Towards consistent VIIRS AOP and IOP products

ZhongPing Lee, JunFang Lin, JianWei Wei, Lin Qi

University of Massachusetts Boston

UMB activities:

1. Evaluation of VIIRS Rrs products

1a. Compare VIIRS Rrs with climatological Rrs of gyre waters

1b. Compare VIIRS Rrs with in situ measurements

1c. Compare VIIRS Rrs with concurrent MODIS Rrs

1d. Compare Rrs from fixed platform

2. Measurement and processing of in situ IOPs

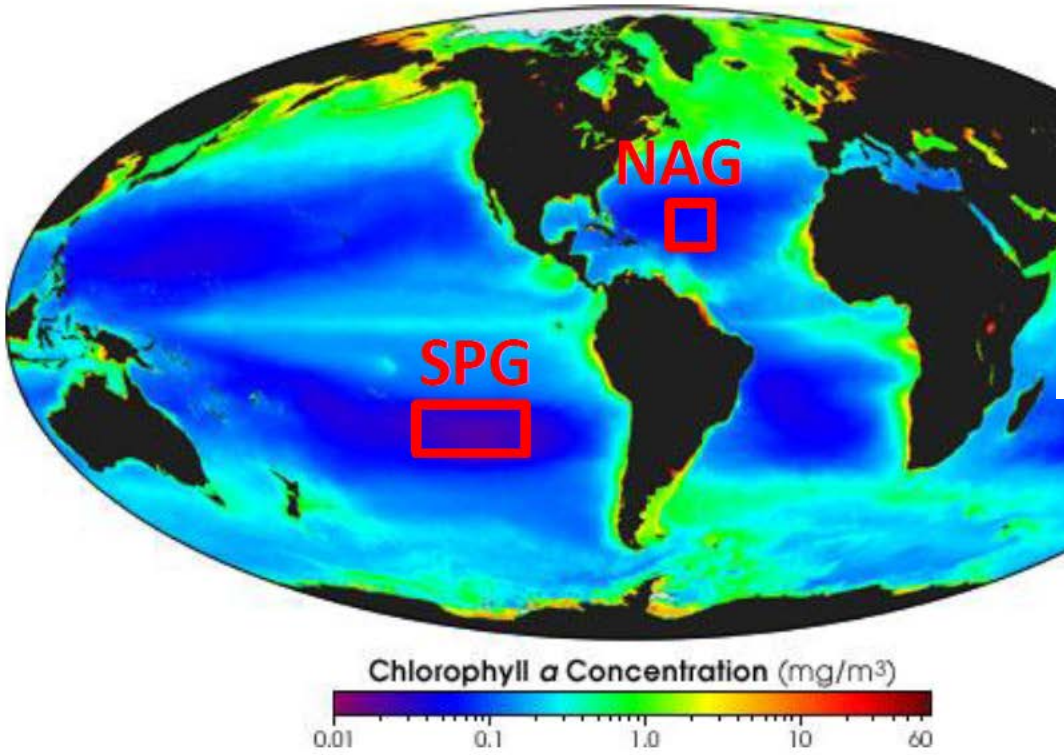
2a. Participate NOAA Cal/Val cruise

2b. Scattering correction of the ac-s system

3. Application of in situ measurements

Hyperspectral absorption coefficient of “pure” seawater derived from in situ Rrs

1a. Compare VIIRS Rrs with climatological Rrs of gyre waters



Band characteristics

	VIIRS		MODISA	
	CW [nm]	Bandwidth [nm]	CW [nm]	Bandwidth [nm]
M1	410	20	412	15
M2	443	15	442	10
M3	486	19	488	10
M4	551	19	547	10

Location: South Pacific Gyre (SPG) and North Atlantic Gyre (NAG)

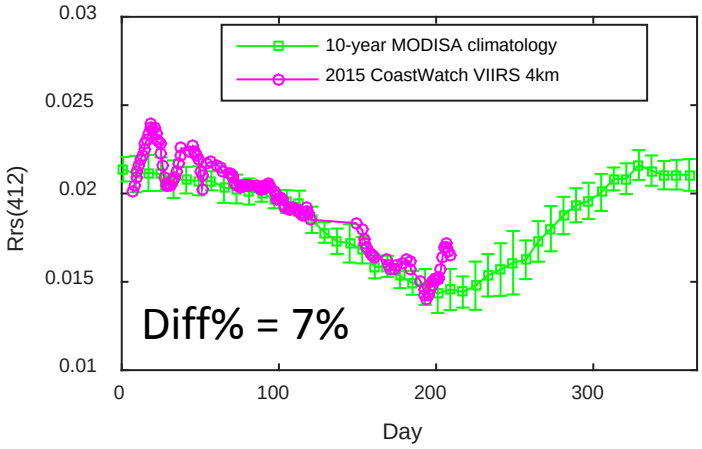
Data: VIIRS (from CLASS), 5/2013-2/2014

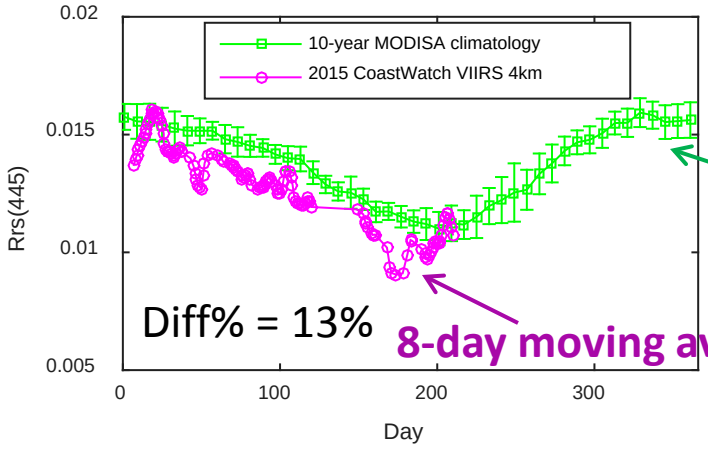
MODIS_Aqua (from OBPG; daily-climatology)

all are area average

South Pacific Gyre (SPG)

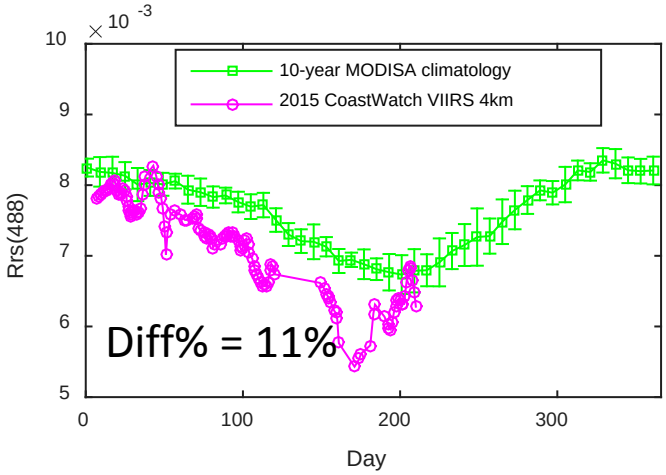
Ocean color comparisons between CoastWatch <1-year data and MODIS Aqua 10-year climatology

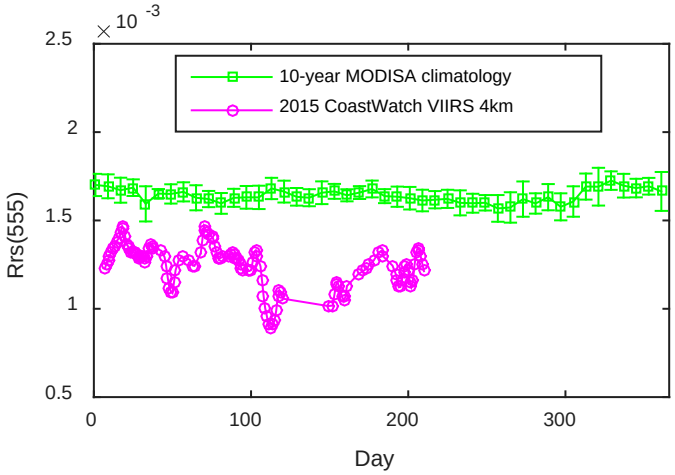




8-day climatology

8-day moving average

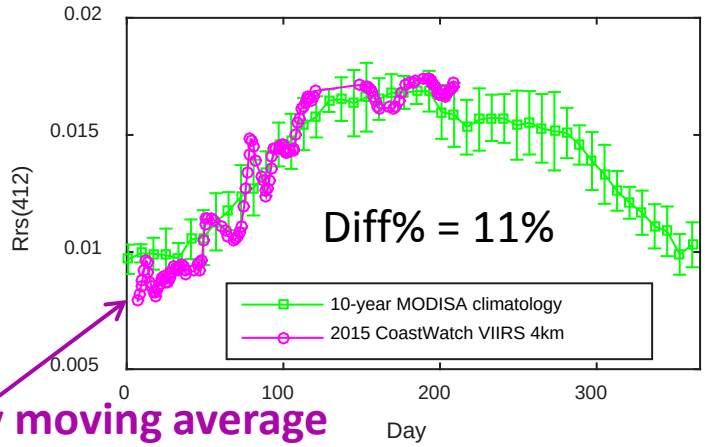




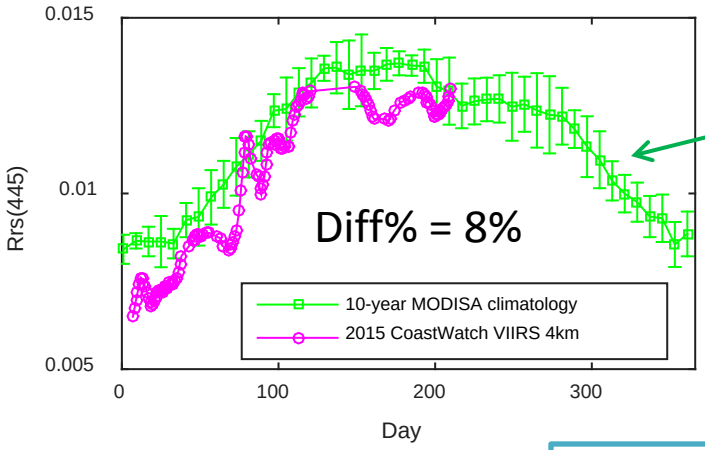
Note the wave difference:
547 vs 555 nm

North Atlantic Gyre (NAG)

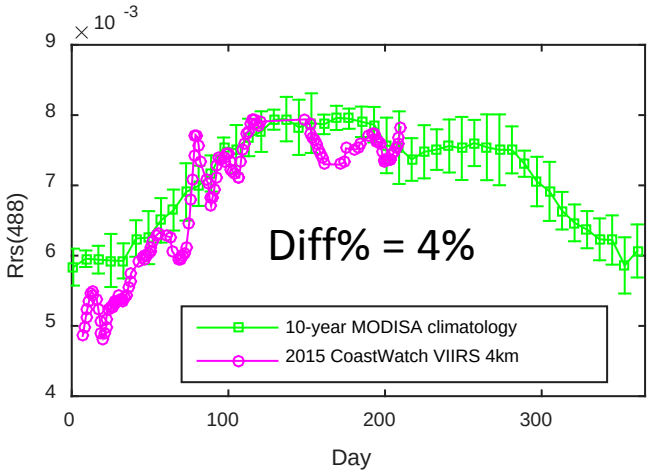
Ocean color comparisons between CoastWatch <1-year data and MODIS Aqua 10-year climatology

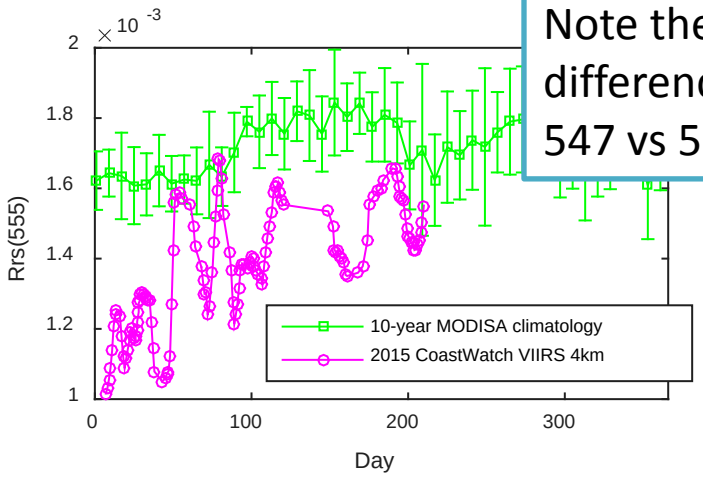


8-day moving average



8-day climatology





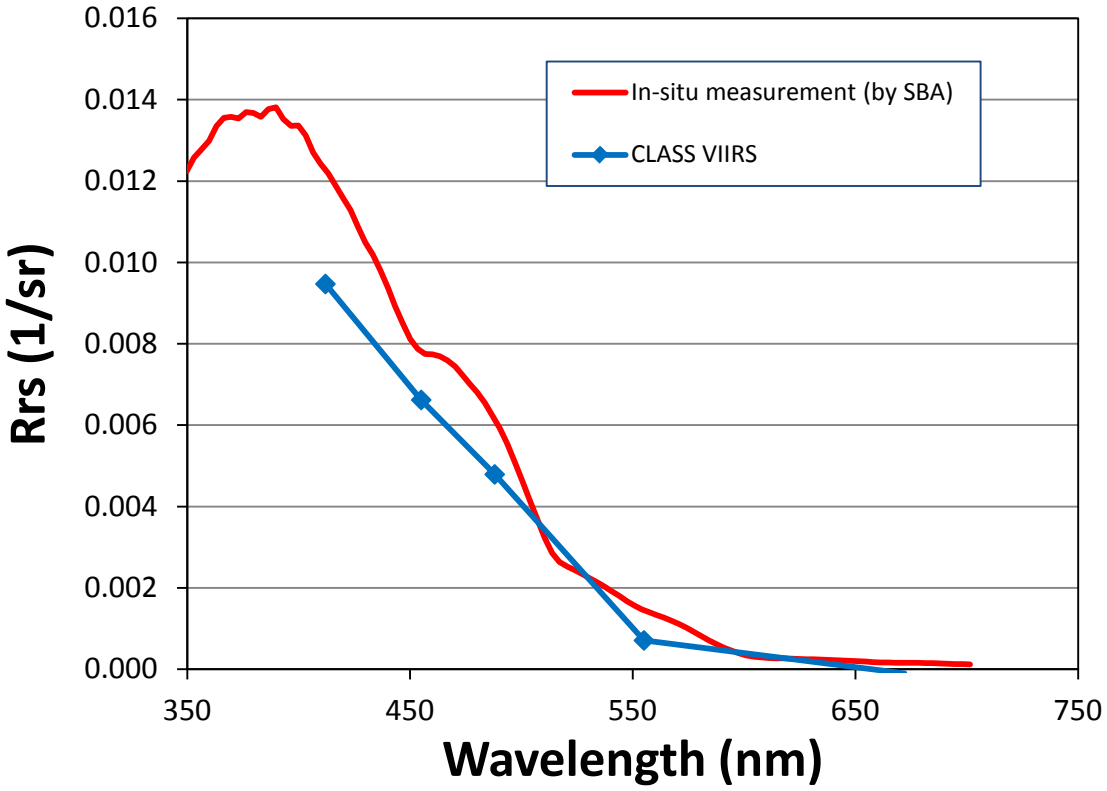
Note the wavelength difference:
547 vs 555 nm

CoastWatch VIIRS Rrs at subtropic gyres are generally consistent with MODIS-A climatology; but occasionally display unexpected values.

1b. Compare VIIRS Rrs with in situ measurements



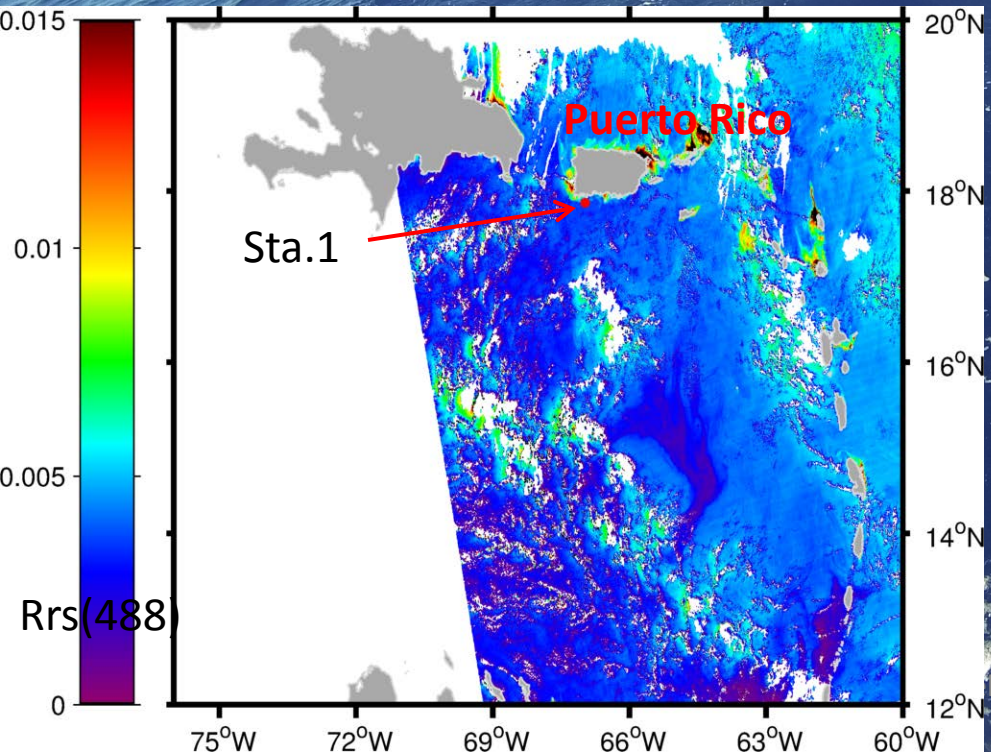
SBA-VIIRS Data Comparison



VIIRS data was averaged over 9 pixels.

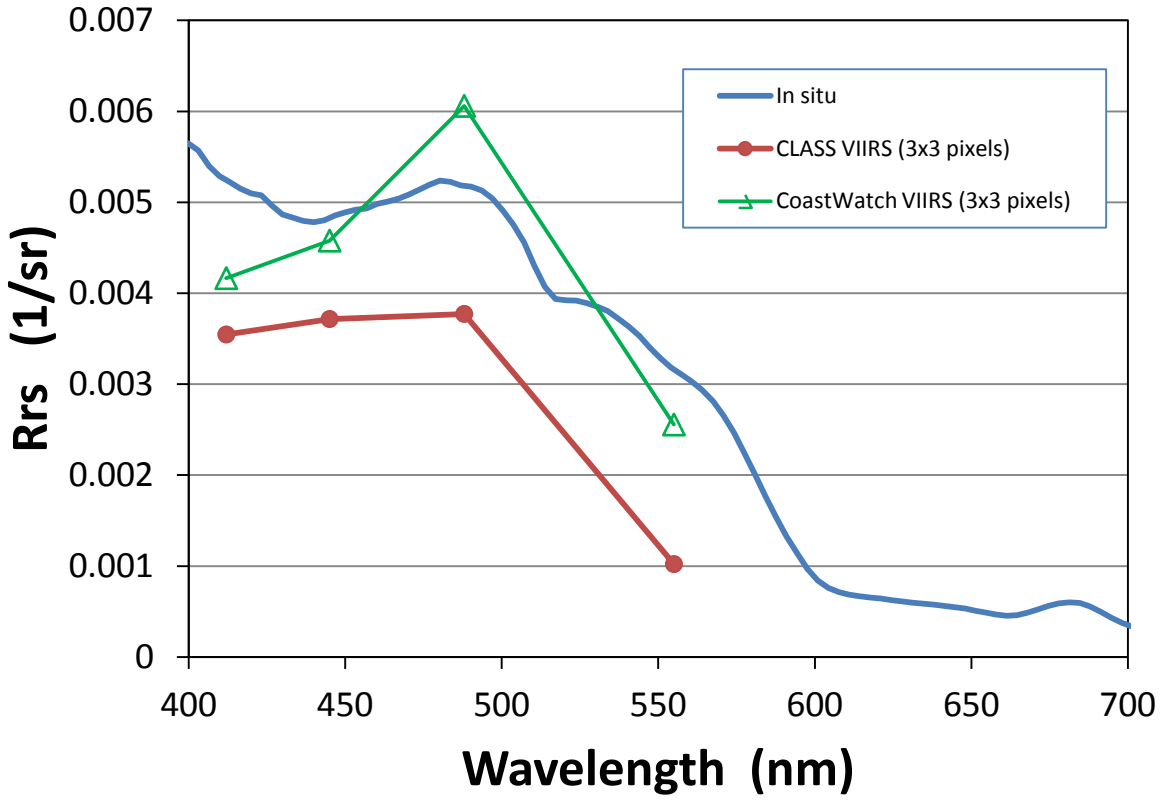
Caribbean Sea (Puerto Rico) Experiments
Dec-13-2014

20141213, VIIRS overpass at 17:00pm
Clear sky; 1.5 m waves;
Time difference: **~1 hrs**



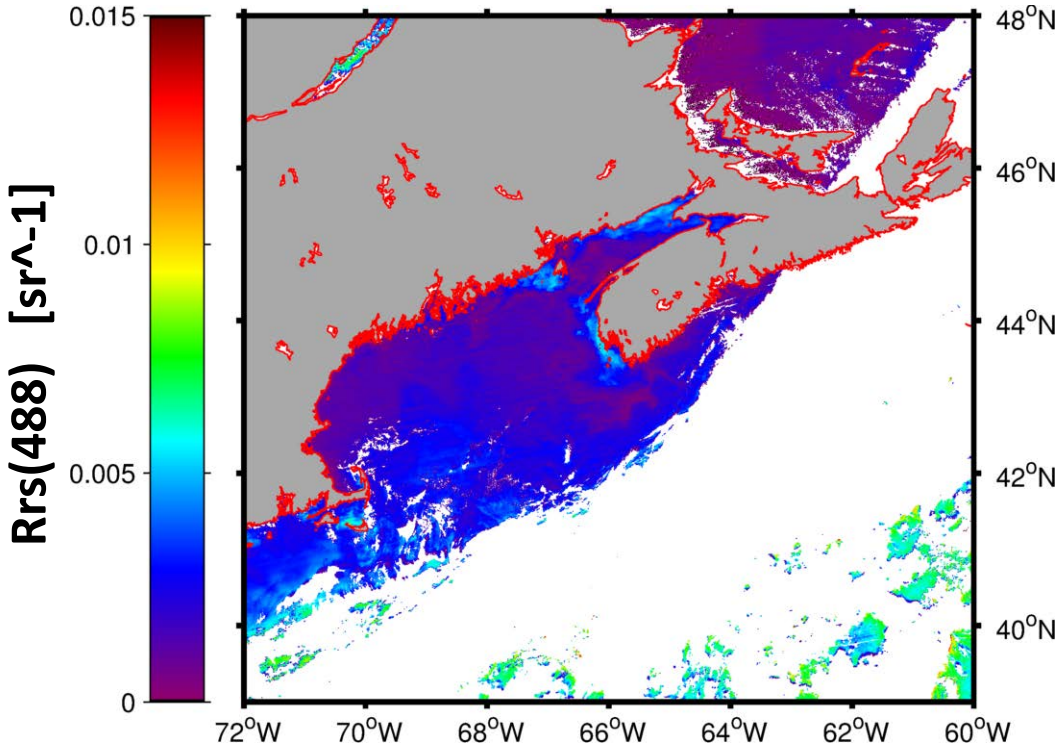
6 miles from the shore

Comparison of in-situ Rrs, CLASS VIIRS and CoastWatch VIIRS products



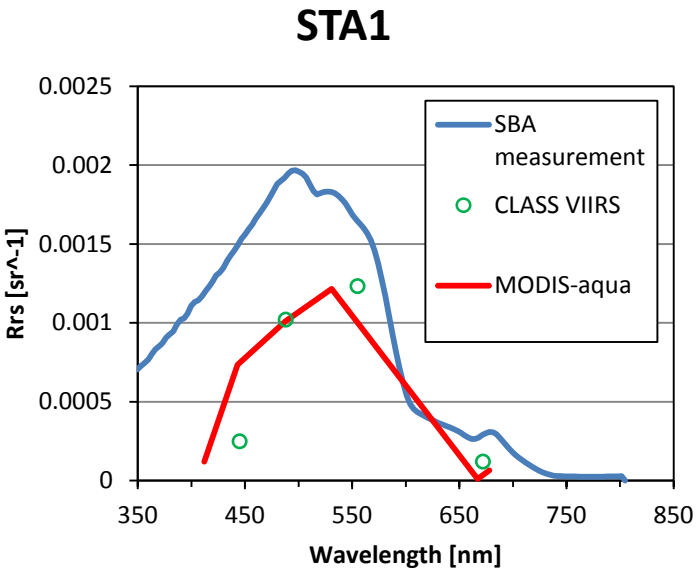
CoastWatch VIIRS products show much better results in this region.

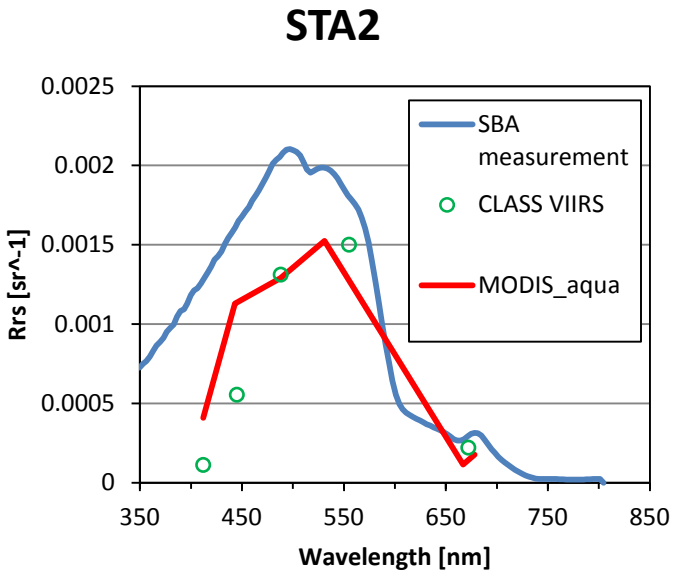
CLASS VIIRS Ocean Color EDR

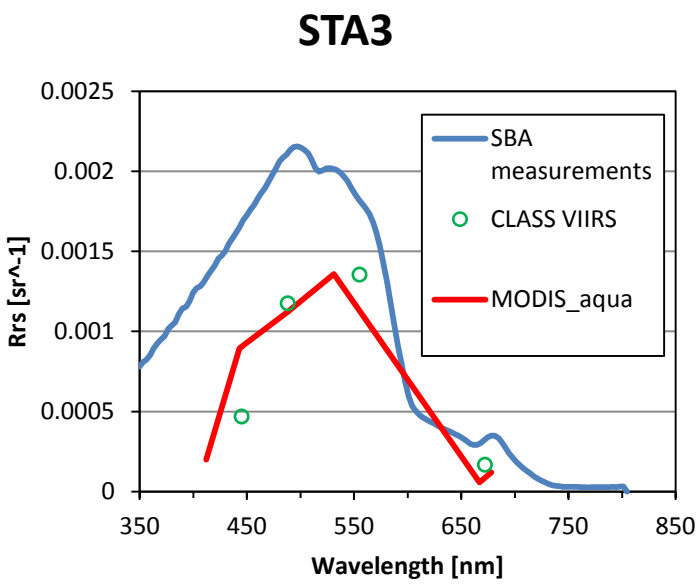


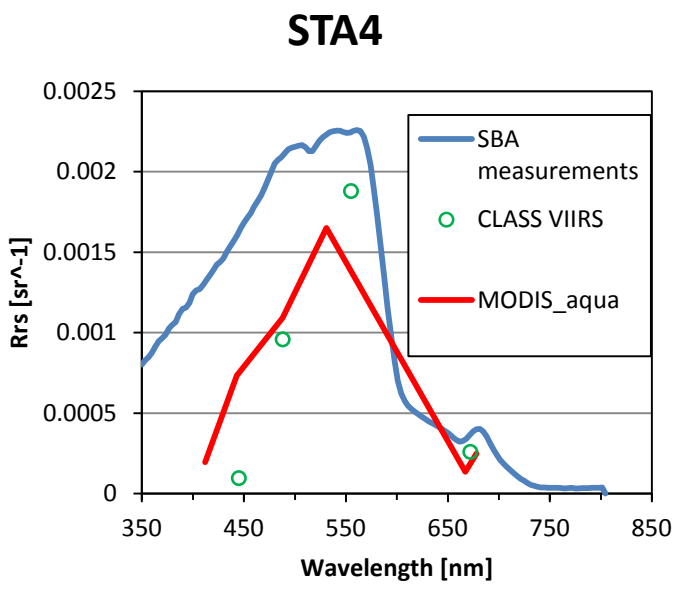
The VIIRS ocean color EDR data is used as is, without further quality control. (Considering ATMWARN flag, all data in Massachusetts Bay can be questionable)

Rrs spectra comparison

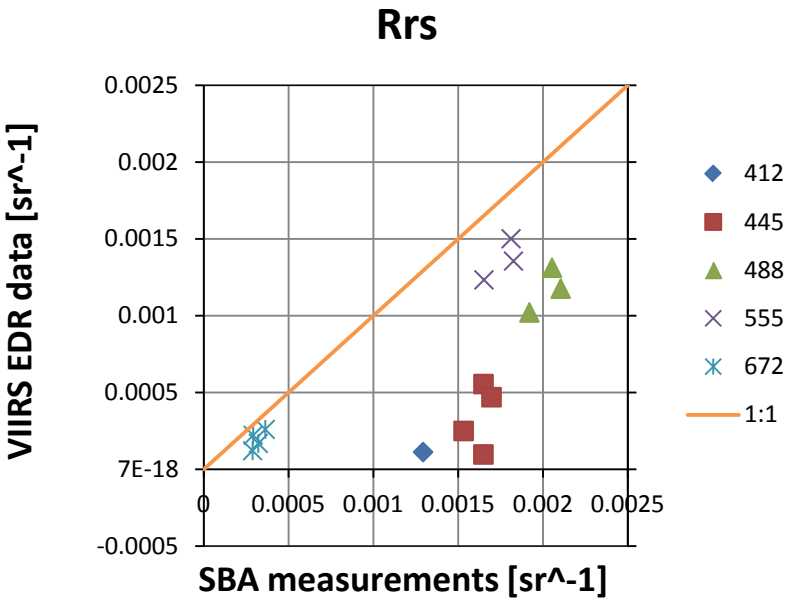


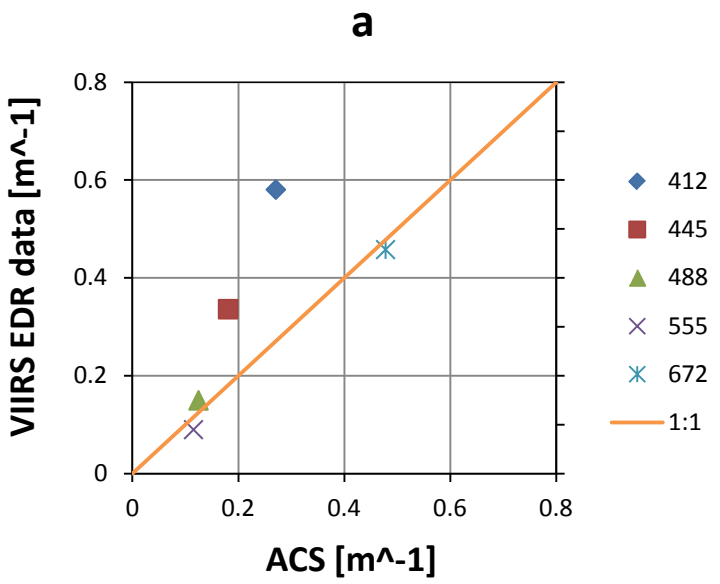


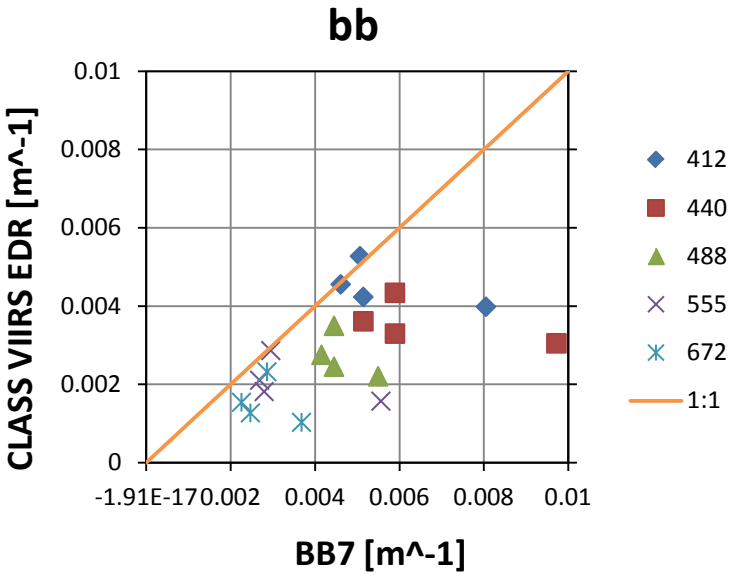




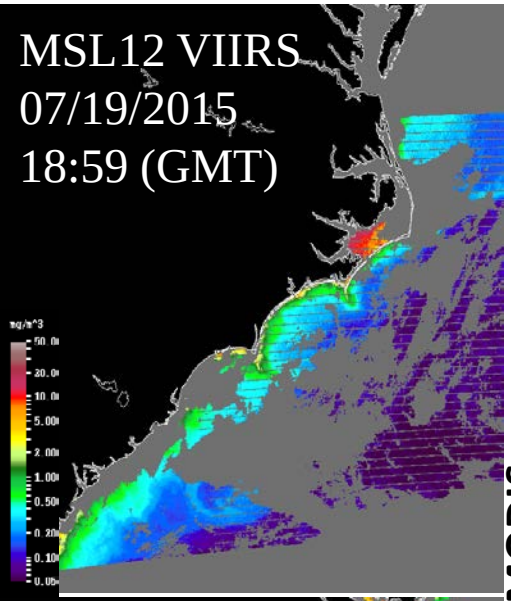
CLASS VIIRS products VS in situ measurements

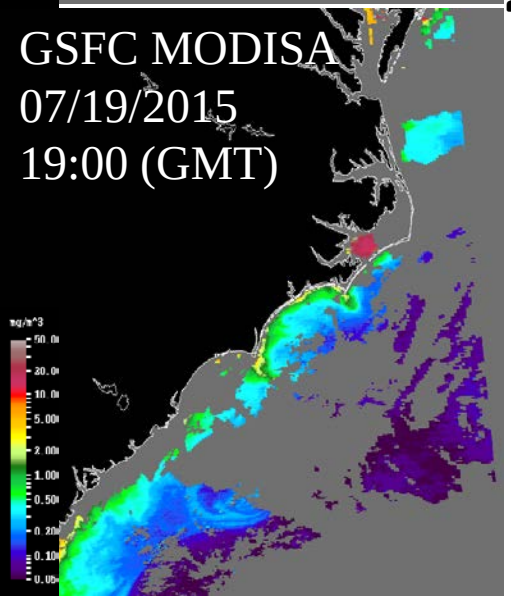




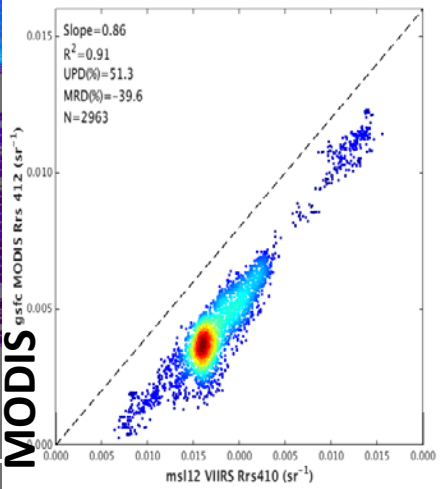


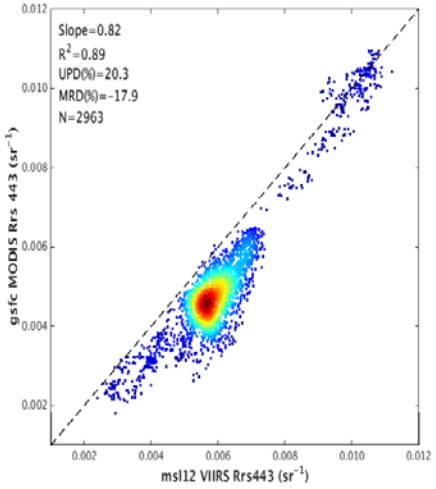
1c. Compare VIIRS Rrs with concurrent MODIS Rrs

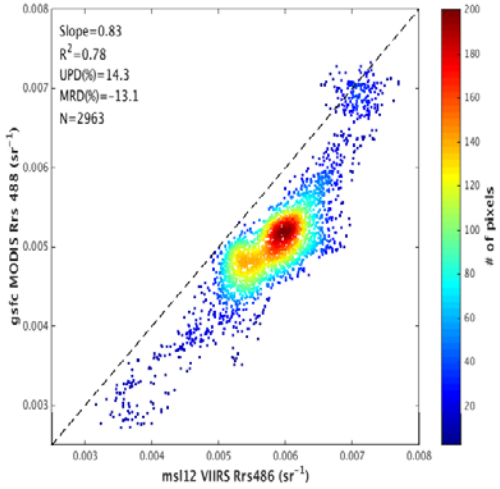


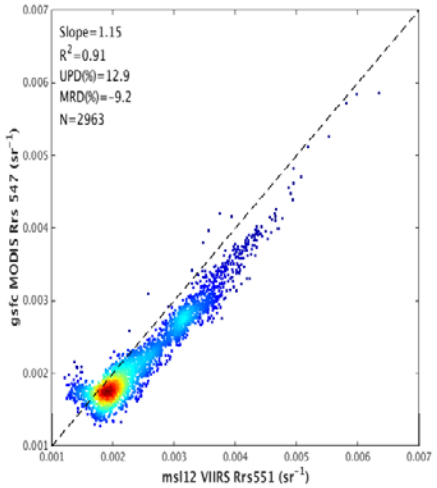


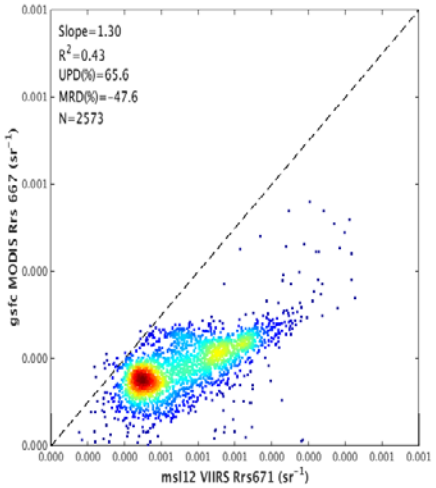
MODIS

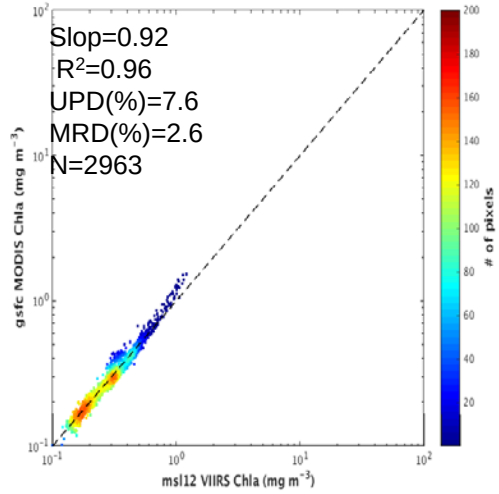






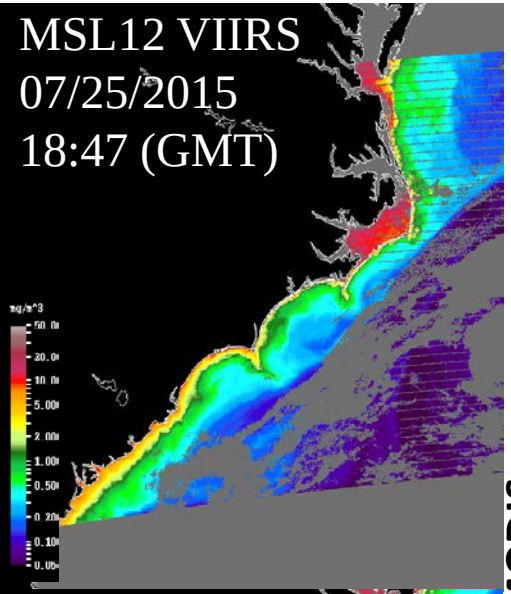


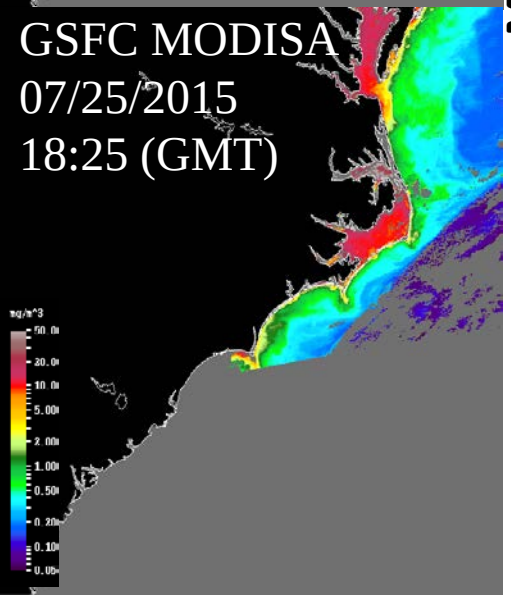




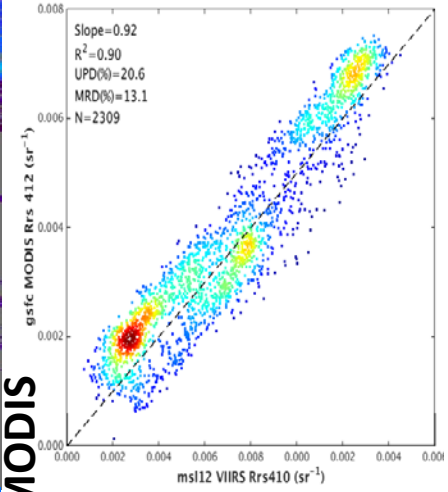
MSL12 VIIRS

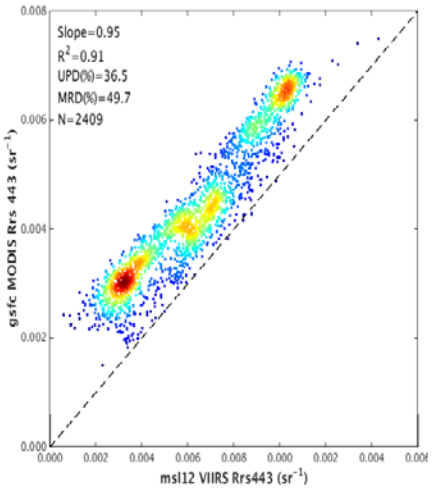
1c. Compare VIIRS Rrs with concurrent MODIS Rrs

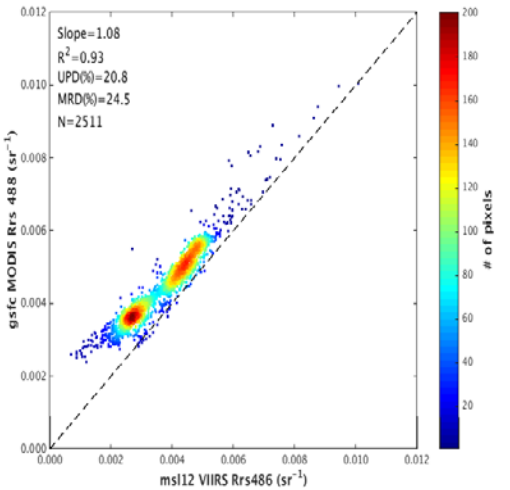


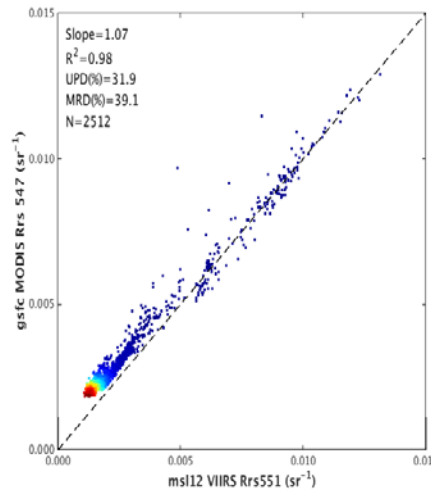


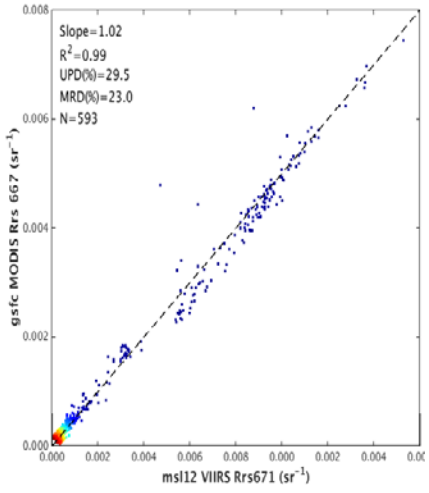
MODIS

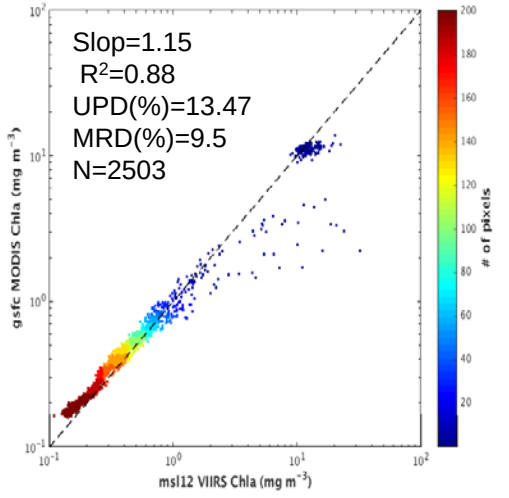




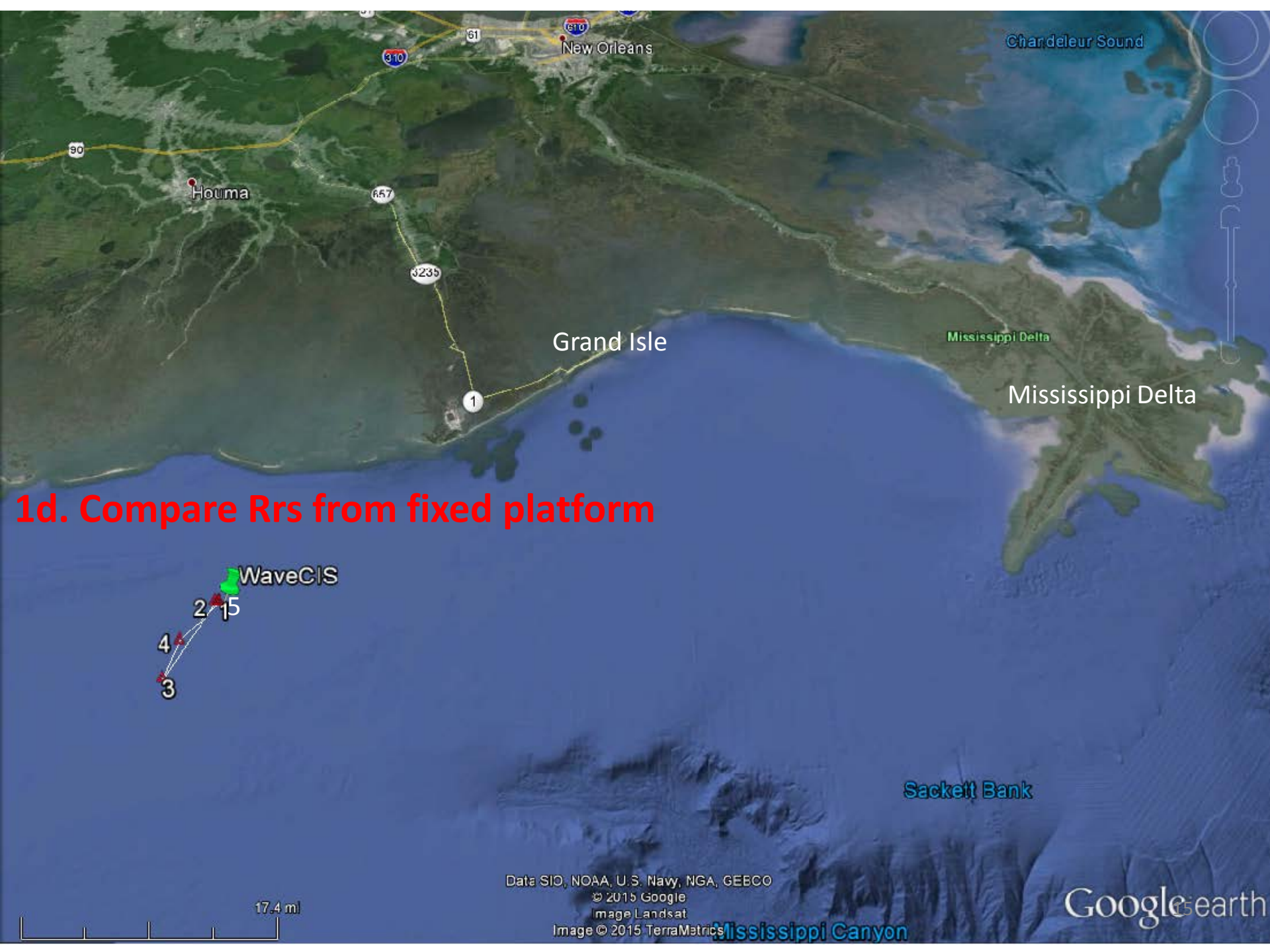




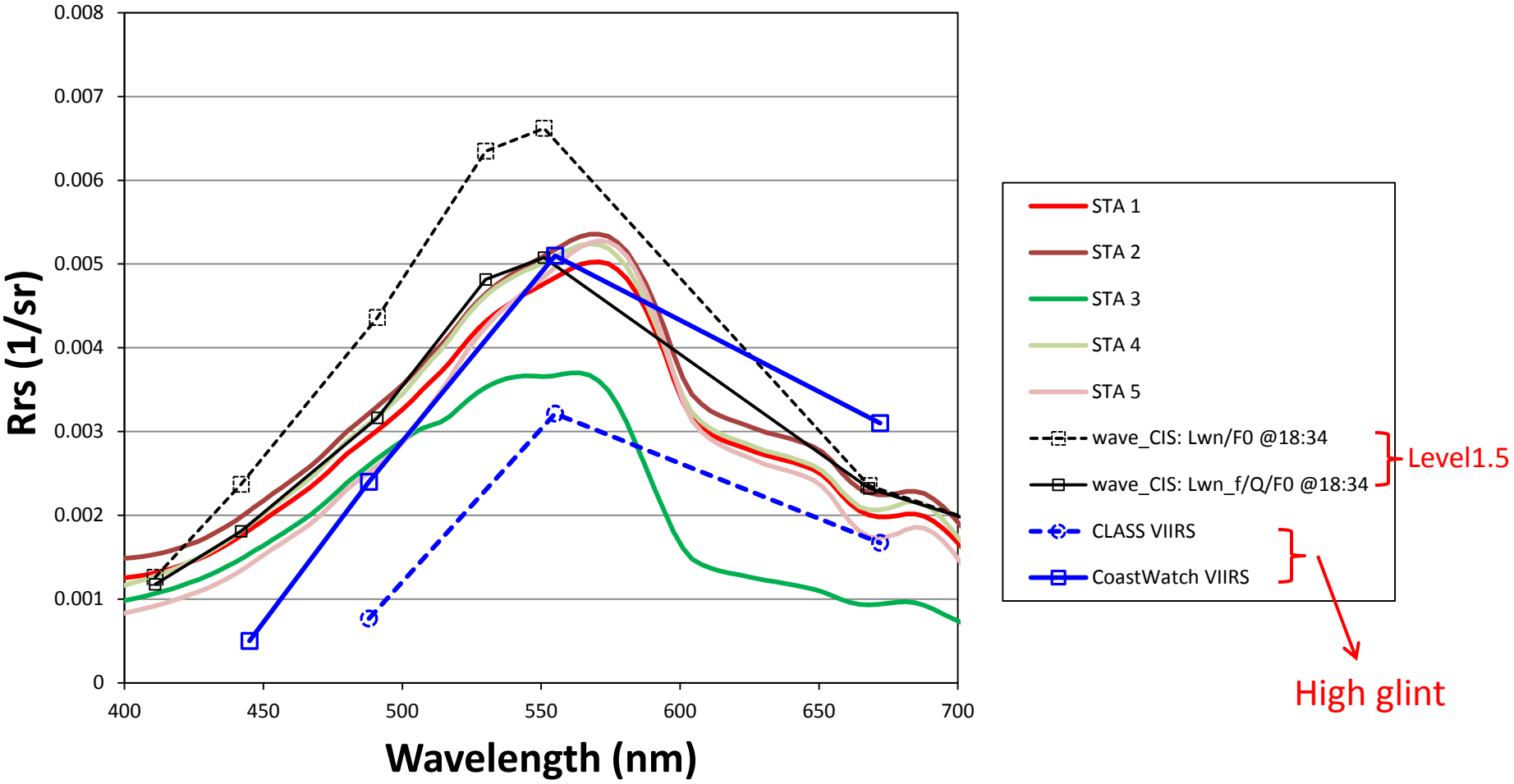




MSL12 VIIRS



1d. Compare Rrs from fixed platform


0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
Rrs (1/sr)
400
450
500
550
600
650
700
Wavelength (nm)
STA 1
STA 2
STA 3
STA 4
STA 5
wave_CIS: Lwn/F0 @18:34
wave_CIS: Lwn_f/Q/F0 @18:34
CLASS VIIRS
CoastWatch VIIRS
Level1.5
High glint

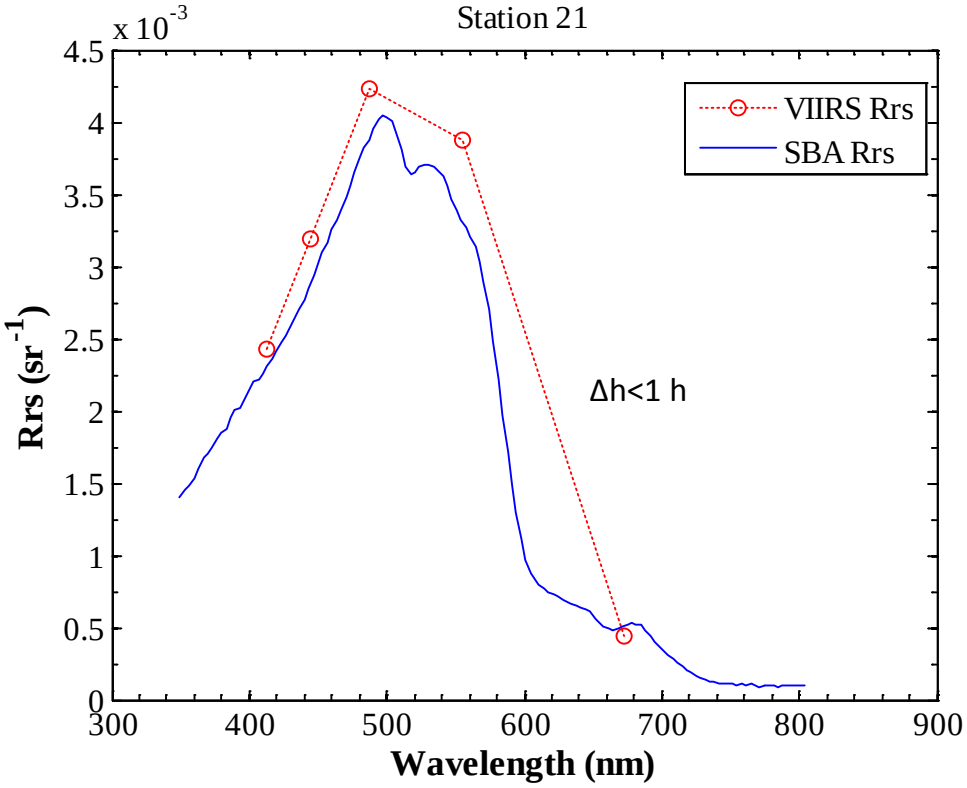
2a. Participate NOAA Cal/Val cruise

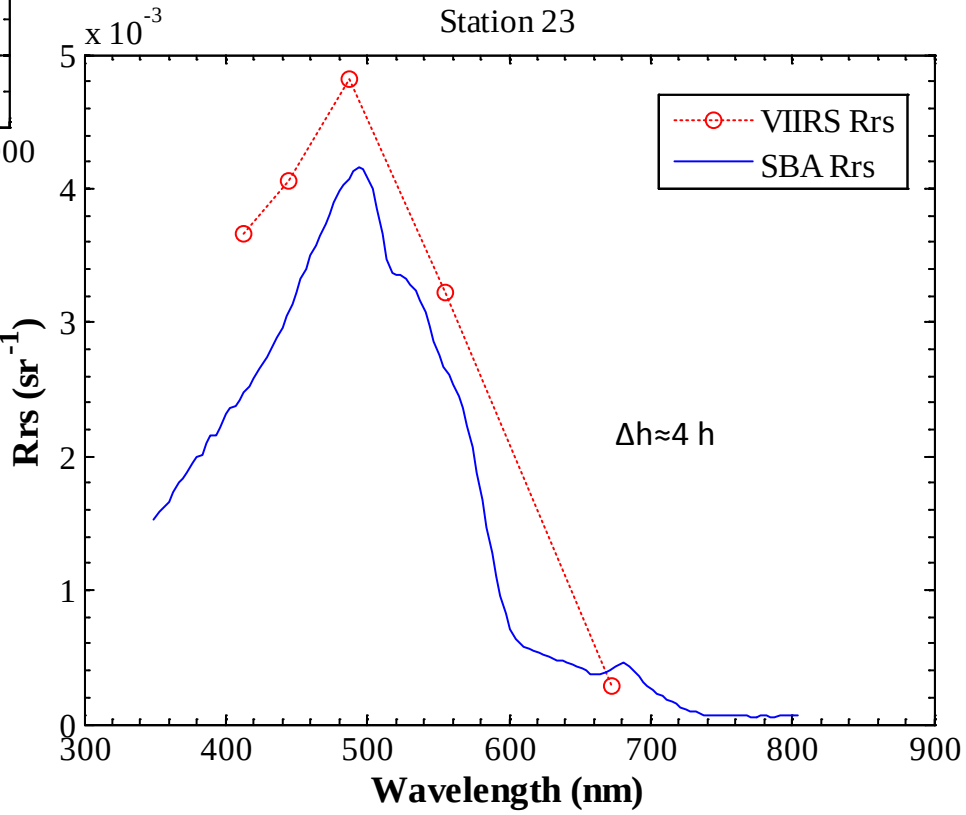
VIRRS Cruise (11/11/2014 - 11/20/2014)

VIRRS	Days	ACSs	BB9	SBA	Spectral Evolution (SR1900)
N	10	21	21	21	11

ECOA Cruise Leg1 (6/17/2015 - 7/3/2015)

ECOA	Days	ACS	HS6	Hyper-Pro	ASD	Micro-TOP
N	17	26	26	20	25	25

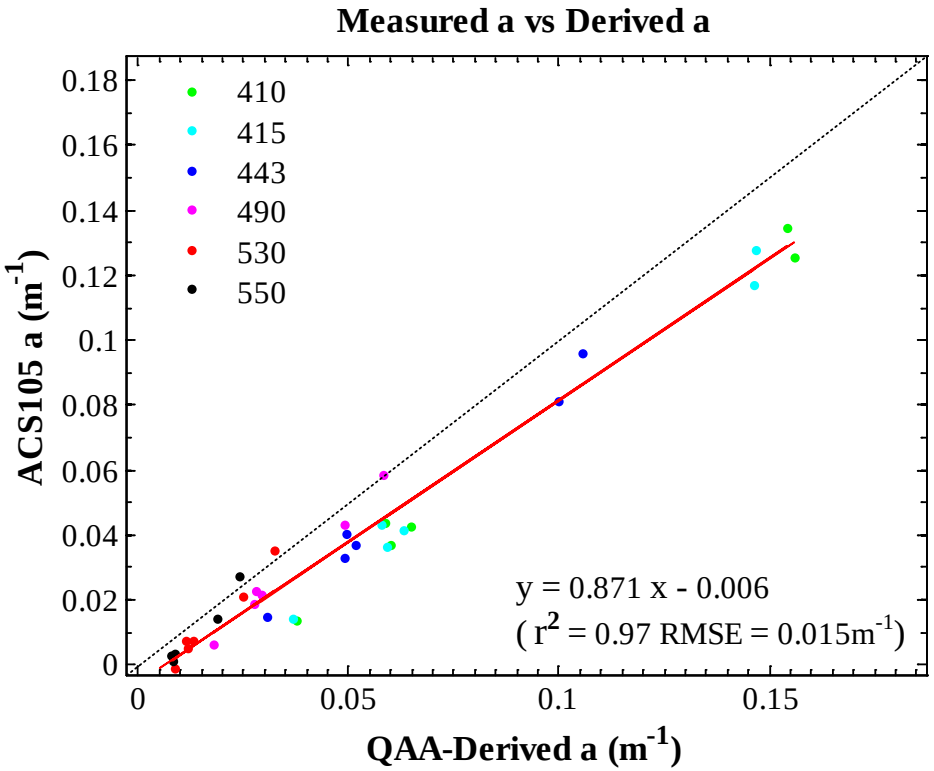

Station 21
x 10^-3
VIIRS Rrs
SBA Rrs
Δh<1 h
Rrs (sr^-1)
Wavelength (nm)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
300
400
500
600
700
800
900

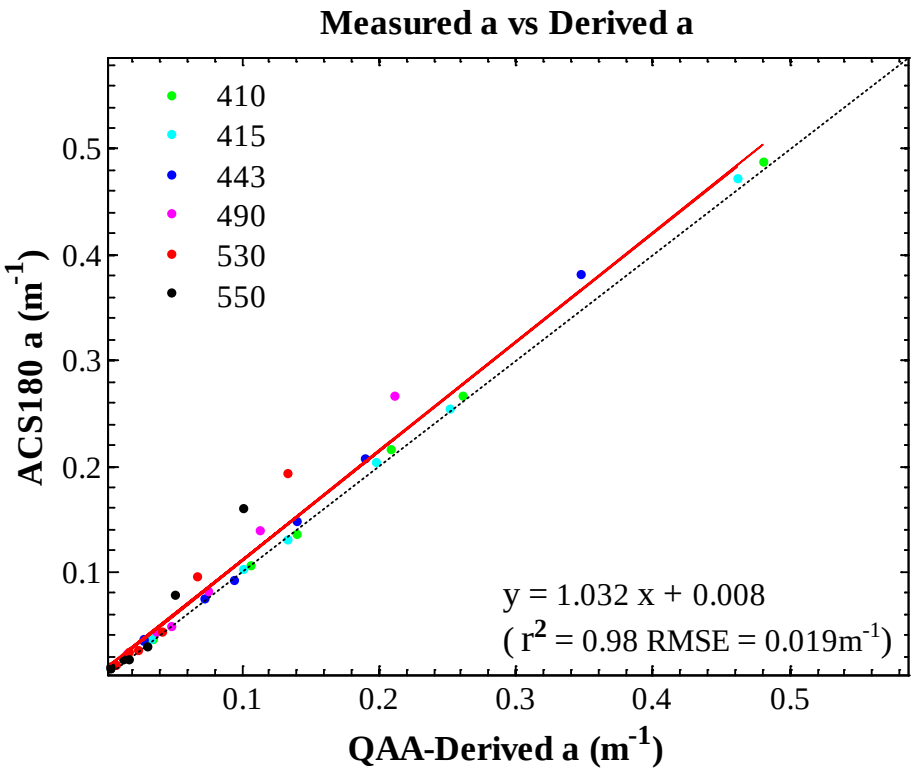

Station 23
x 10^-3
VIIRS Rrs
SBA Rrs
Δh≈4 h
Rrs (sr^-1)
Wavelength (nm)
0
1
2
3
4
5
300
400
500
600
700
800
900

2b. Scattering correction of the ac-s system

Proportional Scattering Correction

$$a(\lambda) = a(\lambda) - \varepsilon \cdot [c(\lambda) - a(\lambda)], \quad \varepsilon = 0.18$$

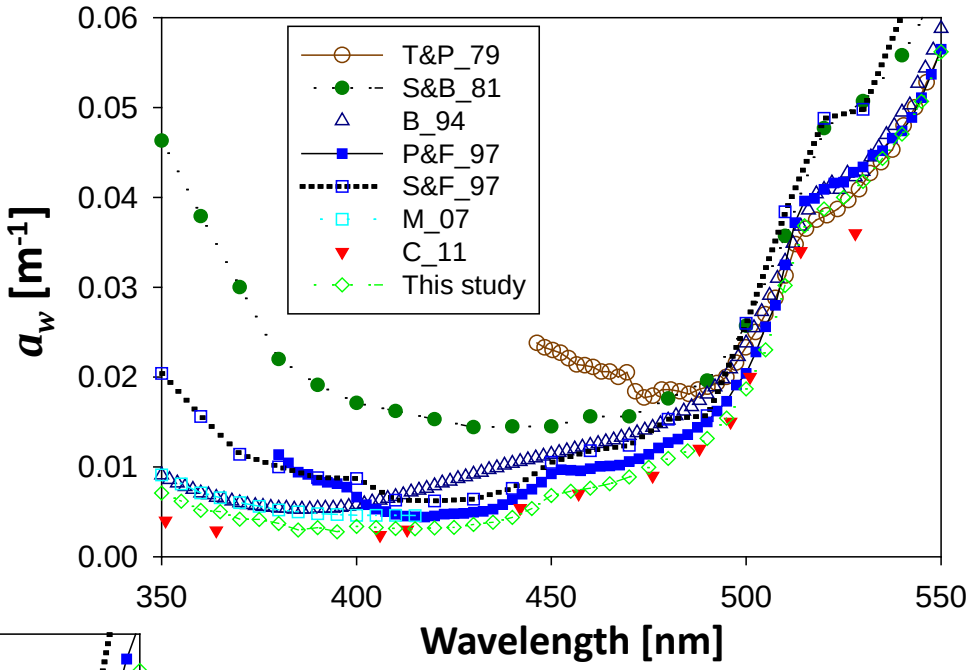


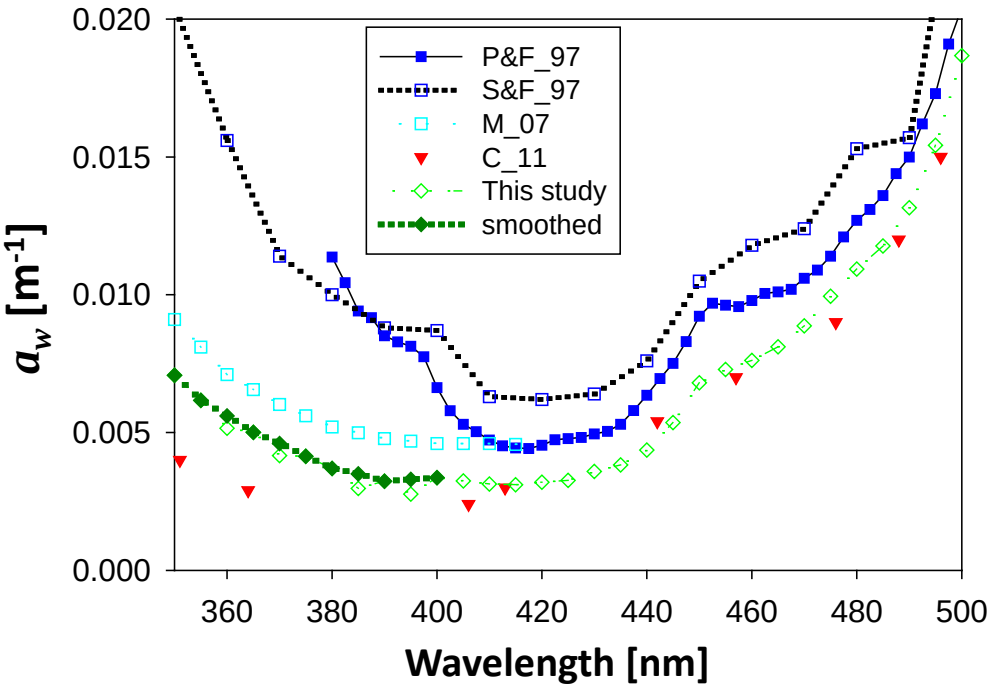


A value of ~0.18 has been suggested for ε when sediments dominate the scattering (Kirk ,1993).

3. Application of in situ measurements

Hyperspectral absorption coefficient of "pure" seawater derived from in situ Rrs





(Lee, Wei, Voss, Lewis, Bricaud, Huot, 2014, " Hyperspectral absorption coefficient of "pure" seawater in the 350-550 nm range inverted from remote-sensing reflectance," Appl. Opt., Vol .54, 546-558).

Plan of FY15

Continue …

1a. Compare VIIRS Rrs with climatological Rrs of gyre waters

1b. Compare VIIRS Rrs with concurrent MODIS Rrs

1c. Compare VIIRS Rrs with in situ measurements
(Puerto Rico, Mass Bay, other opportunities)

2a. Participate NOAA Cal/Val cruise to collect AOP/IOP

Acknowledgements:

NOAA/STAR

Thank you!