TRMM Edition 2b TISA Products Validation and Readiness

D. Young, T. Wong, P. Minnis, and K. Costulis
NASA Langley Research Center

J. Stassi, C. Nguyen, R. Raju, and J. Boghosian
SAIC

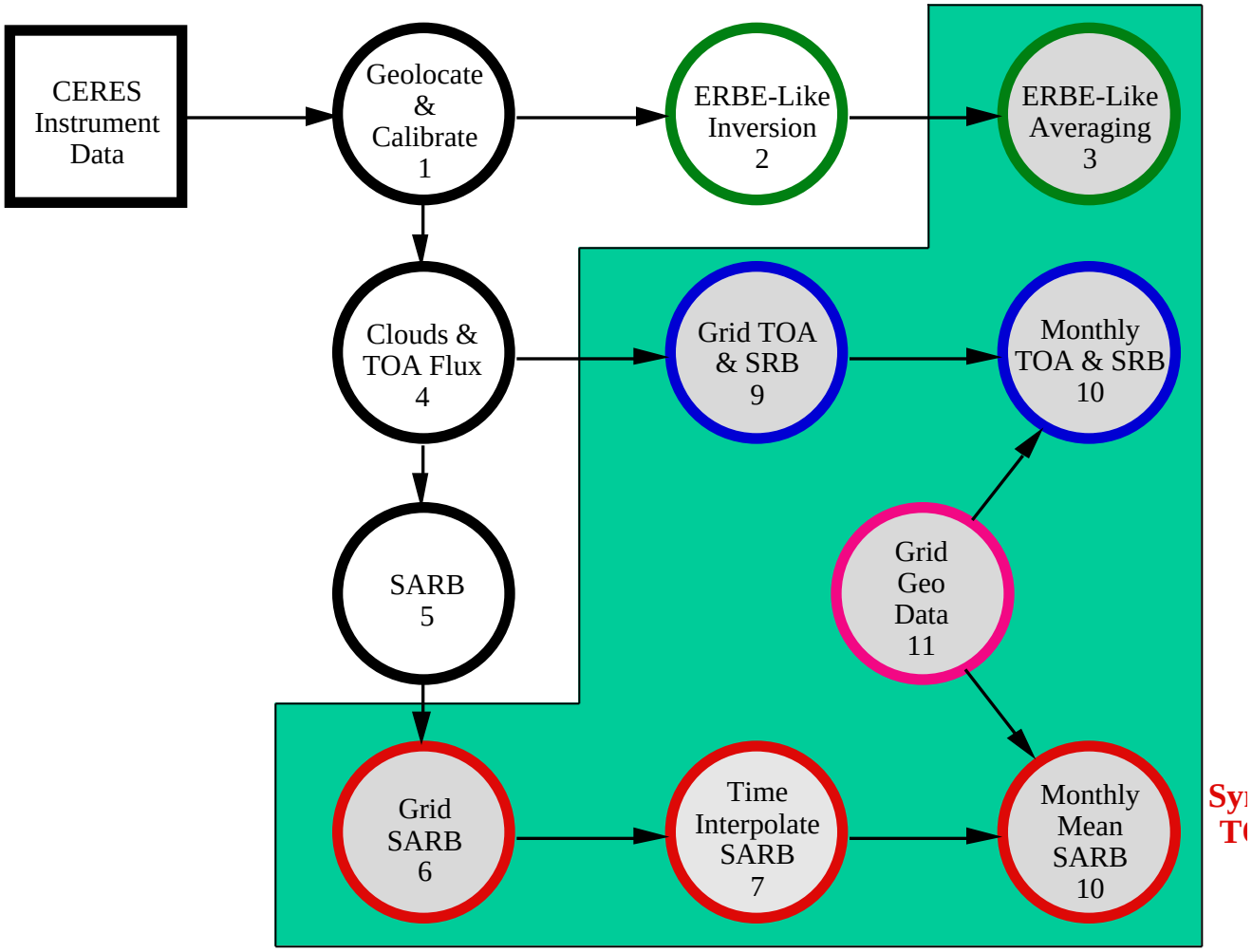
J. Kenyon
AS&M

26th CERES Science Team Meeting
Williamsburg, Virginia
May 14-16, 2002

Time Interpolation and Spatial Averaging (TISA
Overview of Talk

- Product descriptions and schedules
- Progress since January
- Construction of directional models
- Using geostationary data
  - Calibration of imager data
  - Comparisons with ISCCP
  - The search for satellite-to-satellite discontinuities
- GEO-enhanced data
  - Time sampling discussion
  - A look at net fluxes and cloud forcing
- What's next?

Where TISA Fits Into CERES Processing



Upcoming TRMM TISA Products

- Subsystem 10 (Data Product: SRBAVG)
  - Two Interpolation Methods (GGEO & non-GGEO)
  - Uses Cloud Properties from GGEO Data
  - Clear Sky Interpolation Using GGEO
  - Total-sky Fluxes Derived Using ERBE-like ADMs
  - Surface Fluxes
- Subsystem 9 (Data Product: SFC)
  - Gridded SSF
  - Used as input to producing SRBAVG
- Subsystem 11 (Data Product: GGEO)
  - Gridded Geostationary imager data
  - Used for temporal interpolation
  - Not archived

TRMM TISA Schedule

- SRBAVG
  - Beta3 released to public this week
  - Beta4 delivered and ready to process
  - Edition2b due for delivery in late June
- SFC
  - Beta2 released to public
  - Beta4 delivered and ready to process
  - Edition2b due for delivery in early June
- GGEO
  - Not an archival product
  - Beta4 delivered and ready to process
  - Edition2b due for delivery in mid June

Status of TOA and Surface Products

- GGEO
  - 8 months of GGEO run
  - Calibration comparisons with ISCCP underway
- SRBAVG
  - DRMs developed
  - VIRS only cloud product added
  - Clear-sky GEO SW eliminated
  - CERES ADMs used with GGEO SW
    - New NB-BB relationship
  - GGEO LW clear-sky now fit at end of month
  - Debugging in progress
- SFC/FSW
  - Format finalized - reorganized by region
  - ERBE-like averages eliminated
  - Clear-sky redefined as < 0.1%
- Validation in progress

Major Hurdles

Issue	Status
• Total-sky LW algorithm	Done
• Clear-sky LW algorithm	Improved
• Total-sky SW algorithm	Set
– Directional Models	Done
– New ADMs	Done
• Clear-sky SW algorithm	Done
• VIRS/GGEO cloud issues	Revised cloud product
• SFC & SRBAVG HDF Formats	Done
• Data Quality Summaries	Written
• Collection Guide	In Progress
• **GGEO calibration**	**In Progress**
• **Validation**	**In Progress**

Minor Hurdles

• Fix net flux	Fix identified
• Add lat/lon to SRBAVG	Fix identified
• Default vs. 0. fluxes	Fix identified
• Twilight correction	Algorithm ready
• Integrated solar for Sfc fluxes	Algorithm ready
• Add separate cal for desert	Algorithm ready
• Cloud interpolation issues	In testing
• Raw SW averages	In testing
• Minor DRM adjustments	In testing
• Limit high SZA data	In testing

ERBE-like Directional Models
(Albedo as a Function of Solar Zenith Angle)

- Use models for albedo interpolation
  - Biggest effect is on non-GEO means
  - Less important for 3-hourly GGEO data

- Ensure consistency with CERES ADMs
  - Scene types based on ADMs
  - Percentile method on hold

Using Imager Data from Geostationary Satellites for Interpolation (GGEO)

- Current Work
  - Comparisons with VIRS
  - Comparisons with ISCCP
- Effects on fluxes
  - GEO vs. nonGEO differences
    - Diurnal Range
    - Meridional Gradients
    - Net fluxes
    - Cloud Forcing
  - Search for artifacts
    - Longitudinal differences
    - Calibration sensitivity tests

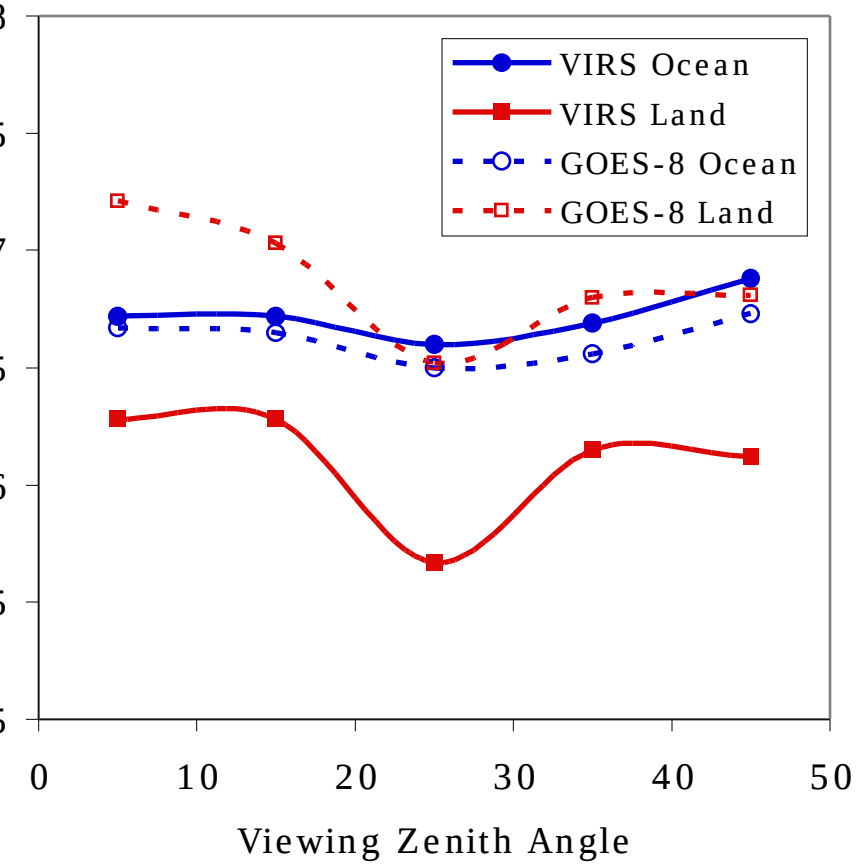
VIRS/GEO Comparisons

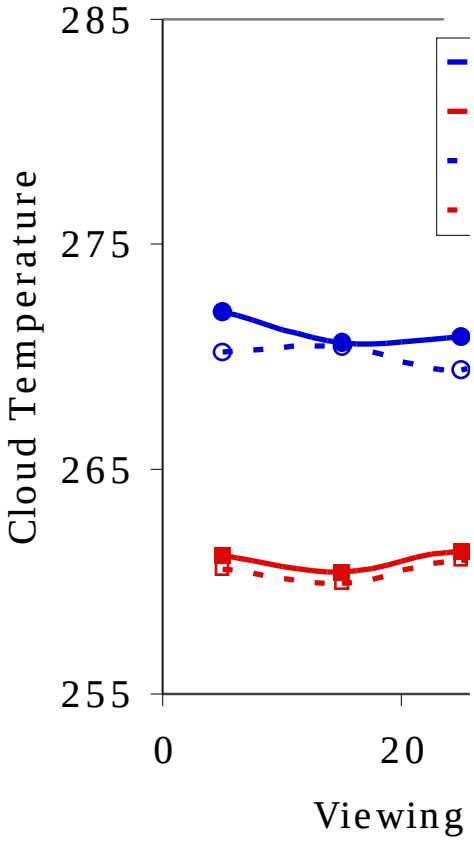
- Looked at all 8 months
  - Results similar to February/July results shown in 01/02
- Viewing and Solar Zenith Dependence
- Regional differences
- Deep convective cloud albedo comparisons
  - code obtained but not implemented

GEO-VIRS Differences (Feb 1998)

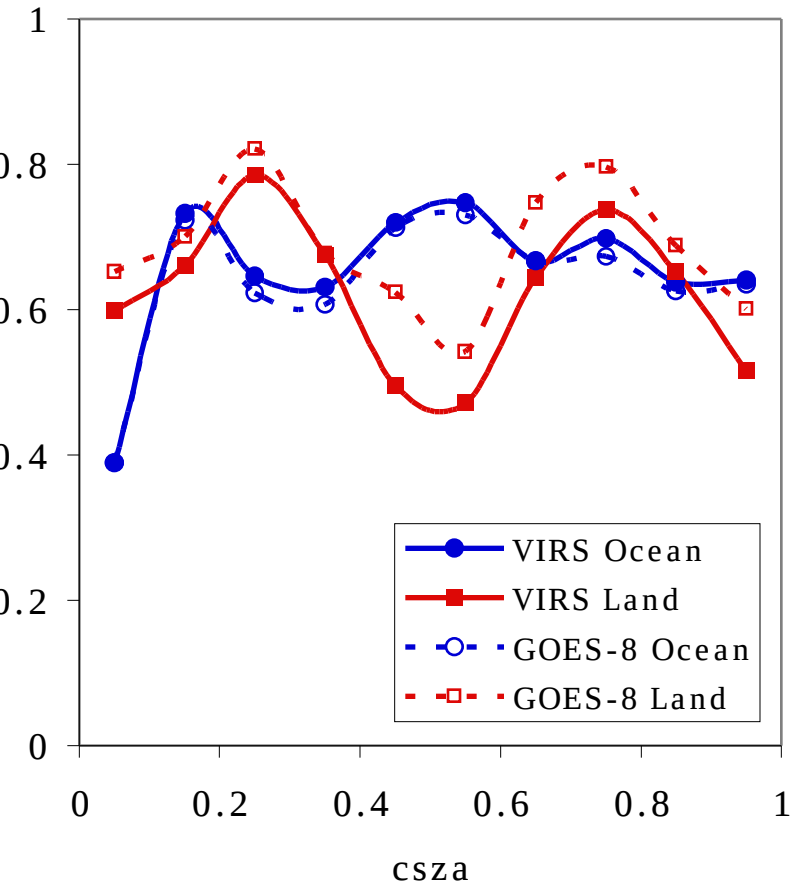
	Cloud Fraction	Cloud T (K)	Optical Depth
GOES-8	+0.01	+0.3	-1.8
GOES-9	0.00	+0.2	-1.6
METEOSAT-5	**+0.10**	+0.6	-2.2
GMS-5	0.00	**+3.8**	-1.8

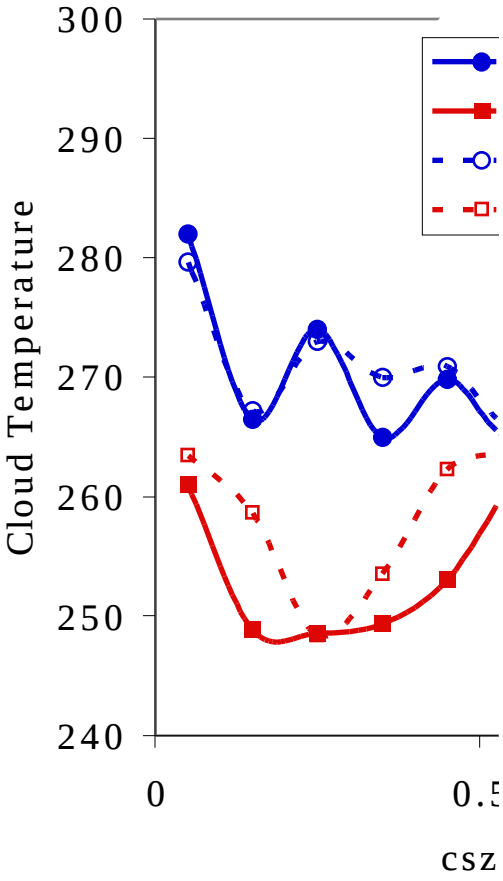
Viewing Zenith comparisons



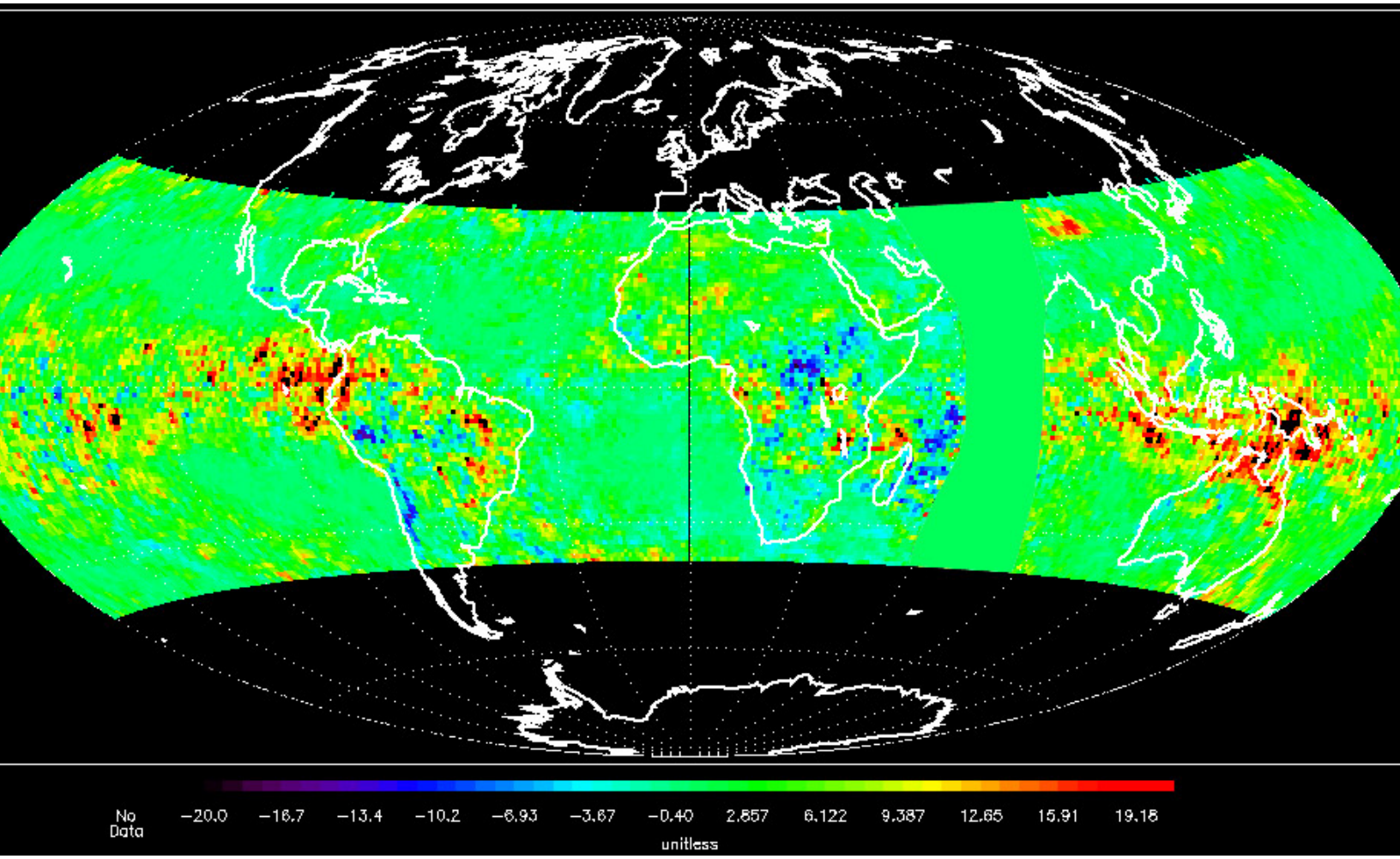


Solar Zenith Comparisons

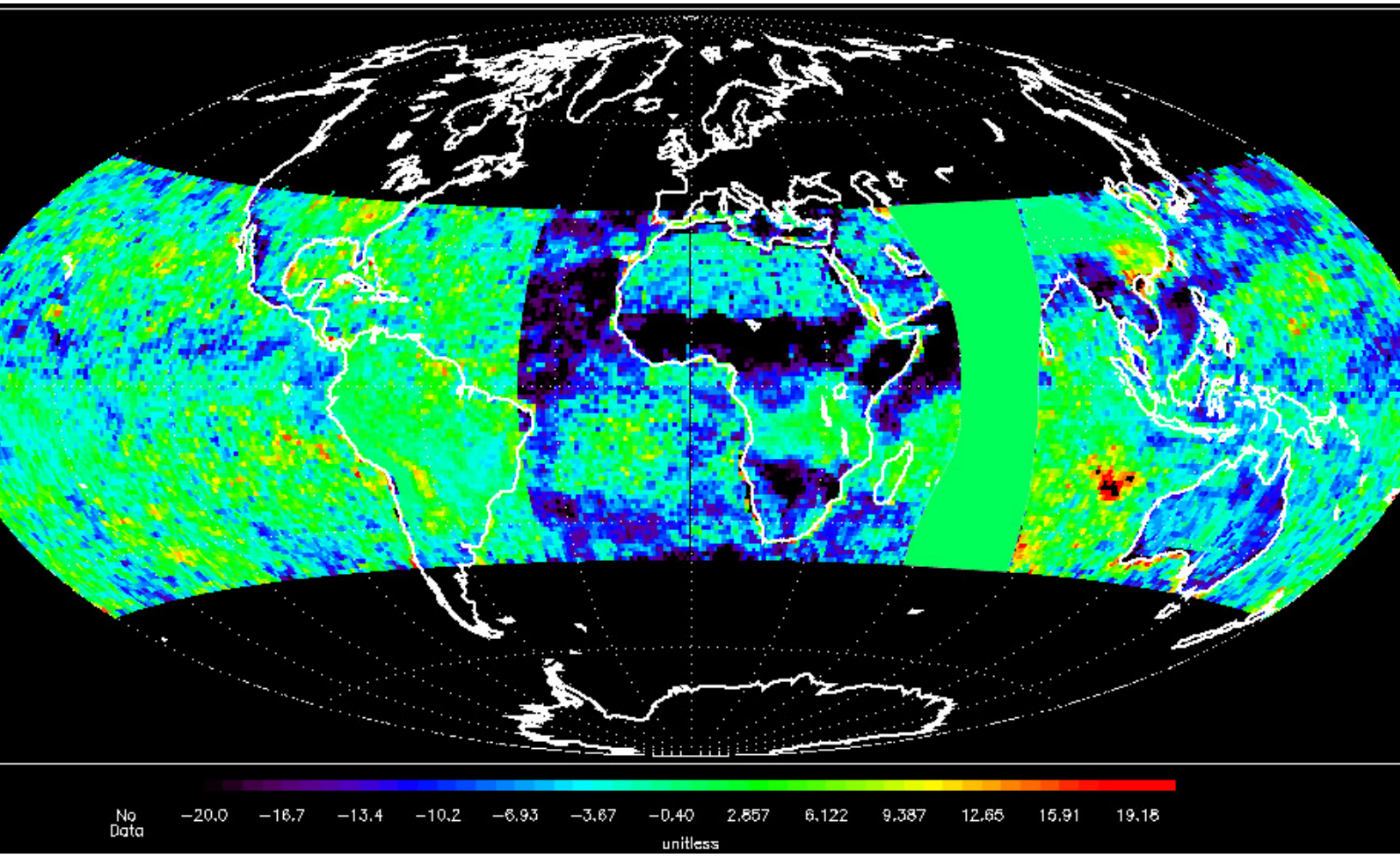




VIRS - GGEO high cloud fraction
February 1998



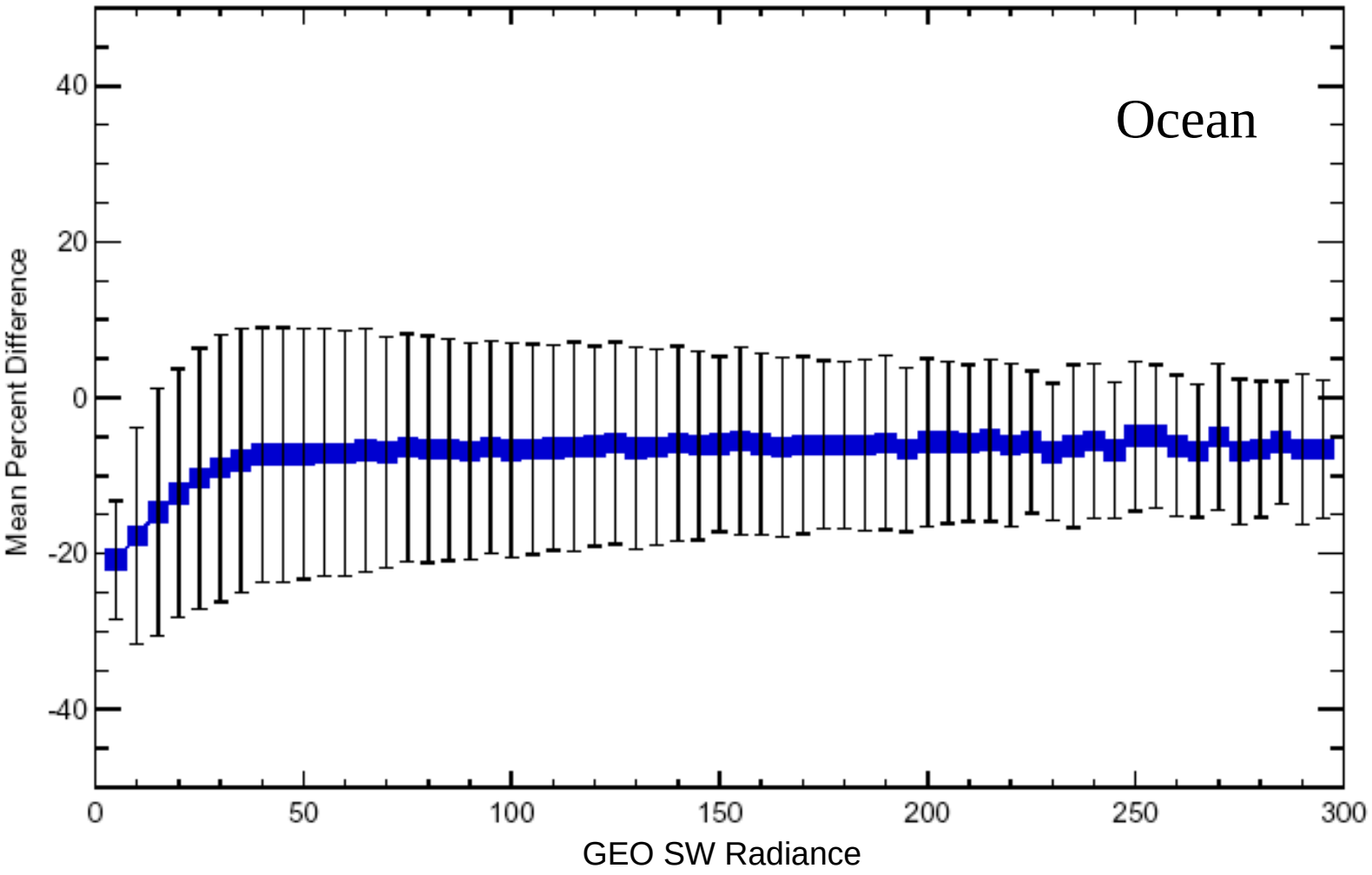
VIRS - GGEO low cloud fraction
February 1998



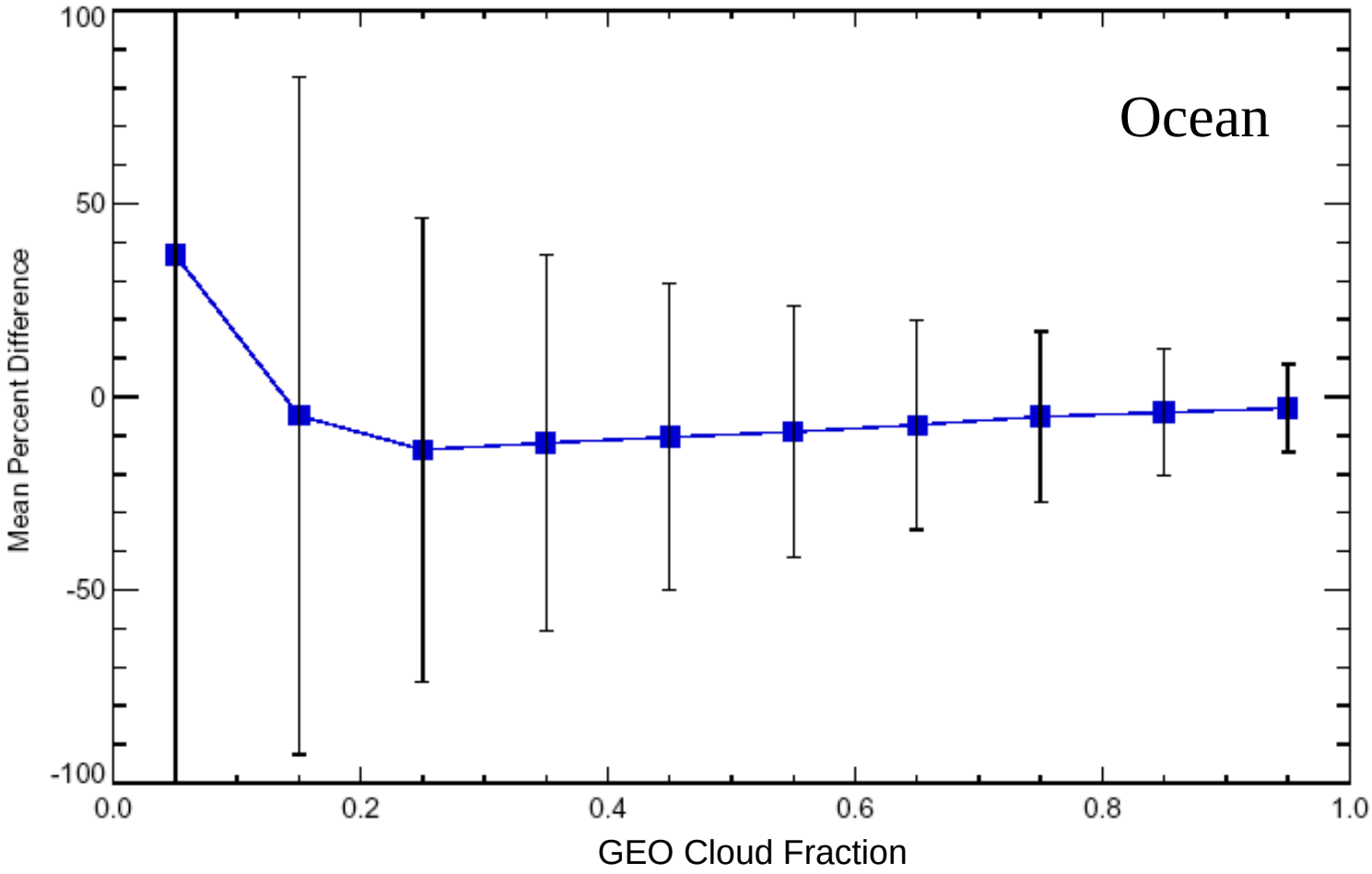
GEO/ISCCP Comparisons

- Eight months of data
  - Individual comparisons for each satellite
  - ISCCP DX data on GEO grid
- Zonal cloud property comparisons
- Instantaneous matched radiance and cloud properties
  - 2°x2° grid used to reduce ISCCP spatial noise
  - Data binned to look for trends
- Final comparison waiting for GEO cal

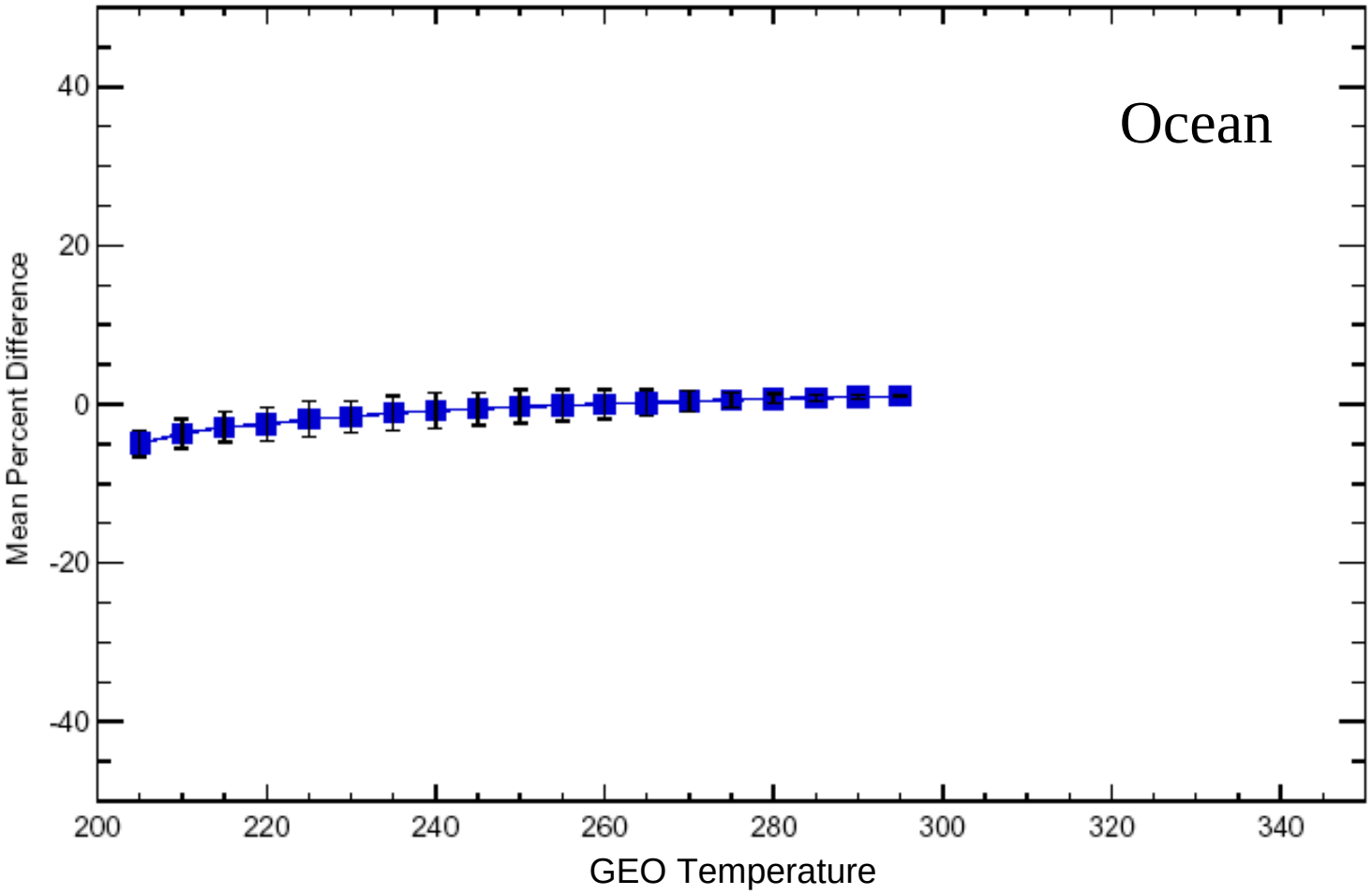
ISCCP-GEO SW Radiance Difference (%)



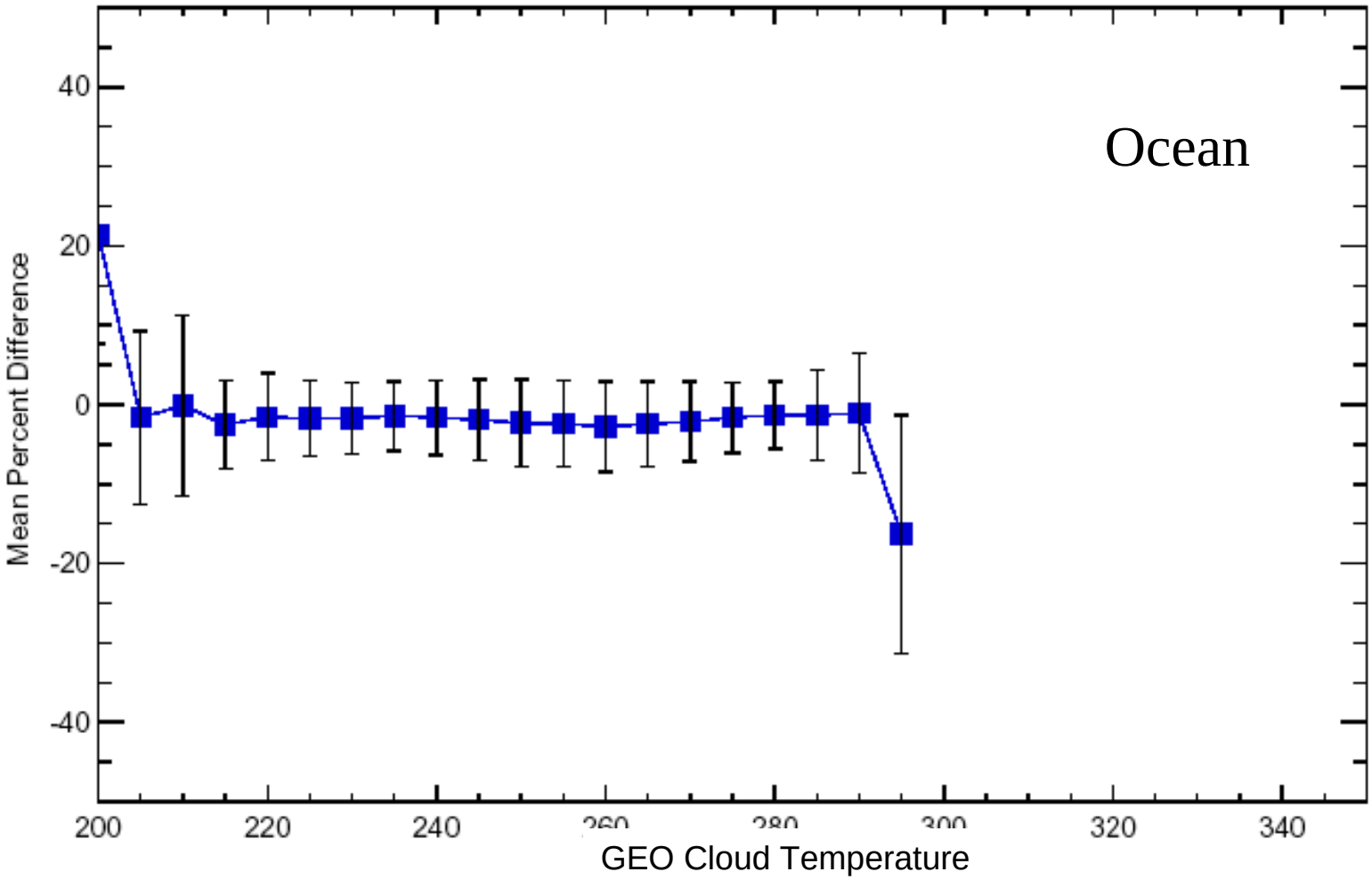
ISCCP-GEO Cloud Fraction Difference (%)



ISCCP-GEO IR Temperature Difference (%)



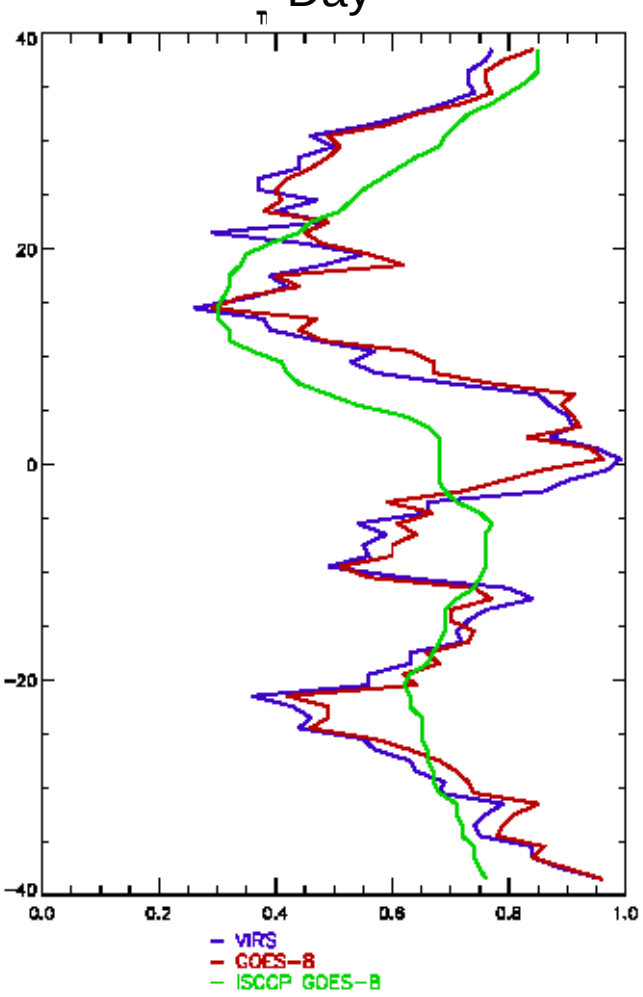
ISCCP-GEO Cloud Temperature Difference (%)



Zonal Mean Cloud Fraction

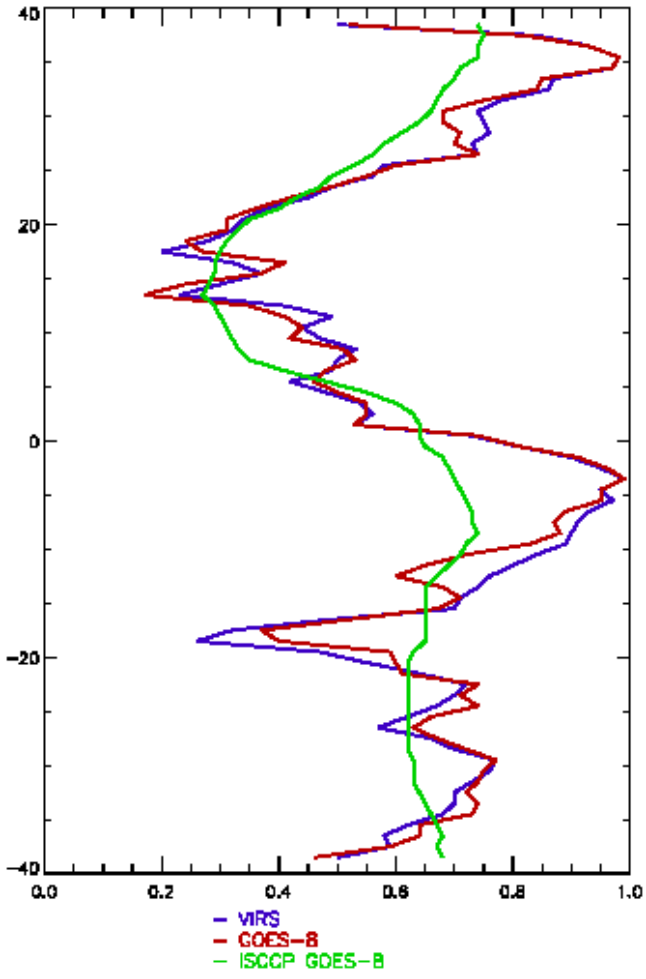
VIRS GOES-8 ISCCP

Day



Latitude

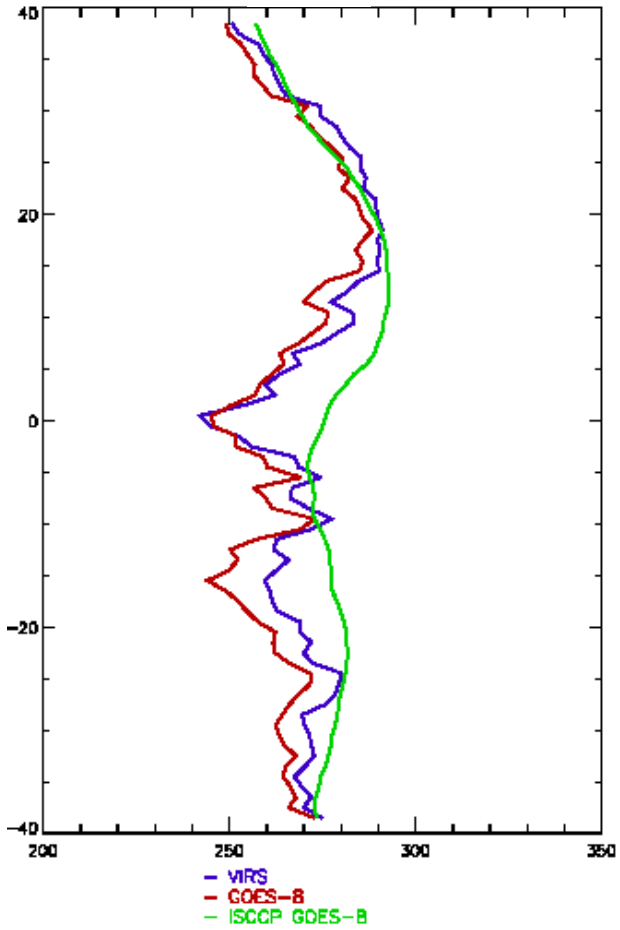
Night



Zonal Mean Cloud Temperature

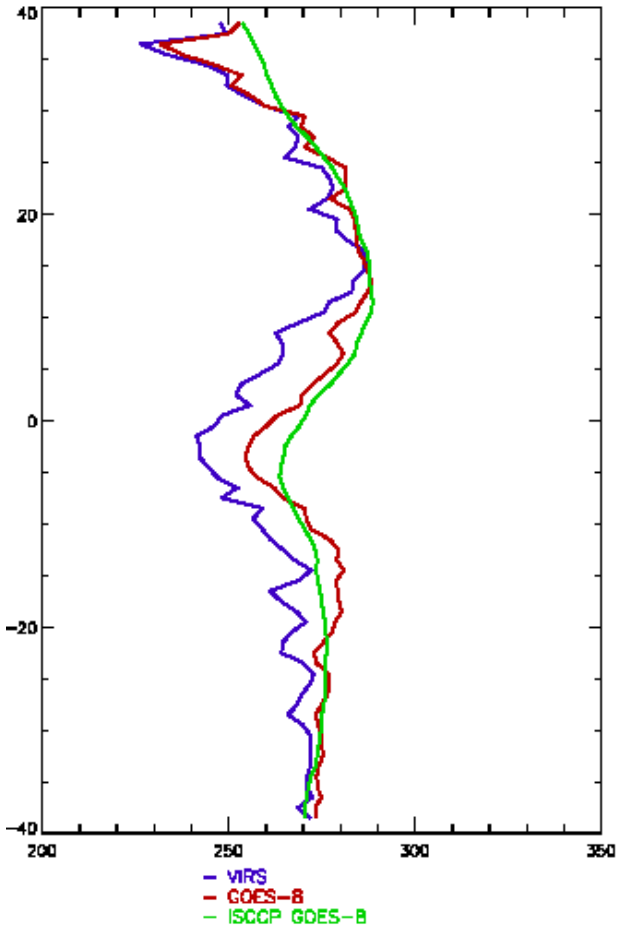
VIRS GOES-8 ISCCP

Day



Latitude

Night

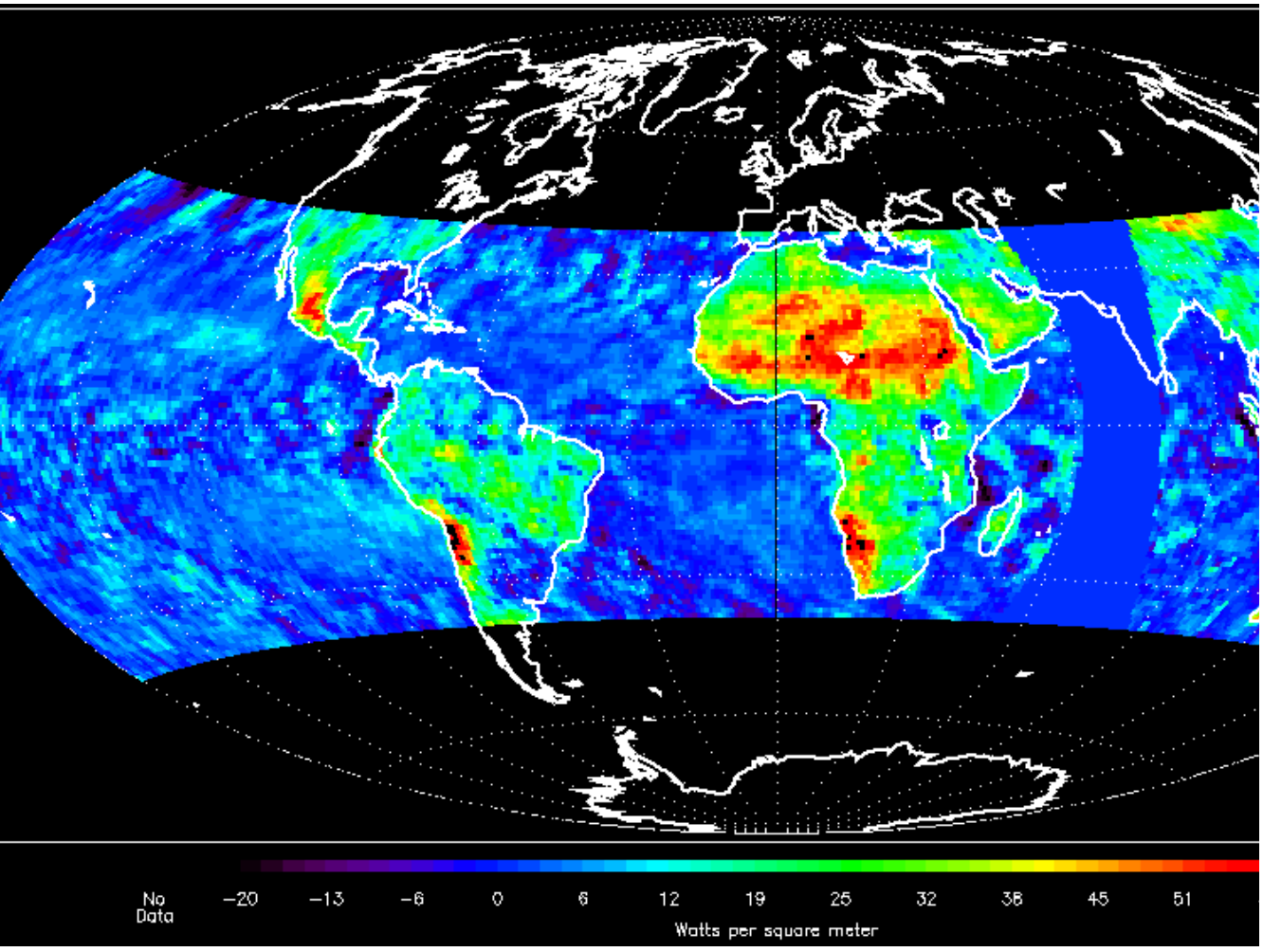


GEO/nonGEO differences

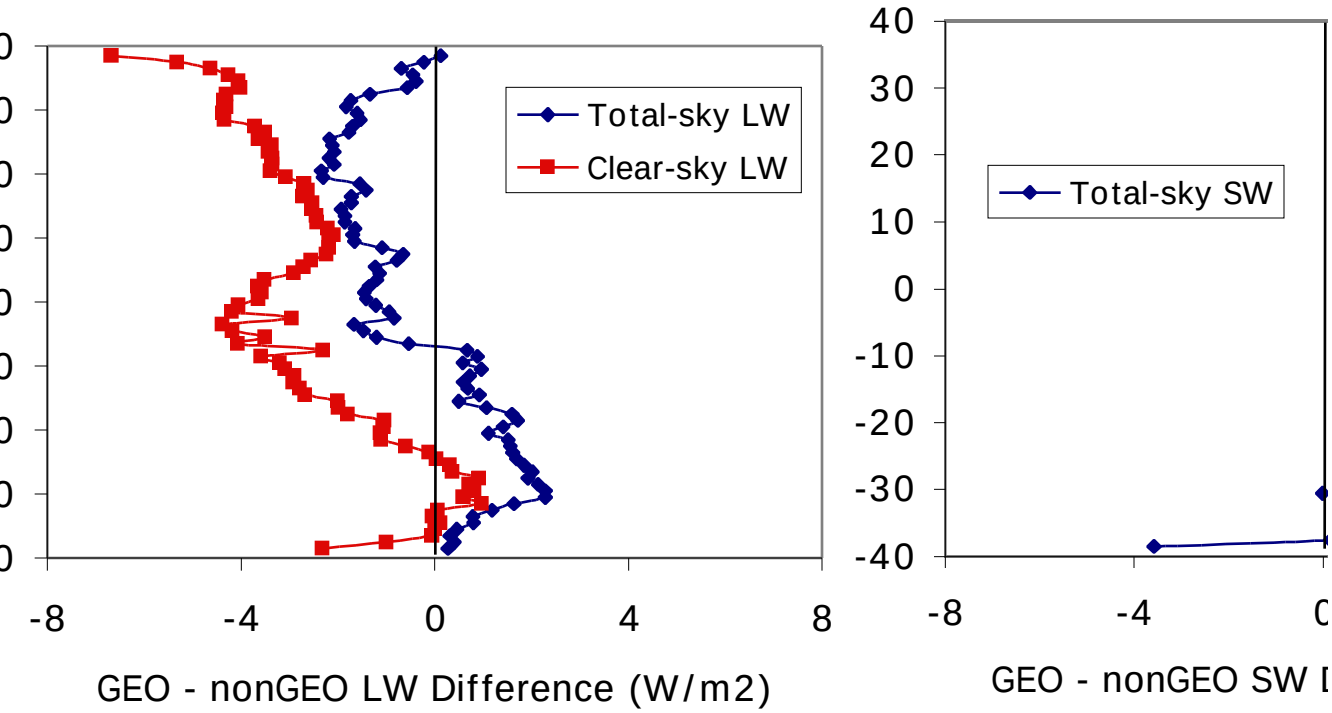
- Diurnal Range
- Meridional Gradients
- Net fluxes
- Cloud Forcing

TRMM February SW Sampling

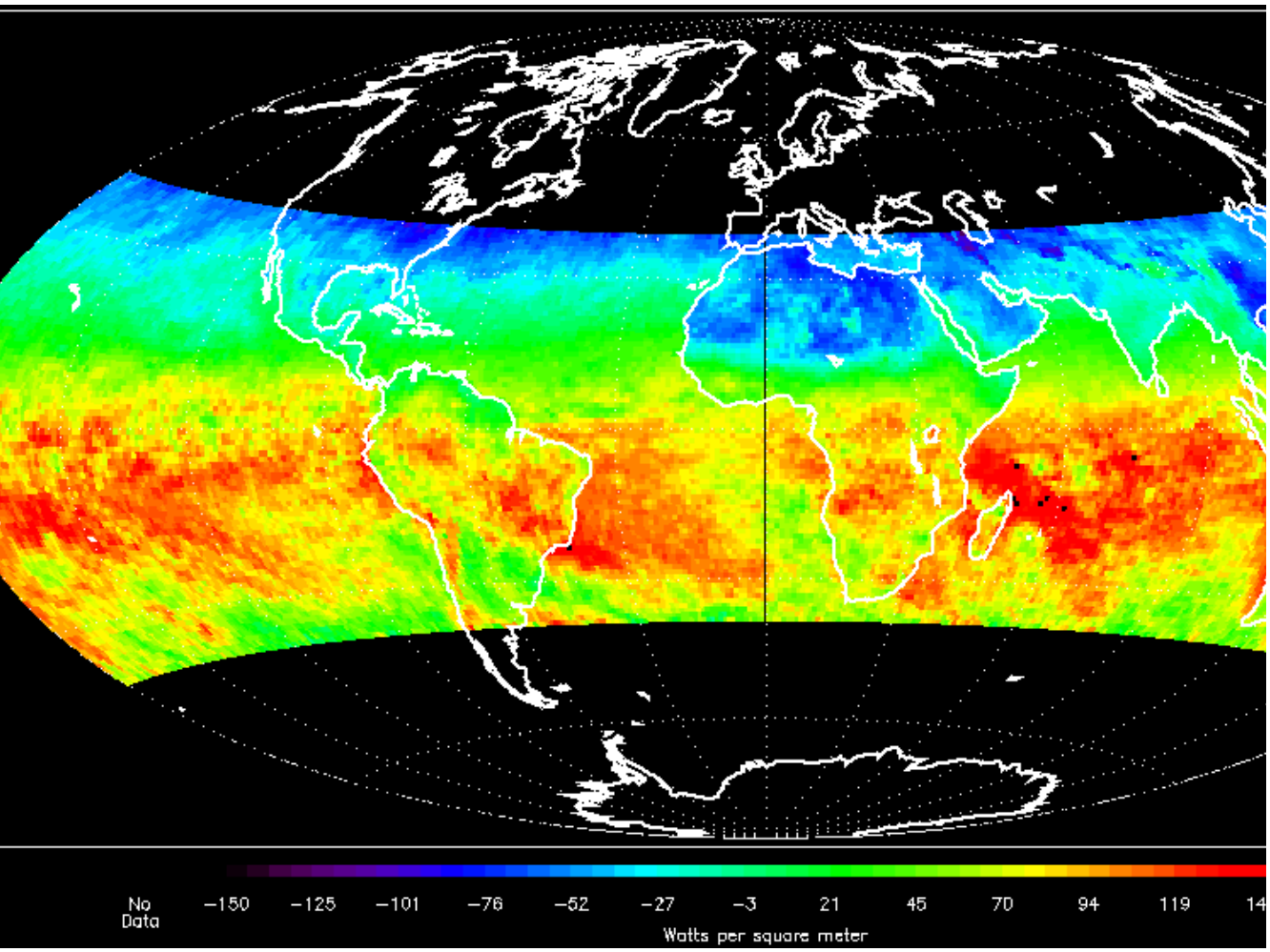
Beta3 GEO-nonGEO Diurnal Range Difference (W/m^2)



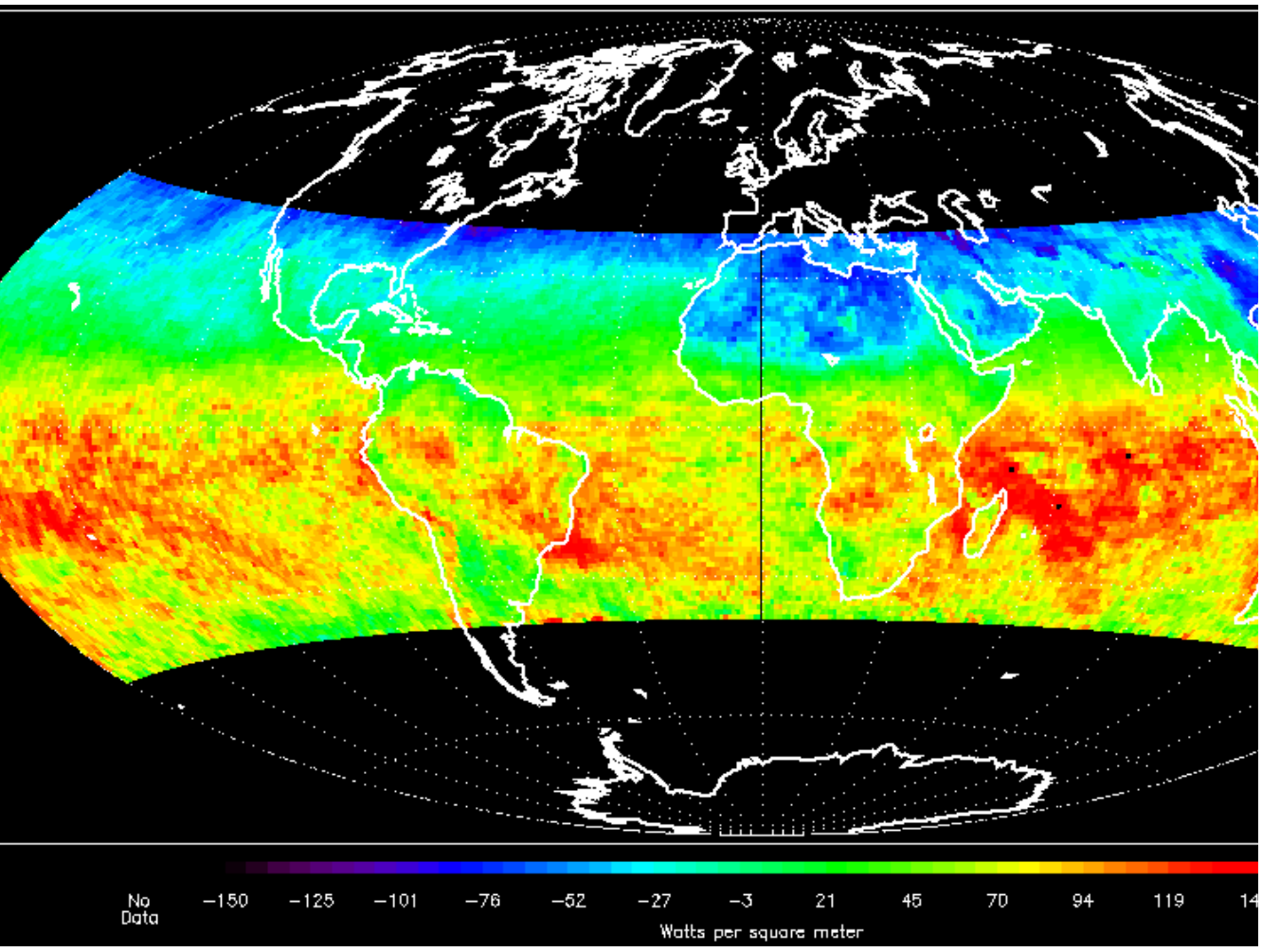
GEO-nonGEO Zonal Mean Differences



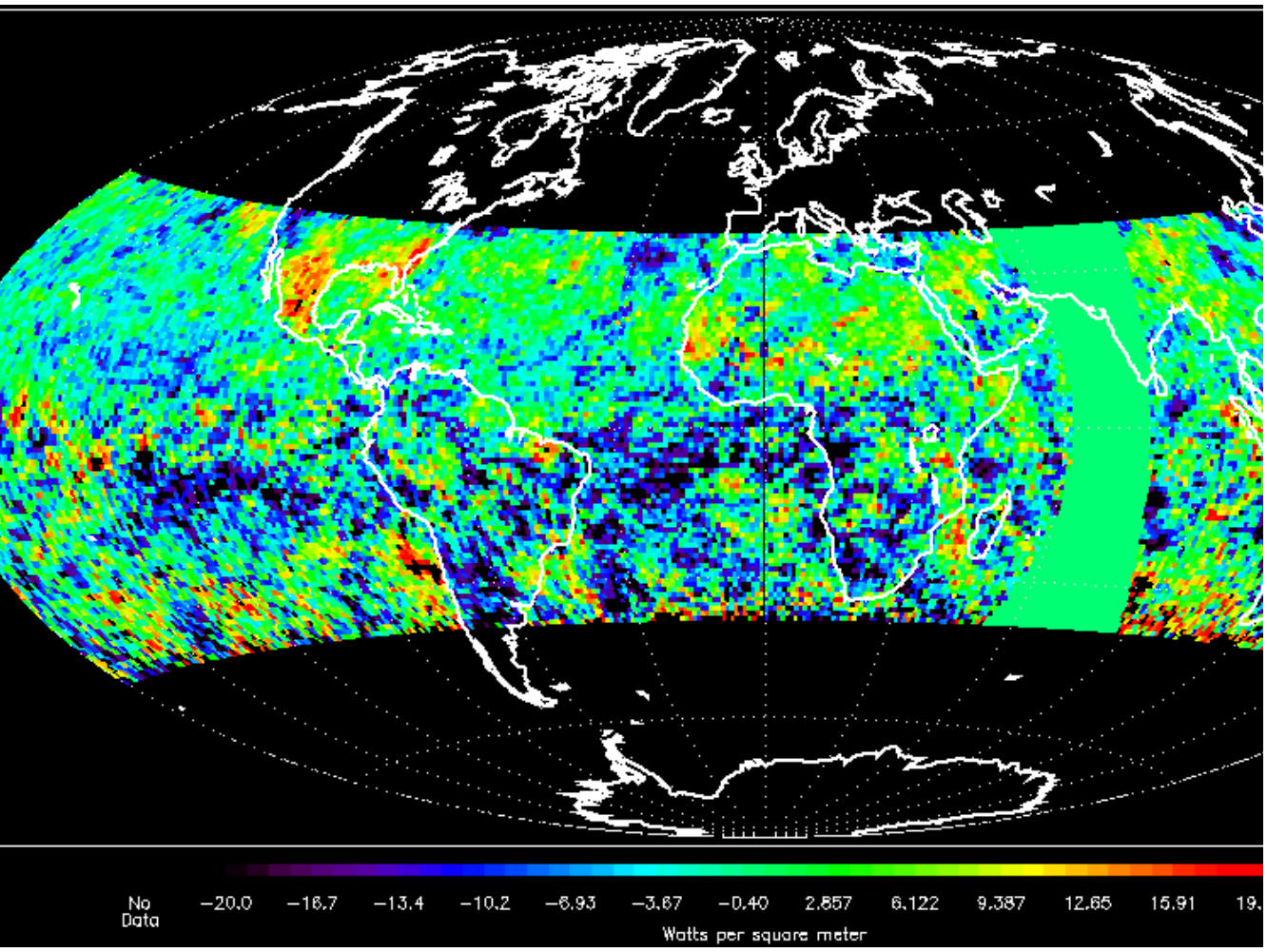
Beta3 nonGEO Net Flux



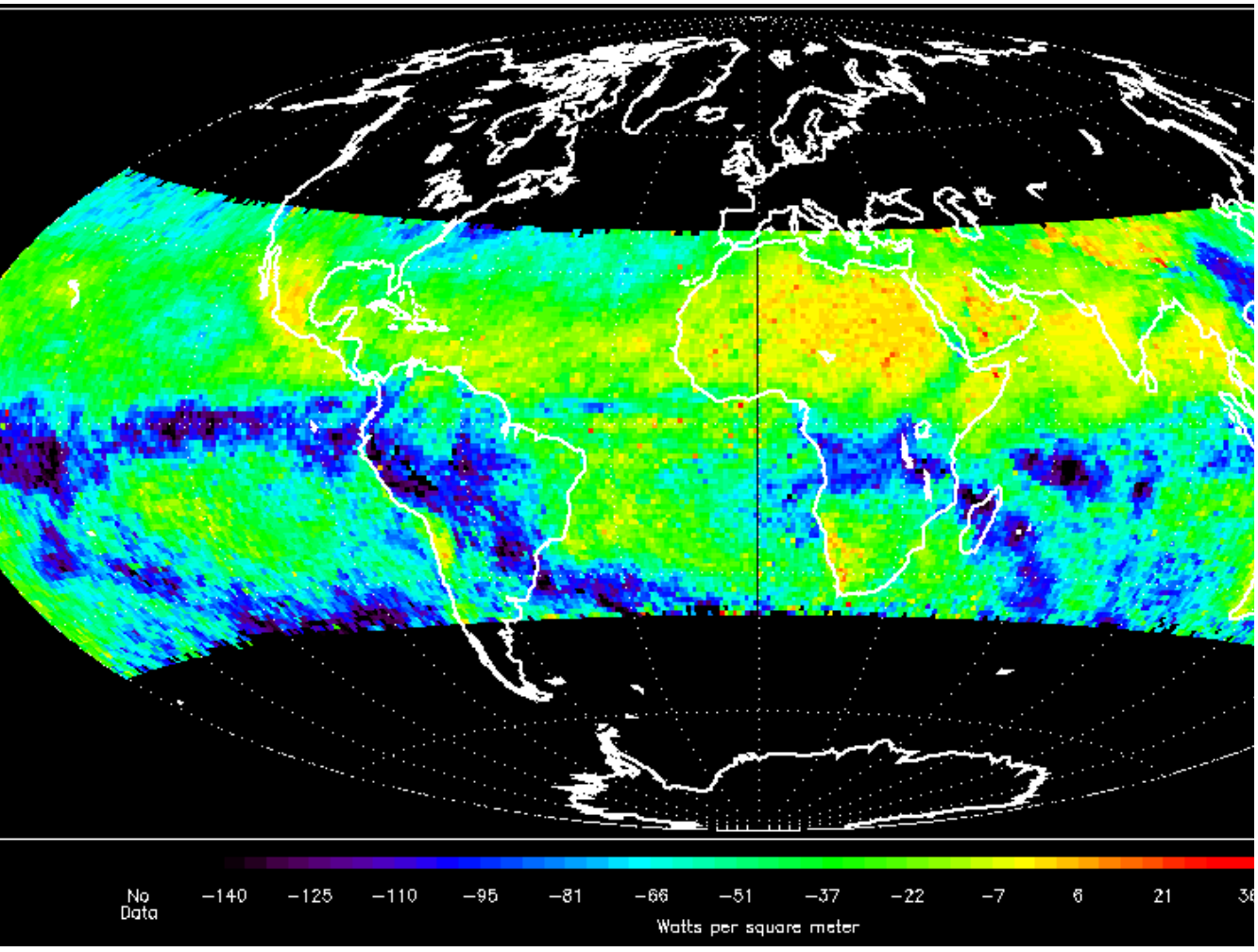
Beta3 GEO Net Flux



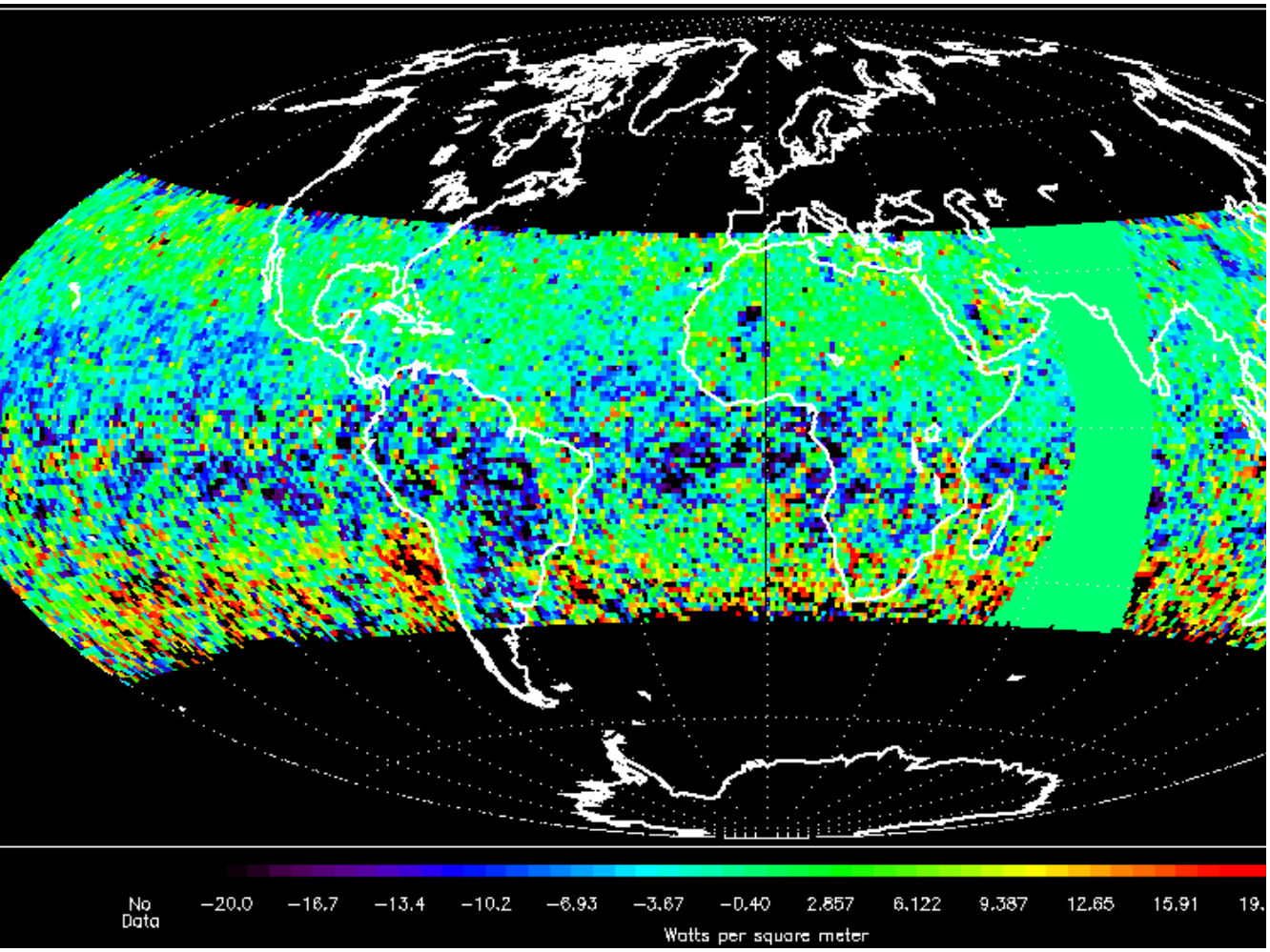
Beta3 GEO-nonGEO Net Flux Difference



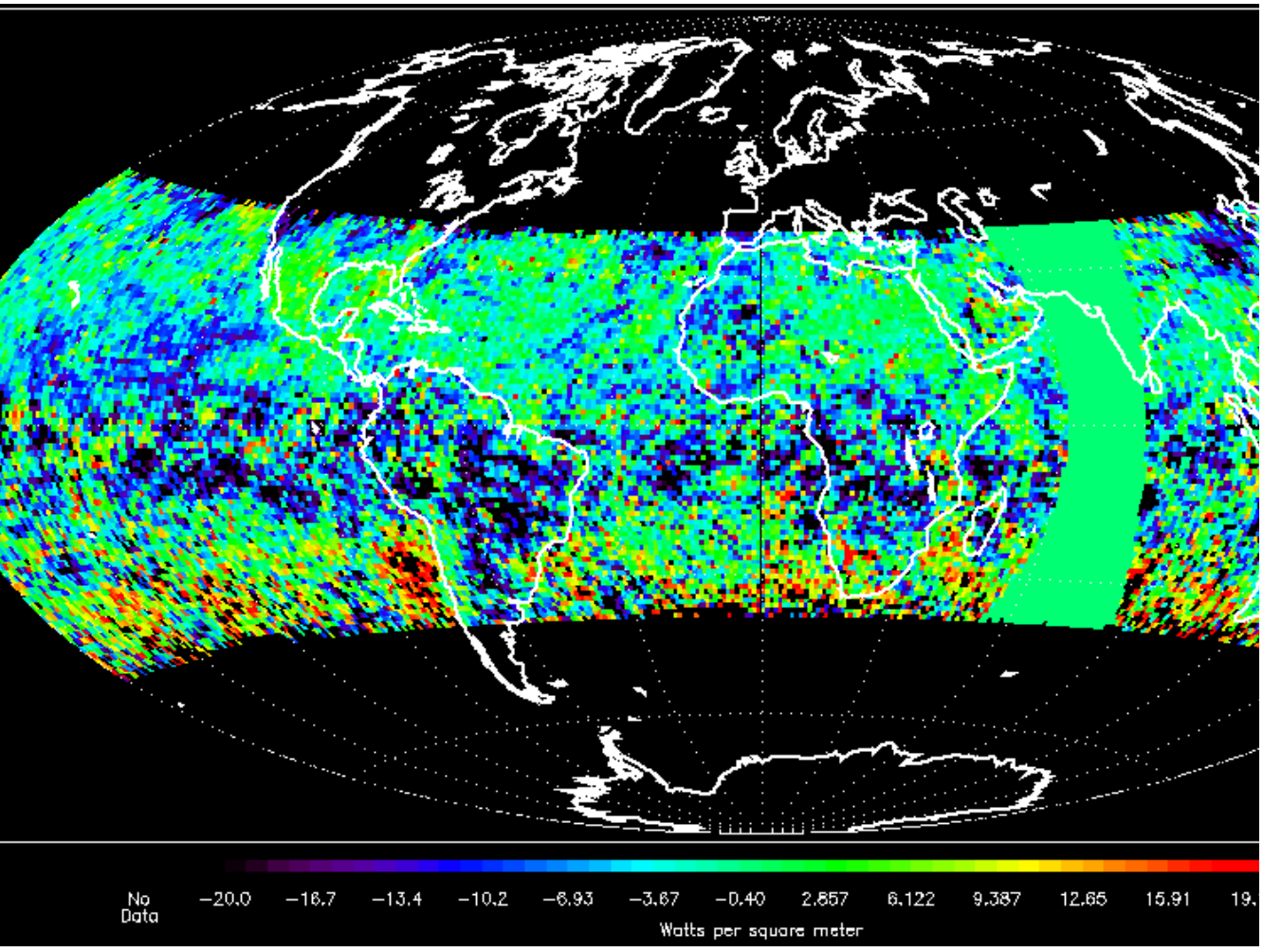
Beta3 GEO SW Cloud Forcing



Beta3 GEO-nonGEO SW Cloud Forcing Difference (W/m^2)



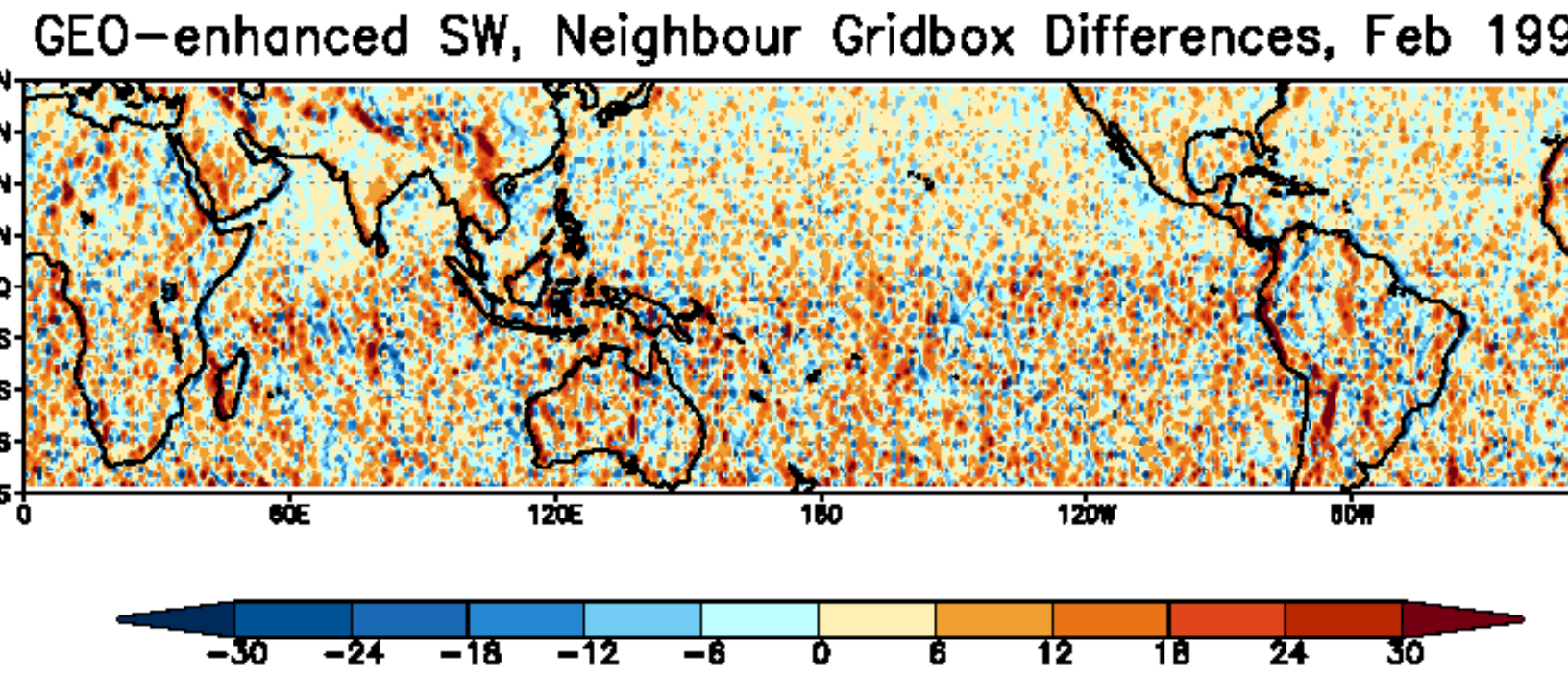
Beta3 GEO-nonGEO Net Cloud Forcing Difference (W/m^2)



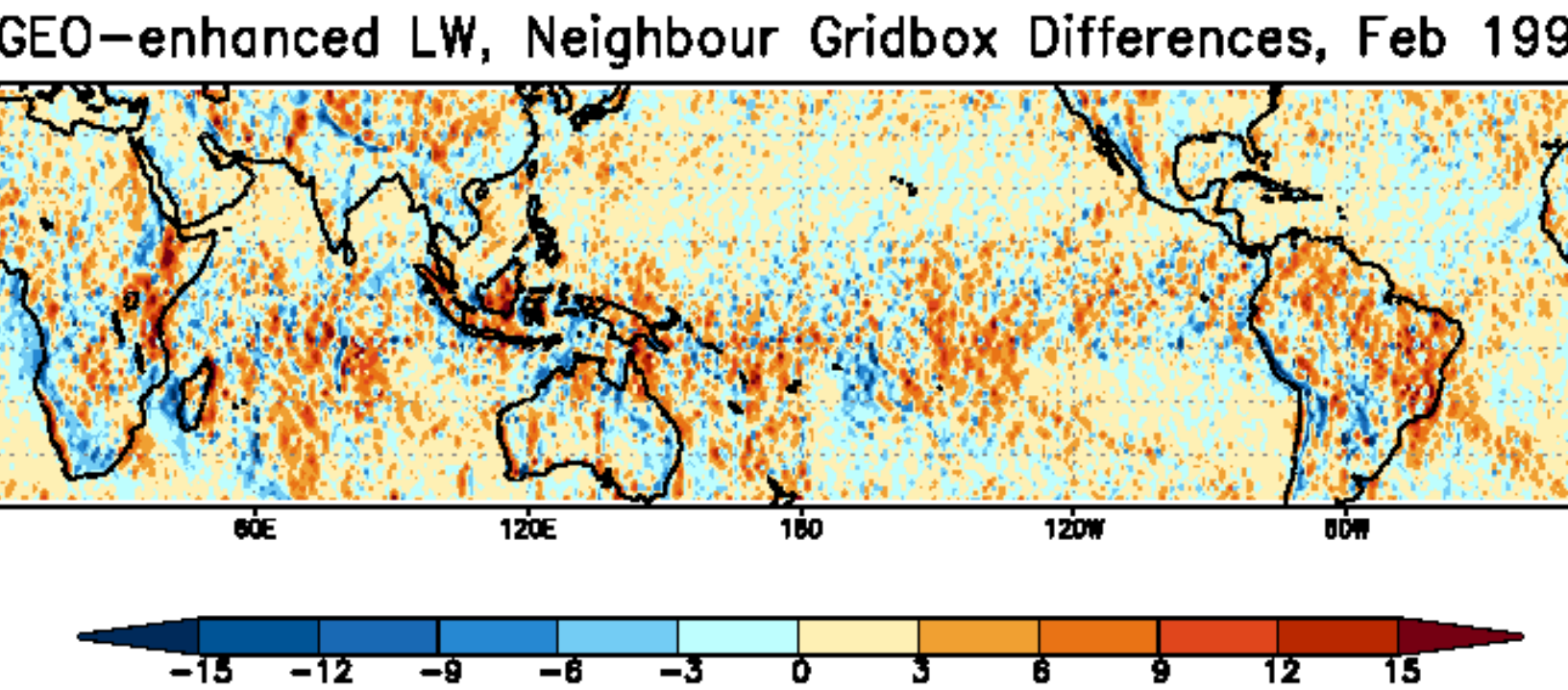
In Search of... GEO Artifacts

- Use difference images (net flux; cloud forcing) to look for the dreaded ISCCP rings
- Study longitude gradient pictures for satellite boundaries
- Focus on local hourly means

SW Flux longitude gradient test



LW Flux longitude gradient test



Future Plans

- Finalize Algorithms
  - Finalize DRM
  - Finalize Geostationary Calibrations
  - Fine-tune LW Clear-sky Algorithms
  - Correct minor problems
- Continued Validation
  - Nine Months of TOA and Surface Flux Comparisons
  - Direct integration validation of DRMs
  - Flux histogram comparisons
  - VIRS/GEO/ISCCP comparisons
  - Continue search for GEO artifacts
- Scheduled Edition2b deliveries in June