

CERES/Terra Edition2 ERBE-like TOA Flux Time Series And Terra/ERBE-like Vs. Terra/SRBAVG

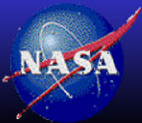
Takmeng Wong and Don Garber

NASA Langley Research Center, Hampton, Virginia

28th CERES Science Team Meeting

Norfolk, Virginia

May 6-8, 2003

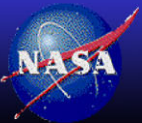


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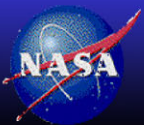
Objectives

- Examine Time Series of CERES/Terra Edition2 Tropical Mean and Global Mean TOA Radiation Budgets
- Study the Interannual Variability of Tropical Mean and Global Mean TOA Radiation Fields
- Explore the Radiative Effects of the 2002 ENSO Event
- ERBE-like Vs SRBAVG Comparison for March 2000

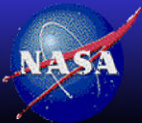
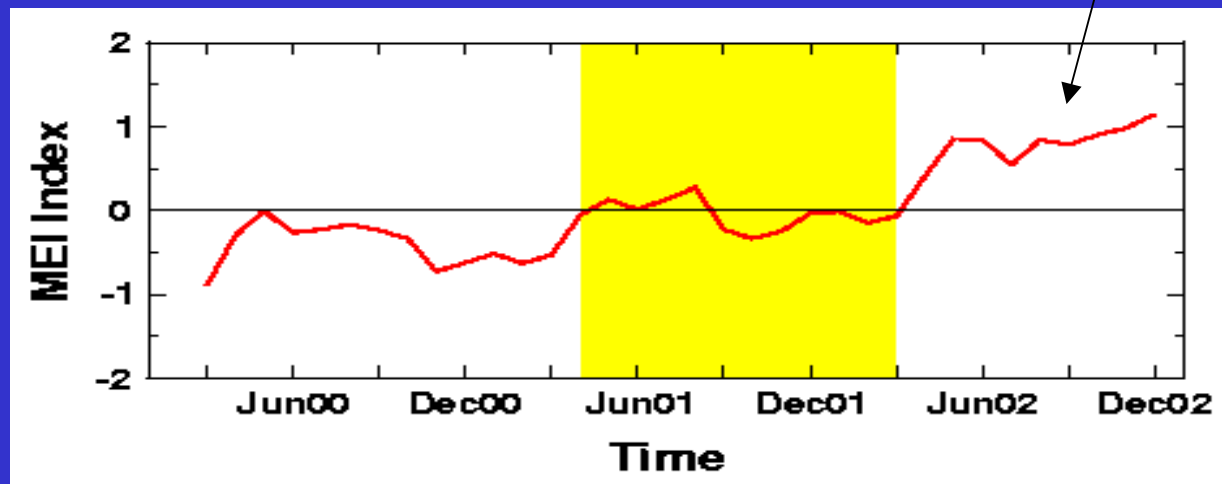
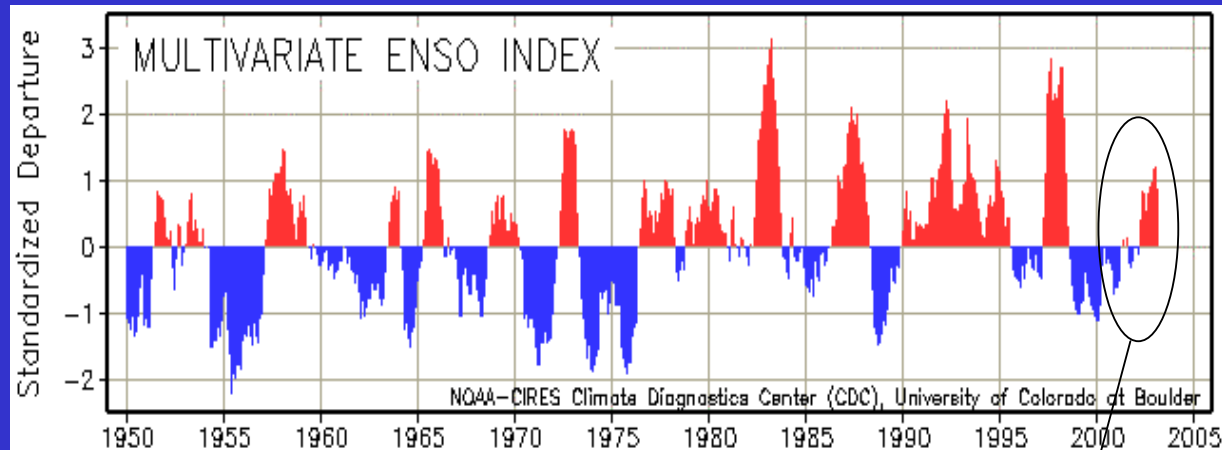


Dataset

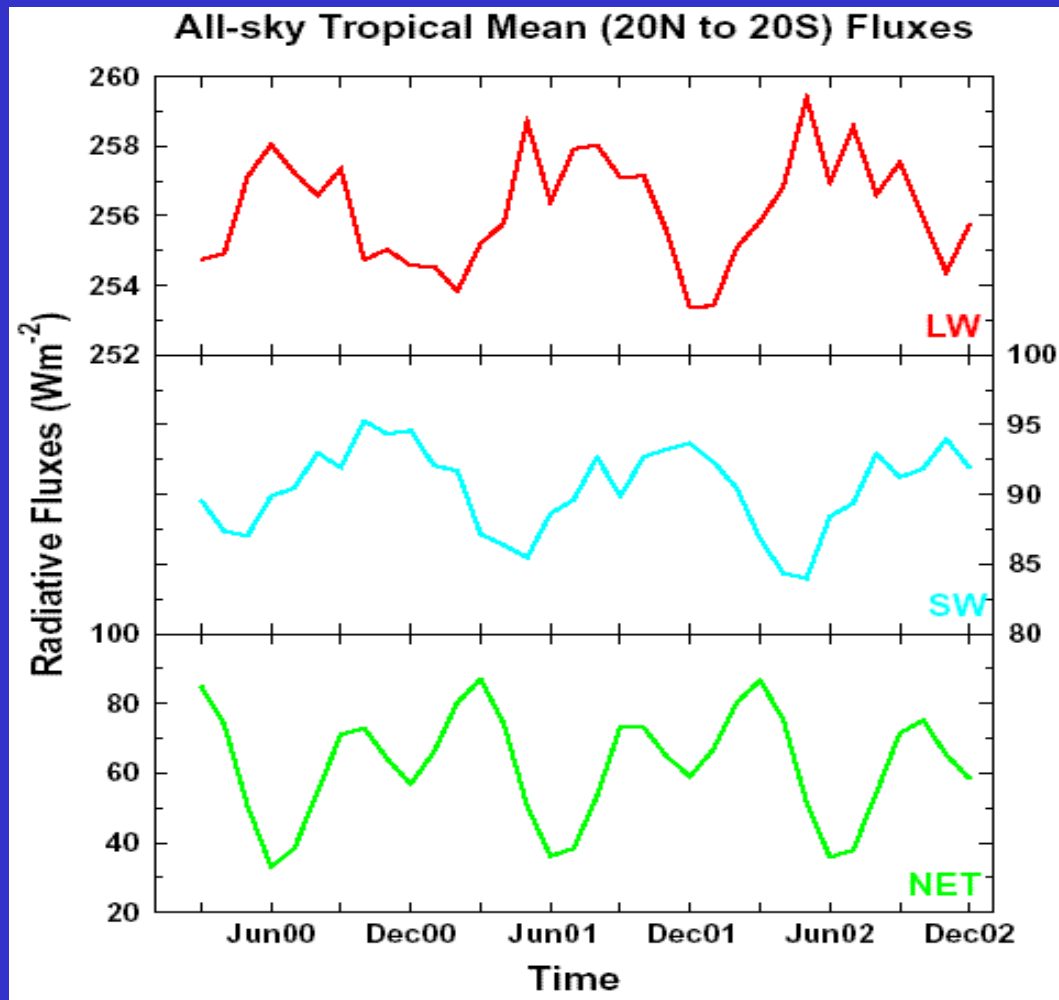
- CERES/Terra ERBE-like Edition2 ES9 Dataset (3/2000 To 12/2002) → Latest Data Containing Instrument Drift Correction
- Cross Track Mode Data Only and Contains Both FM1 and FM2 Data → Minimize Spatial Sampling Noise
- Clear-sky, All-sky Radiation Budget, Cloud Radiative Forcing, ENSO Regional Radiative Anomalies
- CERES/Terra SRBAVG Beta1 Data For March 2000



Time Series of ENSO Index



Time Series of Tropical Mean (20N to 20S) TOA All-sky Radiation Budget



All: $256.2 \pm 1.6 \text{ Wm}^{-2}$

Normal: $256.2 \pm 1.7 \text{ Wm}^{-2}$

No Trend

All: $90.4 \pm 3.0 \text{ Wm}^{-2}$

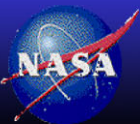
Normal: $90.2 \pm 2.8 \text{ Wm}^{-2}$

No Trend

All: $62.2 \pm 15.7 \text{ Wm}^{-2}$

Normal: $63.1 \pm 15.9 \text{ Wm}^{-2}$

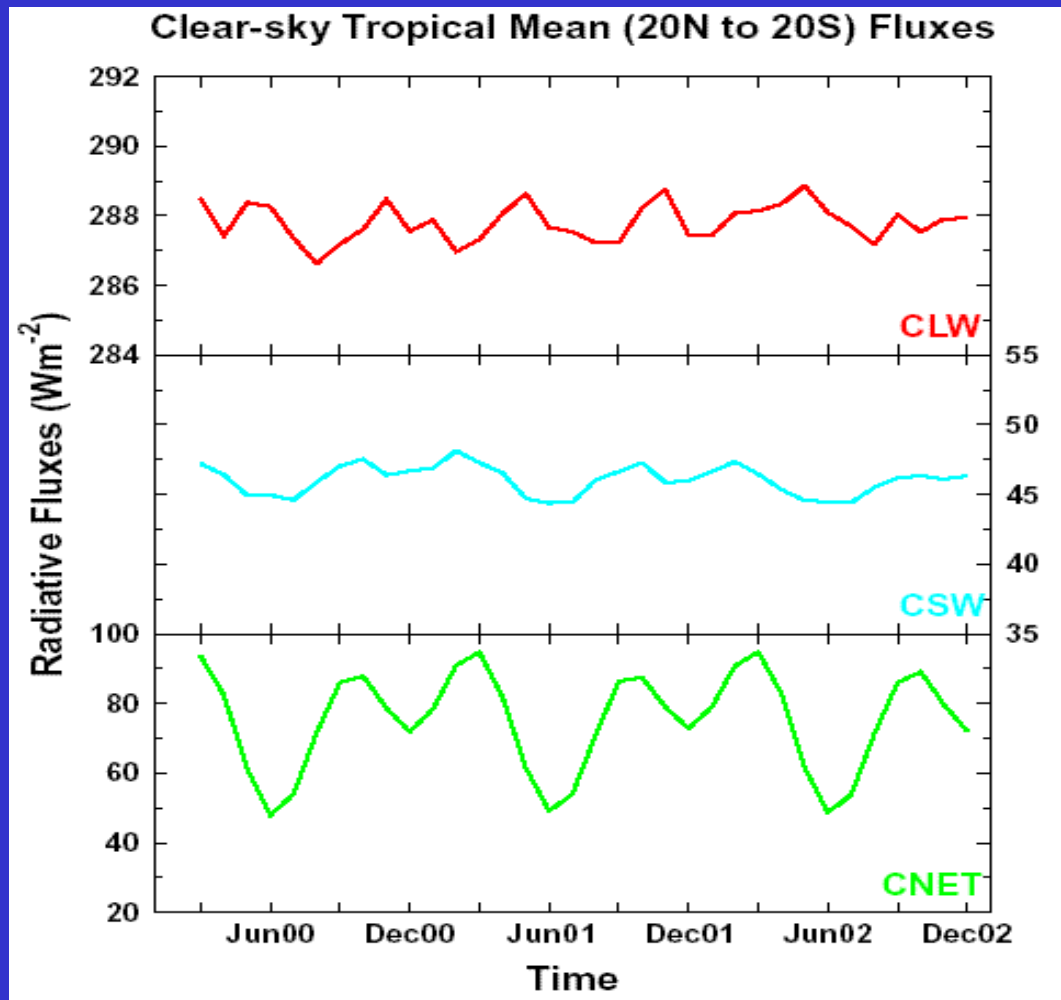
No Trend



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Time Series of Tropical Mean (20N to 20S) TOA Clear-sky Radiation Budget



All: $287.8 \pm 0.5 \text{ Wm}^{-2}$

Normal: $287.9 \pm 0.5 \text{ Wm}^{-2}$

No Trend

All: $46.0 \pm 1.0 \text{ Wm}^{-2}$

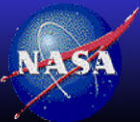
Normal: $46.0 \pm 1.0 \text{ Wm}^{-2}$

No Trend

All: $75.1 \pm 14.4 \text{ Wm}^{-2}$

Normal: $75.6 \pm 14.5 \text{ Wm}^{-2}$

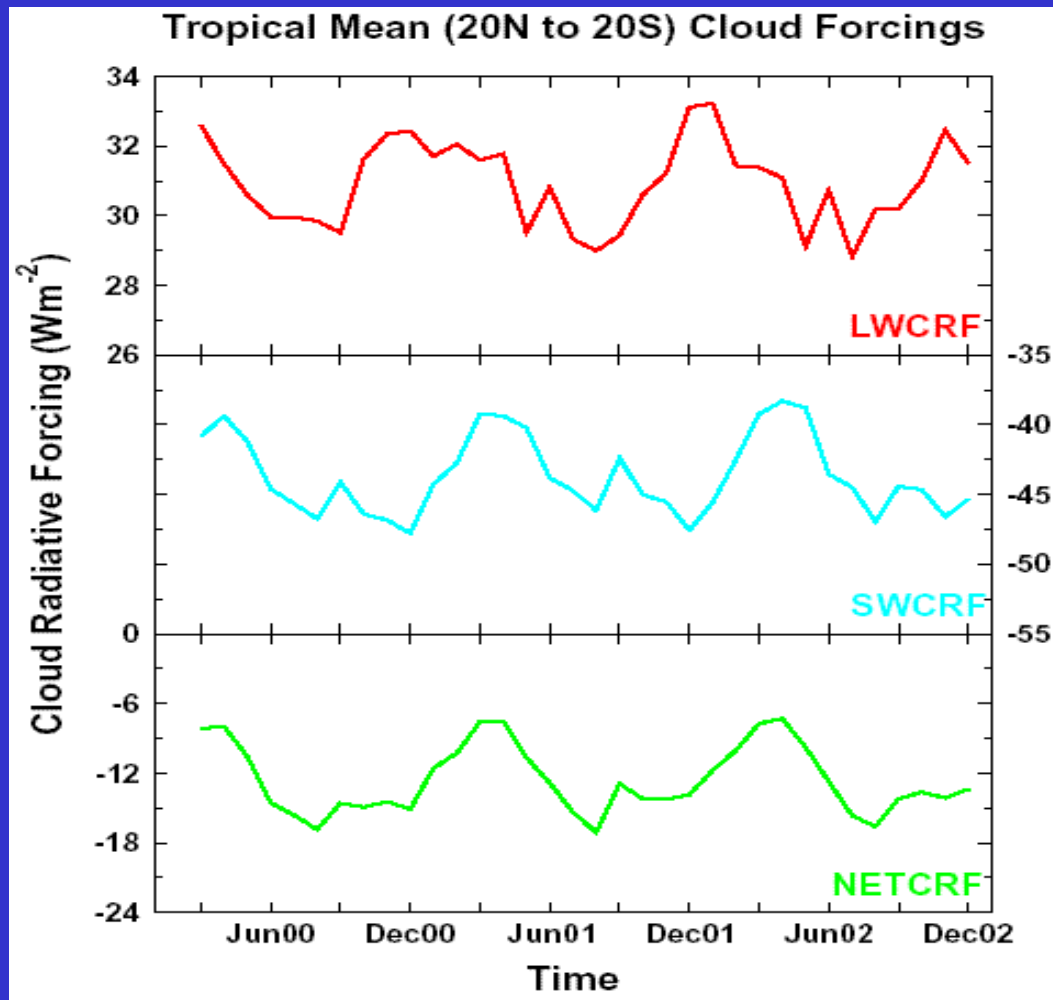
No Trend



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Time Series of Tropical Mean (20N to 20S) TOA Cloud Radiative Forcings



All: $30.9 \pm 1.2 \text{ Wm}^{-2}$

Normal: $30.9 \pm 1.4 \text{ Wm}^{-2}$

No Trend

All: $-43.7 \pm 2.8 \text{ Wm}^{-2}$

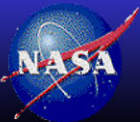
Normal: $-43.5 \pm 2.8 \text{ Wm}^{-2}$

No Trend

All: $-12.6 \pm 3.0 \text{ Wm}^{-2}$

Normal: $-12.4 \pm 2.9 \text{ Wm}^{-2}$

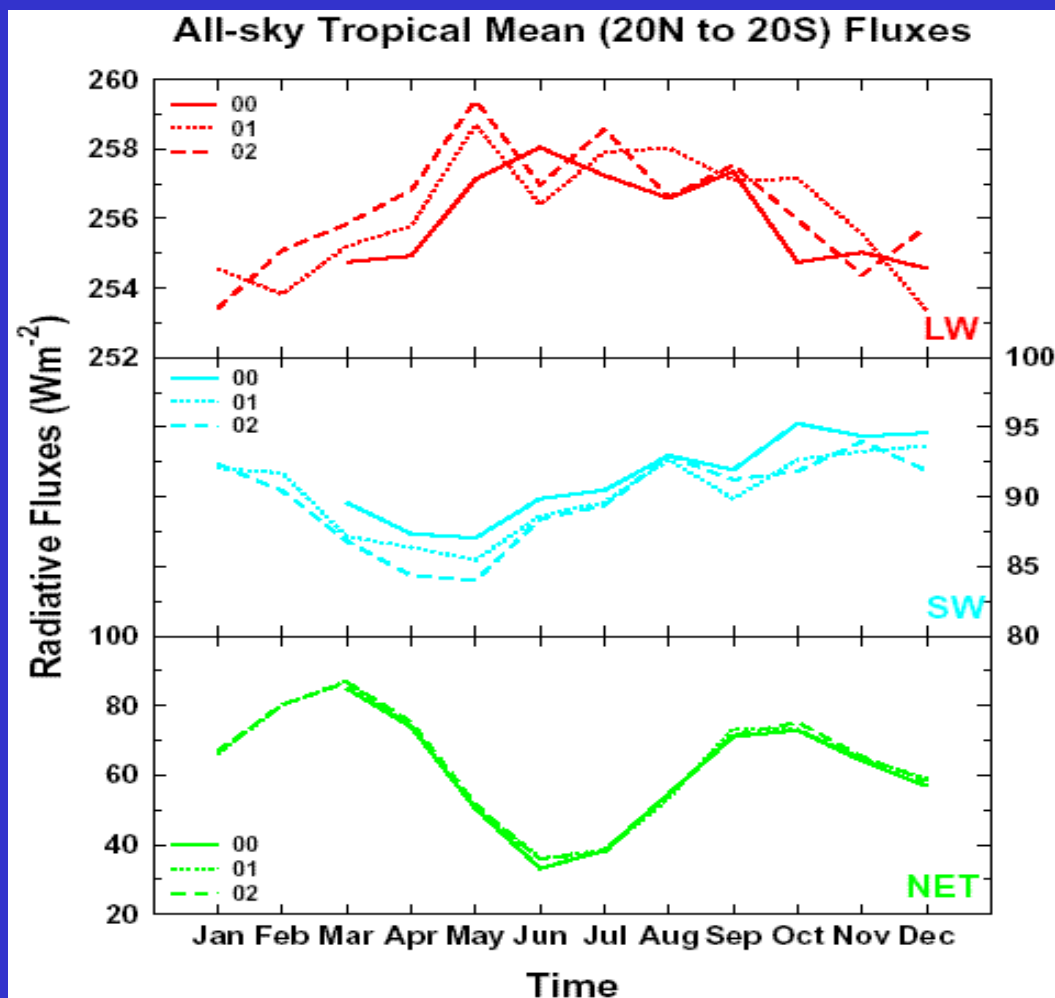
No Trend



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Interannual Variability of Tropical Mean TOA All-sky Radiation Budget



Interannual Variability:

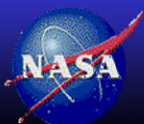
0.2 to 2.4 Wm^{-2}

Interannual Variability:

0.2 to 2.6 Wm^{-2}

Interannual Variability:

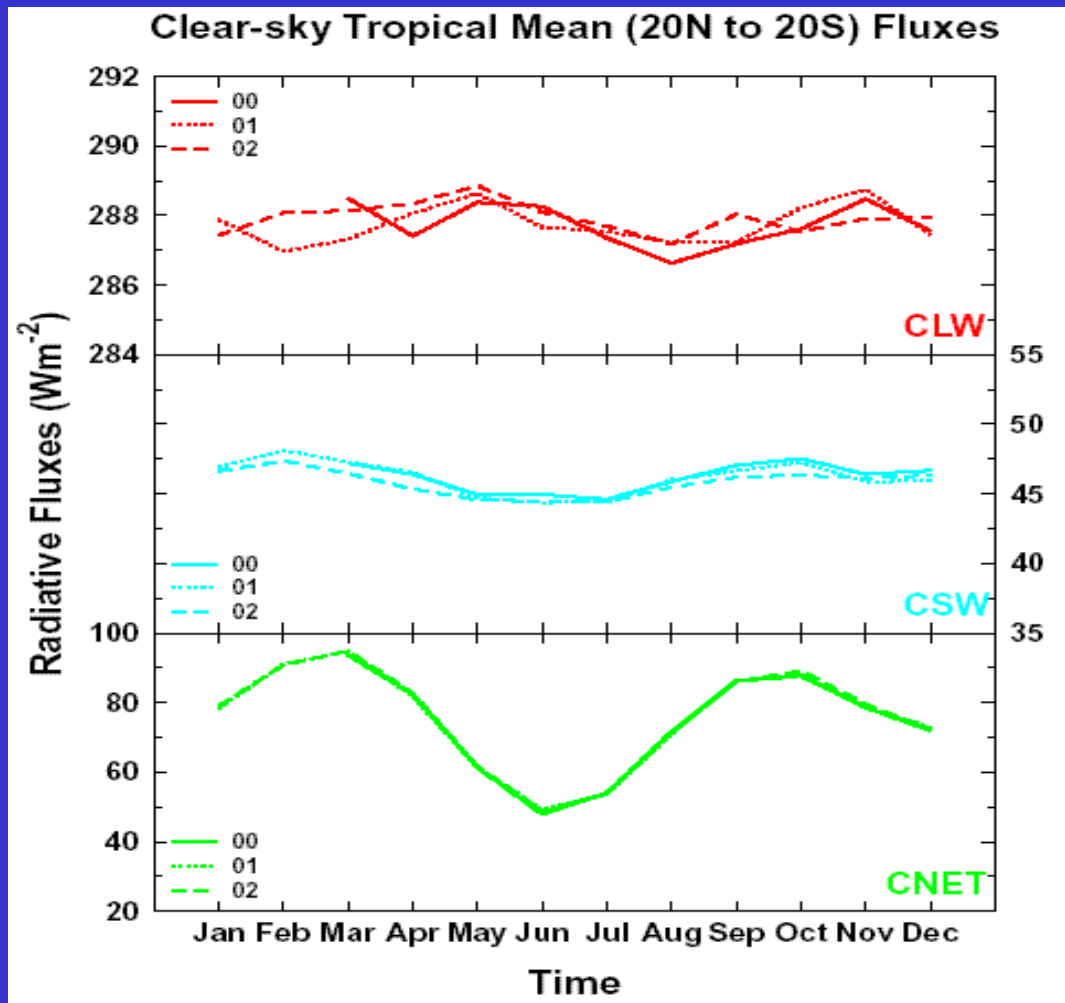
0.1 to 2.9 Wm^{-2}



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Interannual Variability of Tropical Mean TOA Clear-sky Radiation Budget



Interannual Variability:

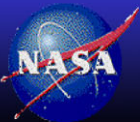
0.0 to 1.2 Wm^{-2}

Interannual Variability:

0.0 to 1.2 Wm^{-2}

Interannual Variability:

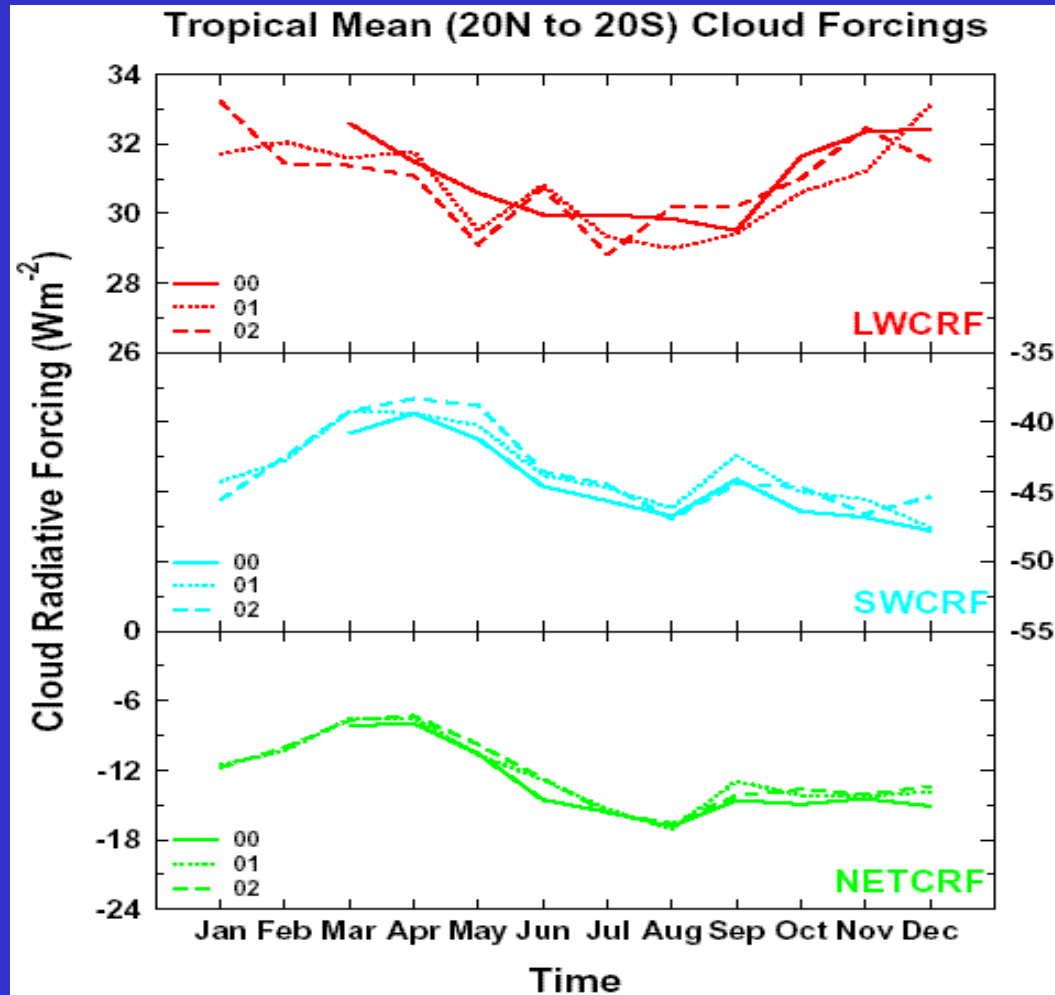
0.0 to 1.6 Wm^{-2}



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Interannual Variability of Tropical Mean TOA Cloud Radiative Forcings



Interannual Variability:

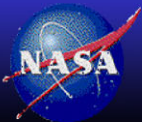
0.1 to 1.6 Wm^{-2}

Interannual Variability:

0.0 to 2.2 Wm^{-2}

Interannual Variability:

0.1 to 1.7 Wm^{-2}

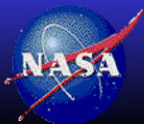
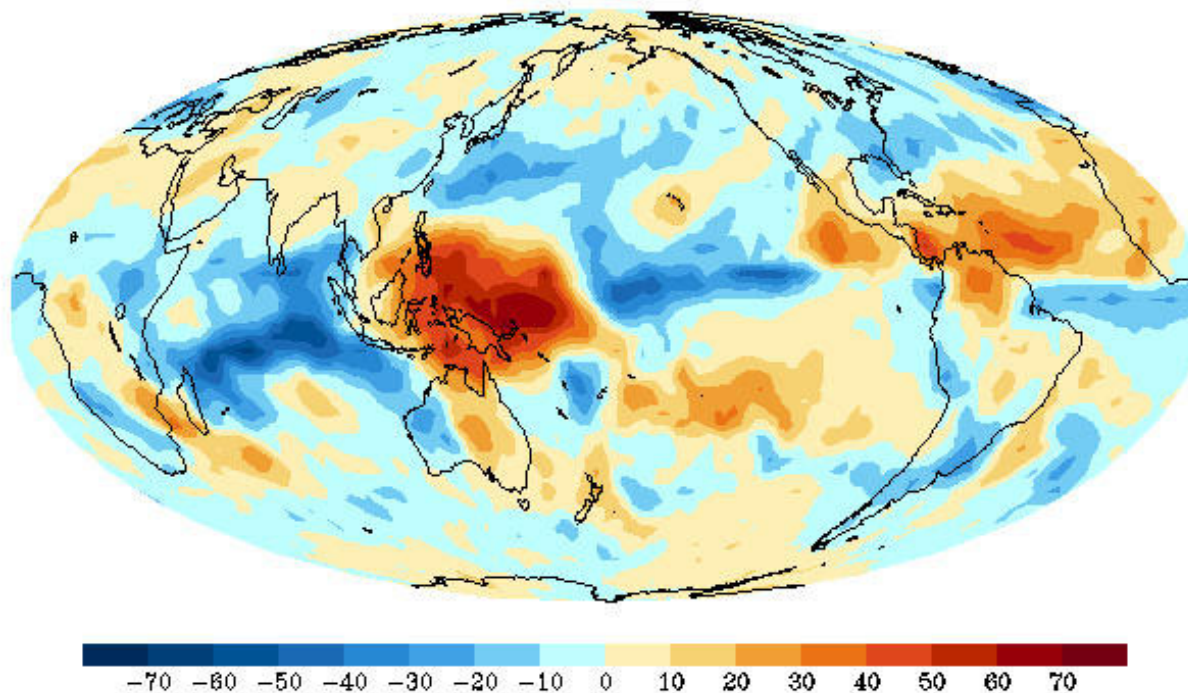


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ENSO Regional TOA Longwave Anomalies

All-sky Longwave Anomalies, 12/2002 Minus 12/2001

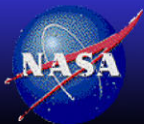
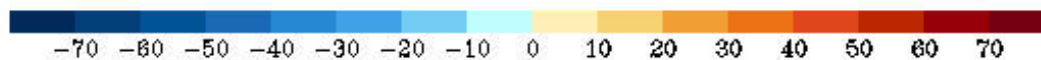
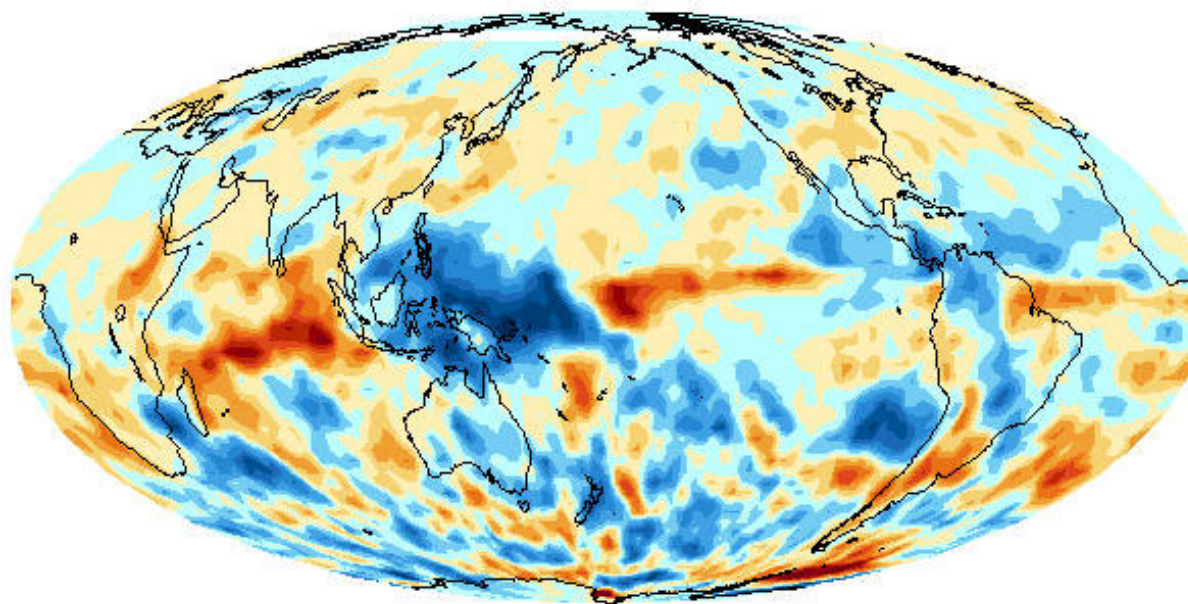


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ENSO Regional TOA Shortwave Anomalies

All-sky shortwave Anomalies, 12/2002 Minus 12/2001

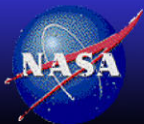
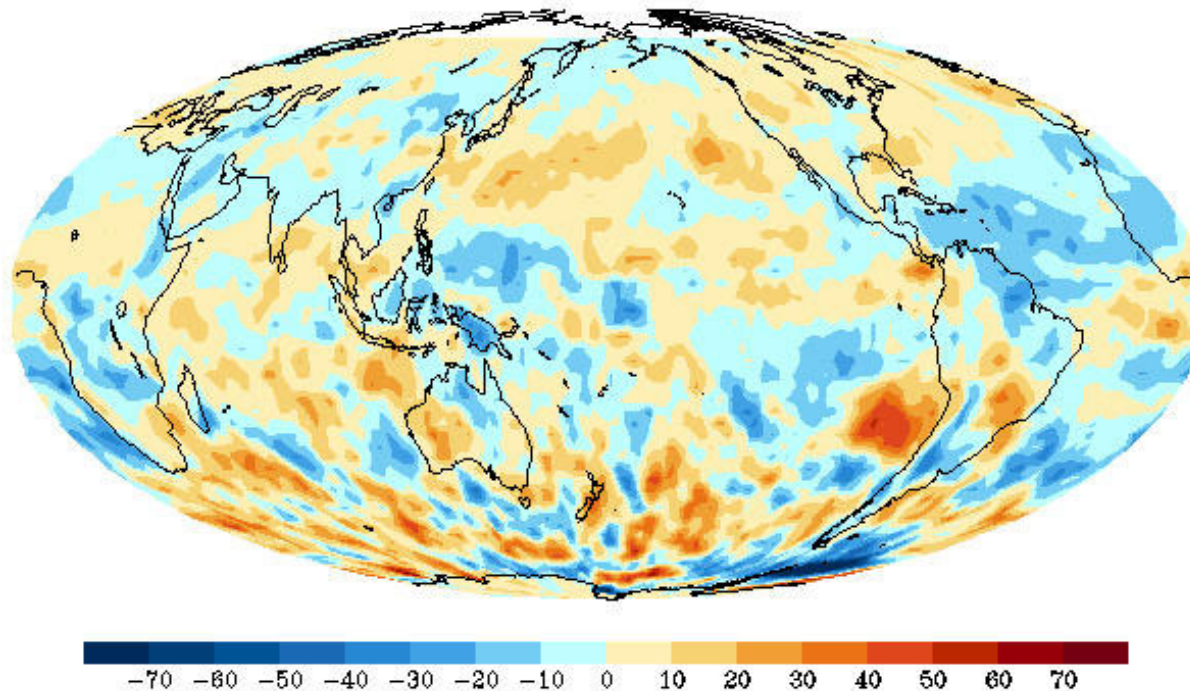


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ENSO Regional TOA Net Anomalies

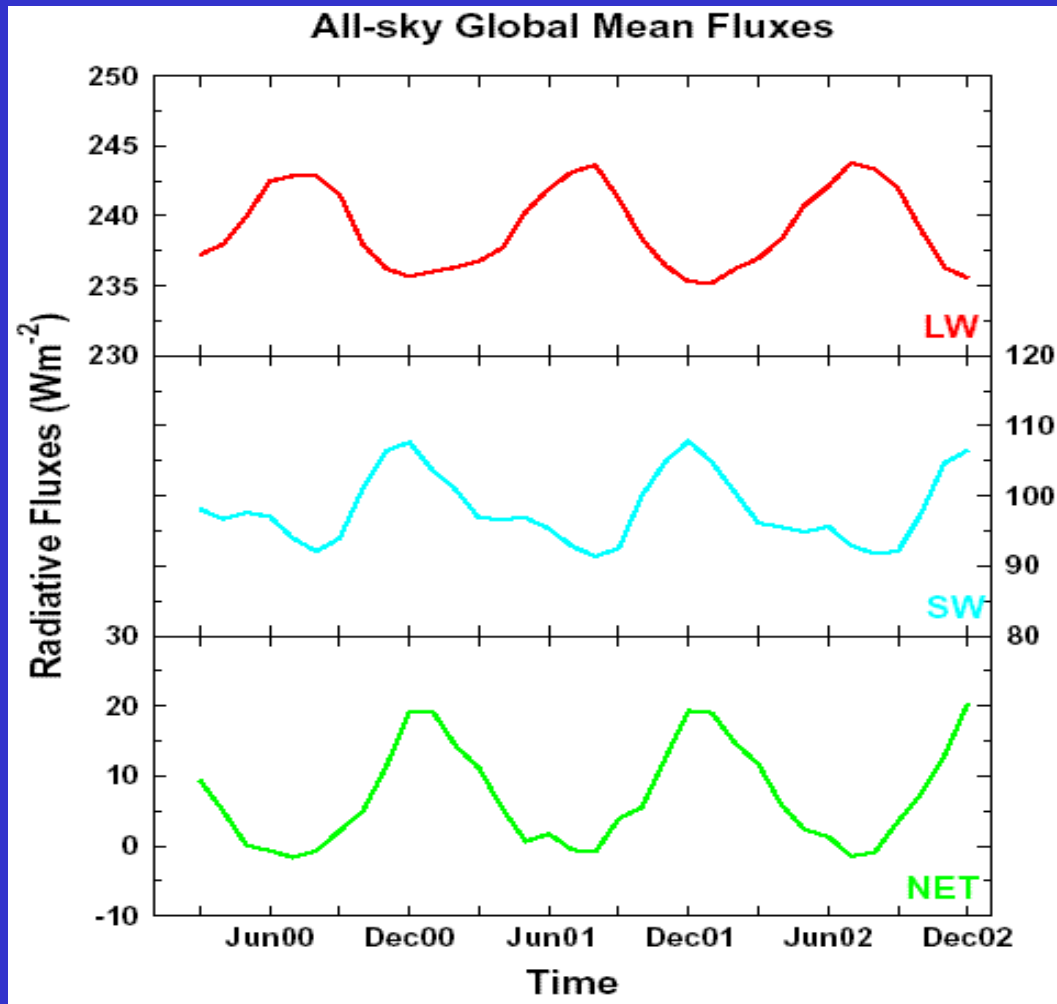
All-sky Net Anomalies, 12/2002 Minus 12/2001



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Time Series of Global Mean TOA All-sky Radiation Budget



All: $239.2 \pm 2.9 \text{ Wm}^{-2}$

Normal: $238.9 \pm 3.0 \text{ Wm}^{-2}$

No Trend

All: $98.2 \pm 5.0 \text{ Wm}^{-2}$

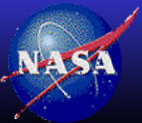
Normal: $98.3 \pm 5.3 \text{ Wm}^{-2}$

No Trend

All: $7.0 \pm 7.1 \text{ Wm}^{-2}$

Normal: $7.8 \pm 7.4 \text{ Wm}^{-2}$

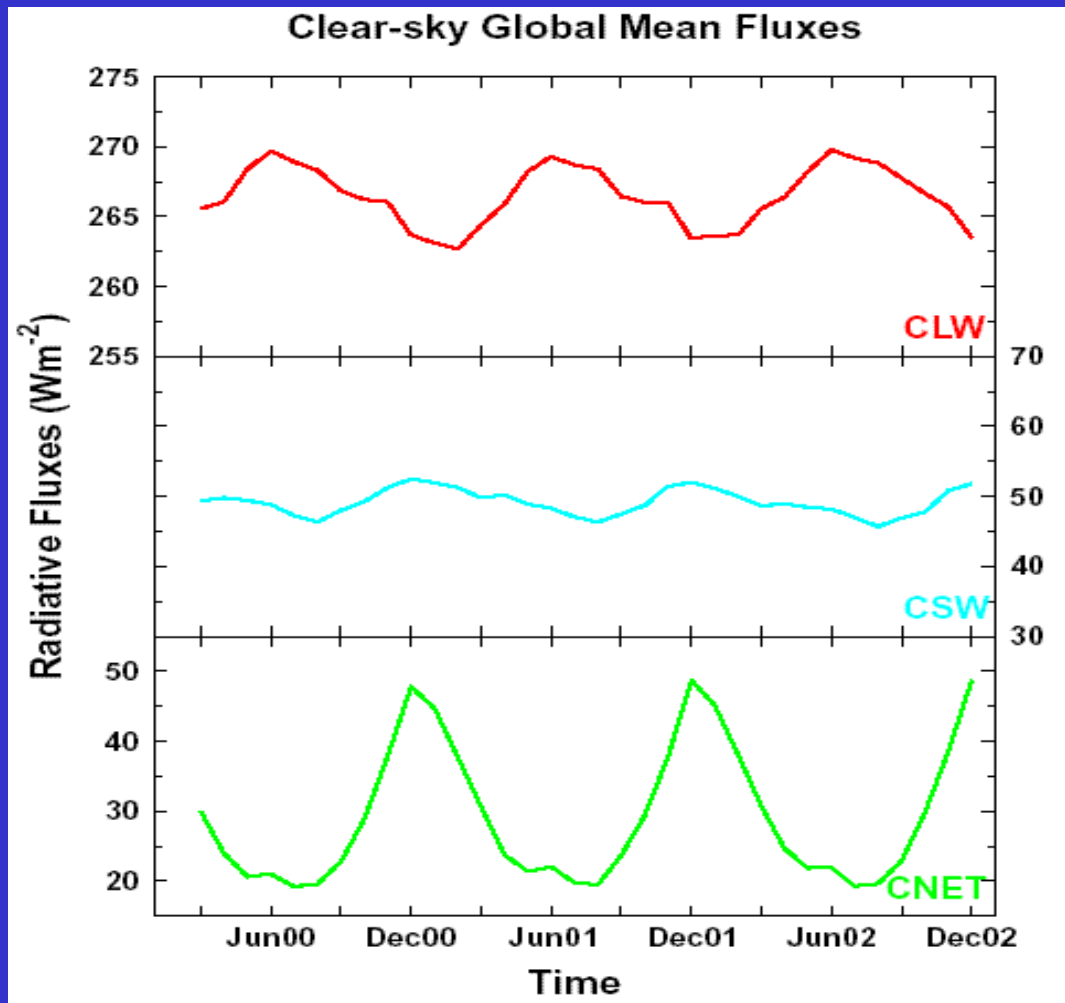
No Trend



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Time Series of Global Mean TOA Clear-sky Radiation Budget



All: $266.5 \pm 2.1 \text{ Wm}^{-2}$

Normal: $266.3 \pm 2.0 \text{ Wm}^{-2}$

No Trend

All: $49.1 \pm 1.8 \text{ Wm}^{-2}$

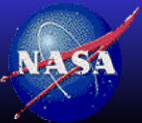
Normal: $49.2 \pm 1.8 \text{ Wm}^{-2}$

No Trend

All: $29.2 \pm 9.7 \text{ Wm}^{-2}$

Normal: $30.0 \pm 10.2 \text{ Wm}^{-2}$

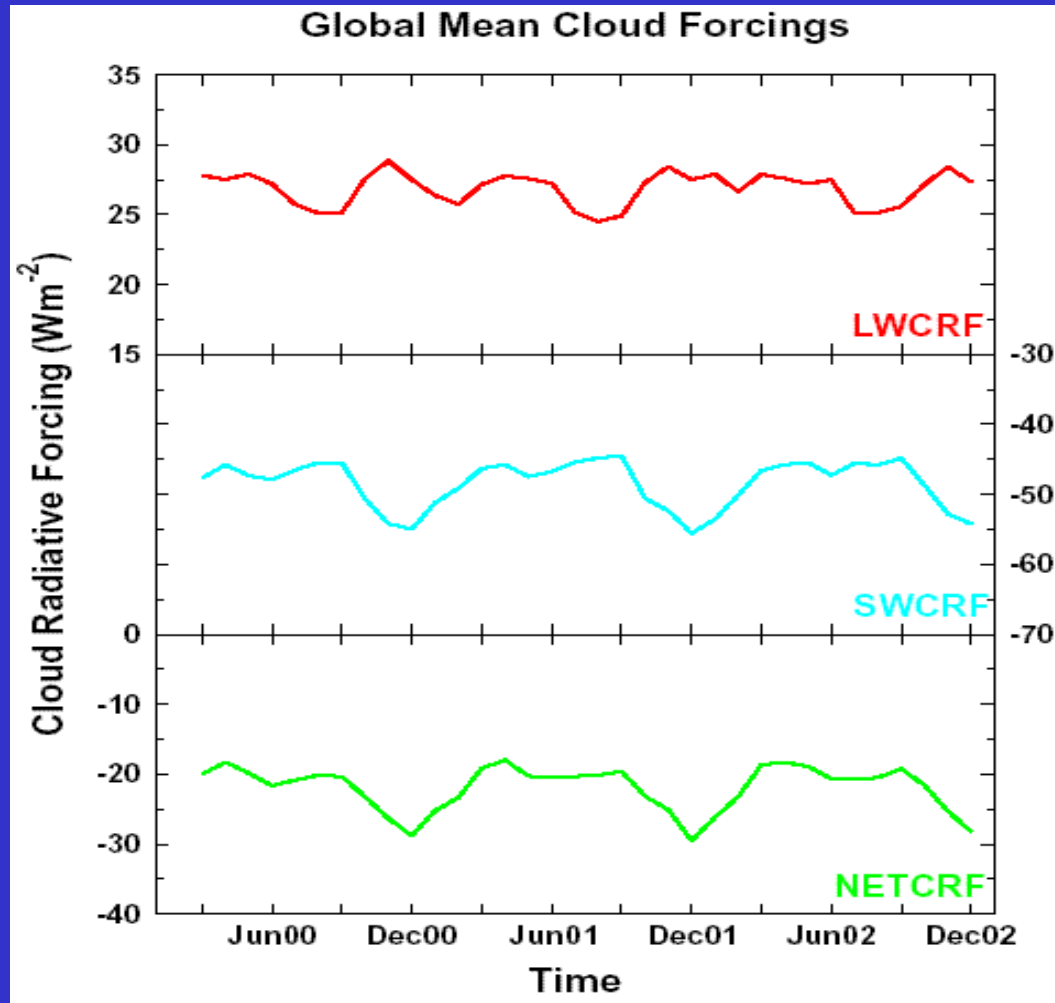
No Trend



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Time Series of Global Mean TOA Cloud Radiative Forcings



All: $26.9 \pm 1.2 \text{ Wm}^{-2}$

Normal: $26.9 \pm 1.3 \text{ Wm}^{-2}$

No Trend

All: $-48.4 \pm 3.4 \text{ Wm}^{-2}$

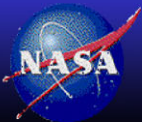
Normal: $-48.6 \pm 3.7 \text{ Wm}^{-2}$

No Trend

All: $-21.9 \pm 3.2 \text{ Wm}^{-2}$

Normal: $-22.0 \pm 3.4 \text{ Wm}^{-2}$

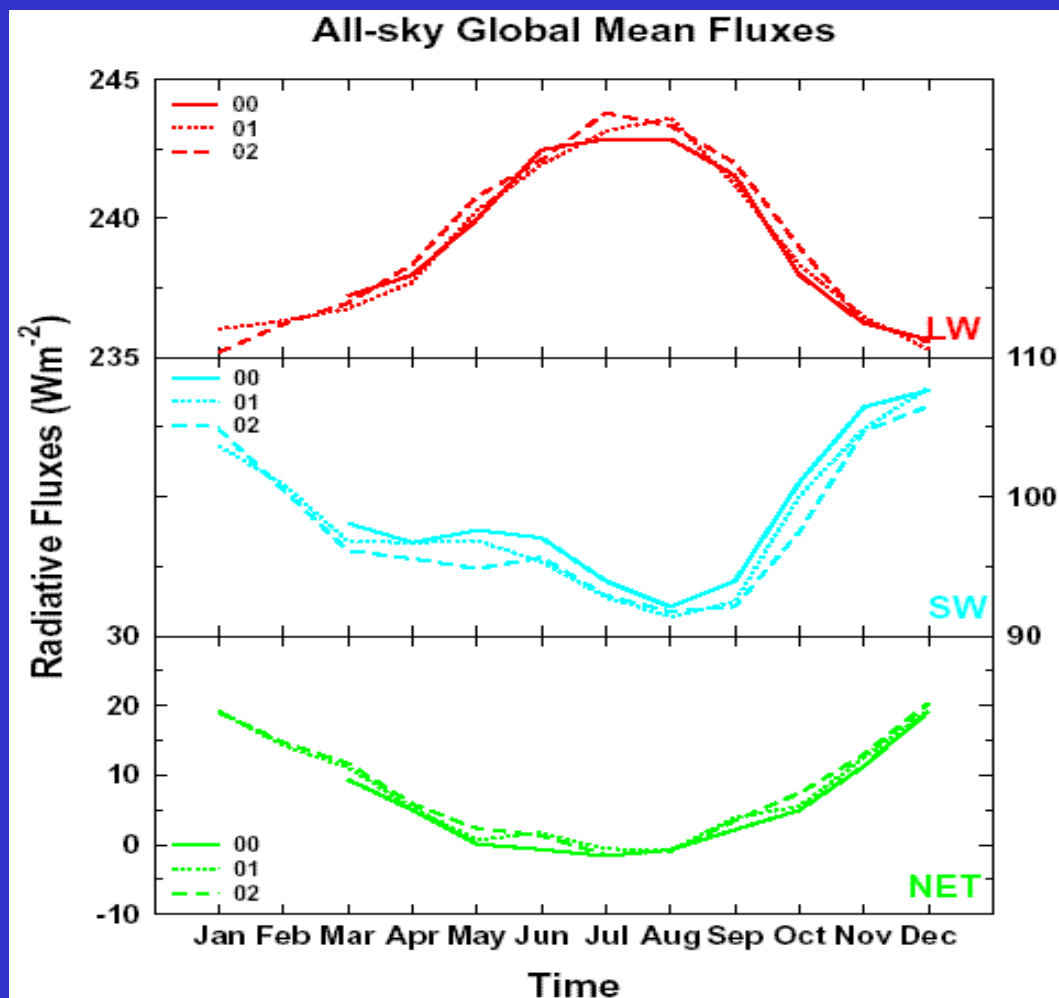
No Trend



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Interannual Variability of Global Mean TOA All-sky Radiation Budget



Interannual Variability:

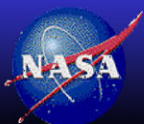
0.1 to 1.0 Wm^{-2}

Interannual Variability:

0.0 to 3.6 Wm^{-2}

Interannual Variability:

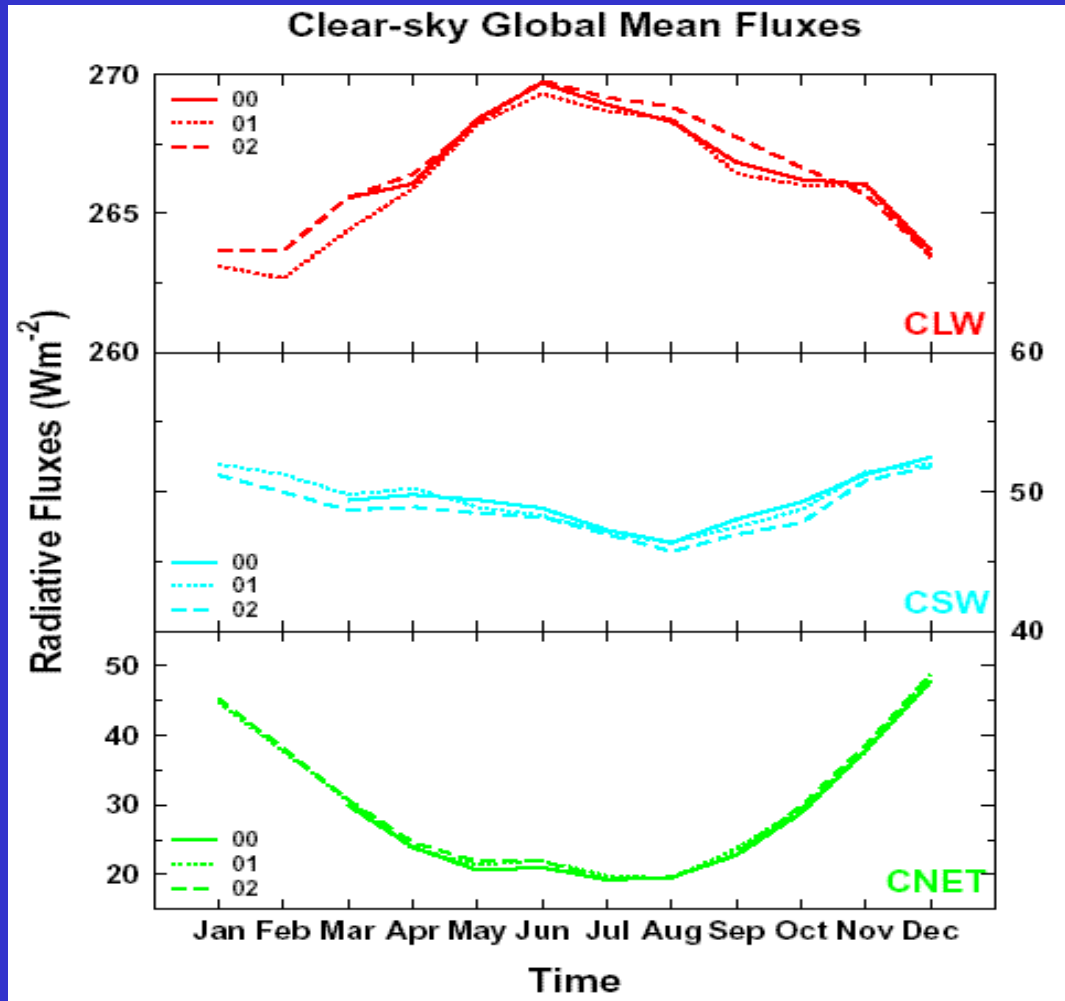
0.1 to 2.5 Wm^{-2}



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Interannual Variability of Global Mean TOA Clear-sky Radiation Budget



Interannual Variability:

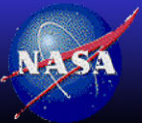
0.0 to 1.3 Wm^{-2}

Interannual Variability:

0.0 to 1.5 Wm^{-2}

Interannual Variability:

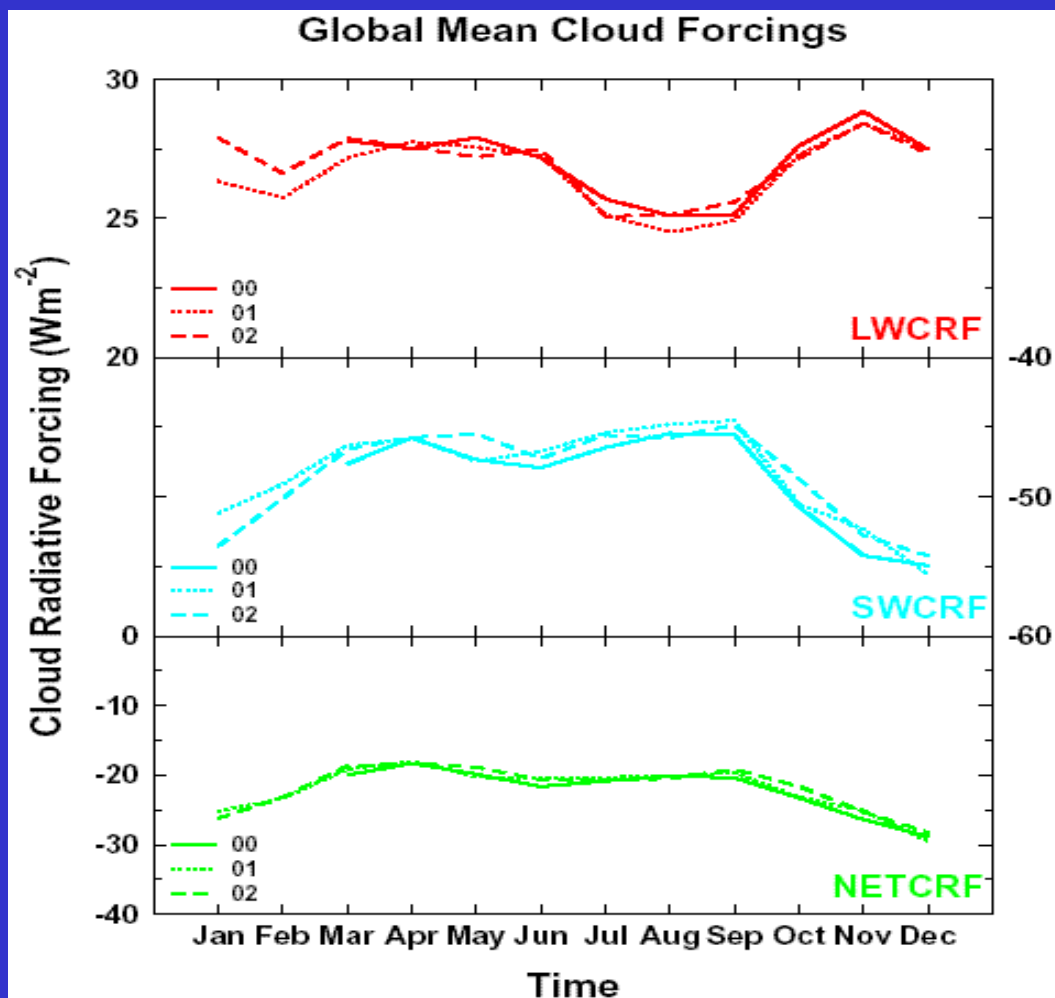
0.0 to 1.2 Wm^{-2}



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Interannual Variability of Global Mean TOA Cloud Radiative Forcings



Interannual Variability:

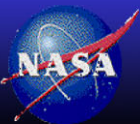
0.0 to 1.5 Wm^{-2}

Interannual Variability:

0.0 to 2.4 Wm^{-2}

Interannual Variability:

0.0 to 1.6 Wm^{-2}

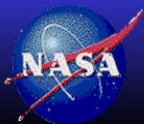
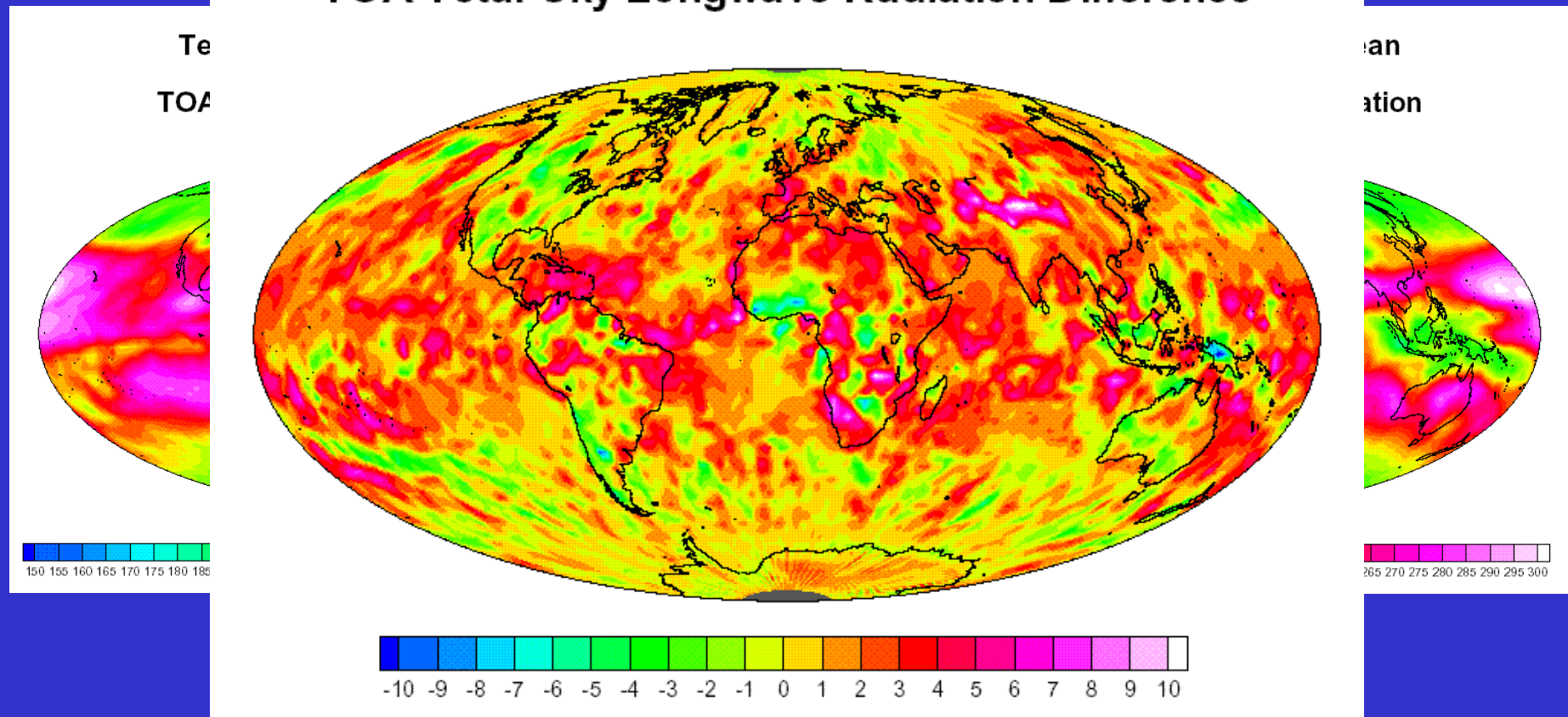


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ERBE-like Vs SRBAVG Regional All-sky Longwave Radiation

Terra March 2000 Monthly Mean
ERBElike - GeoCERES
TOA Total-Sky Longwave Radiation Difference

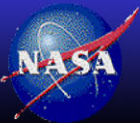
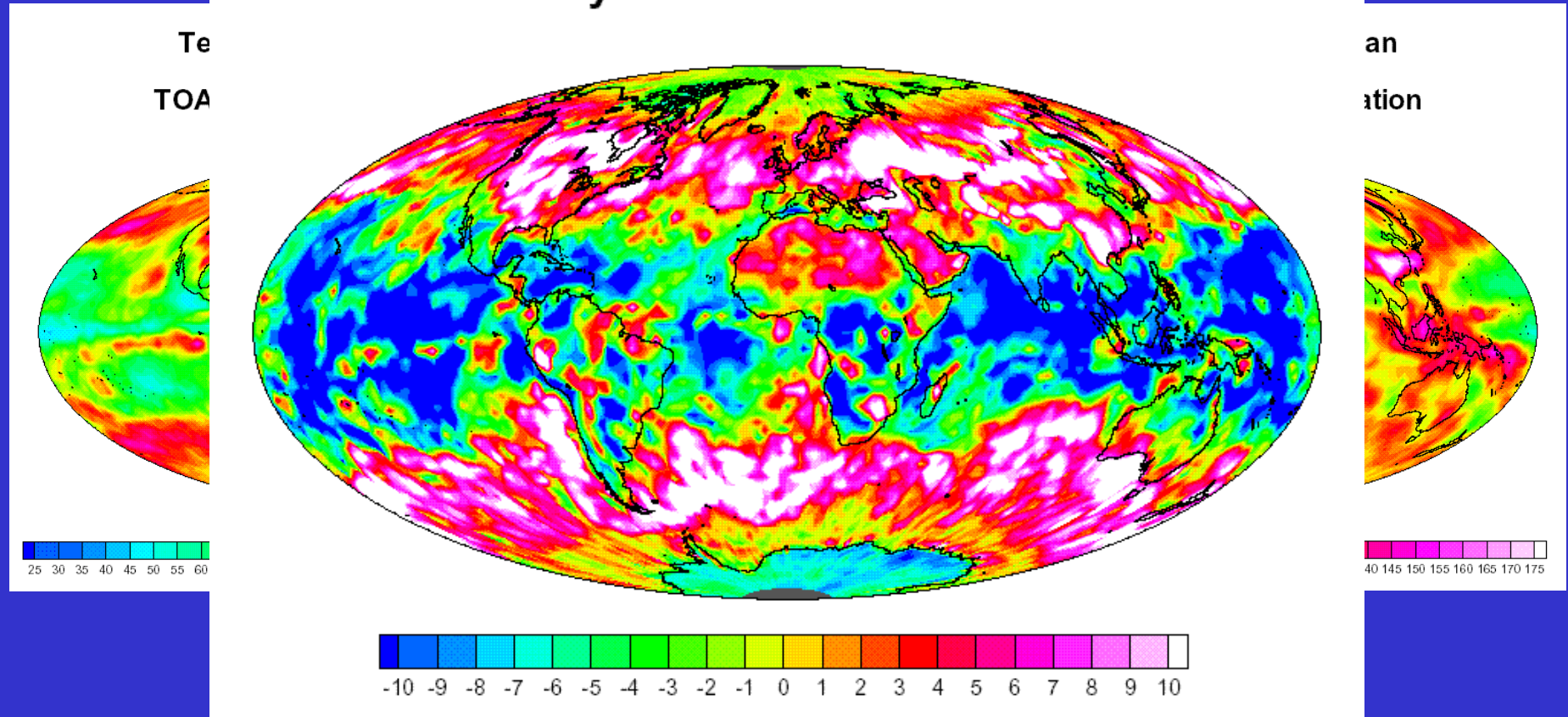


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ERBE-like Vs SRBAVG Regional All-sky Shortwave Radiation

Terra March 2000 Monthly Mean
ERBElike - GeoCERES
TOA Total-Sky Shortwave Radiation Difference

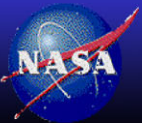
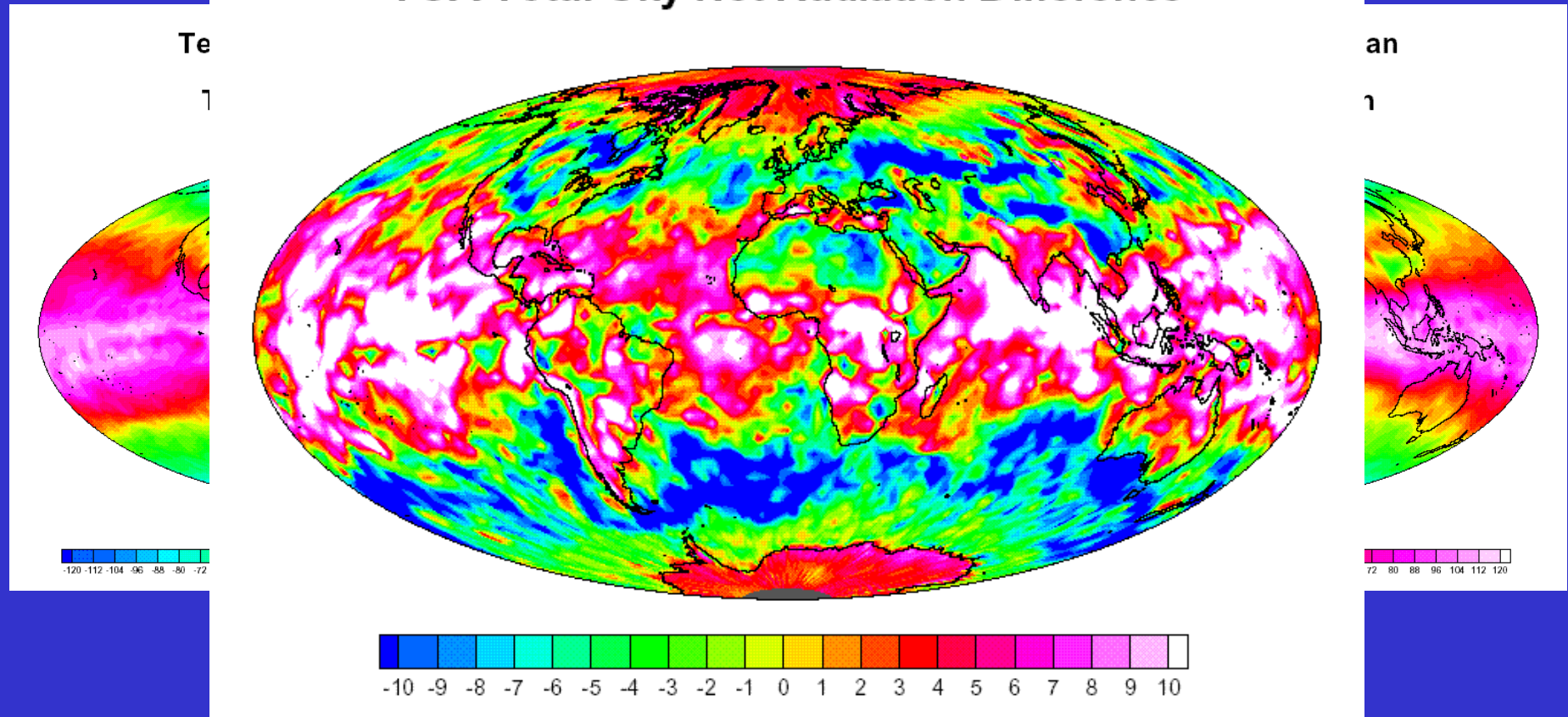


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ERBE-like Vs SRBAVG Regional All-sky Net Radiation

Terra March 2000 Monthly Mean
ERBElike - GeoCERES
TOA Total-Sky Net Radiation Difference



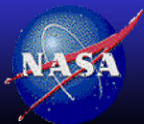
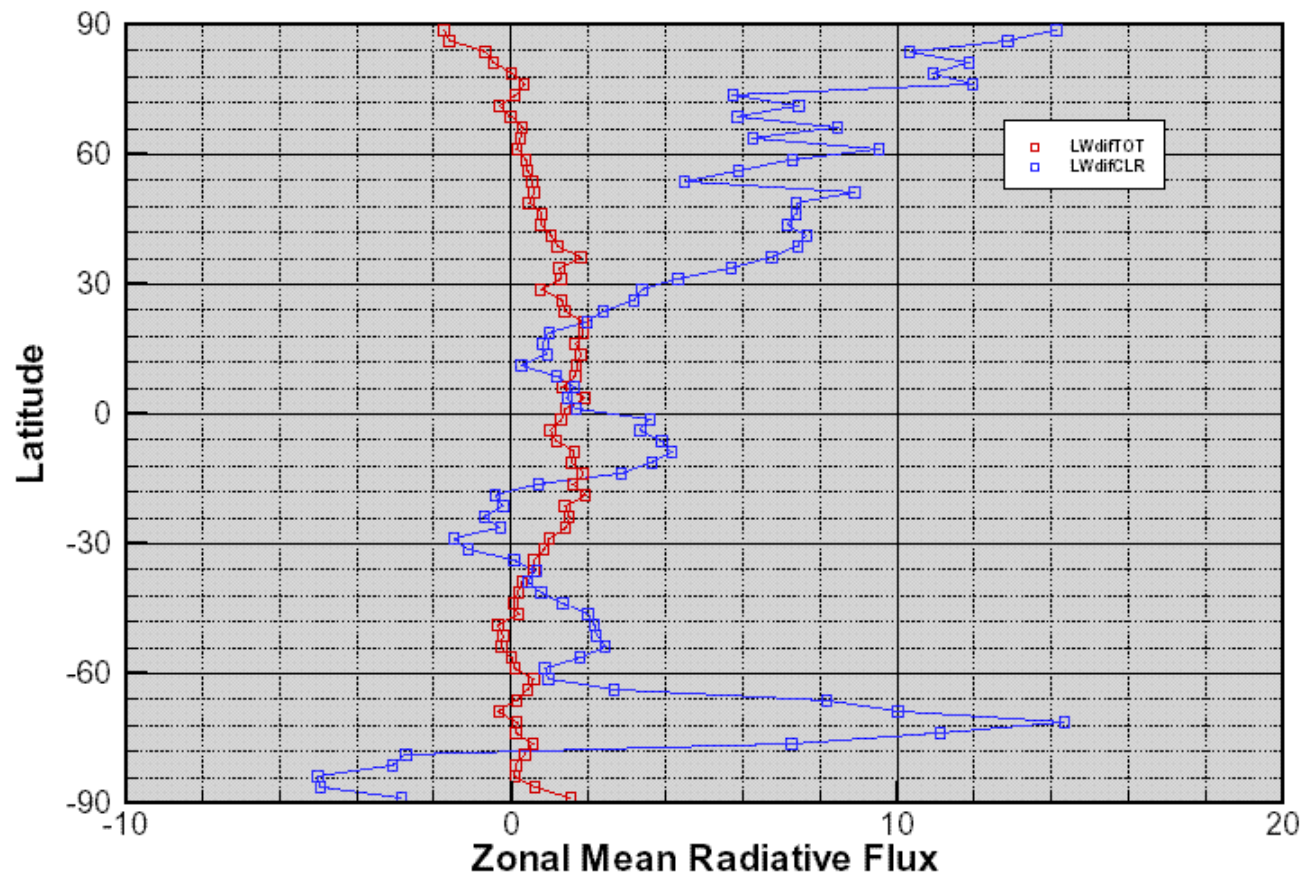
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ERBE-like Vs SRBAVG

Zonal Mean Longwave Radiation

Terra March 2000
Monthly Mean TOA Radiative Flux



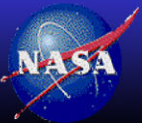
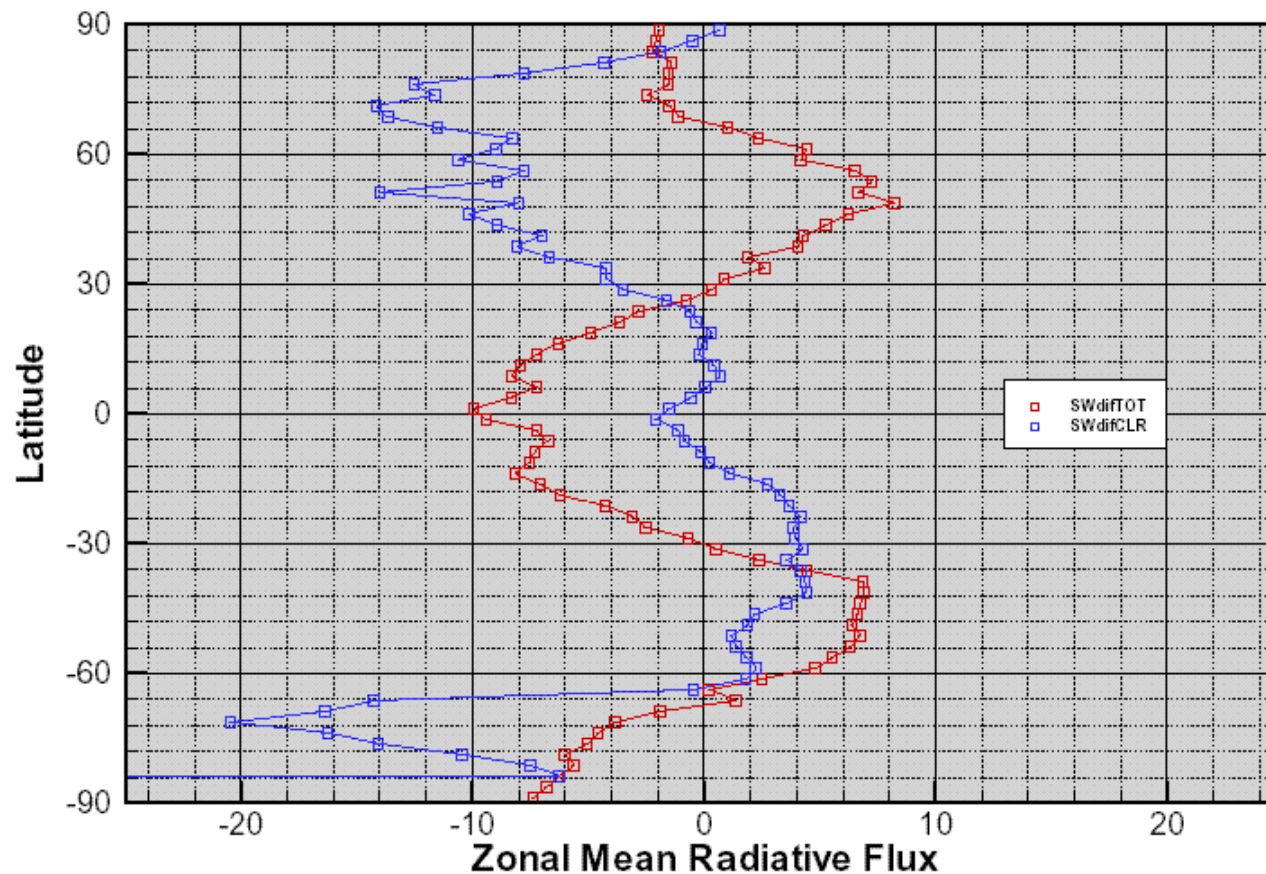
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ERBE-like Vs SRBAVG

Zonal Mean Shortwave Radiation

Terra March 2000
Monthly Mean TOA Radiative Flux

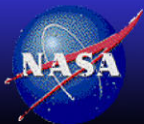
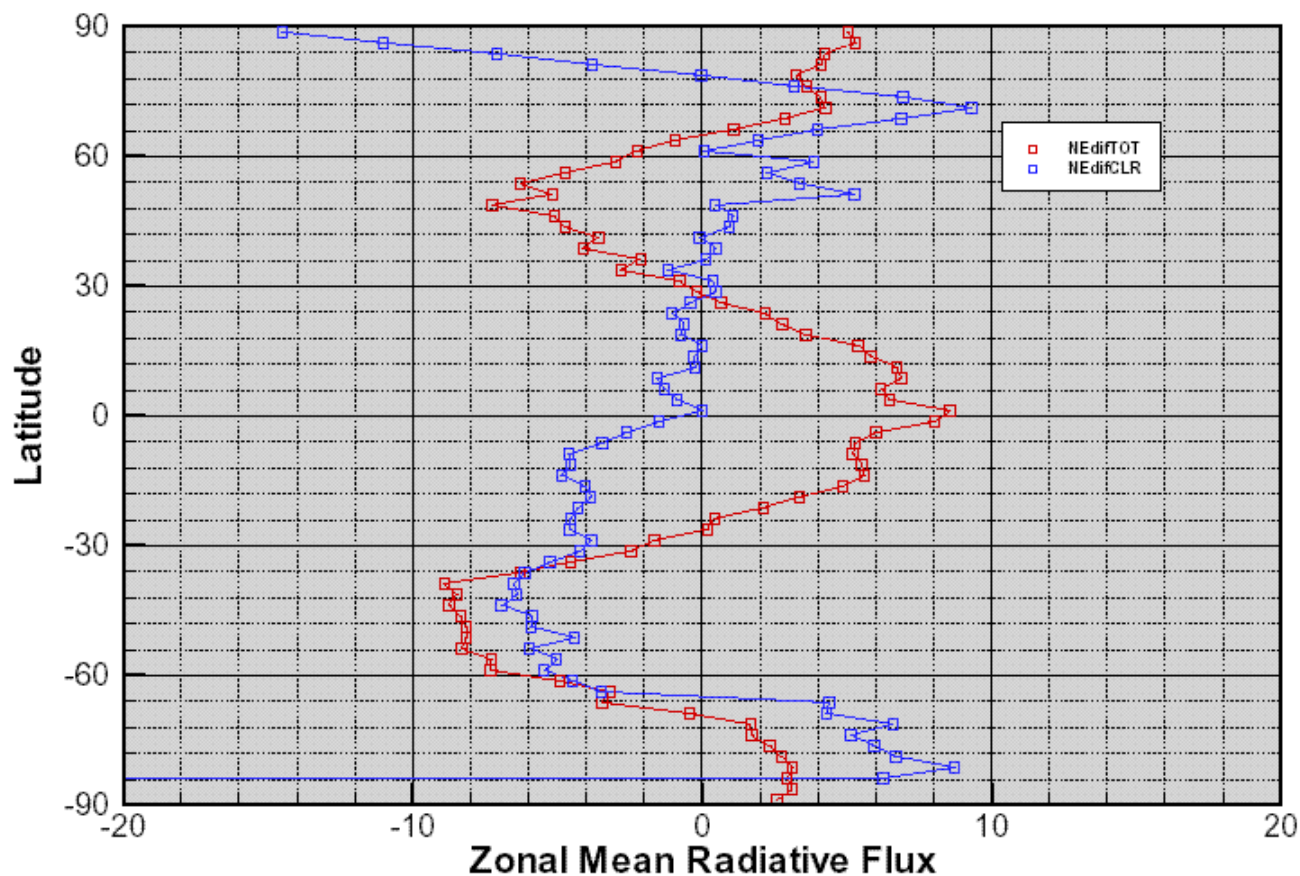


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ERBE-like Vs SRBAVG Zonal Mean Net Radiation

Terra March 2000
Monthly Mean TOA Radiative Flux



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Summary

- Time Series of CERES/Terra Edition2 Tropical Mean and Global Mean TOA Radiation Budgets Show No Statistical Significant Trend During the First 34 Months of Data
- Interannual Variability of Tropical Mean Can Be up to 2.5, 1.5, 2.0 Wm^{-2} for All-sky Radiation, Clear-sky Radiation and Cloud Radiative Forcing, Respectively
- Interannual Variability of Global Mean Can Be Larger or Smaller Than the Interannual Variability of Tropical Mean, Depending on the Specific Variables
- Regional Radiative Effects of the 2002 ENSO Event Are Large; Can Be up to 70 to 80 Wm^{-2} , Even Though Their Tropical Mean Values Are Small.
- ERBE-like Minus SRBAVG: Large ERBE-like Zonal Mean Clear-sky Bias Away from the Tropics; Small Positive ERBE-like Zonal Mean All-sky LW Bias in Most Zones; Large Latitudinal Dependence in the ERBE-like Zonal Mean All-sky SW and Net Flux Bias.

