A Status Update for the FLASHFlux Working Group

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Tonya Davenport and Fenny Wang and the Atmospheric Science Data Center Team (SSAI)

CERES FLASHFlux Overview

- ***FLASHFlux Overview***
  - Uses CERES based production system through inversion
  - Periodic calibration updates projected forward; running 3-day TISA
  - LPSA/LPLA SOFA algorithms for surface fluxes
- ***FLASHFlux Latency Objectives***
  - SSF products within 4 days
  - Global 1x1 daily averages from FF TISA; goal: 6-7 days latency
- ***FLASHFlux Usages***
  - Primarily used for applied science and education (i.e., POWER and Globe Clouds)
  - Supports also QC for selected missions (e.g., NOAA NESDIS)
  - TOA gridded fluxes; normalized to TOA EBAF for annual “State of the Climate” assessments (most recent update through April 2021).

FLASHFlux (v4A) SSF Latency Assessment

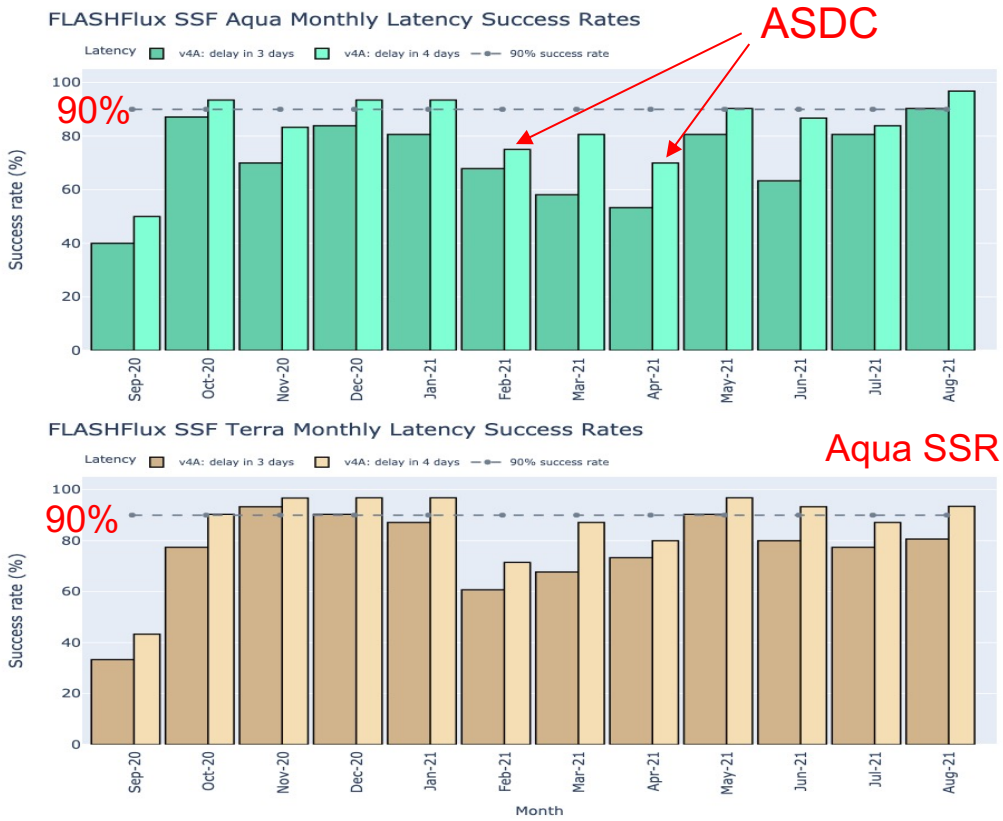
v4A operational in Sep 2020 (delays due to Aqua outage)

Success rate % of time < 3 (dark/thick bar) or 4 days (lighter/thinner bar)

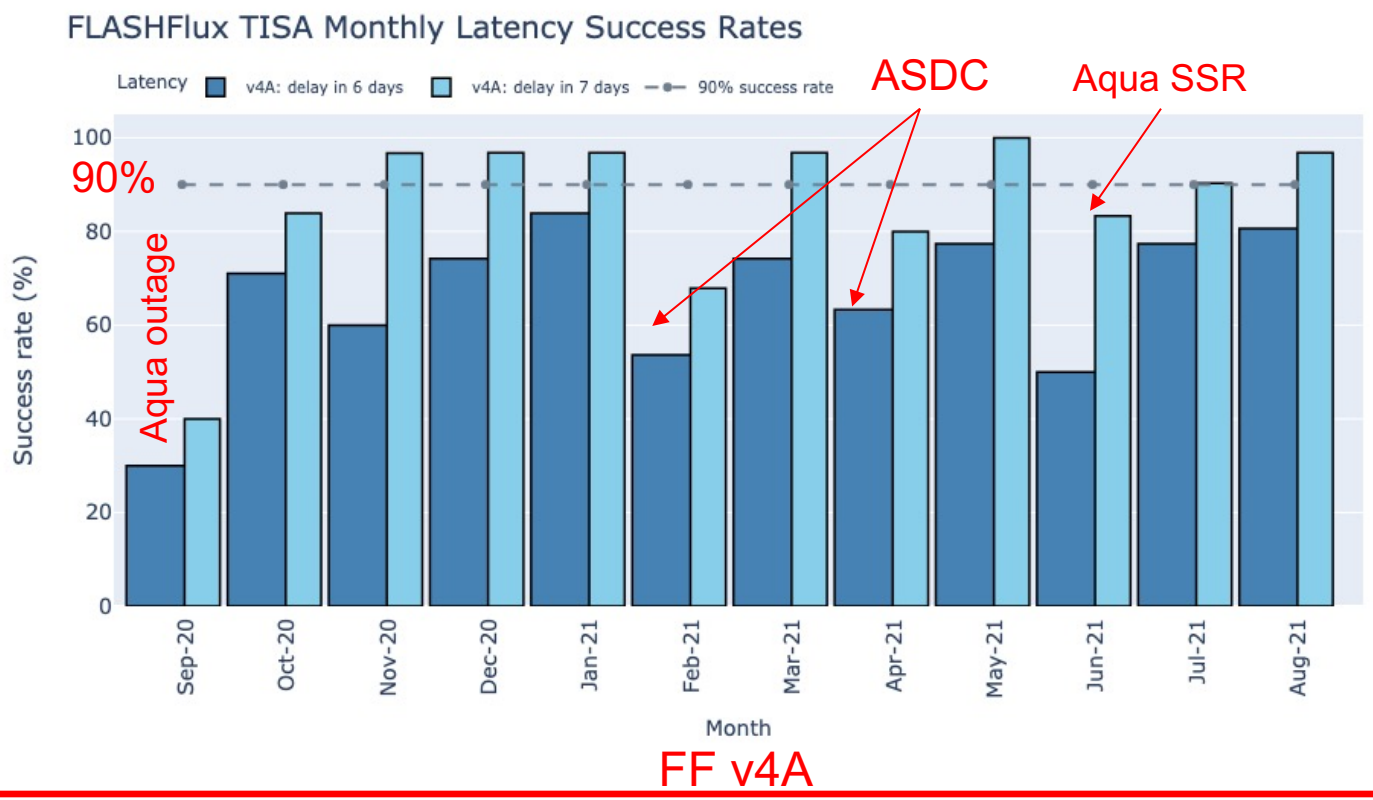
Terra had 7 months at or exceed 90% of days at 4 day latency; Aqua had 5

Lags due to: maneuvers/ satellite issues, ASDC updates/outages

SSF utilized by GLOBE Clouds; occasional satellite algorithm comparisons (i.e., NOAA GOES ABI)



FLASHFlux TISA Latency Assessment



v4A operational in Sep 2020

Success rate % of time < 6 (dark blue) or 7 days (light blue)

7 of 12 months reached 90% of days at 7 day latency

Lags due to: maneuvers, ASDC updates/outages

TISA delivered to POWER Web Services Suite

FLASHFlux Data Delivery via POWER Web Services Portal (2020/10/01 to 2021/09/30)

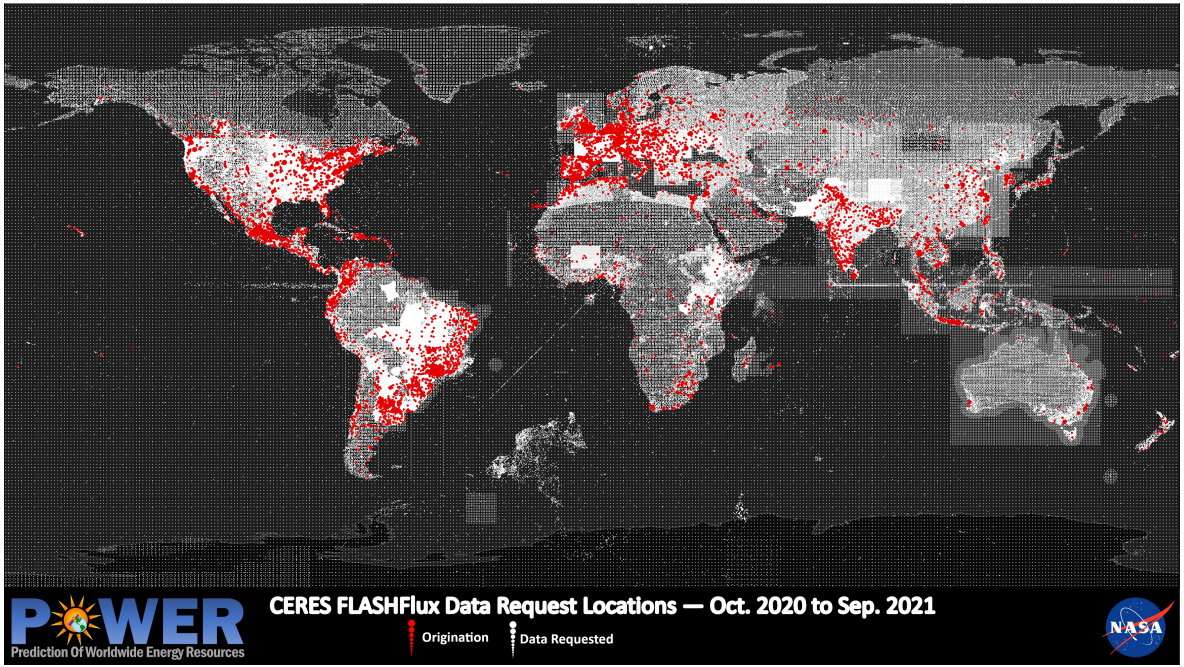
All CERES Orders Delivered via POWER

	Total	Monthly
Unique Users IPs	~94.8 K	~8,992
Requests	~ 35.3 M	~2.95 M

(includes SYN1Deg from Jan 2001 through latest month released)

FLASHFlux Low Latency Orders Delivered via POWER

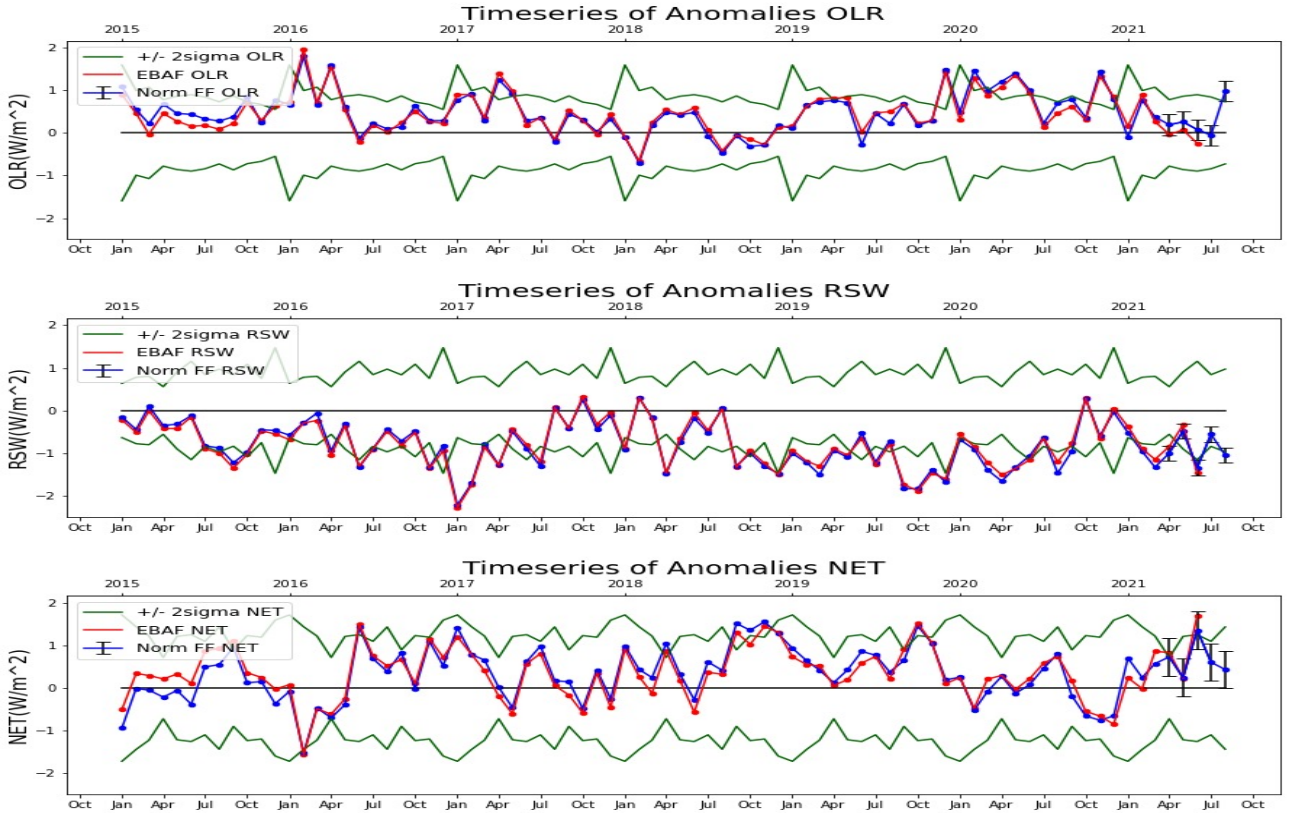
	Total	Monthly
Unique Users IPs	~28.3 K (30%)	~2,712 (30%)
Requests	~23.1 M (65%)	~1.92 M (65%)



Dot density map showing locations of users (red) and data request locations (white). Brighter colors show larger frequency at that location.

EBAF+FF (normalized) TOA Anomalies

- Anomalies relative to July 2005 to June 2015
- Green lines show +/- 2 sigma for each climatological month
- FF Normalized using overlap period begin Jan 2015 and April 2021
- Error bars denoted uncertainty derived from the overlap analysis

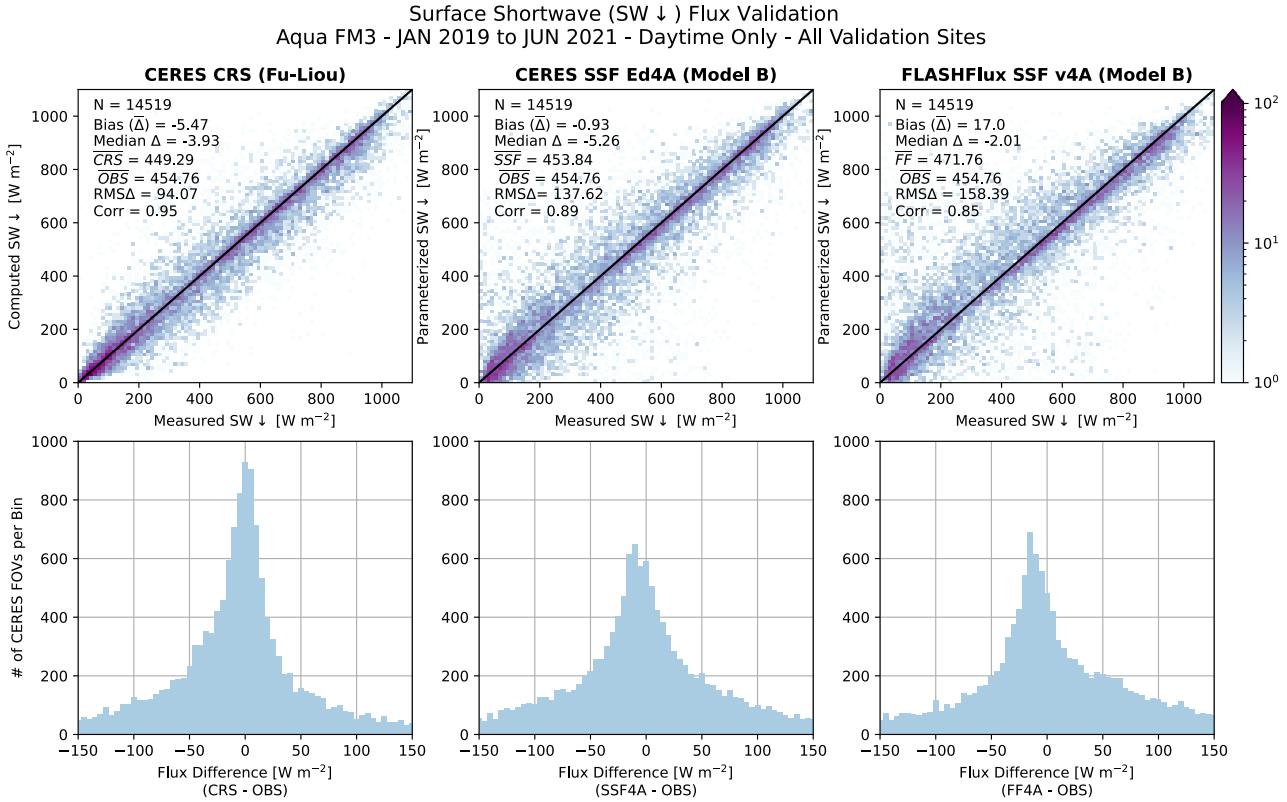


FLASHFlux Status

- ***Production with v4A Begun (since Aug 1, 2020)***
  - Operational FF v4A SSF and TISA v4A: SSF Terra/Aqua through 10/4; TISA through 10/2 (delays in September due to maneuver and missing snow/ice maps)
  - New FF Gain+Spectral coefficients beginning Oct 1
  - Version 4A spans from Jan 1, 2019 through June 2021 for validation (so now 30 months)
- ***Validation and Assessment***
  - SSF relative to CRS, CERES Ed4A SSF (SOFA) and FF and BSRN
  - TISA Daily averages relative to BSRN for Jan 2019 through June 2021
  - DQS for SSF and TISA compare FF to CERES Ed4
- ***FLASHFlux Modernization and Updates***
  - Migration to CERES CATALYST for future production managing (Katie's talk)
  - Evaluating ML based algorithms for future FF SSF data products
  - New GEOS-IT sample data; first cut comparisons to FP-IT
  - NOAA-20 path tested through inversion; upgrading TISA to accommodate
- ***FLASHFlux Information & Data Provision Through ...***
  - Daily and monthly data available in internal subsetter; internal team web site
  - CERES web site and subsetter both SSF and TISA, ASDC (via EarthData) and POWER

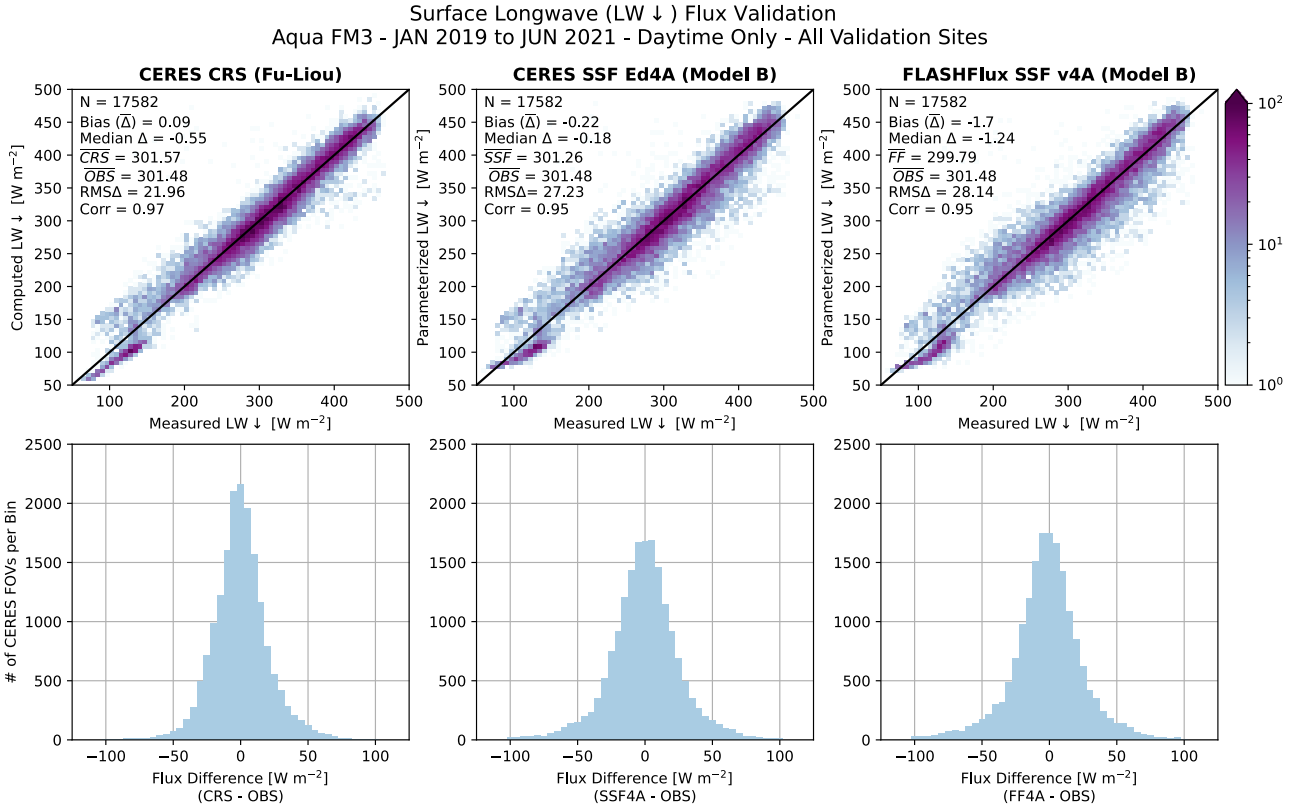
SW Validation vs BSRN Fluxes: CRS and SSF

- Terra SSF validation for CRS, Ed4A and FF for surface SW down
- CRS consistent outperforms, note RMS differences
- New FF polar flux parameterization appears to explain increased scatter (although works better for TISA)
- Continuing assessment



LW Validation vs BSRN Fluxes: CRS and SSF

- Terra SSF validation for CRS, Ed4A and FF for surface daytime LW down
- Much more consistent than SW, but CRS still has lowest RMS
- Similar results for night-time but larger scatter
- Polar fluxes and show interesting relationships



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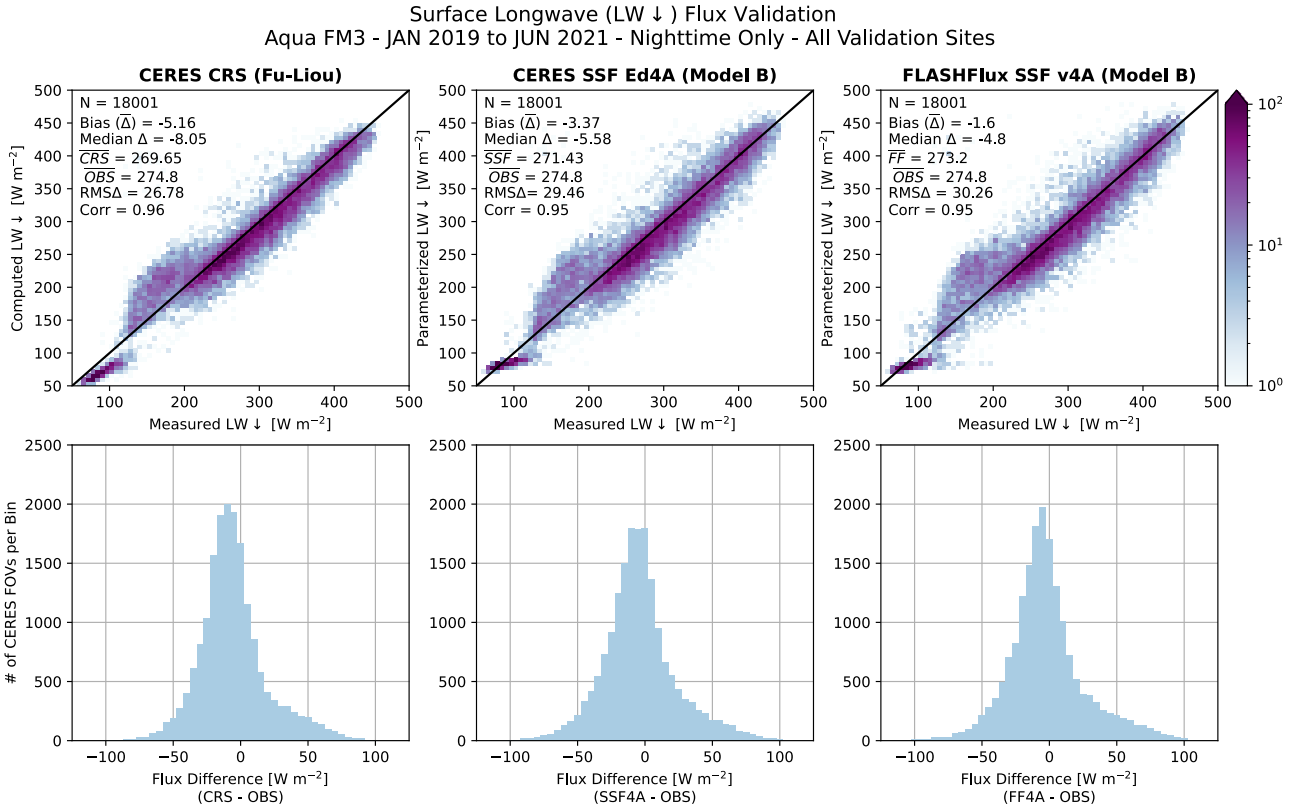


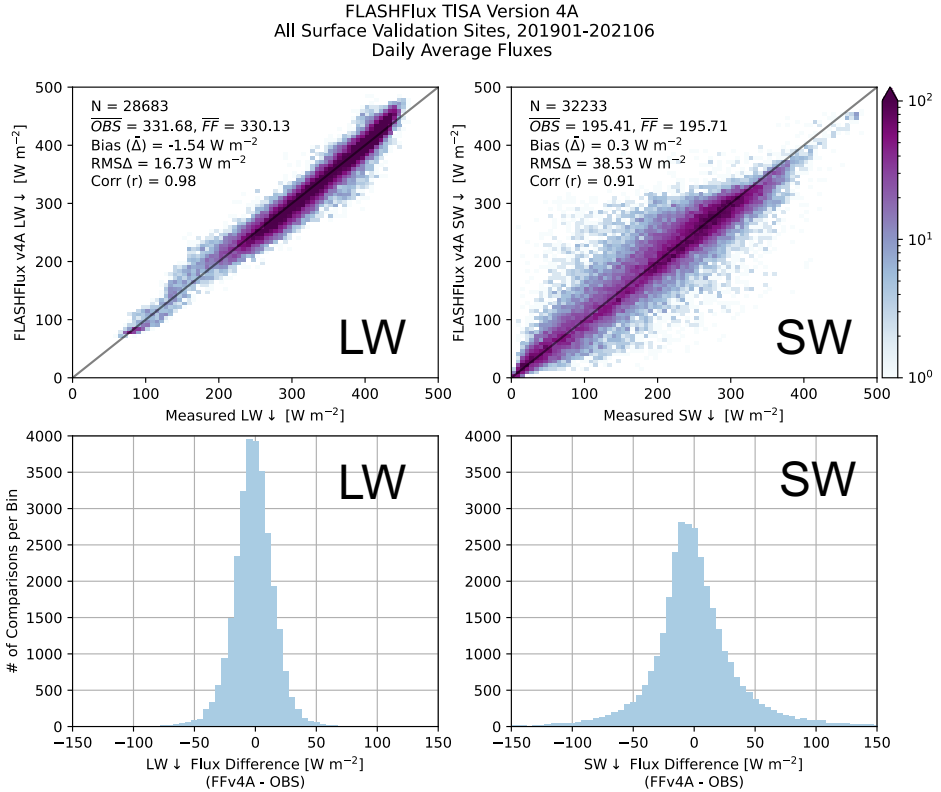
FLASHFlux TISA Validation: BSRN Fluxes

Ensemble FLASHFlux LW and SW Daily Average Comparisons to BSRN Measurements (1/2019-6/2021)

LW: Bias -1.5 W m^{-2}
RMS 16.7 W m^{-2}

SW: Bias 0.3 W m^{-2}
RMS 38.5 W m^{-2}

Histograms show peaked, relatively symmetric distributions, median bias is negative bias for SW, LW



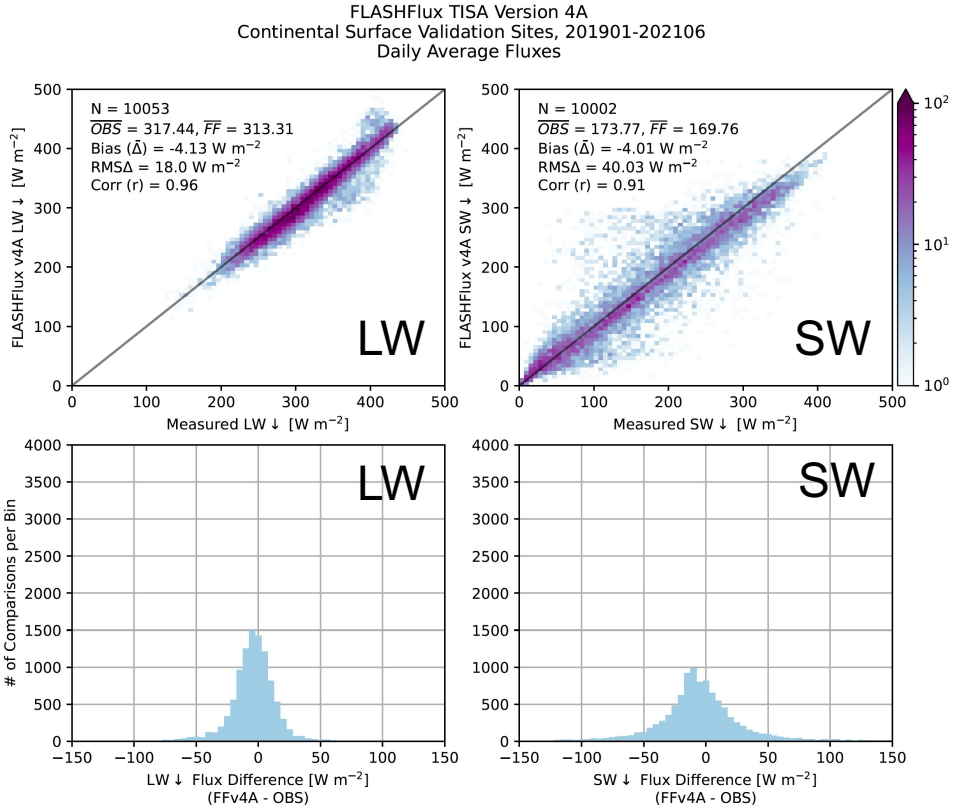
FLASHFlux TISA Validation: Continental Fluxes

Ensemble FLASHFlux LW and SW Daily Average Comparisons to Ocean Buoy Flux Measurements (1/2019-6/2021)

LW: Bias -4.1 W m^{-2}
RMS 18.0 W m^{-2}

SW: Bias -4.0 W m^{-2}
RMS 40.0 W m^{-2}

Histograms show peaked, relatively symmetric distributions, median bias is negative for both

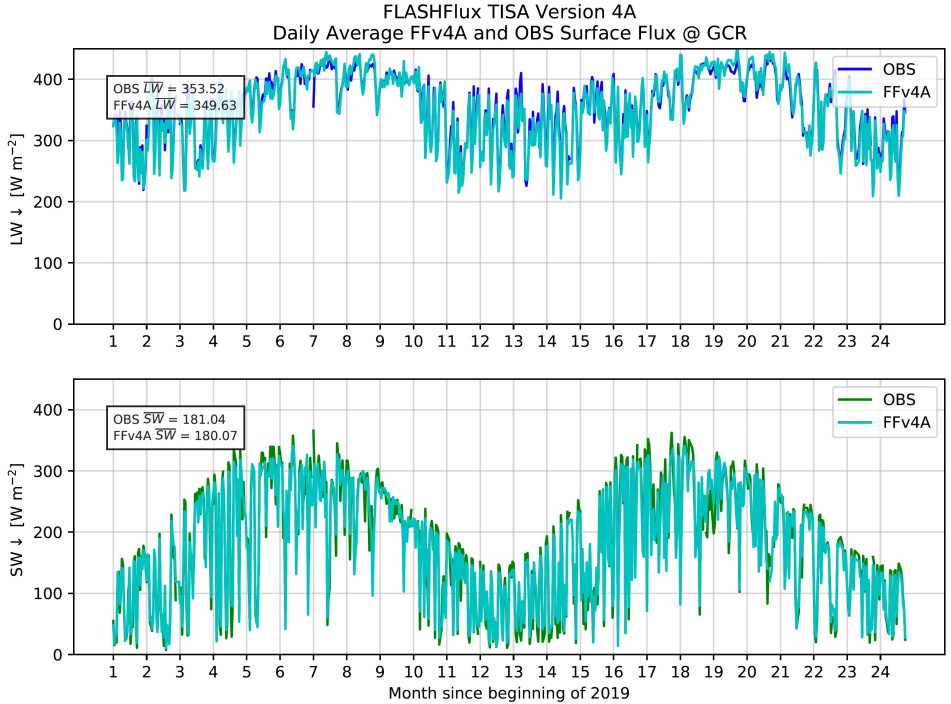


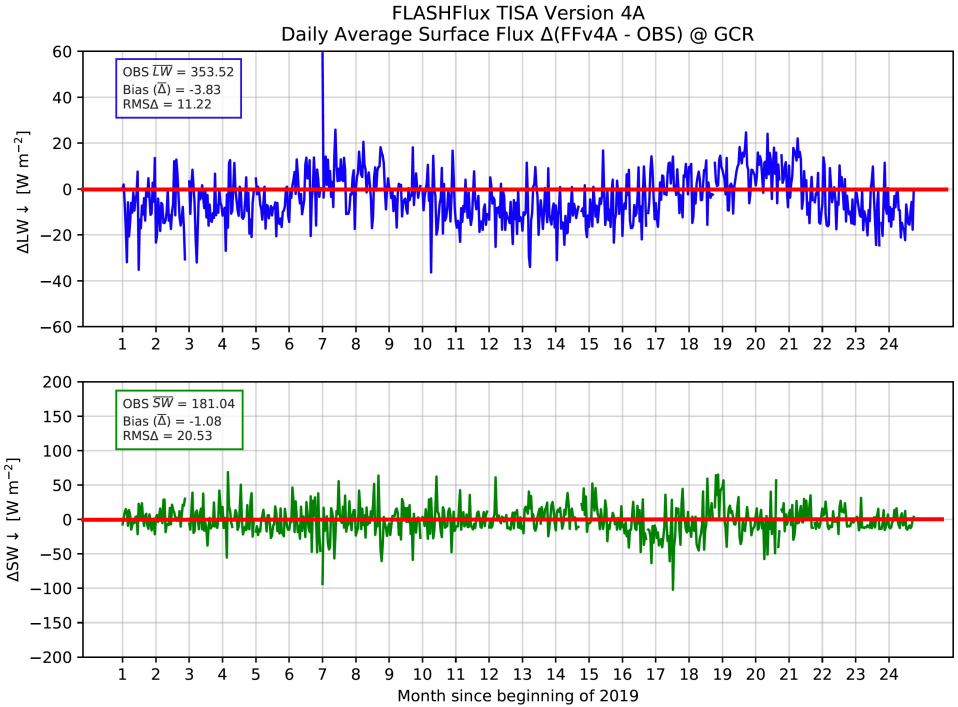
FLASHFlux TISA Validation: BSRN and Ocean Buoy Fluxes

FLASHFlux v4A TISA Daily Average Fluxes (1/2019 – 6/2021)

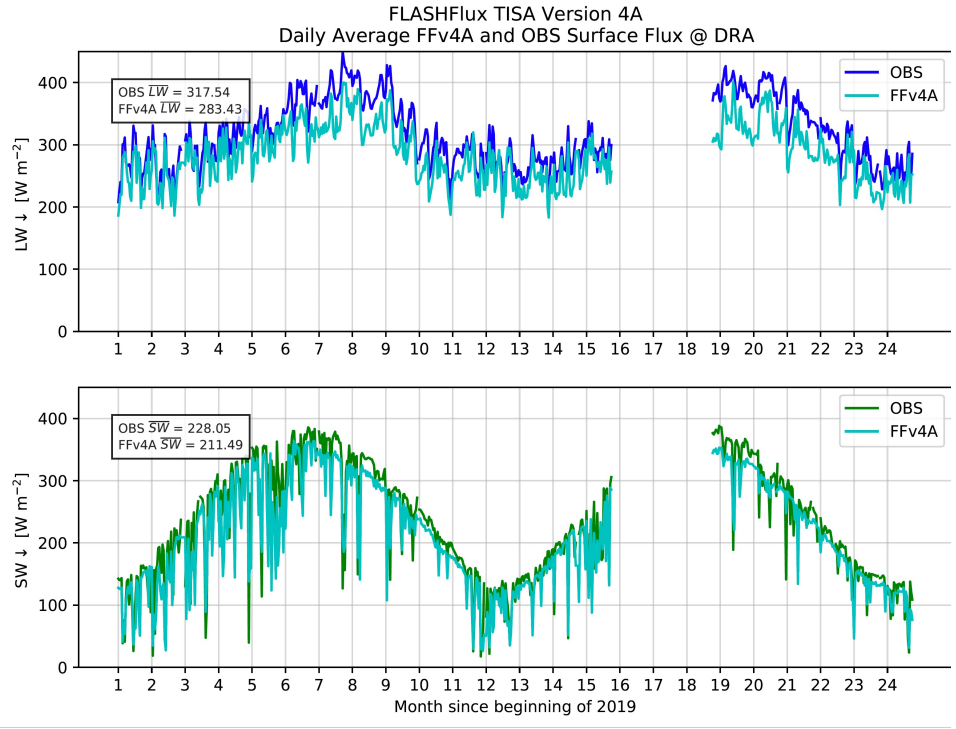
Region Type	LW Bias	LW RMS	# LW Pairs	SW Bias	SW RMS	# SW Pairs
All Ensemble	-1.5	16.7	28,683	0.3	38.5	32,233
Coastal	-0.2	15.7	6369	-1.3	37.0	6164
Desert	-8.5	19.9	2301	-12.3	28.3	2283
Island	6.1	14.7	1935	19.5	47.4	1895
Continental	-4.0	18.0	10053	-4.0	40.3	10002
Polar	0.4	18.8	2989	-8.6	48.4	2028
Ocean buoys	1.0	12.4	5036	6.7	35.7	9861

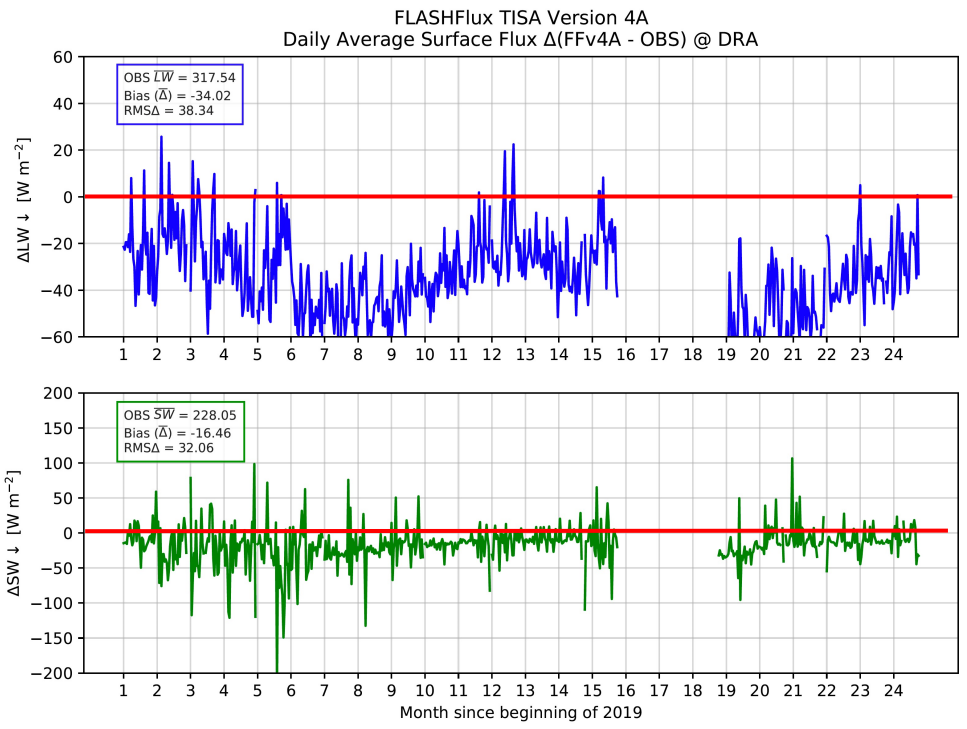
FF Time Series (Goodwin Creek)





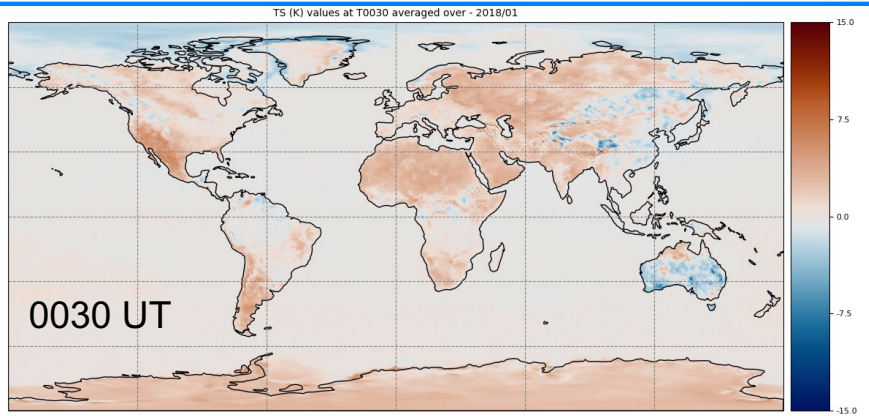
FF Time Series (Desert Rock)

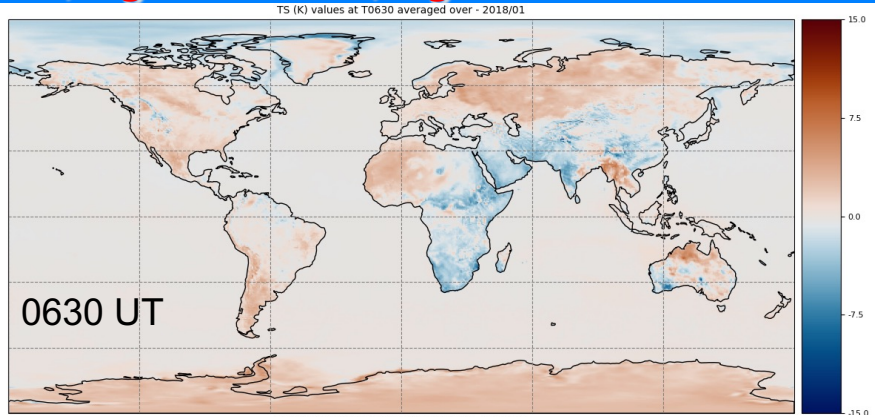


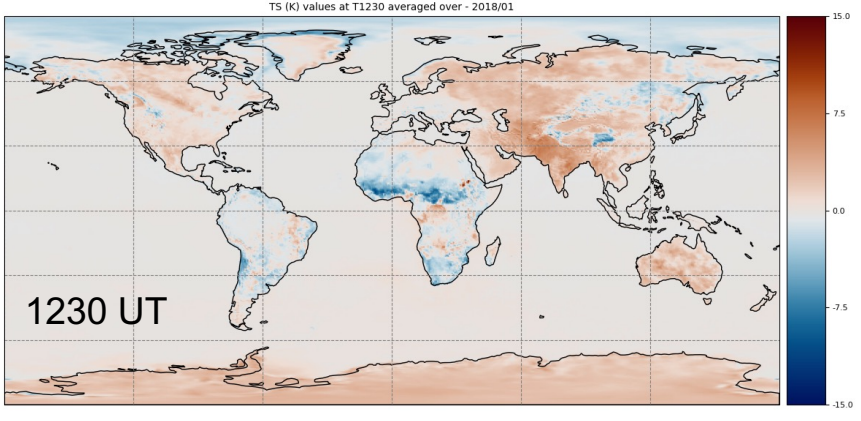


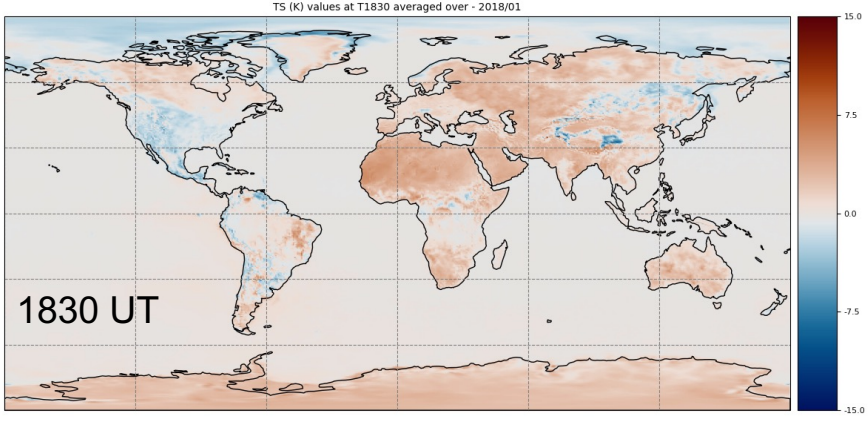
GEOS-IT vs FP-IT: Monthly Averaged Hour Differences

Skin Temperature ($TS_{GEOS-IT;avg} - TS_{FPIT;avg}$ Jan 2018)







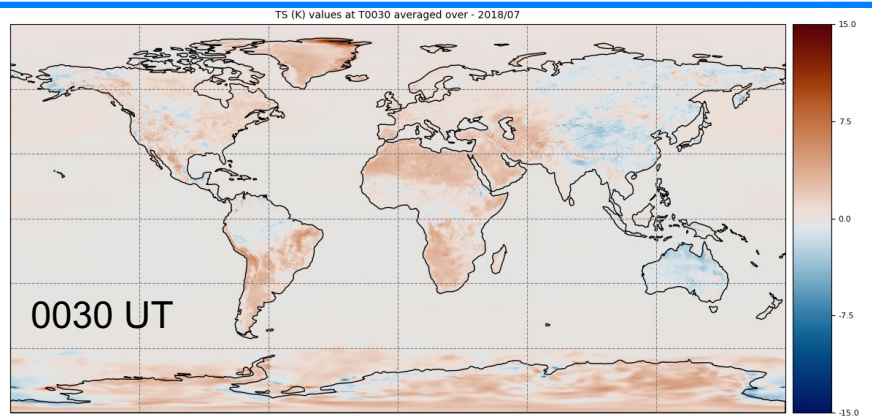


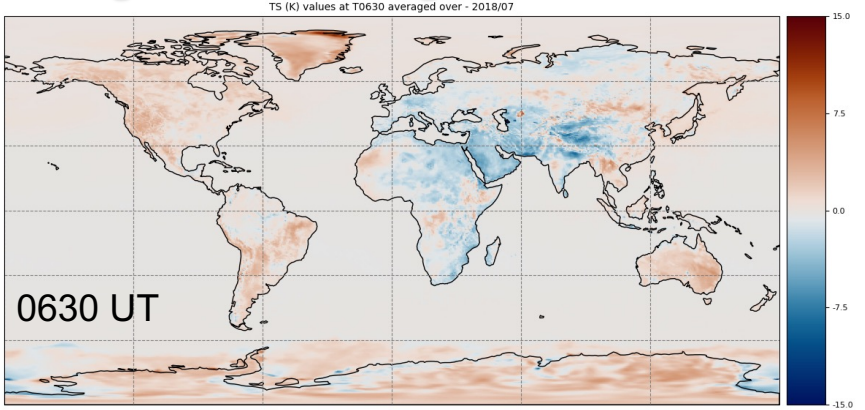
TS - GEOS-IT_FP-IT
K

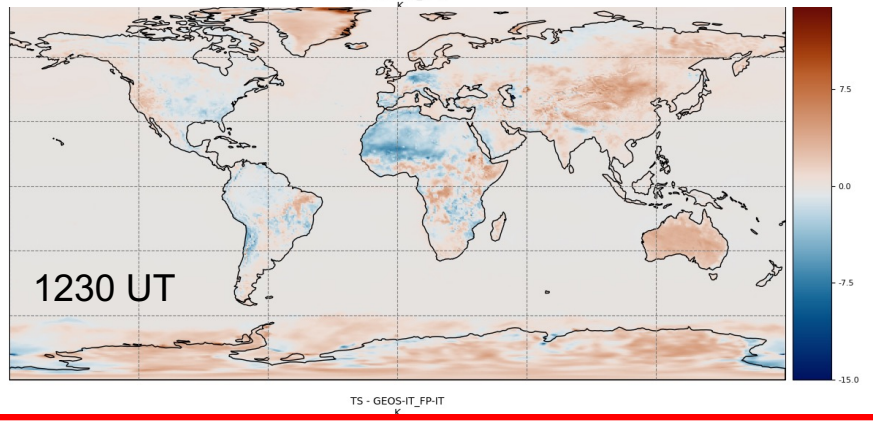
TS - GEOS-IT_FP-IT

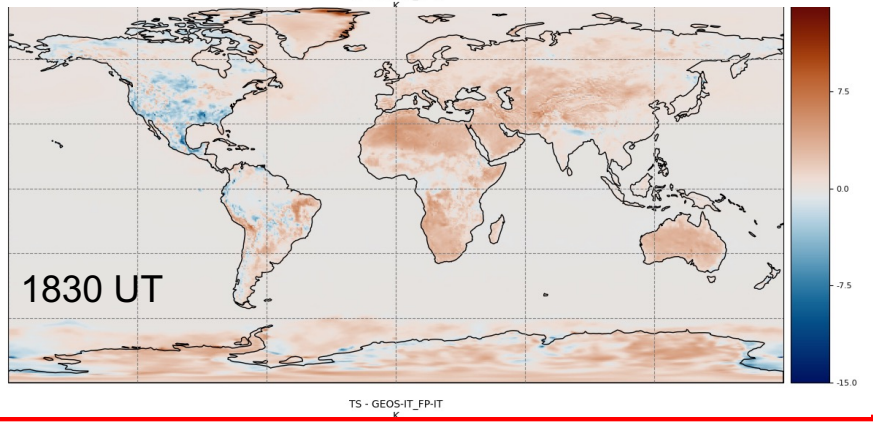
GEOS-IT vs FP-IT: Monthly Averaged Hour Differences

Skin Temperature ($TS_{GEOS-IT;avg} - TS_{FPIT;avg}$ July 2018)









Summary and Continuing Work

- ***FLASHFlux 4A progress***
  - V4A continues in forward production mode; begins on Jan 1, 2019
  - SSF SW surface fluxes show biases over relative to CRS, higher RMS; LW more consistent
  - TISA LW and SW v4A validation reasonable bias/RMS; biases noted for some surface types
- ***FLASHFlux Continuing Work***
  - Continue assessing LPSA, LPLA for improvements (jump to F/L?); ML for SSF?
  - First GOES-IT test year of 2018 provided:
    - Ts/T2m cooler during day - warmer at night; PW slightly less follows cloud patterns
    - User group meeting for discussion on 10/20
  - Production system improvements: migration to CATALYST progressing; hardening of current TISA code for more flexible configurations planned next
- ***FLASHFlux Applications:***
  - Datasets continue being distributed through CERES Subsetter, NASA EO, POWER web services
  - POWER ordering past year: ~94,800 unique IPs; > 35M orders; orders >65% low latency
- ***FLASHFlux Publications:***
  - 2020 SotC published

FLASHFlux Web Sites

now moved to under CERES page

https://ceres.larc.nasa.gov/data/#fast-longwave-and-shortwave-flux-flashflux

Data also served through
https://power.nasa.gov