CERES FLASHFlux Status:

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

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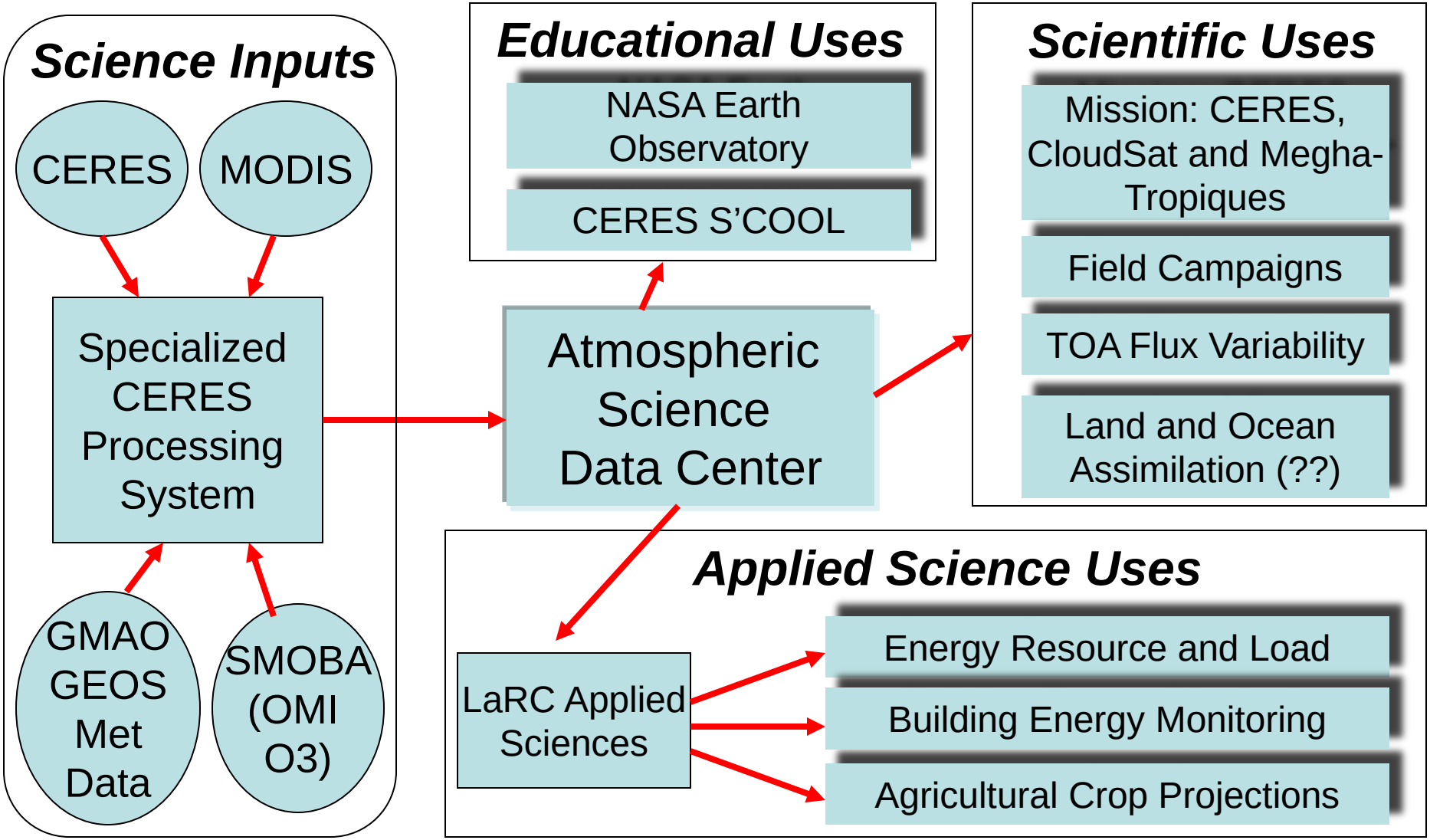
FLASHFlux Overview

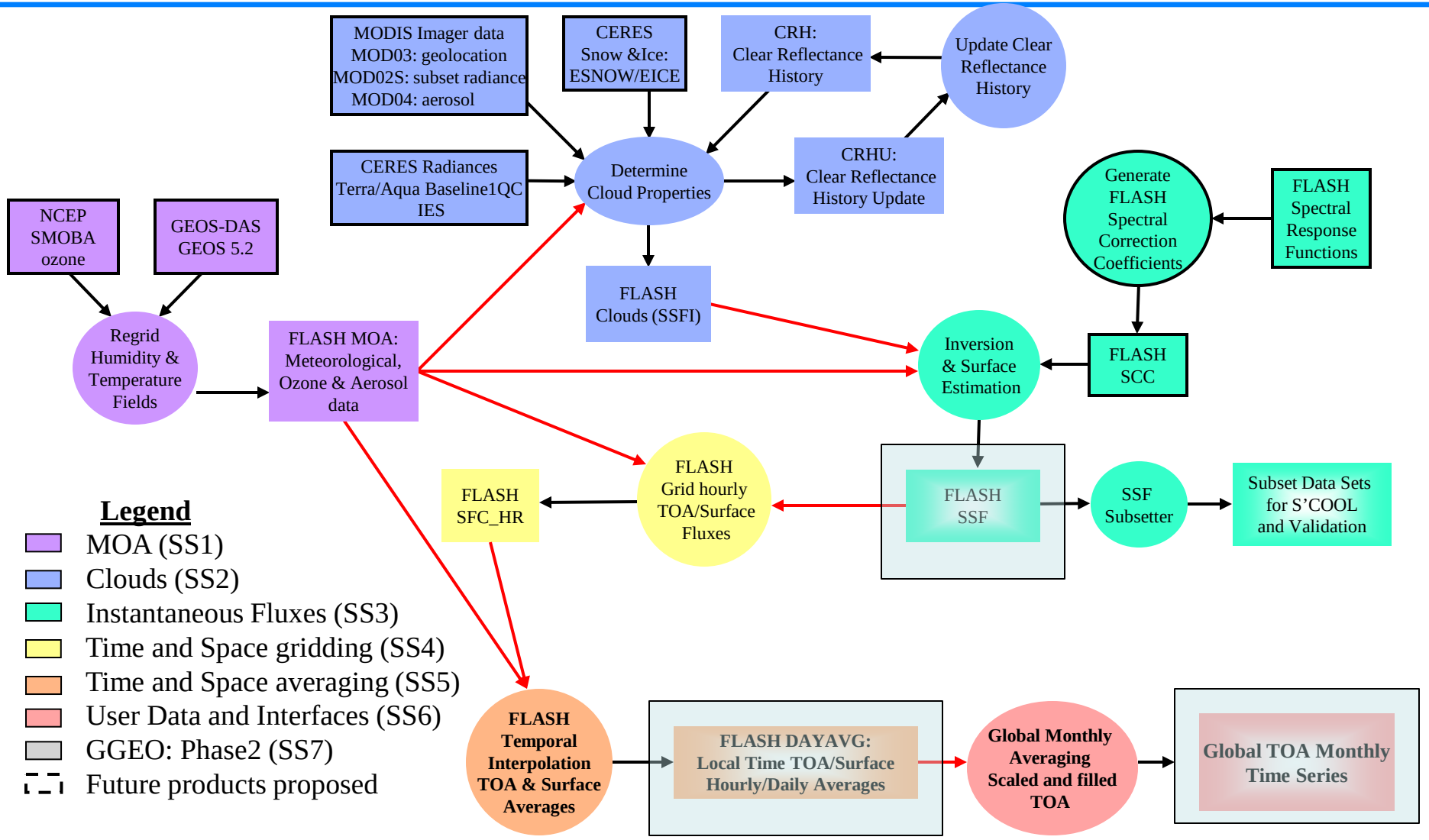
- ***FLASHFLUX = Fast Longwave And SHortwave Radiative Fluxes from CERES and MODIS***

- ***FLASHFlux Objectives***
  - Compute radiative fluxes from CERES and MODIS observations from both Terra and Aqua within one week of measurement (currently available within 4 days)
  - Global gridded and time averaged radiative flux and meteorological data sets using both Terra and Aqua when available (currently available within 6 days)
  - Conduct scientific investigations and provide for scientific and applied science uses
  - Demonstrate processing system pushing data products to research and applications uses

FLASHFLUX: Schematic Mapping to Realized and Potential Uses



FLASHFlux Data Flow (v2G)



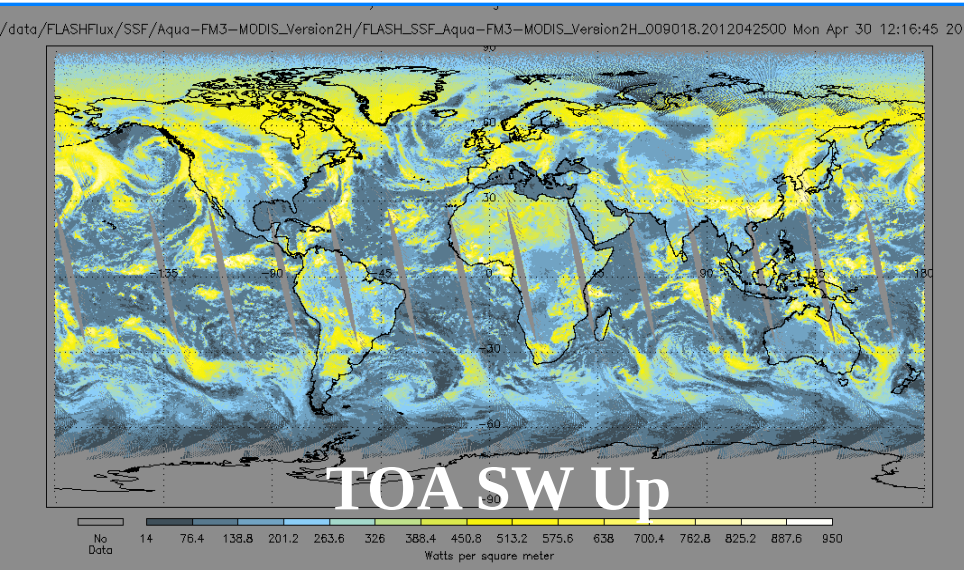
FLASHFlux SSF Data Products

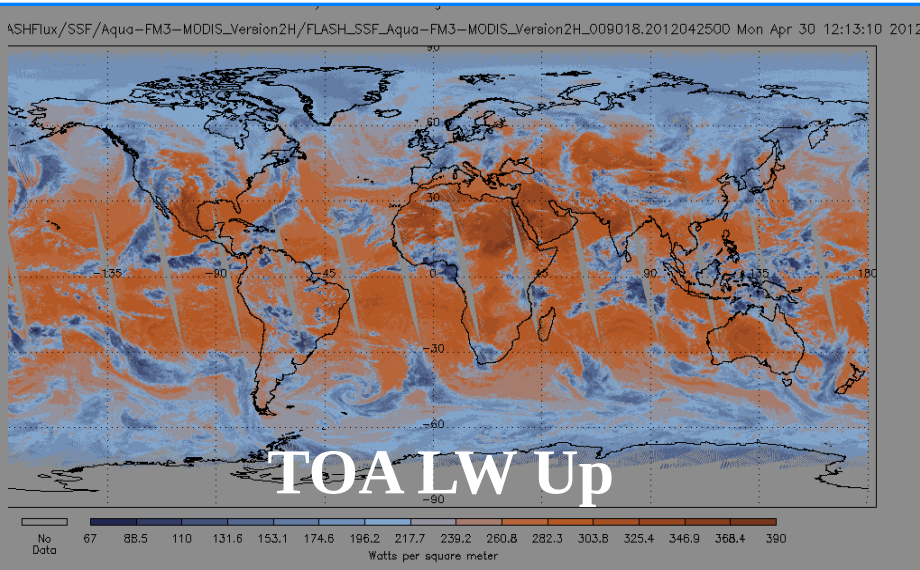
CERES-like Single Scanner Footprint (SSF)
(Terra and Aqua overpasses; 30 km nadir;
Processed through near 4/25/2012)

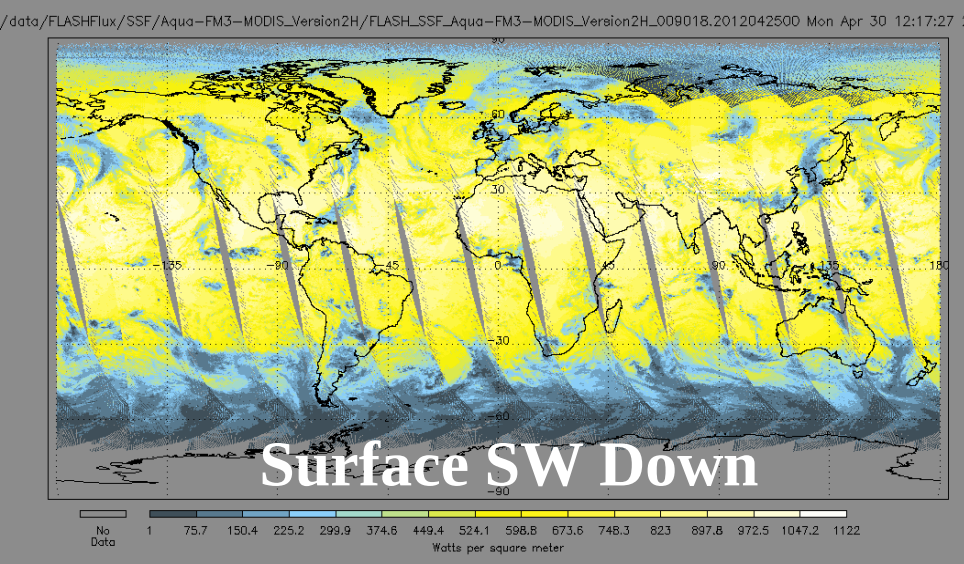
Single Scanner Footprint TOA/Surface Fluxes and Clouds (SSF): One hour of instantaneous FLASHFlux data for a single scanner instrument.				
Select Parameters: Cloud Properties, TOA Fluxes, Surface (Radiative) Fluxes, Unfiltered Radiances, Filtered Radiances, OLR, Surface Types.				
Spacecraft	**Data Set Name** (Select name to order)	**Temporal Coverage (Hourly)**	**Documentation**	**Sample Software**
Aqua	FLASH_SSF_Aqua-FM3-MODIS_Version2G	Jan 1, 2009 - Dec 31, 2011	Data Quality Summary FLASH SSF Version2 | CERES SSF Data Products Catalog R4V1 (PDF)	Readme R4-555 | Read Package R4-555 (C).
	FLASH_SSF_Aqua-FM3-MODIS_Version2H	Jan 1, 2012 - current		
Terra	FLASH_SSF_Terra-FM1-MODIS_Version2G	Jan 1, 2009 - Dec 31, 2011		
	FLASH_SSF_Terra-FM1-MODIS_Version2H	Jan 1, 2012 - Current		

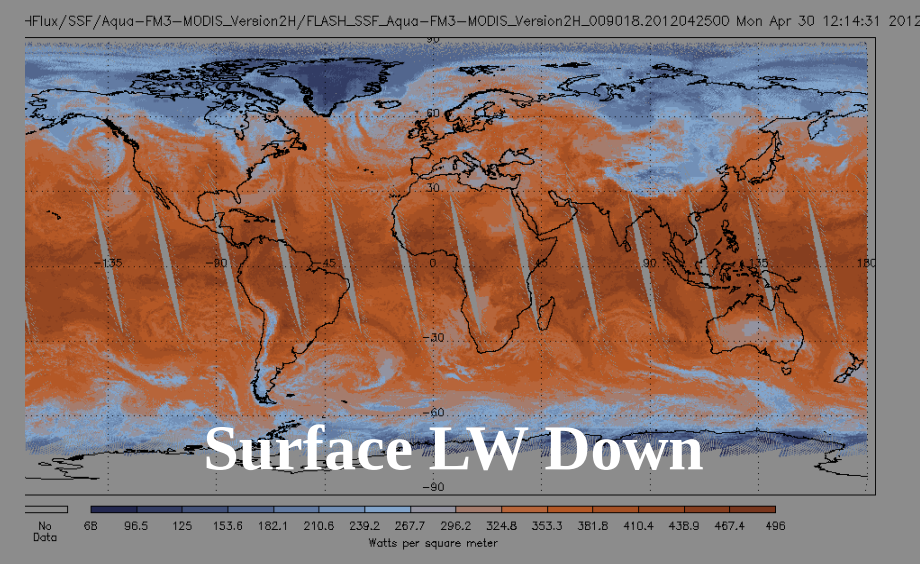
Difference between 2G and 2H is the transition from the old the SGI Warlock to AMI-P (gained 1 day end to end in production)

Overpass Footprint Resolution Products (Aqua Daytime Composite, Apr 25, 2012).



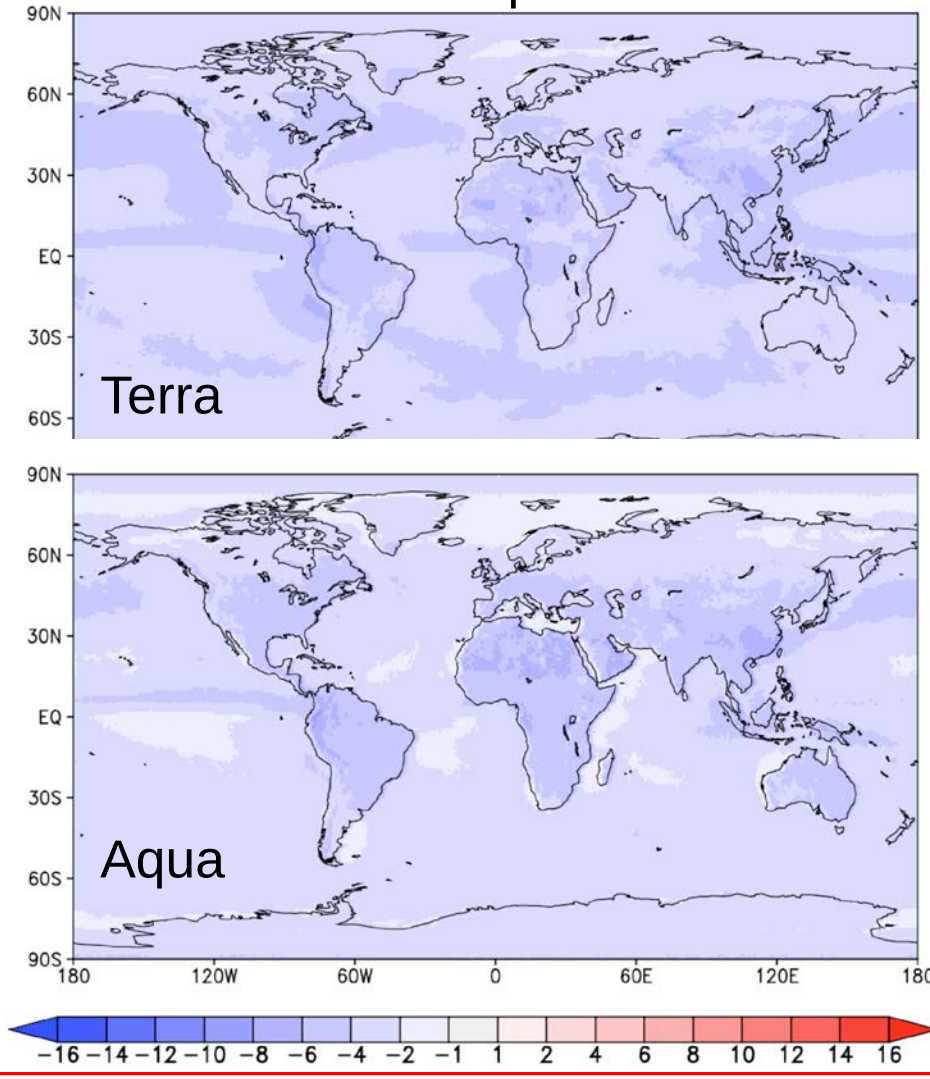




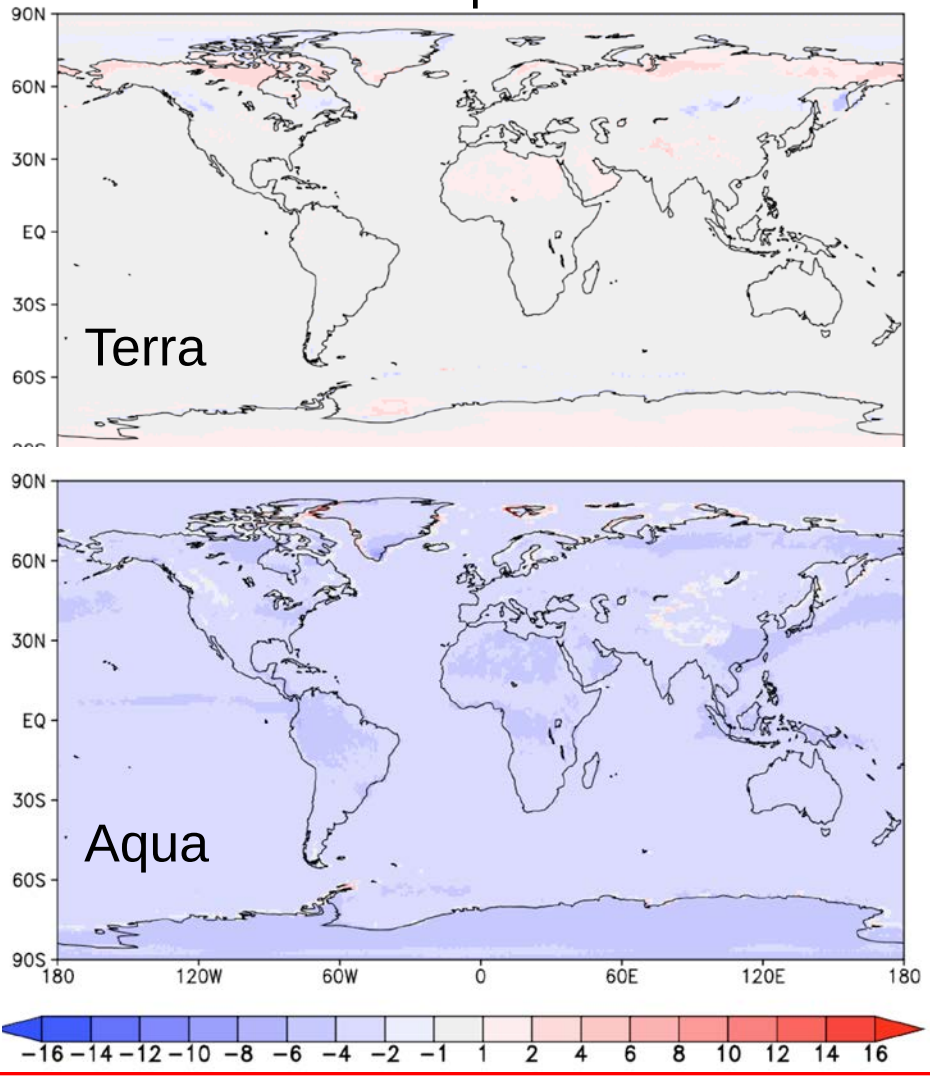


FLASHFlux SSF Validation:
TOA FF 2G – CERES Ed 3

TOA LW Up Difference

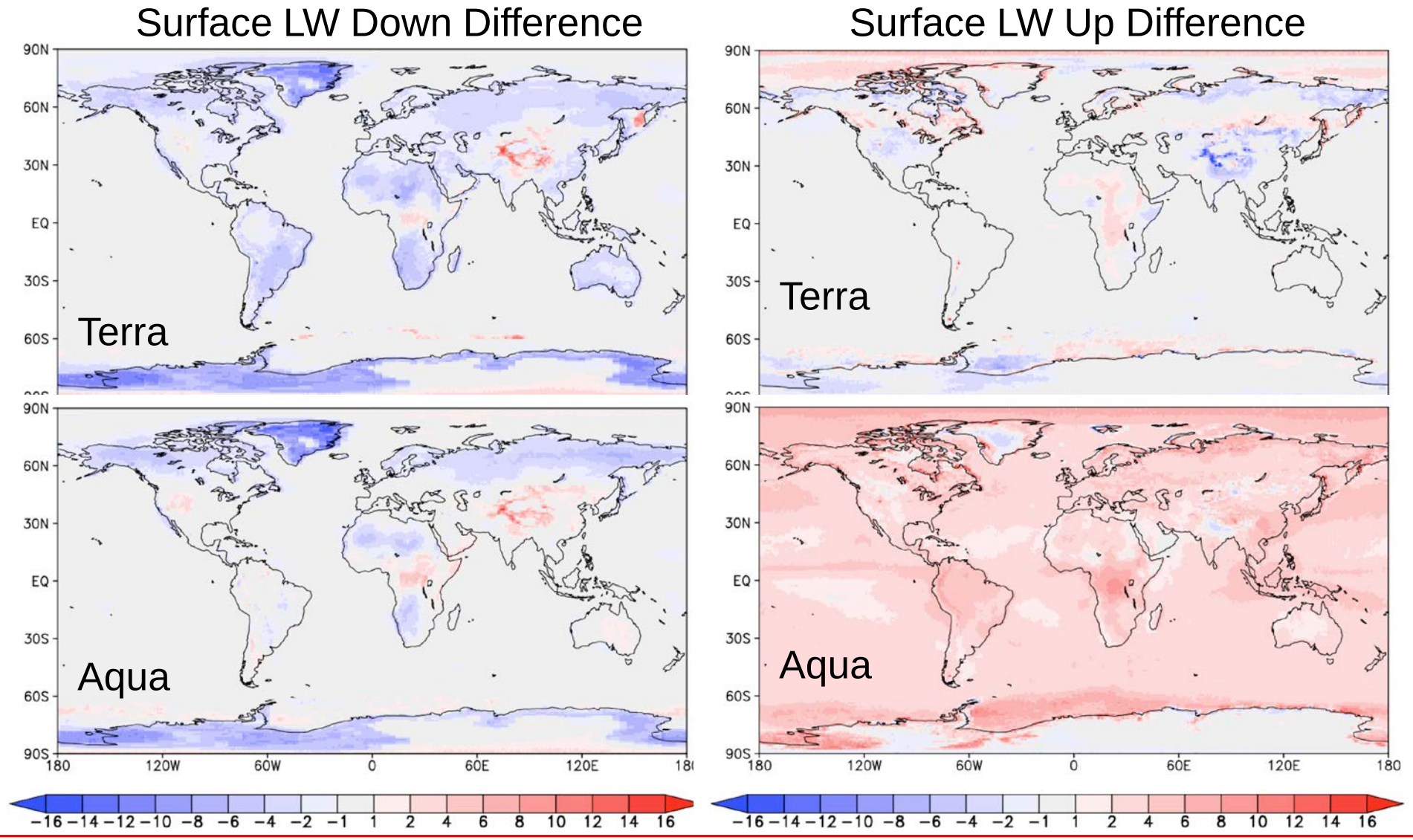


TOA SW Up Difference



Kratz *et al.*, 2012

FLASHFlux SSF Validation:
Surface FF 2G – CERES Ed 3

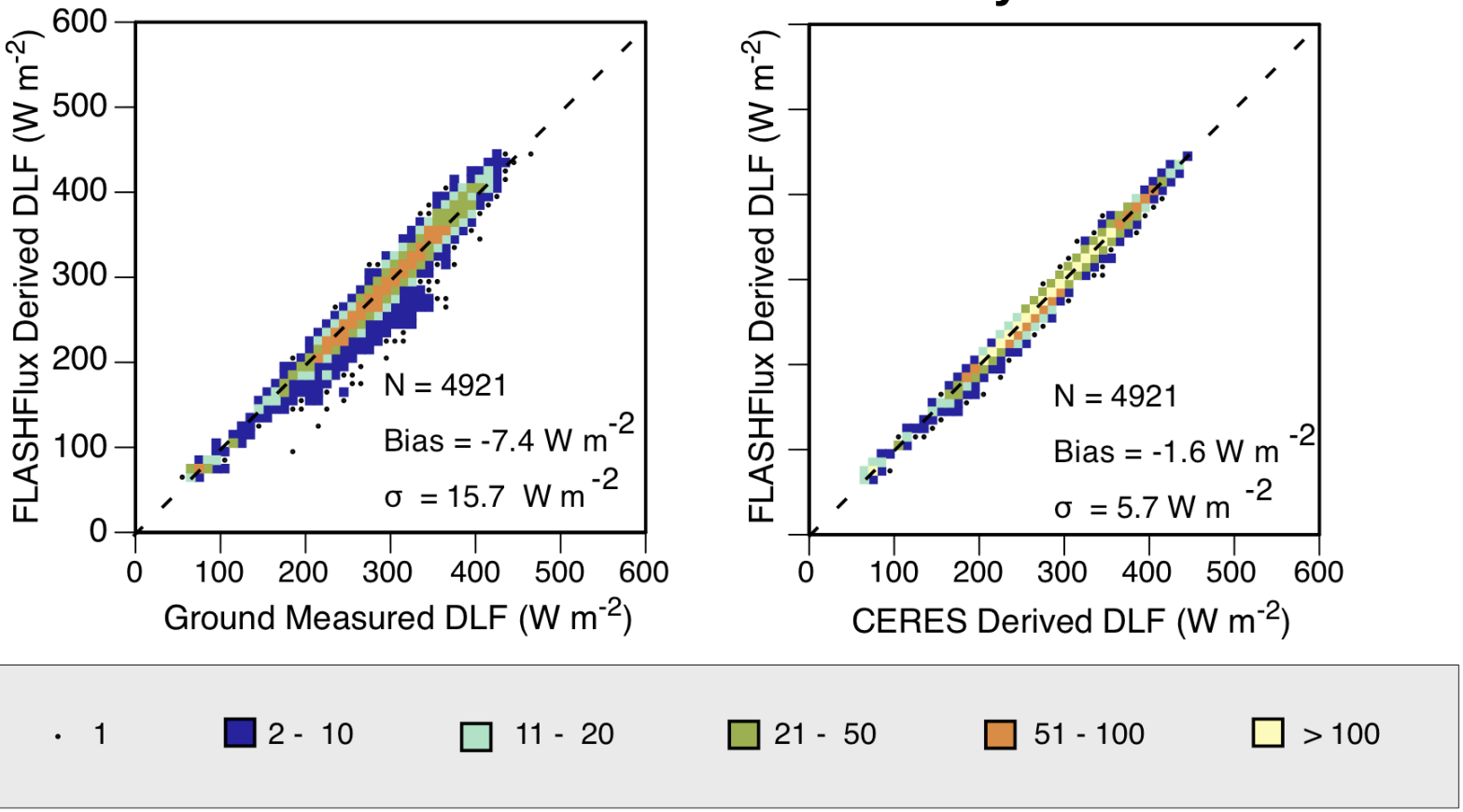


Kratz *et al.*, 2012

FLASHFlux SSF Validation

Overpass validation against BSRN (including SURFRAD and ARM measurements) from Jan 2009 - Dec 2010

Surface LW Down Clear-sky



Kratz *et al.*, 2012

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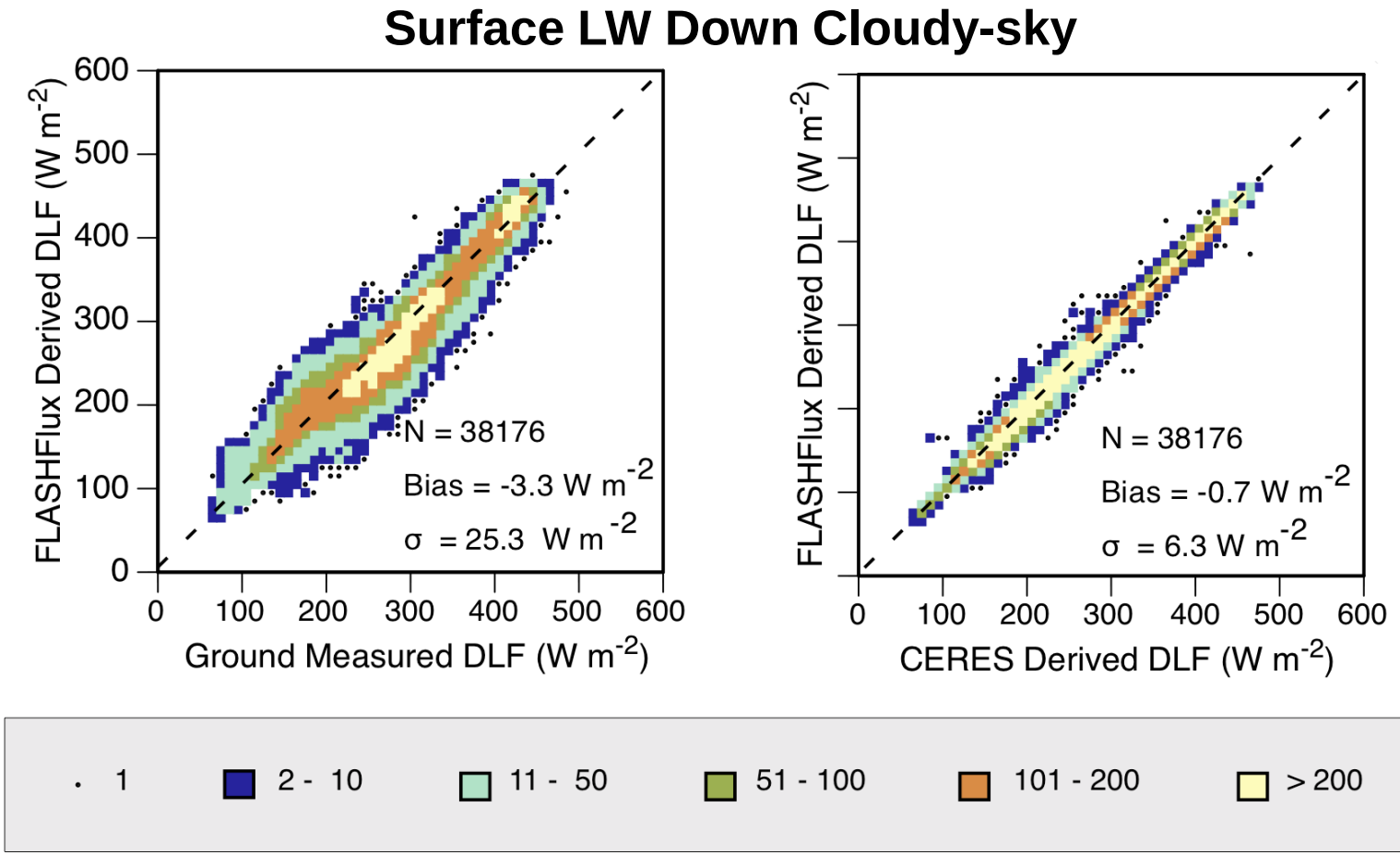
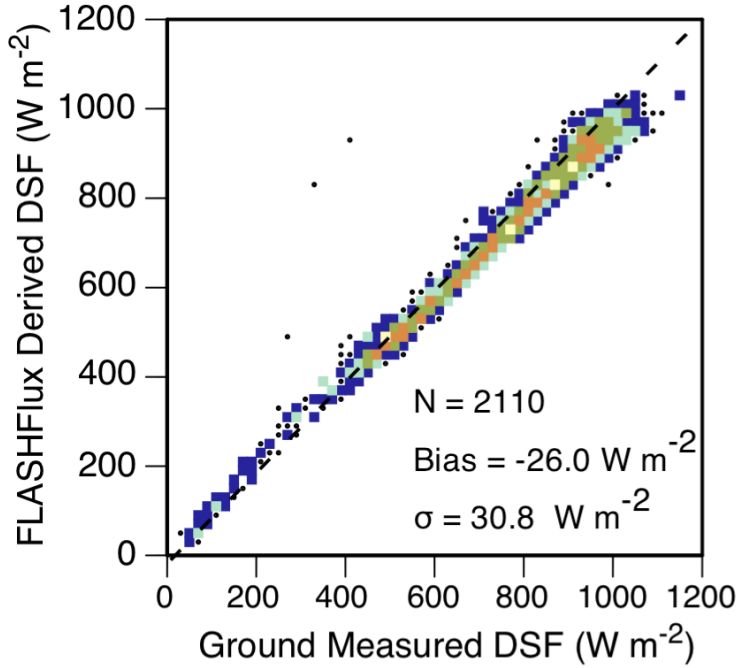


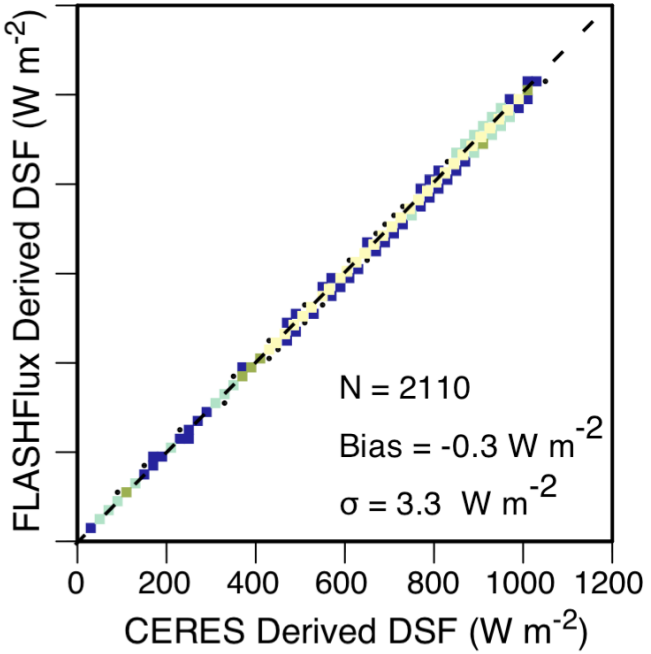
Kratz *et al.*, 2012

FLASHFlux SSF Validation

Overpass validation against BSRN (including SURFRAD and ARM measurements) from Jan 2009 - Dec 2010

Surface SW Down Clear-sky



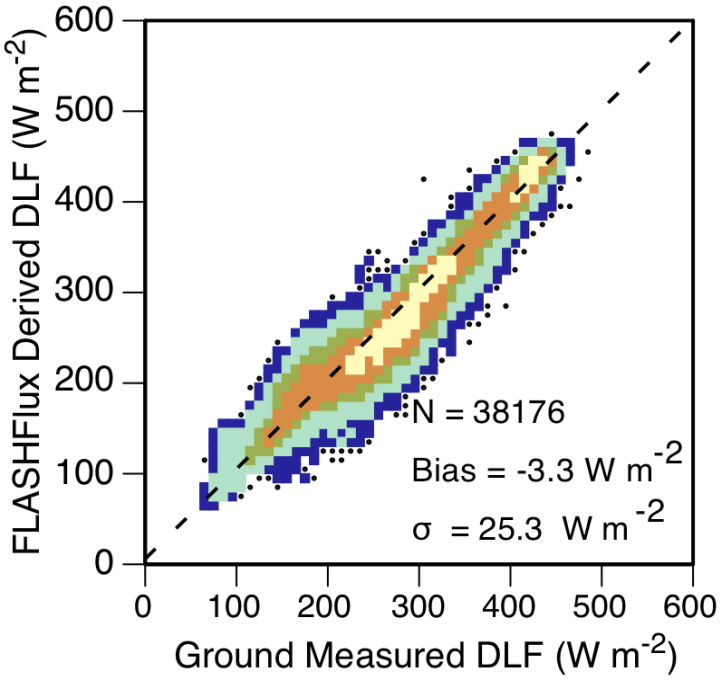


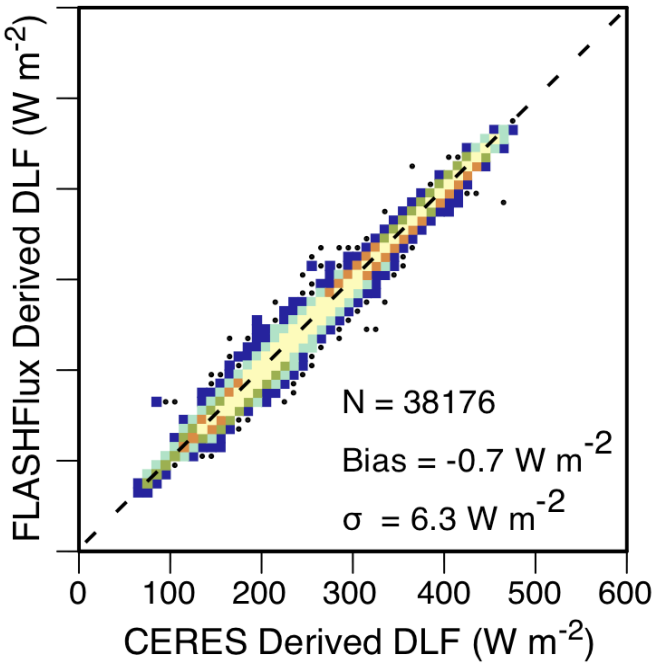
Kratz *et al.*, 2012

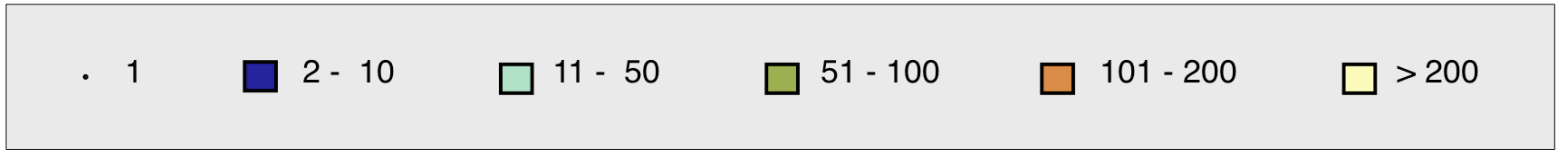
FLASHFlux SSF Validation

Overpass validation against BSRN (including SURFRAD and ARM measurements) from Jan 2009 - Dec 2010

Surface SW Down Cloudy-sky







Kratz *et al.*, 2012

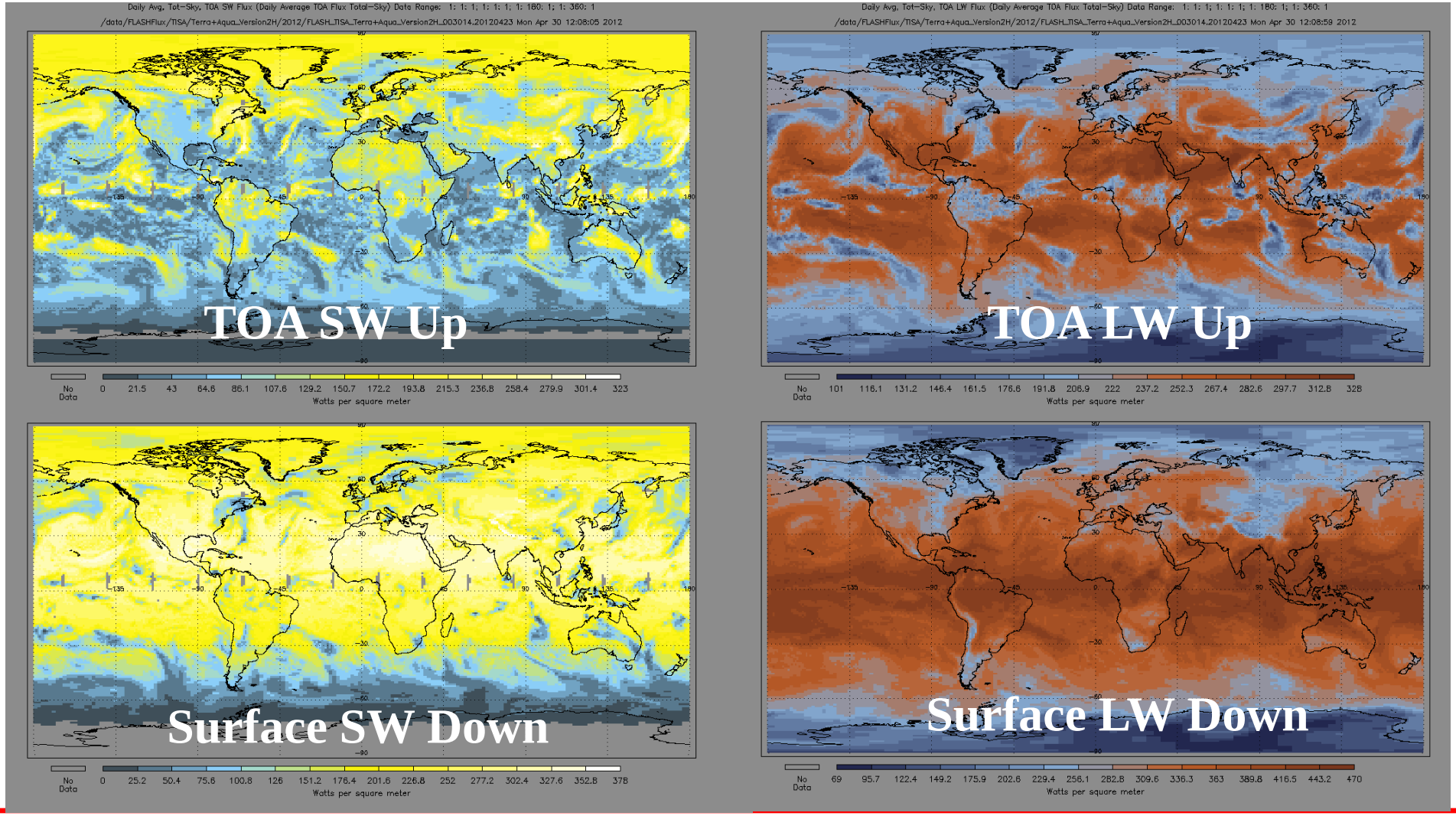
FLASHFlux Data Products

FLASHFlux Gridded and Temporally Averaged Data Products (Terra+Aqua; Hourly/Daily; 1ºx1º resolution; Processed through about 4/23/2012)

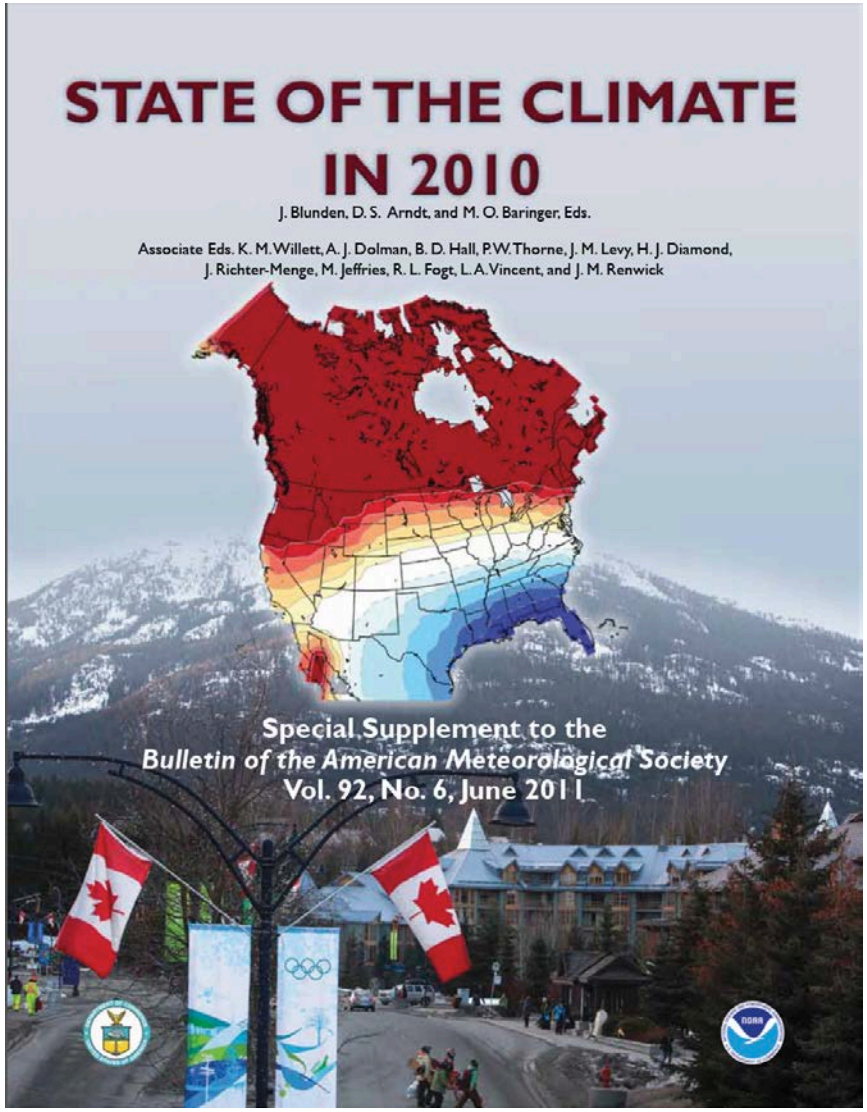
Daily Gridded Single Satellite TOA and Surfaces/Clouds data in HDF (TISA): One day of averaged FLASHFlux data for available scanner instruments.				
Select Parameters: Cloud Properties, TOA Fluxes, Surface (Radiative) Fluxes, OLR, Surface Types. (Complete Parameter List)				
Spacecraft	**Data Set Name** (Select name to order)	**Temporal Coverage (Daily)**	**Documentation**	**Sample Software**
Terra + Aqua	FLASH_TISA_Terra+Aqua_Version2G	Jan 1, 2009 - Dec 31, 2011	Data Quality Summary FLASH TISA Version2	Readme R1V1 | Read Package R1V1 (C).
	FLASH_TISA_Terra+Aqua_Version2H	Jan 1, 2012 - current		

FLASHFlux Gridded and Temporally Averaged Data Products (Apr. 23, 2012)

(Terra+Aqua; Daily; 1ºx1º resolution)



Global Averaged TOA Flux Estimates



- ***CERES FLASHFlux contributed to the special annual BAMS report on the "State of the Climate in 2010".***
- ***Issue appeared in Aug. 2011, providing estimates of changes in year to year Global Earth Radiation Budget for the first time.***
- ***These data have now been extended and used longer overlap with CERES EBAF products.***

State of the Climate 2011

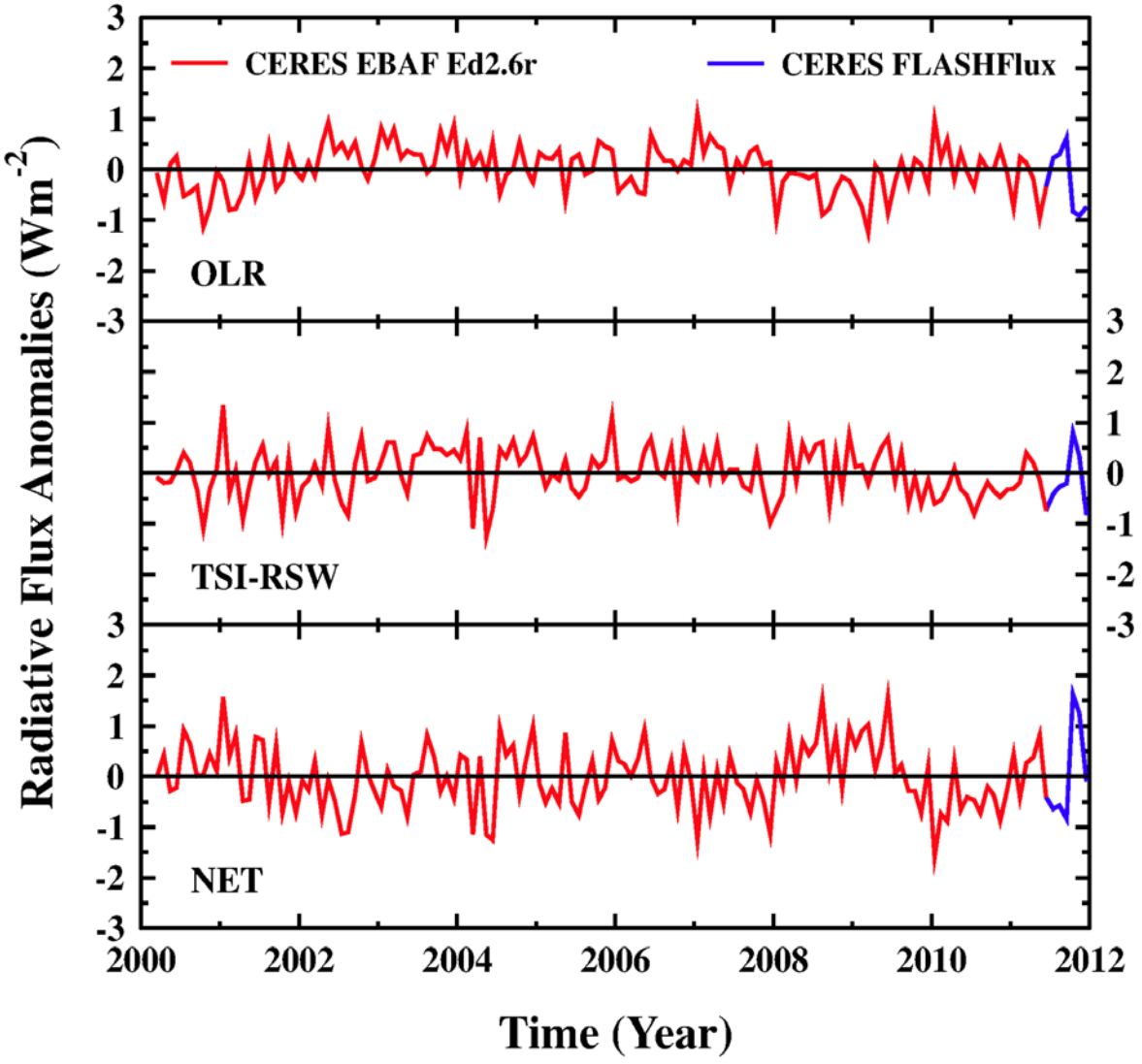
CERES FLASHFlux TOA flux variability for 2011 for BAMS "State of the Climate" report:

- FF monthly average annual global TOA normalized to EBAF from 3/2007 to 2/2011
- 2 σ monthly uncertainty (W m^{-2}) = +/- 0.2/0.1/0.15 for OLR/RSW/Total net
- TSI from SORCE instrument
- Global annual average anomalies:

	One year change (2011 minus 2010)	2011 anomaly (relative to climatology)	Inter-annual variability (2001 to 2011)
OLR	–0.45	–0.30	±0.55
TSI	+0.05	+0.05	±0.20
RSW	–0.20	+0.15	±0.40
Net	+0.70	+0.20	±0.65

State of the Climate 2011

- Time series show relatively large fluctuation
- AIRS OLR shows consistent variability
- Variability is consistent with NAO phase change



Monitoring and Targeting Case: NASA LaRC Badge and Pass Office

SOUTHERN ENERGY MANAGEMENT
ENERGY EFFICIENCY & SOLAR POWER

Badge and Pass Office Solar Energy Project

ESG ENERGY SYSTEMS GROUP

- Overview
- Current Status
- Weather Conditions

Installed in September 2010, this 39.5 KW ground-mounted solar energy system and will produce around 50,000 kilowatt-hours of electricity each year. The system consists of 168 photovoltaic modules mounted in two arrays located behind the Badge and Pass Office. This project demonstrates the performance of solar energy and the benefit of renewable energy being in our overall energy strategy.

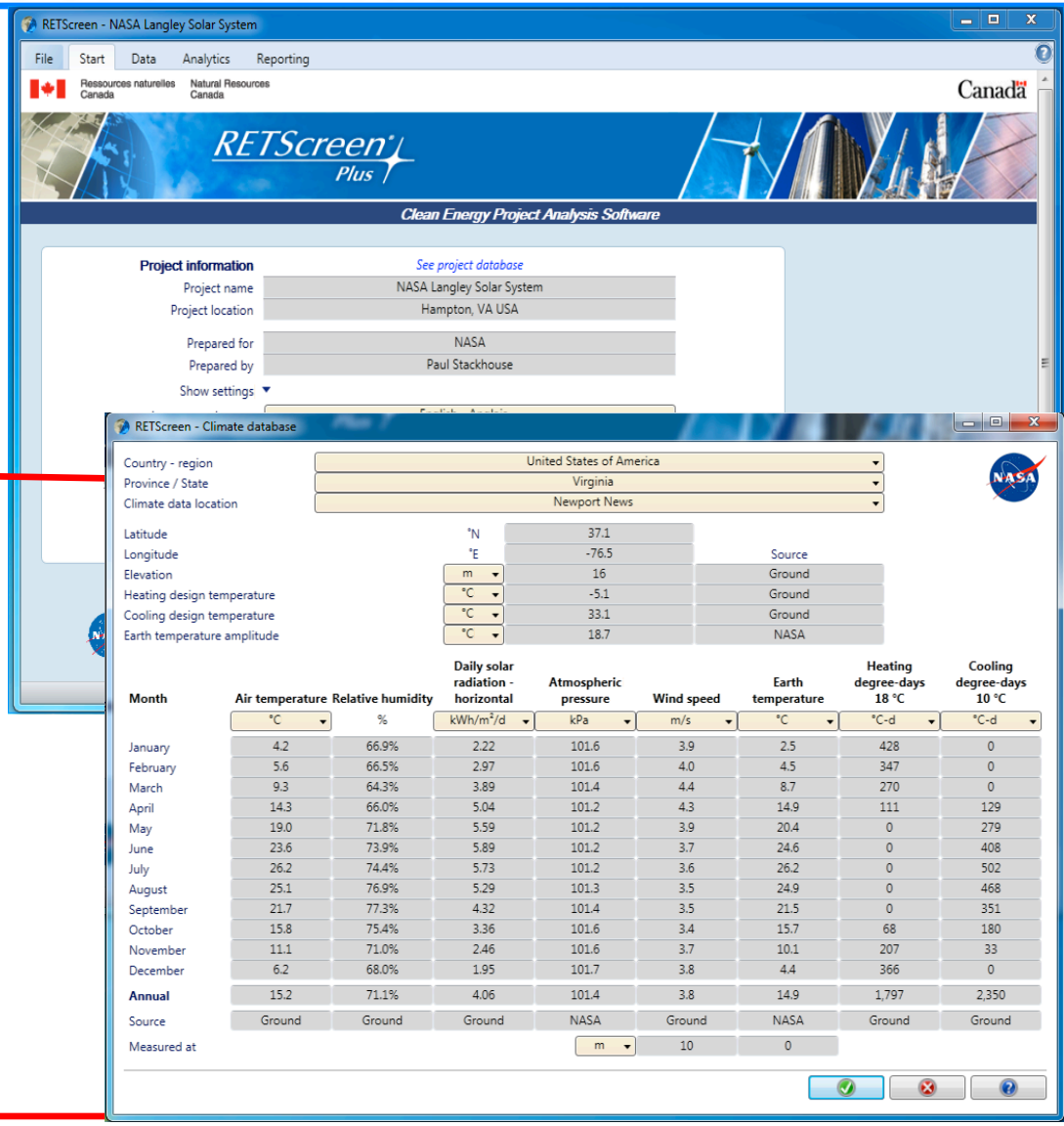
Energy Today	Energy Yesterday	Lifetime Energy
193 kWh	206 kWh	38,035 kWh
Total energy generated by the system today	Total energy generated by the system yesterday	Total energy generated by the system since installation

Energy Monitoring with RETScreen Plus

Objective: Enable "users to monitor, analyze and report key energy performance data to facility operators, managers and senior decision-makers."

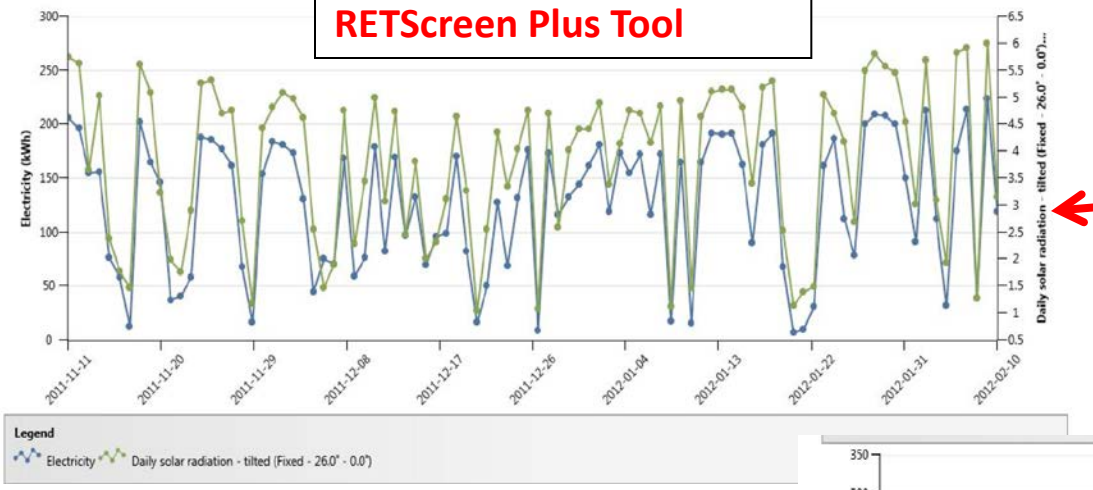
Usage:

1. Determine & obtain building energy and meteorological information for any location in world
2. Use multivariate analysis to determine system performance as a function of meteorological variability
3. Monitoring building energy performance for system changes, target higher efficiency and reporting verification



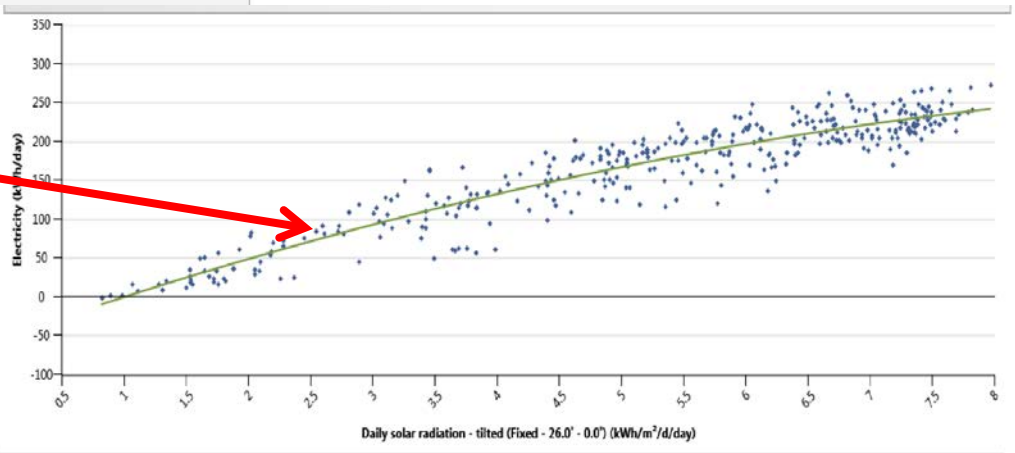
Monitoring and Targeting Case 1: NASA LaRC Badge and Pass Office

RETScreen Plus Tool

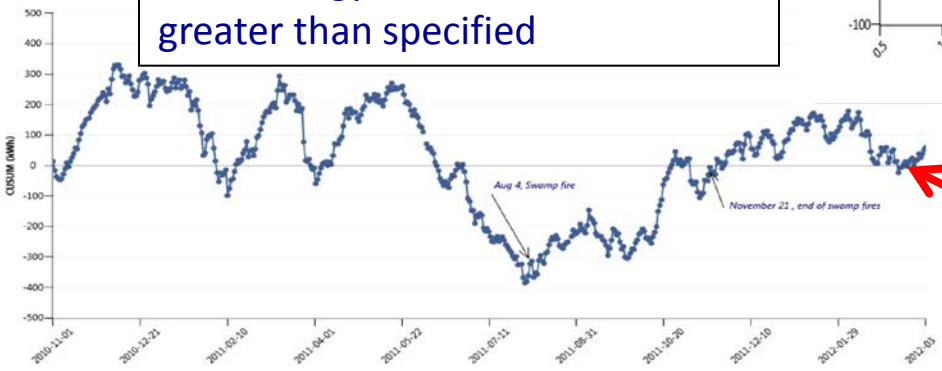


Step 1: LaRC based CERES FLASHFlux project surface solar flux (blue) vs. Solar Panel Electrical Output (green) gives excellent correlation.

Step 2: Regression relationship defines the system as a function of available solar energy



Total Energy = 59,000 kWhr, 18% greater than specified



Step 3: Cumulative differences in output relative to system function shows noise but performance steady.

Current Upgrades for FF v3a

- ***Deliver SCC consistent with CERES Ed 3***
- ***Prepare for new operational reanalysis from GMAO:***
  - GEOS 5.7.2 now operational; split into two streams
  - FP1: Resolution 0.25^{o} lat x 0.3125^{o} lon, new levels
    - Changed more frequently
  - FP2: Resolution 0.5^{o} lat x 0.625^{o} (or 2/3^{o}) lon
    - Changed by user community consent
    - Will be back processed through 2000 (will include AIRS and soon NPP)
- ***Deliver new algorithm changes:***
  - CERES Ed 4 upgrades to the models
    - SW: Rayleigh scattering revision and MATCH aerosols
    - LW: high surface temperature and inversion corrections
  - Ozone from GEOS
- ***Data product subsetting => CERES and ASDC***

Future Upgrades and Challenges

- ***Continued refinement of algorithms:***
  - SW: Cloudy-sky transmission formula
- ***Improve near-real time albedos and aerosols***
  - MATCH too late; another strategy needed
- ***Adapt to MODIS Collection 6***
- ***Deliver and test GEO version of CERES TISA to:***
  - Estimate all-sky/clear-sky TOA and Surface fluxes
  - Provide monthly averaged maps
- ***Improve consistency between CERES algorithms and FLASHFlux (TISA/SYN)***
- ***Develop new products and subsets => parameterizations for the applications like solar industry***

Summary and Conclusions

- ***FLASHFlux Operational and …***
  - Producing global TOA/surface cloud products and radiative fluxes within 1 week after Terra/Aqua overpass
    - SSF products for both Terra and Aqua now used by CloudSat, CERES Science Team, Megha-Tropiques and S'COOL
    - TISA products providing 1^{o}x1^{o} global hourly/daily fluxes for Terra+Aqua data shown accurate for scientific analysis (e.g., TOA Global averages), energy (load forecasting & building monitoring) and agricultural use (e.g. crop modeling).
  - Has large potential for considerably more usage in both science (i.e., data analysis and assimilation) and applied sciences (energy, agriculture and other applications)
- ***FLASHFlux Is Working Towards …***
  - Delivering new improvements in SCC, inputs and algorithms
  - Increasing data accessibility with subsetting
  - Surface flux anomalies by increasing consistency with CERES algorithms; new data products and parameters.

FLASHFlux Web Sites:

http://flashflux.larc.nasa.gov

http://eosweb.larc.nasa.gov/PRODOCS/flashflux/table_flashflux.html

Extras