CERES FLASHFlux Status:

Near-Real Time Surface Radiative Fluxes and Meteorology for Research and Applications

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Tonya Davenport, Lindsay Parker and the Atmospheric Science Data Center Team (SSAI)
FLASHFLUX: Schematic of Current Uses

**CERES FLASHFlux**
- SSF (Lev 2) & TISA (Lev 3) Data Products (ASDC Archive)

**Push subscription**
- **Educational Uses**
  - NASA Earth Observatory
  - CERES S’COOL

  **Local Use (DPO)**
  - **Scientific Uses**
    - CERES Calibration
    - Annual “State of Climate” Report
    - Field Campaigns
    - Mission: CloudSat and Megha-Tropiques

  **Applied Science Uses**
  - Building Energy Monitoring with RETScreen Performance Plus: NASA CASI team and general worldwide usage
  - Agricultural Crop Projections: NASA APIAS, general worldwide usage

**Processed Nightly from DPO**
- POWER Web Portal (power.larc.nasa.gov)

- RETScreen format
- DSSAT format
FLASHFlux Status

- **Continuing production with v3B (since August 2014)**
  - FLASHFlux SSF available via CERES subsetter and ASDC through 8/28
  - FLASHFlux TISA available from ASDC and specialized formats through POWER web portal (power.larc.nasa.gov) through 8/26
  - First TISA netCDF files created

- **Version 3B Validation**
  - Processed and compared to latest validation from BSRN, ARM & buoy

- **Flux Anomalies from the Evolving 2015 El Nino**
  - “State of Climate 2014 Published”
  - Differences between July 2015 and July 2013

- **Applied Science Usage: Expansion to GIS**
  - Agricultural and Energy usage showed continued growth since May (1100+ users, 400,000+ orders per, 21+ GB per month)
  - First efforts to serve CERES using GIS tools for FLASHFlux and SYN1Deg
FLASHFlux .netCDF Format (from Panoply – 8/27/15)
Recent SW Validation: 8/2014 – 7/2015

Version 3B Derived DSF (W m\(^{-2}\))

Ground Measured DSF (W m\(^{-2}\))

Daily Averaged TISA Comparison

<table>
<thead>
<tr>
<th>Ensemble Type</th>
<th>Bias (W m(^{-2}))</th>
<th>RMS (W m(^{-2}))</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Obs</td>
<td>-5.5</td>
<td>34.8</td>
<td>9327</td>
</tr>
<tr>
<td>Continental</td>
<td>-4.4</td>
<td>28.6</td>
<td>3989</td>
</tr>
<tr>
<td>Coastal</td>
<td>-2.6</td>
<td>22.8</td>
<td>2809</td>
</tr>
<tr>
<td>Desert</td>
<td>-4.3</td>
<td>20.5</td>
<td>1091</td>
</tr>
<tr>
<td>High Latitude</td>
<td>-57.8</td>
<td>104.3</td>
<td>229</td>
</tr>
<tr>
<td>Island</td>
<td>3.6</td>
<td>27.7</td>
<td>479</td>
</tr>
<tr>
<td>Buoy</td>
<td>10.2</td>
<td>35.6</td>
<td>559</td>
</tr>
</tbody>
</table>

N = 9327
Bias = -5.5 W m\(^{-2}\)
R.E. = 32.9 W m\(^{-2}\)
Version 3B Derived DLF (W m\(^{-2}\))

Ground Measured DLF (W m\(^{-2}\))

**Recent LW Validation: 8/2014 – 7/2015**

**Version 3B 201408-201507**

**Daily Averaged TISA Comparison**

<table>
<thead>
<tr>
<th>Ensemble Type</th>
<th>Bias (W m(^{-2}))</th>
<th>RMS (W m(^{-2}))</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Obs</td>
<td>-3.8</td>
<td>15.8</td>
<td>9350</td>
</tr>
<tr>
<td>Continental</td>
<td>-7.8</td>
<td>18.2</td>
<td>3814</td>
</tr>
<tr>
<td>Coastal</td>
<td>-1.6</td>
<td>12.7</td>
<td>2819</td>
</tr>
<tr>
<td>Desert</td>
<td>-4.4</td>
<td>14.4</td>
<td>1080</td>
</tr>
<tr>
<td>High Latitude</td>
<td>11.5</td>
<td>21.4</td>
<td>444</td>
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<tr>
<td>Island</td>
<td>-0.2</td>
<td>9.1</td>
<td>451</td>
</tr>
<tr>
<td>Buoy</td>
<td>4.0</td>
<td>14.0</td>
<td>560</td>
</tr>
</tbody>
</table>

N = 9350

Bias = -3.8 W m\(^{-2}\)

R.E. = 15.3 W m\(^{-2}\)

9/1/2015 CERES Science Team Meeting
CERES FLASHFlux contributed to the special annual BAMS report on the “State of the Climate in 2014”.

Issue appeared in Aug. 2015, providing estimates of changes in year to year Global Earth Radiation Budget for the first time.

These data were extended and normalized relative to the CERES EBAF 2.8 products for this report.
State of Climate 2014 Results


Global-monthly average flux anomalies

**Table 2.6.** Global-annual mean TOA radiative flux changes between 2013 and 2014, the 2014 global-annual mean radiative flux anomalies relative to their corresponding 2001–13 mean climatological values, and the 2-σ interannual variabilities of the 2001–13 global-annual mean fluxes (all units in W m⁻²) for the outgoing longwave radiation (OLR), total solar irradiance (TSI), reflected shortwave (RSW) and total net fluxes. All flux values have been rounded to the nearest 0.05 W m⁻².

<table>
<thead>
<tr>
<th></th>
<th>One year change (2014 minus 2013) (W m⁻²)</th>
<th>2014 anomaly (relative to climatology) (W m⁻²)</th>
<th>Interannual variability (2001–13) (W m⁻²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLR</td>
<td>+0.15</td>
<td>+0.15</td>
<td>±0.50</td>
</tr>
<tr>
<td>TSI</td>
<td>-0.05</td>
<td>+0.05</td>
<td>±0.20</td>
</tr>
<tr>
<td>RSW</td>
<td>-0.45</td>
<td>-0.25</td>
<td>±0.40</td>
</tr>
<tr>
<td>Net</td>
<td>+0.25</td>
<td>+0.15</td>
<td>±0.65</td>
</tr>
</tbody>
</table>

**Figure 2.34.** Time series of global-monthly mean deseasonalized anomalies (W m⁻²) of TOA Earth radiation budget for (top) OLR, (middle) absorbed shortwave (TSI–RSW), and (lower) total net (TSI–RSW–OLR) from Mar 2000 to Dec 2014. Anomalies are relative to the calendar month climatology derived for 2001–13. The time series shows the CERES EBAF Ed2.8 1Deg data (Mar 2000–Oct 2014) in red and the CERES FLASHFlux version 3B data (Nov–Dec 2014) in blue; see text for merging procedure. (Source: CERES EBAF Ed2.8 1Deg and the FLASHFlux version 3B.)
2015 Tropical Pacific Anomalies to Date (20N-20S, 120E-100W)

Timeseries of Monthly RSW (Tropical Pacific)

Timeseries of Monthly RSW (Tropical Pacific Anomalies)

WHOI OAflux
Latent & Sensible Heat fluxes + CERES FLASHFlux year-to-year difference for radiative fluxes
Total Net Differences July 2015 - 2013

TOA

FLASHFlux TOA TOTAL NET
JULY 2015

FLASHFlux TOA TOTAL NET
JULY 2015-2013

Surface

FLASHFlux SFC NET TOTAL
JULY 2015

FLASHFlux SFC NET TOTAL
JULY 2015-2013

5/5/2015
CERES Science Team Meeting
POWER makes ASCII time series data from FLASHFlux and FP-IT available for:

1) “Sustainable Building” => energy performance modeling
2) “Agroclimatology” => data format according to DSSAT crop modeling format

### Average Usage Per Month

<table>
<thead>
<tr>
<th>Type</th>
<th>Monthly Users</th>
<th>Monthly Orders</th>
<th>Monthly Data Vol (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable Buildings</td>
<td>788</td>
<td>275,600</td>
<td>5.6</td>
</tr>
<tr>
<td>Agroclimatology</td>
<td>405</td>
<td>128,600</td>
<td>15.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1192</strong></td>
<td><strong>404,200</strong></td>
<td><strong>21.3</strong></td>
</tr>
</tbody>
</table>
Enhancing Applied Science Usage with ArcGIS

**ArcGIS Capabilities**

- High quality viewing (Desktop/Mobile) and printing
- Data Extraction/Subsetting => Python code to support a variety of data formats from ASCII, to .netCDF, to geoTIF
- Simultaneous Dataset Visualization (Swiping)
- Temporal Visualization (time slider)
- Custom Color Ramps
- Pixel/Attribute Value Identification at Selected Location
- Python code to support computation of on-the-fly parameter computation

**Technologies**

- Esri ArcGIS Server & Portal
- OPeNDAP
- PostgreSQL & PostGIS

**Connectivity**

- Climate.gov
- GEOSS (AIP-8)

9/1/2015
CERES Science Team Meeting
GIS Demonstration

Add Web Mapping Service to Geospatial Software
Summary and Conclusions

- **FLASHFlux 3B**
  - Continuing production and validation for v3B; surface site and ARISE
  - Working to add TISA products to CERES subsetter
  - 2015 El Nino anomalies proving very significant

- **FLASHFlux Applications:**
  - Continued growth of usage of FLASHFlux through POWER project
  - Developing GIS tools for CERES/POWER and with ASDC

- **FLASHFlux publications:**
  - 2014 SotC reports published
  - TISA paper next (renewable energy journal?)

- **Future Versions**
  - Must adapt MOA to accept FP-IT (v2) and evaluate use of aerosol
  - Will coordinate with Clouds and Inversion teams to adapt to Ed 4
  - Begin work on NPP SSF production system as new modules arrive
FLASHFlux Web Sites:

http://flashflux.larc.nasa.gov