CHANGES TO ISCCP PRODUCTS

William B. Rossow

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GEWEX/OTHER ASSESSMENTS

- VIS Calibration Confirmed
- IR Calibration of new AVHRRs biased high at hot end (non-linear response)
- Cloud Amount about right (imager sensitivity)
- High cloud amount underestimated (not new)
- Cloud top temperature and optical thickness about right (some issues with cloud top pressure)
- Polar clouds still most uncertain
- Surface temperature too large at high end

NEW ISCCP PRODUCTS (1982-2016)

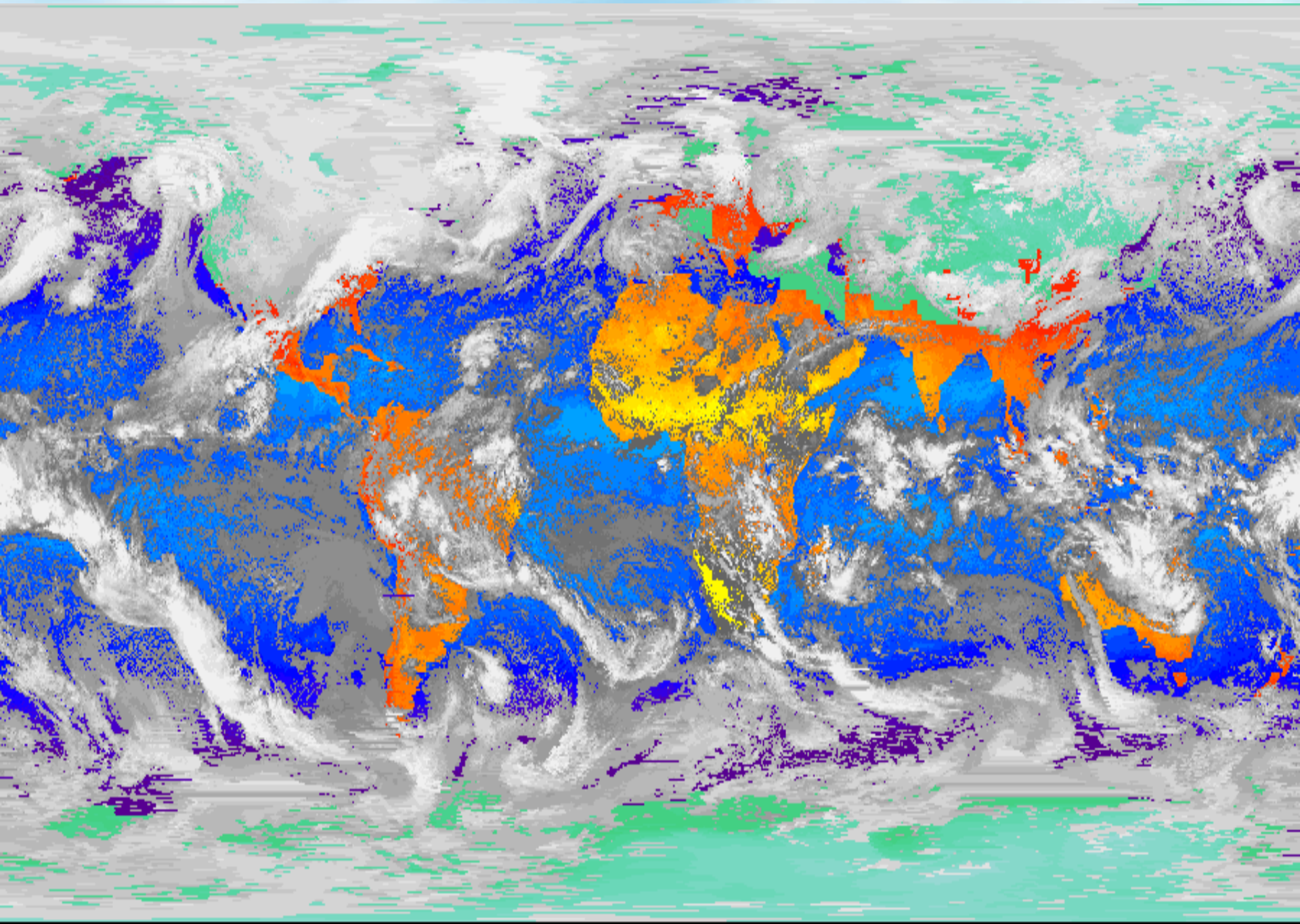
- HXS (like DX): 10 km, 3 hr, by satellite
- HXG (new, like global DX): 10 km, 3hr, global
- HGS (new, like DS): 100 km, 3 hr, by satellite
- HGG (like D1): 100 km, 3 hr, global
- HGH (like D2): 100 km, monthly mean diurnal
- HGM (like D2): 100 km, monthly

- Ancillary: NNHIRS: 100 km, 3 hr, global
- Ancillary: OZONE, SNOWICE: 100 km, daily
- Ancillary: AEROSOL: 100 km, monthly
- Fixed Ancillary: TOPO (10 km), SURFACETYPE (25 km)

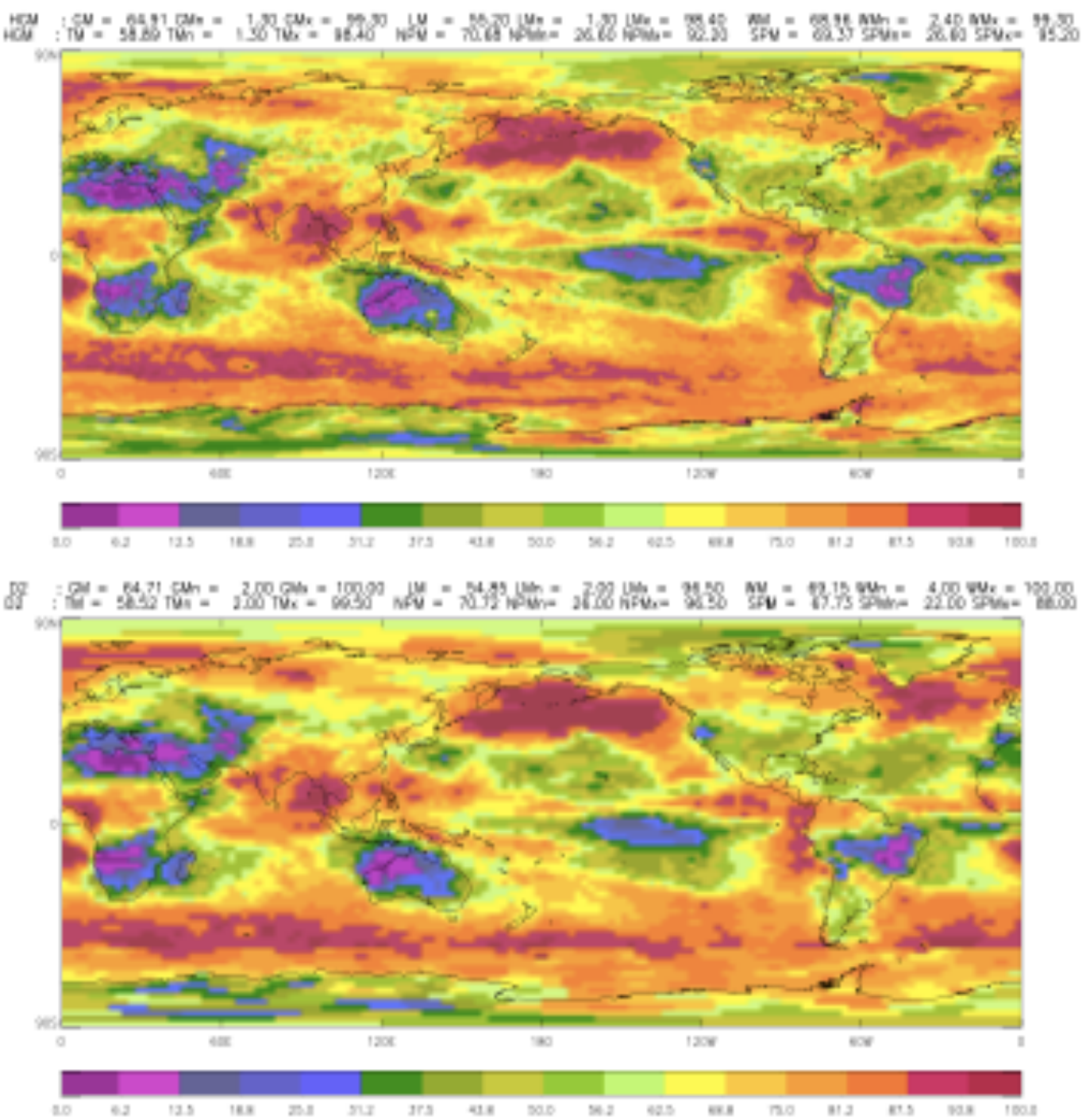
MAIN REFINEMENTS

- VIS & IR Calibrations slightly revised
- Small Detection Threshold Adjustments [esp Polar]
- Changes of microphysics [larger Re, liquid Re ocean-land, new ice scattering phase function, two ice Re]
- Changes of cloud vertical structure [ocean-land, gas included in cloud layers]
- Aerosol effects included
- Surface emissivity included

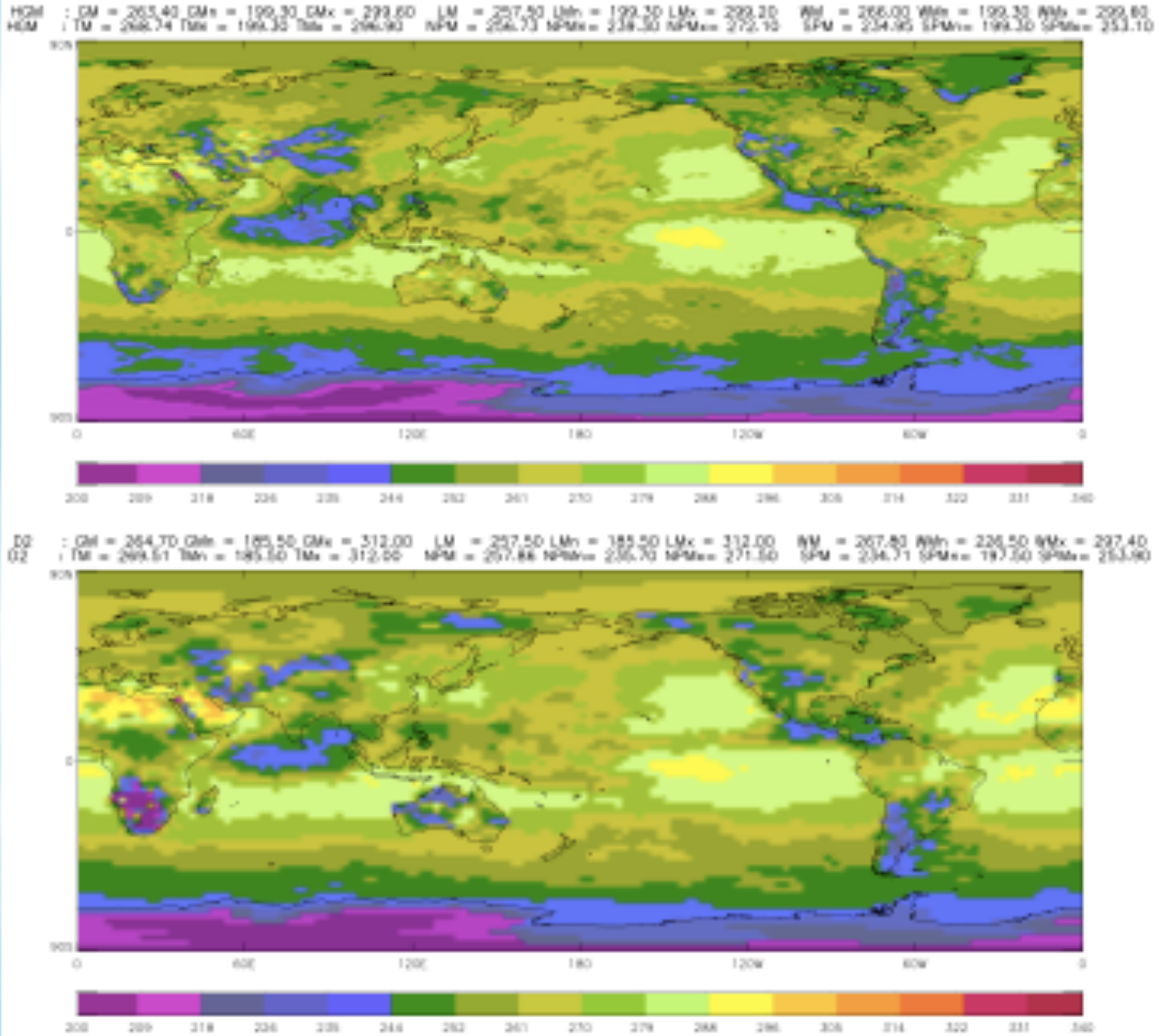
Global HX Picture



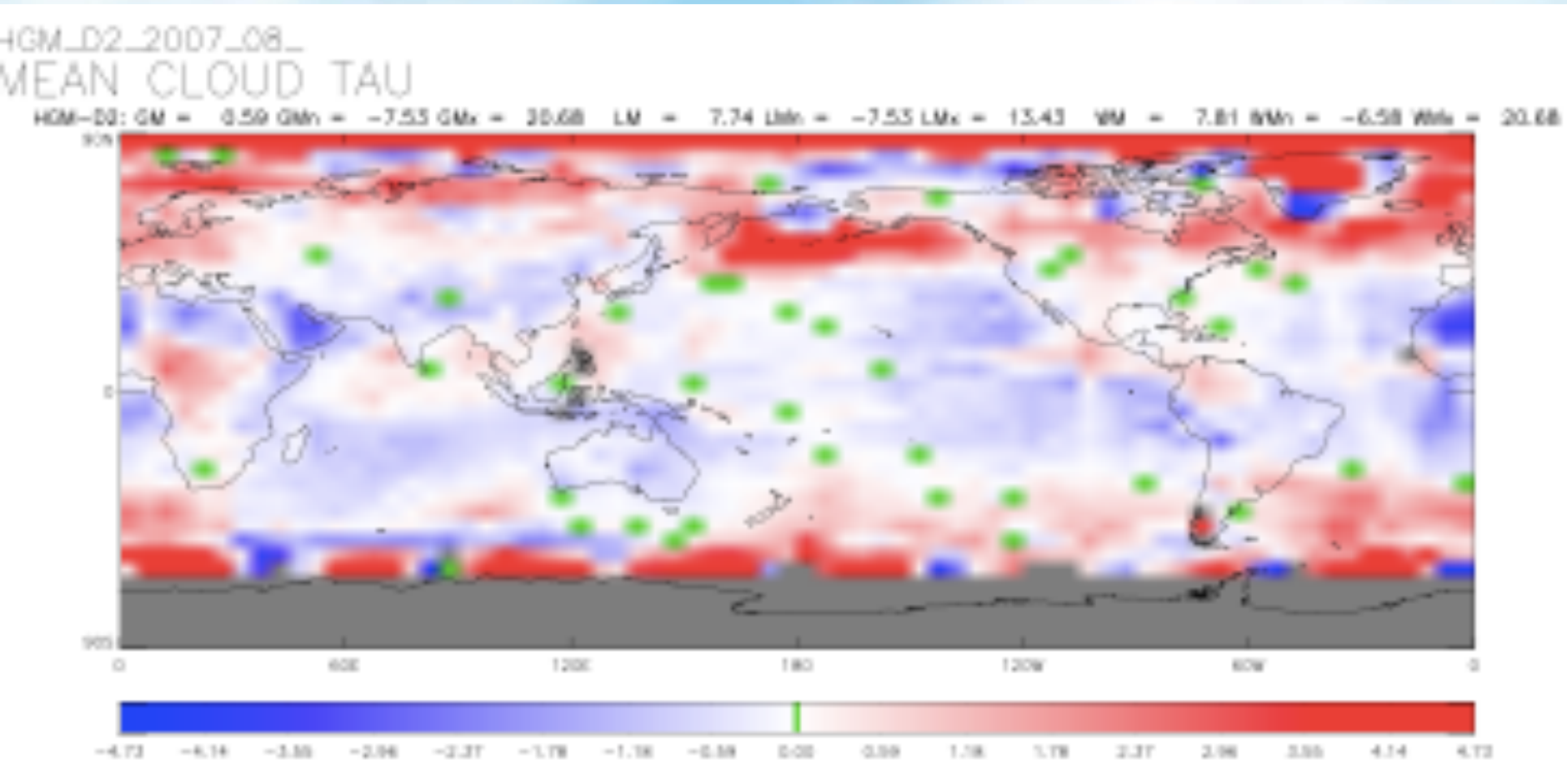
CA



TC


HGM : GM = 265.40 GMn = 199.30 GMx = 293.60 LM = 257.50 LMn = 199.30 LMx = 293.20 WM = 266.00 WMn = 199.30 WMx = 293.60
HGM : TM = 268.74 TMn = 199.30 TMx = 296.90 NPM = 256.73 NPMn = 238.30 NPMx = 272.10 SPM = 234.95 SPMn = 199.30 SPMx = 253.10
90S
0
90N
0
60E
120E
180
120W
60W
0
200 209 218 226 235 244 252 261 270 279 288 296 305 314 322 331 340
D2 : GM = 264.70 GMn = 185.50 GMx = 312.00 LM = 257.50 LMn = 185.50 LMx = 312.00 WM = 267.83 WMn = 226.50 WMx = 297.40
D2 : TM = 269.51 TMn = 185.50 TMx = 312.00 NPM = 257.86 NPMn = 236.70 NPMx = 271.50 SPM = 234.71 SPMn = 197.50 SPMx = 253.90
90S
0
90N
0
60E
120E
180
120W
60W
0
200 209 218 226 235 244 252 261 270 279 288 296 305 314 322 331 340

TAU DIFFERENCE



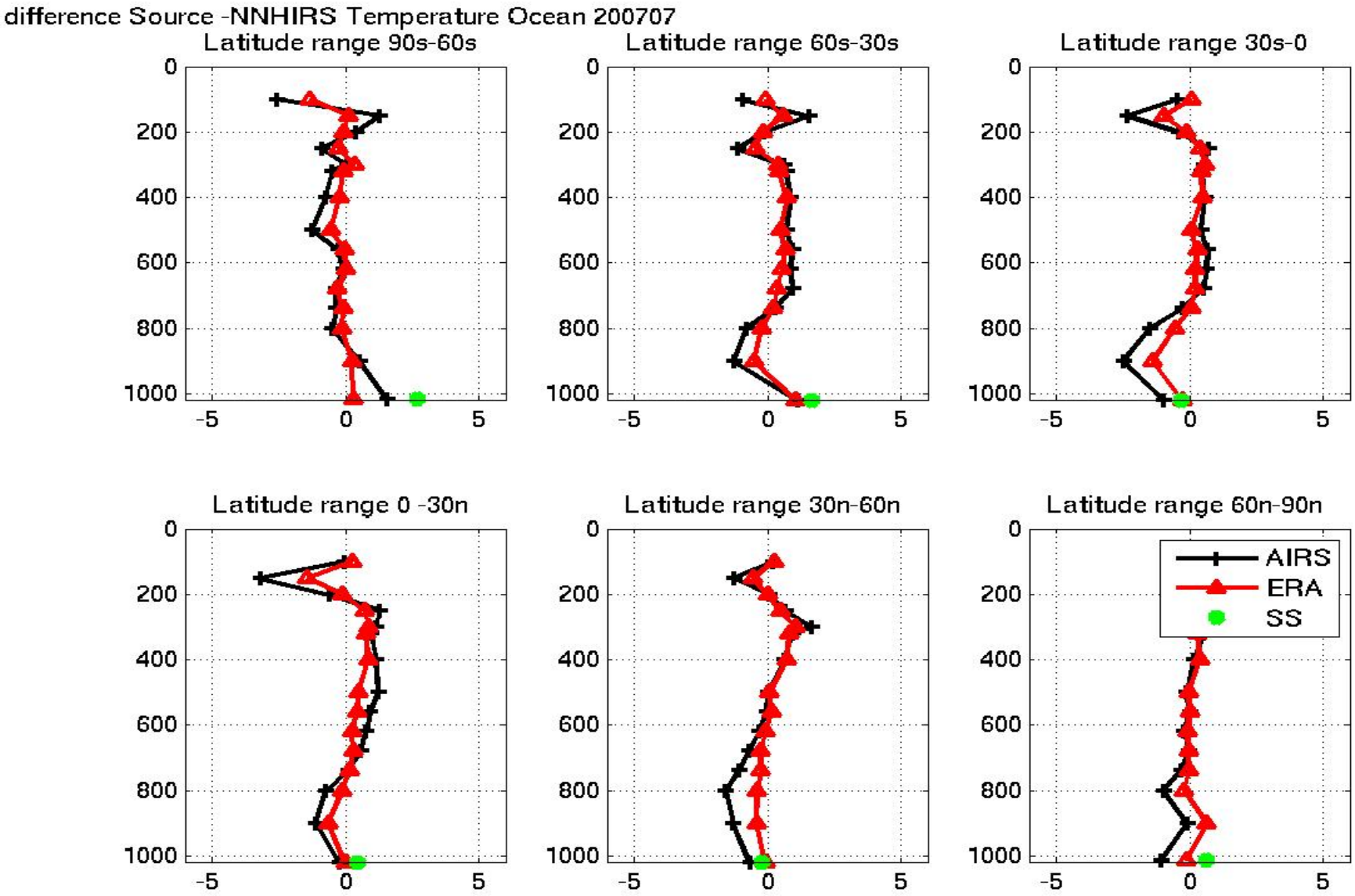
NNHIRS INTERPOLATIONS/ ADJUSTMENTS

- Filters at 1 and 99% -- cloud contamination
- RH low and high constraints (low in winter poles)

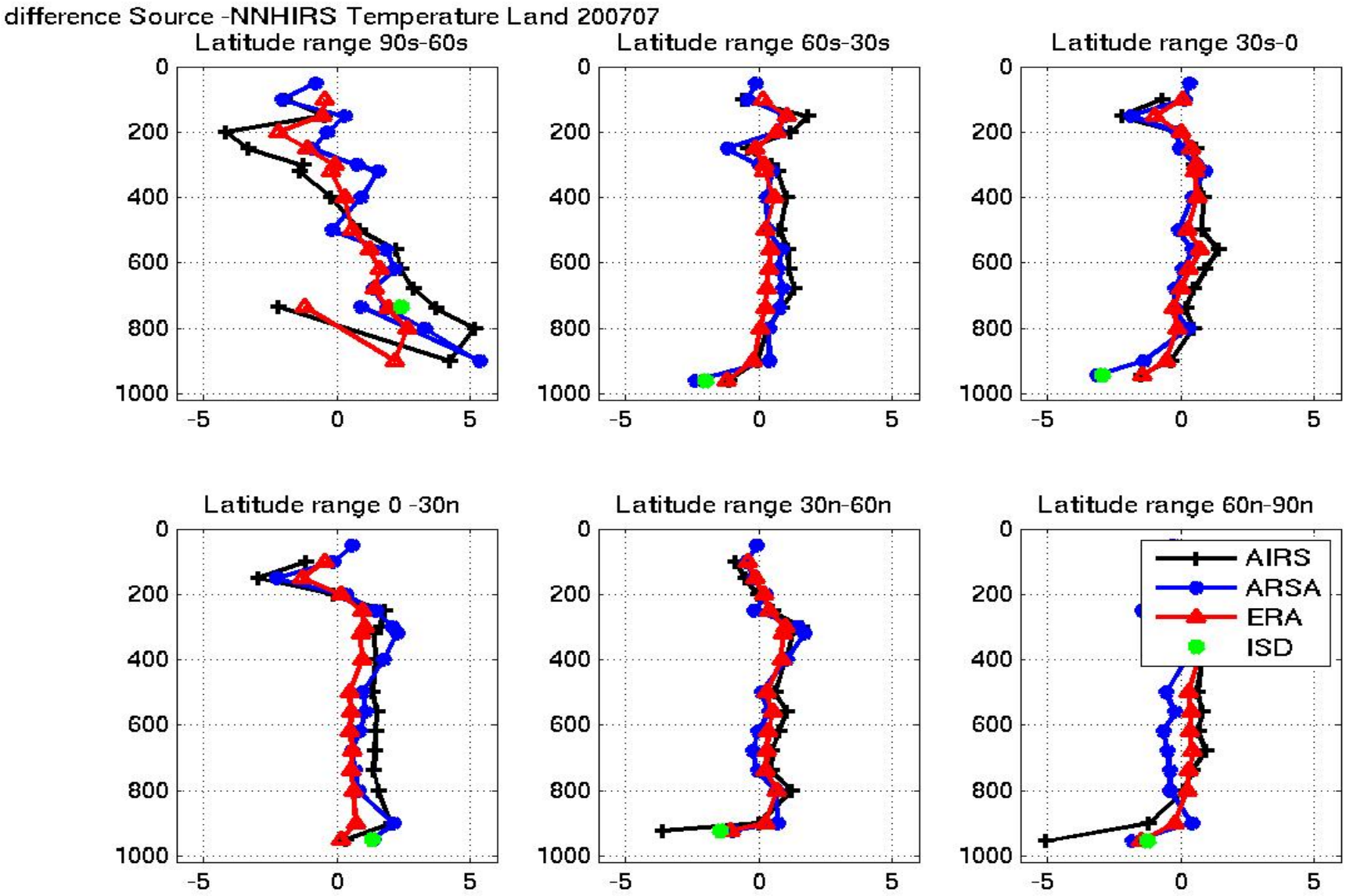
- Ocean daily mean Q, Land daily minimum Q
- Ocean linear time interpolation
- Land diurnal model interpolation

- Ocean QA adjusted by SeaFlux climatology
- Land TA adjusted by ISD climatlogy

NNHIRS PROFILE COMPARISONS



NNHIRS PROFILE COMPARISONS



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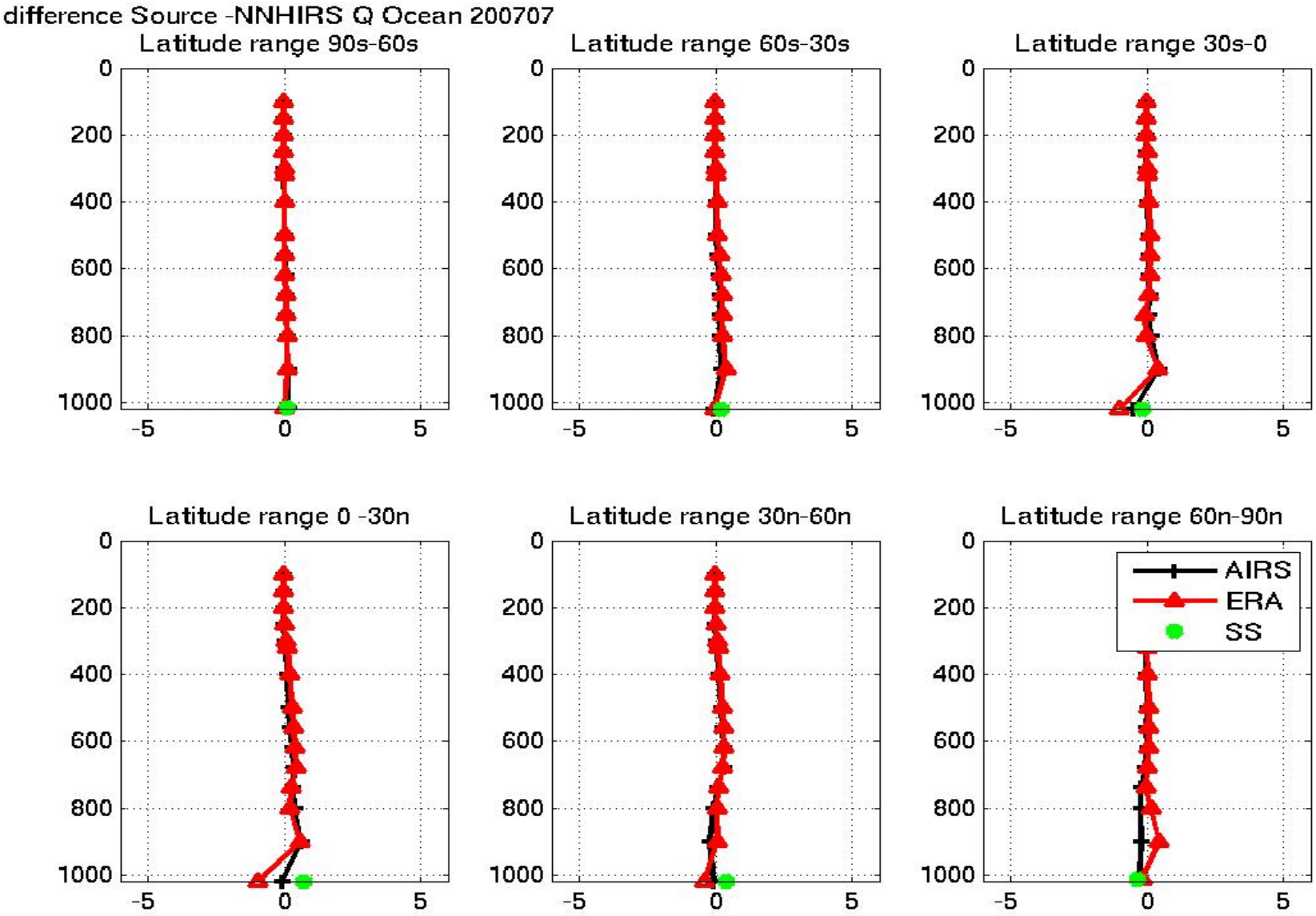
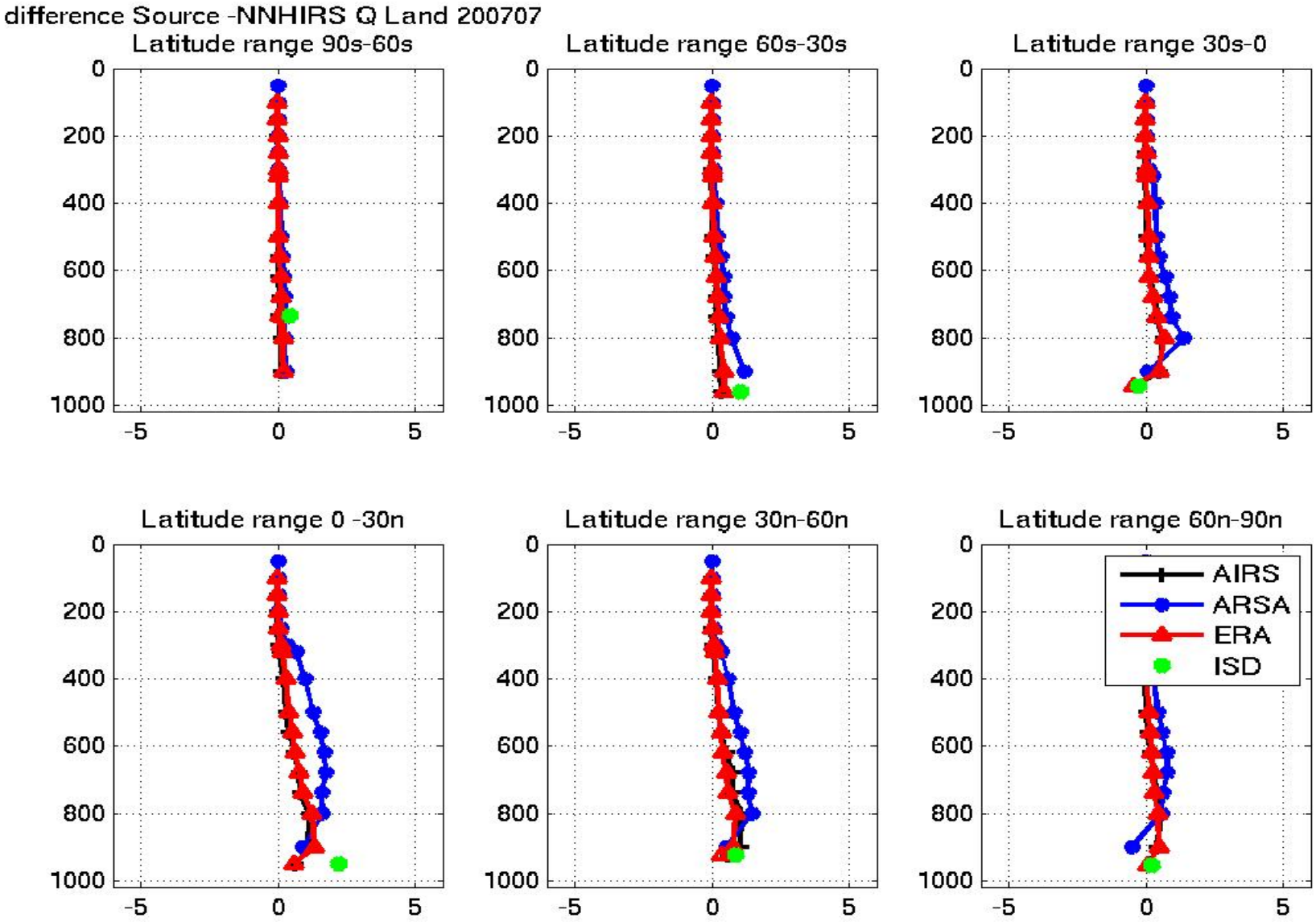


NNHIRS PROFILE COMPARISONS



WHAT'S NEXT?

CLOUD MICROPHYSICS IS GOOD

(Ice and Precipitation Need Work)

CLOUD PROPERTIES/STRUCTURE ARE GOOD

RADIATION & PRECIPITATION ARE GOOD

DYNAMICS !!

HIGH-TIME-RESOLUTION

(SATELLTE DATA & ISCCP CODE AVAILABLE)

RELEASE OF CODE

- Preparing Public Release Package that Allows for Running Code on any version of same satellites at higher resolution than 30 km, 3 hr
- Any satellite imaging data (one month minimum)
- Any replacement Ancillary data (same time interval, same map grid)

BACKUP

WHAT WE NOW KNOW WELL

Cloud Amount = 0.68 ± 0.03 ($\tau > 0.1$)

= 0.56 ($\tau > 2$) to 0.73

= 0.10-0.15 more ocean clouds

≈ 0.45 high, 0.15 middle, 0.40 low

Cloud Top Temperature = 260 ± 2 K (radiative)

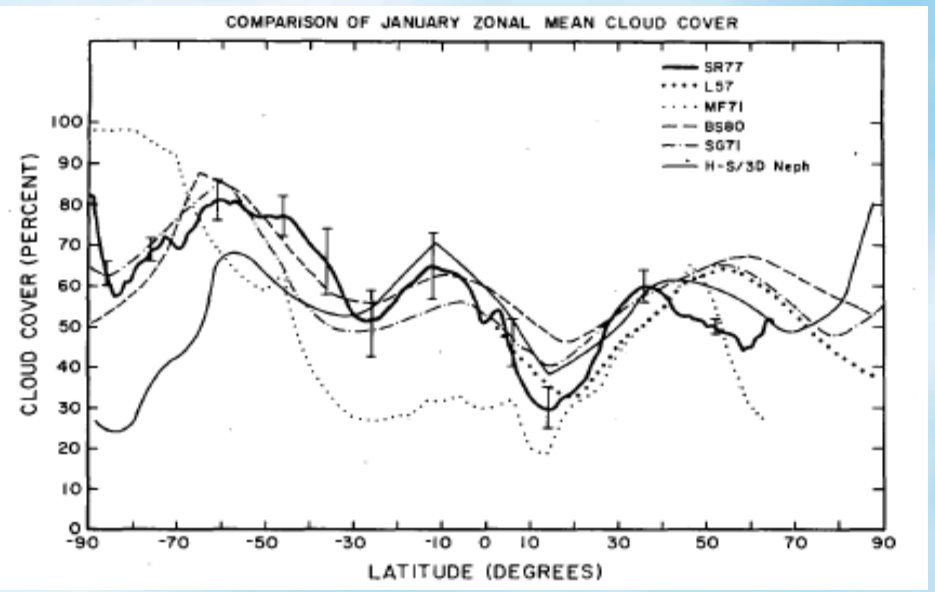
Cloud Optical Thickness = 3.7 ± 0.5 (radiative)

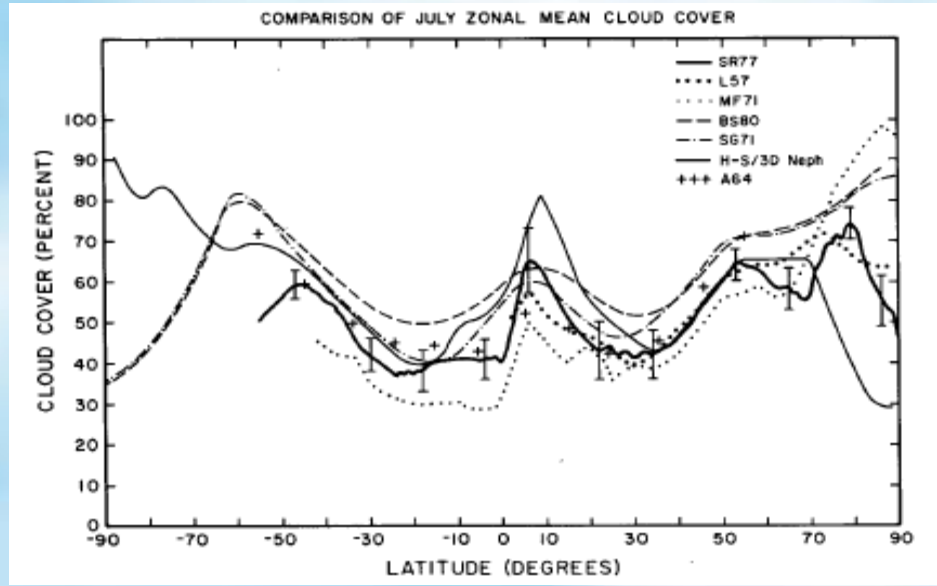
Cloud Particle Size (liq) = 13 (land)–15 (ocean) ± 1

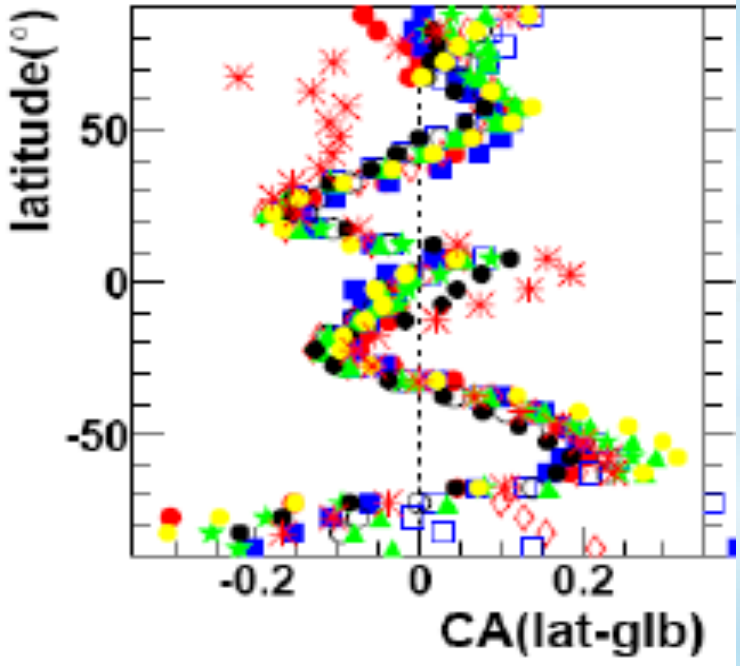
Cloud Particle Size (ice) = 25 ± 3

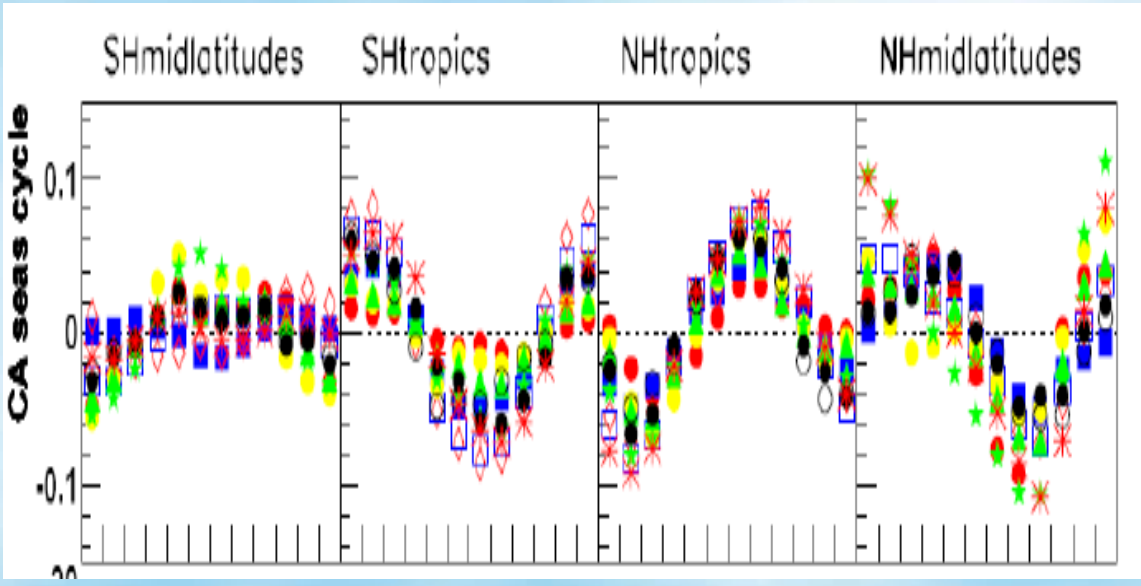
Variability: Diurnal, Synoptic, Interannual

CLOUD AMOUNT

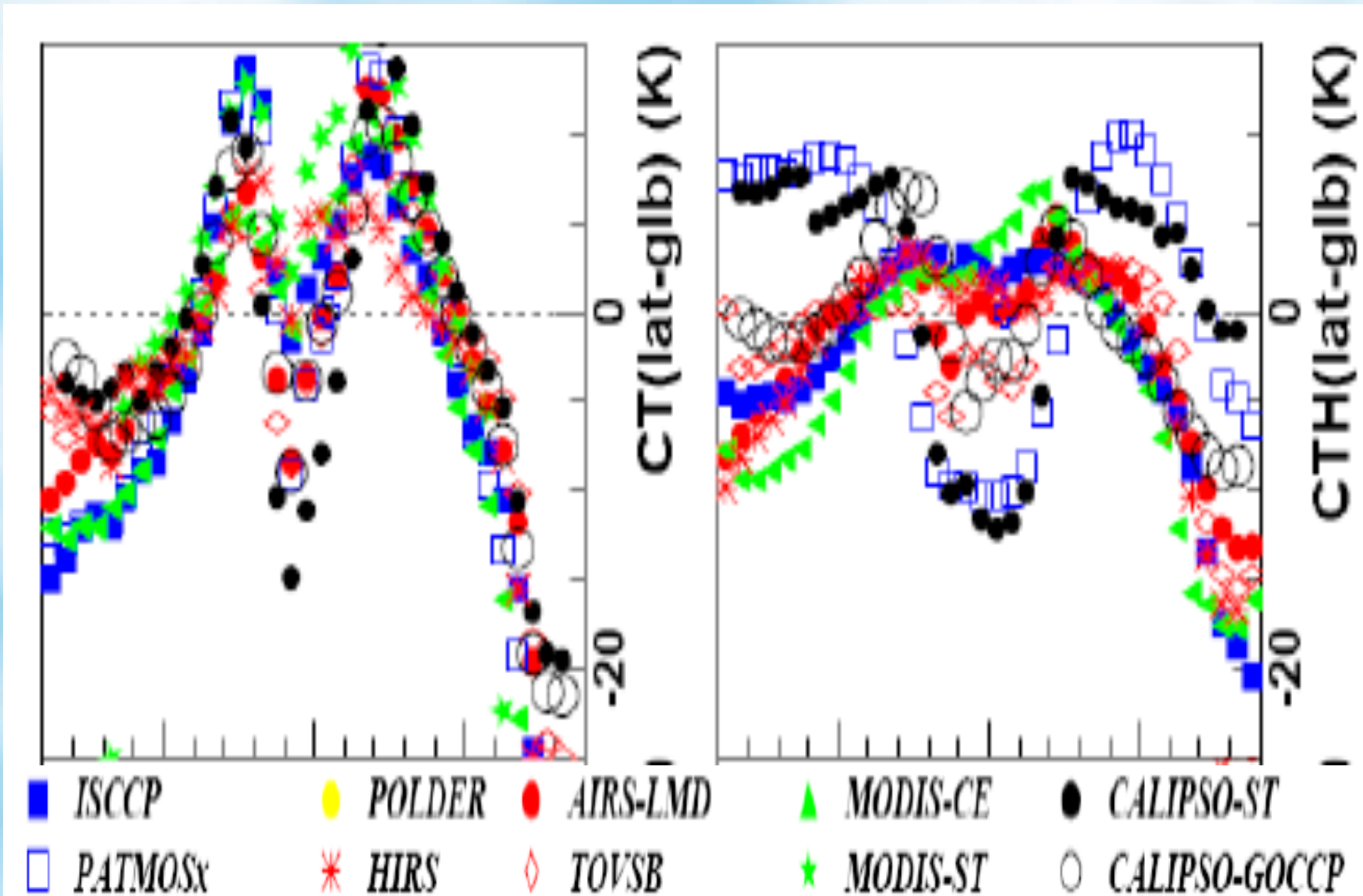




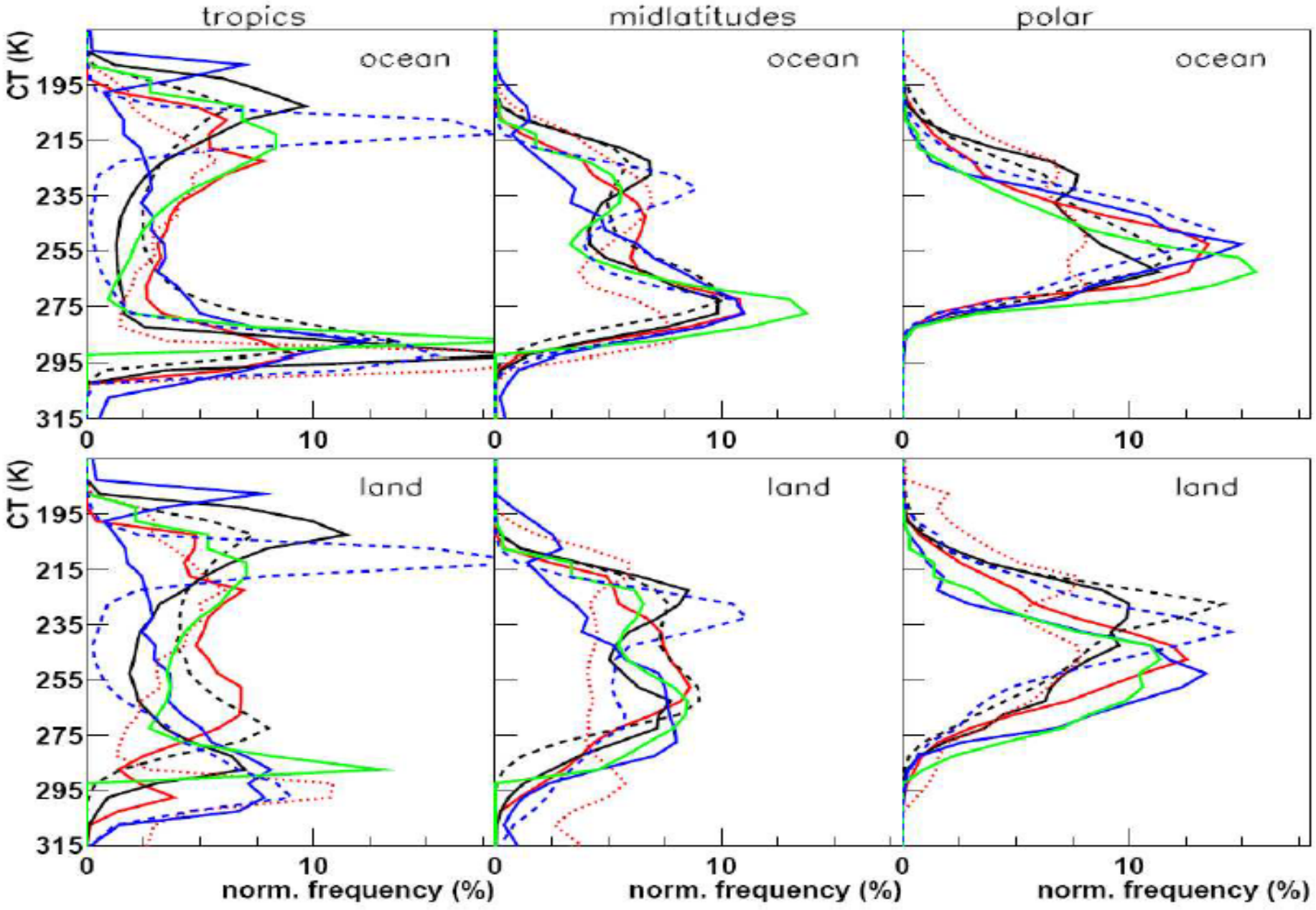




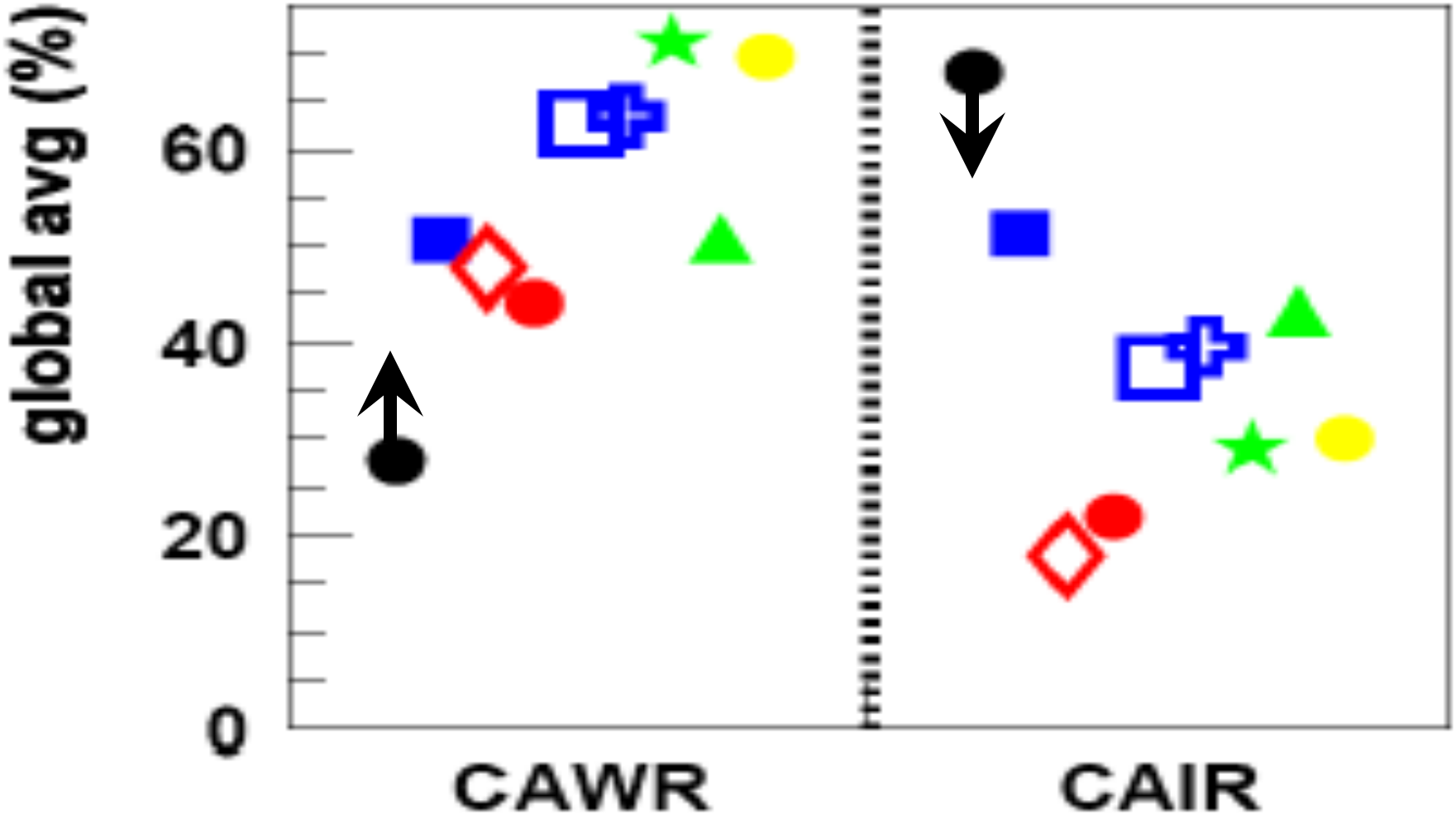
Cloud Top Temperature



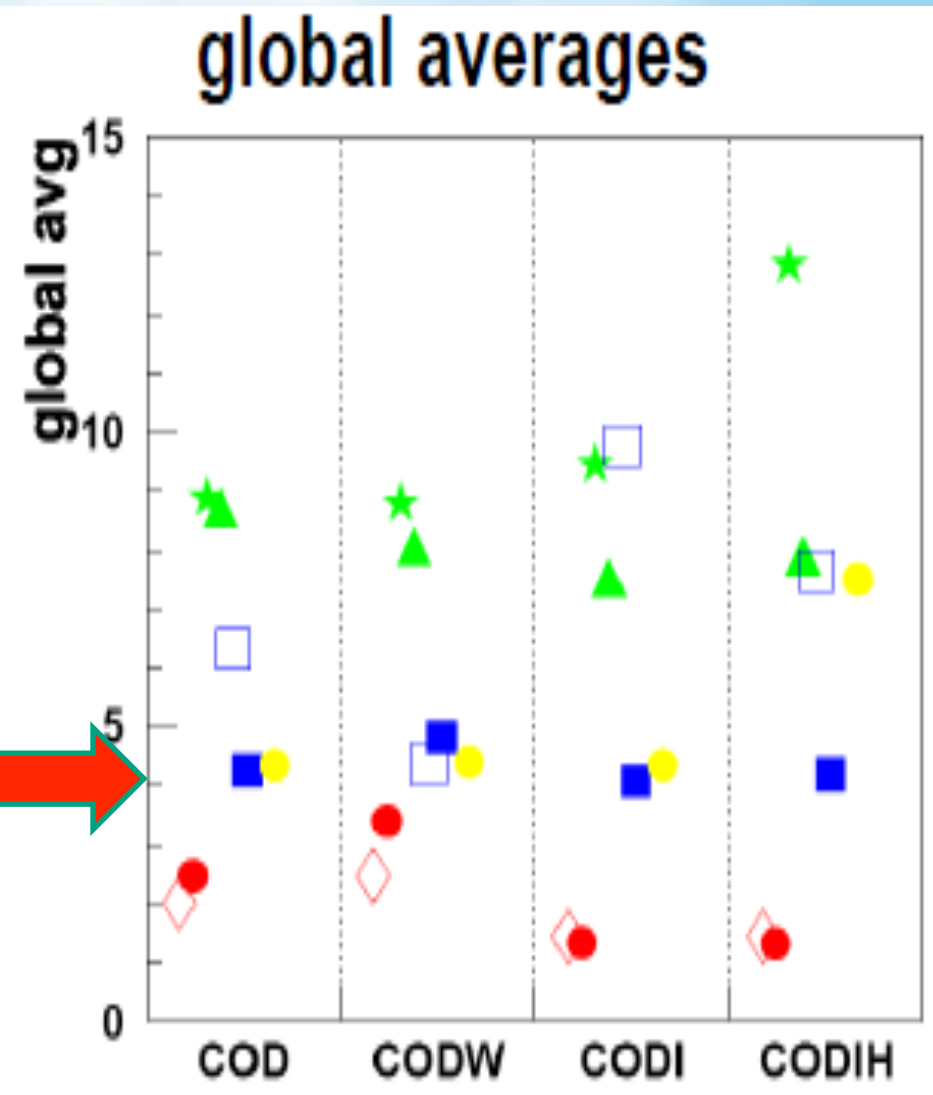
Cloud Vertical Distribution

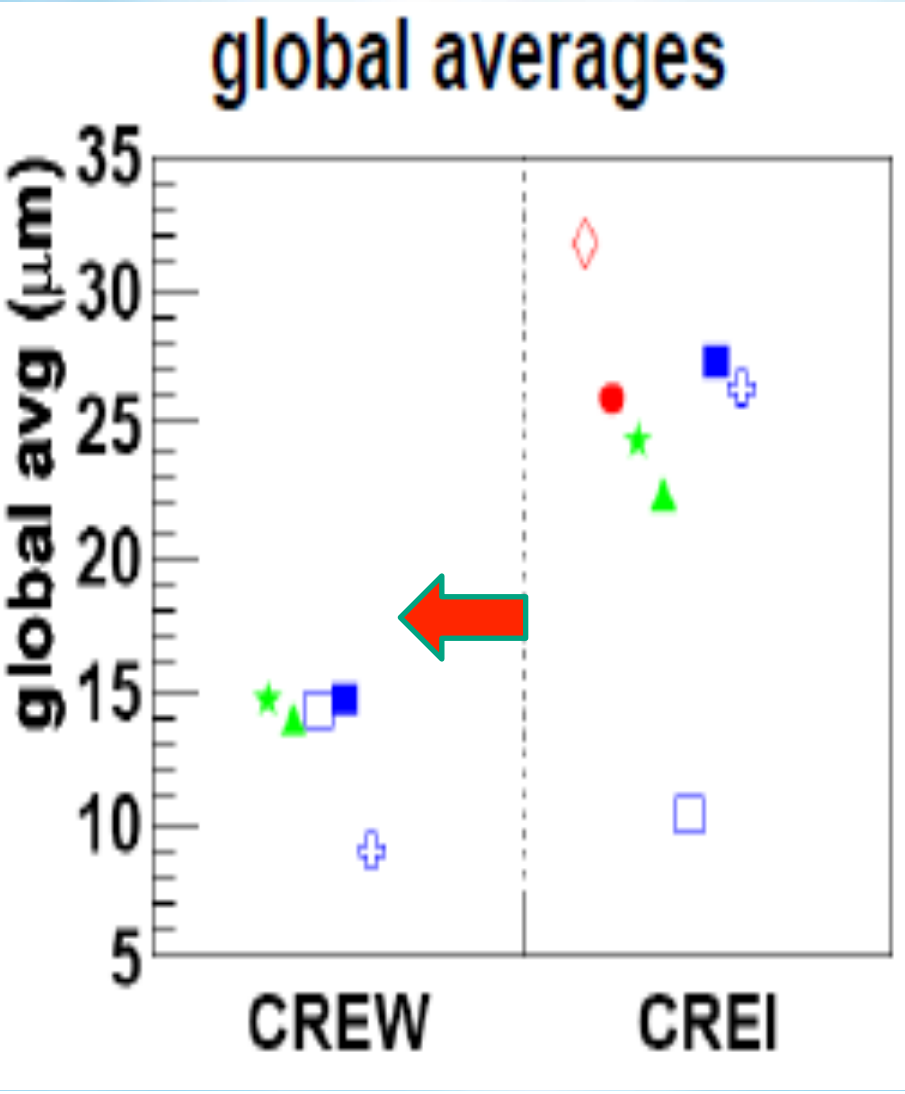


Relative Amounts of Liquid & Ice Clouds



Cloud Optical Thickness & Effective Particle Radius





ISCCP
PATMOSx
AIRS-LMD
TOVSB
MODIS-CE
MODIS-ST
ATSR

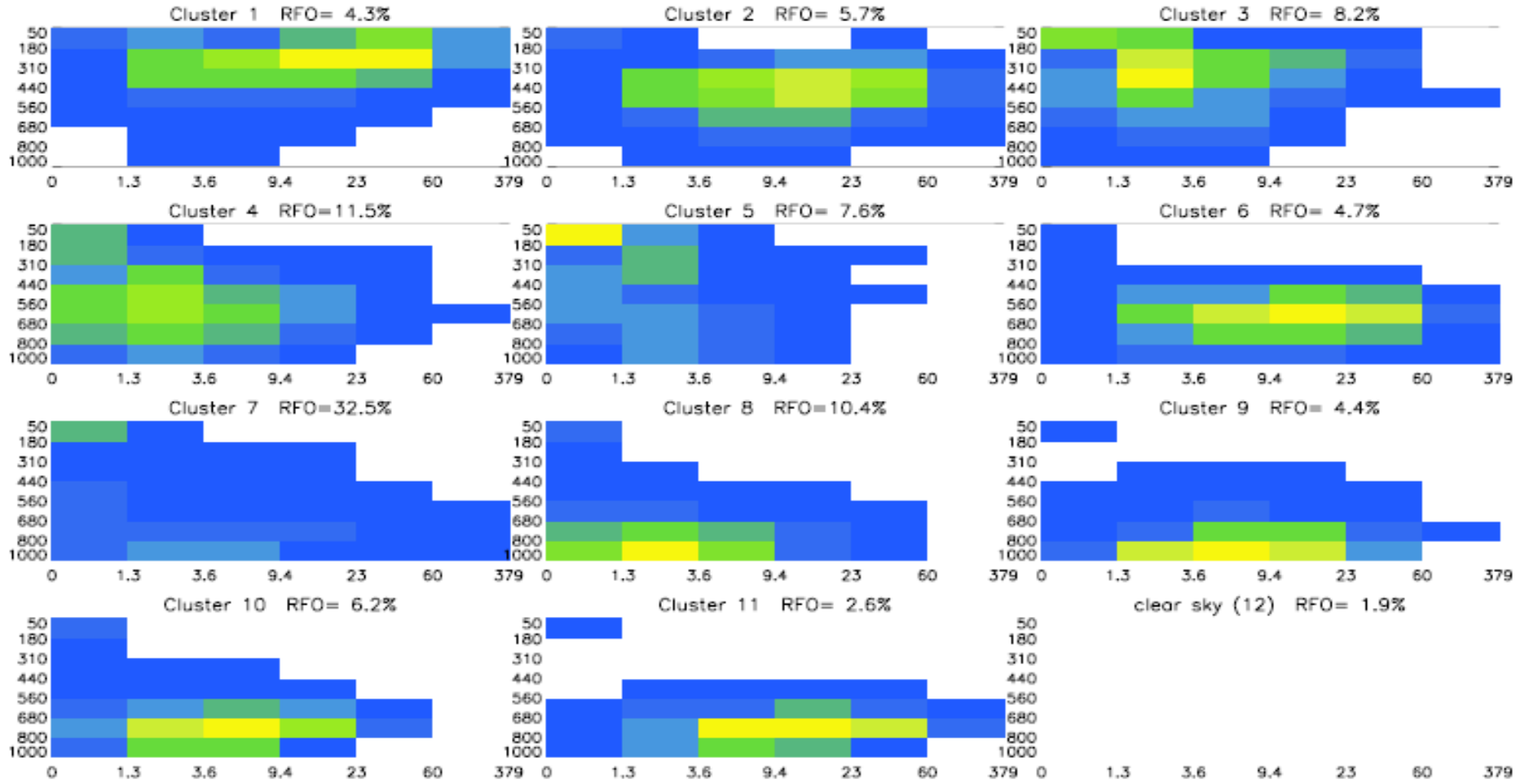
IMPORTANT QUESTIONS "AFTER ISCCP" NOW BEING ADDRESSED

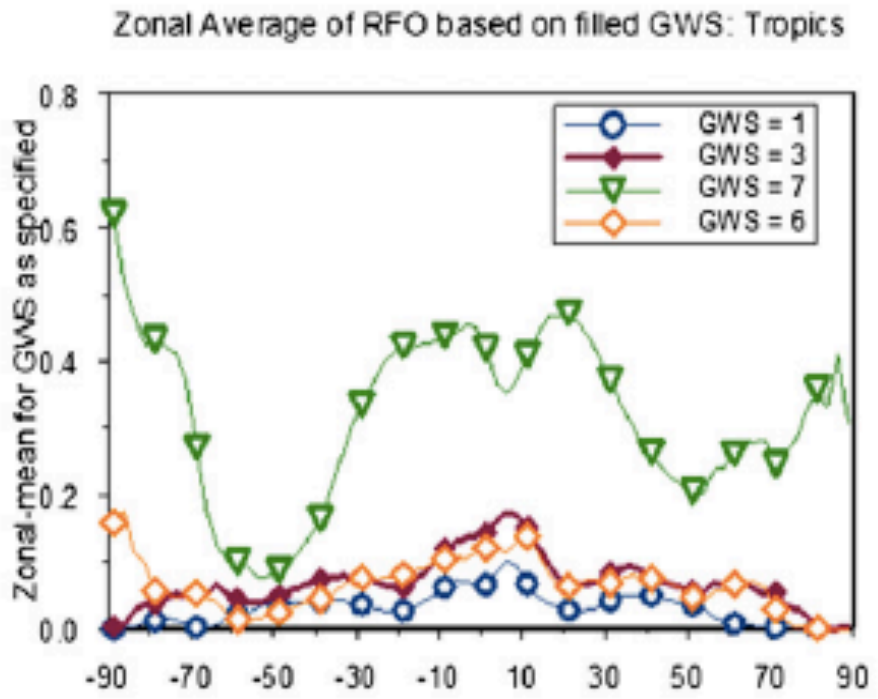
- Cloud Vertical Structure: Layer Thicknesses & Multi-Layer Characteristics – **CloudSat & Calipso**
- Polar Cloud Properties – **Calipso & CloudSat with MODIS/AIRS/AMSU/AMSR**
- "Radiative" Particle Sizes (**MODIS/AIRS**) & "Precipitation" Particle Sizes (**AMSR/AMSU, MLS, TRMM PR, CloudSat**)

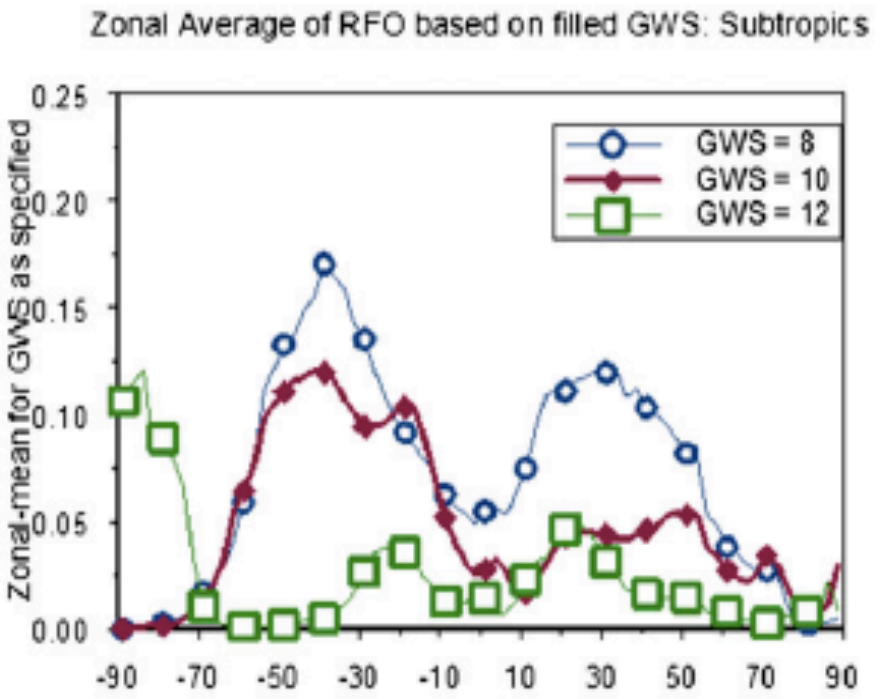
SOME REMAINING QUESTIONS

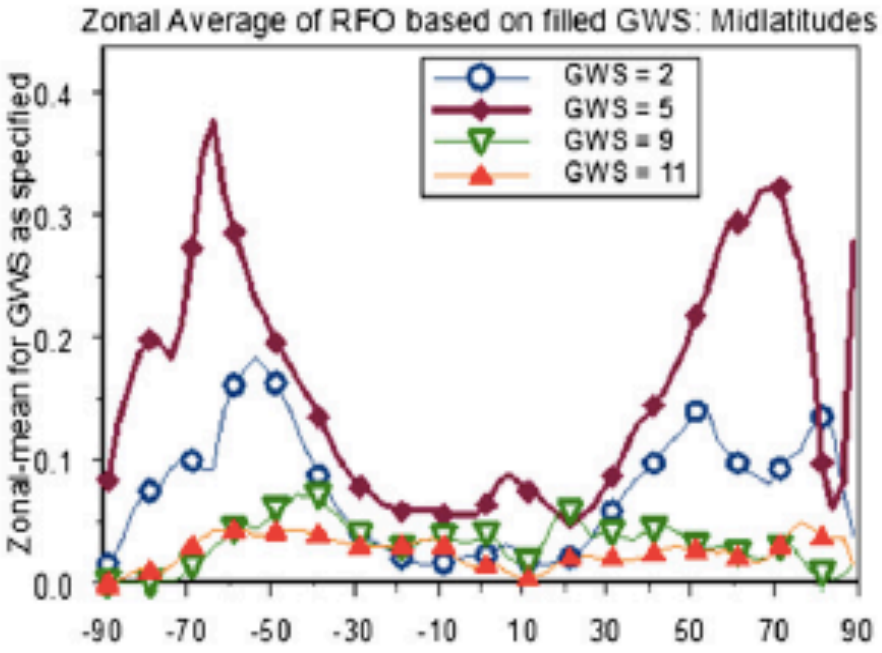
- Diurnal cycle of water path (tau & re)
  - Also better determination of extreme values
- Ice Cloud Microphysics (shape & size distributions)
- Mixed-Phase Clouds & Precipitation

ISCCP GLOBAL WEATHER STATES




Zonal Average of RFO based on filled GWS: Tropics
Zonal-mean for GWS as specified
GWS = 1
GWS = 3
GWS = 7
GWS = 6
0.0
0.2
0.4
0.6
0.8
-90 -70 -50 -30 -10 10 30 50 70 90


Zonal Average of RFO based on filled GWS: Subtropics
Zonal-mean for GWS as specified
GWS = 8
GWS = 10
GWS = 12
0.00
0.05
0.10
0.15
0.20
0.25
-90 -70 -50 -30 -10 10 30 50 70 90


Zonal Average of RFO based on filled GWS: Midlatitudes
Zonal-mean for GWS as specified
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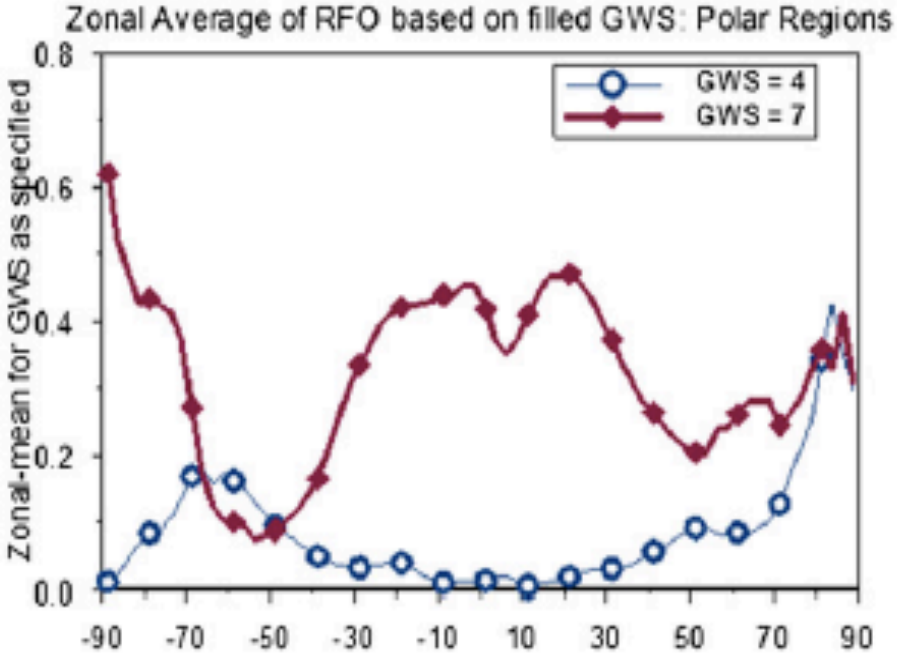
GWS = 5
GWS = 9
GWS = 11
0.0
0.1
0.2
0.3
0.4
-90 -70 -50 -30 -10 10 30 50 70 90


Zonal Average of RFO based on filled GWS: Polar Regions
Zonal-mean for GWS as specified
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GWS = 7
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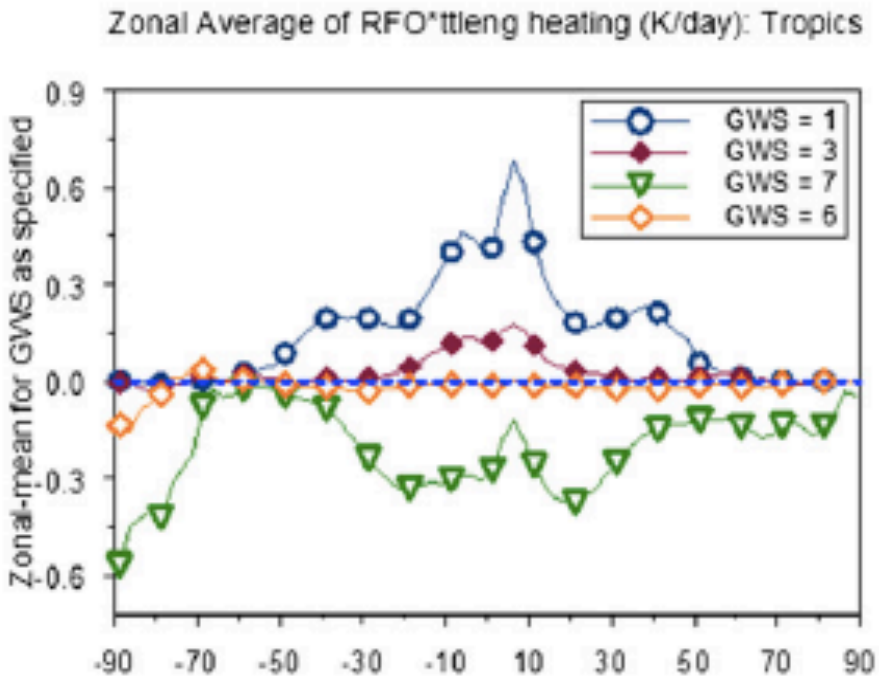
0.2
0.4
0.6
0.8
-90 -70 -50 -30 -10 10 30 50 70 90


Zonal Average of RFO*ttleng heating (K/day): Tropics
Zonal-mean for GWS as specified
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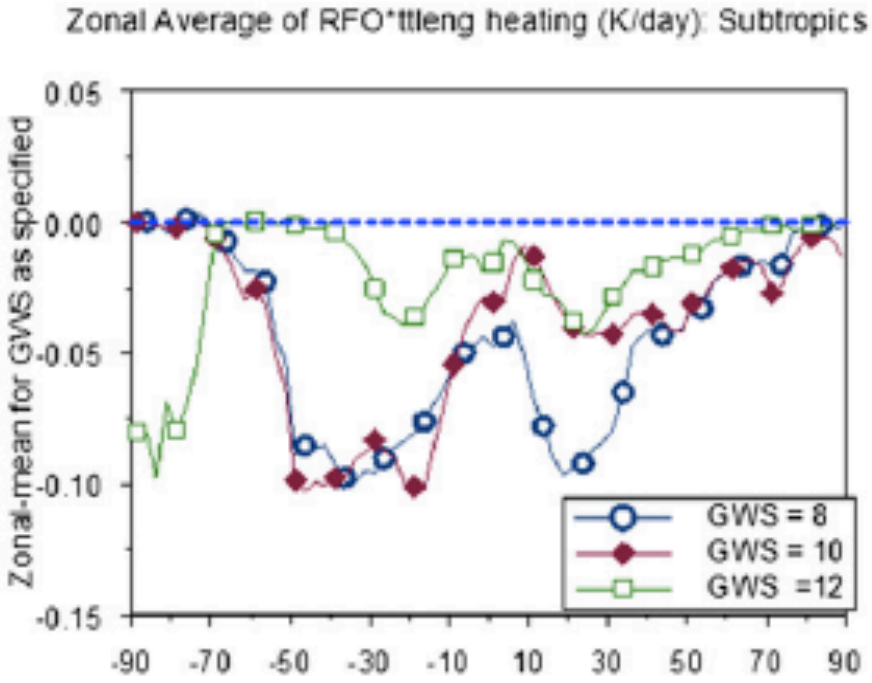
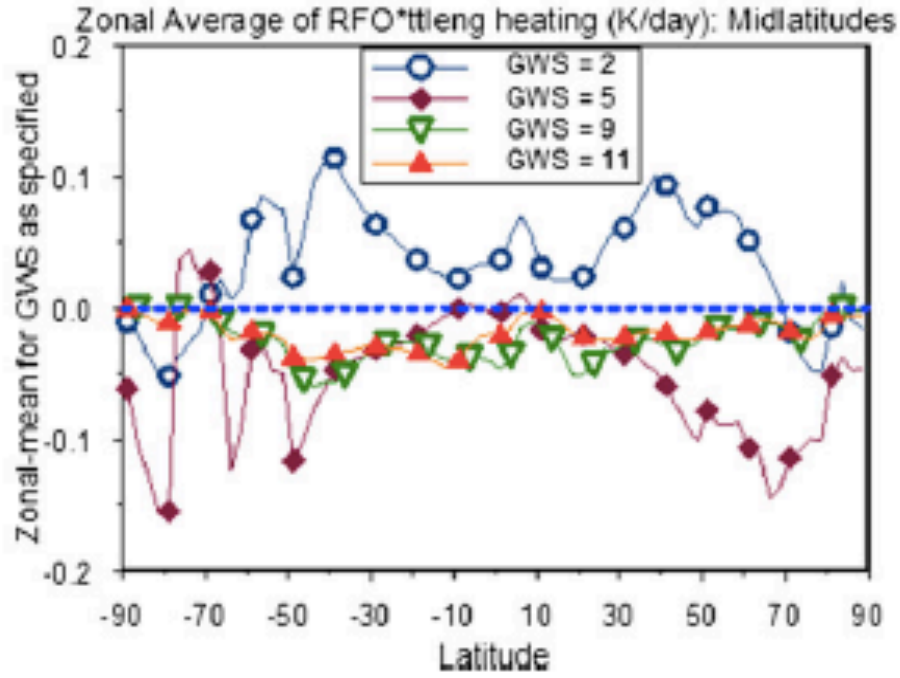
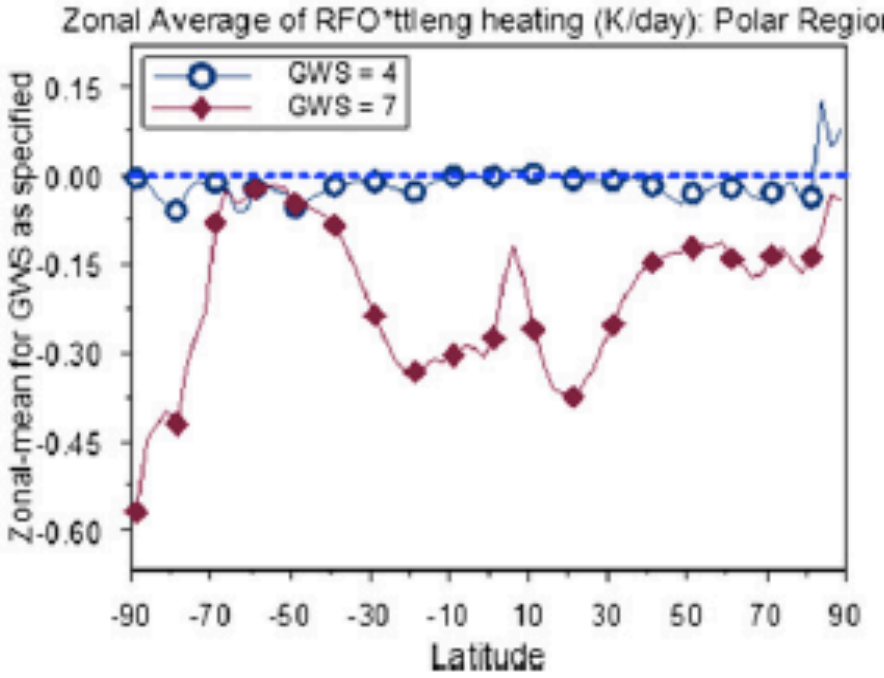
GWS = 3
GWS = 7
GWS = 6
0.9
0.6
0.3
0.0
-0.3
-0.6
-90 -70 -50 -30 -10 10 30 50 70 90


Zonal Average of RFO*ttleng heating (K/day): Subtropics
Zonal-mean for GWS as specified
GWS = 8
GWS = 10
GWS =12
0.05
0.00
-0.05
-0.10
-0.15
-90 -70 -50 -30 -10 10 30 50 70 90


Zonal Average of RFO*ttleng heating (K/day): Midlatitudes
Zonal-mean for GWS as specified
GWS = 2
GWS = 5
GWS = 9
GWS = 11
0.2
0.1
0.0
-0.1
-0.2
-90 -70 -50 -30 -10 10 30 50 70 90
Latitude


Zonal Average of RFO*ttleng heating (K/day): Polar Regions
Zonal-mean for GWS as specified
GWS = 4
GWS = 7
0.15
0.00
-0.15
-0.30
-0.45
-0.60
-90 -70 -50 -30 -10 10 30 50 70 90
Latitude

Factors that Could Cause Spurious Cloud Amount Changes

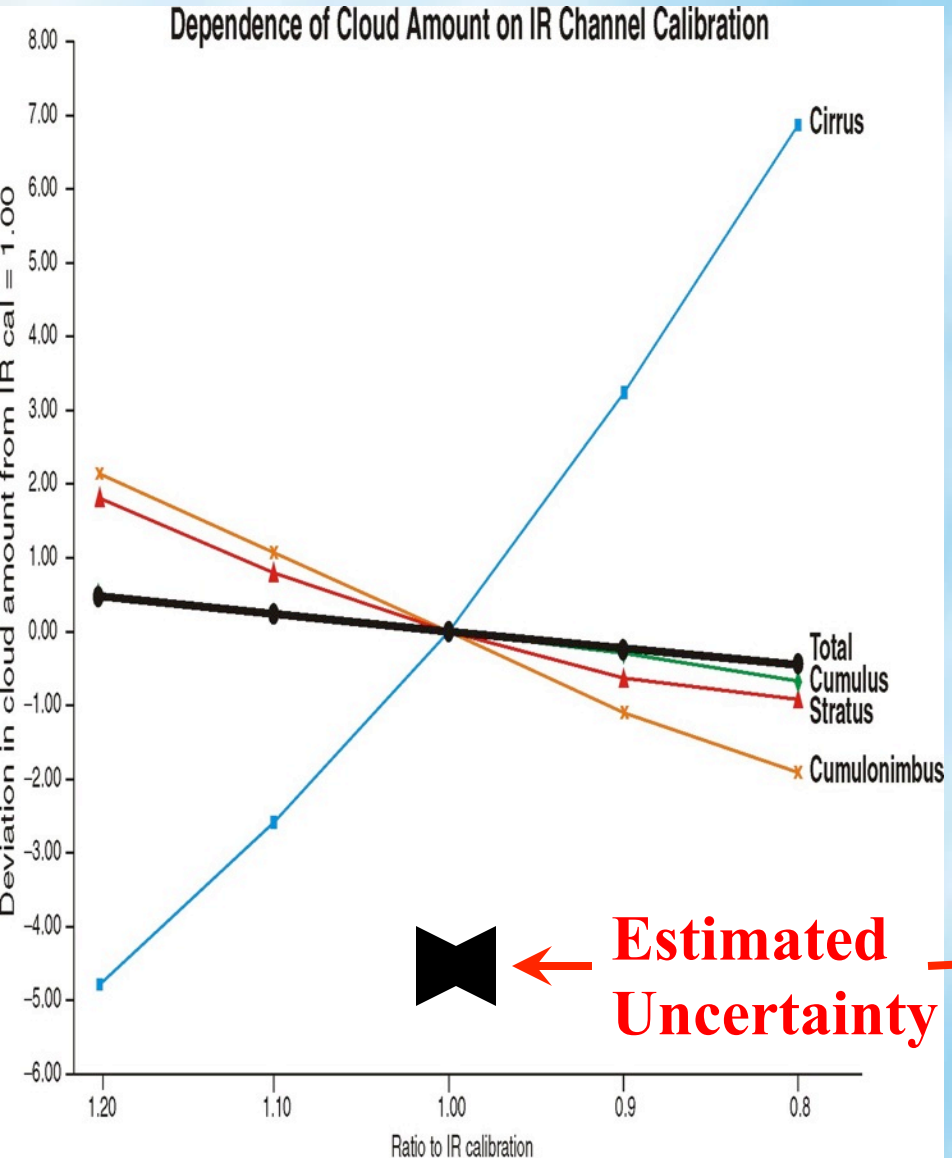
Changes in Radiance Calibration

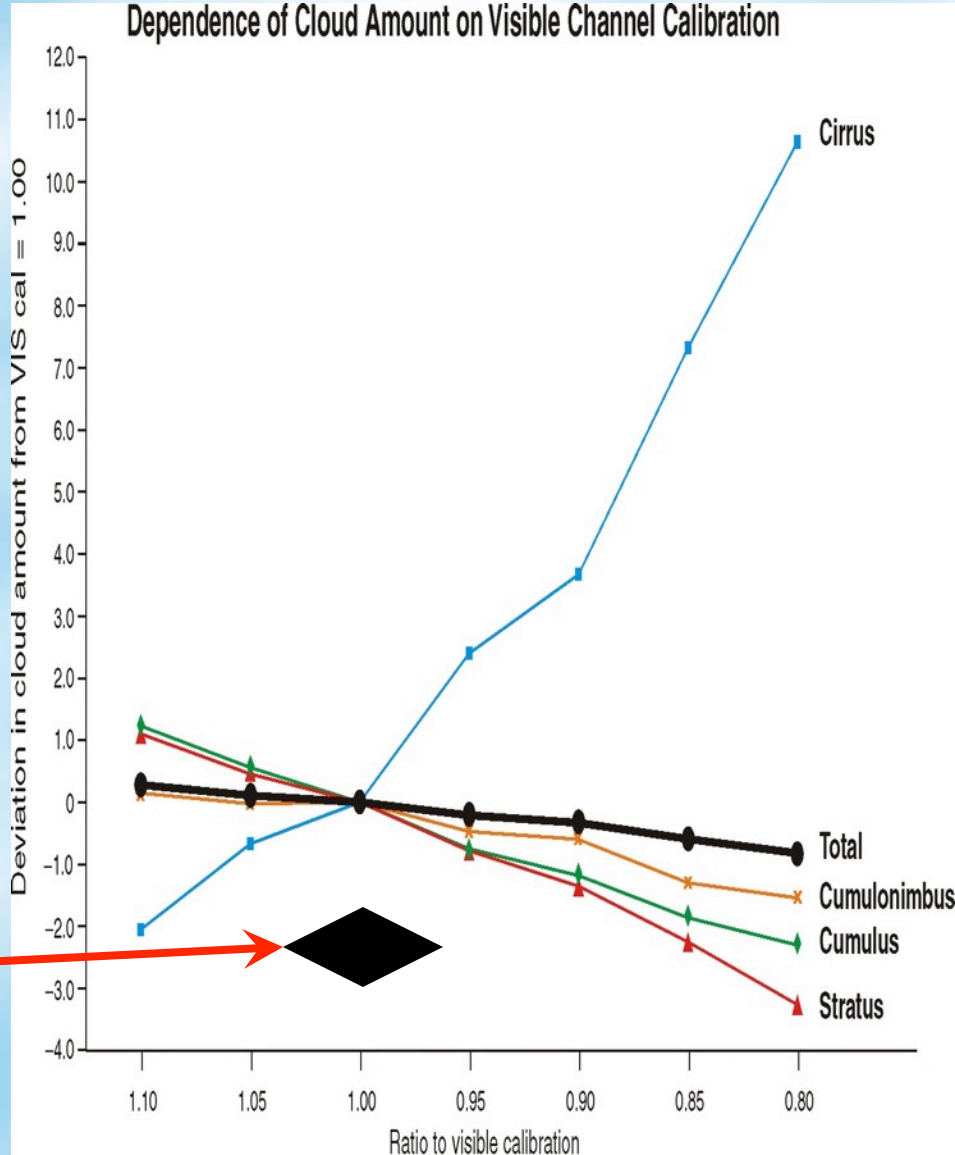
Changes in Cloud Property Distribution

Changes in Satellite Viewing Geometry

Changes in Sampling Distribution and Coverage

Calibration Effect on Total Cloud Amount

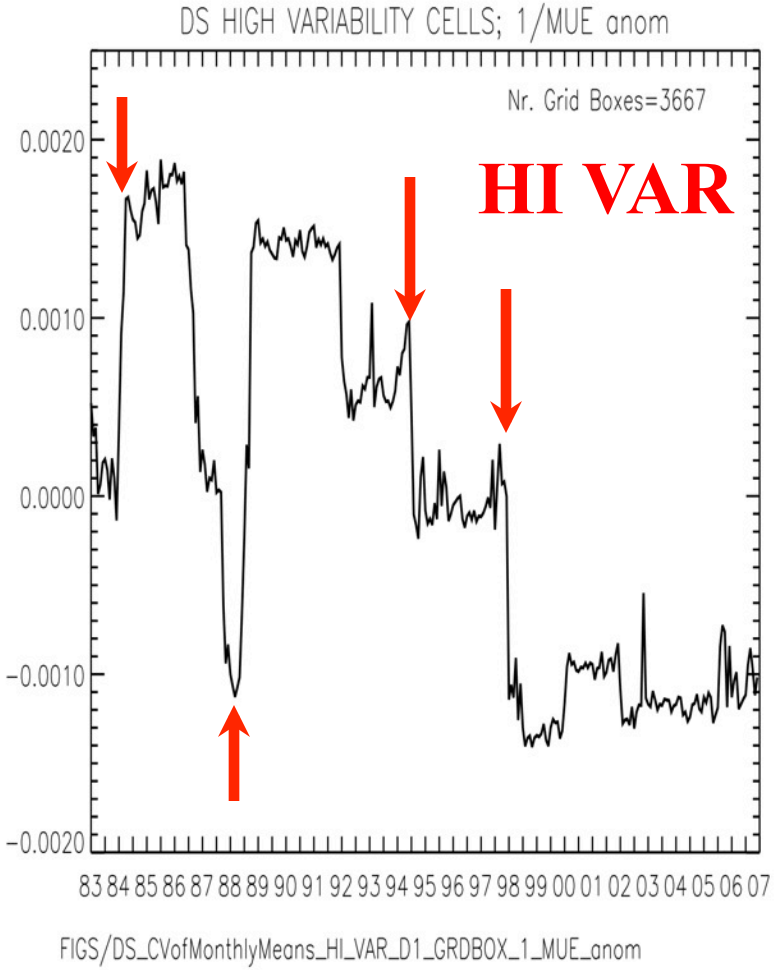


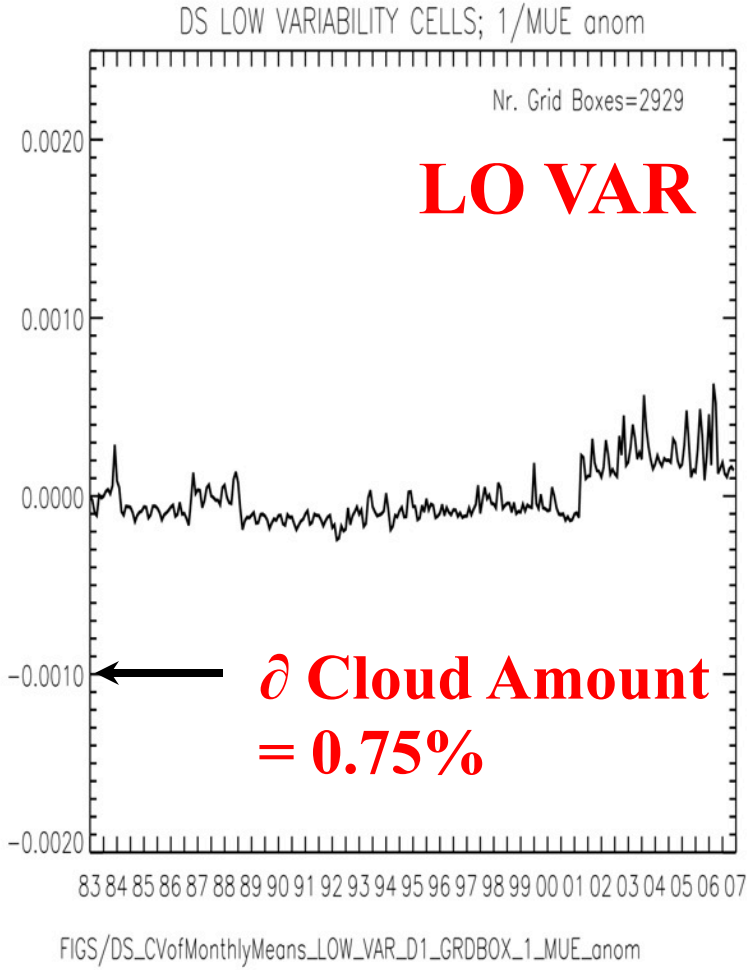


Estimated Uncertainty

1/MUE ANOMALIES

LOOSE THRESHOLD





∂ Cloud Amount / ∂ Mue = 25%

SEPARATED CLOUD AMOUNT ANOMALIES