STAR JPSS 2018
Annual Science Team Meeting

Oceans EDRs and Initiatives
Monday, 27 August 2018

Dedicated NOAA/JPSS Cal/Val Cruises

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International, Interagency and Academic Collaborations

US Agencies

- NOAA/NESDIS/STAR (NOAA)
- Naval Research Laboratory, Stennis Space Center (NRL)
- NASA/Goddard Space Flight Center (NASA)
- National Institute of Standards and Technology (NIST)

European Union

- Joint Research Center of the European Commission (JRC)

Universities

- City University of New York, Long Island; Crest
- Lamont-Doherty Earth Observatory, Columbia University
- University of Massachusetts, Boston
- University of Miami
- University of South Florida
- University of Southern Mississippi
- Florida Atlantic University

Background

- **NESDIS STAR/ORA has been conducting shipboard validation measurements since the CZCS days.**
- **During SeaWiFS there were several dedicated validation cruises and many tied to the Marine Optical Buoy Operations.**
- **More recently, up until 2014, our team and most other ocean color investigators were conducting Cal/Val measurements aboard cruise of opportunity.**
- **NOAA Office of Marine and Aviation Operations Ship-time requests have resulted in the use of NOAA ships for dedicated validation cruises in FY 2015, 2016, 2017, 2018 and coming up in 2019.**

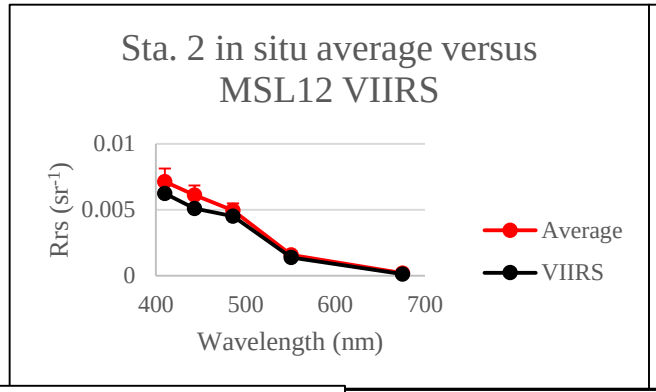
Science Objectives for the Cruise

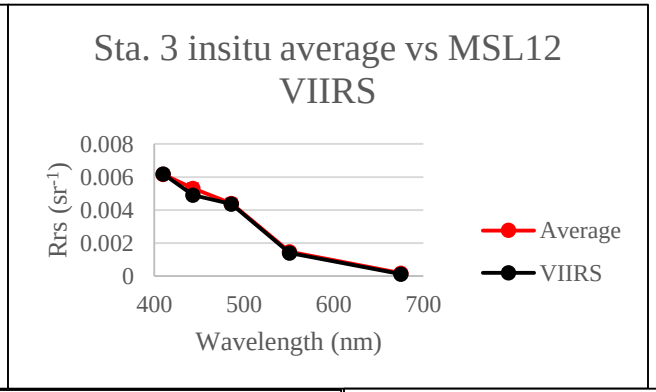
Goals

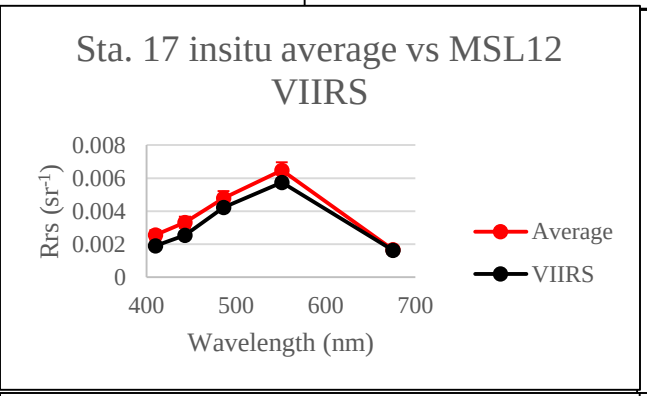
1) Validation of VIIRS JPSS Satellite Ocean Color products - Ground truth ocean color sensors and product

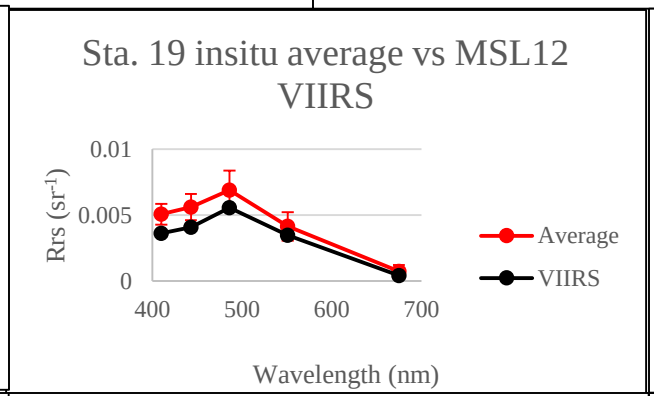
- **Occupied optical stations over four cruises to collect the best in situ matchups with VIIRS and other ocean color sensors used by NOAA.**
- **Water-Leaving Radiance** - HyperPro, HyperTSRB, C-OPS, GER, Spectral Evolution, SBA, HyperSAS, ASD Handheld 2.
- **Conducted pre- and post-cruise inter-cals**
- **Chlorophyll** - HPLC, Fluorometric, (in situ and extracted)
- **Absorption** - ACS, AC9, Spectrophotometric
- **Backscatter** - BB9, BB7, BB3, ECO Puck
- **Phytoplankton Physiology and Functional Types -** Imaging FlowCytobot, Alfa
- **Carbon** - POC and DOC water analysis; plus CDOM
- **Total Suspended Matter** - Gravimetric
- **Aerosol Optical Depth** - Microtops
- **Bi-directional radiance distribution** - NURADS

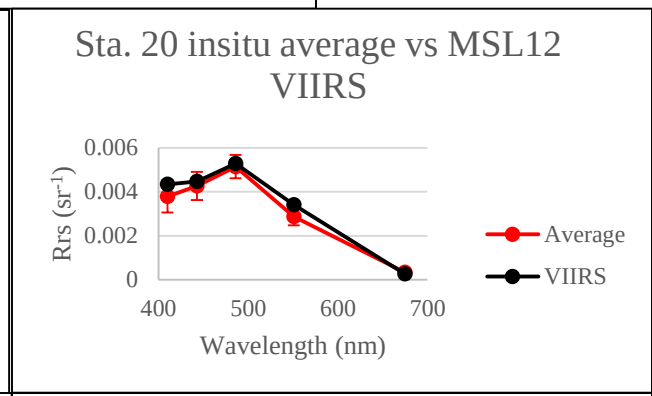
2014 MSL12 VIIRS 5x5 avg vs avg of all Rrs measurements

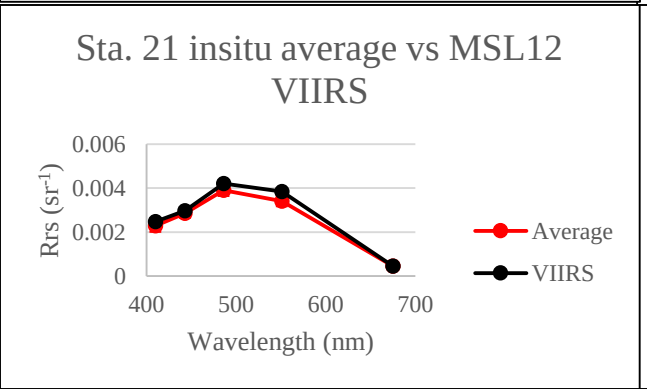


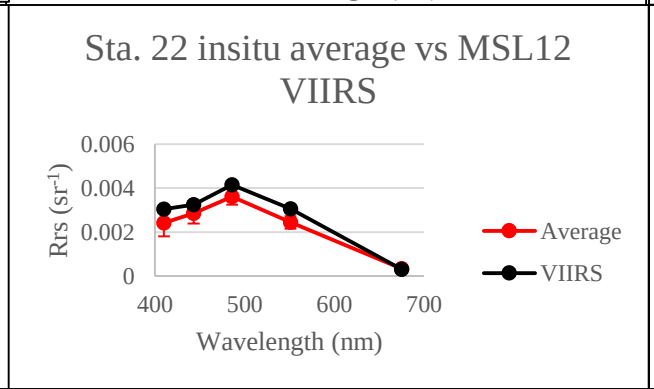


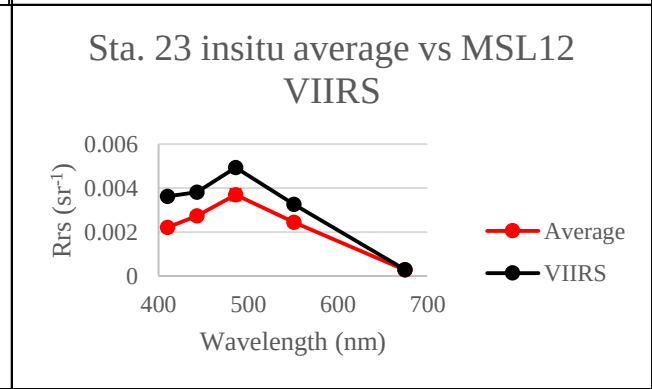










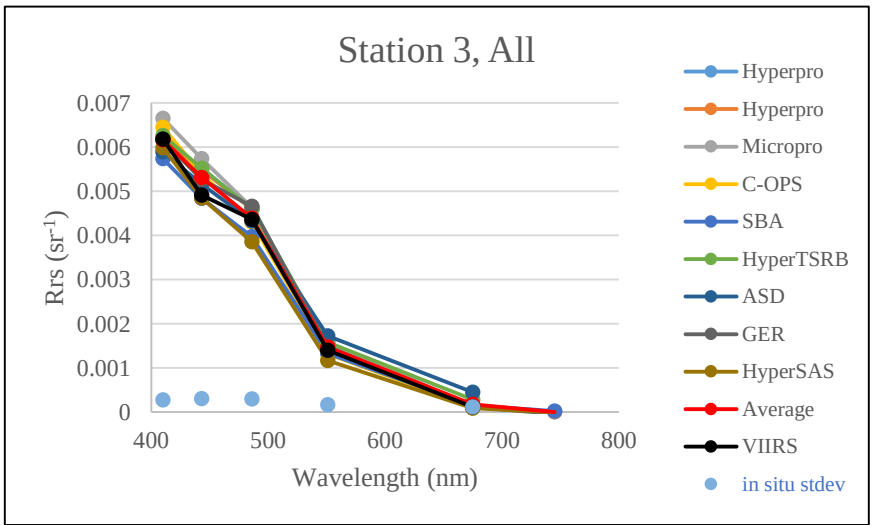


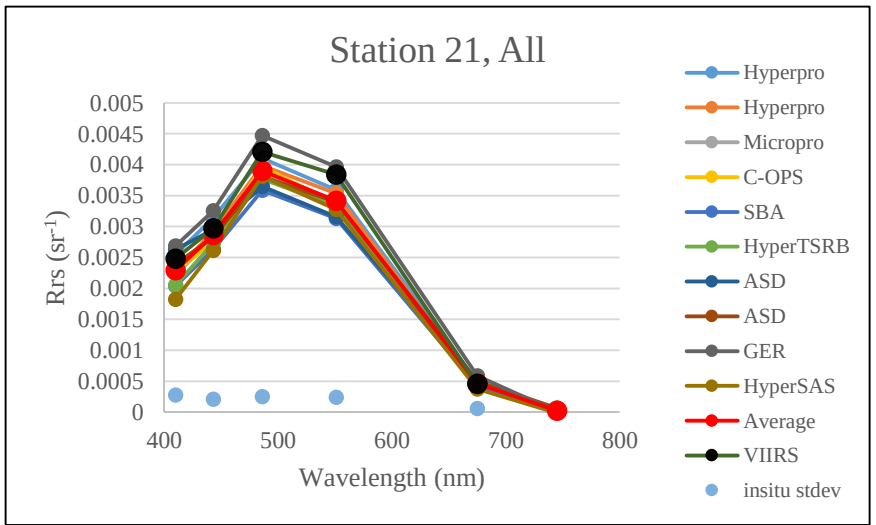
Science Objectives for the Cruise

Goals (cont.)

2) Characterization of uncertainties among the in situ ocean color measurements

a) replicate observations from multiple identical (same model) instruments deployed in parallel;
b) observations of the same in situ parameters but using different types of instruments;
c) different deployment protocols for sample collection;
d) different post-processing methods for the in situ data; and
e) spatial and temporal variability of the ocean waters.
f) Protocol analysis and recommendations.



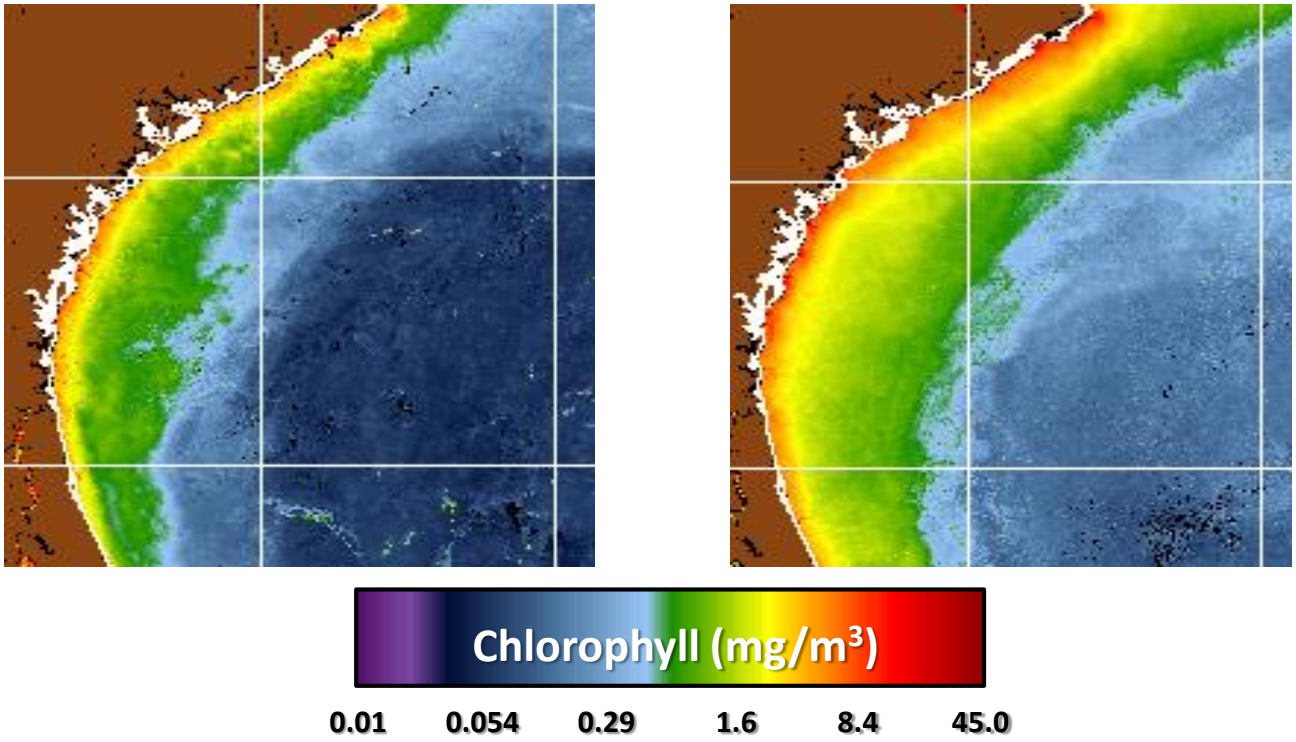


Science Objectives for Cal/Val Cruises

Goals (cont.)

3) Optical characterization of oceanic processes (i.e. coastal, near-shore, cross-shelf, eddies, fronts, filaments, blue water)

Influence of Hurricane Matthew on the Coastal waters



-Can water mass characterization of the representing different bio-physical processes be defined using VIIRS bio-optical products in the a dynamic system?

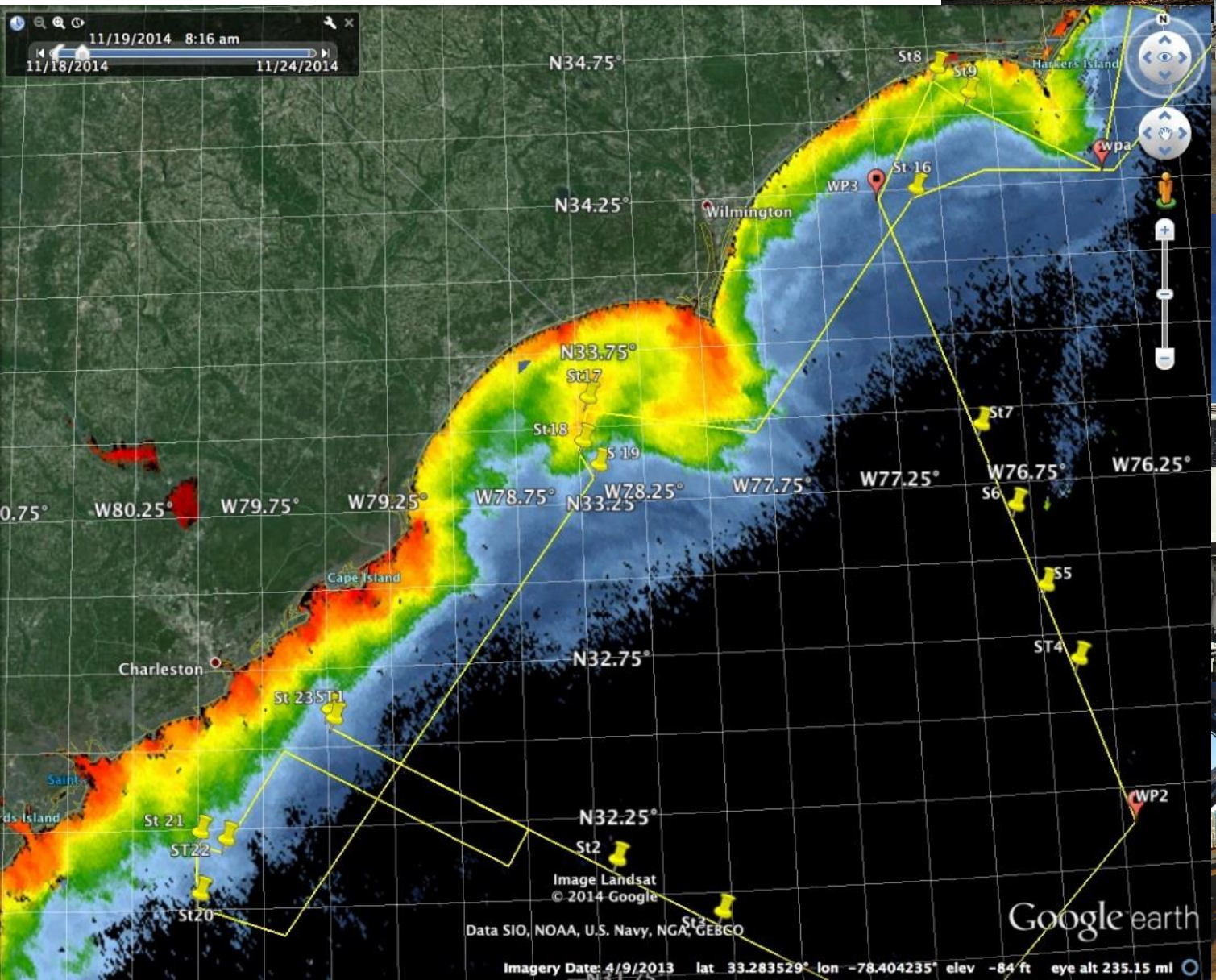
The FY15 cruise (Nov. 10-20, 2014) went in and out of Charleston SC aboard the Nancy Foster. In 10 days occupied 24 stations resulting in 9 good matchups with VIIRS





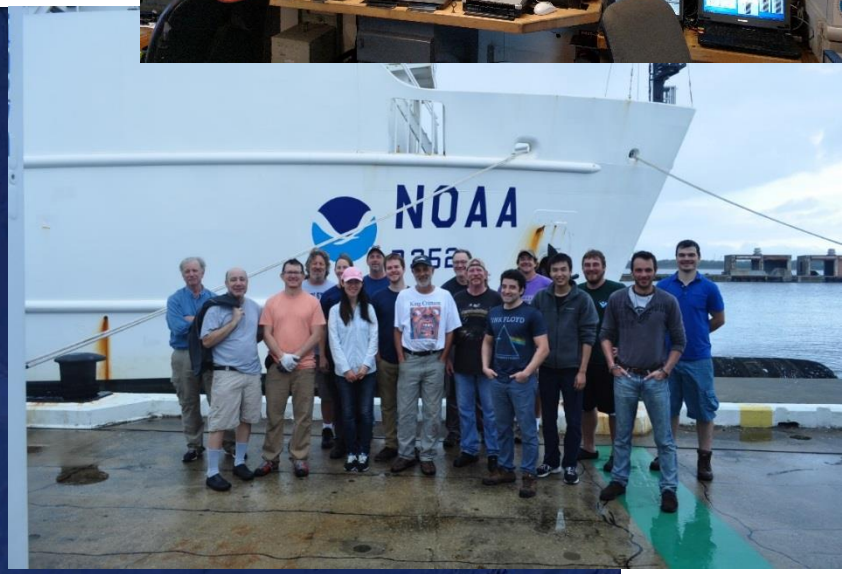






The FY16 cruise (Dec. 2-13, 2015) went in and out of Charleston SC aboard the Nancy Foster. In 12 days occupied 27 stations resulting in 9 good matchups with VIIRS



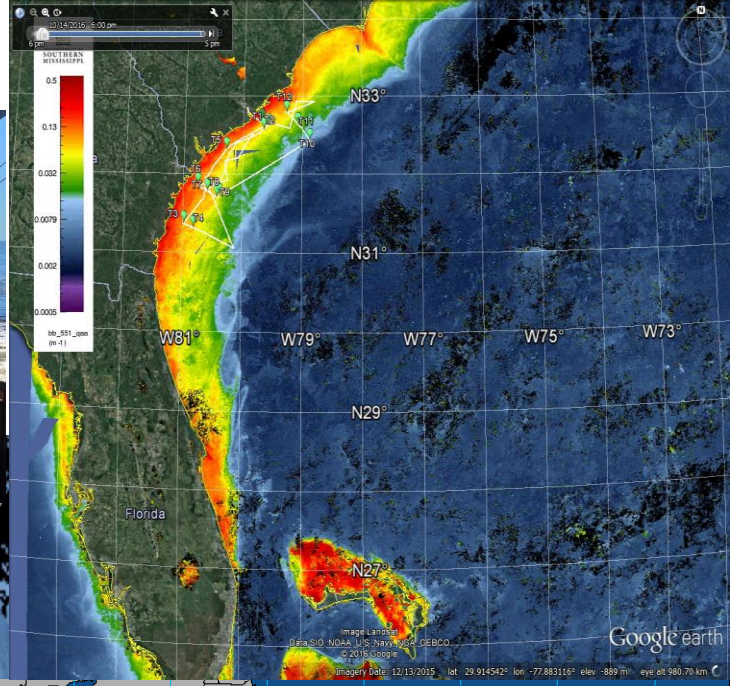


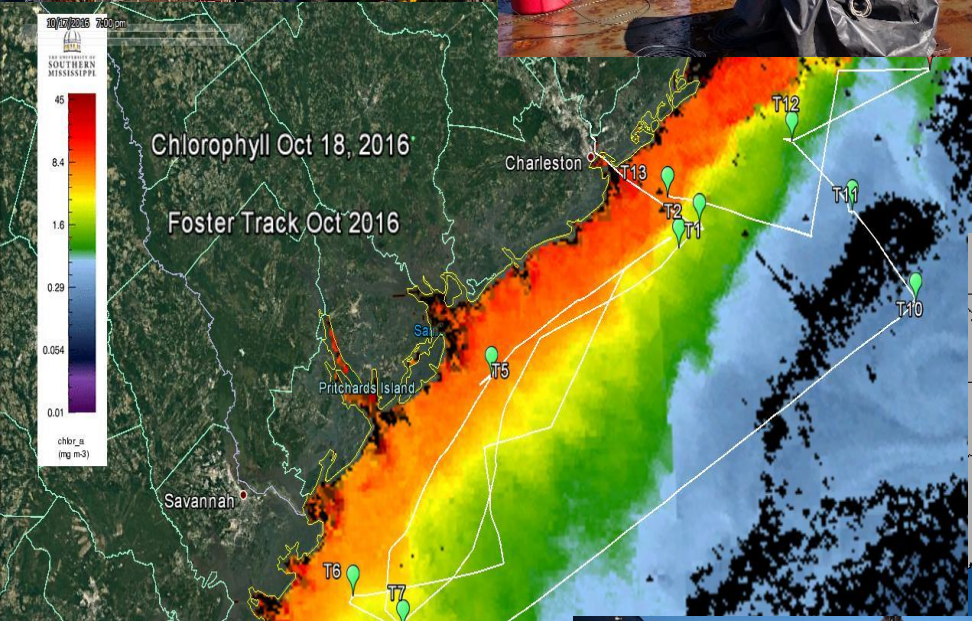


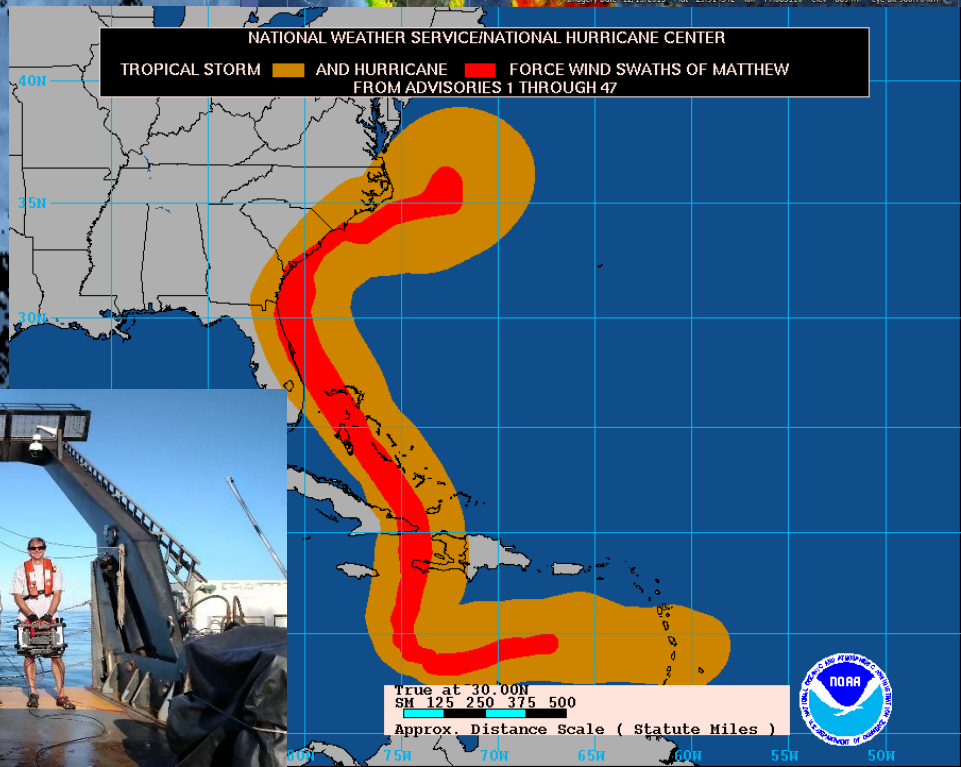
FY 17 VIIRS Cal/Val Cruise III (NF-16-08), October 13 to 18, 2016 aboard the NOAA Vessel Nancy Foster. In and out of Charleston, SC. 13 st.







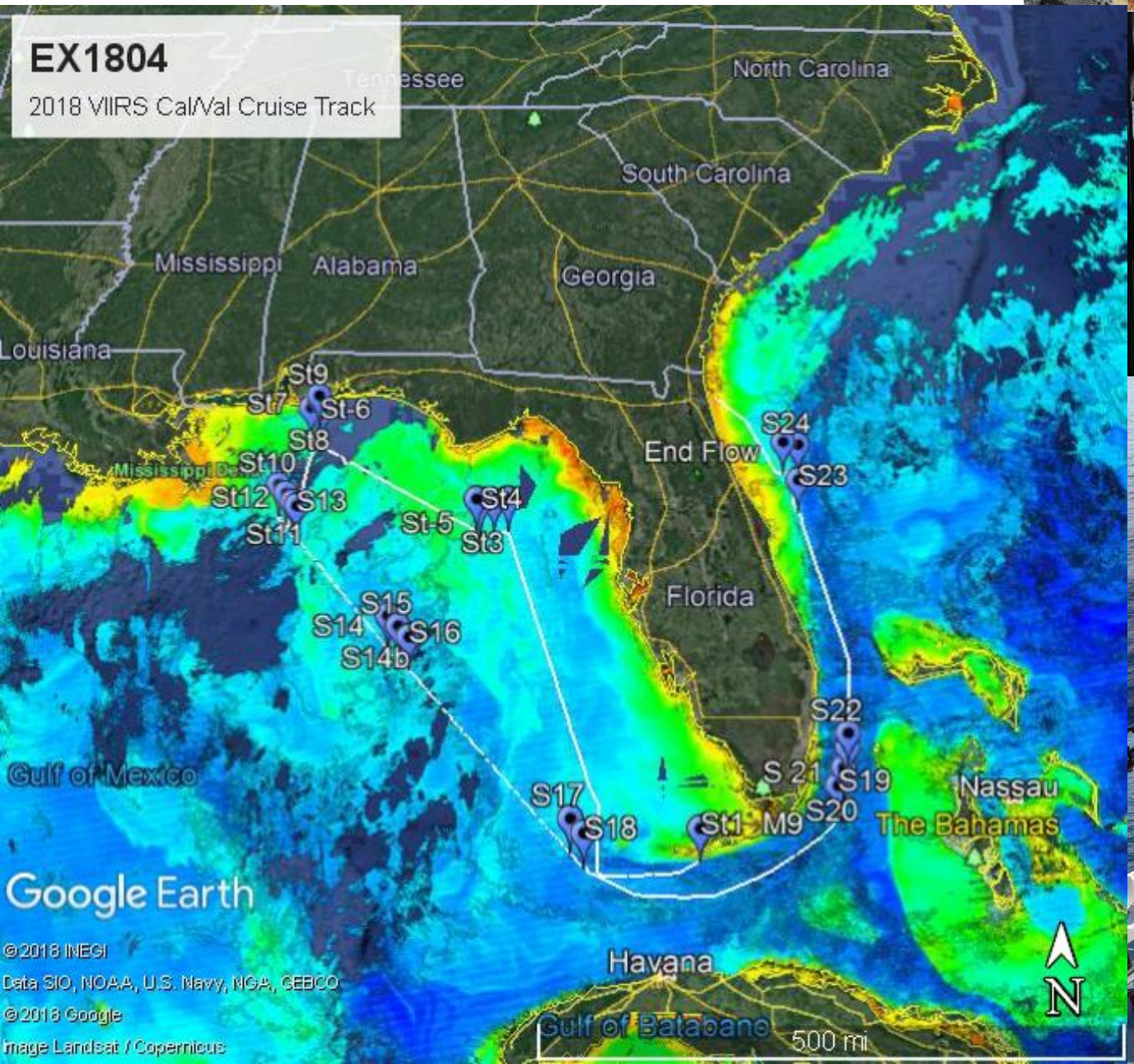






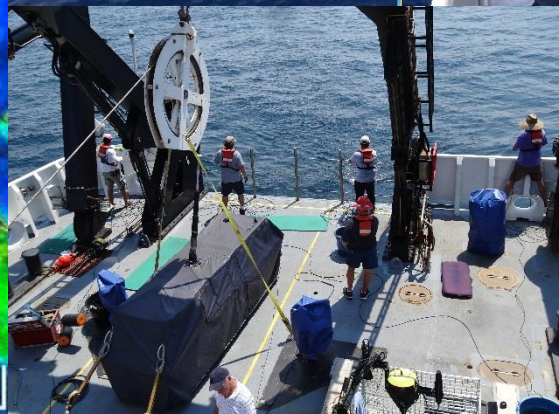
FY18 Cal/Val cruise. May 9 – 18, 2018. NOAA Ship Okeanos Explorer. Miami to Jacksonville. 24 stations, potential 18 matches











Instrument Percent difference relative to average of all instruments

2014 VIIRS Validation Cruise

Band	Hyperpro	Hyperpro	Micropro	C-OPS	SBA	HyperTSRB	ASD	ASD	GER	HyperSAS
410	4.83	-0.41	1.93	-1.49	-9.01	-4.29	6.47	-1.82	4.04	-0.75
443	6.84	3.12	-0.35	-4.21	-8.90	-0.28	1.34	-3.30	6.19	-1.31
486	4.83	3.81	-0.37	-2.19	-9.86	1.01	-4.71	-2.21	10.38	-0.75
551	5.22	4.14	-1.86	-7.24	-9.12	5.52	-0.11	-4.75	8.53	-1.16
675	-9.18	-14.02	-14.91	-17.22	-8.57	36.15	38.47	0.24	5.46	-11.25
All	2.51	-0.67	-3.11	-6.47	-9.09	7.62	8.29	-2.37	6.92	-3.04

2015 VIIRS Validation Cruise

Band	Hyperpro	Hyperpro	Spec Evo	SBA	HTSRB 1	HTSRB 2	ASD 1	ASD 2	ASD 3	GER	HyperSAS
410	3.88	13.32	14.46	-1.04	-0.97	-1.68	-6.04	2.29	-12.15	-7.30	-17.42
443	4.97	10.15	10.09	0.48	-1.31	0.41	-10.97	-3.32	-12.94	-4.97	-4.86
486	6.45	9.93	4.84	1.37	-2.34	3.36	-15.05	-8.95	-14.12	1.09	0.92
551	7.39	3.18	6.46	-2.70	-2.06	6.48	-10.68	-2.11	-8.75	-5.98	-3.61
675	-5.43	-17.26	-3.61	-33.49	50.99	72.27	-5.04	9.29	-7.03	-44.38	-35.22
Average	3.45	3.86	6.45	-7.08	8.86	16.17	-9.56	-0.56	-11.00	-12.31	-12.04

2016 VIIRS Validation Cruise

Band	Hyp 1	Hyp 2	Hyp 3	Float 1	Float 2	SBA	Spec. Evo	GER	HyperSAS	ASD 1	ASD 2	ASD 3	ASD 4
410	6.80	7.56	17.28	-21.40	-8.72	-4.86	13.96	-16.20	12.09	-10.46	-2.70	-6.48	2.52
443	8.62	9.46	17.59	-10.49	-5.03	-1.72	9.17	-9.93	5.19	-6.61	-6.72	-8.32	-2.58
486	10.32	10.44	16.13	-4.61	-2.25	-0.31	6.16	-5.71	3.23	-4.06	-9.32	-9.91	-6.56
551	10.72	10.20	15.33	-3.37	2.38	3.61	5.84	-4.66	0.52	-7.57	-8.89	-11.63	-6.62
675	14.03	5.24	23.49	17.86	12.49	30.87	-2.98	-7.06	-7.12	-25.26	-3.56	-40.01	4.69
avg all	10.10	8.58	17.96	-4.40	-0.22	5.52	6.43	-8.71	2.78	-10.79	-6.24	-15.27	-1.71

MSL12 VIIRS Percent difference relative to in situ

2014 VIIRS Cal/Val Cruise

Band	Hyperpro	Hyperpro	Micropro	C-OPS	SBA	HyperTSRB	ASD	ASD	GER	HyperSAS	Average
410	-6.73	-3.36	-5.39	-2.15	10.31	1.57	-8.17	-8.73	3.33	3.85	**-3.79**
443	-13.15	-10.87	-7.45	-3.93	4.15	-7.42	-8.53	-9.38	-8.44	-3.90	**-8.31**
486	-6.49	-5.70	-1.44	0.45	11.28	-2.84	3.67	-2.83	-8.83	0.35	**-2.30**
551	-3.58	-2.71	4.05	10.21	14.65	-2.89	2.89	3.18	-2.82	5.52	**1.17**
675	-10.37	-0.44	1.06	1.70	-3.34	-28.45	-25.91	-9.02	-22.89	-4.94	**-17.04**
All	-8.07	-4.62	-1.83	1.26	7.41	-8.01	-7.21	-5.36	-7.93	0.18	**-6.05**

2015 VIIRS Cal/Val Cruise

Band	Hyperpro	Hyperpro	Spec Evo	SBA	HTSRB	HTSRB	ASD 1	ASD 2	ASD 3	GER	HyperSAS	Average
410	-10.71	-33.17	-32.44	0.69	-17.95	-2.30	-5.63	-13.05	-6.59	11.00	33.56	**-6.96**
443	-18.16	-31.21	-29.54	-8.79	-22.38	-11.47	-4.18	-11.97	-8.68	-4.17	-4.42	**-14.09**
486	-10.39	-19.94	-14.26	-0.97	-12.37	-5.97	13.50	4.83	4.68	-2.64	-2.58	**-4.19**
551	-20.75	-24.85	-24.76	-7.82	-24.11	-18.53	-0.83	-12.52	-11.21	-6.12	-7.59	**-14.46**
675	-5.97	-7.69	1.95	82.36	-45.75	-40.02	0.21	-15.49	-9.78	82.26	56.15	**8.93**
Average	-13.20	-23.37	-19.81	13.09	-24.51	-15.66	0.62	-9.64	-6.32	16.07	15.02	**-6.16**

2016 VIIRS Cal/Val Cruise

Band	Hyp 1	Hyp 2	Hyp 3	Float 1	Float 2	SBA	Spec. Evo	GER	HyperSA	ASD 1	ASD 2	ASD 3	ASD 4	Average
410	-21.14	-13.021	-14.58	-8.6991	-10.169	-5.1651	-17.349	9.41287	-13.086	-9.5444	-13.751	-15.726	-14.526	-11.33
443	-23.637	-18.248	-16.385	-9.1118	-12.199	-9.3288	-13.487	-6.5252	-10.053	-9.5982	-6.3806	-4.6875	-12.335	-11.6
486	-19.977	-19.423	-10.79	-8.2182	-5.8882	-8.393	-12.214	-8.6991	-9.2464	-3.9016	-0.0429	-8.7008	-4.4225	-9.224
551	-20.499	-16.072	-14.42	-5.4567	-10.169	-12.975	-13.573	-4.5217	-7.5895	-5.0782	-7.3789	0.5504	-1.7808	-9.150
675	-9.0381	23.9794	8.34418	8.53912	6.38464	-10.026	10.6155	13.2666	12.936	30.5061	10.9994	18.1037	0.3017	9.6085
avg all	-18.858	-8.5568	-9.5662	-4.5893	-6.4082	-9.1776	-9.2014	0.58669	-5.4078	0.47673	-3.3107	-2.0921	-6.5525	-6.358

Summary:

- Bring together JPSS ocean color cal/val team investigators from many agencies and universities to test the consistency in validation measurements being provided to processing centers.

- In four cruises we have occupied 88 stations with 48 matchup stations.

- Provided best in situ validation data to NOAA and other agencies responsible for ocean color processing and quality control.

- Identified sampling uncertainties and problems areas and are constantly working to lower the uncertainties and resolve sampling errors.

- Will continue annual validation cruises. Next expedition is in May 2019 aboard the NOAA Ship Nancy Foster along the east coast.

- More information and complete list of measurements can be found in the Cruise Reports-
  - FY2015 - NOAA Technical Report NESDIS 146, DOI:10.7289/V52B8W0Z
  - FY2016 - NOAA Technical Report NESDIS 148, DOI:10.7289/V5/TR-NESDIS-148
  - FY2017 - NOAA Technical Report NESDIS 151, DOI: 10.7289/V5/TR-NESDIS-151

Thank you