Effects of cloud adjacency on TOA radiance and ocean color products: A statistical assessment

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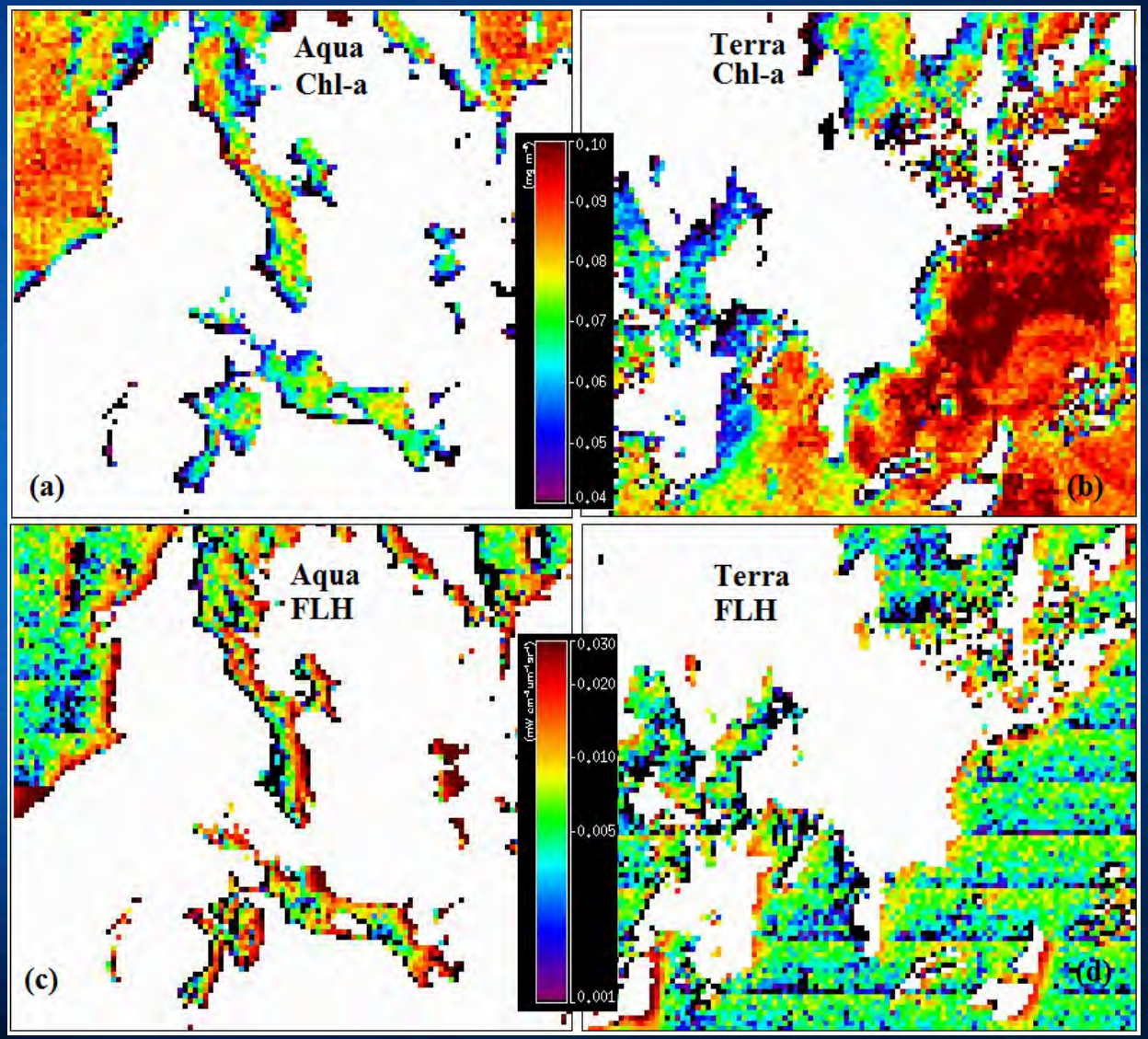
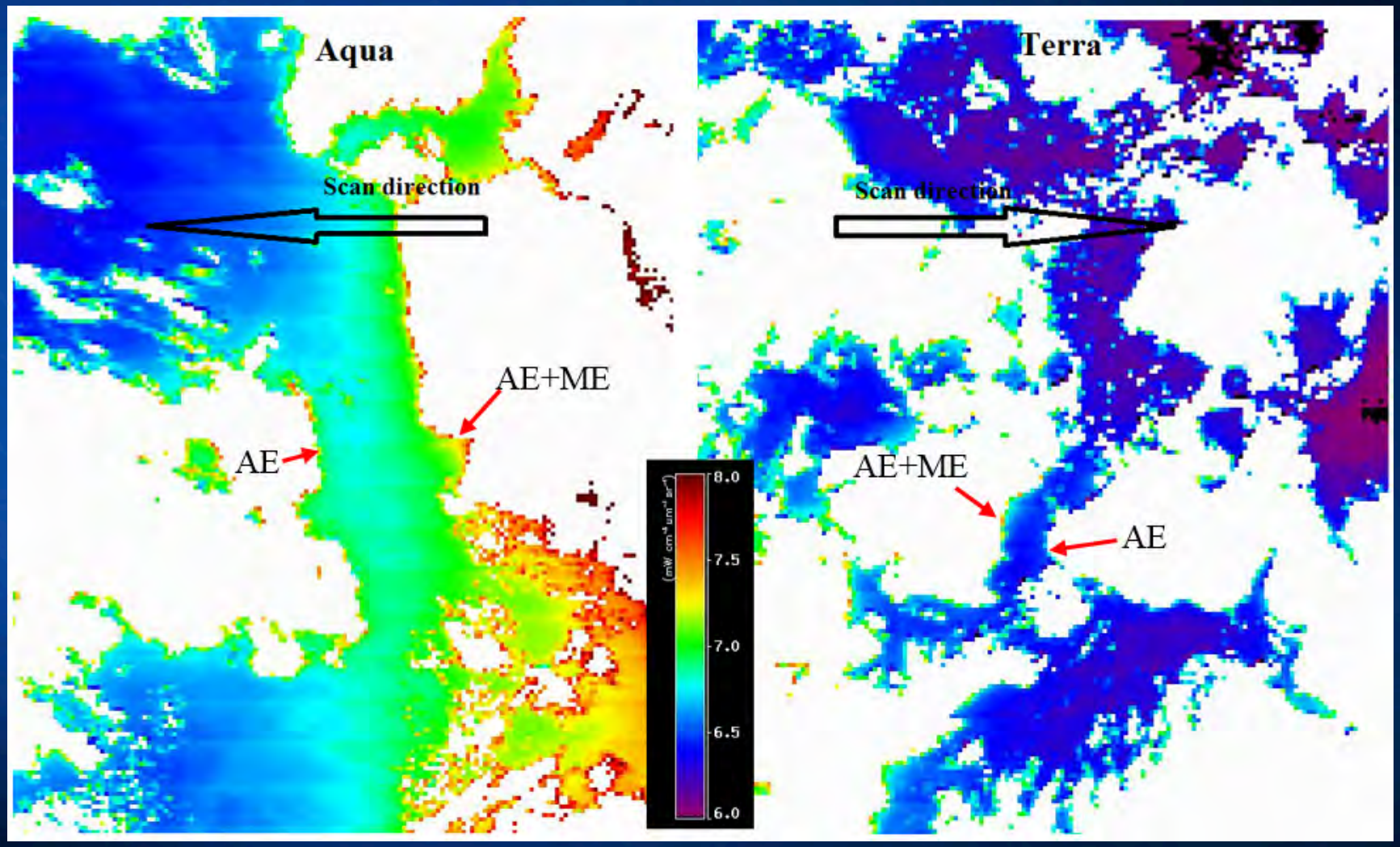
Problem and Motivation



Cloud effects on Chl-a and FLH

Problem and Motivation

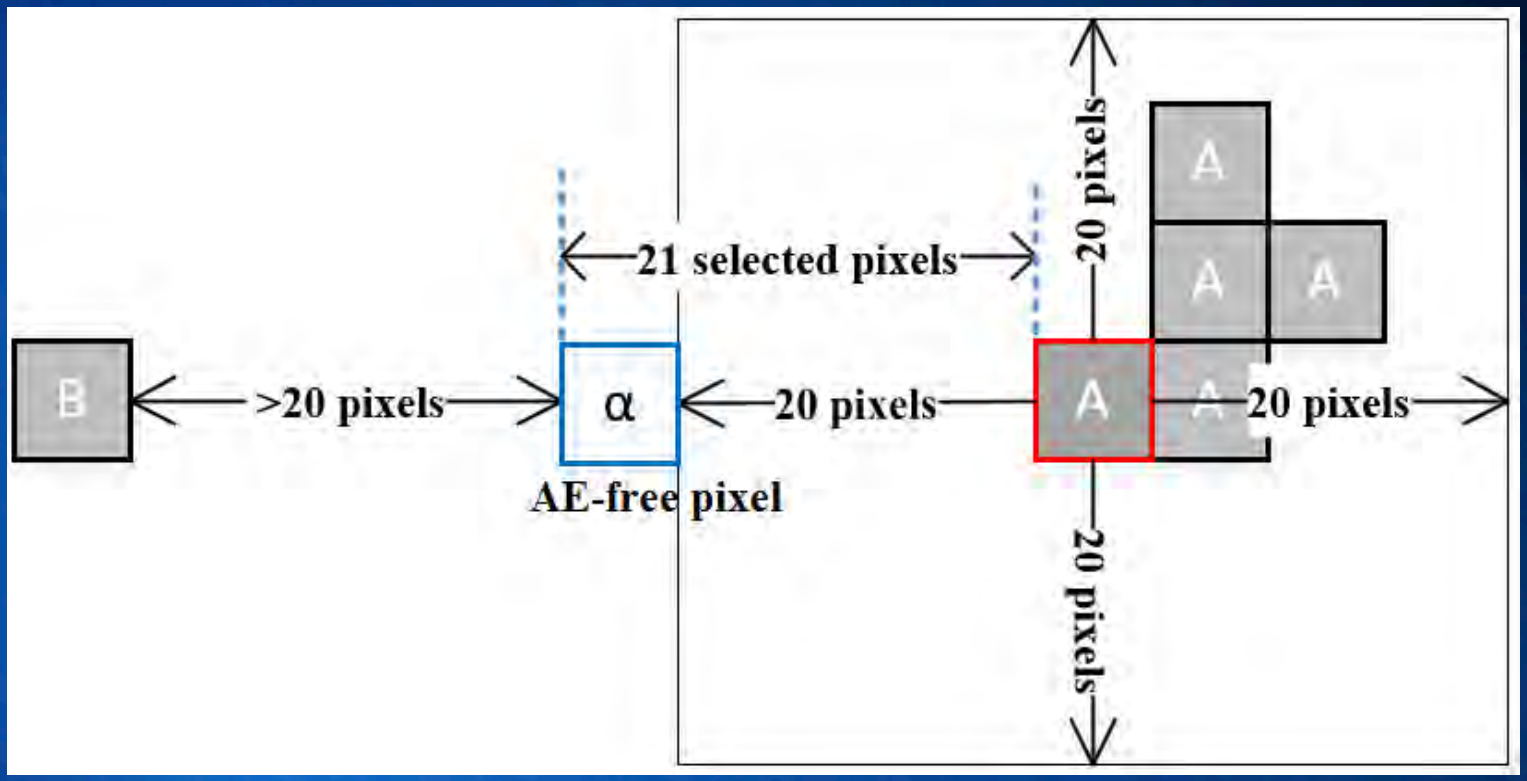


AE and ME in $L_{t,443}$

Objectives

- Understand the spatial scale of cloud adjacency effects in a statistical meaningful approach and evaluate the impacts on the TOA radiance and ocean color products;
- Determine how to minimize such effects on the ocean color products and recover some of the data

Methodology

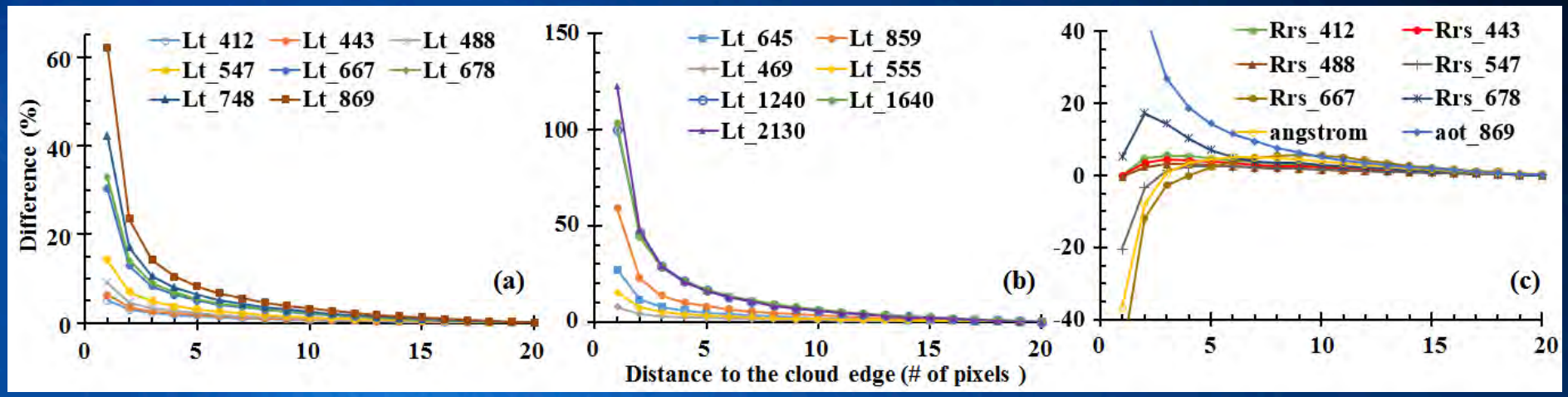


$$\text{Diff}\ (\%) = (\Gamma_i - \Gamma_\alpha)/\Gamma_\alpha \ \text{x}\ 100\%$$

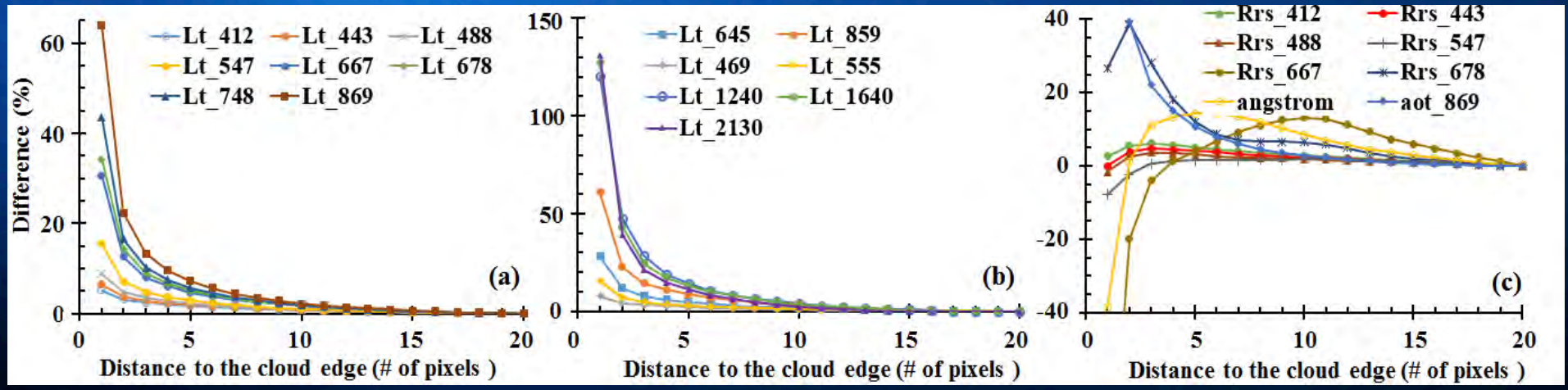
Γ_α and Γ_i are the values of TOA or ocean color products for pixel "α" and the other 20 selected. pixels"α" is the AE-free pixel, and "A" and "B" represent different cloud patches.

Results

ME-free direction



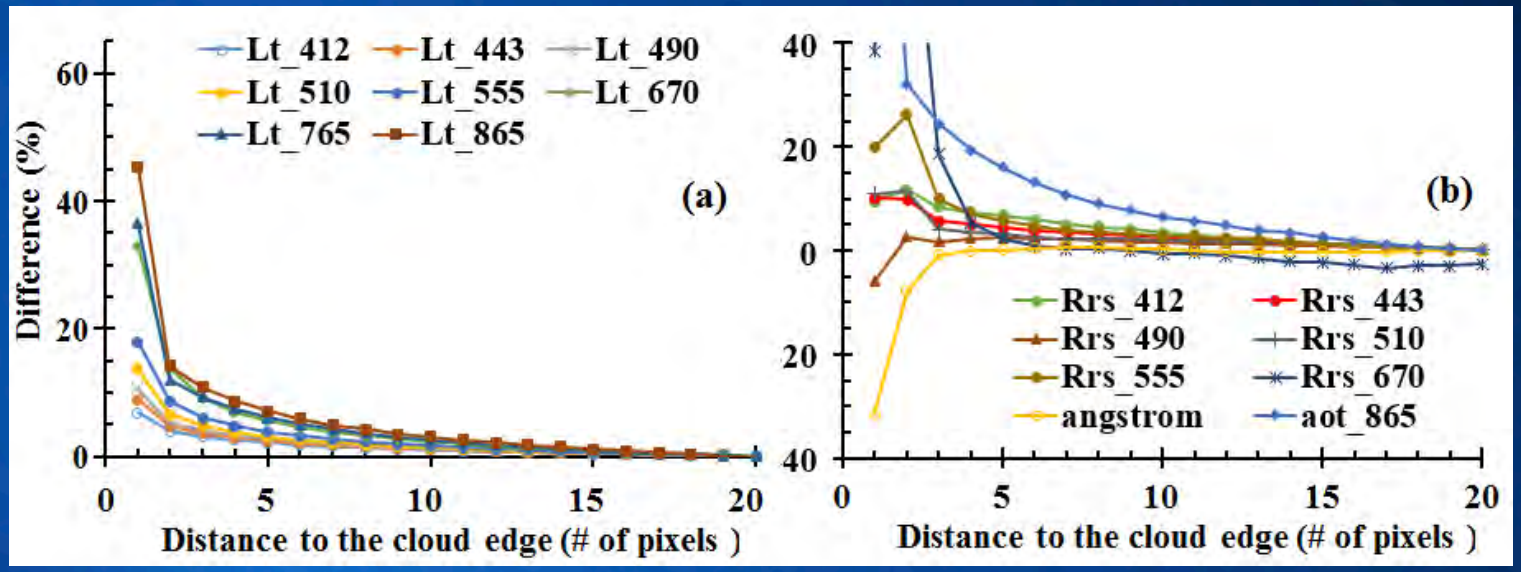
MODISA



MODIST

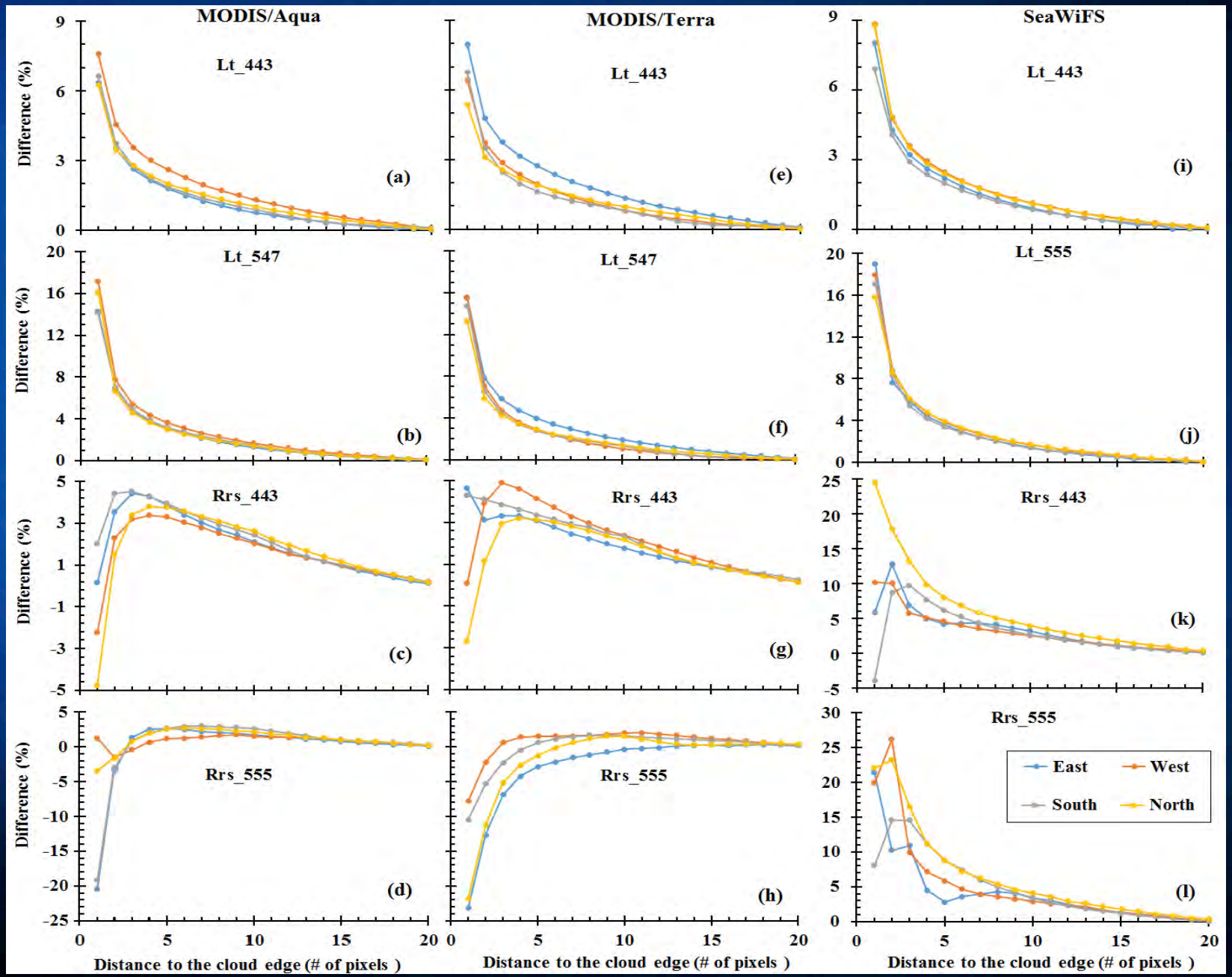
Results

ME-free direction

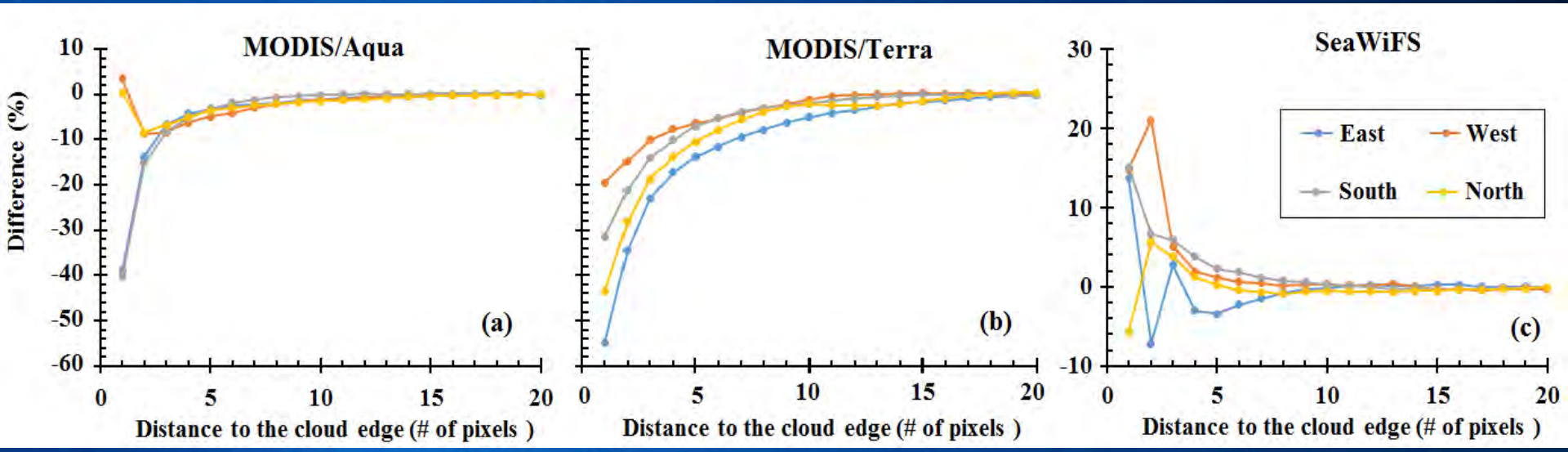


SeaWiFS

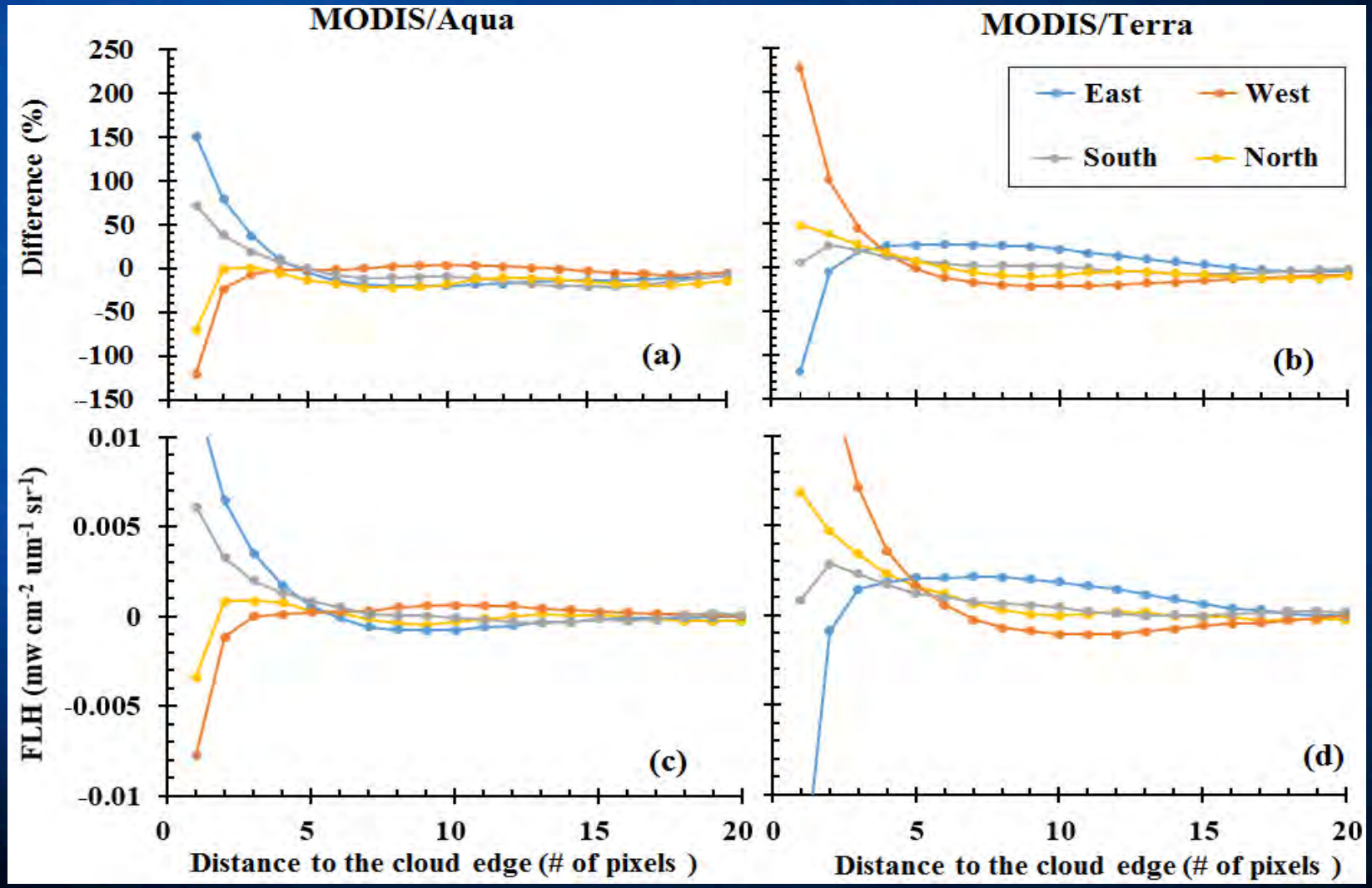
Results: different directions



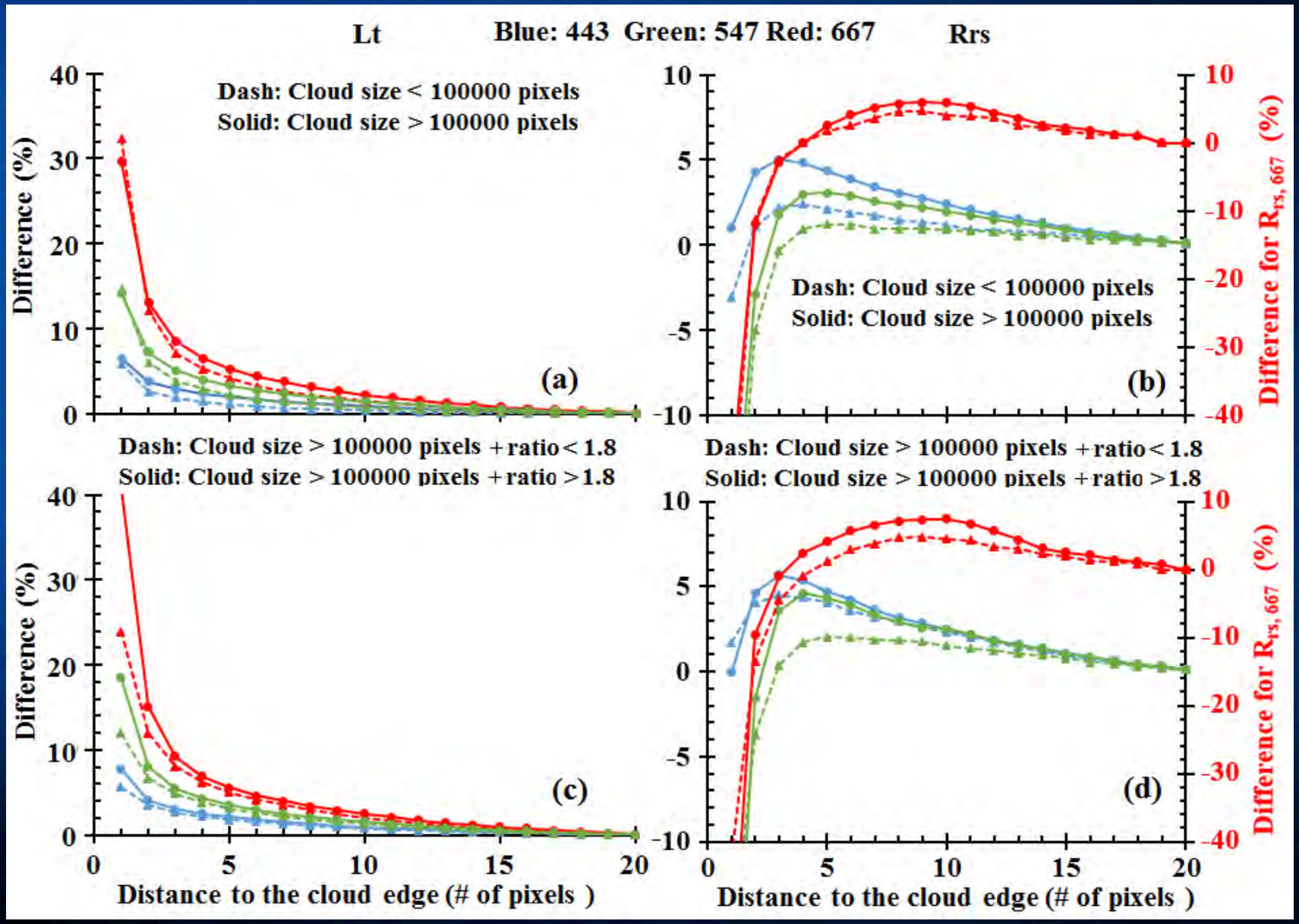
Results: Cloud effects in Chl-a



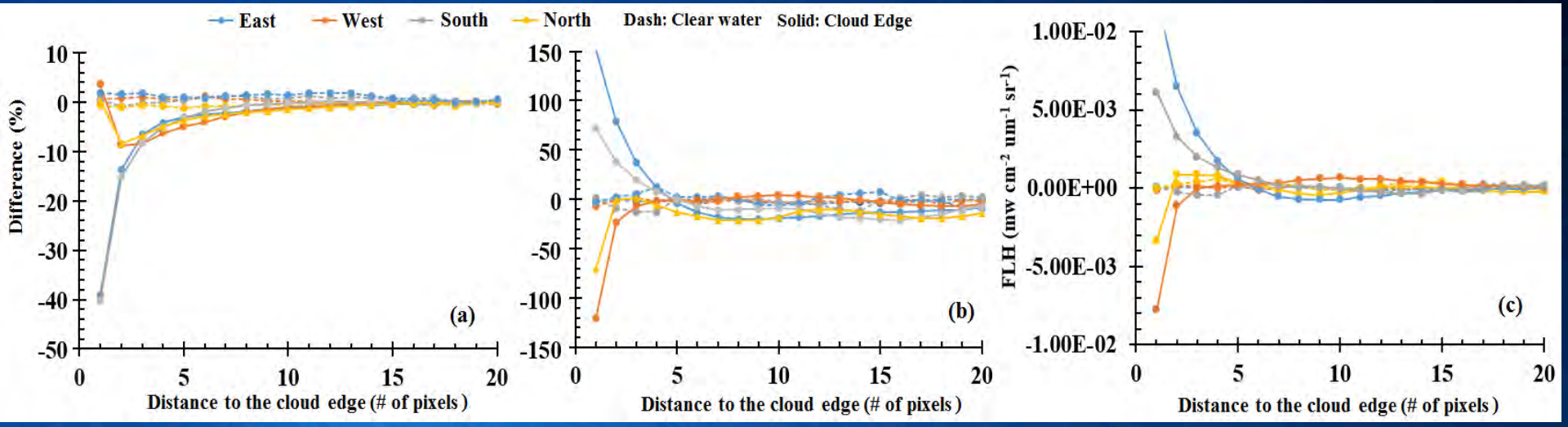
Results: Cloud effects in FLH



Results: influence of cloud size and albedo

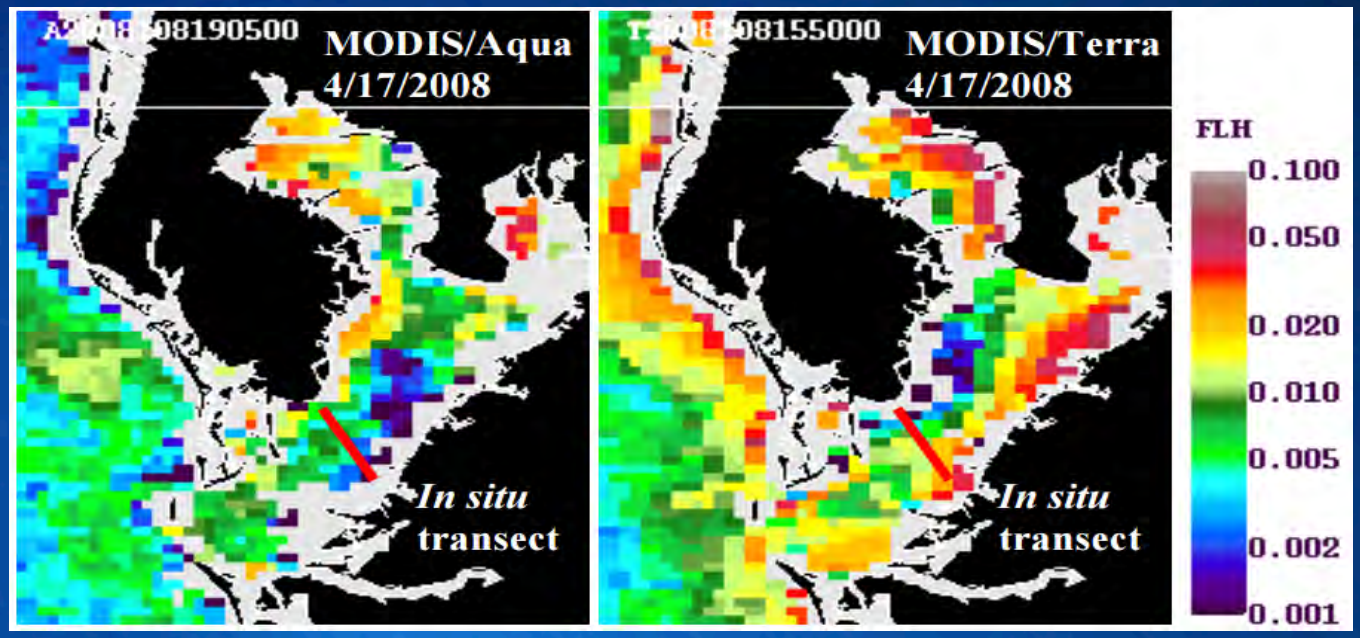


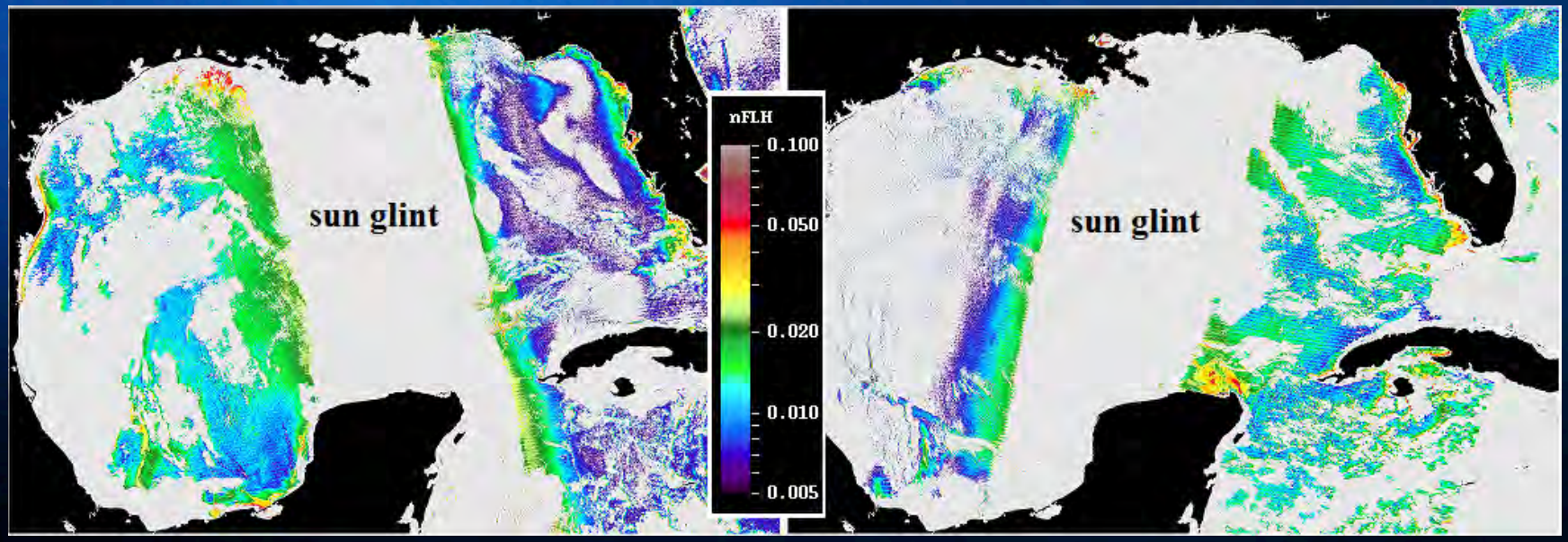
Uncertainties and limitations



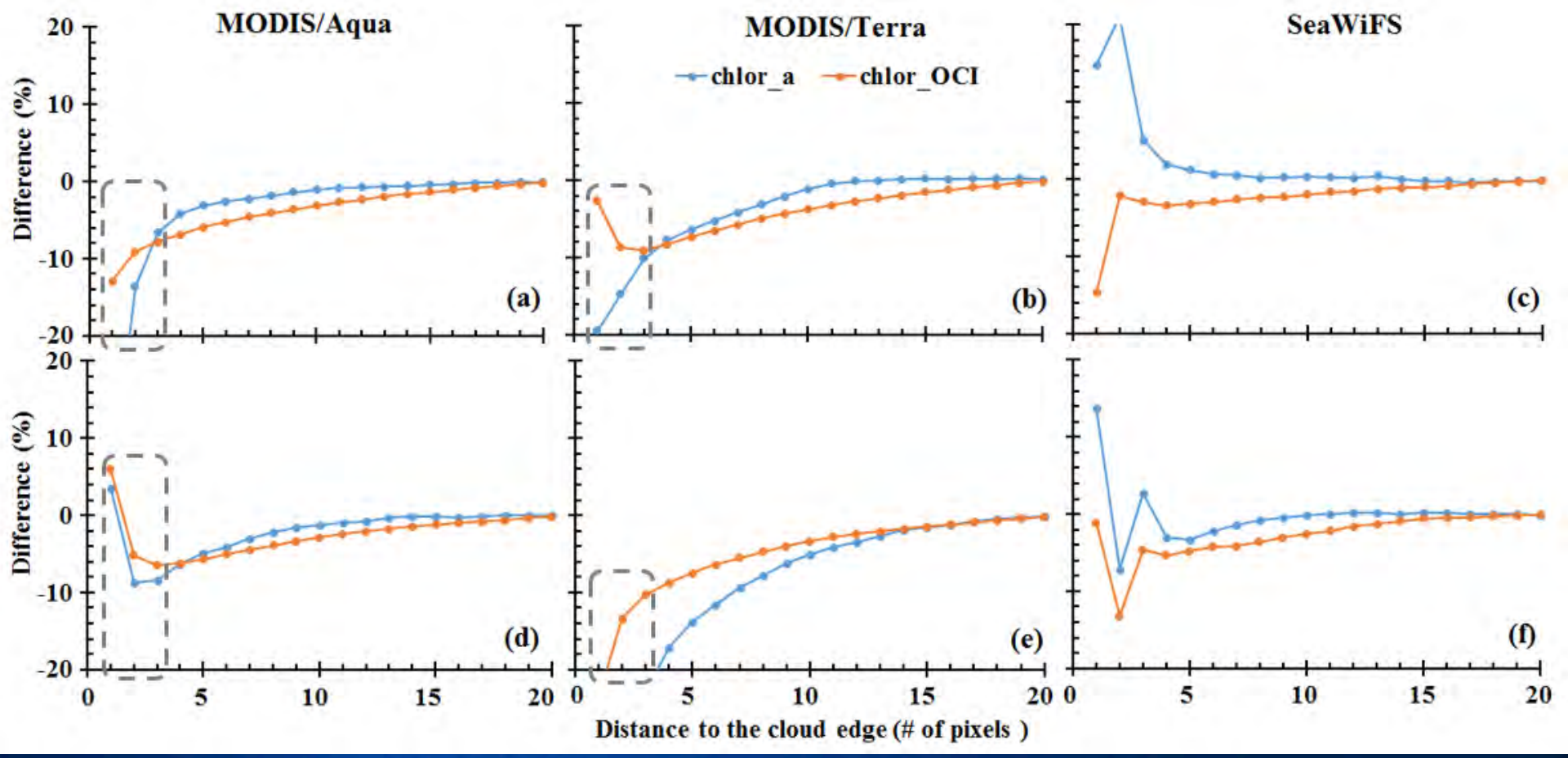
- Changes of up to 2-3% for Chl-a within 20 pixels (or 20 km at nadir).
- The spatial variability of nFLH cloud reach to ~15% in relative difference or 0.0006 mw^{-2} μm^{-1} sr^{-1} in absolute value

Effects from land and sun-glint



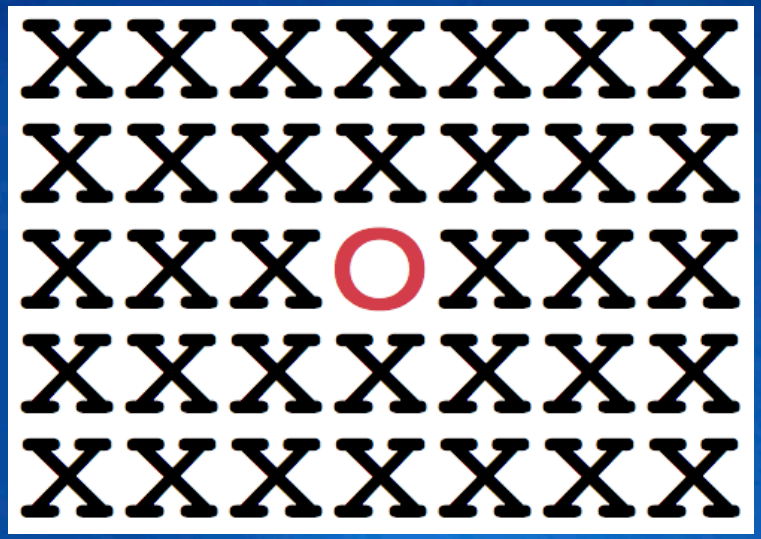


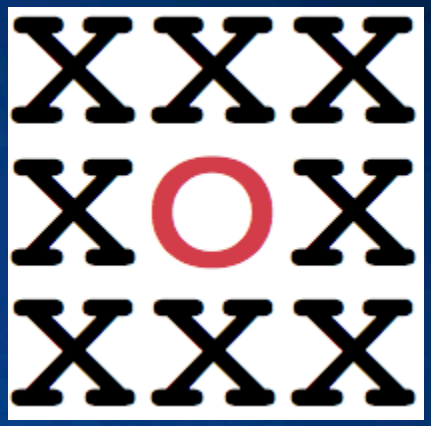
Implications for Chl-a data recovery



Comparison of the cloud AE between Chl_{ocx} and Chl_{OCI} in the ME-free (a, b and c) and ME-affected (d, e and f) directions

Implications for Chl-a data recovery

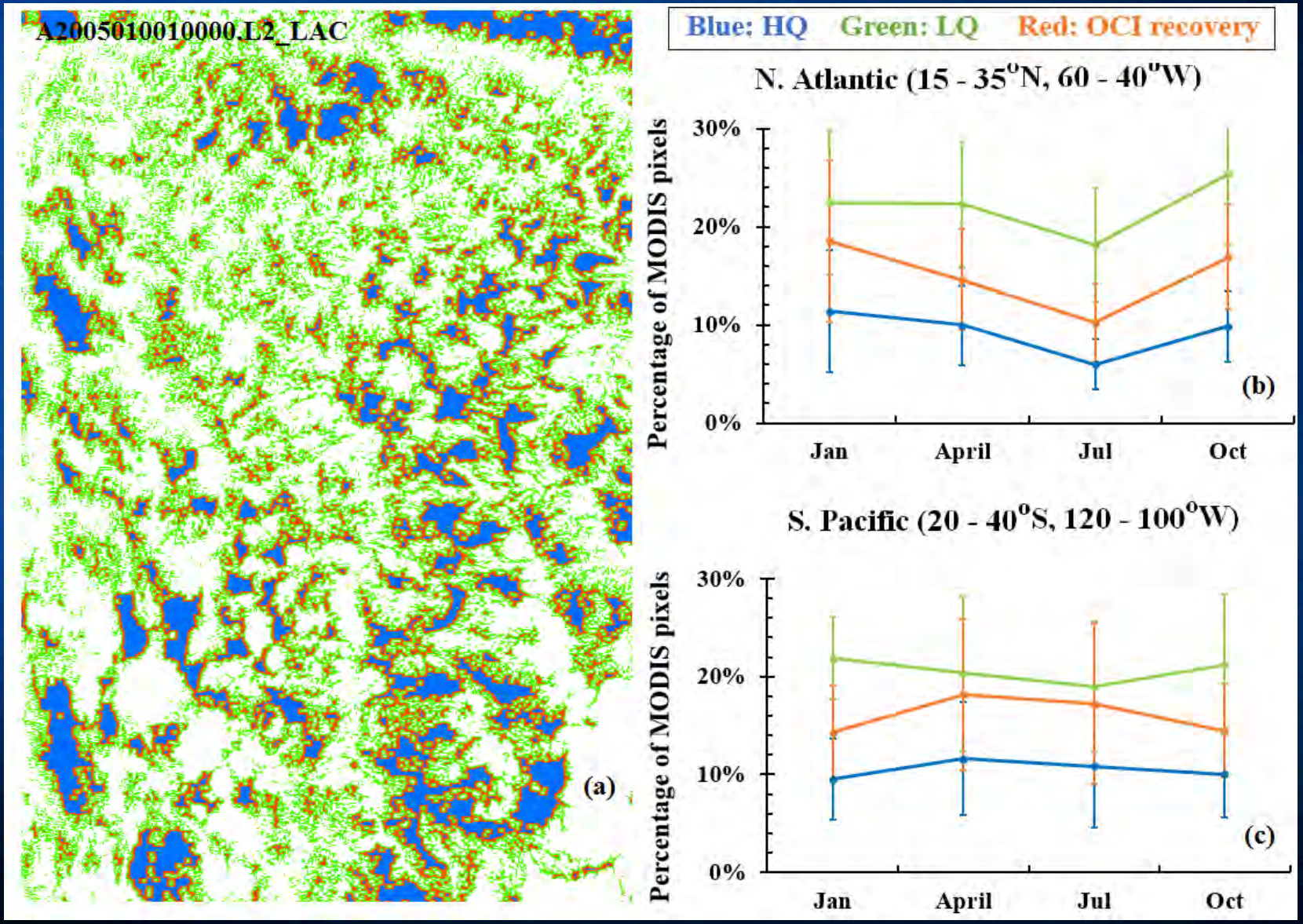




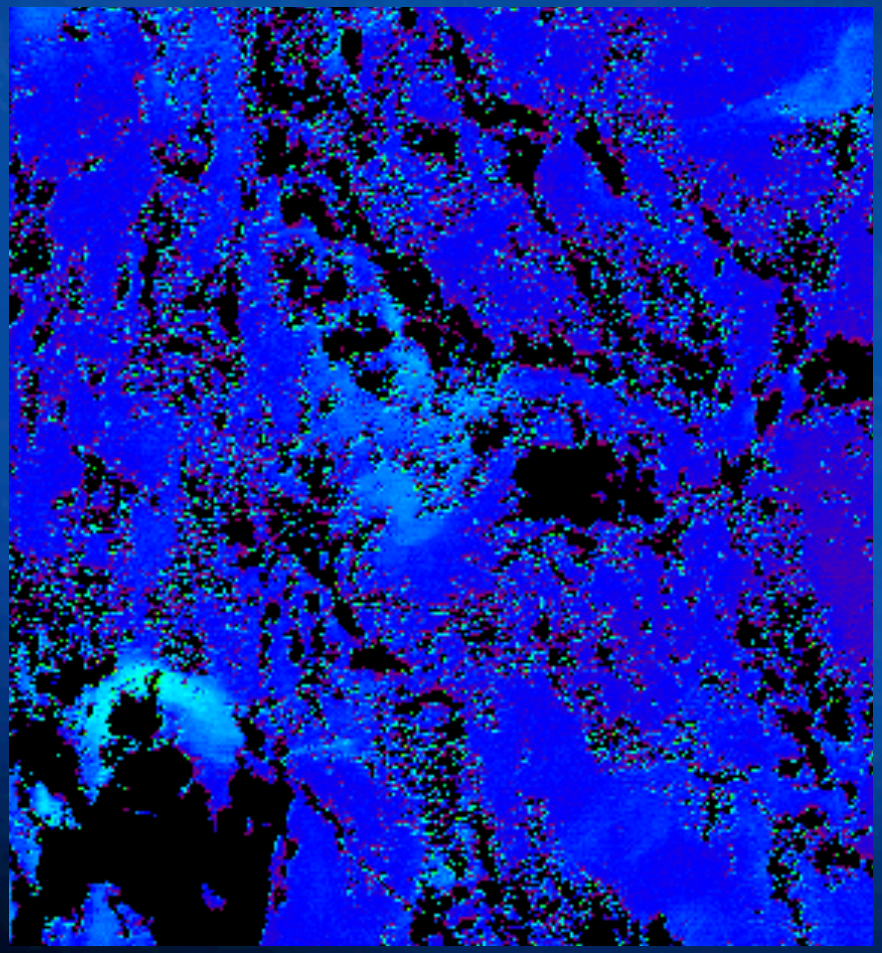
	MODISA		MODIST	
	3x3	5x5	3x3	5x5
East	4.9	3.6	-3.8	-6.9
West	-1.1	0.2	0.9	1.3
South	2.2	0.4	-3.1	-5.0
North	-3.0	-0.5	-9.9	-10.0

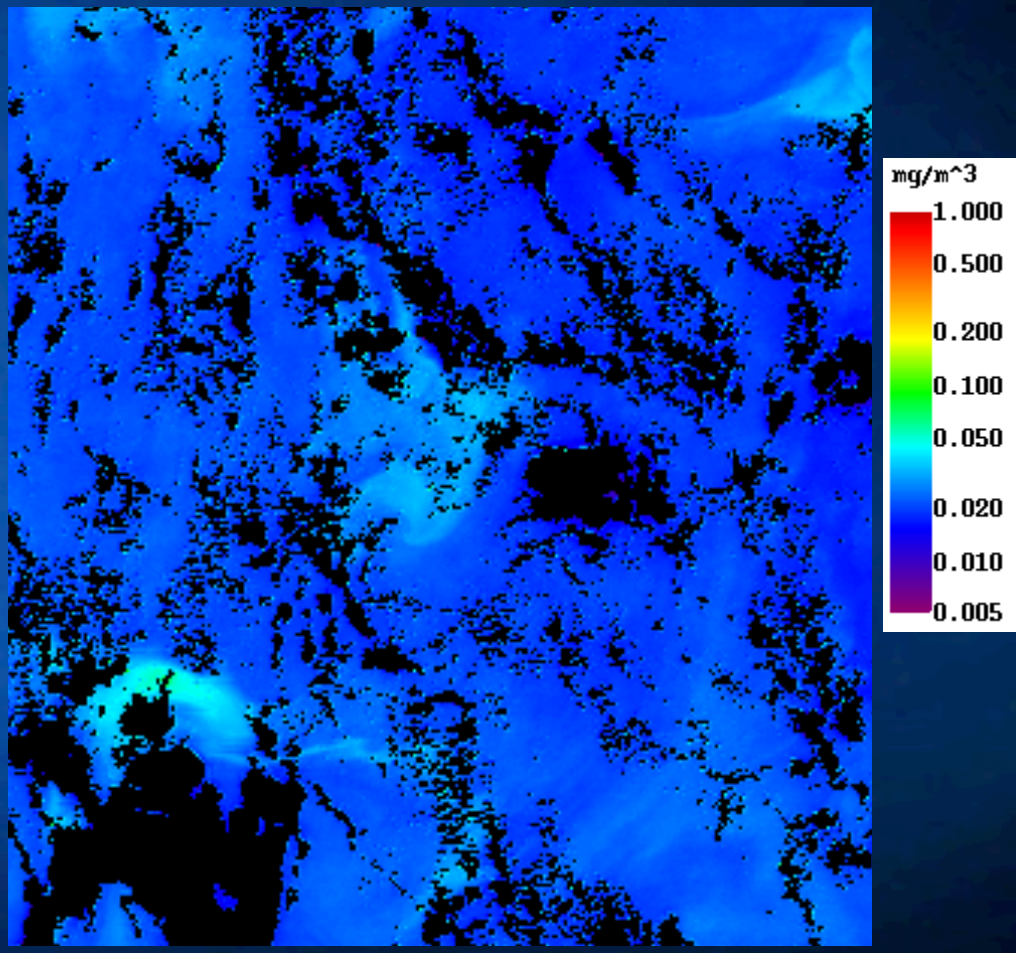
The SeaDAS operational masking window (7x5) could be changed to 3x3 with the new Chl-a algorithm, without losing confidence for the remaining data

Implications for Chl-a data recovery



Data recovery around cloud edges?





Conclusions

- Cloud-adjacent AEs and MEs of two MODIS instruments and SeaWiFS have been estimated using satellite measurements;
- A smaller masking window size (3x3) together with the OCI Chl-a algorithm can result in an increase of > 40% in Chl-a data coverage without losing data quality
- Further validations of the above data recovering approach using field observations are required