OPTICAL REMOTE SENSING OF COASTAL WATERS
BELCOLOUR-2 PROJECT

MICAS PROJECT

In-situ evidence of non-zero reflectance in the OLCI 1020 nm band for a turbid estuary

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OBJECTIVES

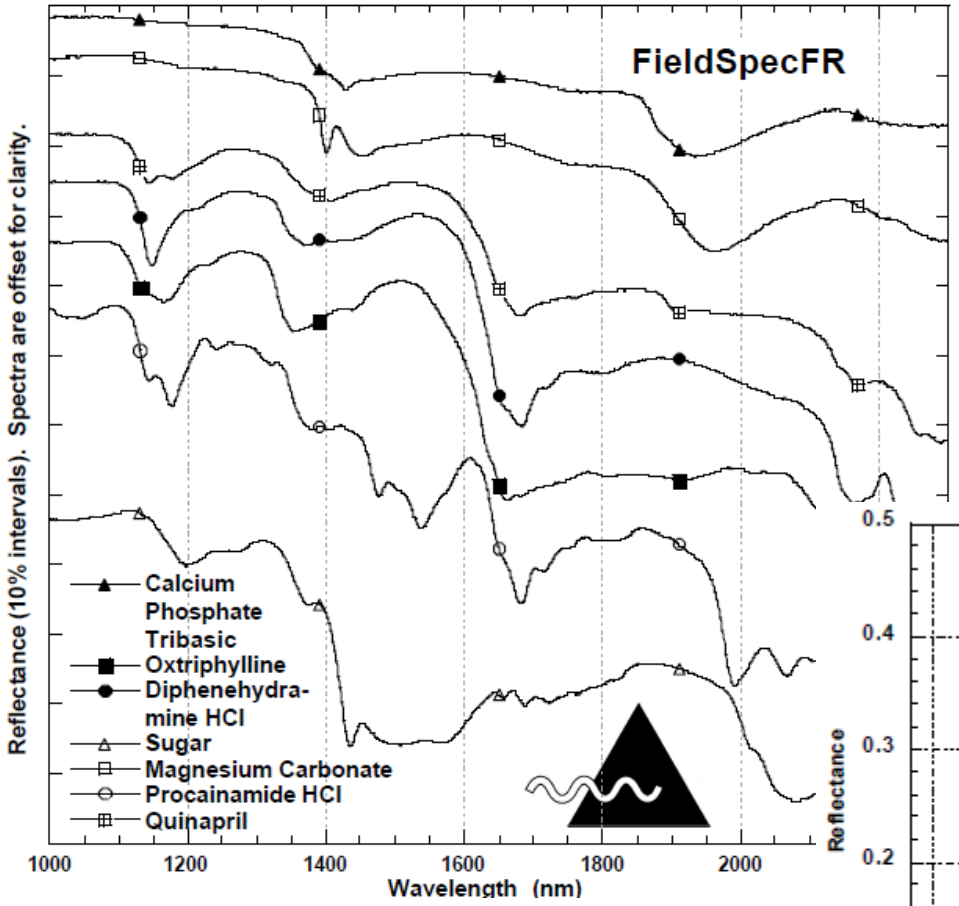
- Wang *et al.* (2007) -> SWIR black pixel assumption to develop atmospheric correction schemes above water for MODIS

- OLCI band at 1020 nm

test the black pixel assumption for the OLCI 1020 nm band

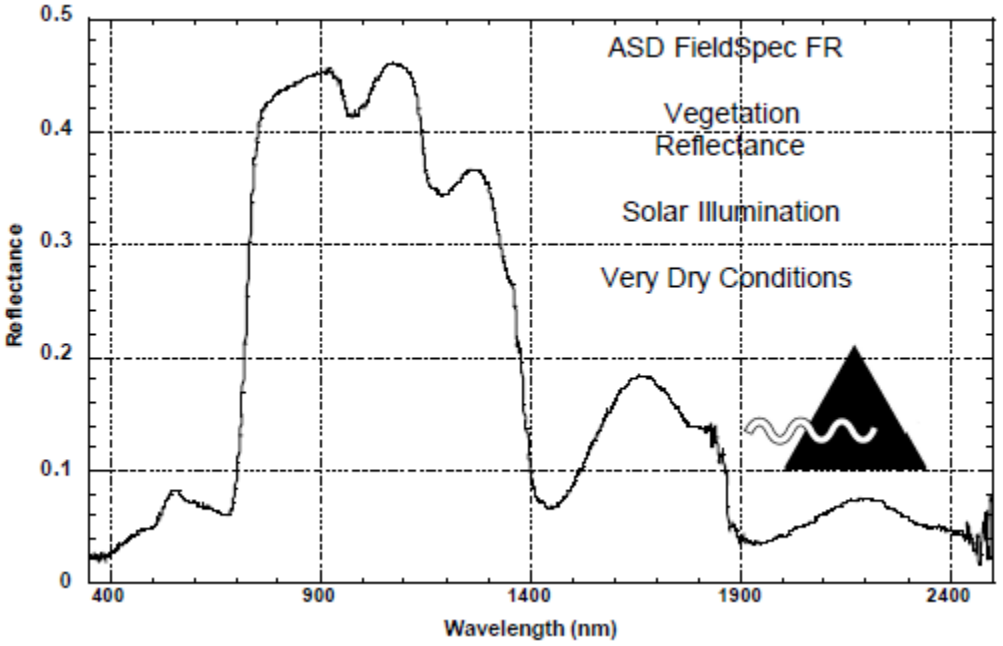
MERIS	OLCI
412.5	400
442.5	412.5
510	442.5
560	510
620	560
665	620
681.25	665
708.75	673.75
753.75	681.25
761.25	708.75
778.75	753.75
865	761.25
885	764.375
900	767.5
	778.75
	865
	885
	900
	940
	1020

METHODOLOGY



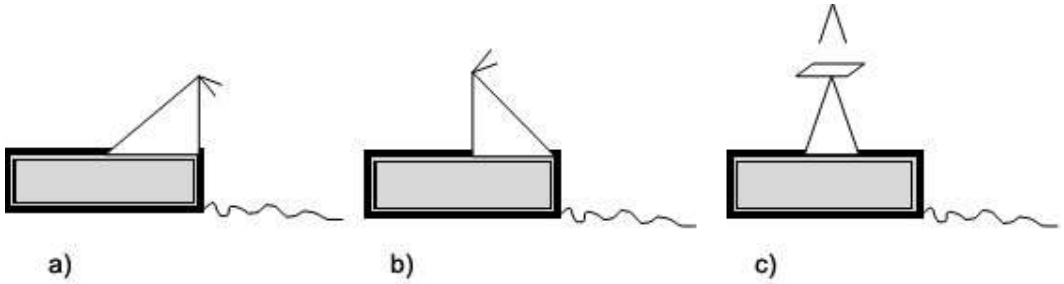
ASD Fieldspec pro

-> 2 instruments
-> yearly calibrated



METHODOLOGY

Measuring water-leaving relfectance with the ASD



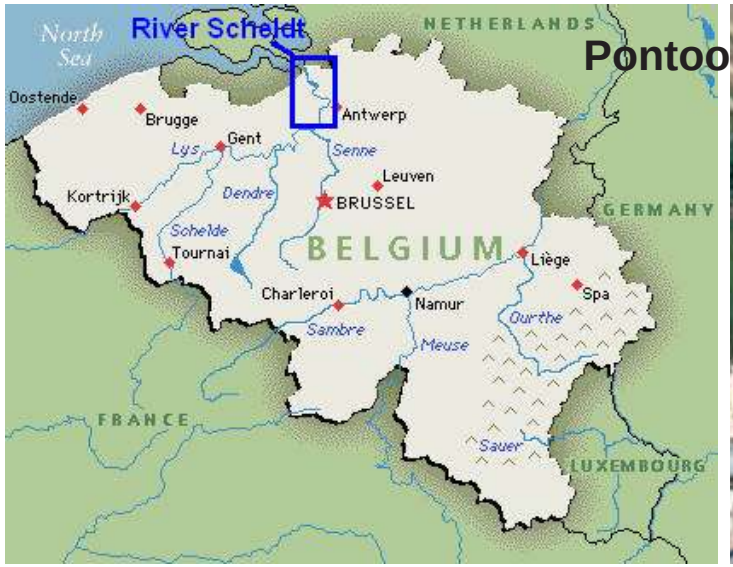
$$R_w = \pi (L_u(a) - \rho_{sky} L_{sky}(a)) / E_d(a)$$

$$\rho_{sky} = 0.0256 + 0.00039 * W + 0.000034 * W^2 \quad \text{for} \quad \frac{L_{sky}(750nm)}{E_d^{0+}(750nm)} < 0.05$$

$$\rho_{sky} = 0.0256 \quad \text{for} \quad \frac{L_{sky}(750nm)}{E_d^{0+}(750nm)} \geq 0.05$$

METHODOLOGY

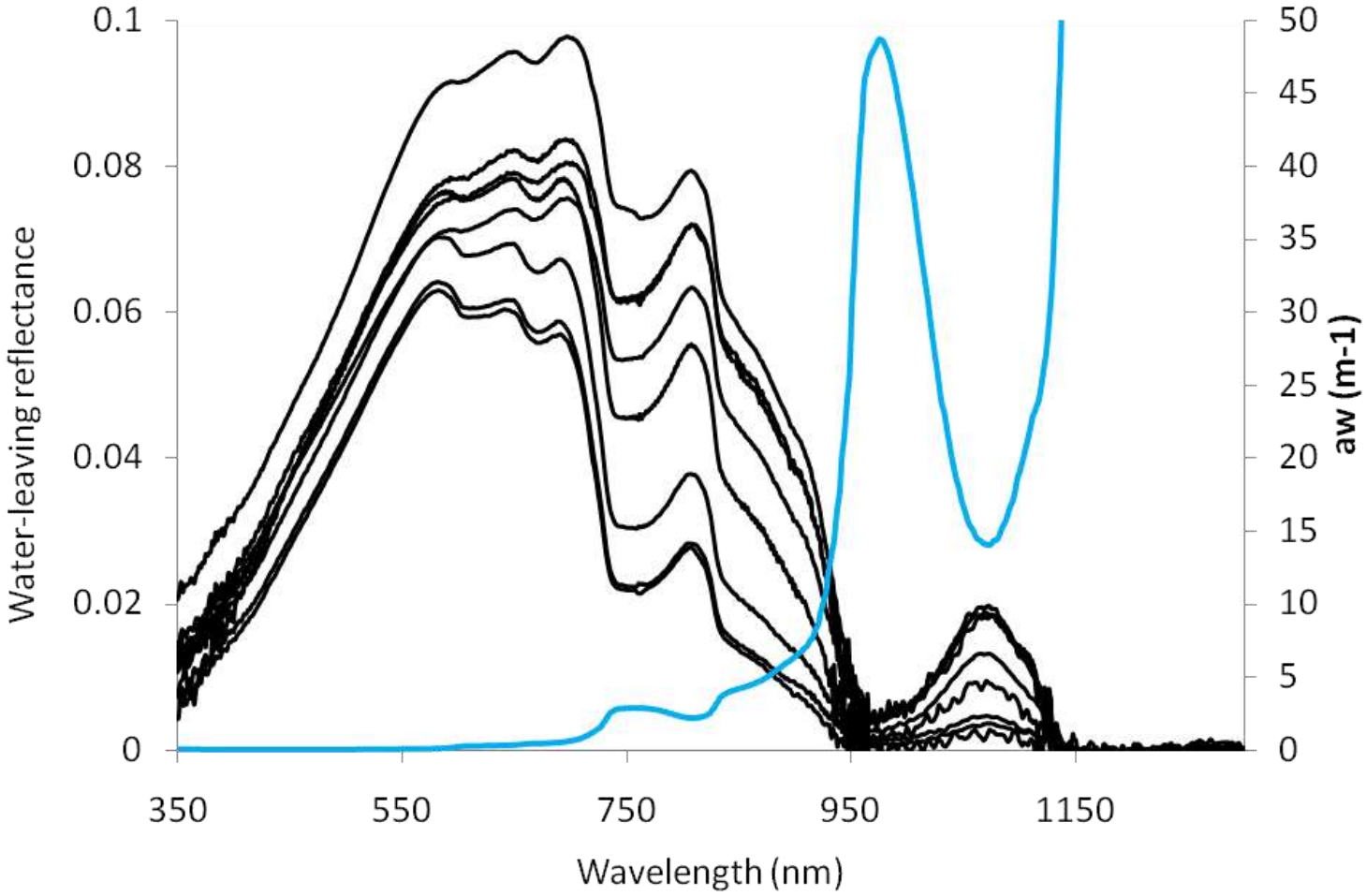
SWIR in-situ measurement campaigns July and October 2010
APEX overflight June 2010



Turbidity (handheld)

RESULTS

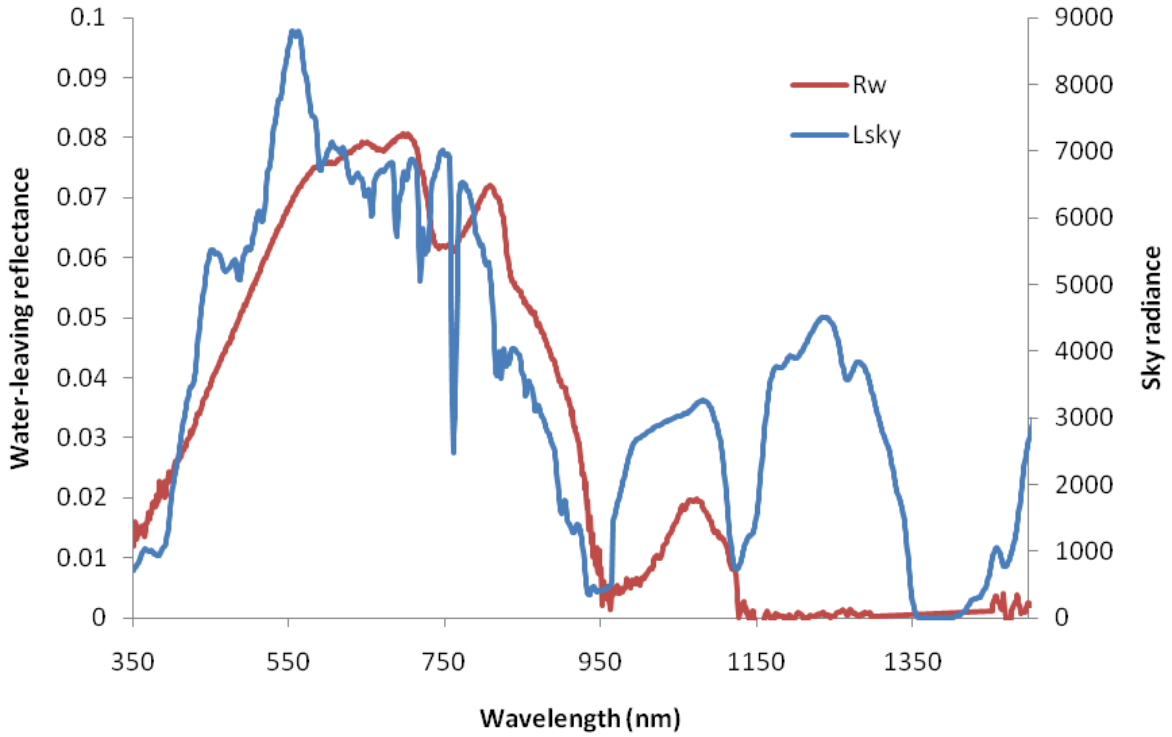
Correction for residual sky glint: Rw – Rw(1200)



Pure water absorption coefficient (Pope & Fry, 1997; Kou *et al.*, 1993)

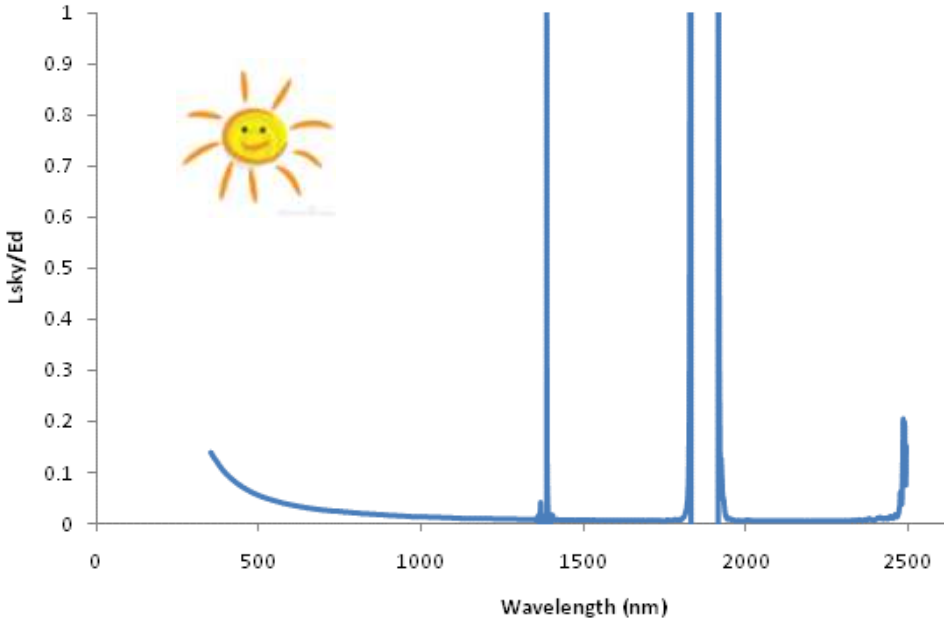
RESULTS

Is this increase due to an incorrect sky glint correction?

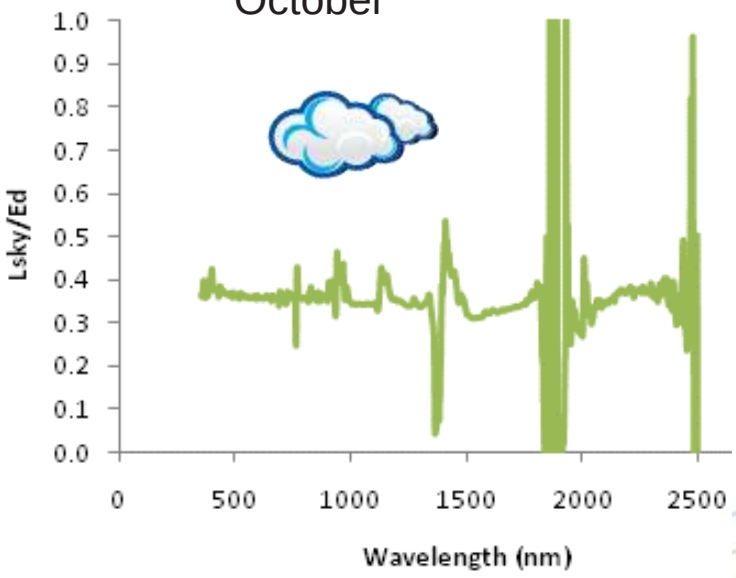


RESULTS

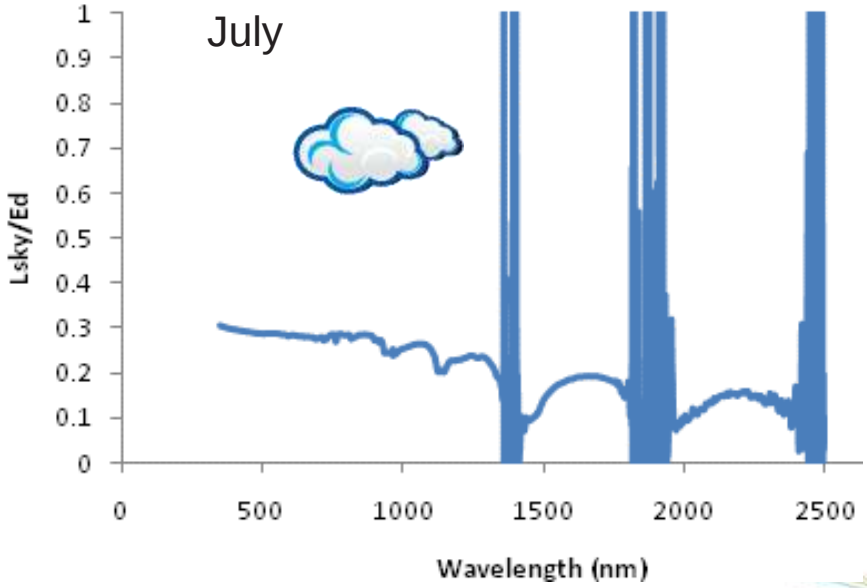
Is it sound to subtract Rw(1200)?
Is Rw(1200) = 0?
Is Lsky/Ed white in spectral shape?



October

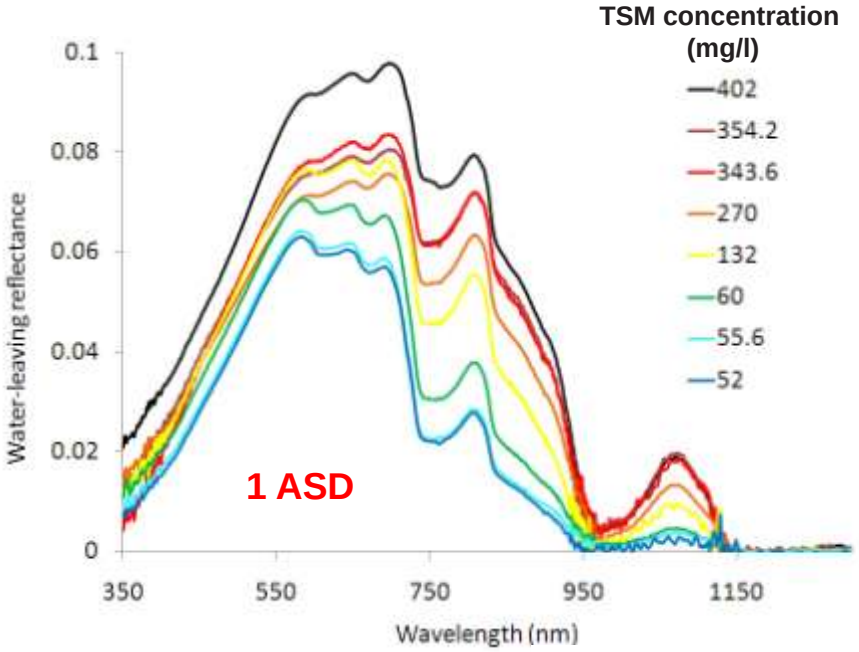


July

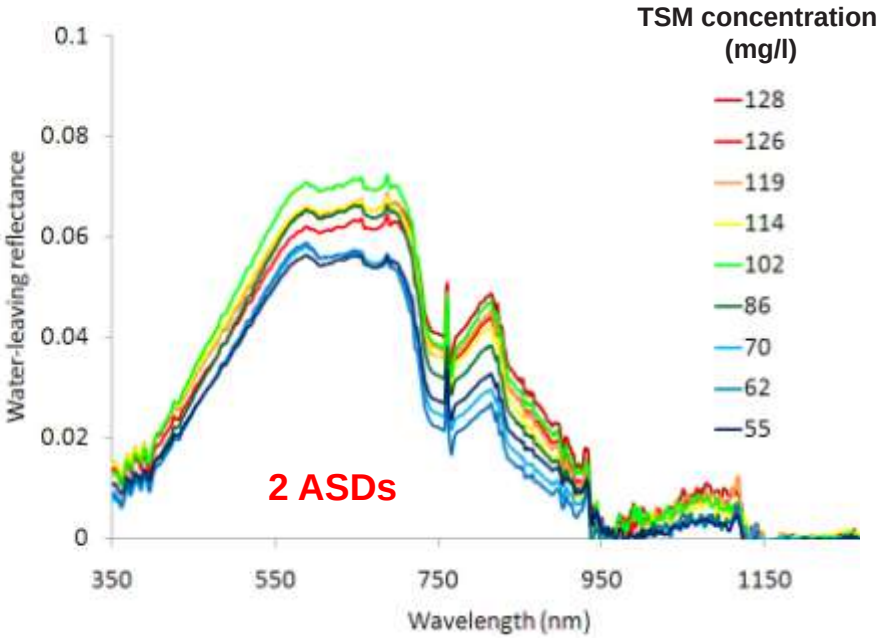


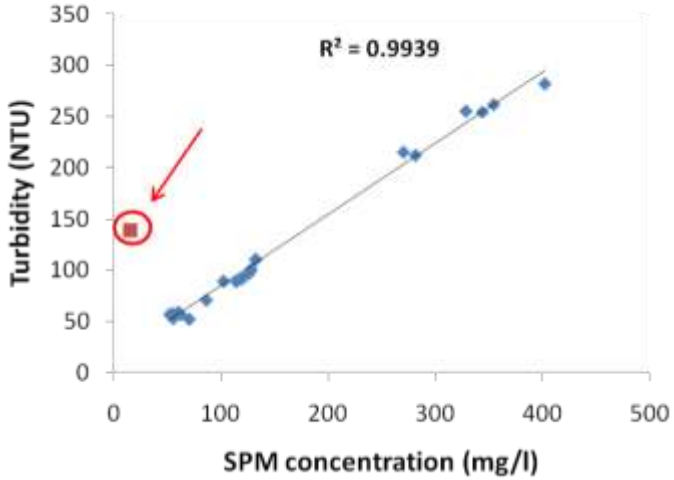
RESULTS

a) water-leaving reflectance July



b) water-leaving reflectance October





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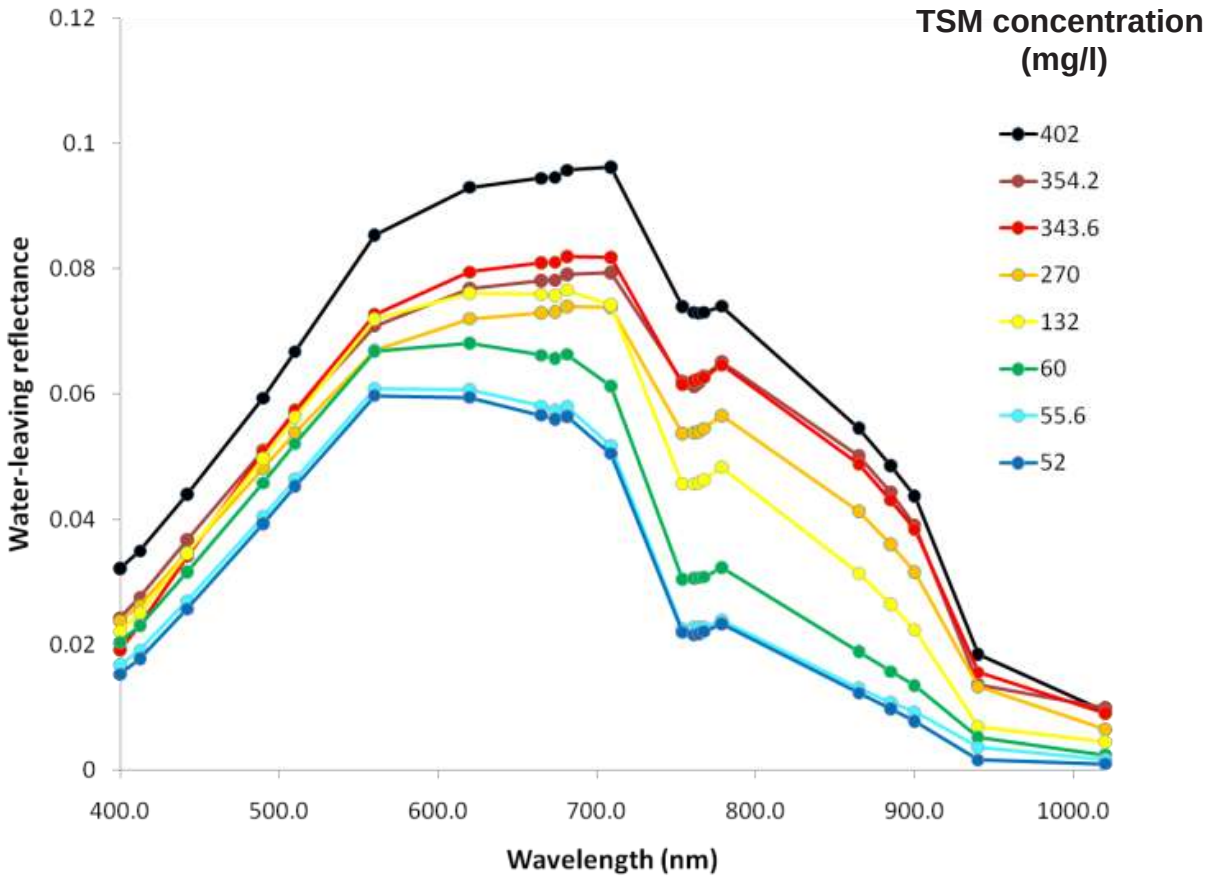
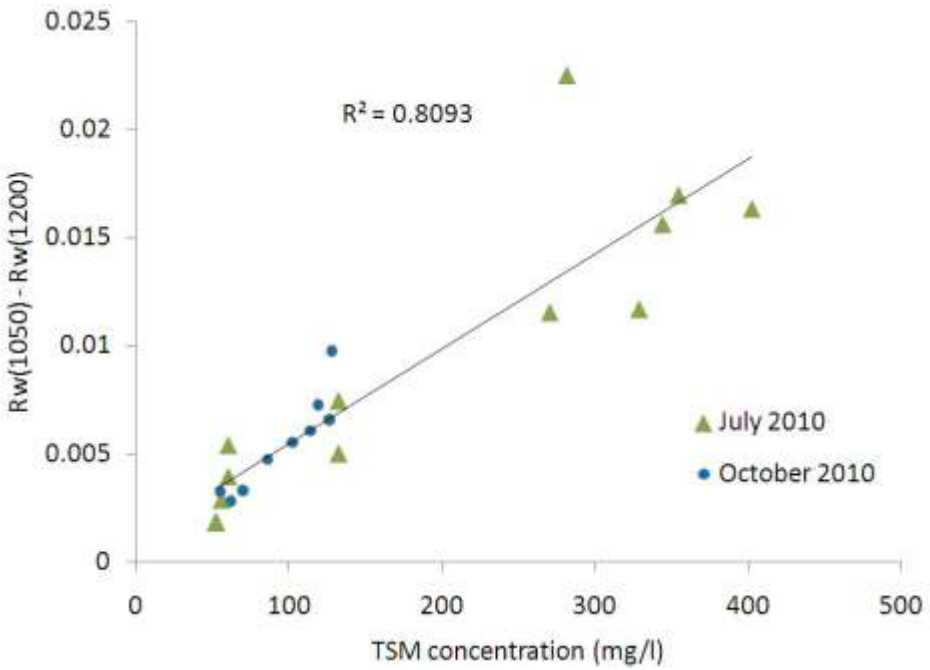
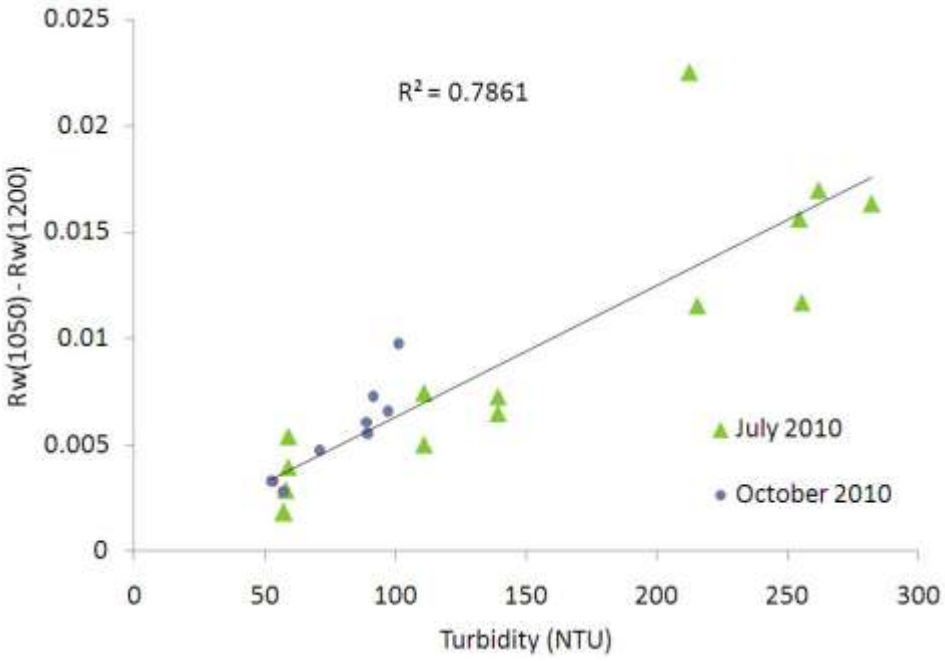
RESULTS

Resampled to the OLCi bands



RESULTS

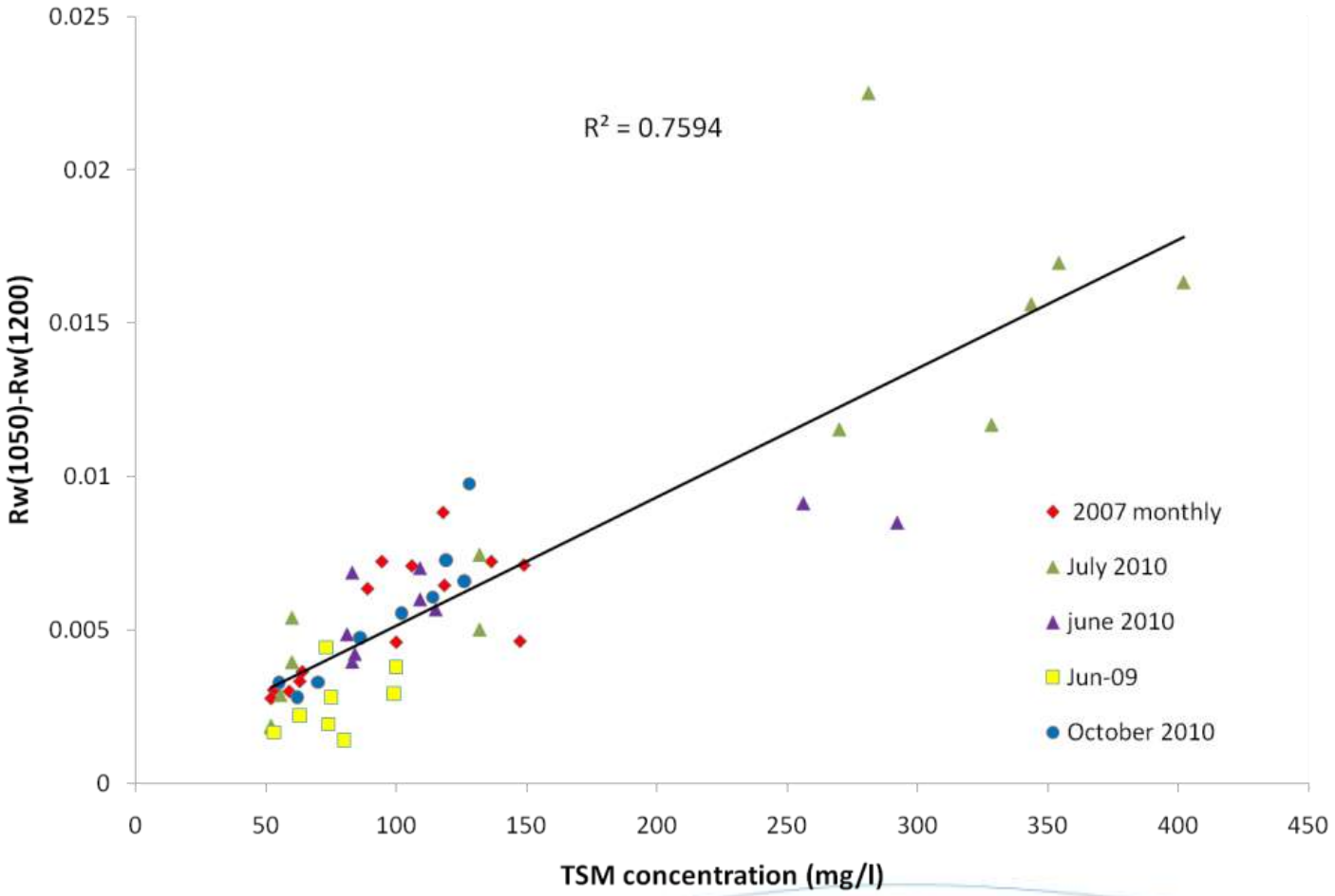




a) Correlations with TSM concentration; b) correlations with turbidity

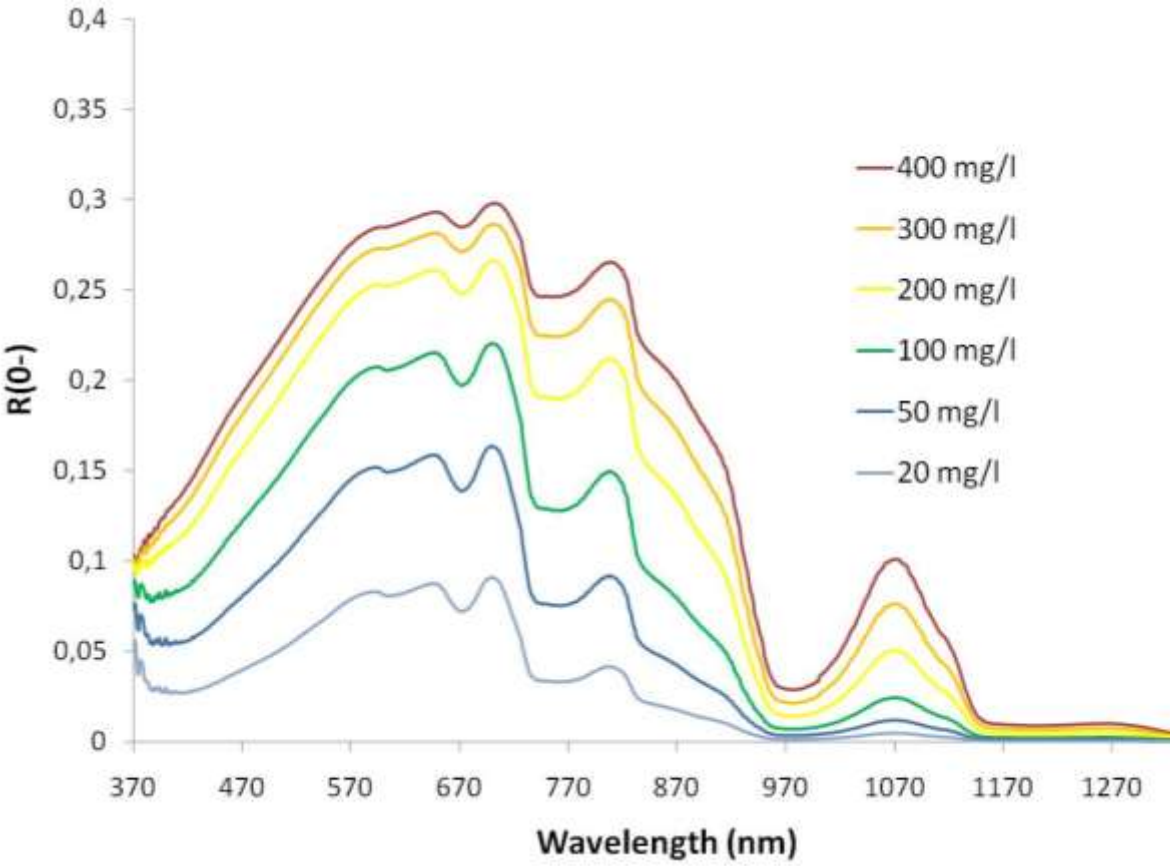
RESULTS

Additional datasets (2007 monthly, June 2009, June 2010)

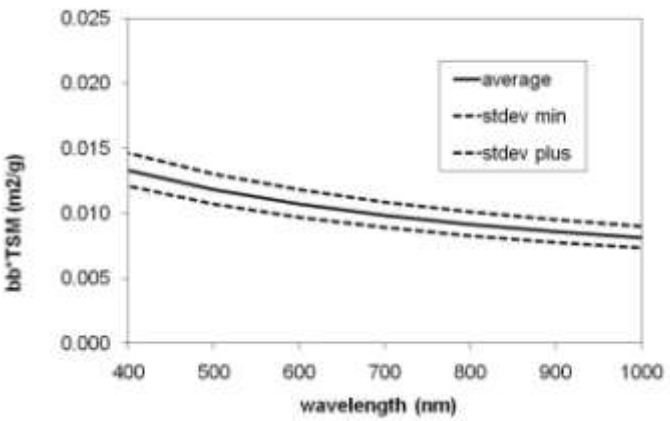


RESULTS

Simulations with Gordon bio-optical model and SIOPS from the Scheldt



Backscattering coefficient



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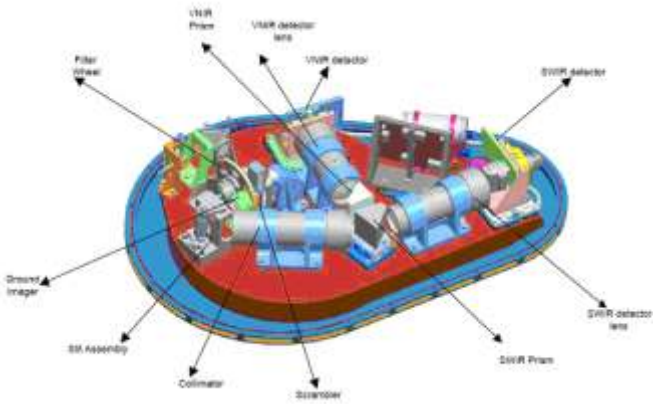
Some more evidence…



APEX (AIRBORNE PRISM EXPERIMENT)

APEX main specifications

Spectral Range	VNIR	380 – 970 nm
	SWIR	940 – 2500 nm
Spectral Bands	VNIR	default 114 bands, reprogrammable
	SWIR	199 bands
Spectral Sampling Interval	VNIR	0.55 – 8 nm over spectral range
	SWIR	5 – 10 nm over spectral range
Spectral Resolution (FWHM)	VNIR	0.6 – 6.3 nm over spectral range
	SWIR	6.2 – 11 nm over spectral range
Spatial Pixels	1000	
FOV (across track)	28	
IFOV	0.48 mrad	
Spatial Sampling Interval	1.75 m @ 3500 m AGL	
Sensor dynamic range	VNIR	CCD, 14 bit encoding
	SWIR	CMOS, 13 bit encoding
Pixel size	VNIR	22.5 µm x 22.5 µm
	SWIR	30 µm x 30 µm
Smile (average over FOV)	0.35 pixels	
Keystone (frown, average over FOV)	0.35 pixels	
Co-Registration (average over FOV)	0.6 pixels	

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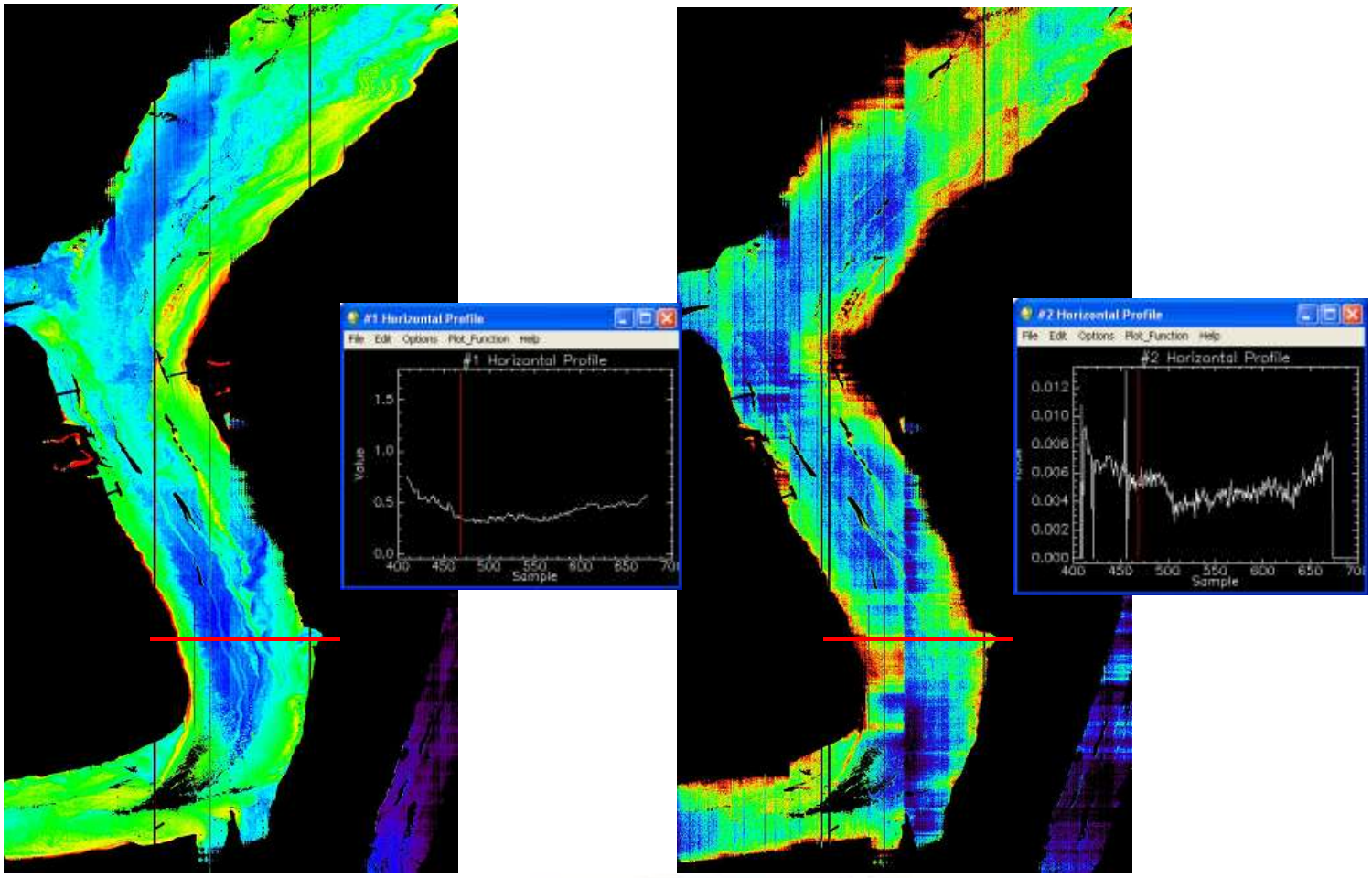
RESULTS

APEX Hyperspectral Scheldt



Rw711/Rw597 Rw 1020

CONCLUSIONS

Assessment of black pixel assumption for the OLCI 1020 nm Band:

-> increase in reflectance between 950 and 1150 nm.

-> positive correlation with TSM

WAY FORWARD

Comparison with TRIOS in VNIR

Further assessment in other regions?

RECOMMENDATIONS FOR COASTCOLOUR

- Turbid water atmospheric correction for future sensors E.g. OLCI
- Retrieving information on TSM backscattering in very turbid areas

Recommendations:

- Water-leaving in-situ measurements for black pixel assessment: include other instruments that measure beyond 1000nm
- Measure SIOPS (Bb) beyond 1000 nm.

Thank you

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http://www.publications.vgt.be