Temporal Interpolation using Geostationary Data An Update

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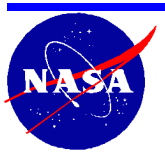


Summary of CERES TRMM TISA Products

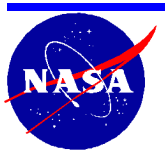
Sub-system	Product	Grid Size	VZ Limit	ADM	Scene ID
SS3	ERBE-Like (ES-4, ES-9)	2.5°	70°	Old ERBE	ERBE MLE
SS10	ERBE TSA (SRBAVG)	1.0°	45°	New ERBE	VIRS
SS10	CERES GGEO TSA (SRBAVG)	1.0°	45°	New ERBE	VIRS
SS8	Synoptic (AVG)	1.0°	45°	New ERBE	VIRS

Comparison of Subsystem 3 ERBE-like and Subsystem 10 ERBE TSA Monthly Mean TOA Fluxes

- ERBE-like
  - 2.5° Grid
  - VZ < 70 °
  - Scene Identification by MLE
  - Old ERBE ADM
- SS10 ERBE TSA
  - 1.0° Grid
  - VZ < 45 °
  - Scene Identification from VIRS
  - New ERBE ADM
- Comparison Method
  - Difference Fluxes Using SS10 Data Re-Gridded to 2.5°
  - Compare Histograms of Fluxes

Temporal Interpolation Using Geostationary Narrowband Data

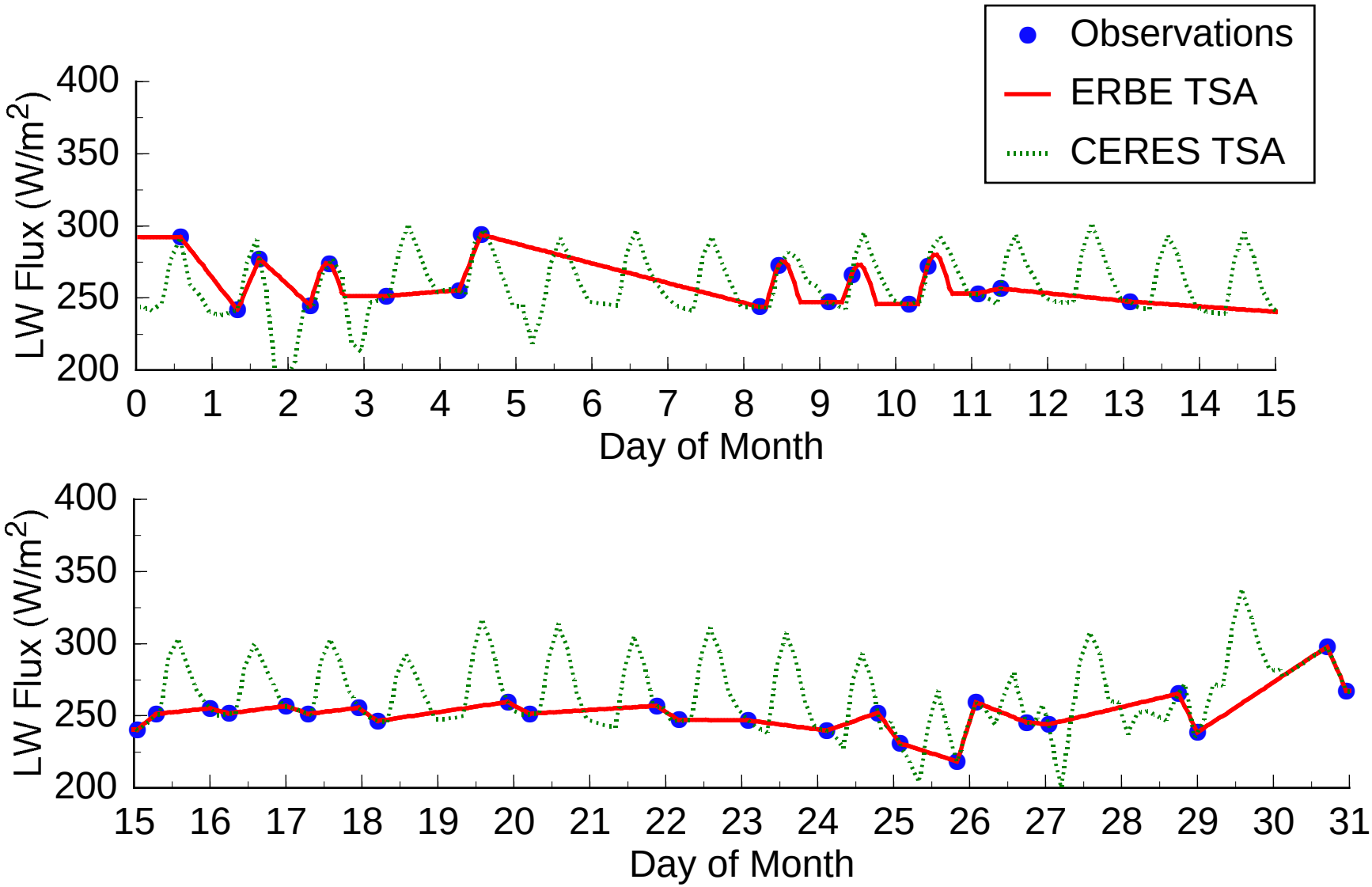
- Geostationary Data Collected for CERES (GGEO)
  - Four Satellites (GOES-8, GOES-9, GMS-5, METEOSAT-6)
  - Visible (0.6 μm) and IR (11 μm) Radiances
  - 3-Hourly, 8-km Resolution
- Data Averaged on CERES 1° x 1°Grid
- Narrowband Calibration Normalized to VIRS
- Narrowband-to-Broadband Conversion Based on ERBE/GOES Relationship
- Fluxes Derived Using Old ERBE ADM
- GGEO-Derived Broadband Time Series Normalized to CERES Fluxes



Time Series of CERES LW Flux From Subsystem 10

TRMM RAP + FAP January 1998

E. Sahara 24.5N 20.5E



Advantage of GGEO Cloud Products

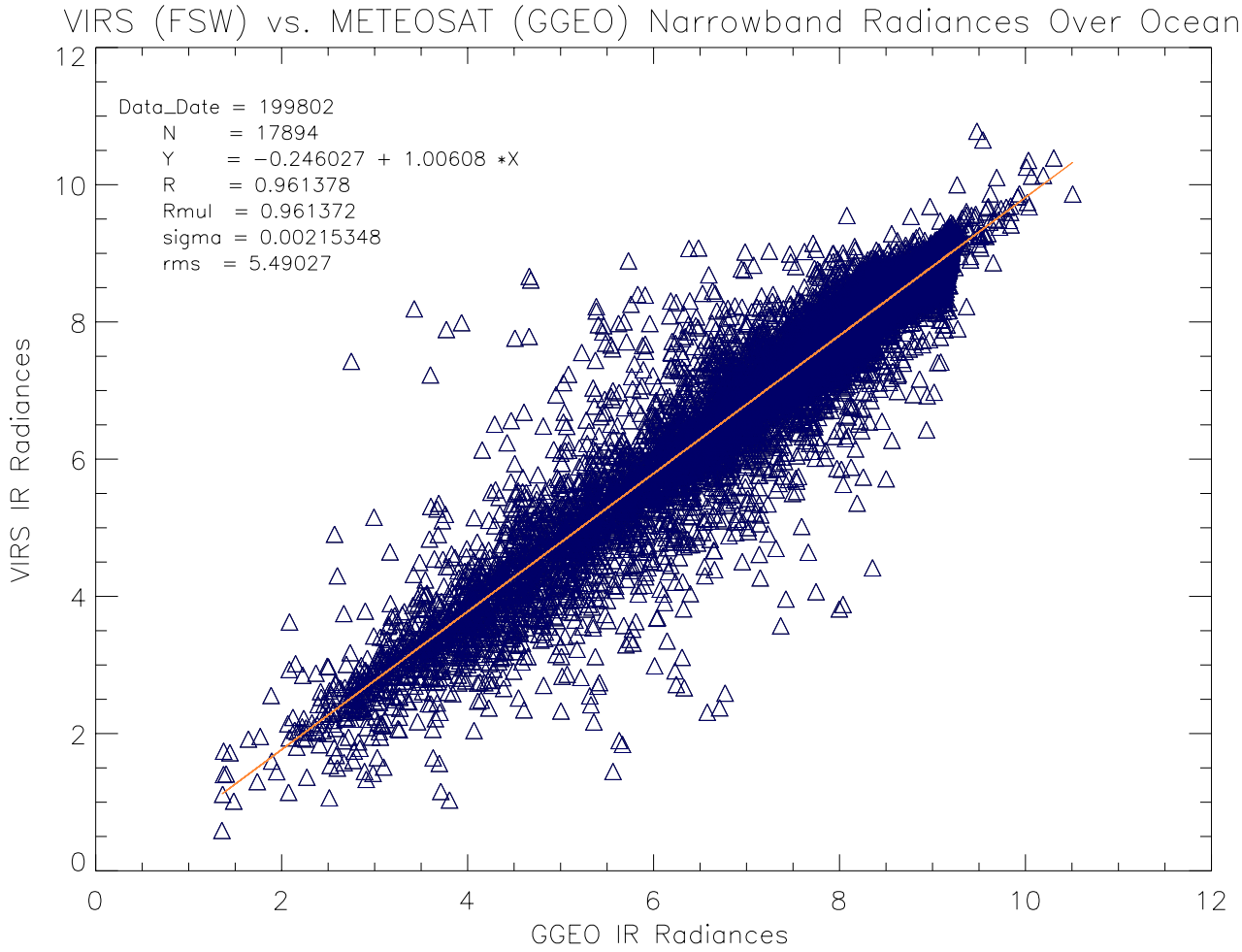
- Improved Monthly Mean Cloud Properties

- Reduction of Instantaneous SW Flux Interpolation Error
  - ERBE-Like: 41 W/m^2
  - GGEO (no clouds): 22 W/m^2
  - GGEO(w/ clouds): 13 W/m^2

- Use of GGEO to Improve LW Clear-sky Interpolation

GGEO Calibration

- Each Satellite Calibration Tied to VIRS/MODIS
- GGEO Data Filtered for Bad Scan Lines and Sunglint
- One-Degree Gridded VIRS and GGEO Radiances Correlated for Data Matched in Time and Angle
- Correlations Calculated Monthly
- Correlations Compared with Detailed Calibrations of Minnis et al.
- NB/BB Correlations from SSF Ray-Matched VIRSand CERES Data


VIRS (FSW) vs. METEOSAT (GGEO) Narrowband Radiances Over Ocean
Data_Date = 199802
N = 17894
Y = −0.246027 + 1.00608 *X
R = 0.961378
Rmul = 0.961372
sigma = 0.00215348
rms = 5.49027
VIRS IR Radiances
GGEO IR Radiances
0
2
4
6
8
10
12

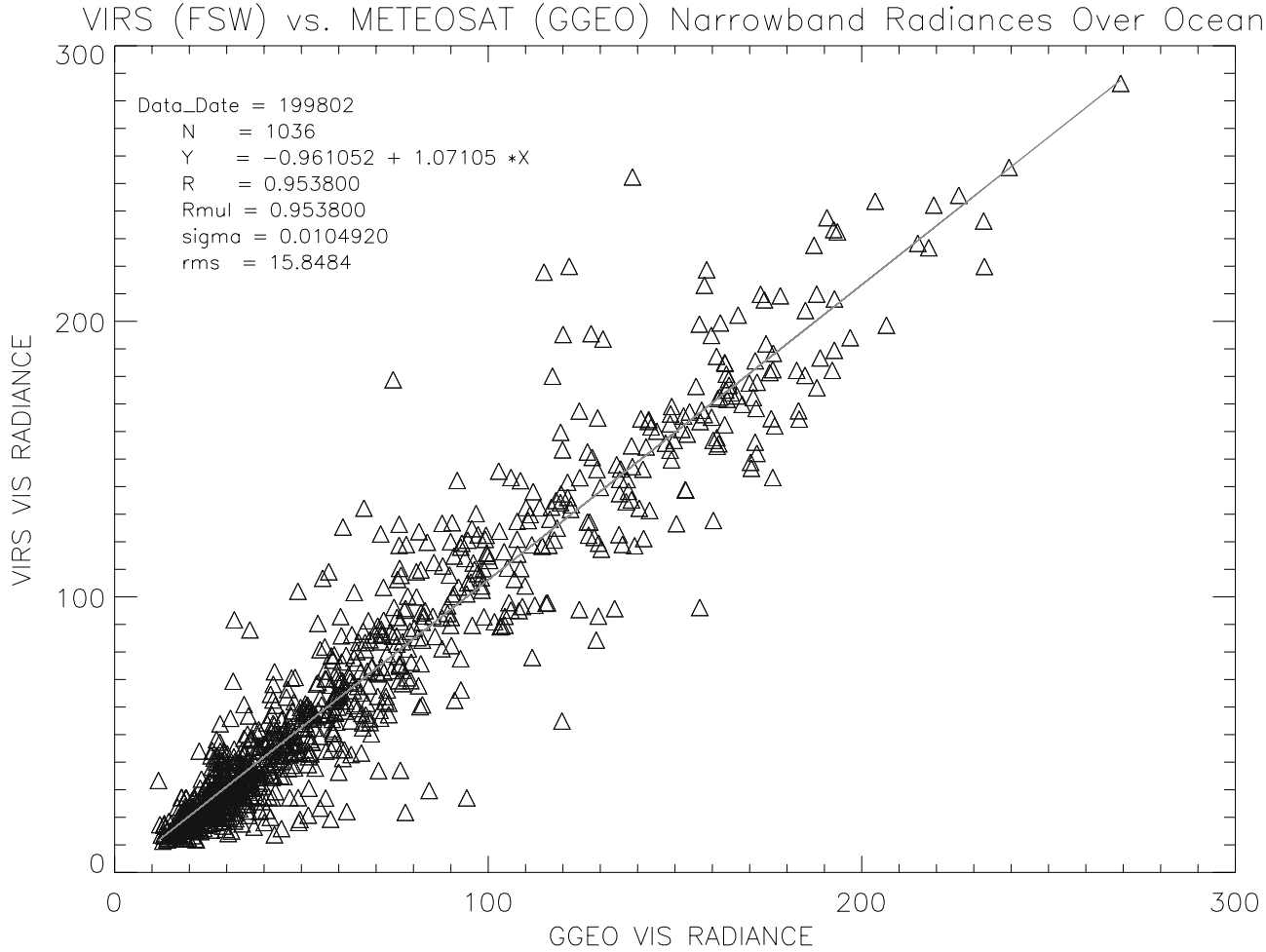

VIRS (FSW) vs. METEOSAT (GGEO) Narrowband Radiances Over Ocean
Data_Date = 199802
N = 1036
Y = −0.961052 + 1.07105 *X
R = 0.953800
Rmul = 0.953800
sigma = 0.0104920
rms = 15.8484
VIRS VIS RADIANCE
GGEO VIS RADIANCE
0
100
200
300

Table 2: VIRS vs. GGEO VISIBLE RADIANCES

Satellite	Month	Points	Offset	Slope	R.	% RMS
METEOSAT	1998 / 01	1451	-9.82	1.478	0.930	28.52
	1998 / 02	1036	-0.96	1.071	0.953	15.84
GMS-5	1998 / 01	1192	10.11	1.020	0.916	36.32
	1998 / 02	1814	14.71	0.901	0.880	32.86
GOES-9	1998 / 01	2059	-0.68(	1.200	0.969	22.46
	1998 / 02	1719	1.06	1.195	0.973	17.52
GOES-8	1998 / 01	1310	-3.43	1.490	0.966	21.31
	1998 / 02	1091	-1.69	1.508	0.974	19.64

Time Match: Half-hour
Satellite Viewing Zenith Angle match: 15°
Relati ve Azimuth: 15°
Solar Zenith Angle < 72d

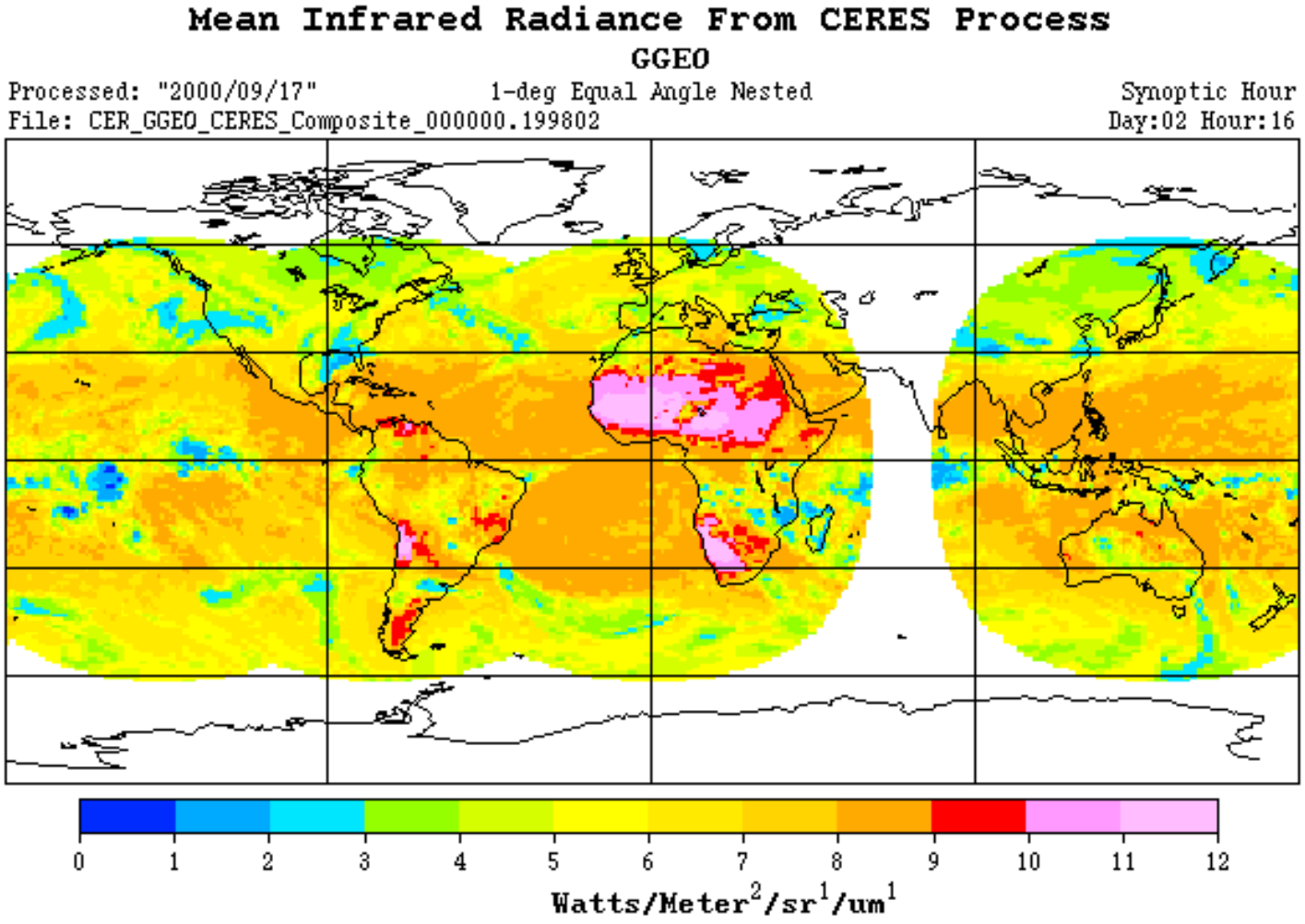
Table 1: VIRS vs. GGEO IR RADIANCES

Satellite	Month	Points	Offset	Slope	R	% RMS
METEOSAT	1998 / 01	19130	-0.0853	0.991	0.956	5.97
	1998 / 02	17894	-0.246	1.00	0.961	5.49
GMS-5	1998 / 01	24870	0.245	0.975	0.943	8.19
	1998 / 02	23180	0.199	0.986	0.943	8.29
GOES-9	1998 / 01	27029	0.0276	0.993	0.974	5.51
	1998 / 02	18895	-0.133	1.011	0.977	5.42
GOES-8	1998 / 01	18272	0.0318	0.953	0.970	5.40
	1998 / 02	15808	-0.0735	1.004	0.977	4.90

Time Match: Half-hour;
Satellite Viewing Zenith Angle match: 15°

Cloud Property Retrievals

- Uses IR/VIS LBTM Retrievals (Run as Subset of CERES Cloud Algorithm)
- Uses CERES Surface Property Maps and MOA Soundings
- Properties;
  - Cloud Amount
  - Cloud Temperature
  - Cloud Height
  - Optical Depth/Emittance (Daytime Only)

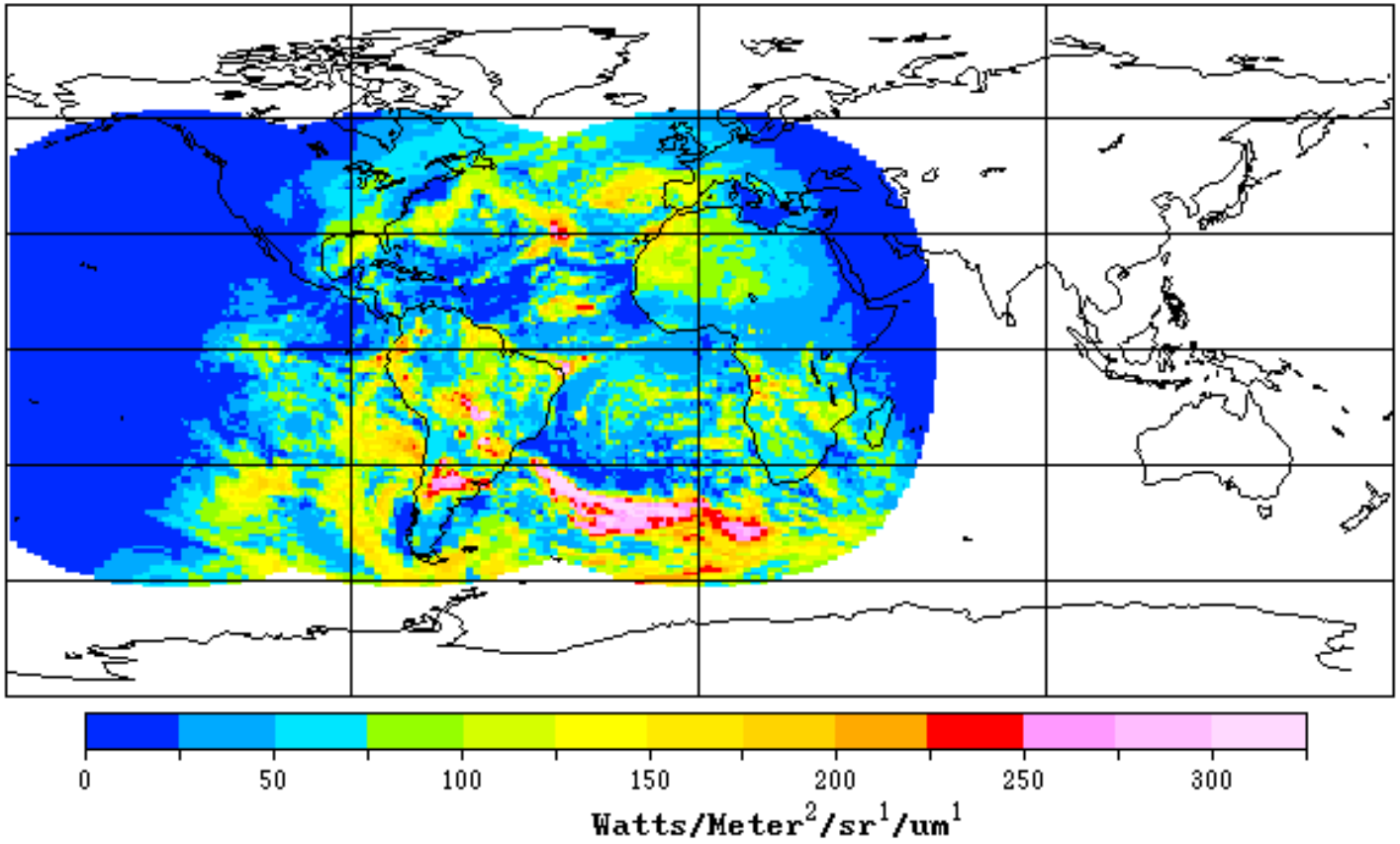

Mean Infrared Radiance From CERES Process
GGEO
Processed: "2000/09/17"
1-deg Equal Angle Nested
Synoptic Hour
File: CER_GGEO_CERES_Composite_000000.199802
Day:02 Hour:16
0
1
2
3
4
5
6
7
8
9
10
11
12
Watts/Meter2/sr1/um1

Mean Visible Radiance From CERES Process

GGEO

Processed: "2000/09/17" 1-deg Equal Angle Nested Synoptic Hour

File: CER_GGEO_CERES_Composite_000000.199802 Day:02 Hour:16



Cloud Percent From CERES Process

GGEO

Processed: "2000/09/17" 1-deg Equal Angle Nested Synoptic Hour

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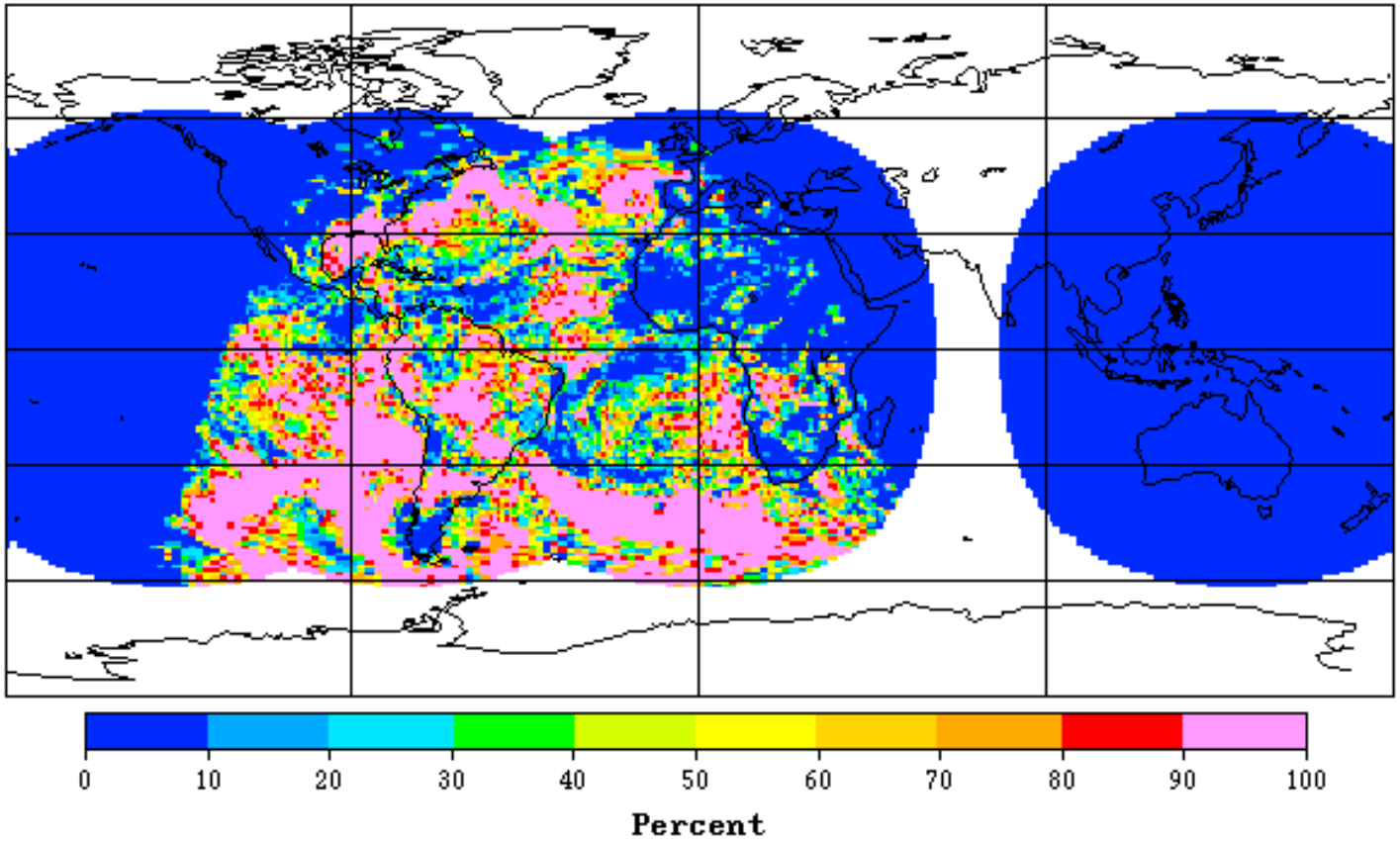

Total Cloud Temperature From CERES Process

GGEO

Processed: "2000/09/17" 1-deg Equal Angle Nested Synoptic Hour

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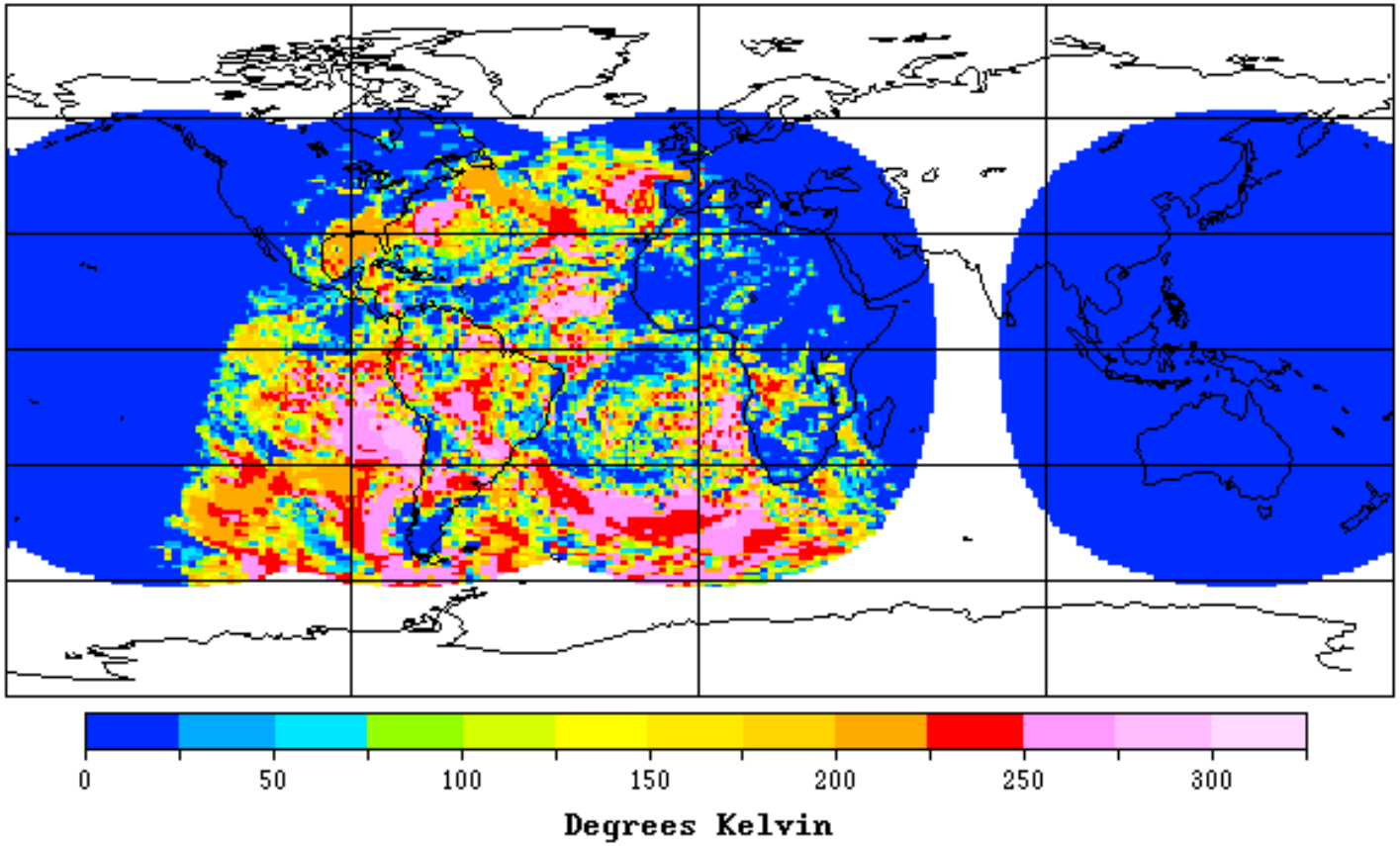

Planned Validation

- Operational Time Series Plots at Validation Sites
- Comparison with Coincident VIRS/MODIS Cloud Properties
- Comparison of Global Cloud Distributions
- Comparison of Surface Fluxes at Interpolated Times

Future Plans

- Produce GGEO-enhanced Monthly Mean Products by Next Science Team Meeting
- Validate Interpolation Algorithm
- Perform Validation Studies of Calibration and Cloud Products
- Address Cloud Property Interpolation Issues
  - Lack of Nighttime Optical Depth
  - Lack of Particle Size / Phase Information
- Compare SW Interpolation Schemes
- Perform Error Analysis for Monthly Means