Automated Short-Term Forecast of *Karenia brevis* Trajectory on the West Florida Shelf

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Karenia brevis Red Tide on the West Florida Shelf

- Toxic dinoflagellate, seawater species
- Kills fish, causes respiratory ailments, substantial economic losses
- Need forecast tools

(*Photo courtesy of Meaghan E. Faletti*)

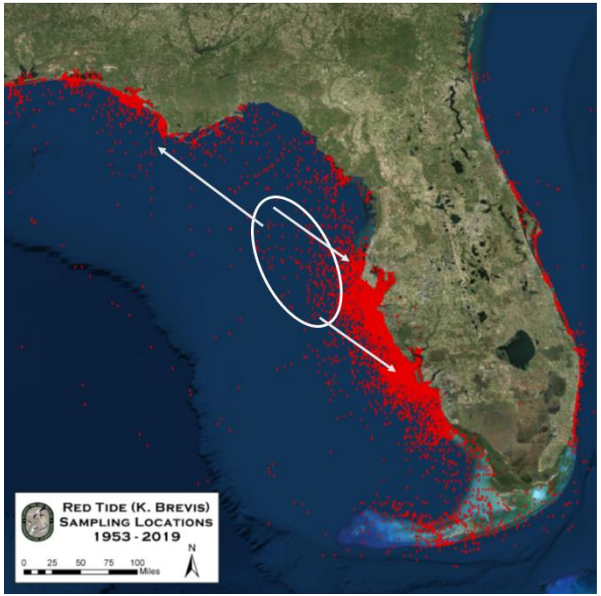
24 hypotheses for the *K. brevis* bloom (*Vargo,* 2009). Further tests are needed for complex physical-biological models.

Walsh et al. (2001, 2003, 2006)

Lenes et al. (2012, 2013)

Try to simplify the complex red tide forecast by just focusing on the advection processes of the HAB cells. Don't consider growth or decay for now.

A short-term tracking tool.



Sampling Locations of *K. brevis* (1953 – 2015)

Weisberg et al. (2019)

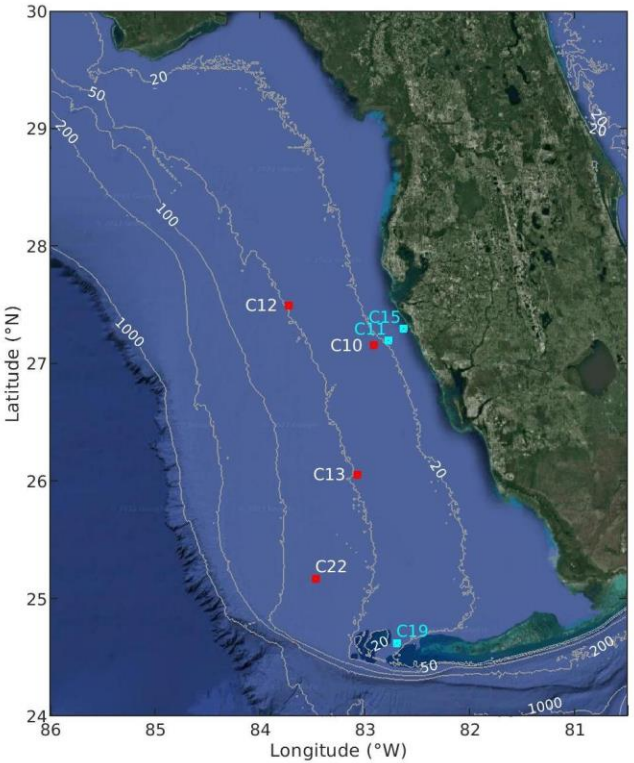
Coastal Ocean Observing Systems on the West Florida Shelf (26+ years)

Funded by IOOS/SECOORA, leveraging FWC/FWRI, NOAA COMIT & NCCOS

Meteorological data:
- Winds
- Air temperature
- Air pressure
- Relative humidity

Short- & long-wave radiation

Surface Buoys
(real-time **met & ocean** data)
C10, C12, C13 & C22



Oceanographic data:
- Water velocity throughout the water column
- Water temperature & salinity at selected depths
- (SUNA data at C12)

Subsurface Moorings
(delayed-time ocean data)
C11, C15 & C19

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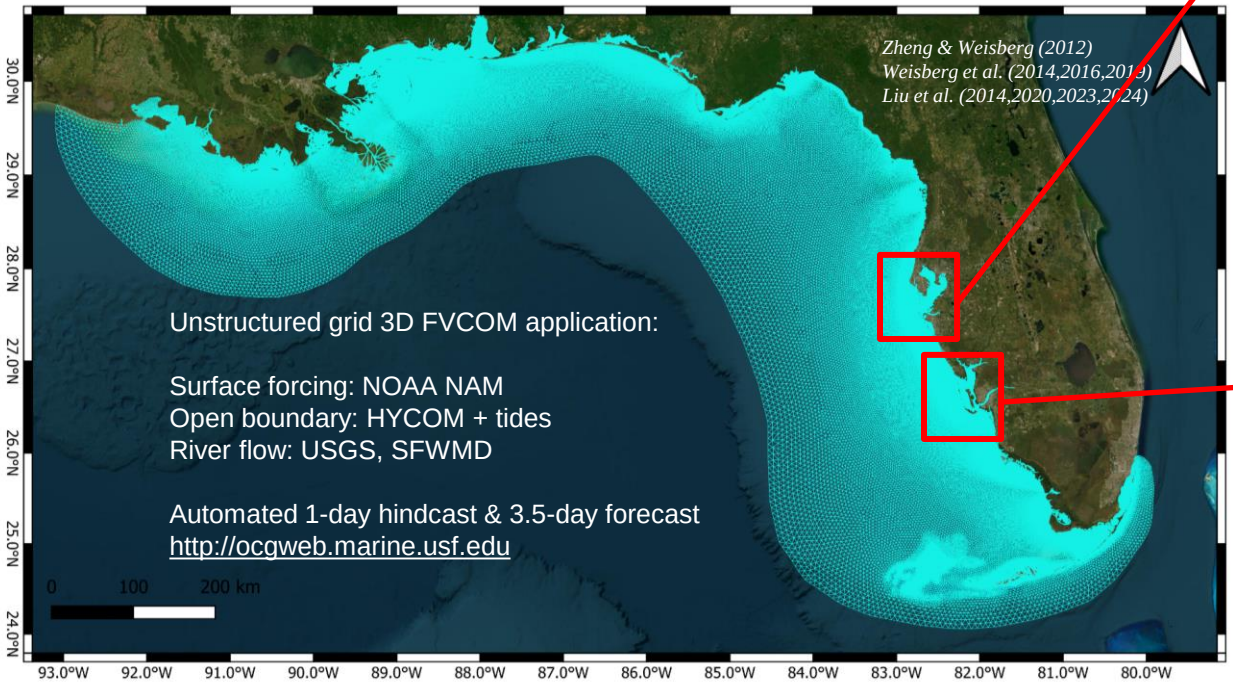
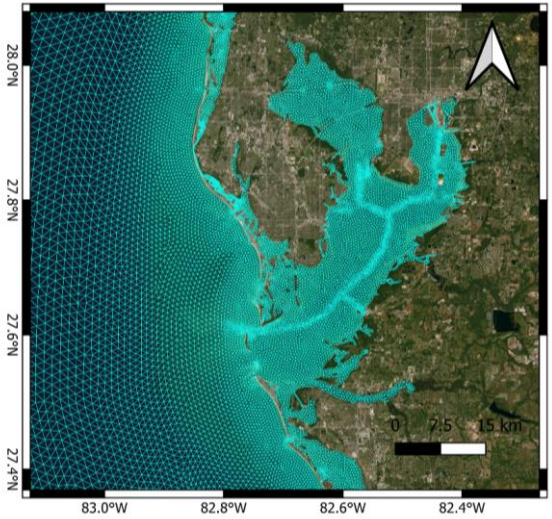
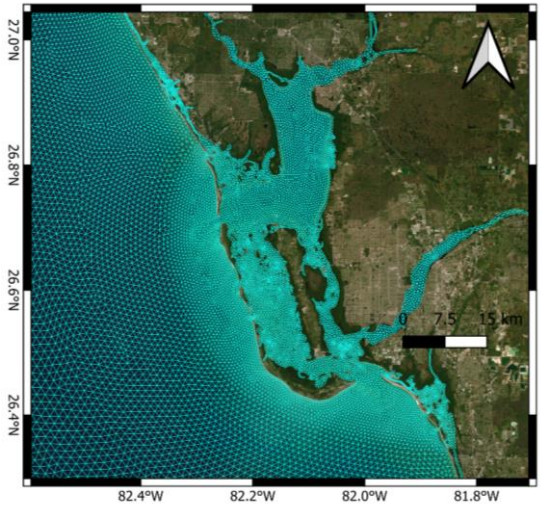
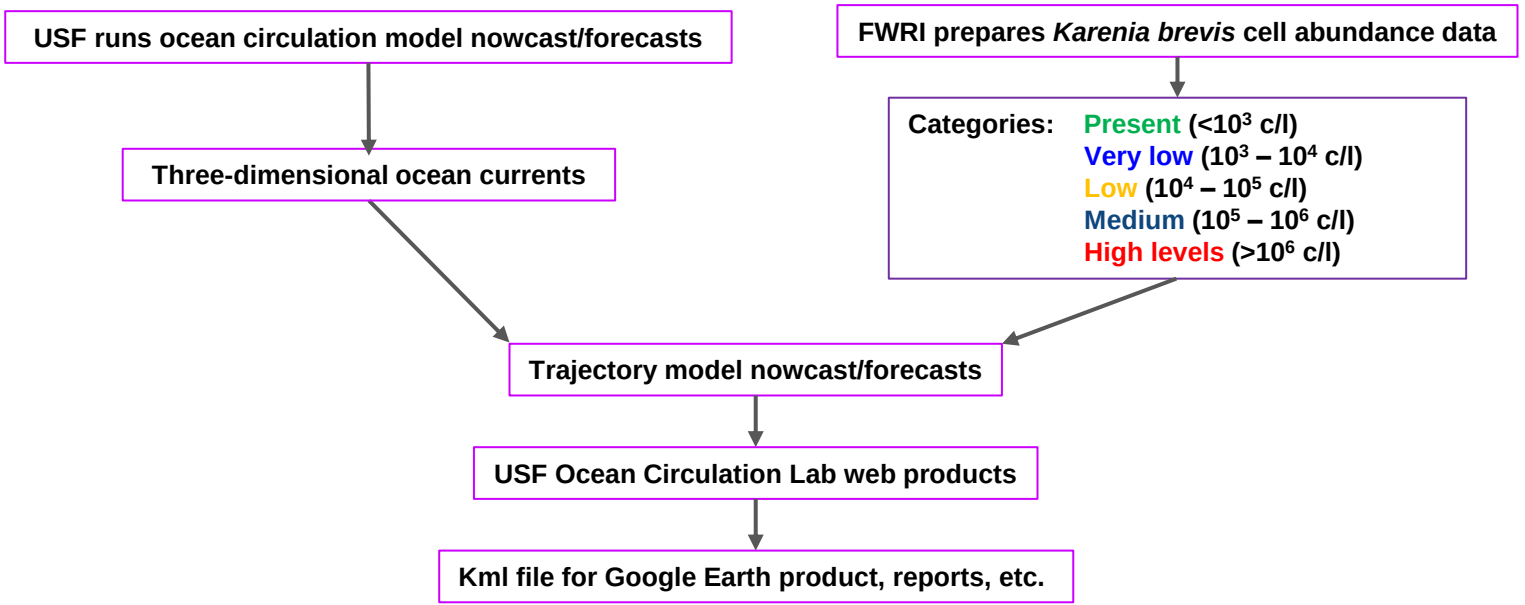
West Florida Coastal Ocean Model (WFCOM) & Tampa Bay Coastal Ocean Model (TBCOM) Nowcast/Forecast Systems







Automated Red Tide Trajectory Nowcast/Forecast



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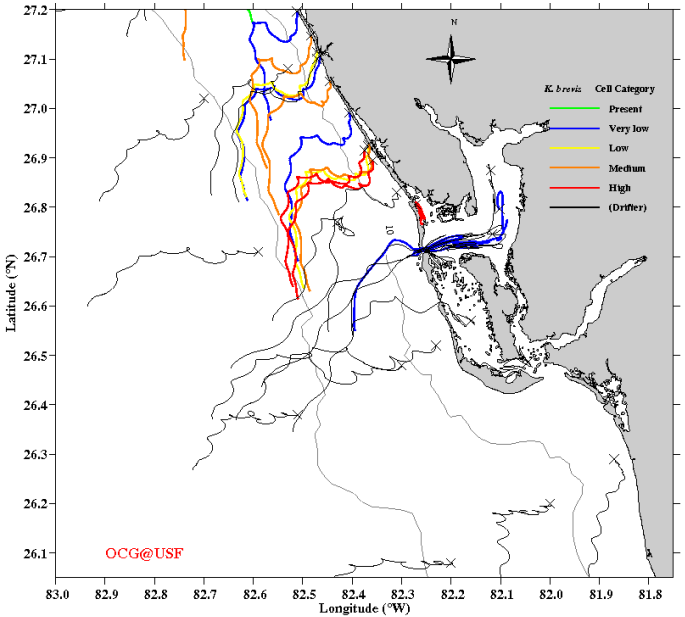
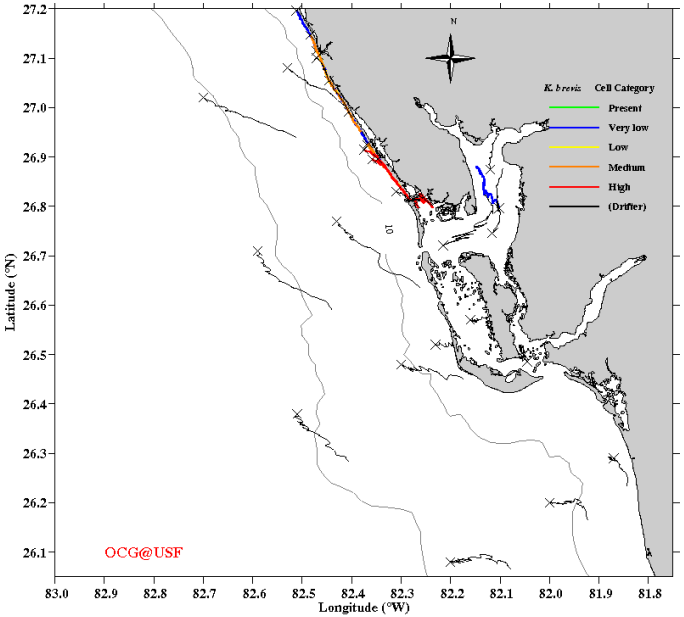
WFCOM-Based Red Tide Trajectory Forecast Products

USF/FWRI collaboration: http://ocgweb.marine.usf.edu/hab_tracking/

Near Surface Trajectory



Near Bottom Trajectory



HAB Beaching Product

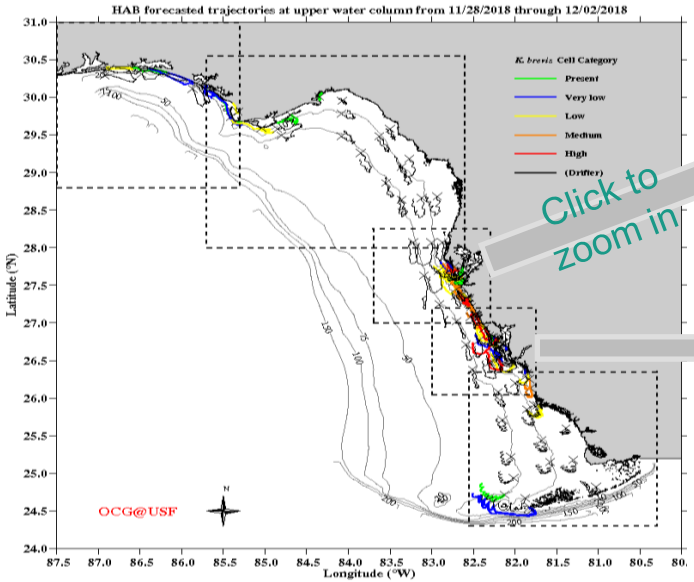
Example: 11/5 – 11/9/2022

Flow is fully 3D!

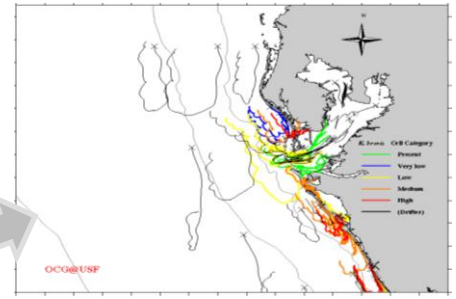
WFCOM-Based Red Tide Trajectory Forecast Products

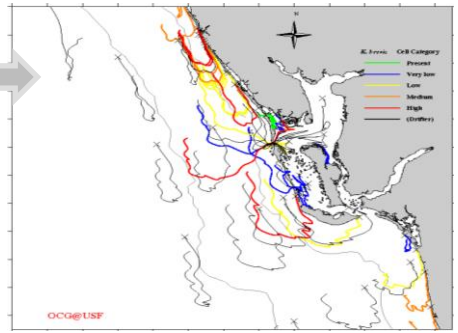
USF/FWRI collaboration: http://ocgweb.marine.usf.edu/hab_tracking/

Short-Term Trajectory Forecast
(automated daily update)

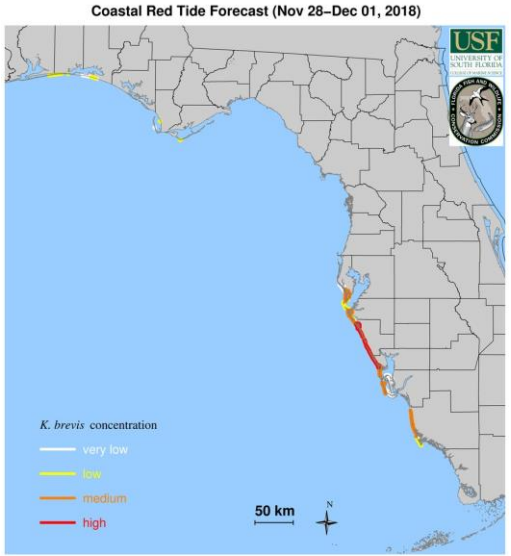


Click to zoom in



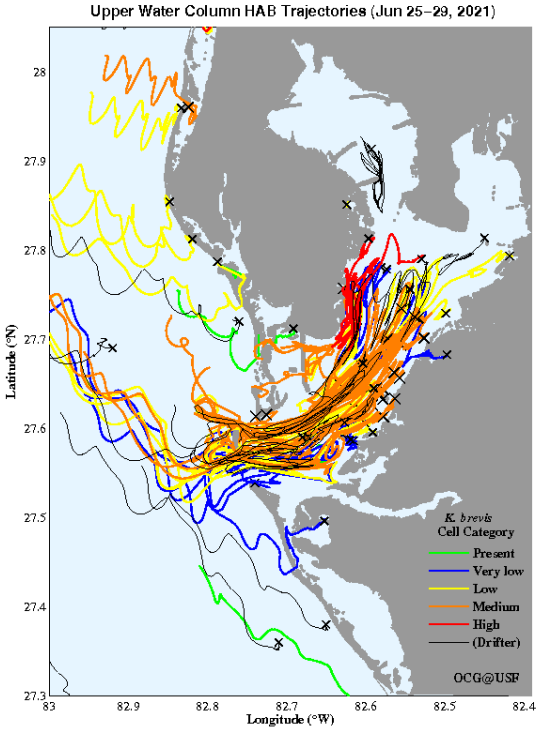


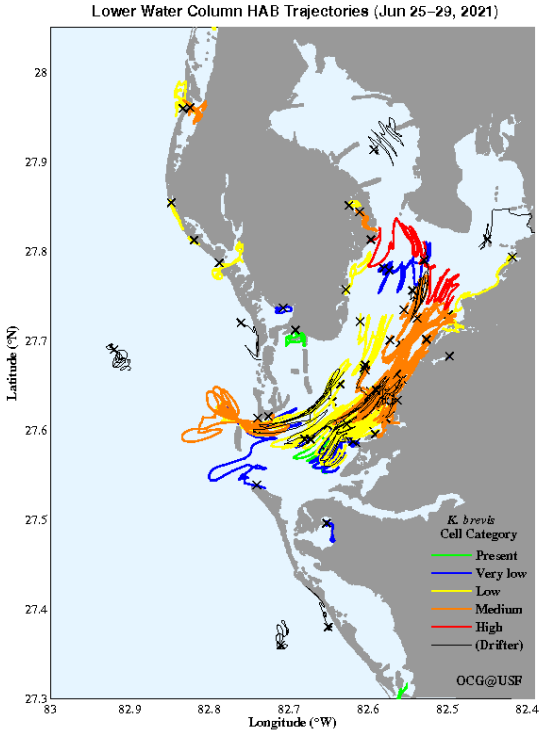
Coastal Risk Forecast
(updated every Wed & Fri)

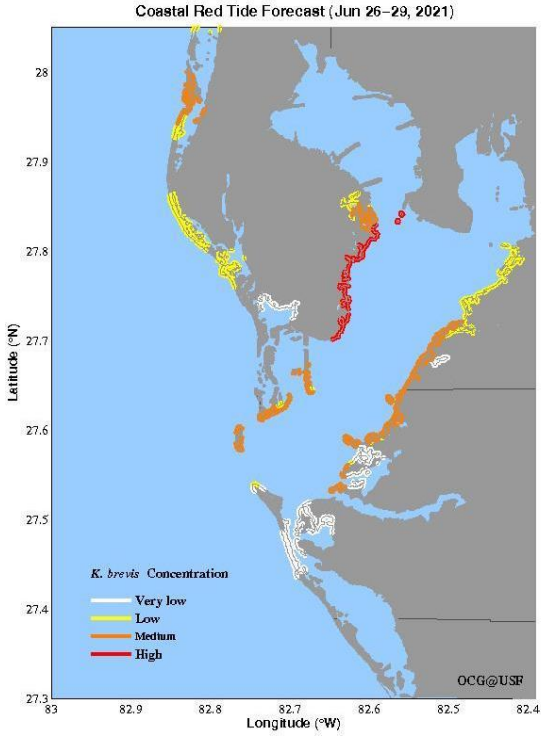


TBCOM-Based Red Tide Trajectory Forecast Products

USF/FWRI collaboration: http://ocgweb.marine.usf.edu/hab_tracking/





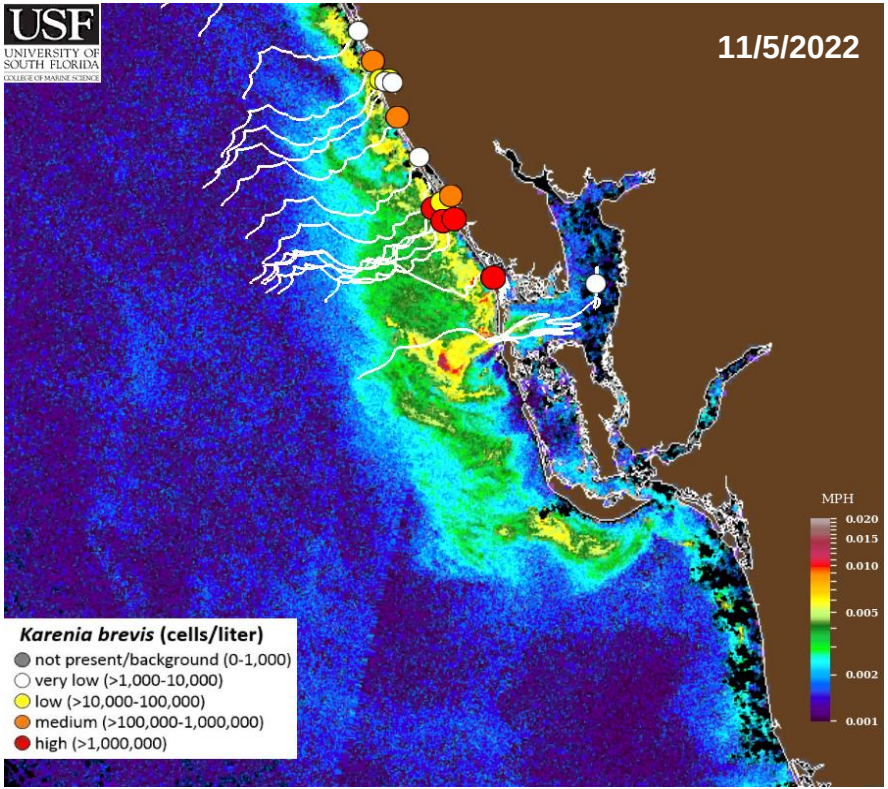


Automated daily update

Piney Point wastewater discharge into Tampa Bay in 2021.

See my poster on Thursday.

Surface Trajectories Overlaid with Satellite HAB Product



Kml file is generated for further integration with other products:
https://optics.marine.usf.edu/projects/IRIS.html

OLCI/Sentinel-3B Maximum Peak Height (MPH)

More spatially synoptic context for the *K. brevis* bloom.

The short-term trajectory forecast projected offshore transport of the nearshore bloom over the next several days.

Users of the Short-Term Forecast Product (1)

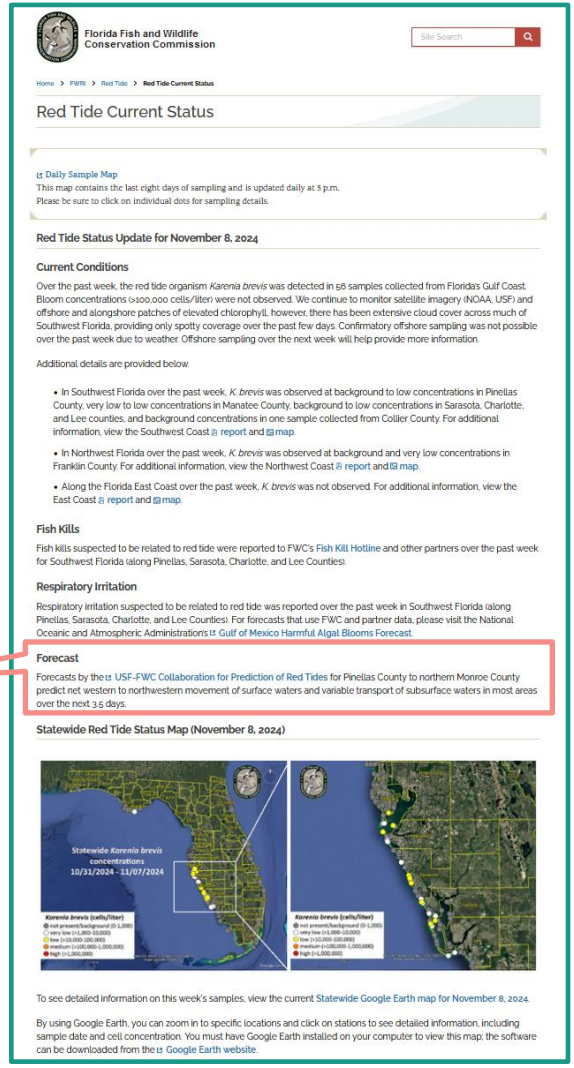
http://ocgweb.marine.usf.edu/hab_tracking/

FWC/FWRI Red Tide Current Status Official Report

(https://myfwc.com/research/redtide/statewide/)

Forecast

Forecasts by the USF-FWC Collaboration for Prediction of Red Tides for Pinellas County to northern Monroe County predict net western to northwestern movement of surface waters and variable transport of subsurface waters in most areas over the next 3.5 days.



Florida Fish and Wildlife Conservation Commission

Site Search

Home > FWRI > Red Tide > Red Tide Current Status

Red Tide Current Status

Daily Sample Map
This map contains the last eight days of sampling and is updated daily at 5 p.m.
Please be sure to click on individual dots for sampling details.

Red Tide Status Update for November 8, 2024

Current Conditions

Over the past week, the red tide organism *Karenia brevis* was detected in 56 samples collected from Florida's Gulf Coast. Bloom concentrations (>100,000 cells/liter) were not observed. We continue to monitor satellite imagery (NOAA, USF) and offshore and alongshore patches of elevated chlorophyll, however, there has been extensive cloud cover across much of Southwest Florida, providing only spotty coverage over the past few days. Confirmatory offshore sampling was not possible over the past week due to weather. Offshore sampling over the next week will help provide more information.

Additional details are provided below.

- In Southwest Florida over the past week, *K. brevis* was observed at background to low concentrations in Pinellas County, very low to low concentrations in Manatee County, background to low concentrations in Sarasota, Charlotte, and Lee counties, and background concentrations in one sample collected from Collier County. For additional information, view the Southwest Coast report and map.
- In Northwest Florida over the past week, *K. brevis* was observed at background and very low concentrations in Franklin County. For additional information, view the Northwest Coast report and map.
- Along the Florida East Coast over the past week, *K. brevis* was not observed. For additional information, view the East Coast report and map.

Fish Kills

Fish kills suspected to be related to red tide were reported to FWC's Fish Kill Hotline and other partners over the past week for Southwest Florida (along Pinellas, Sarasota, Charlotte, and Lee Counties).

Respiratory Irritation

Respiratory irritation suspected to be related to red tide was reported over the past week in Southwest Florida (along Pinellas, Sarasota, Charlotte, and Lee Counties). For forecasts that use FWC and partner data, please visit the National Oceanic and Atmospheric Administration's Gulf of Mexico Harmful Algal Blooms Forecast.

Forecast

Forecasts by the USF-FWC Collaboration for Prediction of Red Tides for Pinellas County to northern Monroe County predict net western to northwestern movement of surface waters and variable transport of subsurface waters in most areas over the next 3.5 days.

Statewide Red Tide Status Map (November 8, 2024)

To see detailed information on this week's samples, view the current Statewide Google Earth map for November 8, 2024.

By using Google Earth, you can zoom in to specific locations and click on stations to see detailed information, including sample date and cell concentration. You must have Google Earth installed on your computer to view this map; the software can be downloaded from the Google Earth website.

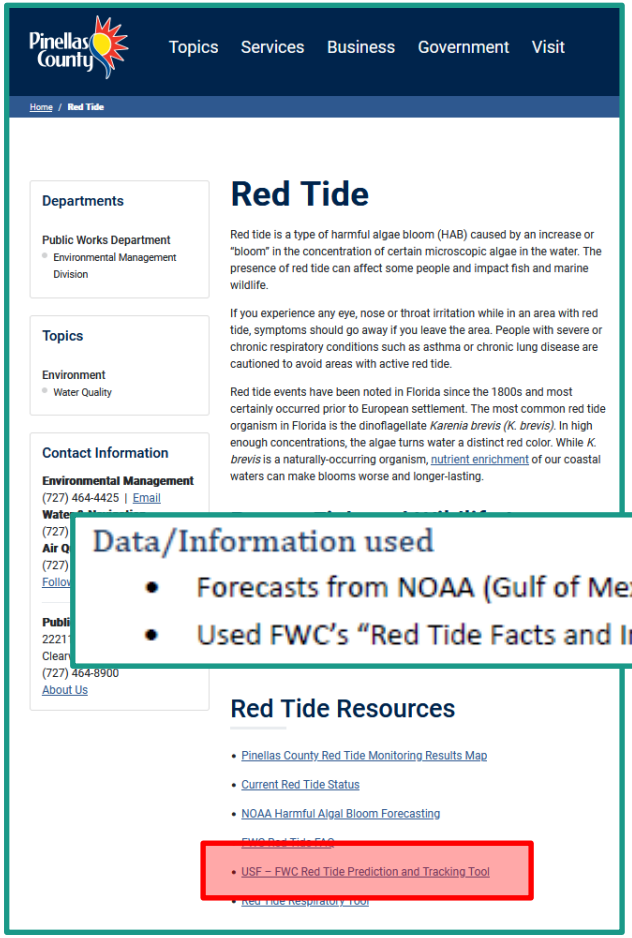
Users of the Short-Term Forecast Product (2)

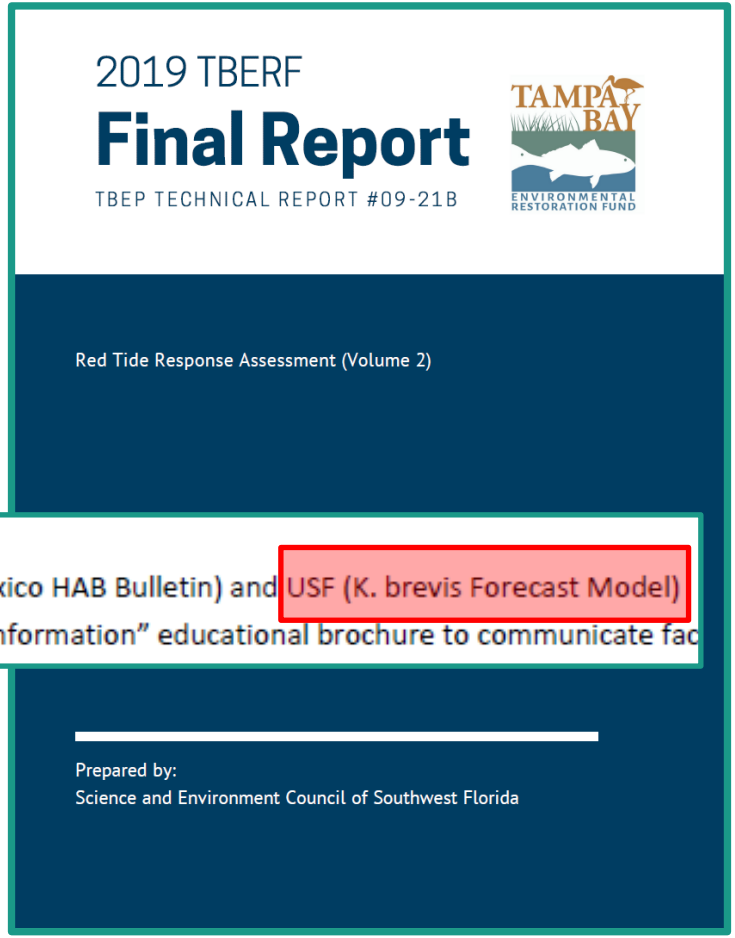
http://ocgweb.marine.usf.edu/hab_tracking/

Local County Managers

- Environmental management
- Dead fish collection
- Dumpster deployment

Example:
https://pinellas.gov/red-tide/





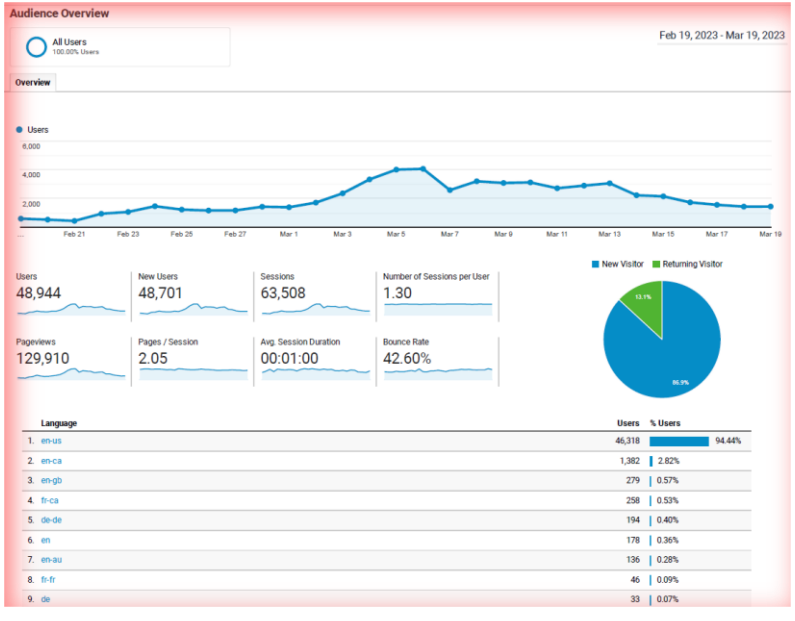
Users of the Short-Term Trajectory Forecast Product (3)

http://ocgweb.marine.usf.edu/hab_tracking/

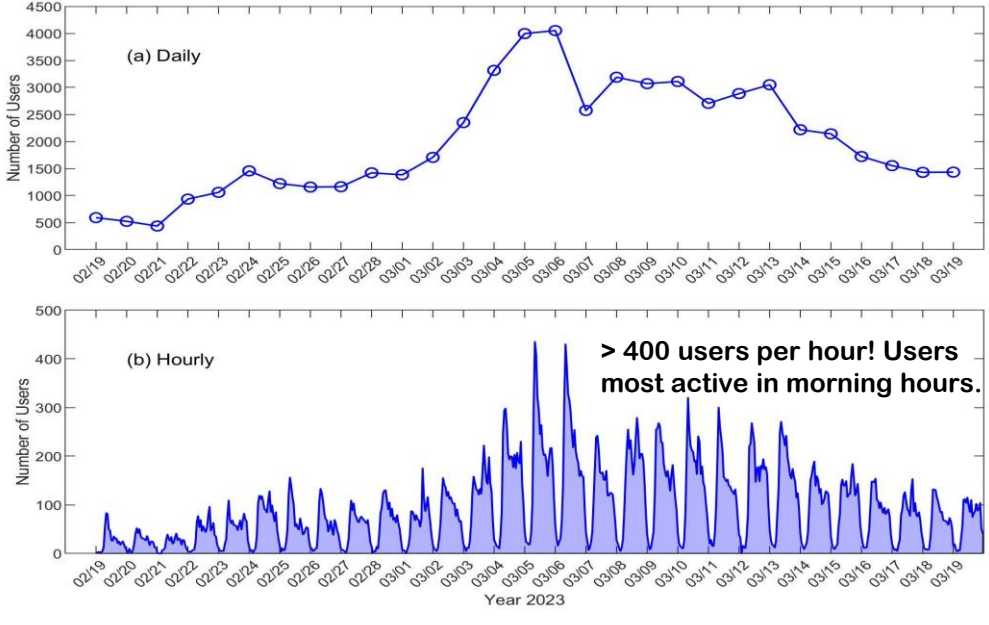
Online Users

Google Analytics: (Example: 2023 spring break season)

More than 48,000 users in 30 days!



More than 4,000 users per day during spring break peak days!



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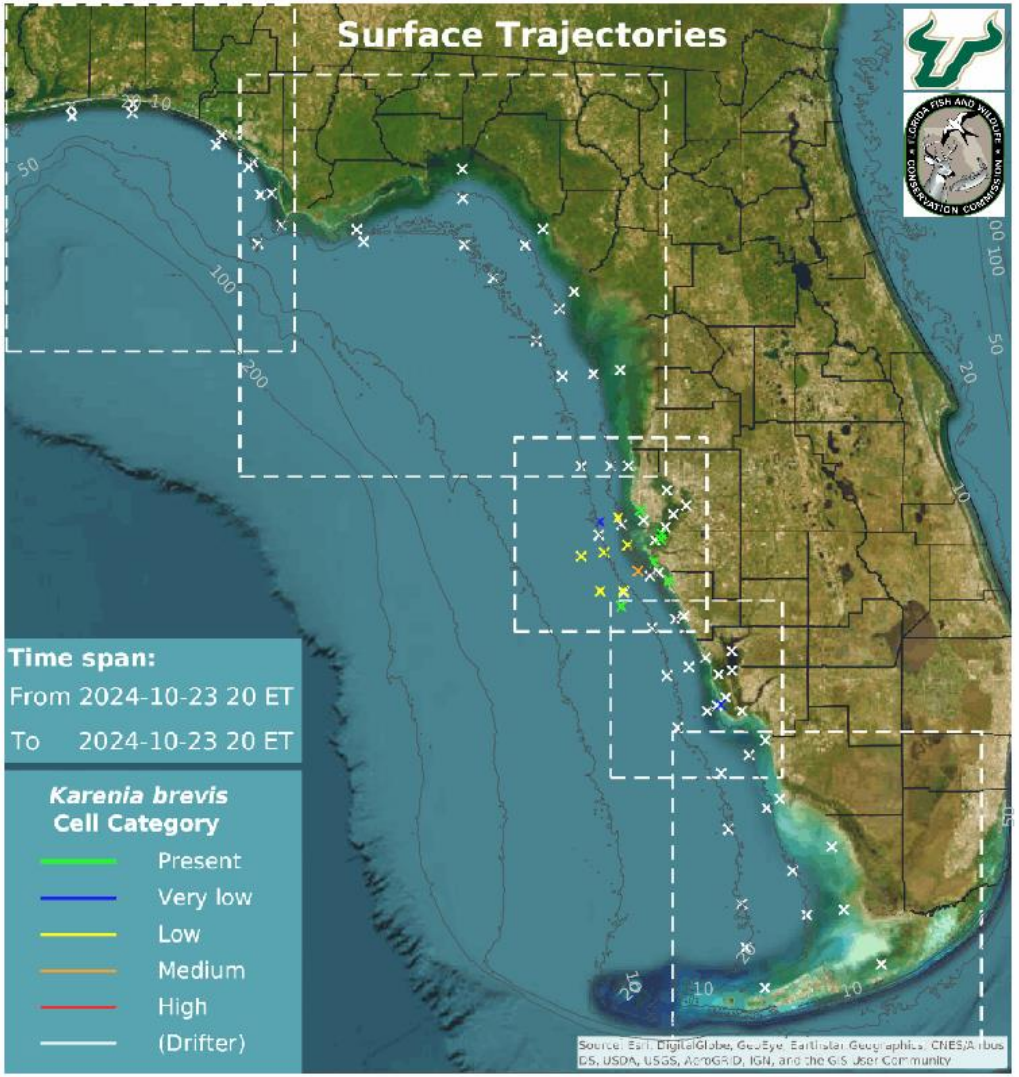
A New Look

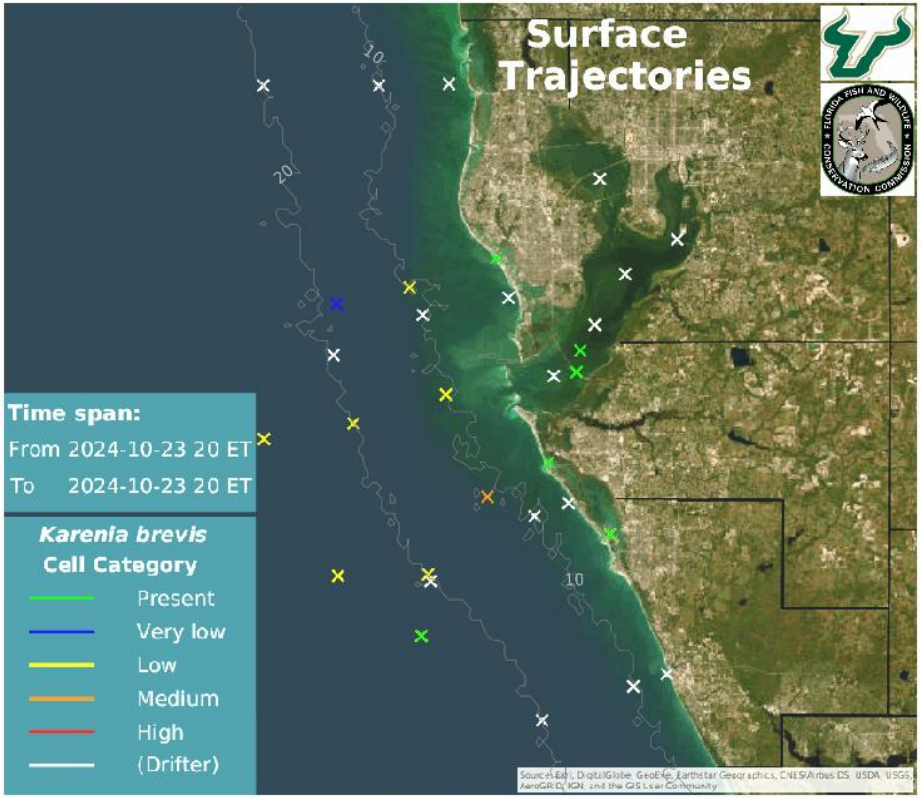
Tracking the *K. brevis* cells identified in the rapid response cruise after Hurricanes Helene and Milton.

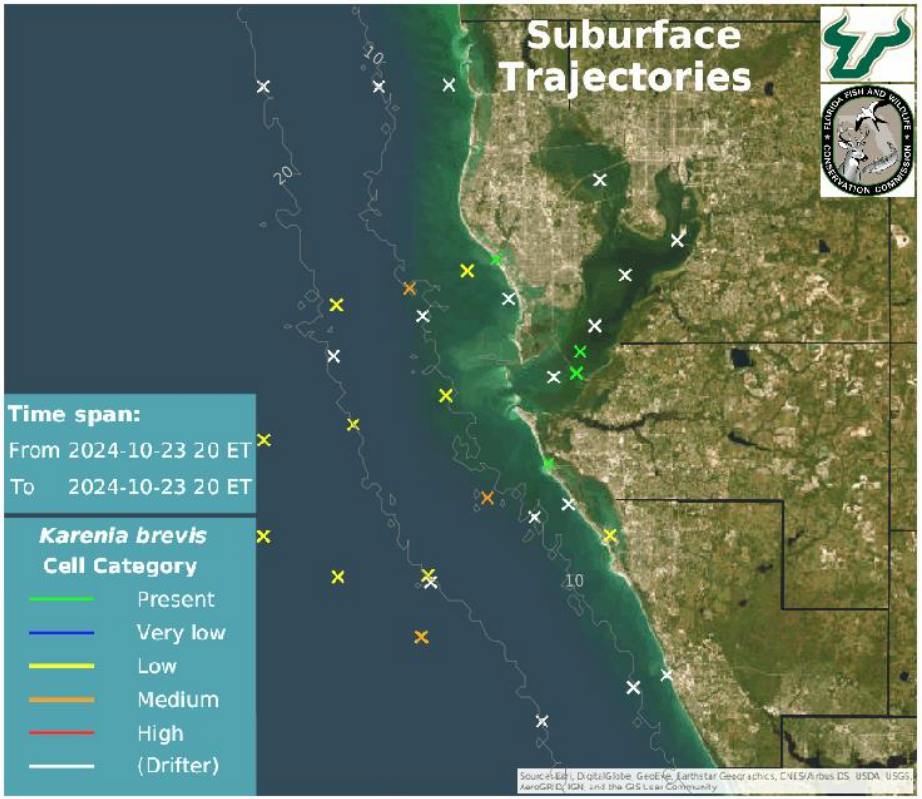
http://ocgweb.marine.usf.edu/



A Coastal Upwelling Event

http://ocgweb.marine.usf.edu/





Surface cells are transported offshore, and compensated by near bottom cells upwelled from offshore.

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COMPS Coastal Ocean Monitoring and Prediction System

Summary

- USF/CMS maintains **a coordinated coastal ocean observing and modeling program** for the WFS, and has applied these tools in studying the marine environmental issues of societal importance.
- **A short-term trajectory forecast tool** is developed for Florida red tide. Once blooms occur on the shelf, both WFCOM and TBCOM nowcast/forecast systems are used to track the observed *K. brevis* cell count data and provide 3.5 day forecast.
- The tracking tool displays modeled **bloom trajectories at the surface and near-bottom** because the flow differs at the surface and bottom.
- **Five categories of cell concentrations** (present, very low, low, medium, and high) that each approximately represent an order of magnitude difference in *K. brevis* cell abundance are reported.
- More general and user-friendly coastal **red tide beaching products** are also produced.
- These products serve as a practical application of the state-of-the-art numerical ocean circulation model in tracking the complex red tide before a comprehensive physical-biological *K. brevis* HAB model is developed for operational forecast.

http://ocgweb.marine.usf.edu/