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Validation of water reflectance satellite products using an automated hyperspectral system (HYPERNETS site) in the Río de la Plata (Argentina)

- Spatial considerations -

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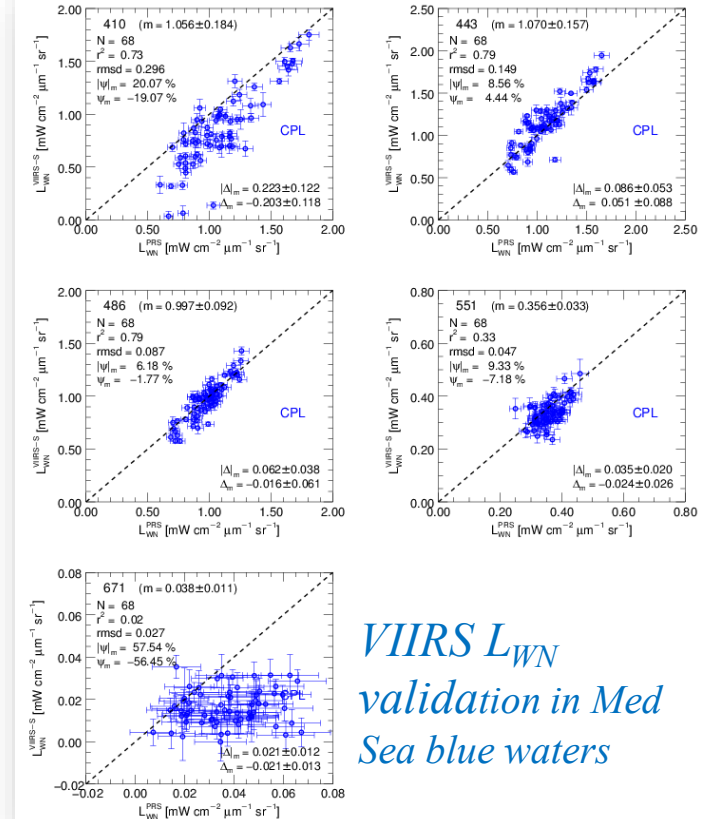
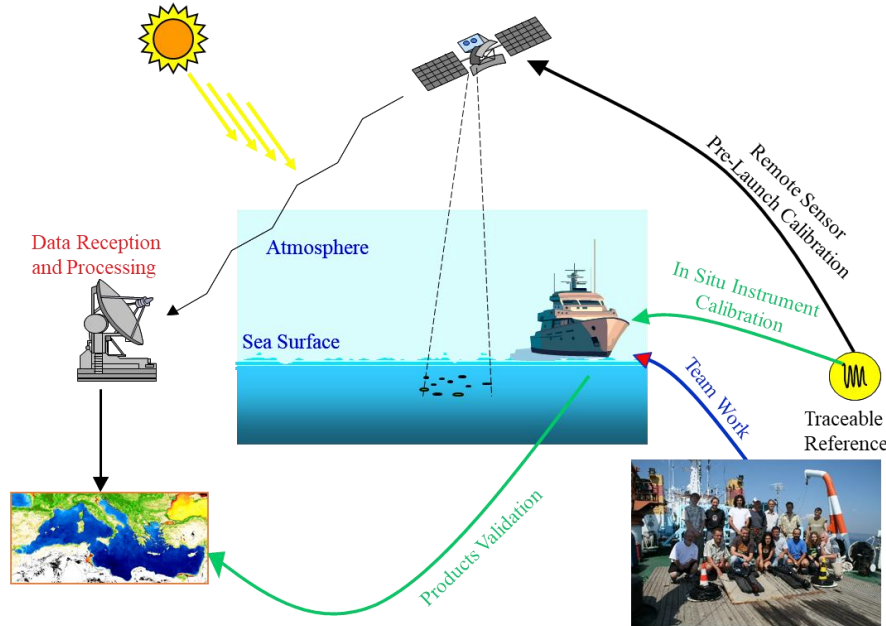
Using the automated HYPERNETS hyperspectral system for multi-mission satellite ocean colour validation in the Río de la Plata, accounting for different spatial resolutions

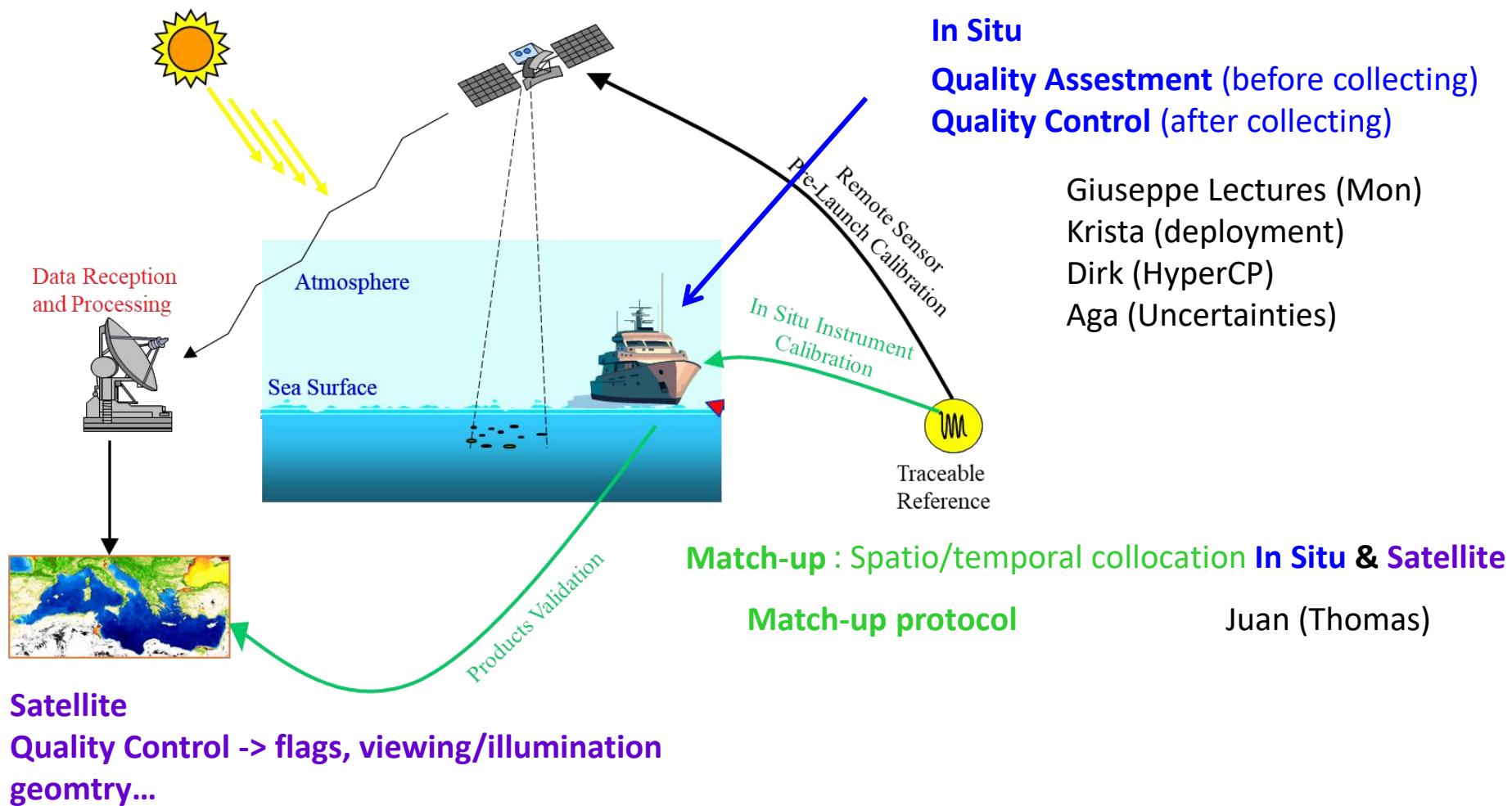
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Validation of satellite data products

Validation is the process of assessing, by independent means, the quality of the data products derived from the system outputs





Match-up Protocol (many decisions to make...)

Temporal considerations

- Time difference between In situ data and satellites overpass (+/- 20 min, 1 h, 2 h...)?

Spatial considerations

Site-specific analysis

EUMETSAT's Matchup Protocols

- Size of pixel window extraction (3x3, 5x5, 7x7)? Location of win
- Number of valid pixels of win using flags (all? 50%, ...) -> which
- Statistics within window: Mean of pixels with Median < 1.5 std
- homogeneity test: CV < X% (10%, 15%, 20%,...?)

Apply local knowledge-based modifications

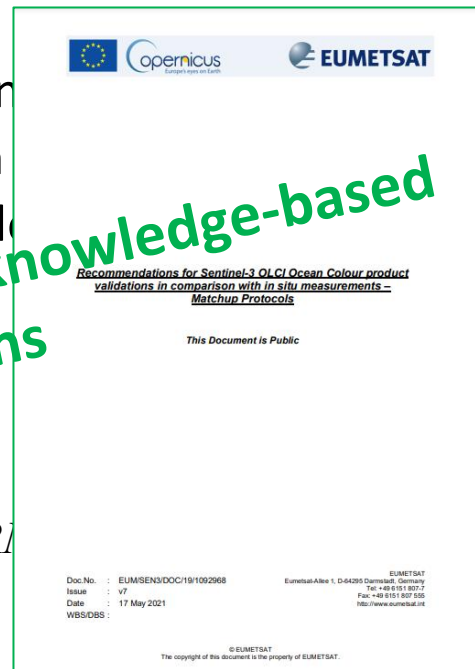
Statistics to evaluate the results

$$RPD = \frac{1}{N} \sum_{i=1}^N \frac{\rho_{sat} - \rho_{situ}}{\rho_{situ}} \times 100$$

$$APD = \frac{1}{N} \sum_{i=1}^N \frac{|\rho_{sat} - \rho_{situ}|}{\rho_{situ}} \times 100$$

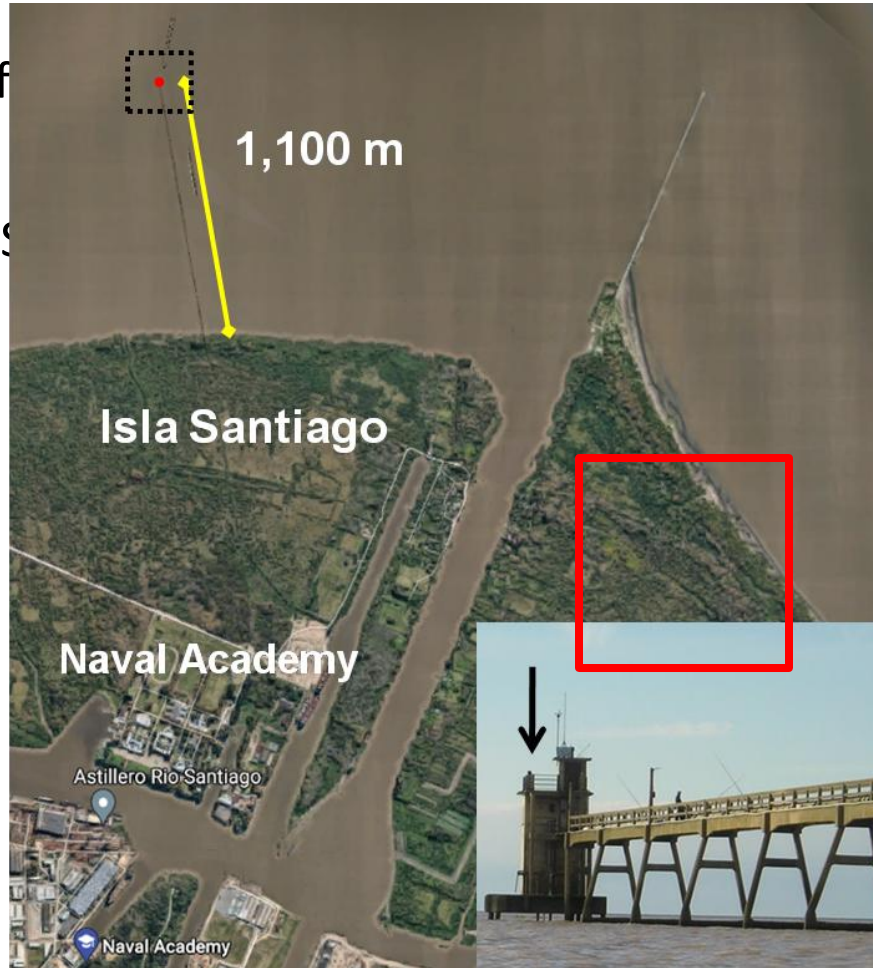
RPD

SMA type II Regression: Slope, R²



Río de la Plata study area

- Large f
- Drains
- High TS



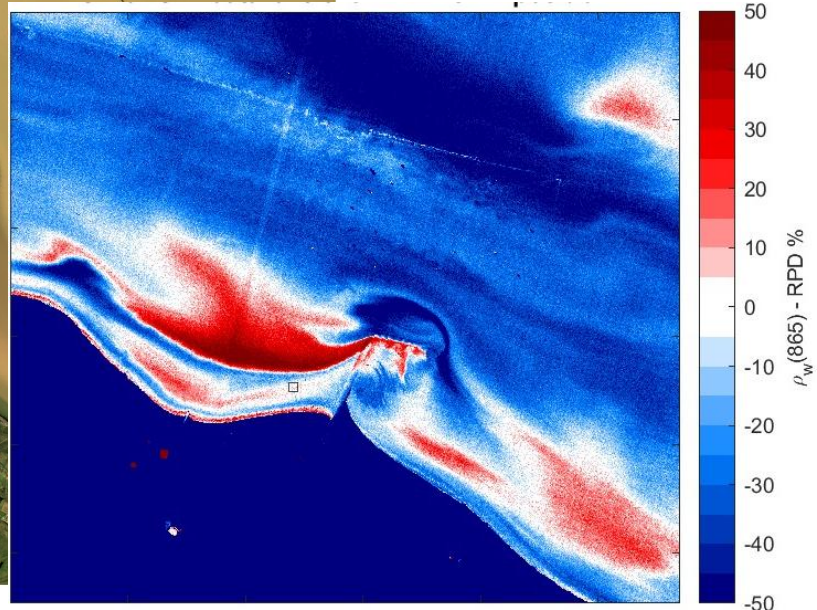
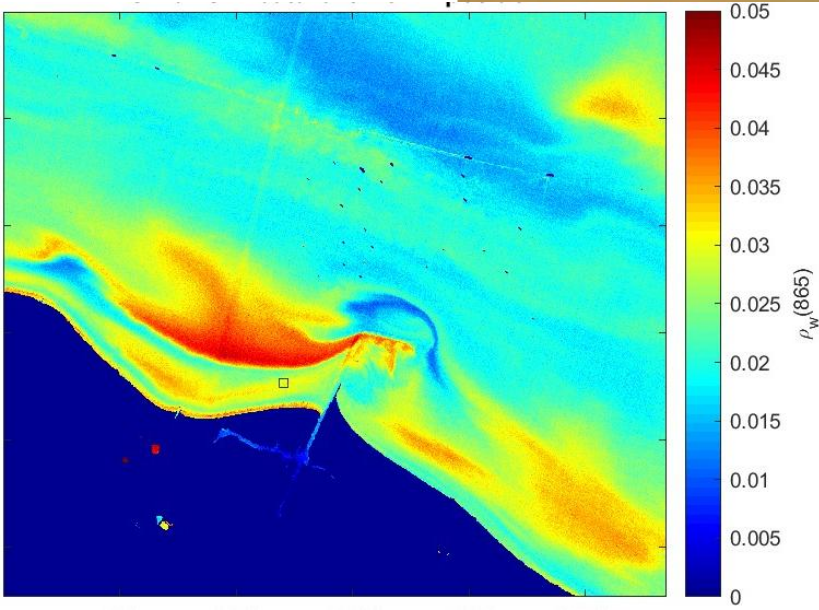
g for sat val

Spatial variability

S2A/MSI 2018-08-27 14:01:39
 ρ_s RGB



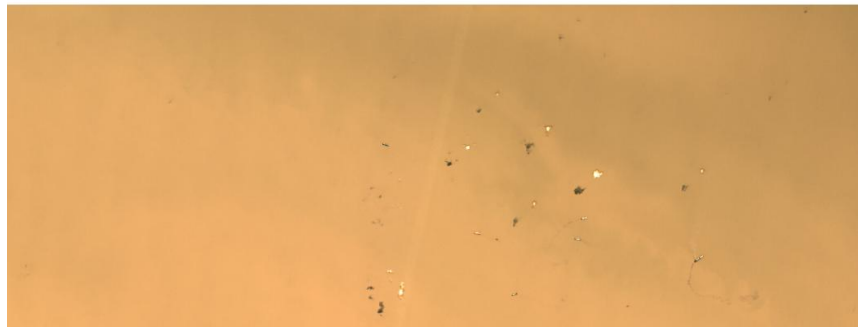
$$RPD_i = \frac{\rho_i - \rho_{site}}{\rho_{site}} \times 100$$



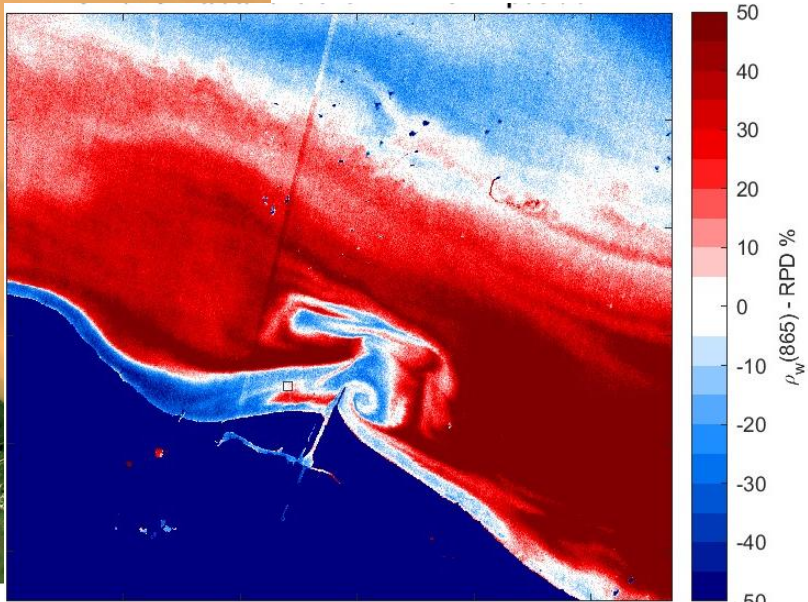
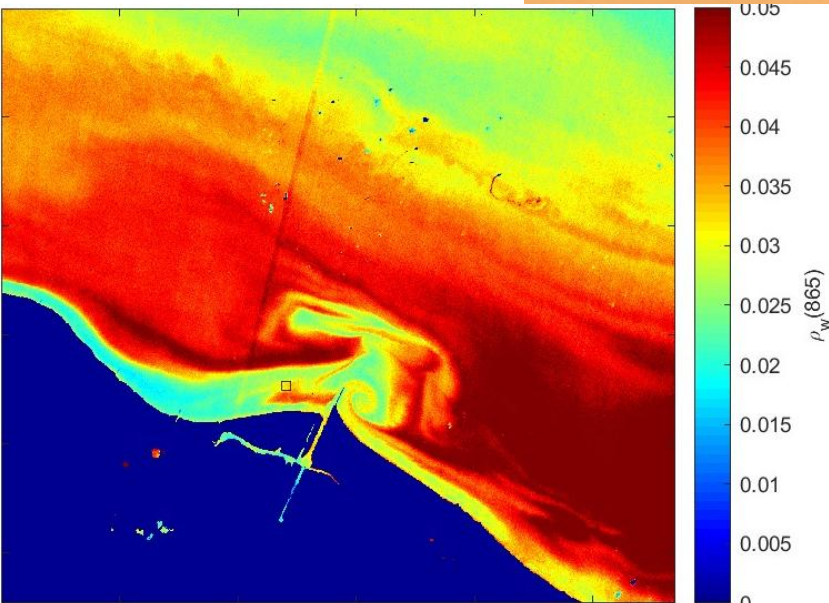
Spatial variability

S2A/MSI 2019-03-25 14:02:10

ρ_s RGB



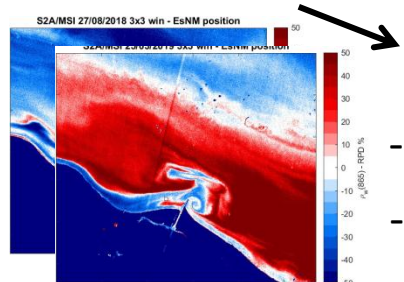
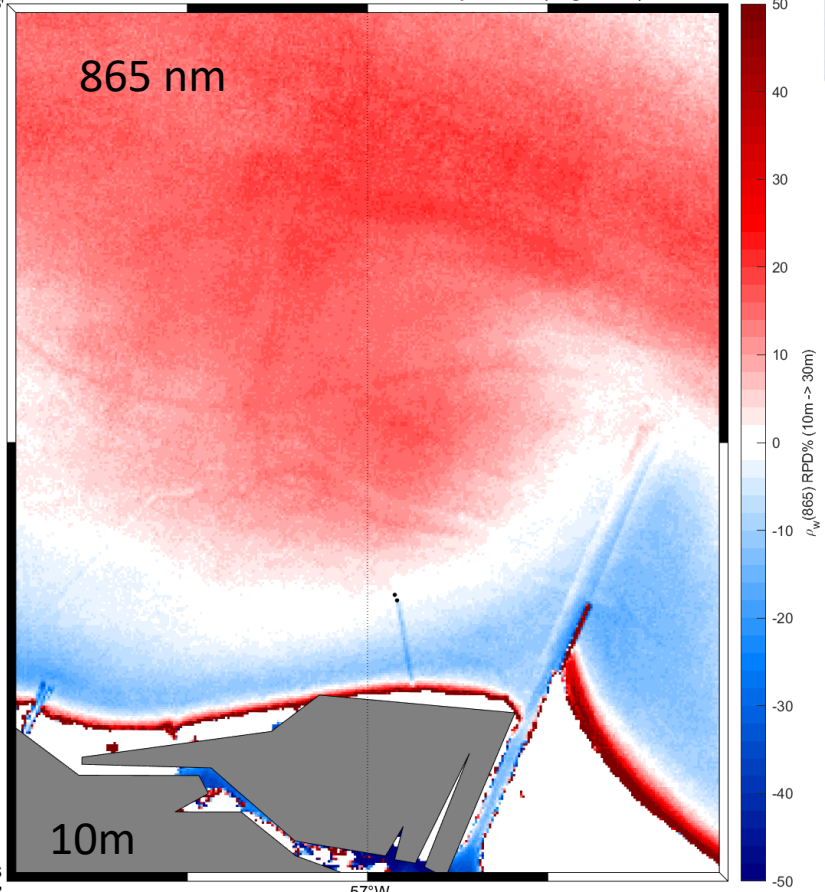
$$RPD_i = \frac{\rho_i - \rho_{site}}{\rho_{site}} \times 100$$



Quantify spatial variability

S2 (A&B) time series 2016-2021

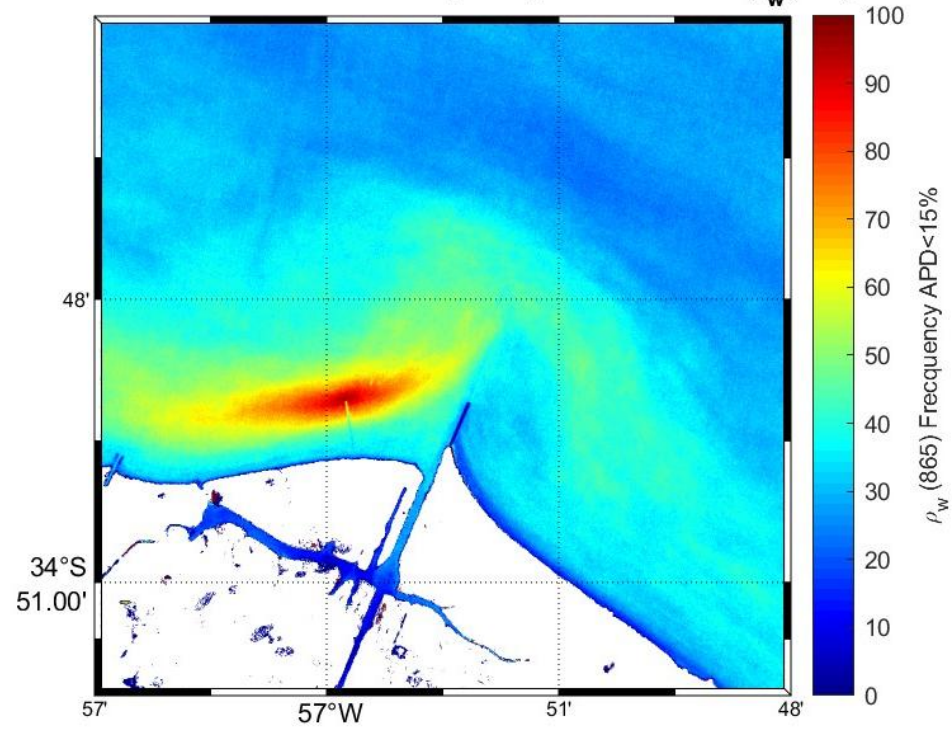
S2/MSI 865nm MedRPD% 10m -> 30m LPAR positions (orig & new)



$$APD_i = \frac{|\rho_i - \rho_{site}|}{\rho_{site}} \times 100$$

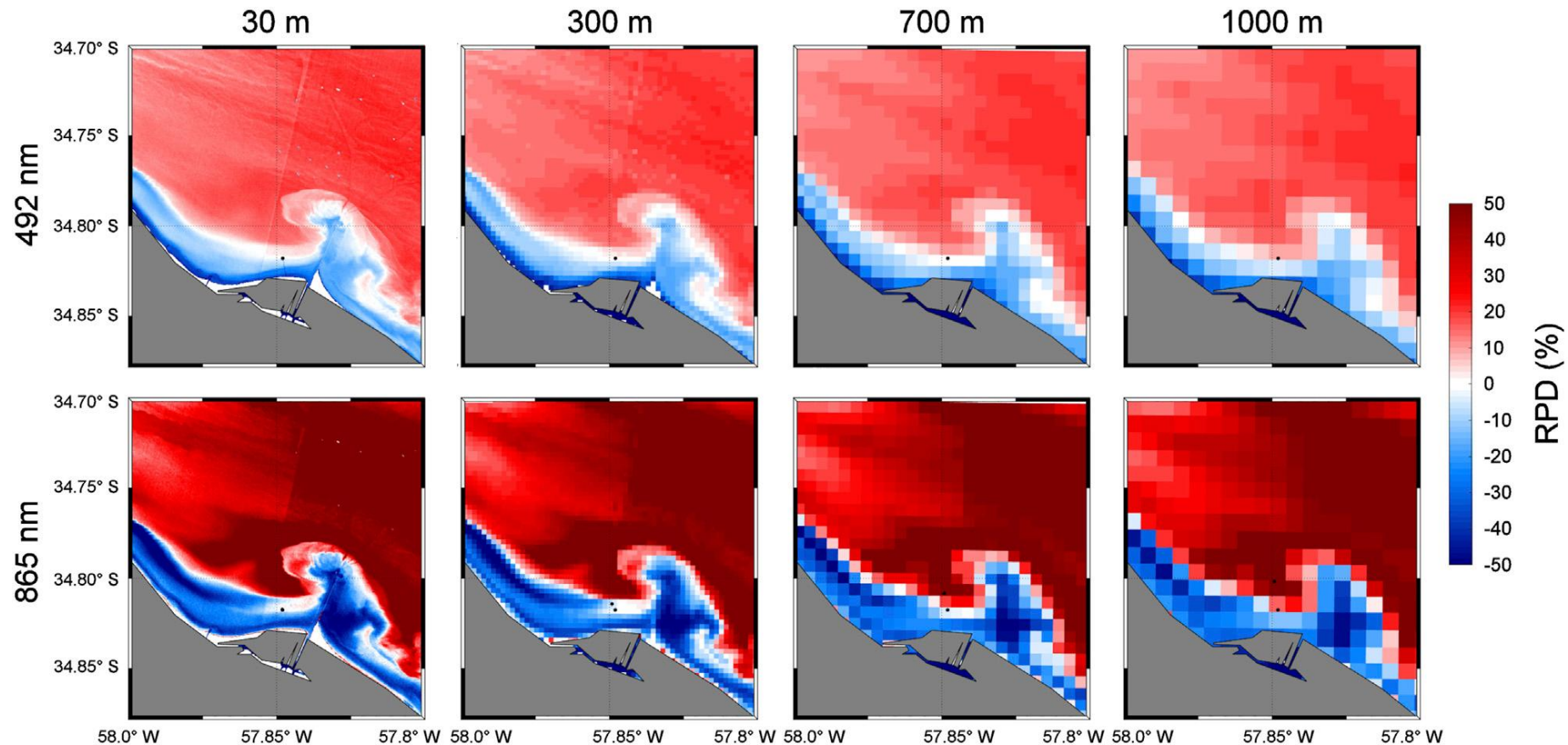
- daily APD maps (10m)
- calculate frequency of $APD < 15\%$

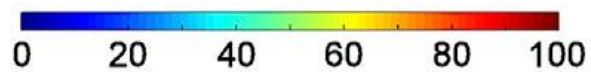
RdP-EsNM S2 2015-2021 Frequency of $APD\% < 15 - \rho_w(865)$



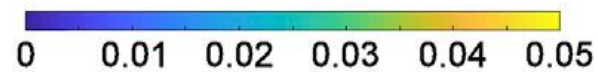
Resample S2 (10m) to different spatial resolutions...

Comparing $\rho_{\text{site}}(10\text{m})$ to $\rho_i(X\text{ m})$

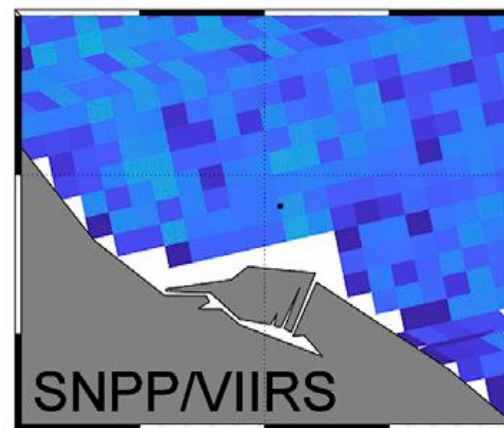
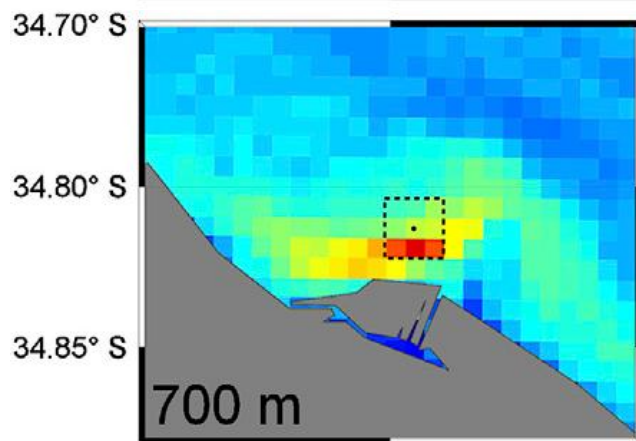
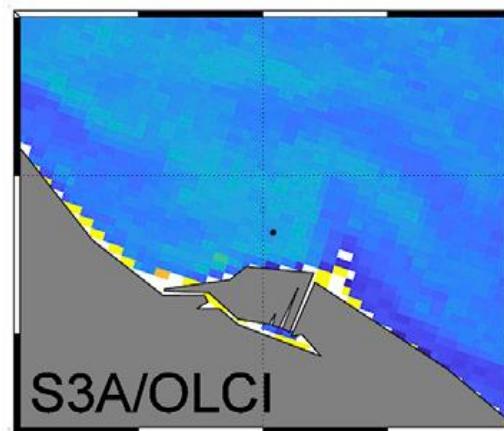
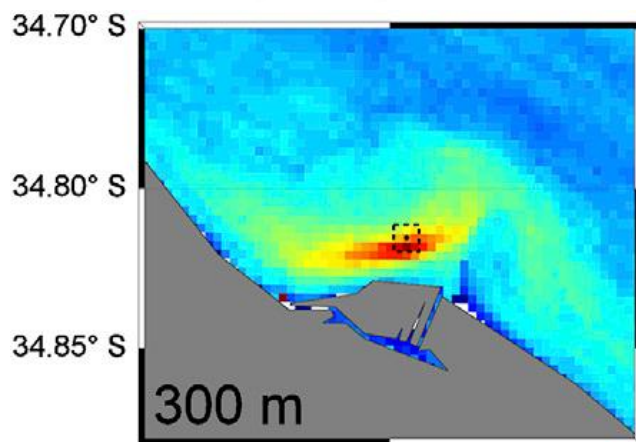


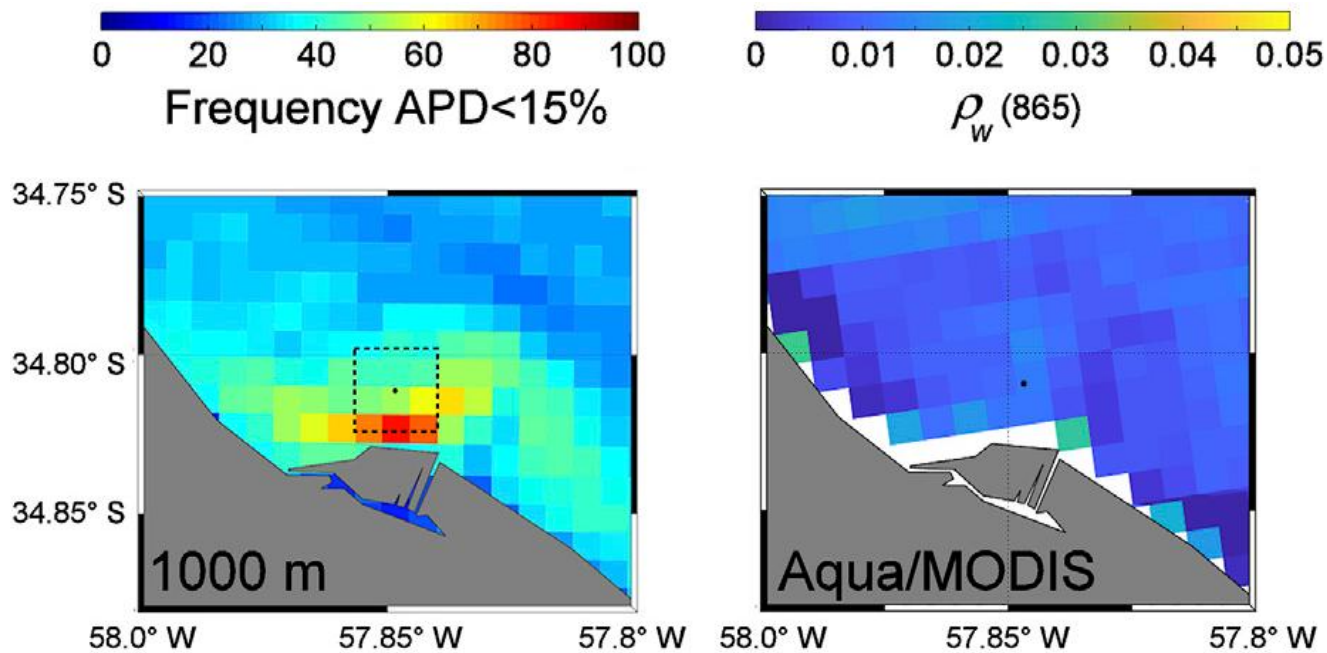


Frequency APD<15%

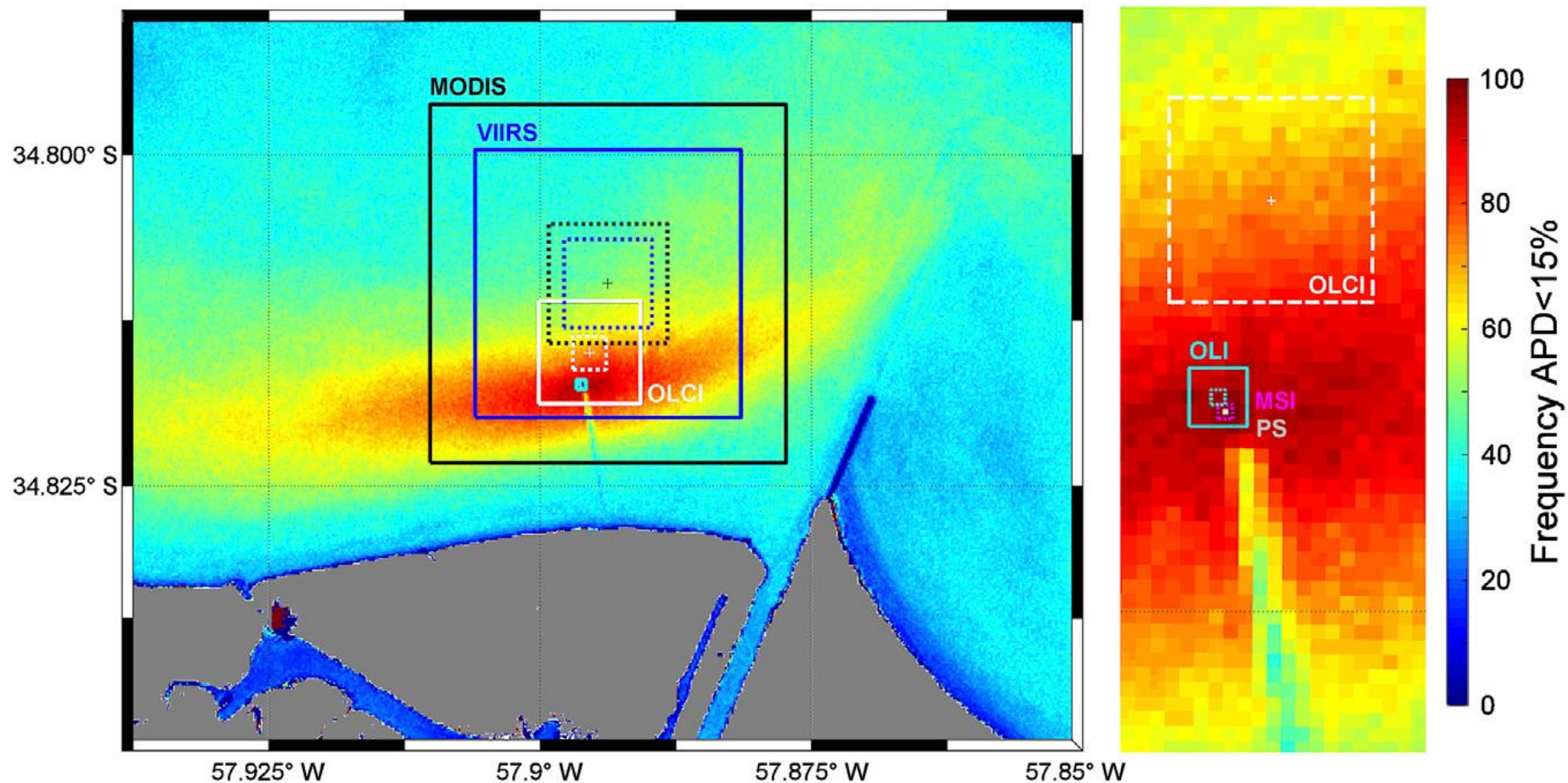


$\rho_w(865)$





Reference pixel selection



--- Reference pixel

..... Exact location

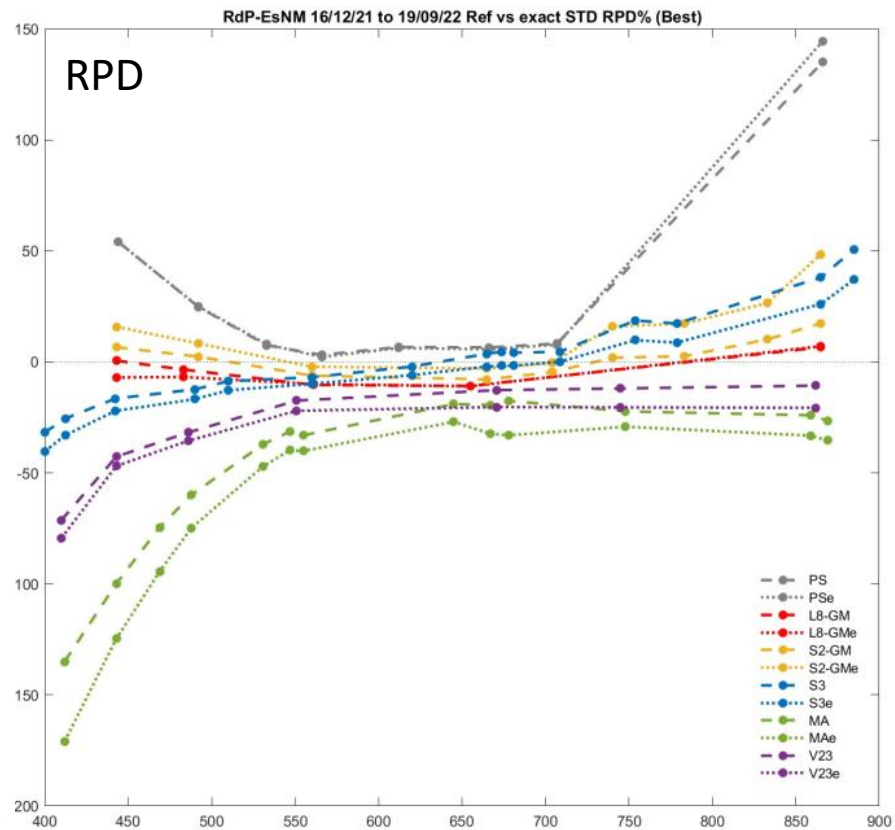
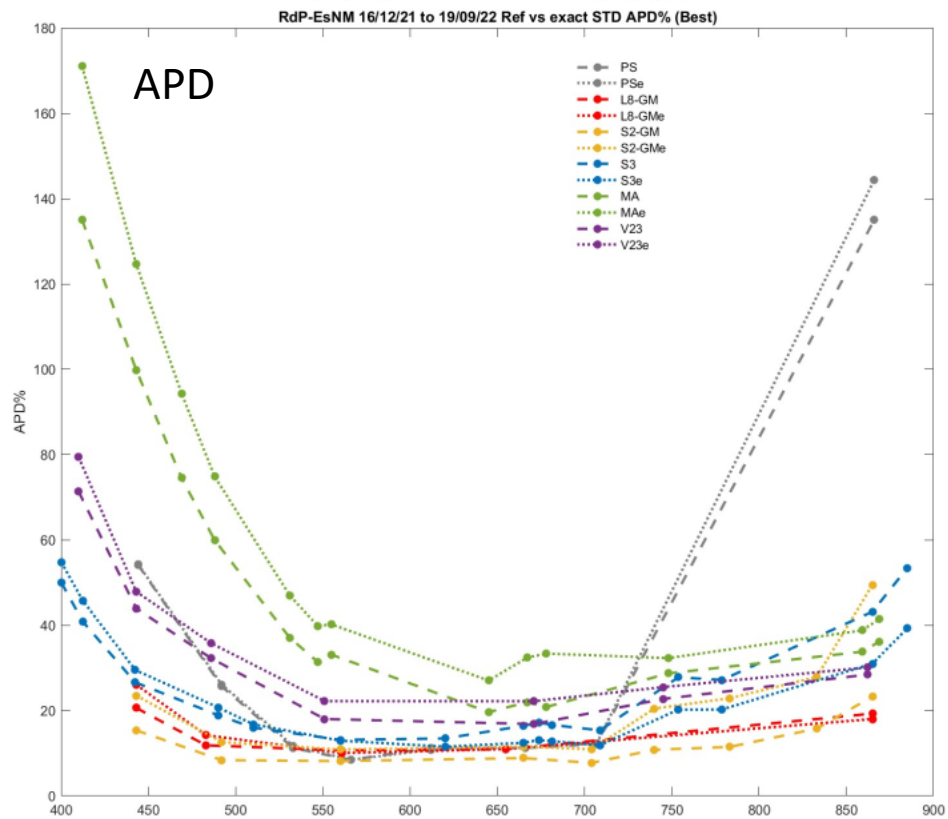


TABLE 3 Reference pixel location depending on the spatial resolution of the systems and statistics for 492 and 865 nm bands. medAPD: median absolute percentage difference (%), medRPD: median relative percentage difference (%).

Resolution [m]	Sensor	Latitude [°]	Longitude [°]	Statistics	492 nm	865 nm
3	SD	-34.817570	-57.896118			
10/20	MSI	-34.817493	-57.896960	medAPD	1.44	1.58
				medRPD	0.05	0.12
				RMSD	0.0014	0.0009
30	OLI/PRISMA	-34.817356	-57.896229	medAPD	1.17	2.67
				medRPD	0.51	0.60
				RMSD	0.0018	0.0033
300	OLCI	-34.814934	-57.895401	medAPD	2.85	7.14
				medRPD	1.72	2.48
				RMSD	0.0040	0.0058
700	VIIRS	-34.809700	-57.893700	medAPD	4.75	12.47
				medRPD	3.43	7.56
				RMSD	0.0057	0.0087
1,000	MODIS	-34.809700	-57.893700	medAPD	4.63	11.18
				medRPD	2.80	6.14
				RMSD	0.0051	0.0077

Match-up

Temporal considerations

- In situ data **interpolated** to time of satellites overpass (<20 min), if two measurements w/ 30 min of satellite overpass

Spatial considerations

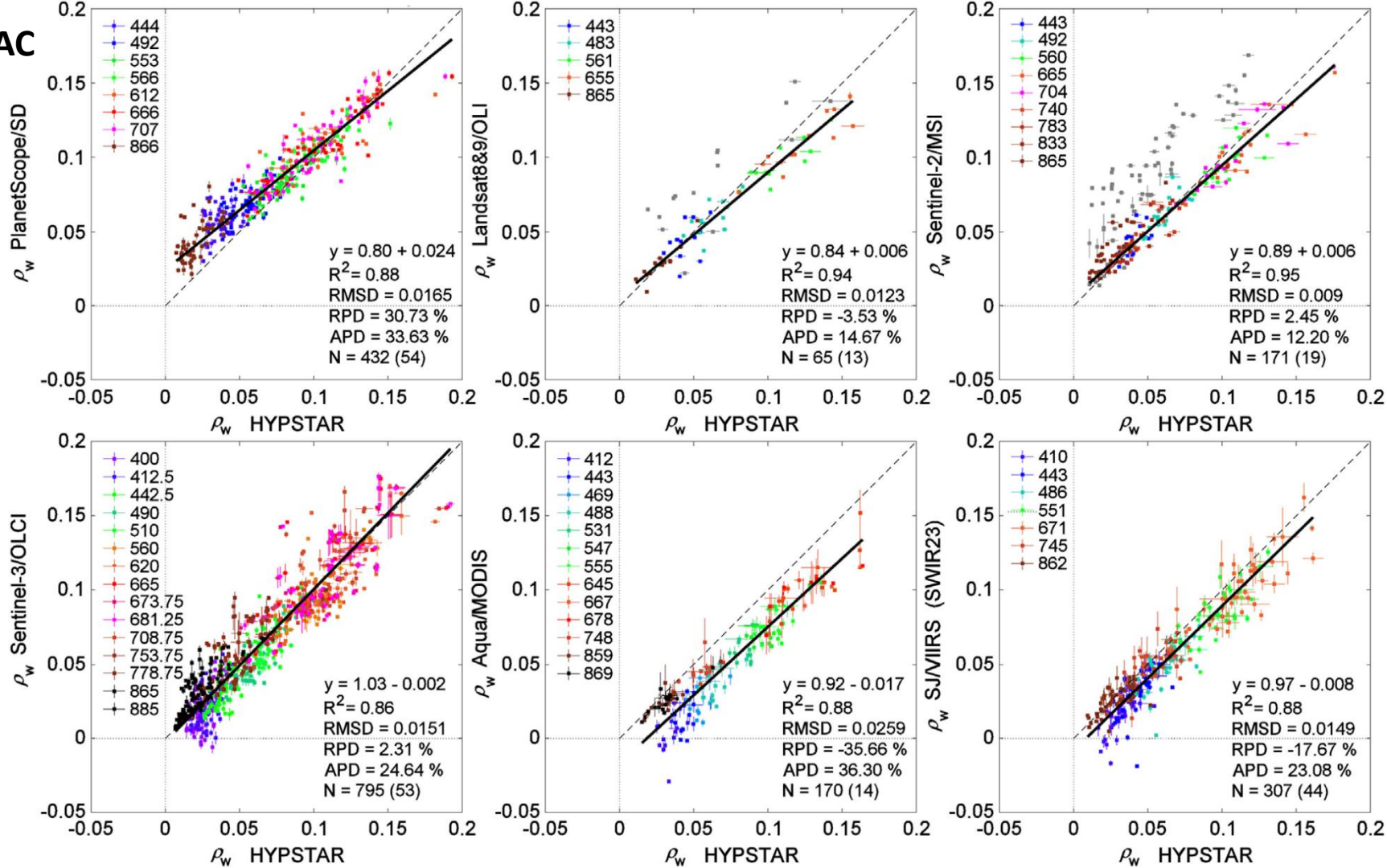
- 3 x 3 pixel window extraction
- 5 out-of-9 valid pixels (flags suggested for each processor were used)
- Mean of pixels with Median < 1.5 stdev
- CV<15%

Statistics

$$RPD = \frac{1}{N} \sum_{i=1}^N \frac{\rho_{sat} - \rho_{situ}}{\rho_{situ}} \times 100 \quad APD = \frac{1}{N} \sum_{i=1}^N \frac{|\rho_{sat} - \rho_{situ}|}{\rho_{situ}} \times 100 \quad RMSD = \sqrt{\frac{\sum_{i=1}^N (\rho_{sat} - \rho_{situ})^2}{N}}$$

SMA type II Regression: Slope, R²

Std AC



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Thank you!

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