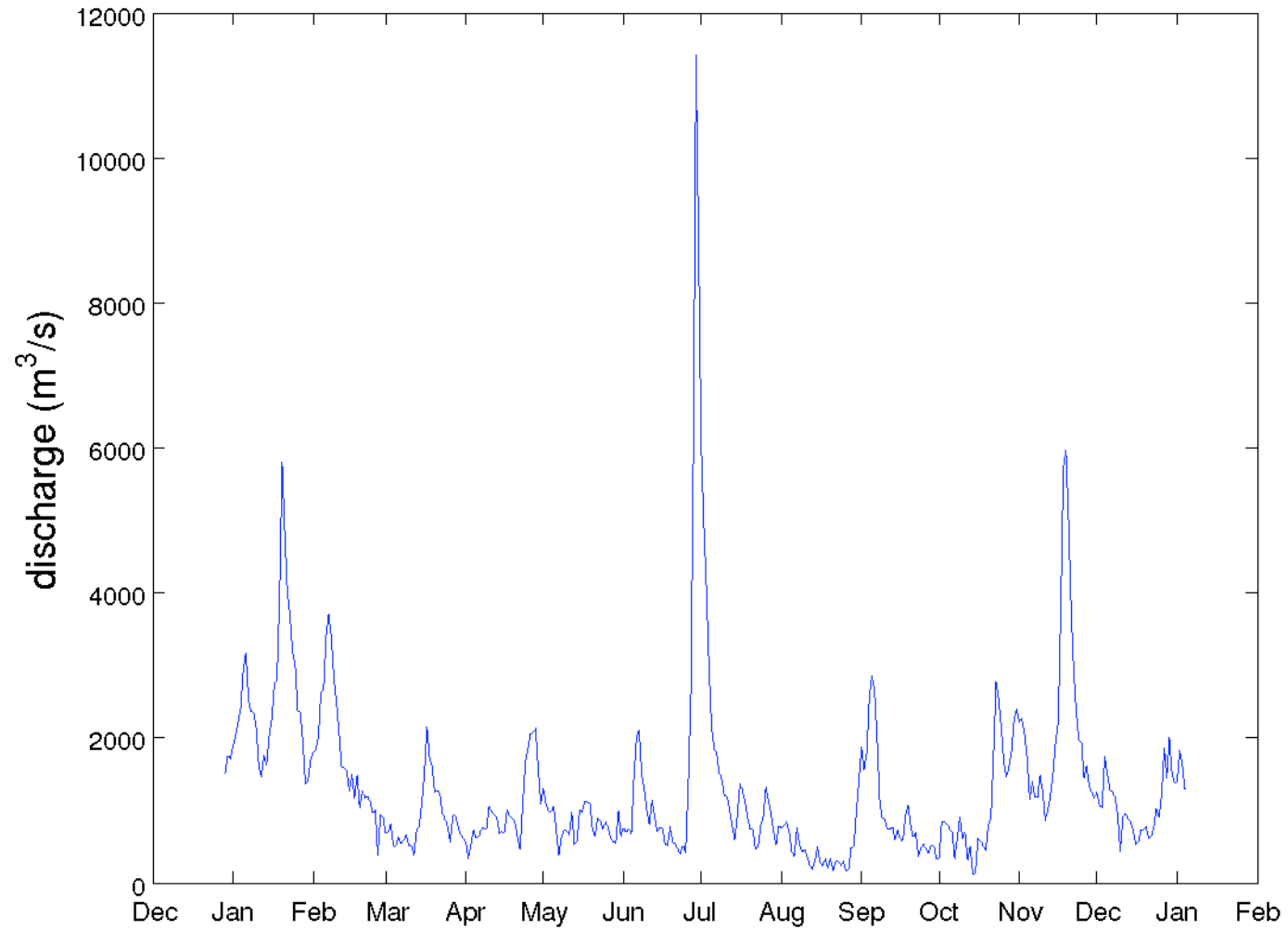




Susquehanna river discharge of year 2005 at gage 01578310



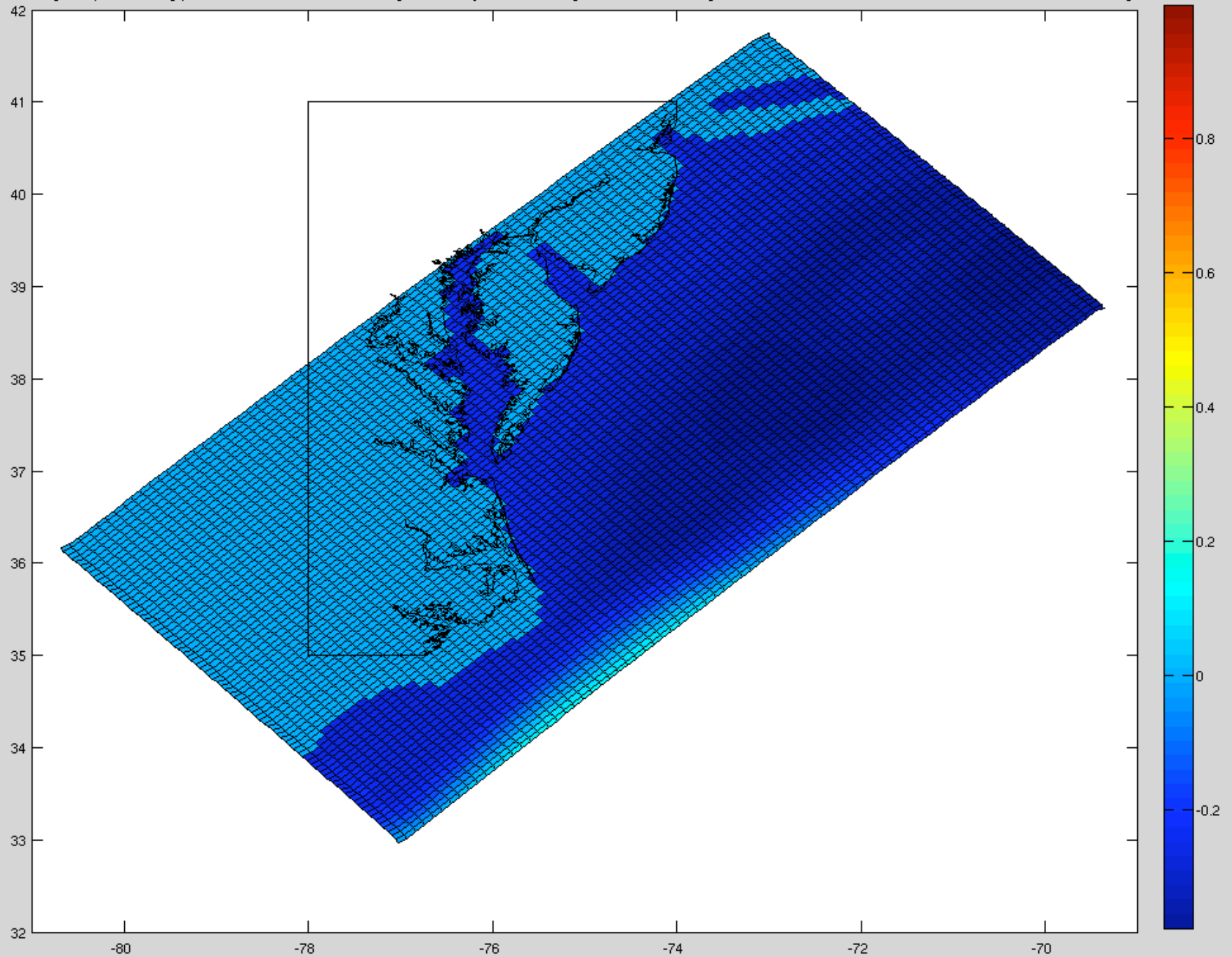
Susquehanna river discharge of year 2006 at gage 01578310



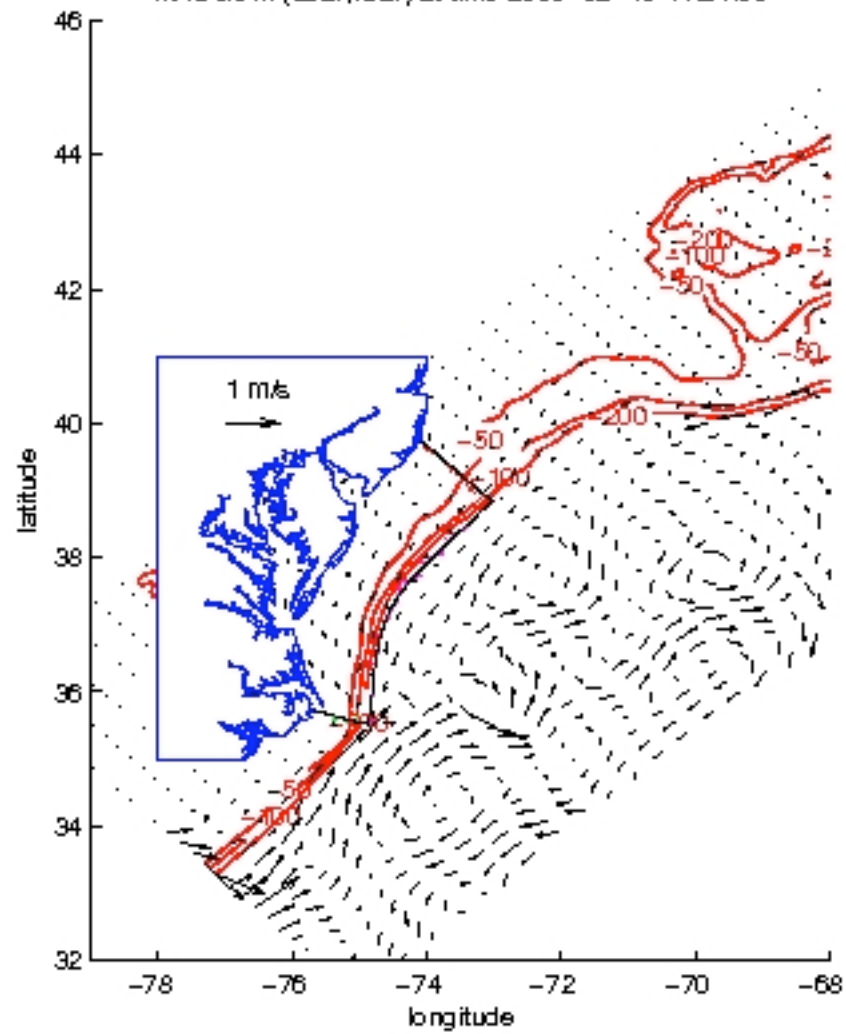
OBC

- Model Interoperability Tool used for nesting MACROMS within MABGOM (He, Ruoying, NCSU) or HYCOM

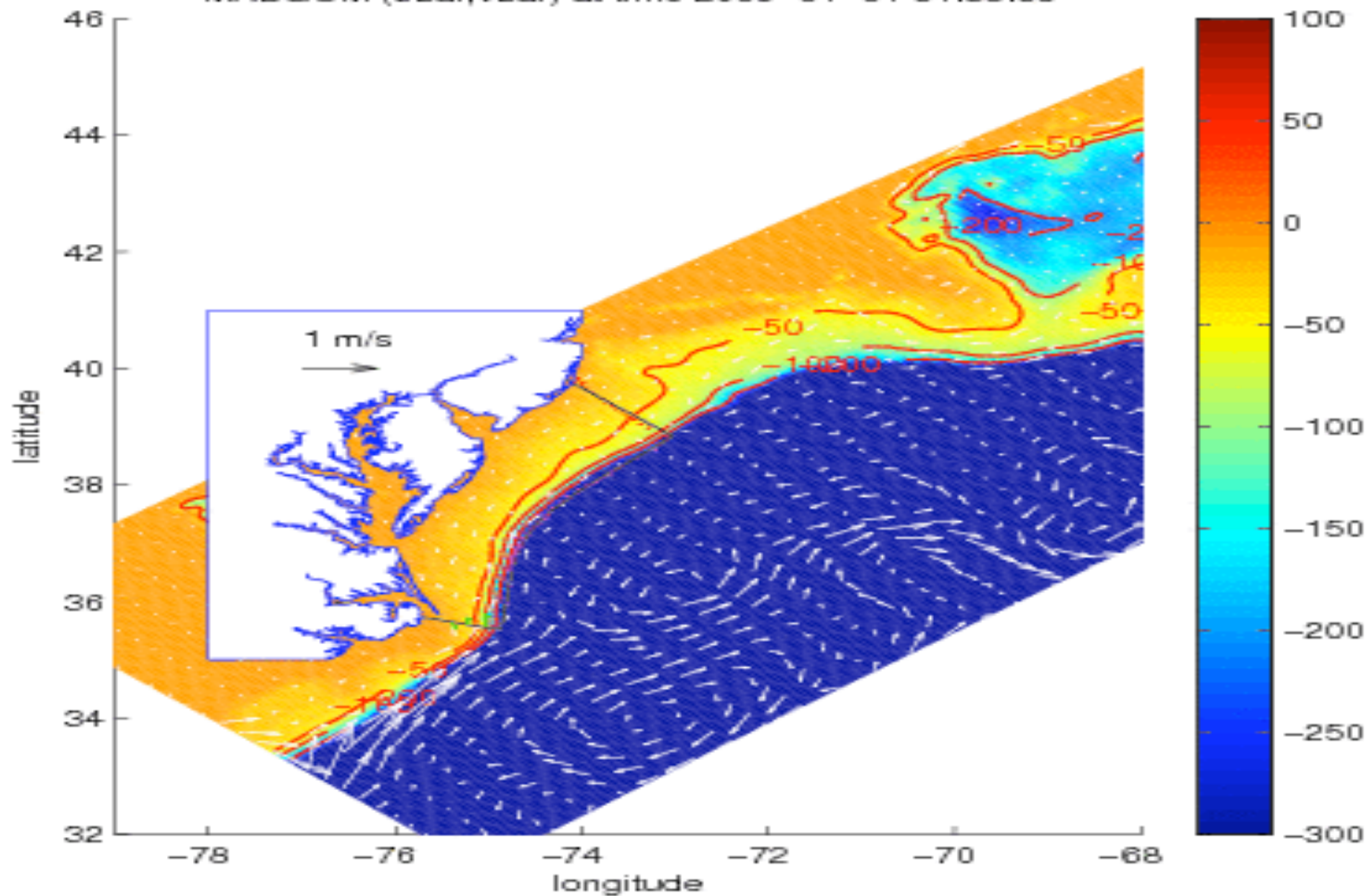
mean(year) averaged(half-day) zeta in 2005 in mabgom <http://tashtego.marine.rutgers.edu:8080/thredds/dodsC/roms/mabgom/v6/avg.html>



MABGOM (ubar,vbar) at time 2005-02-10 11:21:00



MABGOM (ubar,vbar) at time 2005-01-01 01:33:00



Surface Forcing

- NCEP NARR data:

Qair

Sw_rad

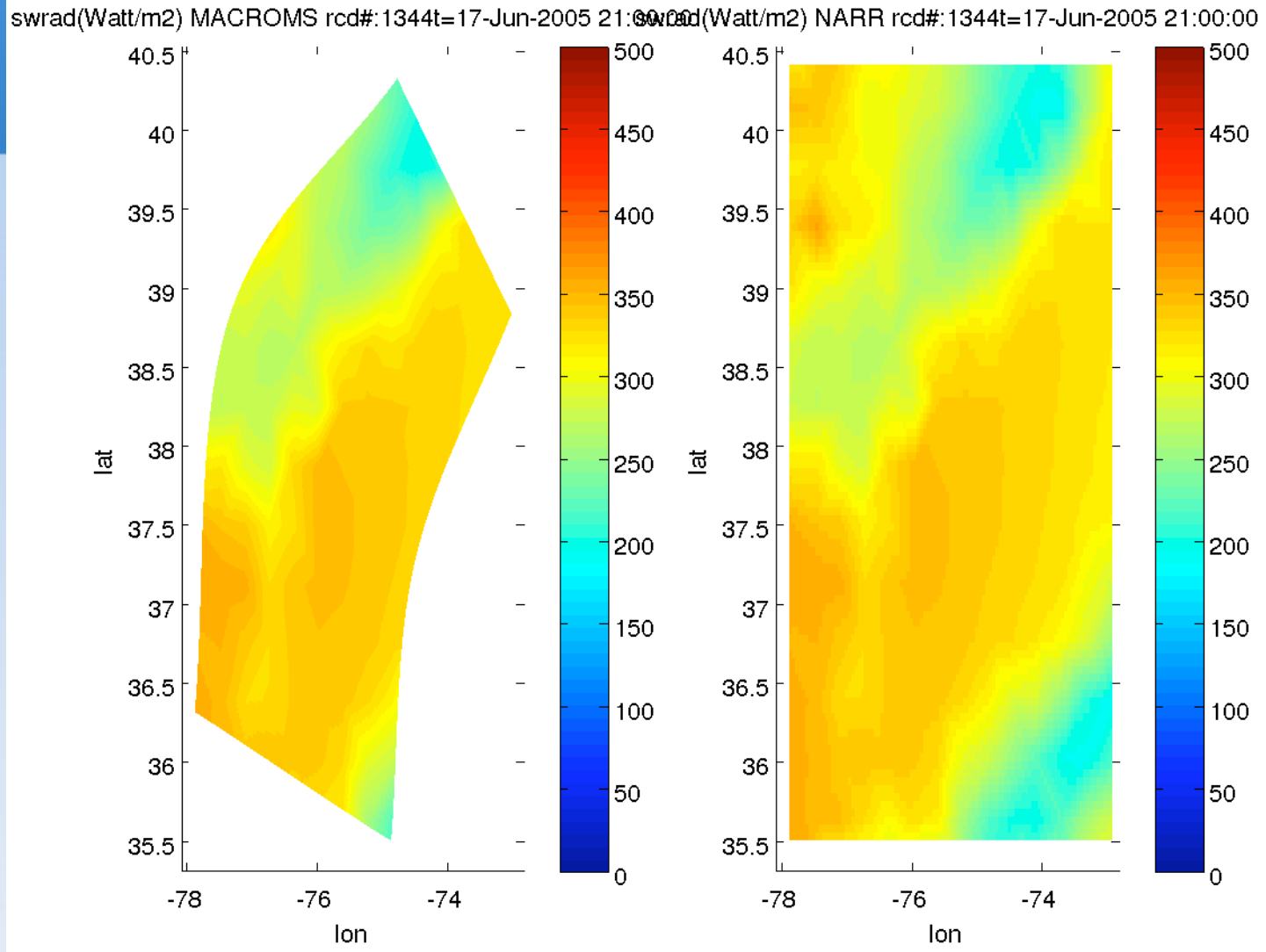
Lw_rad

Pair

Tair

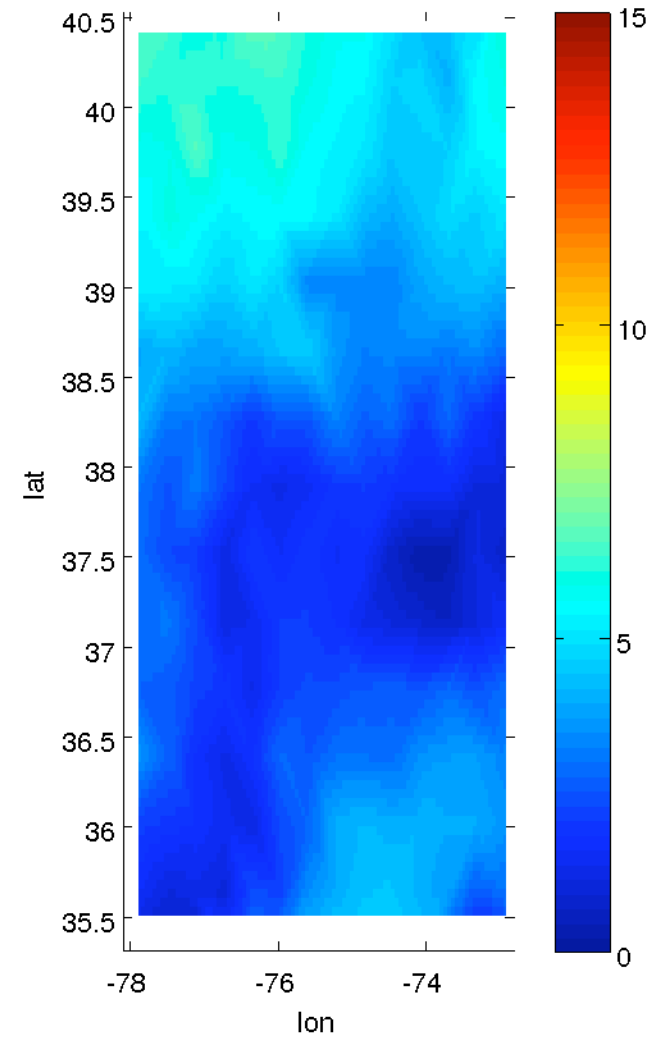
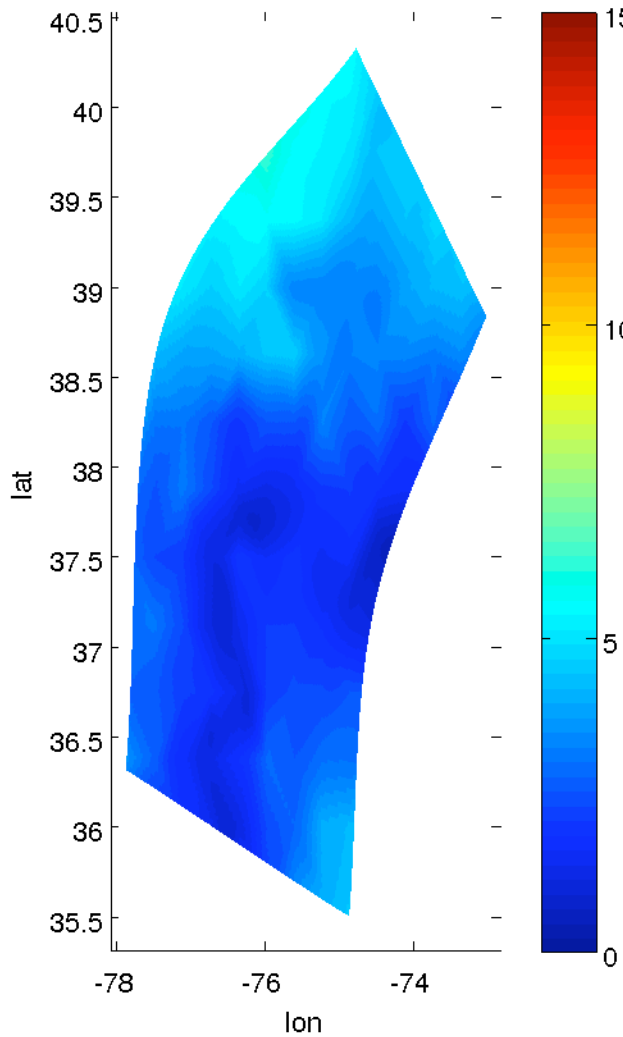
U10m, V10m

NARR Short Wave Radiation (w/m²), Jun-17, 2005



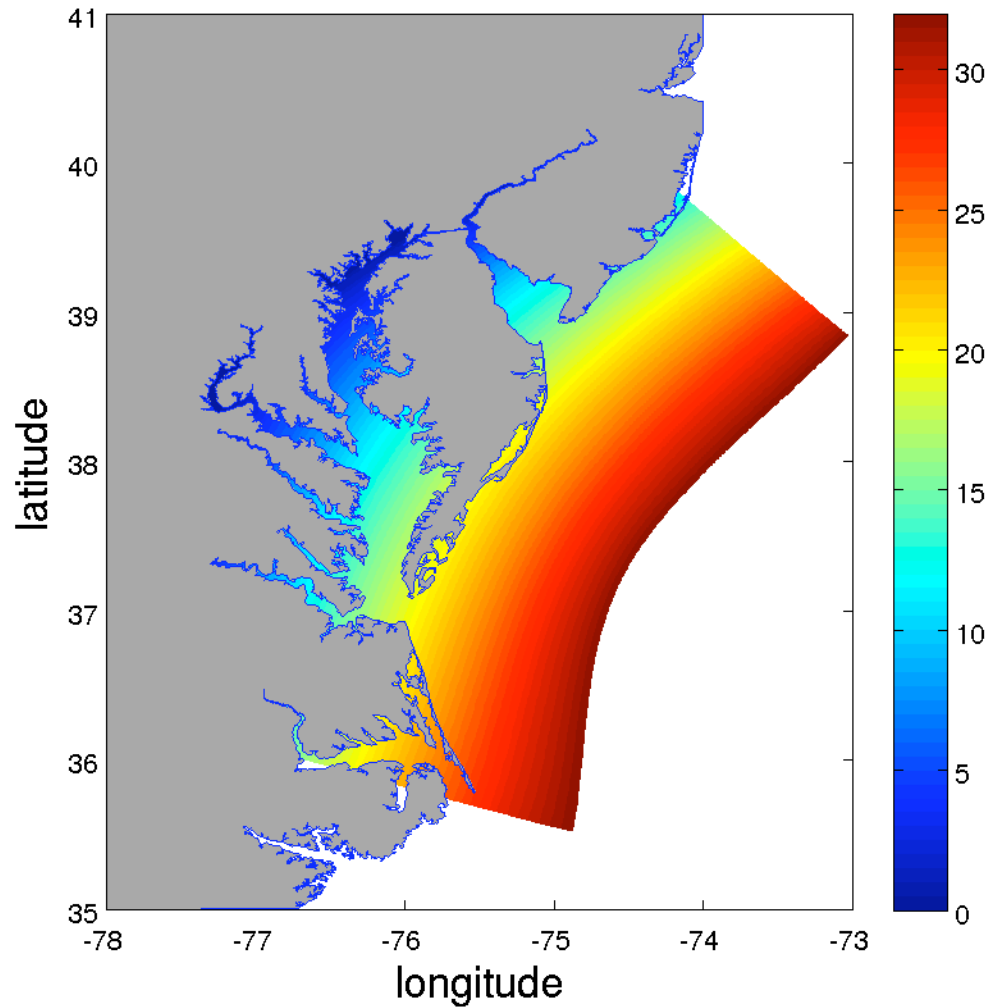
NARR 10m wind speed (m/s), Jun-17, 2005

velo_m_ag(m/s) MACROMS rcd#:1344t=17-Jun-2005 21:00:00

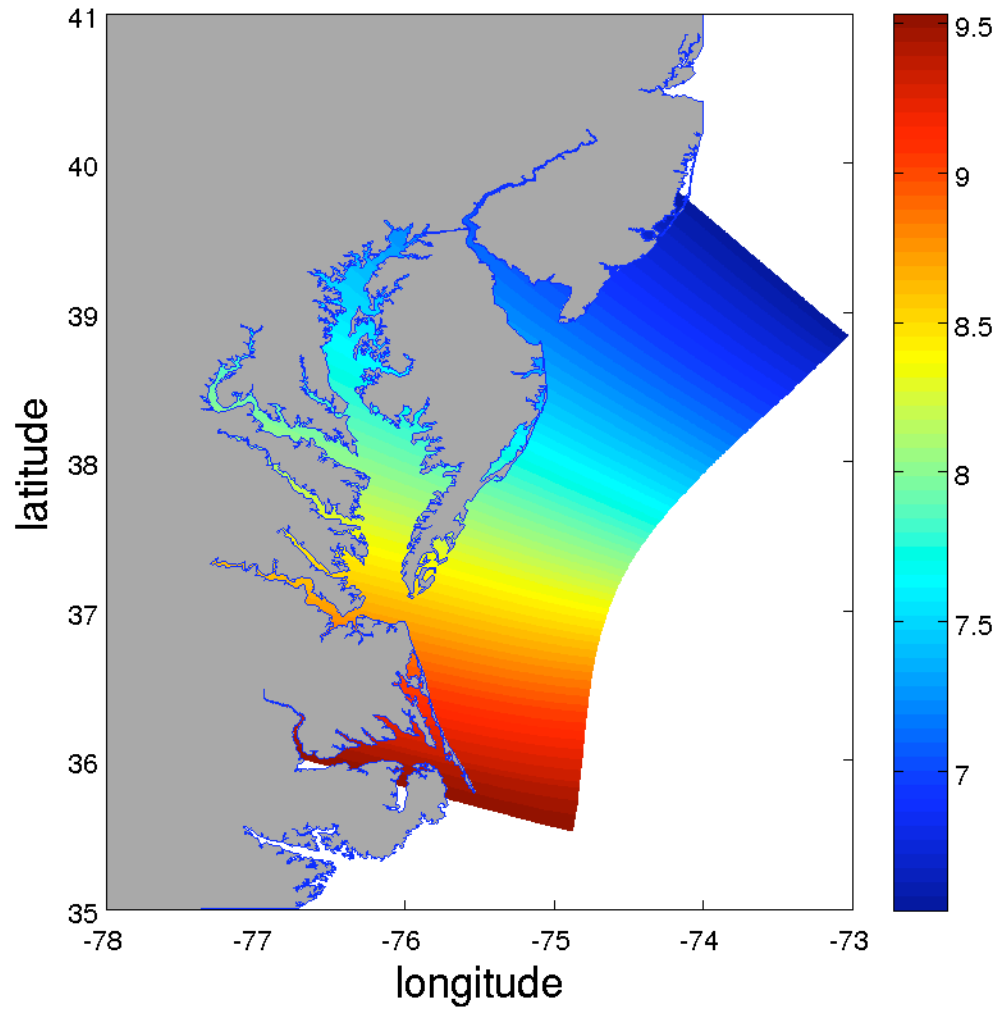


Initial Condition

MACROMS initial condition: surface salinity (PSU)
time: 01-Jan-2005



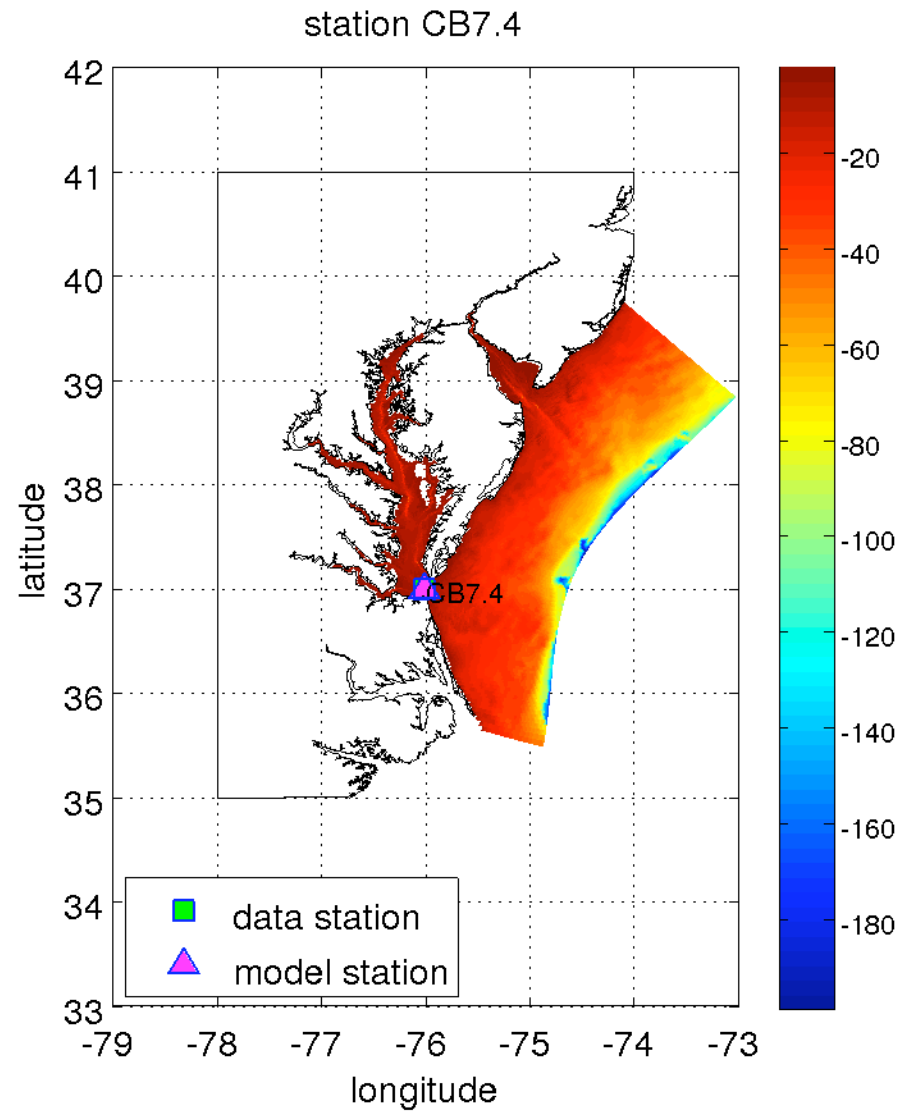
MACROMS initial condition: surface temperature(deg-C)
time: 01-Jan-2005



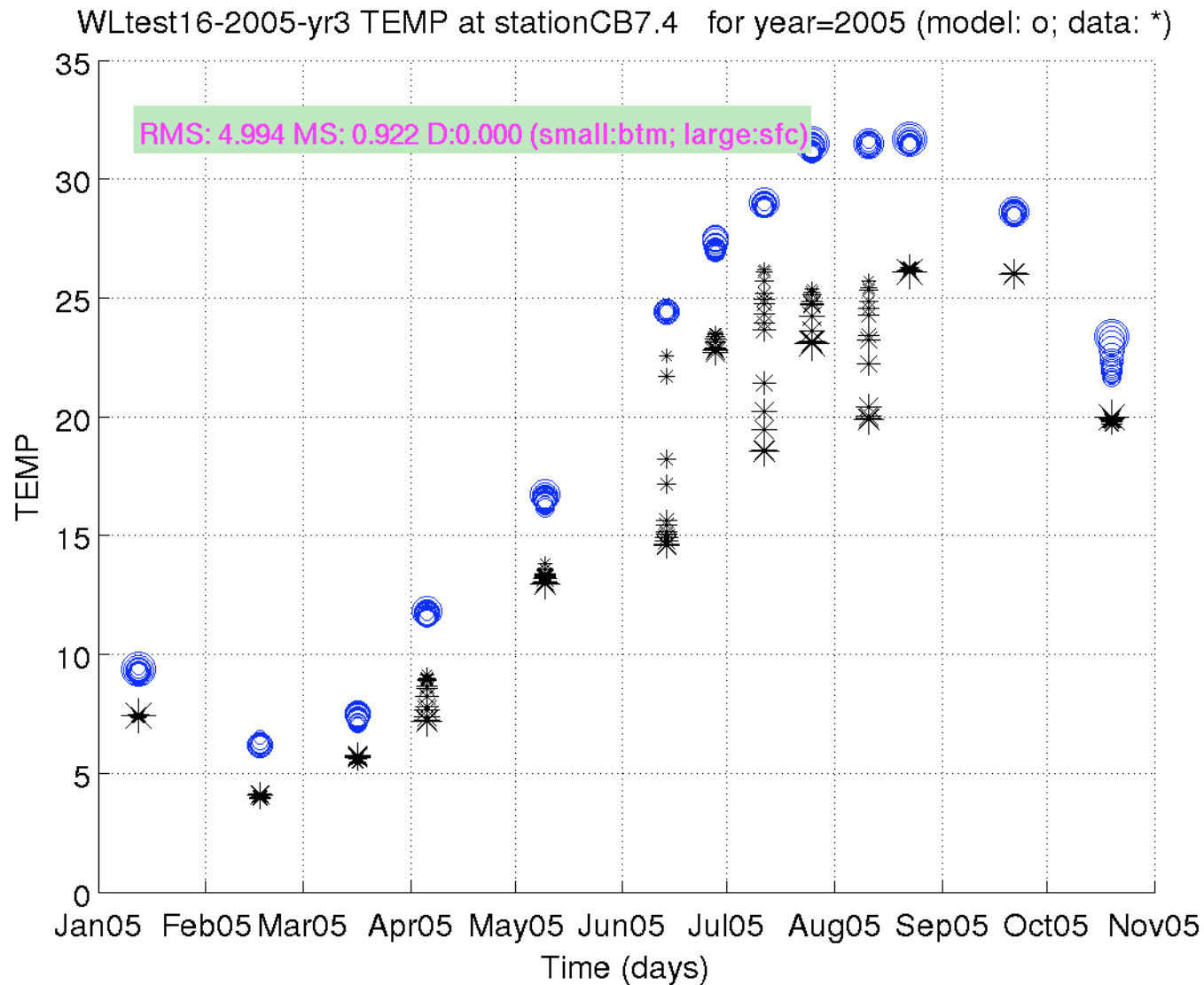
Initial Test Setup

- 2005 - 2006
- SOLAR_SOURCE radiation scheme
- Nudge to MABGOM non-tidal water-level, T, S at OBC
- K-omega turbulence model
- Dt=60 sec
- Nz=20 levels
- Quadratic bottom drag
- 2 year spin up for 2005

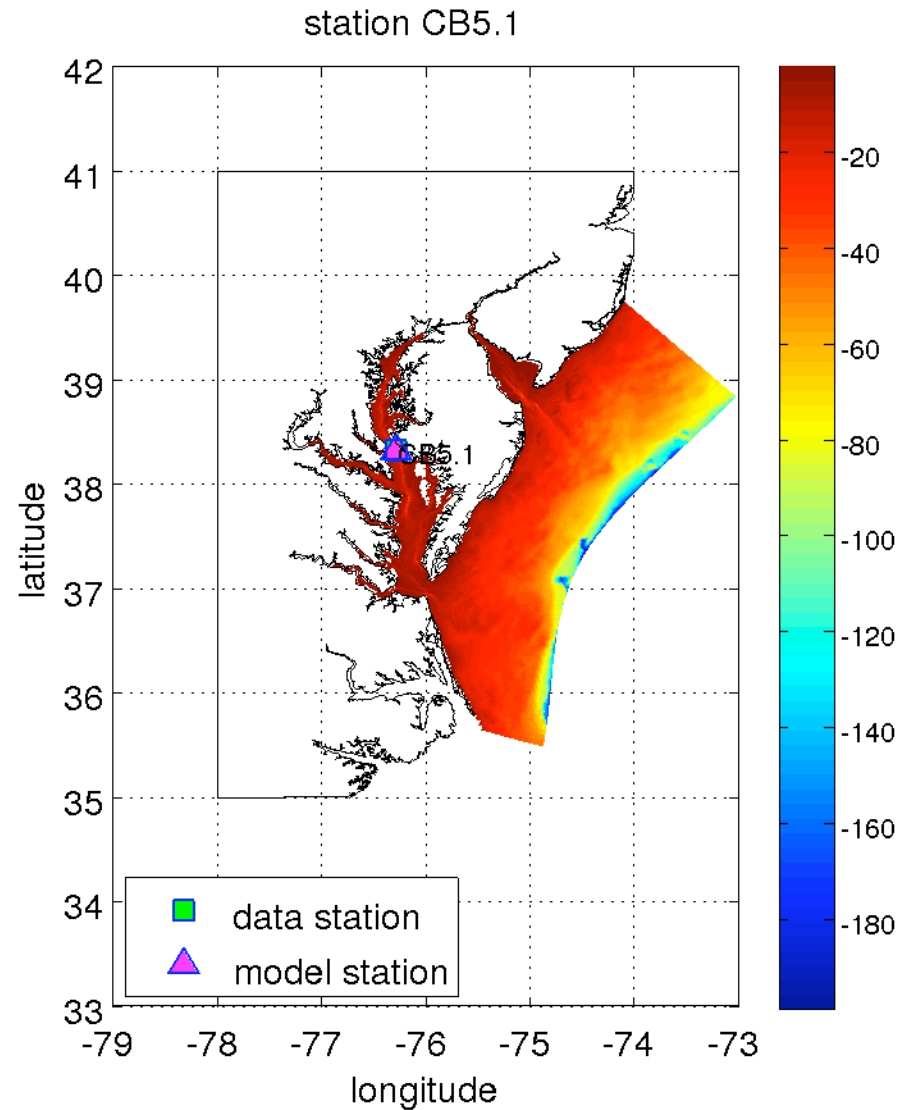
Temperature Prediction 2005



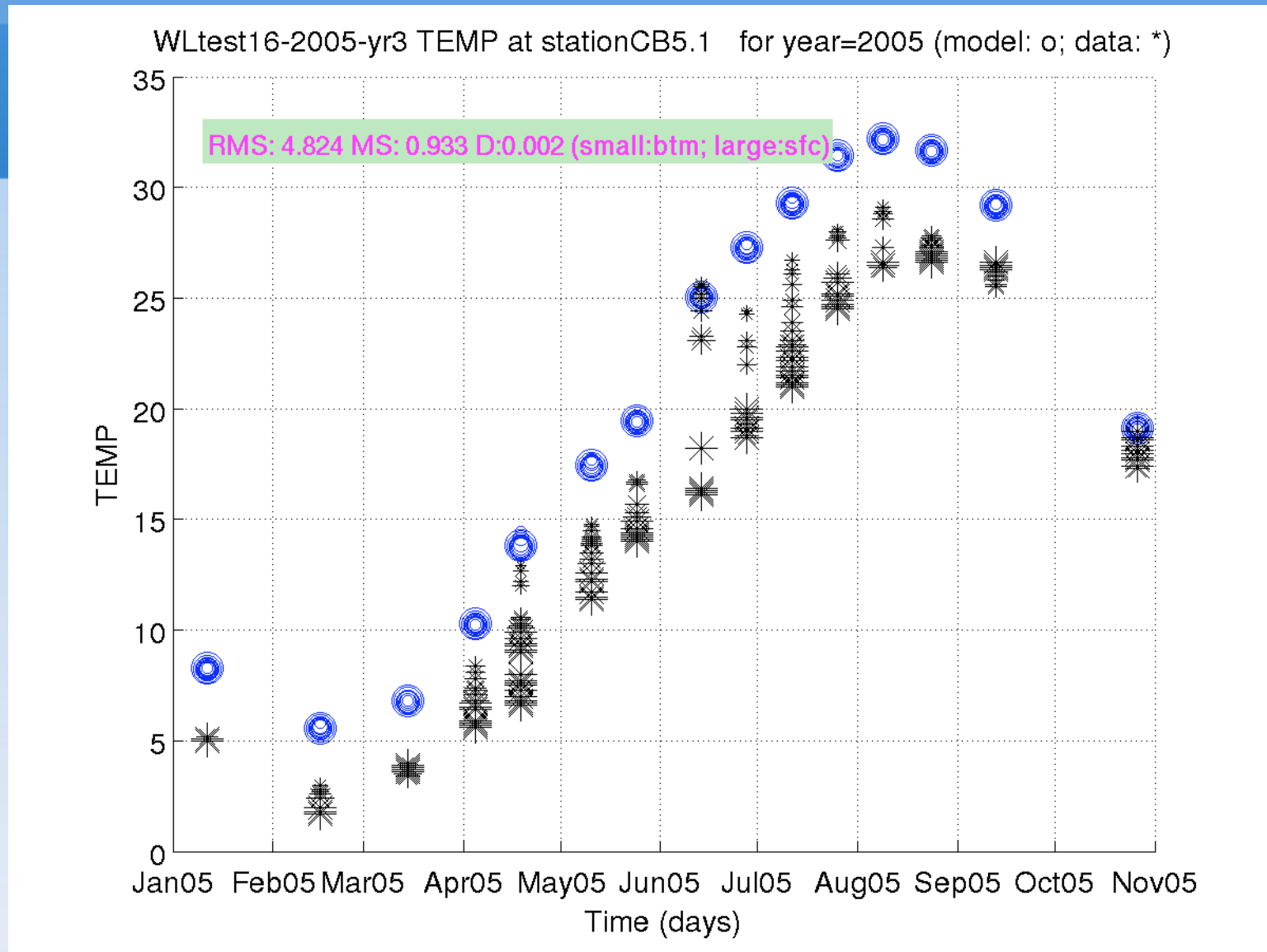
Temperature Comparison (CB7.4)



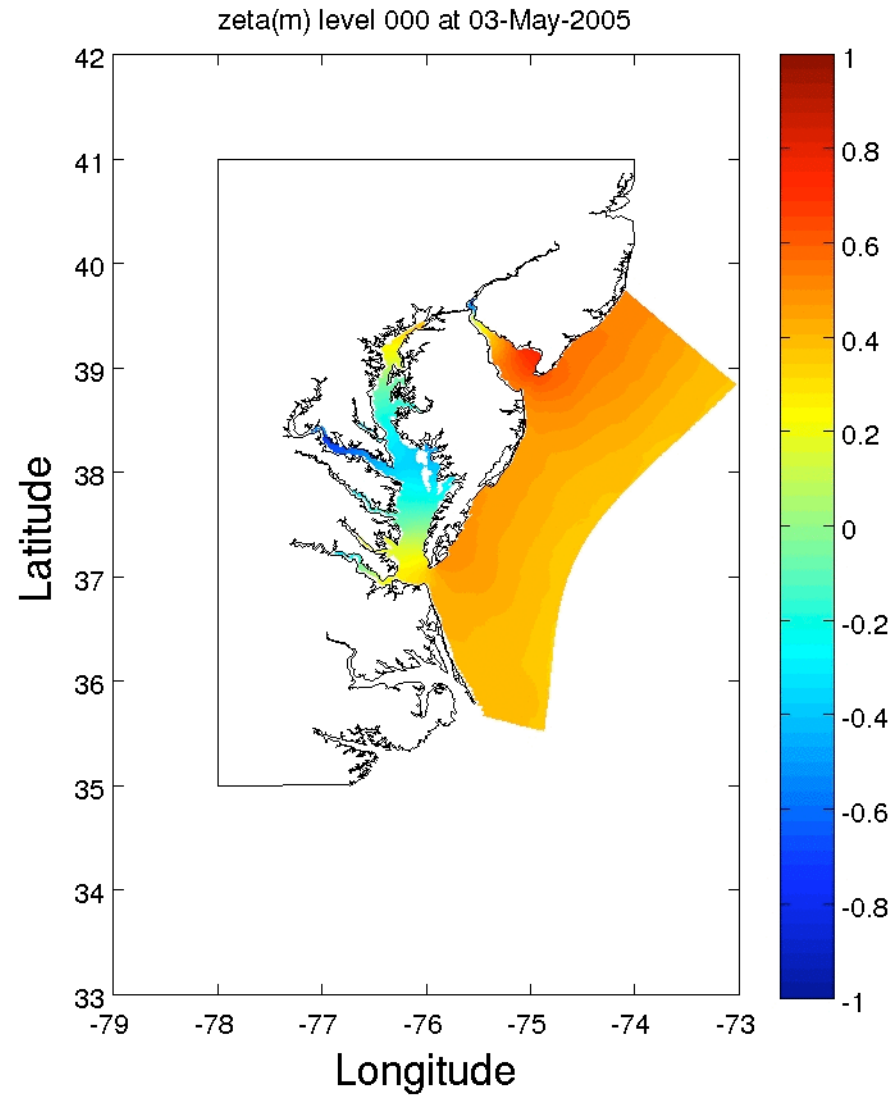
Temperature Comparison (CB5.1)



Temperature Comparison (CB5.1)

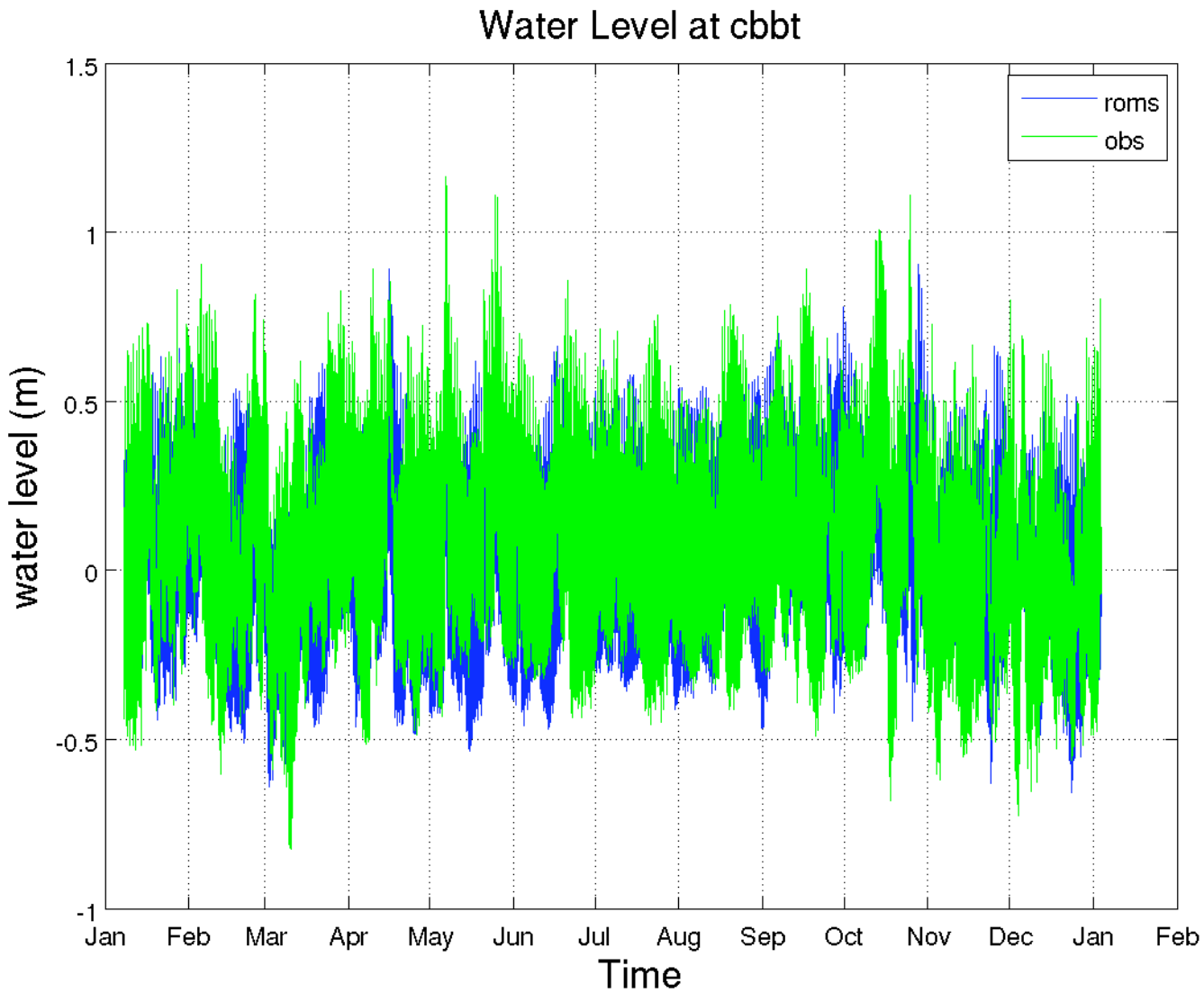


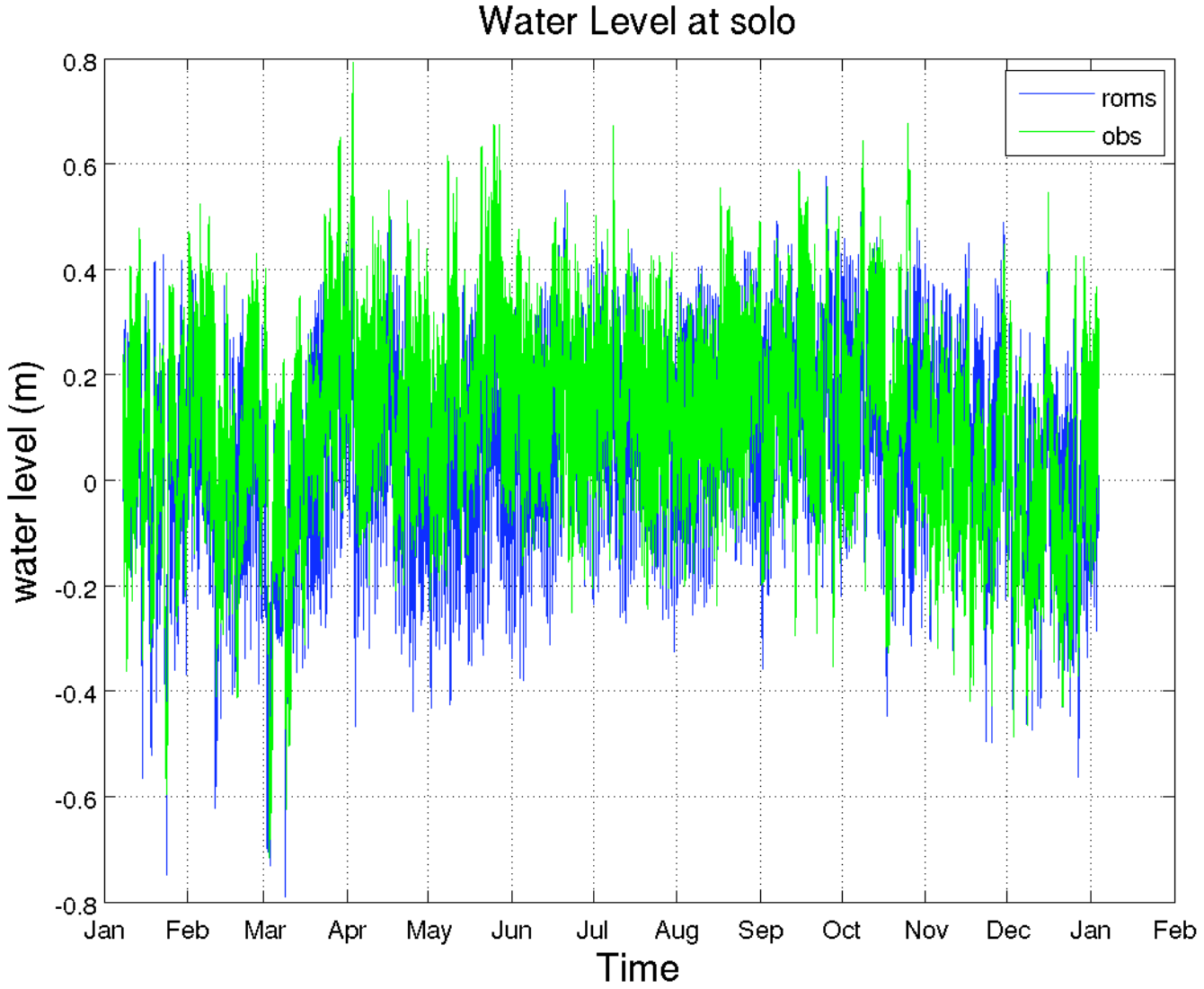
Water Level Prediction 2005

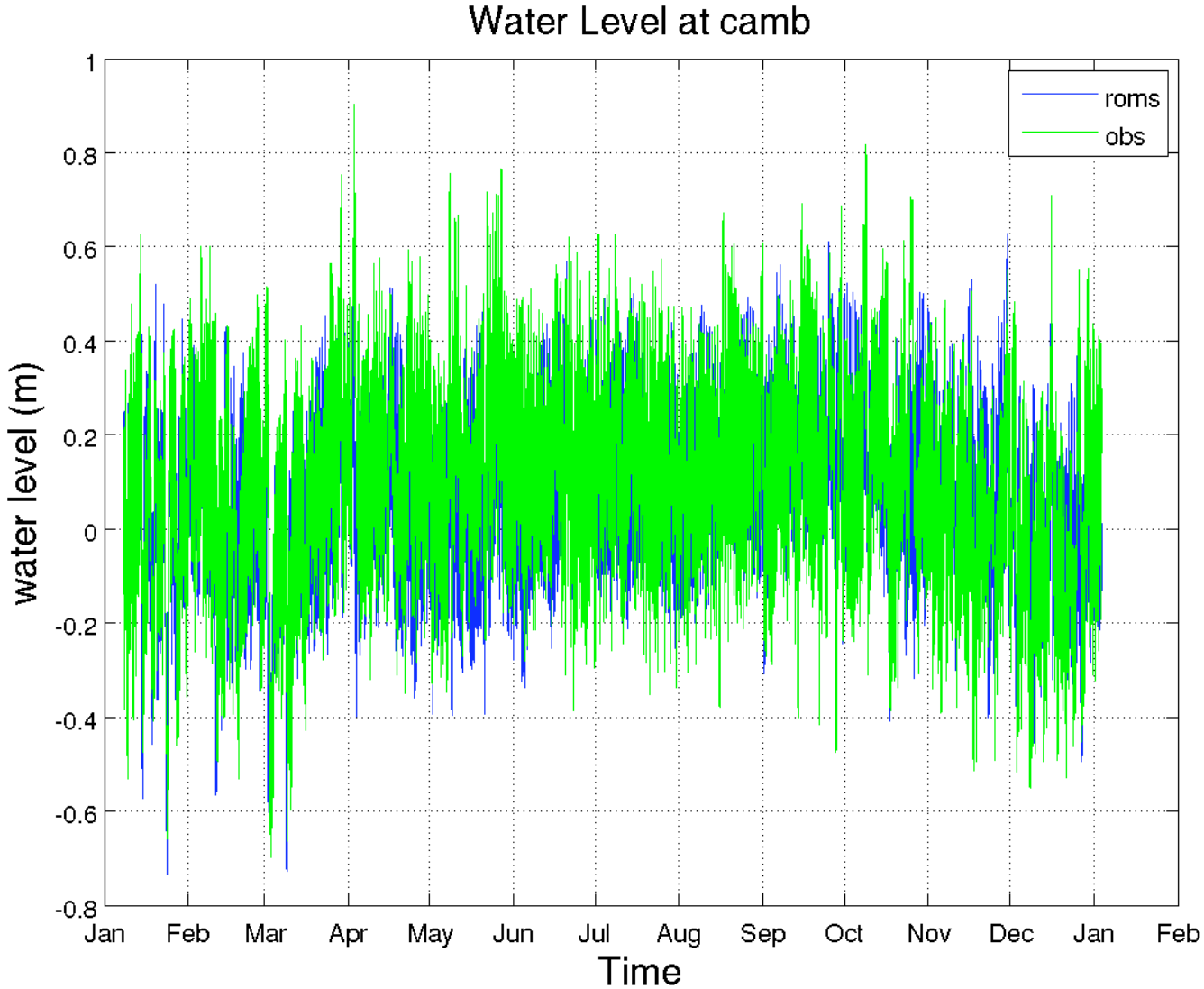


Water Level Prediction 2005

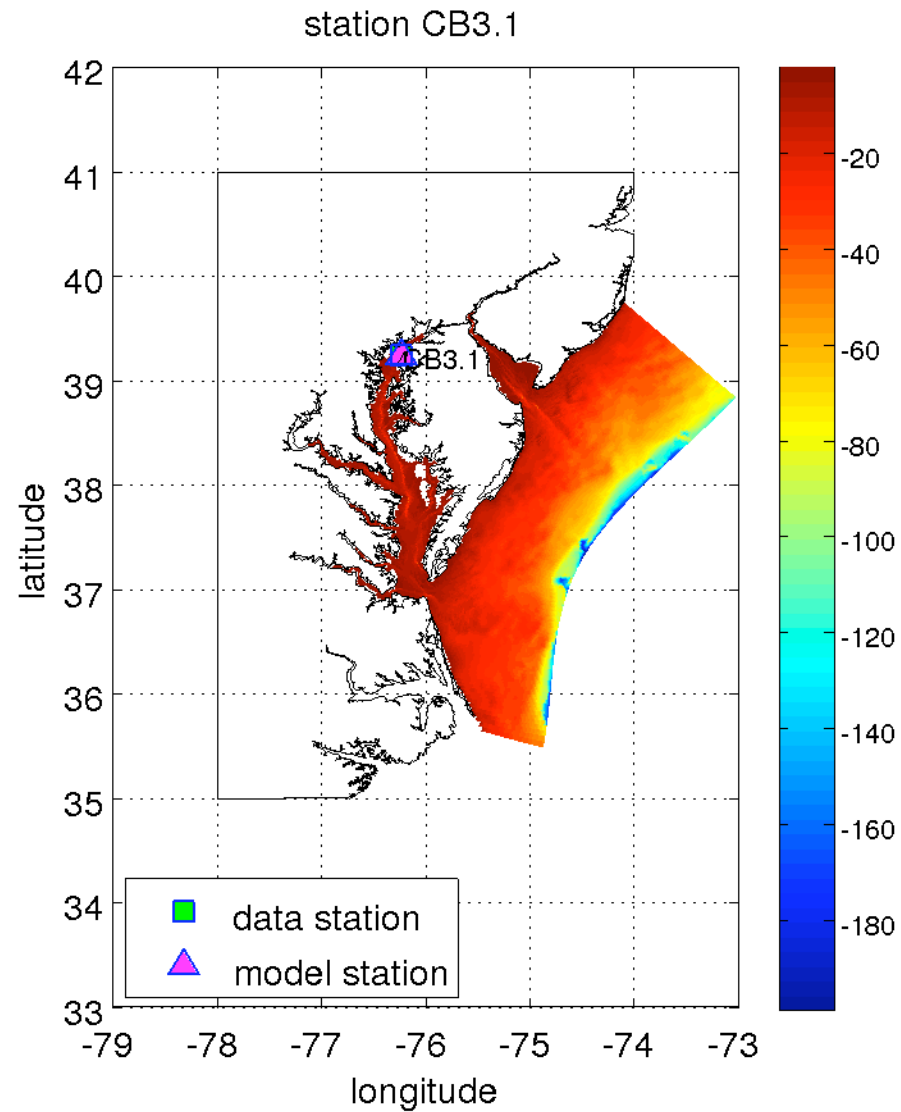
CBBT



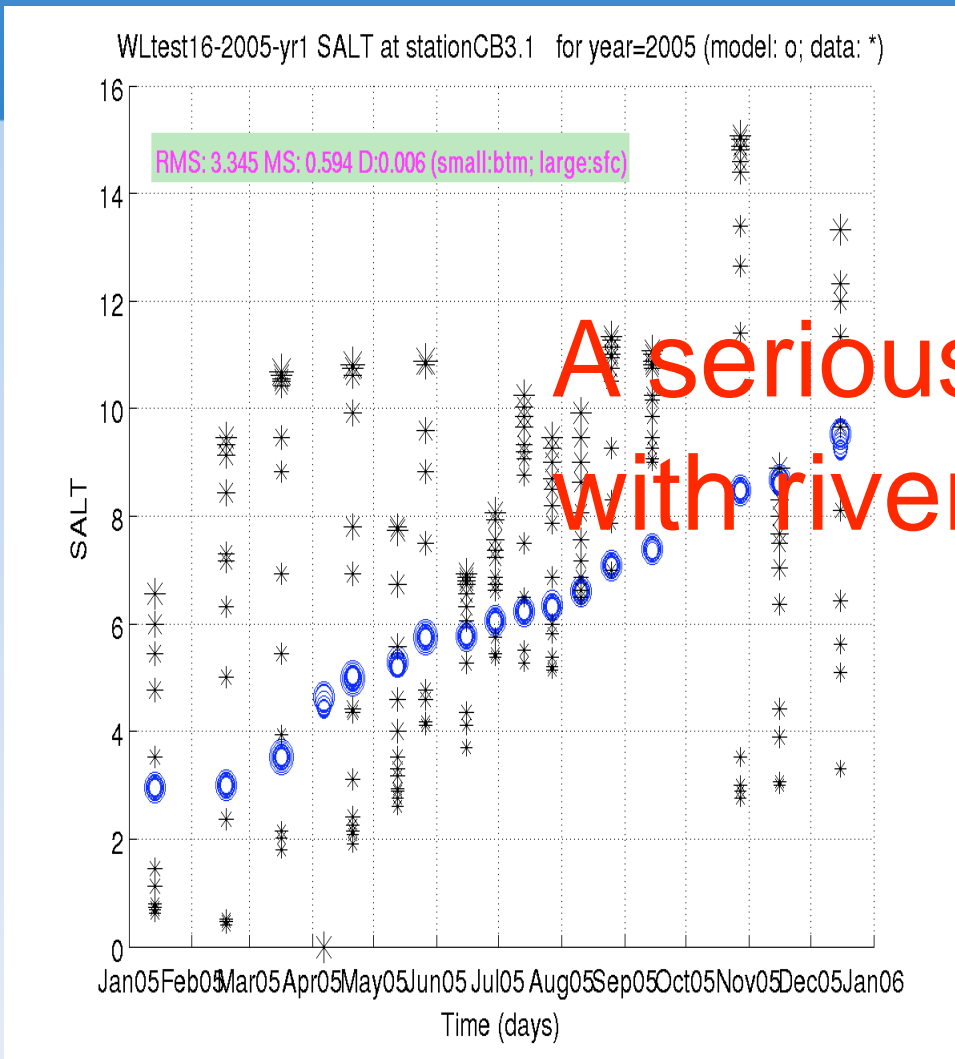




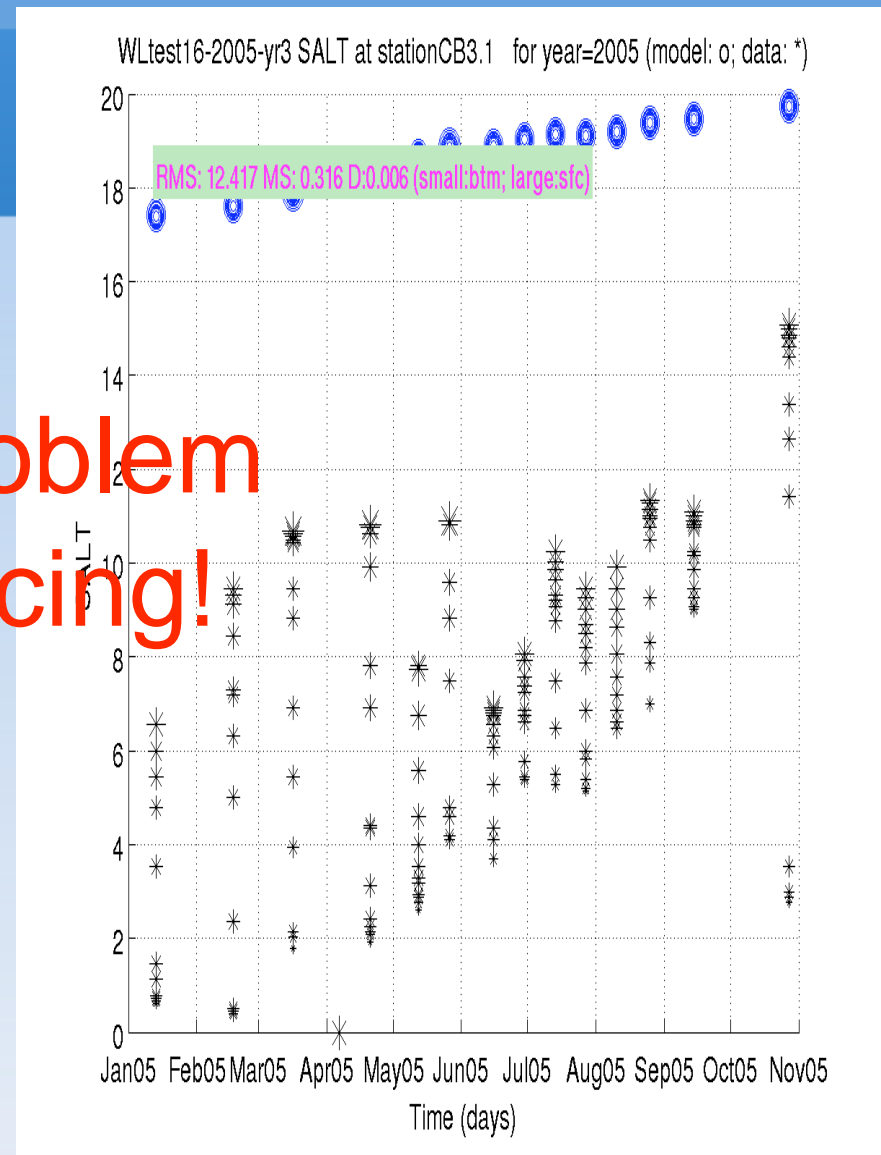
Salinity Prediction 2005



Salinity Comparison (CB3.1)



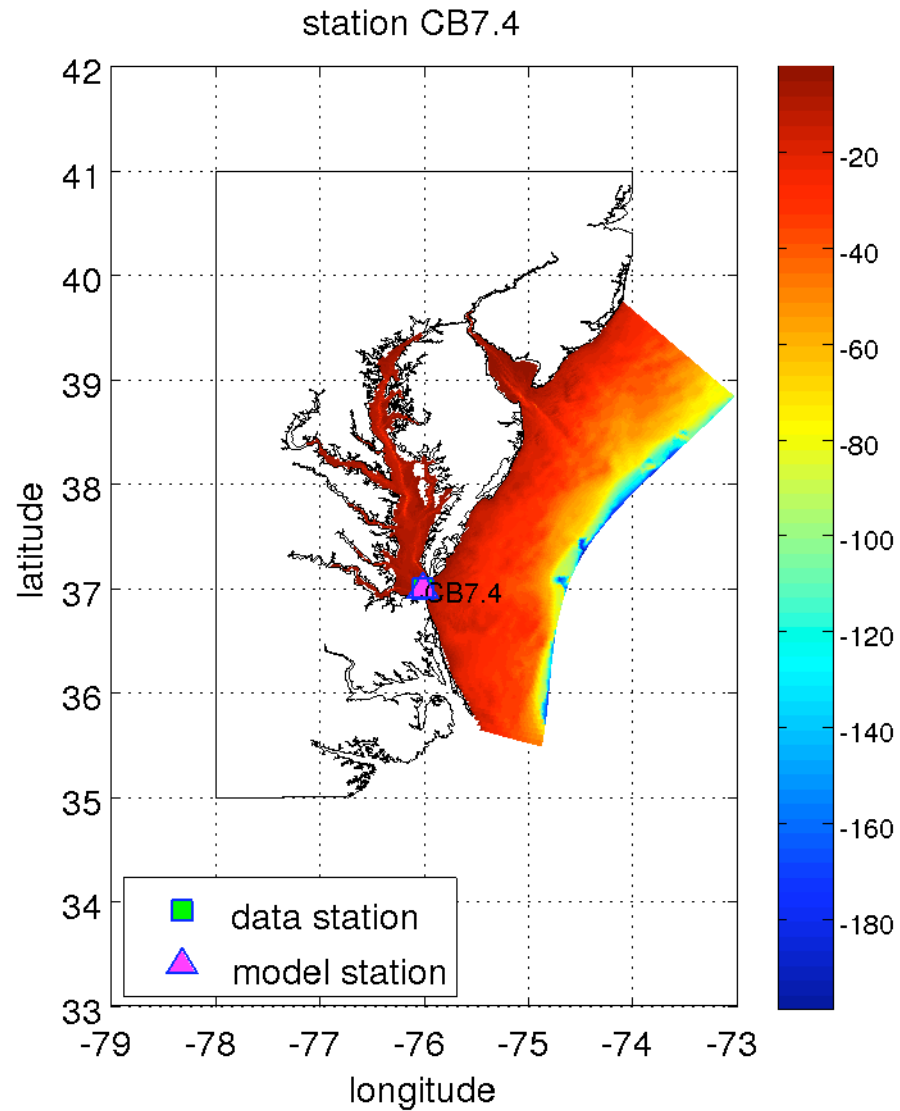
YR1



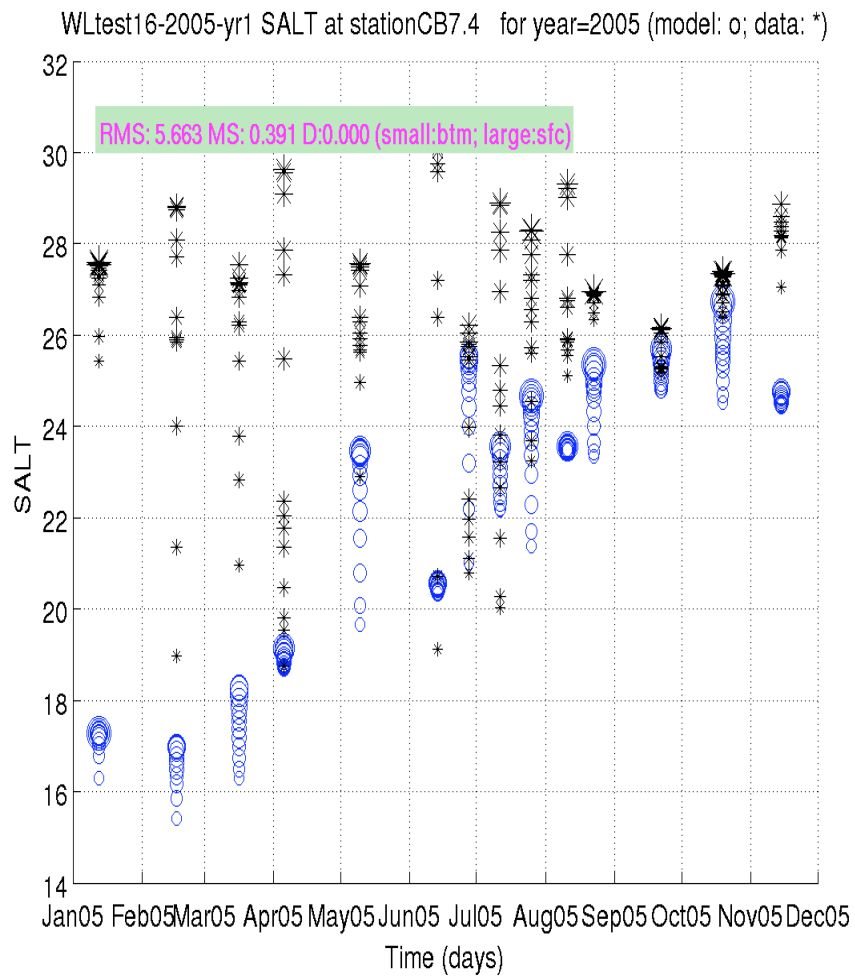
YR3

A serious problem
with river forcing!

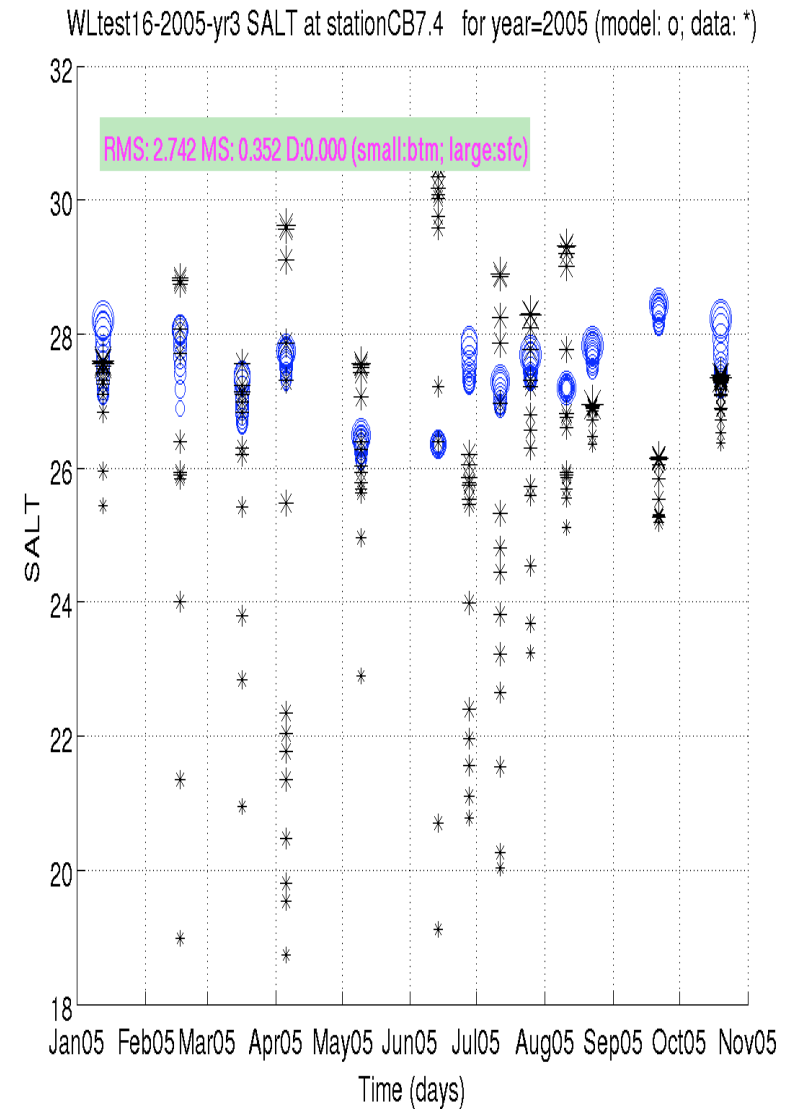
Salinity Comparison (CB7.4)



Salinity Comparison (CB7.4)



YR1

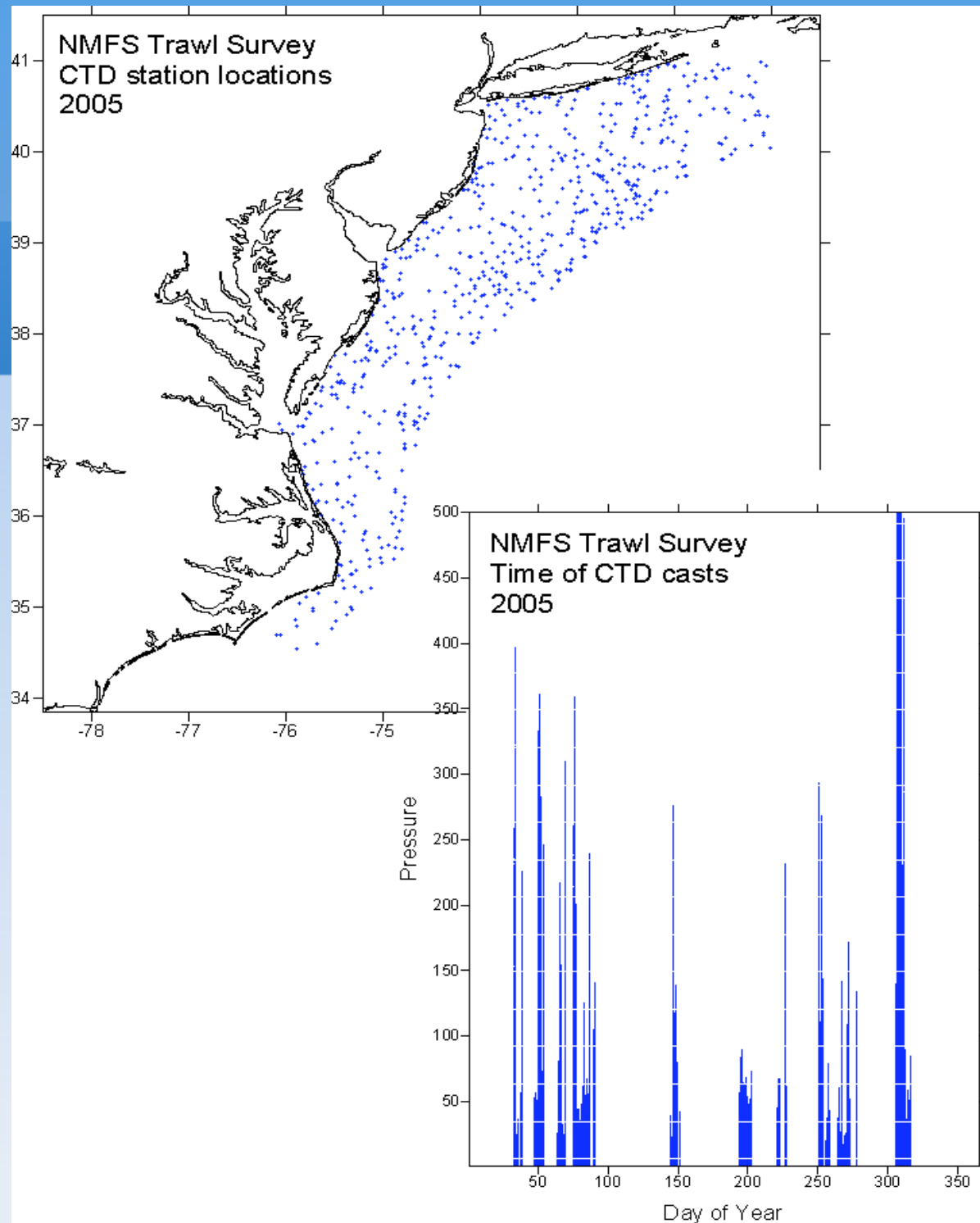


YR3

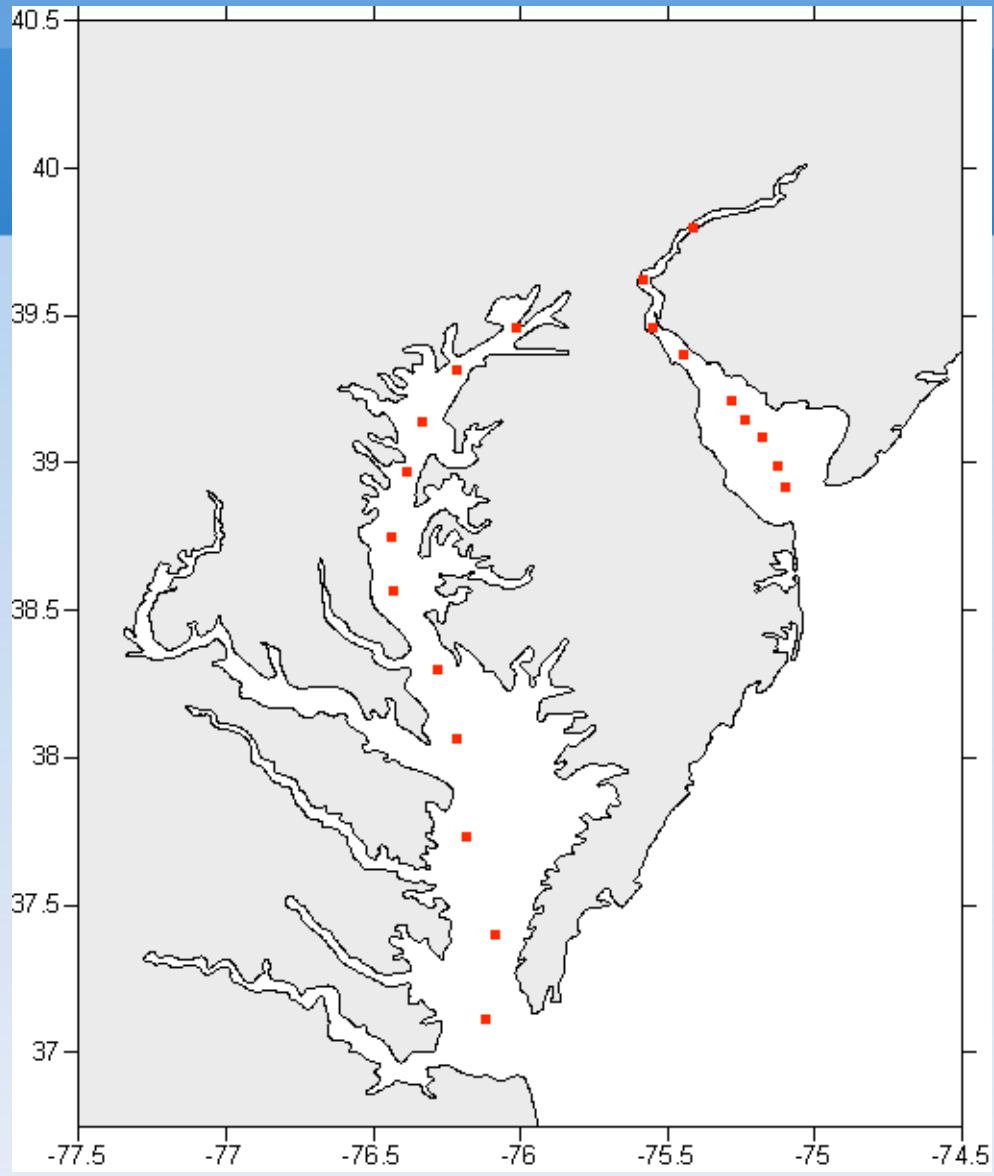
Concurrent Work and Future Plans

- Couple with LTRANS for larval transport
 - Interaction between estuary plumes and shelf
 - Interaction with Gulf Stream
- Use CTD data for estuary and extensive shelf validation
- Study the impacts of CnD Canal
 - Interannual variability, impact on stratification

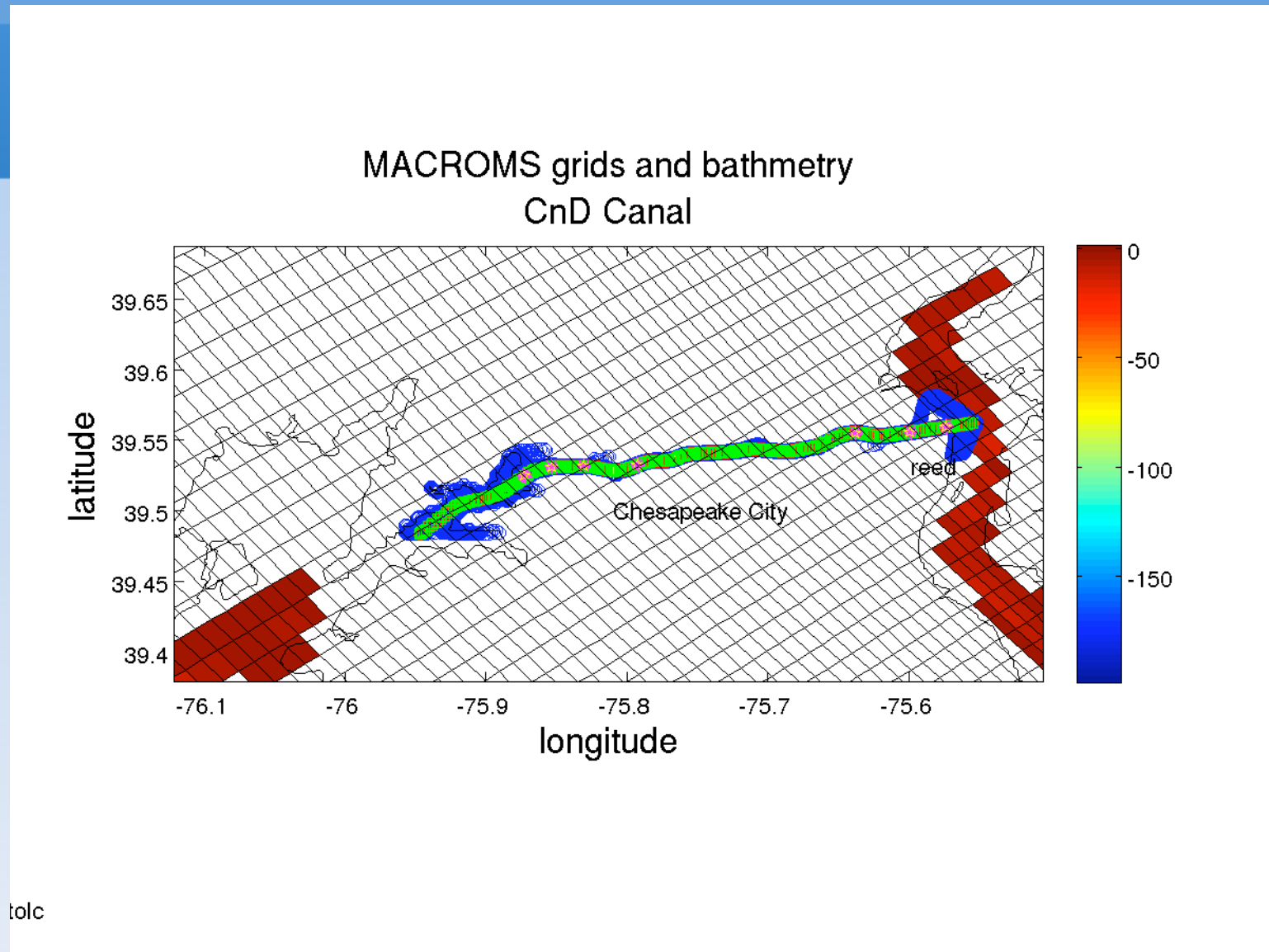
NMFS CTD 2005



RVCH CTD, Aug 5-8, 2005

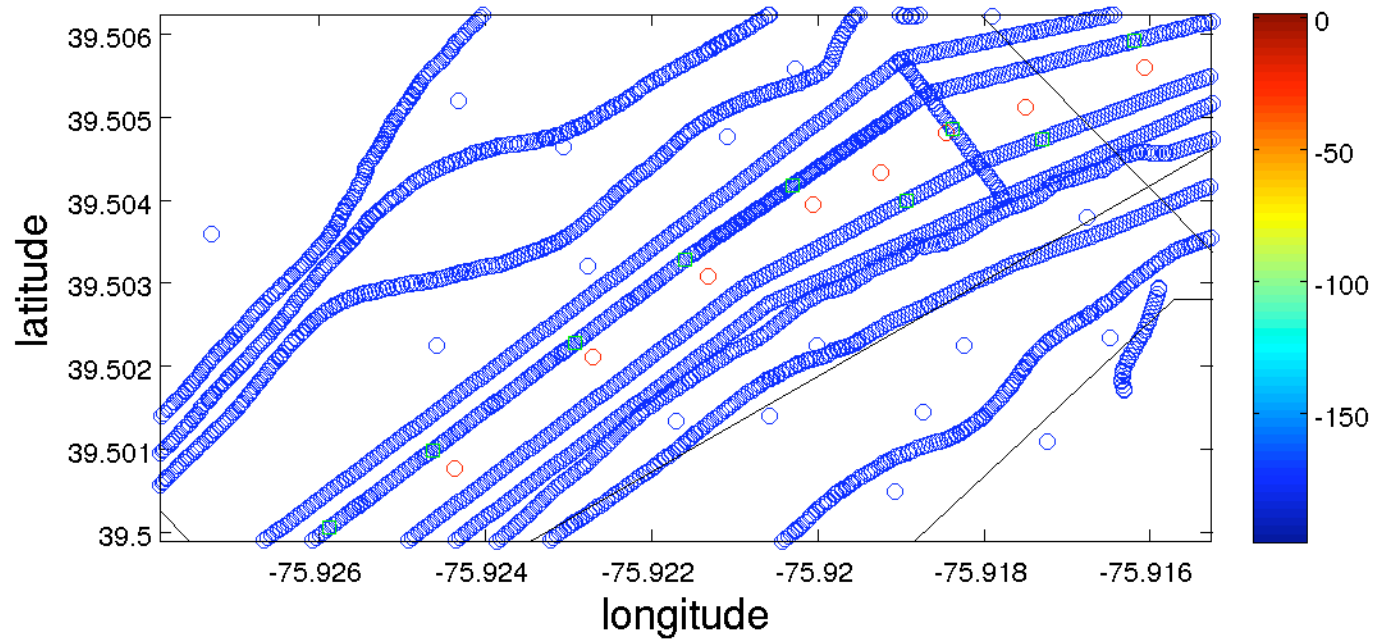


CnD Impact on Both Estuaries

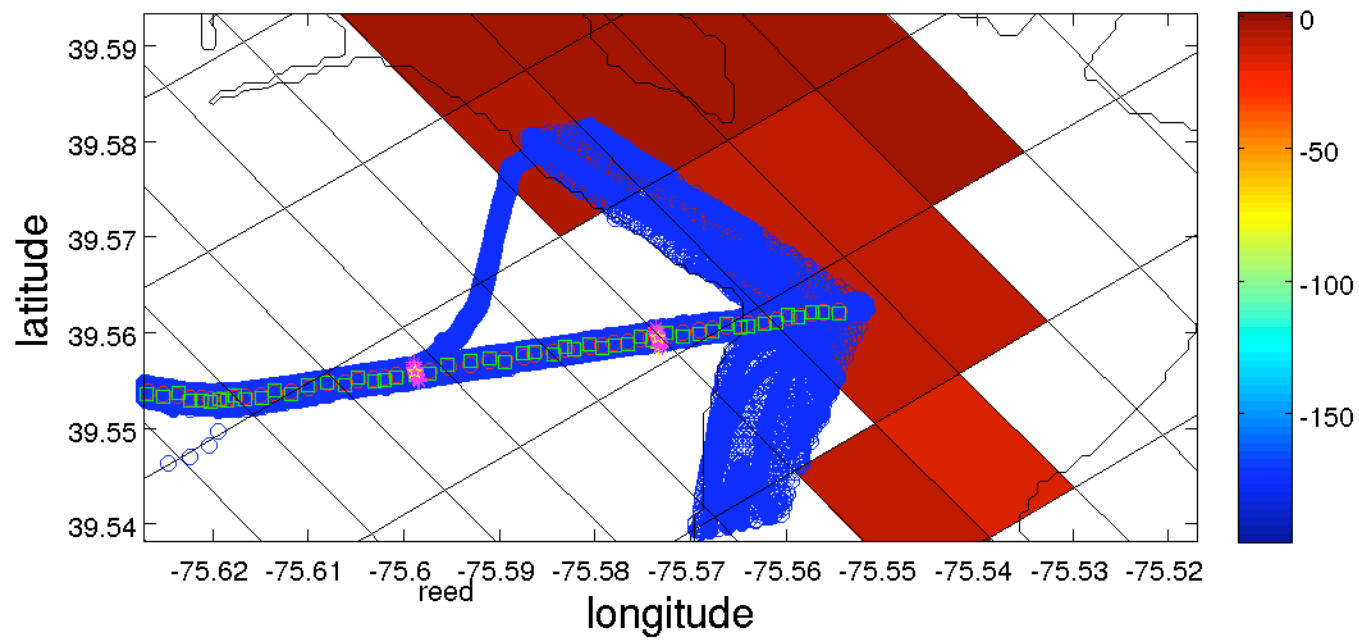


Grid Need to Be Locally Adjusted!

MACROMS grids and bathymetry CnD Canal



MACROMS grids and bathymetry CnD Canal



Conclusion

- MACROMS is setup and opensource based on ROMS3.0
- LTRANS is included as a module
- Model can be nested within MABGOM or HYCOM
- Preliminary test was based on 2005 and 2006
- Temperature and water level predictions are modestly satisfactory at this stage
- Salinity simulation needs further investigation
- Extensive validation based on CTD and other data sources is required
- On going work includes studying the impacts of CnD Canal to the system and larval transport