

# Applications of VIIRS Ocean Color for Real Time Adaptive Sampling

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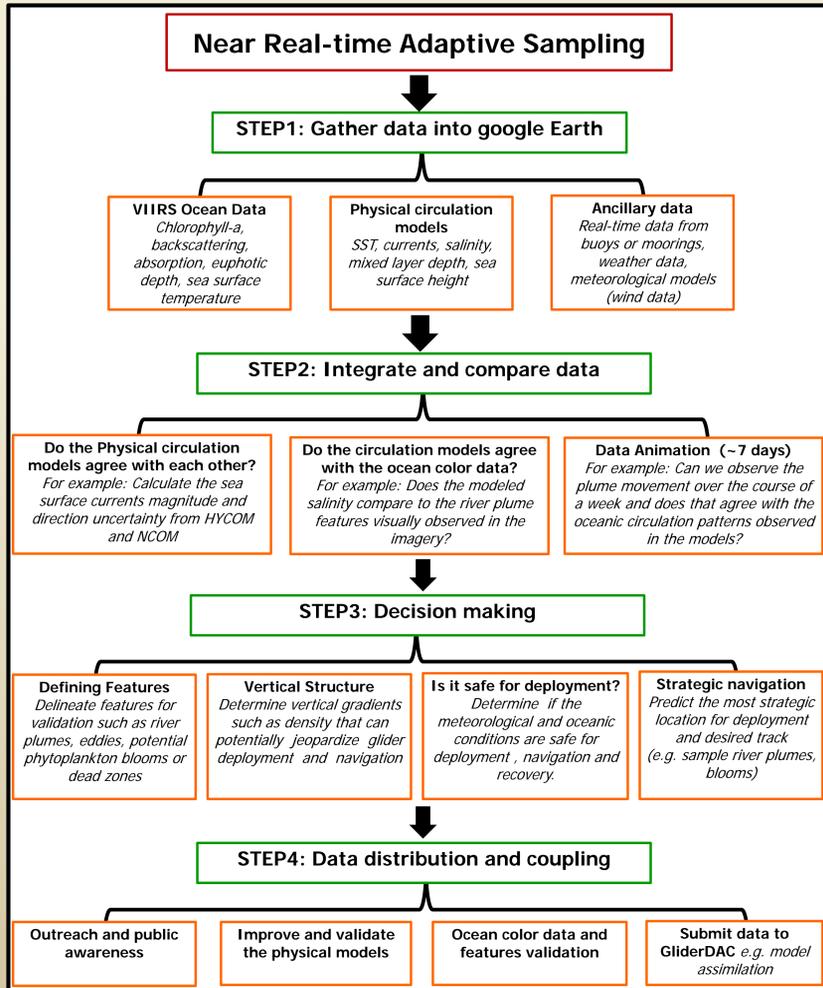
## Abstract

The Visible Infrared Imaging Radiometer Suite (VIIRS) ocean color time series is providing a real time characterization of the biological and physical processes occurring in the Gulf of Mexico. Daily VIIRS ocean products are being coupled with several ocean circulation models (HYCOM and NCOM) and *in situ* data from glider and ships, and are integrated together at USM's Ocean Weather Laboratory. The laboratory is demonstrating the rapidly changing conditions occurring in a riverine-dominated system and the interaction with the offshore current and eddies. The VIIRS data provide an enhanced capability to support how we define the uncertainty of ocean models and characterize how the ecosystem is responding to the physical processes. The real time data fusion of satellite, models, and *in situ* observations are providing the capability to adaptively sample the ocean features and processes. A recent "AUV Jubilee" in the Gulf of Mexico demonstrated the operational applications for VIIRS ocean color products to coordinate glider and *in situ* operations. VIIRS is providing essential products for identifying the river filaments, which can then be targeted for sampling with gliders or other vessels.

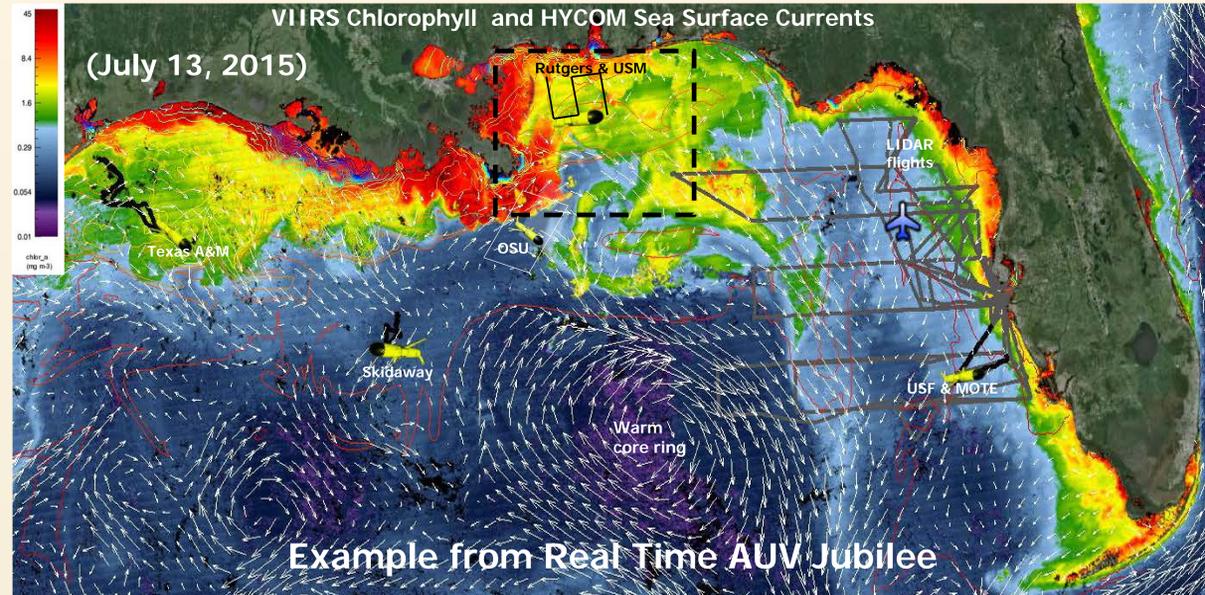
## Objectives

- Establish adaptive sampling for gliders during the AUV Jubilee on July 13-17, 2015 and coordinate ocean observing operations in the Gulf of Mexico
- Enable improved ocean sampling strategies to support physical models, satellites, aircraft, and ships
- Couple VIIRS ocean color data with physical models to determine the locations for glider deployment, strategic navigations and safe operations.
- Establish open dialogue and collaboration with scientists among the Gulf of Mexico
- Submit data to the Glider Data Archive Center for assimilation into operational models
- STEM curriculum development and teacher participation in operational oceanography

## Method for Adaptive Sampling

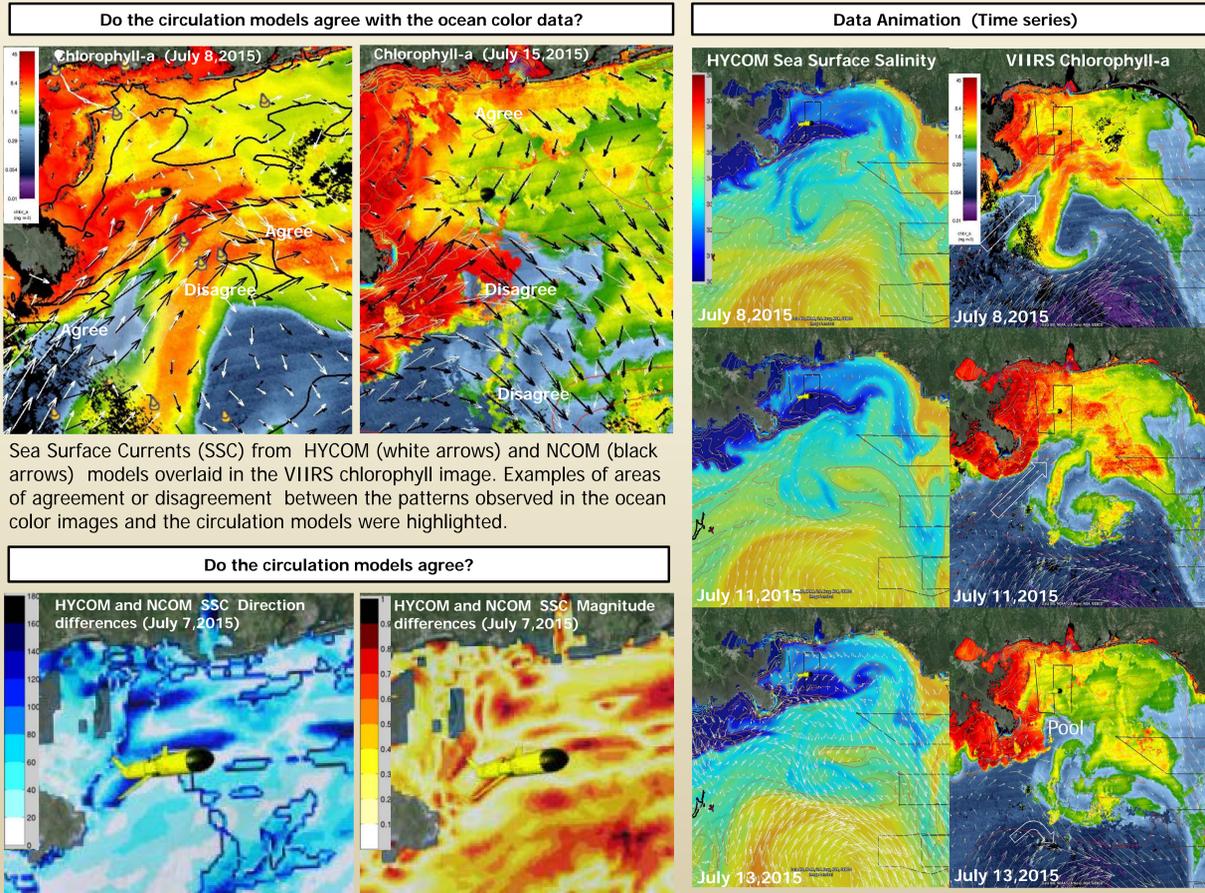


## Step1: Assemble data into Google Earth during AUV "Jubilee"



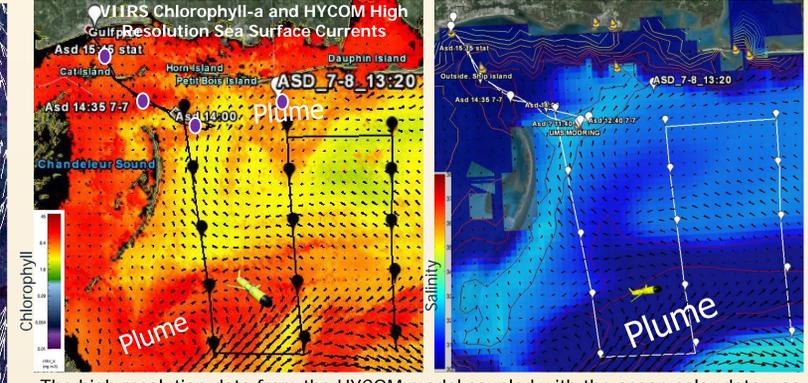
Example from Real Time AUV Jubilee  
 Gliders can be "guided" to sample specific ocean features of interest (e.g., river plumes) using VIIRS satellite ocean color data and physical circulation models. The integration of VIIRS Chlorophyll-a data with circulation models. Location of glider and Lidar tracks from all the participants during the AUV Jubilee event during July 2015.

## Step2: Integrate and compare data



Sea Surface Currents (SSC) model differences between the HYCOM and NCOM models. Differences in the direction (Right) and magnitude (Left). This is helpful to identify areas of discrepancy between the models. The sequence of images allow the visualization of the evolution of features such as river plumes. The white arrow represents an intrusion of saltier waters that eventually gets trapped inside the less dense riverine waters. We can also observe the evolution of the river plume and the separation of a filament into an eddy. Overall, the patterns observed in the chlorophyll-a images are well matched by the HYCOM salinity model.

## Step3: Decision making, validation



The high resolution data from the HYCOM model coupled with the ocean color data was used to decide the deployment location in order to sample the river plume. VIIRS identified plume locations slight different from models. Stations collected for validation !! The salinity and density locations is crucial for glider buoyancy. Plume location and density gradients were too high for deployment, and sampling. We are prepared for Glider deployments using VIIRS for locations plumes.

## Step4: Data distribution and coupling

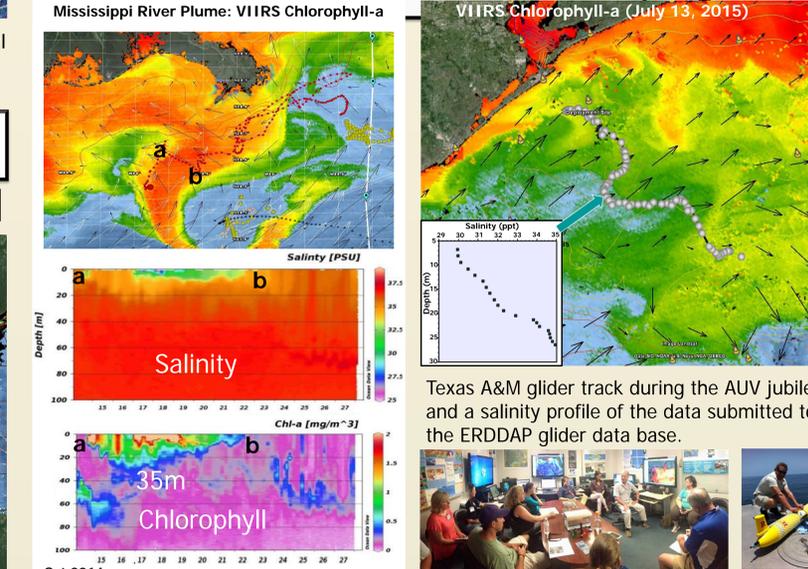


Photo during the Gulf of Mexico AUV Jubilee daily meetings to coordinate glider deployment, outreach activities, and a glider deployment.

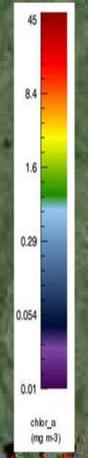
## Summary

- The VIIRS data provide an enhanced capability to support how we define the uncertainty of ocean models and characterize how the ecosystem is responding to the physical processes. **"VIIRS validates Models in dynamic River Plumes!"**
- The real time data fusion of satellite, models, and *in situ* observations are providing the capability to adaptively sample the ocean features and processes.
- A recent "AUV Jubilee" in the Gulf of Mexico demonstrated the operational applications for VIIRS ocean color products to coordinate glider and *in situ* operations.
- VIIRS is providing essential products for identifying the river filaments, which can then be targeted for sampling with gliders or other vessels.
- The AUV Jubilee provided the opportunity to integrate outreach activities and teachers from all over the nation. Teachers were taught about gliders and how to integrate satellite data into their STEM curriculum development.

## AUV Jubilee Participants

University of Southern Mississippi, Rutgers University, Texas A&M University, Mote Marine Laboratory, University of South Florida, Skidaway Institute of Oceanography, Oregon State University, Gulf Coast Ocean Observing System, NOAA, Roffer's Forecasting

VIIRS Chlorophyll-a 7-days composite  
(July 13, 2015)  
HYCOM Sea Surface Currents SSS Contours



Texas A&M

Rutgers & USM

OSU

Skidaway

LIDAR  
flights

USF & MOTE

Warm  
core ring

Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
Image Landsat

Google earth

