How can one retrieve cloud properties using ARM zenith radiance measurements ?

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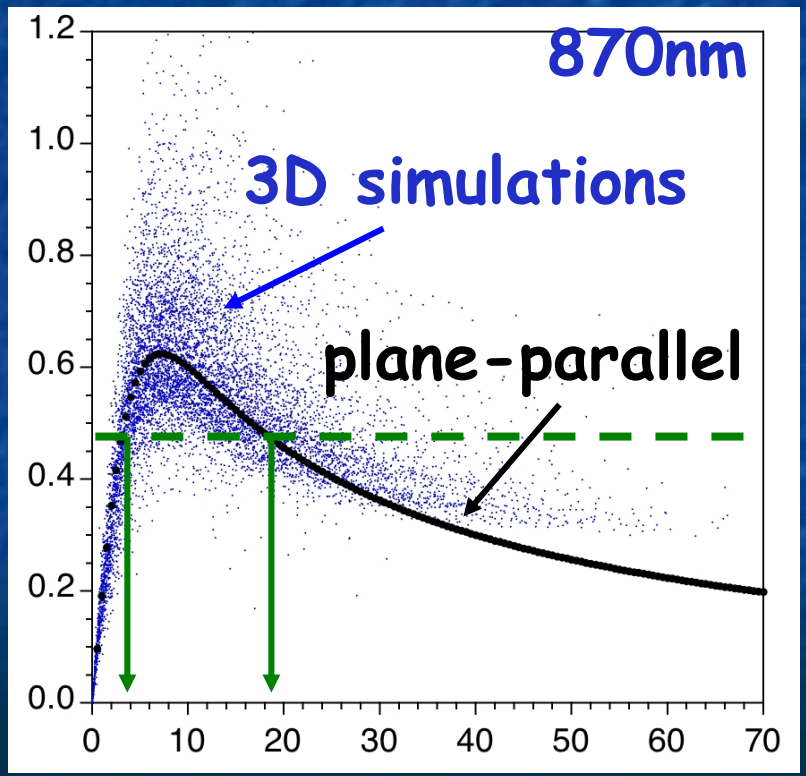
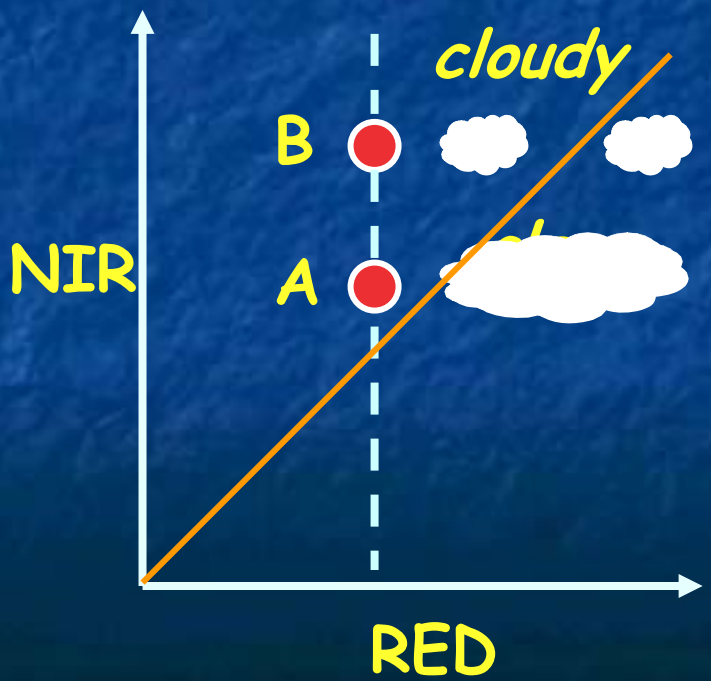
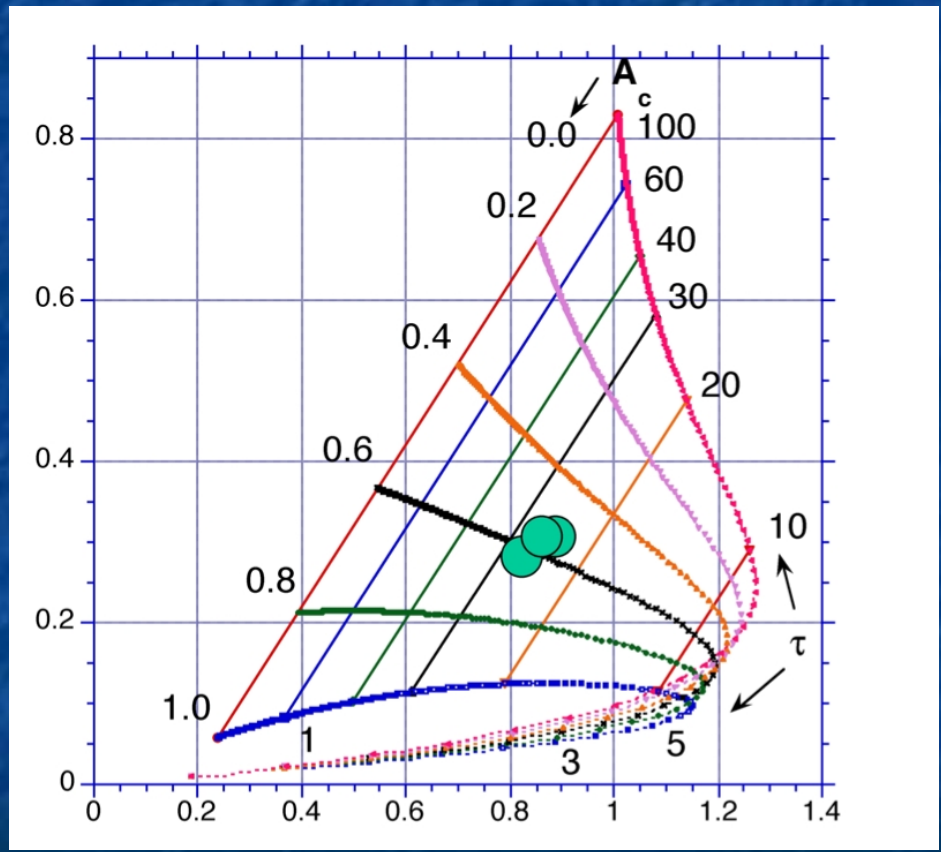
2-channel Narrow-Field-Of-View radiometer:
1.2°FOV
673 (RED) & 870 (NIR) nm

Radiance



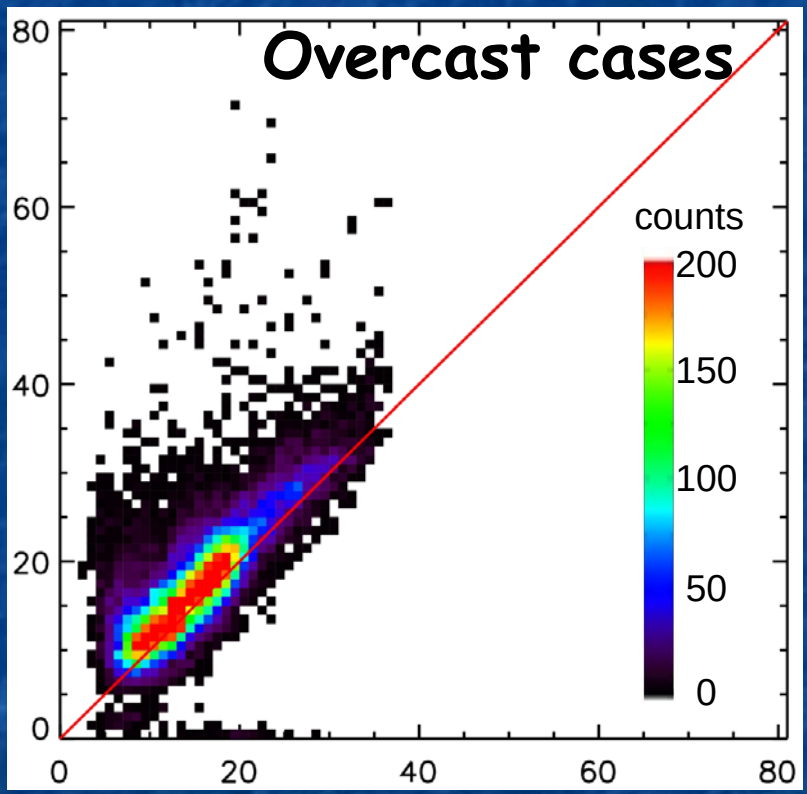


Retrieval method for cloud optical depth & effective cloud fraction (REDvsNIR)



What did we learn from the Pt. Reyes experiment?

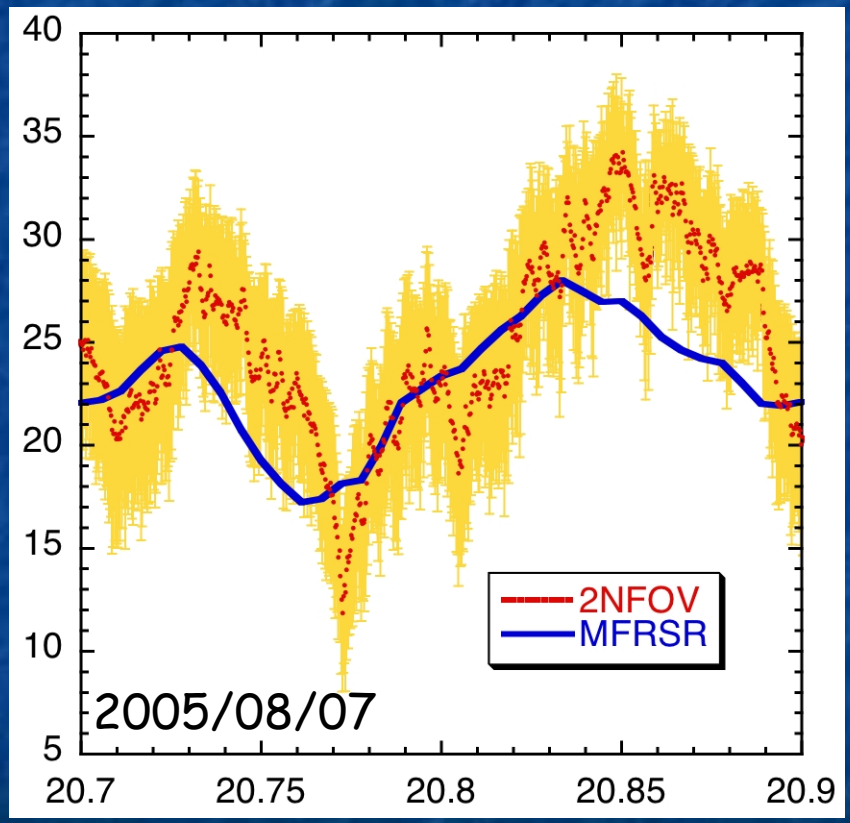
Retrievals from 2NFOV



Retrieved cloud optical depth from MFRSR (Min's group)

Uncertainty of our retrievals

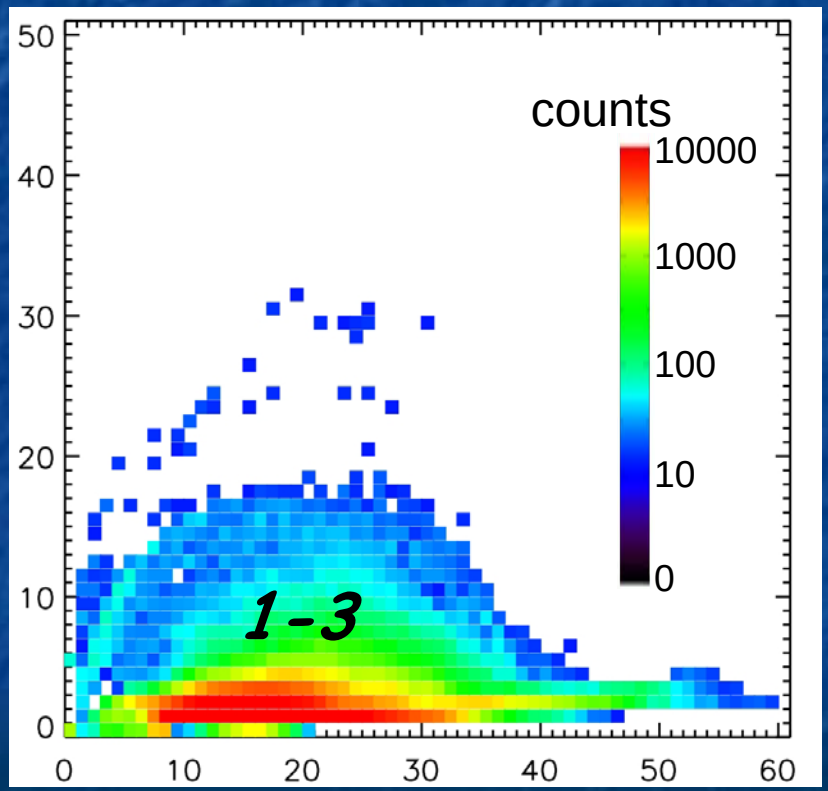
Retrieved cloud optical depth



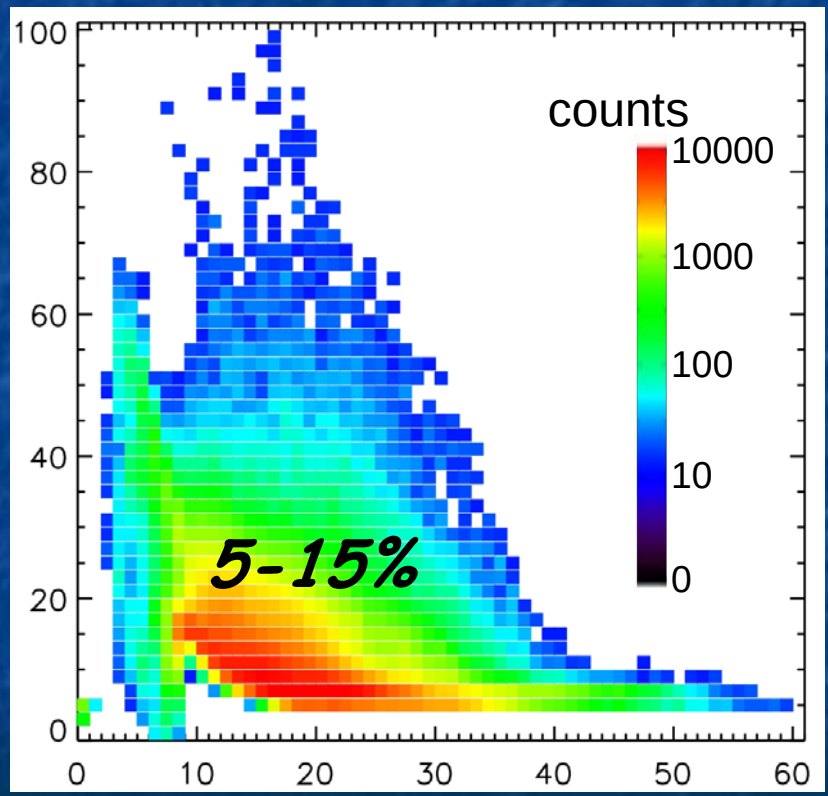
- Radiance:
  - 3% at RED
  - 3% at NIR
- Surface albedo:
  - 10% at RED
  - 5% at NIR

Uncertainty in cloud optical depth for all overcast cases

standard deviation



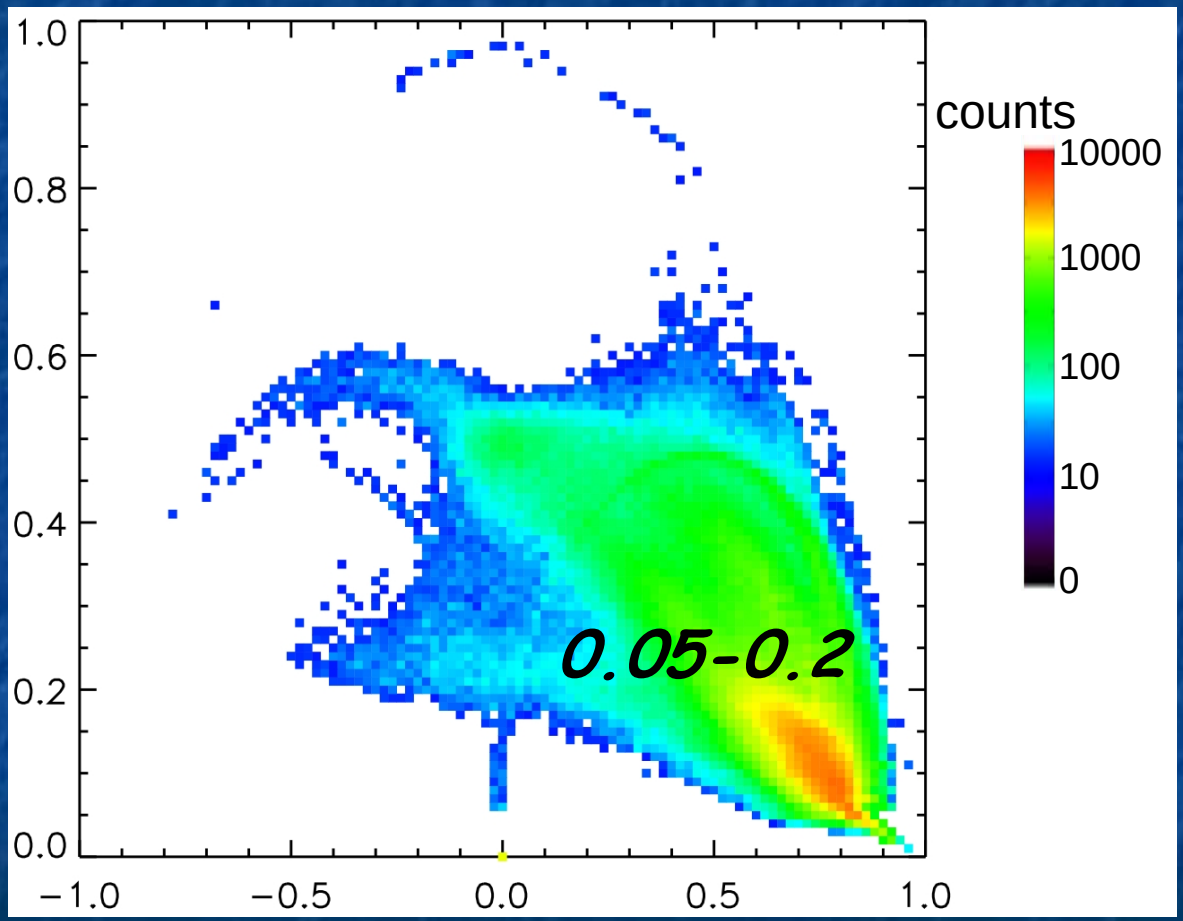
standard deviation (%)



Retrieved cloud optical depths from 2NFOV

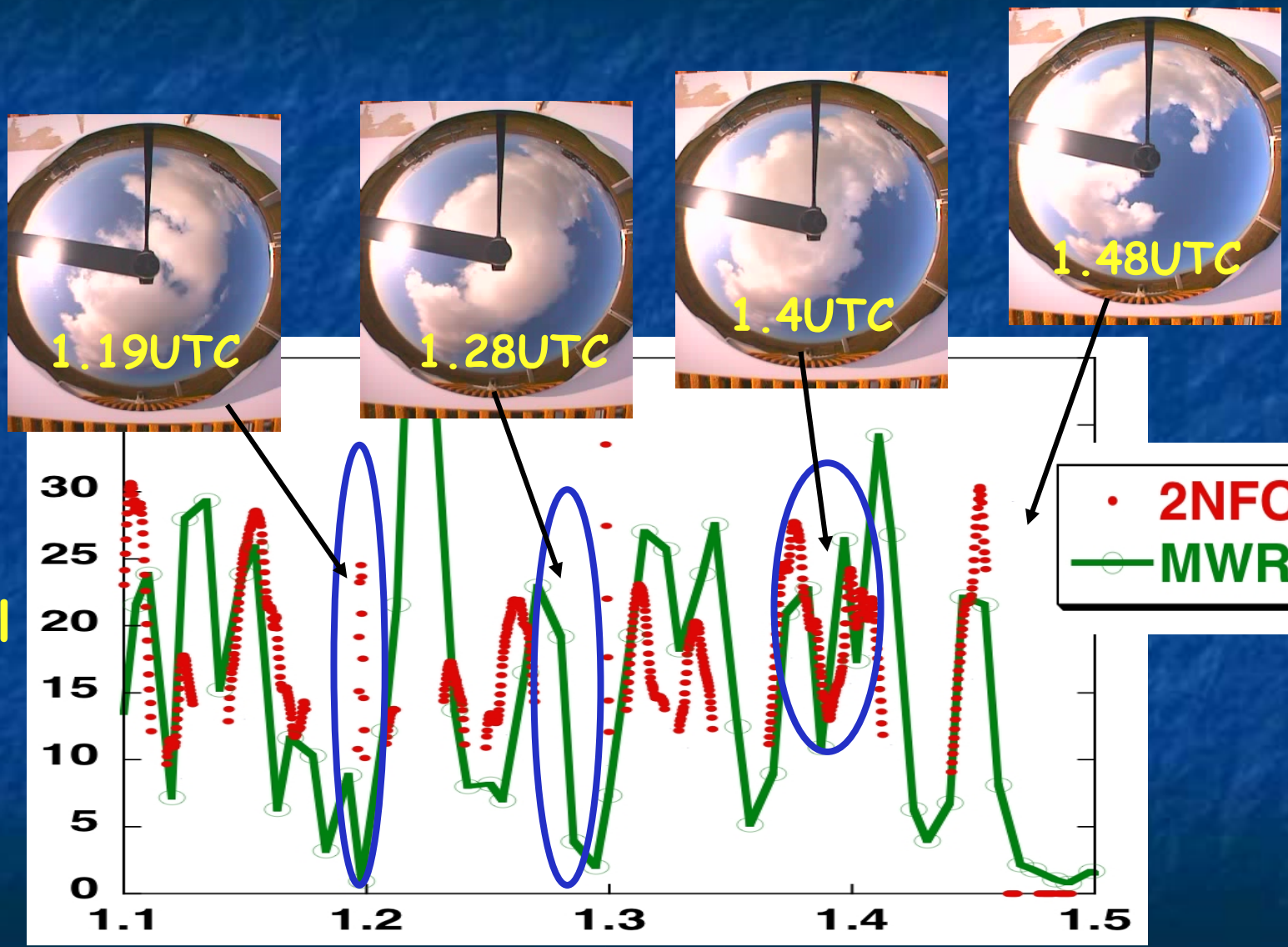
Uncertainty in effective cloud fraction for all overcast cases

standard deviation



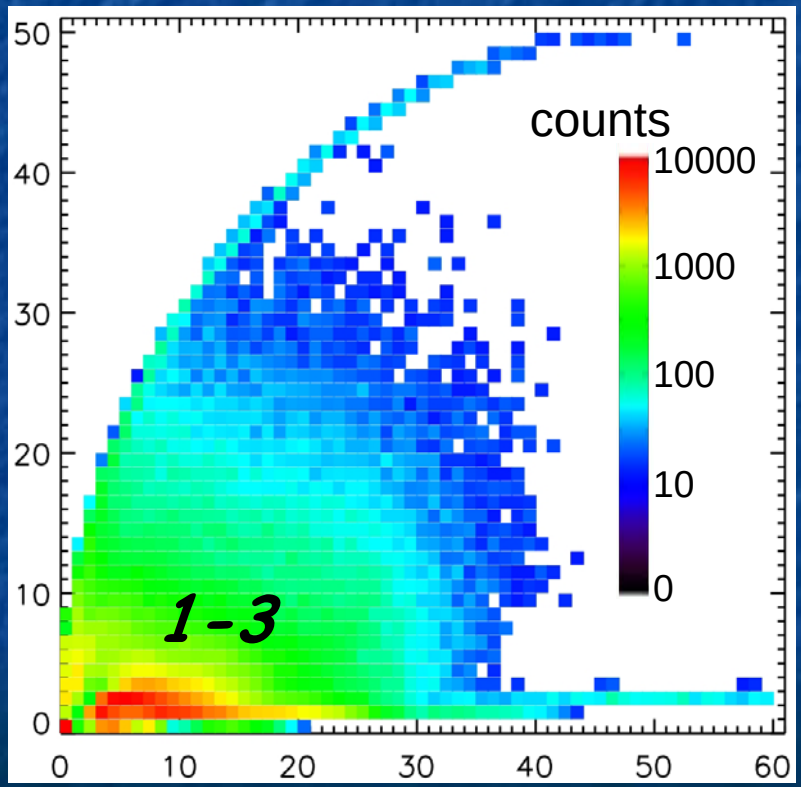
Retrieved effective cloud fraction from 2NFOV

For broken clouds …

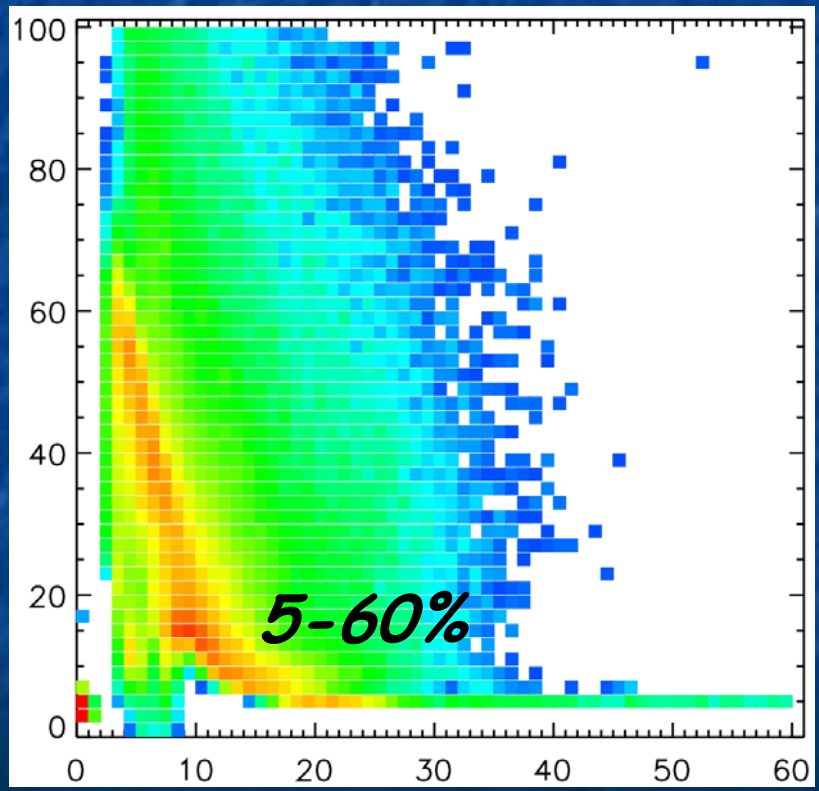


Uncertainty for all broken clouds

standard deviation

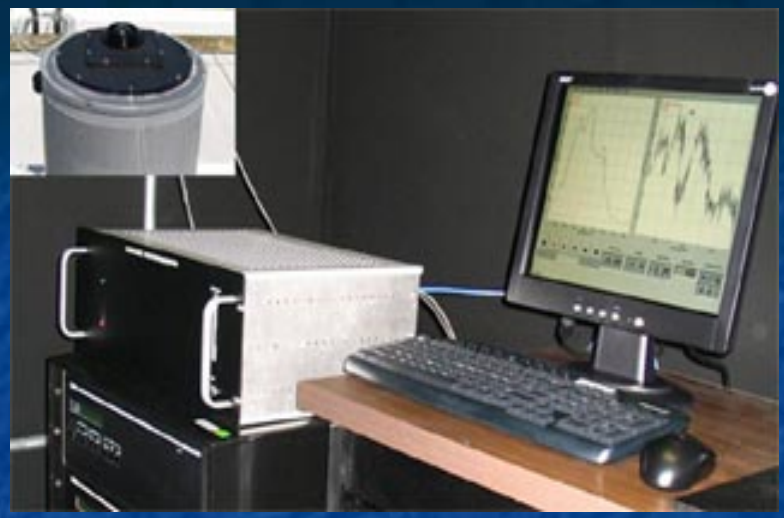


standard deviation (%)



Retrieved cloud optical depths from 2NFOV

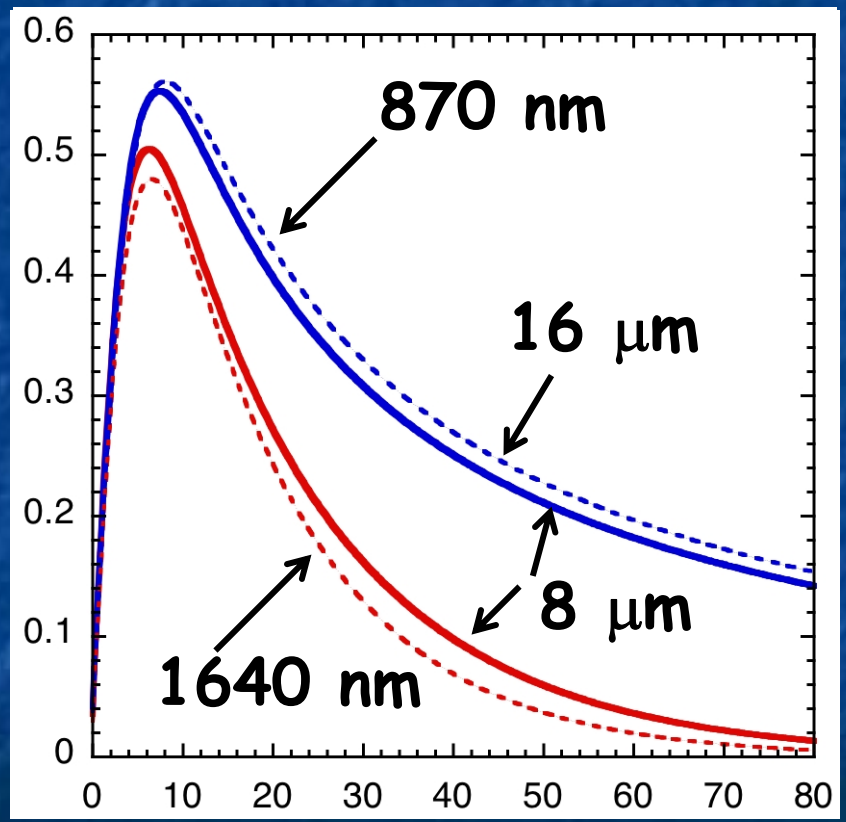
ARM Shortwave Spectrometer (SWS) :
1.4° FOV; 350-2170 nm; 1s



- Wavelengths with different surface reflectance
  - Cloud optical depth
  - Effective cloud fraction
- Wavelengths with different water absorption
  - Cloud optical depth
  - Effective radius of cloud droplets

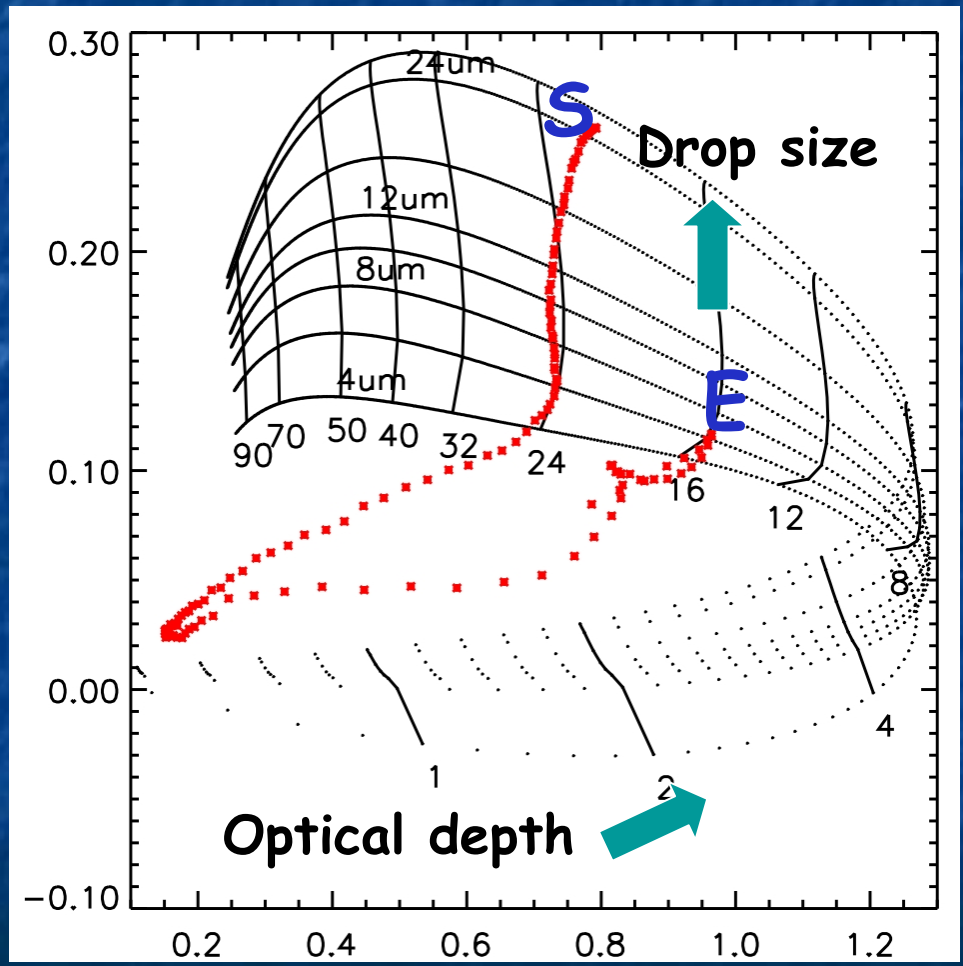
Retrieve effective radius of cloud droplets from 870 (NIR) & 1640 nm (MIR)

Radiance

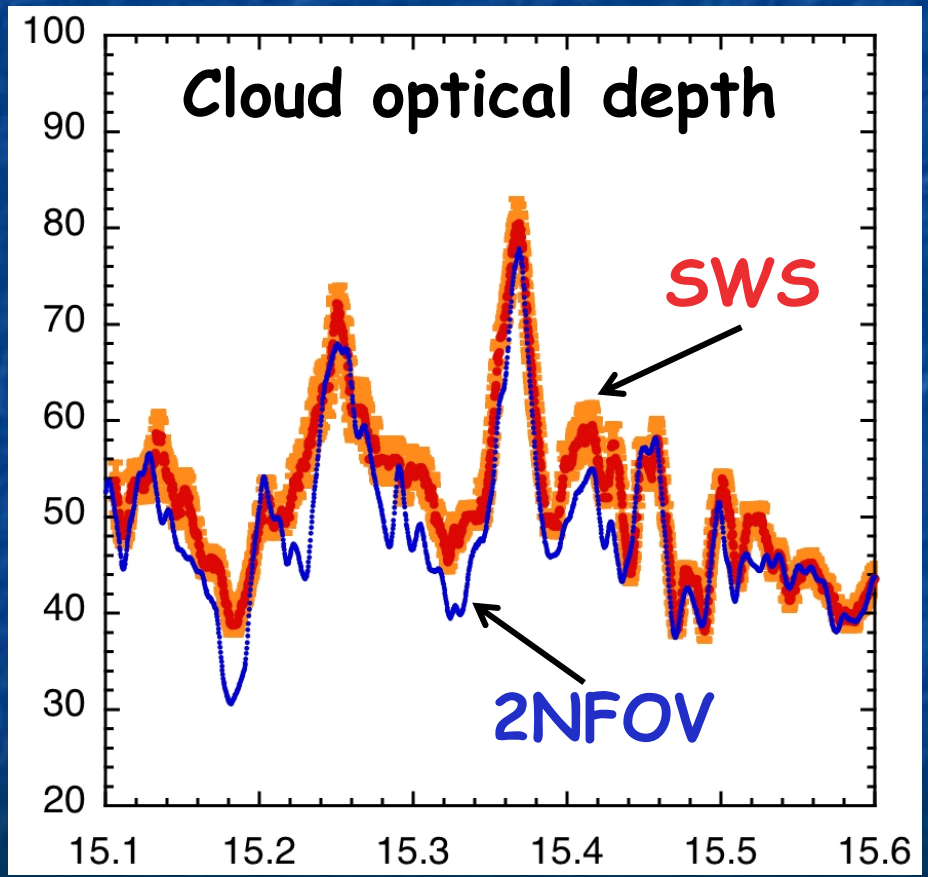


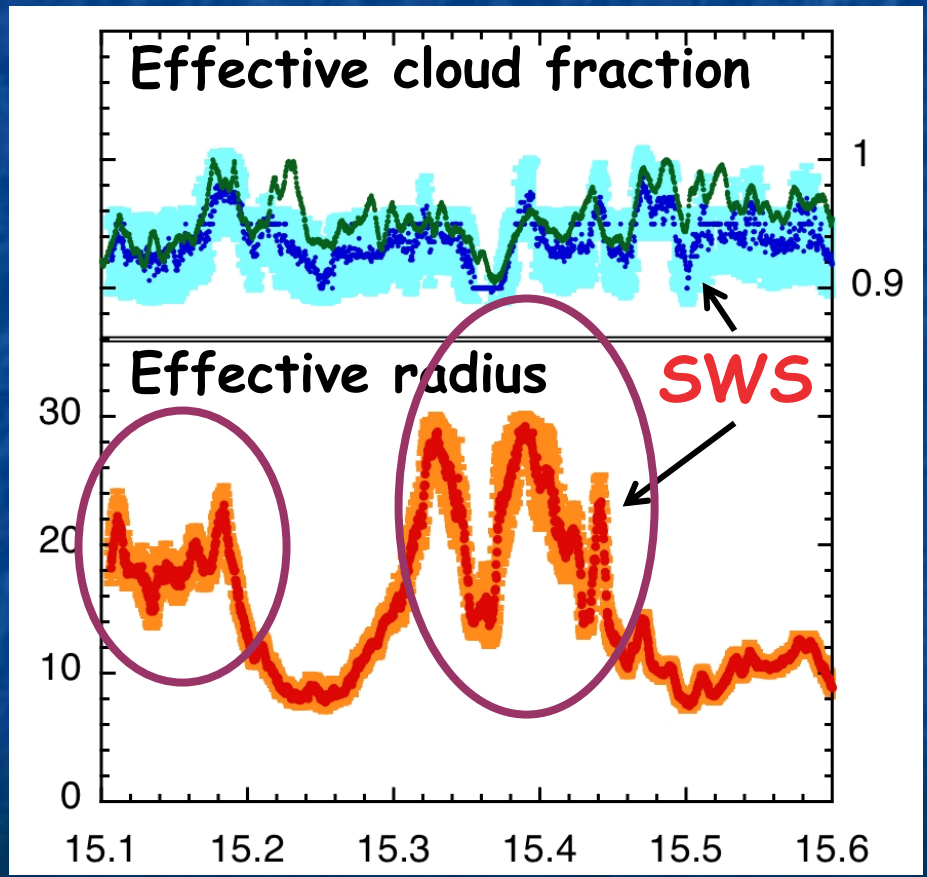
Cloud optical depth

Retrieval method for drop size



Compare SWS-retrieved cloud properties with those from 2NFOV

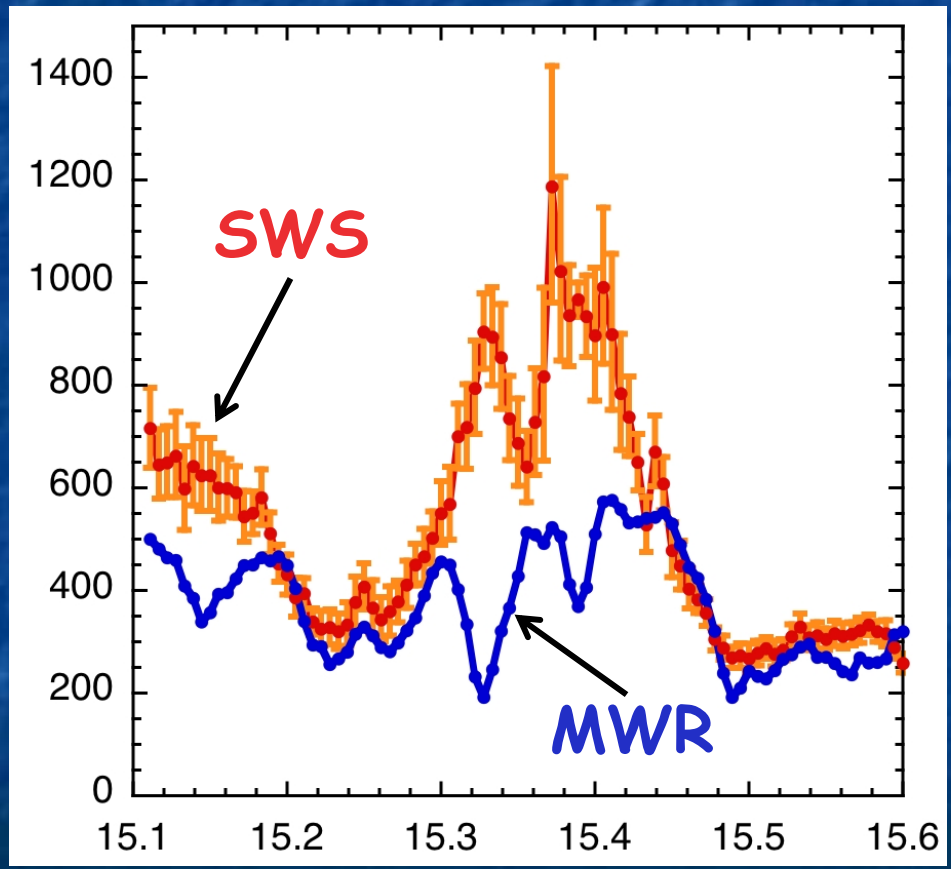




Time (UTC)

Compare retrieved liquid water paths with those from MWR

Liquid water path (g/m2)



Summary

- Retrieved cloud properties (cloud optical depth, particle size, and effective cloud fraction) using the ARM new shortwave spectrometer are promising.
- More inter-comparisons in radiance need to be done, especially for 1.6 um.
- Uncertainties are now provided for all retrievals from the 2NFOV.