USC-OSU VIIRS Cal/Val 2017

STAR JPSS Annual Science Meeting
14-18 August 2017, College Park, MD

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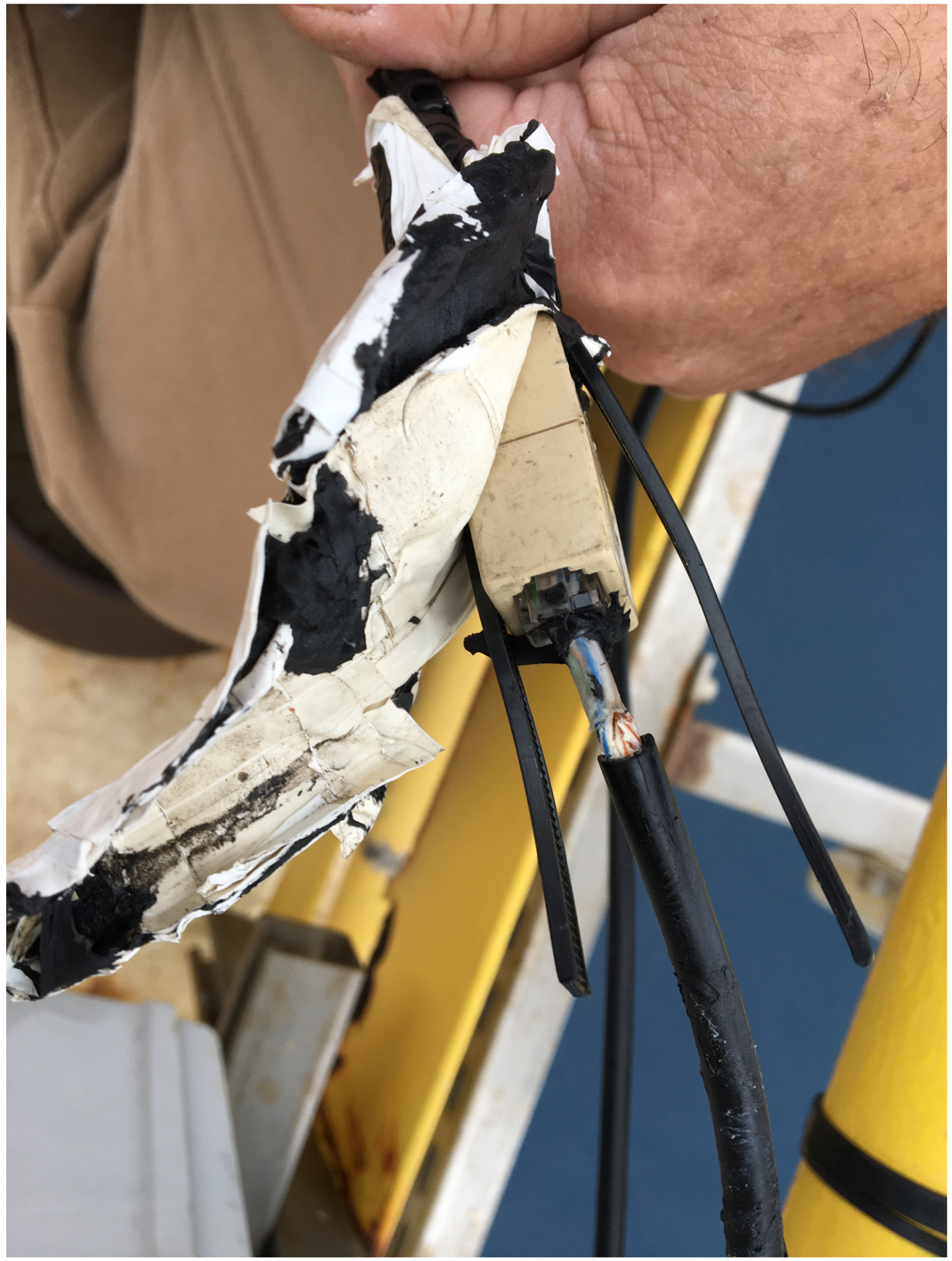
Outline

- Platform Eureka Operation
- Side by Side SeaPRISM Comparisons
- NOAA Cruise
  - Spectral Evolution Rrs automation with uncertainties
  - Plaque Comparisons
- Current Work: Eureka Cruise Fall 2017

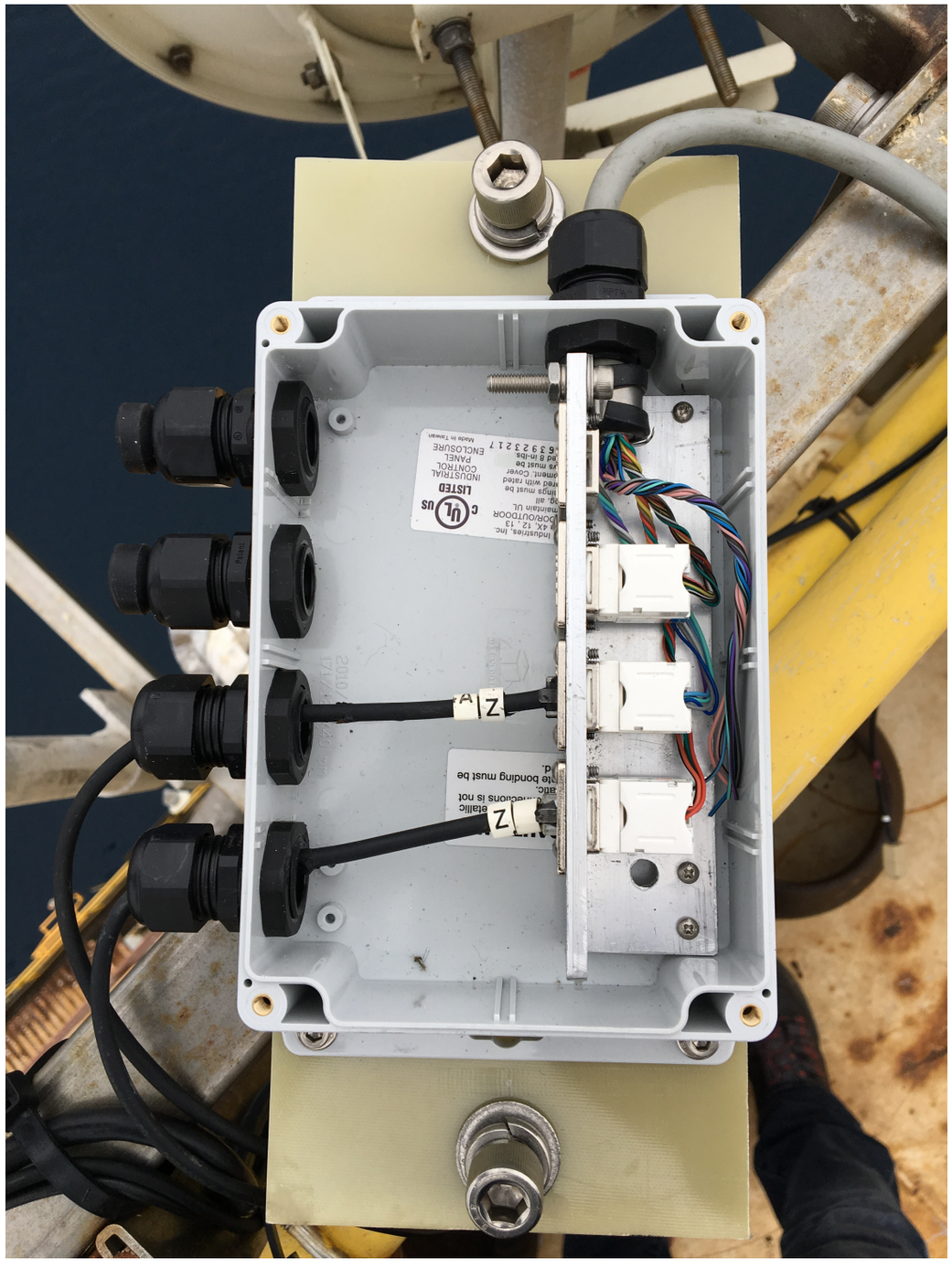

Lomita
Signal Hill
Palos Verdes Estates
Long Beach
Orange
Garden Grove
Rancho Palos Verdes
CA-47
Westminster
Santa Ana
Tustin
Seal Beach
Los Angeles
Fountain Valley
Huntington Beach
Irvine
Costa Mesa
Newport Beach
Oil Platform Eureka
USC-OSU SeaPRISM Site
Laguna Beach
Santa Catalina Island
Avalon

Infrastructure Upgrades at Platform Eureka

RJ-12 Coupler with self vulcanizing putty and electrical tape



NMEA Box with RJ-12 Keystone connector and cable gland



Side-by-side SeaPRISM Comparison

1 September —> 31 December 2016
119 Matches

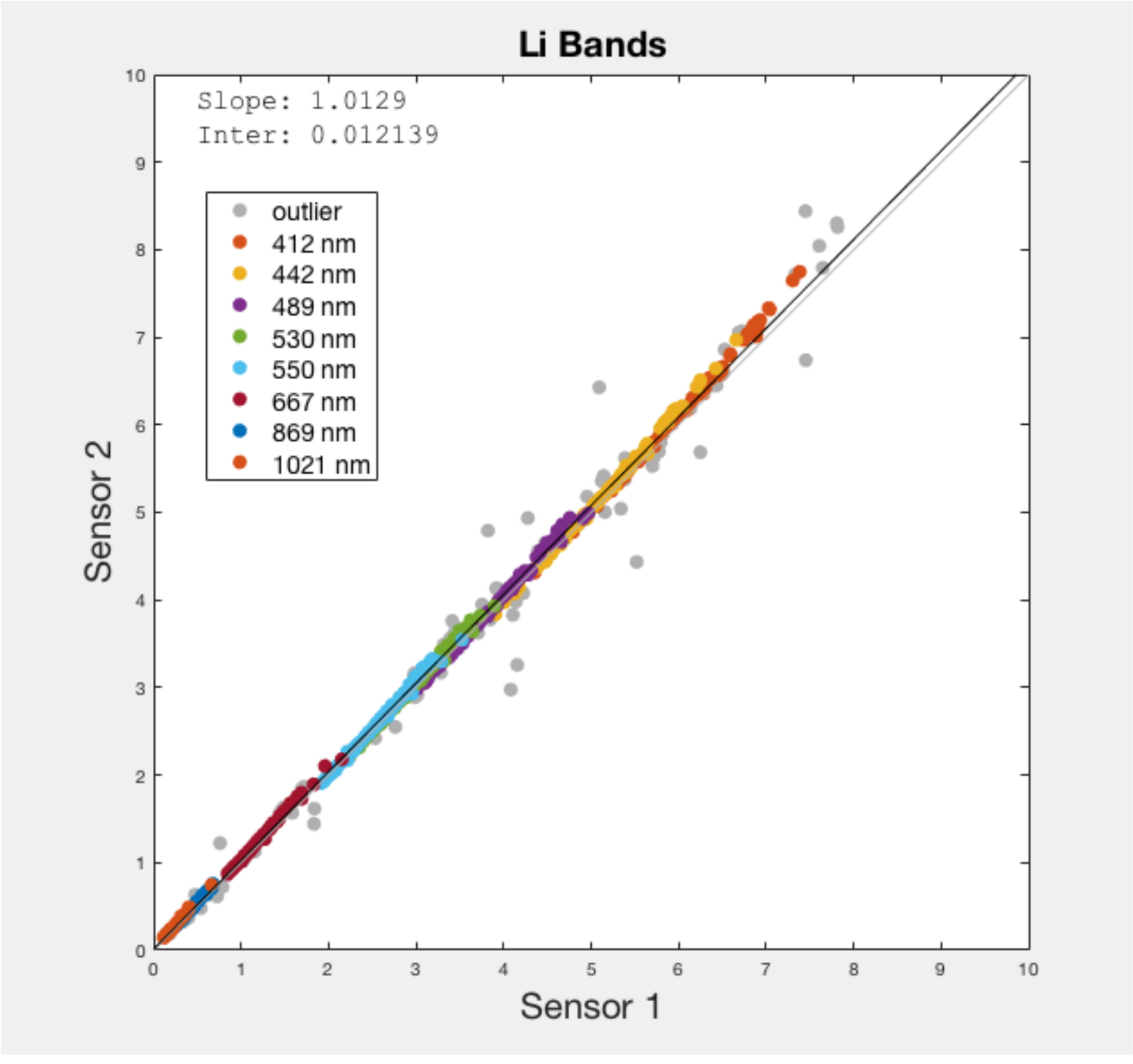
SeaPrism_2 Removed 5 December 2017

Outlier Rejection

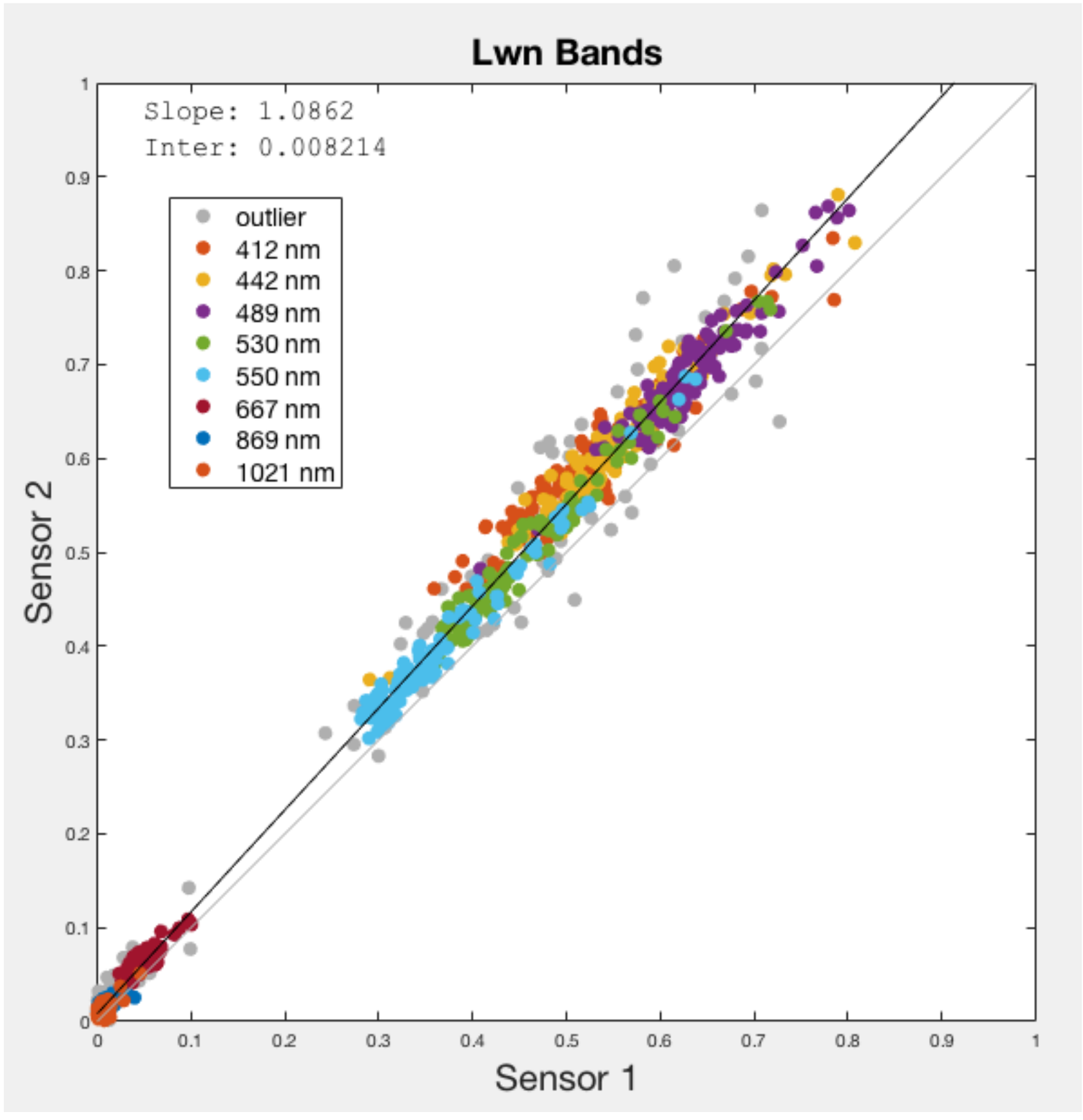
Remove 10% (12 points out of 119) of data
with largest difference from initial linear regression

SeaPrism 1: Instrument 612
SeaPrism 2: Instrument 058

Sky Radiance Sensor Comparisons (Regression on All Bands)



Normalized Water Leaving Radiance Sensor Comparisons (Regression on All Bands)



Notes

Outlier rejection effect is minimal (but still good practice)

Sky Radiance provides (rough) estimate of ‘instrument’ noise and bias.

Water leaving radiance provides (rough) estimate of ‘processing’ noise and bias.

Sensors show a ‘difference’ of ~10% in field, but ‘stable’ (a stable bias over time) that is easily corrected with a ‘vicarious’ — field based, band-by-band — adjustment.

Working on paper comparing ‘field’ variances to 'lab' cal variances.

Cal/Val Cruise 2016 (Hurricane Matthew)

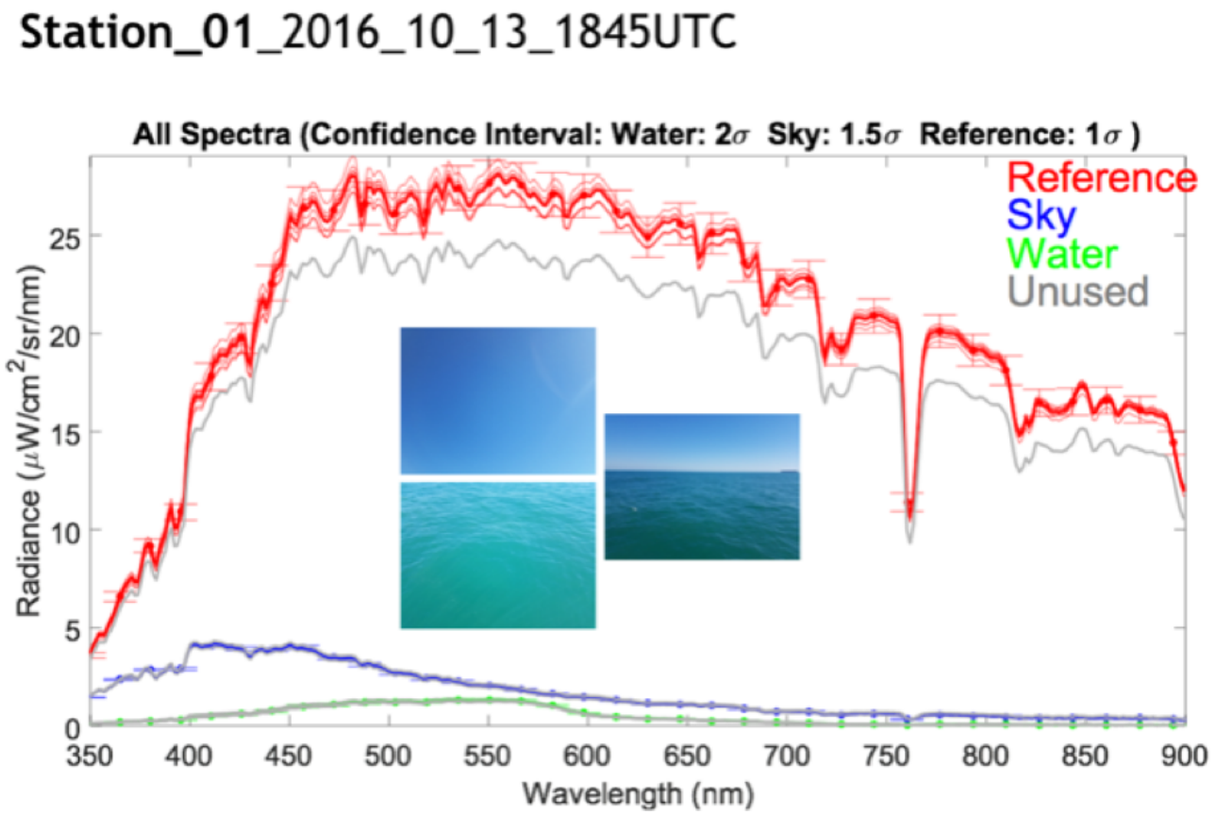
— *SPECTRAL EVOLUTION and HyperPro DATA COLLECTION*

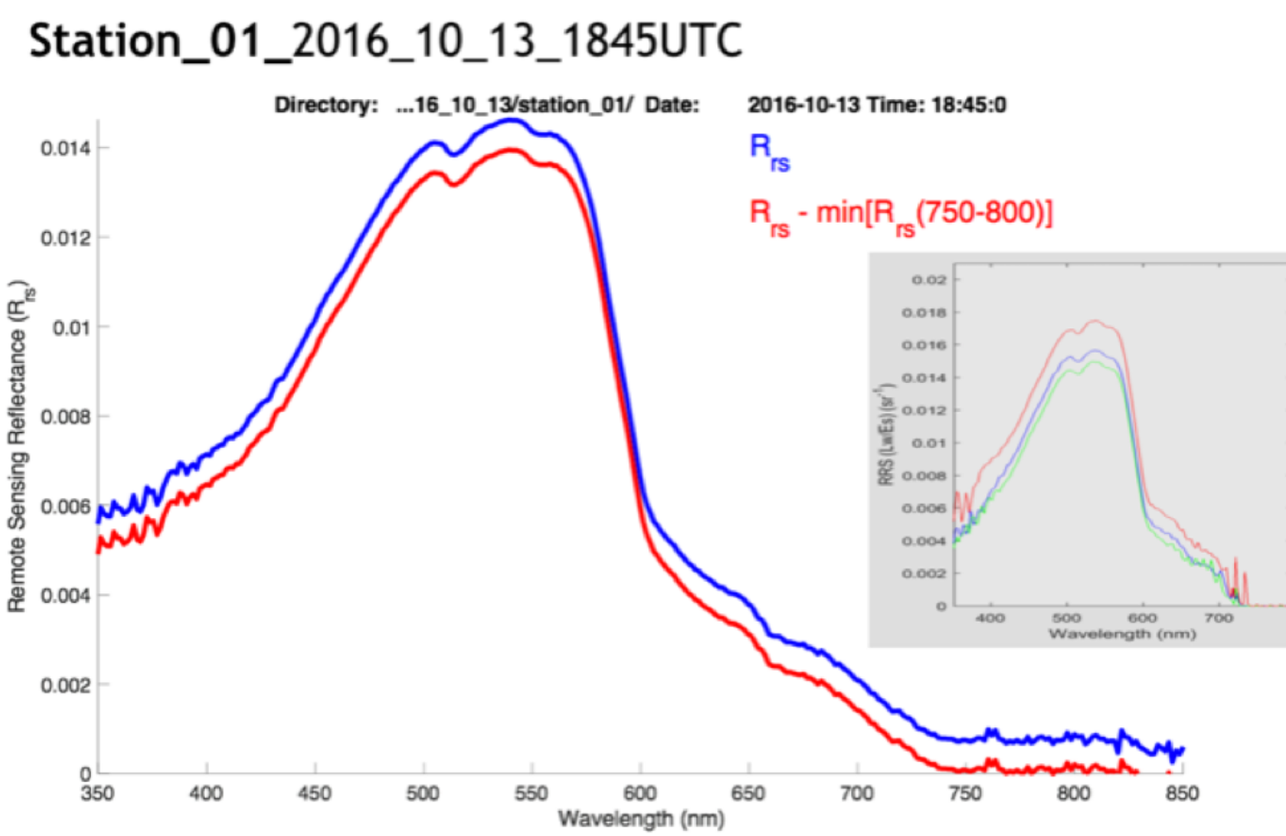
http://www.spectralevolution.com/lightweight_portable_battery_operated_spectrometer.html

STATION	Date and UTC Time	LAT / LONG	Decimal Degrees	NOTES
1	10/13/2016	LAT	32.6223	Trychodesmium
	1845	LONG	-79.5790	
2	10/13/2016	LAT	32.5797	Trychodesmium
	2125	LONG	-79.6480	
3	10/14/2016	LAT	31.3715	
	1340	LONG	-80.9720	
4	10/14/2016	LAT	31.3183	wind_sp > 16 kts
	1825	LONG	-80.8177	
5	10/15/2016	LAT	32.3035	wind_sp >>16kts
T (B&C)	1845	LONG	-80.3057	
7	10/16/2016	LAT	31.7832	wind_sp >>16kts
	1545	LONG	-80.5820	
8	10/16/2016	LAT	31.7028	wind_sp >>16kts
	1810	LONG	-80.4275	
9	10/16/2016	LAT	31.7272	wind_sp > 16 kts
	2050	LONG	-80.3845	
10	10/17/2016	LAT	32.4335	blue water
	1410	LONG	-78.8830	
11	10/17/2016	LAT	32.6340	blue-green
	1805	LONG	-79.0792	
12	10/17/2016	LAT	32.7942	green
	2035	LONG	-79.2692	
13	10/18/2016	LAT	32.6842	turbid and oily
	1405	LONG	-79.6868	

Automated processing application to compute Remote Sensing Reflectance from Spectral Evolution

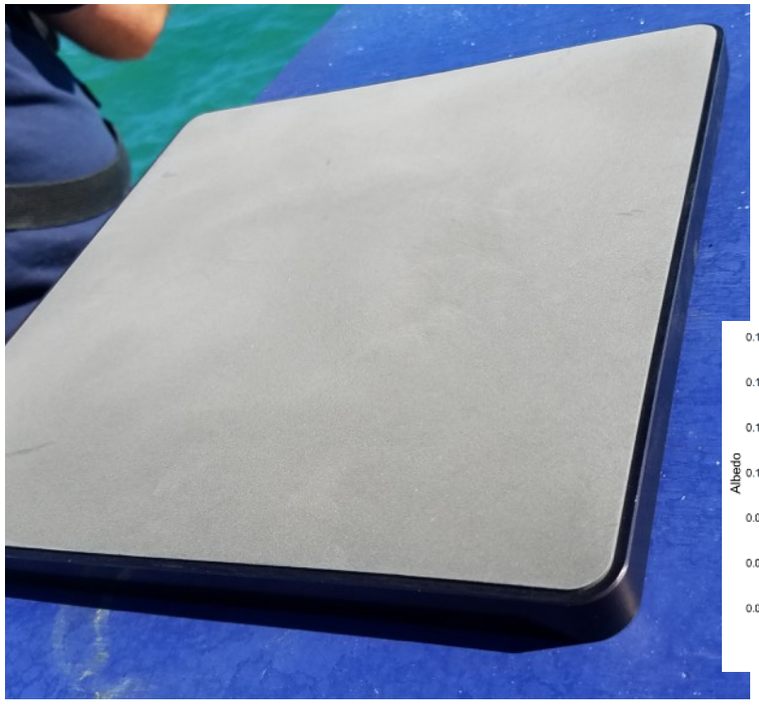
Automated processing application to compute Remote Sensing Reflectance from Spectral Evolution above water radiance measurements. Statistical procedures are used to remove outliers and data is resampled and binned to a standard grid Data from Nancy Foster Cruise is shown.





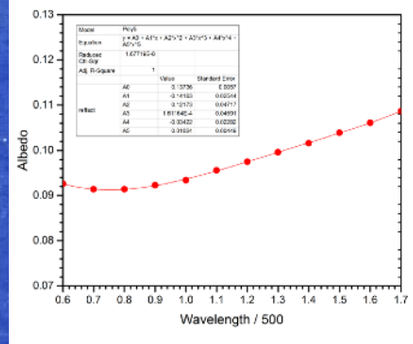
PLAQUE DIFFERENCES

OSU_white



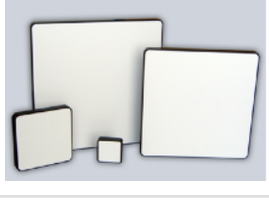
NRL_gray

courtesy
S. Ladner



STPECTRALON

https://www.labsphere.com/site/assets/files/1828/spectralon_targets.pdf



All Stations

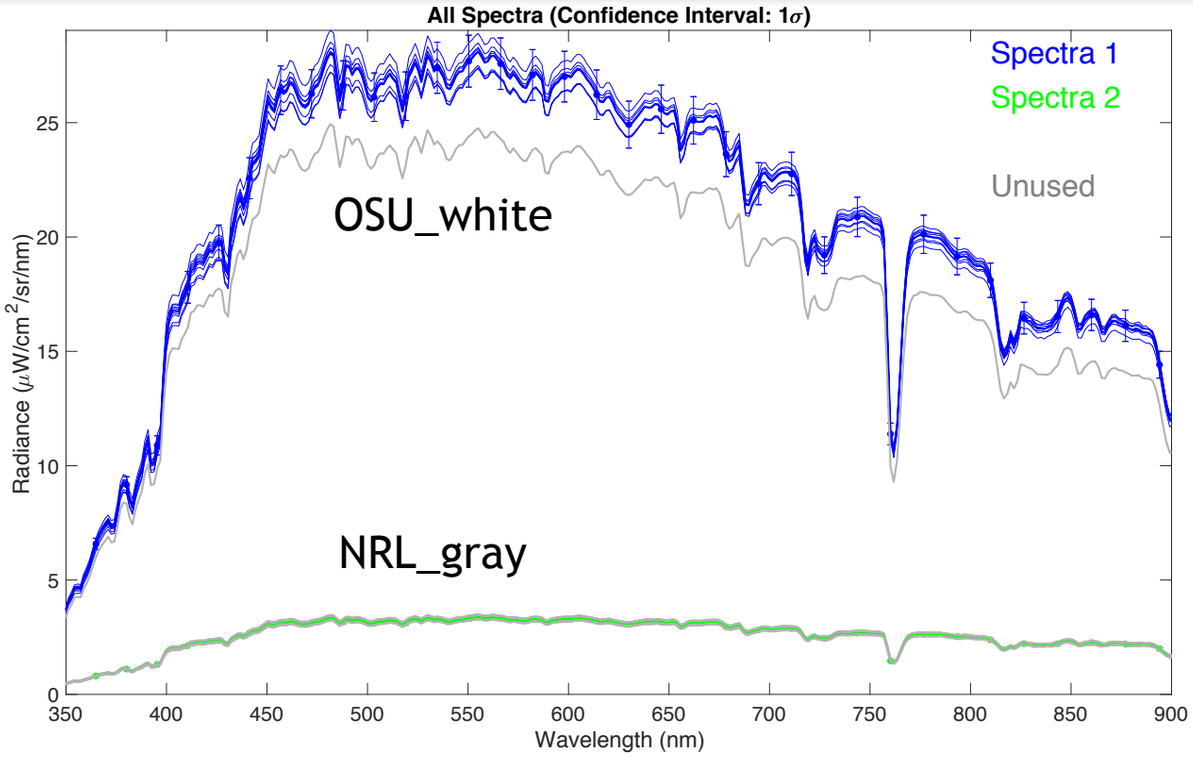
NIST_blue

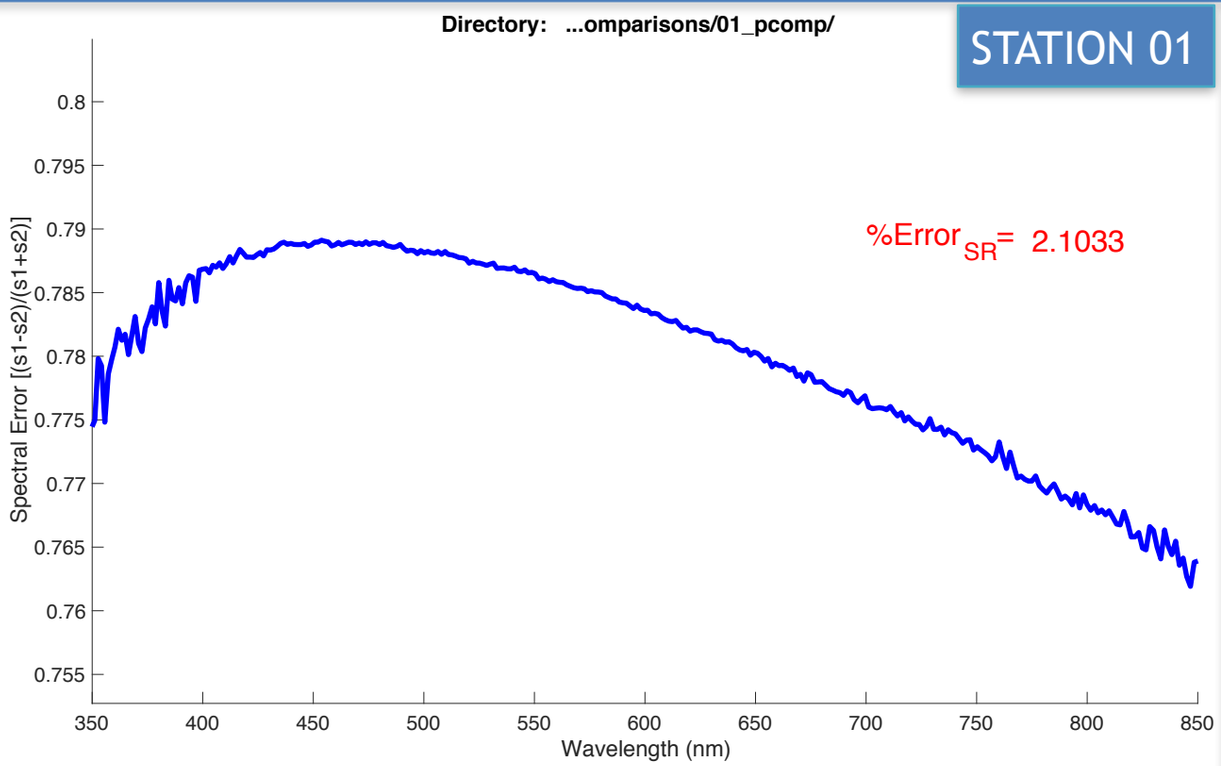
Schematic

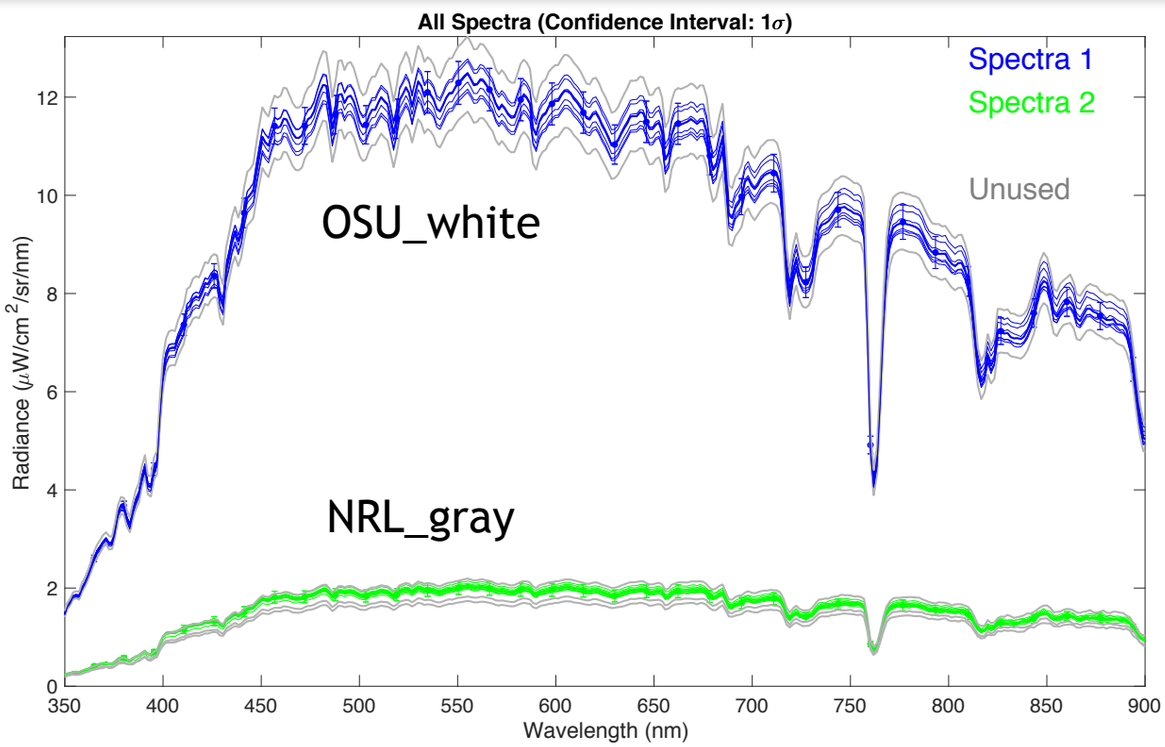
Stations 05 and 11 only

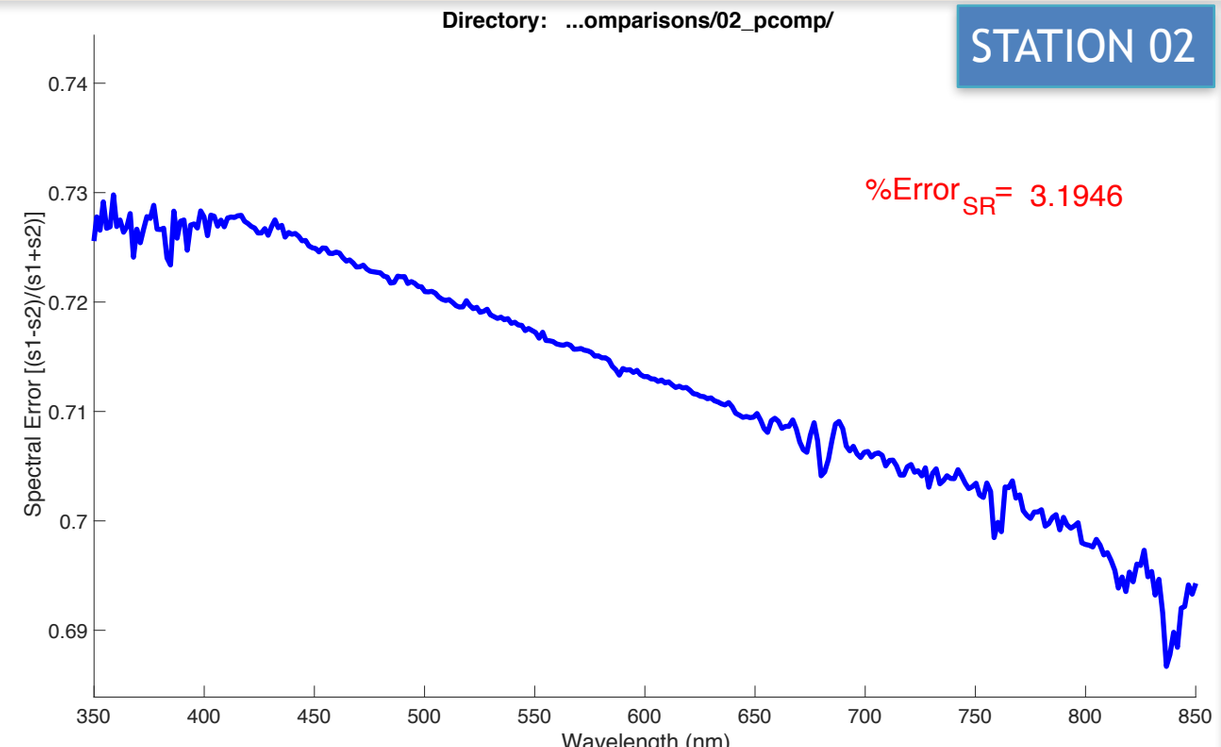
NRL_g and OSU_w PLAQUE DIFFERENCES 10/13/2016

— *Spectral Evolution CONSECUTIVE MEASUREMENTS, STATION 01 & 02*









SUMMARY AND OBSERVATIONS

- R_{RS} obtained for all stations from measured spectra S_{ref}, S_{w+s}, S_{sky}; R_{RS} = (S_{w+s} - S_{sky}*M)/(pi*S_{ref}/0.99), where M is Mobley correction
  - Qualitatively matches HyperPro results for most stations

- Quantified differences between reference plaques measured consecutively for OSU SEV instrument: OSU_{white}, NRL_{grey}, $NIST_{blue}$
  - Typical contribution to spectral error: 2~5%

- Experimental uncertainty needs better quantification
  - Challenges due to varying reflections from nearby surfaces (hull, bridge, etc.) on-board the Nancy Foster
    => Comprehensive error-budget needed (instruments, plaques, FOV, angular and temporal acquisition differences)
    => Define error component analysis & quantification methods

  - Experimental uncertainty due to sea-state (winds >>16kts for 40% of the stations)
    => Implementing new baseline reconstruction algorithms for OSU data processing of above water measurements

Working on new data products by ‘fusing’ data from VIIRS with Sentinel-2, GOES-R that builds on NOAA’s ‘Variational’ methods.

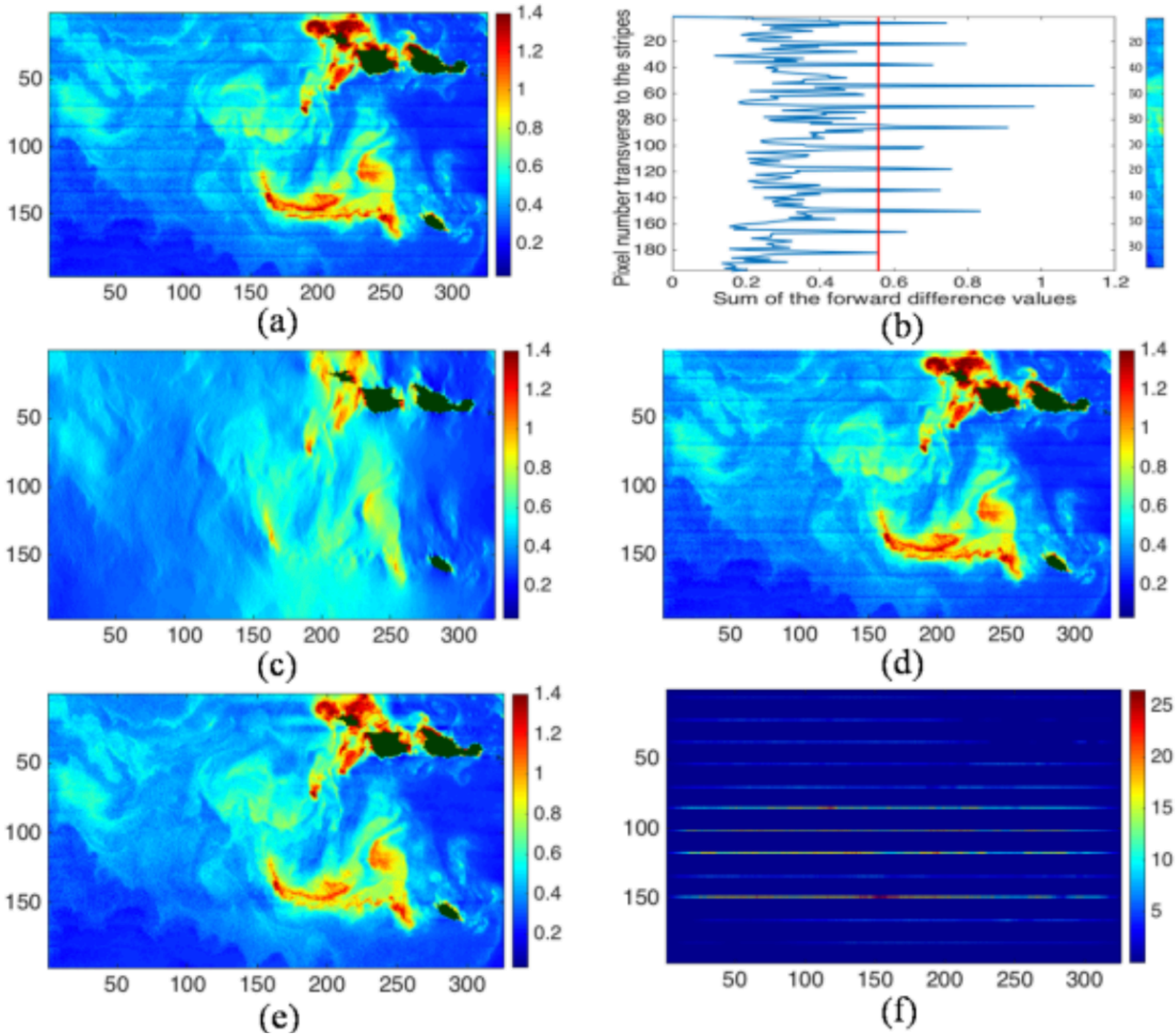


Figure 7. Panel **(a)** shows the cropped region shown in Fig. 6 and the graph **(b)** shows the S curve with the threshold and the image piece (columns 137 to 148) that we used compute the values of S curve. The panels **(c)**, **(d)** and **(e)** represent the destriped images of **(a)** with $\alpha = 1$ with unweighted regularization term and $\alpha = 10^{-5}$ and $\alpha = 10^{-2}$ with weighted regularization term, respectively. Panel **(e)** provides the best solution for the destriped image. Panel **(c)** is over regularized whereas panel **(d)** is not sufficiently regularized. Panel **(f)** represents the percentage error between panels **(a)** and **(e)**.

Regularization destriping of remote sensing imagery, Nonlinear Processes in Geophysics., 24, 367–378, 2017.

Current Work

- Fall Eureka Cruise
- Side by Side Field Cal/Variance SeaPRISM paper
- Working on new products using data fusion with VIIRS and other sensors (Sentinel-2, Landsat-8, GOES-R, …)
- Working on protocols for both hand-held spectrometers as well as HyperPROs with NOAA.


04 April 2017