Preliminary retrievals of cloud properties from the AMF/COPS campaign

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The cloud optical properties of interest are:

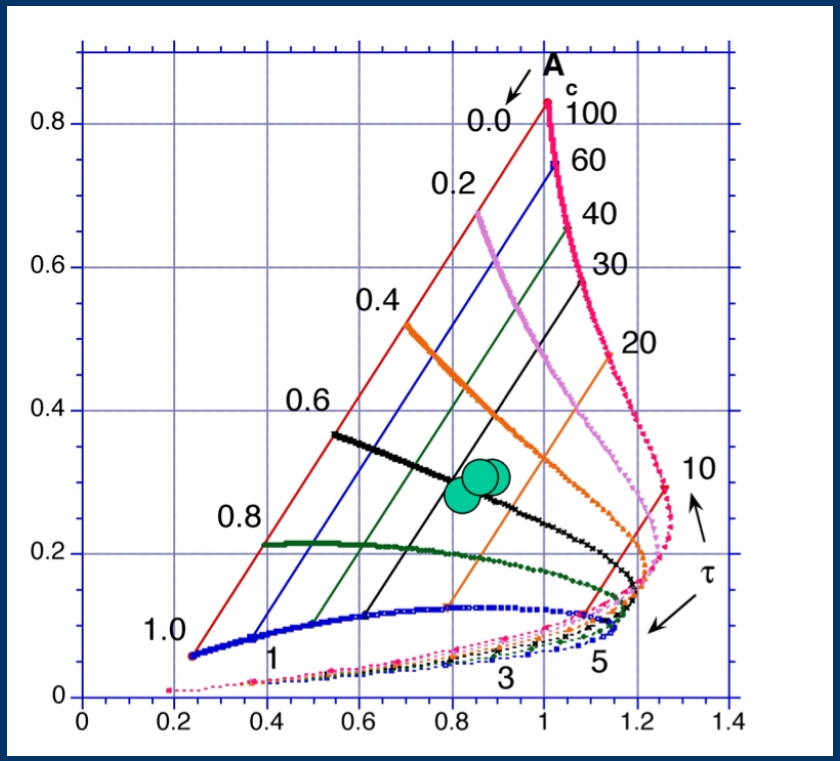
- Cloud optical depth τ – the great unknown
- Radiative cloud fraction
- Cloud effective drop size, r_{eff}

$$\tau = \frac{3}{2}\frac{LWP}{r_{eff}}$$

r_{eff} in μm, LWP in g/m²

The 2-ch narrow-field-of-view radiometer (2NFOV)

Retrieving cloud optical depth & effective cloud fraction using our REDvsNIR method



2NFOV during the COPS

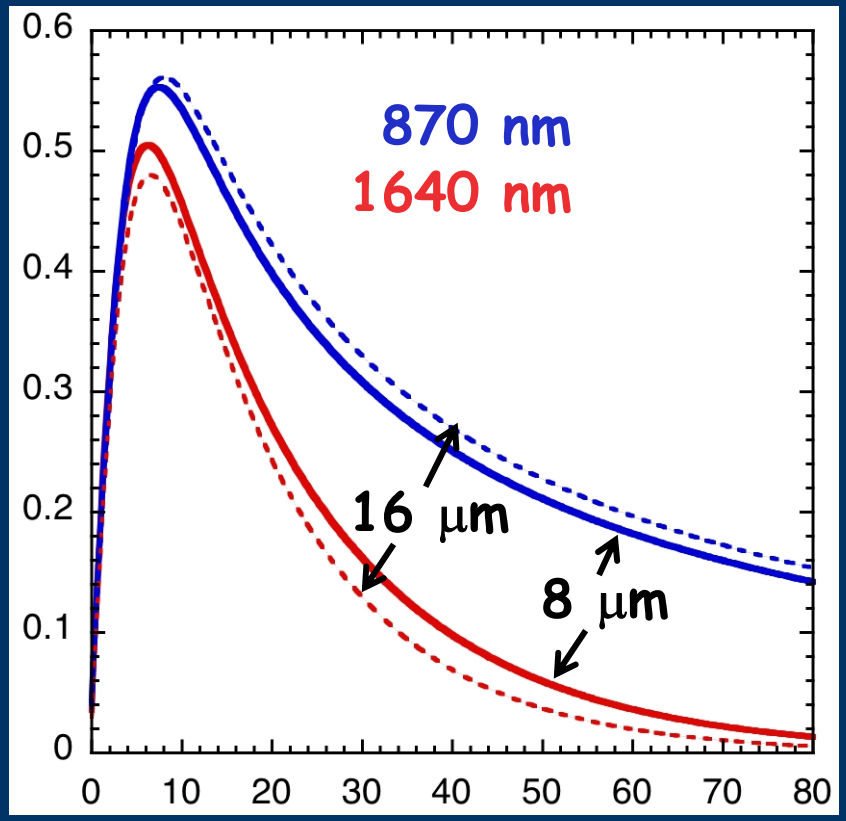
The AMF Cimel now works in "cloud mode"

Normal aerosol mode
(sun-seeking)

Cloud mode
(zenith-pointing)

Using Cimel's data at 675, 870 &1640 nm, we retrieve cloud optical depth, effective radius, and effective cloud fraction.

Zenith radiance



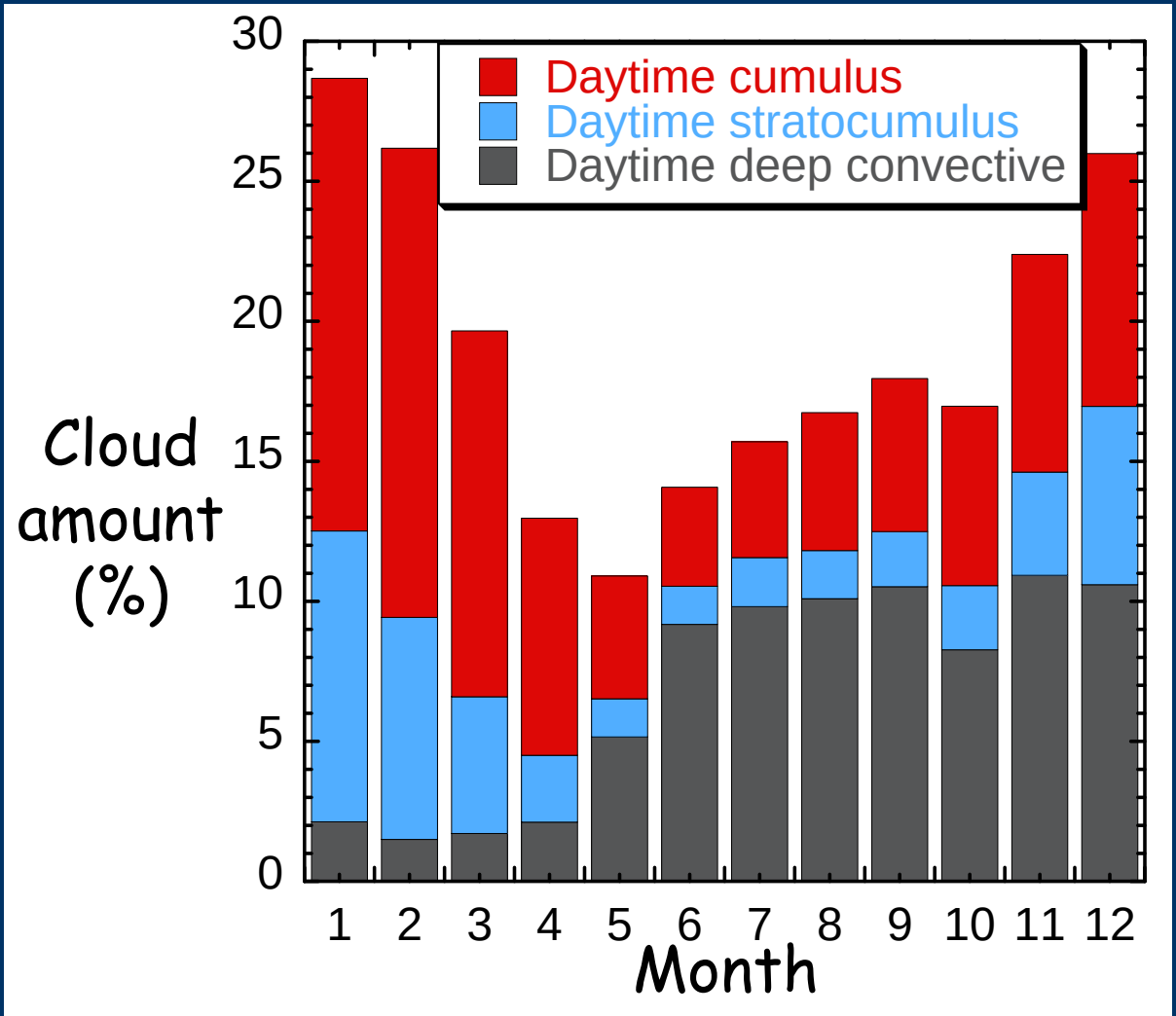
We build LUTs:

$$I_{675} = I_{675}(\tau, A_c, R_{eff})$$
$$I_{870} = I_{870}(\tau, A_c, R_{eff})$$
$$I_{1640} = I_{1640}(\tau, A_c, R_{eff})$$

Multi-filter rotating shadowband radiometer (MFRSR)

works for overcast cases

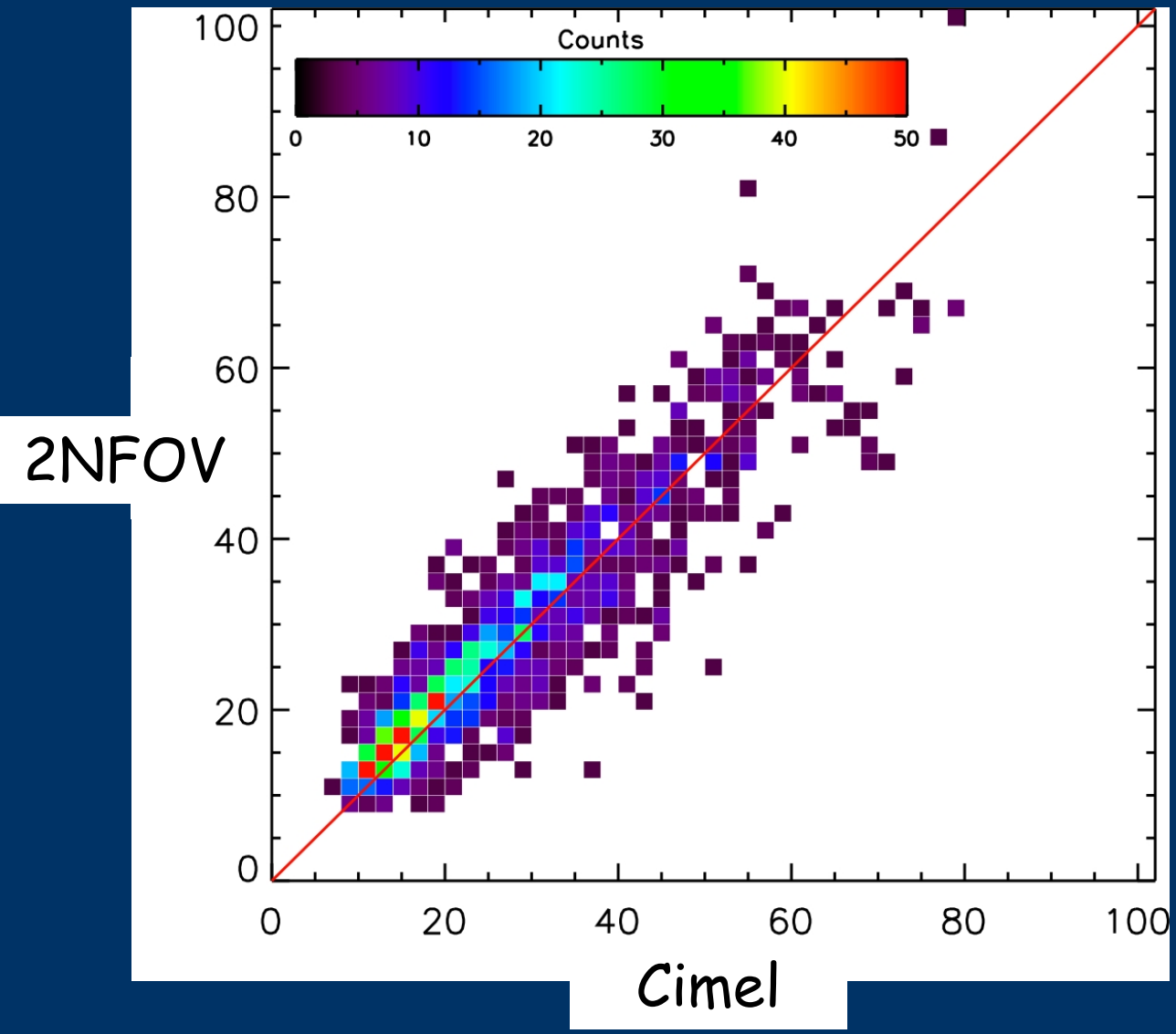
ISCCP cloud fractions show a high degree of fractional cloudiness



Microwave radiometer (MWR)

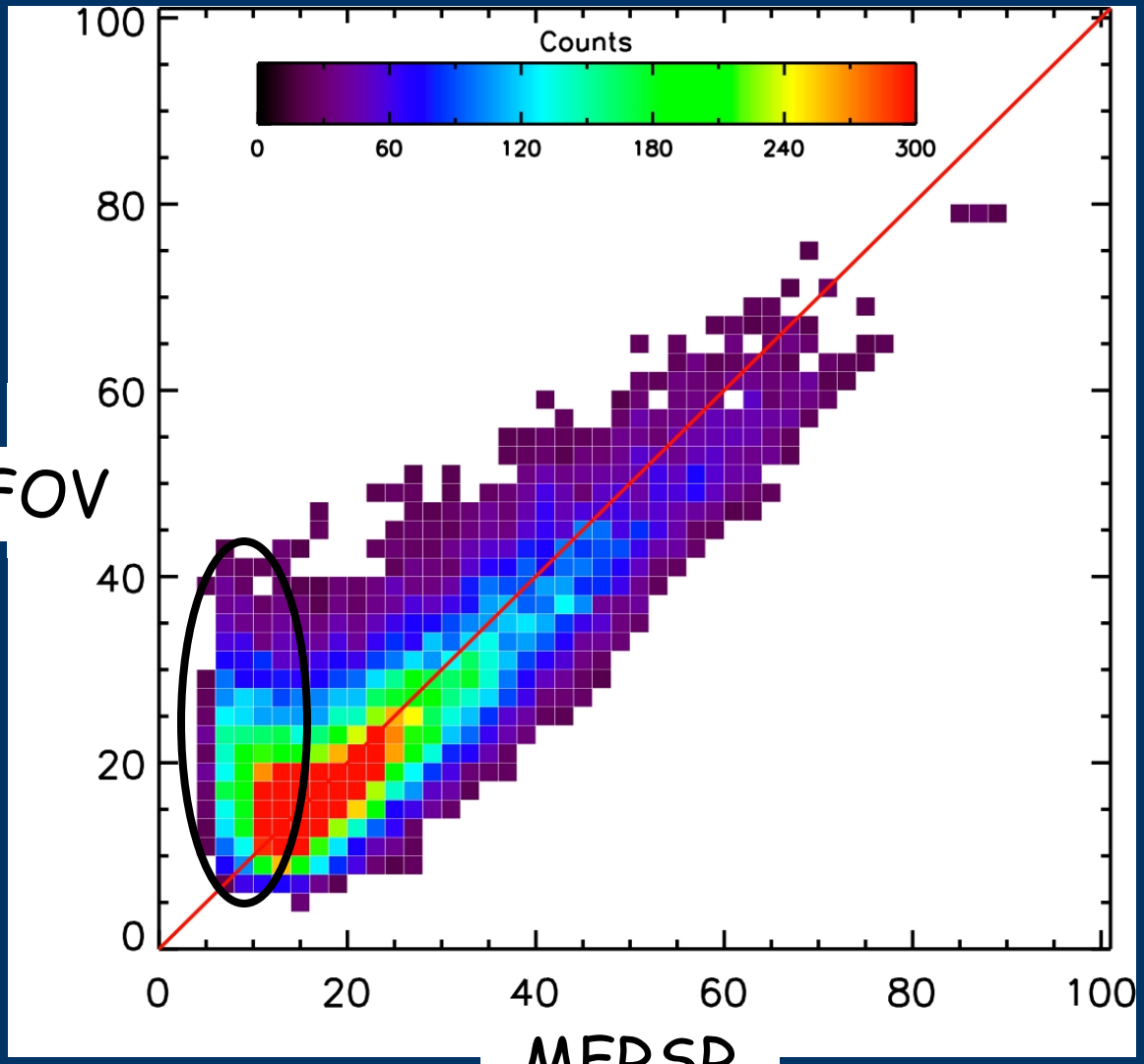
works for broken clouds too

Compare retrieved cloud optical depths from 2NFOV and Cimel



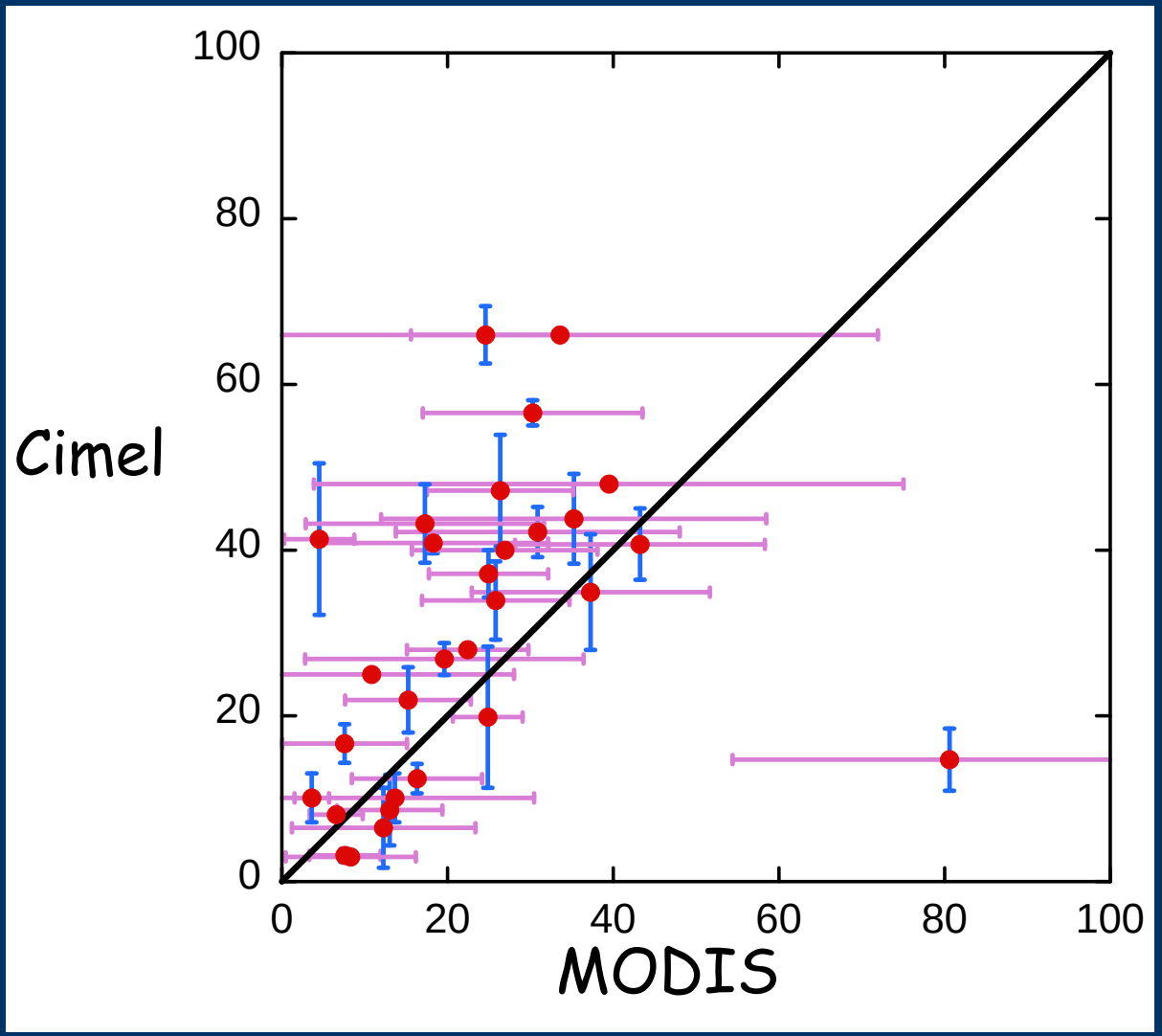
The majority of retrievals agree within 5.

Compare retrieved cloud optical depths from 2NFOV and MFRSR



For "relatively overcast cases" only.

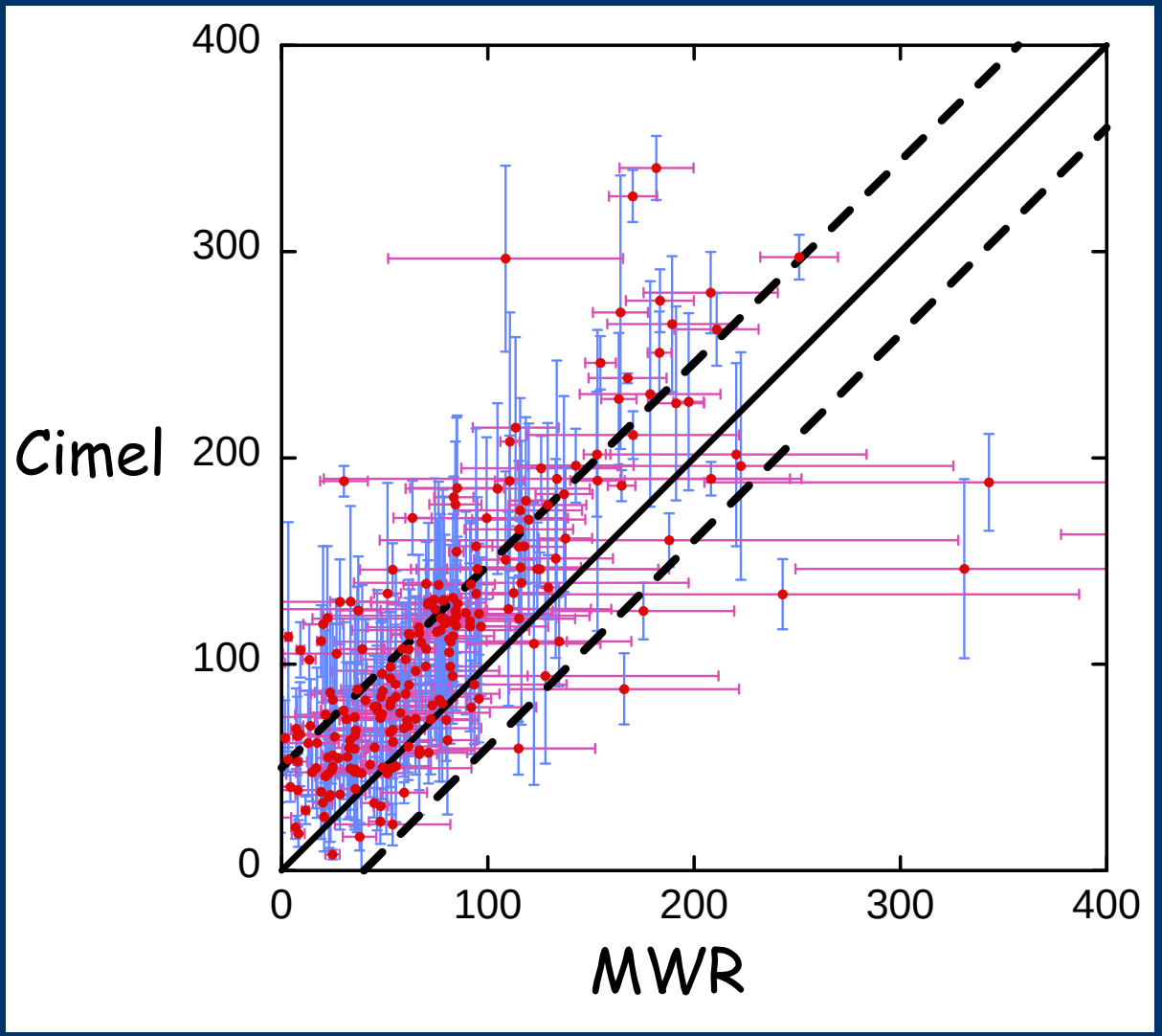
Compare retrieved cloud optical depths to those from MODIS



	Mean
Cimel	30
MODIS	23

	Deviation
Cimel	18
MODIS	15

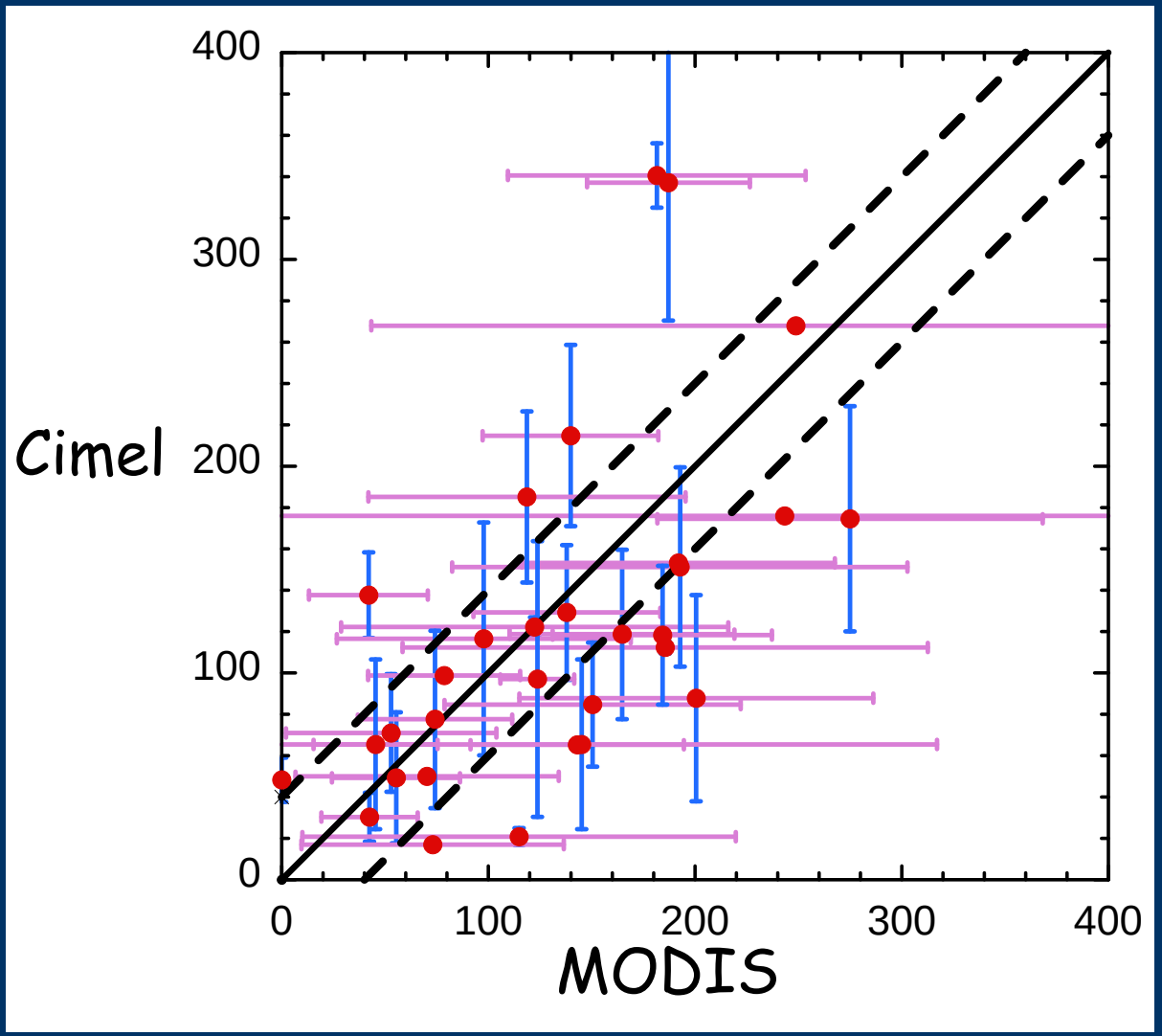
Compare retrieved liquid water paths to those from the ARM MWR



	Mean
Cimel	112
MWR	80

	Deviation
Cimel	63
MWR	64

Compare retrieved liquid water paths to those from MODIS



	Mean
Cimel	125
MODIS	136

	Deviation
Cimel	82
MODIS	65

Summary

- Clouds in COPS were far from the idealized homogeneous 1D clouds assumed by most retrieval method.
- Our method using zenith radiance performed quite well in retrieving cloud optical depth and liquid water path.
- Intercomparisons between our method, the microwave radiometer, the MFRSR flux method, and MODIS retrievals are reasonably satisfactory.