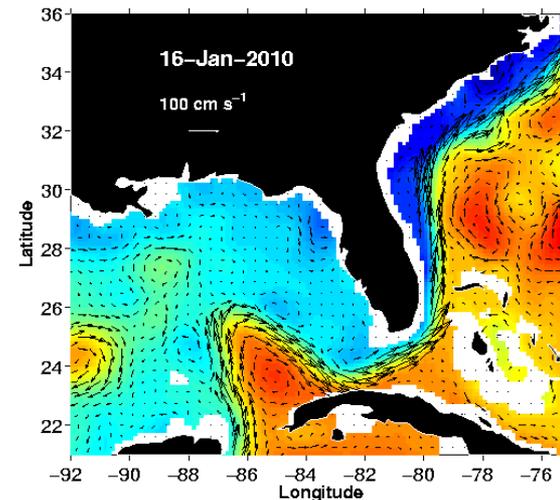
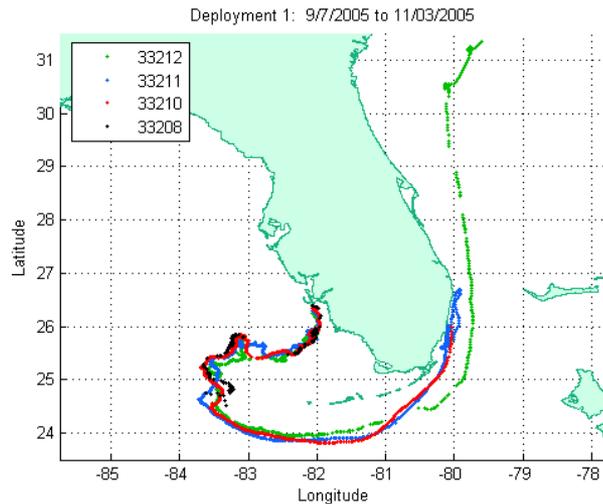


Examples of Spatial and Ecosystems Connectivity across the West Florida Shelf and the Southeast U.S.

R.H. Weisberg



**NWQMC/IOOS/RA: Water Quality Workshop
Baltimore, MD
January 25, 2010**

1. Water Quality Issues:

HABs, D.O., Source waters, Fisheries

2. User Community:

Agencies (local, state, and federal), public, commercial and recreational fishers, scientists

3. Process:

- a. Coordinating observations and models;***
- b. Downscaling from the deep ocean to the estuaries with multiple models: HYCOM, ROMS, FVCOM;***
- c. Coordinating agency WQ obs. with academic R&D, i.e., HABs + other measures by the FWC with circulation obs./models by USF and NCSU;***
- d. Employing new sensor delivery systems with real time telemetry (USF BSOP and subsequently gliders).***

4. Outcomes:

- a. Scientific insights and publications.*
- b. An automated, internet accessible red tide tracking tool (USF and FWC).*
- c. A Center for Prediction of Red Tide (CPR), joint between USF and the FWC.*

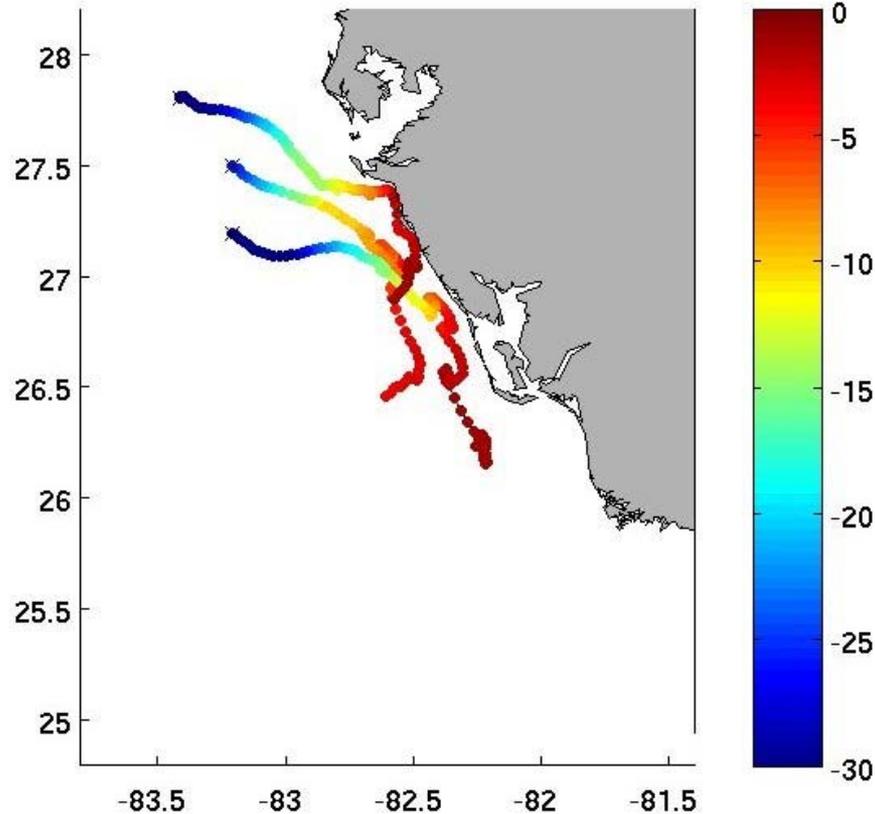
5. Metrics for tracking success and measuring performance (“Return on Investment”)

Obs./model comparisons: \underline{V} , η are ongoing, plus limited T/S. D.O., nuts, HABs are awaiting more routine data collection and more complete WQ/ecological models, where ecological model is defined as a coupled, physical-biological model with a sufficient number of biological state variables to represent HABs and fisheries.

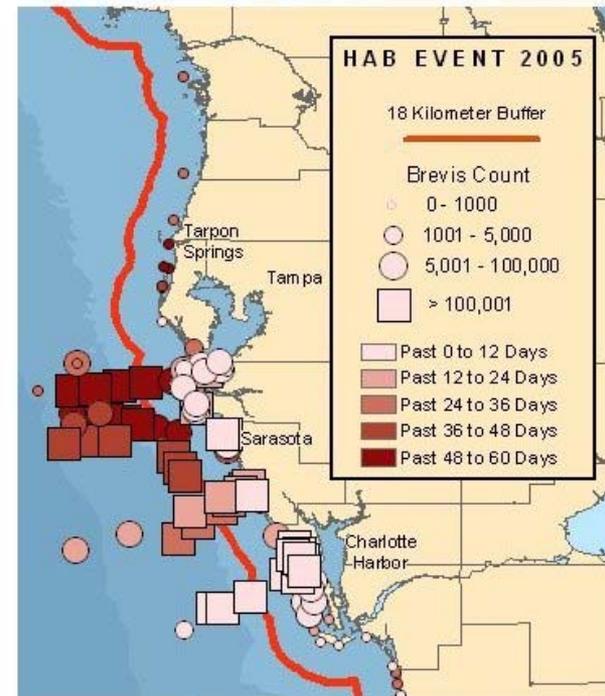
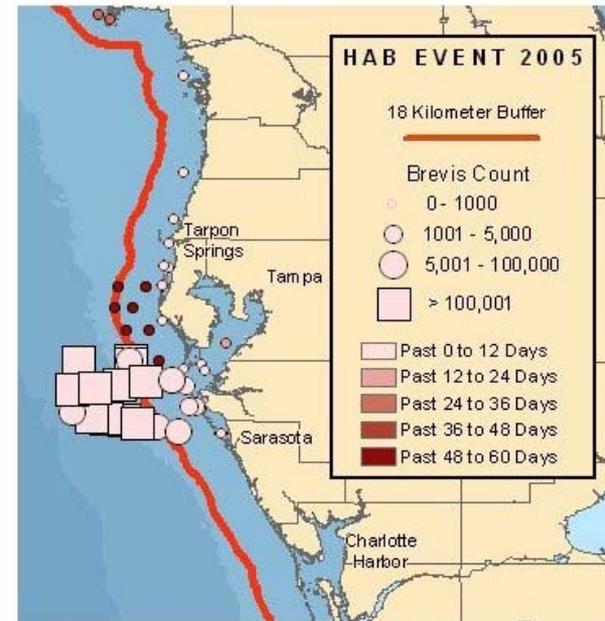
Outcome example:

K. brevis was transported to the beach in the bottom Ekman layer

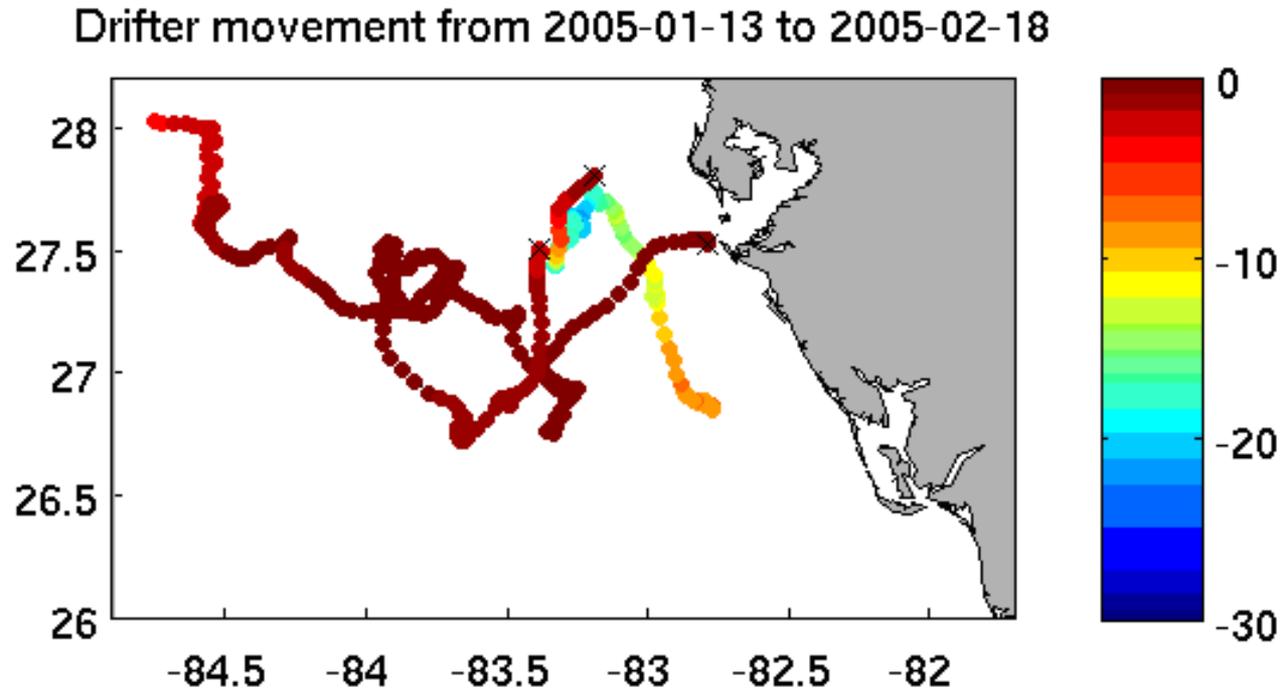
Drifter movement from 2005-01-13 to 2005-02-18



Modeled particle trajectories from the USF WFS N/F model (ROMS nested in Global HYCOM)



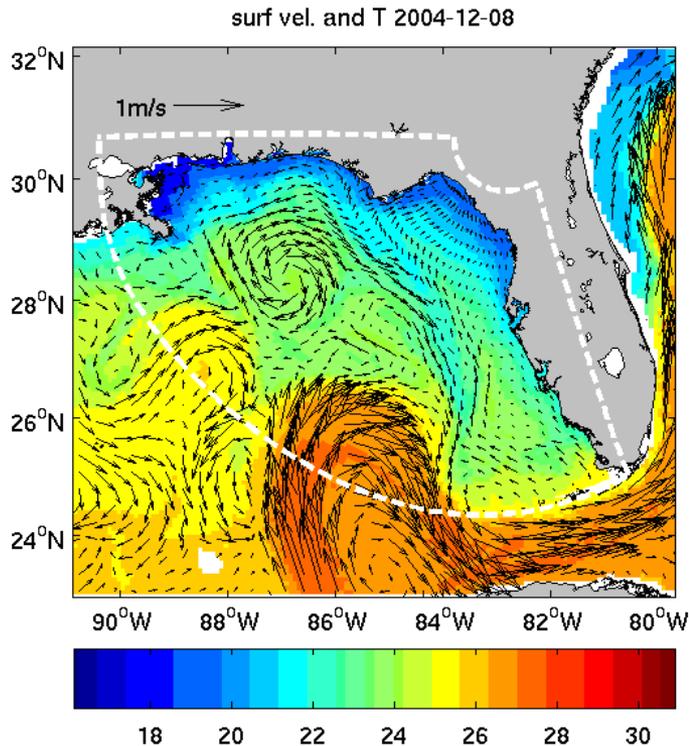
In contrast to the onshore transport of near bottom *K. brevis* cells, those at the surface were transported offshore.



Subsequent tracking showed that once *K. brevis* cells arrived nearshore then were advected up and down the coastline in a predictable manner.

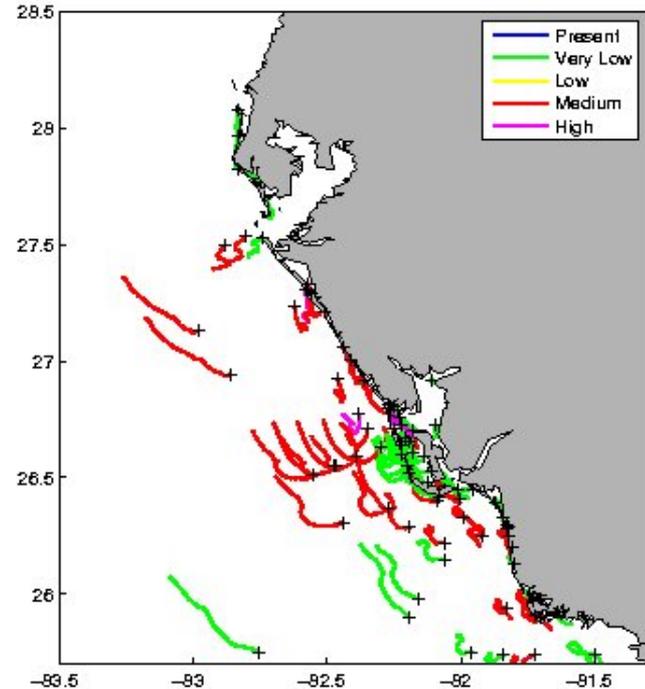
Legacy Outcomes

(For now, subject to funding: Florida ceased red tide R&D for lack of \$\$, and RAs are largely unfunded)



Automated, Internet accessible, WFS
N/F model:
ROMS nested in HYCOM

Trajectories from cell count locations from 2006-10-06 to 2006-10-10

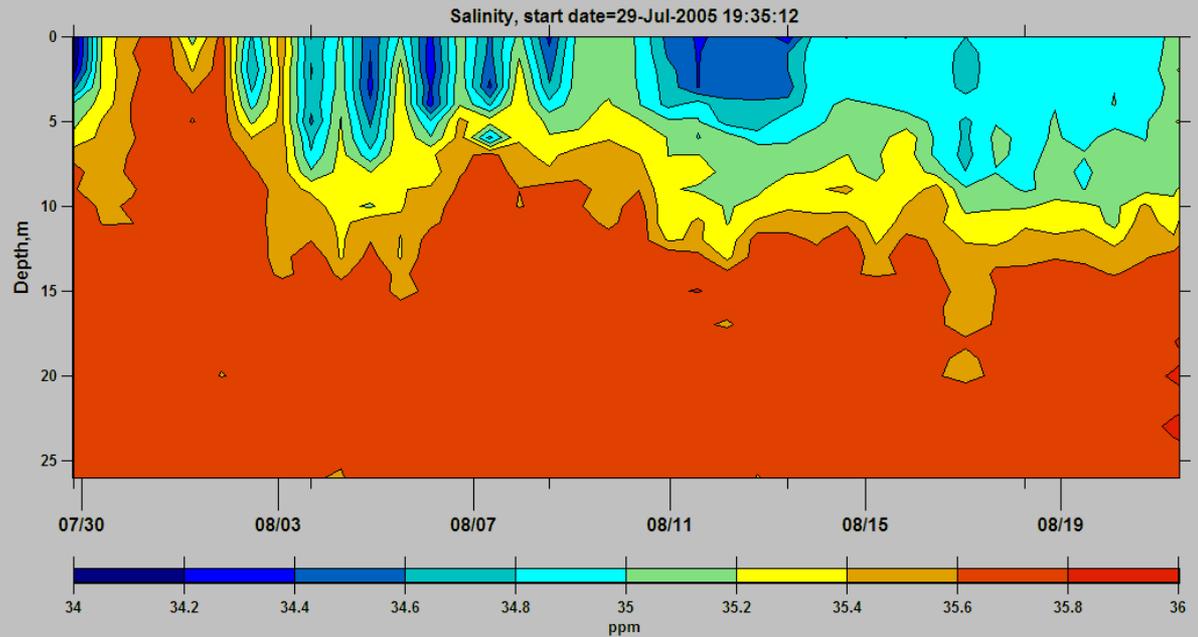
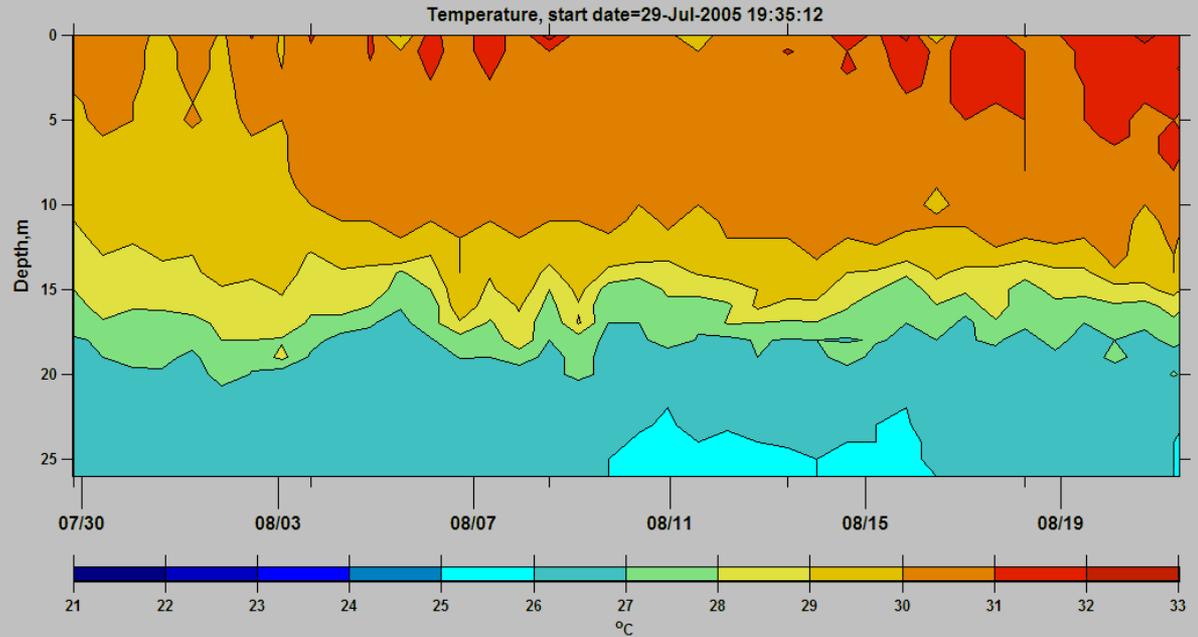
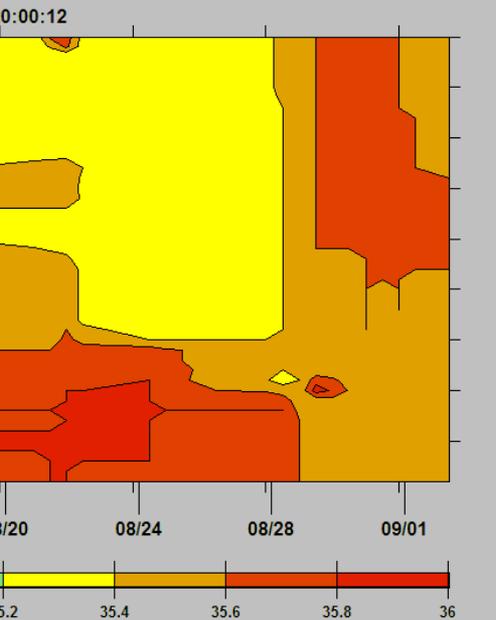
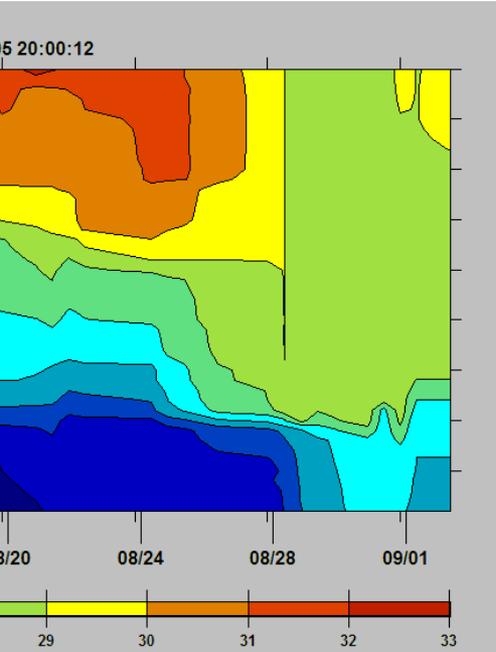


Red tide tracking/forecast tool:
USF-FWC initiated summer 2006

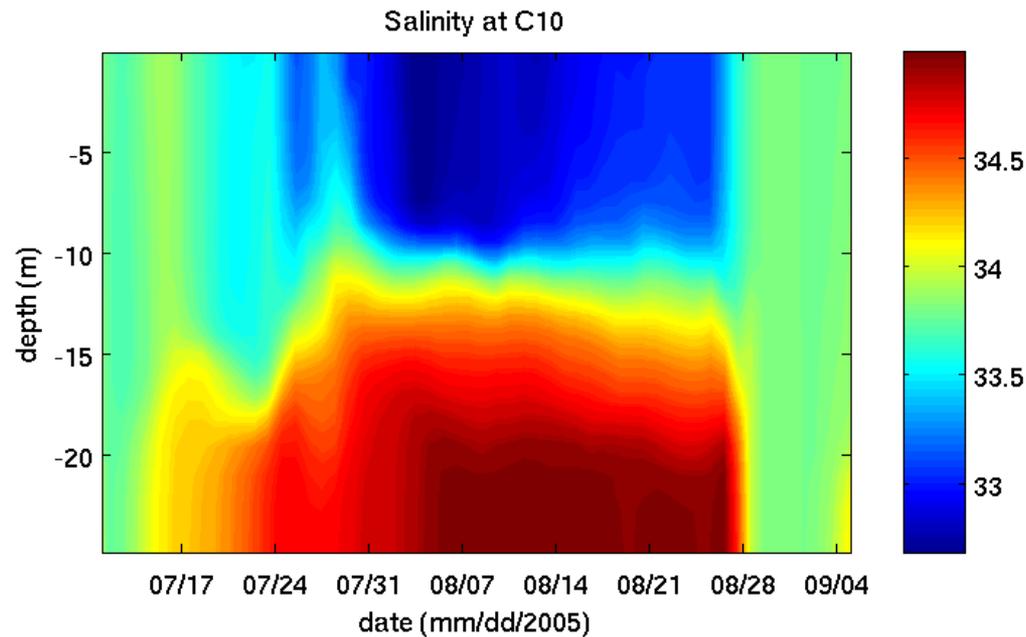
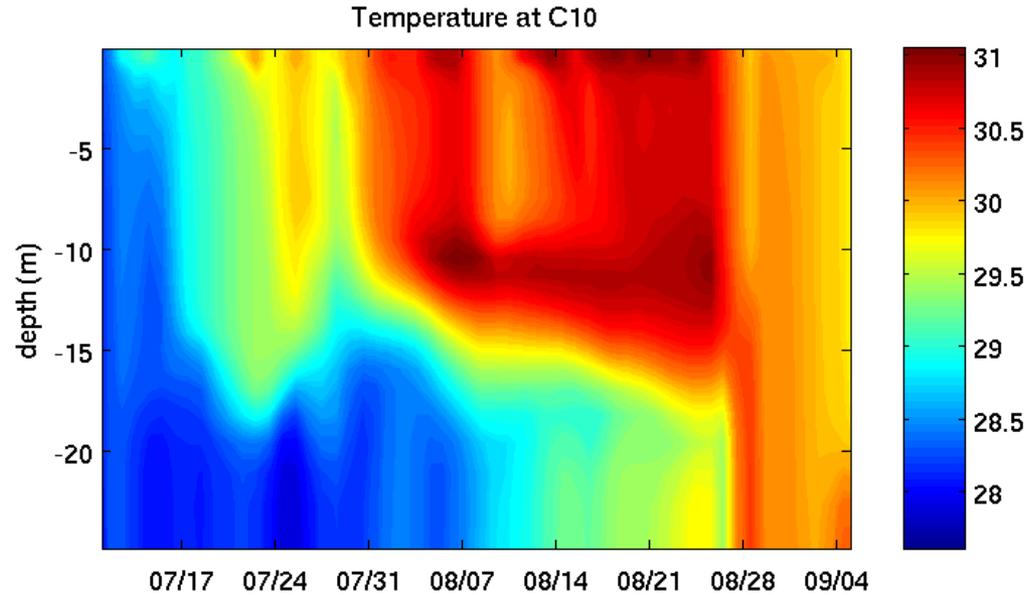
6. Value added from advances in technology:

Bottom Stationed Ocean Profiler to use with gliders in sustained, synoptic mapping missions.

BSOP in Summer 2005: H. Katrina (left); T/S stratification ► benthic die-off (right)

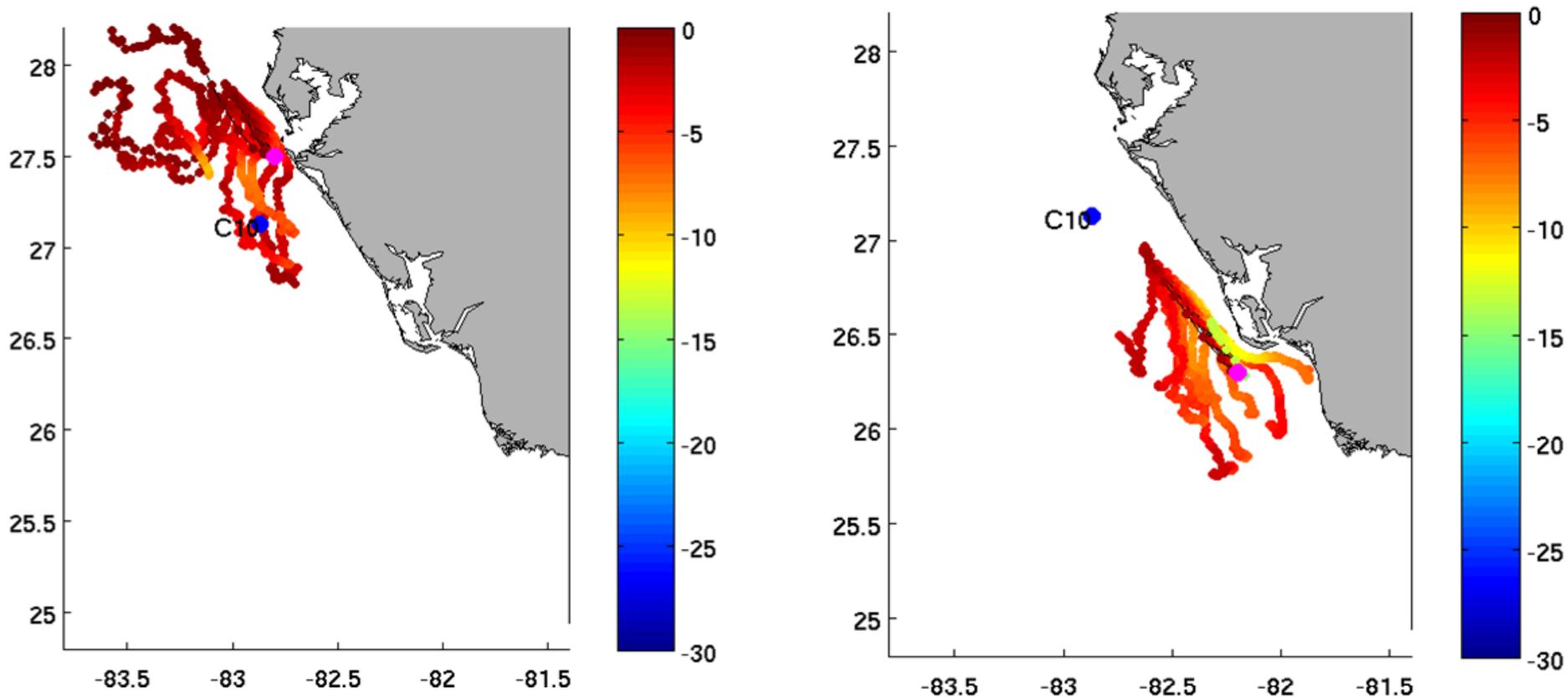


Modeled T/S time series at the C10 location showing the BSOP observed stratification



Source water origin from simulated float trajectories, 7-9-06 to 8-3-06:

The near surface water observed by BSOP in the vicinity of mooring C10 originated near the mouth of Tampa Bay, not Charlotte Harbor. This dispels the myth that all WQ ills originate from Lake Okeechobee runoff.



Connectivities again: Spatial and trophic levels.

2006 was a typical WFS **red tide** year, whereas 2007 was not. This is important for fish because ***K. brevis*** makes its living killing fish.

Using circulation models, along with FWC ***K. brevis*** and fish kill observations, we determined that:

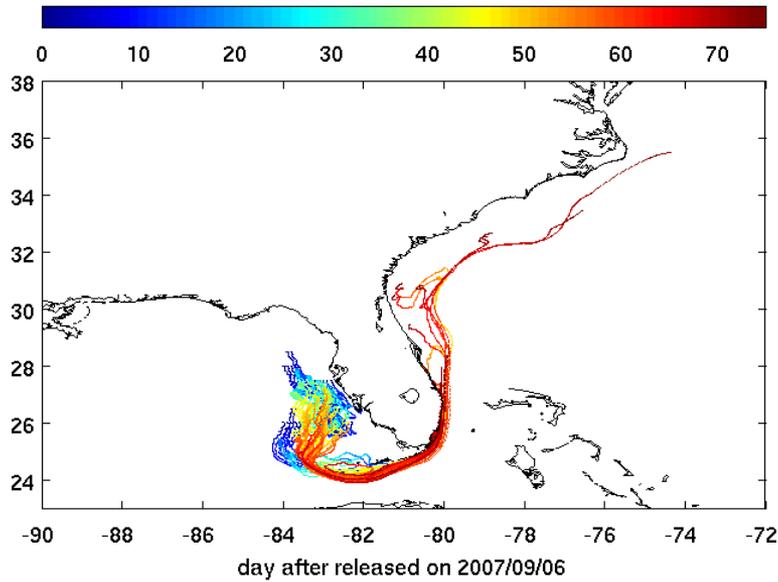
- a. 2007 was a WFS export year to both the east coast and points farther west, whereas*
- b. 2006 was a WFS retention year.*
- c. Fish kills showed opposite behavior, i.e., death on the east coast in 2007; death on the WFS in 2006.*

These multidisciplinary findings of ecologically-based management importance demonstrate accomplishment through academic/state agency partnership.

Model simulated surface drifter trajectories:

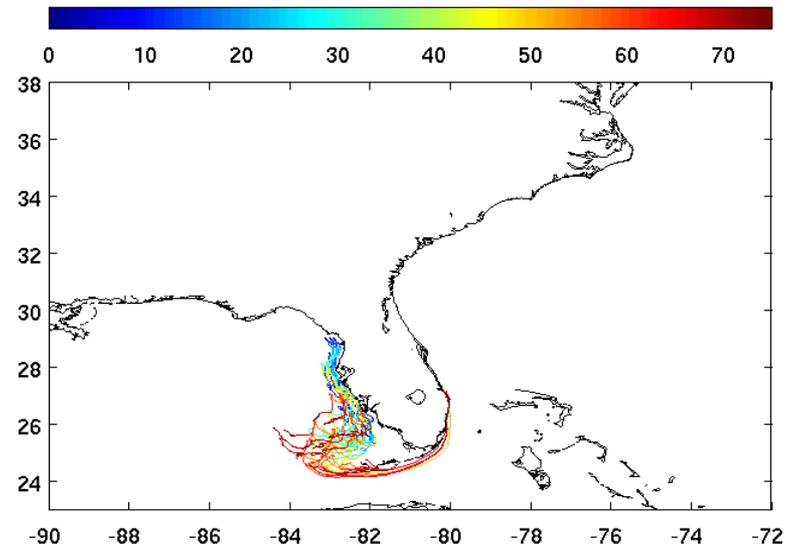
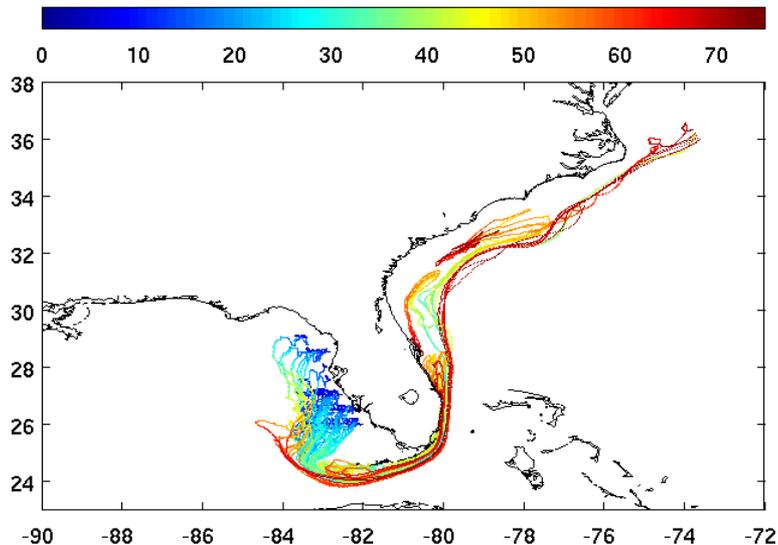
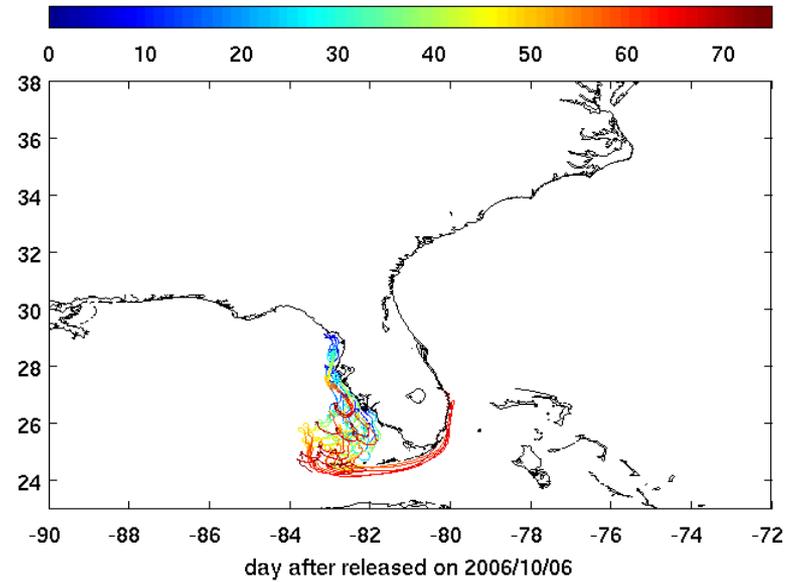
8/6/07 and 9/6/2007

day after released on 2007/08/06



9/21/06 and 10/6/2006

day after released on 2006/09/21



Red tide went to the east coast in 2007; it stayed on the west coast in 2006

7. Gaps and needs for improved outcomes:

Ecosystems-Based-Management requires quantitative understandings of the spatial and trophic level connections that define the ecosystem. The ocean circulation is fundamental because it fuels primary productivity by uniting nutrients with light, and it facilitates trophic interactions by distributing water properties. Hence no improved outcomes will result until the gap in building and sustaining COOS (including coordinated models) is filled. The same can be said for Marine-Spatial-Planning.

Finally, ecology is not biology; it is multidisciplinary. It follows that Ecosystems-Based-Management is not the sole purview of fisheries; it's the whole shebang. Fisheries management will continue to fail until that broader concept is adopted. Similarly, Marine-Spatial-Planning without connectivity is meaningless.