CERES FLASHFlux Status: Progress toward Version 4A and New GIS-enabled Web Site

Low Latency Surface Radiative Fluxes and Meteorological Parameters for Research and Applications

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Jason Barnett, Booz-Allen-Hamilton

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

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

**Scientific Uses**
- CERES WGs
- Annual “State of Climate” Report
- Field Campaigns
- Mission: CloudSat and Megha-Tropiques

**Applied Science Uses**
- Building Energy Monitoring with RETScreen Expert: for NASA center buildings and general worldwide usage
- Agricultural Crop Projections: NASA.APIAS, ICASA general worldwide usage

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

**Push subscription**
- Local Use (DPO)
- ASDC Order As Needed

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

**9/26/2017**
CERES Science Team Meeting
FLASHFlux v3C Status

• **Production with v3C (MODIS C5/C6) (since Jan 1, 2017)**
  – Now uses FP-IT (GEOS 5.12.4) and MODIS Collection 6 (after March 28)
  – FLASHFlux TISA available via CERES subsetter, ASDC and specialized formats through POWER web portal (power.larc.nasa.gov) 5-6 days latency
  – Plan to continue production for 2017 while production adapted to MODIS C6.1

• **Current Activities**
  – V3B v V3C and MODIS Coll. 5/6 differences evaluated
  – Validation for V3B, V3C-MC5, V3C-MC6
  – Development towards V4A => V4A through FLASHflux SSF being tested (uses MC6); adapt to MODIS Collection 6.1

• **FLASHFlux Data Provision Through POWER:**
  – New POWER web portal in beta and nearly ready for release
  – Leverages OPeNDAP with both direct API and GIS-based Data Access Viewer
  – Multiple output formats supported => parameters aimed to specific usages
**FLASHFlux Versions**

- **V3B (GEOS 5.9.1, MC5)**
- **12/1/16**
- **1/1/17**
- **3/29/17**
  - (started 8/1/14)

- **V3C (MC5, GEOS 5.12.4)**
- **V3C (MC6, GEOS 5.12.4)**
- **12/31/2017** – requires MODIS through 1/2/18

- **V4A (CERES Ed 4, MC6.1, GMAO 5.12.4)**
- **12/1/17**
- **1/1/18**

MC = MODIS Collection 5/6/6.1
GEOS = FP-IT version
Current v3C Production System

Using FP-IT (GEOS 5.12.4)

FLASHFlux Processing Stream

MODIS Collection 6

Legend:
- MOA (SS1)
- Clouds (SS2)
- Instantaneous Fluxes (SS3)
- Time and Space gridding (SS4)
- Time and Space averaging (SS5)
Recent SW Validation: 1/2017–7/2017

**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>
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<tr>
<td>All Obs</td>
<td>0.9</td>
<td>34.2</td>
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<td>-5.8</td>
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<td>High Latitude</td>
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<td>57.4</td>
<td>179</td>
</tr>
<tr>
<td>Island</td>
<td>1.1</td>
<td>22.4</td>
<td>349</td>
</tr>
<tr>
<td>Buoy</td>
<td>13.6</td>
<td>43.9</td>
<td>1857</td>
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Version 3C
201701-201707

All site ensemble

Bias = 1.9 W m$^{-2}$
RMS = 34.2 W m$^{-2}$

\[ \hat{N} = 5541 \]

Daily Averaged TISA Comparison

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Recent SW Validation: 1/2017 – 7/2017

SURFACE SW Down Bias

9/26/2017
CERES Science Team Meeting
Recent LW Validation: 1/2017 – 7/2017

Version 3C
201701-201707

All site ensemble

N = 5541
Bias = -4.5 W m\(^{-2}\)
RMS = 14.8 W m\(^{-2}\)

Daily Averaged TISA Comparison

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<tr>
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<td>16.6</td>
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</tr>
</tbody>
</table>
Recent LW Validation: 1/2017 – 7/2017

SURFACE LW Down Bias

9/26/2017
CERES Science Team Meeting
Multi-Version Difference Time Series: SW

FLASHFlux - Ground Measured DSF (Wm\(^{-2}\))

- **SGP**
  - Mean = 160.1 Wm\(^{-2}\)
  - Bias = -1.1 Wm\(^{-2}\)
  - RMS = 16.4 Wm\(^{-2}\)

- **FPK**
  - Mean = 137.2 Wm\(^{-2}\)
  - Bias = -9.7 Wm\(^{-2}\)
  - RMS = 21.6 Wm\(^{-2}\)

- **KWA**
  - Mean = 234.9 Wm\(^{-2}\)
  - Bias = 0.2 Wm\(^{-2}\)
  - RMS = 22.0 Wm\(^{-2}\)

- **TAM**
  - Mean = 240.1 Wm\(^{-2}\)
  - Bias = 6.4 Wm\(^{-2}\)
  - RMS = 24.9 Wm\(^{-2}\)
Multi-Version Difference Time Series: LW

**SGP**
- Mean = 309.8 Wm$^{-2}$
- Bias = -7.9 Wm$^{-2}$
- RMS = 12.2 Wm$^{-2}$

**FPK**
- Mean = 266.5 Wm$^{-2}$
- Bias = -3.1 Wm$^{-2}$
- RMS = 11.4 Wm$^{-2}$

**KWA**
- Mean = 422.6 Wm$^{-2}$
- Bias = 3.1 Wm$^{-2}$
- RMS = 10.7 Wm$^{-2}$

**TAM**
- Mean = 324.6 Wm$^{-2}$
- Bias = -3.9 Wm$^{-2}$
- RMS = 11.6 Wm$^{-2}$
Near Future: Moving FLASHFlux Toward V4

<table>
<thead>
<tr>
<th>Attribute</th>
<th>FF v3C (MC6)</th>
<th>FF v4A</th>
<th>FF v4B</th>
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<tbody>
<tr>
<td>Baseline 1QC</td>
<td>Previous</td>
<td>New calibration</td>
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<tr>
<td>GEOS FP-IT input</td>
<td>GEOS 5.12.4</td>
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<tr>
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<td>Ed 4 compatible</td>
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<tr>
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<td>Collection 6</td>
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<tr>
<td>Clouds</td>
<td>Ed 2</td>
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<tr>
<td>SIBi (Snow/ICE Brightness Index)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Inversion (improved ADMs)</td>
<td>Ed 2</td>
<td>Ed 4</td>
<td>Ed 4</td>
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<td>Aerosols</td>
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<td>MATCH climatology</td>
<td>GEOS 5.12.4</td>
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<tr>
<td>Flux Algorithms</td>
<td>Unchanged</td>
<td>Unchanged</td>
<td>A0, Ap adjustments; new clear-sky TOA &amp; surface albedos (current work)</td>
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<tr>
<td>TISA</td>
<td>Ed 2</td>
<td>Compatible w/ Ed 4 (current work)</td>
<td>Compatible w/ Ed 4 (custom CERES TSI?)</td>
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<tr>
<td>Data Processed</td>
<td>March 28 - present</td>
<td>Planned to begin 12/1/17</td>
<td>None</td>
</tr>
<tr>
<td>Validation Results</td>
<td>1/1/17 – 7/31/17</td>
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</tr>
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</table>
POWER Applied Science project aims to make NASA data more accessible

New POWER Website serves as a platform for discovery of multiple data access points

POWER web site now in beta: power.larc.nasa.gov/new
Main Data Accessibility Options

Multiple Data Access Options

The POWER Data Access Options are currently in BETA. All content, capabilities and data may not be fully available. If you have any questions or would like to be part of our beta testing team please do not hesitate to Contact Us.

Data Access Viewer  
Responsive web mapping application providing coordinate and parameter selections in an easy-to-use interface. Analyze your request with dynamic plotting capabilities and expanding output options such as ASCII, CSV, JSON, NetCDF, ICASA and GEOTIFF based on the community, spatial and temporal average selected.

Web Data Access Service  
Access the POWER data holdings through your own custom script or application by using the Data Access Web Processing Service. This service provides a JSON return with links for downloading data in multiple other outputs based on the community, spatial and temporal average selected.
Graphical Data Access
- \( \frac{1}{2} \times \frac{1}{2} \) deg; within 5-7 days of obs
- multiple parameters from FLASHFlux, GMAO, etc. available
- parameters arranged by application community (i.e., renewable energy, buildings, agroclimatology)
- Multiple data output formats

Three Applications:
- Time series at a single point (daily, monthly, 30 year)
- Regional times series (limited area)
- Global climatology (30 year)
POWER: Data Access Viewer

Single Point Time series

1. Select community
2. Select daily, monthly or climatology
3. Select location
4. Select time period
5. Select output format
6. Select parameter
Complete instructions to setup URL based data access (API using OPeNDAP)

Provide immediate access to the data parameters and time periods required

Returned file formatted for general software (Excel, GRaDs, MatLab) or customized script/coding for Decision Support Tools (RETScreen, HOMER)
Summary and Conclusions

• **FLASHFlux 3C and 4A progress**
  – Continued producing v3C (MODIS C6); evaluation
  – Developing v4A compatible with CERES Ed 4; will move to MODIS Collection 6.1
  – Evaluating changes to SW MODEL B

• **FLASHFlux Applications:**
  – New web site featuring GIS tools for CERES/FF/POWER and with ASDC to raise discoverability and accessibility in beta form and scheduled for release by Dec 1

• **FLASHFlux publications:**
  – 2016 SotC report published
  – Future papers: FLASHFlux TISA applications including energy

• **Future Versions**
  – Developing v4A by migrating CERES Ed 4 Clouds (collection 6.1) and Inversion; must adapt current FF TISA => target Jan ‘18
  – Longer-term Upgrades (Spring ‘18): Refine SW Model B, Assess & adapt CERES TSI to FLASHFlux TISA, Assess FPIT aerosol assimilation
FLASHFlux Web Sites:

https://flashflux.larc.nasa.gov

https://power.nasa.gov &
https://power.nasa.gov/new (in Beta)