

Evaluation of VIIRS performance over coastal waters and its capacity to detect dark water and harmful algal blooms

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Objectives

- Evaluate/Validate VIIRS ocean color data products
- Demonstrate VIIRS capacity in studying coastal oceans (water quality, harmful algal blooms, oil spills)
- Share data and results with community to advance science and mission planning

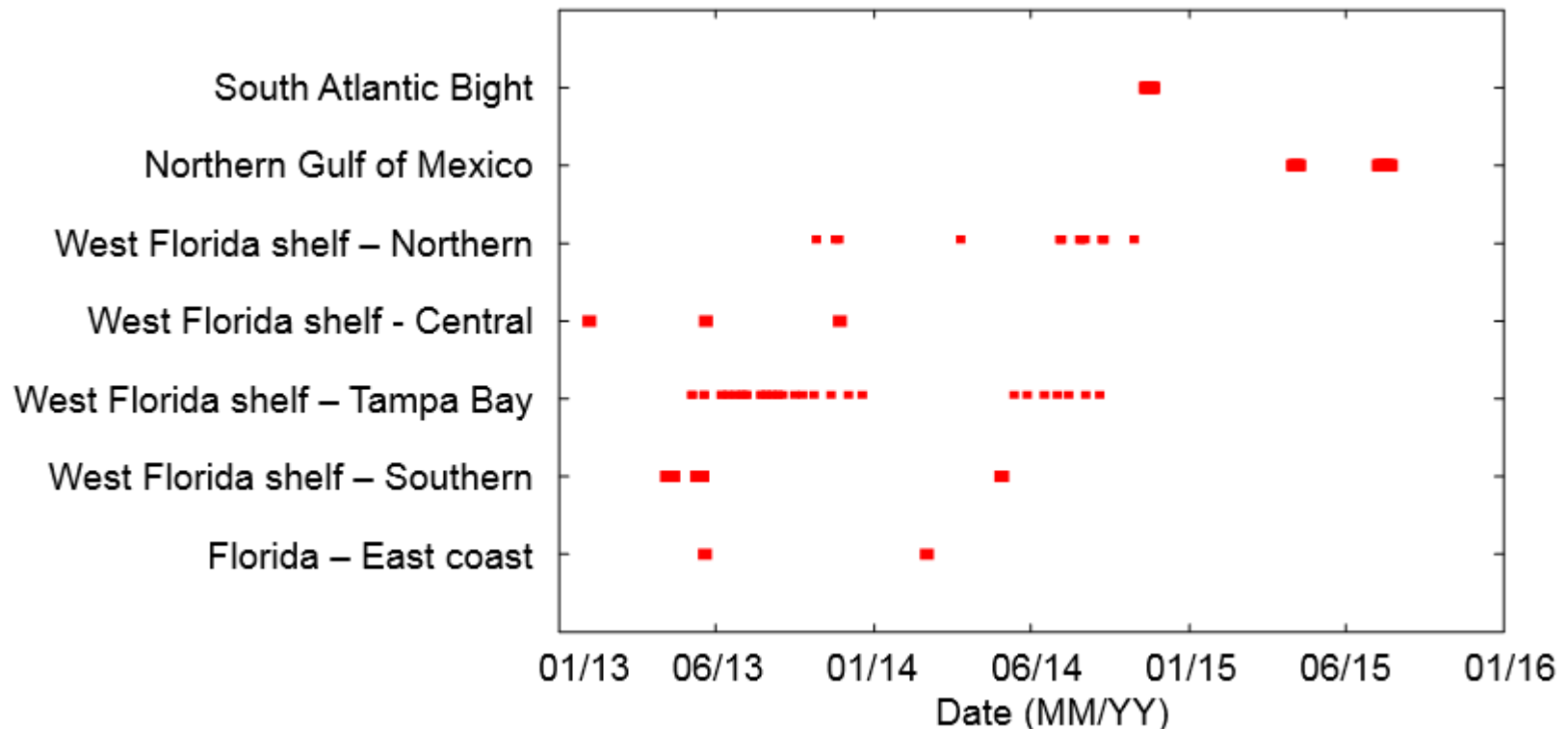
How?

- Field measurements following community-accepted protocols
- Satellite data analysis and comparison with field measurements
- Communication with science team and the community
- Technical reports and publications

Field Measurements

Conducted by USF Optical Oceanography Lab in collaboration with other groups.

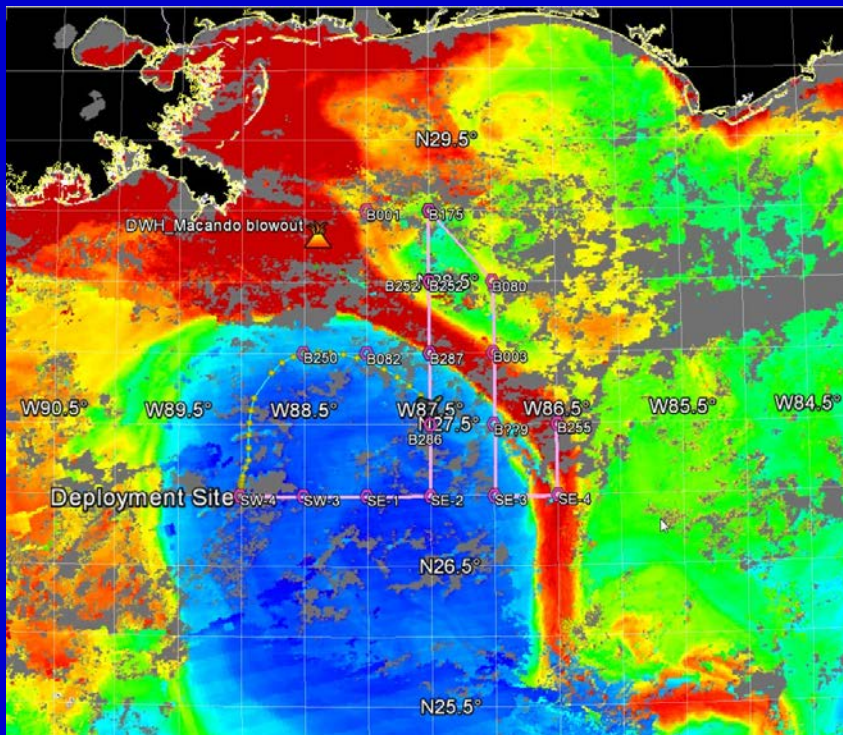
All measurements have filter-pads absorptions and CDOM absorptions. Most measurements also have scattering and reflectance IOPs. Some have taxonomy and profiling data.



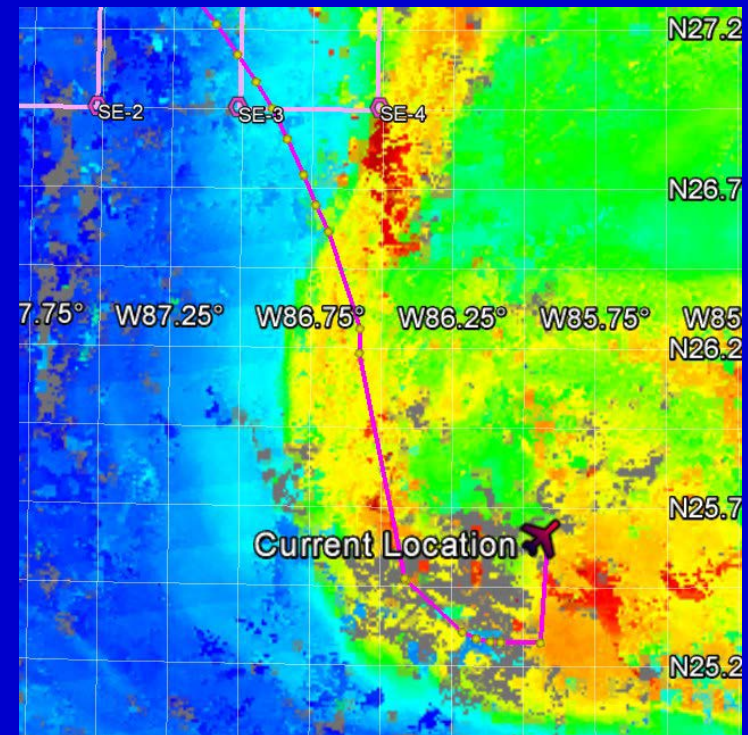
Field Measurements

An example from the DEEPEND02 cruise (Aug 8 – 22, 2015)

MODIS 5-day composite ending
Aug 12, overlaid with cruise
stations and glider track to Aug 12



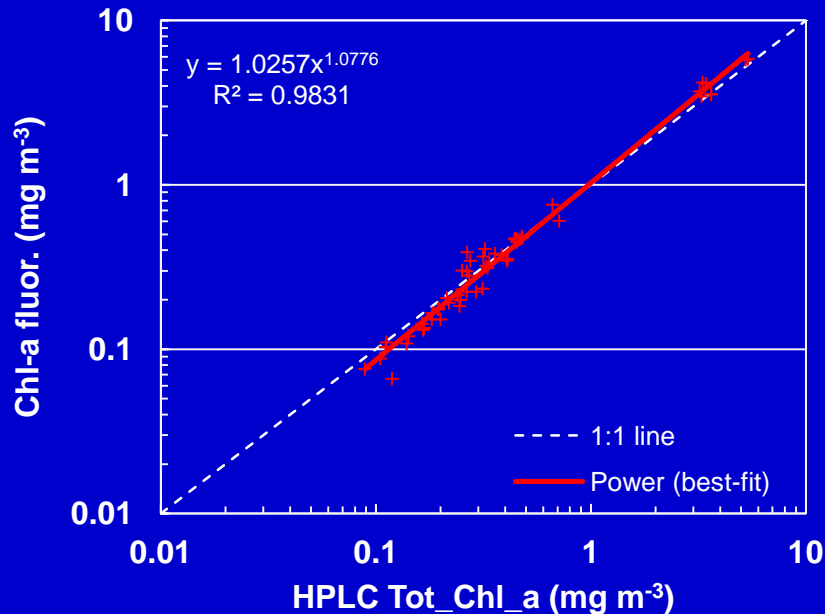
MODIS 3-day composite showing
glider track up to Aug 18



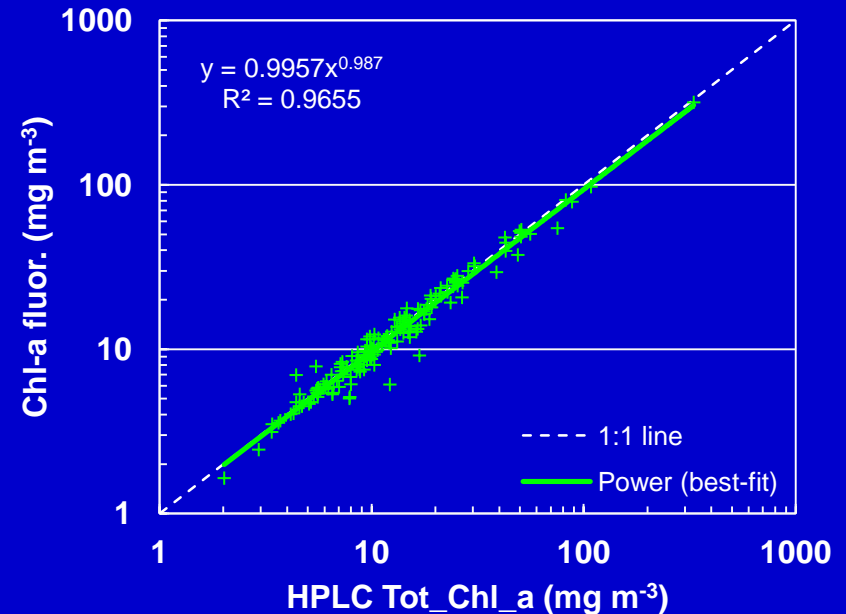
Field Measurements

Protocols follow community standards to assure high quality

Southwest Florida Shelf (Feb. 2012) (n=57)



Old Tampa Bay (Jun.-Dec. 2013) (n=166)



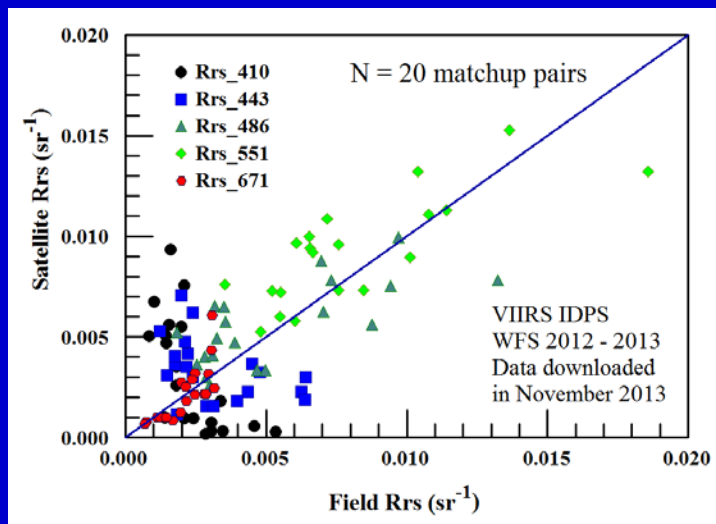
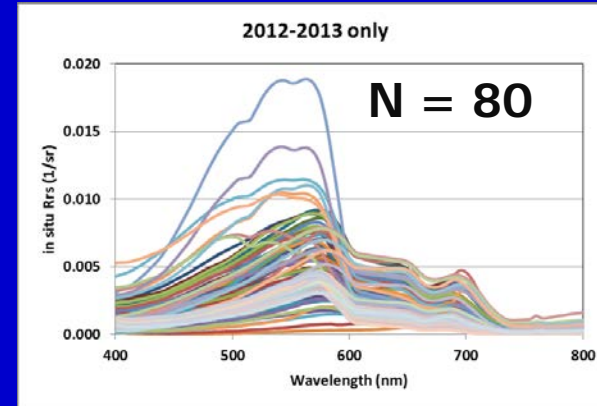
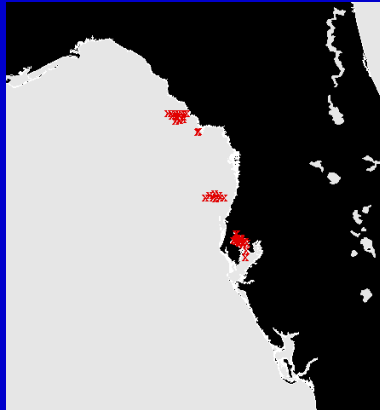
VIIRS data processing

Three data sources

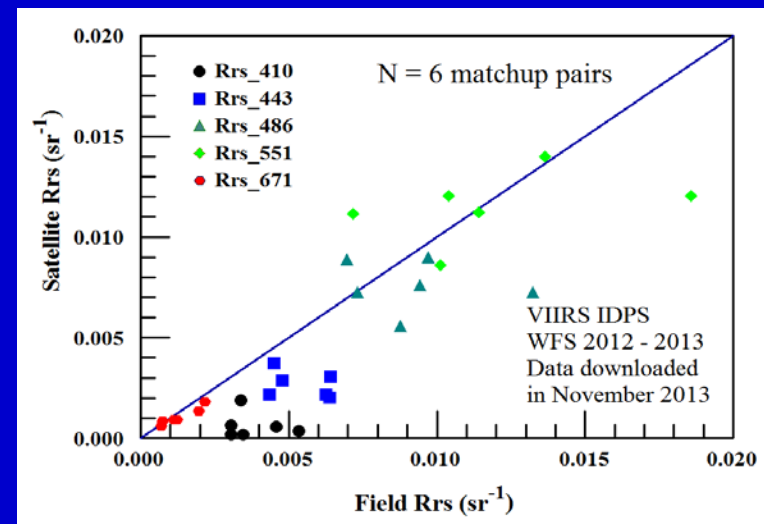
- IDPS processing – during early stage of validation
- NOAA/NESDIS MSL12 processing – limited availability
- NASA/GSFC L2GEN processing – for cross-sensor comparison

VIIRS data product evaluation

Evaluation during initial phase (IDPS processing)



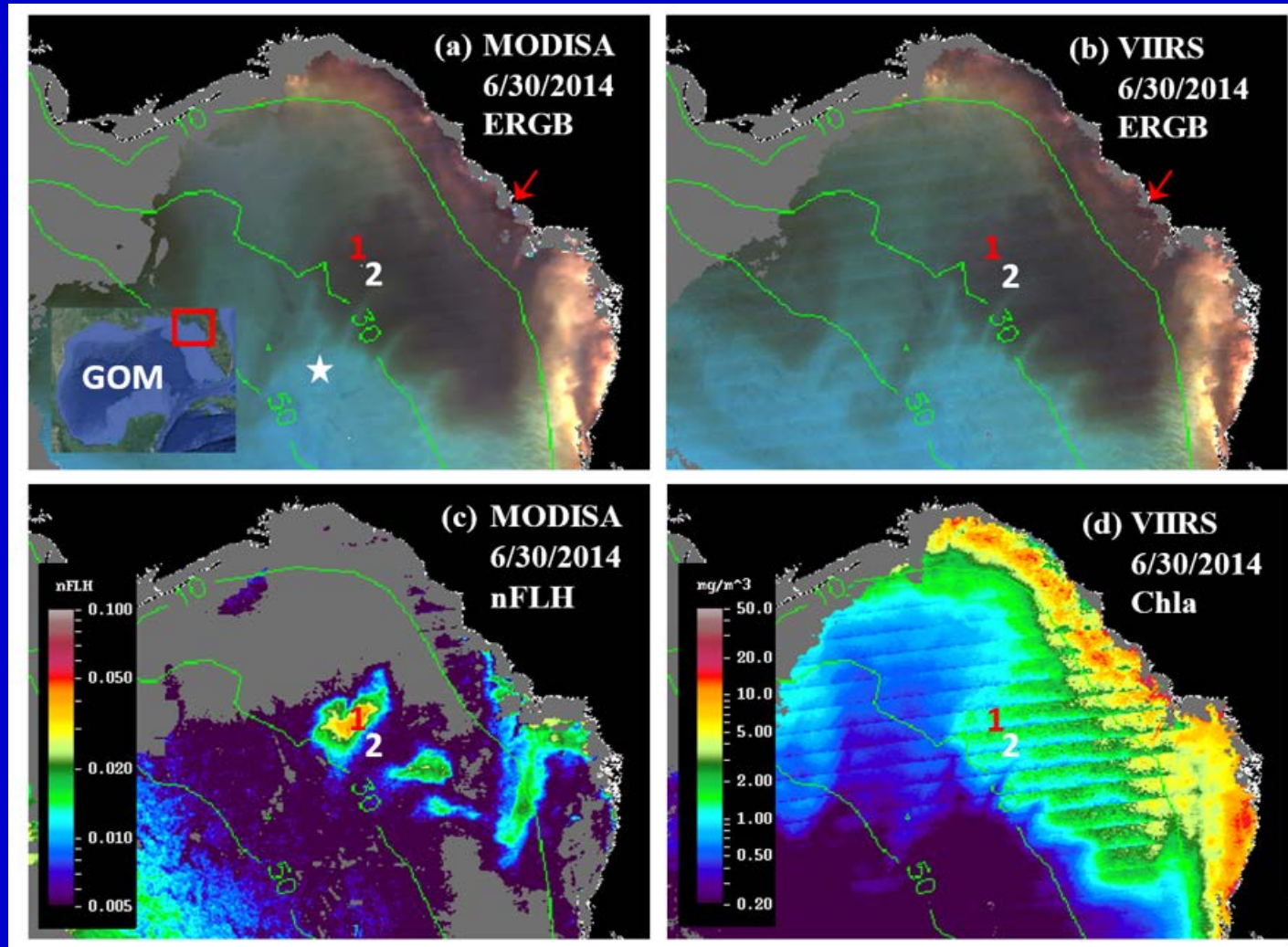
QF Flags not applied



QF Flags applied

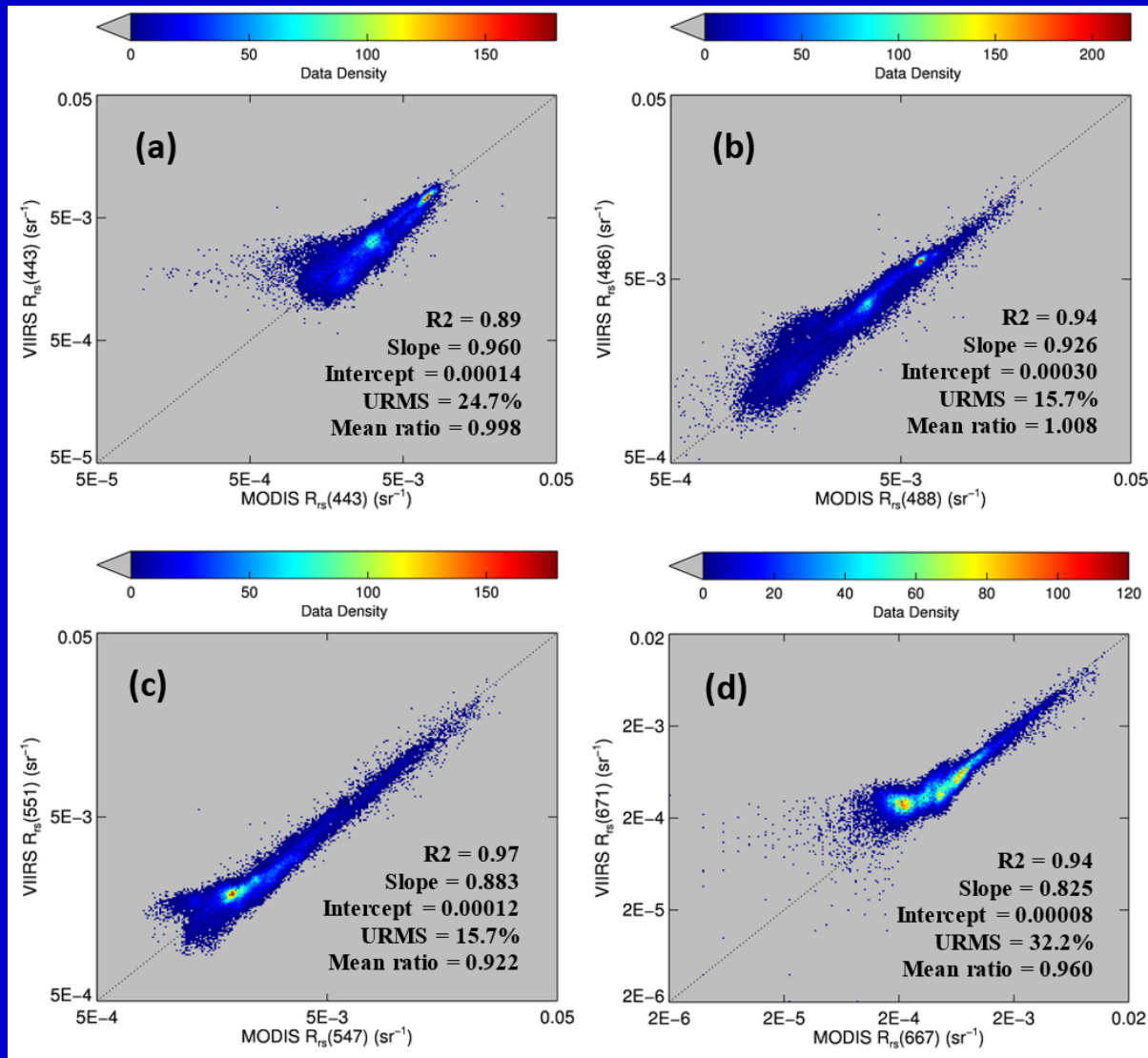
VIIRS over dark water and HABs

Demonstration of difficiency and temporal solution



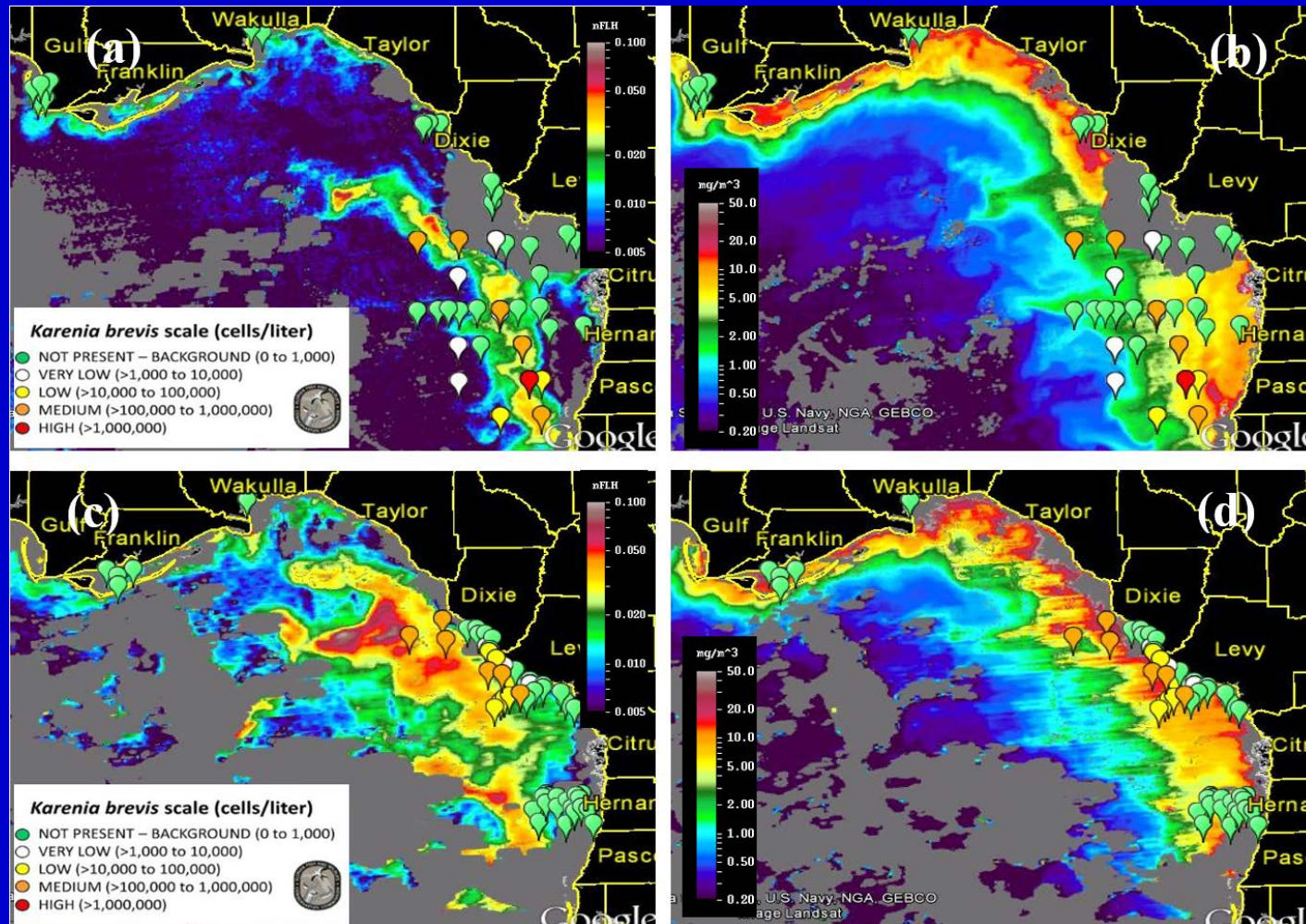
VIIRS over dark water and HABs

Most pixels agree well between MODIS and VIIRS, for all bands



VIIRS over dark water and HABs

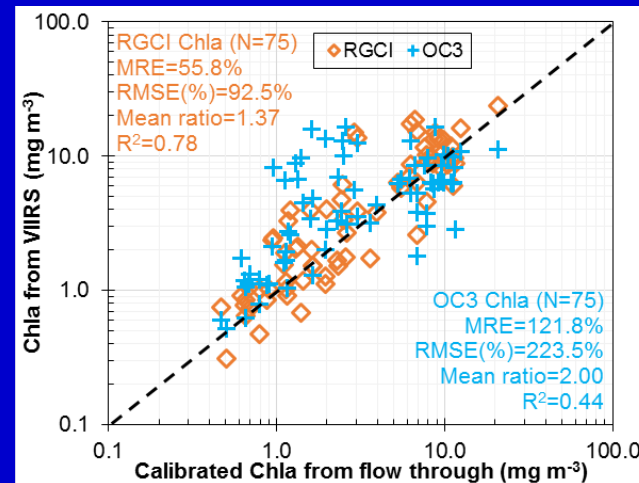
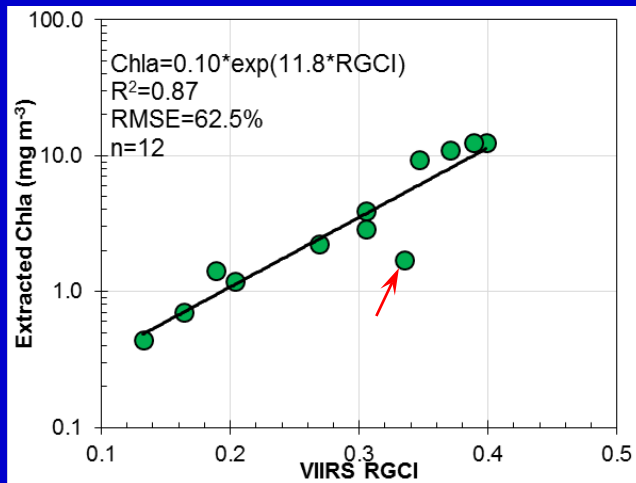
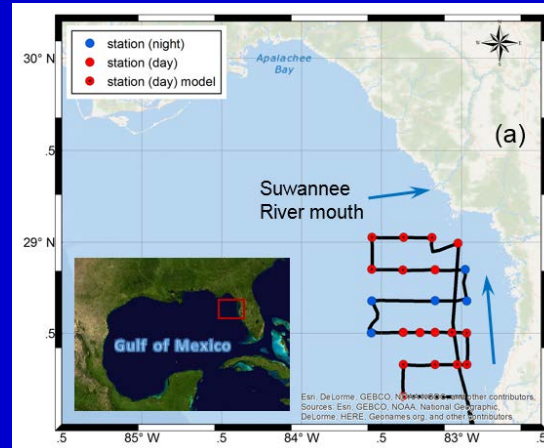
However, bloom patterns can only be revealed by MODIS FLH (Hu et al., 2015)



FWC has been using MODIS FLH to track HABs in near real-time for years

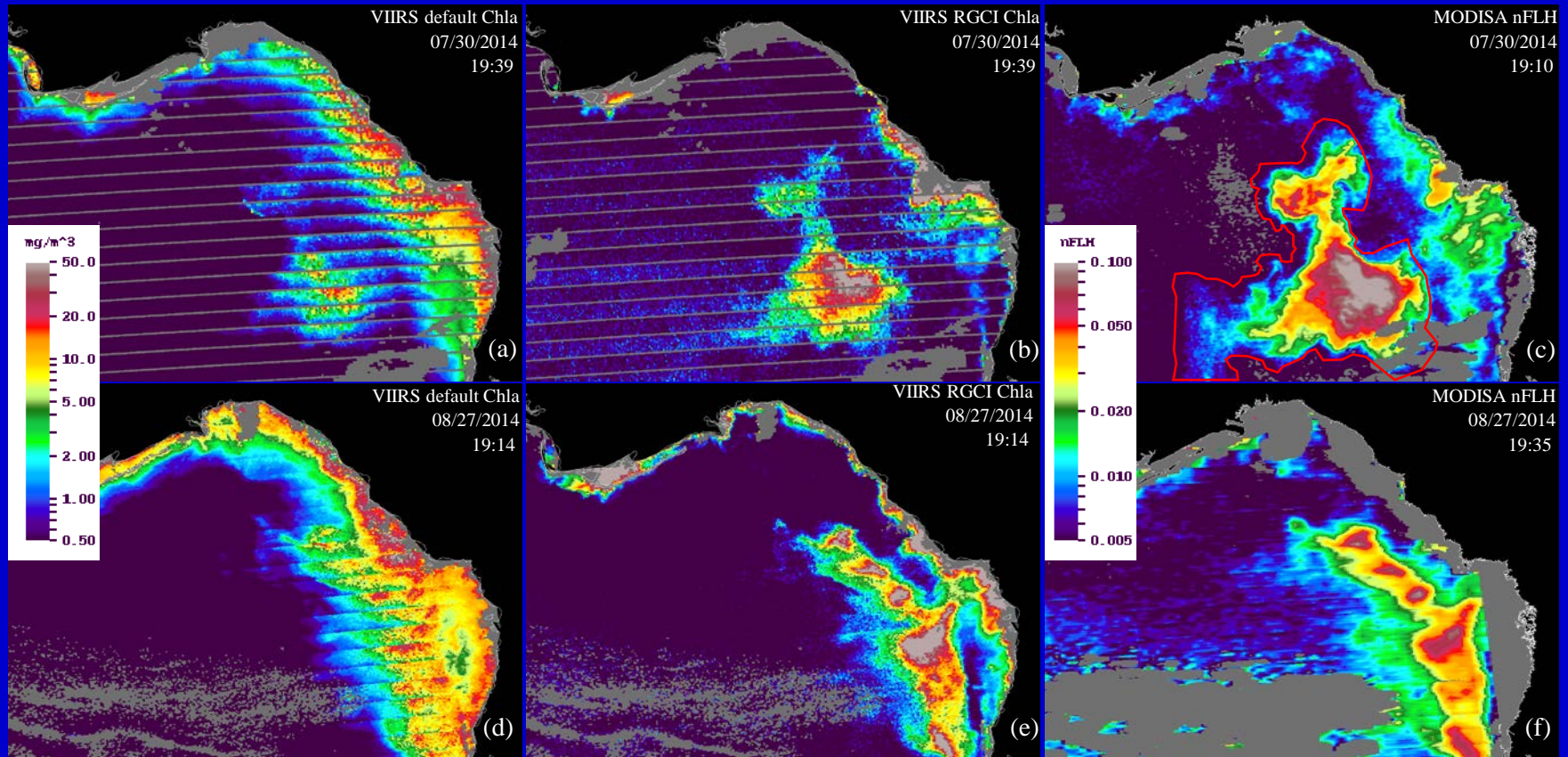
VIIRS over dark water and HABs

A Red-Green-Chlorophyll-Index (RGCI) performs better than OC3



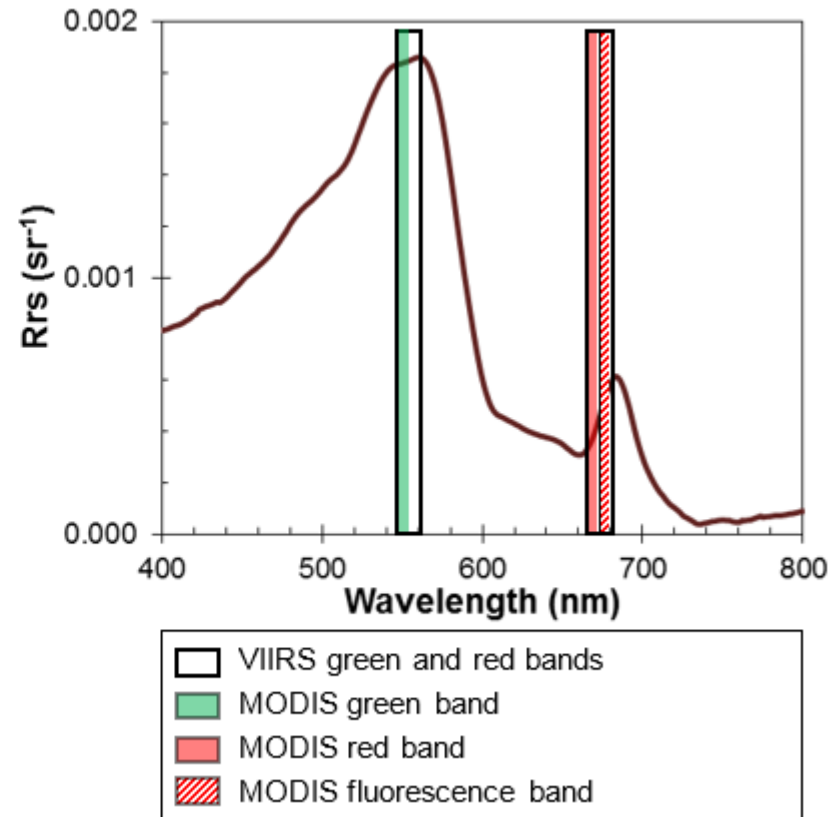
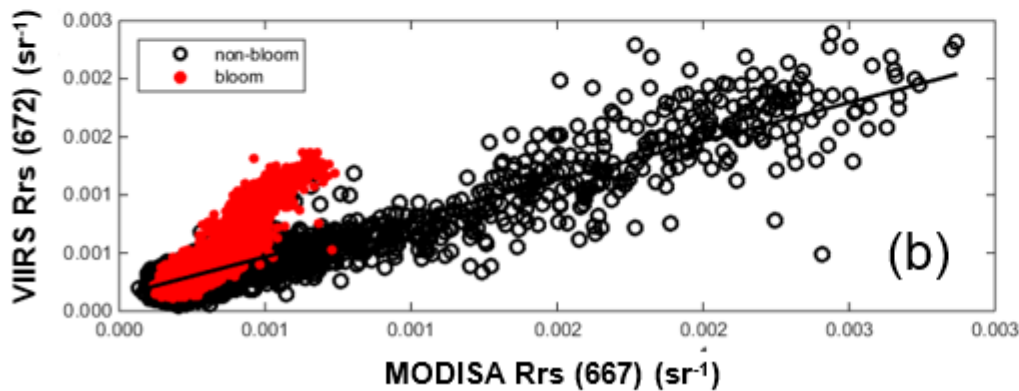
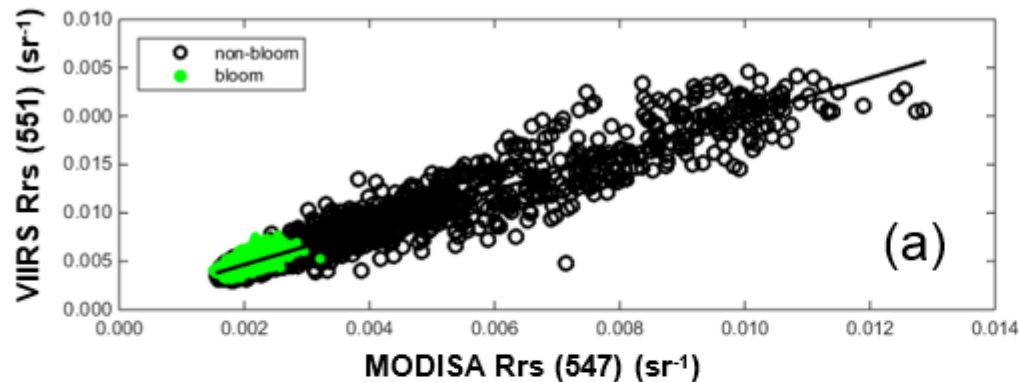
VIIRS over dark water and HABs

VIIRS RGCI reveals similar patterns as MODIS FLH (Qi et al., in press)



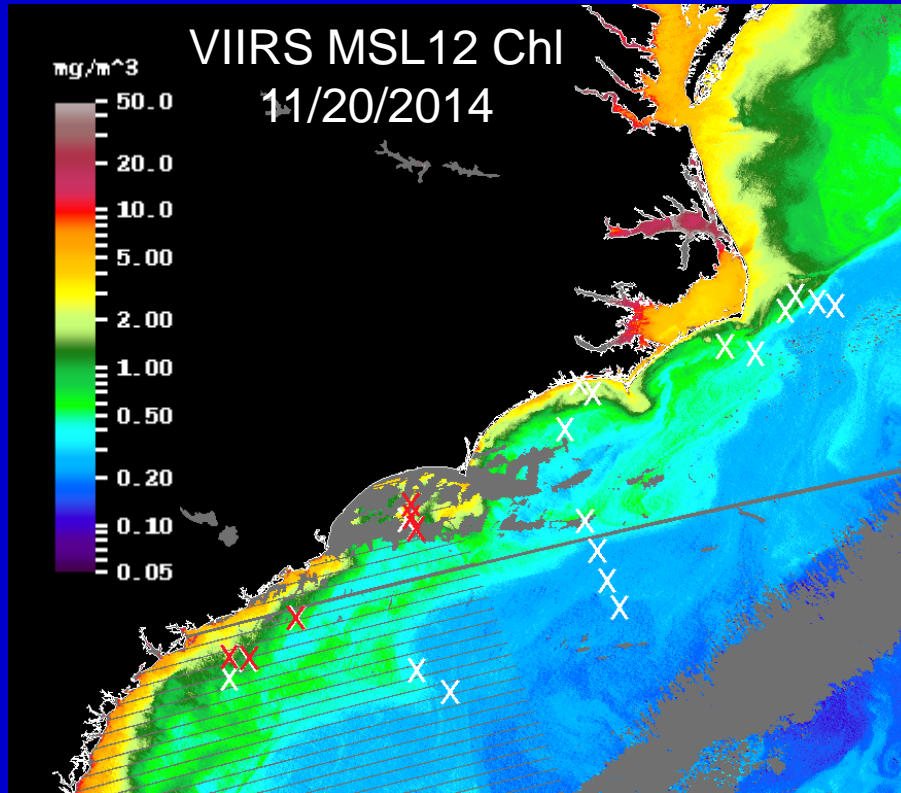
VIIRS over dark water and HABs

Why? CDOM dominates light absorption in the blue so blue bands cannot be used. VIIRS red band (662 – 682 nm) encompasses the MODIS red band (662 – 672) and FLH band (672 – 682).

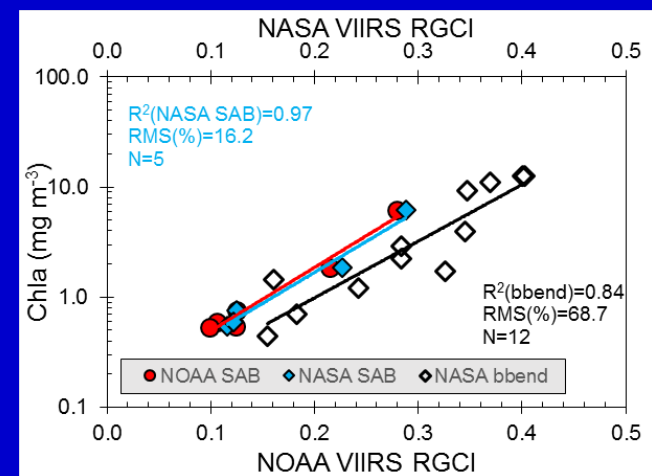
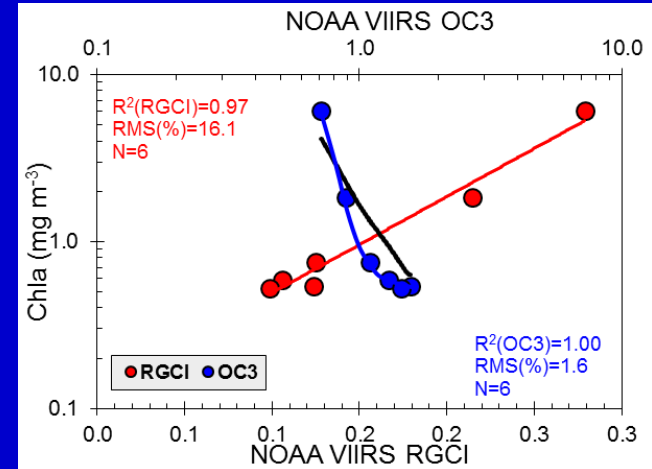


RGCI for other coastal regions?

Test over the South Atlantic Bight using NOAA/VIIRS Nov 2014 cruise data



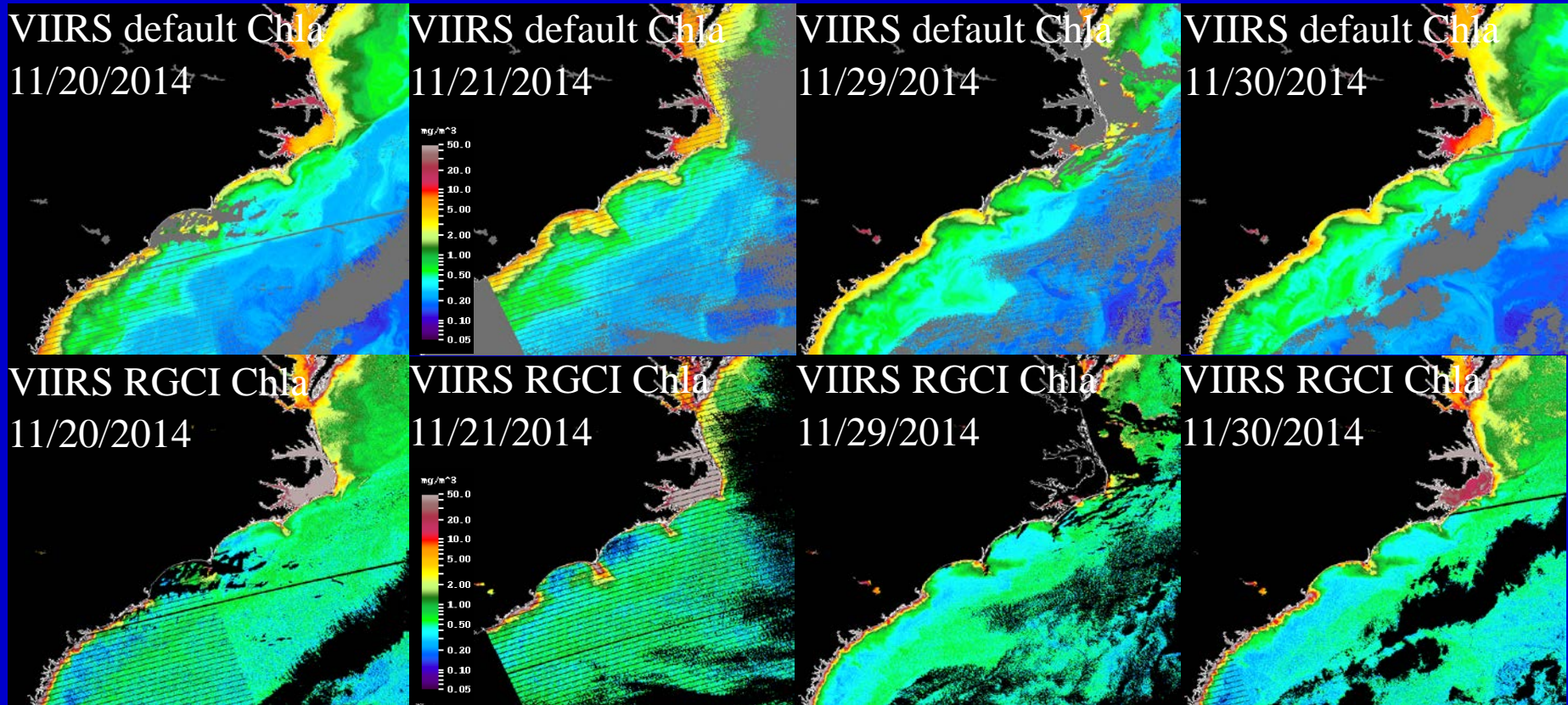
23 stations in total, each with about 3 depths measured. Only 6 found same day (+/- 12 hours) VIIRS data.



RGCI for other coastal regions?

Test over the South Atlantic Bight using NOAA/VIIRS Nov 2014 cruise data

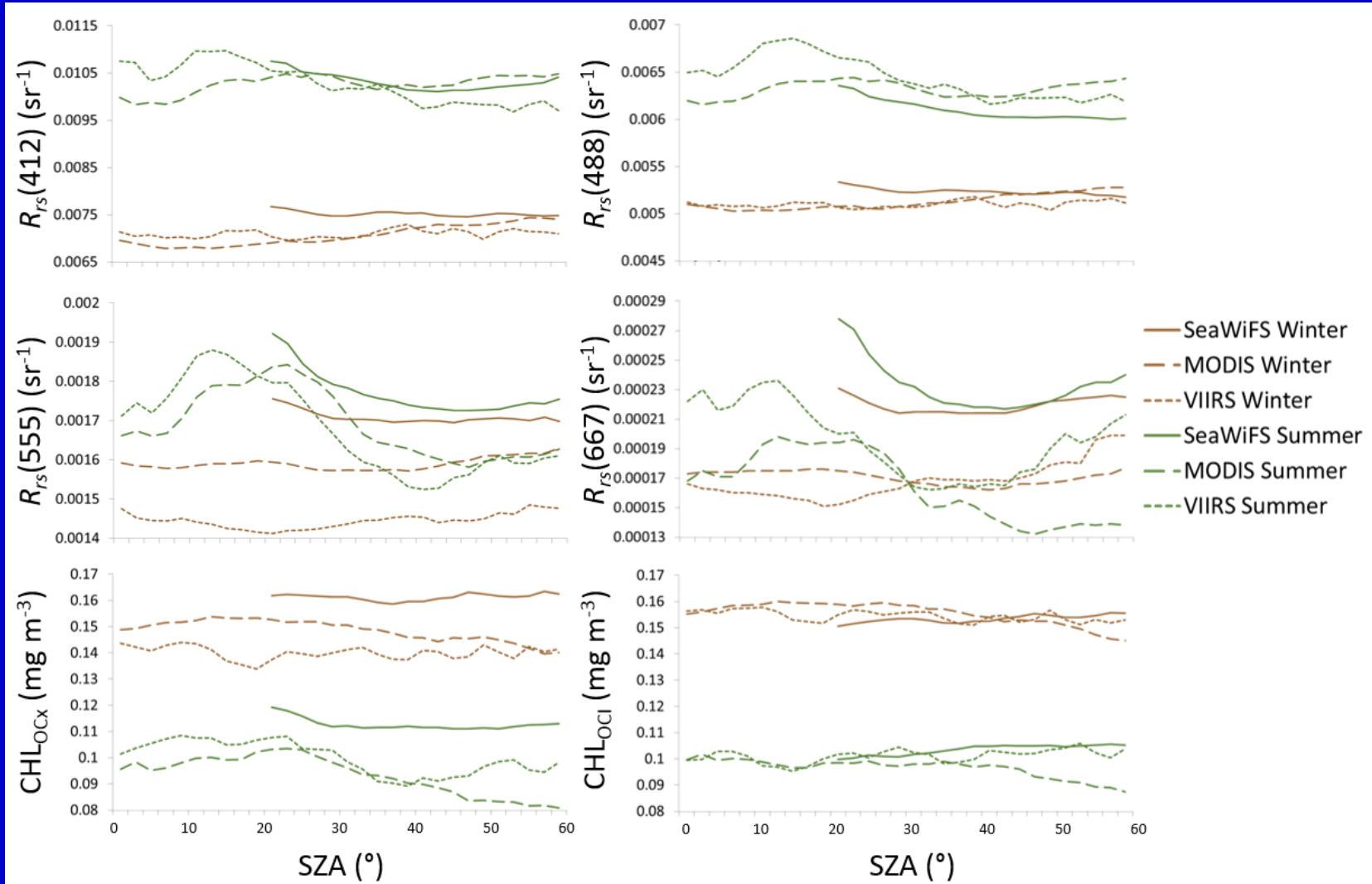
RGCI is not applicable in very low (< 0.2) or very high (> 10) chl waters



These results were derived from NOAA MSL12 processing

Cross-sensor comparison

SeaWiFS, MODIS, VIIRS products as a function of viewing angle, Gulf of Mexico



From Barnes and Hu (submitted, also see poster)

Summary

- Collected, processed, and shared field data through several dedicated cruises and cruises of opportunity
- Evaluated of VIIRS data from different processings (IDPS, NASA GSFC, NOAA MSL12)
- Demonstrated VIIRS capacity in detecting and monitoring dark water and HAB events

Publications

Hu, C., B. B. Barnes, L. Qi, et al. (2015). A harmful algal bloom of *Karenia brevis* in the northeastern Gulf of Mexico as revealed by MODIS and VIIRS: A comparison. Sensors, 15:2873-2887, doi:10.3390/s150202873.

Qi, L., C. Hu, J. Cannizzaro (in press). VIIRS observations of a *Karenia brevis* bloom in the Northeastern Gulf of Mexico in the absence of a fluorescence band. IEEE GRSL.

Barnes, B. B., and C. Hu (submitted). Dependence of satellite ocean color data products on viewing angles: A comparison between SeaWiFS, MODIS, and VIIRS. RSE.

Barnes, B. B., and C. Hu (2015). Cross-sensor continuity of satellite-derived water clarity in the Gulf of Mexico: Insights into temporal aliasing and implications for long-term water clarity assessment. IEEE Trans. Geosci. & Remote Sens., 53:1761-1772.

What's Next?

- Continue field and laboratory experiments to support VIIRS cal/val and science applications
 - Finish processing data from past cruises
 - Participate in new cruises
- Continue evaluation of VIIRS products, especially from MSL12 processing
 - Use data collected by the Cal/Val team
 - Extend to data collected by other groups
- Improve algorithms and data products to have better absolute accuracy and relative consistency
 - Biooptical properties
 - Blooms and other image features
- Publish results in journal articles and promote VIIRS II

Backup slide: relax to 12-day matchup instead of 1-day matchup for SAB cruise

