

Retrieving cloud properties from new Shortwave Spectrometer observations (preliminary)

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Thanks to

Peter Pilewskie, John Pommeir, Ilya Slutsker, Brent Holben

ARM **Shortwave**
Spectrometer (SWS) :
1.4° FOV; 350-2170 nm; 1s

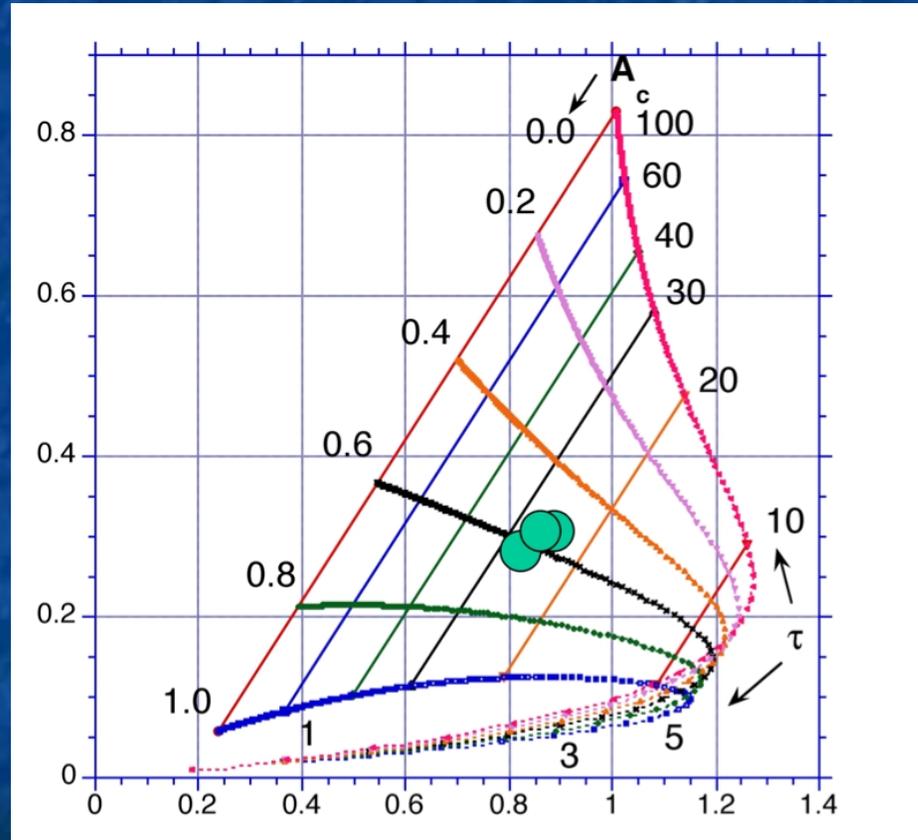
Cloud mode



1.2° FOV
673 (RED) & 870 (NIR) nm

Retrieval method for cloud optical depth & effective cloud fraction (REDvsNIR)

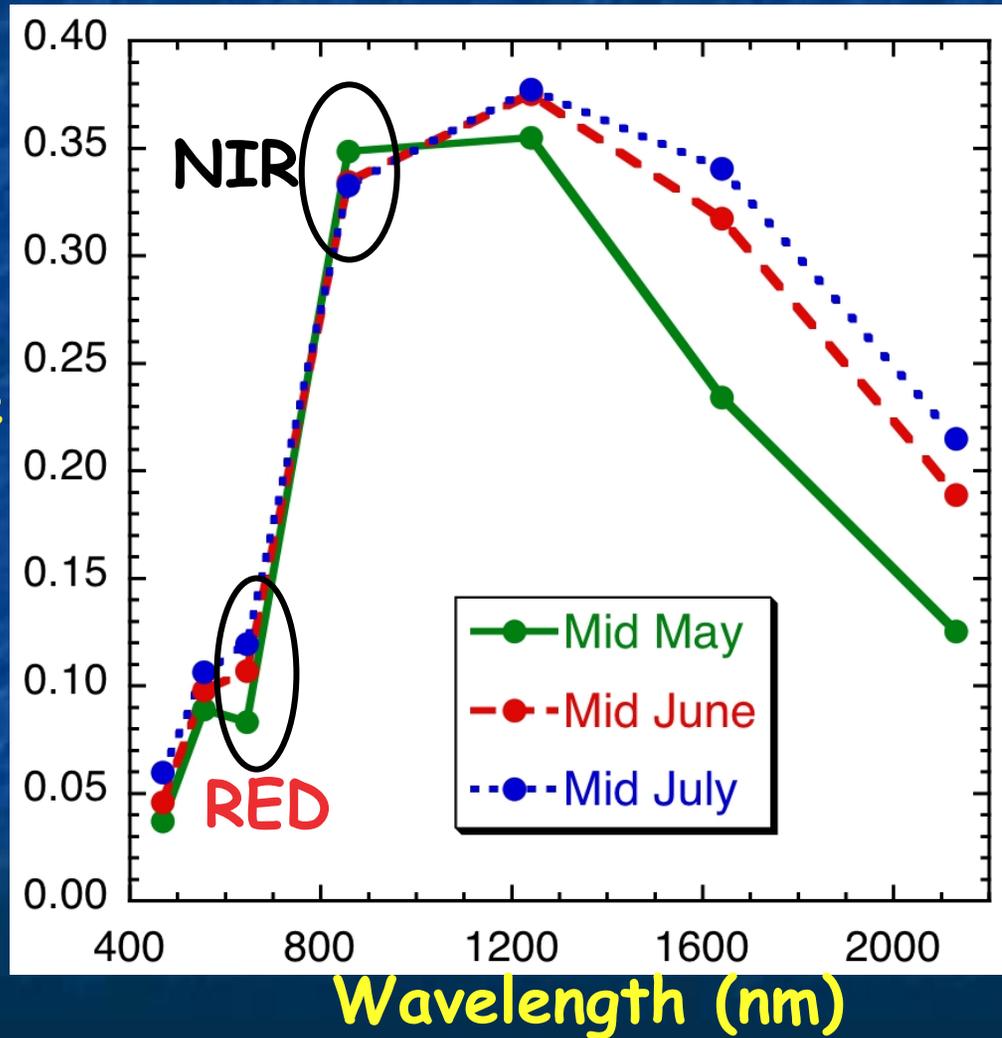
NIR-RED



NIR+RED

Spectral surface reflectance

Surface
albedo



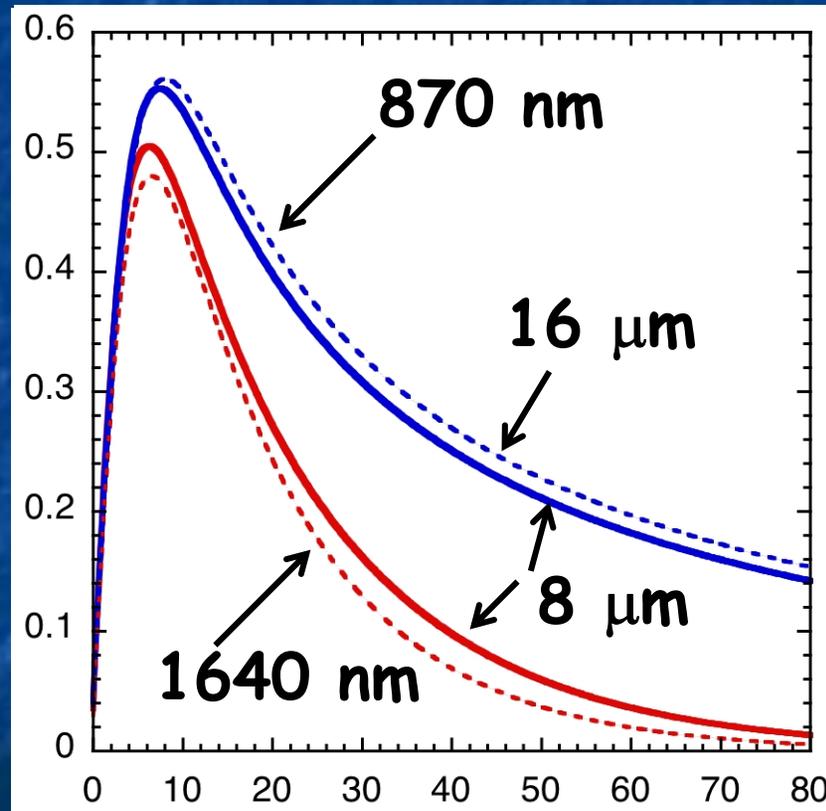
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Terra

How to retrieve effective radius of cloud droplets?

- **Larger droplets:**
 - Stronger forwarding
 - Stronger absorption
- **From satellites:**
 - The above two factors reduce reflectance (Nakajima & King, 1990).
- **From ground-based observations:**
 - The above two factors are competing (Rawlins & Foot, 1990; Platnick, 2000).

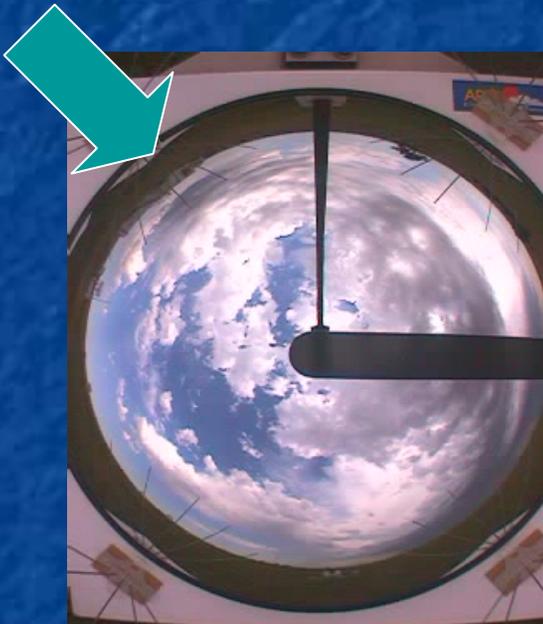
Retrieve effective radius of cloud droplets from 870 (NIR) & 1640 nm

Radiance

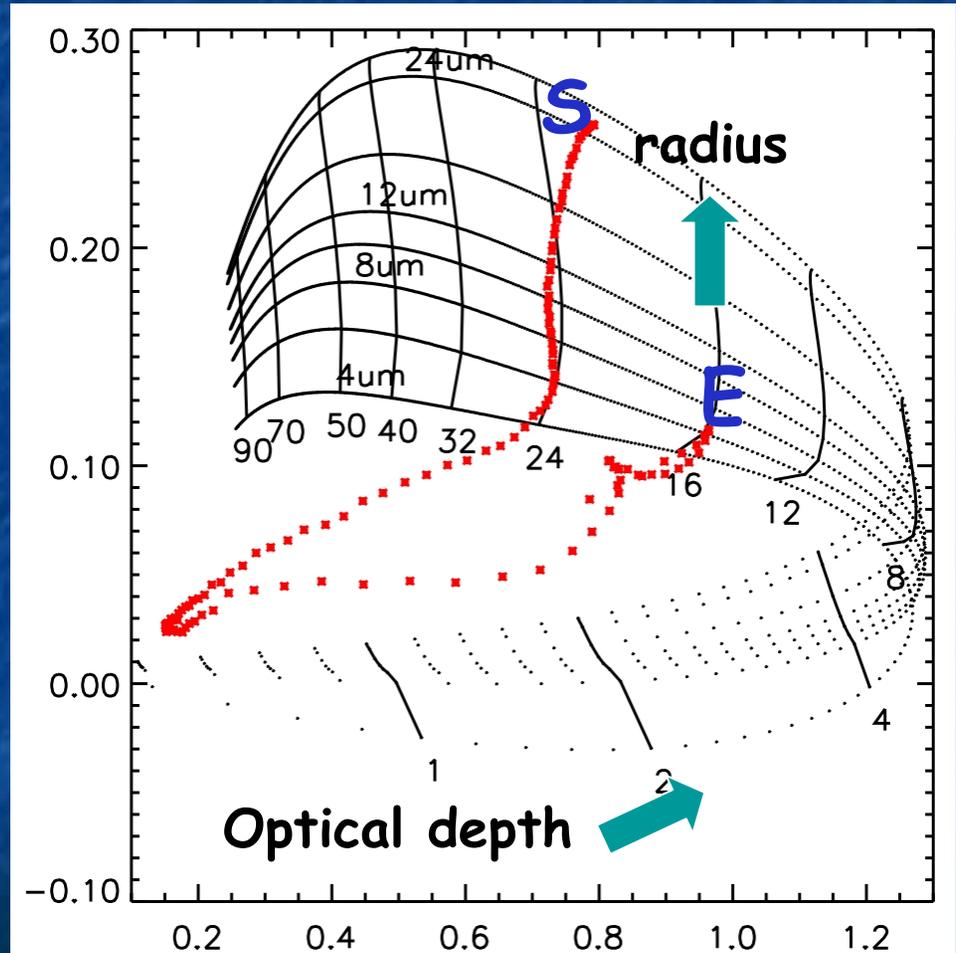


Cloud optical depth

Retrieval method for drop size

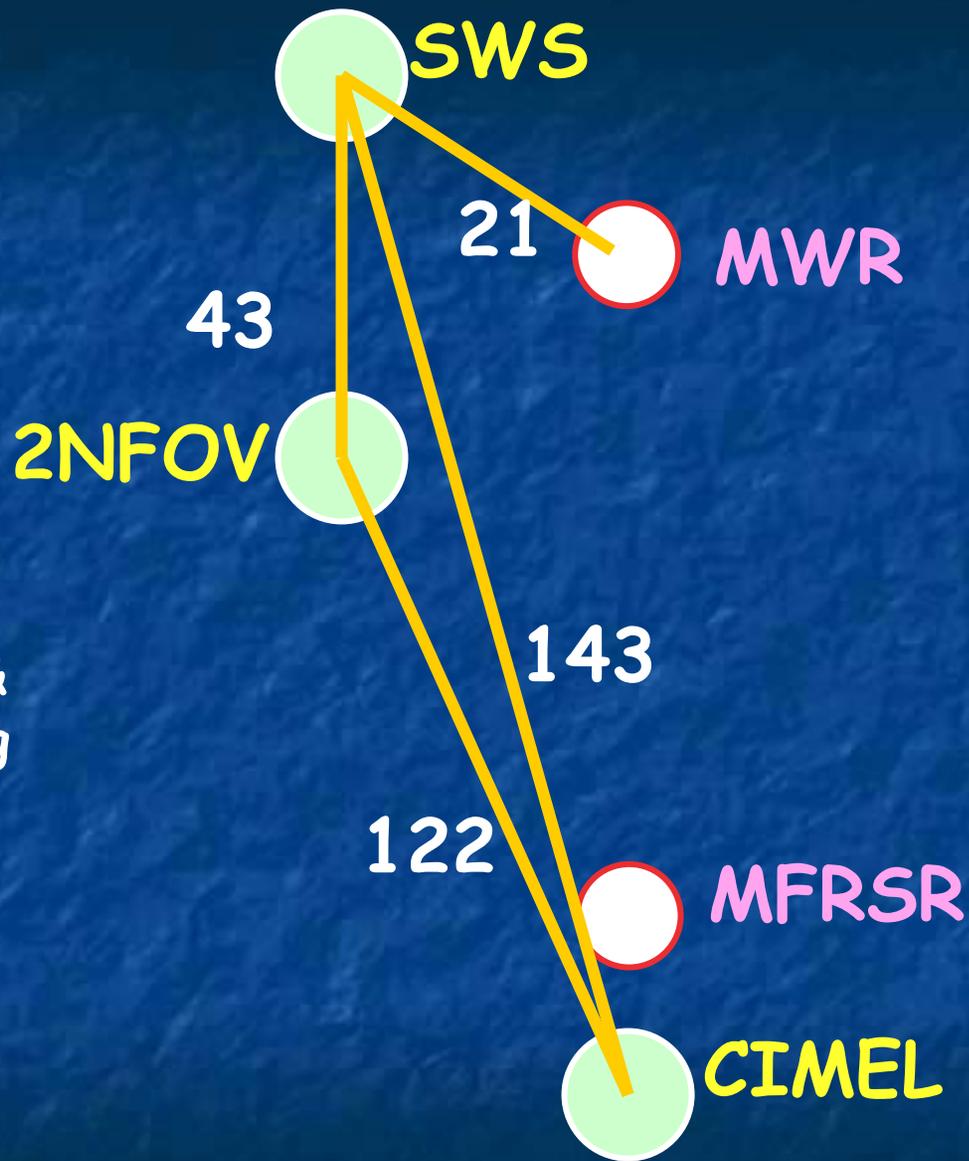


NIR- 1.6 μ m



NIR+ 1.6 μ m

Instrument locations

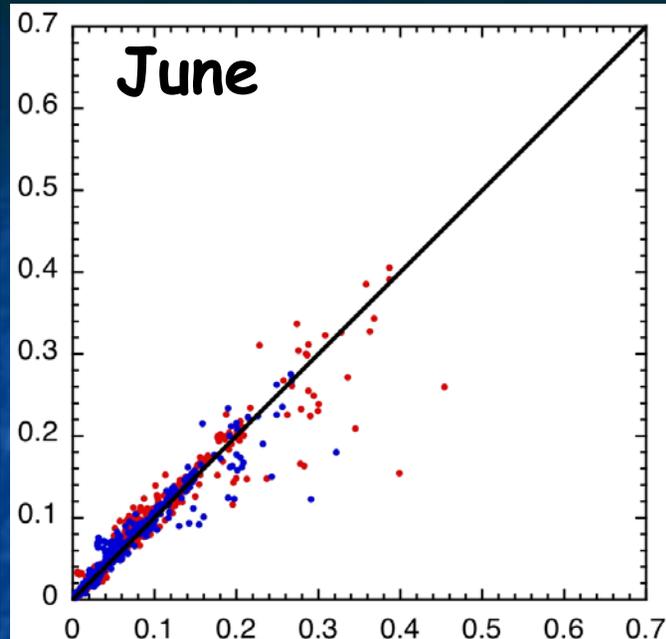
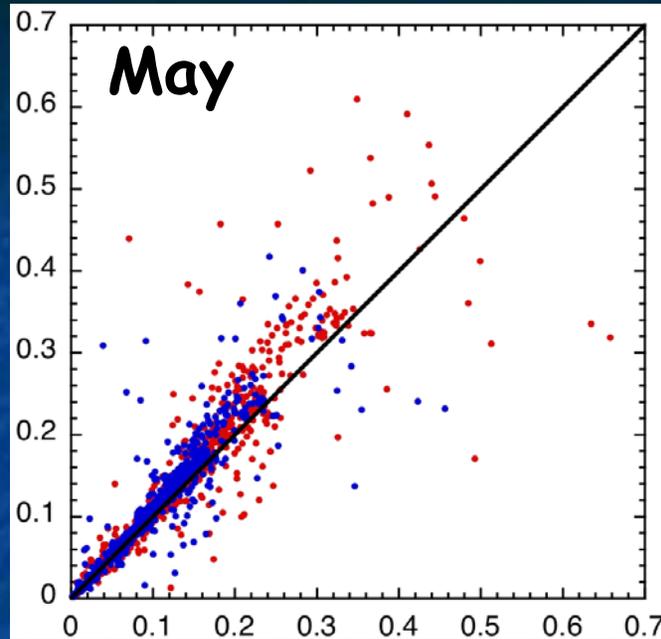


Thanks to Dan Rusk & Pat Dowell for walking off the distances !!

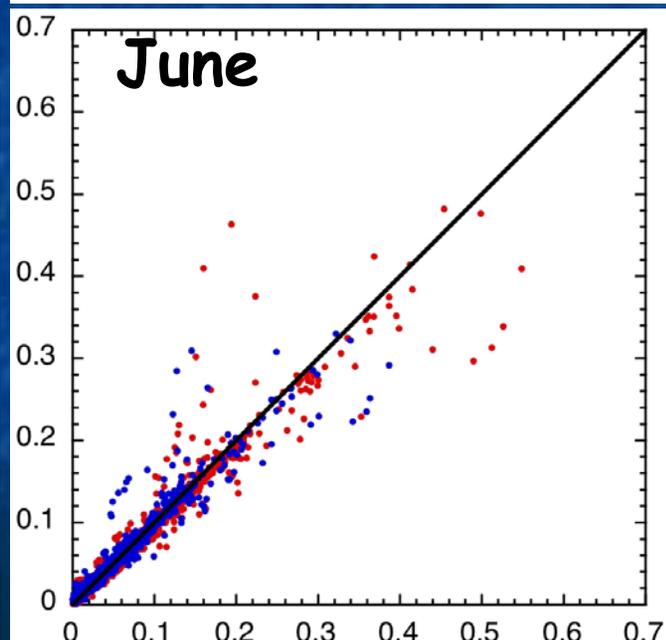
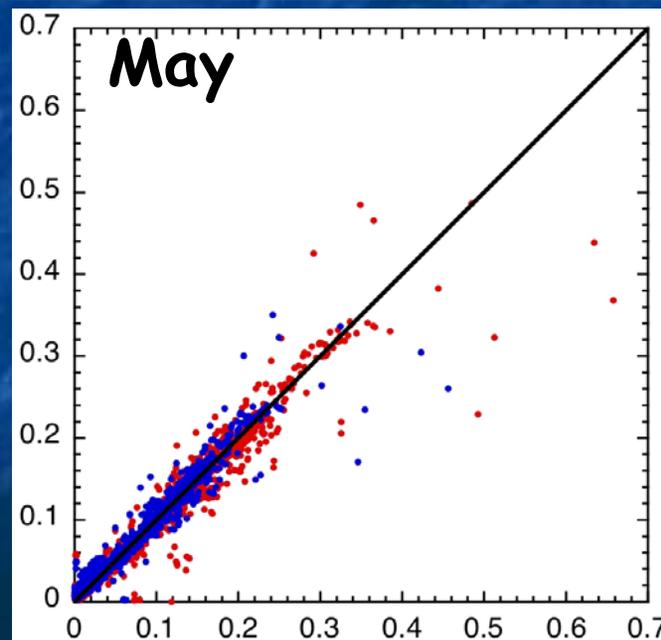


SWS

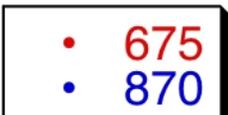
Radiance



2NFOV



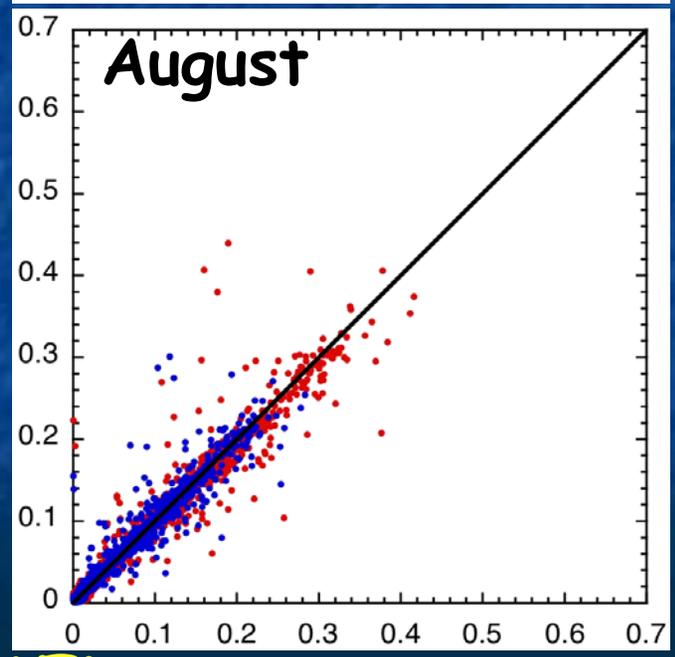
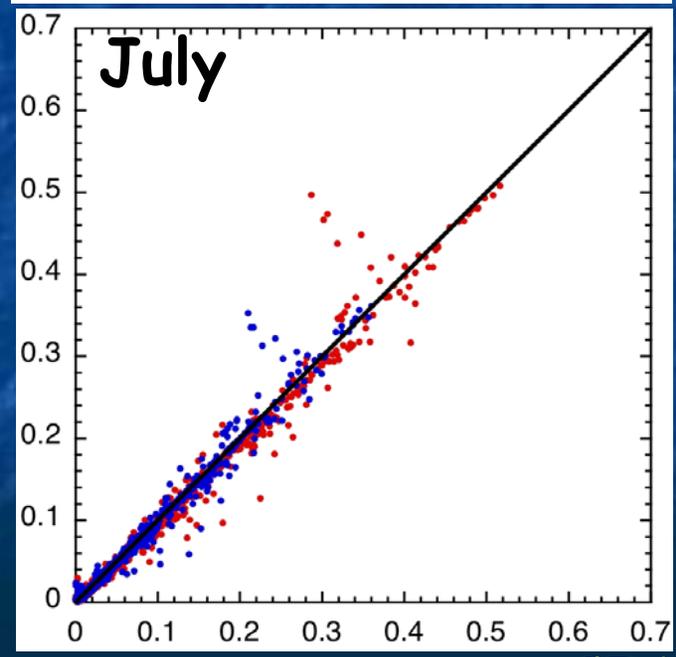
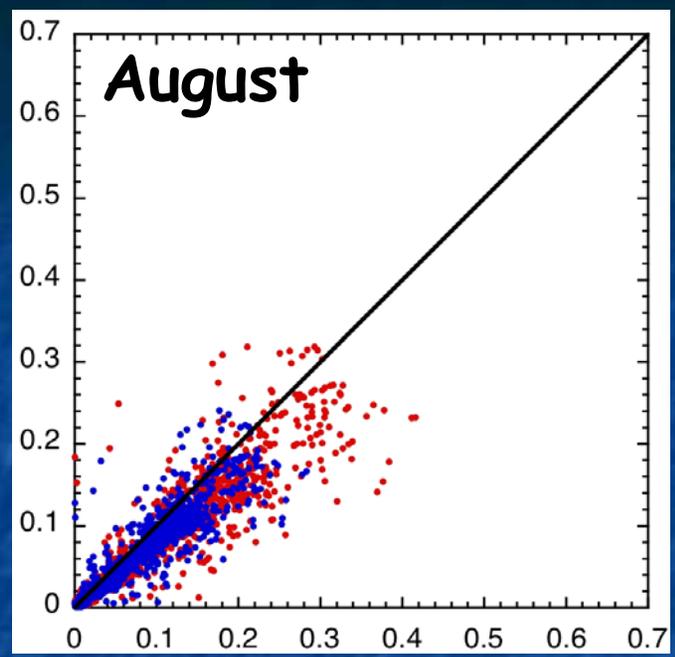
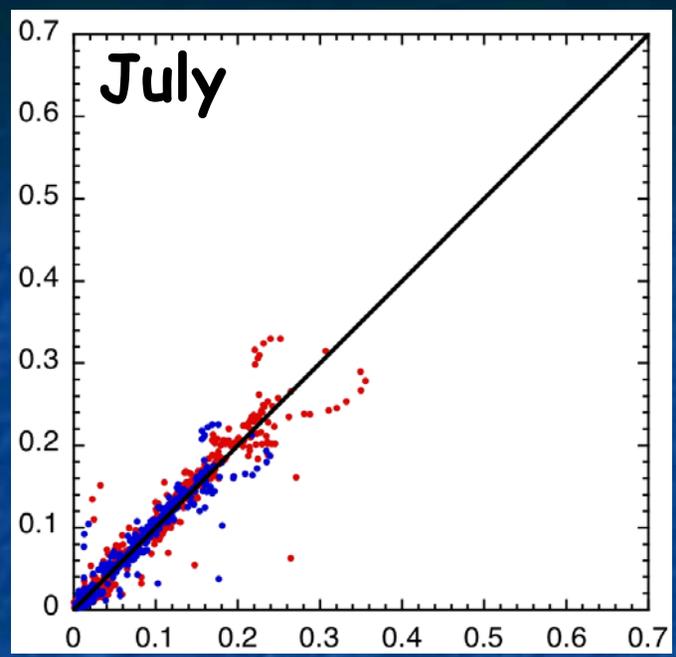
CIMEL



SWS

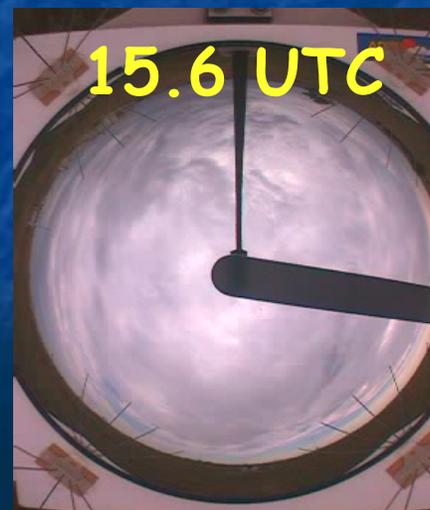
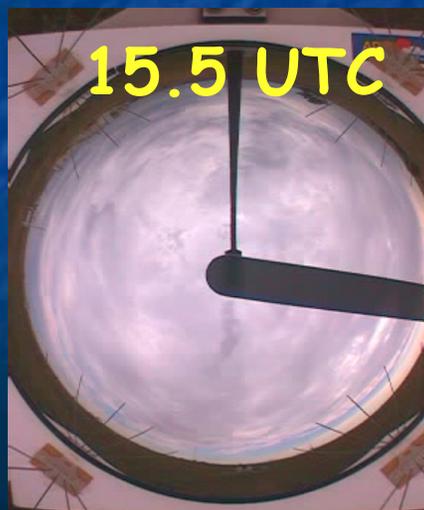
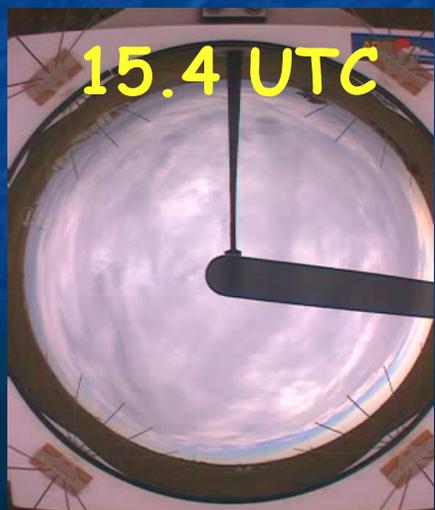
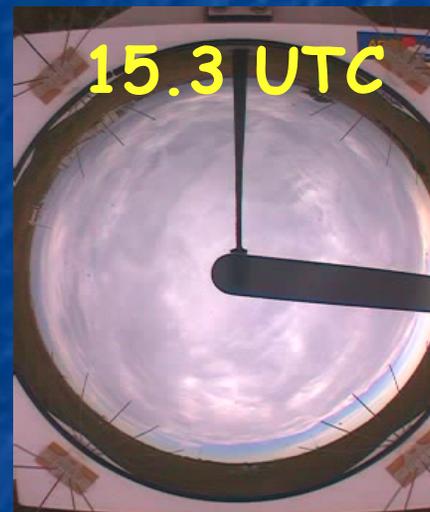
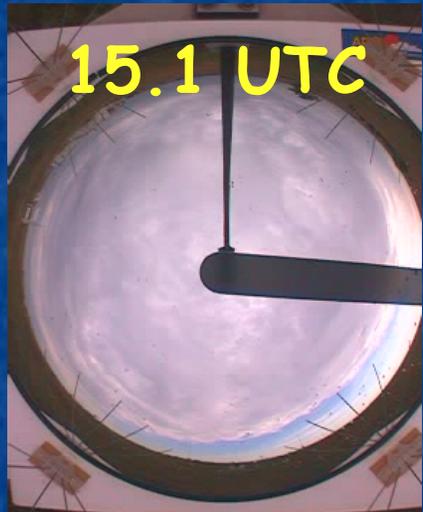
Radiance

2NFOV

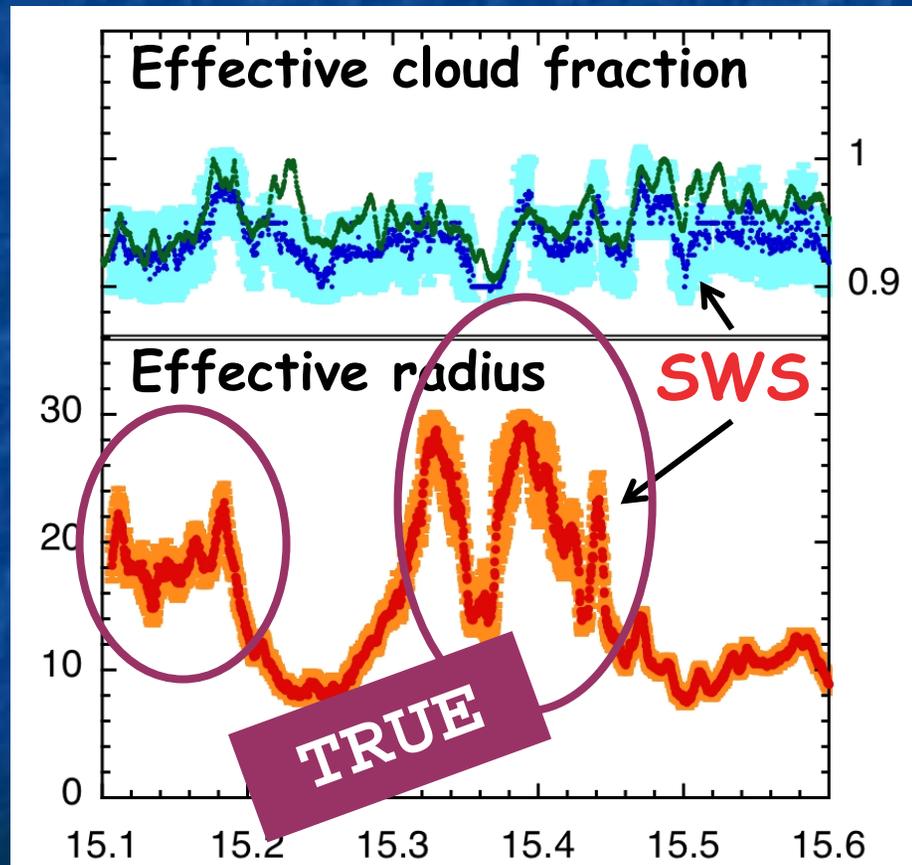
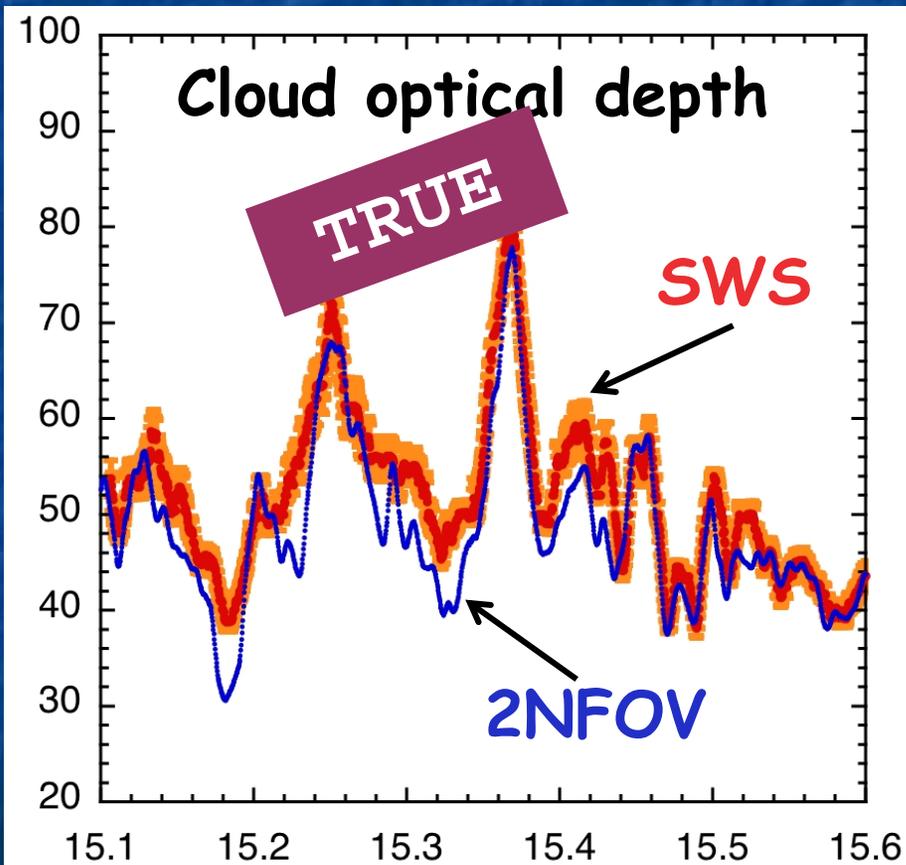


CIMEL

Retrieve 2006/07/27



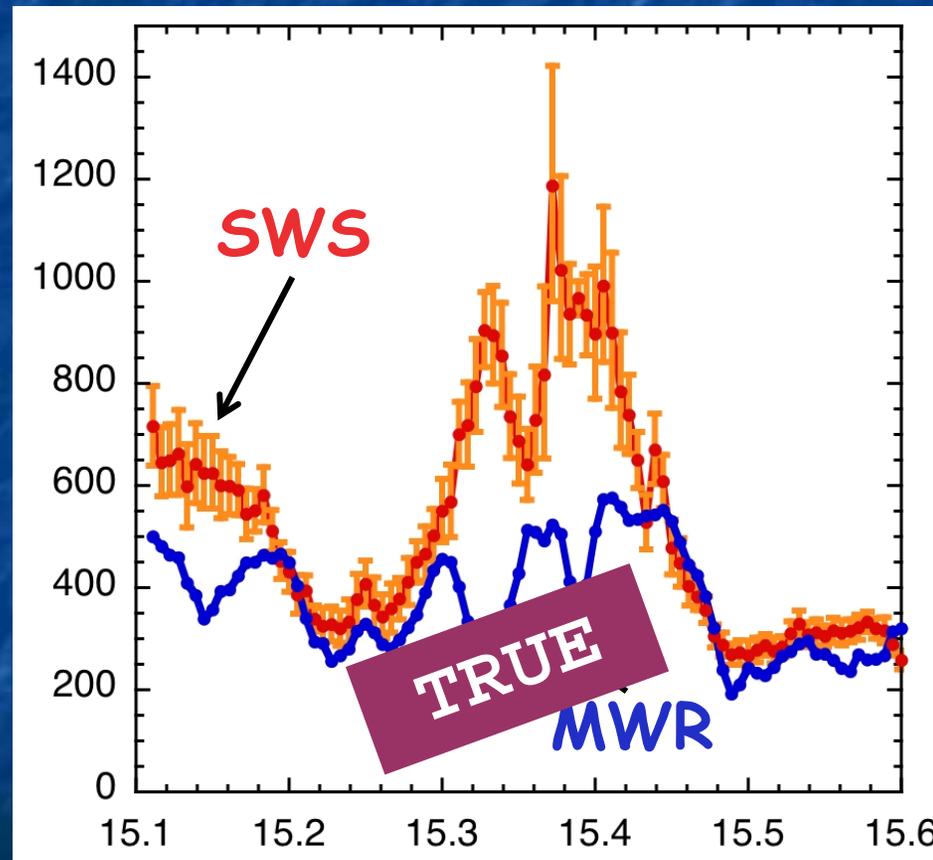
Compare retrieved cloud properties with those from 2NFOV



Time (UTC)

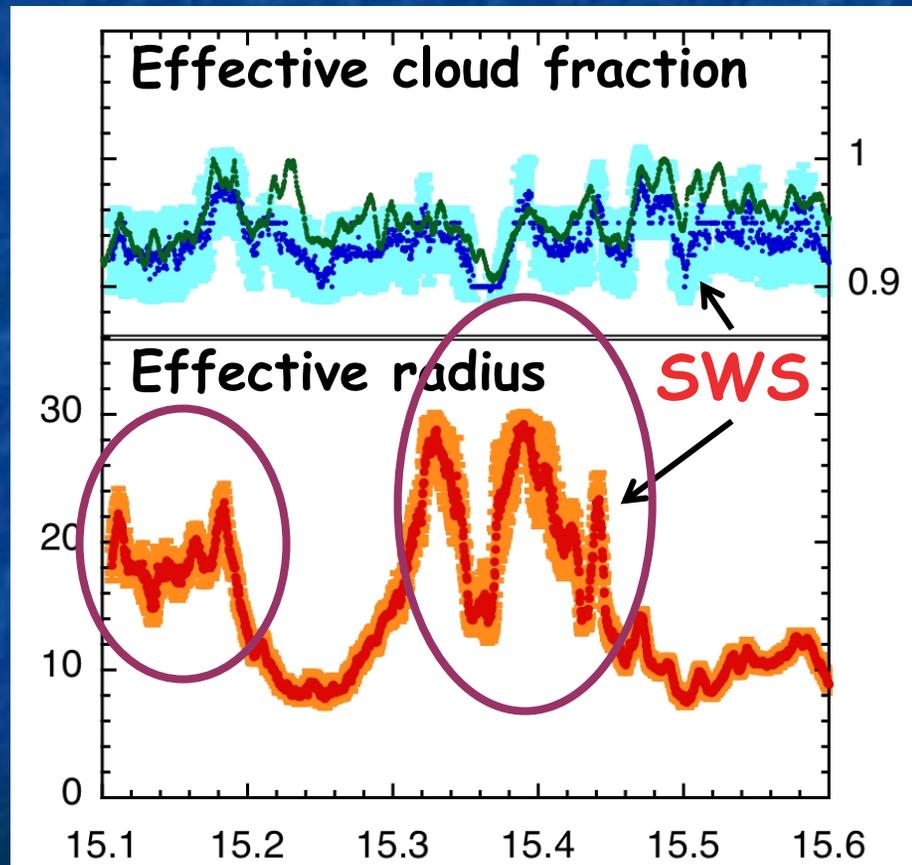
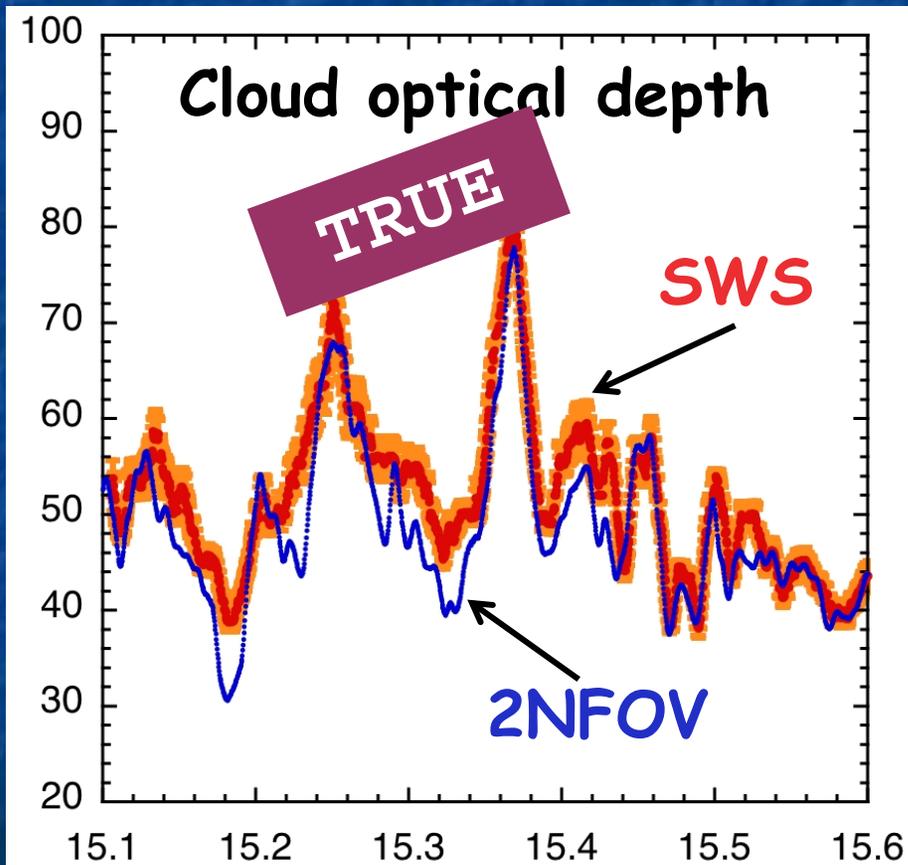
Compare retrieved liquid water paths with those from MWR

Liquid water path (g/m²)



Time (UTC)

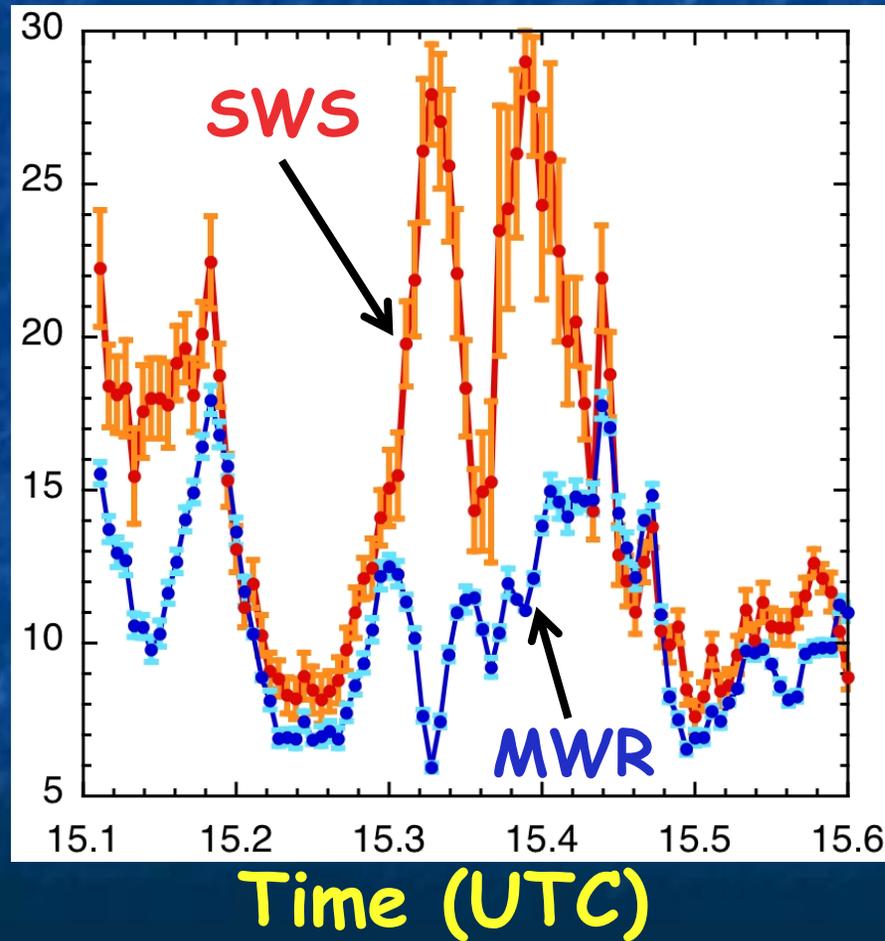
Compare retrieved cloud properties with those from 2NFOV



Time (UTC)

Compare retrieved effective radius with those from MWR-retrieved LWP

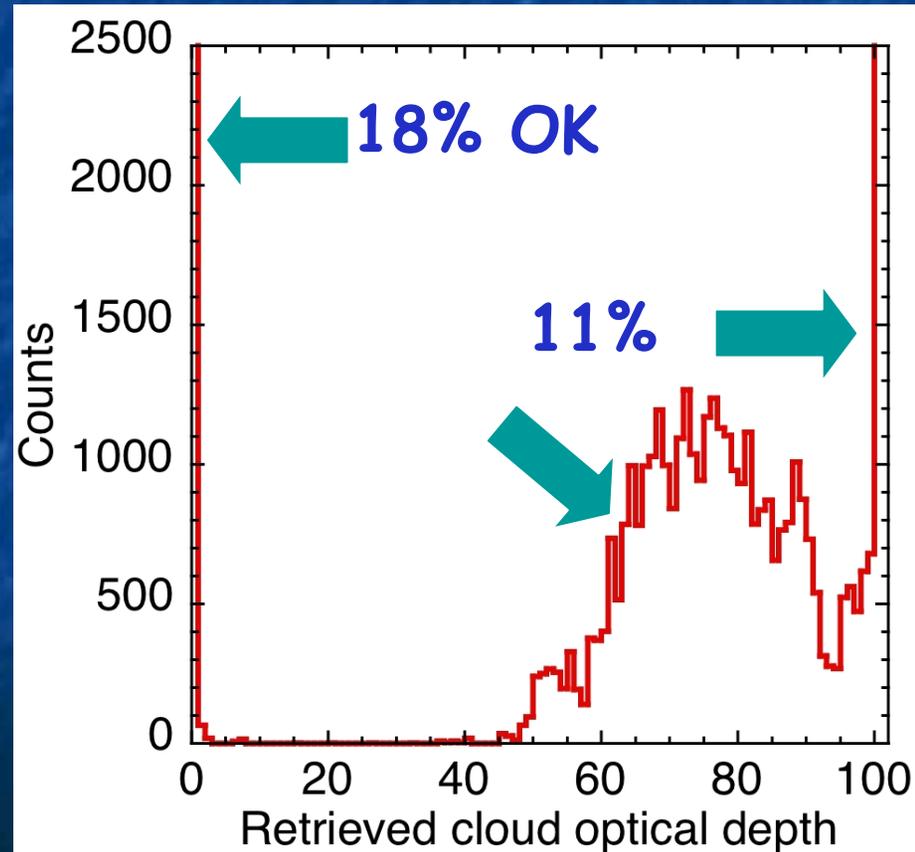
Effective radius (μm)



For clear-sky cases...

- 2NFOV: radiance at RED > radiance at NIR
- CIMEL: no cloud mode data
- Total sky images: clear

Clear	63%
Out of LUT	8%
Retrieved	29%

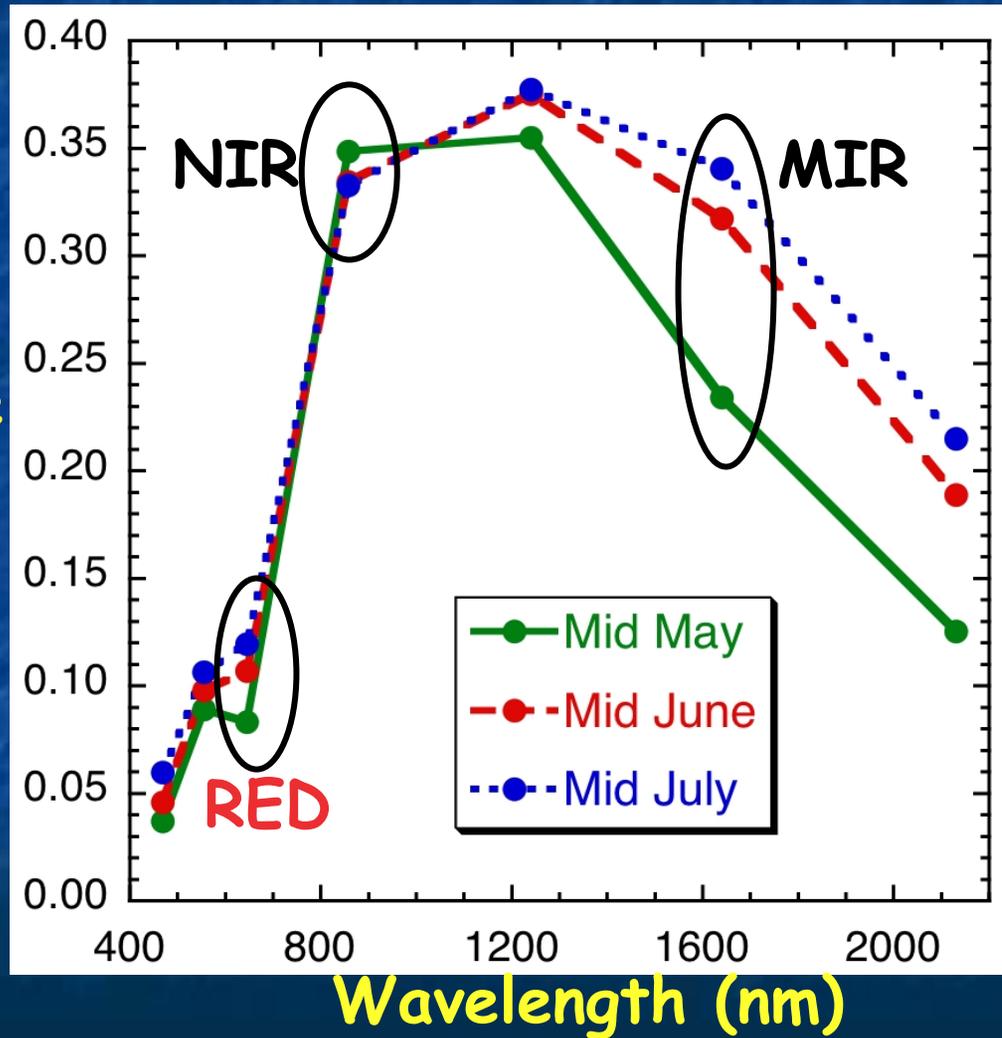


Summary and future work

- Retrieved cloud optical depths and effective cloud fractions from SWS agree with those from 2NFOV.
- More inter-comparisons in radiance need to be done, especially for 1.6 μm .
- Model simulations and error analysis for cloud drop size retrievals will be conducted in the near future.

Spectral surface reflectance

Surface
albedo

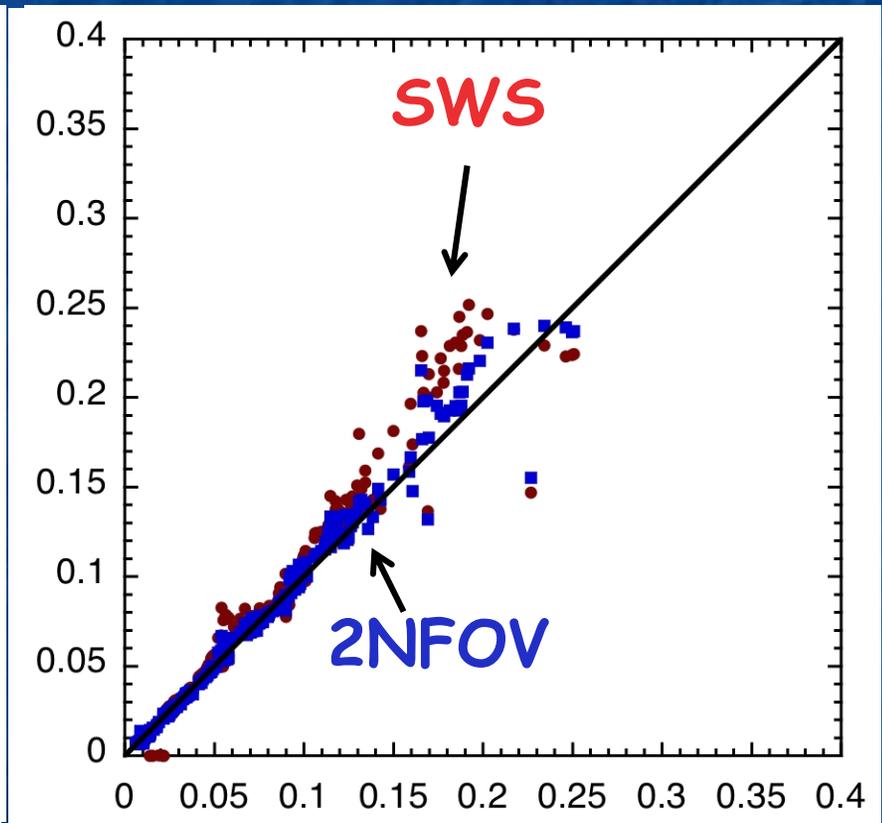
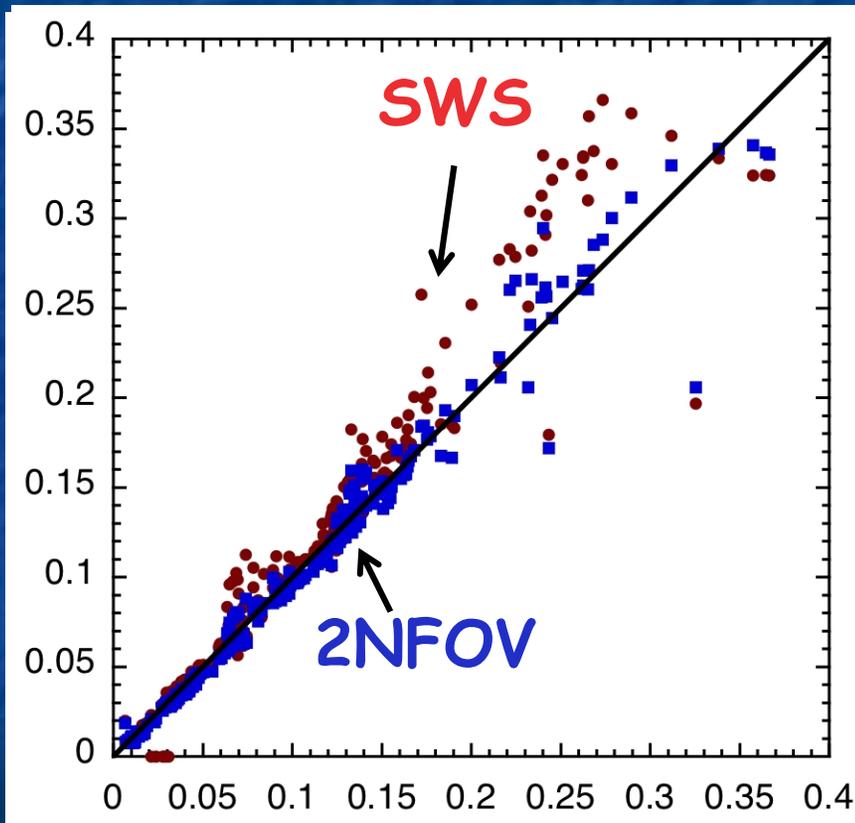


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For overcast cases only...

Radiance at RED

Radiance at NIR



CIMEL