Radiative Transfer for NEWS C^3M Product

Ceres STM SARB Working Group April 28-30 2009

- NEWS CCCM Calipso/Cloudsat/Ceres/Modis TEAM Members
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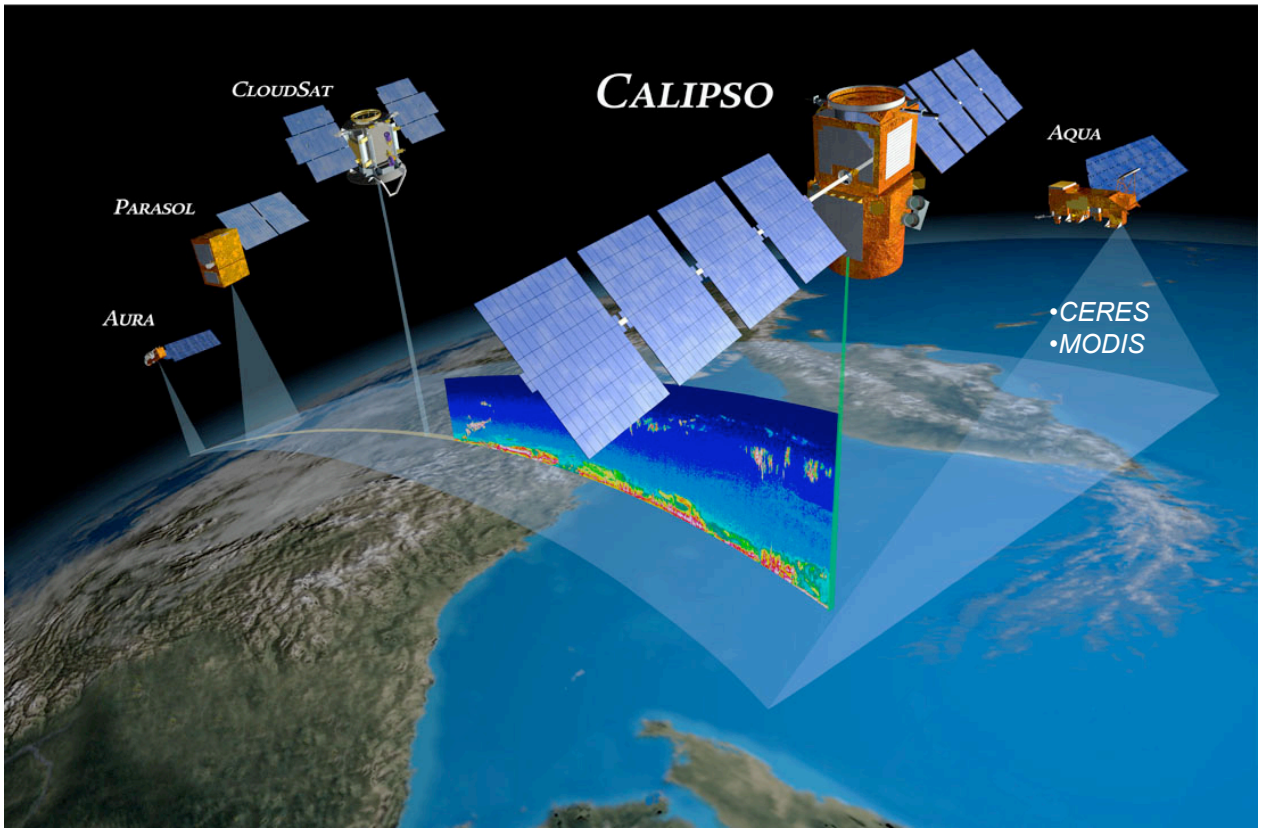
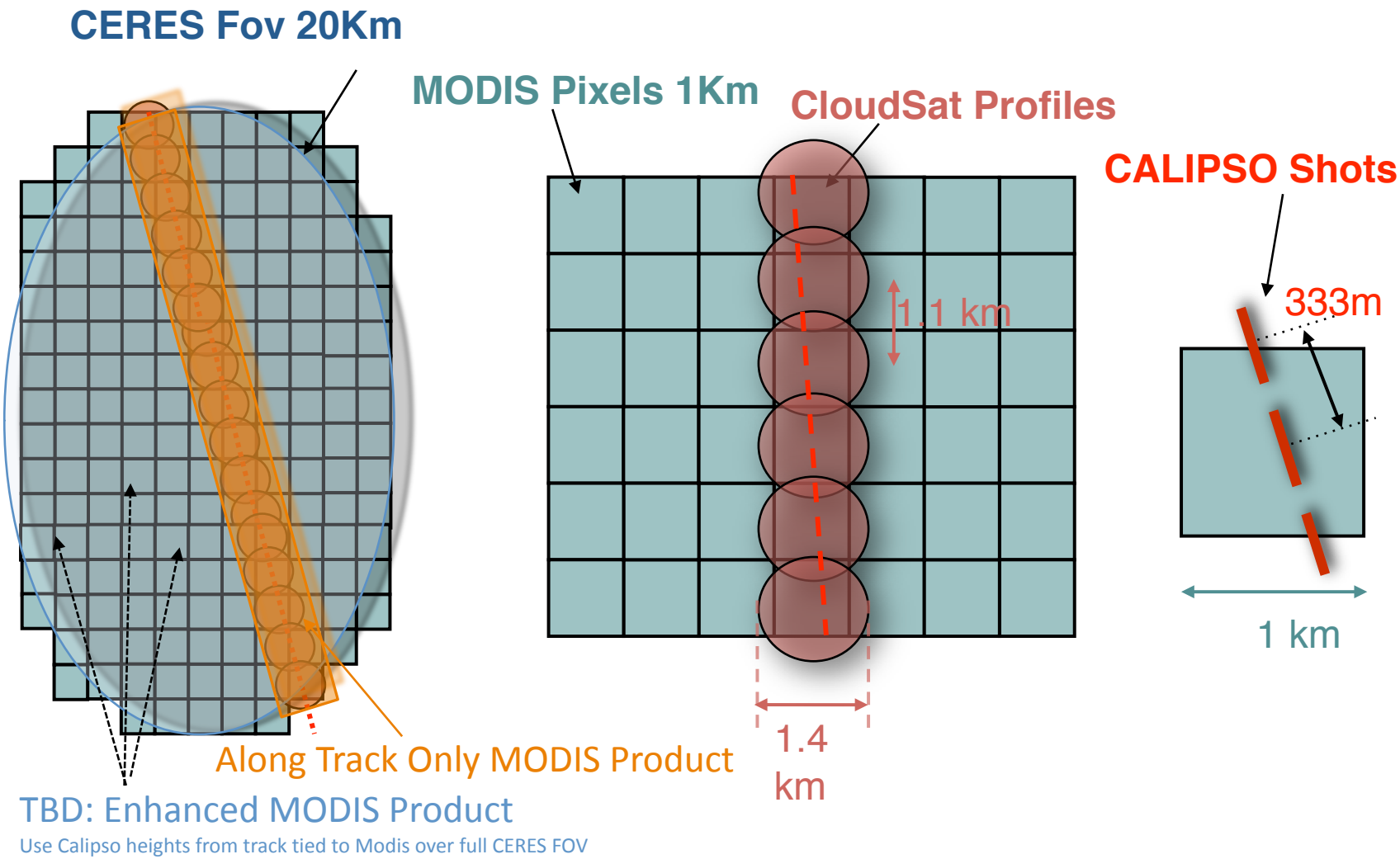
    - (Calipso, Cloudsat, Modis) Cloud Product
  - Walt Miller
    - CERES Convolution
  - Fred Rose
    - Fu-liou Radiative Transfer

AQUA A-Train

- CERES
  - Broadband Flux
- CLOUDSAT
  - Radar
- CALIPSO
  - Lidar
- MODIS
  - Multi Spectral Imager



CERES CALIPSO CLOUDSAT MODIS Collocation



Courtesy S. Sun-Mack

NEWS CCCM RT Overview

- Modified FU-LIOU code (18Sw,12Lw) bands, 128 levels , 4stream SW
- Geos5 MOA profiles of [Temperature, Humidity , Ozone]
  - T_{skin} when Cloudy
- MODIS / Minnis Clouds
  - Optical depth, Phase , Particle Size
- CALIPSO /CLOUDSAT
  - Cloud Heights and Vertical Overlap
  - Extinction profile (Maximum of ONE per CERES FOV)
- Surface Albedo (NO CERES Toa based retrievals)
  - Ocean & SeaIce
    - COART Zhonghai Jin spectral LUT , f(SZA,TAU,WIND,Chlorophyll)
  - Land & Snow <70N
    - MCD43C1 :: MODIS Spectral BRDF (Terra& Aqua combined)
- Aerosols
  - CALIPSO extinction profiles
  - Match constituents ties to OPAC spectral optical properties

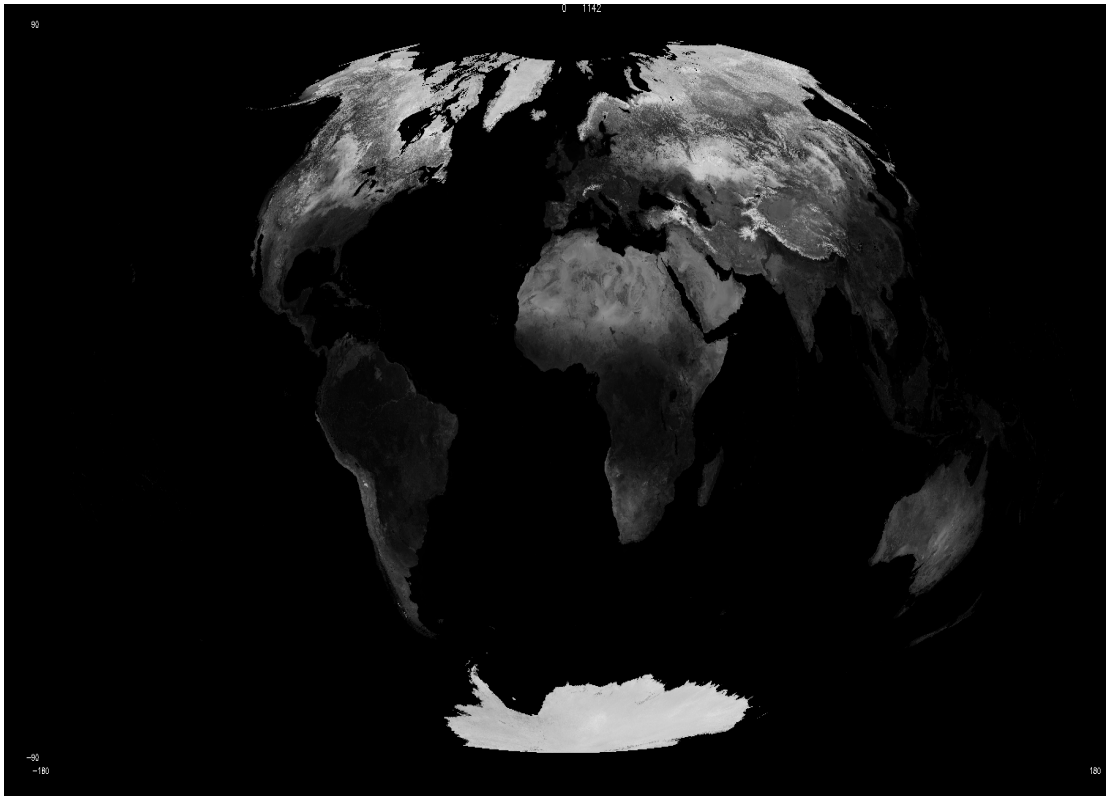
MODIS MCD43C1 Spectral Surface Albedo Product

A.H.Strahler & C.Schaff @ Boston Univ.

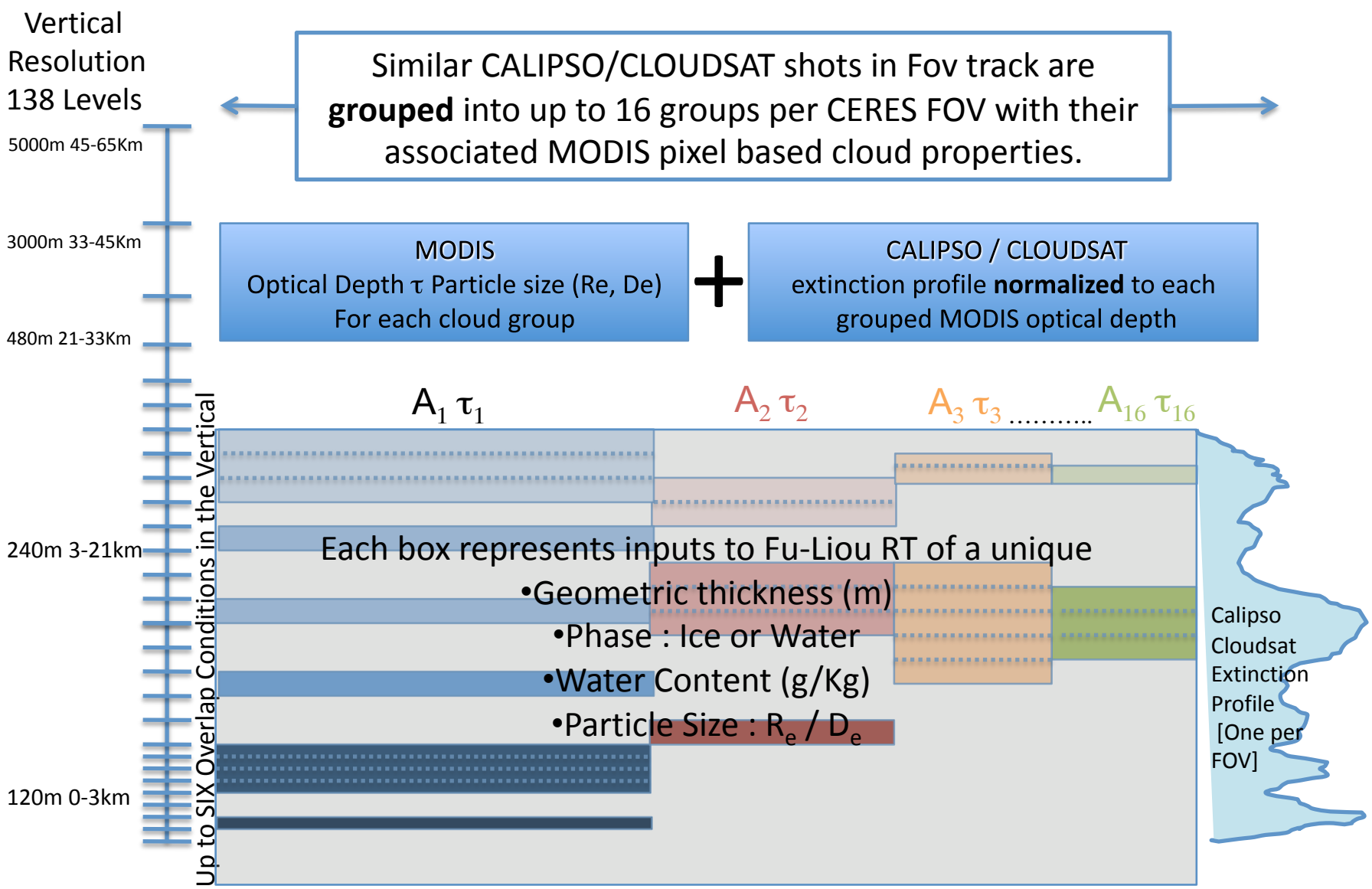
- Terra Aqua Combined
- Collection 5 MODIS
- Every 8 days
- 16 day integration
- 7 Wavelengths
- ~5Km spatial resolution
- 3 parameter BRDF
  - (iso, vol, geo)
  - f(SZA ,Tau)

- Gap Filling for C^3M
  - Composite maps
    - Seasonal
    - Yearly

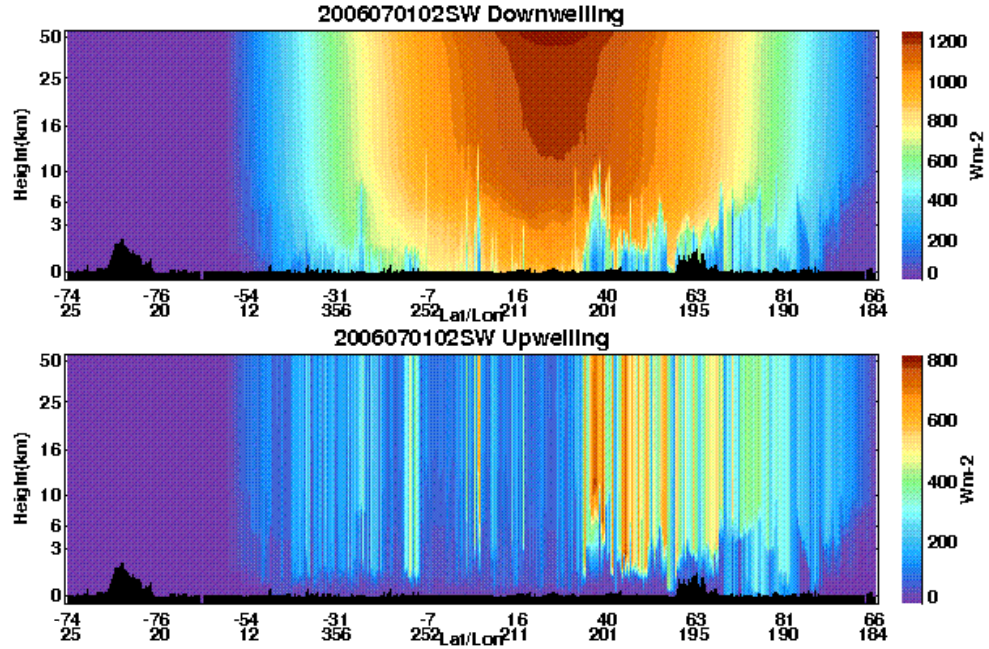
MCD43C1.A2007001_A2007088.005

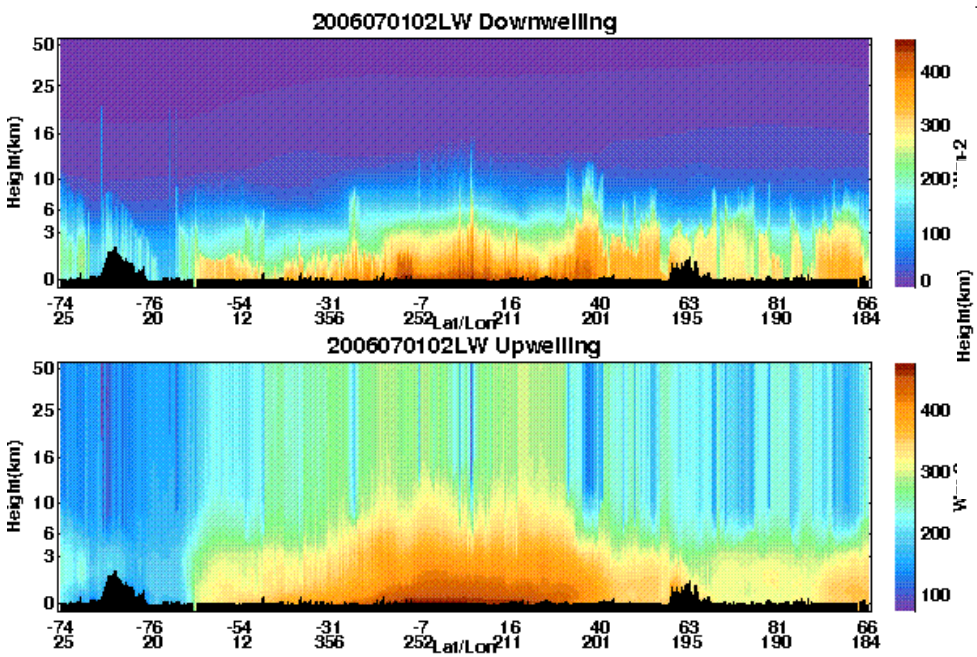


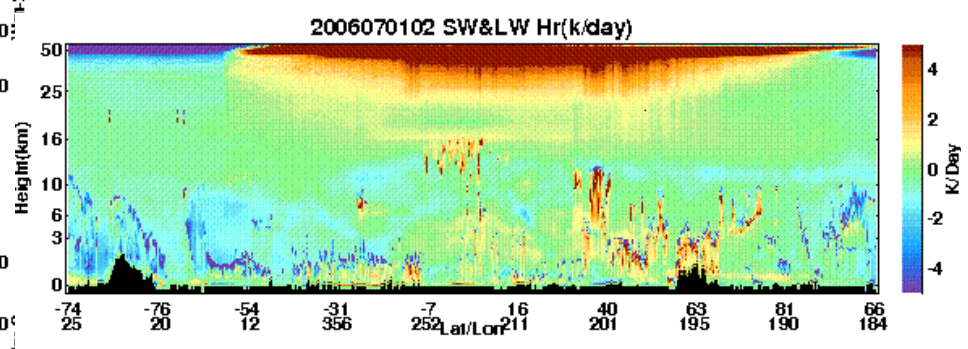
NEWS CCMS Radiative Transfer



NEWS CCCMS Flux & Heating Rate Example Profiles 2006_07_01_02



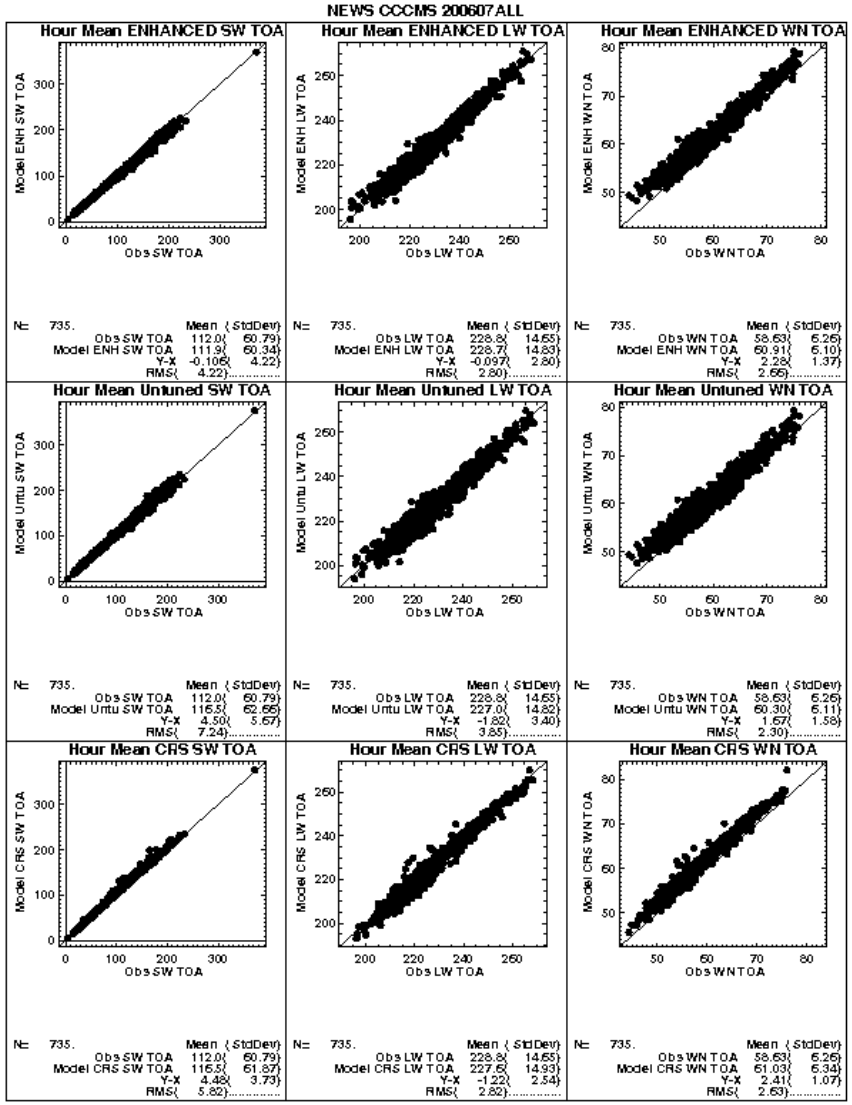




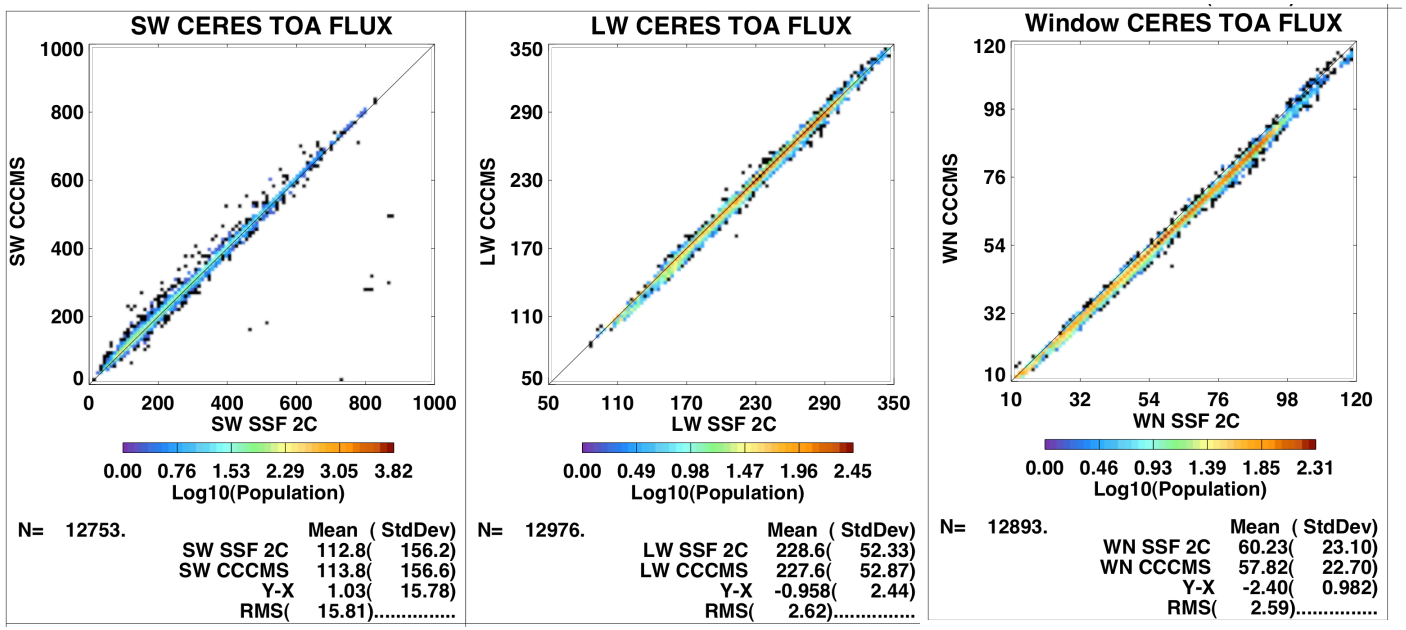
NEWS CCCMS MONTHLY Mean & Hourly Stddev

NEWS Rel2A CCCMS Jul07	Short wave	Long wave	Window
CERES* Observed	112.0	228.8	58.63
Enhanced- Obs	-0.10 (4.2)	-0.09 (2.8)	2.28 (2.6)
Standard- Obs	4.5 (7.2)	-1.82 (3.6)	1.75 (2.3)
CRS*- Obs.	4.5 (5.82)	-1.2 (2.8)	2.41 (2.63)

CERES* : Non-Edition Flashfluxlike
CRS* : NEWS run of CRS code.



CCCMS TOA CERES Fluxes

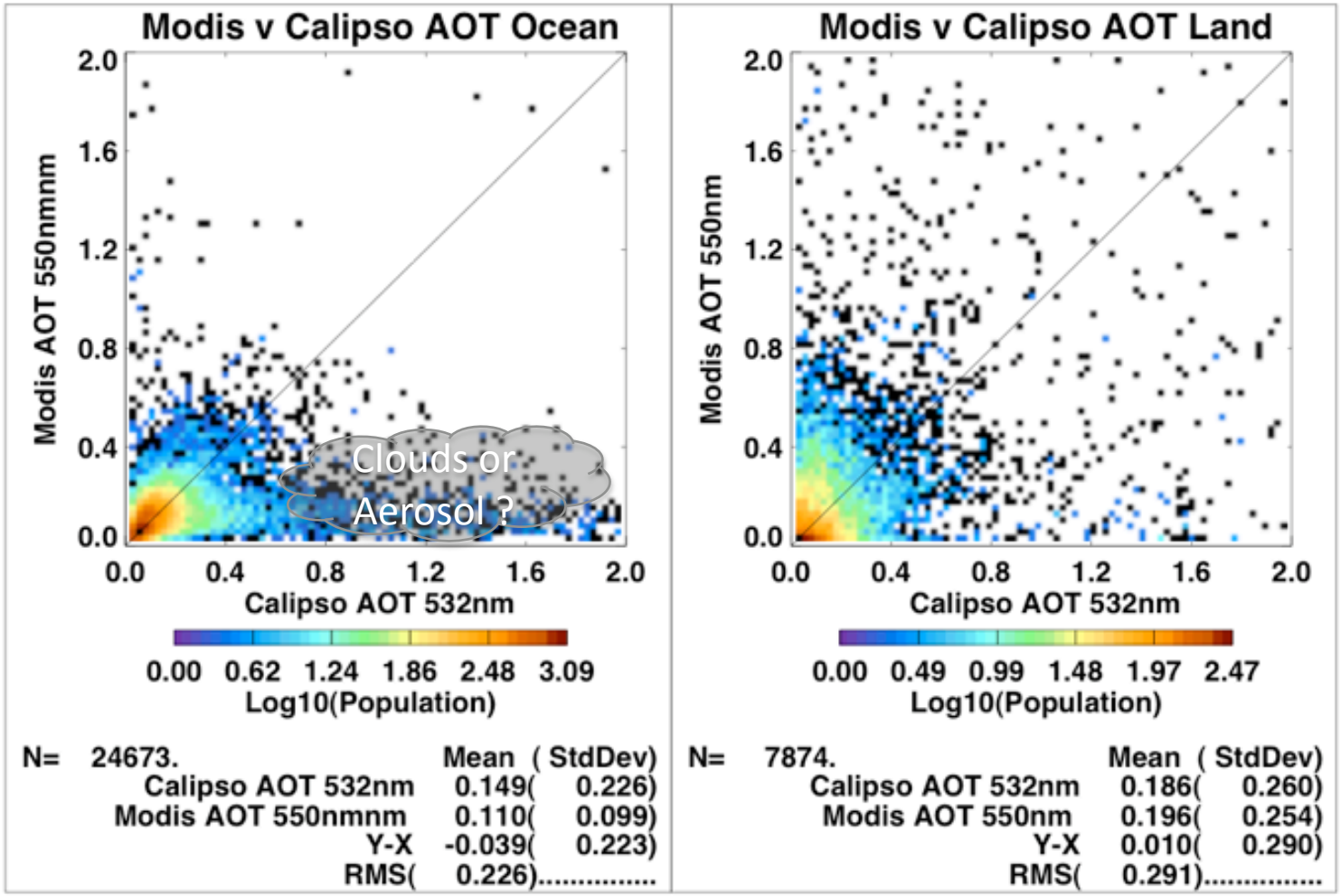


+0.9% SW Rev1 OK -0.4% LW -2.4Wm-2 (**- 4.0%)**Wn ???

•CER_SSF_Aqua-FM3-MODIS_Edition2C_034040.20060701

•CER-NEWS_CCCM_Aqua-FM3-MODIS-CAL-CS_RelA2_902902.20060701
-Flashflux-like: Edition1-CV IES with the same spectral response as FLASHFLUX
-Spectral response and gains from April 2006
-With equivalent of a Rev1 (1%SW) correction

Comparison of MODIS MOD04 and CALIPSO Aerosol Optical Depths (July 2006)

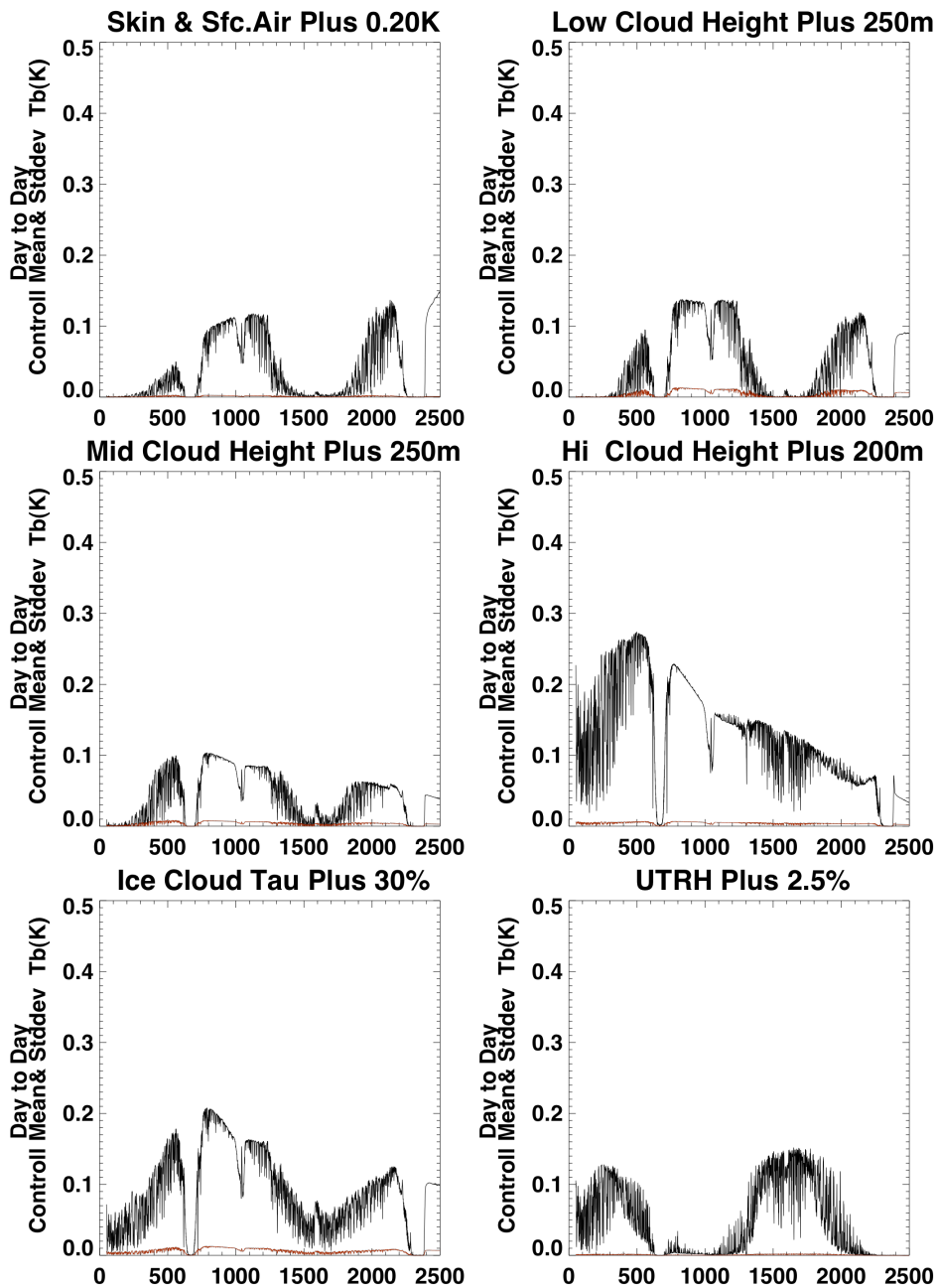


Sideshow#1:
CLARREO uses NEWS CCCMS data along with PCRTM (Principal Component Radiative Transfer Model) from Xu Liu

Computation of Climate Benchmark Fingerprints.

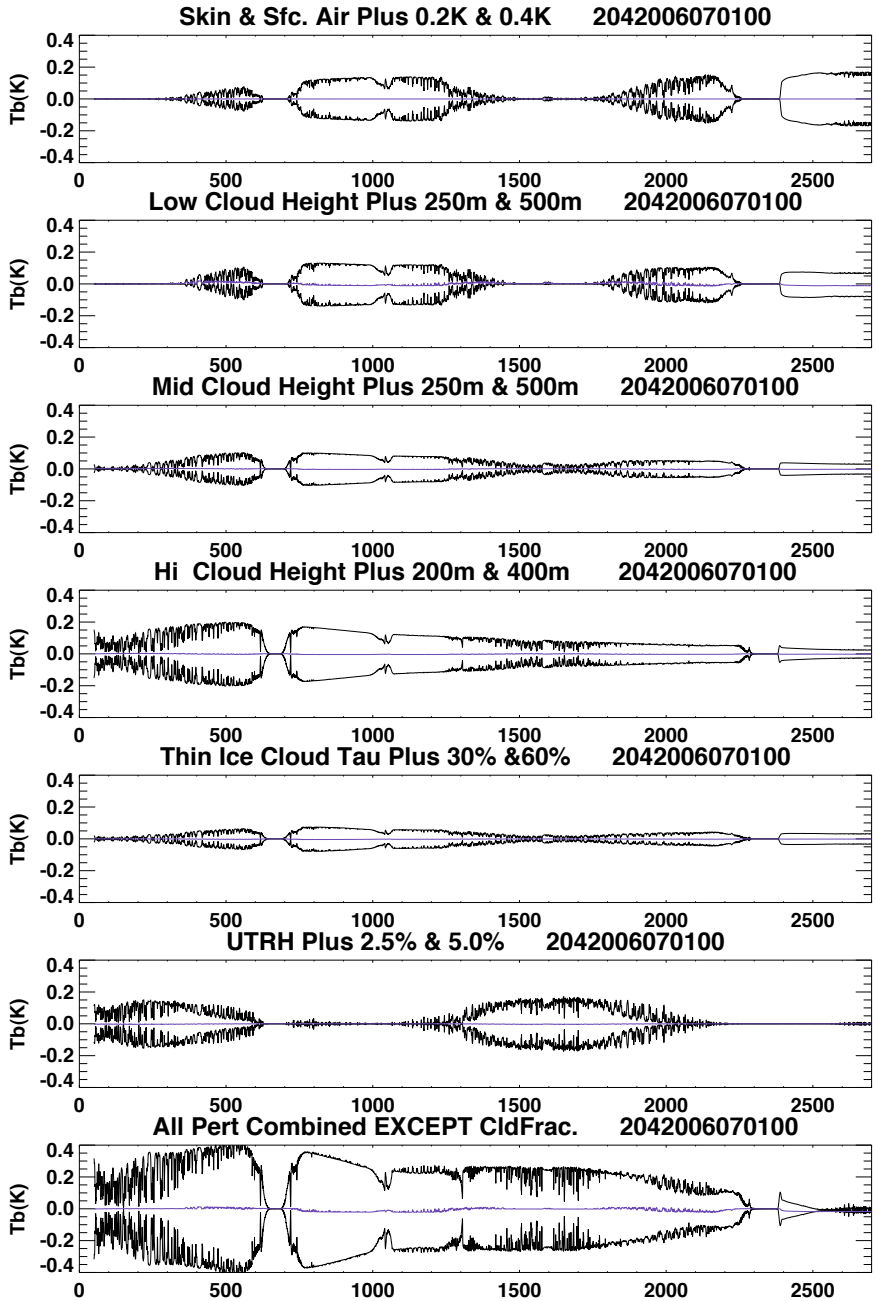
Partial derivatives of nadir longwave spectral brightness temperature

Idea in a nutshell :
Attribute long term decadal spectral radiance differences from CLARREO to spectral fingerprints.



LW radiance perturbations are linear over the small expected range of decadal climate change

Therefore attribution using linear regression possible.

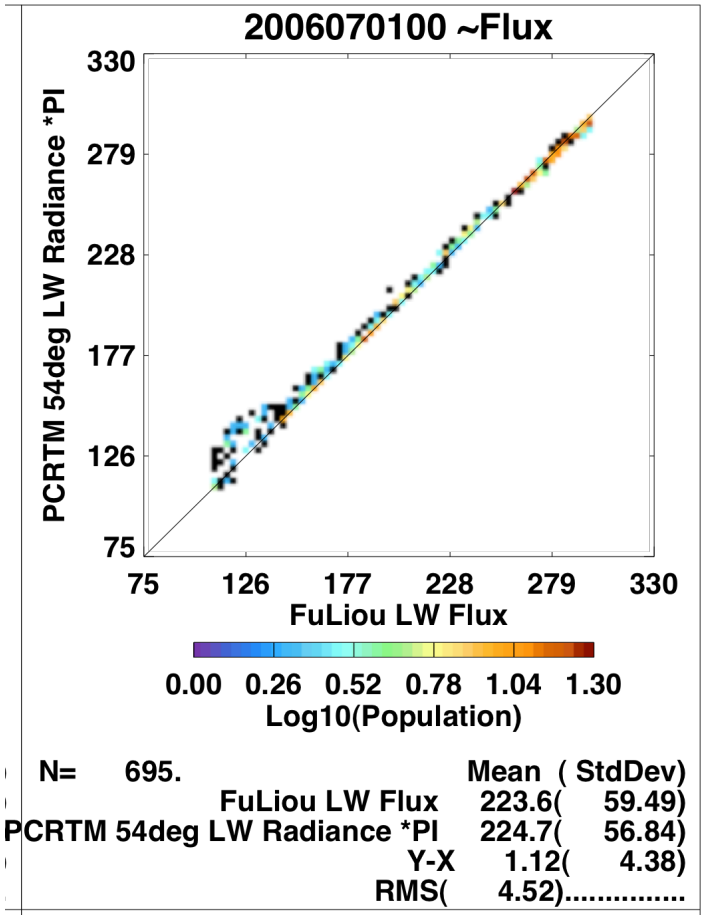


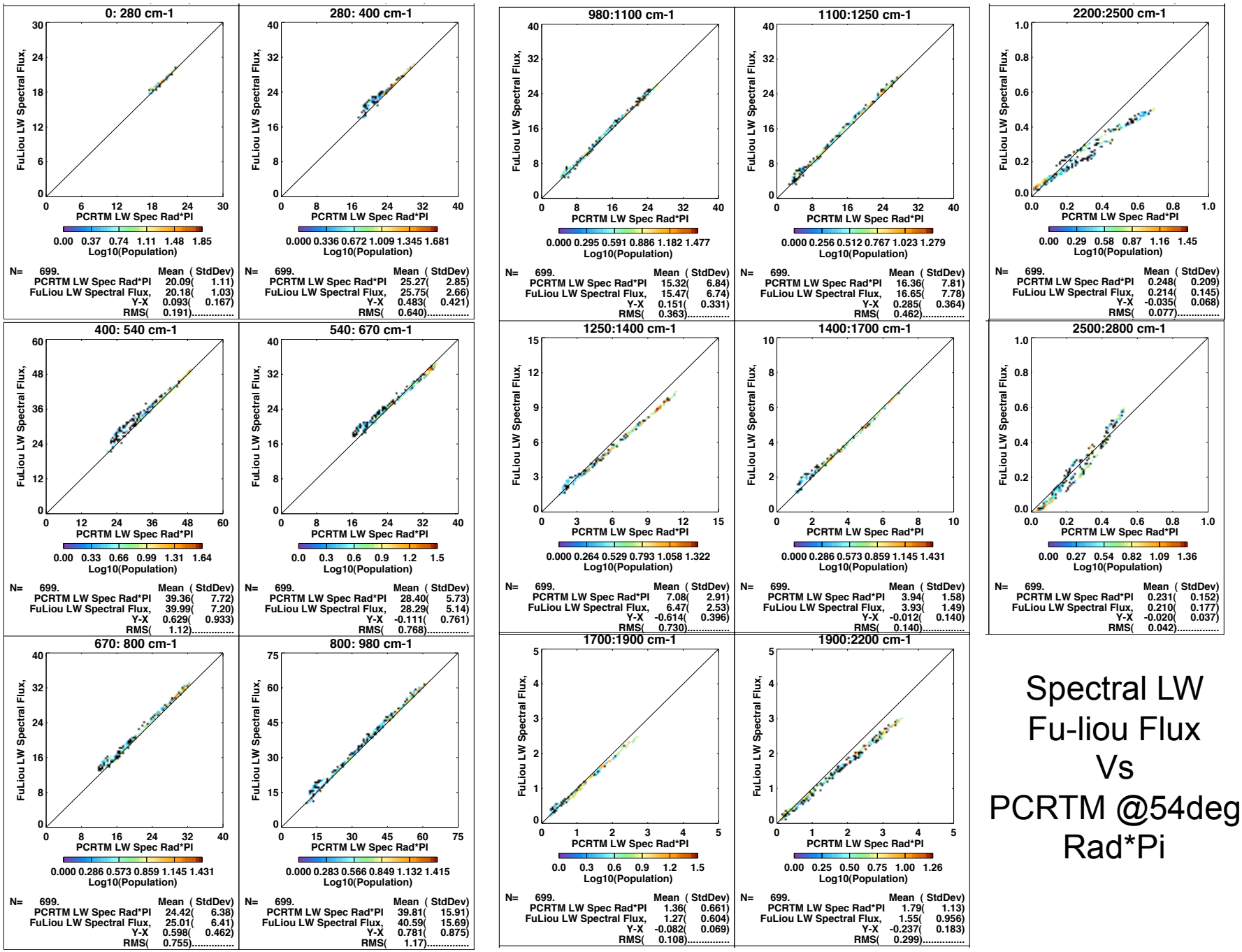
Sideshow #2:
Comparing Fu-Liou LW to PCRTM

Uses NEWS CCCMS data in PCRTM runs at View Angle of 54deg

PCRTM has limitation of using effective radiating temperature. Differences occur for geometrically thick clouds

Broadband and spectral differences





Spectral LW
Fu-liou Flux
Vs
PCRTM @54deg
Rad*Pi