Why the red tide over the West Florida Shelf in 2008 is mild: A view from ocean circulation

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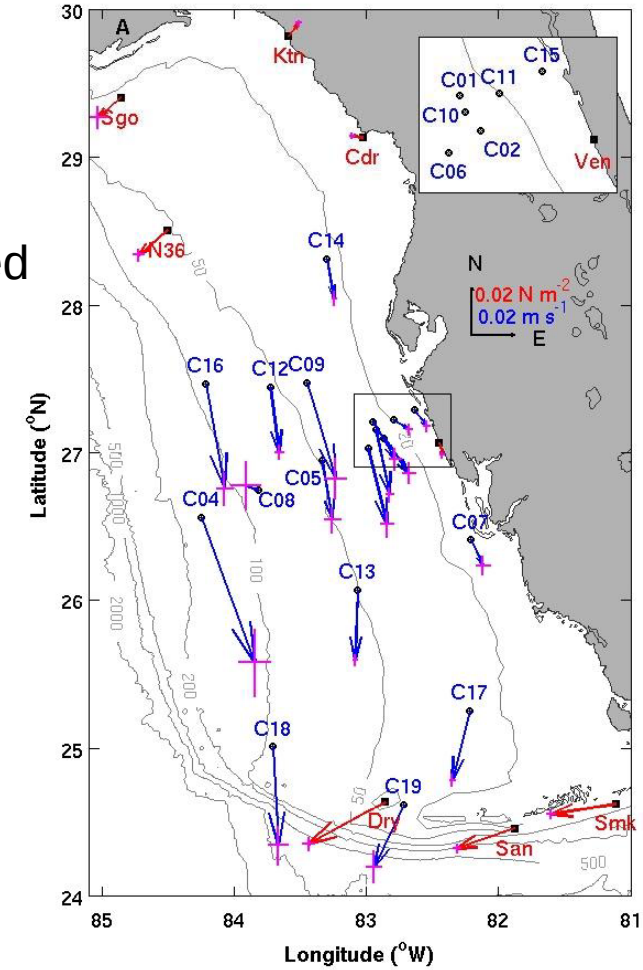
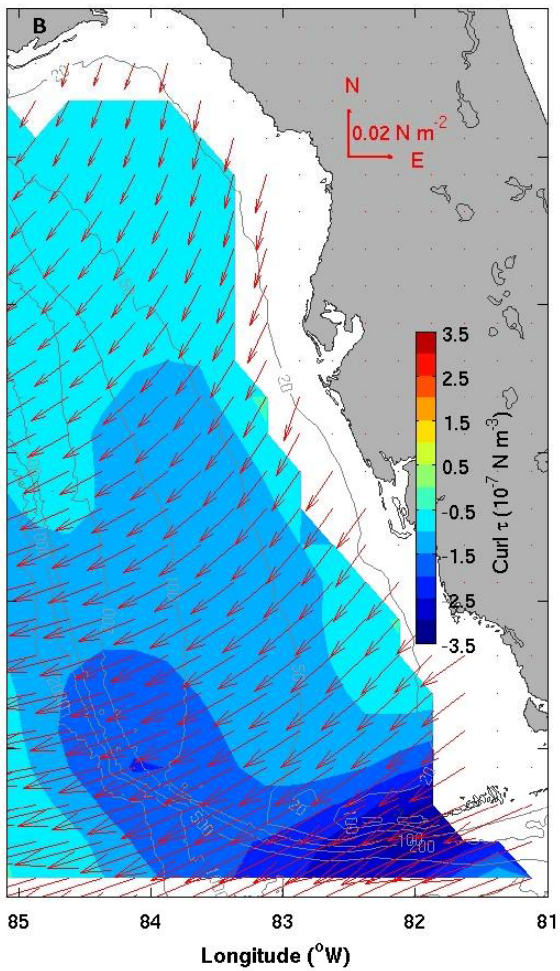
Outline

1. Introduction: Mean circulation patterns from moored observations
2. Brief info on model settings/forcing
3. Model validation: coastal sea level & velocity time series
4. Why the red tide over the West Florida Shelf in 2008 is mild? Monthly mean circulation during Jun – Dec 2008
5. Why the red-tide detected in Oct 2008 only stay in a short period? Case study using snapshots of daily mean surface currents

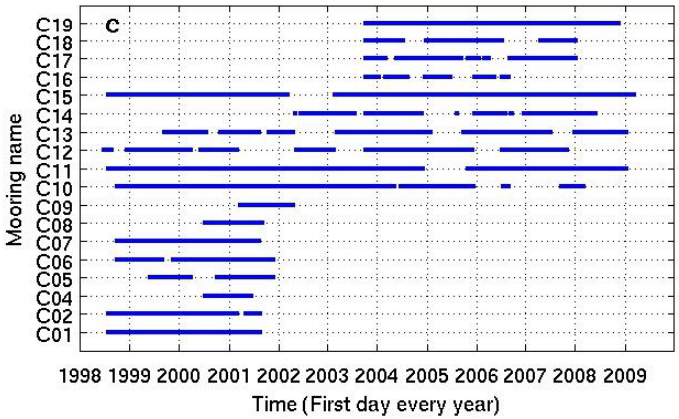
Mean winds & depth-averaged velocity

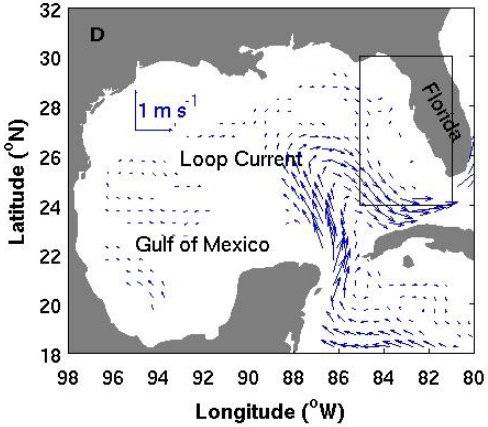




Mean winds & wind stress
(SCOW, Risien & Chelton 2008)

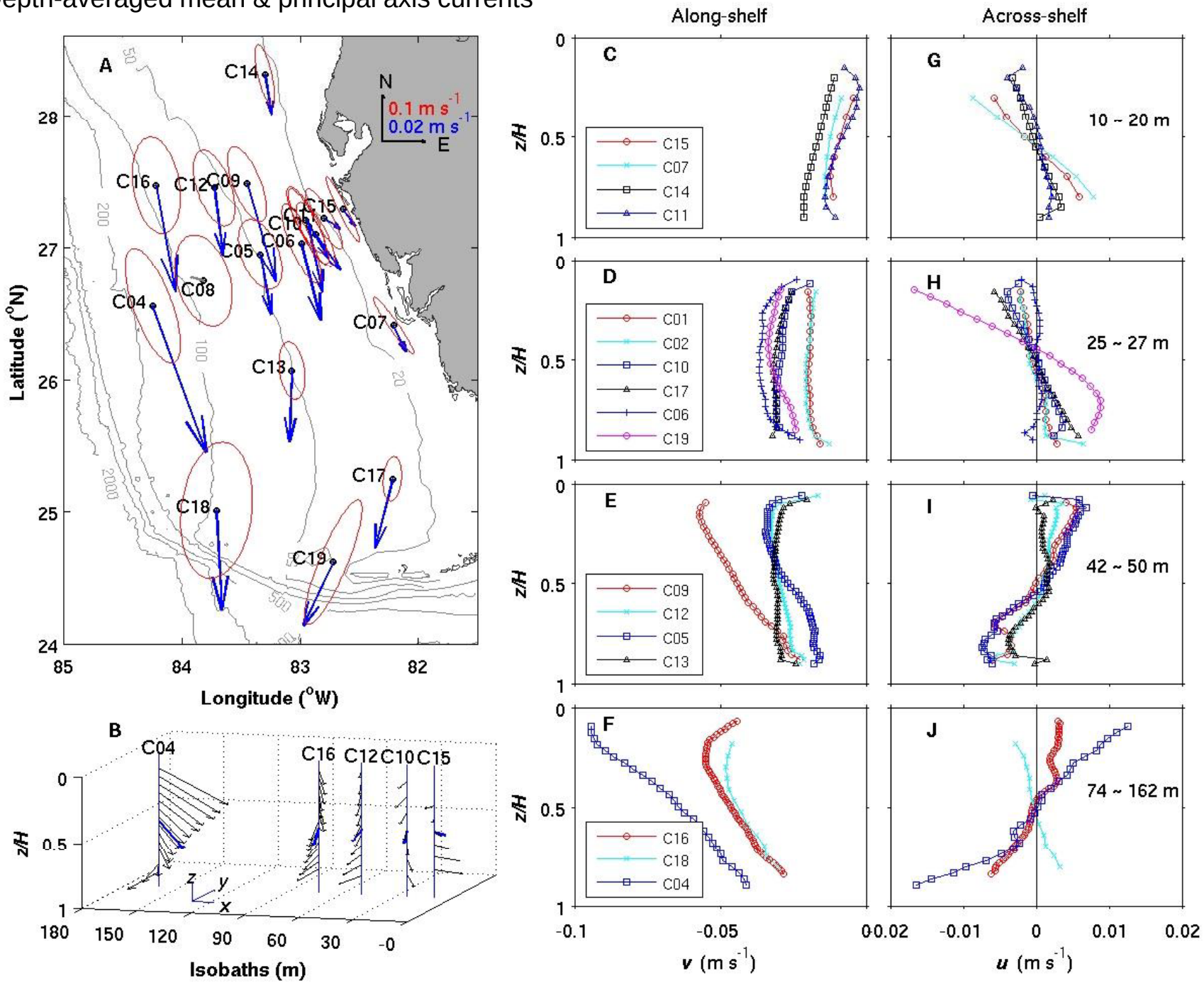
Timeline of moorings

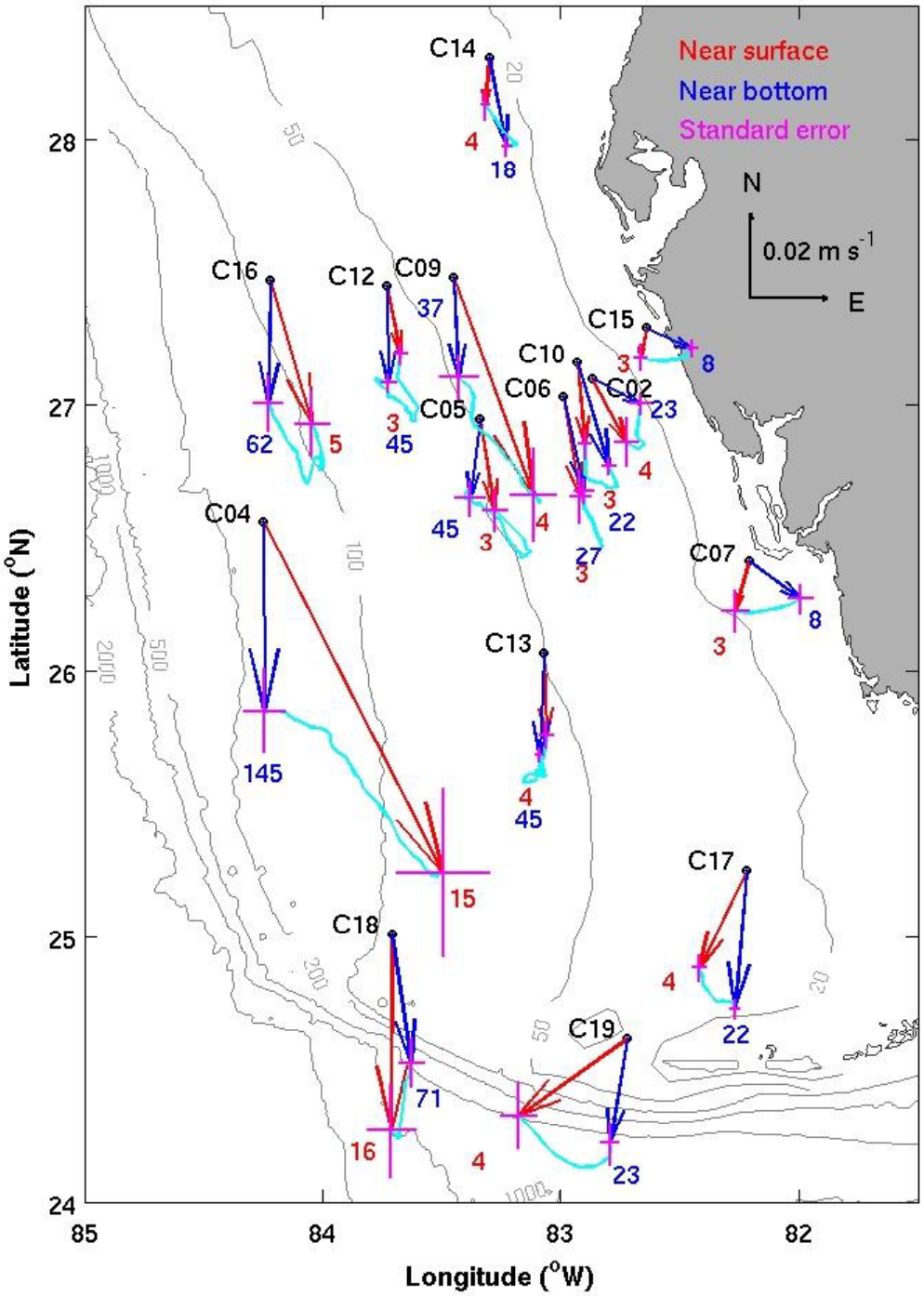




Mean surface geostrophic velocity
(Rio et al. 2005)

Depth-averaged mean & principal axis currents

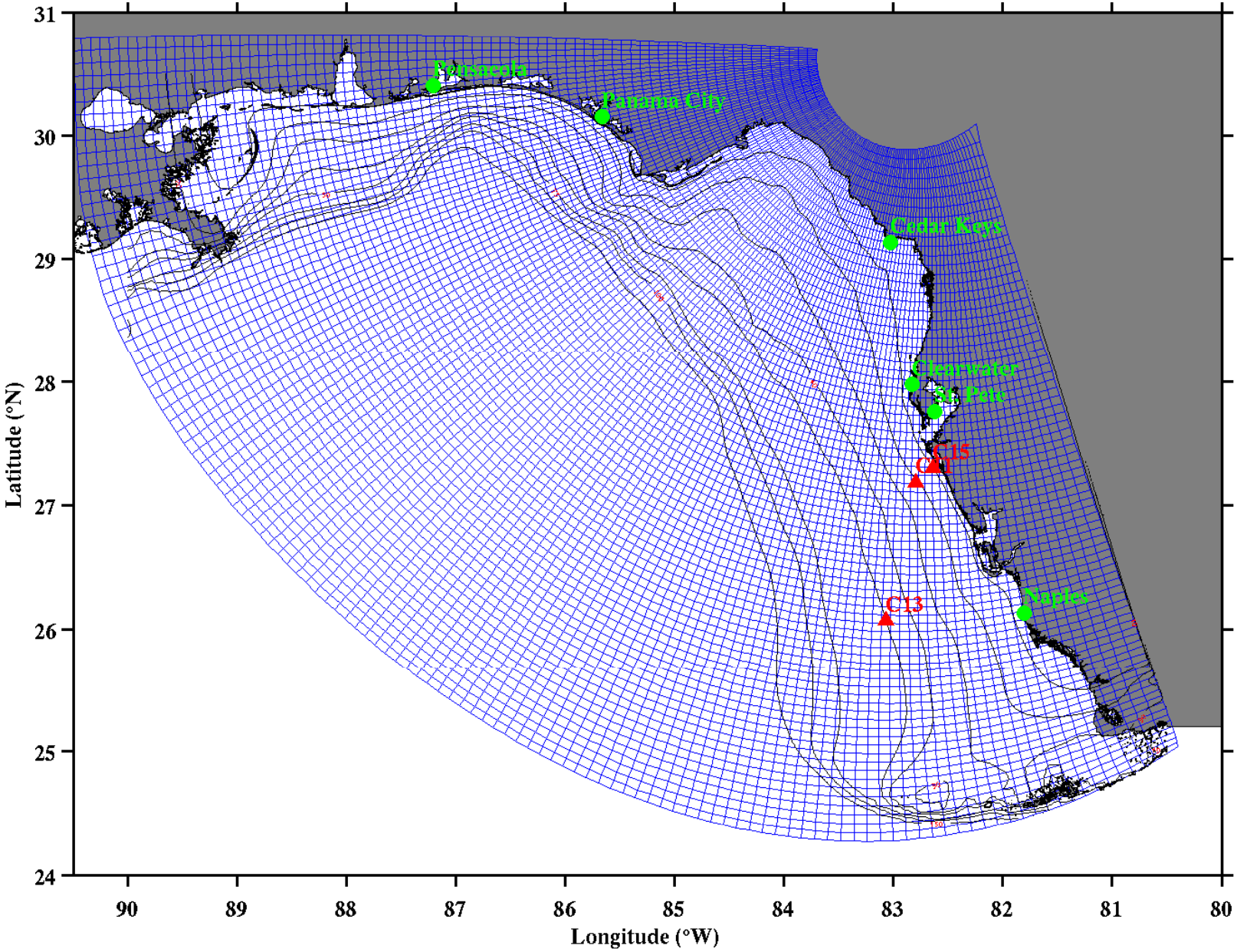




Zonation of mean velocity veering with depth on the West Florida Shelf

The mean velocity vectors veer systematically with depth, with a change in polarization occurring across the shelf: The velocity vectors veer shoreward over shallow water and seaward over deeper water. Thus, along with its shelf-wide southward orientation, the mean flow is upwelling over shallow water and downwelling seaward from the inner shelf.

West Florida Shelf Model Grid and Observation Stations



Numerical Model Hindcast

Model: ROMS

Forcings:

Wind and heat flux: NCEP reanalysis

Open boundary condition: one-way nesting to global HYCOM

Initial condition: global HYCOM

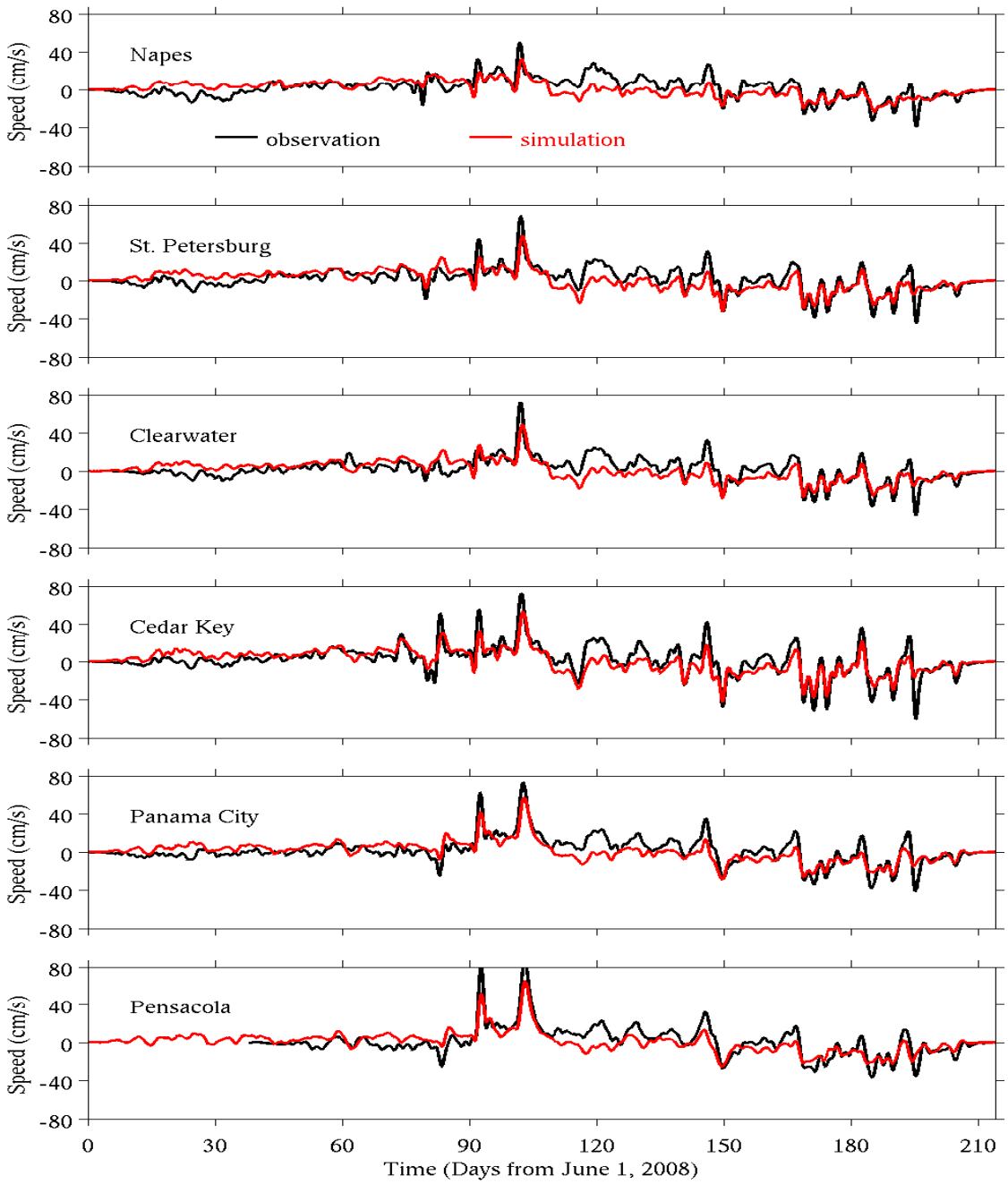
Simulation Period:

June ~ December 2008

Web Sites:

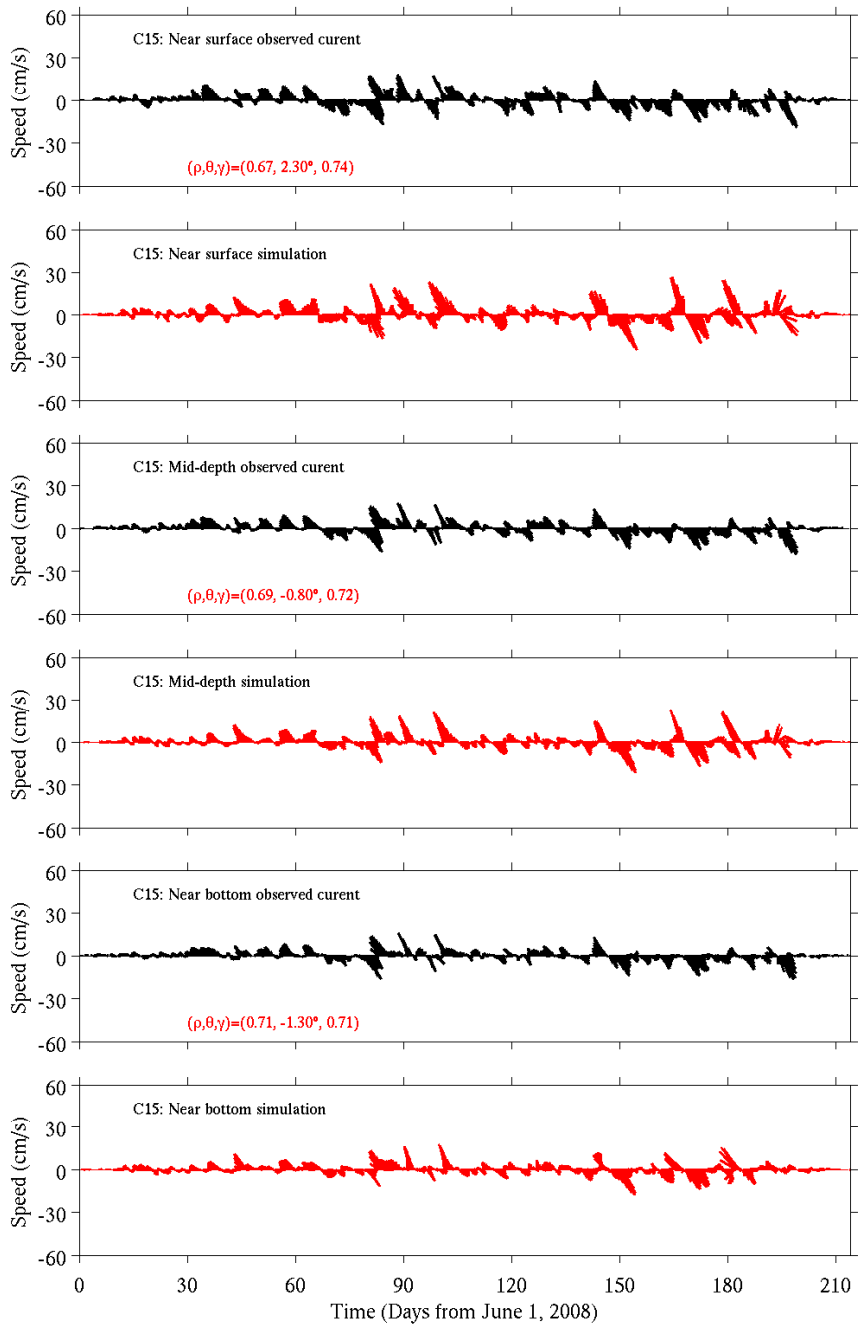
http://ocg2.marine.usf.edu/~zheng/research/ROMS/ROMS08_June_Dec_global_nativegrid.html

Model-Data Comparison: Sea Level (36h low-pass)



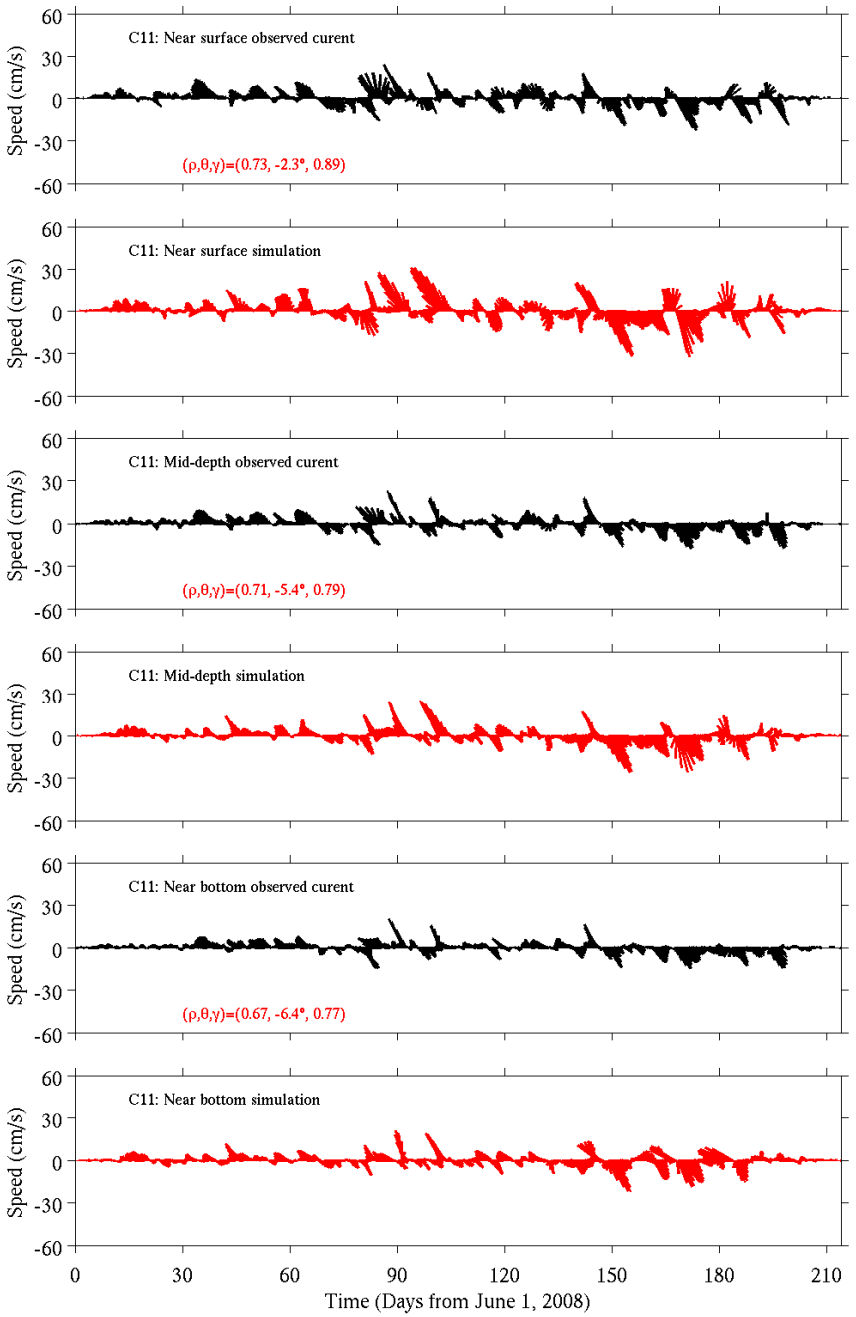
Model-Data Comparison: Velocity (36h low-pass)

C15 (10 m)



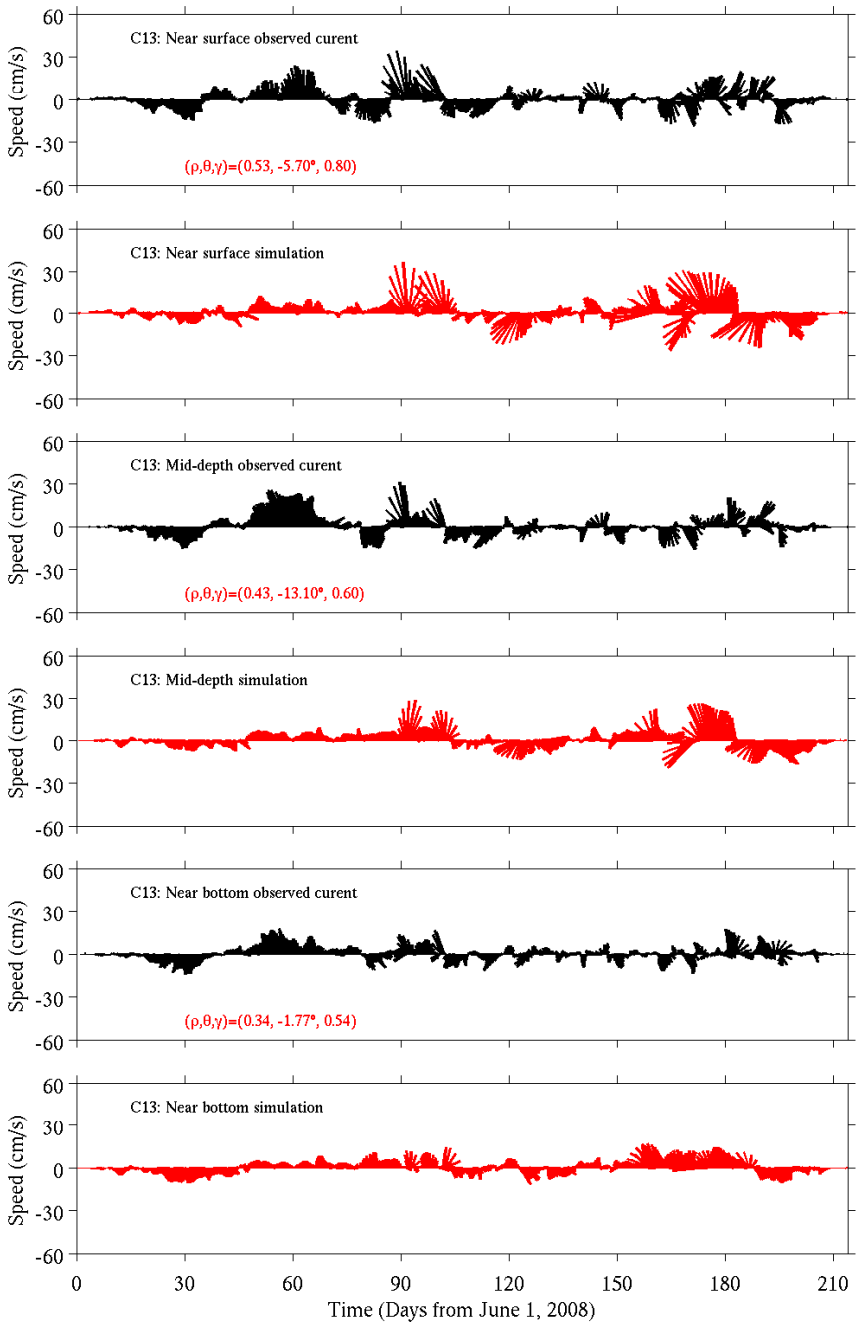
Model-Data Comparison: Velocity (36h low-pass)

C11 (20 m)



Model-Data Comparison: Velocity (36h low-pass)

C13 (50 m)

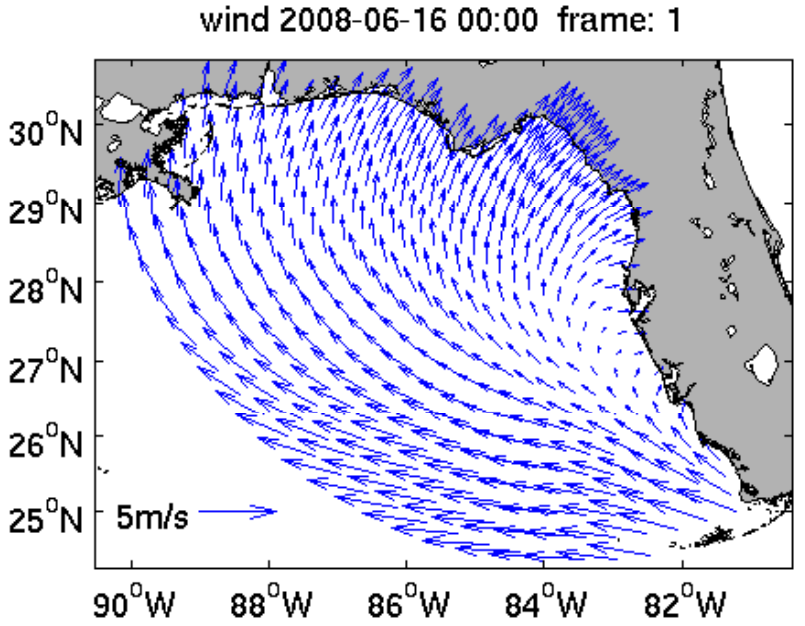


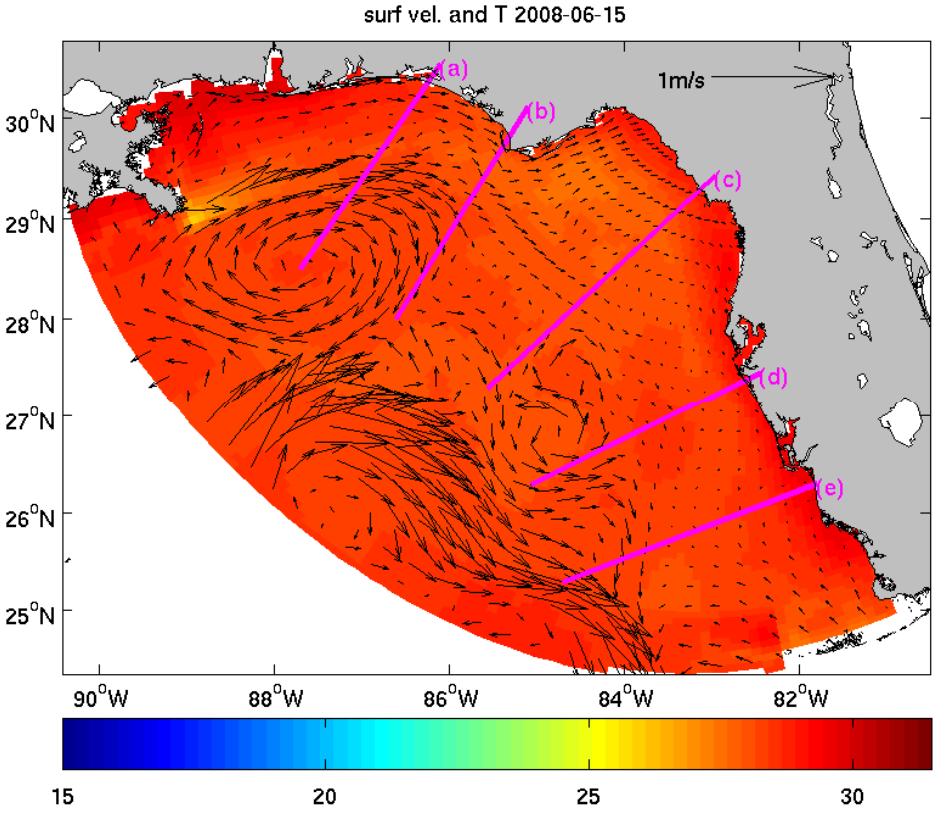
Why the red tide over the West Florida Shelf in 2008 is mild?

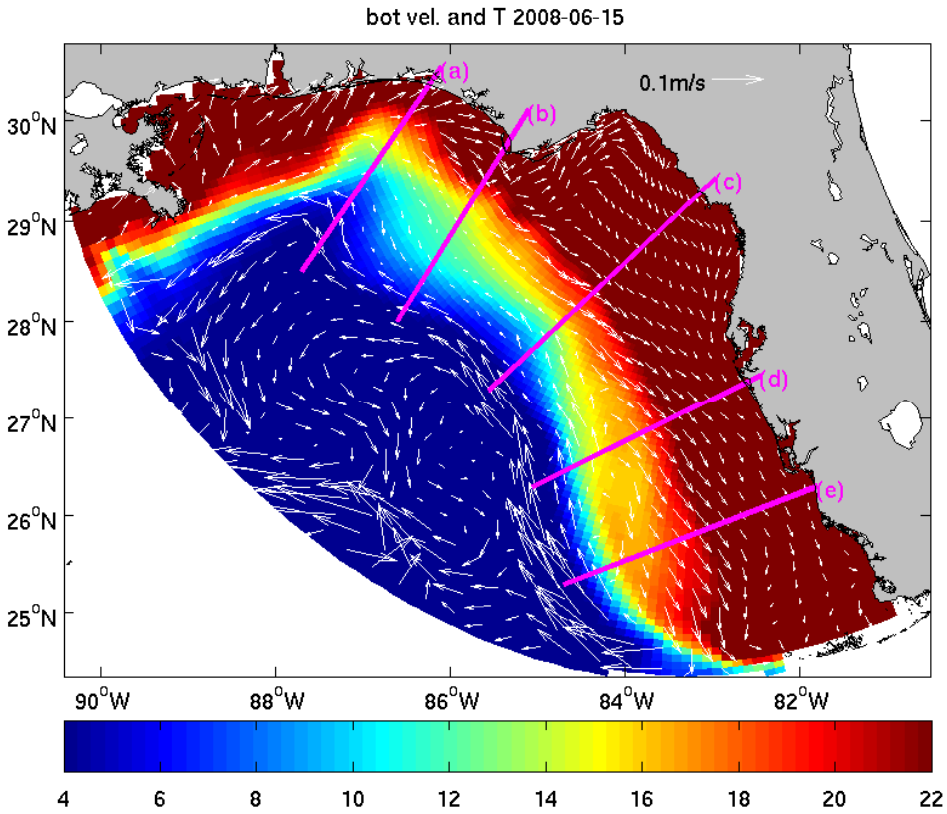
Monthly mean near surface & near bottom currents

Monthly mean winds & currents

June

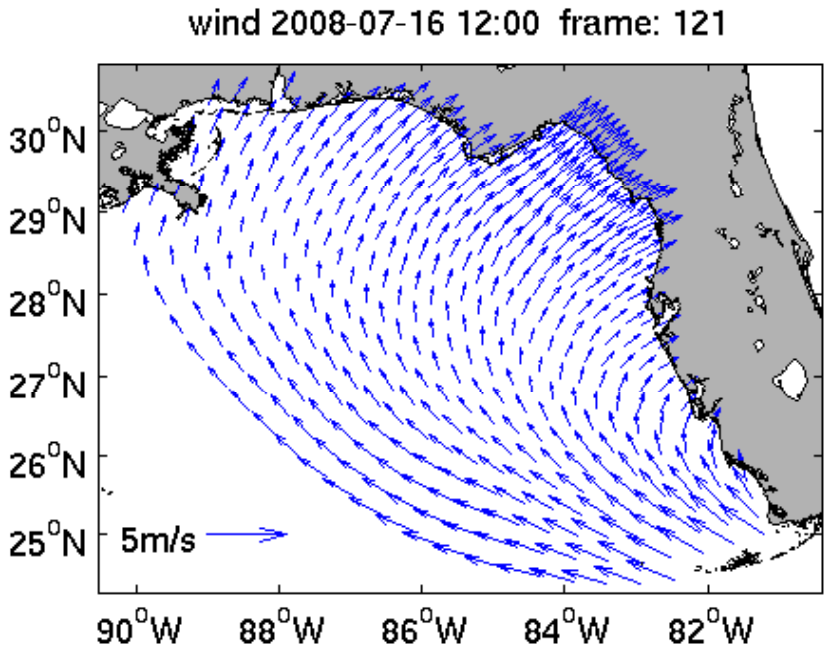


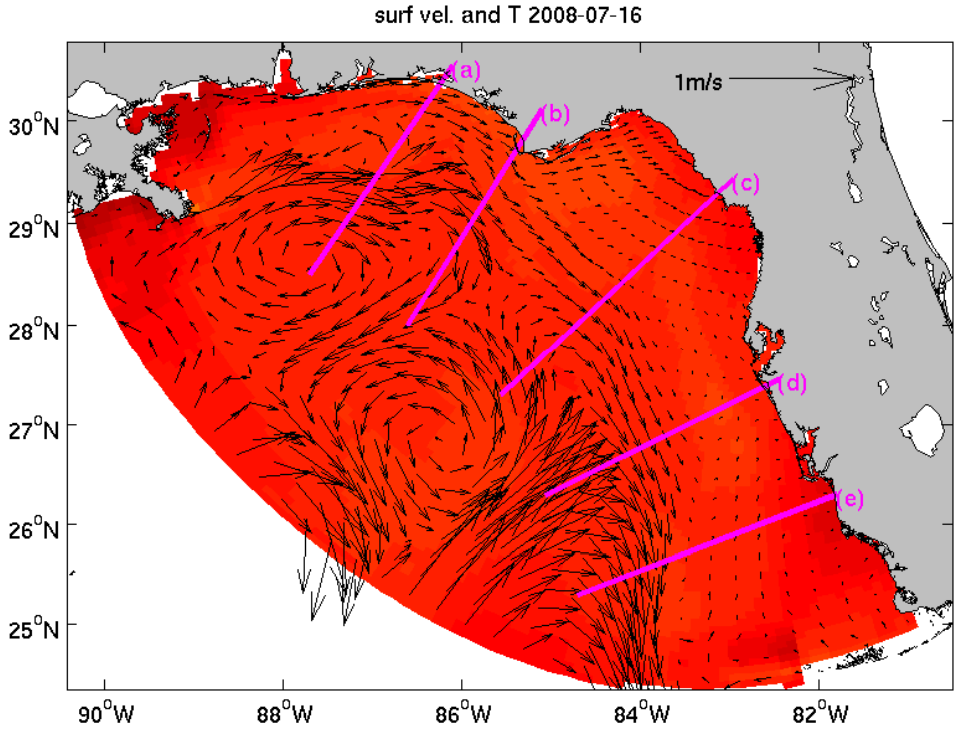


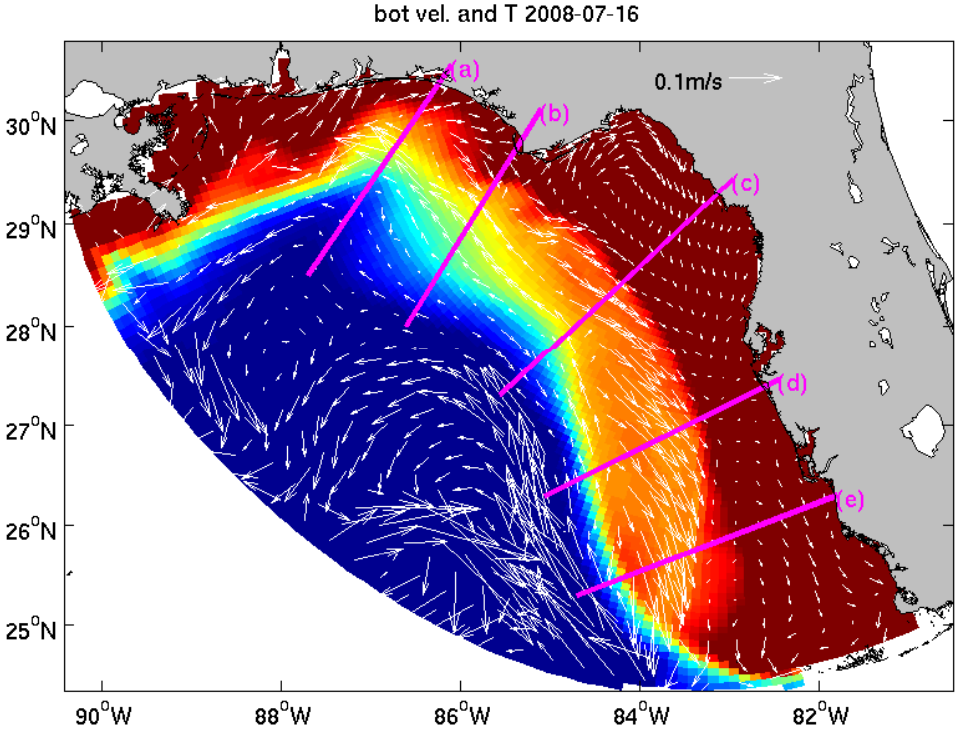


Monthly mean winds & currents

July

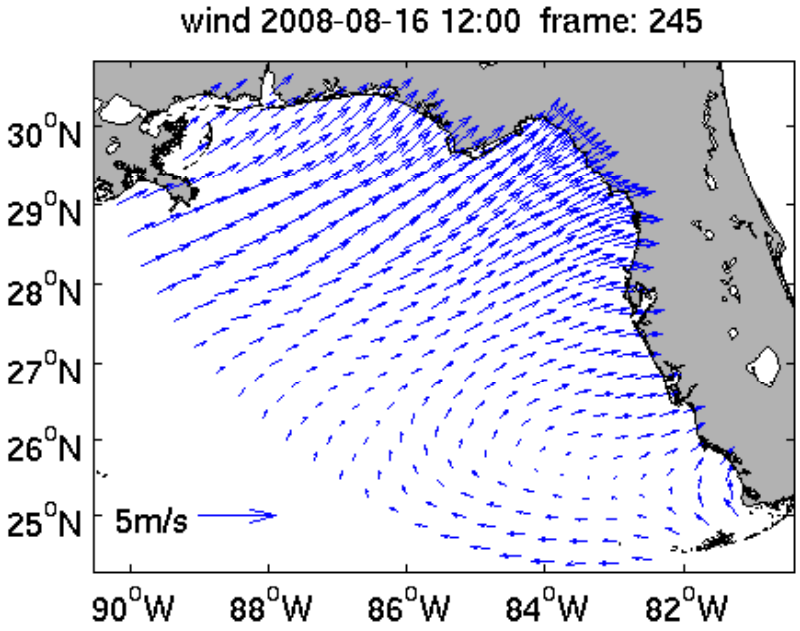


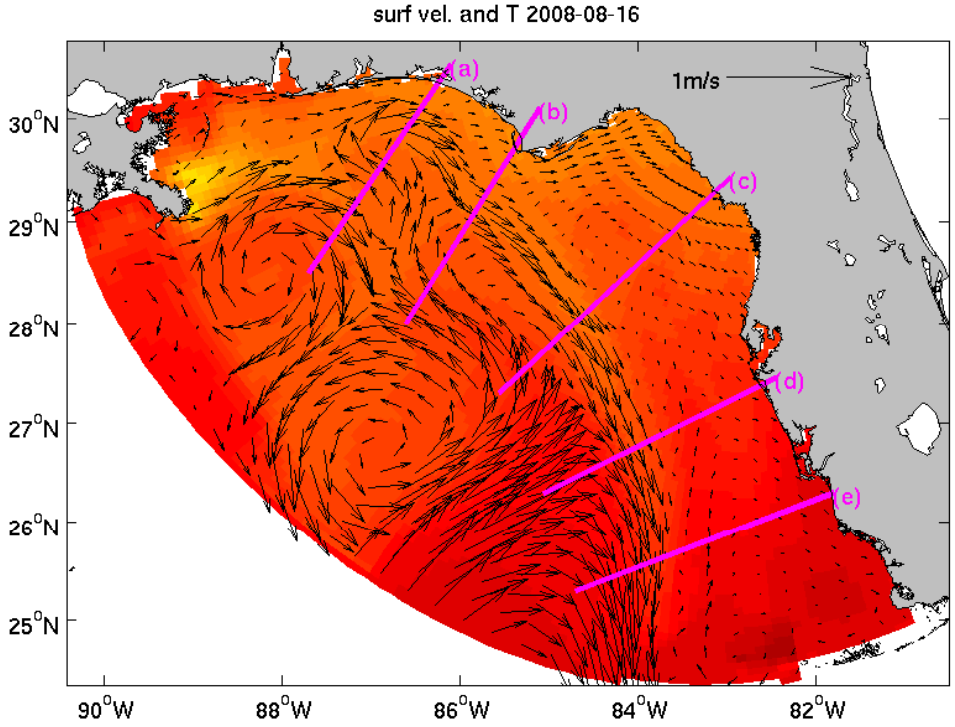


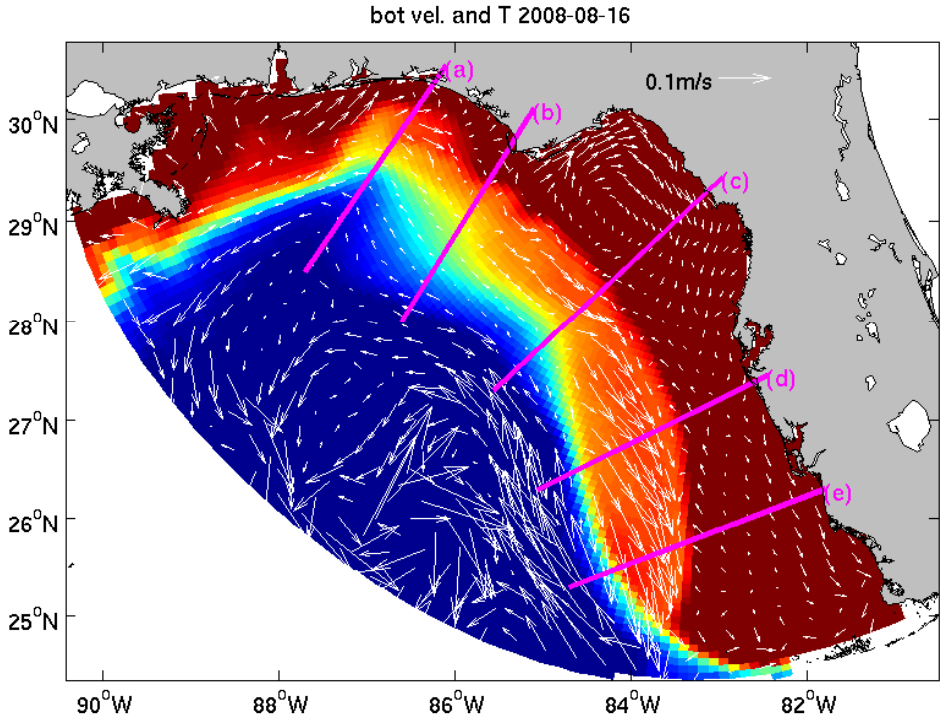


Monthly mean winds & currents

August

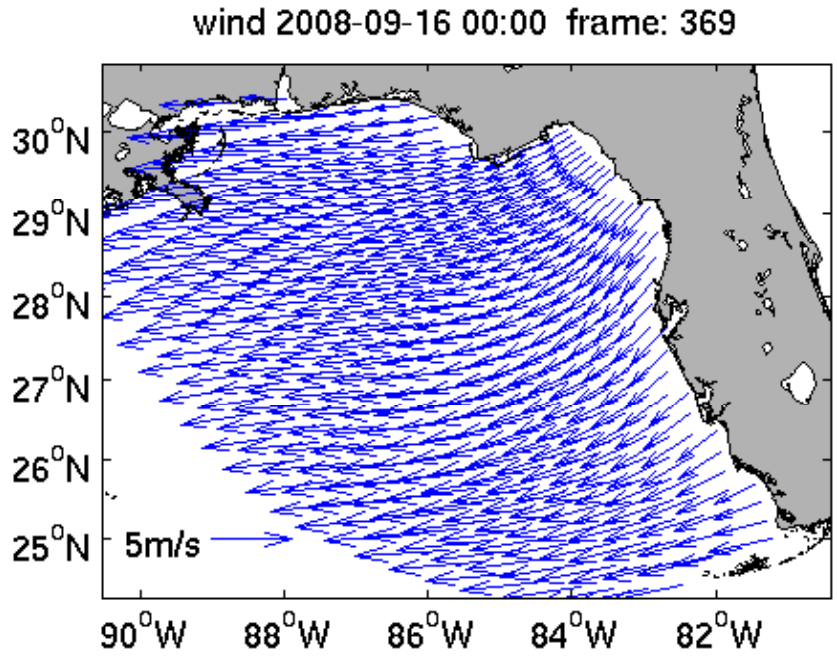




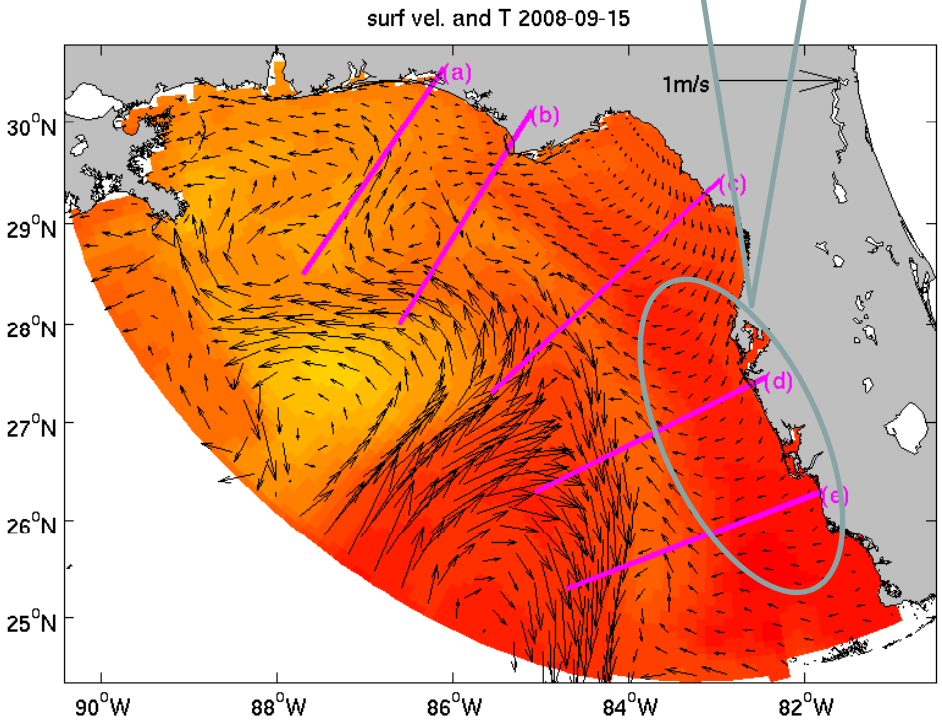


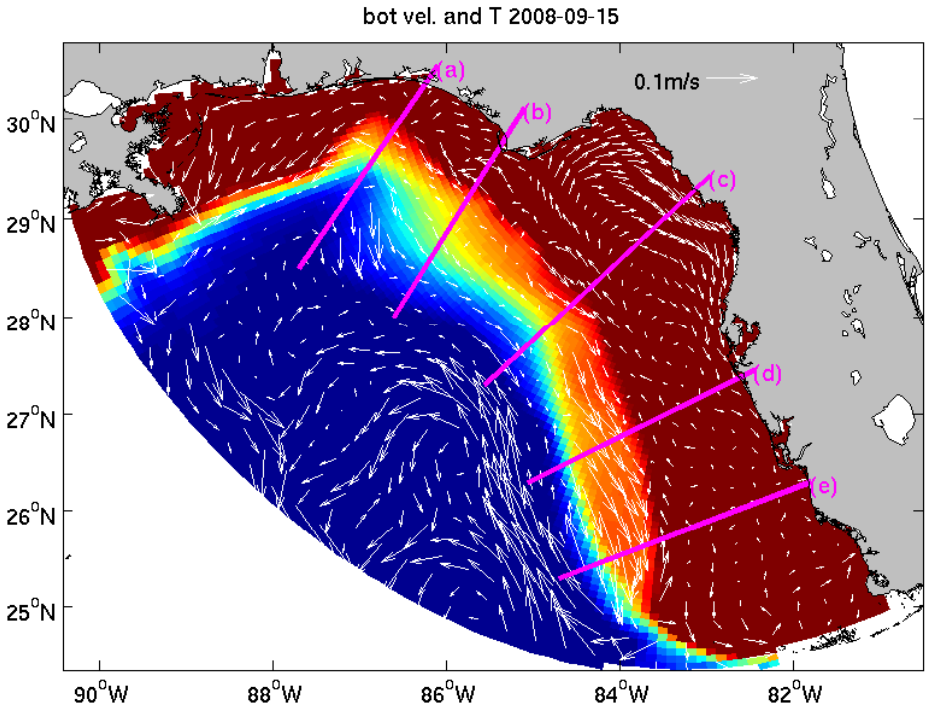
Monthly mean winds & currents

September



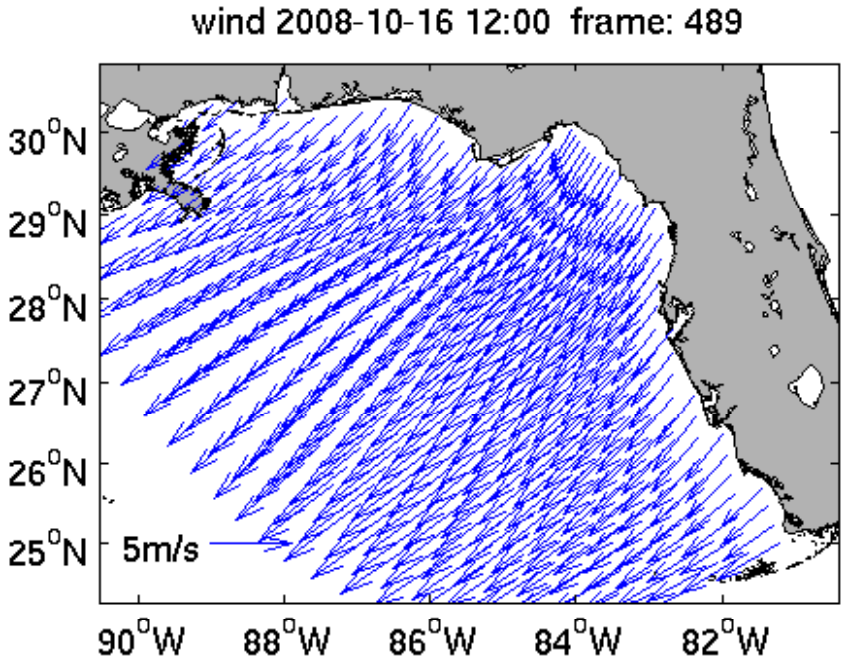
Offshore transports



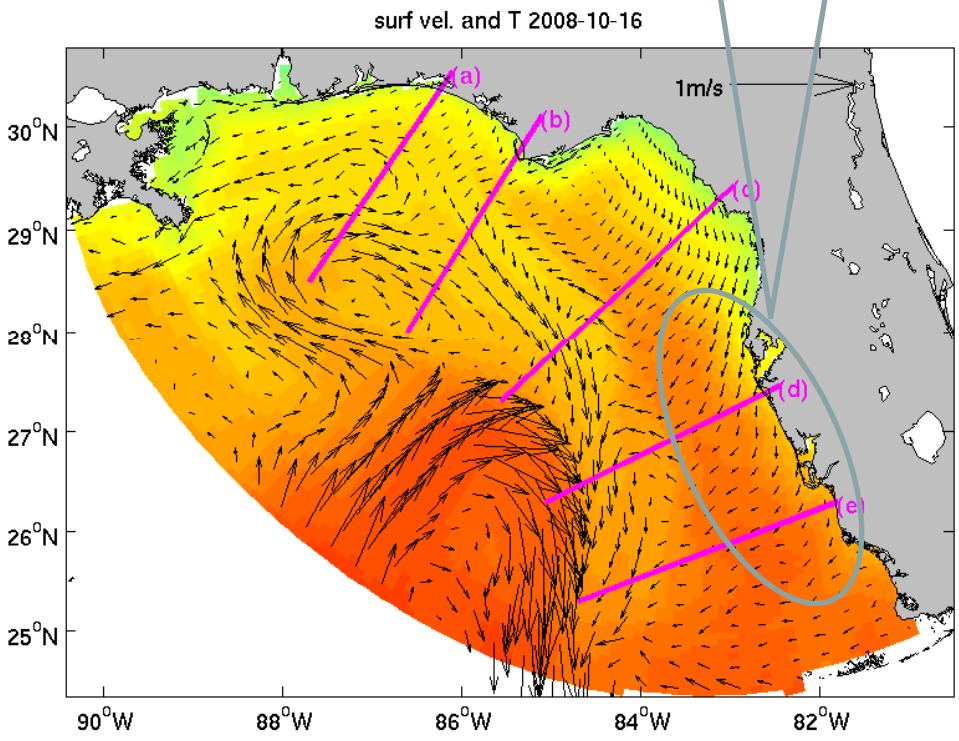


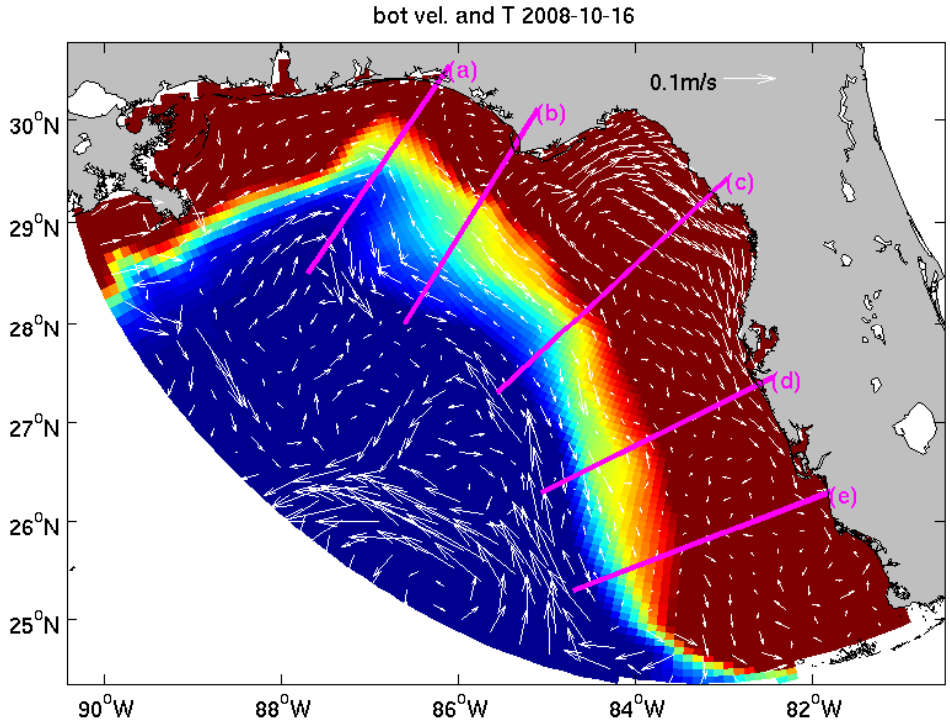
Monthly mean winds & currents

October



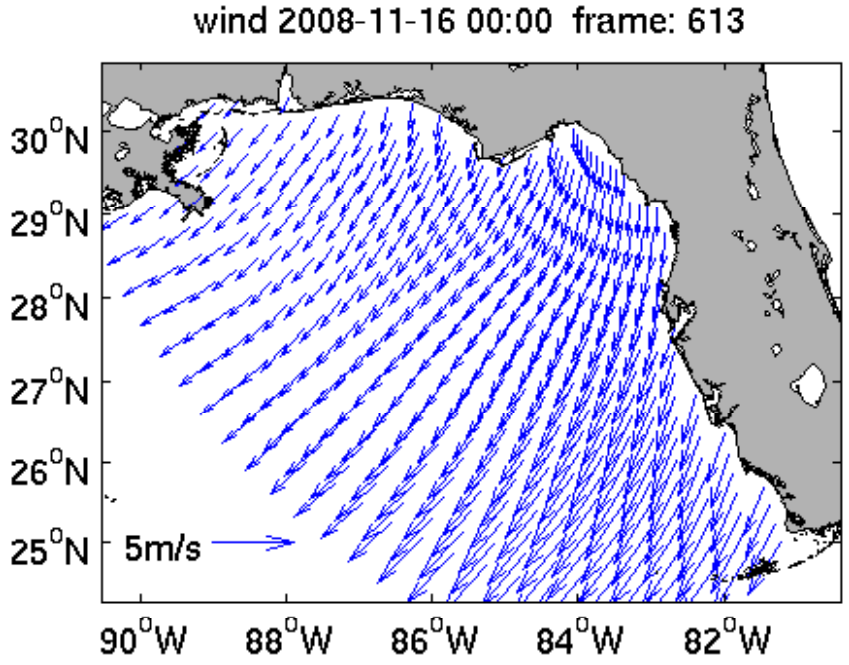
Offshore transports

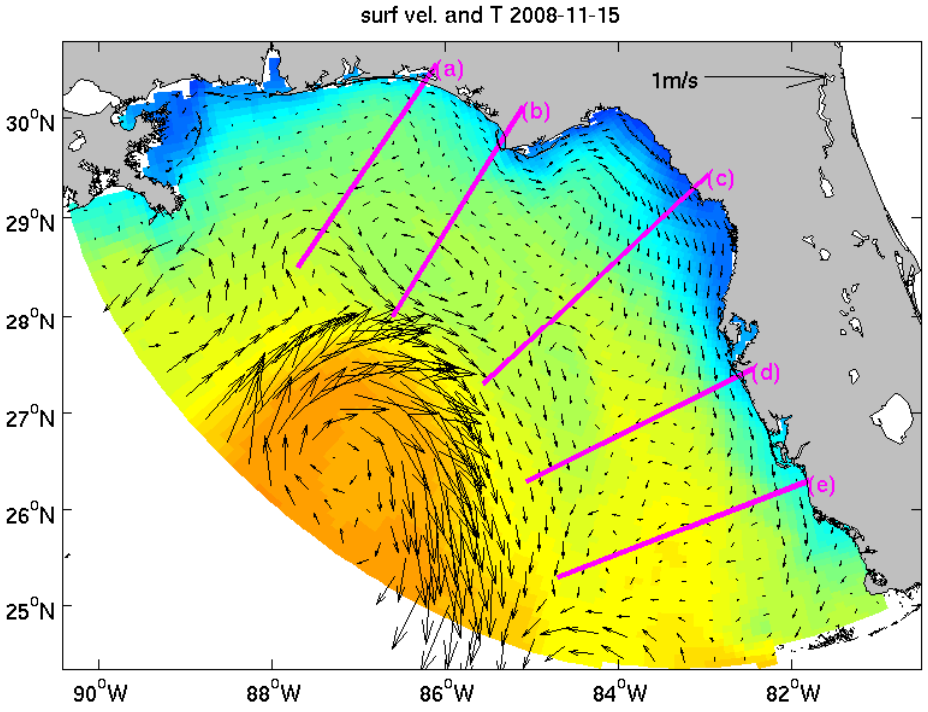


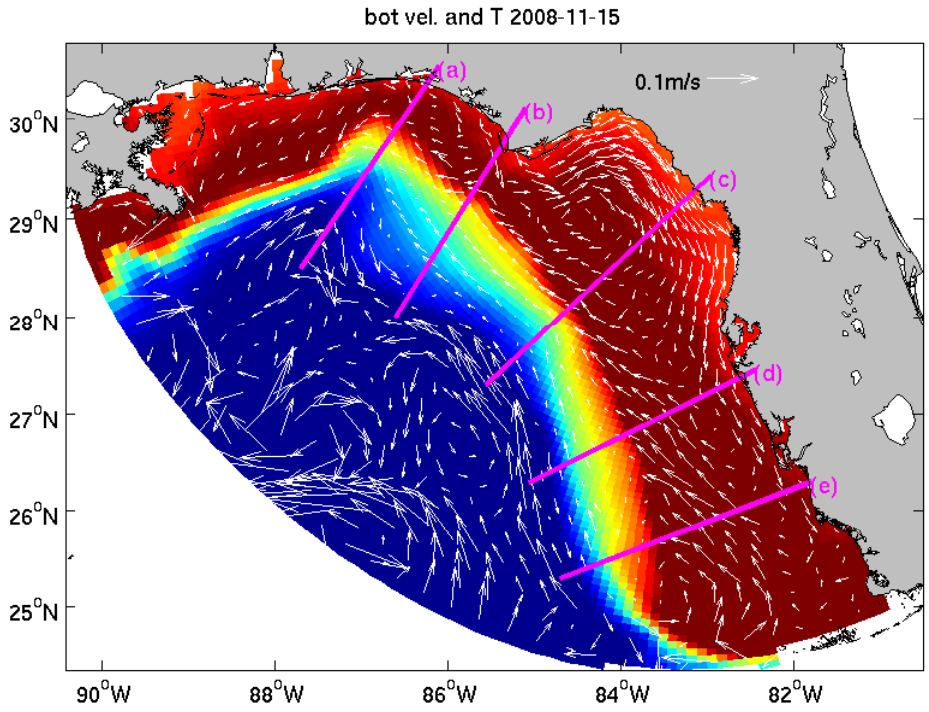


Monthly mean winds & currents

November

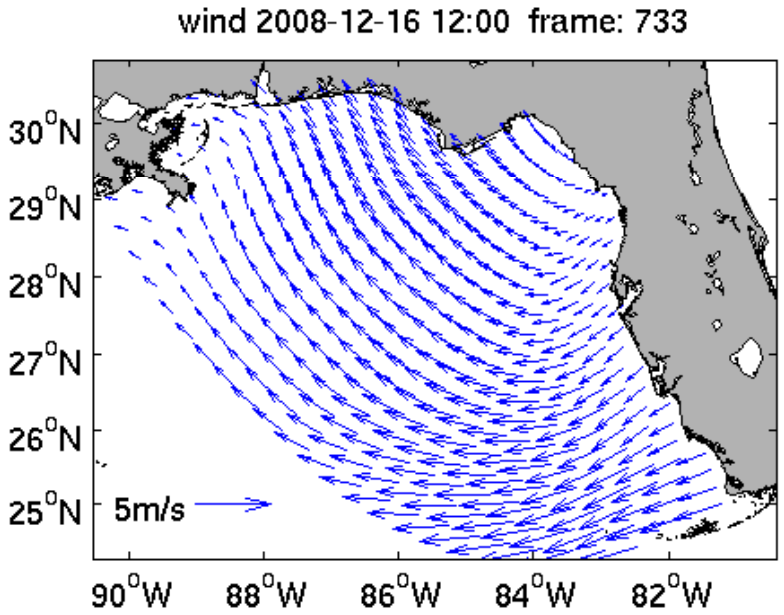


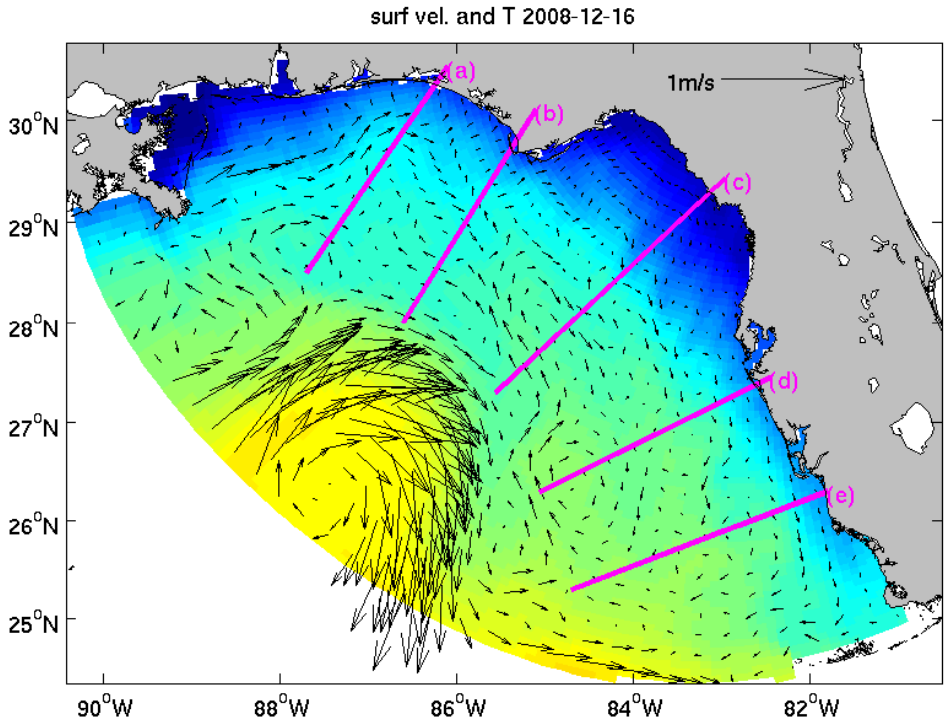


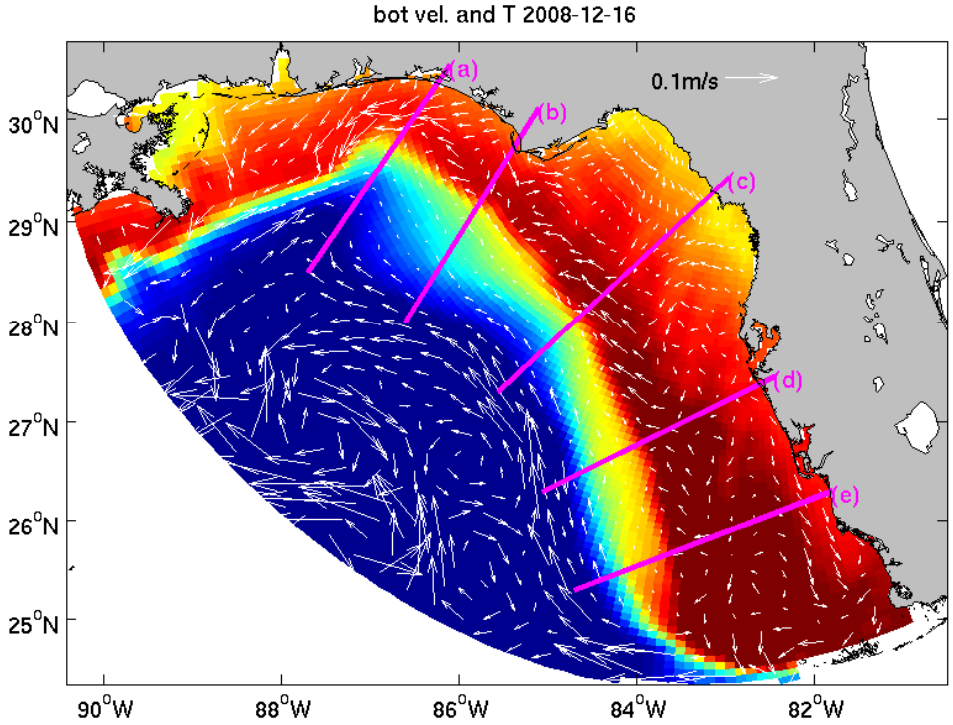


Monthly mean winds & currents

December

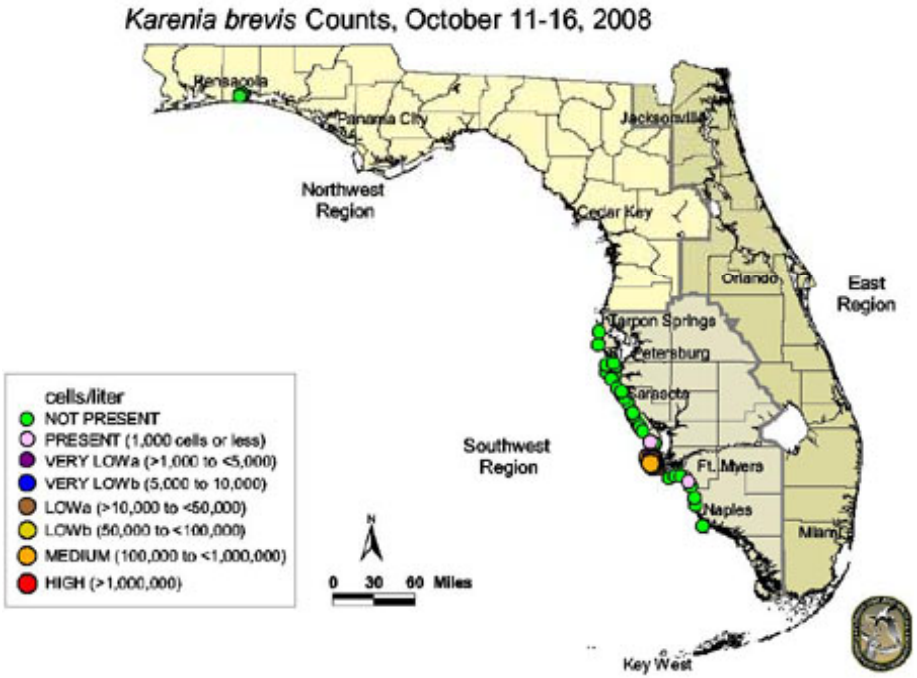


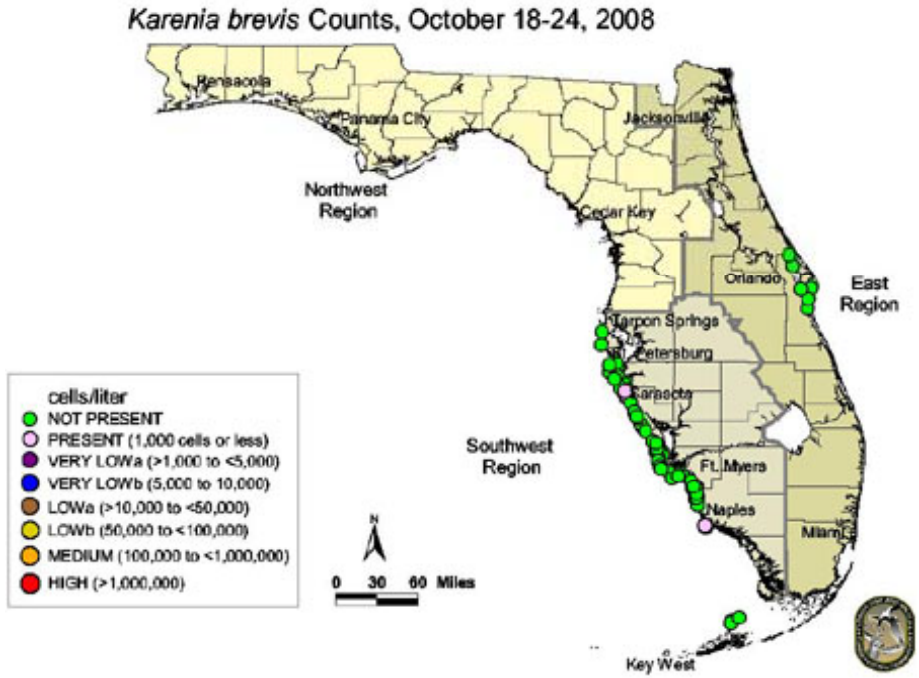




Why the red-tide detected in October only stay in a short period?

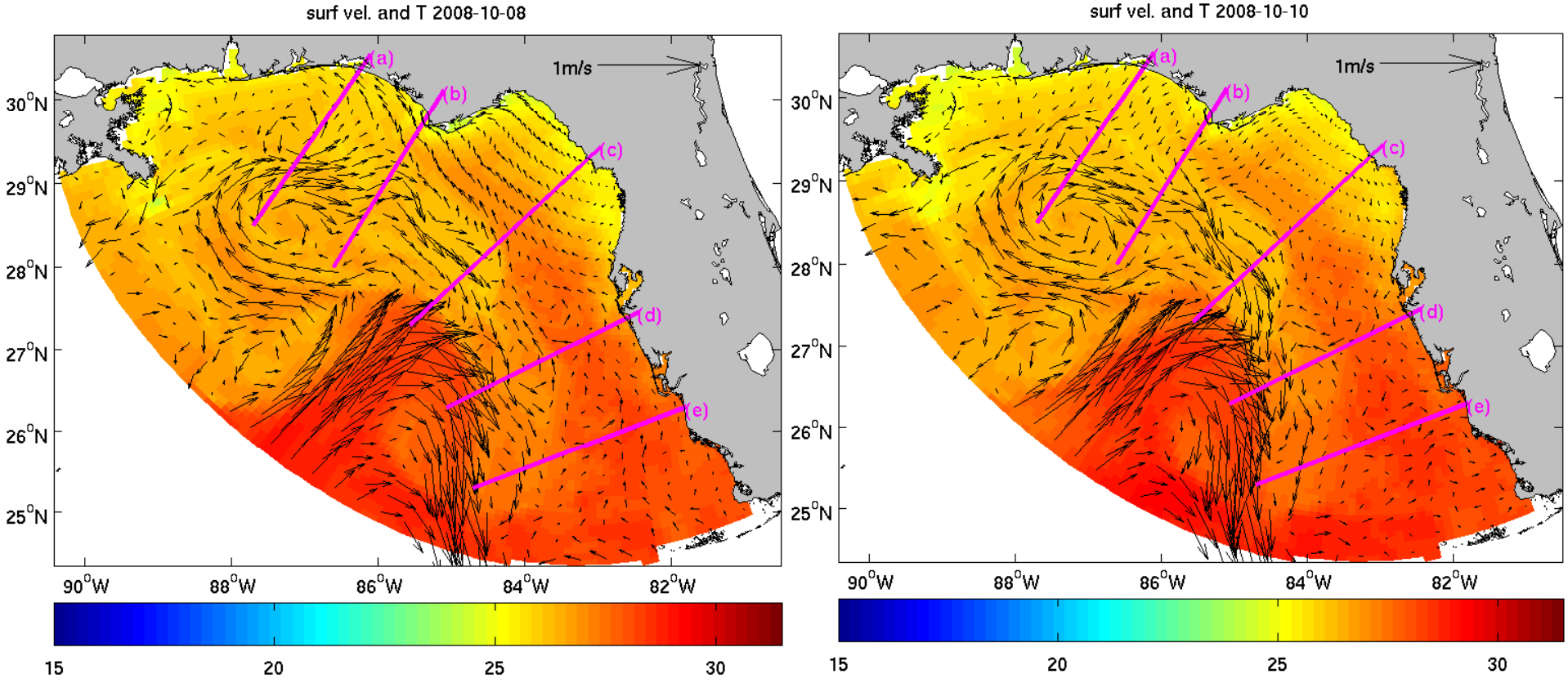
FWRI Observations





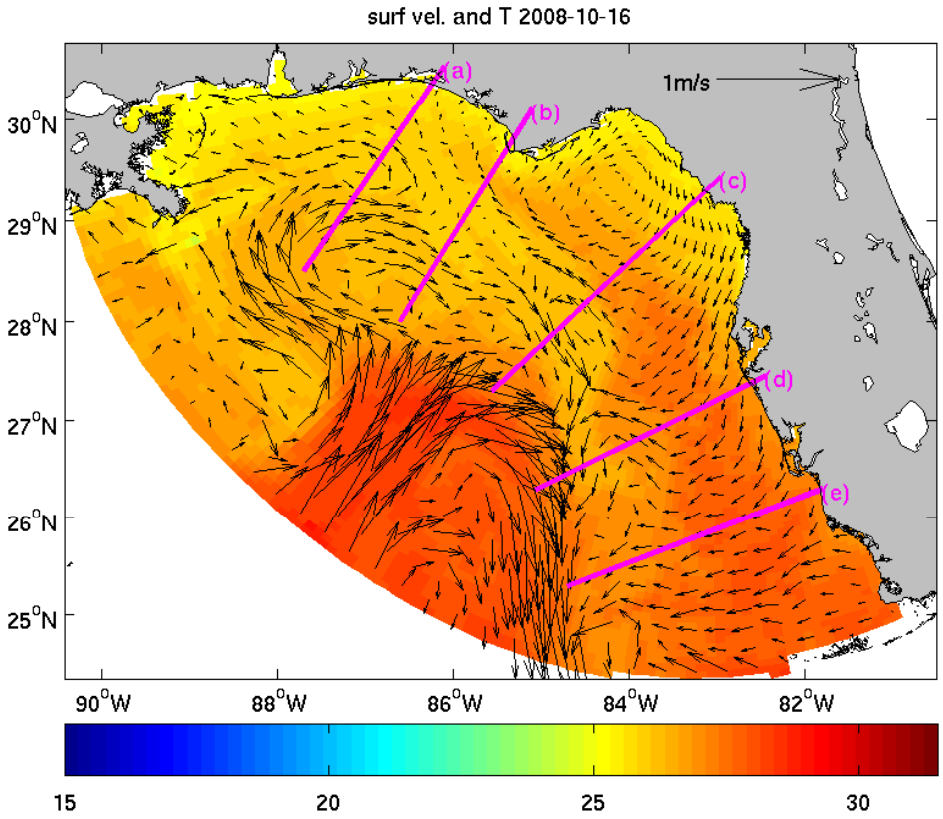
Prior to the red tide was detected:

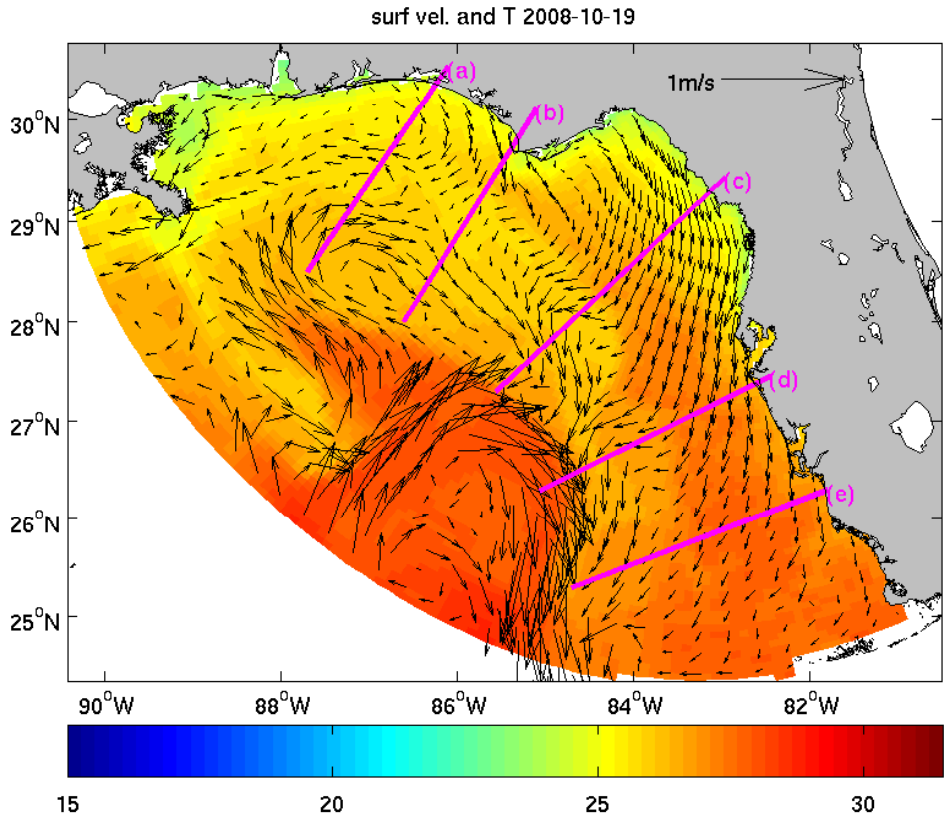
Daily mean surface current



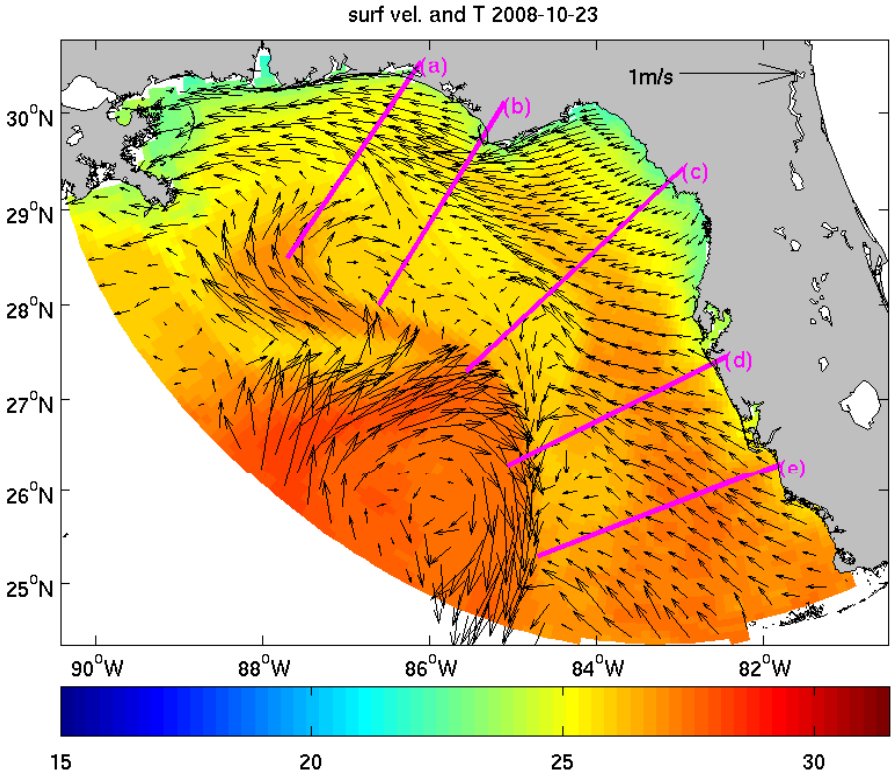
After the red tide was detected:

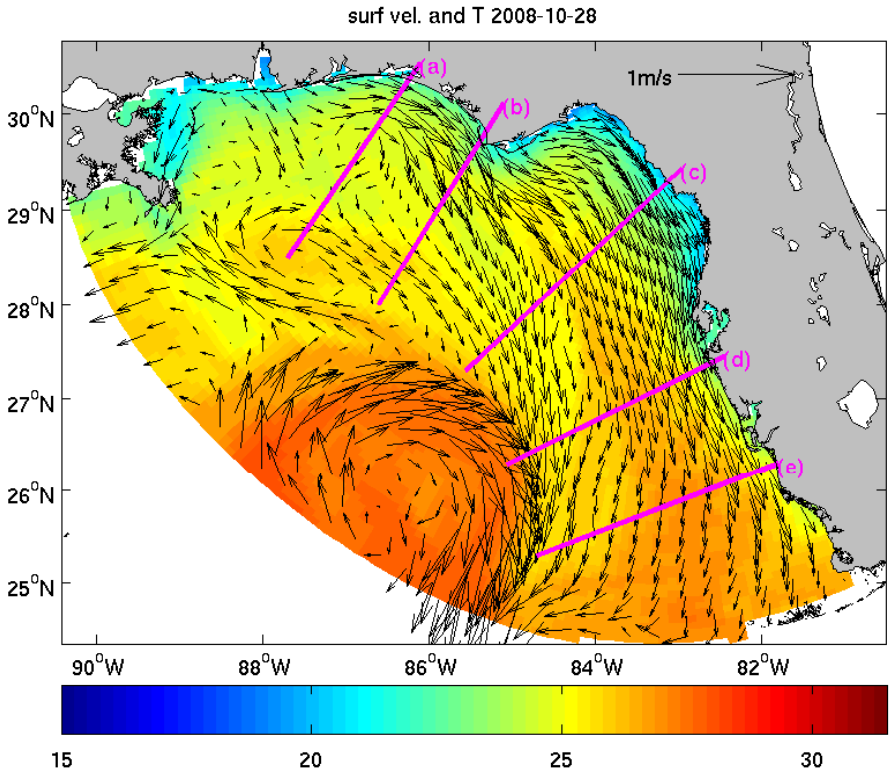
Daily mean surface current

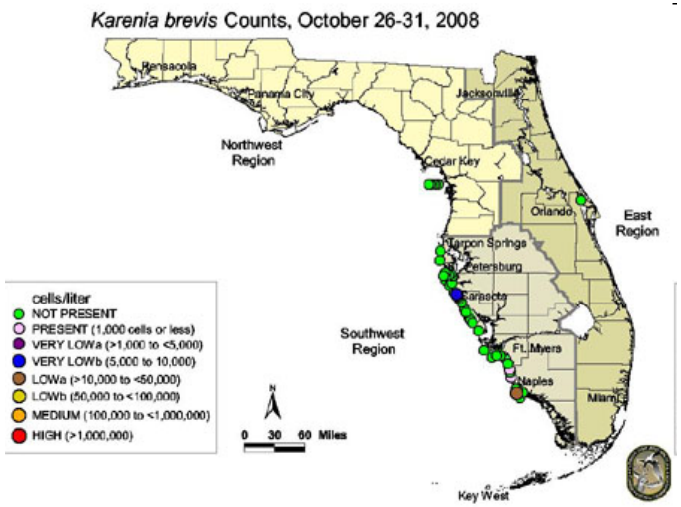




Surface currents after the red tide was detected (cont.)







Summary

- **Ocean circulation model hindcast shows that the high-nutrient deep-water transported to the WFS inner shelf was limited from Jun through Dec 2008. Thus, the red tide over the WFS in 2008 was mild.**

- **The Oct red tide event can be linked with ocean circulation. Before the red tide was reported outside of the Charlotte Harbor, there were a few days of weak onshore surface currents (Oct 8 ~ 10). Surface currents were offshore in the following two weeks, which transported the red tide away from the coast. This might explain why the Red-Tide outside of the Charlotte Harbor disappeared quickly in Oct.**