Cal Val Telecon
Nov 15 , 2018

Stennis - Cal Val Team
Update on VIIRS Ocean Color Cal Val

Bob Arnone
Sherwin Ladner
Bill Gibson
Wes Goode

To discuss.

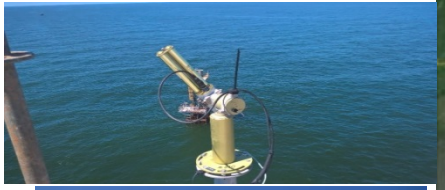
1. **WavCIS – Update**
2. **WAVICIS Matchup NRL- Protocols - Investigated**
3. **Cal Val Cruise - Okeanos Explorer Ship**
   1. **Floating Hyperpro Protocols and Evaluation**
   2. **Protocols for Above Water**
      ASD & Spectral Evolution
   3. **Matchups Above water, Floats w/ SNPP, J20, MODIS**
   4. **Flowthrough Example and Status**

Plans – Flowthough

XBT- for Flowthrough affects on surface

VIIRS and Salinity for the red tide . (E. Stumpf)

WavCis SeaPrism Status
SN 638



Instrument Update and Present Status:

WavCIS operational for the complete year –
Have 3 visits to offshore WavCIS site this year.

- **May 25. The site computer experienced an automatic forced shut down due to debris in CPU cooling fan. The computer was changed out. Communications with the Sea Prism was thought to be working & verified by NASA, but that was not the case. This resulted in no data from May 25th until July 25th. Weather delays & other field trips prevented a prompt return back out there.**
- **July 26 - Trip out to replace SN 638 for calibration with SN 610.**
  - **SN 610 from NASA was installed but failed about an hour later.**
  - **SN 638 was put back into service**
  - **communications problem with the computer solved by replacing PC cable at the Sea Prism. The USB to Serial adapter and cable to the instrument box were proven to be good.**
  - **All data was downloaded from the previous day and verified as having transferred to NASA.**
- **SN 610 was sent back to NASA for repairs.**
  - **The problem was a bad Processor Chip connection. Chip was cleaned, Instrument tested good and returned back to LSU.**
- **A trip is scheduled to replace SN 638 with SN 610, but presently delayed due to persistent bad weather & sea state conditions, estimated completion by end of November.**

WavCIS 2018 Operating 186 points to Oct				Visited Site	NASA Calibrated
Sensor	610	638	Info		
Jan		1-31			
Feb		1-29			
Mar		1-31			
Apr		1-30			
May		1-25	Com down May25	May 31	
Jun		Down			
July		25-31	610 Sent to NASA	July 26	
Aug		1-31	610 returned NASA		610 calibrated
Sept		1-30			
Oct		1-31			
Nov	1-31				
Dec	1-31				

Protocol for Satellite Matchup with AeroNET-OC – WAVCIS - NRL

Satellite Constraints

1. Spatial: 5x5 pixels – mean Lwn value - 50% and center pixel valid
2. Temporal: insitu data matchup within + - 3 hour from overpass time
3. Zenith Angle: < 70 degrees (*Investigating Solar Zenith Angle Constraints*)
4. *FLAG* Masking: Cloud 865nm albedo/threshold 0.05 (No VIIRS Cloud Mask) – *CLDICE*, Glint threshold 0.025 (default 0.005 more aggressive) - *HIGLINT*, *ATMFAIL* using Gordon Wang w/ 80 models cannot compute aerosol, *HILT – L1a saturated at sensor level.*
5. Spectral: All satellite channels must be positive.

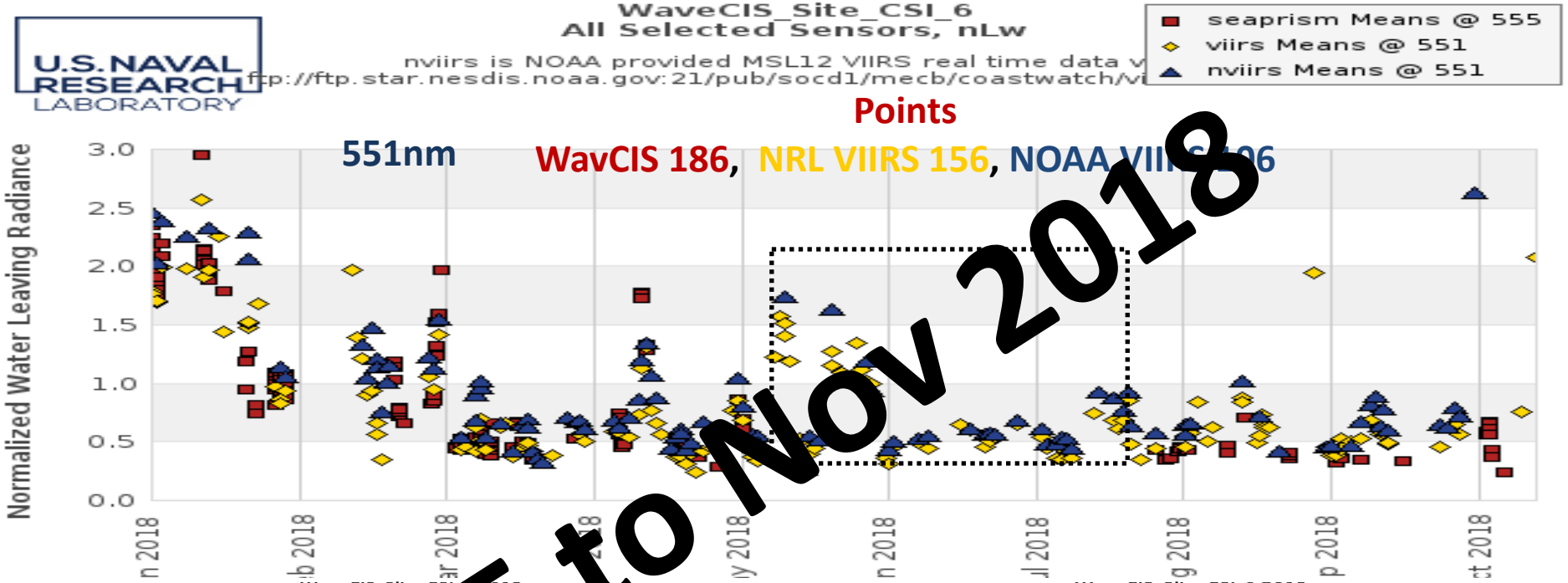
Matchup Closest in Time

WAVCIS Data (AeroNET-OC) & Constraints (daily 20 minutes)

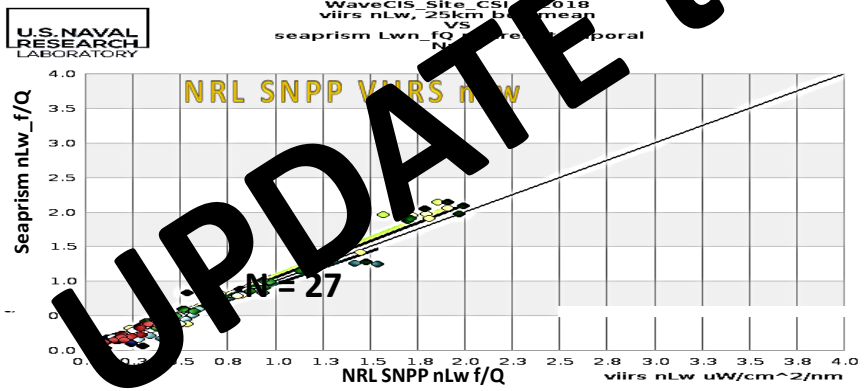
1. Level 1.5 spectral Fresnel corrected Lwn f/Q (real-time for monitoring)
2. Spectral: All visible channels must be positive.
3. AOT < 0.2.
4. Wind Speed < 8 m/s.
5. Cloud screening by NASA – not included in file if cloudy.
6. https://aeronet.gsfc.nasa.gov/cgi-bin/data_display_seaprism_v3?site=WaveCIS_Site_CSI_6&nachal=2&level=2&place_code=10

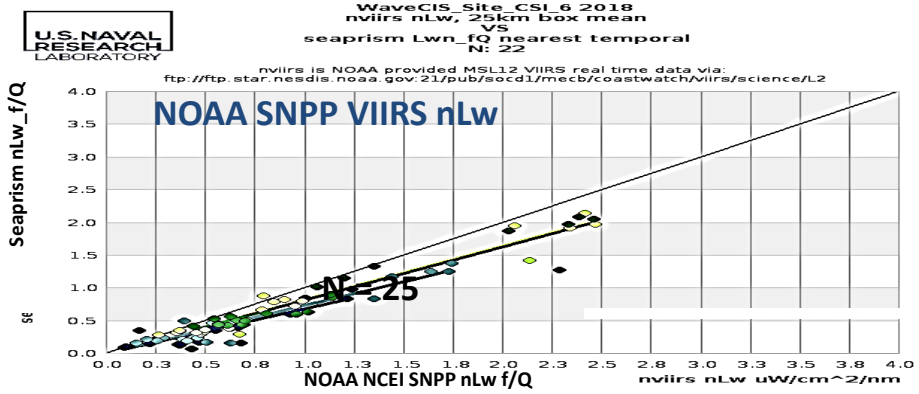
Analyses of Uncertainty of Constraints is being examined.
Pixel resolution, Zenith Angles, Time constraints, Winds, etc

WaveCIS Jan 2018 - Oct 2018



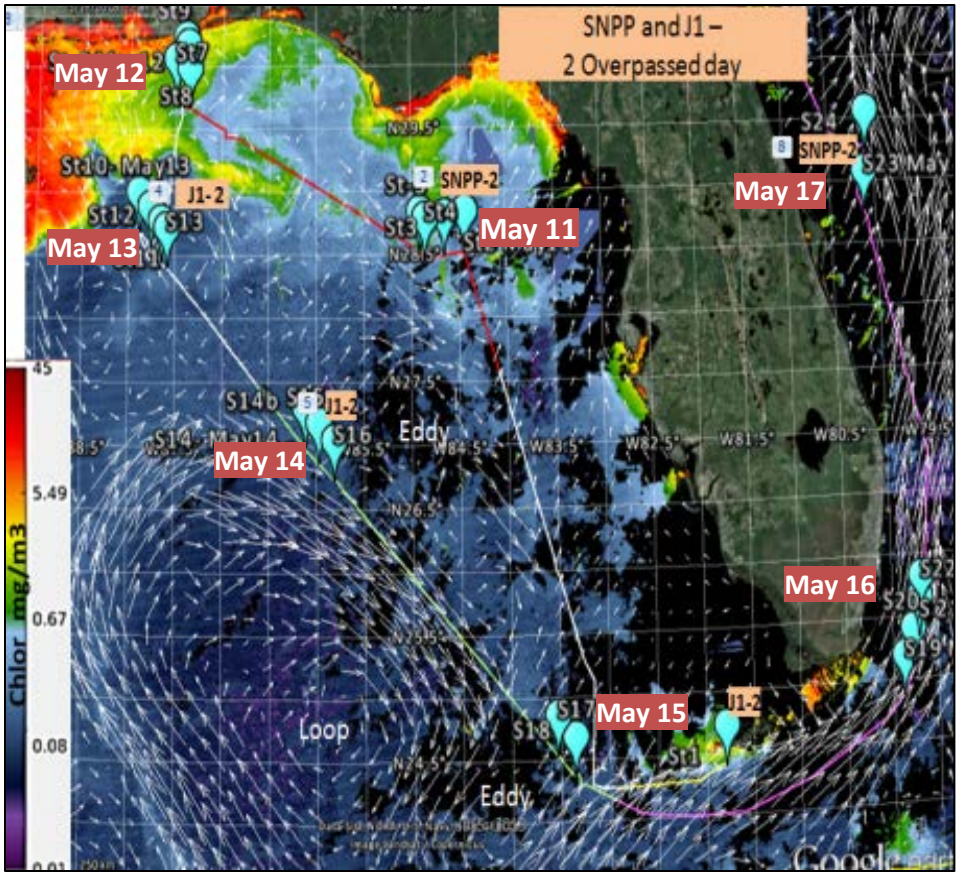
UPDATE to Nov 2018

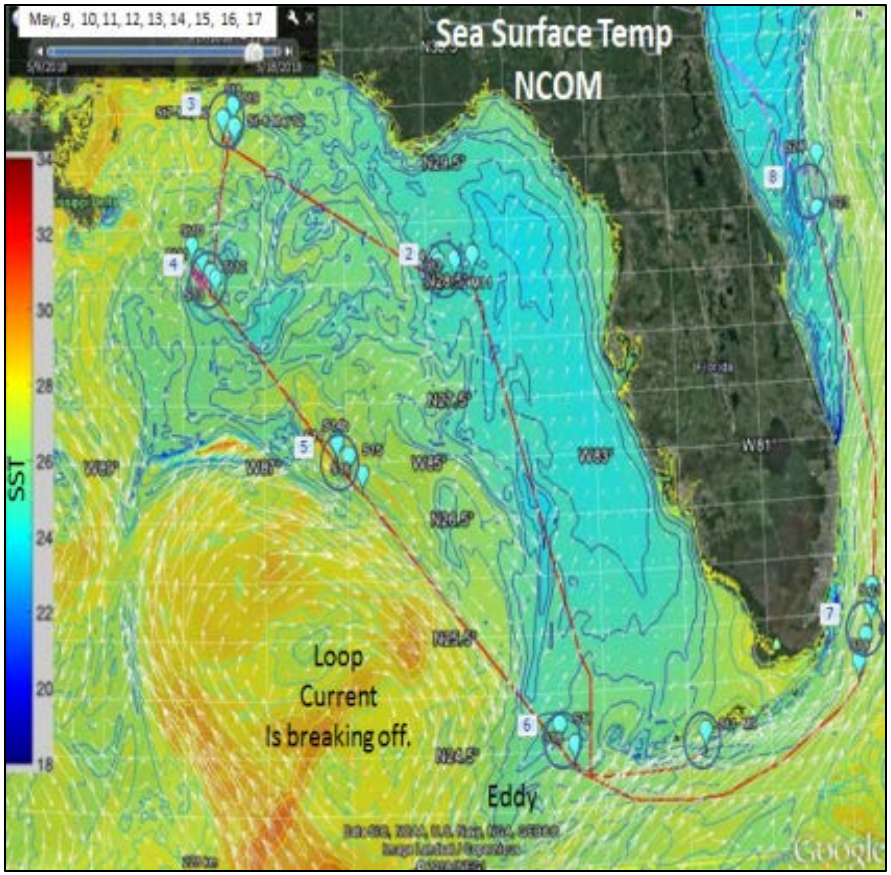




STATS	410		443		486		551		671
	NRL	NOAA	NRL	NOAA	NRL	NOAA	NRL	NOAA	NRL
R^2	0.85	0.81	0.94	0.92	0.98	0.96	0.98	0.91	0.91
Slope	1.09	0.68	0.95	0.72	1.08	0.82	1.05	0.81	0.98
Ratio	1.08	0.69	0.95	0.70	1.03	0.80	1.05	0.81	0.96

Okeanus Cruise May 2018





May 9th station 1 in Key West offshore waters at Gulf Stream's edge.

***May 10th* in transit from the Florida Keys to the northern Gulf of Mexico.**

***May 11th* stations 2, 3, 4 5 in coastal waters northern Gulf of Mexico shelf break- Apalachicola Plume**

May 12th **stations 6, 7, 8 and 9 in coastal waters across river plumes (MOBILE, Mississippi) Pensacola coastal.**

May 13th stations 10, 11, 12 and 13 in **offshore waters** near the BP Deep Water Horizon **oil spill site**.

May 14th stations 14, 15 and 16 in **offshore waters** at **Loop Current Eddy**.

May 15th stations 17 and 18 in **offshore** waters at Loop Current Edge and including a Gulf Stream eddy.

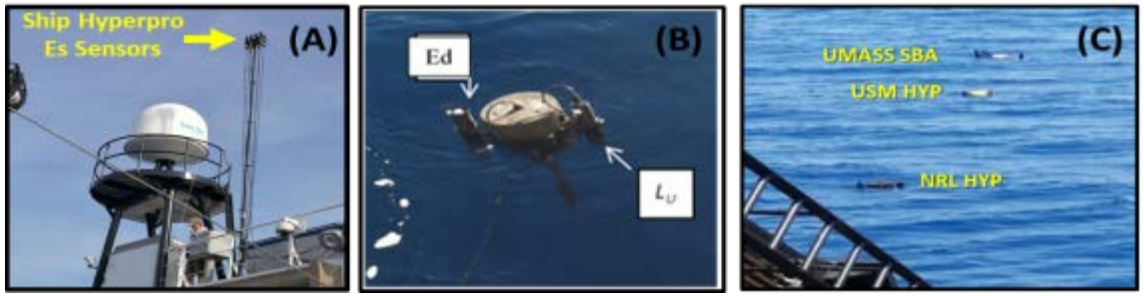
May 16th stations 19, 20, 21 and 22 in **offshore** waters along the western Atlantic Gulf Stream

May 17th stations 23 and 24 in waters located near the Gulf Stream and **in coastal waters** near Jacksonville, FL.

Processing Protocols for Floating HyperPro using new Calibration 2018

This method works

FINAL The ProSoft 8.1.4.1



Key West Okeanos Explorer

Cal file processing in HYPERPRO with Mike Ondrusek new cal files . USM avg 18.zip

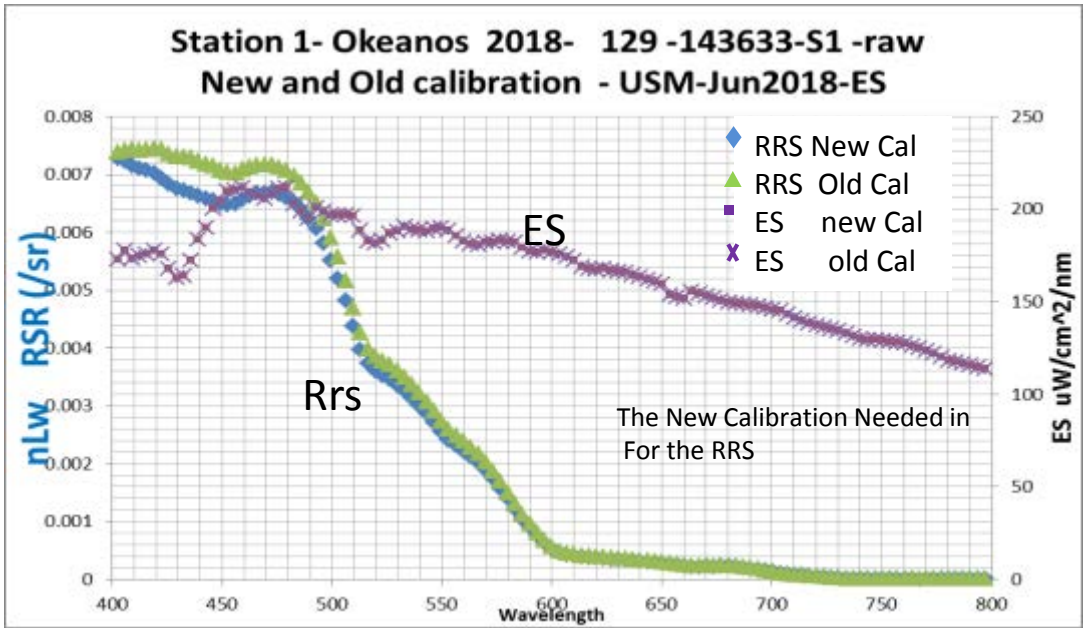
Data processed to Level 4 = in ASCI L4 data of nLW
This is using ES/Lu could also use ED/ Lu

Comparison of the Old Vs the new Calibration – 3 years. Close

Affect of new calibration

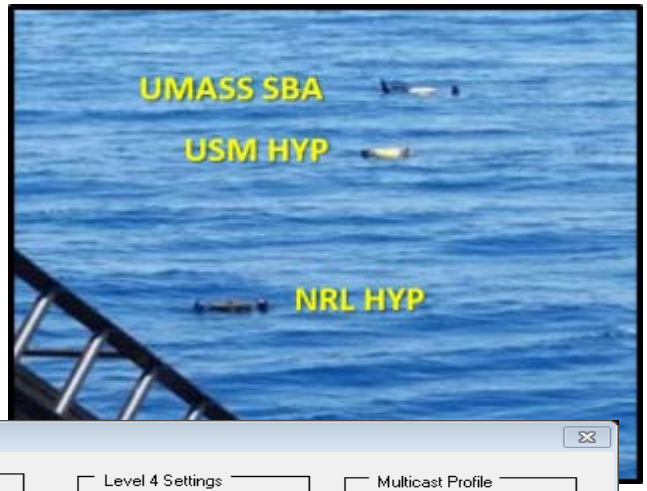
Cal old and new
For station 1

RSR And ES



Floating Hyperpro - ProSoft 8.1.4.1 processing

Level 4 Products for ASCI files to produce nLw spectra



Surface tilt 2
Criteria for processing

ProSoft 8.1.4_1

File Tools Ascii Help

Processing Context

Current Instrument: USM-Jun2018-ES

New Edit Delete Import

Current Parameters: USM_May3

New Edit Delete Import

Multi-Level Processing

Level 1 --> 2
Level 1 --> 2s
Level 1 --> 3a
Level 1 --> 4

Single Level Processing

Level 1 --> 1a
Level 1a --> 1b
Level 1b --> 2
Level 2 --> 2s
Level 2s --> 3a
Level 3a --> 4

Multicast Graphs

Save All Close All

Editing Parameters For Context USM_May3

Level 2 Settings
Stray Light Correction: OFF
Thermal Correction: OFF
Surface Edit: ON
Profile Edit: OFF
Multicast Profile: OFF
Min Wavelength (nm): 400
Max Wavelength (nm): 800

Data Filtering
Deglitch Profiler Data: OFF
Profiler Noise Threshold: 5
Upper Depth Level (m): 0
Lower Depth Level (m): 10000
Deglitch Reference: OFF
Reference Noise Threshold: 20

Surface Editing
High Tilt (deg): 2

Level 2s Interpolation
Depth Resolution (m): 0.10
SeaBASS Output

Level 3a Averaging
Bin Interval (m): 0.50
Bin Width (m): 0.10
Time Interval (sec): 2
Time Width (sec): 1
Wavelength Interp (nm): OFF
Wavelength Match
SeaBASS Output

Level 4 Settings
Integration Points: 5
Reflection Albedo: 0.043
Reflectance Index: 0.021
Refractive Index: 1.345
ET Solar Irradiance: Neckel & Labs / Thuillier
Default Salinity (psu): 35

Multicast Profile
Wavelength Interp (nm): OFF
Normalization: OFF
Data Filtering: OFF
Filter Threshold: 10
K Range Check Ed: ON
K Range Check Lu: ON
Depth Extrapolation: ON

Dark Correction
Auto Dark Correction: SHUTTER
Dark Bins: 20
Shutter Dark Deglitch: OFF

Profile Editing
Auto Edit (Single Cast): ON
High Tilt (deg): 2
Low Velocity (m/sec): 0.1
Minimum Depth (m): 0
Maximum Depth (m): 10
Select Casts (Multicast)

Cancel

Level 4 Options

- Diffuse Attenuation Coefficient (k)
- Propogate Optical Variables to Surface
- Water Leaving Radiance (Lw, Lwn)
- Surface Remote Sensing Reflectance
- Surface Reflectance
- Chlorophyll Surface Estimate (SeaBAM OC2)
- Chlorophyll Surface Estimate (Gordon 88)
- Chlorophyll Profile Estimate (Morel 2001)
- Water Properties
- Remote Sensing Reflectance Profile
- Reflectance Profile
- Photosynthetically Available Radiation (PAR)
- Vertical Energy Fluxes

Okay

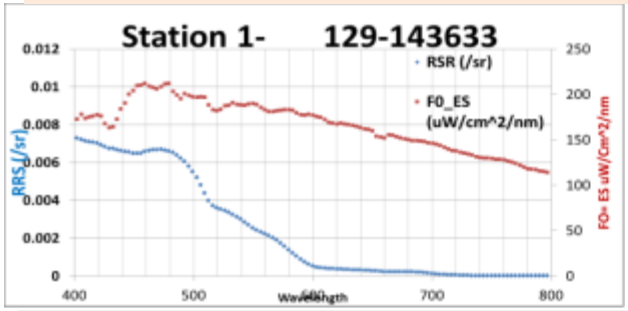
Floating Hyperpro - USM- NRL

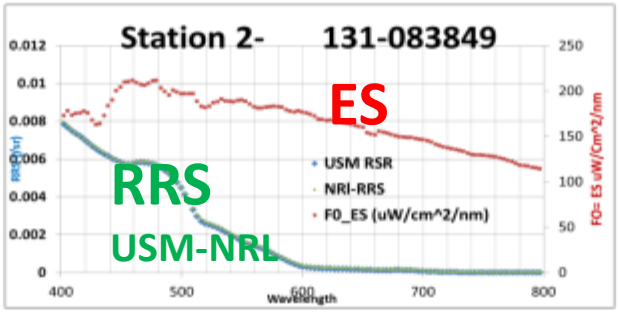
Prosoft 8.1.4 .

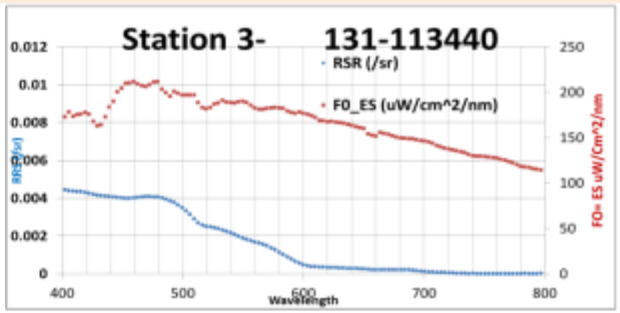
Used the Calibration from Mike for ES and LU.

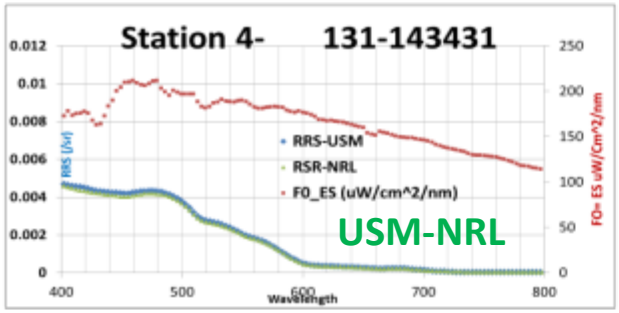
Used a protocol for Hyperpro Processing presented last year.

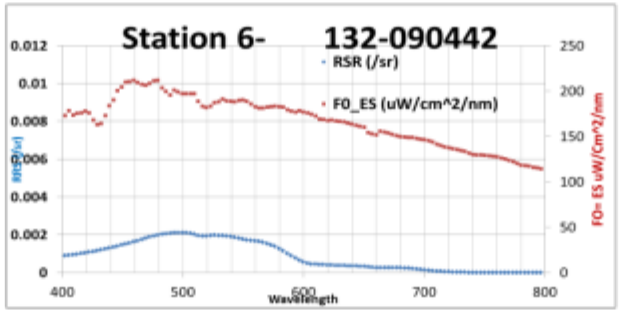
Got Similar Water leaving Radiance response from the 2 HP Floats

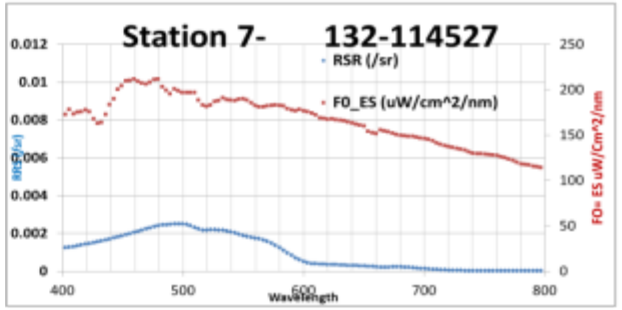


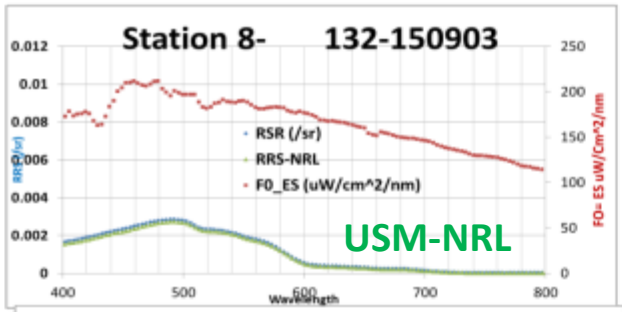


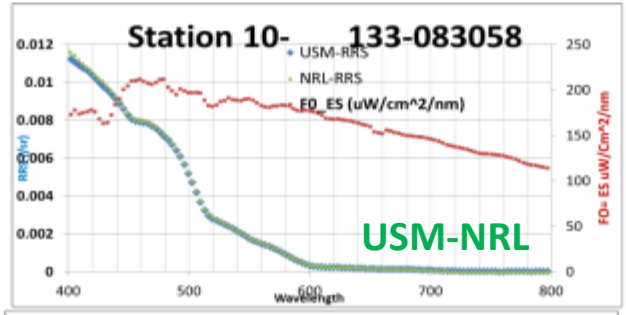


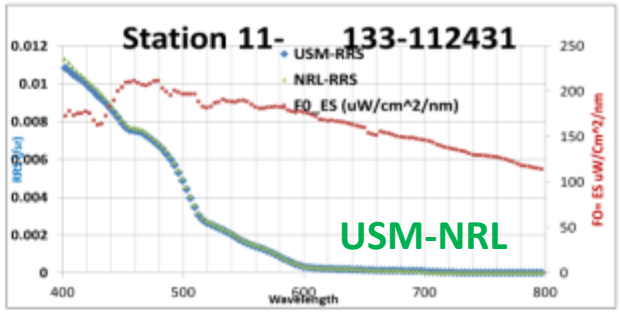


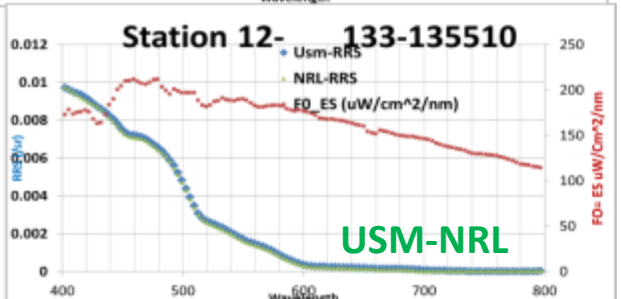


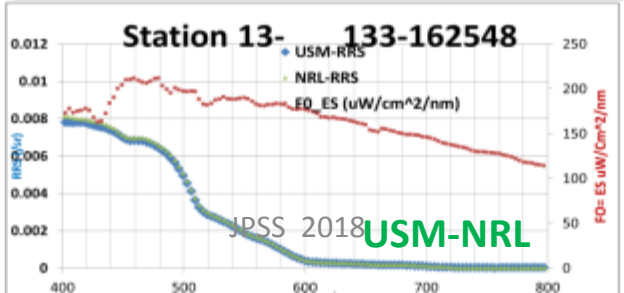


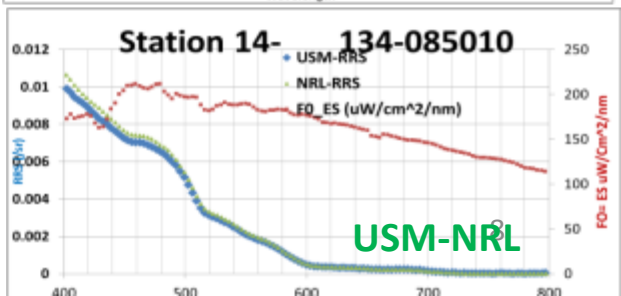












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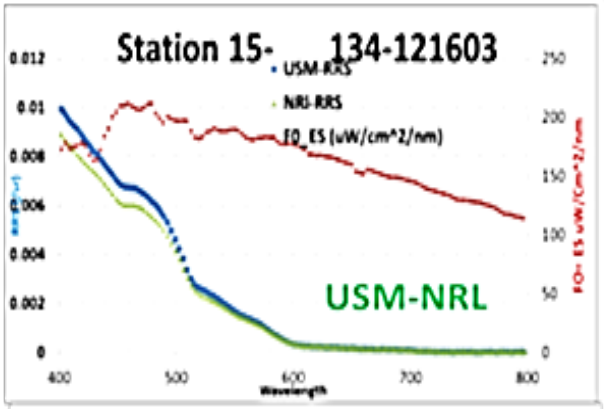
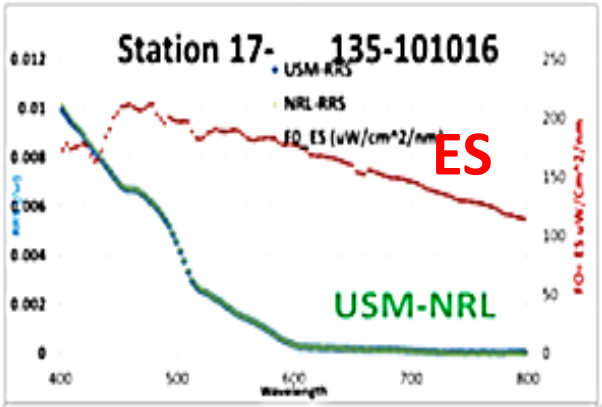
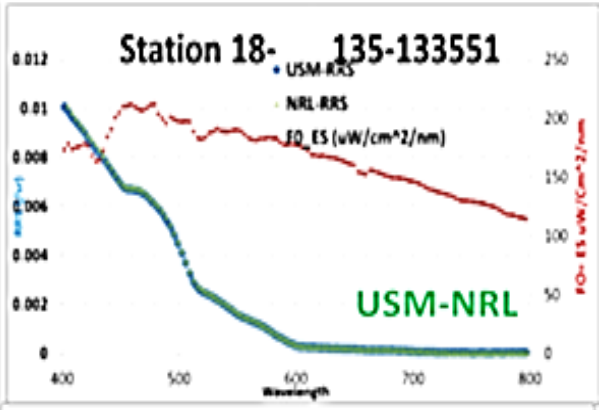
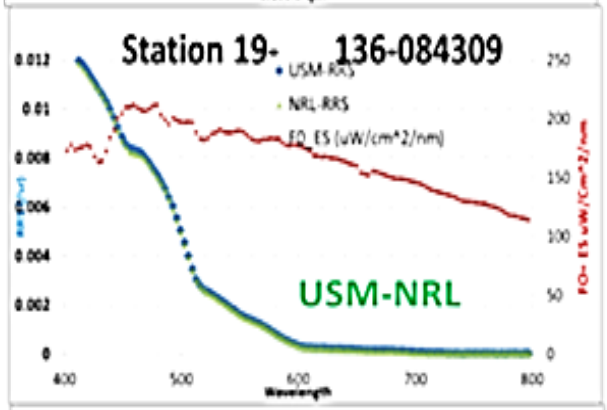
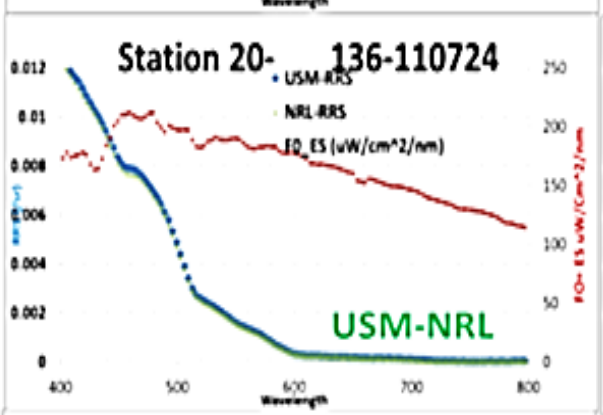
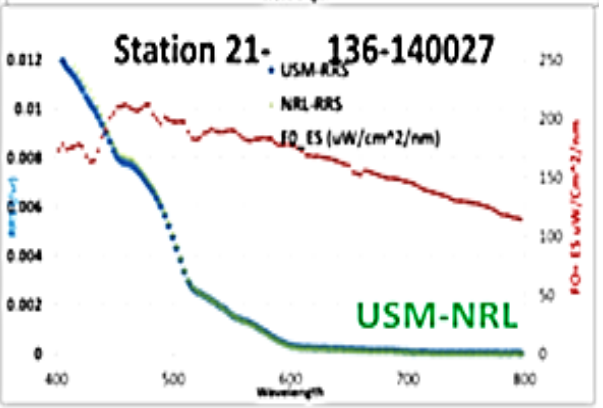


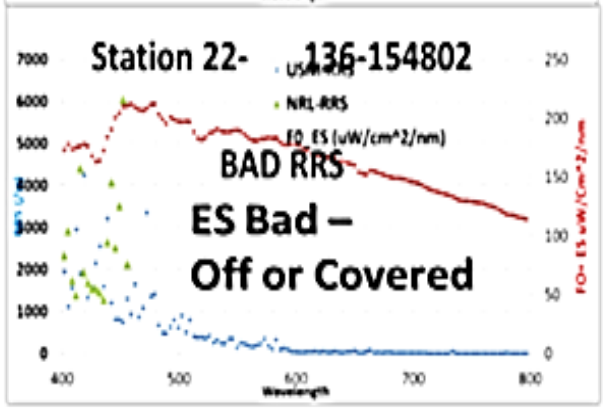


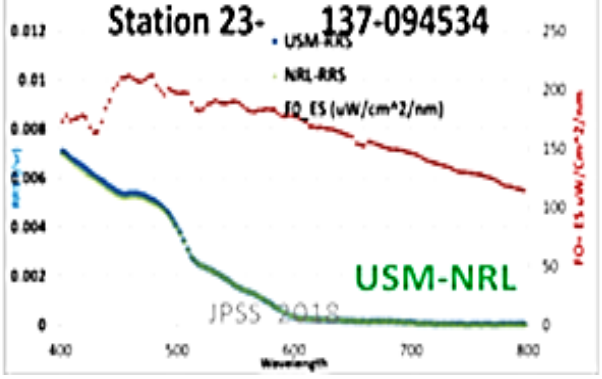












Little uncertainty in the Float Hyperpro sensor

2018 Okeanos Explorer Above Water Rrs Sensor Protocols

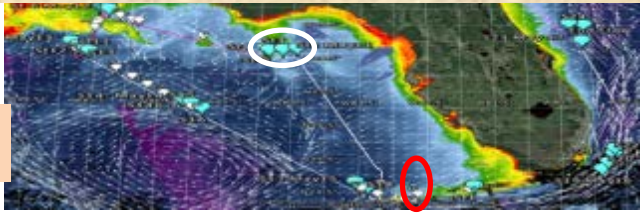
ASD and Spectral Evolution (SEV)

1. All above water instruments were configured with settings to average 5 (ASD) and 10 (SEV) spectra and to collect dark currents.
2. Integration time was optimized for each target prior to collection (i.e., integration time of sensor was changed based on relative brightness of the target and new dark counts were taken to correct for instrument noise).
3. Integration times ranged from 68ms to 4352ms.
4. Using a fore-optic attachment (degree based on groups fore optic – NRL's was 10 degrees), five (ASD) and 10 (SEV) consecutive spectra were taken of each of the following targets: sky, reference plaques (NOAA White and Grey, NIST Blue) and water.
5. Measurements were taken on Bow.
6. The sensor zenith angles for the sky, reference plaques and water measurements were 40°, 40° and 40°, respectively.
7. The relative azimuth angle of the sensor to the sun was approximately 90° but may have been adjusted up to 135° depending on sky condition (blue region), plaque shadowing and sea surface contamination.
8. Collected @ 22 stations.
9. The OSU post-processing software (MatLab) was used for both ASD and SEV. $Rrs = (Sw+s - Ssky\ \rho(\theta))/(\pi Sp/refl)$
10. Post Processing: automatic exclusion of bad spectra, baseline-subtraction and the application of the surface reflectance correction rho, based on the solar azimuth and wind speed (Mobley 2015).

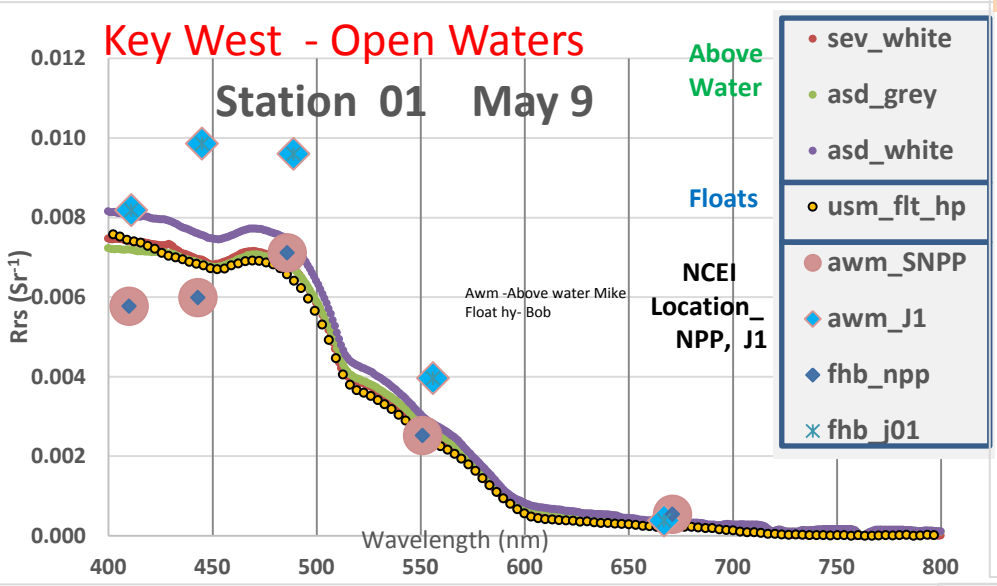
Matchup NOAA NCEI data "Center pixel extraction"

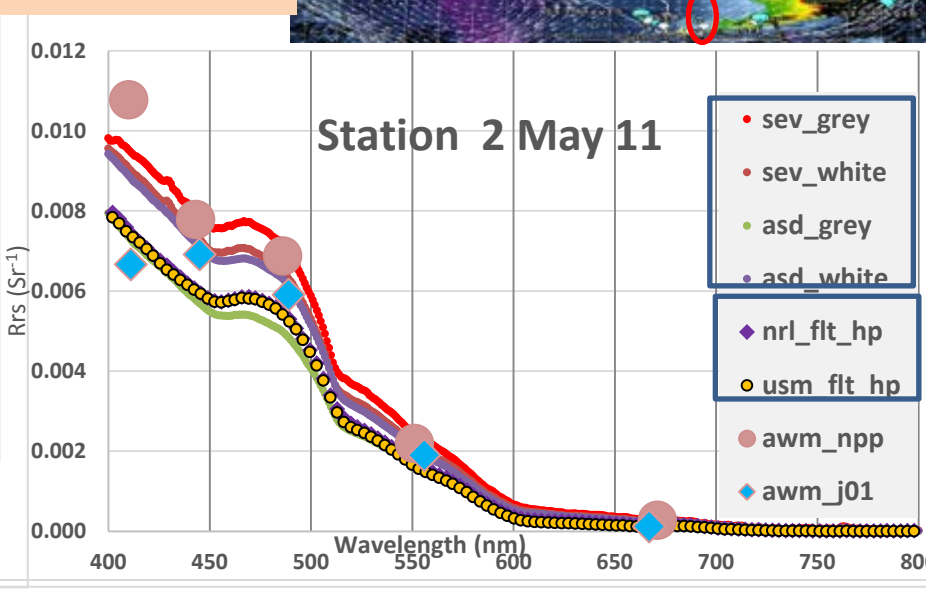
a) Above Water b) Floats - C) SNPP - J01,2 (NCEI)

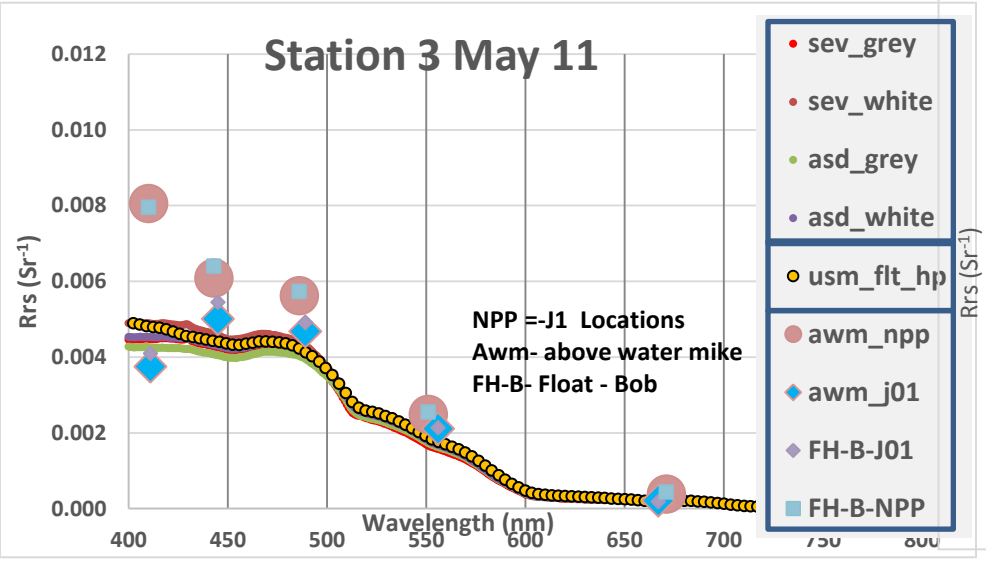
d) Lat Lon positions

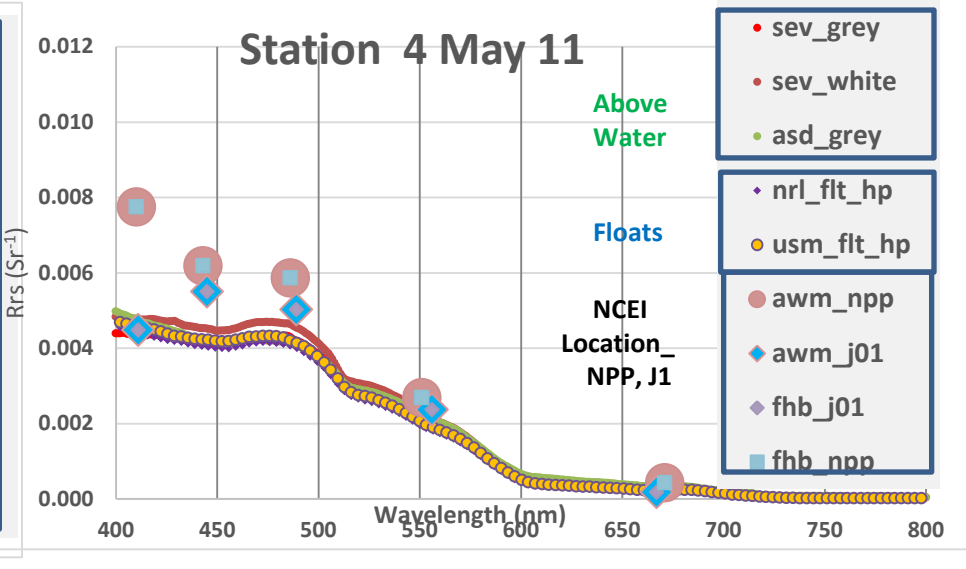


Shelf Waters







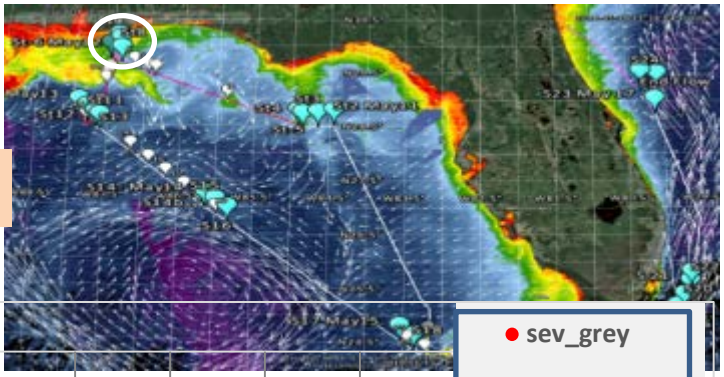


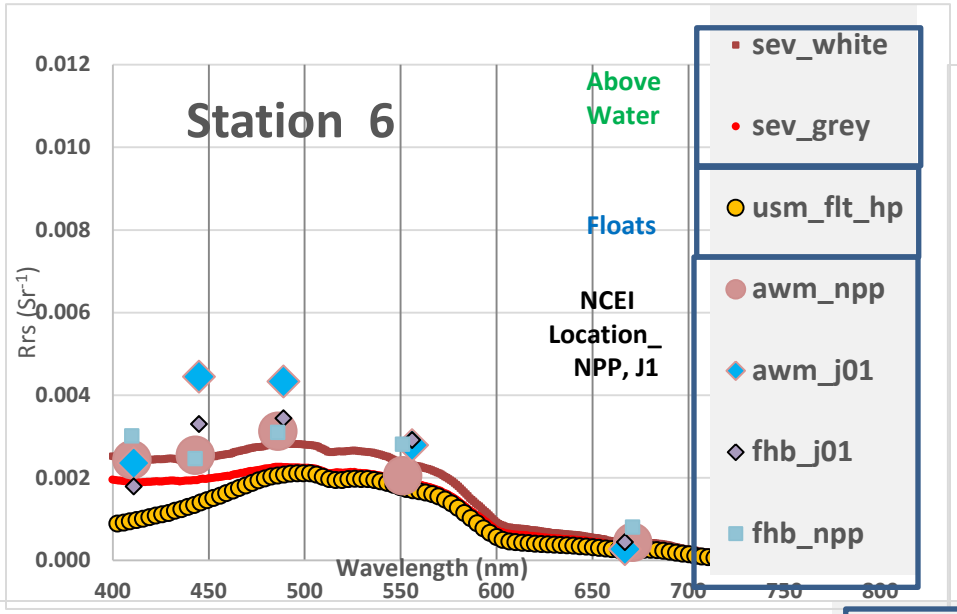
a)Above Water b) Floats - C) SNPP - J01 (NCEI)

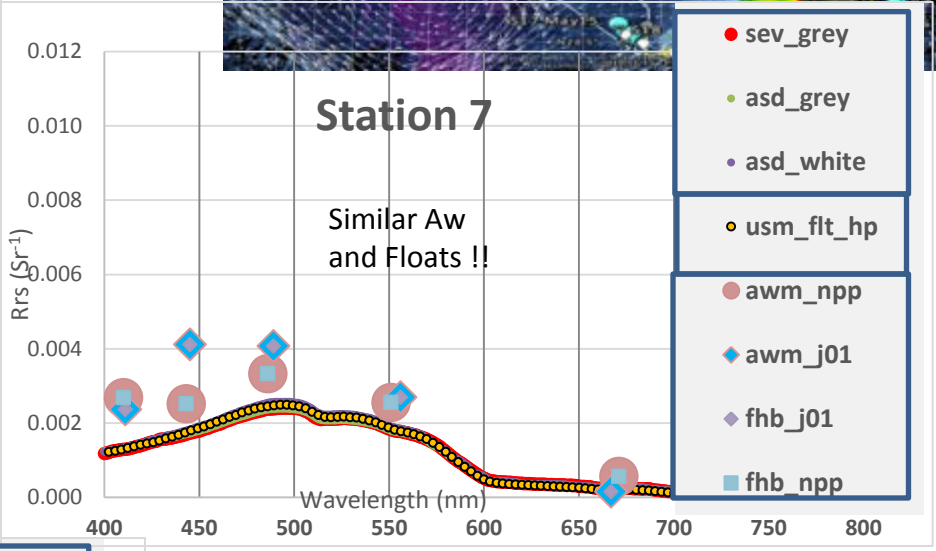
Reordered Lat Lon positions

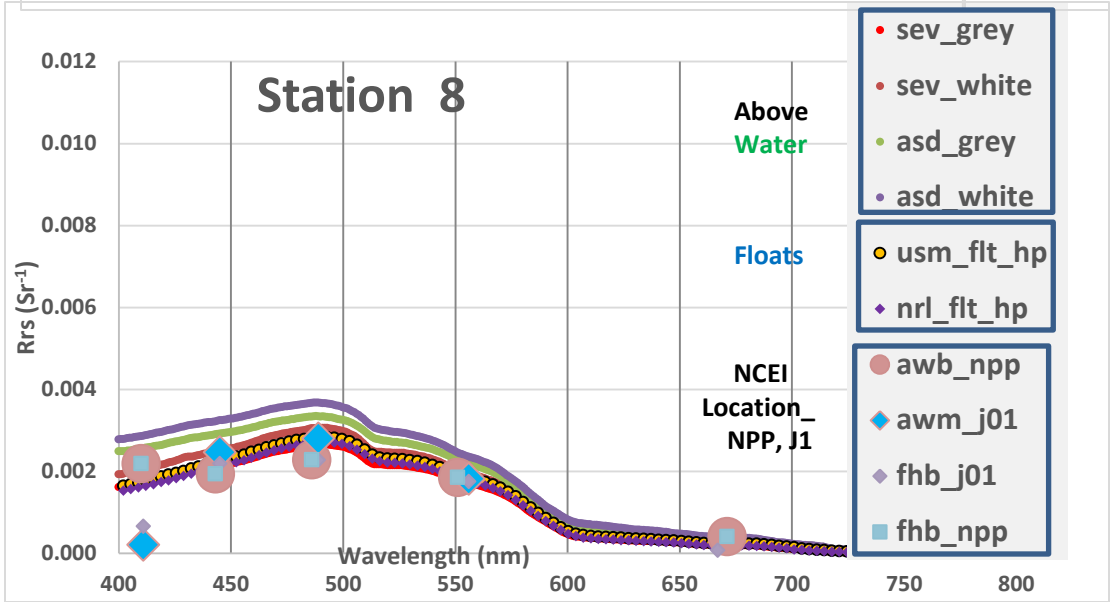
May 12

Coast Waters- Plume







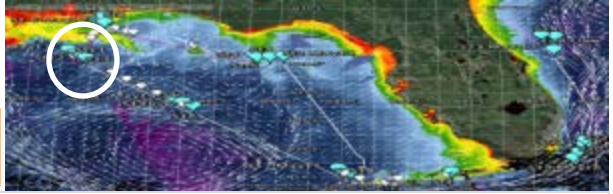


Sev – Spectral evolution .. Grey , white plaques
ASD-

flt-hp- Float Hyperpro

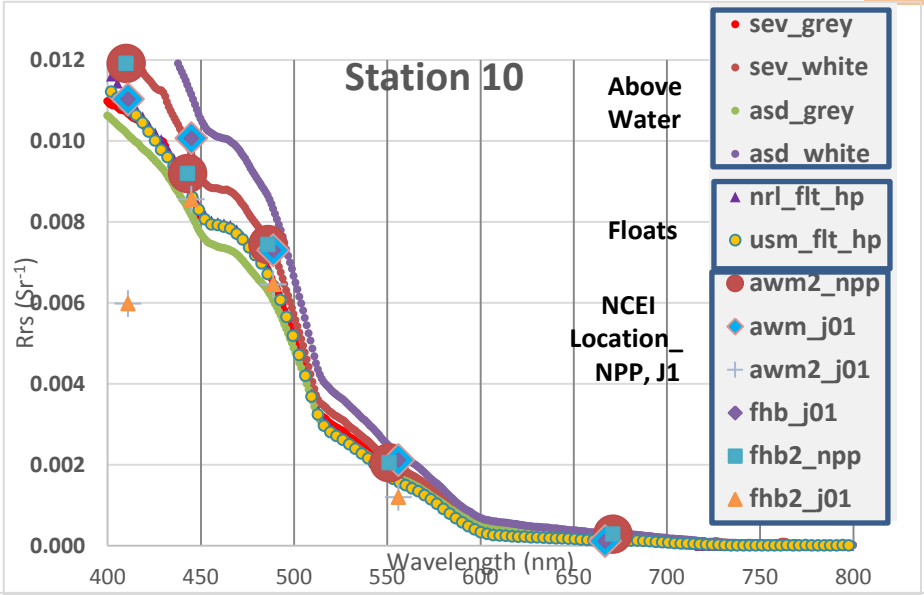
Good Agreement of sensors
Above water and Floats HY.

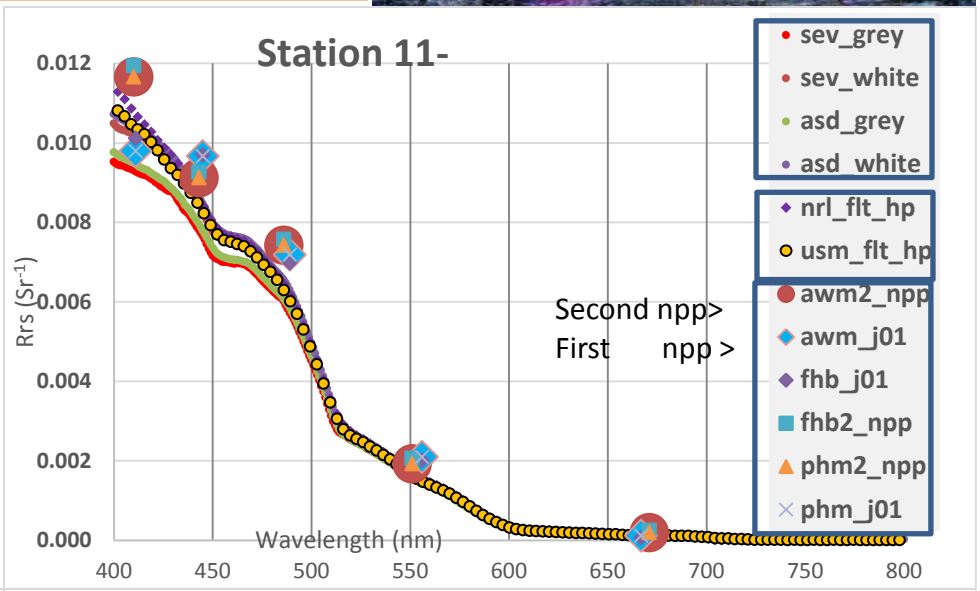
a)Above Water b) Floats - C) SNPP - J01 (NCEI)

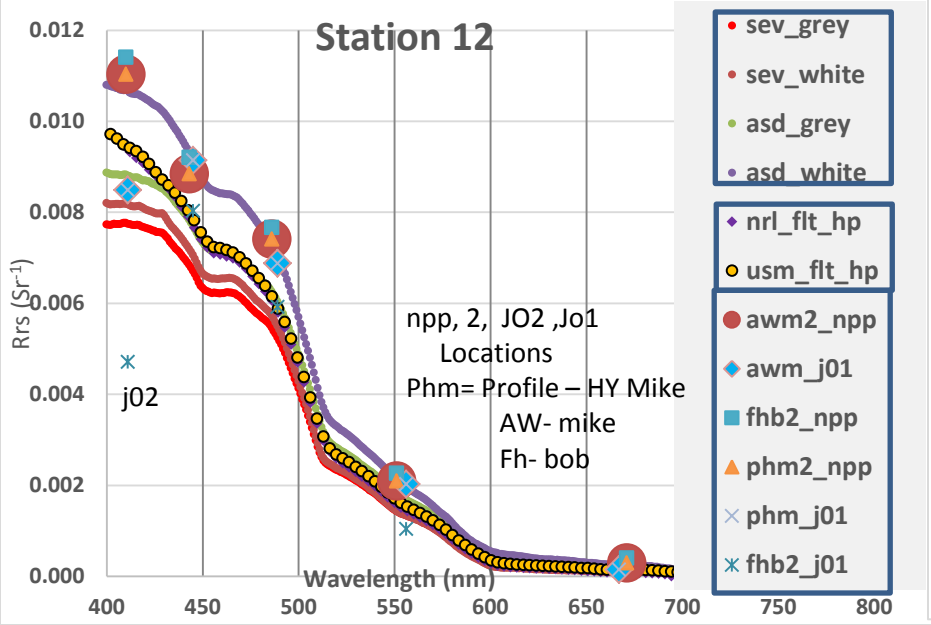


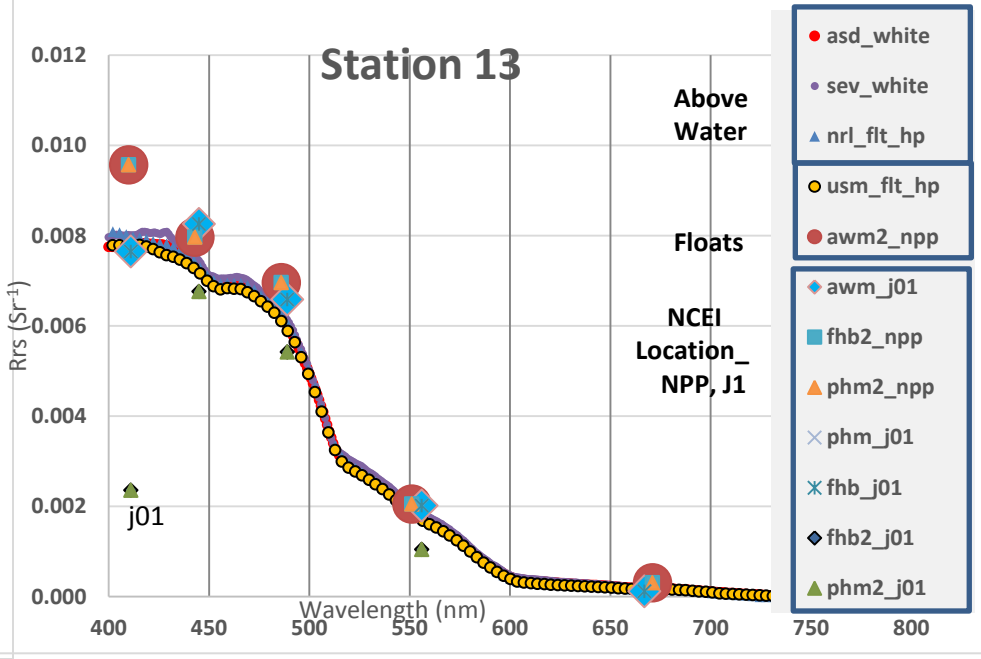
May 13

Open Ocean waters





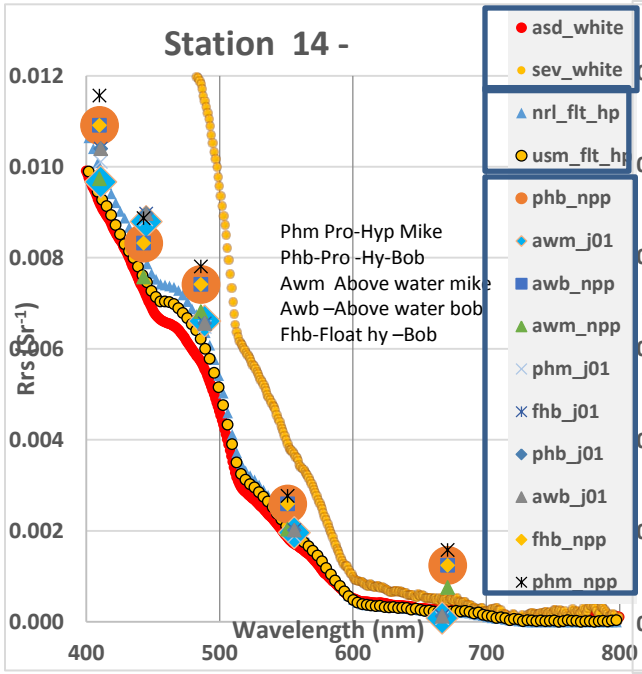


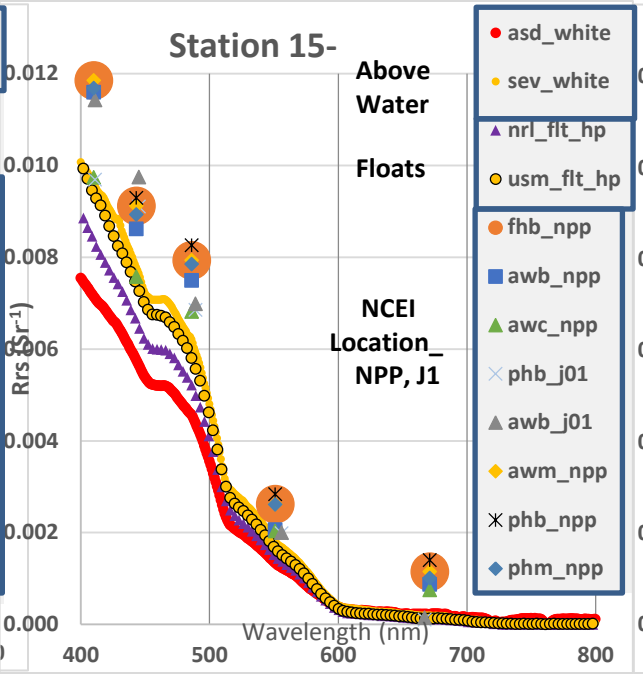


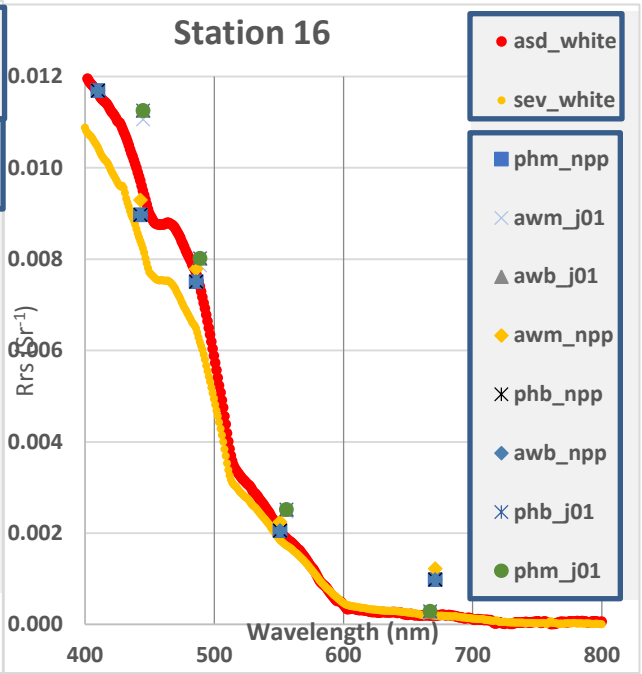
a)Above Water b) Floats - C) SNPP - J01 (NCEI)

May 14

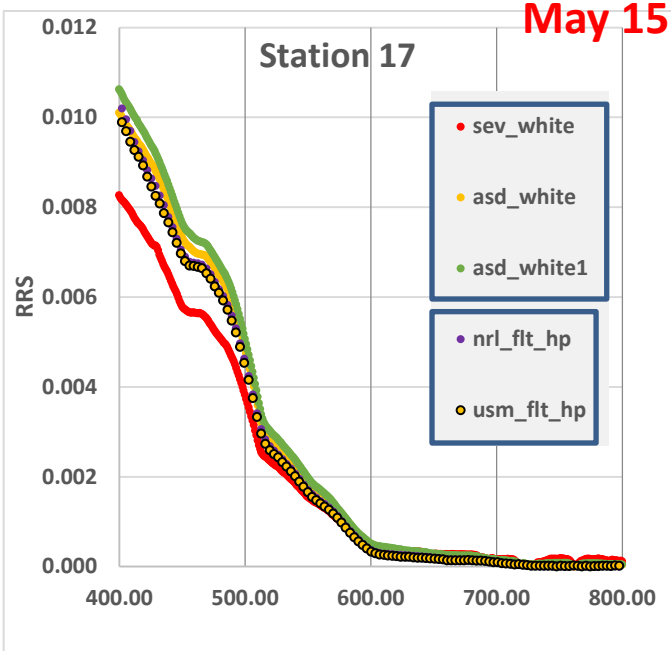
Open Ocean Loop Eddy

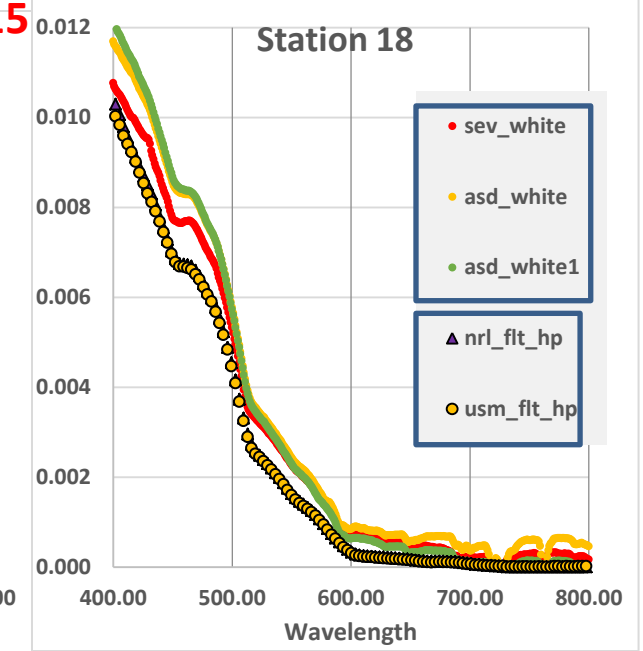


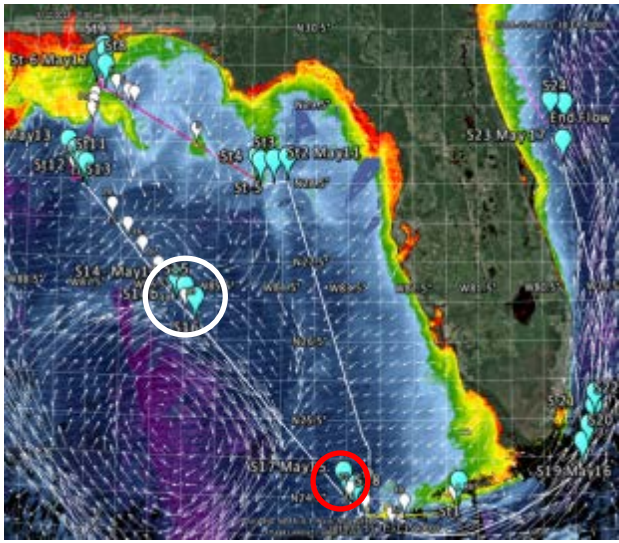




May 15



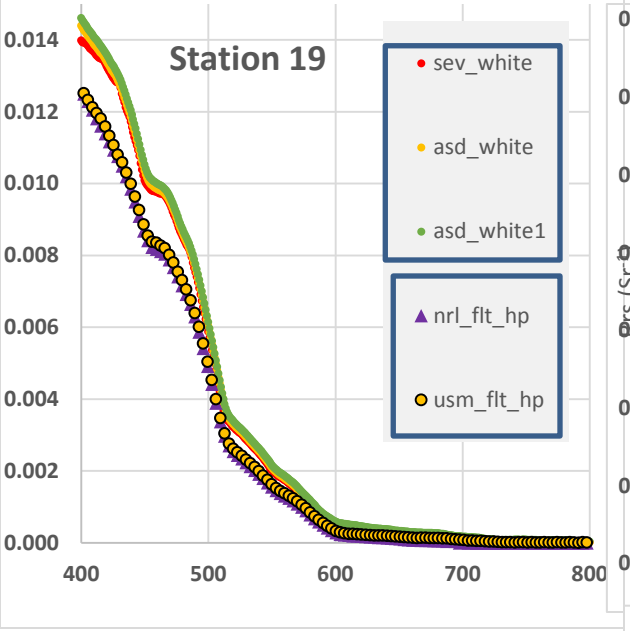


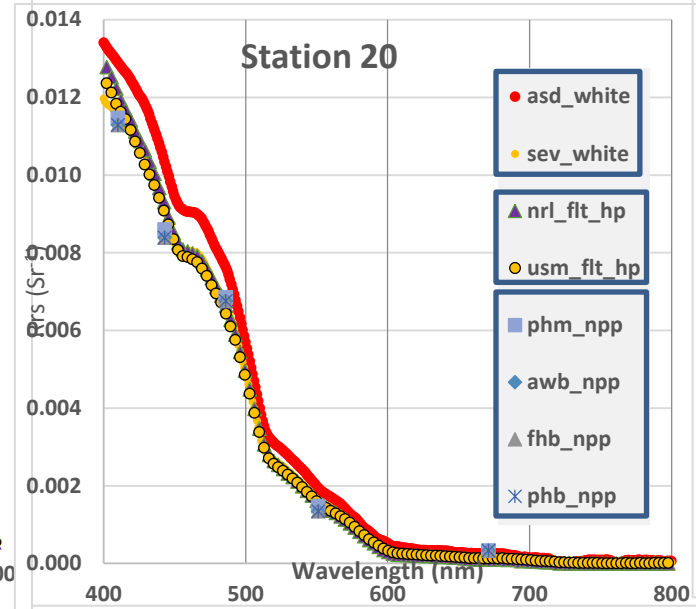


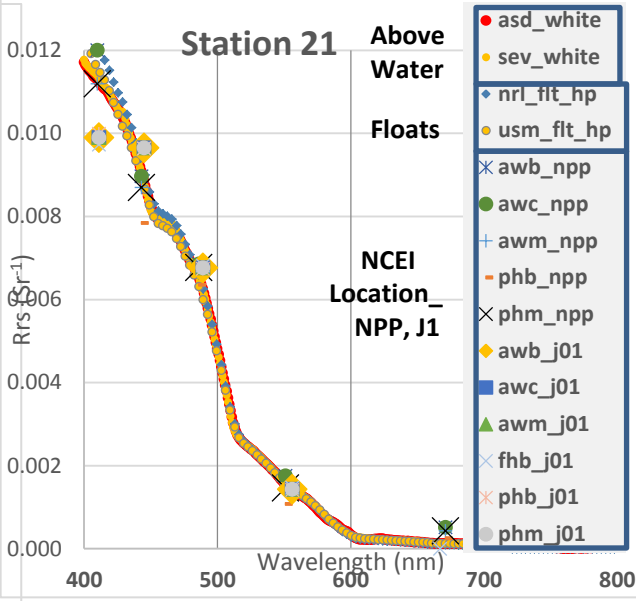
a)Above Water b) Floats - C) SNPP - J01 (NCEI)

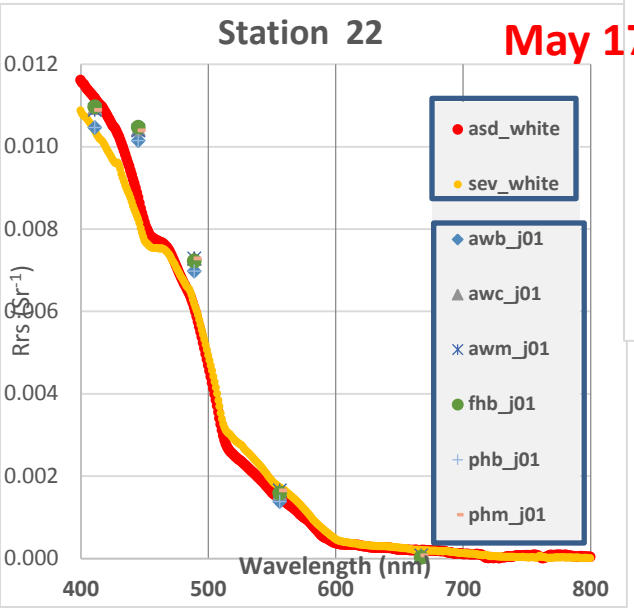
May 16

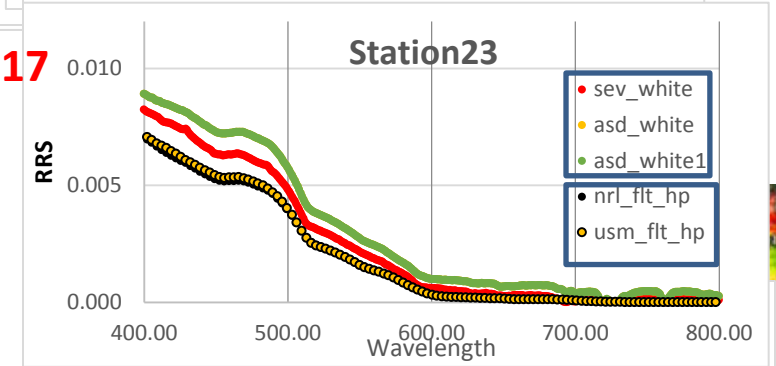
Gulf Stream Waters

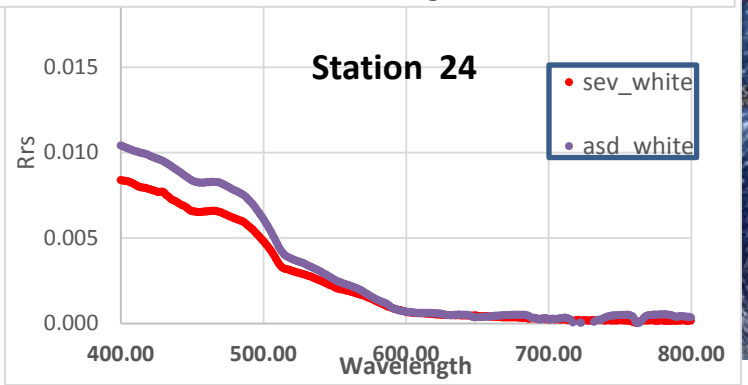


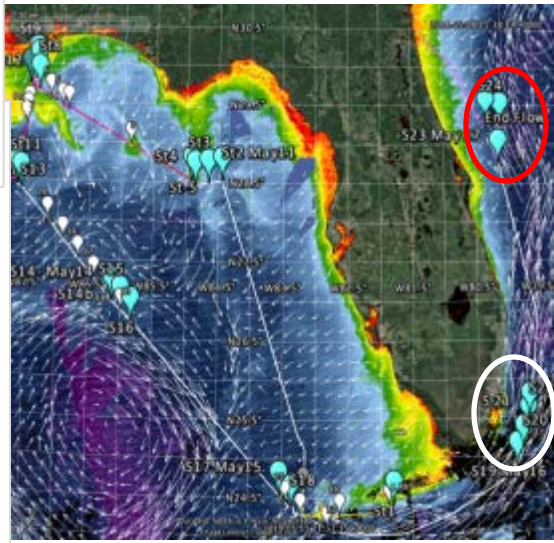






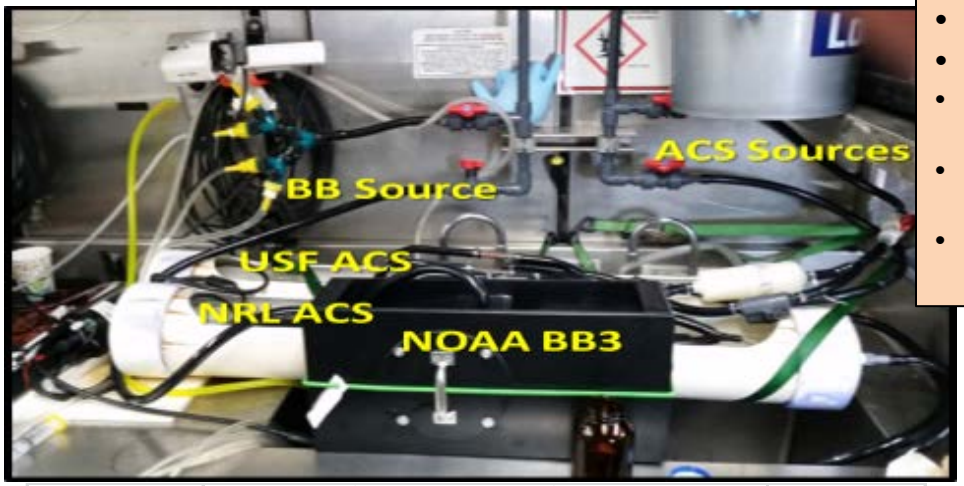






2018 Okeanos Explorer Flowthrough ACS

Post Processing and QC underway!



Stennis group's IOP continuous flowthrough wet lab setup:

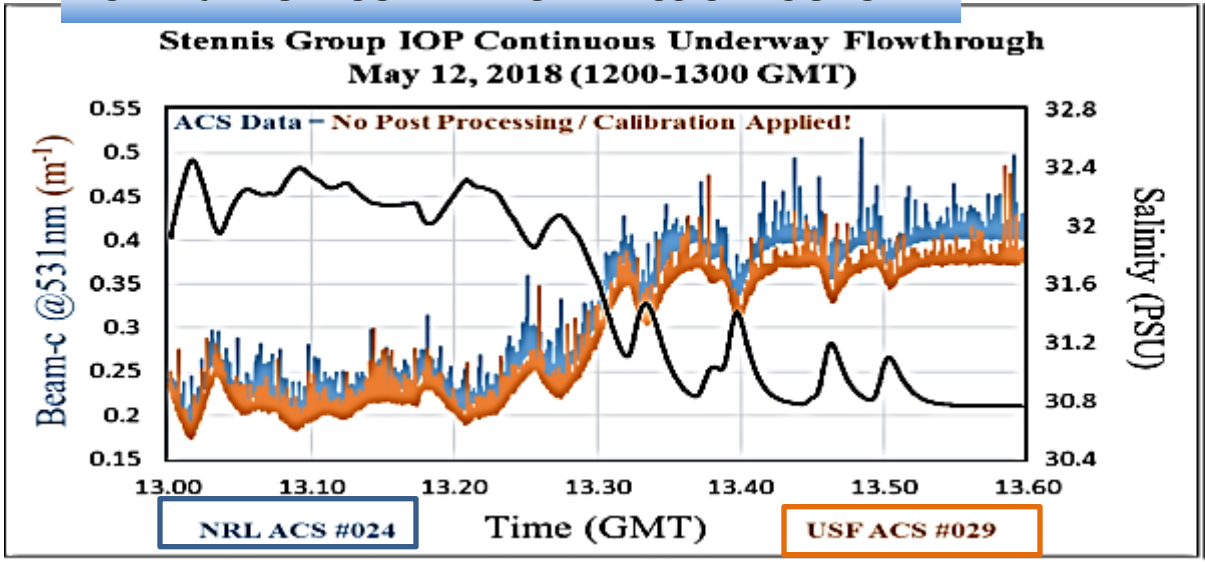
- *2 hyperspectral ACS instruments (NRL #024 and USF #029)*
- *BB3 Backscattering sensor (NOAA) @440,532,650 nm.*
- *Note: The 2 ACS instruments were placed inside PVC tubes to maintain constant temperature bath during operation.*
- *The BB3 instrument was placed inside a flow cell.*
- The 2 ACS sensors were calibrated daily with new device (dev) files running Nanopure water through the instruments

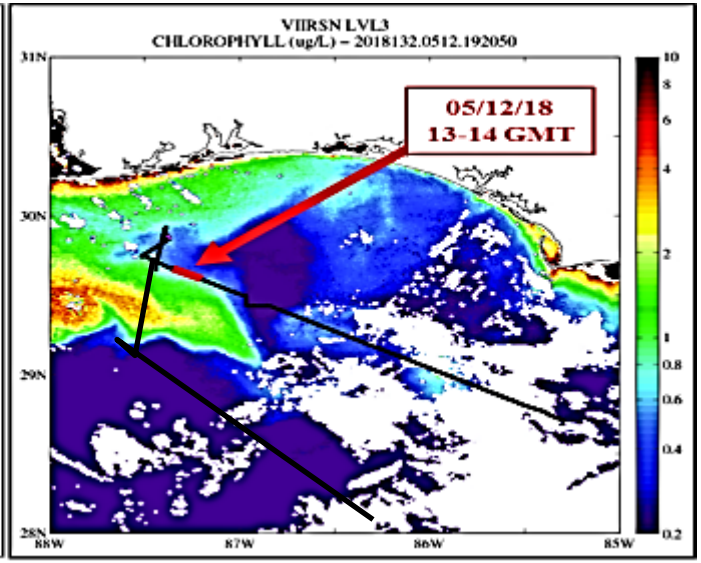
Stennis Flowthrough Data set				
Latitude	Longitude	Time	Flurescence	
Beam Attenuation	Absorption	at 399-755nm		
Total Vol Scattering	Particle Scattering	Backscattering particle	Total Backscattering	at 440,532, 650 nm

Post processing protocol used (WetLabs 2011) include:

1. Temperature and salinity corrections were applied to ACS absorption data using the coincident ship Thermo-salinograph data.
2. Temperature correct pure water calibration data.
3. Subtract the pure water calibration data from the in situ data.
4. Omit spikes in data due to bubbles, etc., using a std filter.
5. Apply bump using lowest (-) spectral value.
6. Scatter correct total absorption (a_t) [*Rottgers et al*, 2013].
7. Apply secondary bump using lowest (-) spectral value.
8. Add spectral pure water absorption coefficients [Pope and Fry, 1997].
9. Compute spectral scattering $b = c_t - a_t$

Similar IOP 531nm BOTH ACS SENSORS





1) Plans – - continue Flowthough

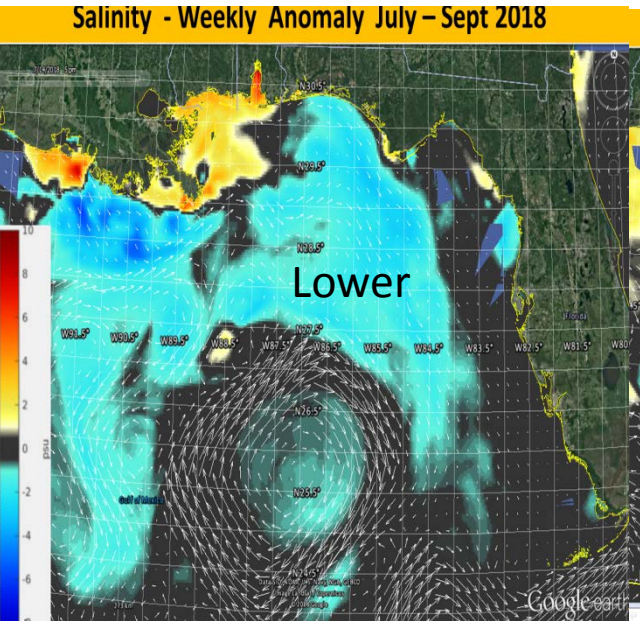
2) XBT- profiles temp changes in top 3 m at Flowthough

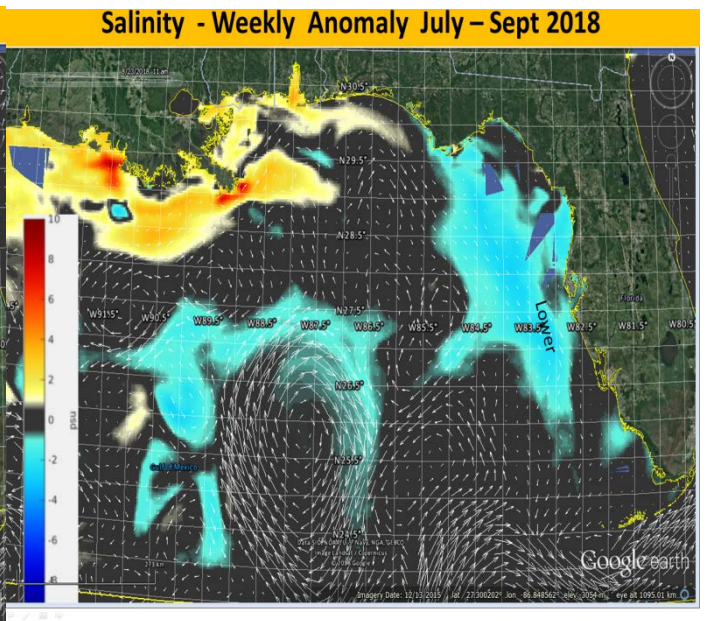
Red Tide Recent: Did the movement of River plume Salinity affect the Florida red red tide ?

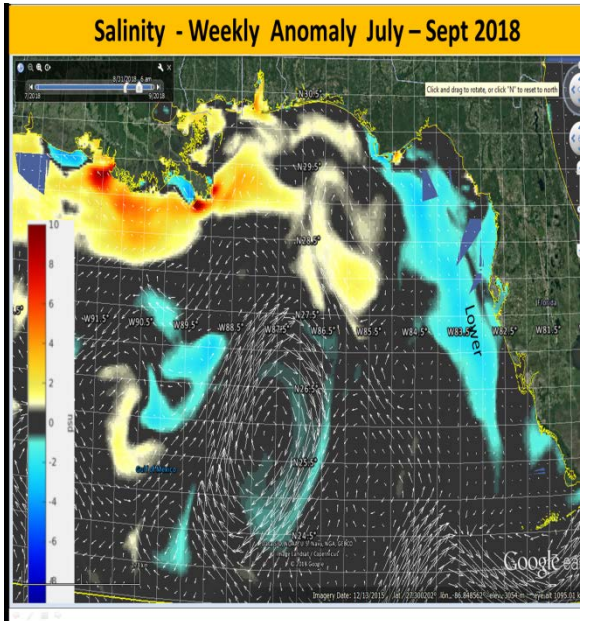
(What was the River Plumes Eastward Movement -- R Stumpf

Images in TAMPA Times ?? IIRS and Salinity for the Red Tide . ??

Salinity Anomaly – Movement of Mississippi River plume to East Gulf







Stennis - Nov , 2018 Summary:

- **WavCIS – Platform Update – Update the 638 sensor**
- **WavCIS – Matchup Protocols - Constraints being evaluated**
- **2018 Cal/Val Okeanos Explorer Cruise**
  - **Floating Hyperpro Evaluation and Protocols (Delivered)**
  - **Above Water Matchups and Protocols (Delivered)**
  - **ASD and Spectral Evolution w/ SNPP- J20**
  - **Flowthru Setup and Protocols (Processing and QC Underway)**

Summary

- **Good Agreement of the Above water and Floats RRS and NCEI**
- **The time /location for each sensor at each station is important for matchup !**

END