CLOWD BBHRP Retrieval Algorithm Intercomparison

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Objectives

1. Use BBHRP framework to evaluate cloud property retrieval algorithms
   - Evaluate flux residuals at surface and TOA
   - Different CLOWD types
2. Develop set of heating rates for CLOWD types
   - Evaluate model simulations
   - Examine heating rate profiles for different types (i.e. Marine BL, NSA)
   - Assess required accuracy for retrievals

$LWP < 100\ g/m^2$

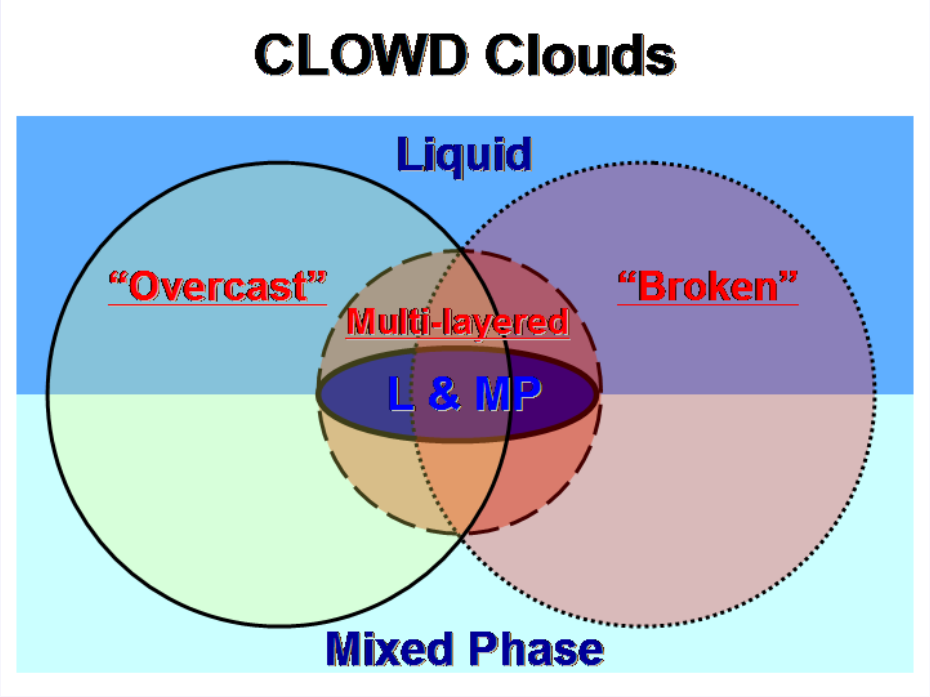


Figure courtesy Andy Vogelmann

CLOWD Cases

- Overcast, single-layered warm cloud
- Broken, single-layered warm cloud
- Broken mixed-phase cloud & Multi-level clouds

CLOWD-BBHRP Study Periods

1. Point Reyes (AMF)
   - Overcast
2. COPS (AMF)
   - Broken & Overcast (warm)
3. NSA
   - Overcast Mixed-Phase
4. SGP
   - Multiple cases – Nine multi-year data set
   - Inputs for about 3 years are already ready
   - Microbase, Merged Sounding, & Aerosol BE

First Study Period: Pt. Reyes

1 July - 31 September 2005

- Overcast clouds ~85% of the time during Jul-Aug
- Screen for overcast cases
- Cloud base was almost always less than 500 m
- Cloud thickness (from radar) was order 300 m
- Only a few short periods with multiple cloud layers

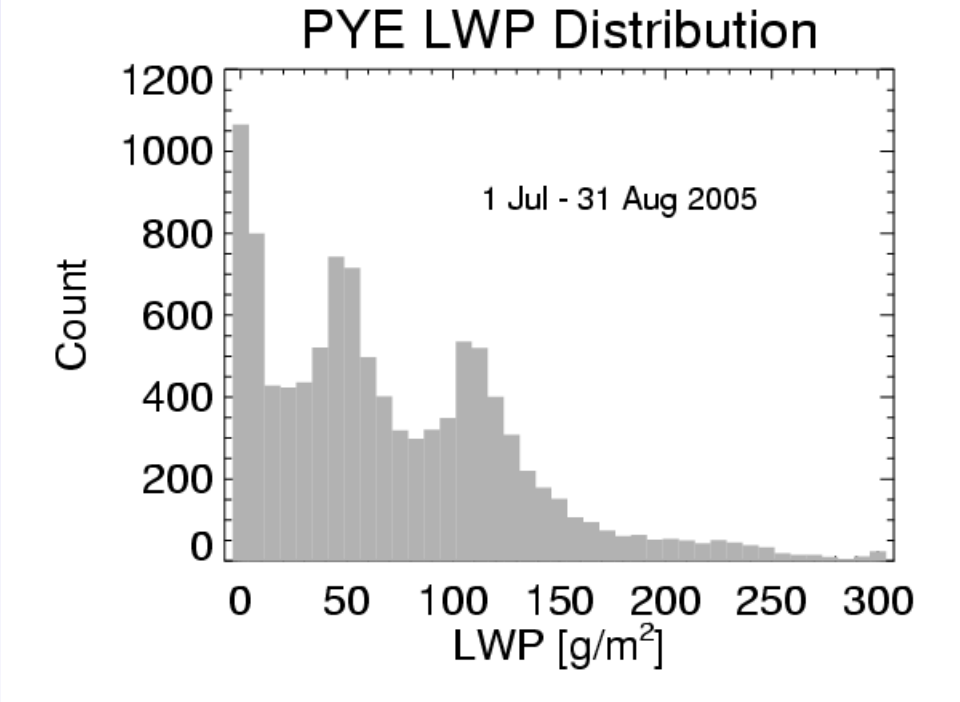
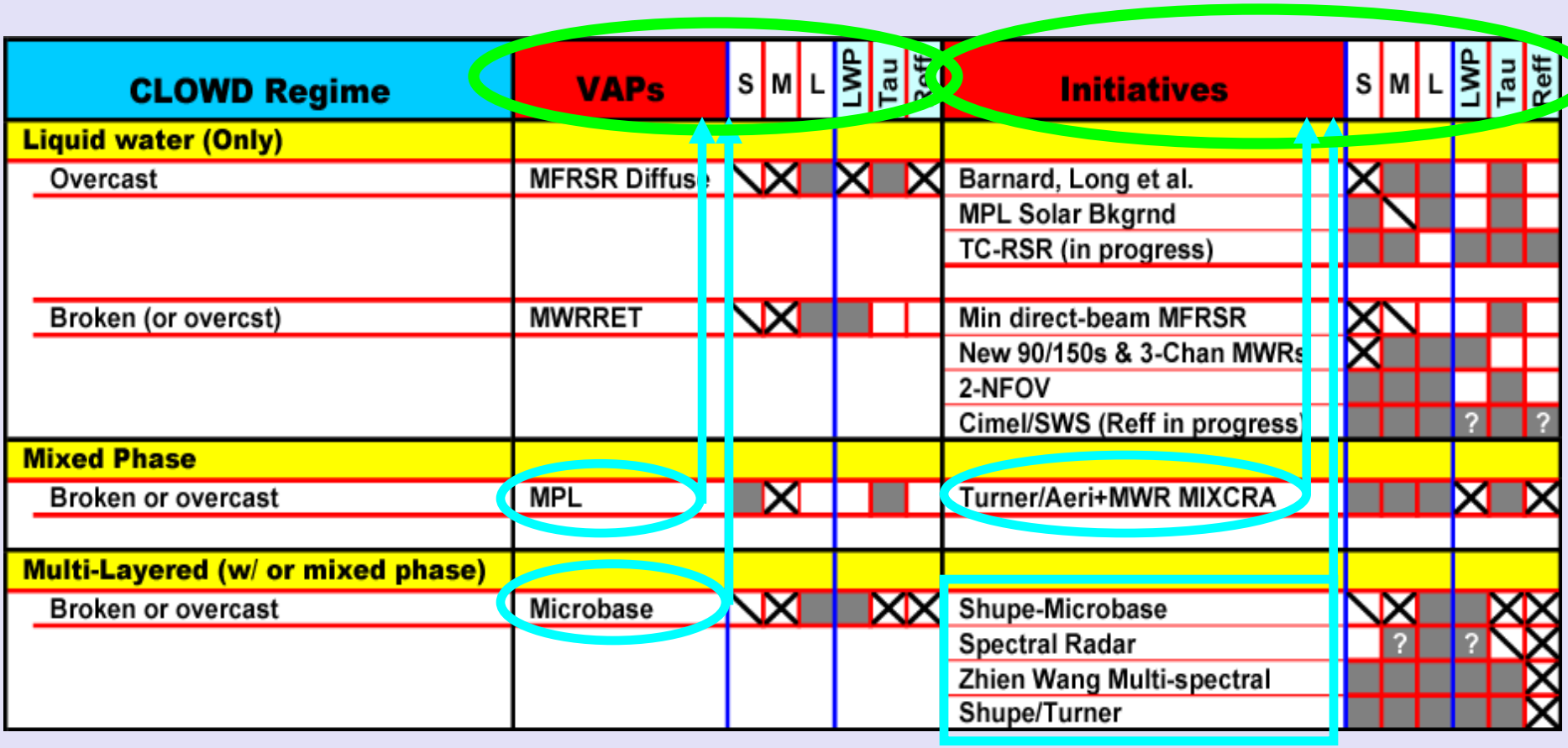


Figure courtesy David Turner



KEY

S="Small"; LWP < 25 gm^{-2}
M="Medium"; 25 < LWP < 100 gm^{-2}
L="Large"; LWP > 100 gm^{-2}

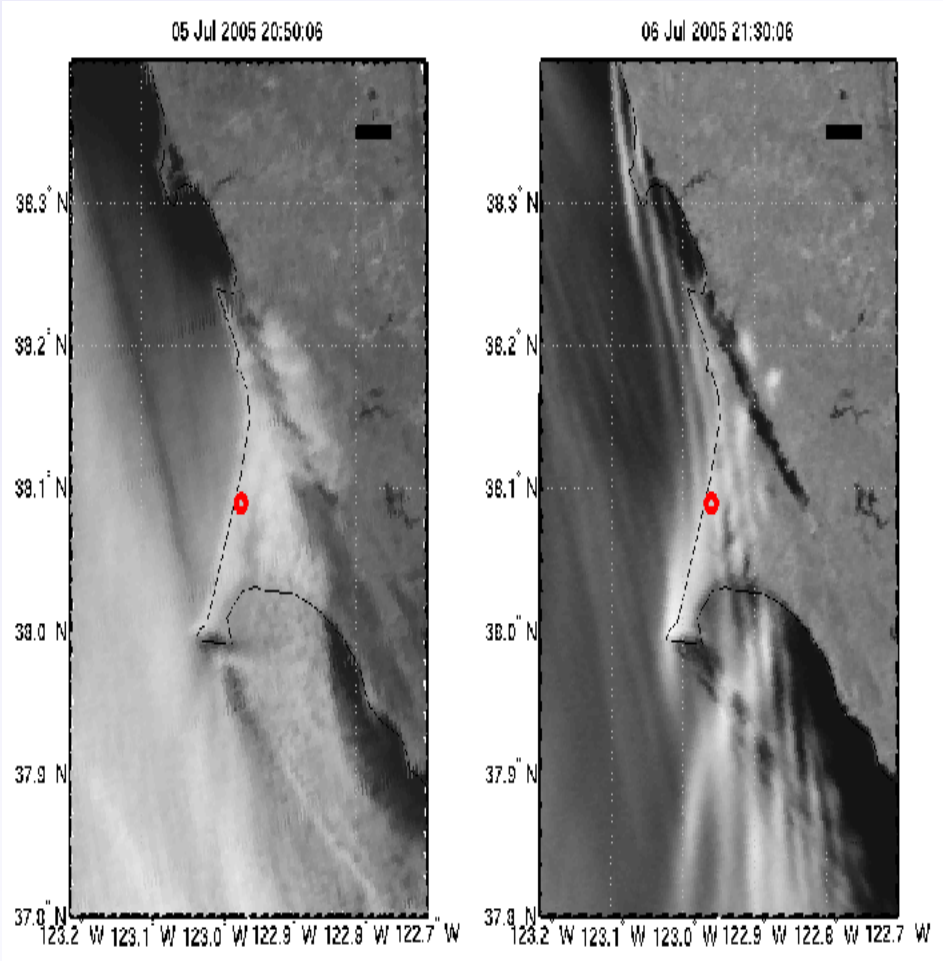
- No retrieved information
- Uncertain quality
- Good quality, maybe by indirect method
- Best quality
- ? Under development; Anticipate high quality

Table courtesy Andy Vogelmann

All methods might not have been tested on true CLOWD types (the really thin stuff)

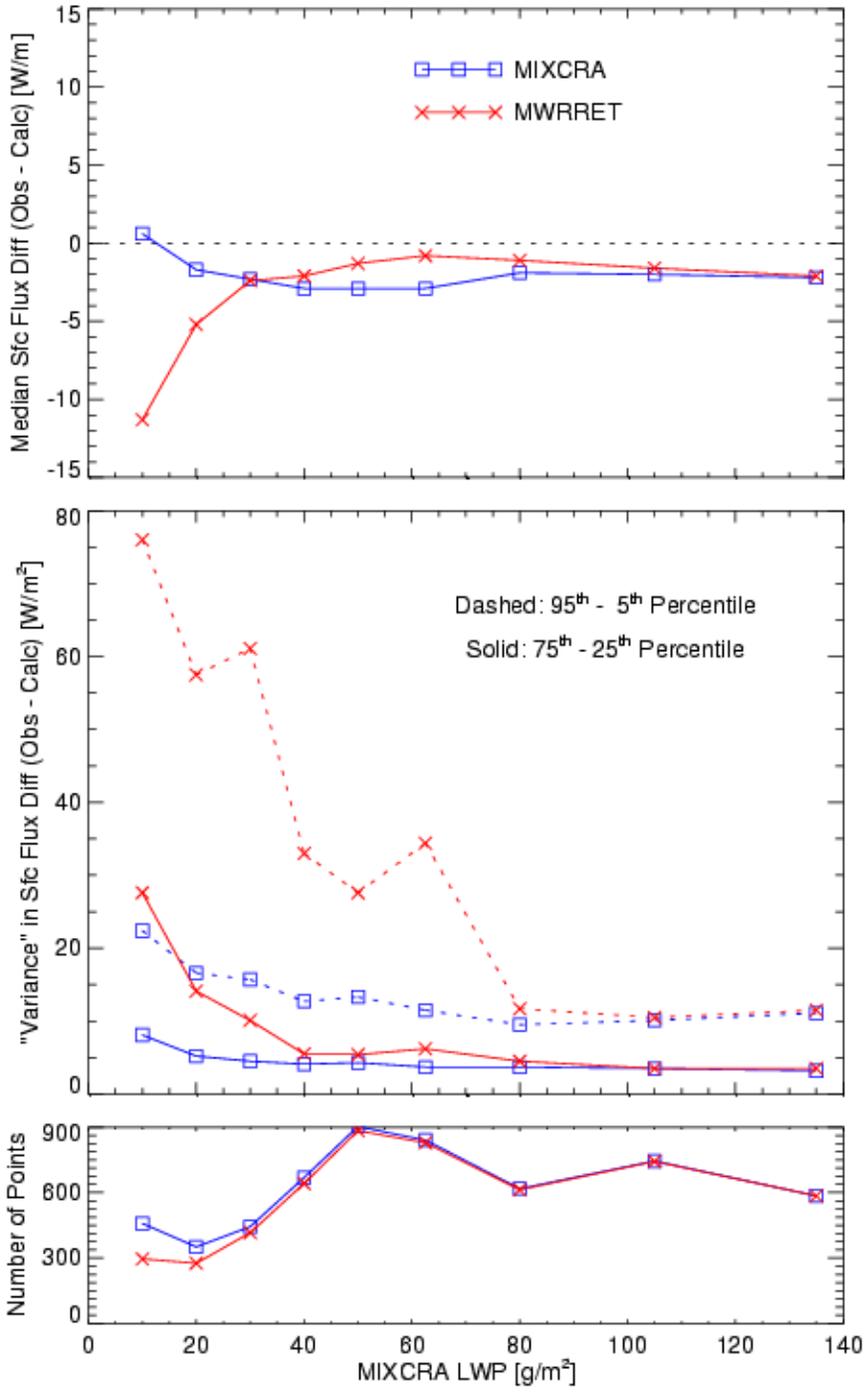
Current Progress

- Collect necessary inputs
  - Cloud properties
  - Aerosol distribution
  - Surface Albedo
- Put cloud and aerosol properties etc. into netcdf file formats
- Acquire surface and TOA flux observations for residual comparisons
  - Surface radiometers
  - TOA fluxes – issues due to inhomogeneous cloud field



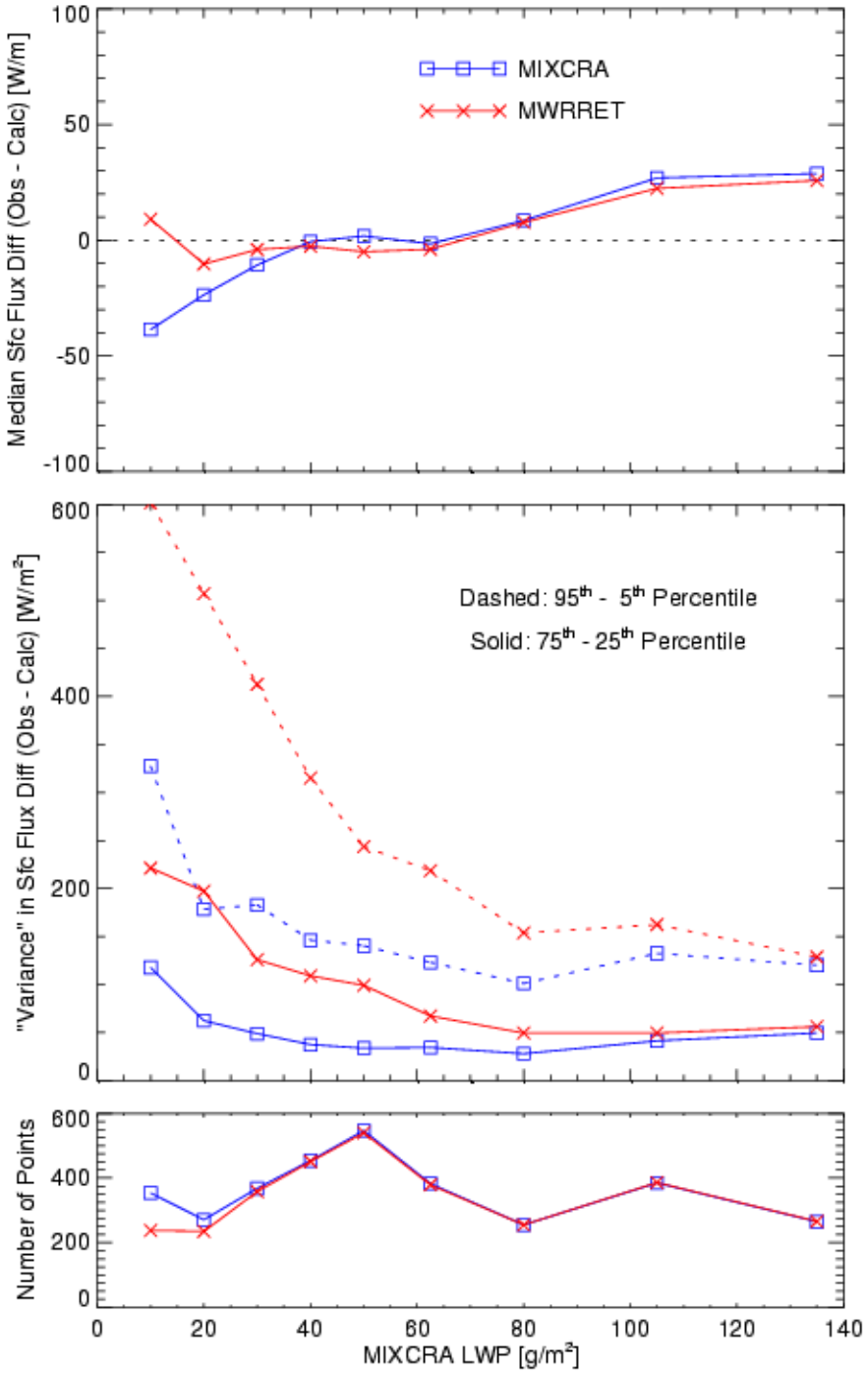
Analysis Considerations

- Distribution of mean layer quantities into vertical profile
  - Cloud boundaries from lidar/radar measurements (courtesy M. J. Bartholomew)
  - Assume adiabatic profile for vertical distribution (0.9 adiabaticity)
- Choose 30 min cloudy periods (overcast)
- Assume no aerosols as a first approx.
- Surface Albedo
  - No upwelling MFR measurements available
  - 85% land, 15% water
  - Need Albedos for the 14 RRTM shortwave bands (Eli Mlawer)



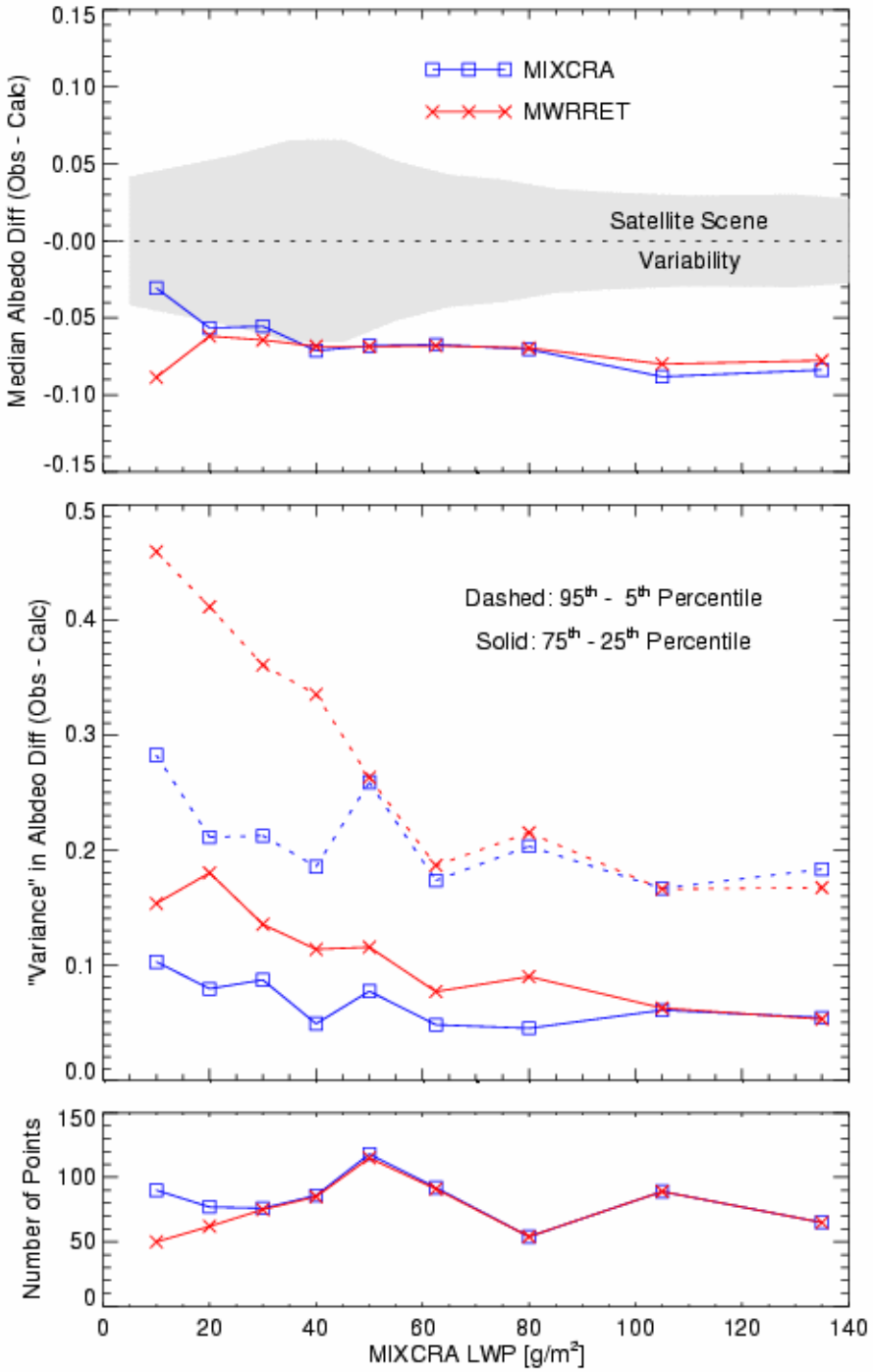
Surface LW Closure Exercise (Turner)

- Compare MIXCRA and MWRRET cloud props
- Use cloud properties in 1-D RT model to compute surface LW flux
- Compare calcs with the pyrgeometer obs
- Mean bias is smaller for MIXCRA
- Variance in flux residuals is significantly smaller for MIXCRA than MWRRET
- Similar results day and night



Surface SW Closure Exercise (Turner)

- Similar exercise as LW closure
- *No aerosols included in the calculations*
- MIXCRA shows negative bias, but small amount of aerosol would improve results (and worsen MWRRET results)
- Variance in MIXCRA results is much lower than variance in MWRRET results for LWP below 120 g/m^2



TOA SW Closure Exercise (Turner)

- Similar exercise as SW surface closure
- *No aerosols included in the calculations*
- Both methods show negative bias, but small amount of aerosol would improve result slightly
- Unable to get agreement with both surface and TOA by changing LWP
- Variance in MIXCRA results is much lower than variance in MWRRET results for LWP below 100 g/m^2

Next Steps

- Finalize input parameters
- Obtain TOA Fluxes
  - Using hand navigation improves comparison, but is time consuming
  - Approach will be to compare to a hand full of cases from Mandy to assess uncertainty
- Collect retrievals from other participants!