HYCOM in the South Atlantic Bight:
Performance and Client Applications

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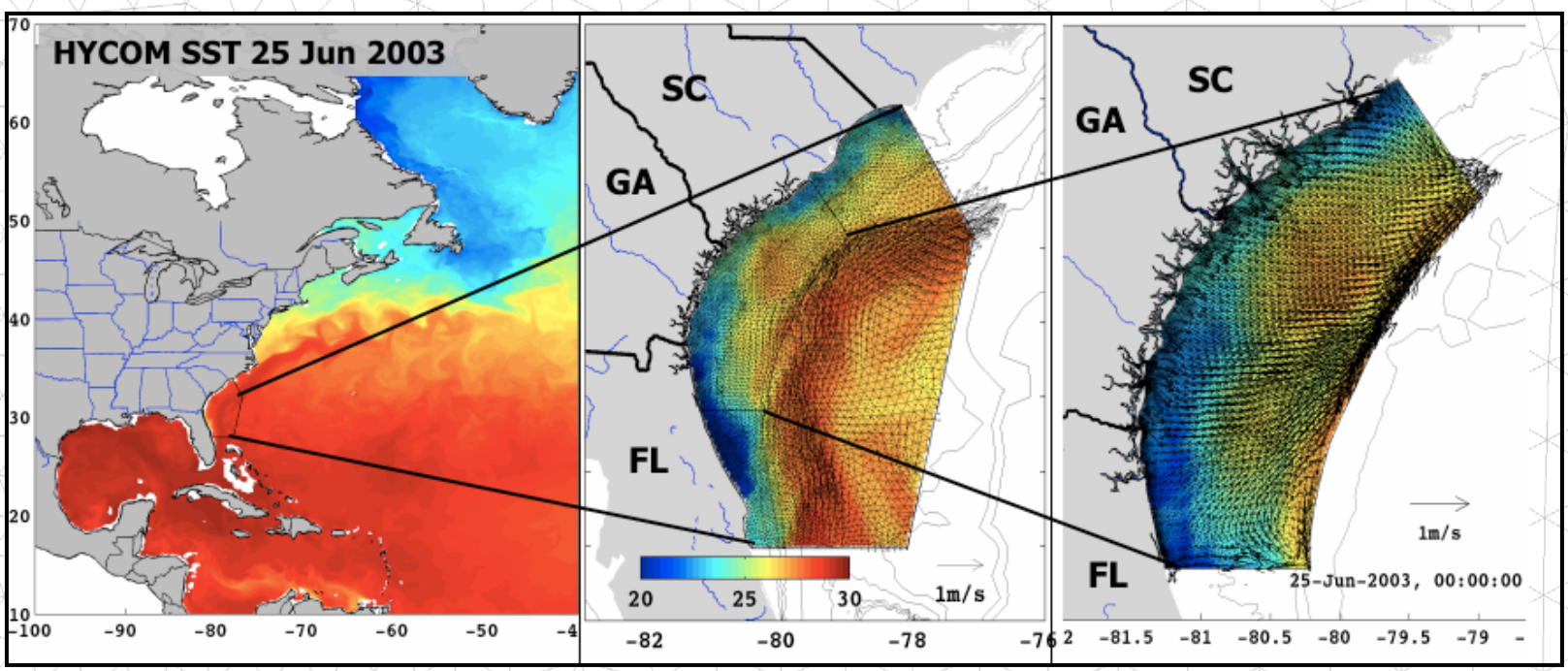

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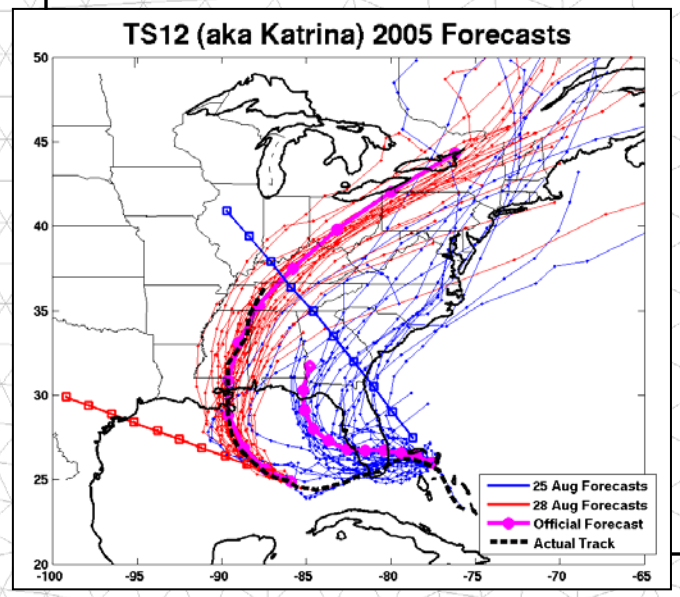
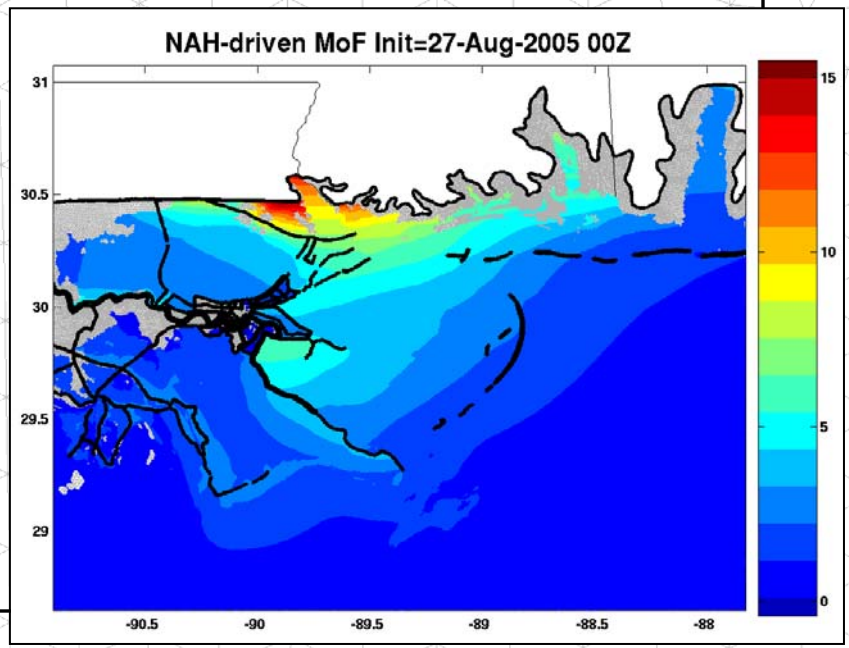
UNC Group Activities

- HYCOM/GODAE NOPP
- Provide ***SEACOOS*** - South Atlantic Bight (SAB) modeling component
- SCOOP - Operational Storm-surge and Inundation project

  –**High-res operational storm surge, Ensemble Approach**

  -Katrina Reanalysis





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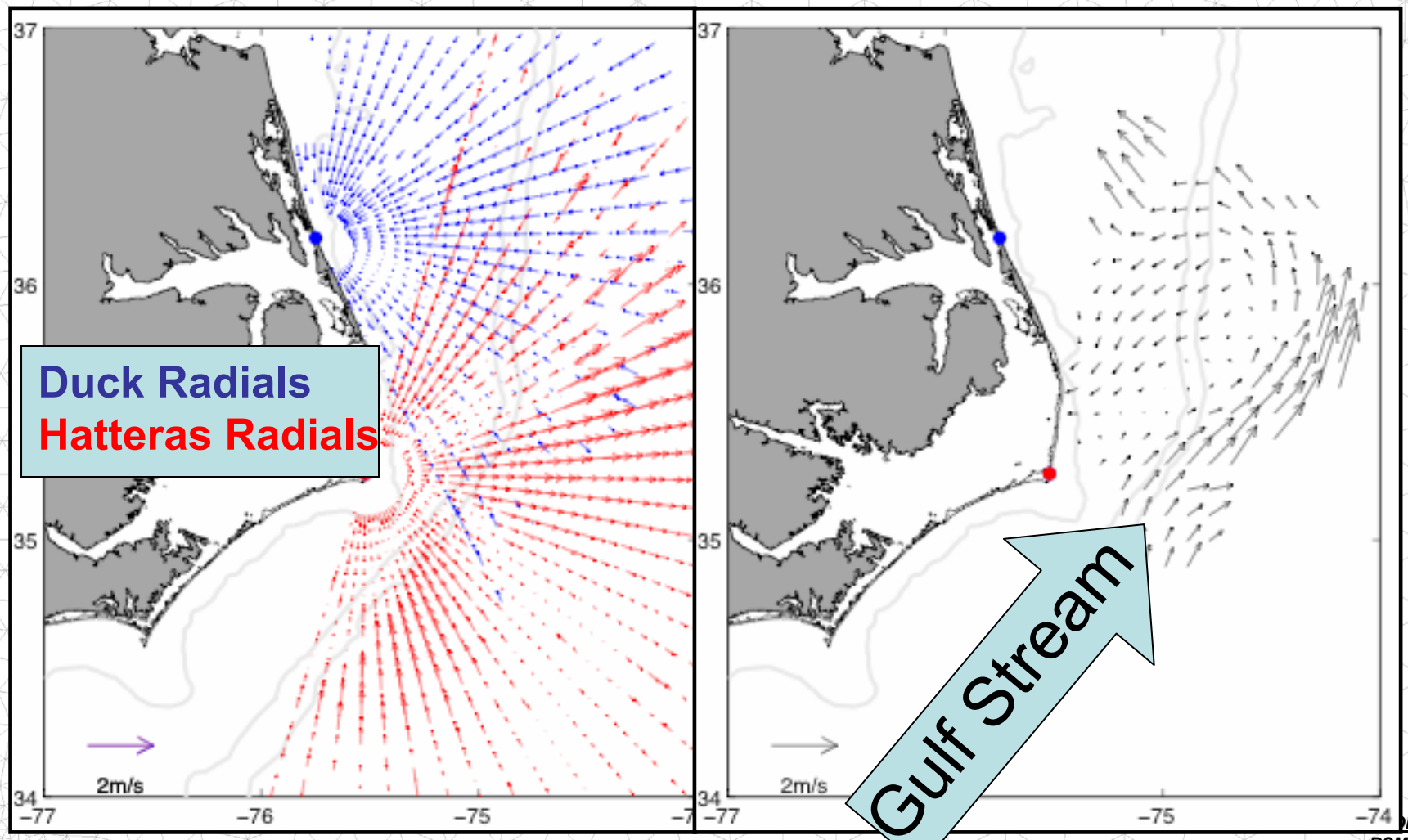
NOPP/HYCOM Activities in the SAB

- Comparison of HYCOM to SAB Observations
  - SAB Water levels
  - Mid-shelf temperature
  - Cape Hatteras CODAR
- Simulations in the SAB : Nested Applications
  - Hindcasting
    - Strong event studies (e.g. Summer 2003 cooling)
    - Evaluation of HYCOM BCs in SAB
  - Shelf/coastal zone **Prediction** System
    - Evolution of SABLAM
      - South Atlantic Bight Limited Area Model
      - Previously NOPP-funded project (FY00-FY03)

Obs and HYCOM in the SAB

Cape Hatteras CODAR Installation

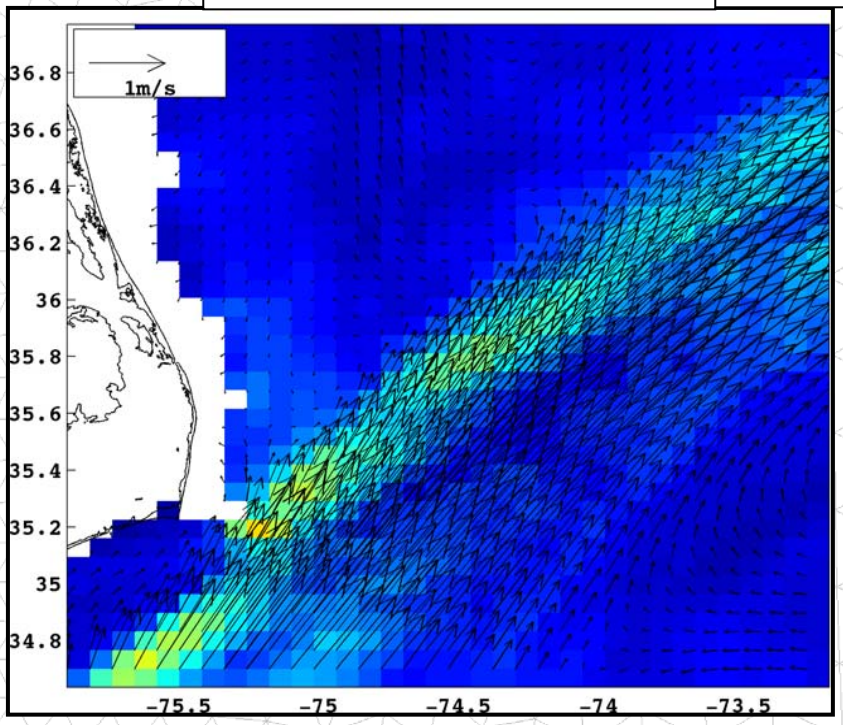
Capturing GS Surface Variability

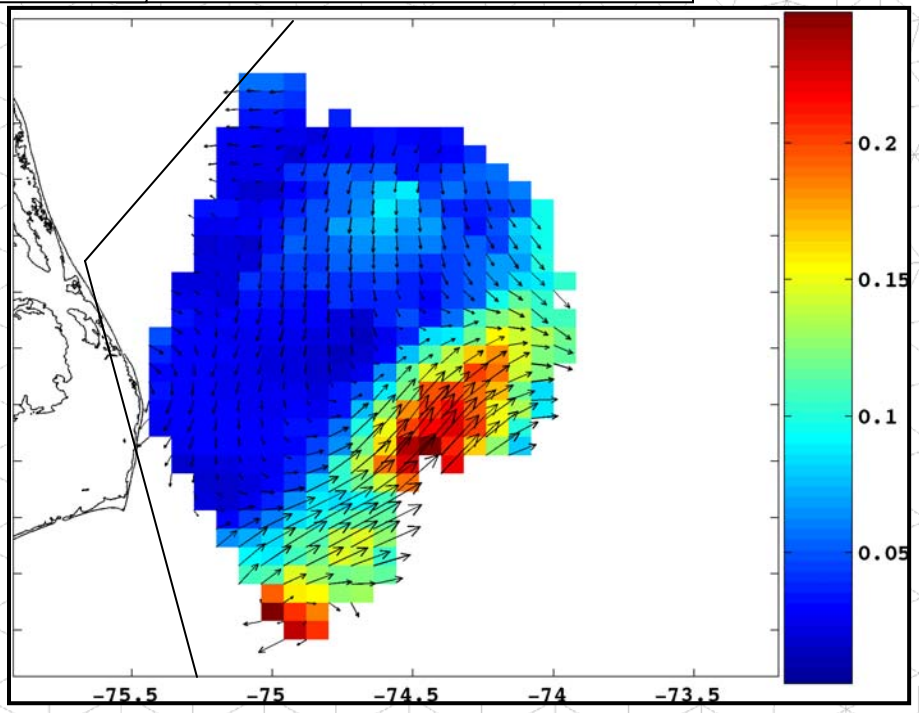


Obs and HYCOM in the SAB

Mean Surface U,V Var(Speed)

HYCOM	Sept 2003	CODAR

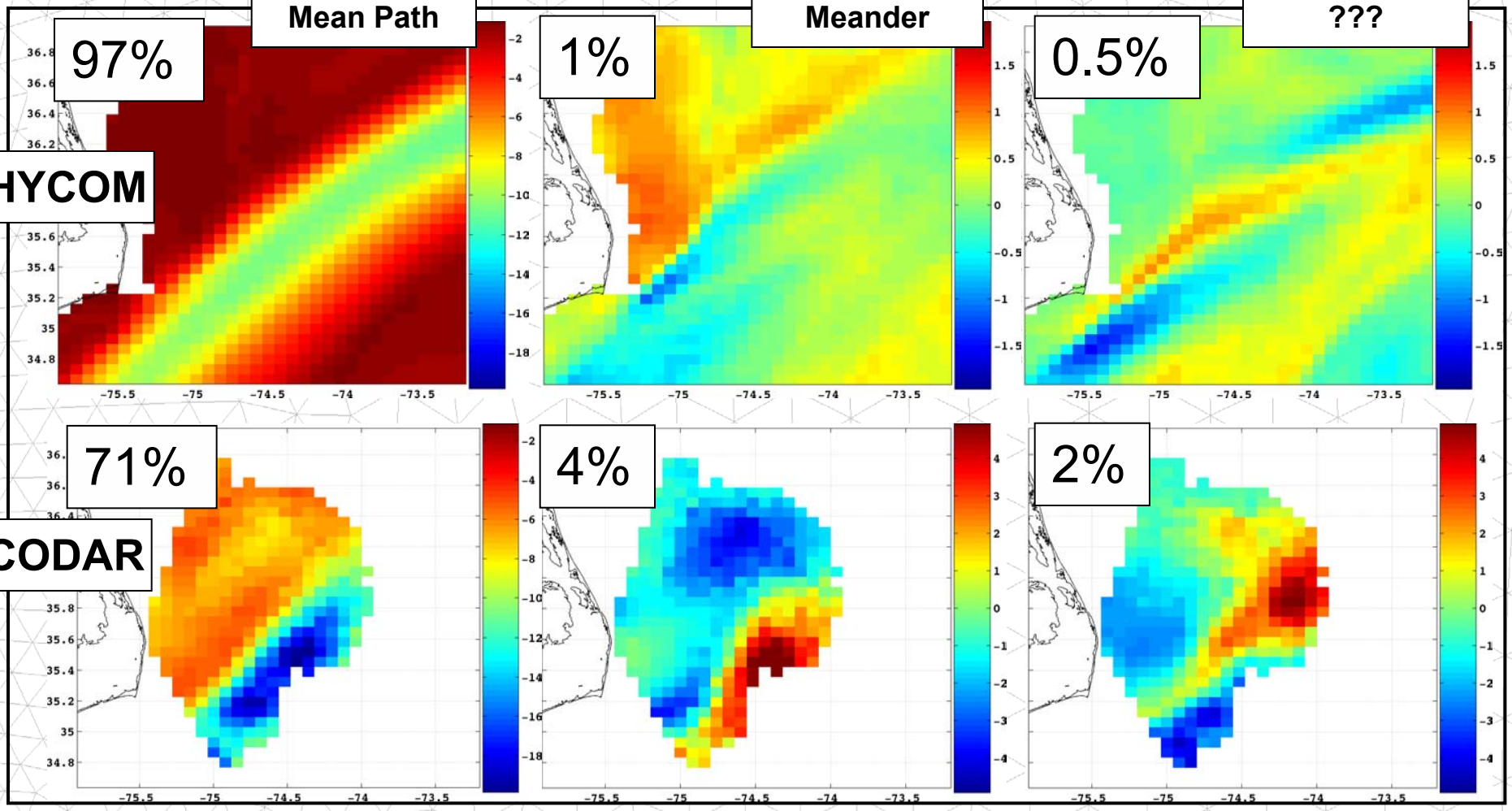




Mean velocity (vectors) and speed variance (color) in the Cape Hatteras region for the month of September 2003.

Obs and HYCOM in the SAB

Spatial (Surface) EOFs - Speed



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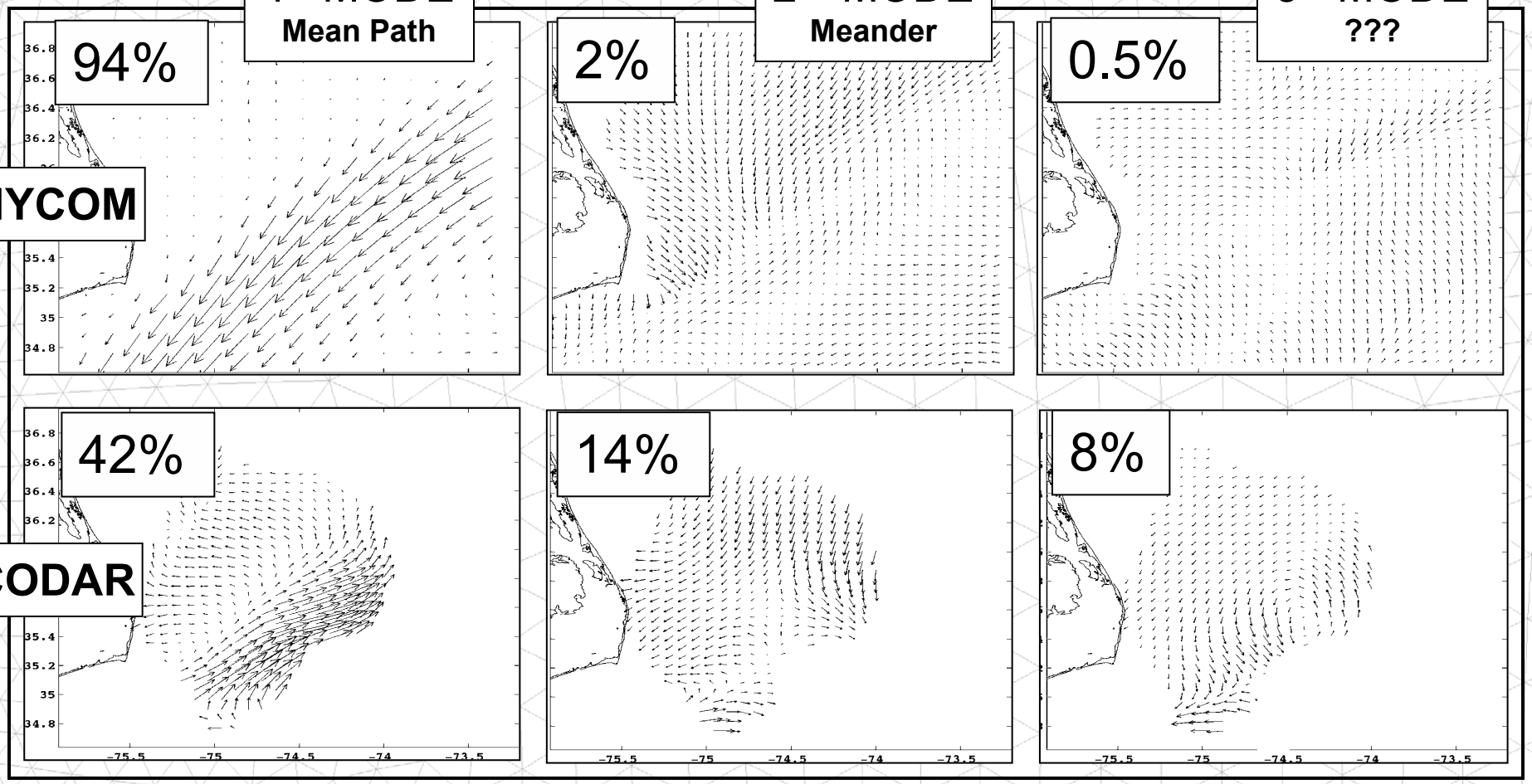
Obs and HYCOM in the SAB

Spatial EOFs - Velocity

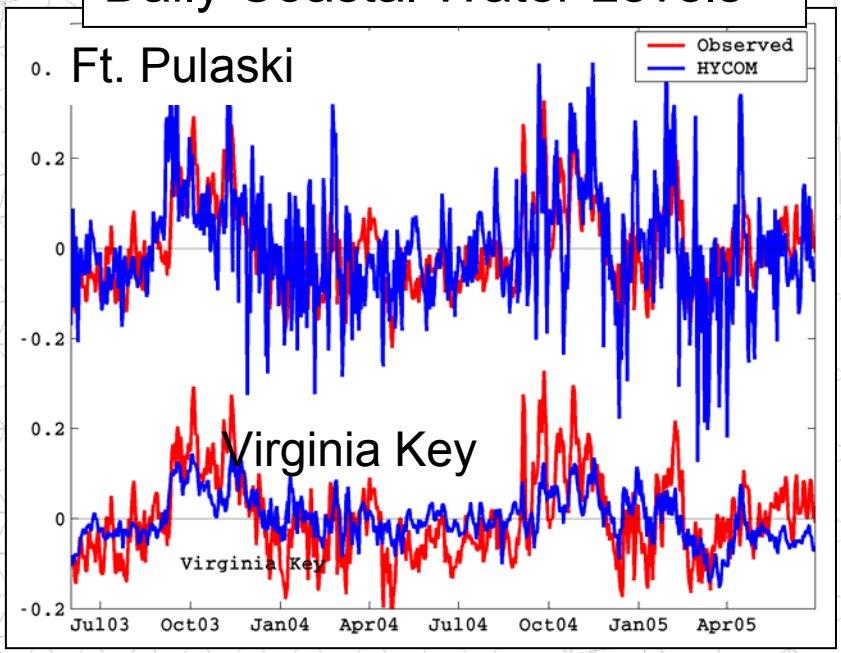


Cape Hatteras HYCOM mixed layer (upper) and CODAR (lower) first three complex principal components. The percent variance represented by each mode is also reported. The EOFs are computed for the month of September 2003.

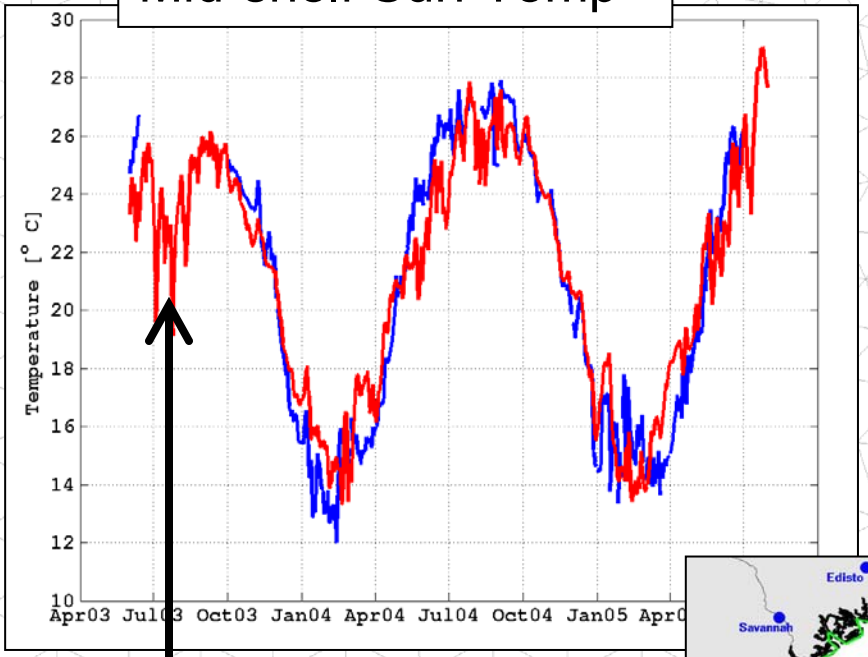
Obs and HYCOM in the SAB

Water levels and Temperature

Daily Coastal Water Levels

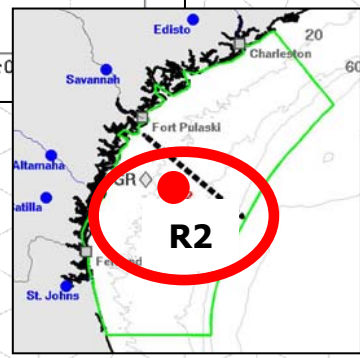


Mid-shelf Surf Temp



Sea level Std. Dev. [m]	*OBS*	*HYCOM*
Ft. Pulaski	.16	.11
Virginia Key	.10	.05

- Strong Eastcoast-wide Cooling in Summer 2003
- RMSE = 1.2 deg C



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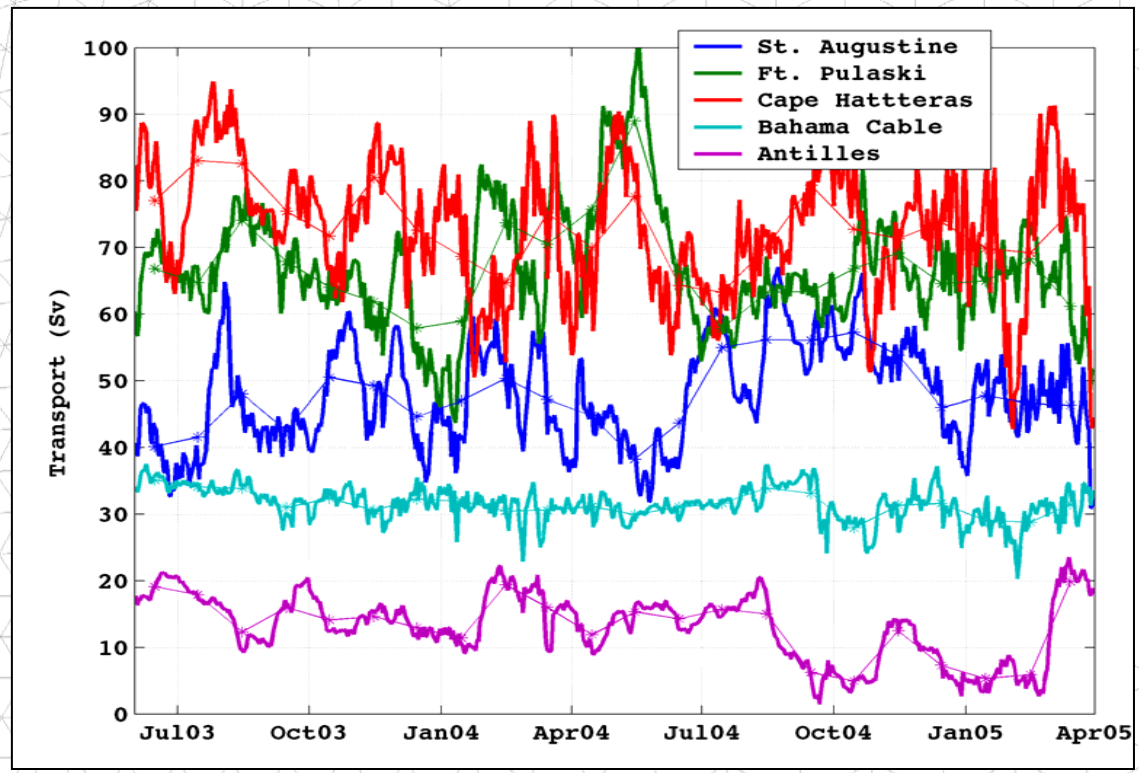
HYCOM (Best-Estimate)
Transports in the SAB



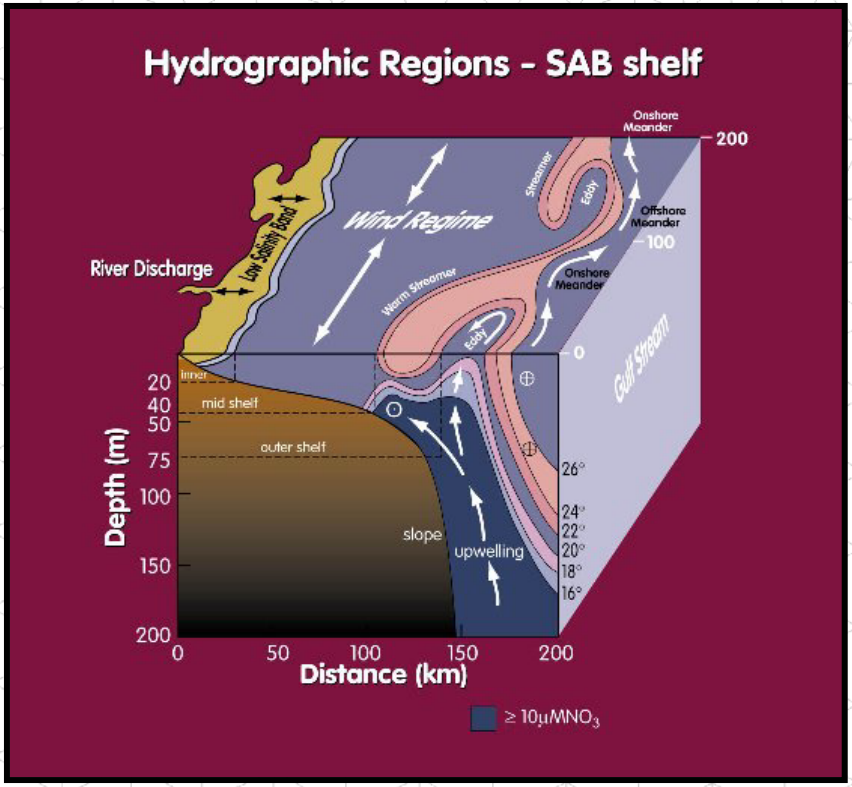
TRANSPORT	Mean (Sv)	Std (Sv)
Cape Hatteras	73	9.8
Ft. Pulaski	67	9.1
St. Augustine	48	7.6
Bahama Cable	31	2.7
Antilles	13	5.0

Primary Modeling Objectives:

•Currently, **neither** *basin-scale* **nor** *regional-scale* models can include all relevant scales/physics for shelf prediction

• We ***augment*** basin-scale HYCOM TS initializations and estimates of TS and sea level along a limited-area domain open boundary, with **locally enhanced resolution, physics, and forcing**, through nesting procedures.

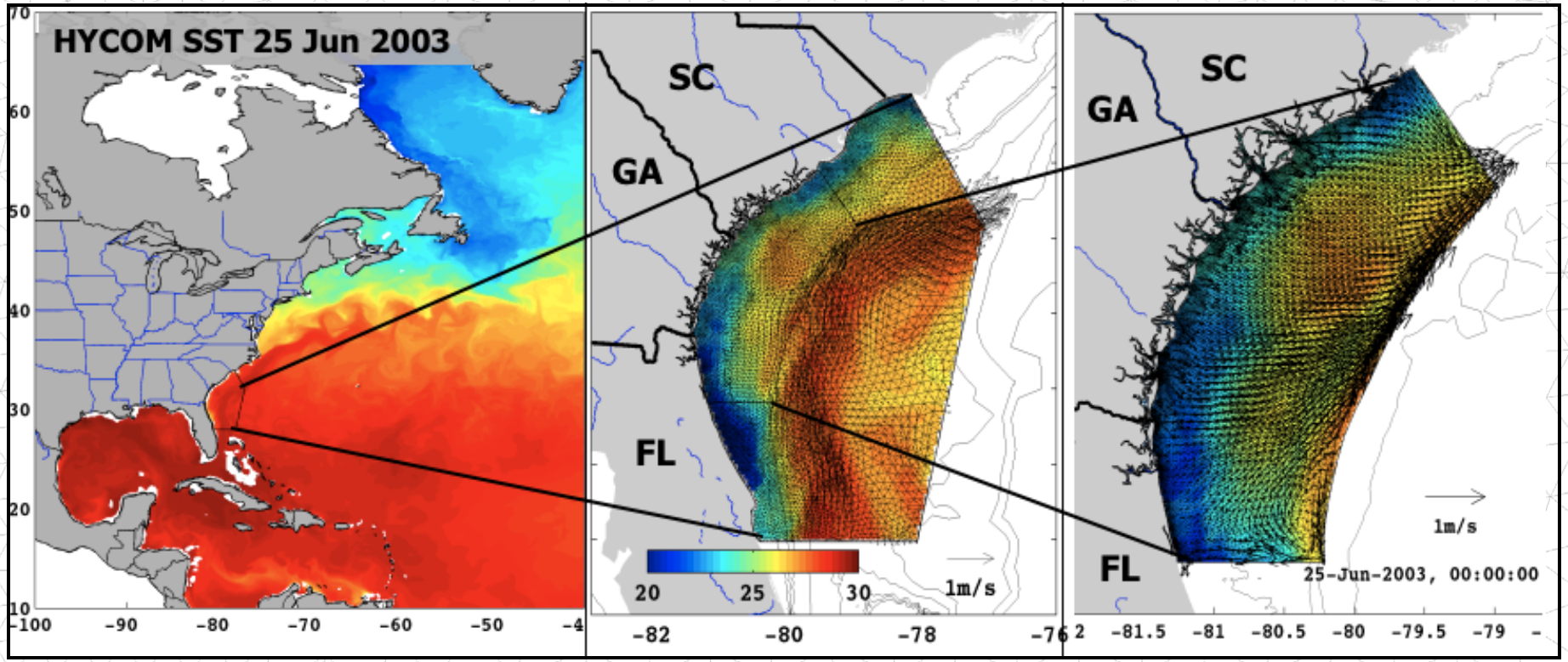
• **Inner-shelf**	coast-20m isobath	*Tides, Winds, Rivers*
• **Mid-shelf**	20m-50m isobaths	*Winds, Tides, Q-Flux*
• **Outer-shelf**	50m-Shelfbreak	*W.B.C. Influences*



SAB Modeling “Additions” using HYCOM as IC and BC estimator

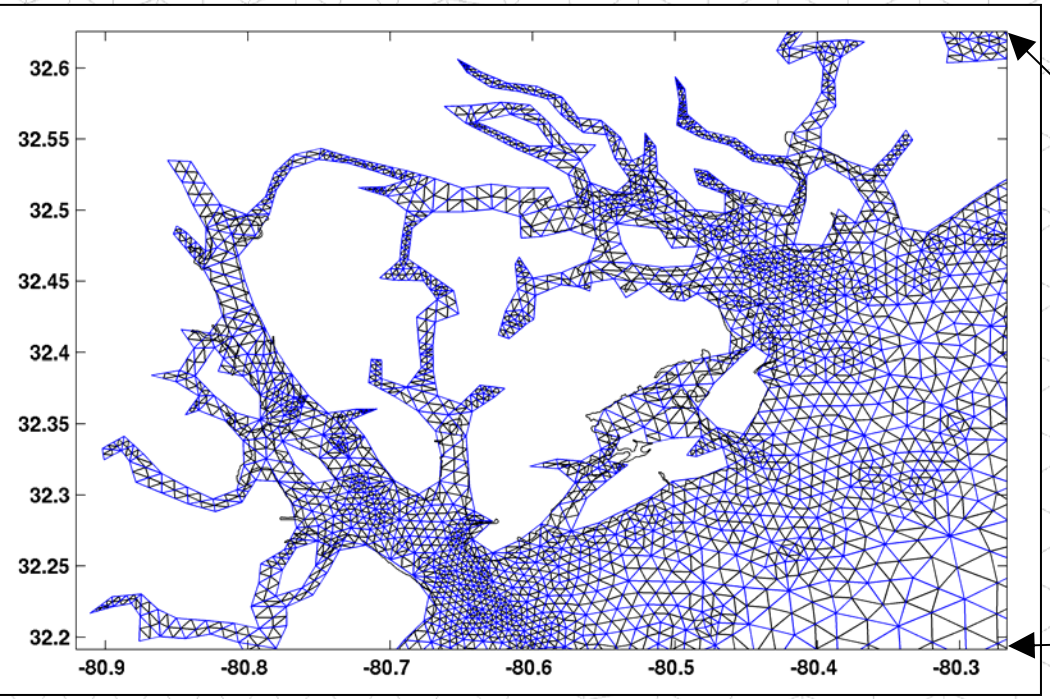
	HYCOM (NRL)	***QUODDY***
Resolution	**~1/12 deg O(10 km)**	**50 m to 5 km**
Bathymetry	**ETOPO5 + local improvements**	**NGDC Coastal Relief Model**
Coastal Wall	**~10-m isobath**	**0-m contour line in NGDC CRM**
Rivers	**NONE in SAB**	**7**
Tides	**NONE**	**Tides (*Blanton et al, 2004.*)**

SAB Nested Regional and Limited-Areas Models

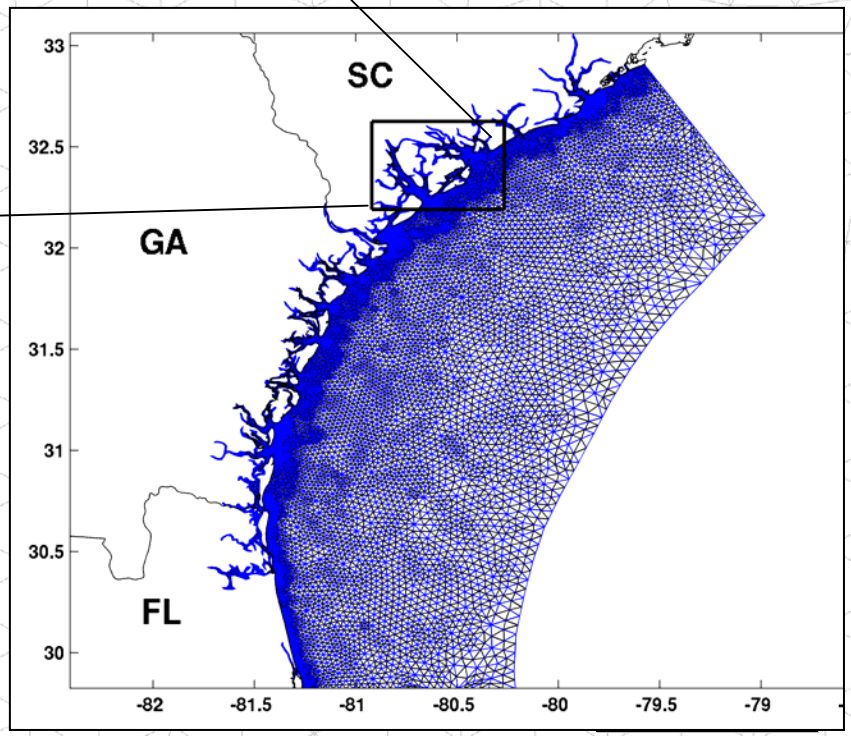


UNC-SAB modeling system sequence that nests the regional-scale QUODDY implementation (middle) within the 1/12 deg operational HYCOM-GODAE model (left). The limited-area QUODDY implementation (right) includes the estuary and tidal inlets along the Georgia/South Carolina coast and extends to the shelf-break.

SAB Limited-Area Model



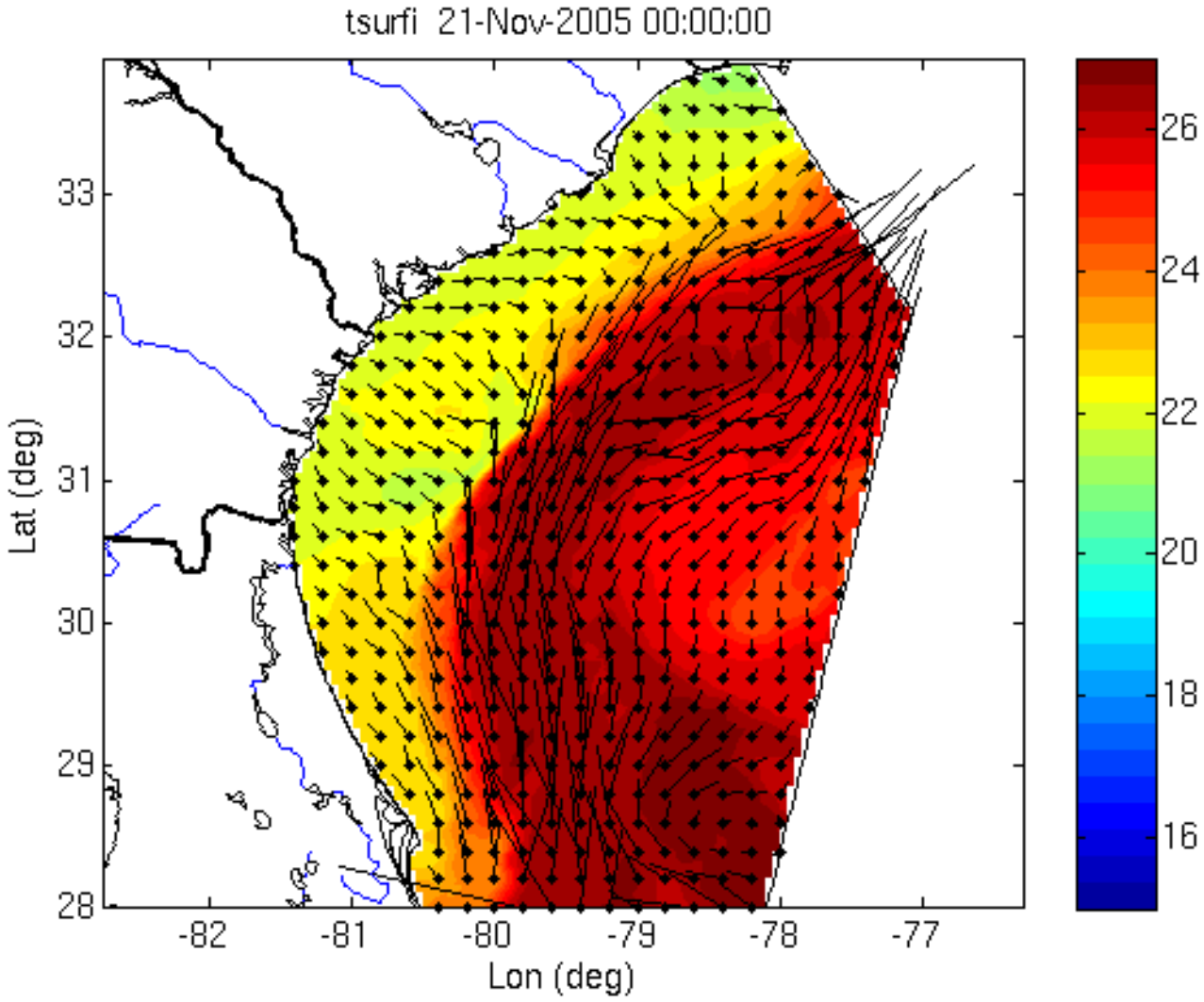
Example of Estuary-to-Shelfbreak Finite Element Mesh



Coastal Simulation Engine: QUODDY

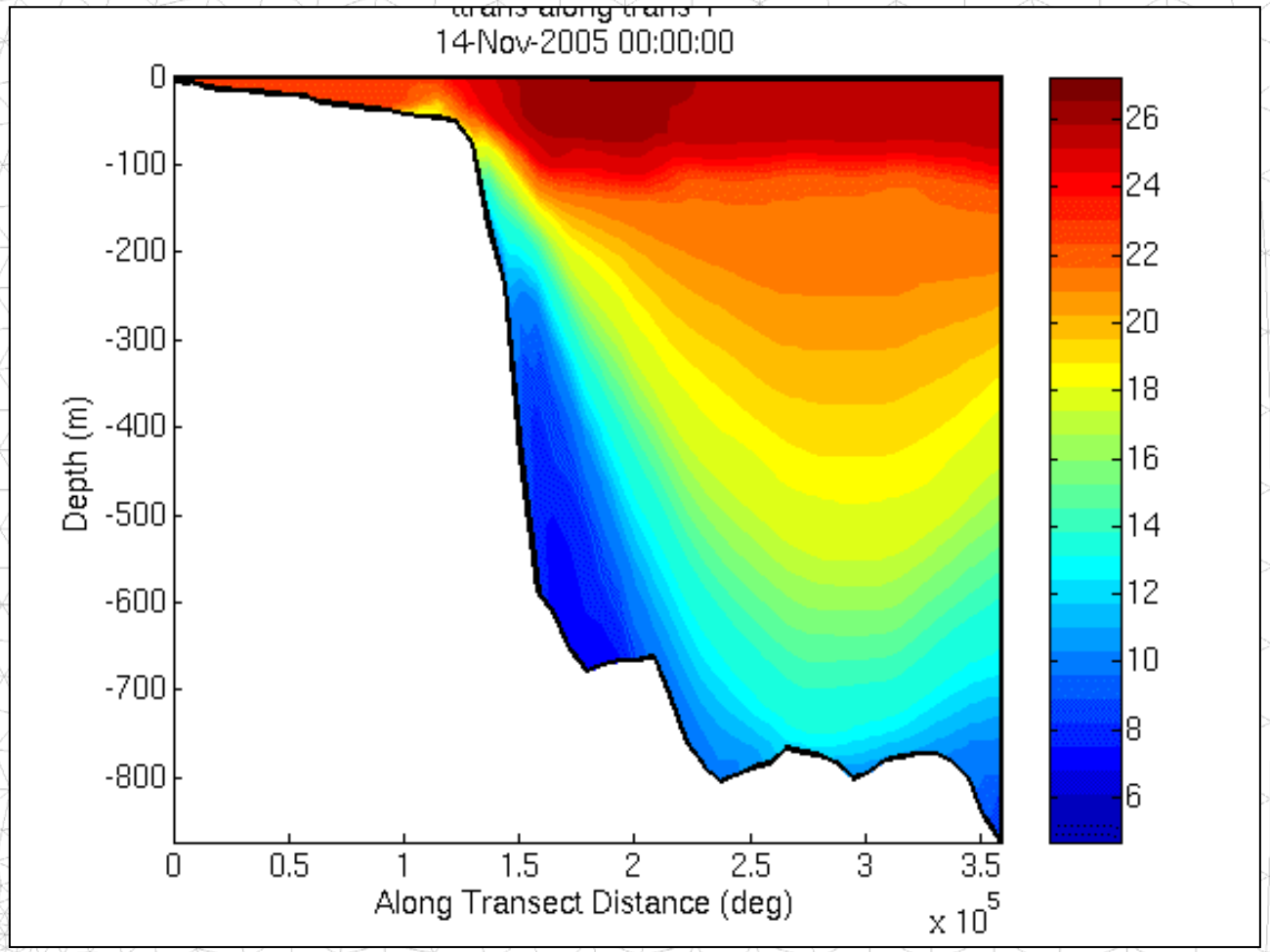
- Nonlinear, prognostic, finite element (Lynch et al, CSR, 1996)
- Pointwise-Corrected Transport (Kliem, OM, 2004)

SAB HYCOM -->> QUODDY



- Interpolated to regular grid for Viz.
- Init Date=21 Nov 2005
- 5-day tidal spin-up from 16 Nov
- HYCOM HC/FC TS on OBC

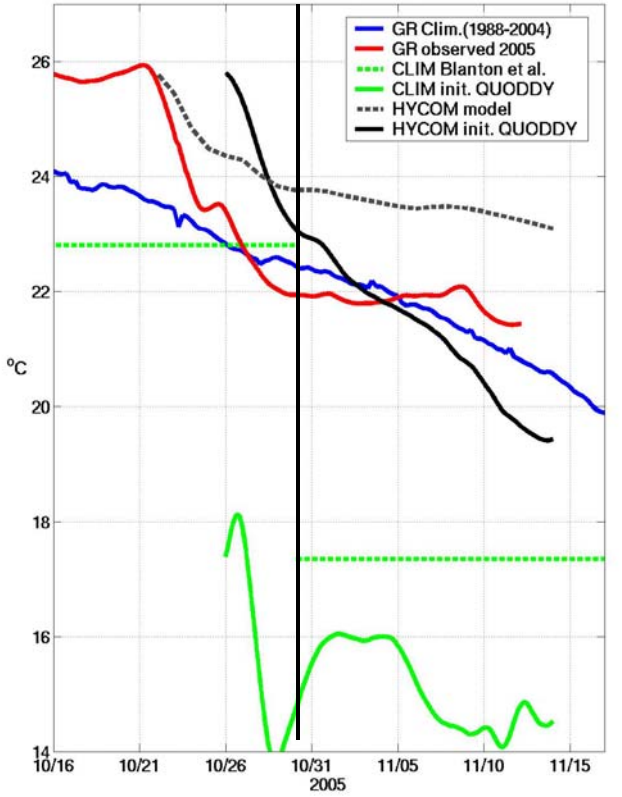
SAB HYCOM -->> QUODDY



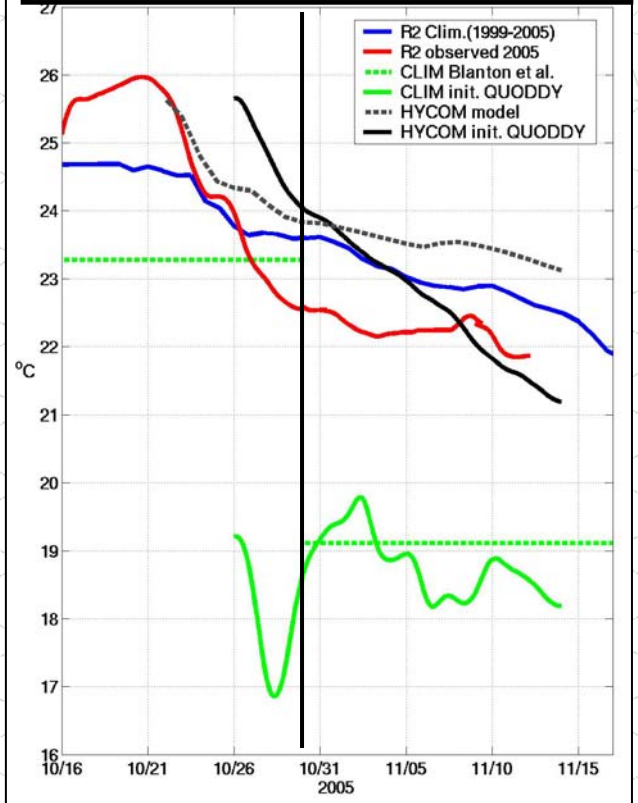
- Cross-shelf temp. trans.
- Init Date 14 Nov 2005
- 5-day tidal spin-up from 16 Nov
- HYCOM HC/FC TS on OBC

Temperature HCs

Surface Temp.
Gray's Reef (Oct-Nov 2005)



Bottom Temp.
R2 Tower (Oct-Nov 2005)



- Regional QUODDY
- Various Initializations
  - HYCOM BestEst
  - SAB Climatology
- Forcing:
  - Tides
  - NAM Fluxes
  - OBC:
    - Climatology
    - HYCOM

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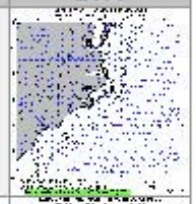
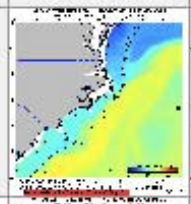
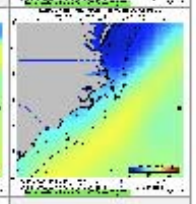
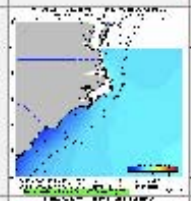
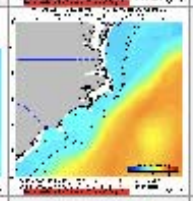
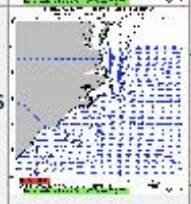
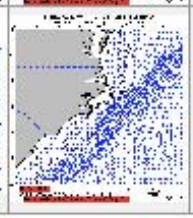
Model Output

by Luke Stearns — last modified 2005-12-03 10:34

Parameter	ADCIRC	HYCOM	ETA
Wind			
Sea Surface Temperature			
Water Level			
Surface Currents			

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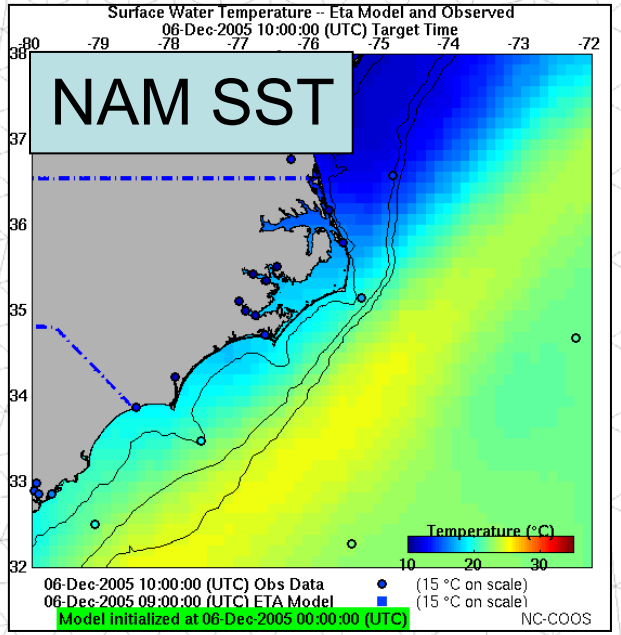

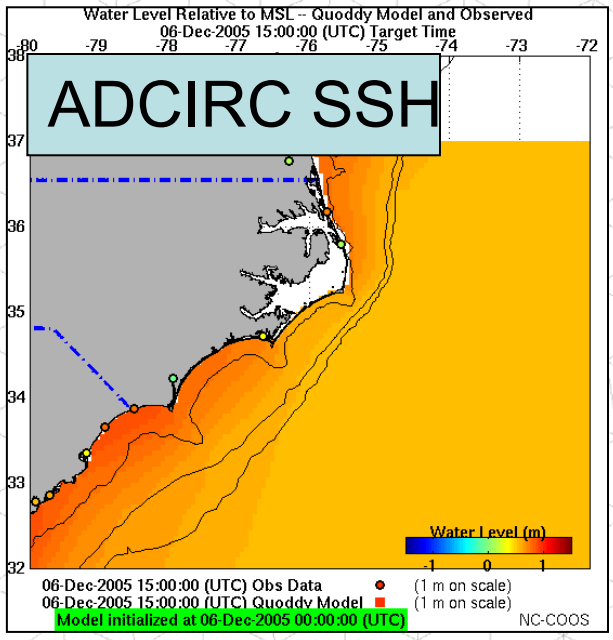

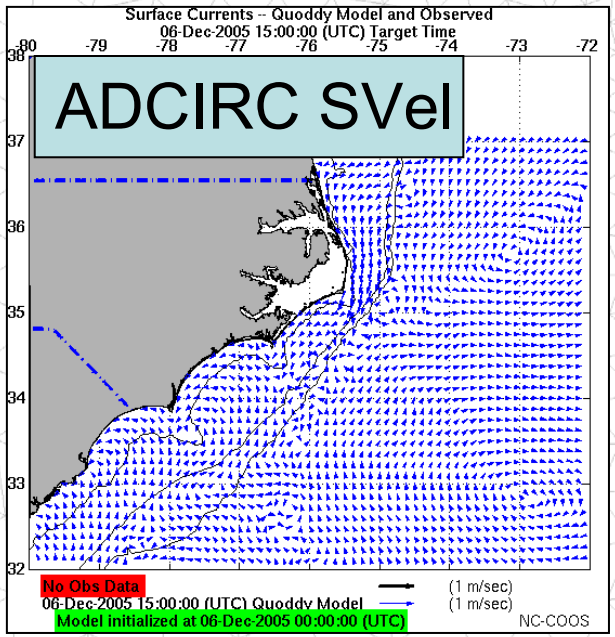

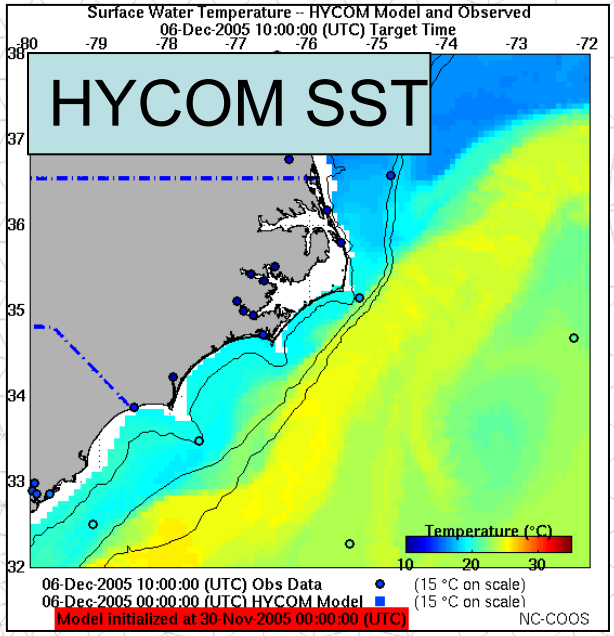

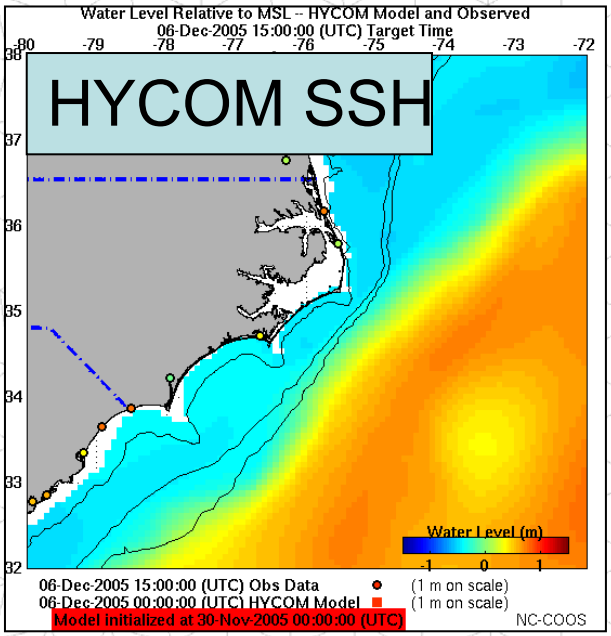

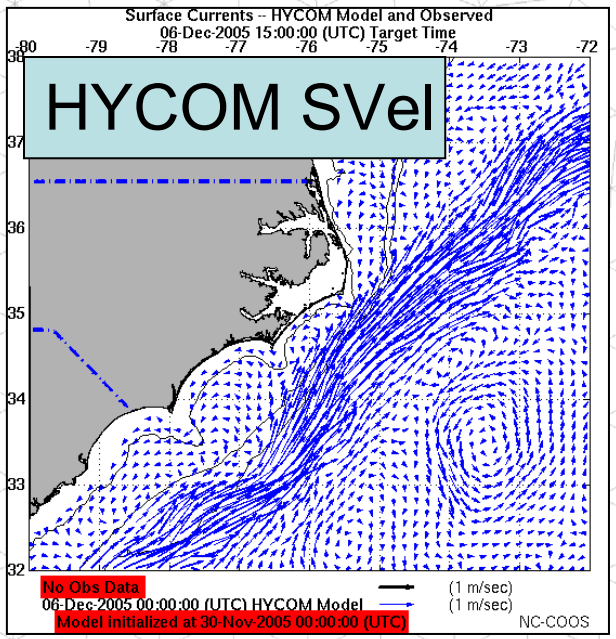

Plans

- Links to NCEP HYCOM (Lozano/Rao)
  - Coupled HYCOM/WRF winds and pressure for storm-surge applications
  - Smoother shelfbreak transition
  - Higher NC/FC update frequency
- Move to Baroclinic ADCIRC
  - Main Advantage: MPI!!!!!
- Formal BC impact analysis
- FC Skill Assessment of BCs
- General basin-scale model issues:
  - Coastal Wall definition
  - Bathy in SAB

Data Access/Distribution

- In demonstration mode, which we are in, timely availability of HYCOM NC/FC is not critical.

- In future “Operational” modes, immediate availability of NC/FC IS critical.

- We need to consider peer-to-peer methods
  - ?? LDM - push of solutions as they become available at NRL
  - ?? Replica services