Laboratoire d'Océanologie
et de Géosciences
UMR 8187 – CNRS – Univ. Lille – ULCO

Université
Littoral Côte d'Opale

IOCCG WG on atmospheric correction over turbid waters

03 May 2021
IOCCG annual meeting

Scope of the WG

- This WG: only on nLw(NIR) ≠ 0

- **Not sensor-specific** → MODIS-A just an application

- Other issues not adressed

- One dedicated chapter
  - Adjacency effects
  - Other issues (absorbing aerosols, CDOM)

Choice of AC

- NASA standard AC (GW94; Bailey et al., 2010)
- MUMM AC (Ruddick et al., 2000; 2006)
- NIR-SWIR (Wang and Shi, 2008)
- UV AC (He et al., 2012)
- SWIR Extrapolation AC (He and Chen, 2014)
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- Polymer (Steinmetz et al., 2011)
- **C2RCC (Doerffer and Schiller, 2007)**

Summarize of the data processing (1/2)

ALGORITHM	AERONET-OC DATA	LOG DATA	SIMULATED DATA	SATELLITE IMAGES
STD				
MUMM			N/A	
NIR-SWIR				
UV				
SWIRE				
ANN Schroeder				
ANN Fan				
GDE				
POLYMER				

Summarize of the data processing (1/2)

ALGORITHM	AERONET-OC DATA	SIMULATED DATA
STD		
MUMM		N/A
NIR-SWIR		
UV		
SWIRE		
ANN Schroeder		
ANN Fan		
GDE		
POLYMER		
CR2CC	In progress	In progress

Evaluation of atmospheric correction

→ Classic match-up analysis

→ Simulated dataset for sensitivities studies

→ Inspection of satellite images over contrasted coastal regions (Rrs and aerosol optical properties)

Evaluation of atmospheric correction

→ Classic match-up analysis

→ Simulated dataset for sensitivities studies

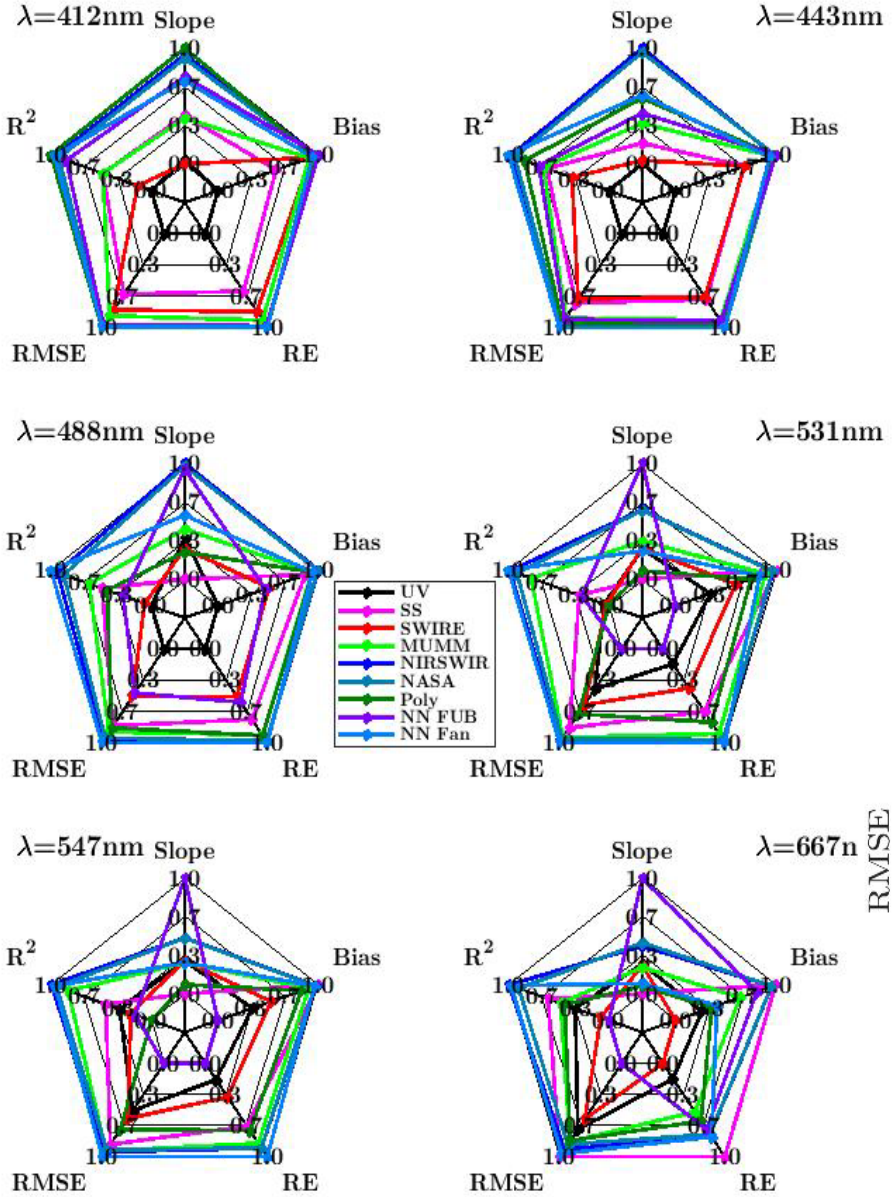
→ ~~Inspection of satellite images over contrasted coastal regions (Rrs and aerosol optical properties)~~

How to evaluate for providing guidances and recommendations?

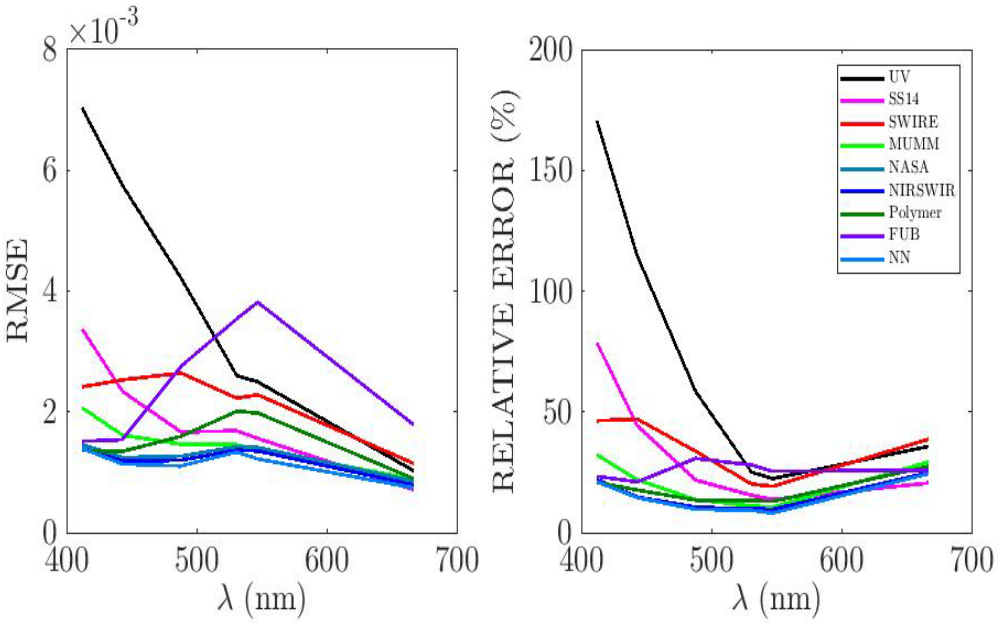
→Classic match-up analysis with AERONET-OC

→ Simulated dataset for sensitivities studies

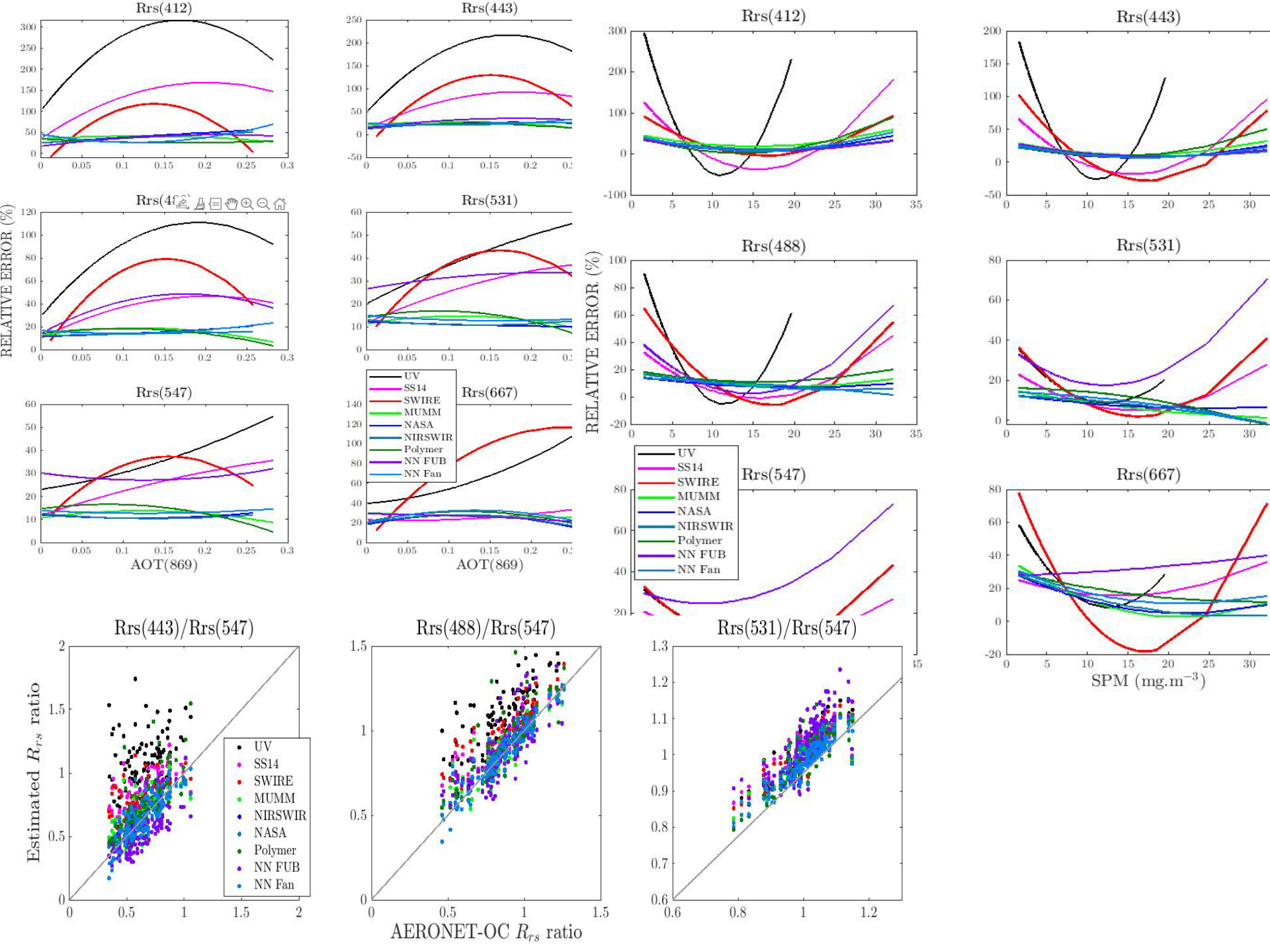
→Inspection of satellite images over contrasted coastal regions (Rrs and aerosol optical properties)

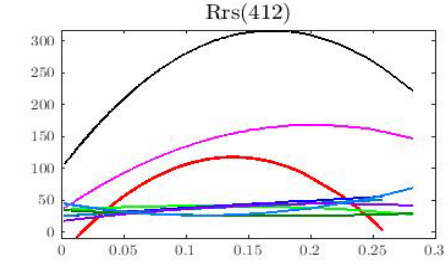


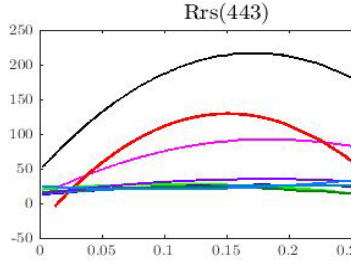
ALGORITHMS	QAS	χ^2 (%)	SAM (°)	S_{tot} (/42)
UV	0.80	136	14.11	13.67
SS14	0.91	42.08	9.02	29.09
SWIRE	0.82	18.50	7.14	22.57
MUMM	0.95	11.81	5.38	34.39
NIRSWIR	0.96	6.83	4.03	38.37
NASA	0.96	6.94	4.03	37.73
Polymer	0.97	14.61	5.01	32.82
NN FUB	0.95	11.51	6.31	23.02
NN Fan	0.97	6.27	4.10	38.63

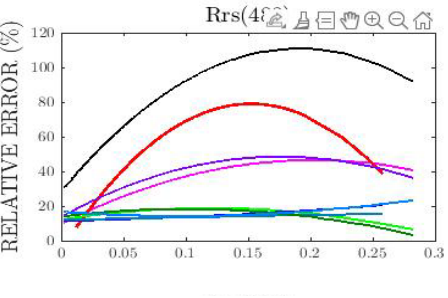


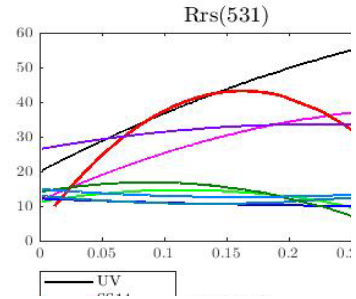
Individual match-up (only positive spectra)

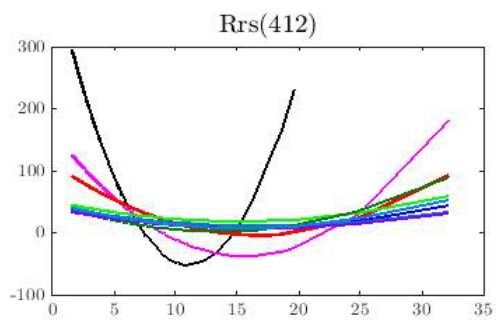

Rrs(412)
Rrs(443)
Rrs(488)
Rrs(531)
Rrs(547)
Rrs(667)
RELATIVE ERROR (%)
AOT(869)
UV
SS14
SWIRE
MUMM
NASA
NIRSWIR
Polymer
NN FUB
NN Fan
SPM (mg.m^{-3})
Rrs(443)/Rrs(547)
Rrs(488)/Rrs(547)
Rrs(531)/Rrs(547)
Estimated R_{rs} ratio
AERONET-OC R_{rs} ratio

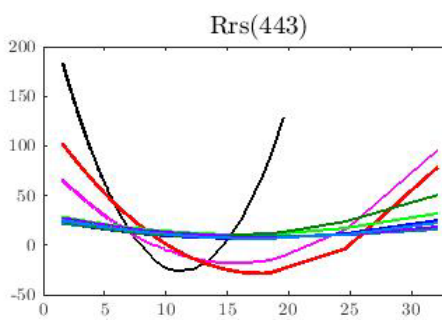


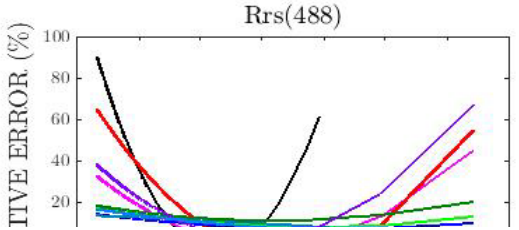


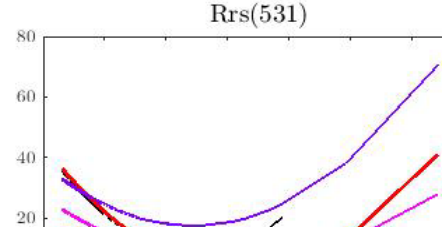




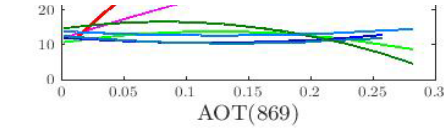


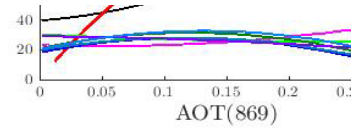


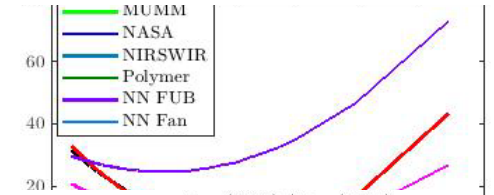


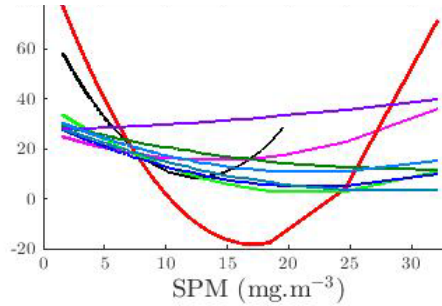


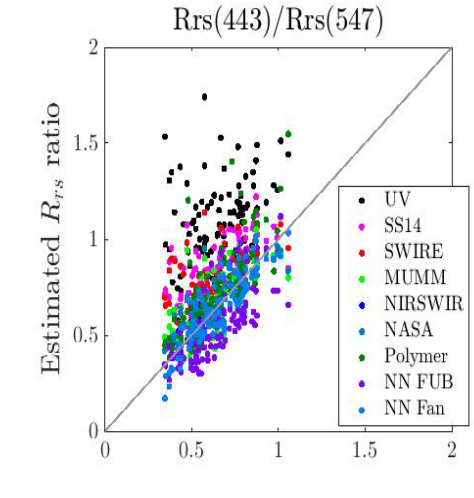
Same work for common match-ups

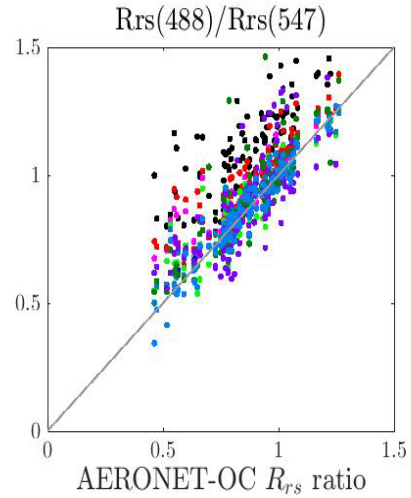


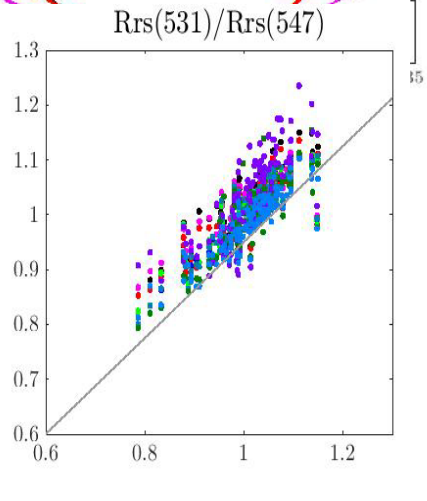












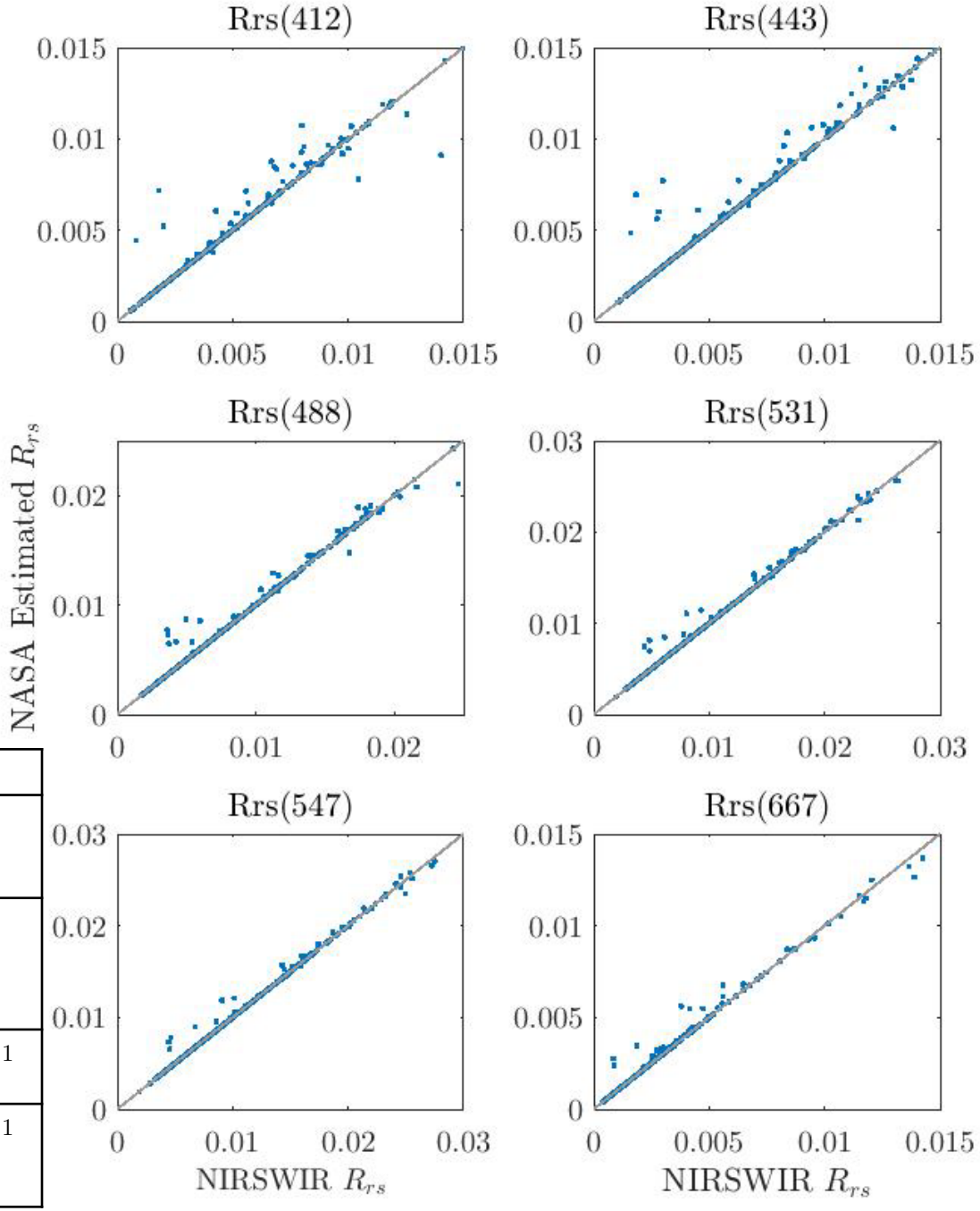
STD vs NIR-SWIR

- NIR-SWIR algo switches as a function of turbidity and chl-a concentration

- How often does it switch to SWIR bands?

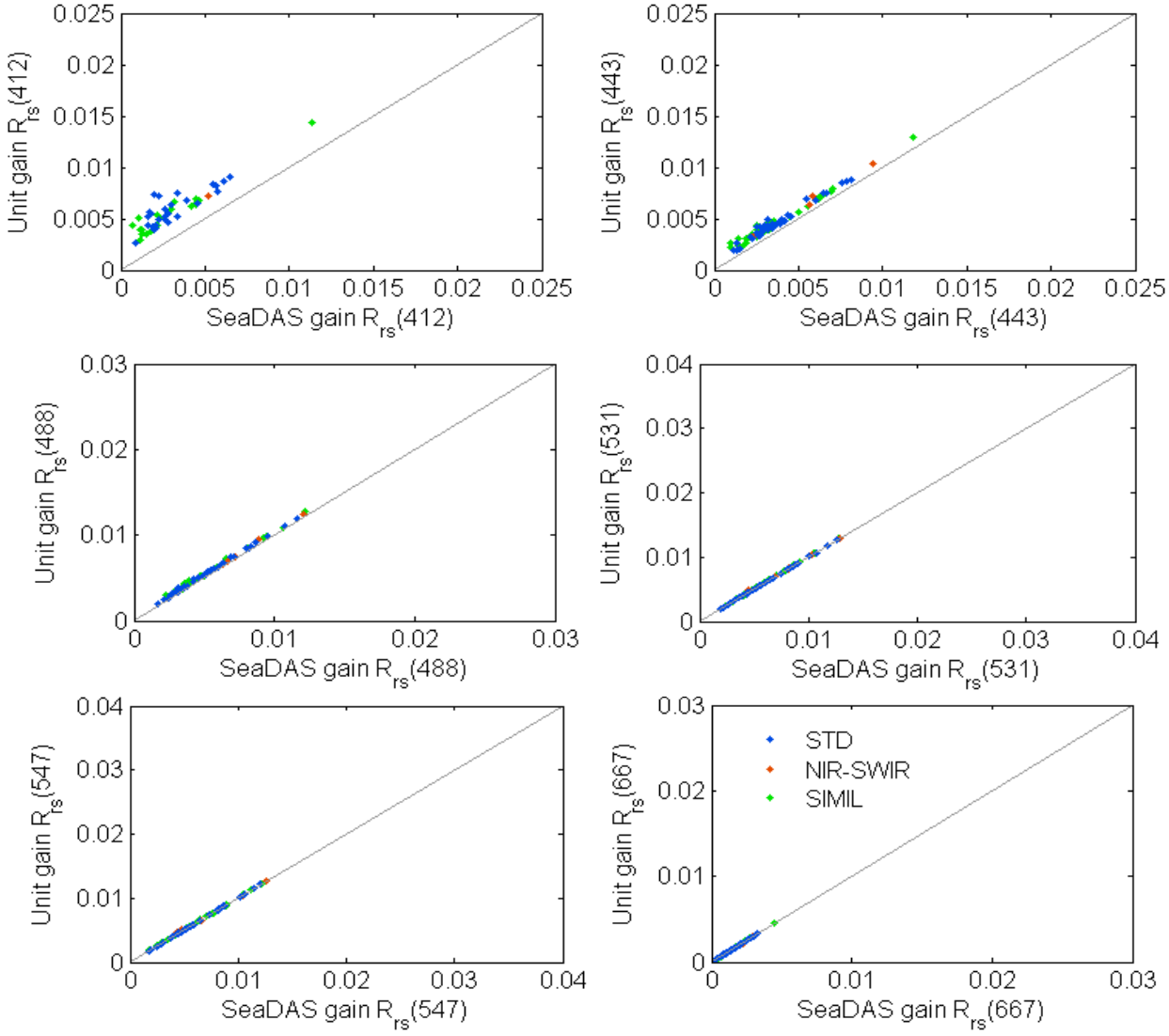
- 120 switches (/510; 23.5%)
- 69 providing bad matchups because of low SWIR SNR
- 51 valid match-ups with switches
- Impact of switching to SWIR bands on the 51 valid match-ups

	412	443	488	531	547	667
REL.ERR NASA	**29**	**18**	**12**	**11**	**11**	**19**
REL.ERR NIRS WIR	35	23	15	12	12	22
RMSE NASA	**0.0021**	**0.0018**	**0.0018**	0.0020	0.0021	0.0011
RMSE NIRS WIR	0.0022	0.0020	0.0020	0.0020	0.0021	0.0011



Scatterplot of estimated $Rrs(\lambda)$ from STD AC model versus NIR-SWIR AC model $Rrs(\lambda)$ at different wavelength (412, 443, 488, 531, 547 and 667 nm)

Impact of the vicarious calibration: Does it advantage STD?



Scatterplot of estimated *Rrs*(λ) from three different AC models for SeaDAS gain versus unit gain at different wavelength (412, 443, 488, 531, 547 and 667 nm) for COVE station (**Gain Check**).

How to evaluate for providing guidances and recommendations?

→Classic match-up analysis

→Simulated dataset for sensitivities studies

Which algorithms?

- NASA standard AC (GW94; Bailey et al., 2010)
- MUMM AC (Ruddick et al., 2000; 2006) → not possible
- NIR-SWIR (Wang and Shi, 2007)
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Almost finalized → Double-checking the results with algorithm's providers

Table of contents of the report

- Introduction about AC in turbid/coastal waters
- Presentation of the AC used in the study → Completed
- Description of the datasets → Completed
  - Simulated
  - In-situ: AERONET
- Evaluation using simulated dataset → To be finished by 31/07
- Evaluation using AERONET-OC dataset → Completed
- Other issues → In progress
  - Adjacency effects
  - Absorbing aerosols
- Conclusion

Drawbacks/flaws

- Only moderate turbid waters
- MODISA spectral band response not included
- No evaluation for optical water types (Moore et al., 2015; Mélin and Vantrepotte, 2015)
- No vicarious calibration for most AC

Thank you
Merci