CERES/Aqua Edition1 Vs. CERES/Terra Edition2 ERBE-like TOA Fluxes

Takmeng Wong
NASA Langley Research Center, Hampton, Virginia

29th CERES Science Team Meeting (2nd Telecon)
Hampton, Virginia
October 15, 2003
Objectives

- Compare CERES/Aqua Edition1 and CERES/Terra Edition2 ERBE-like TOA Fluxes: Regional, Zonal, and Global Scale; Monthly and Annual Mean.

- Examine the Effects of Temporal Sampling On ERBE-like Radiation Fields: Terra (10:30 am) Vs. Aqua (1:30 pm)
Datasets

- CERES/Aqua Edition 1 and CERES/Terra Edition 2
- Extracted All-sky and Clear-sky Fluxes
- Combined FM1 and FM2 Data to Form A Single Terra Dataset
- Combined FM3 and FM4 Data to Form A Single Aqua Dataset
Terra (10:30am) and Aqua (1:30pm) Orbit

N.H. Polar Regions: Aqua (am), Terra (pm)

Both Orbits overlap at Near Noon and Midnight at Polar Regions

SW Temporal Sampling Differences Increase from North to South; Greatest in S.H.
Monthly Mean Comparisons
Terra and Aqua Longwave Flux, July 2002

CERES All-sky Outgoing Longwave Radiation

July 2002
Aqua - Terra SW Differences, July 2002
Aqua - Terra Net Differences, July 2002

CERES Differences (Aqua-Terra), All-sky Net

July 2002
Time Series of Global Mean Fluxes

CERES Global Mean All-sky Outgoing Longwave
July 2002 to June 2003

CERES Global Mean All-sky Reflected Solar
July 2002 to June 2003

CERES Global Mean All-sky Net
July 2002 to June 2003

CERES Global Mean All-sky Flux Differences (Aqua-Terra)
July 2002 to June 2003
Time Series of Tropical Mean Fluxes

CERES Tropical Mean All-sky Outgoing Longwave
July 2002 to June 2003

CERES Tropical Mean All-sky Reflected Solar
July 2002 to June 2003

CERES Tropical Mean All-sky Net
July 2002 to June 2003

CERES Tropical Mean All-sky Flux Differences (Aqua-Terra)
July 2002 to June 2003
Time Series of Tropical Mean Clear Fluxes

CERES Tropical Mean Clear-sky Outgoing Longwave
July 2002 to June 2003

CERES Tropical Mean Clear-sky Reflected Solar
July 2002 to June 2003

CERES Clear Mean Clear-sky Net
July 2002 to June 2003

CERES Tropical Mean Clear-sky Flux Differences (Aqua-Terra)
July 2002 to June 2003
Aqua - Terra Zonal Mean LW Differences

CERES Flux Differences (Aqua-Terra), All-sky Outgoing Longwave
Aqua - Terra Zonal Mean SW Differences

CERES Flux Differences (Aqua-Terra), All-sky Reflected Solar
Aqua - Terra Zonal Mean Clr SW Differences

CERES Flux Differences (Aqua-Terra), clear-sky Reflected Solar
Annual Mean Comparisons
Terra and Aqua Longwave Flux

CERES All-sky Outgoing Longwave Radiation, Annual Mean
July 2002 to June 2003
Aqua - Terra LW Differences

CERES Annual Mean Differences (Aqua-Terra), All-sky Outgoing Longwave

July 2002 to June 2003

NASA Langley Research Center / Atmospheric Sciences
Terra and Aqua Shortwave Flux

CERES All-sky Reflected Solar Radiation, Annual Mean
July 2002 to June 2003

Terra

Aqua
Aqua - Terra SW Differences

CERES Annual Mean Differences (Aqua–Terra), All-sky Reflected Solar
July 2002 to June 2003
Terra and Aqua Net Flux

CERES All-sky Net Radiation, Annual Mean
July 2002 to June 2003

Terra

Aqua
Aqua - Terra Net Differences

CERES Annual Mean Differences (Aqua-Terra), All-sky Net
July 2002 to June 2003
Terra and Aqua Zonal Mean Fluxes

CERES Annual Mean All-sky Flux
July 2002 to June 2003

CERES Annual Mean All-sky Flux Differences (Aqua−Terra)
July 2002 to June 2003
Terra and Aqua Zonal Mean Clear Fluxes
# Terra and Aqua Global Mean Fluxes

<table>
<thead>
<tr>
<th></th>
<th>Terra</th>
<th>Aqua</th>
<th>Aqua-Terra</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW</td>
<td>238.9</td>
<td>238.8</td>
<td>0.9</td>
</tr>
<tr>
<td>SW</td>
<td>97.2</td>
<td>96.7</td>
<td>-0.5</td>
</tr>
<tr>
<td>Net</td>
<td>5.3</td>
<td>4.9</td>
<td>-0.4</td>
</tr>
<tr>
<td>Albedo</td>
<td>28.46%</td>
<td>28.32%</td>
<td>-0.14%</td>
</tr>
<tr>
<td>Clear LW</td>
<td>266.6</td>
<td>268.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Clear SW</td>
<td>48.6</td>
<td>49.5</td>
<td>0.9</td>
</tr>
<tr>
<td>Clear Net</td>
<td>29.5</td>
<td>26.8</td>
<td>-2.7</td>
</tr>
<tr>
<td>Clr Albedo</td>
<td>14.25%</td>
<td>14.50%</td>
<td>0.25%</td>
</tr>
</tbody>
</table>
# Terra and Aqua Tropical Mean Fluxes

<table>
<thead>
<tr>
<th></th>
<th>Terra</th>
<th>Aqua</th>
<th>Aqua-Terra</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW</td>
<td>256.4</td>
<td>256.9</td>
<td>0.5</td>
</tr>
<tr>
<td>SW</td>
<td>90.4</td>
<td>91.3</td>
<td>0.9</td>
</tr>
<tr>
<td>Net</td>
<td>62.5</td>
<td>61.2</td>
<td>-1.3</td>
</tr>
<tr>
<td>Albedo</td>
<td>22.09%</td>
<td>22.29%</td>
<td>0.20%</td>
</tr>
<tr>
<td>Clear LW</td>
<td>287.9</td>
<td>289.6</td>
<td>1.7</td>
</tr>
<tr>
<td>Clear SW</td>
<td>46.3</td>
<td>47.5</td>
<td>1.2</td>
</tr>
<tr>
<td>Clear Net</td>
<td>74.6</td>
<td>72.1</td>
<td>-2.5</td>
</tr>
<tr>
<td>Clr Albedo</td>
<td>11.31%</td>
<td>11.59%</td>
<td>0.28%</td>
</tr>
</tbody>
</table>
Main Summary

• CERES/Aqua and Terra ERBE-like Fluxes Show Regional Differences (both monthly and annual Mean) Consistent With Diurnal Sampling Differences of the Two EOS Satellites
• Time Series of Global/Tropical Mean Flux Differences (Aqua-Terra) Show a Small Positive Slope in the All-sky Longwave Fluxes After 12/2002 → Need Longer Time Series to See if this Slope Continues
• However, Time Series of Global/Tropical Mean Clear Flux Differences (Aqua-Terra) Are Very Small → No Changes ??
• Annual Mean Zonal Mean SW Differences (Aqua-Terra) Show Largest Differences In the S.H.; Consistent with the Larger Differences in Daytime Sampling Time between the Two Satellites.
• Annual Mean Global Mean Differences (Aqua-Terra) Are Less Than 1 Wm^{-2} For LW, SW, and Net. Clear-sky Fluxes Differences Are Less Than 2.7 Wm^{-2}
• Annual Mean Tropical Mean Differences (Aqua-Terra) Are Less Than 1 Wm^{-2} For LW and SW and Less Than 1.5 Wm^{-2} For Net. Clear-sky Fluxes Differences Are Less Than 2.6 Wm^{-2}
Extra Materials
Terra and Aqua Shortwave Flux, July 2002

CERES All-sky Reflected Solar Radiation
July 2002

Terra

Aqua
Terra and Aqua Net Flux, July 2002

CERES All-sky Net Radiation

July 2002

Terra

Aqua
Aqua - Terra Zonal Mean Net Differences

CERES Flux Differences (Aqua-Terra), All-sky Net

NASA Langley Research Center / Atmospheric Sciences
Aqua - Terra Zonal Mean Clr Net Differences

CERES Flux Differences (Aqua-Terra), Clear-sky Net

NASA Langley Research Center / Atmospheric Sciences