Modeling the West Florida Shelf Circulation with POM, ROMS and FVCOM:

Inter-Comparisons Gauged Against in-situ Data

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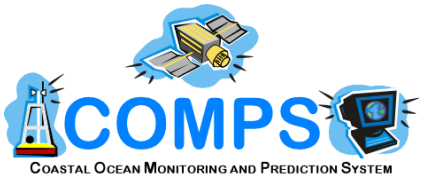


Motivation & Approach

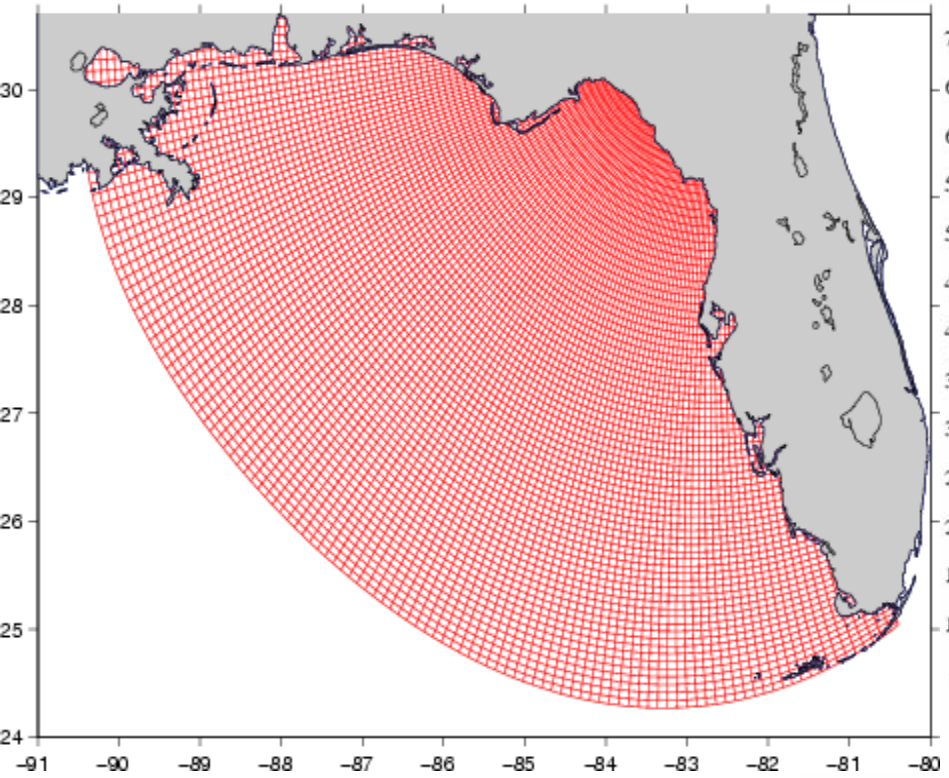
- The West Florida Shelf (WFS) circulation, as demonstrated by previous studies, responds primarily to shelf-wide local forcing. This wide, gently sloping shelf is therefore ideal for testing coastal ocean models.

- Three Terrain-following Coastal Ocean Models are considered:

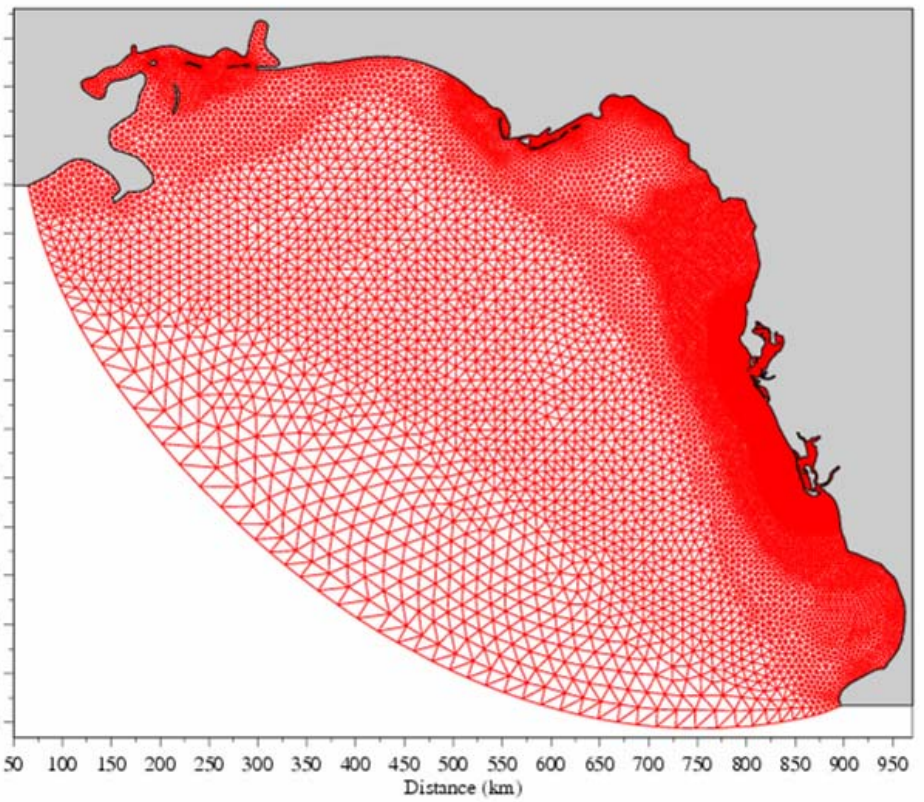
1. the Princeton Ocean Model (POM)
2. the Regional Ocean Modeling System (ROMS),
3. the Finite Volume Coastal Ocean Model (FVCOM).

- WFS circulation simulations are performed for Spring 2001 using all three models. We focus on the shelf responses to local forcing (winds, heat flux, and rivers), and neglect deep ocean influence (i.e., Loop Current).

Grid for POM & ROMS



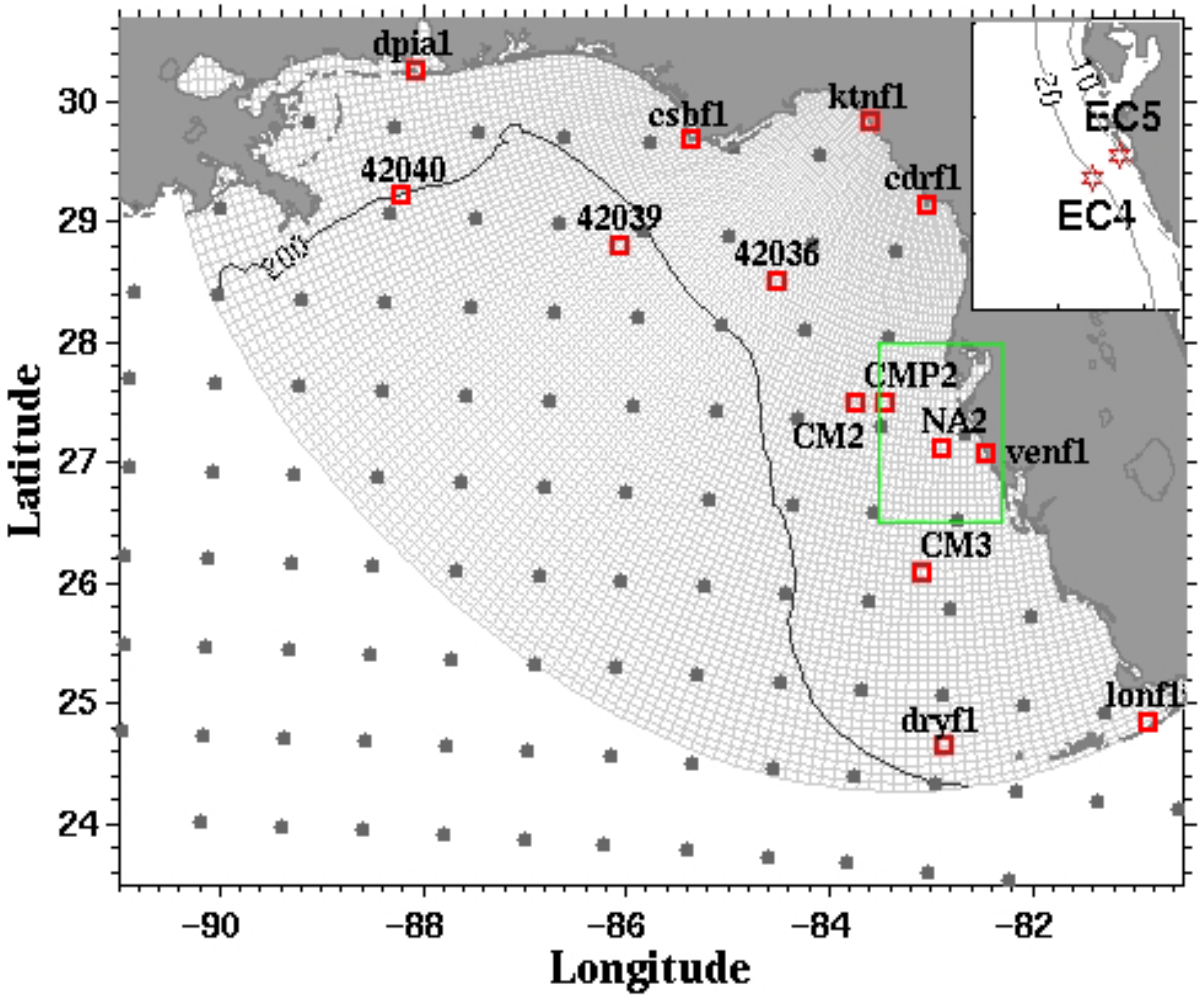
Grid for FVCOM



Surface Forcing: NCEP surface heat flux reanalyses + optimal interpolated wind fields.

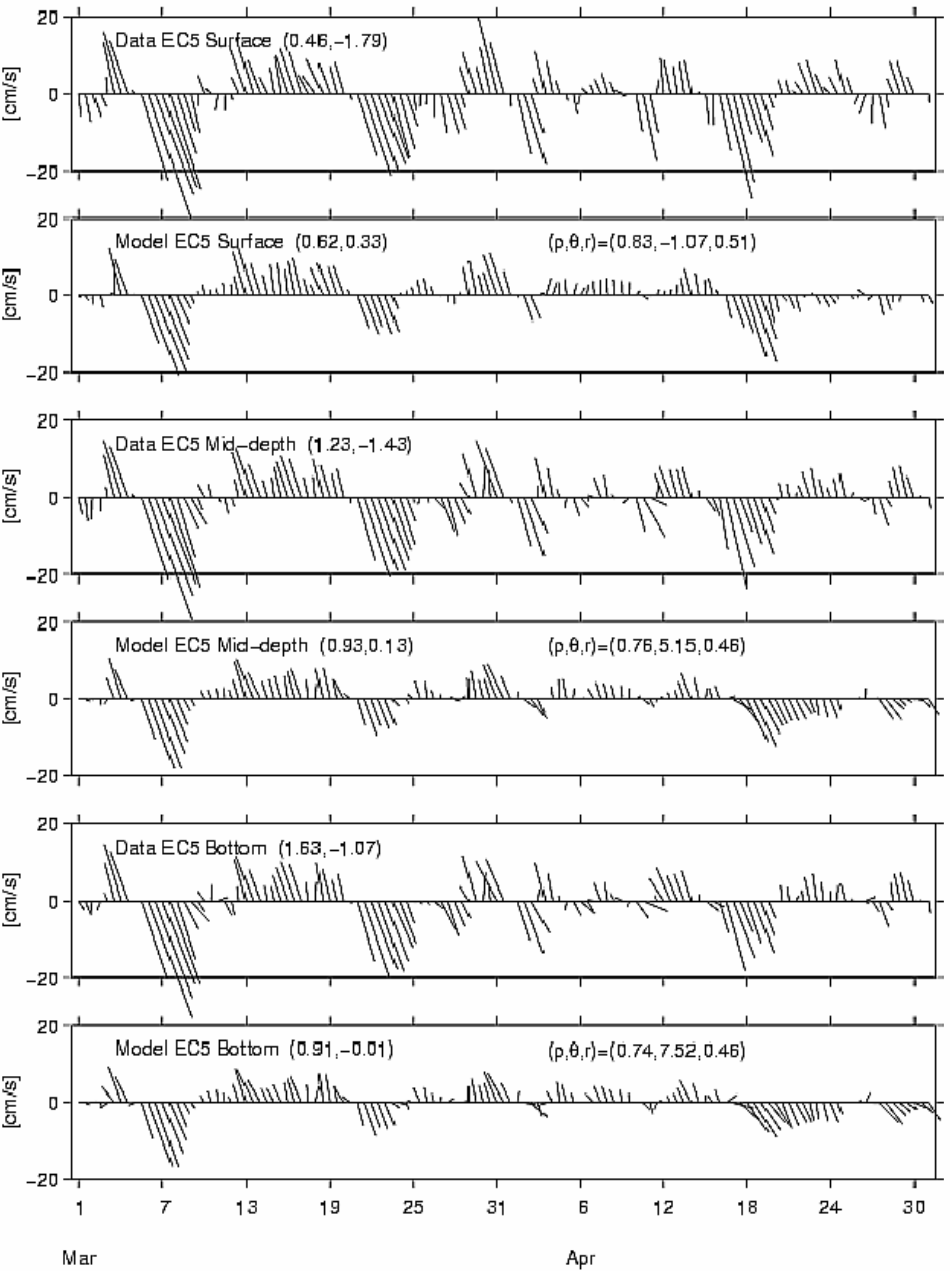
Initial Condition: Density profile averaged from spring shelf hydrographic

West Florida Shelf ocean model domain in relation to the ETA data assimilation system (EDAS) grid and the various in-situ wind stations

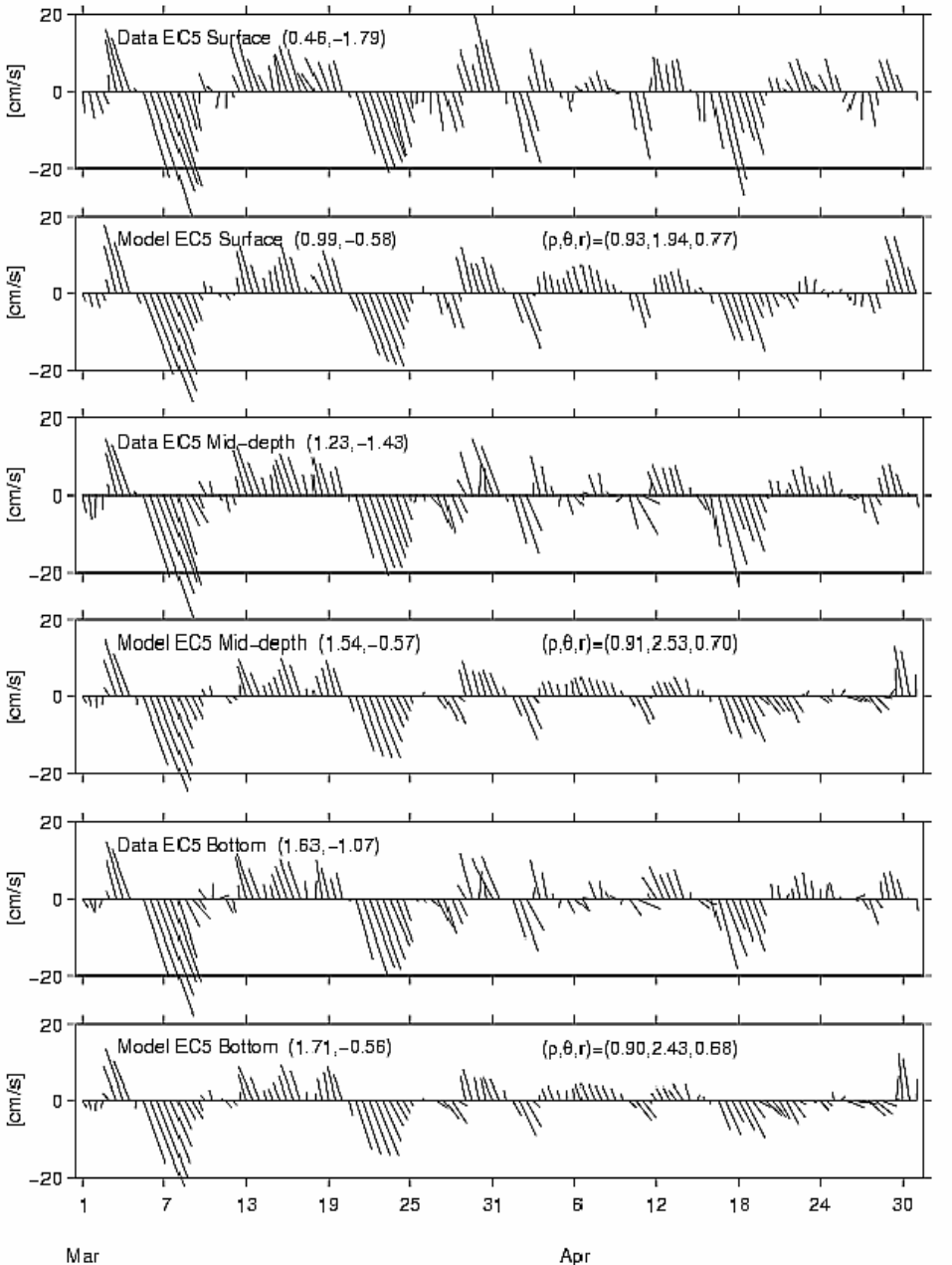


Surface wind fields are reconstructed by merging EDAS with *in-situ* winds through optimal interpolation. (*He et al., GRL, 2004*)

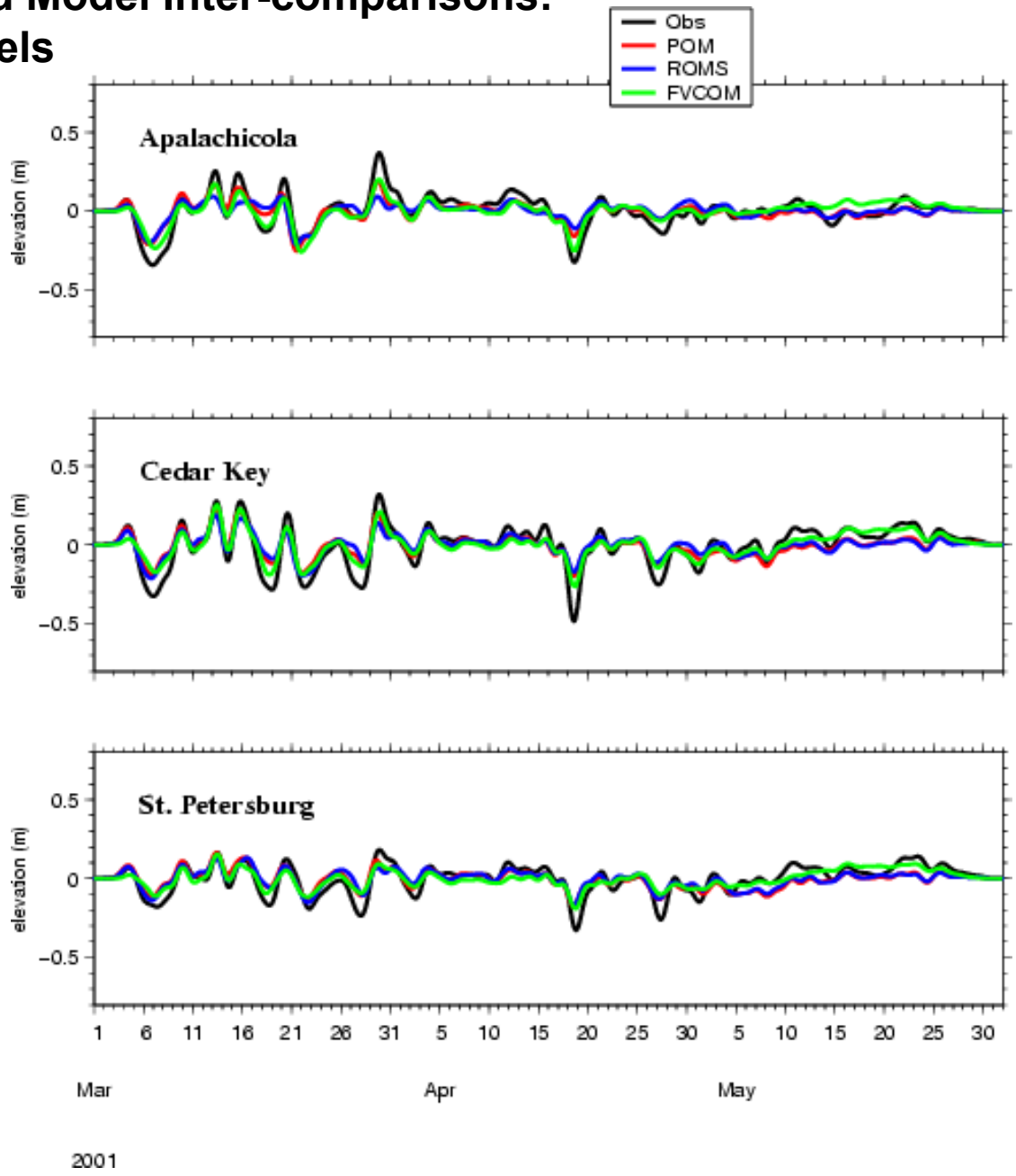
Driven by EDAS Wind



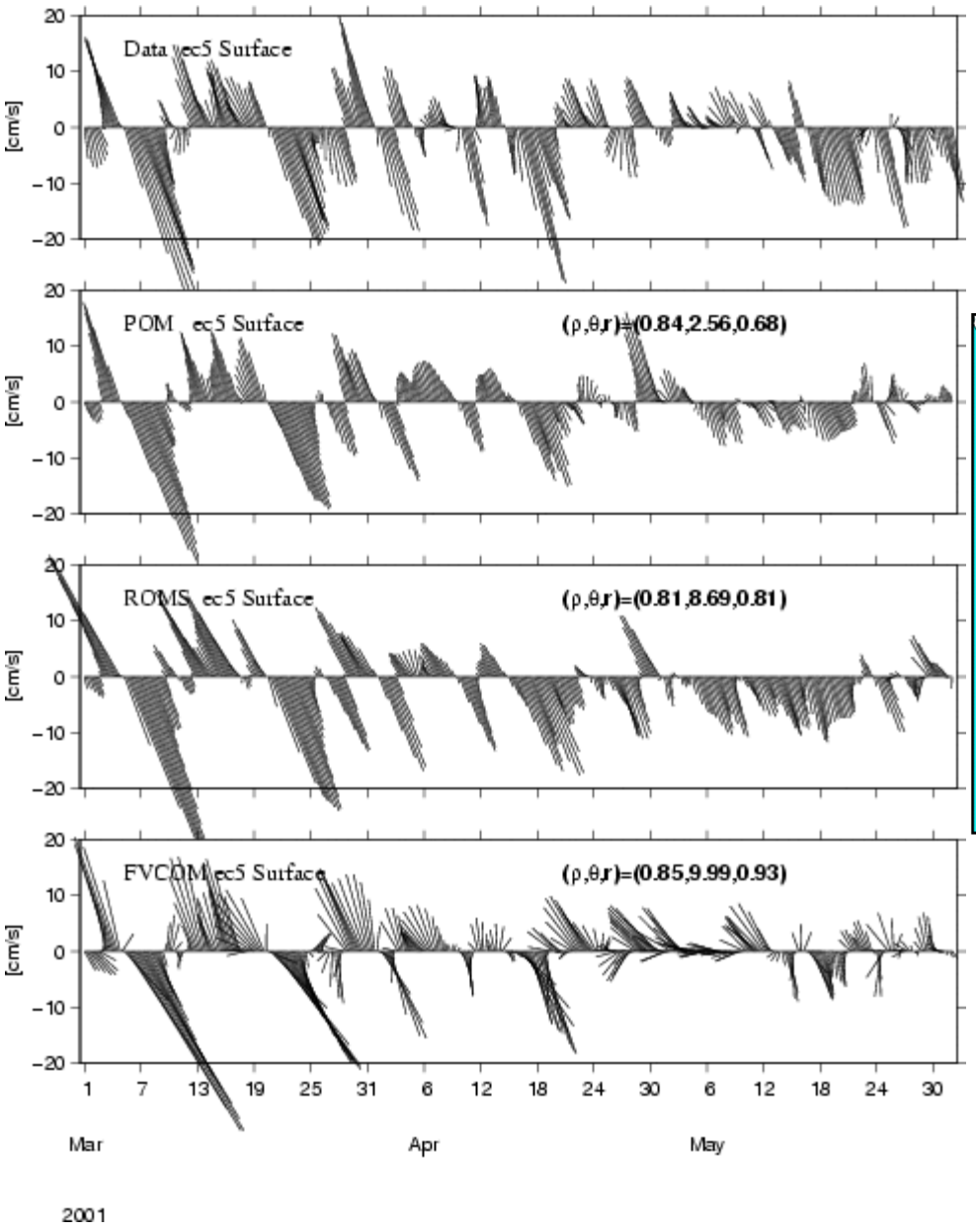
Driven by OI merged Wind

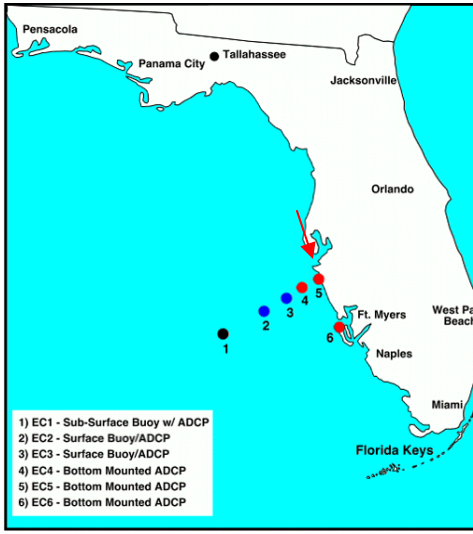


Data and Model Inter-comparisons: Sea Levels

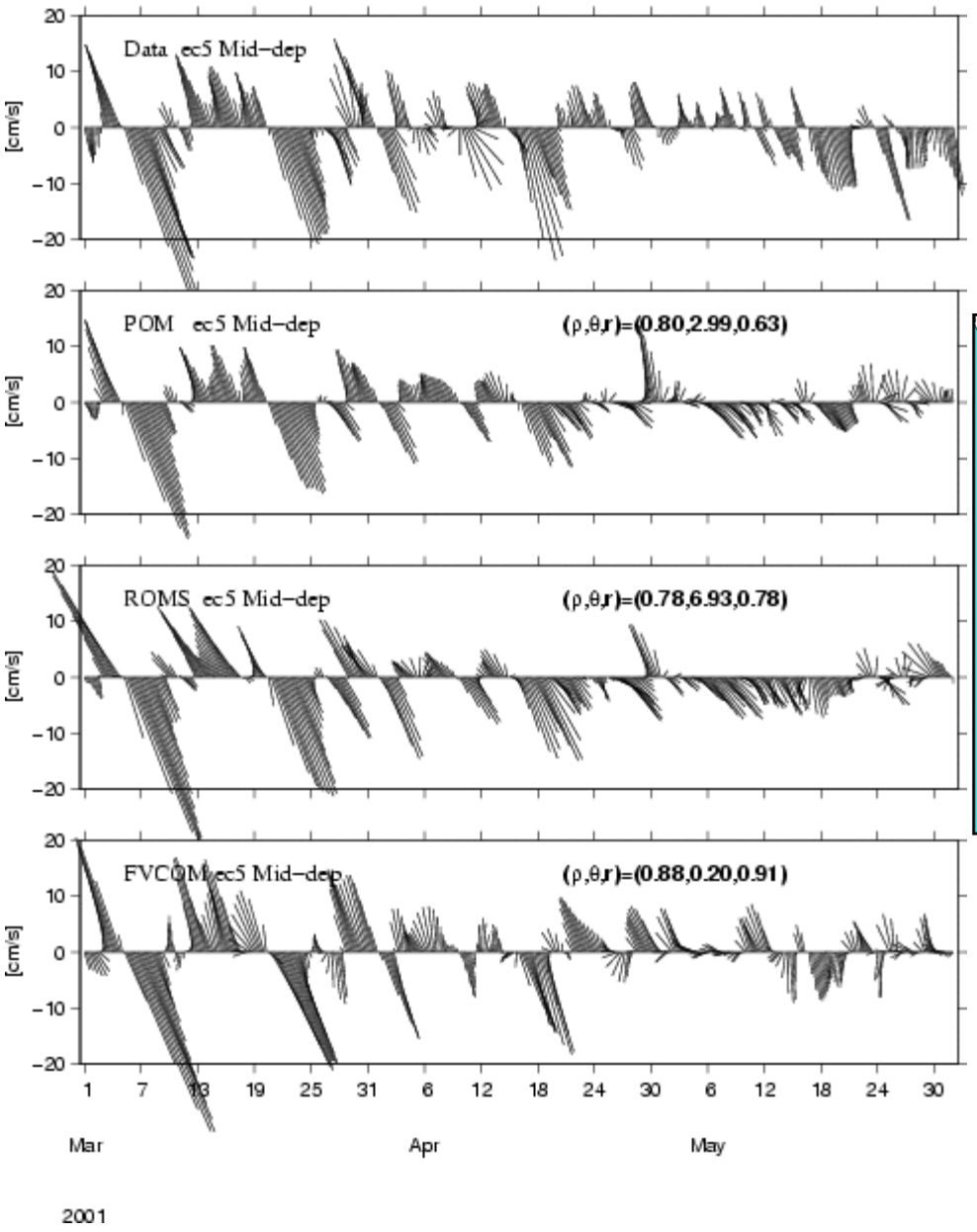


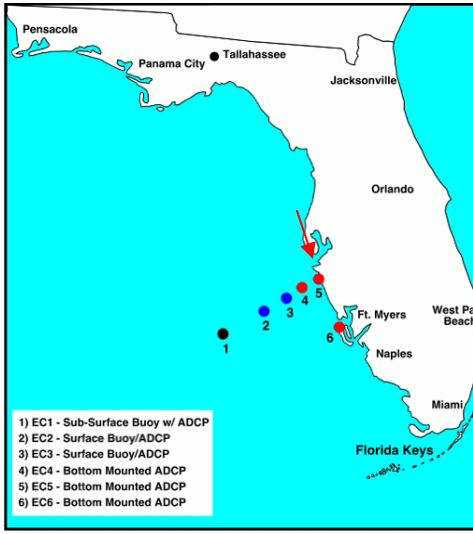
Surface Current Comparisons: 10 m isobath



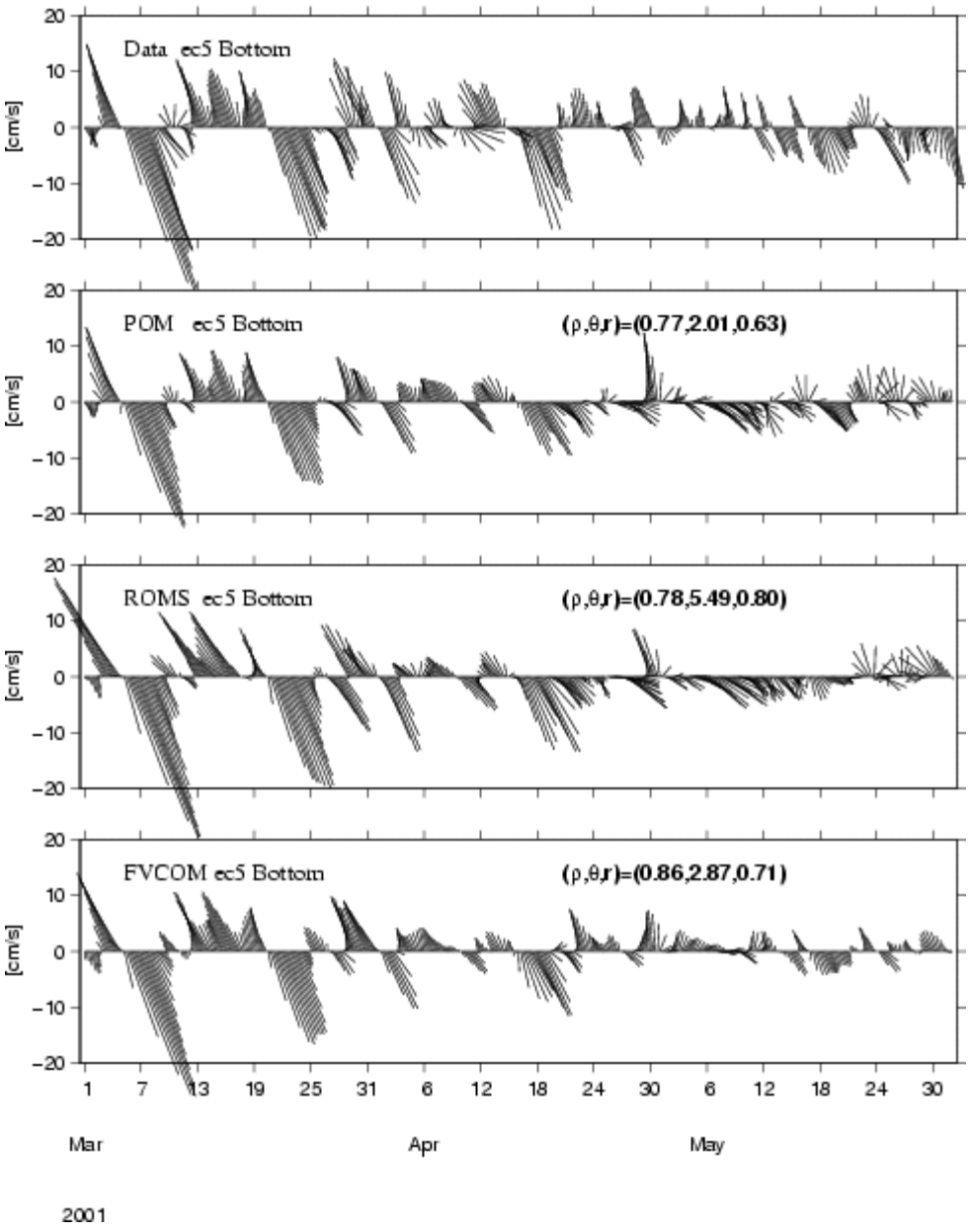


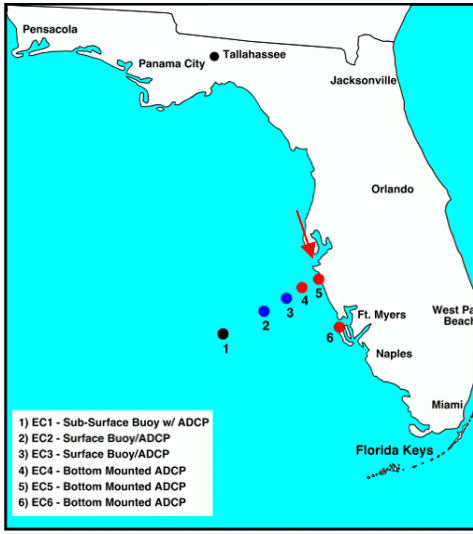
Mid-depth Current Comparisons : 10 m isobath



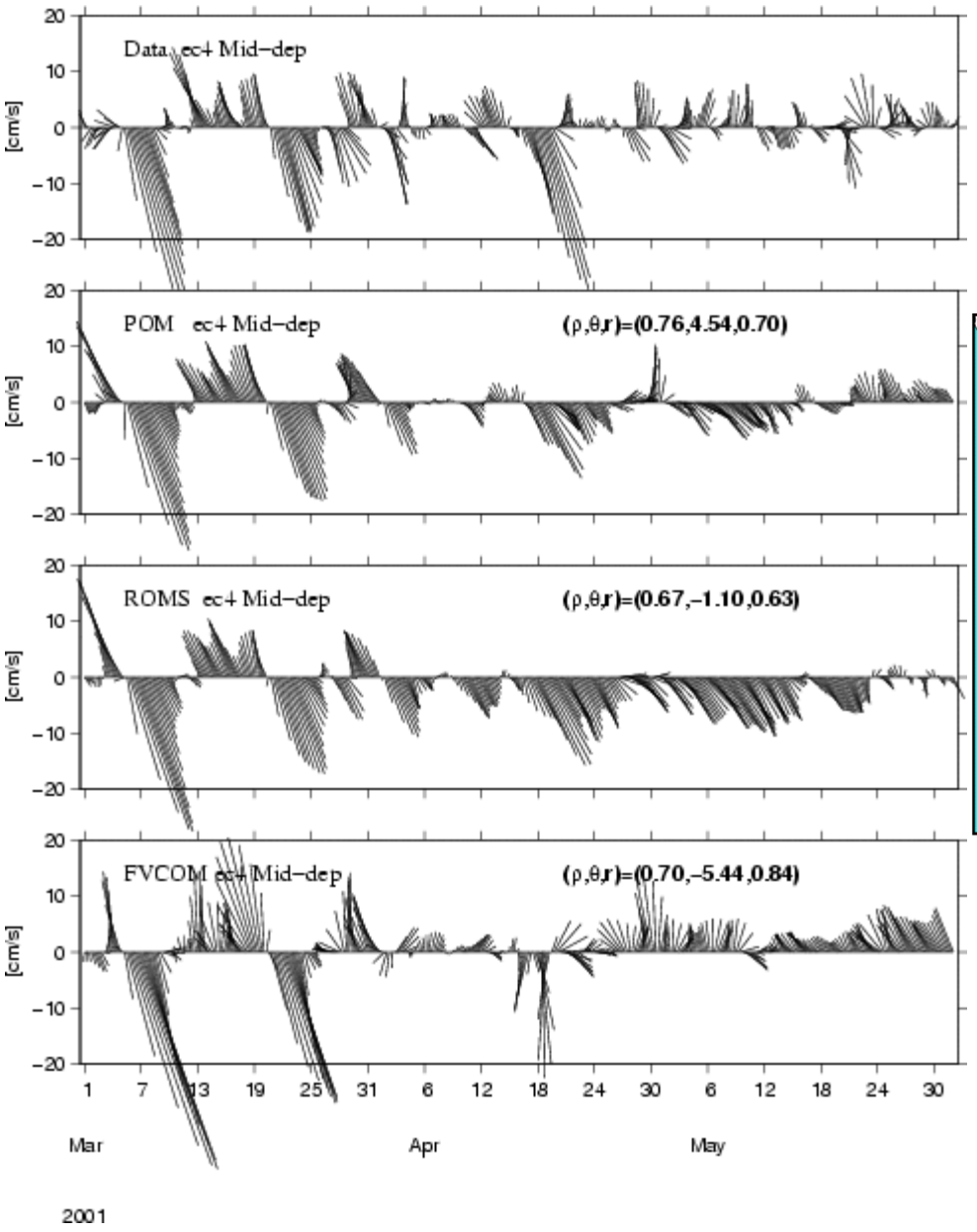


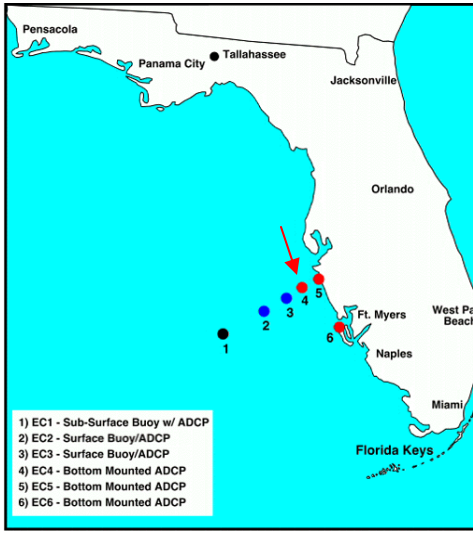
Bottom Current Comparisons : 10 m isobath



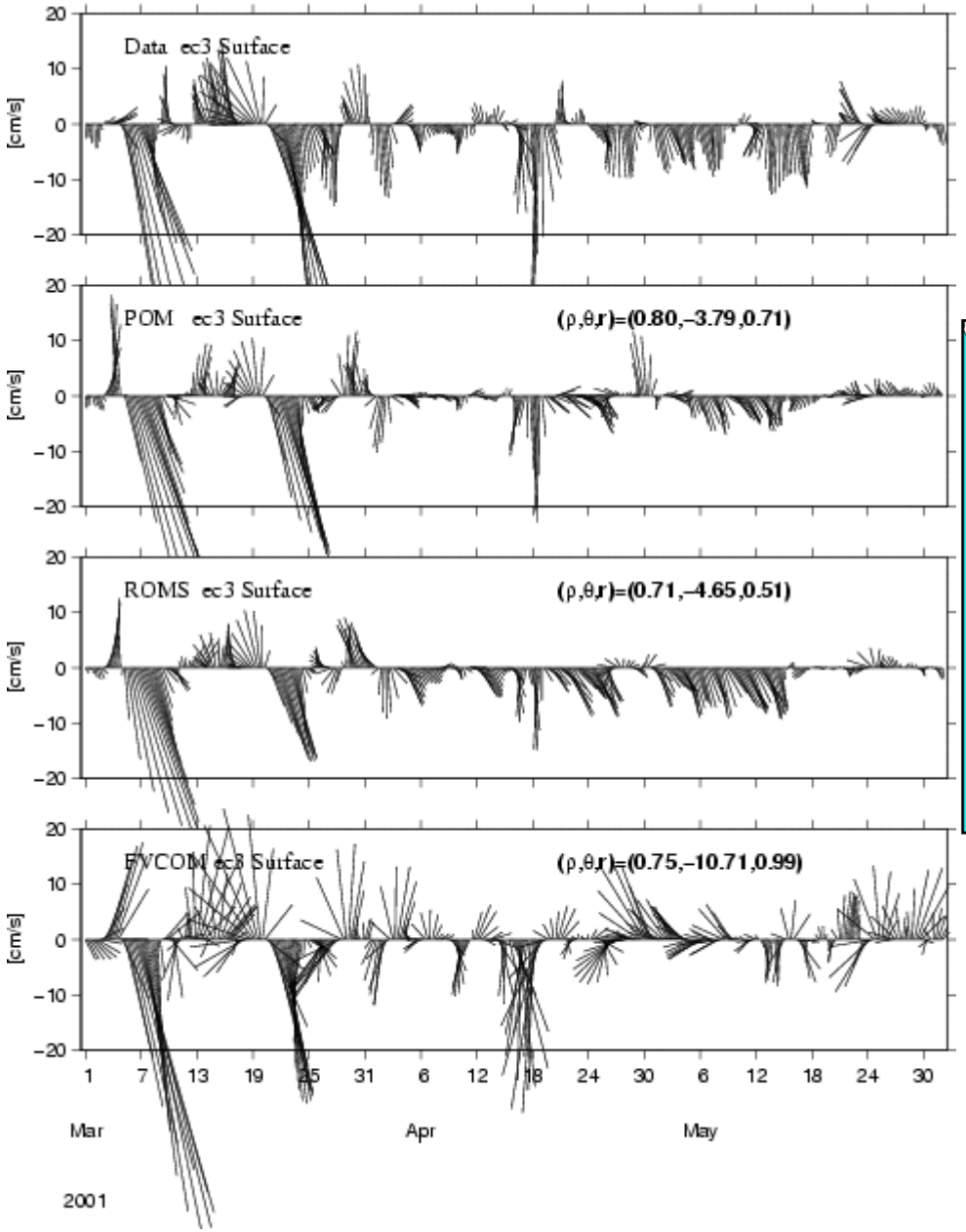


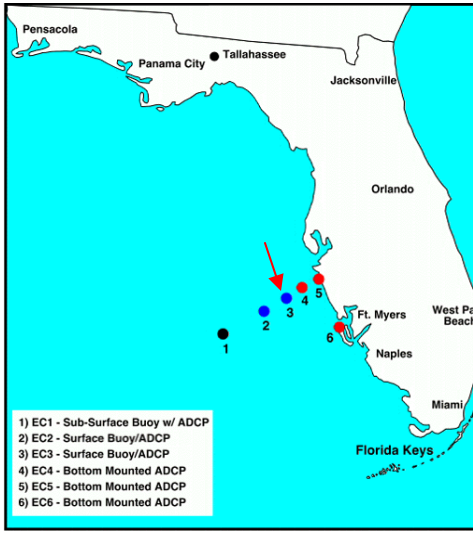
Mid-depth Current Comparisons: 20 m isobath



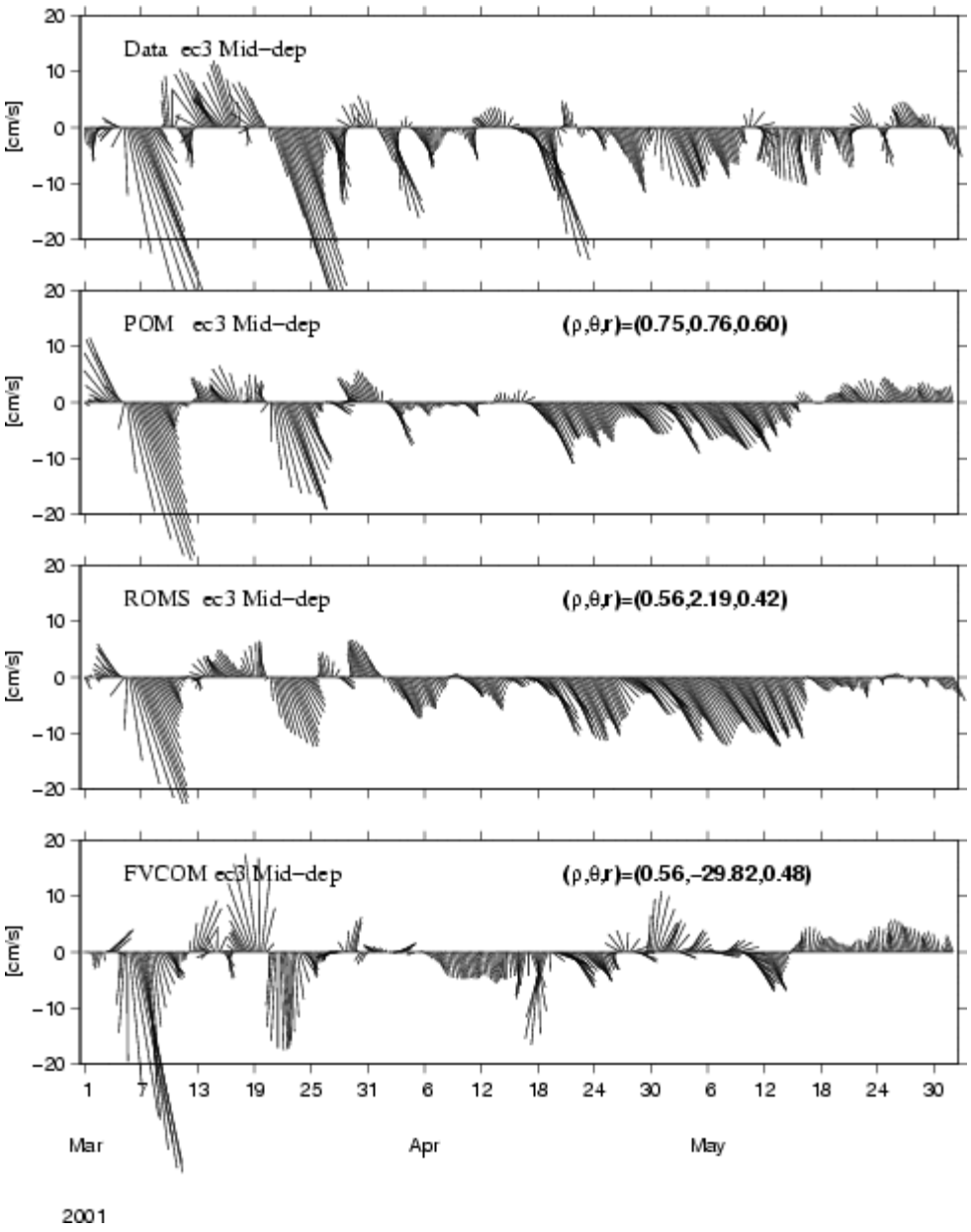


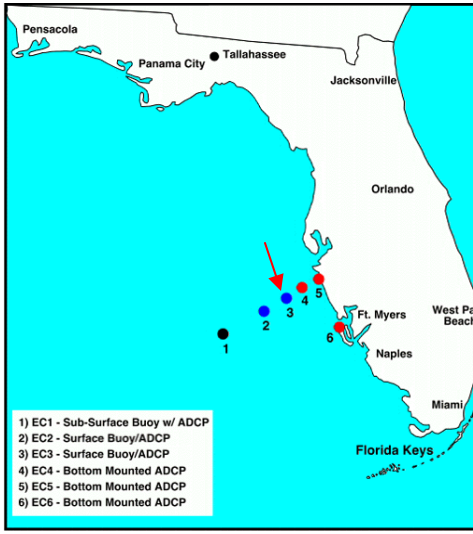
surface Current Comparisons: 30 m isobath



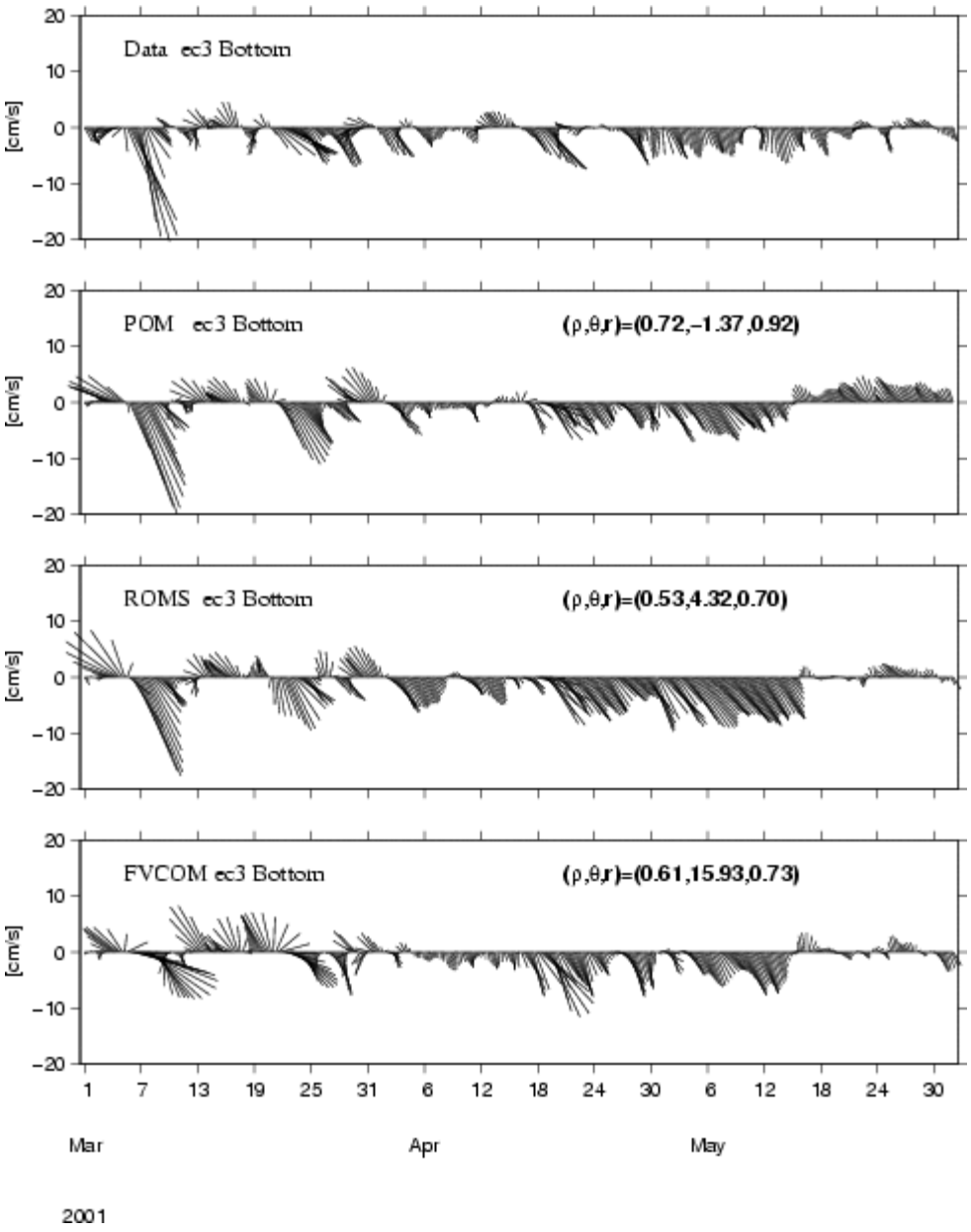


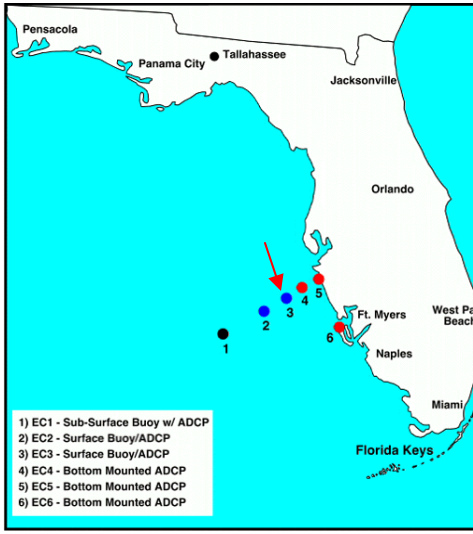
Mid-depth Current Comparisons: 30 m isobath

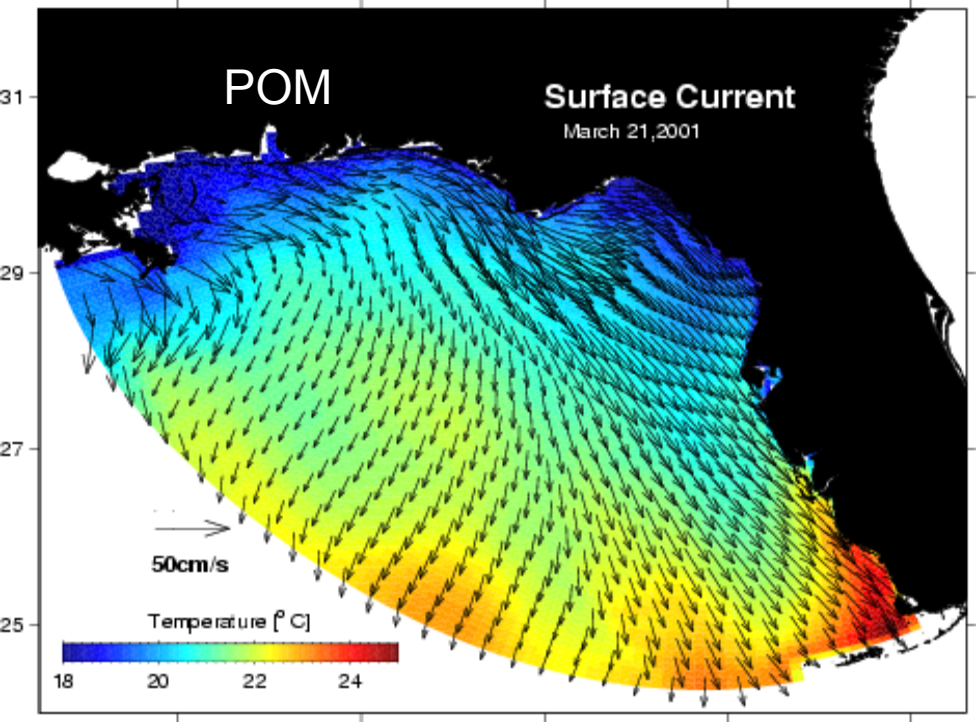


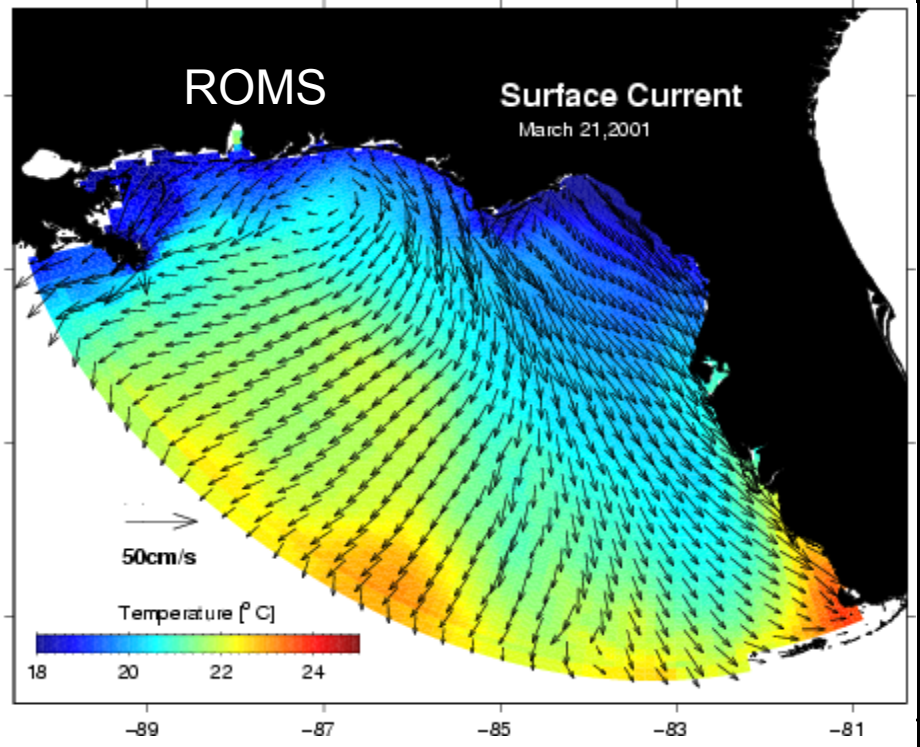


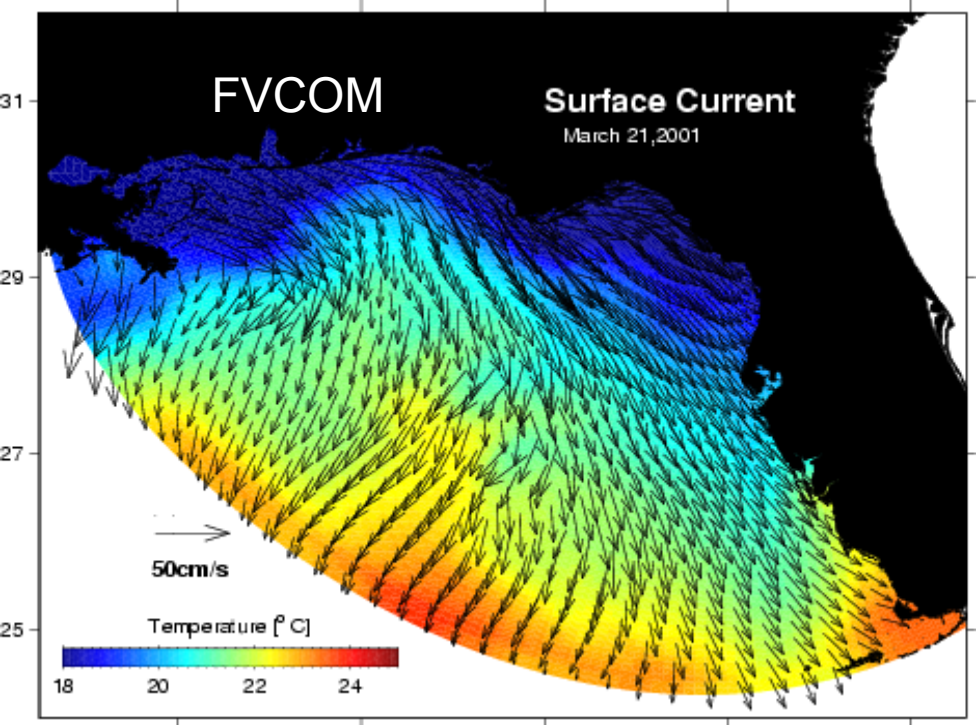
Bottom Current Comparisons: 30 m isobath



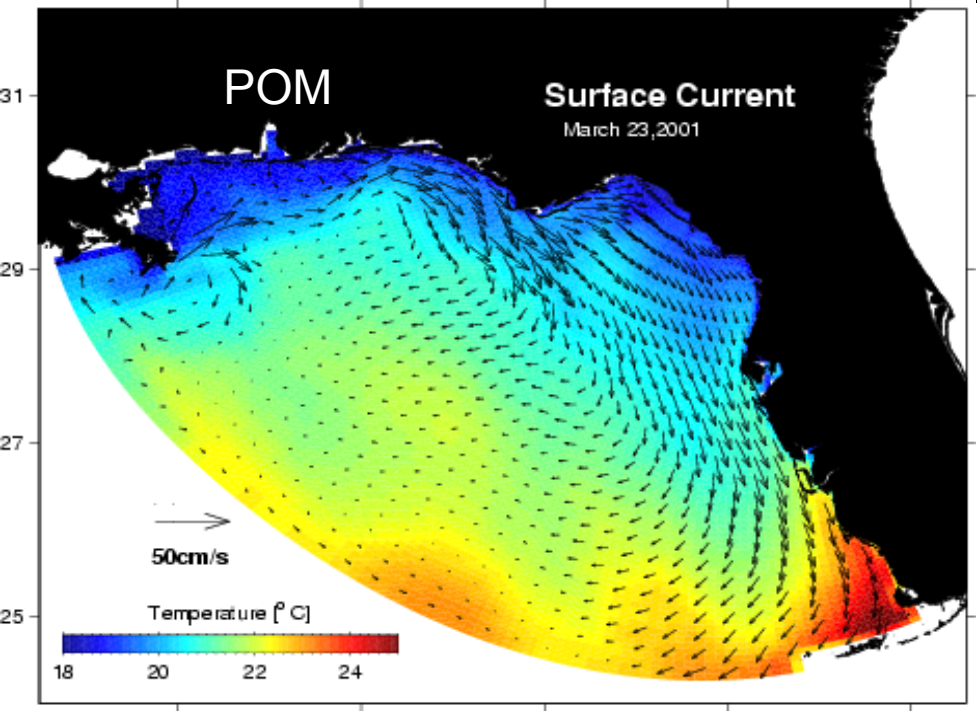


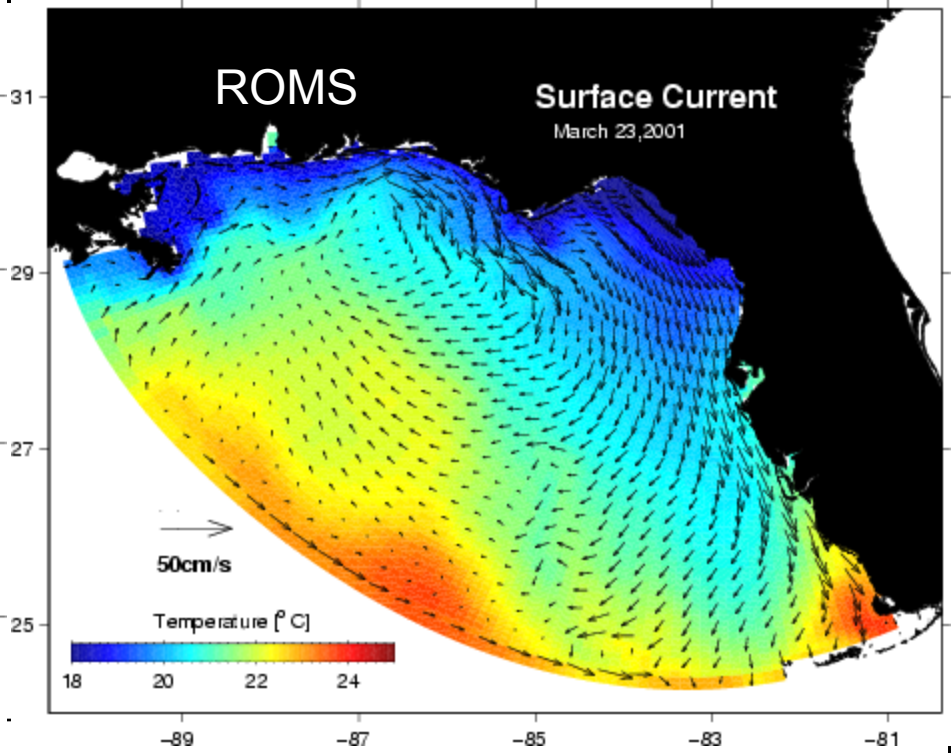


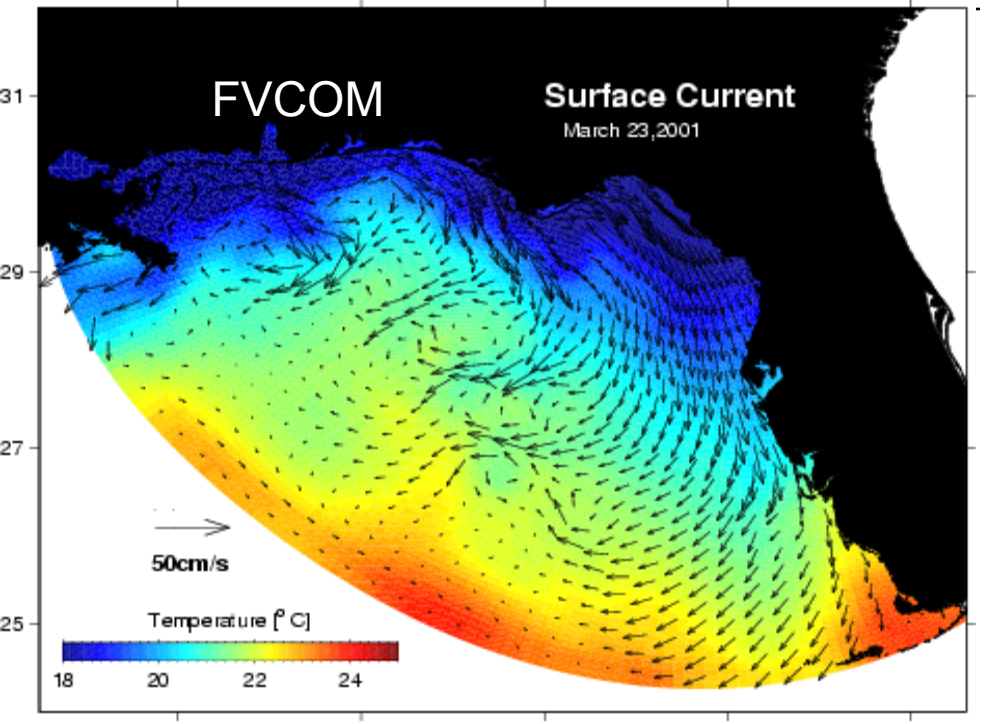




Surface Current and Temperature
March 21, 2001

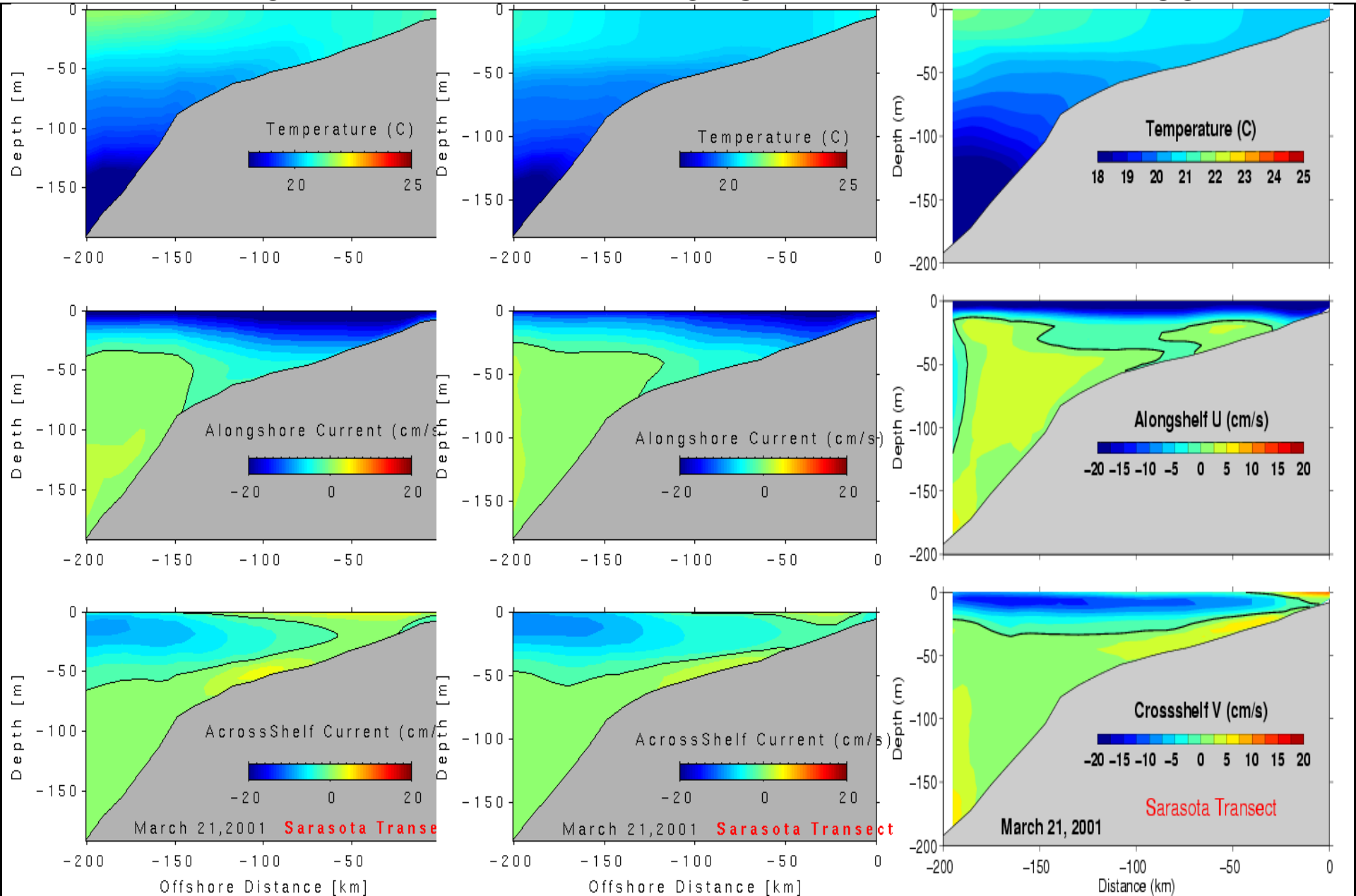




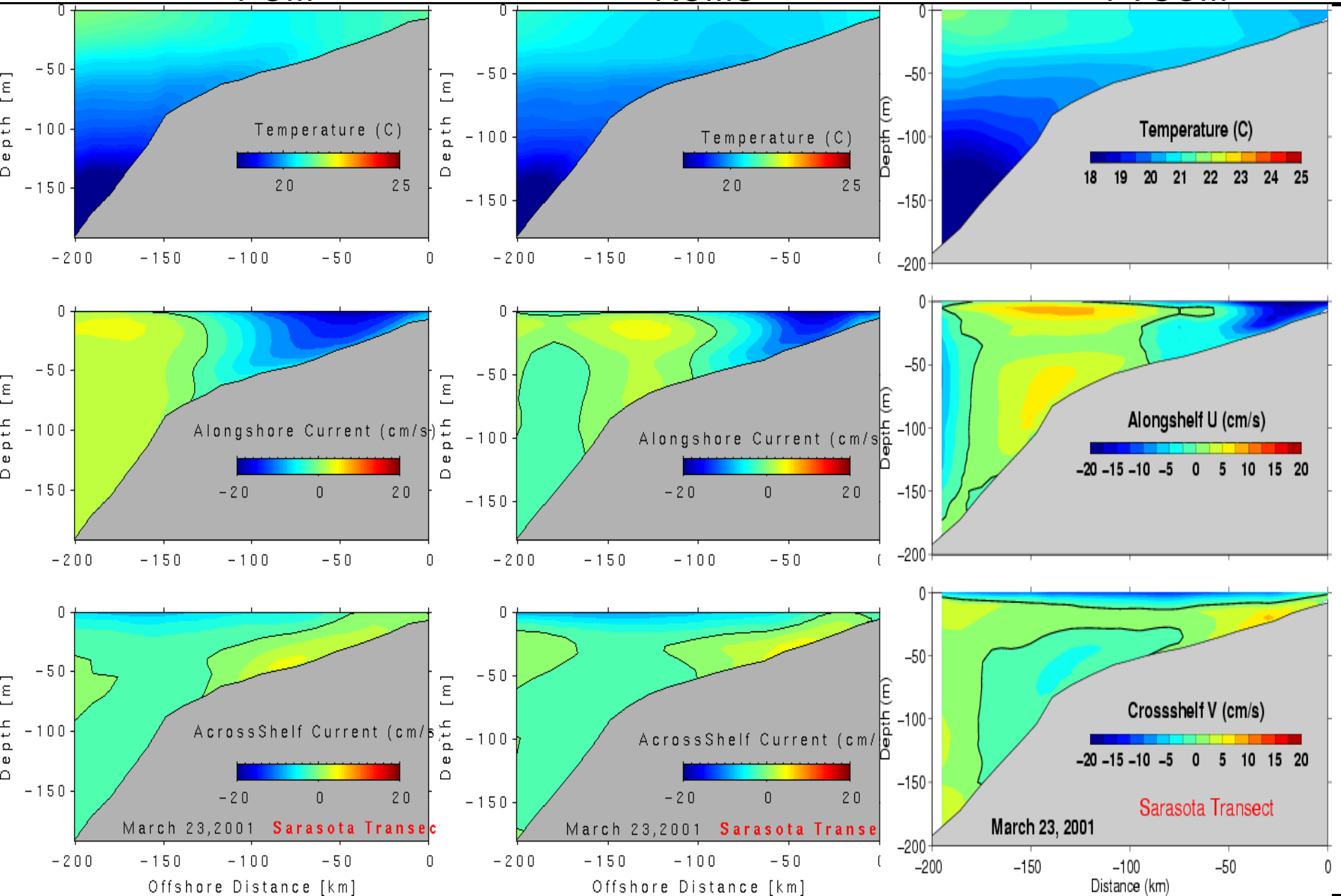


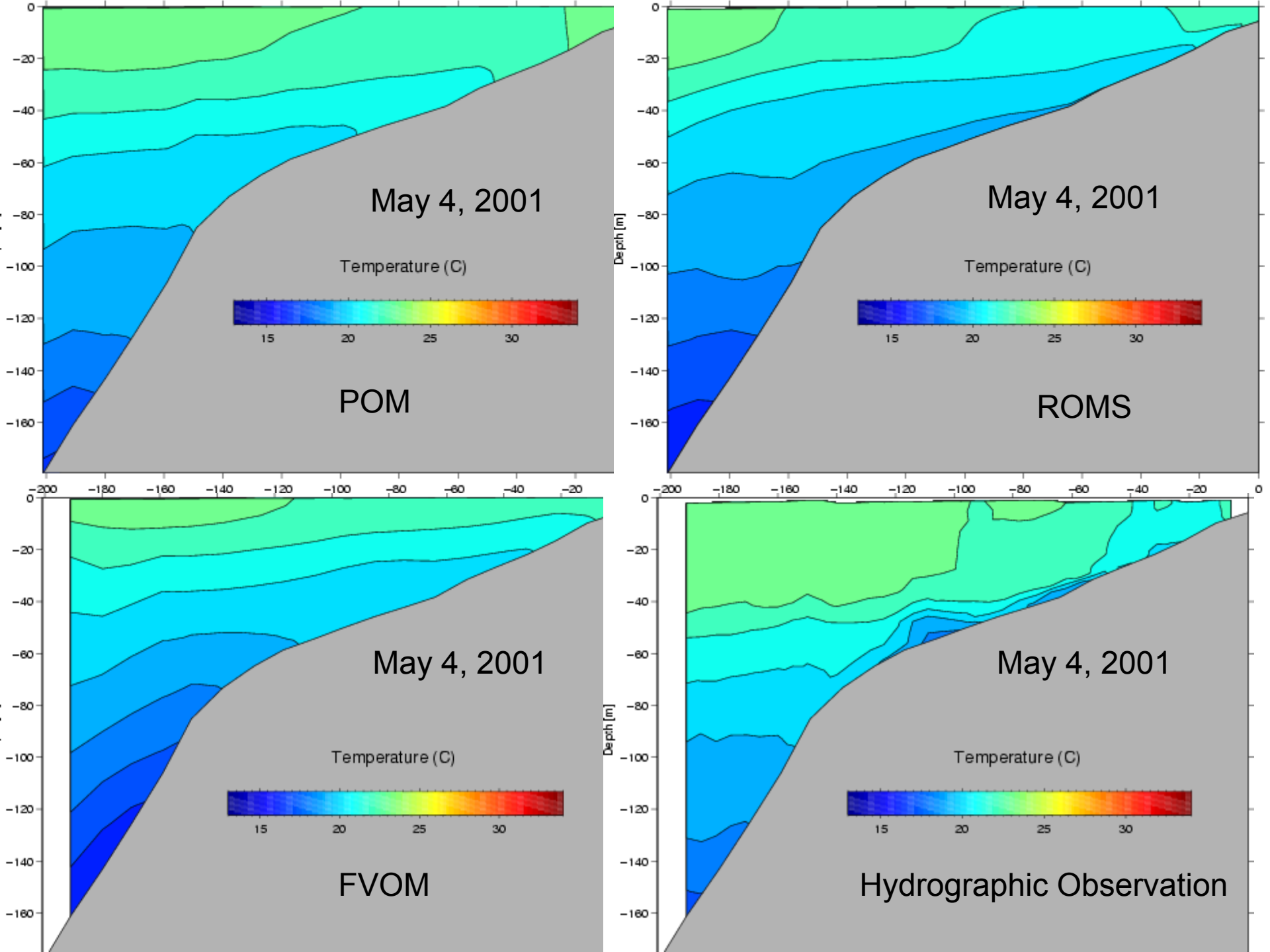
Surface Current and Temperature
March 23, 2001

Across-shelf Transect off Sarasota: March 21, 2001

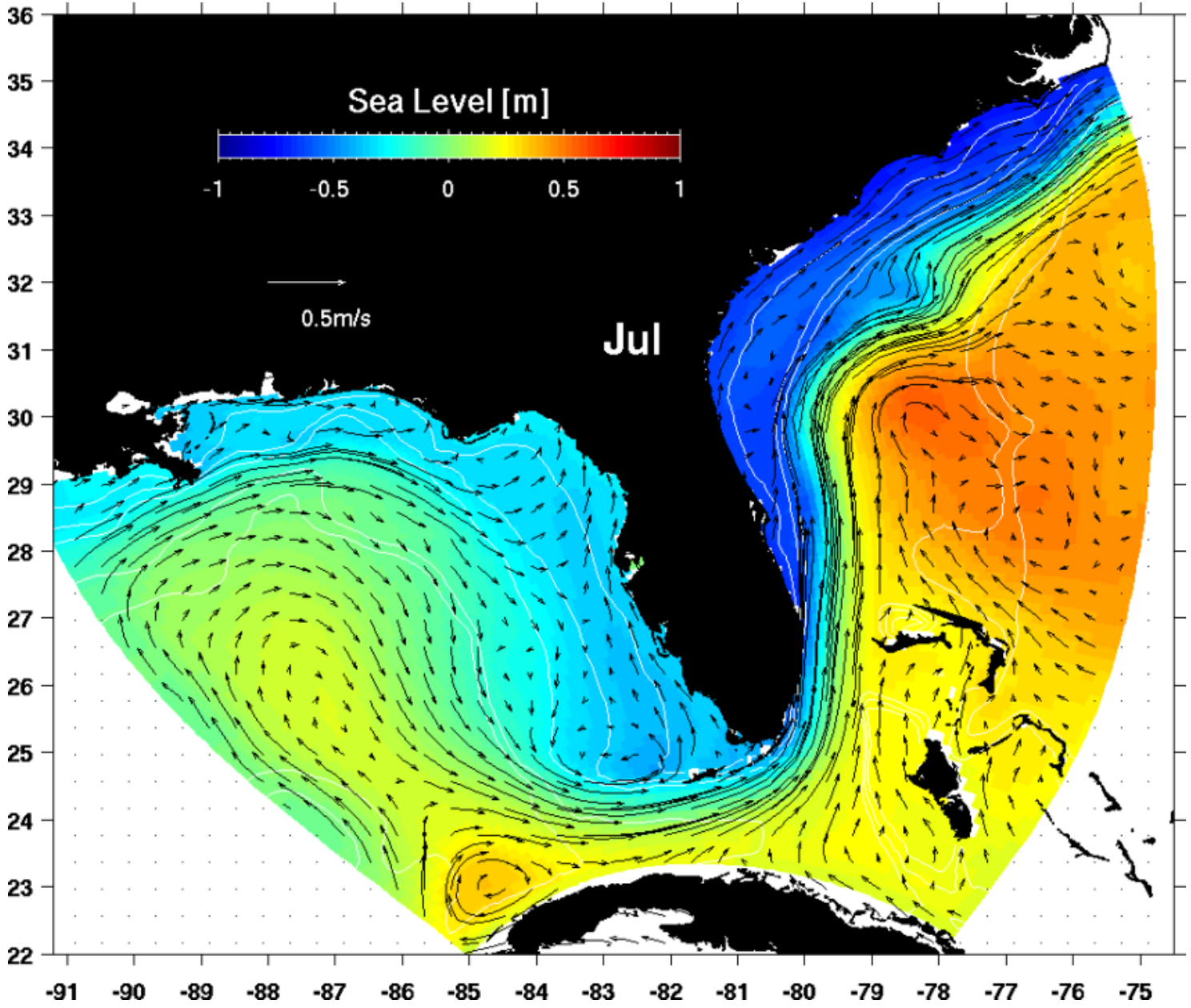


Across-shelf Transect off Sarasota: March 23, 2001

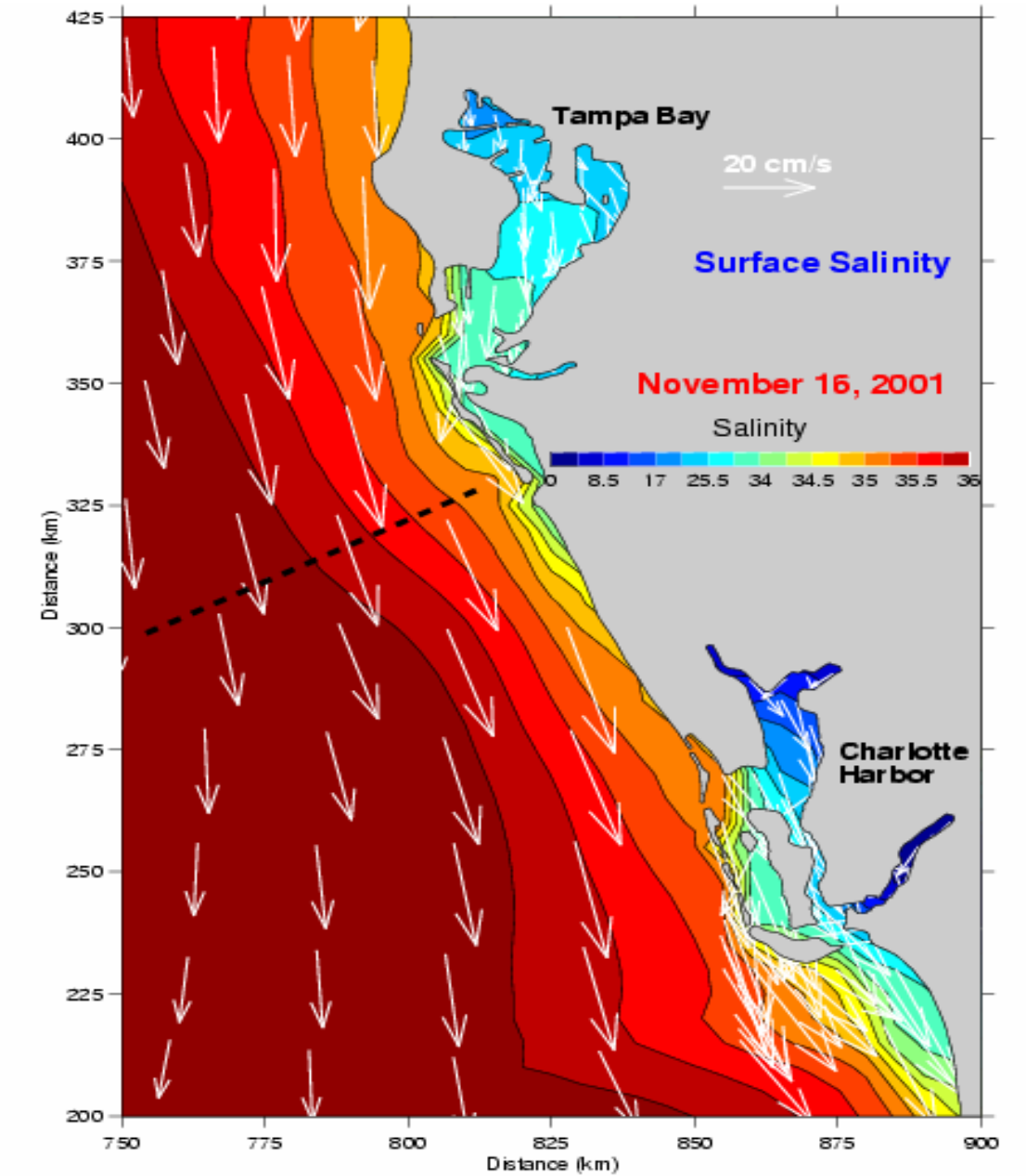



May 4, 2001
Temperature (C)
15
20
25
30
POM
May 4, 2001
Temperature (C)
15
20
25
30
ROMS
Depth [m]
May 4, 2001
Temperature (C)
15
20
25
30
FVOM
May 4, 2001
Temperature (C)
15
20
25
30
Hydrographic Observation
Depth [m]
0
-20
-40
-60
-80
-100
-120
-140
-160
-200
-180
-160
-140
-120
-100
-80
-60
-40
-20
0

SEACOOS Domain with ROMS



WFS FVCOM linking the estuaries with the shelf



Conclusions

- **Models are sensitive to their forcing fields. Better forcing leads to better model simulations. This strongly justifies Coastal Ocean Observing Systems (COOS).**
- **When gauged against in-situ data, POM, ROMS, and FVCOM all perform reasonably well. Yet, differences exist in the details (due to model grids, numerical schemes, and parameterizations). Drawing inference from simulations without data is dangerous. Therefore COOS will benefit from closely coordinated observations and models.**
- **Free model runs eventually deviate from observations because of density field disparities. This necessitates the use of data assimilation for constraining the model fields.**
- **The effects of deep ocean forcing become increasingly important seaward of the inner shelf. This necessitates nesting with larger scale models.**

WFS HYCOM Directions

- **Develop strategies for the nesting of regional models with HYCOM.**
- **Compare the HYCOM 1/12 degree simulations for 1999/2000 with regional WFS data.**
- **Implement assimilation strategies for COMPS/SEACOOS data:**
  - **Coastal η**
  - **Moored $\underline{V}$, T, S**
  - **HF-radar surface $\underline{V}$**
  - **Profiling float T, S**
  - **OI SST**
  - **OI surface color**
  - **Climatological T, S**