

Evaluation of HYCOM Performance on the West Florida Shelf

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Primary Collaborators:

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Smedstad, James Cummings**

Goals

- **Document sensitivity of nested HYCOM West Florida Shelf simulations to initial and boundary conditions provided by GODAE products**
 - HYCOM to HYCOM nesting
 - Initially compare three products
 - Free-running Gulf of Mexico model (baseline)
 - 0.08° Atlantic OI hindcast
 - NCODA Gulf of Mexico hindcast
- **Evaluate HYCOM performance as a coastal ocean model**
 - Ongoing model improvement effort
 - Tidal forcing
 - ROMS pressure gradient formulation
 - Wetting-drying
 - Bottom boundary layer parameterizations

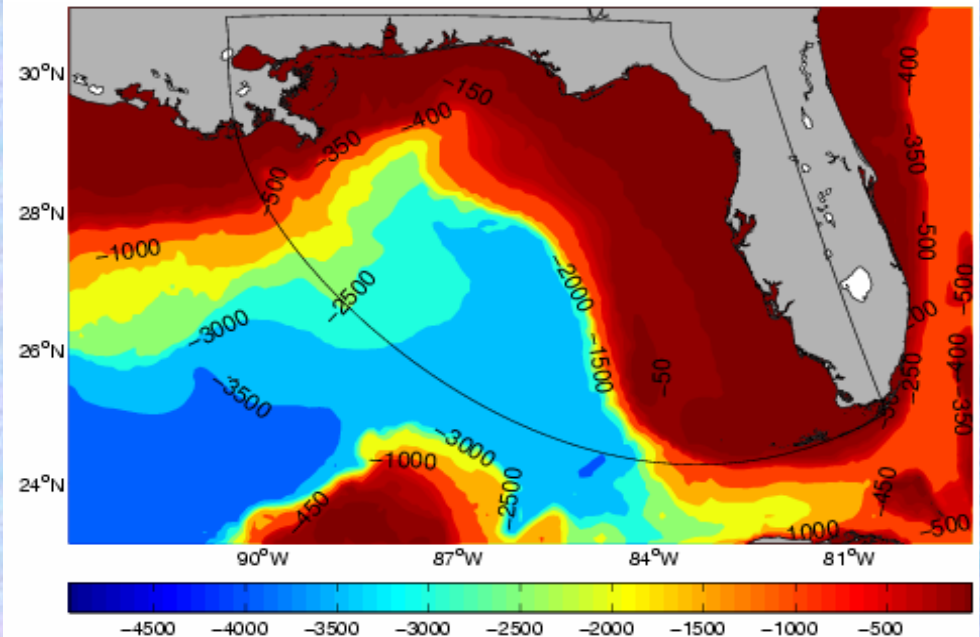
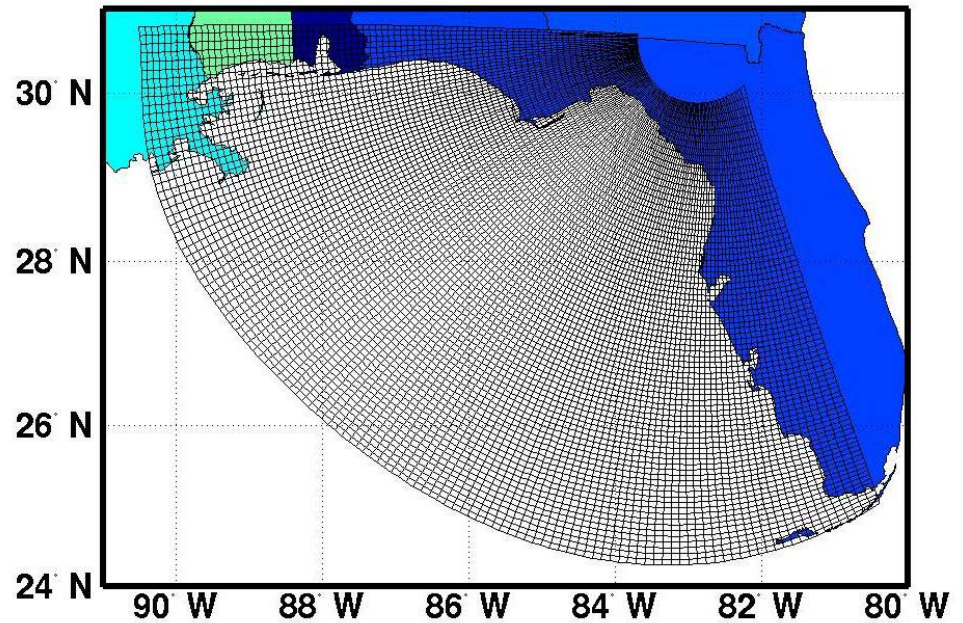
WFS Simulations

- **Performed on USF curvilinear WFS grid**
 - Facilitate future model-model comparisons
- **Changes from outer model (value added)**
 - 6 additional layers at the top
 - Enables sigma coordinates to resolve both the surface and bottom boundary layers out to the shelfbreak
 - COAMPS (27km) atmospheric forcing
- **Run for 2004-2005**
 - Fields archived every 6 hr for analysis
- **Three experiments**
 - Free-running IC/BC
 - HYCOM-NCODA IC/BC
 - Atlantic OI IC/BC

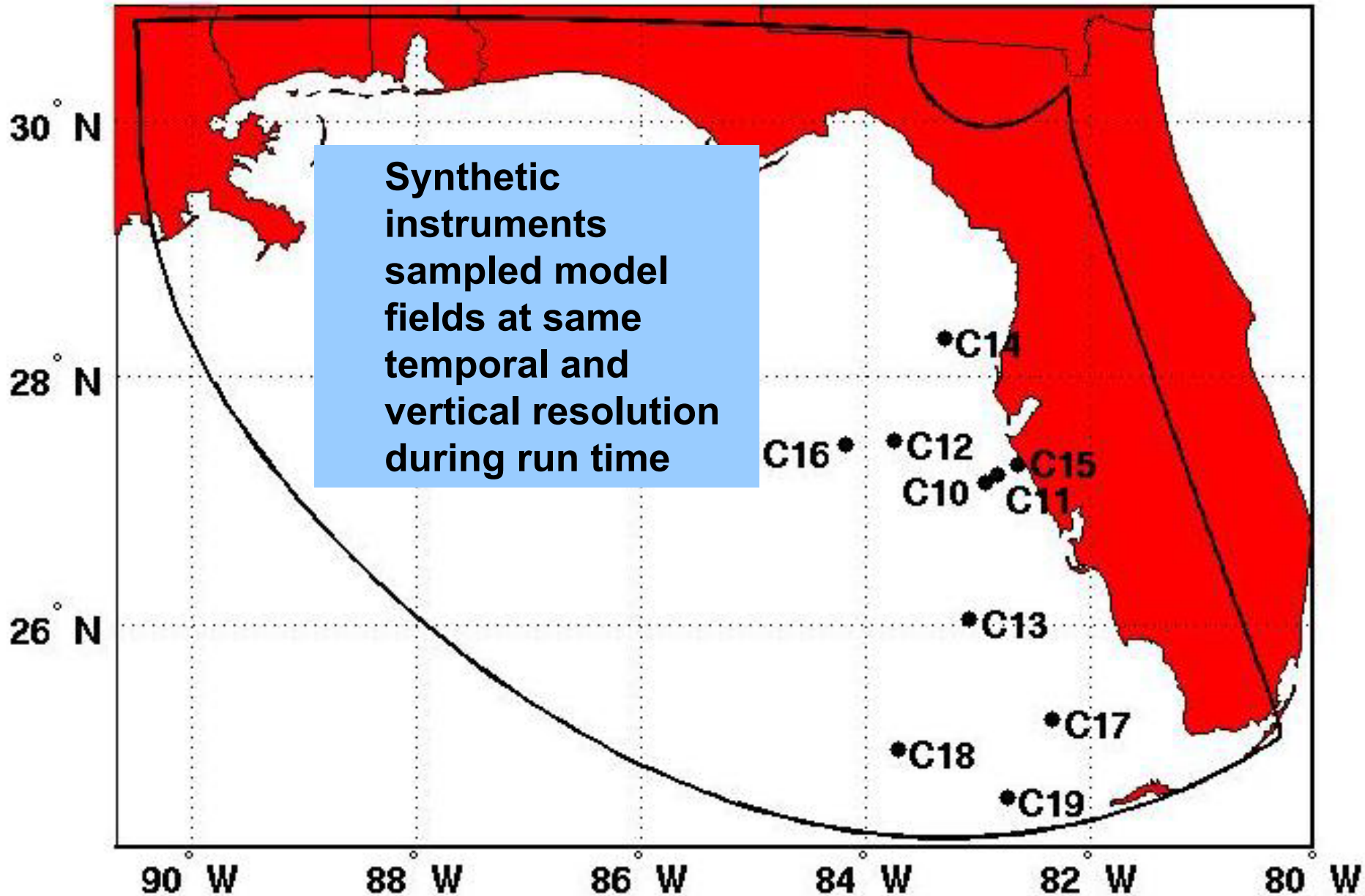
**University of South
Florida curvilinear grid
and bathymetry
(122 x 82 mesh)**

**One nesting boundary
Layer, 11 grid points
wide**

WFS Grid



Stations



Outline

- **Problem with Atlantic OI nesting**
- **Impact of distance to the nesting boundary**
- **Sensitivity of WFS currents to outer model choice**
 - Free-running model vs. NCODA assimilation
- **Impact of pressure gradient formulation**
 - ROMS vs. original Montgomery potential

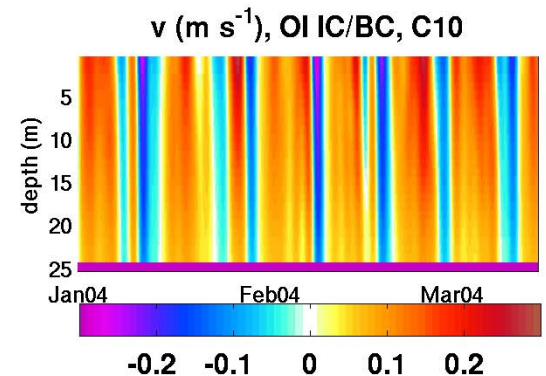
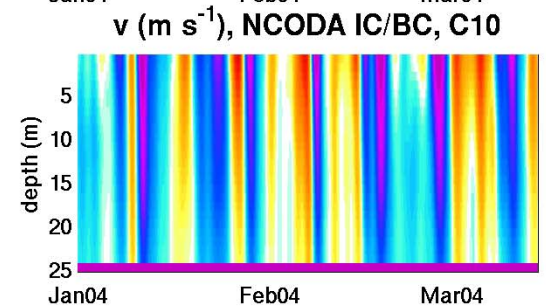
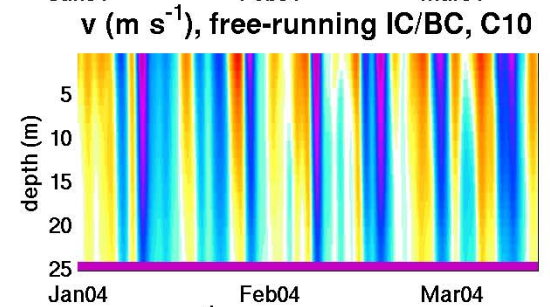
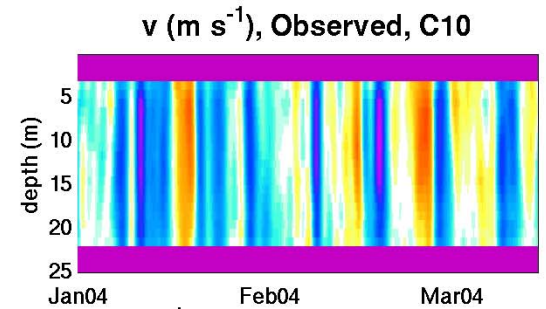
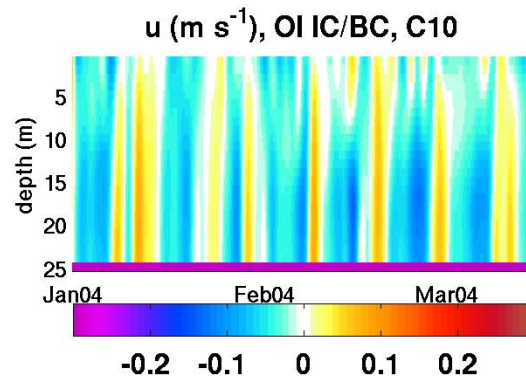
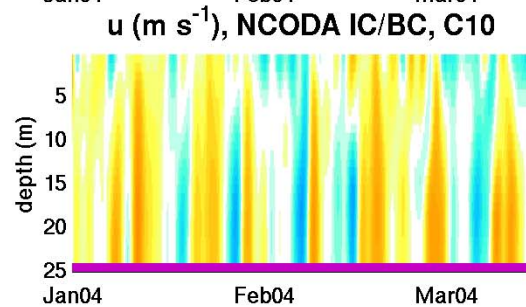
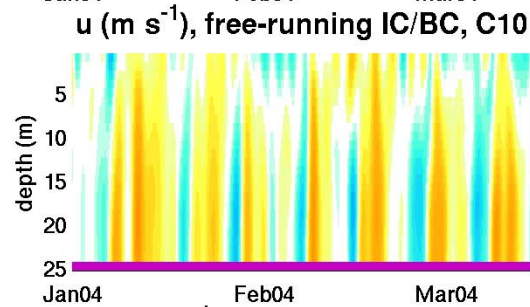
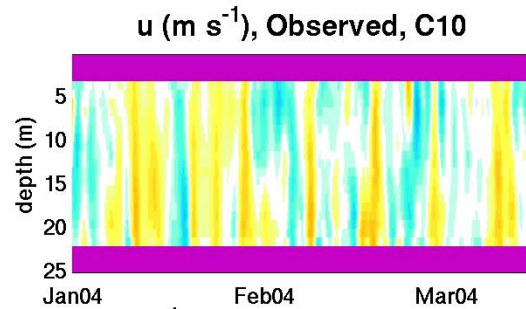
Mooring C12

Observed

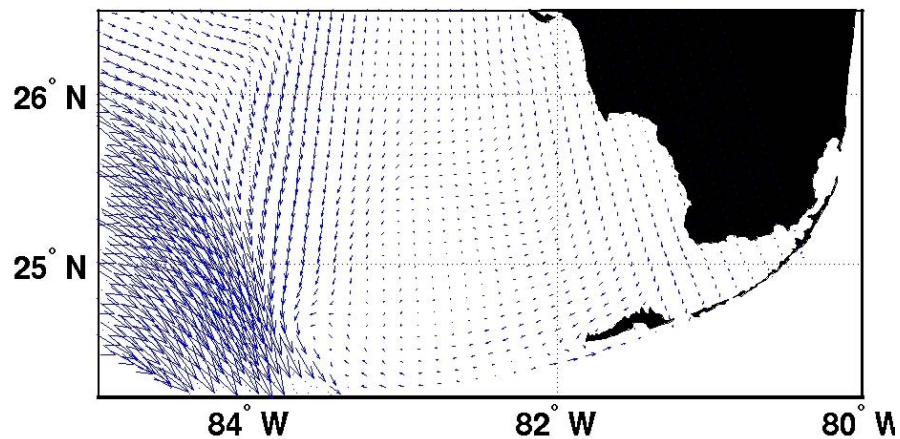
GOM Free

GOM NCODA

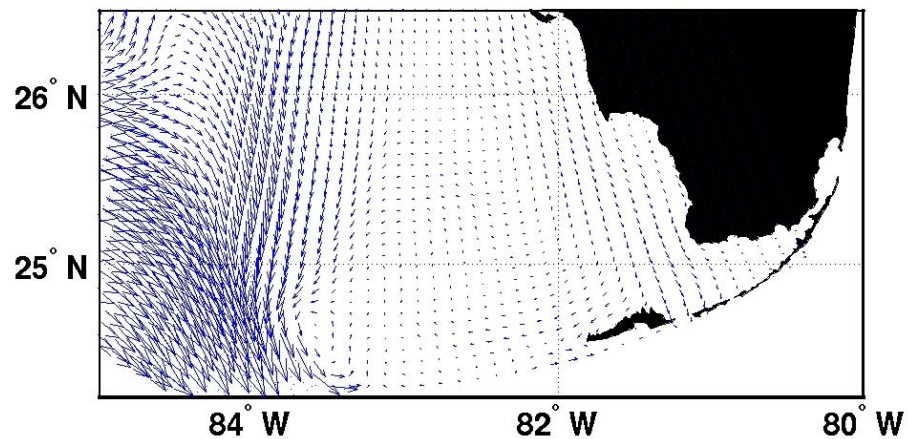
Atlantic OI



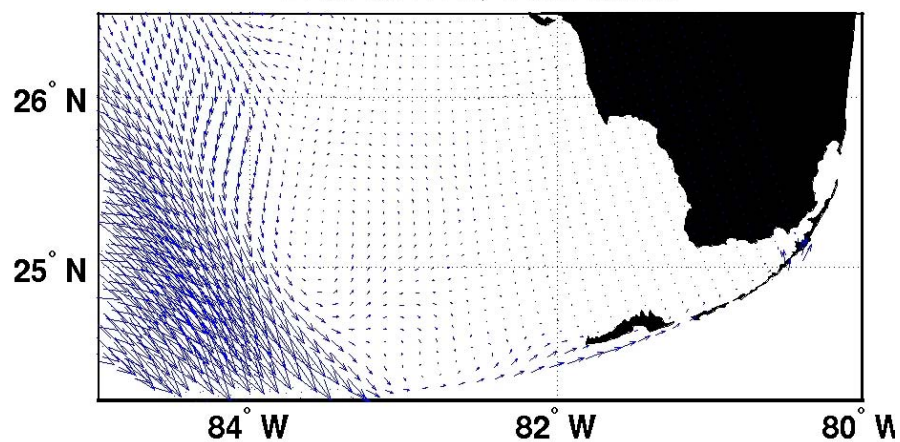
NCODA Mean Flow, Outer Model



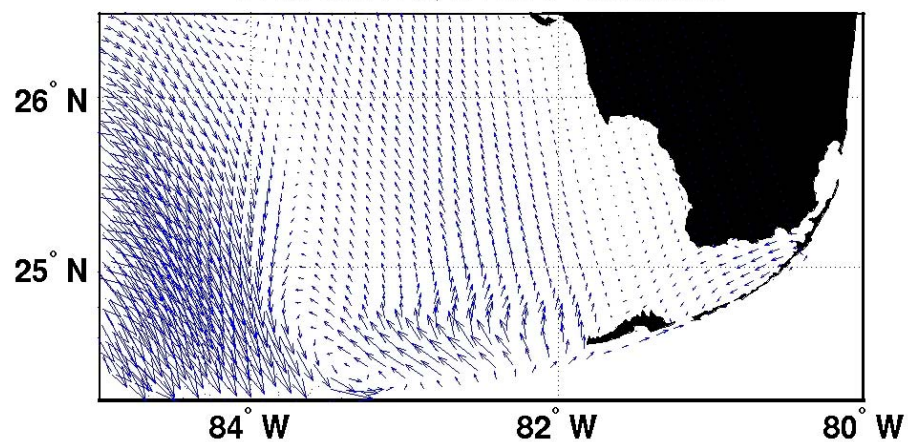
NCODA Mean Flow, Nested Simulation



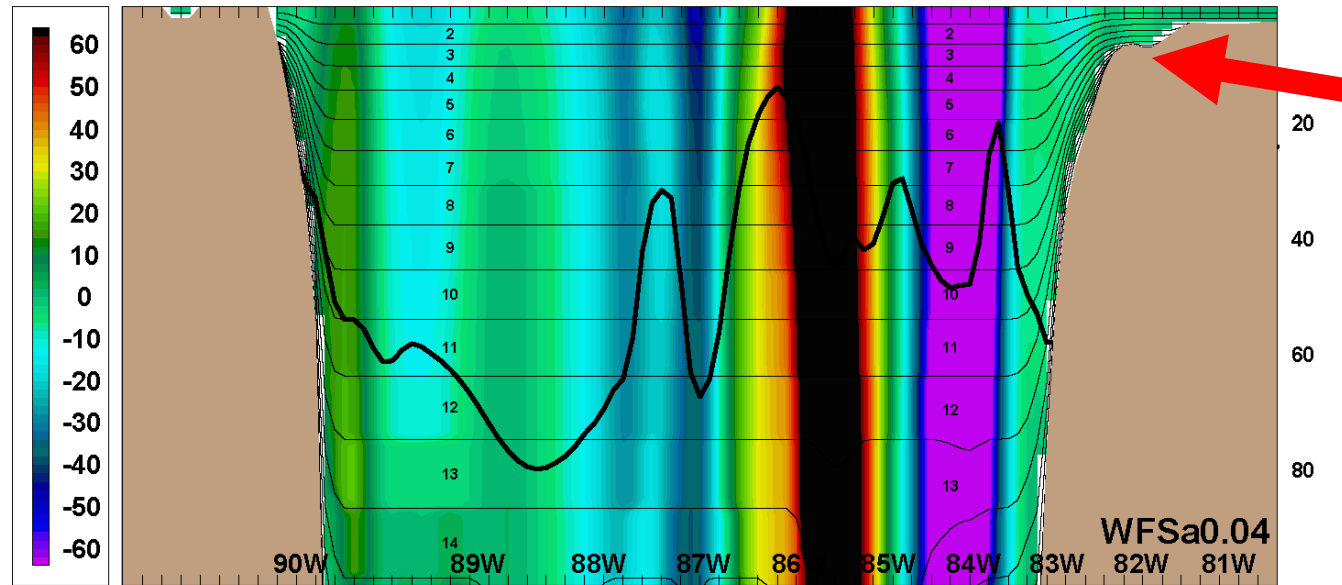
OI Mean Flow, Outer Model



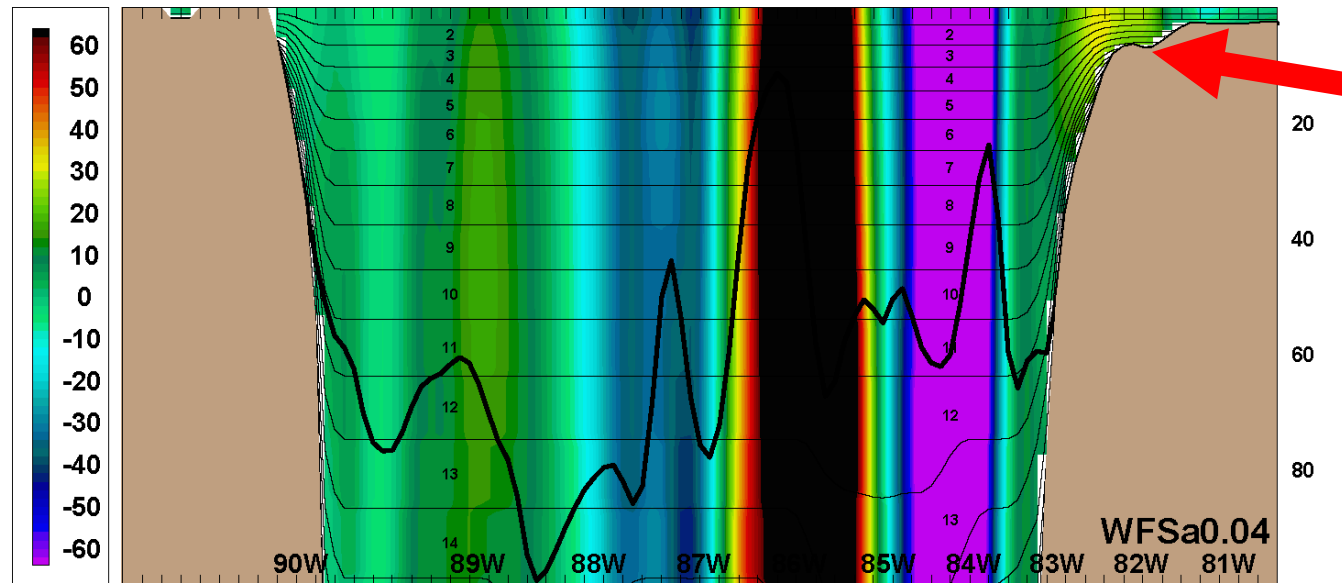
OI Mean Flow, Nested Simulation



v-velocity zonal sec. 25.27n Jan 22, 2004 00Z [09.1H]



v-velocity zonal sec. 25.27n Jan 22, 2004 00Z [31.0H]



Outline

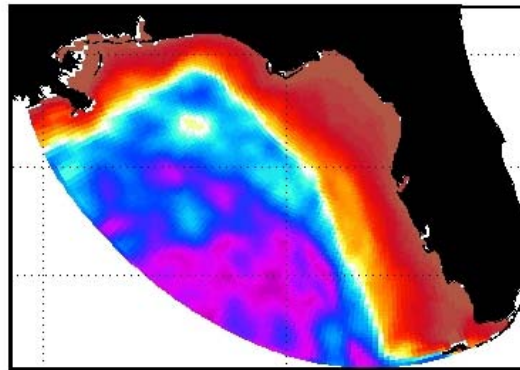
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Vector surface velocity correlation, 2004-2005

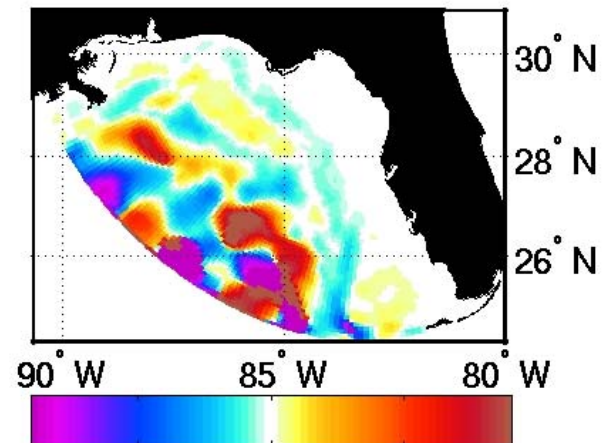
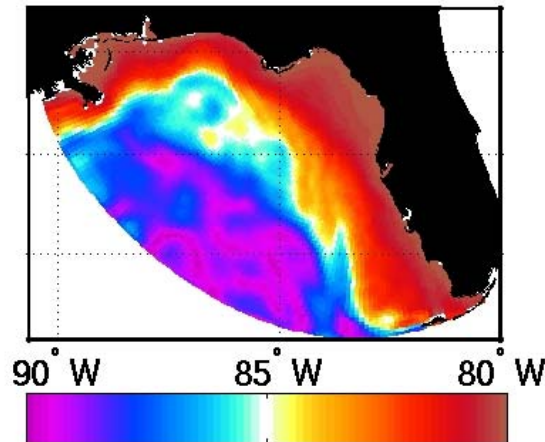
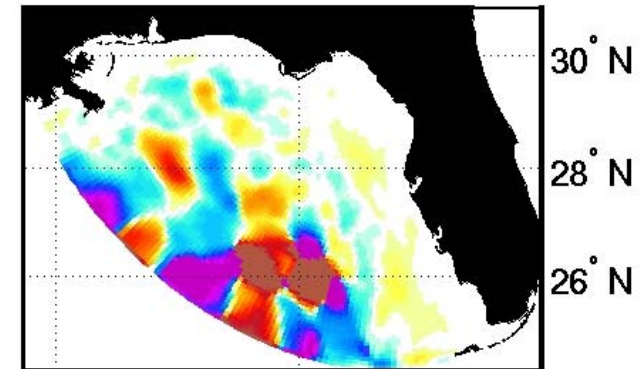
Outer model
fields, free-
running vs.
NCODA

Nested
simulation
fields, free-
running vs.
NCODA

Correlation Magnitude



Correlation Phase



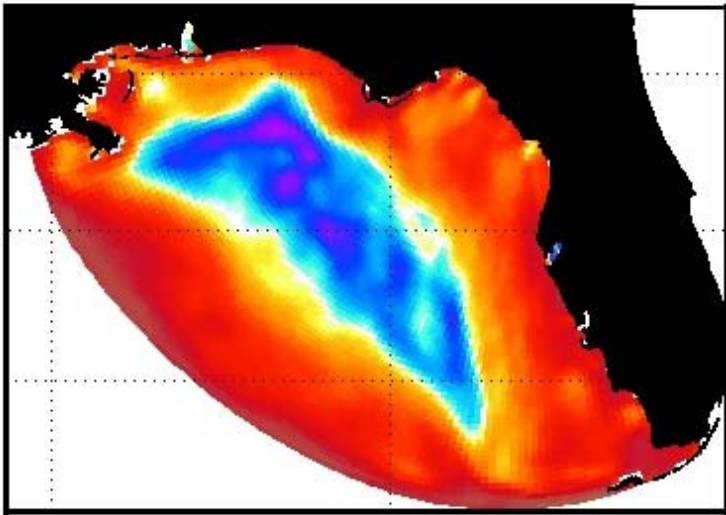
0 0.5 1

-50 0 50

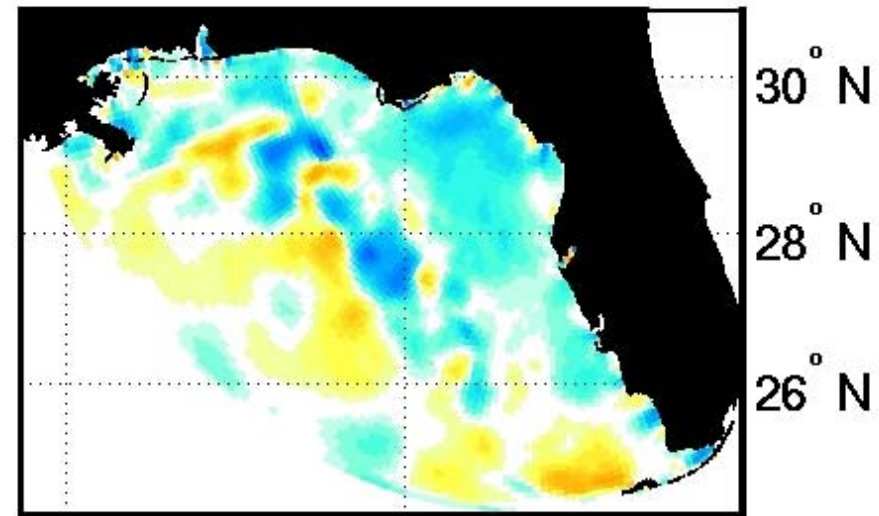
Vector surface velocity correlation, 2004-2005

NCODA case
outer model
vs. simulation

Correlation Magnitude



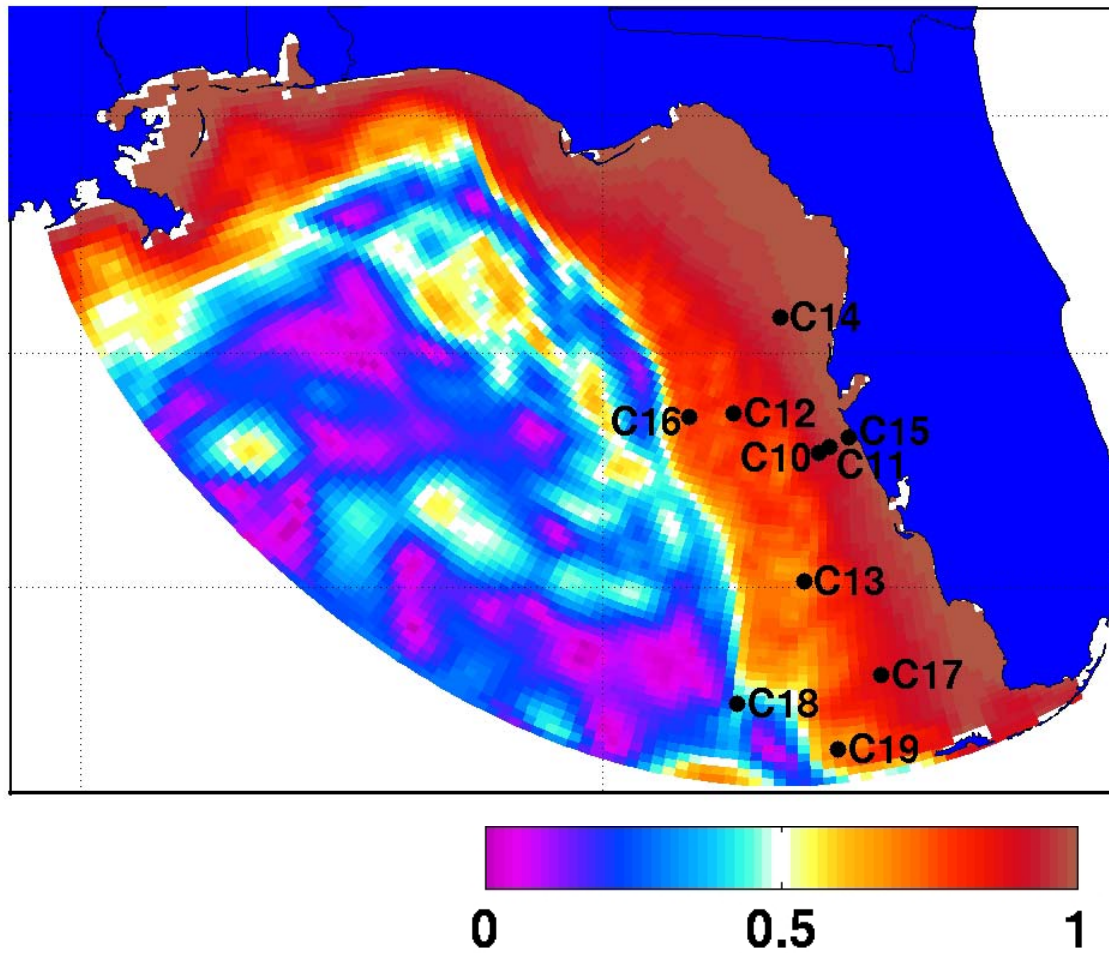
Correlation Phase



Outline

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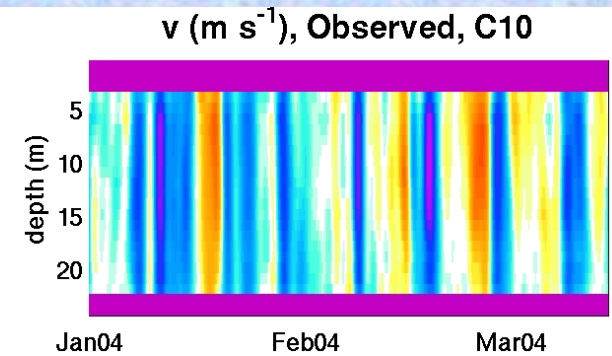
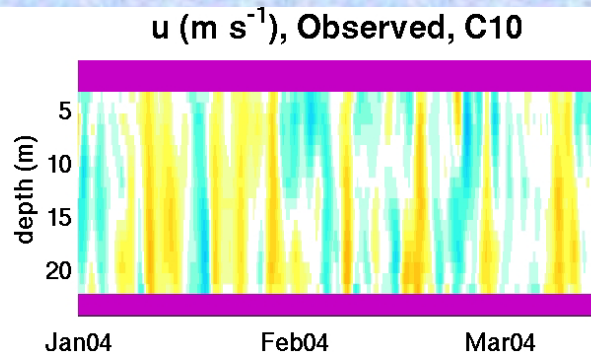
Winter 2005 Correlation Magnitude



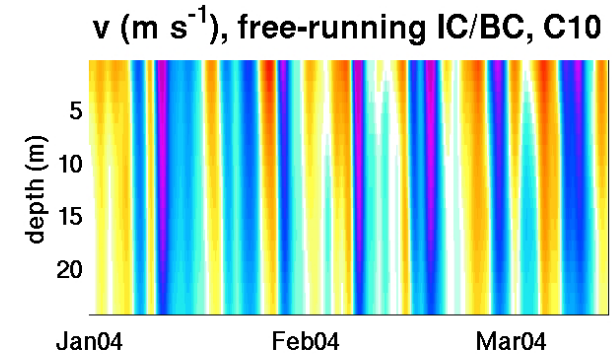
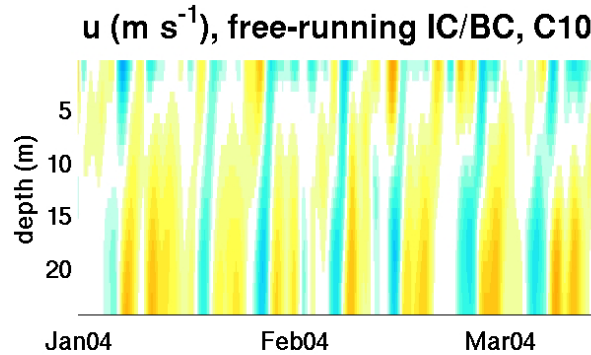
C10, Winter 04

Vector correlation >0.8

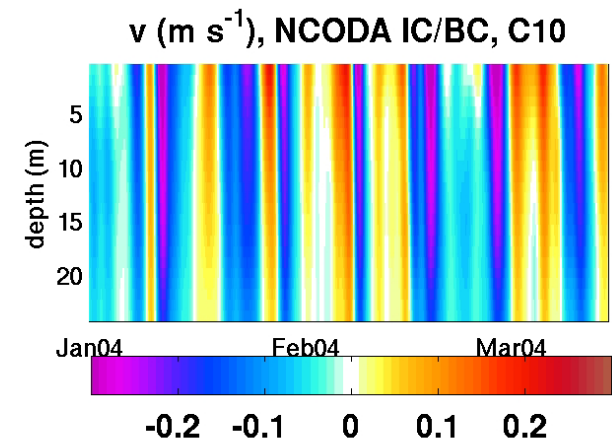
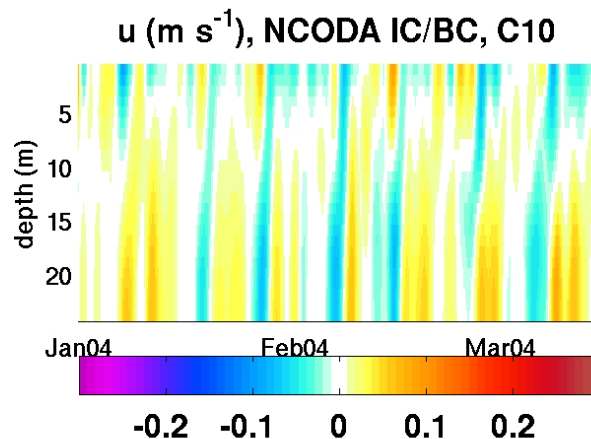
Observed



Free



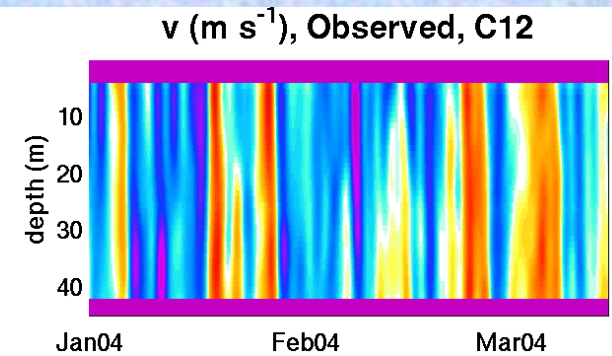
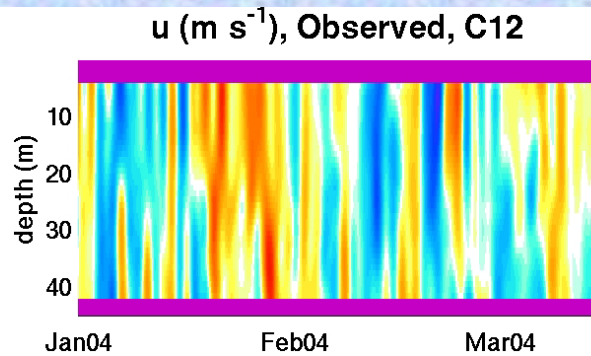
NCODA



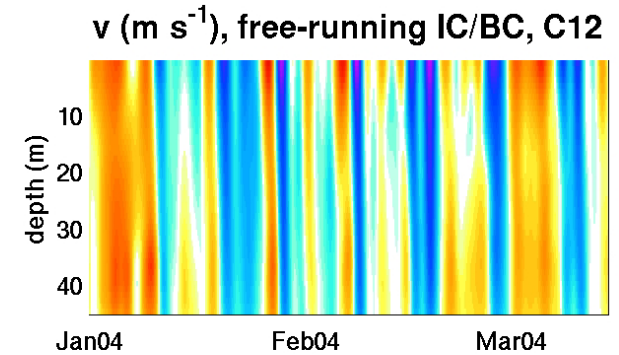
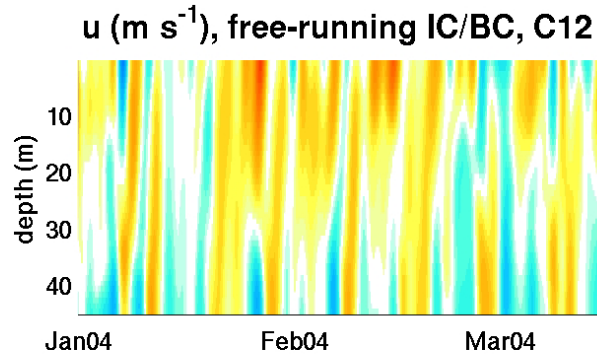
C12, Winter 04

Vector correlation ~ 0.6

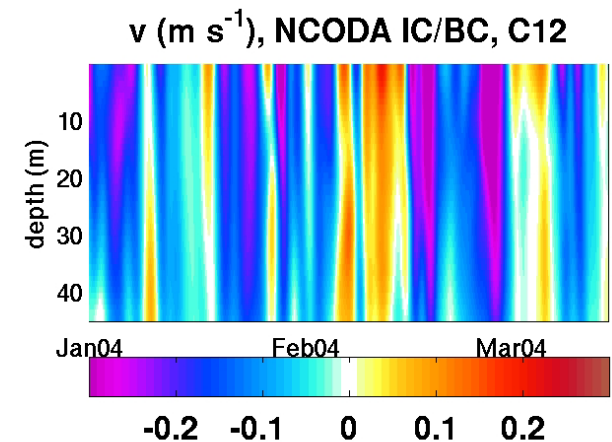
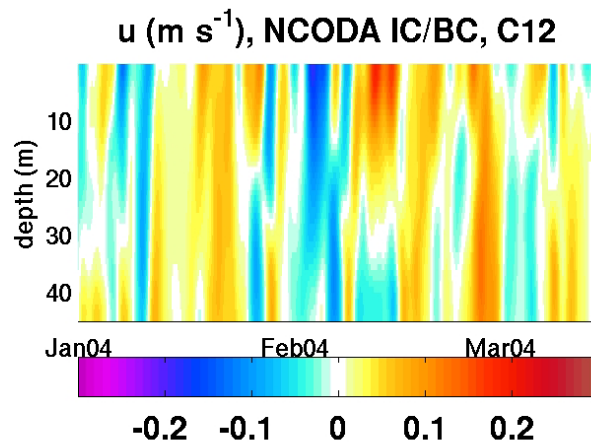
Observed



Free



NCODA

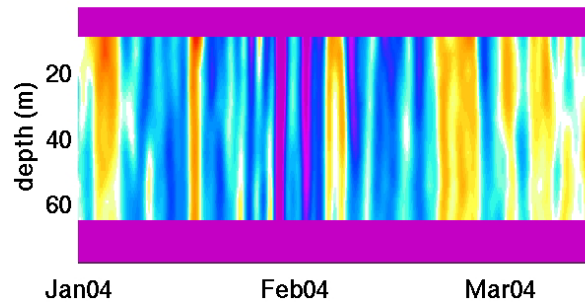


C18, Winter 04

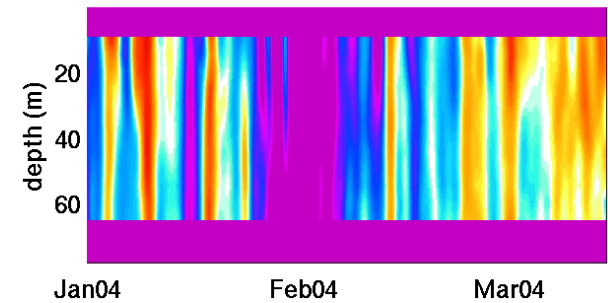
Vector correlation ~ 0

Observed

u (m s^{-1}), Observed, C18

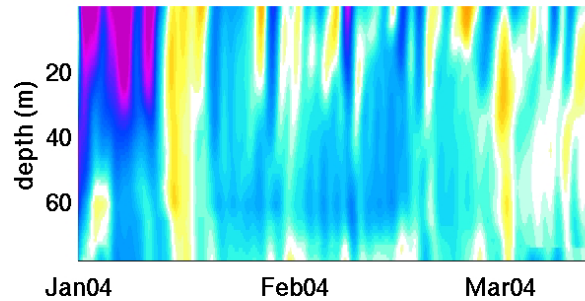


v (m s^{-1}), Observed, C18

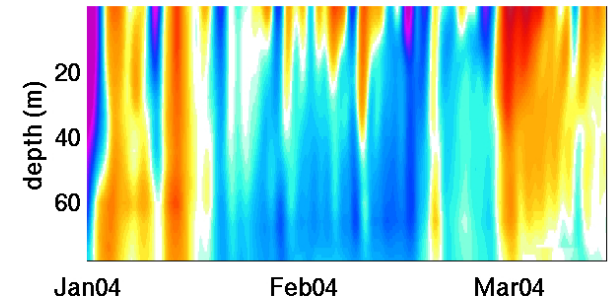


Free

u (m s^{-1}), free-running IC/BC, C18

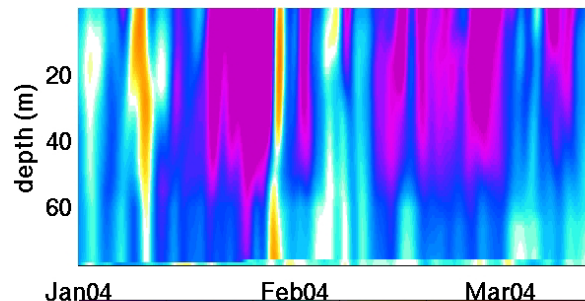


v (m s^{-1}), free-running IC/BC, C18

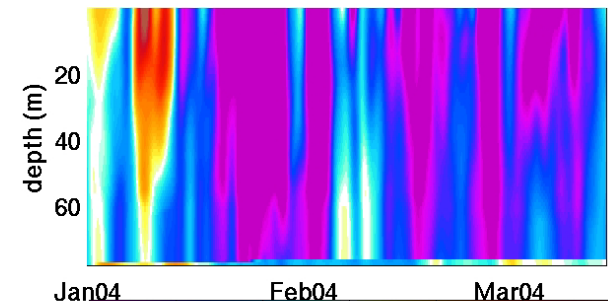


NCODA

u (m s^{-1}), NCODA IC/BC, C18



v (m s^{-1}), NCODA IC/BC, C18



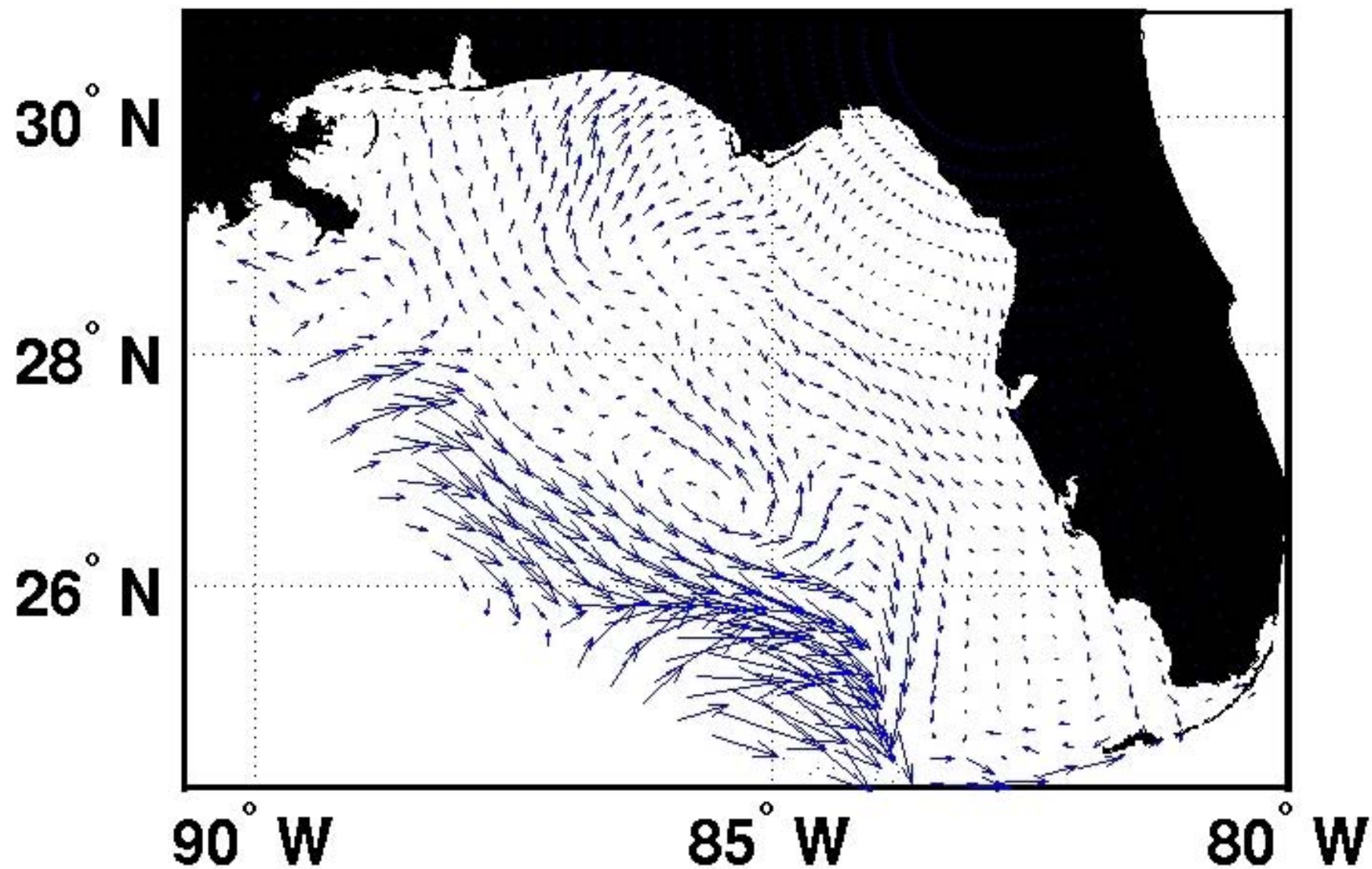
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-0.2 -0.1 0 0.1 0.2

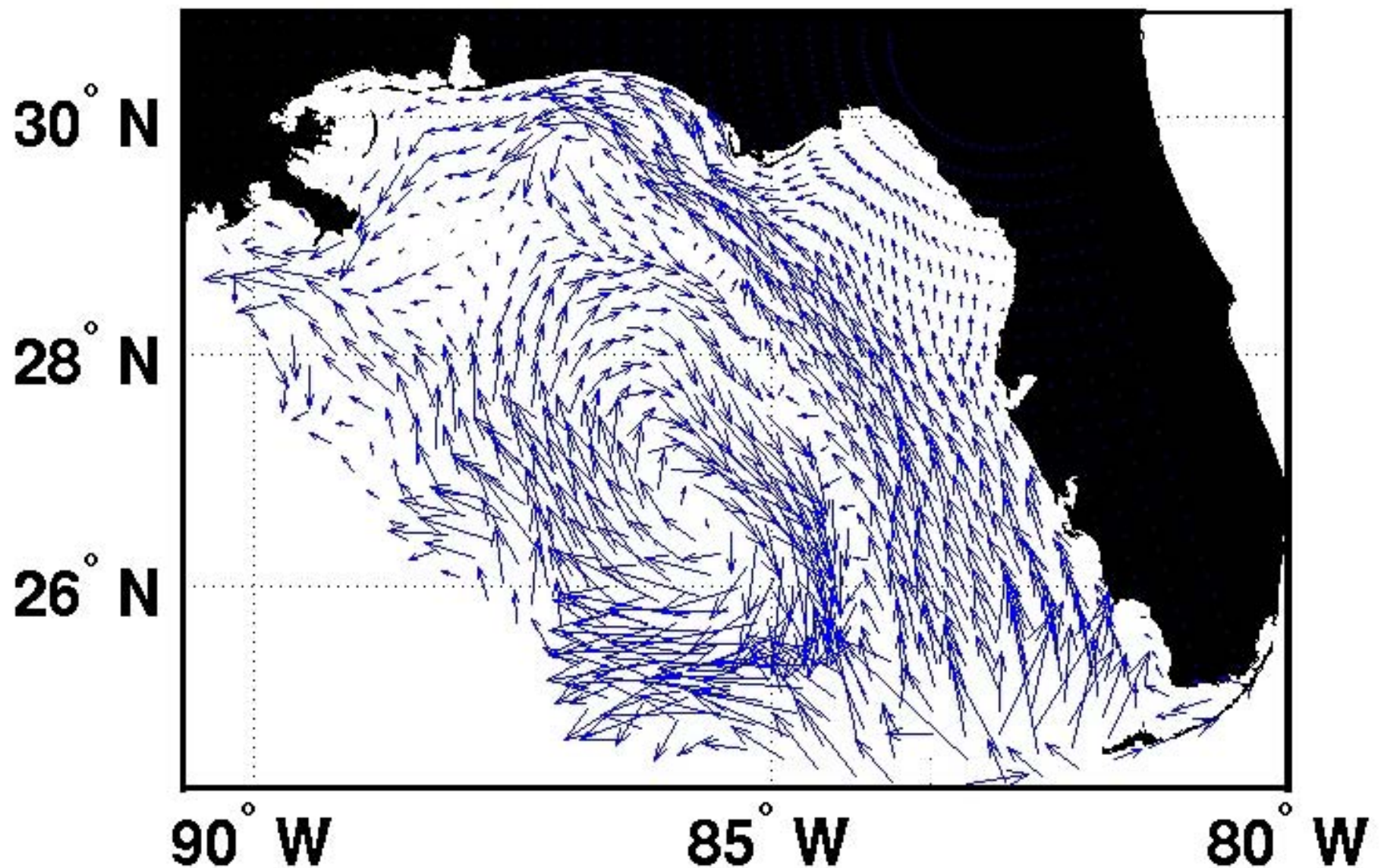
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Mean Flow, MONTG PG



Mean Flow Difference, MONTG vs ROMS PG



Plans

- **WFS**
 - Ongoing HYCOM evaluation
 - Scientific studies in collaboration with USF group
 - Directly compare HYCOM to ROMS
- **Test new version of vertical grid generator**
- **Evaluate ROMS PG formulation using seamount problem**
- **Hurricane response studies (with N. Shay, C. Lozano)**
- **Other collaborative projects**
 - Interannual Atlantic Ocean climate (with Z. Garraffo, E. Chassignet, A. Bozec, S. Lozier)
 - SoFLA analysis (with V. Kourafalou)
 - OSSE development effort (with V. Kourafalou)
 - “Wide” Caribbean domain (western tropical Atlantic, with V. Kourafalou, Z. Garraffo, and many others)