

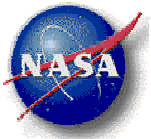
Temporal Interpolation Using Geostationary Data: Getting Closer to Reality

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

J. Stassi, C. Nguyen, R. Raju, S. Sun-Mack, and E. Kizer
SAIC

P. Heck
AS&M

23rd CERES Science Team Meeting
Williamsburg, Virginia
January 23-25, 2001

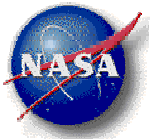


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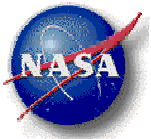
Objectives

- Status of Subsystem 10 (Data Product: SRBAVG)
 - Two Interpolation Methods (GGEO & non-GGEO)
 - Now Uses Cloud Properties from GGEO Data
 - Clear Sky Interpolation Using GGEO
 - Total-sky Fluxes Derived Using ERBE-like ADMs
- Validation
 - Clouds
 - Calibration
 - VIRS comparisons
 - Climatology Comparisons
 - Fluxes
 - ERBE-like Comparisons
 - Compare Monthly Means w/ and w/o GGEO
 - Surface Flux Comparisons



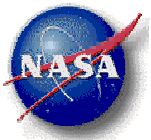
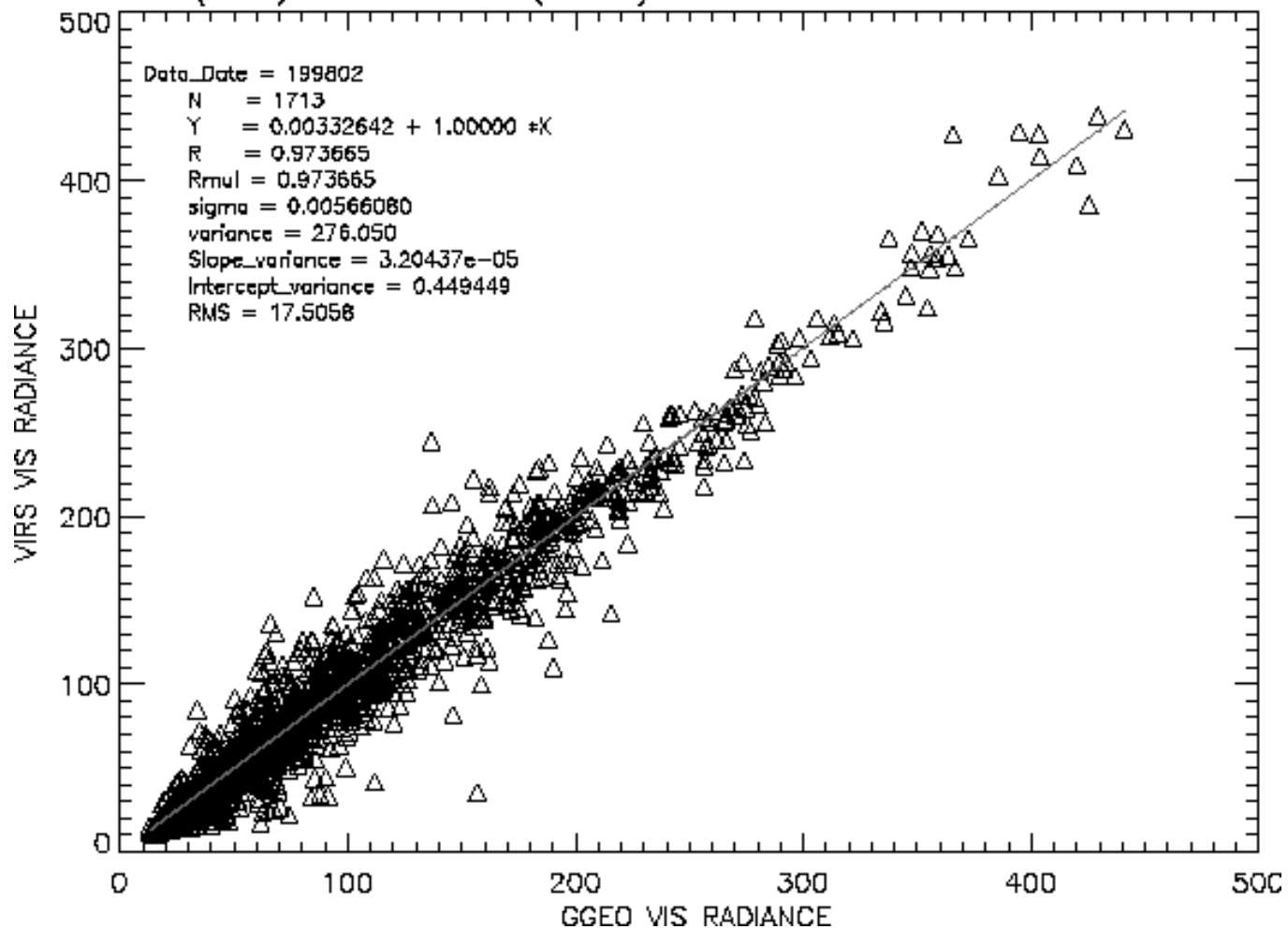
G GEO Cloud Property Retrievals

- G GEO Calibration Tied to VIRS
- 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 (using standard 4 CERES layers)
 - Optical Depth/Emittance (Daytime Only)



Recalibrated GOES-9 Visible Data

VIRS (FSW) vs. GOES-9 (GGEO) Narrowband Radiances Over Ocean

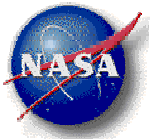
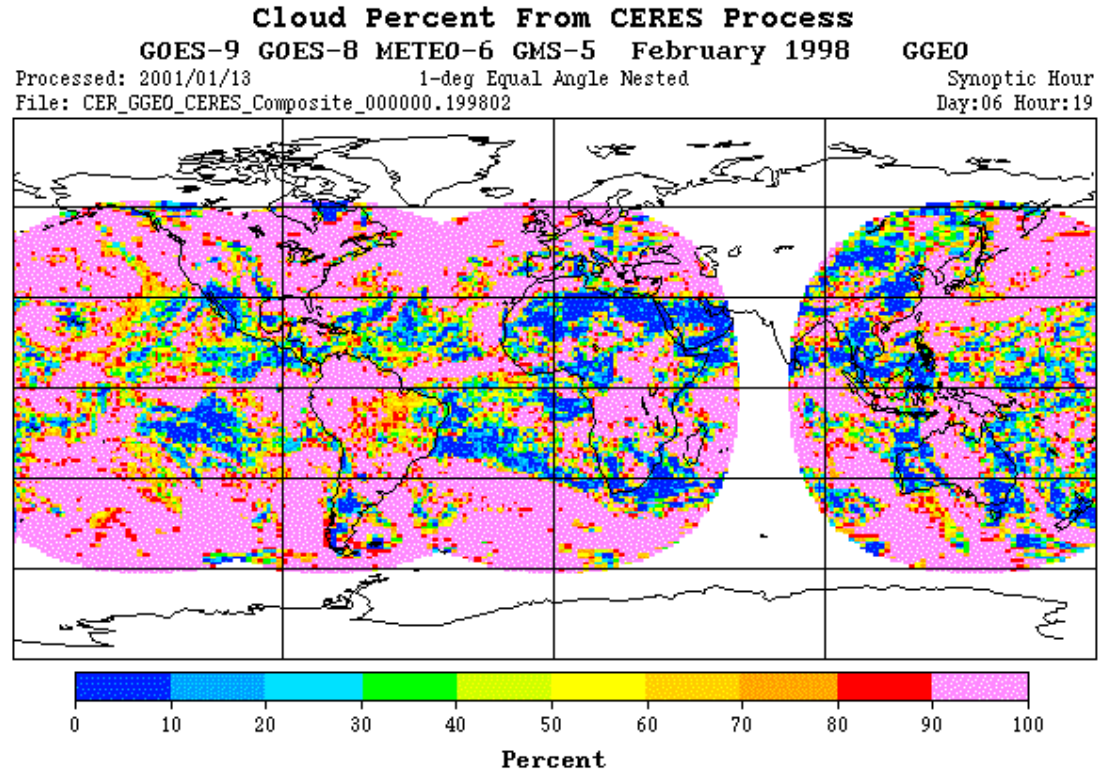


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GCEO Cloud Amount

18 GMT February 6, 1998



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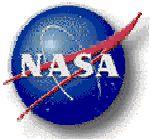
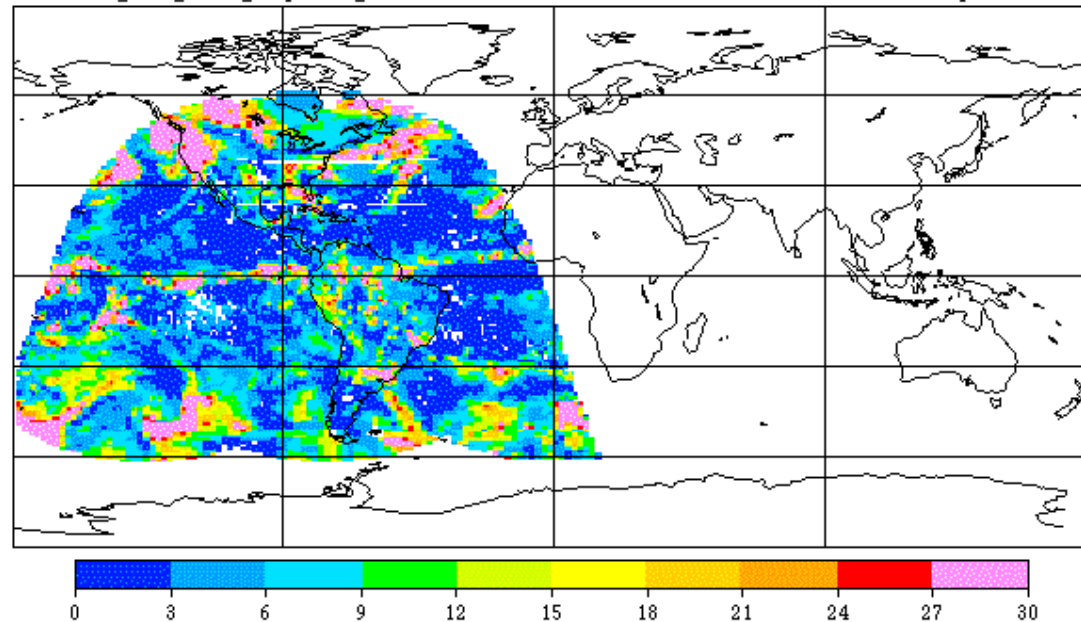
GCEO Optical Depth

18 GMT February 6, 1998

Total Cloud Optical Depth From CERES Process

GOES-9 GOES-8 METEO-6 GMS-5 February 1998 GCEO

Processed: 2001/01/13 1-deg Equal Angle Nested Synoptic Hour
File: CER_GCEO_CERES_Composite_000000.199802 Day:06 Hour:19



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GGEO Cloud Temperature

18 GMT February 6, 1998

Total Cloud Temperature From CERES Process

GOES-9 GOES-8 METEO-6 GMS-5 February 1998 GGEO

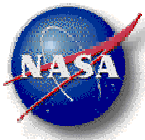
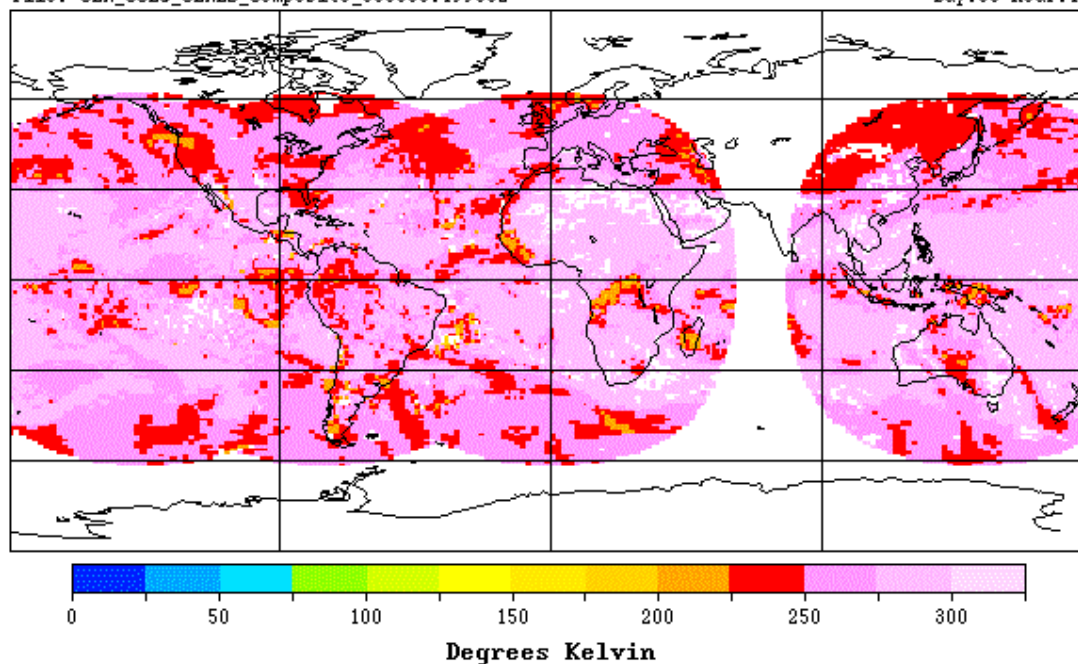
Processed: 2001/01/13

1-deg Equal Angle Nested

Synoptic Hour

File: CER_GGEO_CERES_Composite_000000.199802

Day:06 Hour:19



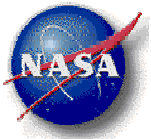
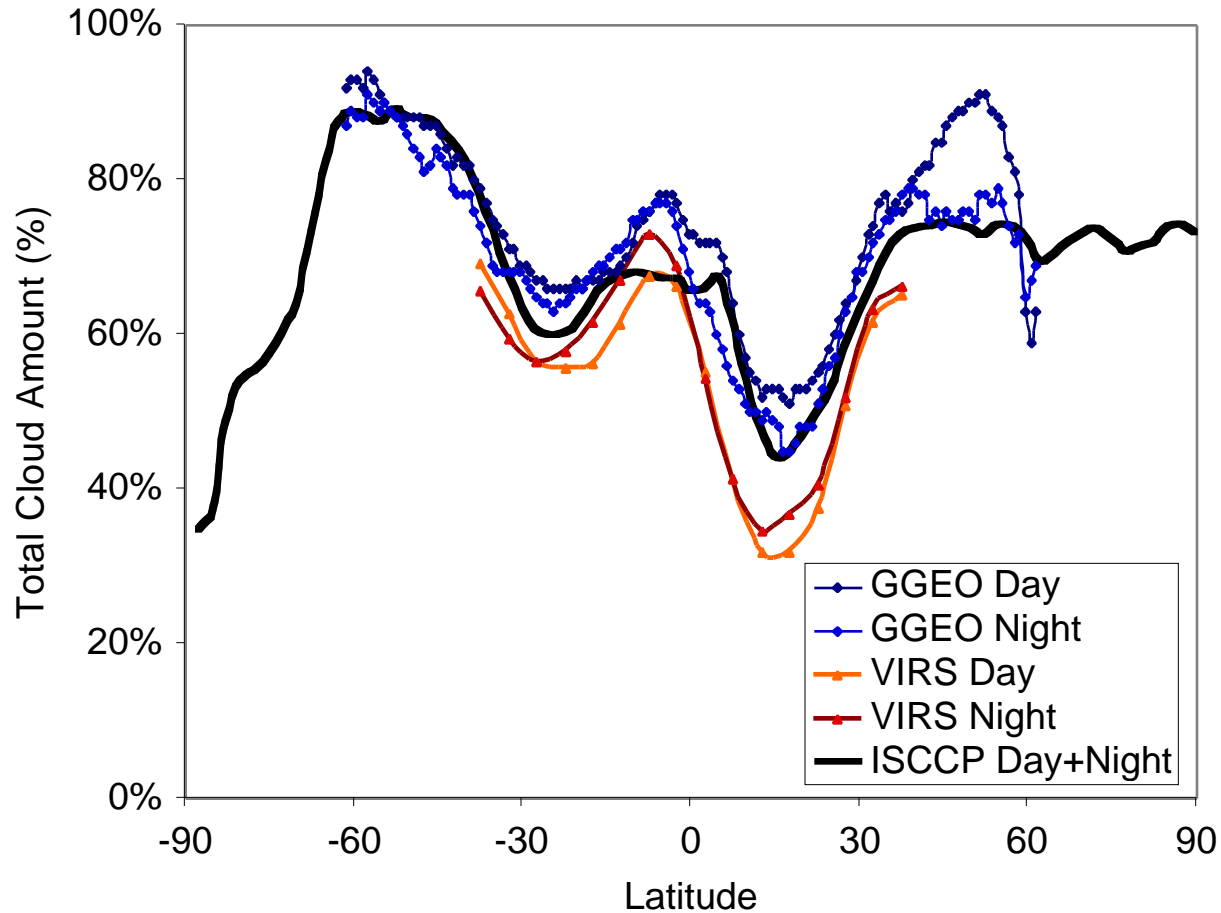
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Zonal Mean Cloud Amount Comparison

GEO & VIRS: February 1998

ISCCP: February 1986-1993

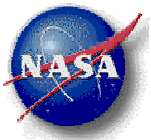


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Mean Cloud Amount from GEO, VIRS, and ISCCP 40°N - 40°S

	Day	Night	Total
GGEO Feb 1998	0.68	0.65	0.66
VIRS Feb 1998	0.54	0.57	0.56
ISCCP Feb 1986-1993			0.63



Instantaneous VIRS-GOES-9 Comparison 5-Minute Matching

VIRS

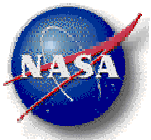
Mean = 67.5

Sigma = 33.3

GGEO

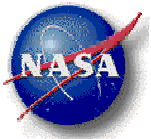
Mean = 72.1

Sigma = 31.4



Summary of GGEO-VIRS Instantaneous Cloud Amount (%) Comparison

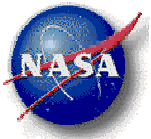
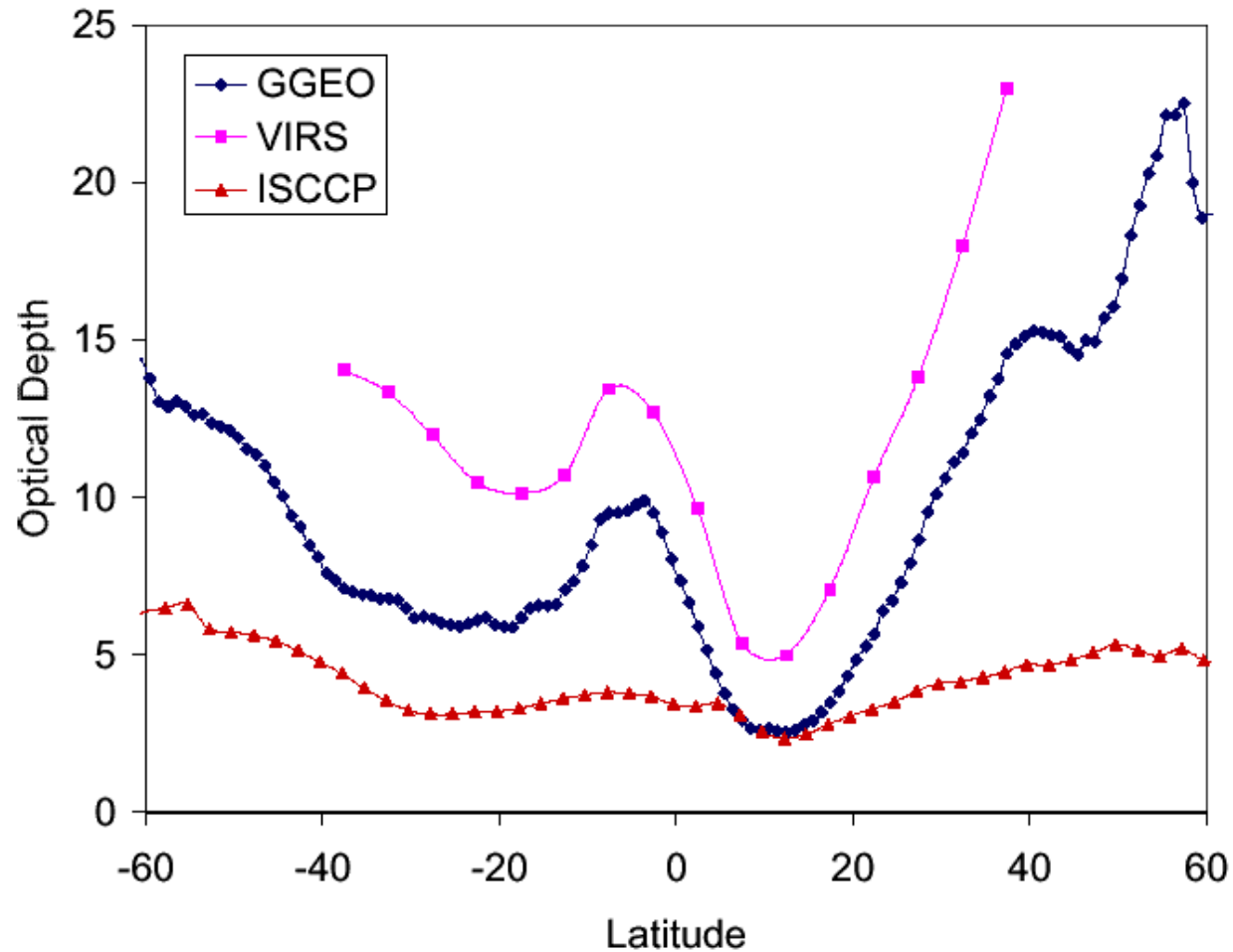
	Day		Night	
	Ocean	Land	Ocean	Land
GGEO	72.1	70.8	78.6	72.0
VIRS	67.5	68.9	71.4	67.6
GGEO - VIRS	4.6	1.9	7.2	4.4



Zonal Mean Optical Depth Comparison

GEO & VIRS: February 1998

ISCCP: February 1986-1993

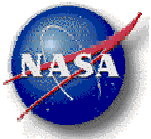


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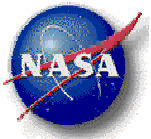
Future GGEO Cloud Property Validation

- Standard QC Reports
 - Parameters
 - Cloud Amount
 - Optical Depth
 - Temperature / Height
 - Zonal Means
 - Viewing and Solar Zenith Dependence
 - Deep Convective Cloud Albedos
- Intercomparisons
 - VIRS / MOSIS
 - Overlapped GGEO Satellites
 - ARM Satellite & Surface Observations
 - Climatology (ISCCP)



Flux Comparisons

- ERBE-like
 - 2.5° Grid
 - $VZ < 70^\circ$
 - Scene Identification by MLE
 - Old ERBE ADM
- SS10 ERBE TSA
 - 1.0° Grid
 - $VZ < 45^\circ$
 - Scene Identification from VIRS
 - New ERBE ADM ([Total-Sky Fluxes not on SSF](#))
- Comparison Method
 - Scatter Plots of SS10 Data Matched to ERBE-like 2.5° Data
 - Compare Histograms of Fluxes



Monthly Mean Total-sky LW Flux (non-GGEO Method)

Total-sky TOA Longwave Flux From CERES Process

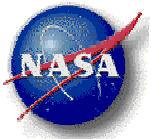
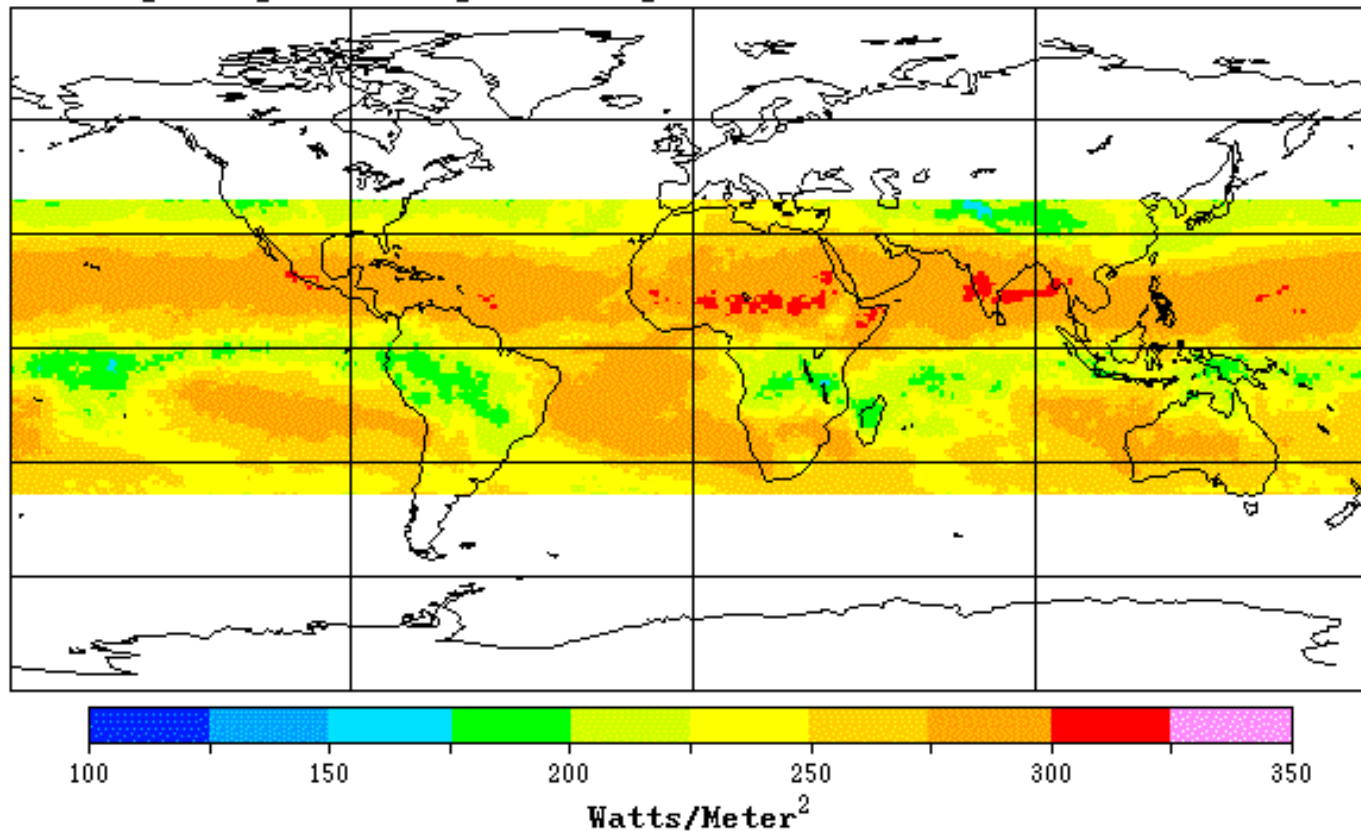
TRMM_PFM February 1998 SRBAVG

Processed: 2001/01/19

1-deg Equal Angle Nested

Monthly Mean (Method A)

File: CER_SRBAVG1_TRMM-PFM-VIRS_ValidationR2_000000.199802



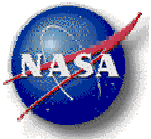
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Comparison of ERBE-like and SS10 non-GGEO Total Sky LW Fluxes

Mean Difference = 1.7 W/m²

Sigma = 5.7 W/m²

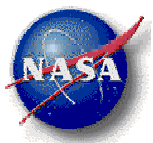


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ES4 ERBE-like and SRBAVG Flux Summary

40°N - 40°S W/m ²		ERBE-like (ES-4)	SRBAVG nonG GEO	ES4 - SRBAVG
Total-Sky LW Flux	Mean	257.4	255.7	1.7
	Sigma	28.7	28.8	5.7
Total-Sky SW Flux	Mean	97.1	96.6	0.5
	Sigma	29.9	33.2	12.1
Clear-Sky LW Flux	Mean	285.9	283.6	2.3
	Sigma	14.2	14.3	4.7
Clear-Sky SW Flux	Mean	50.1	49.0	1.1
	Sigma	18.2	19.0	8.5



Monthly Mean Total-sky LW Flux (GGEO Method)

Total-sky TOA Longwave Flux From CERES Process

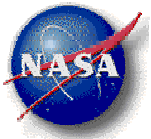
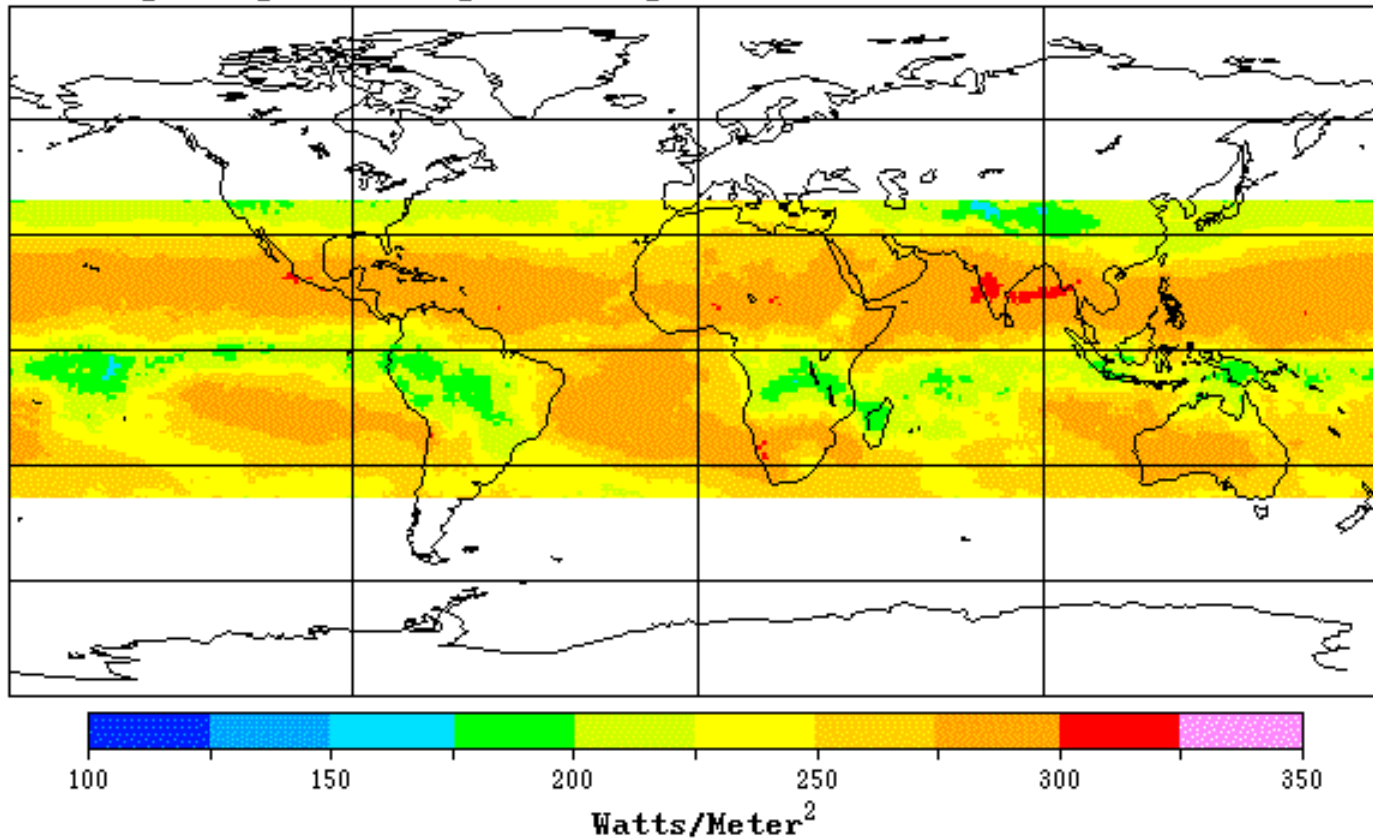
TRMM_PFM February 1998 SRBAVG

Processed: 2001/01/19

1-deg Equal Angle Nested

Monthly Mean (Method B)

File: CER_SRBAVG1_TRMM-PFM-VIRS_ValidationR2_000000.199802



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Monthly Mean Total-sky LW Flux Difference (non-GGEO Method - GGEO Method)

Total-sky TOA Longwave Flux Difference from CERES

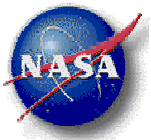
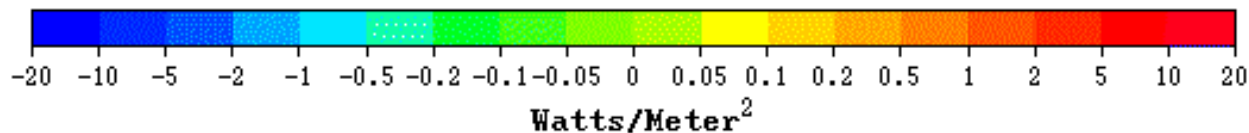
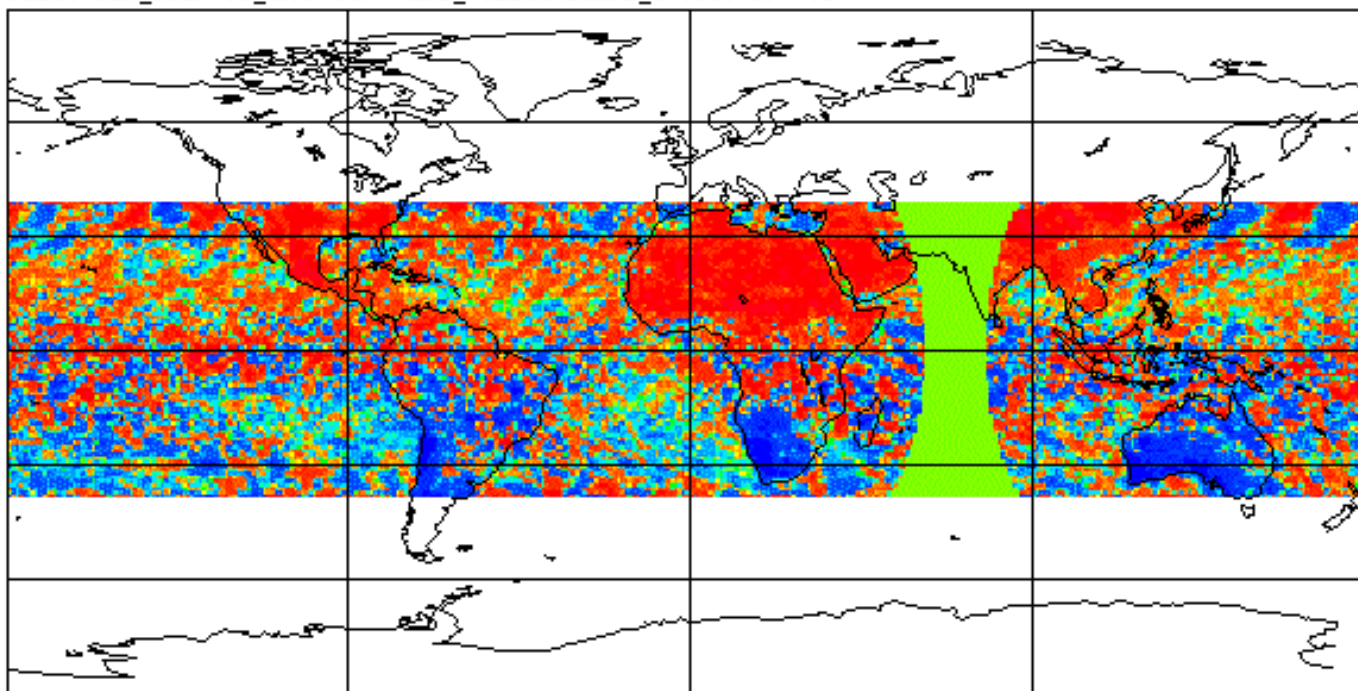
TRMM_PFM February 1998 SRBAVG

Processed: 2001/01/19

1-deg Equal Angle Nested

Monthly Mean (A-B)

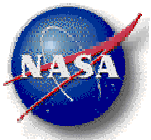
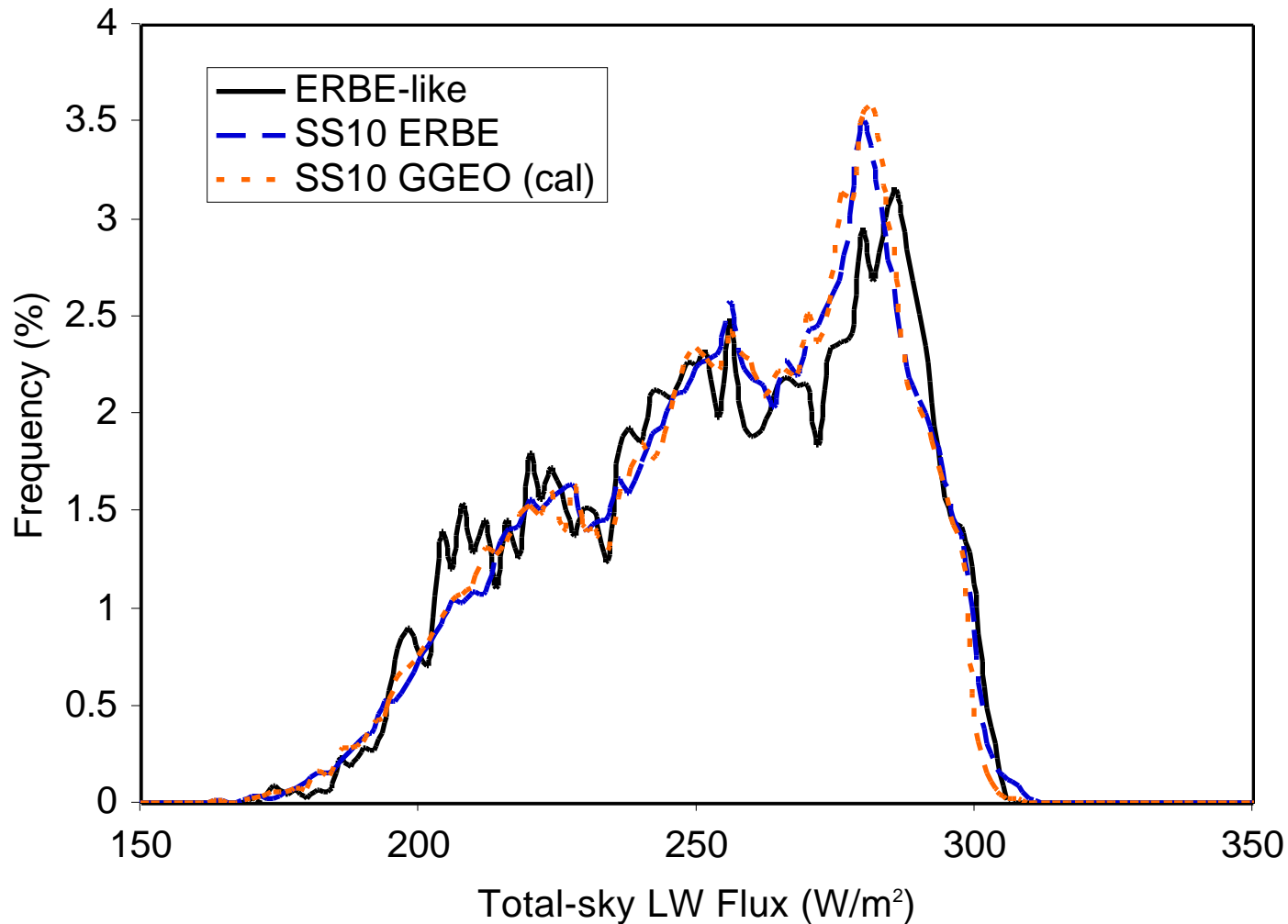
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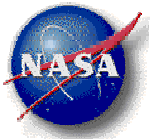
Histogram of ERBE-like and SS10 Total-Sky LW Fluxes



SRBAVG non-GGEO and GGEO Total-Sky LW Flux Comparison

Mean Difference = 0.4 W/m²

Sigma = 3.4 W/m²



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Monthly Mean Clear-sky LW Flux Difference (non-GGEO Method - GGEO Method)

Clear-sky TOA Longwave Flux Difference from CERES

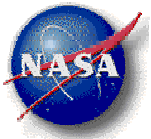
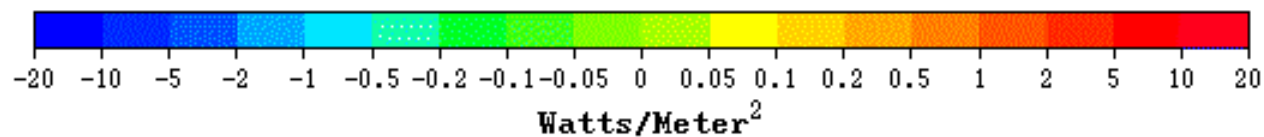
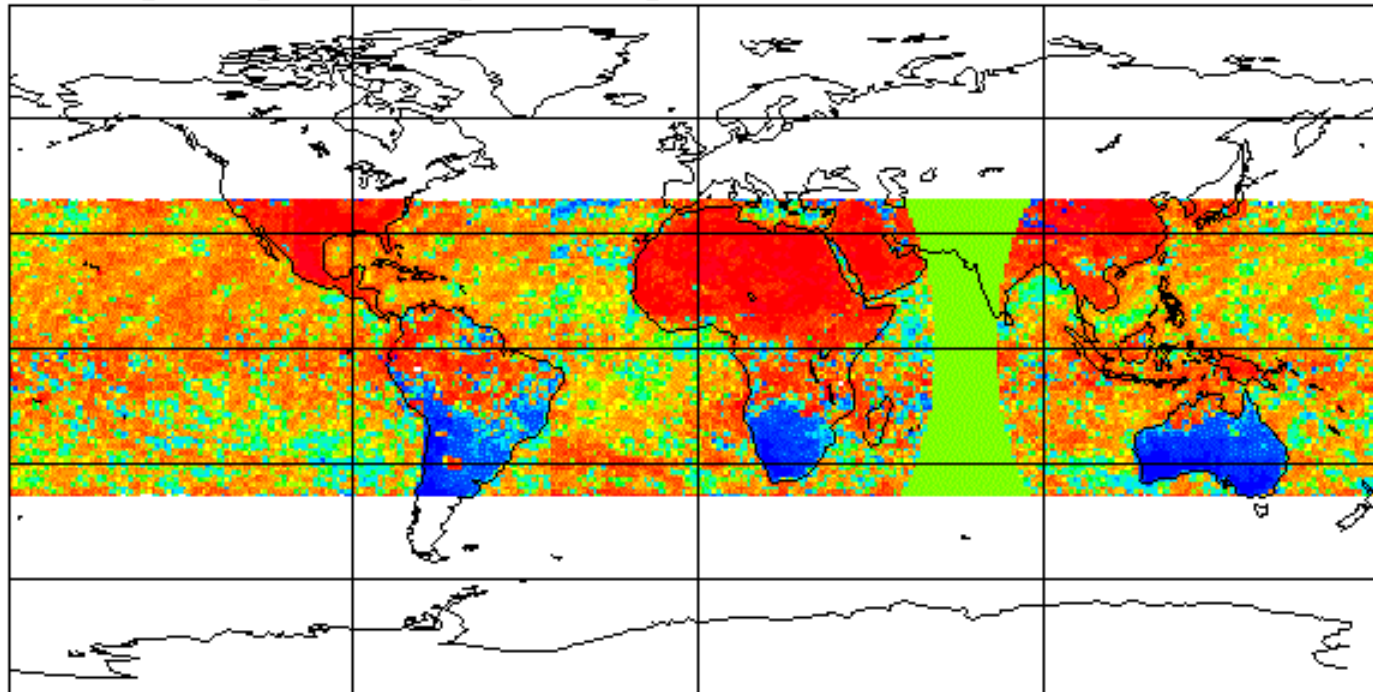
TRMM_PFM February 1998 SRBAVG

Processed: 2001/01/19

1-deg Equal Angle Nested

Monthly Mean (A-B)

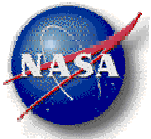
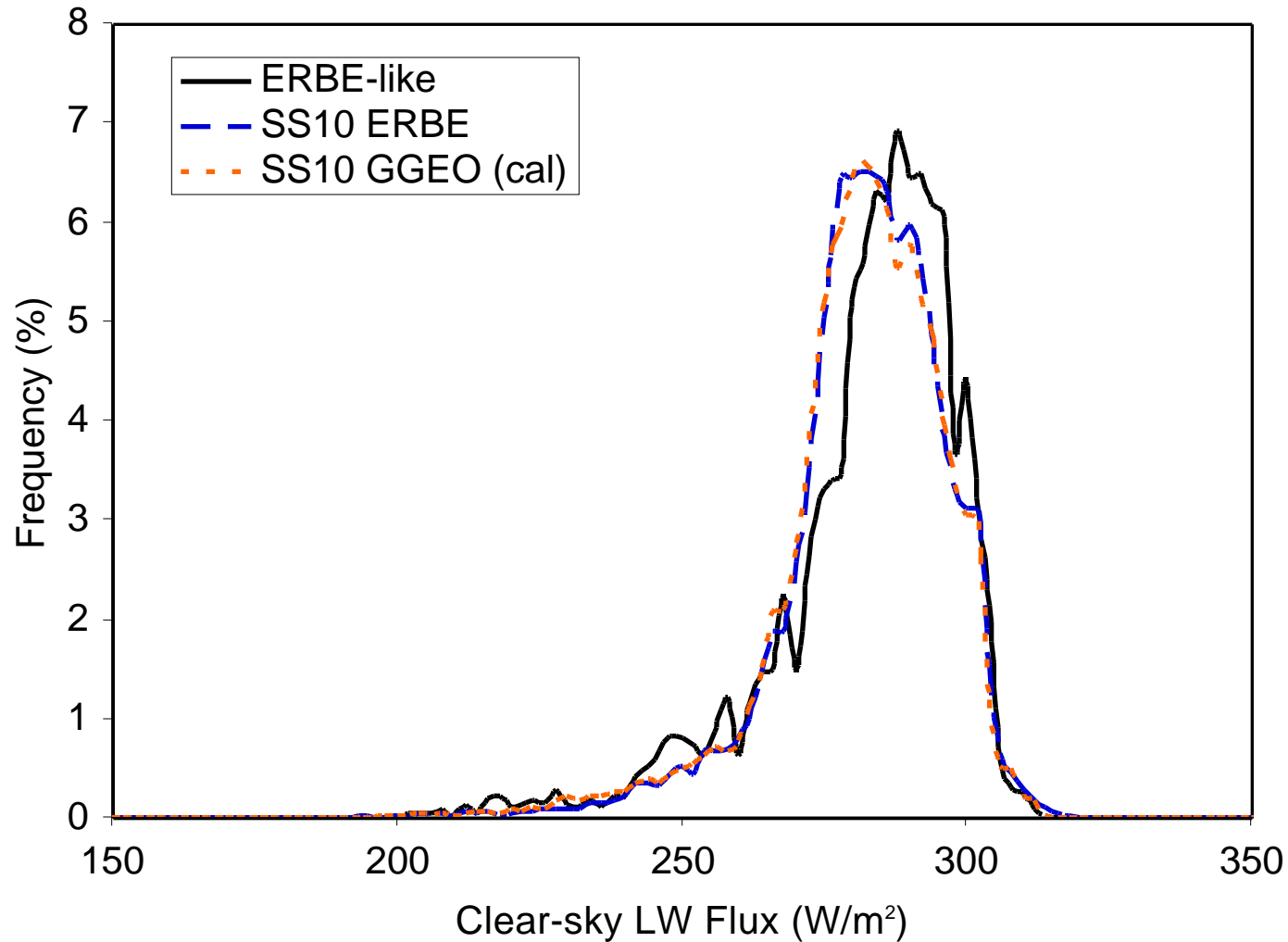
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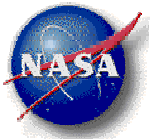
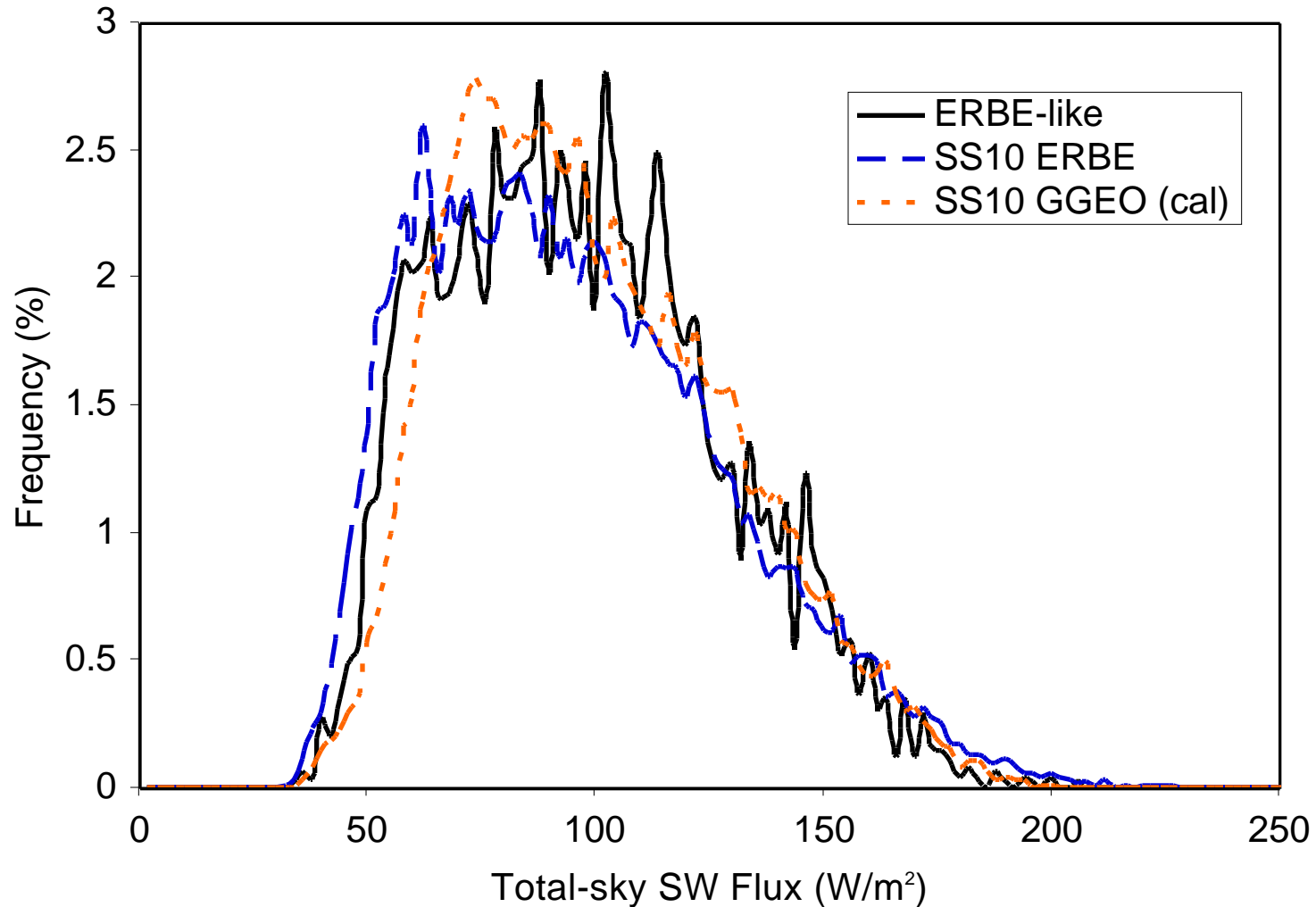
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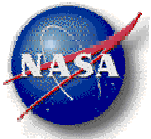
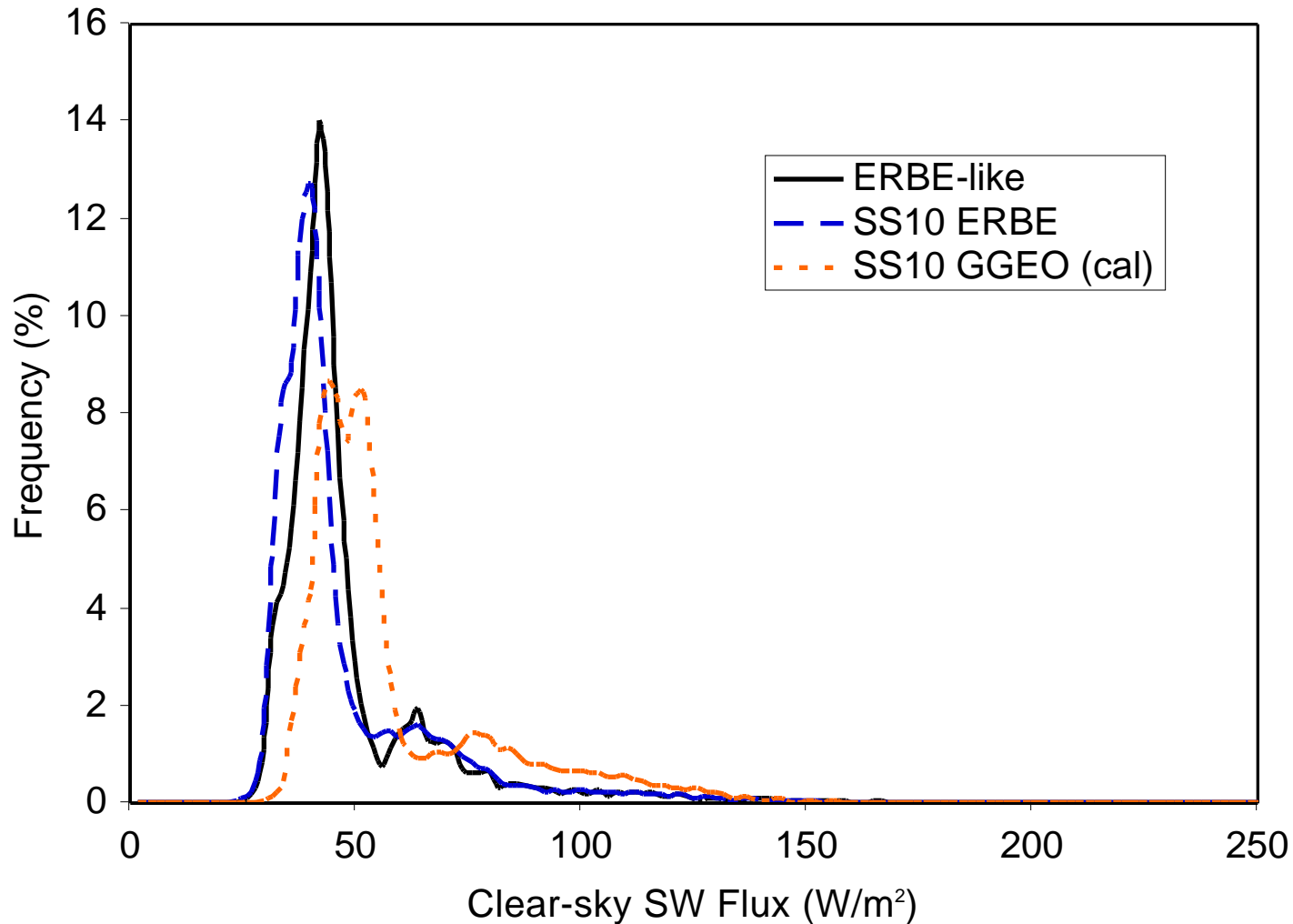
Histogram of ERBE-like and SS10 Clear-Sky LW Fluxes



Histogram of ERBE-like and SS10 Total-Sky SW Fluxes



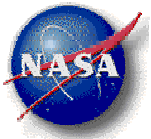
Histogram of ERBE-like and SS10 Clear-Sky SW Fluxes



SRBAVG ERBE and GGEO Clear-Sky SW Flux Comparison

Mean Difference = -10.8 W/m^2

Sigma = 8.8 W/m^2

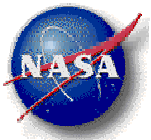


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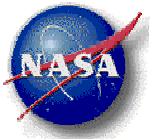
SRBAVG nonGGEO and GGEO Flux Summary

40°N - 40°S W/m ²		SRBAVG nonGGEO	SRBAVG GGEO	nonGGEO - GGEO
Total-Sky LW Flux	Mean	255.7	255.1	0.4
	Sigma	28.8	28.7	3.4
Total-Sky SW Flux	Mean	96.6	100.4	-3.6
	Sigma	33.2	29.9	13.3
Clear-Sky LW Flux	Mean	283.6	282.5	0.8
	Sigma	14.3	14.9	2.8
Clear-Sky SW Flux	Mean	49.0	59.7	-10.8
	Sigma	19.0	21.7	8.8



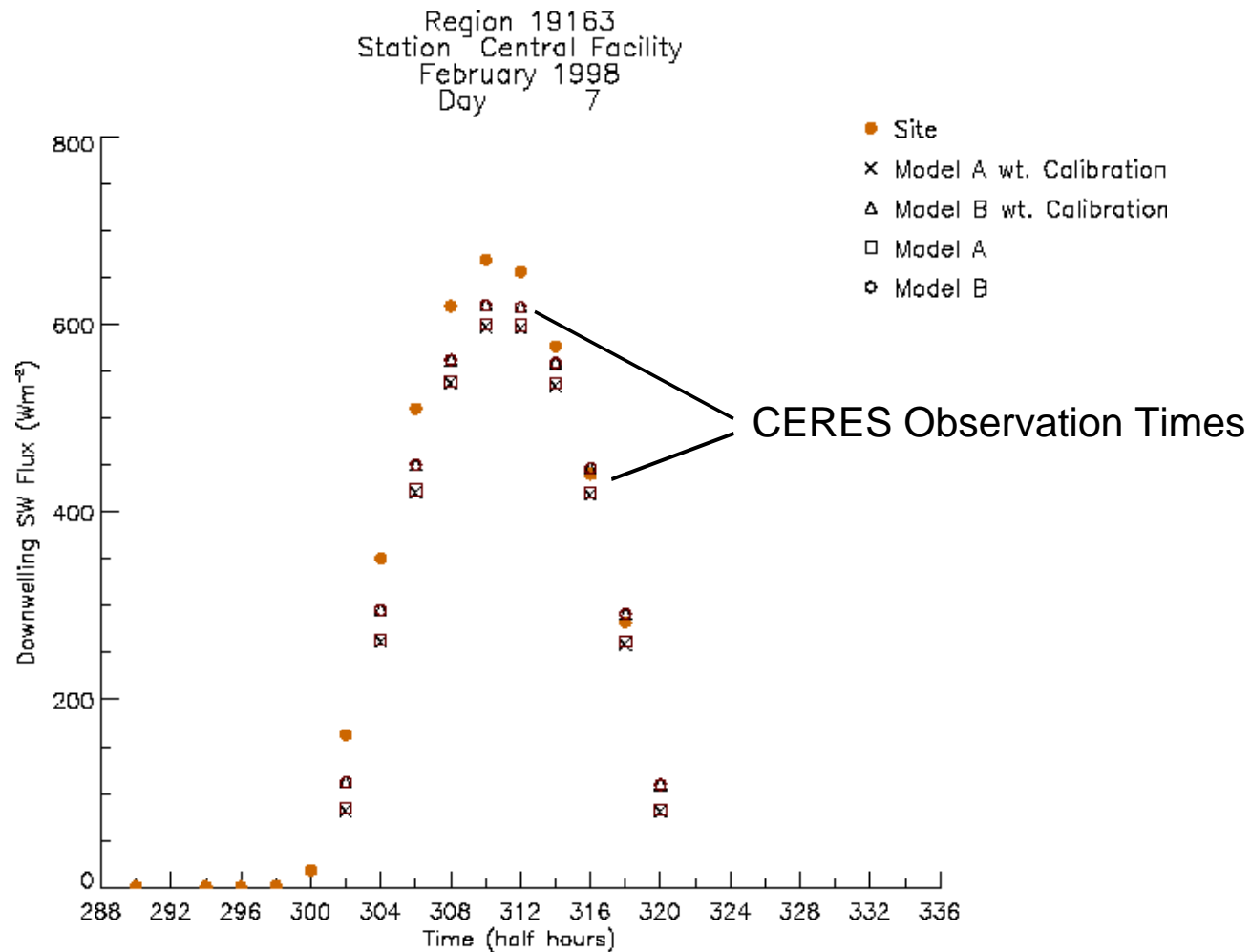
Comparison of SS10 and Surface Fluxes

- Use GGEO-interpolated $1^{\circ} \times 1^{\circ}$ Gridded Fluxes
- TOA Flux interpolated to all hours of Month
- Surface Fluxes Computed Using CERES TOA-Surface Algorithms
 - Downwelling Clear-sky SW
 - Downwelling Total-Sky LW
- Match with Hourly Averaged Data From ARM Central Facility
- Compare Bias and rms of Interpolated Comparison with Instantaneous Results of Kratz



Surface Downwelling Clear-sky SW Time Series

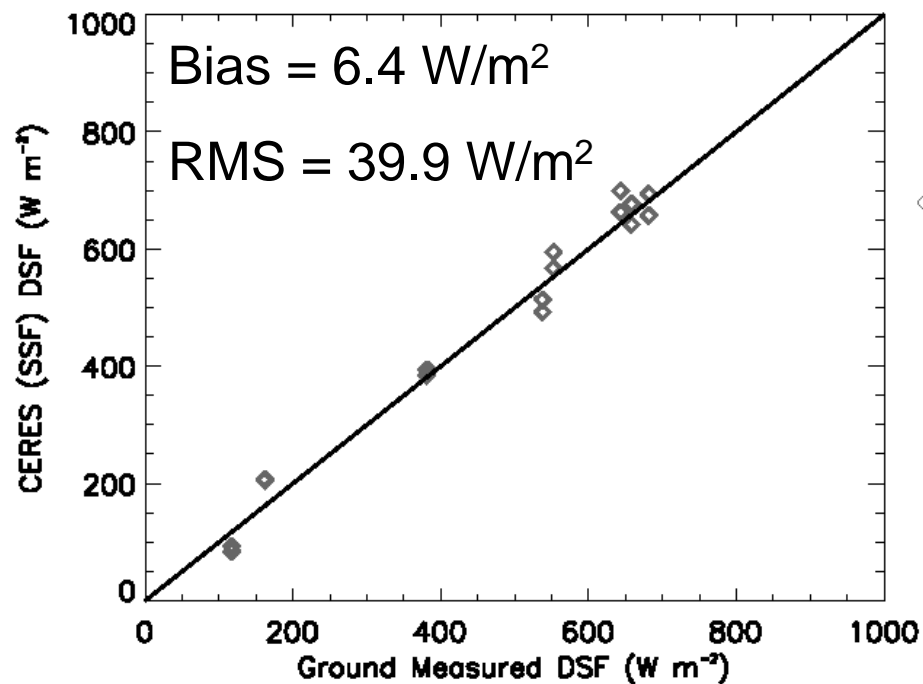
ARM Central Facility February 7, 1998



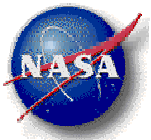
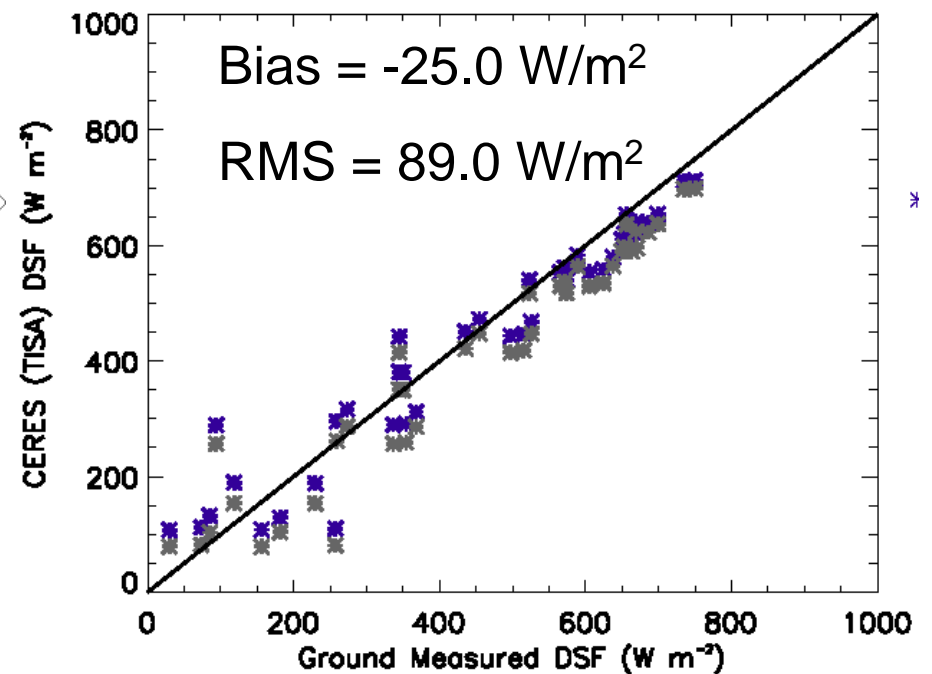
Instantaneous & Interpolated Downwelling Surface Clear-Sky SW Flux

ARM Central Facility February 1998

CERES Footprint vs. Surface

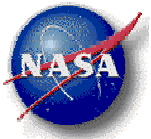
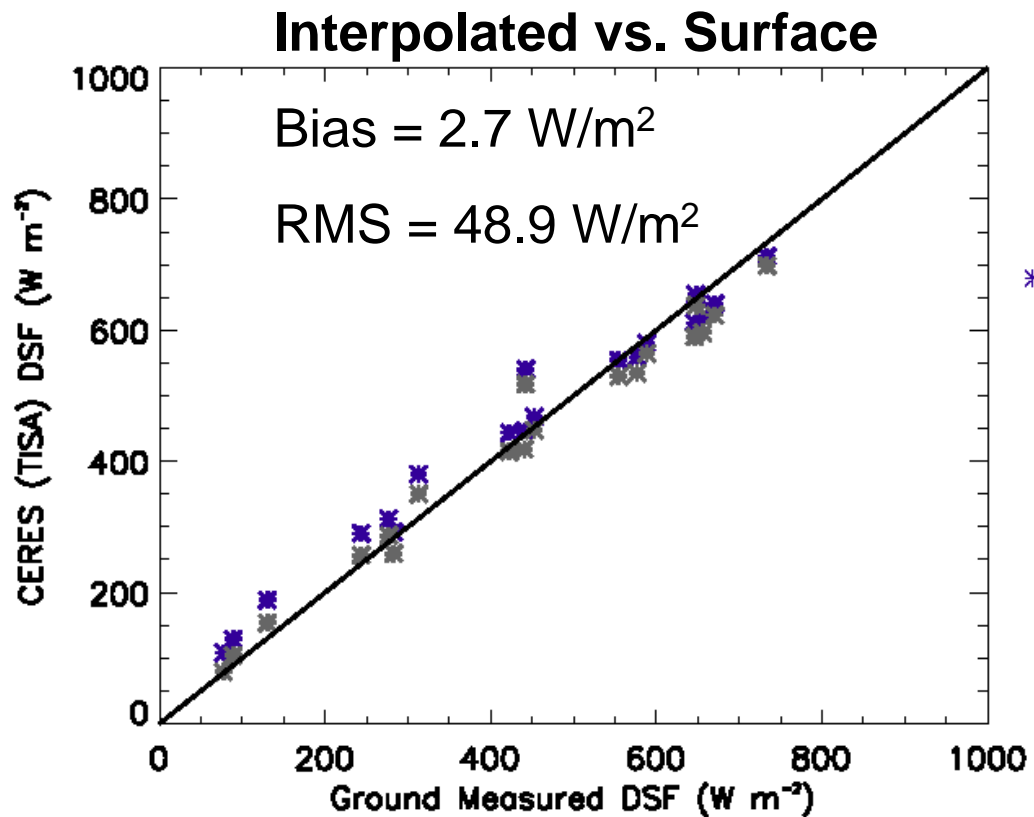


Interpolated vs. Surface



Instantaneous & Interpolated Downwelling Surface Clear-Sky SW Flux

ARM Central Facility February 1998
Afternoon Data Only

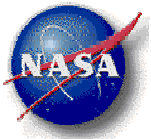
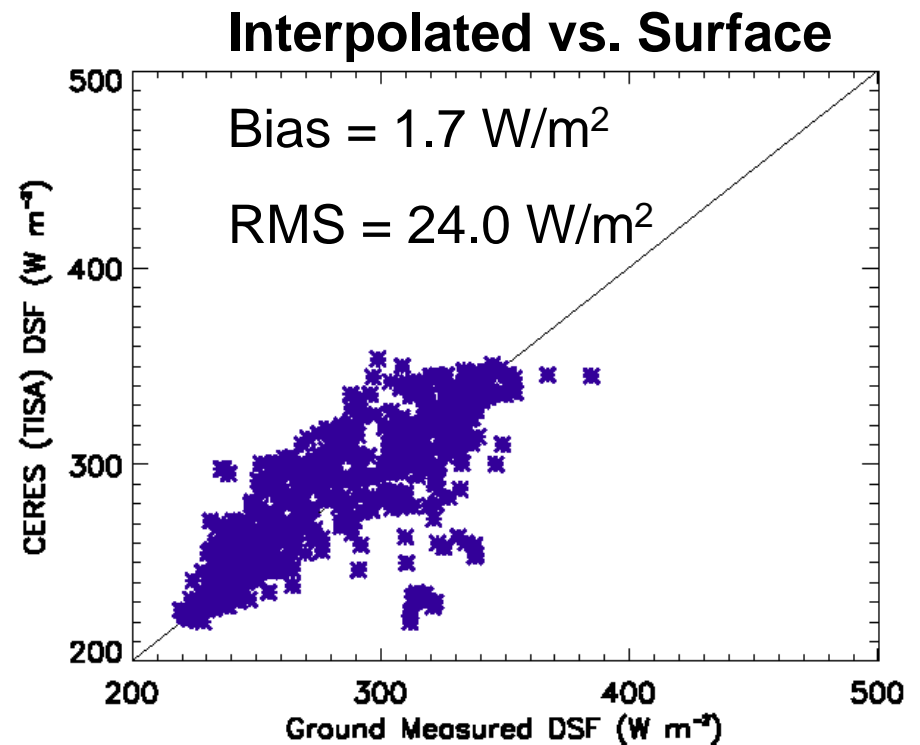
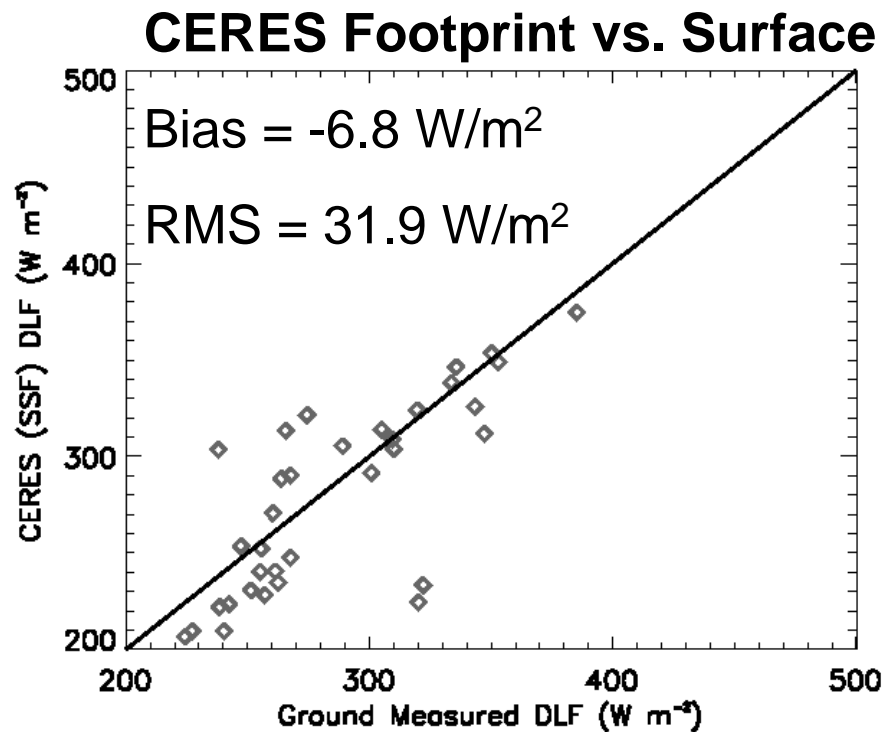


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Instantaneous & Interpolated Downwelling Surface Total-Sky LW Flux

ARM Central Facility February 1998



Future Plans

- Create More Realistic Total-Sky Validation Product
 - ERBE-like Fluxes + VIRS Clouds
 - Preliminary ADM's
- Continued Validation
 - Cloud Comparisons
 - Calibration
 - Flux Comparisons
 - DRM Construction
- Study Cloud and SW Flux Normalization
- Finalize Error Analysis
- Compare SW Algorithms
- Scheduled Archival in Fall 2001

