CERES/Terra ERBE-like TOA Fluxes:
An Update Of FM-1 Vs. FM-2

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Abstract

An updated intercomparison between CERES/Terra monthly mean FM-1 and FM-2 ERBE-like TOA fluxes were presented using three additional data months from August to October 2000. In general, most of the differences between CERES/Terra FM-1 and FM-2 ERBE-like monthly mean fluxes can again be explained by the differences in sampling pattern of the two CERES instruments (i.e, RAP vs. cross-track scan mode sampling). In term of tropical mean TOA longwave/shortwave radiation, the CERES/Terra cross-track monthly mean ERBE-like data are always running higher/darker than their corresponding RAP data, respectively. Due to the three-months scan mode cycling nature of the two CERES/Terra instruments, it is recommended that data users should exercise cautions when using CERES/Terra ERBE-like monthly-mean TOA fluxes for climate study. Specifically, users should (1) separate CERES/Terra monthly mean data based on instrument scan mode operation, (2) use only CERES/Terra cross-track scan mode monthly mean data for climate study and long term comparison with ERBE monthly mean data set, and (3) avoid mixing CRES/Terra monthly mean data from different scan mode operations.
Lessons Learned From Last Meeting

• Performed Comparisons Using CERES/Terra FM-1 And FM-2 Data From March, April, And May 2000

• Zonal Mean Differences < 2 Wm\(^{-2}\) Except At Poles

• All-sky Regional Monthly Mean Differences Due Primarily To Temporal Sampling; Cross-track Mode Having Better Temporal Sampling --> **RAP Vs. Cross-track Sampling Issue**

• Clear-sky SW Differences Due To MLE Over Snow; RAP Mode Value Too Low --> **RAP Vs. Cross-track Sampling Issue**

• Clear-sky LW Differences (< 0.5%) Appear To Be Instrument-Based; FM-1 Being Higher --> **Instruments Calibration Issue**

• SW Differences Depends On Viewing Zenith Angle; ADM Problem --> **RAP Vs. Cross-track Sampling Issue**
# CERES/Terra Scan Mode Operation

<table>
<thead>
<tr>
<th>Month (2000)</th>
<th>FM-1</th>
<th>FM-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>Both</td>
<td>Both</td>
</tr>
<tr>
<td>April</td>
<td>RAP</td>
<td>Cross-track</td>
</tr>
<tr>
<td>May</td>
<td>Cross-track</td>
<td>RAP</td>
</tr>
<tr>
<td>June</td>
<td>Cross-track</td>
<td>RAP</td>
</tr>
<tr>
<td>July</td>
<td>Cross-track</td>
<td>RAP</td>
</tr>
<tr>
<td>August</td>
<td>RAP</td>
<td>Cross-track</td>
</tr>
<tr>
<td>September</td>
<td>RAP</td>
<td>Cross-track</td>
</tr>
<tr>
<td>October</td>
<td>RAP</td>
<td>Cross-track</td>
</tr>
<tr>
<td>November</td>
<td>Cross-track</td>
<td>RAP</td>
</tr>
</tbody>
</table>

Total–Sky Shortwave Flux

RAPS(FM1)–FAPS(FM2) CERES/Terra  April 2000
Clear-Sky Shortwave Flux

RAPS(FM1)–FAPS(FM2) CERES/Terra  April 2000
Comparison of Crosstrack and RAP ERBE-Like Scene ID (6 GMT May 16 2000)

Cross-Track (FM1)

Blue = Clear Snow
Green = Clear Land

RAP (FM2)
Clear-Sky Longwave Zonal Differences
RAPS– FAPS CERES/Terra

CLW Flux Differences (W/m²)

Latitudes

April 2000
May 2000
Comparison of FM1 (Crosstrack) and FM2 (RAP) SW Fluxes (May 2000)

VZ

Ocean
Land
Snow
Desert
Comparison of FM1 and FM2 Crosstrack SW Fluxes (March 2000)

-1.00%
-0.50%
0.00%
0.50%
1.00%
-0.50%
-1.00%

VZ

Ocean
Land
Snow
Desert

FM1 - FM2 Flux Difference (%)
RAP Vs. Cross-track Comparisons: An Update

• Comparisons Of Monthly Regional, Zonal Mean, And Tropical Mean Flux Differences For
  - March 2000
  - April 2000
  - May 2000
  - August 2000
  - September 2000
  - October 2000
Total-Sky Shortwave Flux
RAPS(FM1)–FAPS(FM2) CERES/Terra  April 2000
**Tropical Mean Longwave/Shortwave Anomaly* Comparisons**

<table>
<thead>
<tr>
<th>Month (2000)</th>
<th>Cross-track</th>
<th>RAP</th>
<th>Xtrack-RAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>2.3/-6.6</td>
<td>1.6/-5.8</td>
<td>0.7/-0.8</td>
</tr>
<tr>
<td>May</td>
<td>4.6/-5.3</td>
<td>2.8/-4.7</td>
<td>1.8/-0.6</td>
</tr>
<tr>
<td>June</td>
<td>---</td>
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</tr>
<tr>
<td>July</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>August</td>
<td>3.7/-5.0</td>
<td>3.2/-3.8</td>
<td>0.5/-1.2</td>
</tr>
<tr>
<td>September</td>
<td>4.6/-7.4</td>
<td>4.0/-6.4</td>
<td>0.6/-1.0</td>
</tr>
<tr>
<td>October</td>
<td>2.7/-4.3</td>
<td>2.0/-3.5</td>
<td>0.7/-0.8</td>
</tr>
</tbody>
</table>

* Anomaly Based On 1985 To 1989 ERBE/ERBS Scanner Period
Decadal Variability in Tropical Mean (20S - 20N) Longwave Radiation from 5 Different Broadband Instruments for 1985 - 2000

Anomalies Referenced to 1985 through 1989 Baseline

Future Variability ???
Summary

- Reproduced Most Of The Lessons Learned From Last Meeting Using Three New Data Months,
  - Clear-sky SW Differences Due MLE Over Snow
  - Instrument-Based Clear-sky LW Differences
- All-sky Regional RAP Minus Xtrack Differences Seem To Decrease With the New Data Months; Suggesting An Improvement In Temporal Sampling Of The RAP Data
- Tropical Mean Longwave/Shortwave Comparisons Shows Xtrack Data Running Higher/Lower Than RAP Data, Respectively, Throughout The Data Period
Recommendation

- Need To Separate CERES/Terra Data Based On Instrument Scan Mode Operation
- Use CERES/Terra Cross-track Scan Mode Data For Climate Study And Long Term Comparison With ERBE Data
- Avoid Mixing CERES/Terra Monthly Mean Data From Different Scan mode Operations