



Fast Longwave and Shortwave Radiative Flux (FLASHFlux) From CERES and MODIS Measurements

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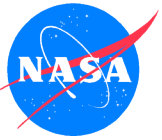
And the Atmospheric Science Data Center Team (SSAI)

Special Acknowledgement: Tristan L'Ecuyer (CloudSat, CSU)



FLASHFlux Talk Overview

- ***Objectives***
- ***Processing and Data Products***
- ***Data Product Validation***
 - Surface measurements
 - CloudSat observations
- ***Scientific and Applied Science Uses***
 - Examples:
 - 2007 Arctic Summer Anomalies
 - Faulty Surface Measurements
 - Future Uses
- ***Future Plans***
- ***Summary and Conclusions***

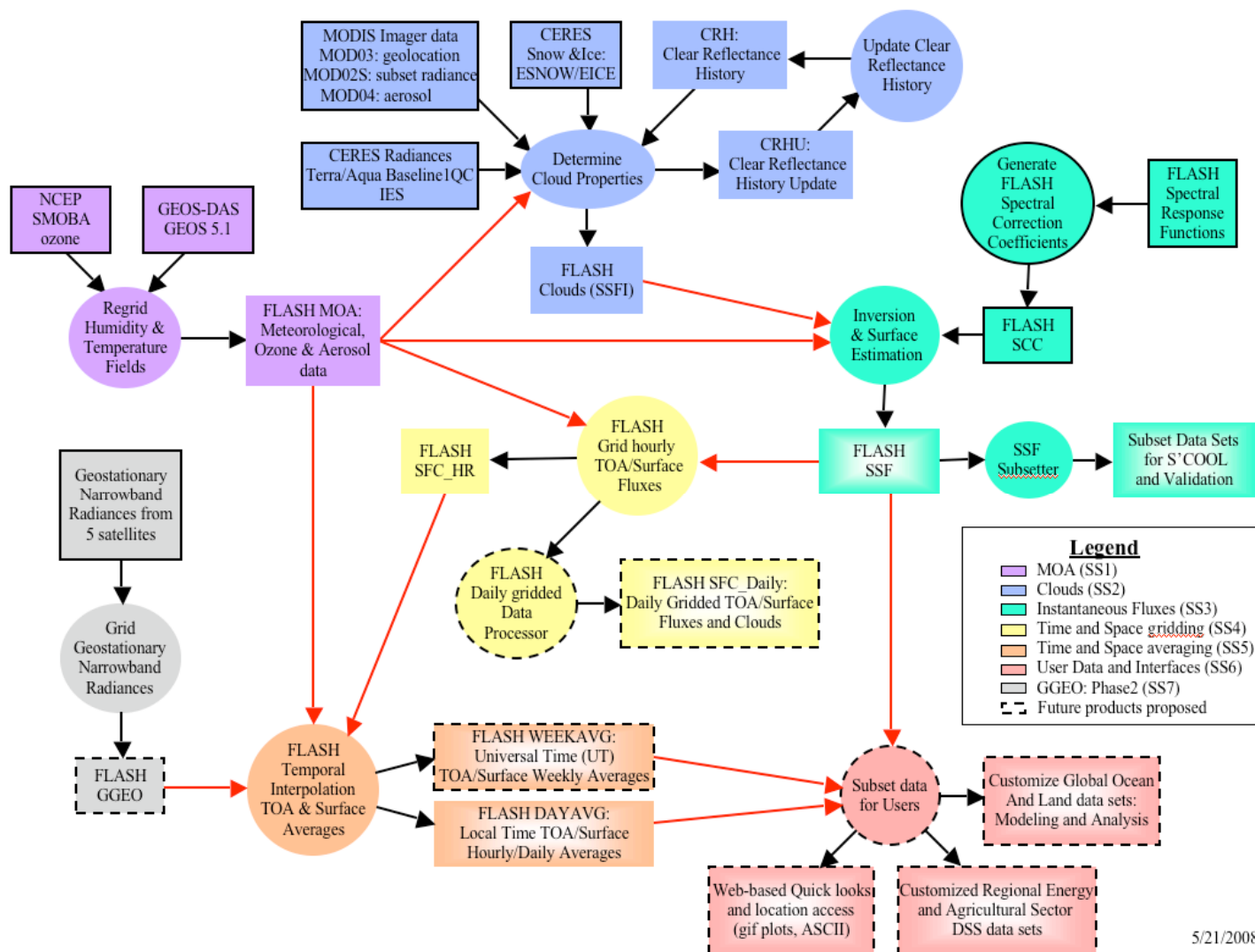


FLASHFLUX Overview

- ***Fast Longwave And Shortwave Radiative Fluxes from CERES and MODIS => FLASHFLUX***
- ***FLASHFlux Objectives***
 - Compute radiative fluxes from CERES and MODIS observations from both Terra and Aqua within one week of measurement (currently available within 5 days)
 - Global gridded and time averaged radiative flux and meteorological data sets using both Terra and Aqua when available (currently available within 7 days)
 - Conduct scientific investigations and provide for scientific and applied science uses
 - Demonstrate processing system adaptable to NPP and beyond pushing data products to research and applications uses



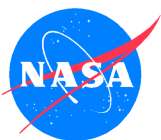
FLASHFlux Data Flow



5/21/2008



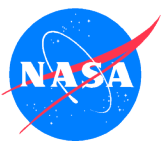
7/16/2008



FLASHFlux SSF Data Products

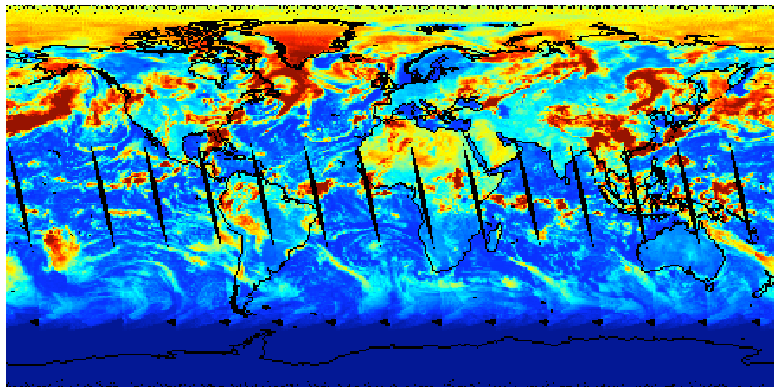
CERES-like Single Scanner Footprint (SSF) (Terra and Aqua overpasses; 30 km nadir)

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 Version2D	Nov 30, 2007 - current	Data Quality Summary FLASH SSF Version2 CERES SSF Data Products Catalog R4V1	Readme Read Package (C)	
	FLASH SSF Aqua-FM3-MODIS Version2C	Sep 30, 2007 - Dec 2007			
	FLASH SSF Aqua-FM3-MODIS Version2B	Mar 31, 2007 - Oct 8, 2007			
	FLASH SSF Aqua-FM3-MODIS Version2A	Dec 31, 2006 - Apr 30, 2007			
	FLASH SSF Aqua-FM3-MODIS Version1B	Apr 15, 2006 - May 2, 2007	Data Quality Summary FLASH SSF Version1 CERES SSF Data Products Catalog R4V1		
Terra	FLASH SSF Terra-FM1-MODIS Version2D	Nov 30, 2007 - Current	Data Quality Summary FLASH SSF Version2 CERES SSF Data Products Catalog R4V1		Readme Read Package (C)
	FLASH SSF Terra-FM1-MODIS Version2C	Sep 30, 2007 - Dec 2008			
	FLASH SSF Terra-FM1-MODIS Version2B	Mar 31, 2007 - Oct 8, 2007			
	FLASH SSF Terra-FM1-MODIS Version2A	Dec 31, 2006 - Apr 30, 2007			
	FLASH SSF Terra-FM1-MODIS Version1C	Jul 1, 2006 - May 2, 2007	Data Quality Summary FLASH SSF Version1 CERES SSF Data Products Catalog R3V4		
	FLASH SSF Terra-FM1-MODIS Version1B	5/01/2006 - 7/20/2006			
	FLASH SSF Terra-FM1-MODIS Version1A	3/01/2006 - 4/30/2006			

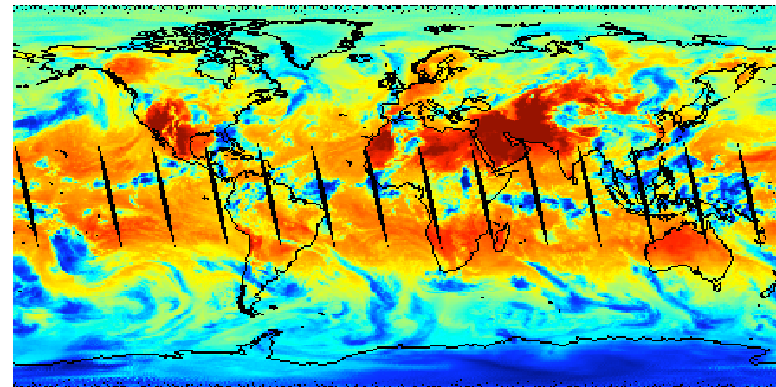


Overpass Footprint Resolution Products (Daily Composite)

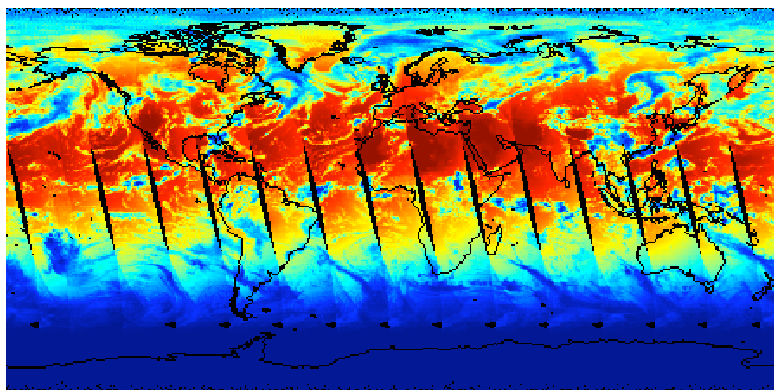
TOA SW Up



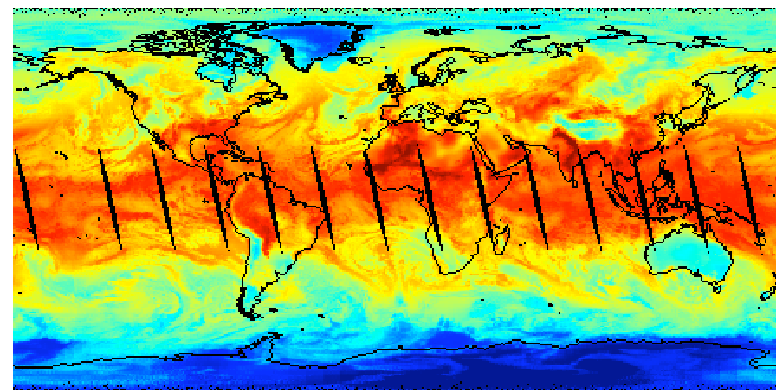
TOA LW Up

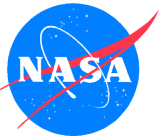


Surface SW Down



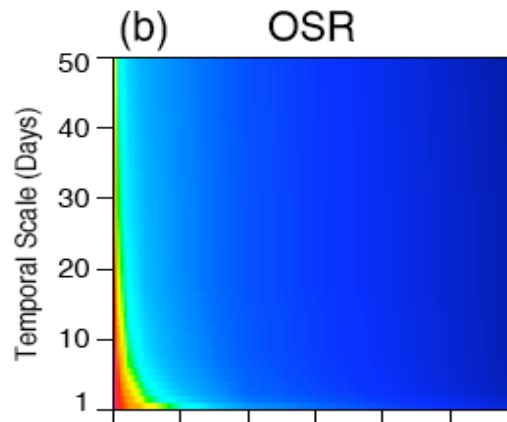
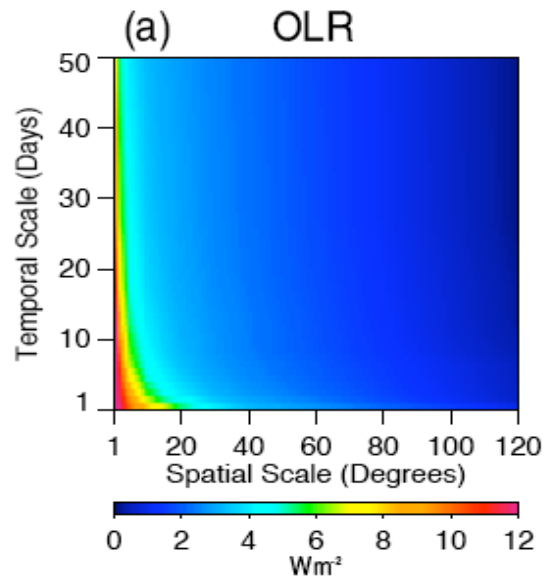
Surface LW Down





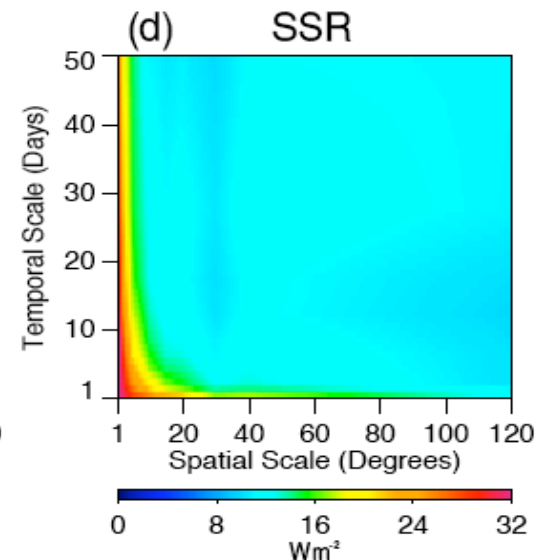
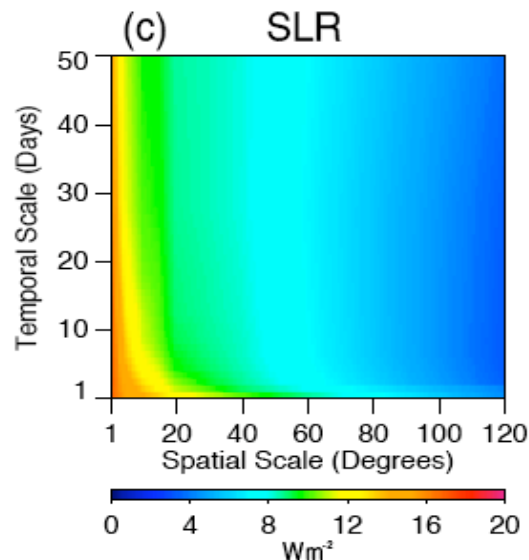
FLASHFlux SSF Validation

CloudSat Fluxes vs. FLASHFlux (L'Ecuyer et al., 2008)



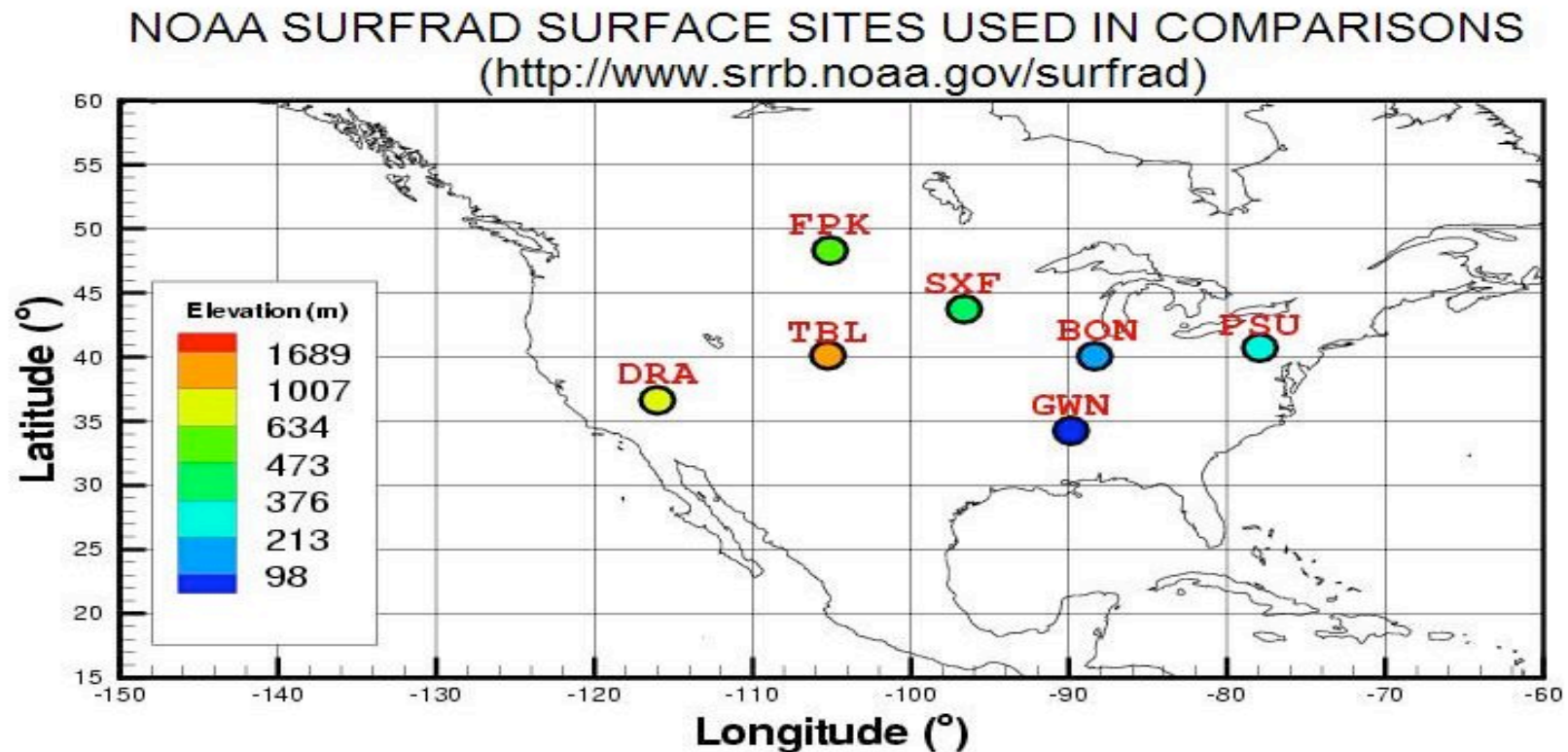
**Outgoing LW (a)
and SW (b) RMS
Flux differences**

**Surface LW (c)
and SW (d) RMS
Fluxes differences**





FLASHFlux: Validation Sites

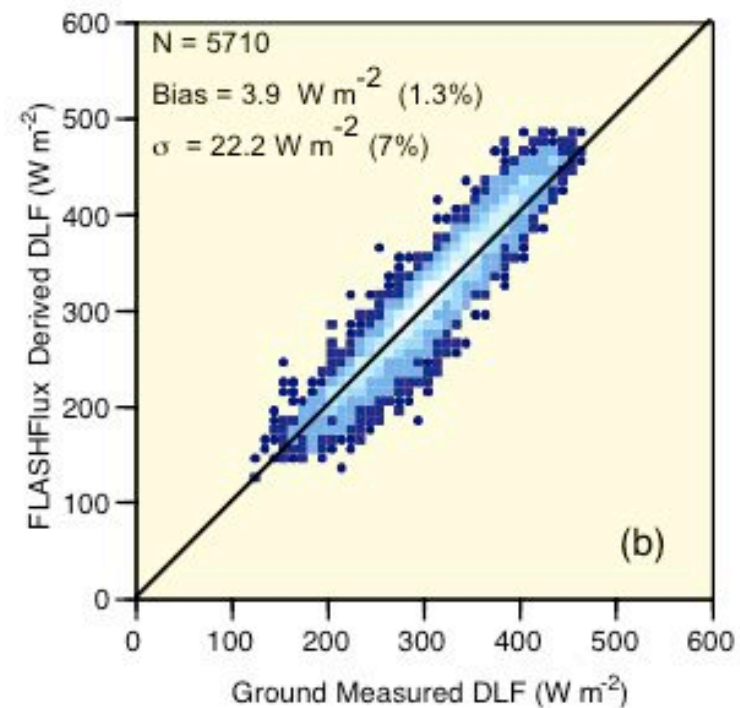
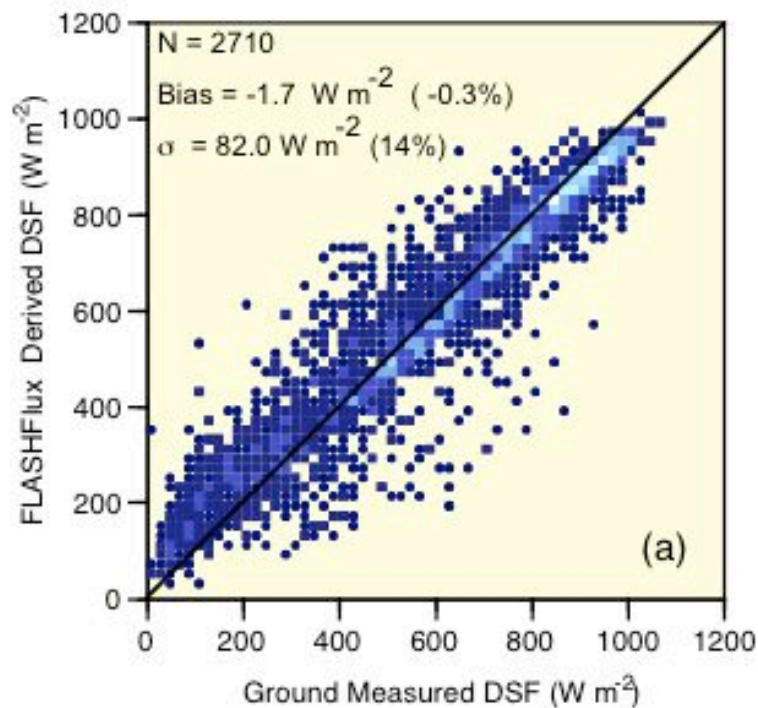


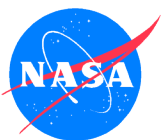
FPX – Fort Peck, MT; SXF – Sioux Falls, SD; BON – Bondville, IL;
DRA – Desert Rock, NV; TBL – Table Mountain, CO;
PSU – Penn State, PA; GWN – Goodwin Creek, MS



FLASHFlux SSF Validation

Instantaneous validation against SURFRAD





FLASHFlux Data Products

FLASHFlux Gridded and Temporally Averaged Data Products (Terra+Aqua; Hourly/Daily; 1°x1° resolution)

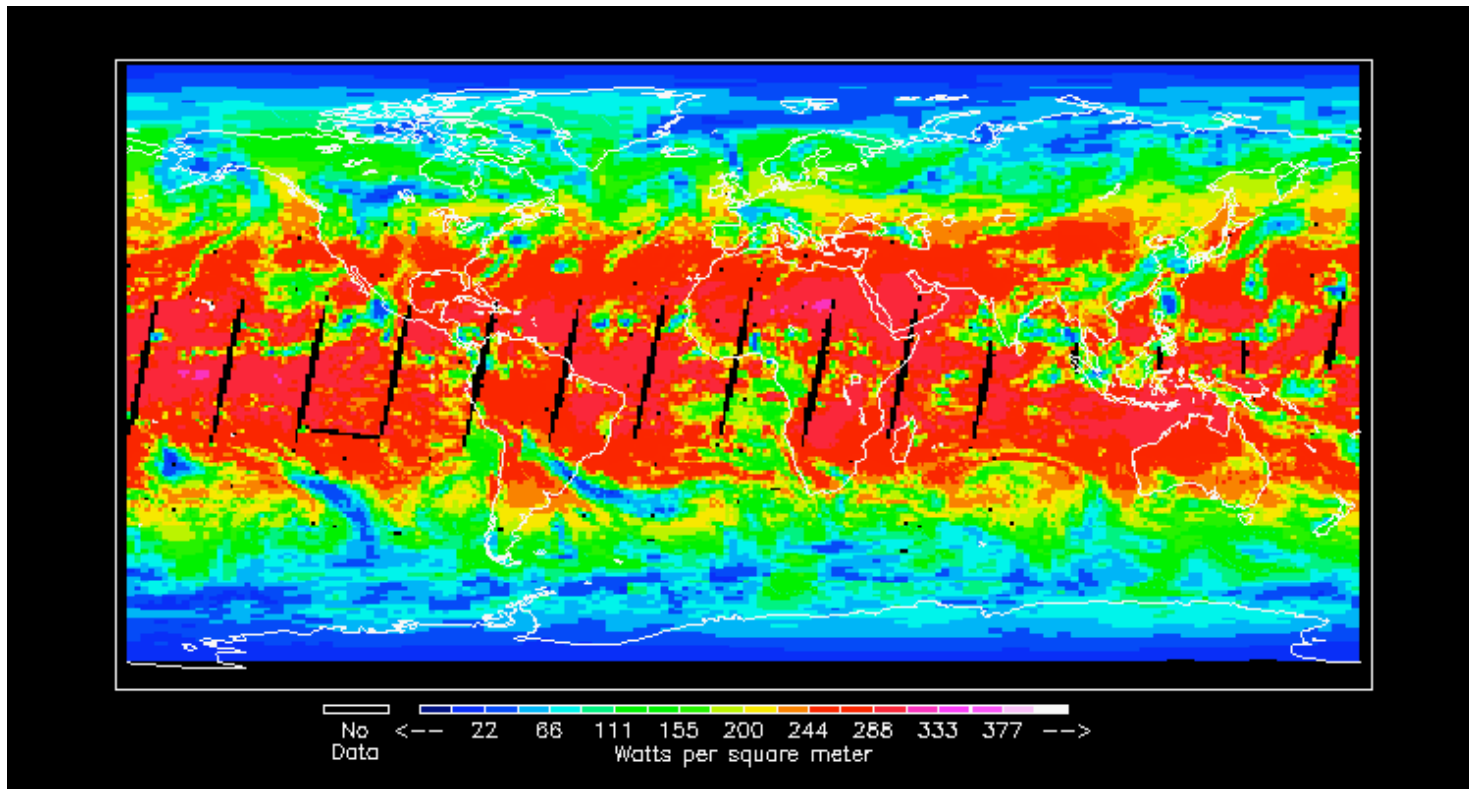
Daily Gridded Single Satellite TOA and Surfaces/Clouds data in HDF (TISA): One day of averaged FLASHFlux data for available scanner instruments.				
Select Parameters: Cloud Properties, TOA Fluxes, Surface (Radiative) Fluxes, OLR, Surface Types. (Complete Parameter List) Note: Beta data products are NOT regarded as publishable and will not be maintained in the archives.				
Spacecraft	Data Set Name (Select name to order)	Temporal Coverage (Daily)	Documentation	Sample Software
Terra + Aqua	FLASH TISA Terra+Aqua Version2D	Dec 1, 2007 - current	Data Quality Summary FLASH TISA Version2	Readme Read Package (C) .
	FLASH TISA Terra+Aqua Beta6	Oct 1, 2007 - Dec 2007	not available	
	FLASH TISA Terra+Aqua Beta5	Apr 1, 2007 - Oct 6, 2007		
	FLASH TISA Terra+Aqua Beta4	Jan 1, 2007 - Apr 29, 2007		
	FLASH TISA Terra+Aqua Beta3	Jul 1, 2006 - Apr 30, 2007		



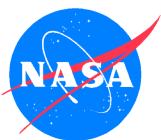
Time & Space Averaged Products

*FLASHFlux: Global TOA and Surface Fluxes within
1 week of observation from Terra and Aqua*

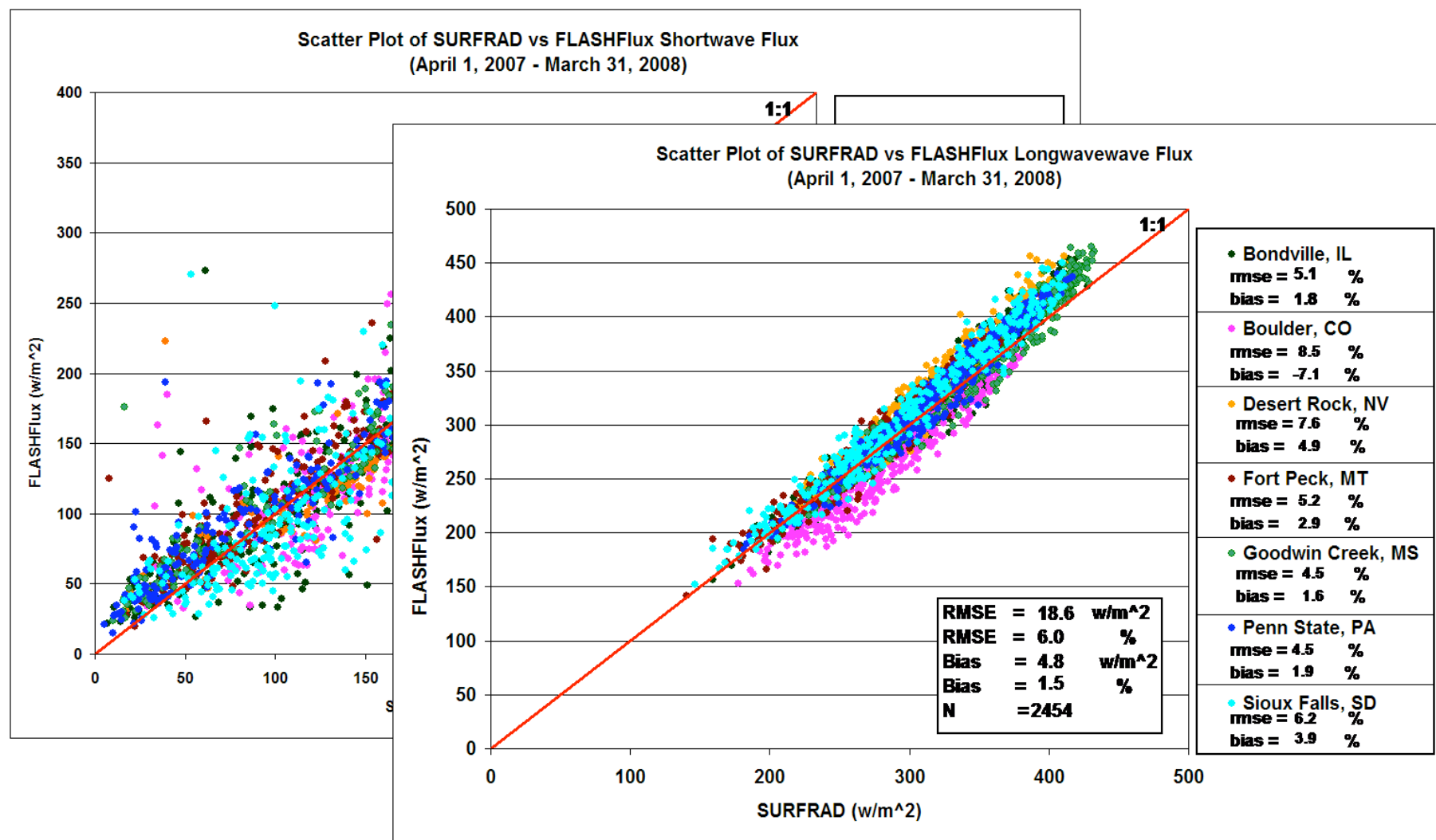
FLASHFlux (CERES/MODIS, GMAO)



Daily Average Solar Irradiance (Wm^{-2})



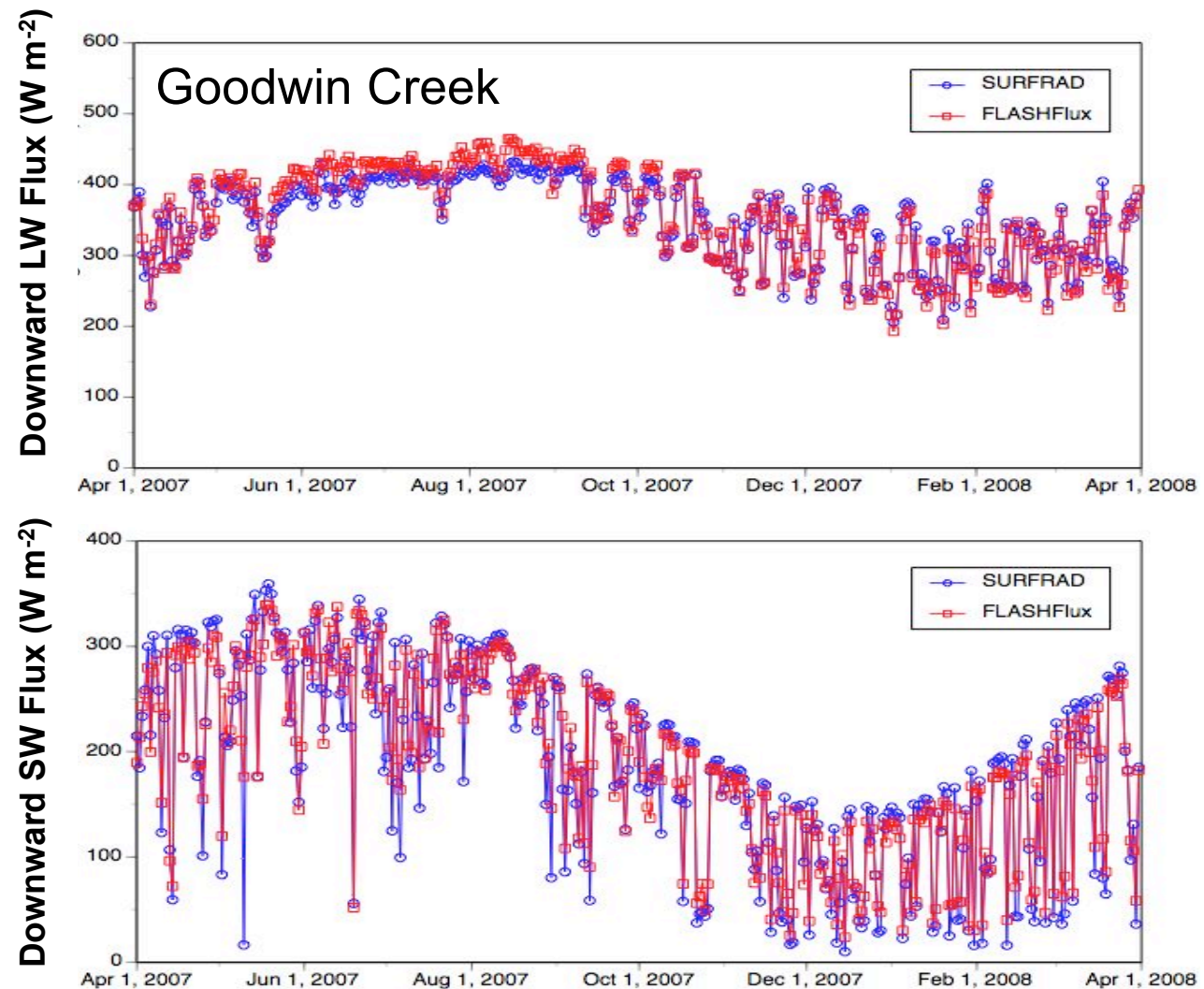
Time & Space Averaged Validation

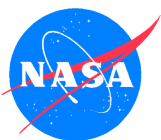




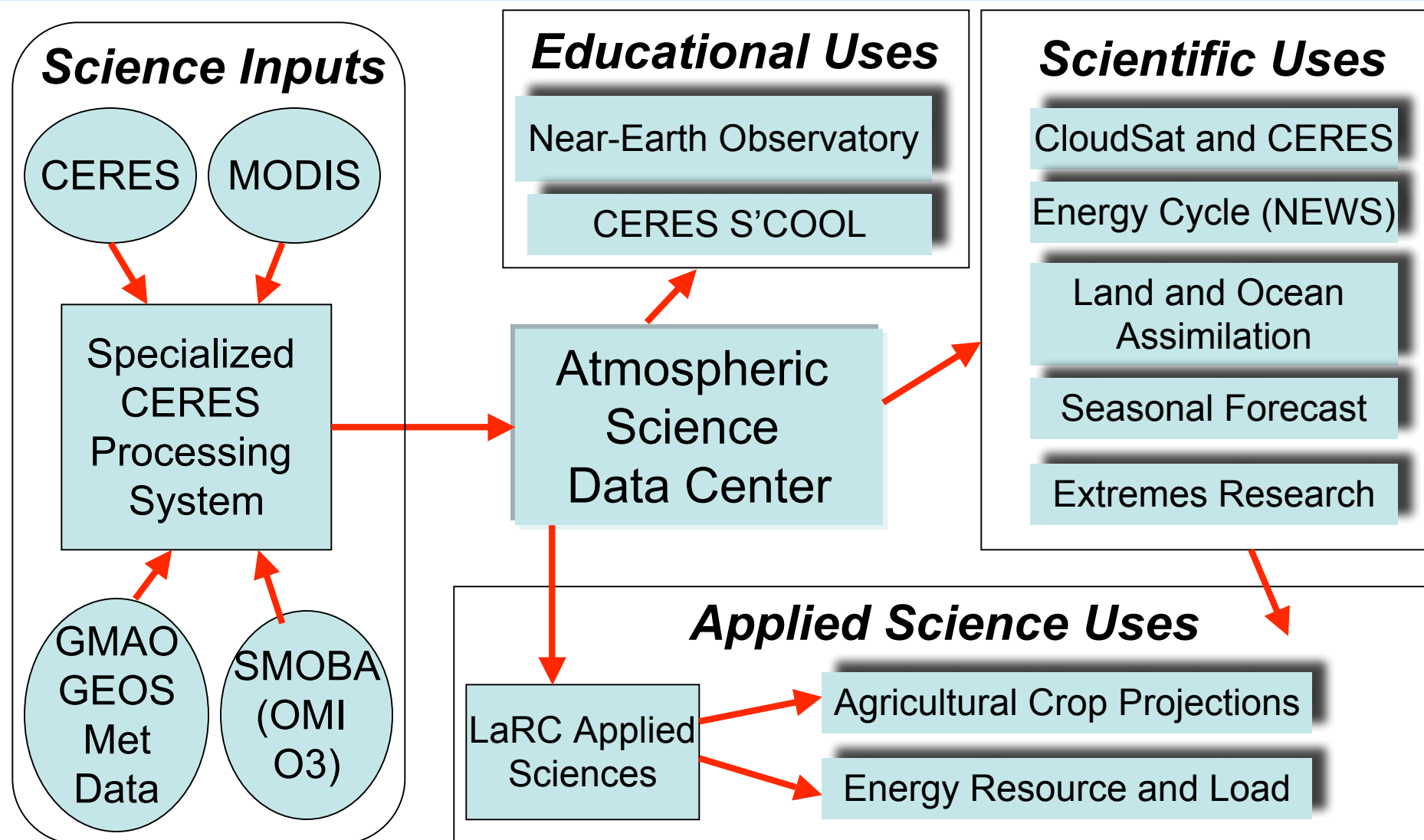
Time & Space Averaged Validation

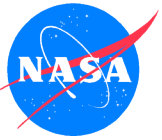
Daily
averaged
values
correlate
well with
measured
values in
LW and SW





FLASHFLUX: Schematic Mapping to Realized and Potential Uses

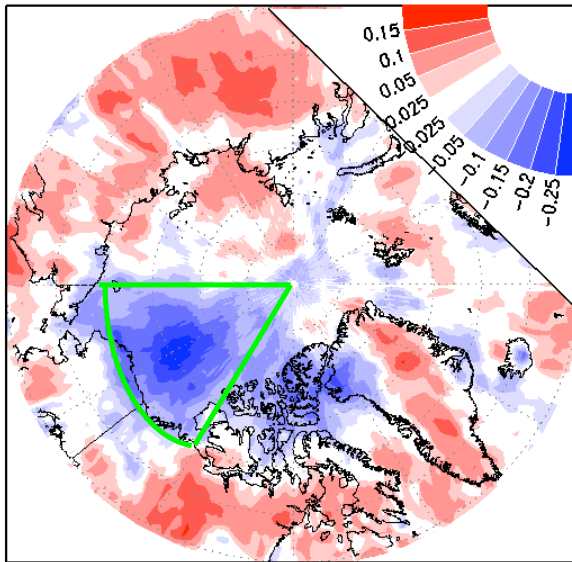




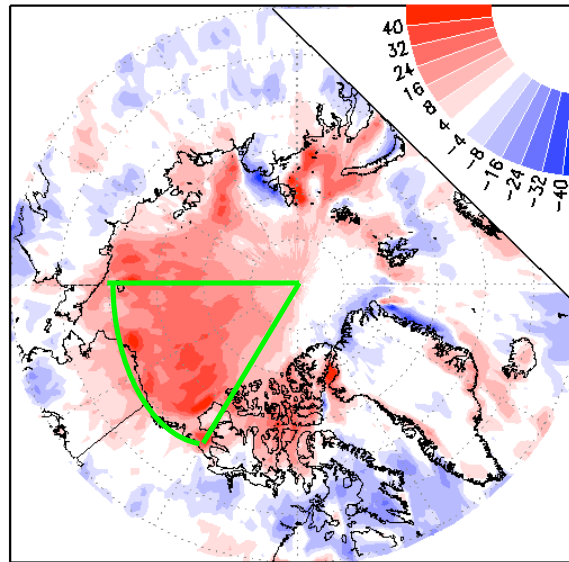
FLASHFlux Scientific Analysis

Mean of JJA 2007 - Mean JJA 2000-2004 (from CERES)

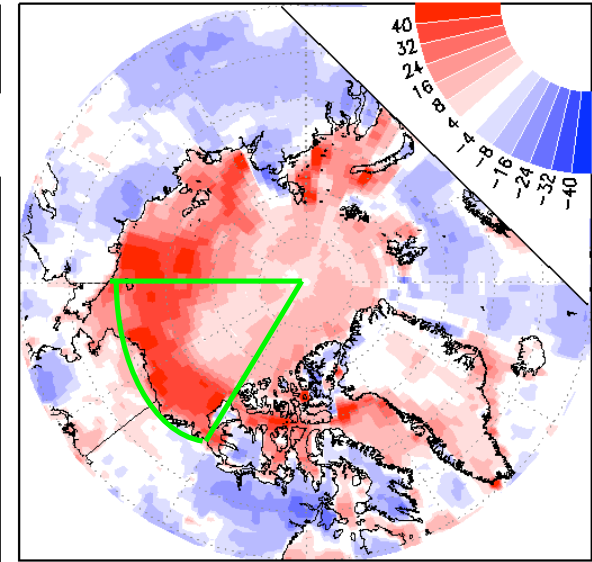
Cloud Fraction
Anomaly



TOA Total Net Flux
Anomaly (W m^{-2})



Surface Total Net Flux
Anomaly (W m^{-2})



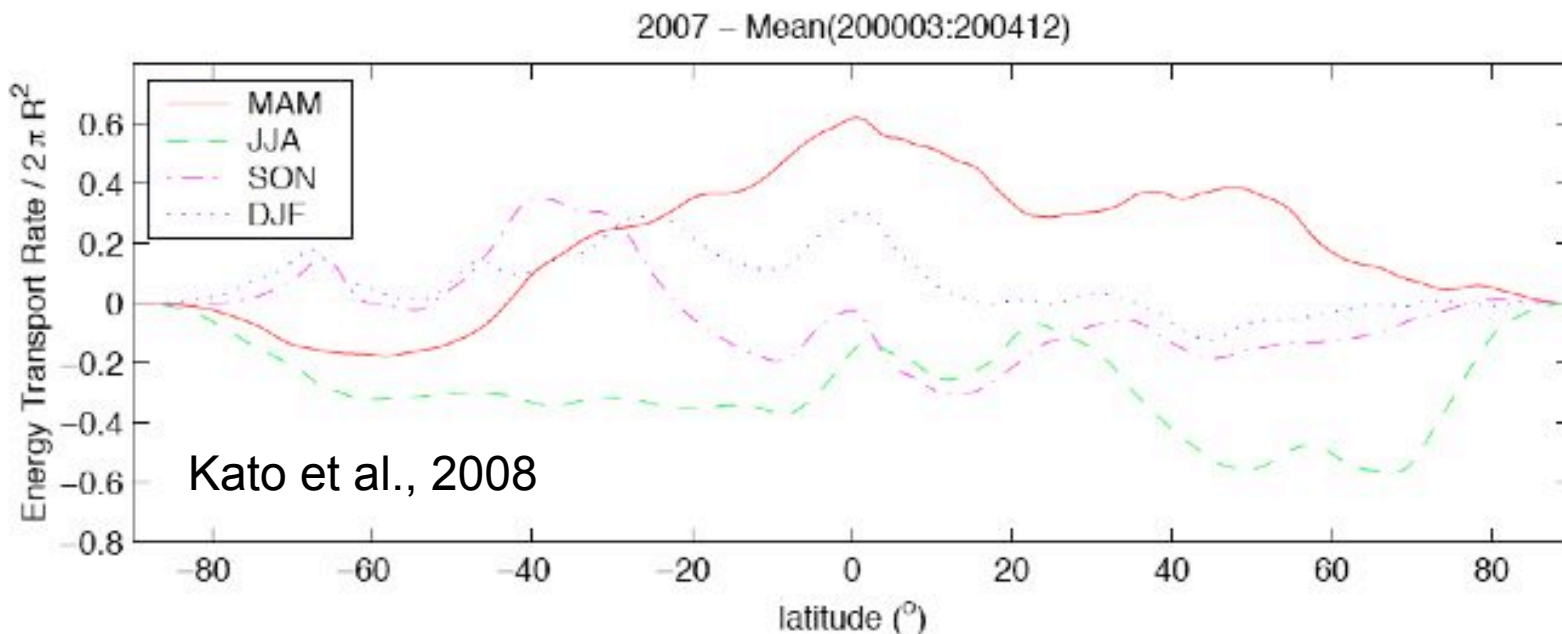
Western Arctic Sector Averages (120 W to 180 W; 70N to Pole)
-13.8% **+24.2 W m^{-2}** **+21.4 W m^{-2}**



FLASHFlux Scientific Analysis

Meridional Energy transport

Anomalies of the rate of meridional energy transport



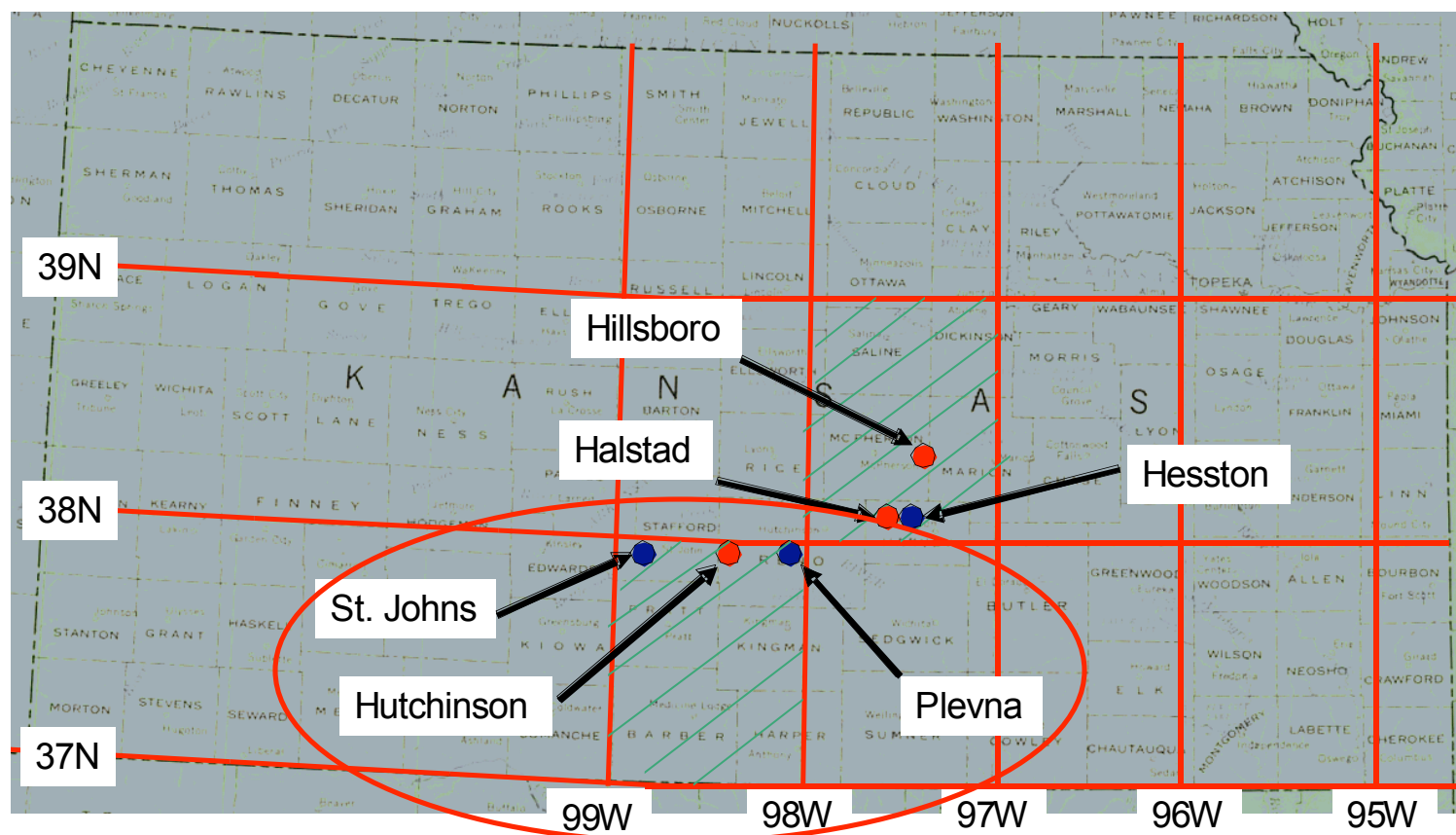
How much are these related to sea ice anomalies?

Is there any relations to a larger cloud cover in March - May 2007 ?

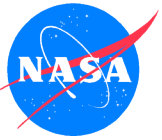


FLASHFlux: Find Errant Agricultural Sites for Improved Crop Modeling

- - Atmospheric Radiation Measurement (ARM) Ground Site (DOE)
- - High Plains Research Climate Center (HPRCC) Ground Site (Agricultural Site)



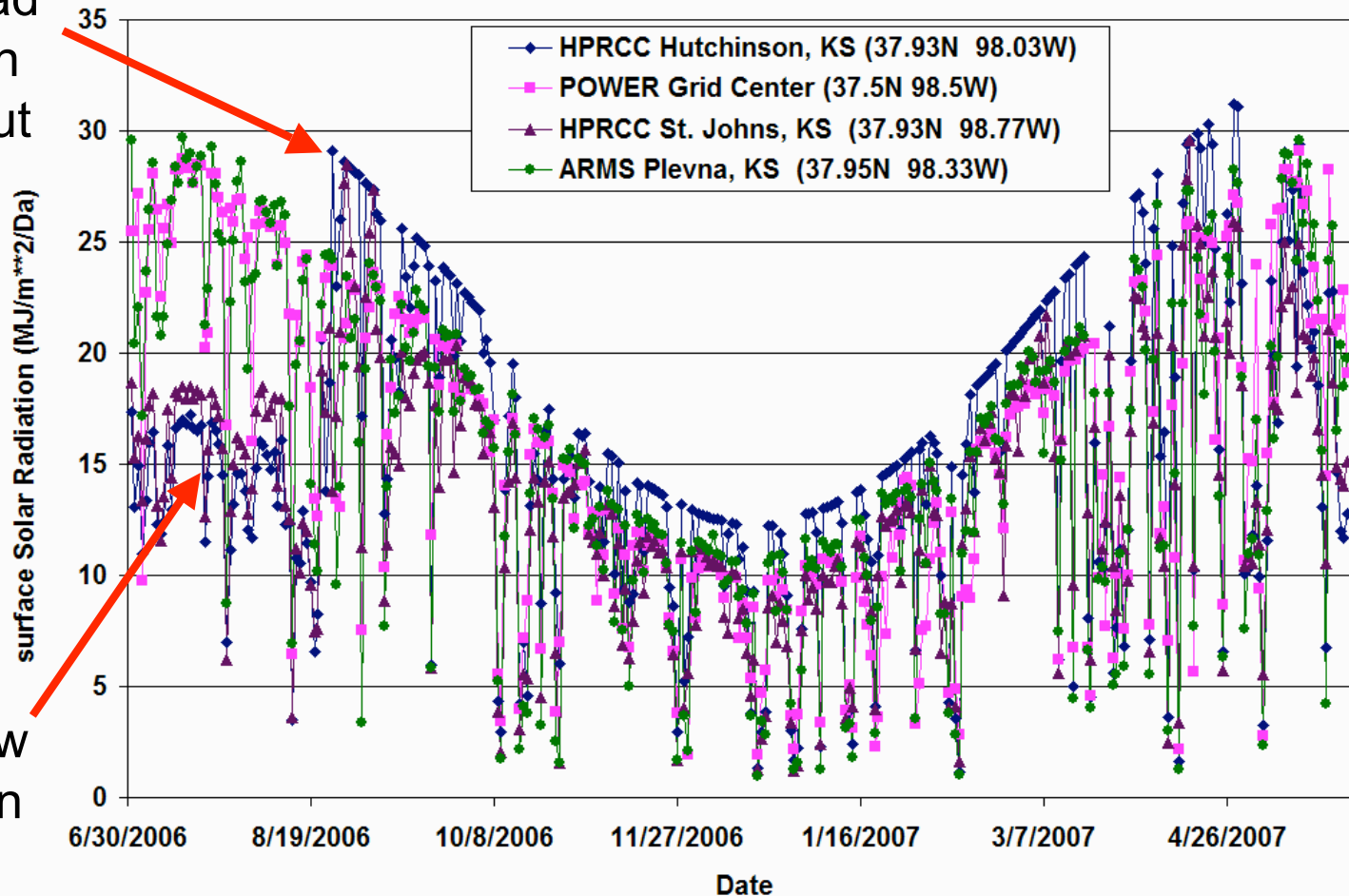
Note: agricultural sites used for crop yield projections



FLASHFlux: Find Errant Agricultural Sites for Improved Crop Modeling

One Ag site
retains bad
calibration
throughout
year

Time Series of Ground Site Observations at ARM Site Plevna, KS
and HPRCC Sites at Hutchinson, KS and St. Johns, KS, and POWER Data

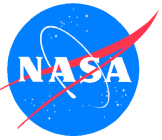


Both Ag
sites show
calibration
error



Future FLASHFlux Data Uses

- ***Global, Land and Ocean Assimilation***
 - GMAO GEOS => global validation of cloud radiative effects
 - GLDAS => 1x1 fluxes useful for input to coarse assimilation runs & analysis
 - Ocean Analysis => useful for input to ocean analysis project (WHOI)
- ***Energy Applications***
 - Independent daily data sets required for Building Monitoring and Targeting Program (NRCAN RETScreen)
 - Consistent global solar radiation for crop modeling and analysis of most season



Future Upgrades

- ***Enhance Hourly fluxes with World's Geosynchronous satellites***
 - Subsystem already exists in CERES; need to adapt to near-real time operation;
 - particularly important is cross-calibration
- ***Enhance horizontal resolution to 1/2 x 1/2 degree***
 - Increase resolution require change in subsampling
 - Great increase in volume of intermediary and public products



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, S'COOL and soon CALIPSO
 - TISA products providing 1°x1° global hourly/daily fluxes for Terra+Aqua data shown accurate for scientific analysis (e.g., Arctic Analysis CloudSat, NEWS) and agricultural use (e.g. Agriculture).
 - Has large potential for considerably more usage in both science (data analysis and assimilation) and applied sciences (energy)
 - Demonstrates potential as part of future systems like NPP and NPOESS
- ***FLASHFlux Is Working Towards ...***
 - Improving hourly global gridded fluxes using geosynchronous systems for higher temporal resolution
 - Enhancing horizontal resolution to improve applicability to scientific and applied science problems.



FLASHFlux Web Sites:

<http://flashflux.larc.nasa.gov>

***[http://eosweb.larc.nasa.gov/
PRODOCS/flashflux/
table_flashflux.html](http://eosweb.larc.nasa.gov/PRODOCS/flashflux/table_flashflux.html)***