



FLASHFlux Working Group Status: Assessing FF NOAA-20 Products and Future Upgrades

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POWER Team: Bradley MacPherson and Christopher Higham (Booz-Allen-Hamilton)

Atmospheric Science Data Center Team (SSAI)



CERES FLASHFlux Overview

- **FLASHFlux Overview**

- Uses CERES based production system through inversion (w/ quarterly calibration updates projected forward)
- Running 3-day TISA utilizing morning and afternoon orbiters

- **FLASHFlux Latency Objectives**

- SSF products within 3-4 days
- Global 1x1 daily averages from FF TISA; goal: 5-7 days latency

- **FLASHFlux Uses**

- 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 .



FLASHFlux Operational Status

- **FF Production System Updates:**

- Continuing FF SSF production:

- Terra v4a SSF (since 2019)
- NOAA-20 v1a SSF (v1A; 3/1/23 back to 10/1/22)

- Transitioned TISA from Terra+Aqua to Terra+NOAA-20 (reprocessed v4B; processed back to 10/1/22)

- Delivered MOA for GEOS-IT; beginning production

- **FF Production status:**

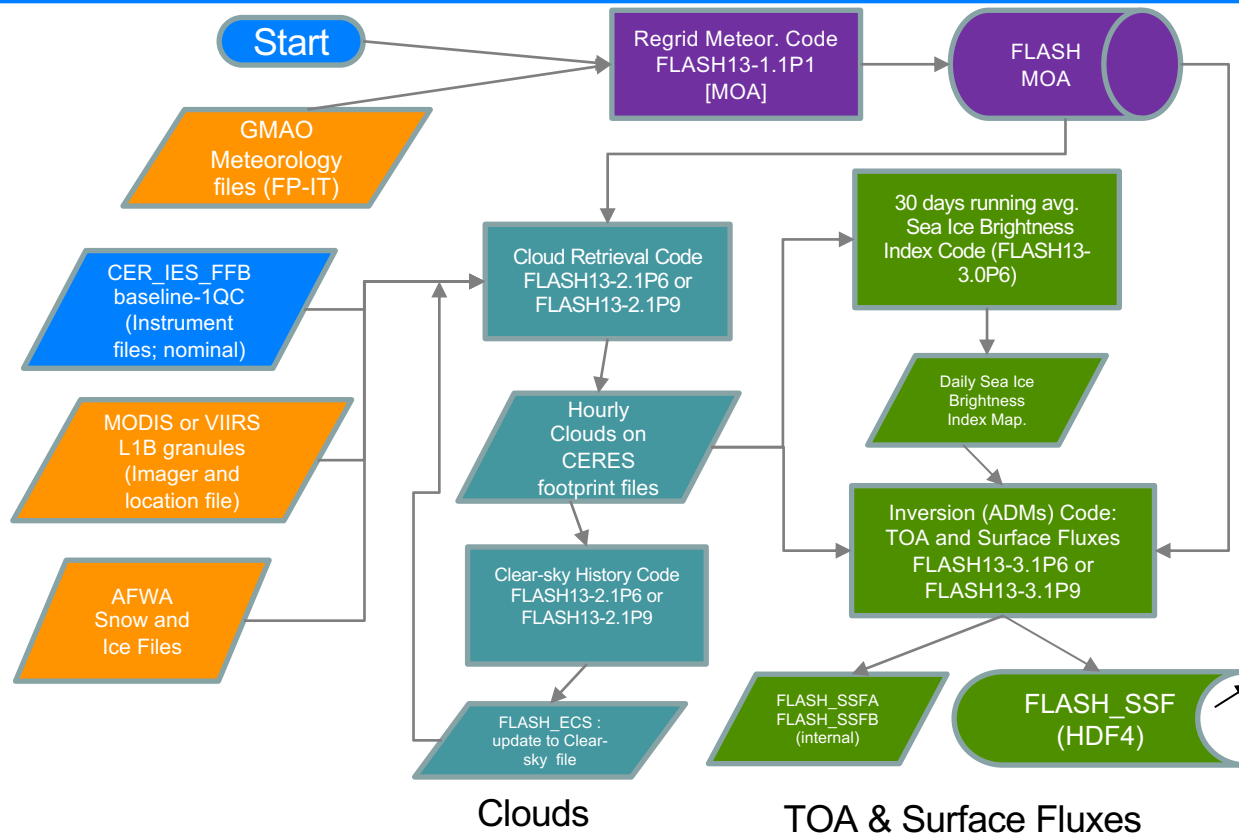
- Current Status:

- SSF Terra: 10/14/23; SSF Aqua: 3/31/23 (stopped on March 31)
- SSF NOAA-20: 10/14/23 (processed back to 10/1/22)
- TISA v4B (Terra+NOAA-20): 10/12/23 (processed back to 10/1/22)

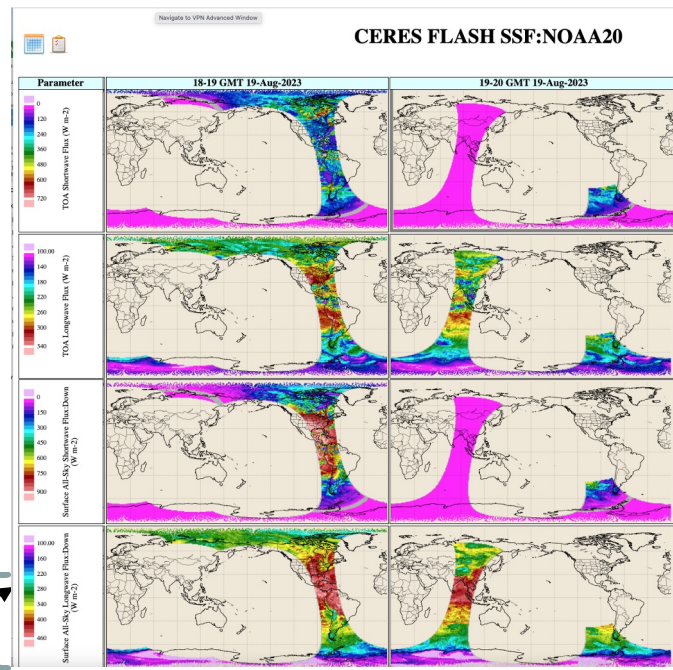
- Updated calibration coefficients received & promoted as cc change effective 10/1/23



FLASHFlux SSF Data Flow



Sample Data from 8/19/23





FLASHFlux SSF Latency Assessment

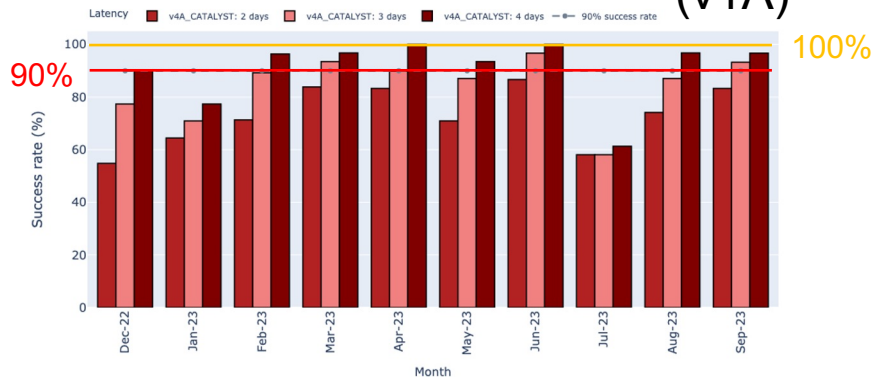
Success rate (%) of time data archived within 2, 3, or 4 days of observation

Lags due to: maneuvers/satellite issues, ASDC updates/outages, ASDC Dropbox/Darkhorse, GSFC LAADS and/or SIPS

SSF utilized for operational satellite algorithm comparisons (i.e., NOAA GOES ABI); Applications like Solar Irradiance Forecasting and Educational applications like GLOBE Clouds.

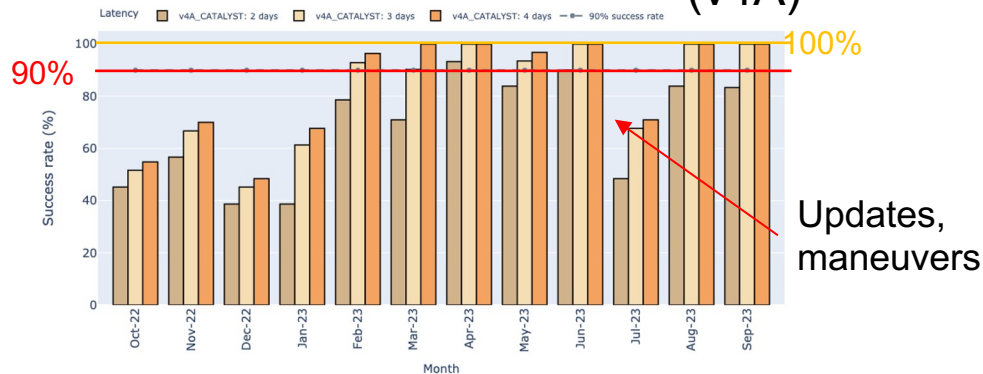
FLASHFlux SSF NOAA20 Monthly Latency Success Rates

(v1A)



FLASHFlux SSF Terra Monthly Latency Success Rates

(v4A)



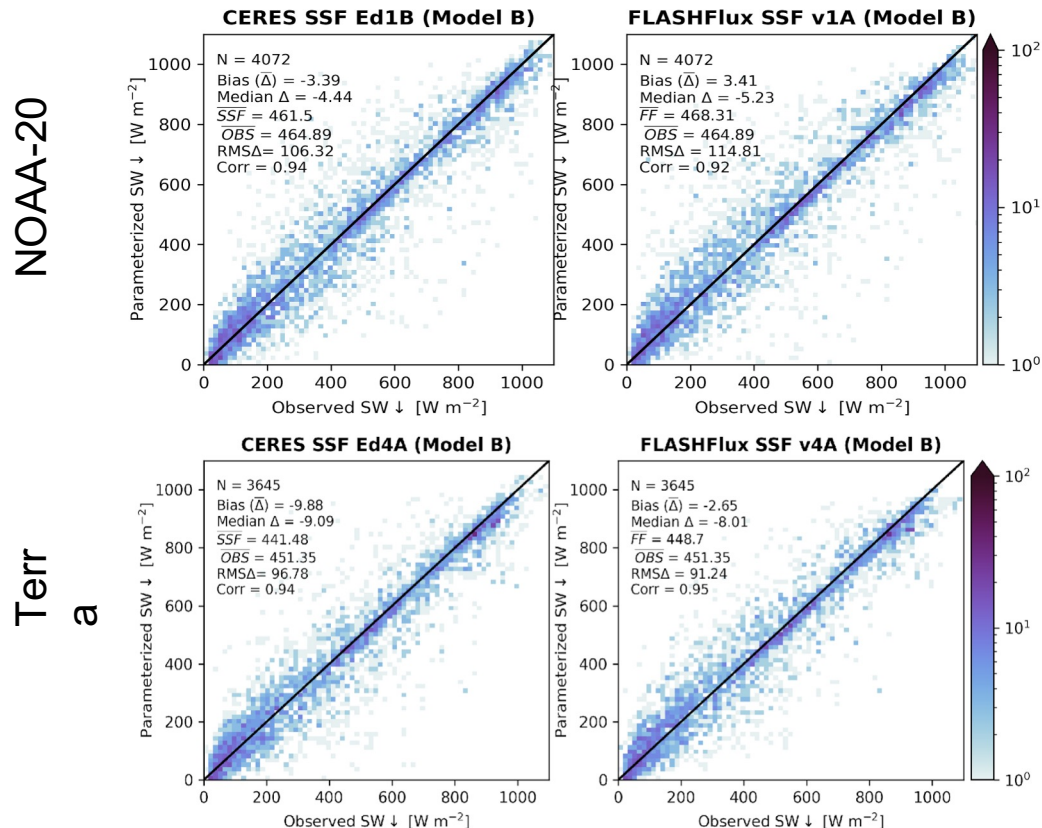


FF SSF SW Flux Validation: 10/2022-6/2023

Overpass SW flux validation with BSRN measurements:

- Left CERES SSF (Model B)
- Right FLASHFlux SSF (Model B)
- Top NOAA-20, Bottom Terra

Both FLASHFlux SW NOAA-20 and Terra radiative fluxes have biases < 2%; RMS < 25%



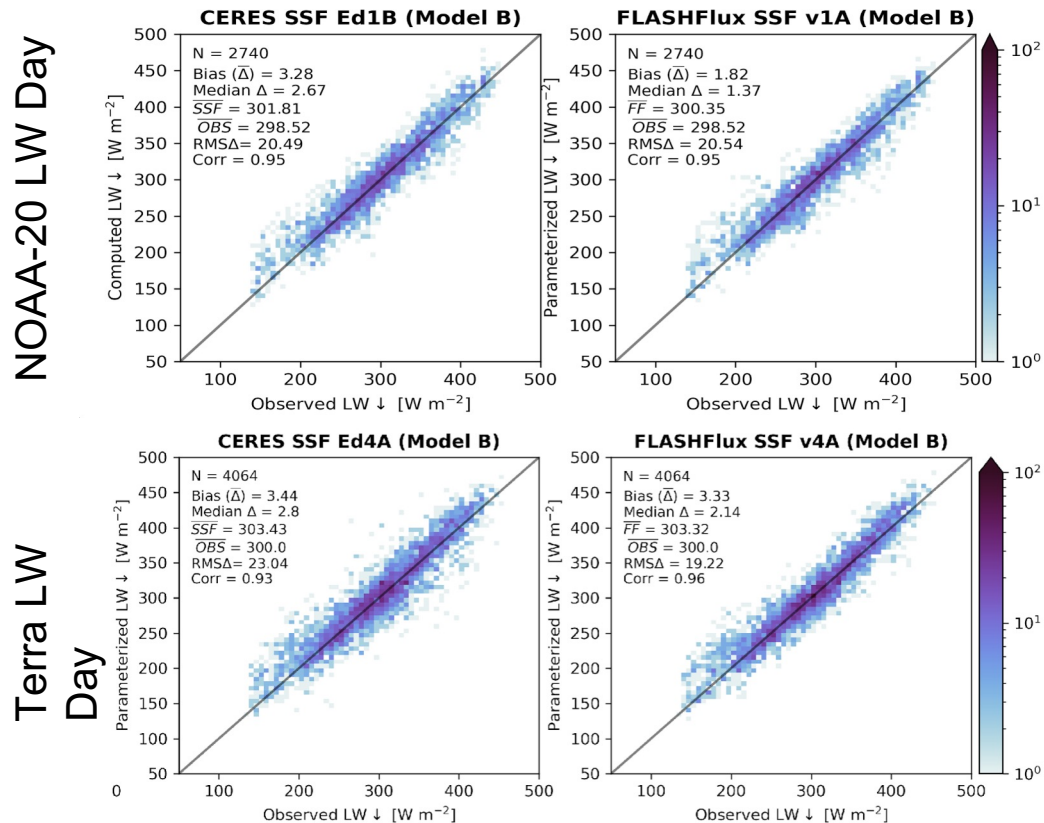


FF SSF LW Flux Day Validation: 10/2022-6/2023

Overpass LW daytime flux validation with BSRN measurements:

- Left CERES SSF (Model B)
- Right FLASHFlux SSF (Model B)
- Top NOAA-20, Bottom Terra

Both FLASHFlux SW NOAA-20 and Terra radiative fluxes show consistent biases < 1%; RMS's < 7%



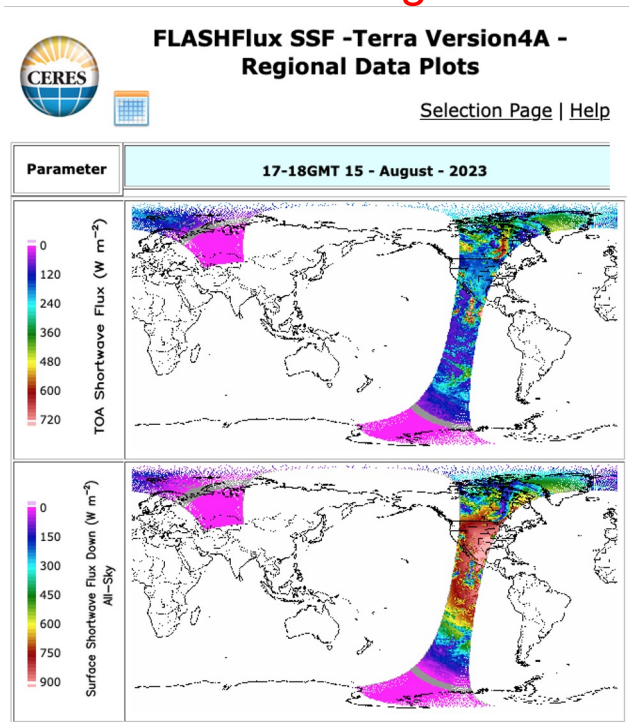


FLASHFlux SSF Usage: Solar Energy

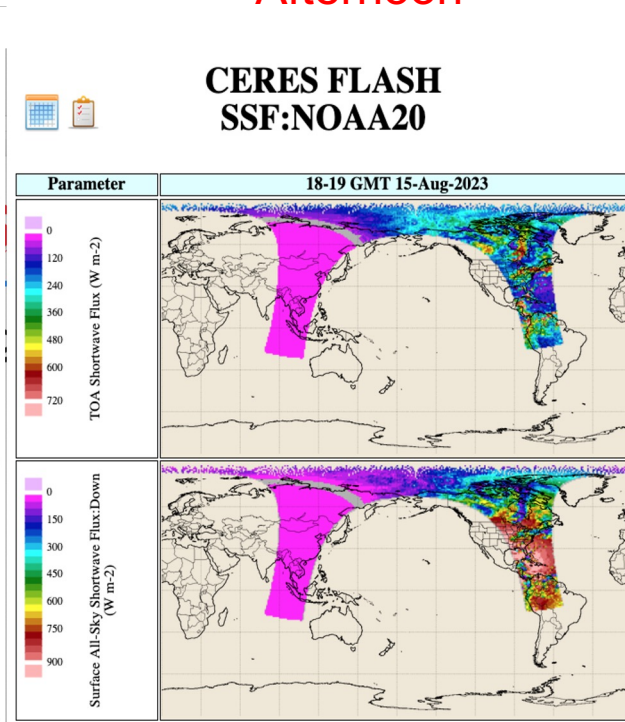
Solar Forecasting Team (Dalhousie U/ Consortium)

- Utilizing surface fluxes from SSF to scale forecasts
- Particularly useful for higher latitudes (> 60 N)
- Latency 2-4 days sufficient

Morning

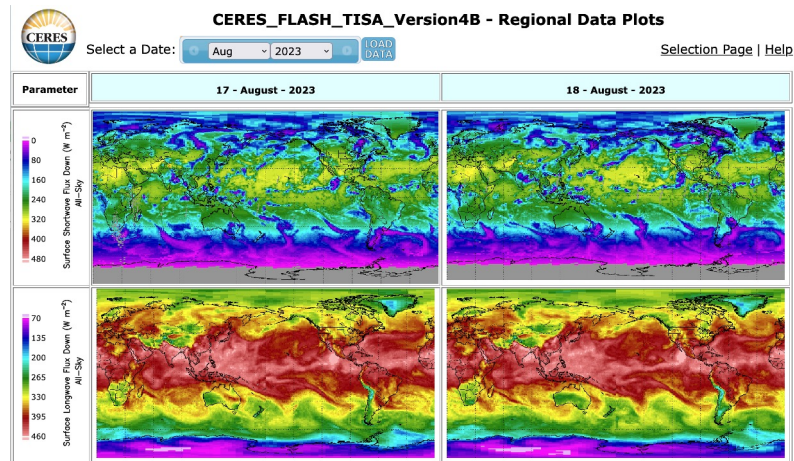
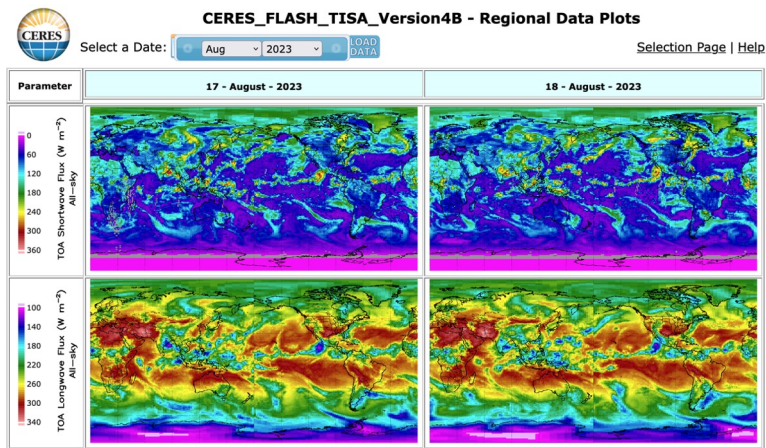
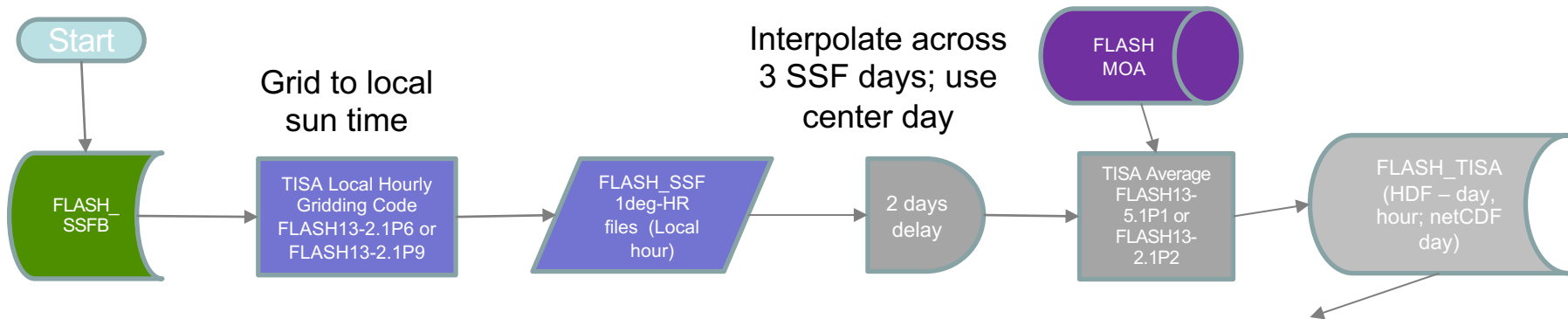


Afternoon





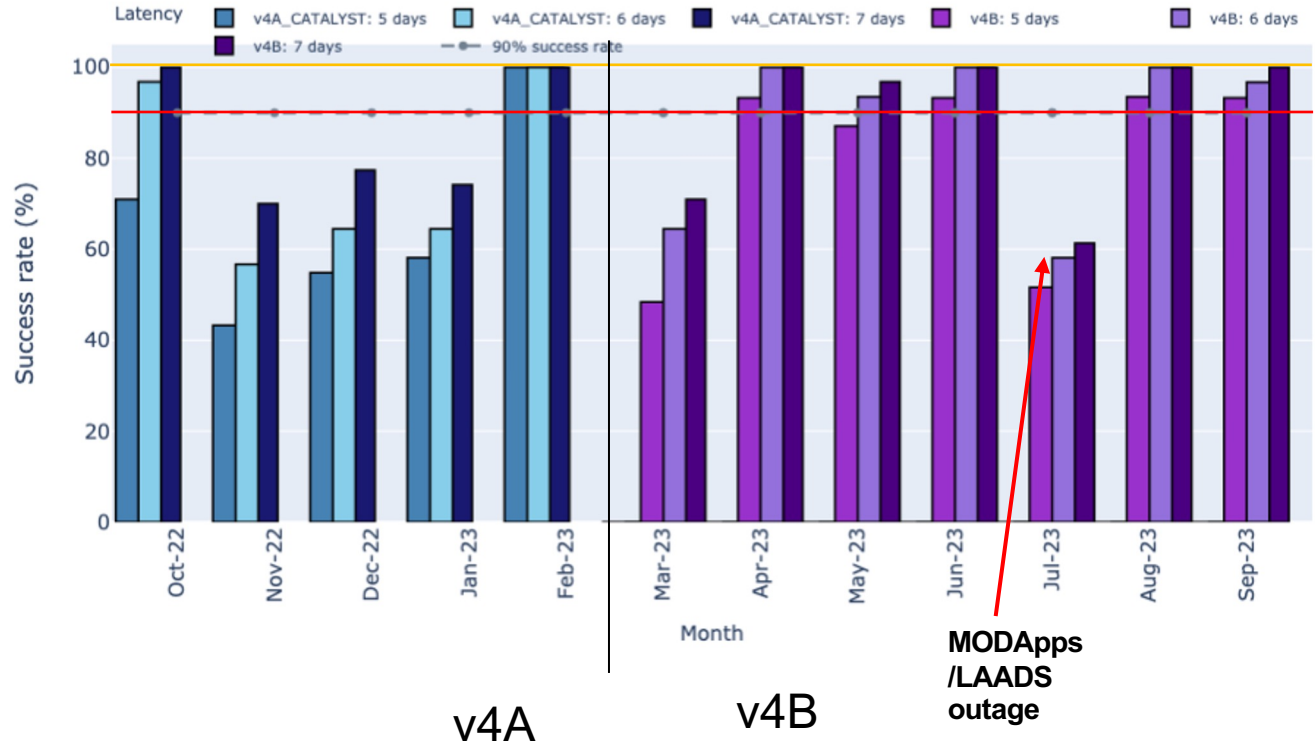
FLASHFlux TISA Data Flow





TISA Latency Statistics (v4A/v4B)

FLASHFlux TISA Monthly Latency Success Rates



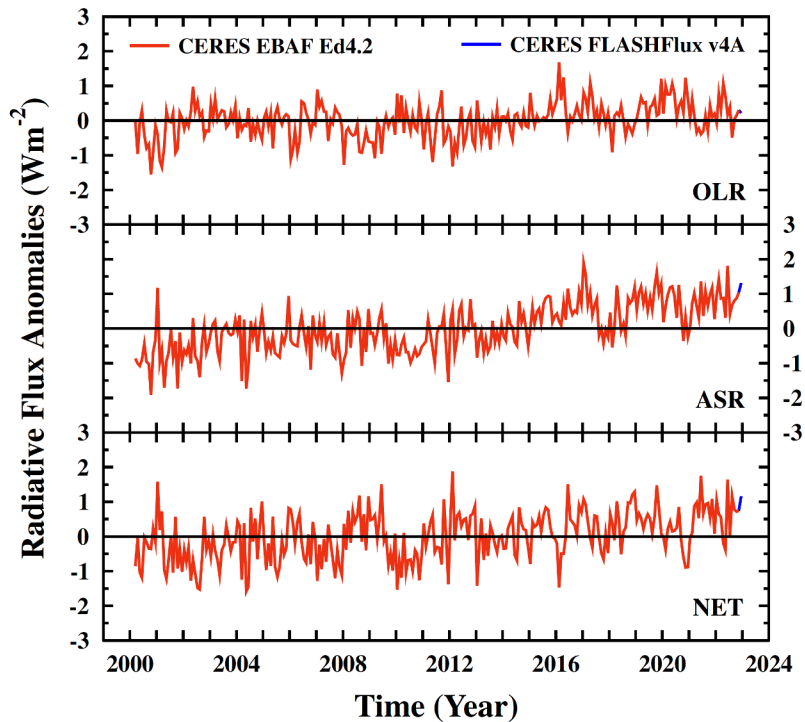
v4A success rates for TISA to be archive in 5, 6 or 7 days after observation

v4B began production in March 2023



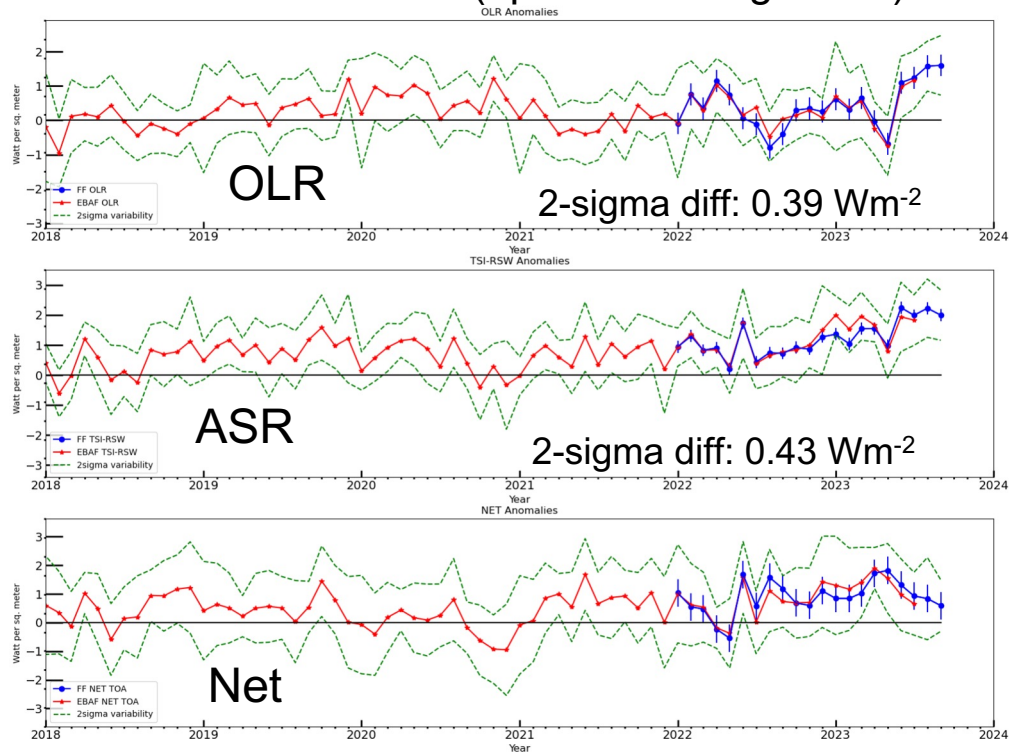
FLASHFlux TISA Application: Updated Anomalies

TOA Flux Anomalies (through 2022)



Wong *et al.*, 2023, submitted to BAMS

TOA Flux Anomalies (updated through 9/23)



Includes TISA 4A/4B transition



FLASHFlux TISA Validation: Surface Fluxes

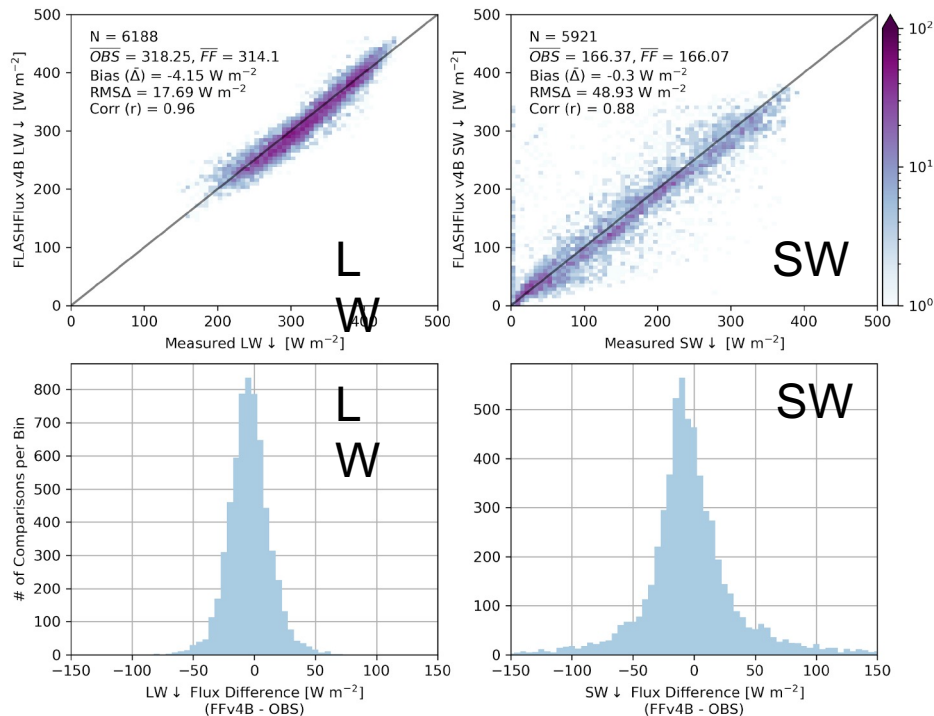
Ensemble FLASHFlux Version4A LW
and SW Daily Average Comparisons to
Surface Measurements (01/2019-
12/2022)

LW: Bias -4.2 W m^{-2} ($\sim -1.3\%$)
RMS 17.7 W m^{-2} ($\sim 5.6\%$)

SW: Bias -0.3 W m^{-2} ($\ll 1\%$)
RMS 48.9 W m^{-2} ($\sim 29.3\%$)

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

FLASHFlux TISA Version 4B
All Surface Validation Sites, 202210-202306
Daily Average Fluxes





FLASHFlux Data Accessibility Through POWER



Different users require different ways to access the same data

The POWER Project

Provides solar and meteorological data sets from NASA research for support of renewable energy, building energy efficiency and agricultural needs.

Supported by NASA Earth Science's *Applied Sciences Program*

POWER's Web-Based Docs Pages

- > [Data Methodology](#)
- > [Data Services Documentation](#)
- > [Data Access Tutorials](#)

POWER celebrated its 25th Anniversary at **POWER's first virtual Global Community (GloCo) Summit event** held on 21-22, September 2022. You can view the event materials, agenda, and recordings here: [GloCo Event Page](#)

<https://power.larc.nasa.gov>

POWER Hourly API 0.33 Oct
<https://power.larc.nasa.gov/api/openapihourlytempapi/>
 The API allows hourly data requests of POWER Analysis Ready Data (ARD).
 More documentation: <https://power.larc.nasa.gov/docs/services/api/openapihourly/>

Data Requests

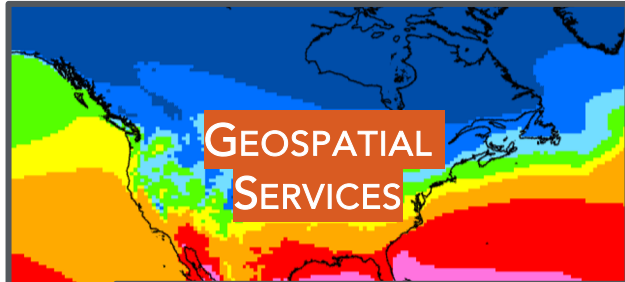
GET /api/temporal/hourly/point Single Point Data Request

Configuration Settings

GET /api/temporal/hourly/configuration Configuration Settings request

Schemas

API Information
 version: 0.33
 name: power



NASA POWER | Data Browse

Folder: power-analysis-ready-datastore

Show: 50 entries

Object	Last Modified	Timestamp	Size
power_901_annual_meteorology_utc.zarr/			
power_901_annual_radiation_utc.zarr/			
power_901_constants.zarr/			
power_901_daily_meteorology_lst.zarr/			

POWER | Data Viewer beta 4.0.3

Prediction of Worldwide Energy Resource (POWER) | Data Access Viewer (Enhanced State)

Temperature at 2 Meters
 Temperature at 2 Meters Maximum Average
 Temperature at 2 Meters Minimum Average

Wind Speed at 10 Meters
 Wind Speed at 10 Meters Maximum Average
 Wind Speed at 10 Meters Minimum Average

Wind Direction at 10 Meters
 Wind Direction at 10 Meters Maximum Average
 Wind Direction at 10 Meters Minimum Average

Wind Speed at 50 Meters
 Wind Speed at 50 Meters Maximum Average
 Wind Speed at 50 Meters Minimum Average

Wind Direction at 50 Meters
 Wind Direction at 50 Meters Maximum Average
 Wind Direction at 50 Meters Minimum Average

Wind Speed at 100 Meters
 Wind Speed at 100 Meters Maximum Average
 Wind Speed at 100 Meters Minimum Average

Wind Direction at 100 Meters
 Wind Direction at 100 Meters Maximum Average
 Wind Direction at 100 Meters Minimum Average

Service Annual Meteorology Layer: Wind Speed at 10 Meters Time: 2000 Units: m/s

1981 2000 2010 2020 6hr: 45.82 1hr: 144.82

Creating **trusted, value-added, easy-to-use** Application Ready Data & Services



FLASHFlux Data Delivery via POWER Web Services Portal (2022/08/01 to 2023/07/31)

CERES Data Orders Delivered via POWER < 3 weeks latency (FLASHFlux Data)

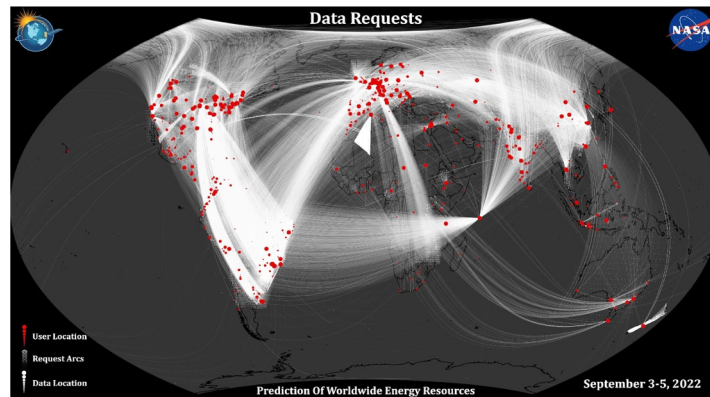
	Total	Monthly	Avg. Last 3 Months
Unique Users IPs	~36.9 K (13%)	~3.9 K (14%)	~4.8 K (15%)
Requests	~33.8 M (28%)	~2.8 M (30%)	~3.3 M (34%)

CERES Data Orders Delivered via POWER including SYN1Deg and FLASHFlux data

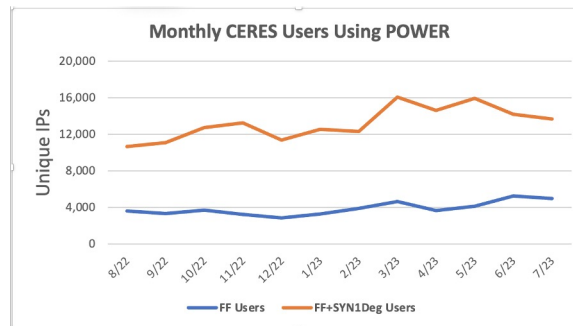
	Total	Monthly	Avg. Last 3 Months
Unique Users IPs	~134.8 K (48%)	~13.2 K (48%)	~14.6 K (46%)
Requests	~ 66.4 M (57%)	~5.8 M (55%)	~5.0 M (50%)

(includes SYN1Deg from Sep 2001 through latest month released)

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



Accumulated over 3 days



Total FF+SYN1Deg users
50-60% increase

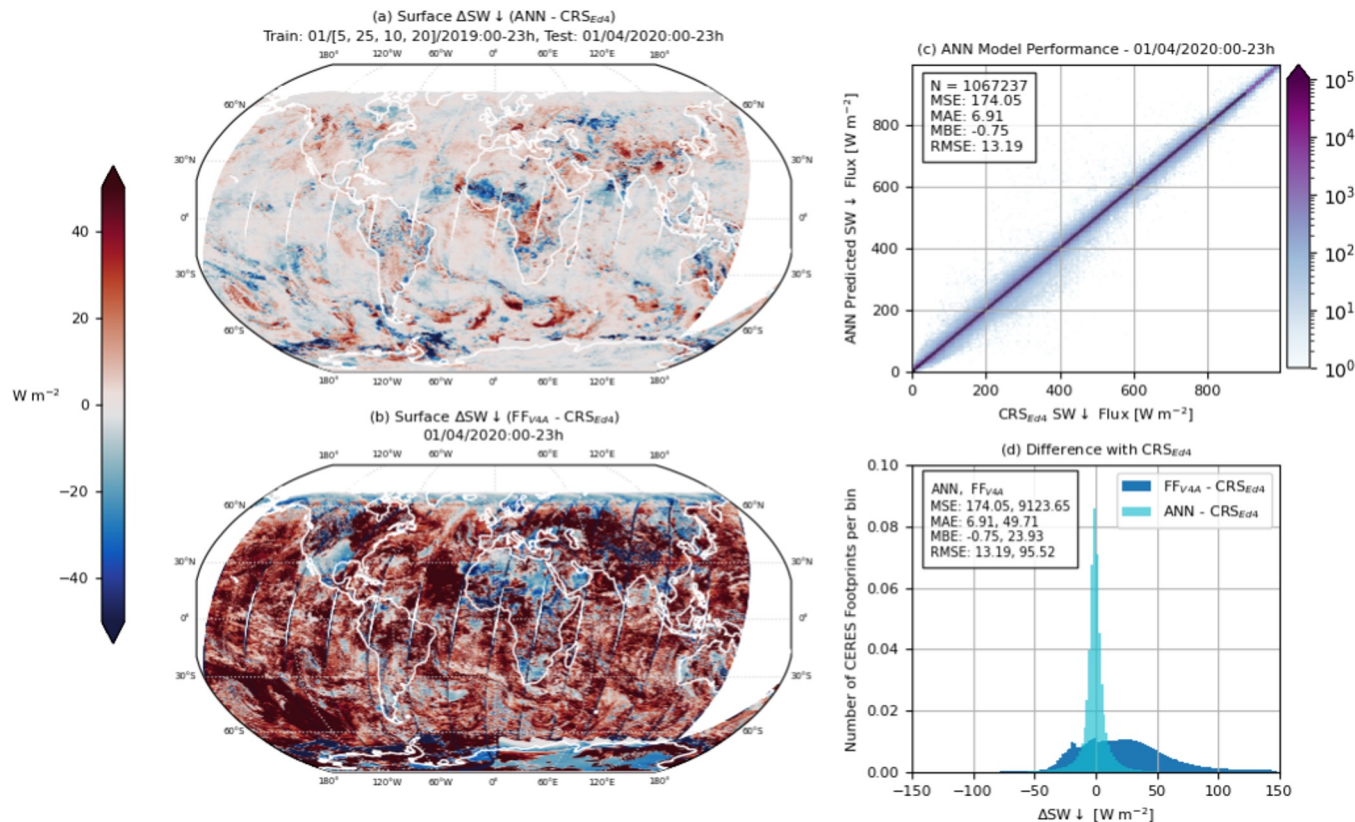
FF users increased by about 35% in the last year



Future Flux SSF Flux Algorithm Updates: NN SW

Preliminary Neural Net training results:

- CRS Ed1 used for training since uses full Fu/Liou RT
- 4 separate days for Jan 2020 used
- Variables: TOA SW, CF, COD, AOD, etc.
- Comparison of FF to CRS at bottom

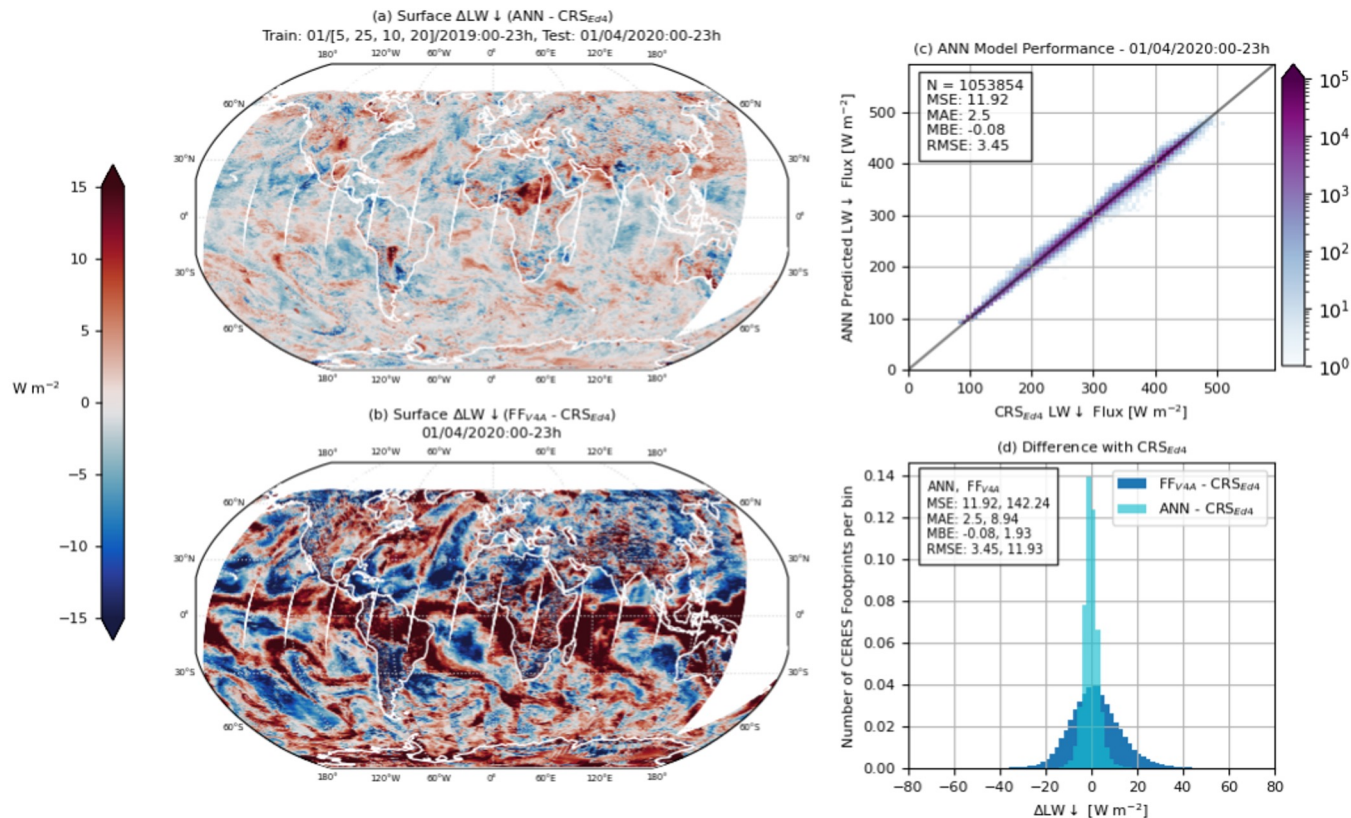




Future Flux SSF Flux Algorithm Updates: NN LW

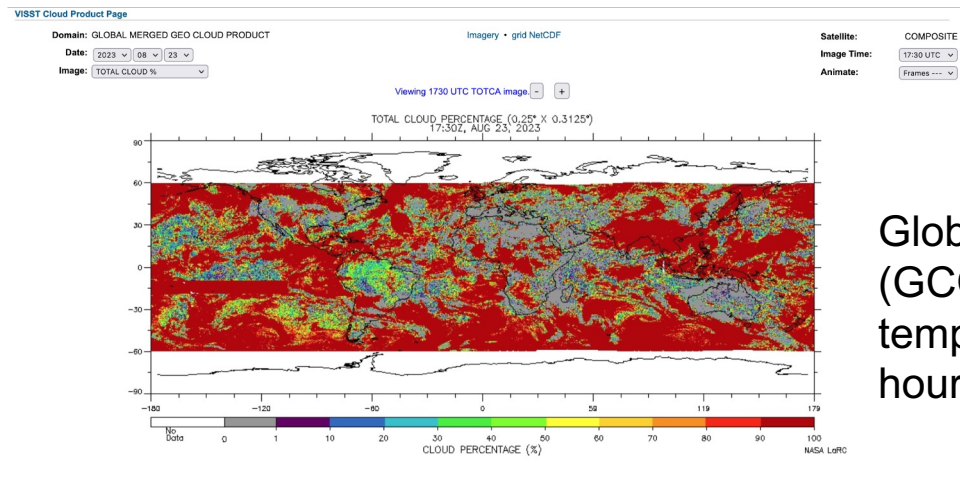
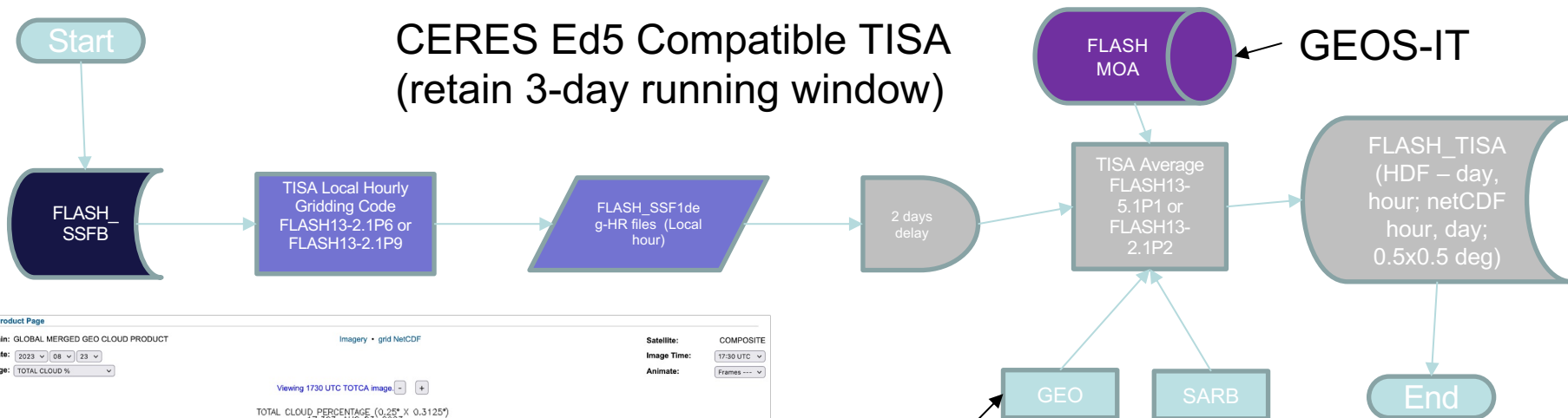
Preliminary Neural Net training results:

- CRS Ed1 used for training since uses full Fu/Liou RT
- 4 separate days for Jan 2020 used
- Variables: CF, COD, AOD, Cloud top, Cloud base, etc.
- Comparison of FF to CRS at bottom





“Near Future” FLASHFlux TISA Data Flow



Global Cloud Composite (GCC) Merged GEO for temporal interpolation/hourly products

Full Fu-Liou RT Calculations



FLASHFlux Summary

- **Production with NOAA-20 SSF and TISA v4B Continues via CATALYST**
 - FF NOAA-20 v1A SSF (10/14/23) and Terra v4A (10/14/23); Aqua SSF ceased 3/31/23
 - TISA v4B Terra/NOAA-20 through 10/12; satisfying latency goals
 - New FF Gain+Spectral coefficients beginning Oct 1st, 2023.
- **Validation and Assessment Relative to BSRN/Buoy**
 - CERES and FLASHFlux SSF through June 2023; low biases; RMS's comparable
 - TISA v4B daily averages through June 2023 (9 months); low biases; RMS larger at some sites
- **FLASHFlux Modernization and Updates**
 - Update to new GEOS-IT sample data: Goal Operational Jan 1, 2024 (some overlap months)
 - ML non-linear based algorithms for future FF SSF data products: Goal Operational April 2024
 - Migrate configuration to NOAA-20 + GCC GEO & F/L Fluxes: Goal Operational August 2024
- **FLASHFlux Information & Data Provision Through ...**
 - CERES web site and subsetter both SSF and TISA, ASDC (via EarthData) and POWER
 - FF+Syn1 POWER Distribution in last year: ~134K unique IPs; > 66M orders; orders >34% low latency
 - 2022 BAMS State of the Climate TOA Flux reports published



FLASHFlux Web Sites

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

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

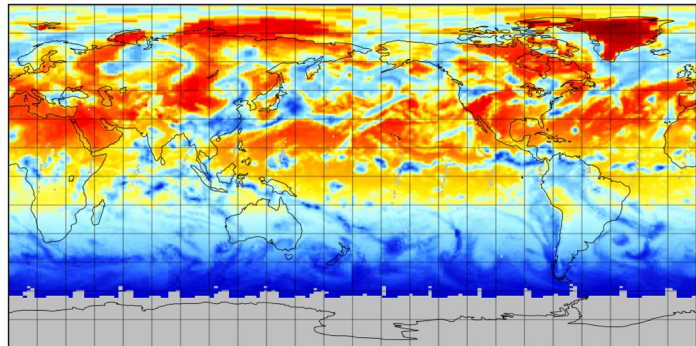


Extras



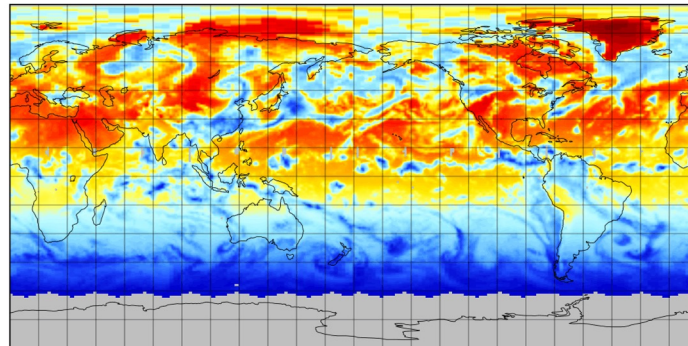
Surface SW Down

Downward Shortwave Surface Flux



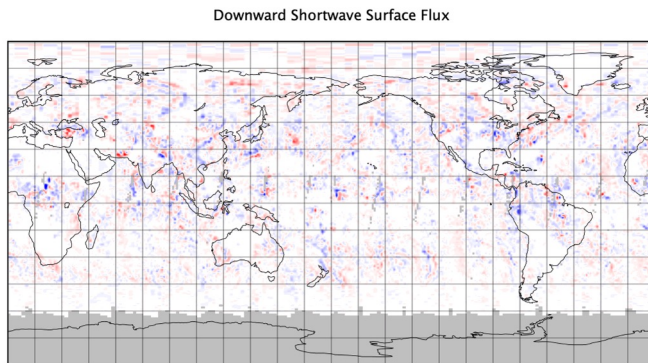
2022.06.12
Downward Shortwave Surface Flux ($W\ m^{-2}$)
Terra-NOAA20
Data Min = 0.1, Max = 411.1, Mean = 188.5

Downward Shortwave Surface Flux



2022.06.12
Downward Shortwave Surface Flux ($W\ m^{-2}$)
Terra-Aqua
Data Min = 0.2, Max = 411.1, Mean = 188.7

NOAA20 + Terra



2022.06.12
Downward Shortwave Surface Flux - Downward Shortwave Surface Flux ($W\ m^{-2}$)
NOAA20 minus Aqua
Data Min = -155.5, Max = 132.8, Mean = 0.1

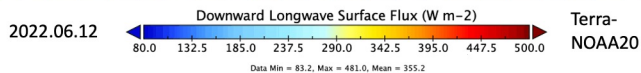
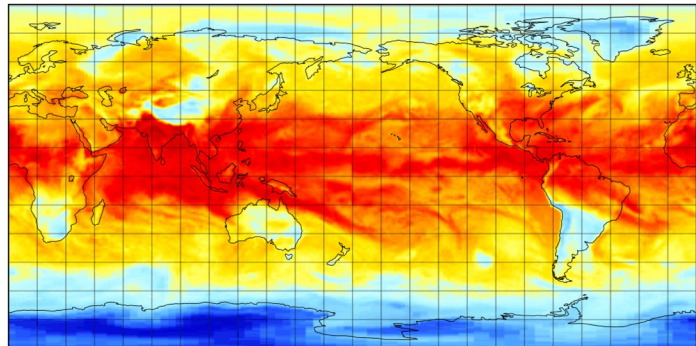
Aqua + Terra

Differences Terra-NOAA20 minus Terra-Aqua

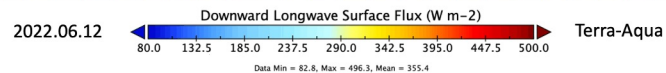
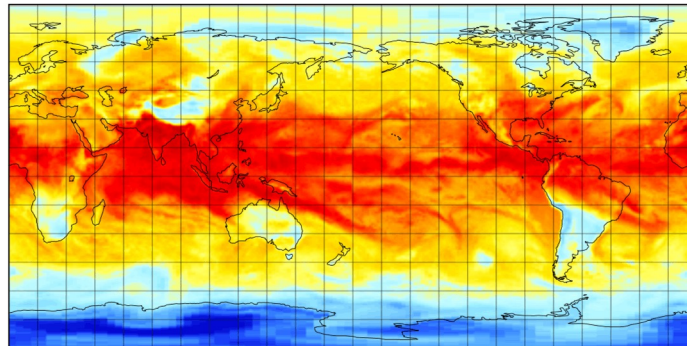


Surface LW Down

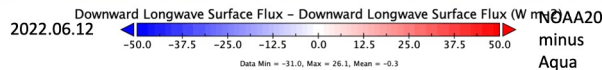
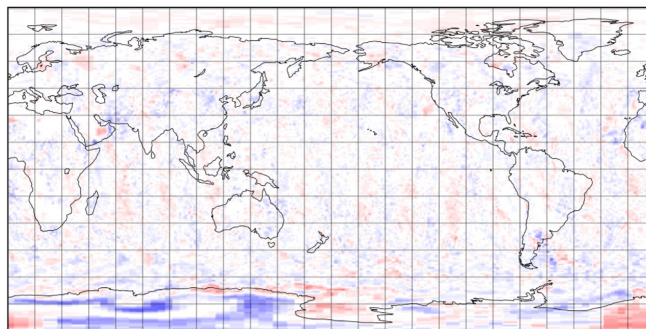
Downward Longwave Surface Flux



Downward Longwave Surface Flux



Downward Longwave Surface Flux



NOAA20 + Terra

Aqua + Terra

Differences Terra-NOAA20 minus Terra-Aqua

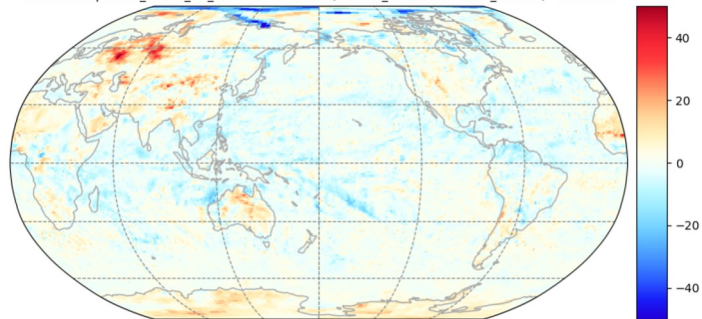


Assessing GEOS-IT: All-Sky Surf LW Down Differences (Jan, Jun 15, 2018)

Jan All-Sky Surf LW Down (w/ GEOS-IT – FP-IT)

Units: $W m^{-2}$

TISA Terra-Aqua SFC_DOWN_LW_ALL Flux Difference (DevRun_111111 - DevRun_999999) - 20180115



FF SFC_DOWN_LW_ALL Flux - Wm^{-2}

Global Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	-0.2022	5.007	3.3027
60-90N	-0.6161	8.9421	5.545
30-60N	0.8929	5.5597	3.5622
0-30N	-1.3146	4.5707	3.255
0-30S	-1.0147	4.5295	3.3025
30-60S	0.3348	2.684	1.8724
60-90S	2.9375	3.8006	2.9726

Land Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	1.0896	5.8561	4.2557
60-90N	2.1292	6.1036	4.1667
30-60N	2.7896	5.99	4.0231
0-30N	0.5619	6.0614	4.7003
0-30S	-0.0866	5.6067	4.2508
30-60S	1.4698	4.3045	3.3297
60-90S	1.9914	2.8992	2.0752

Ocean Statistics

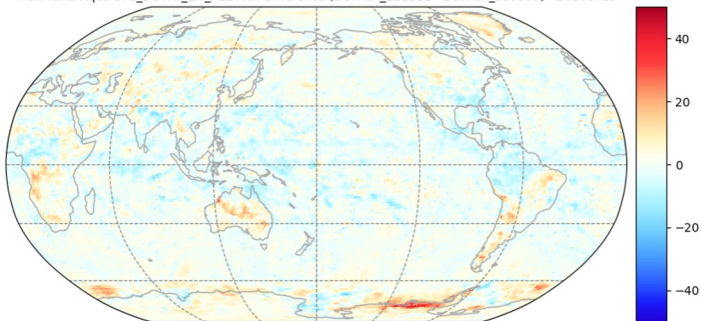
Diff Stats	Mean	StdDev	Mean Abs Difference
Global	-1.0672	3.3112	2.4463
60-90N	0.1668	2.0783	1.4767
30-60N	-1.2261	2.8224	2.1052
0-30N	-2.3038	3.1116	2.3095
0-30S	-1.3694	3.9864	2.9847
30-60S	0.2371	2.4718	1.741
60-90S	0.5652	1.4897	1.1012

Snow/Ice Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	1.3466	8.1657	5.2576
60-90N	-1.1343	9.7683	6.3311
30-60N	1.9059	7.0955	4.7145
0-30N	--	--	--
0-30S	--	--	--
30-60S	--	--	--
60-90S	4.8224	4.0603	3.2039

July All-Sky Surf LW Down (w/ GEOS-IT – FP-IT)

TISA Terra-Aqua SFC_DOWN_LW_ALL Flux Difference (DevRun_111111 - DevRun_999999) - 20180715



FF SFC_DOWN_LW_ALL Flux - Wm^{-2}

Global Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	-0.2574	4.1239	2.8615
60-90N	0.9618	3.1469	2.2283
30-60N	-0.0383	3.5326	2.5815
0-30N	-1.7314	3.7796	2.817
0-30S	-0.6223	4.3731	3.0701
30-60S	0.2173	2.532	1.7782
60-90S	3.4908	6.5413	4.4537

Land Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	0.2018	4.8701	3.6308
60-90N	0.8823	3.2476	2.3917
30-60N	0.1595	4.1189	3.1417
0-30N	-1.3231	4.751	3.6562
0-30S	1.079	6.1544	4.7405
30-60S	1.9123	4.2945	3.2095
60-90S	4.7377	5.3338	3.9246

Ocean Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	-0.9301	2.934	2.1847
60-90N	-0.023	1.5748	1.0871
30-60N	-0.3037	2.5253	1.8315
0-30N	-1.9465	3.1282	2.3705
0-30S	-1.2713	3.232	2.4018
30-60S	0.028	2.1429	1.6073
60-90S	1.007	1.9178	1.3973

Snow/Ice Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	3.1215	6.2475	4.2442
60-90N	1.6497	3.3818	2.3853
30-60N	0.2578	4.4484	3.6579
0-30N	--	--	--
0-30S	--	--	--
30-60S	1.9391	5.2355	3.6273
60-90S	3.6415	6.8675	4.6902

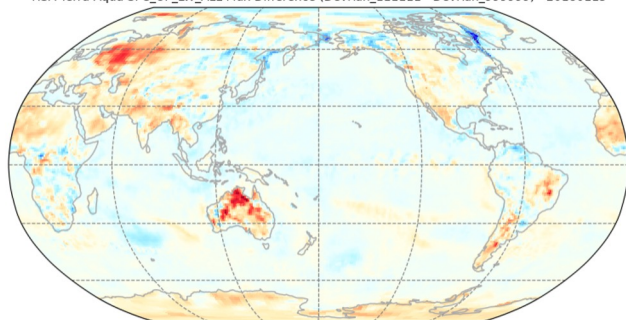


Assessing GEOS-IT: All-Sky Surf LW Up Differences (Jan, Jun 15, 2018)

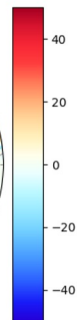
Jan All-Sky Surf LW Up (w/ GEOS-IT – FP-IT)

Units: $W\ m^{-2}$

TISA Terra-Aqua SFC_UP_LW_ALL Flux Difference (DevRun_111111 - DevRun_999999) - 20180115



FF SFC_UP_LW_ALL Flux - Wm^{-2}



Global Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	0.7063	5.781	3.7996
60-90N	-0.259	8.6218	6.131
30-60N	1.1119	6.606	4.6927
0-30N	-0.0823	5.4453	3.7099
0-30S	0.7684	5.726	3.3114
30-60S	0.5183	3.4994	2.2664
60-90S	3.9171	4.7563	3.9886

Land Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	3.6851	8.1257	6.1329
60-90N	3.0366	7.1518	5.276
30-60N	4.3661	7.177	5.3213
0-30N	3.5397	7.7693	6.404
0-30S	3.2538	9.7663	6.9855
30-60S	4.2934	7.2743	5.6802
60-90S	3.0629	4.4838	3.1943

Ocean Statistics

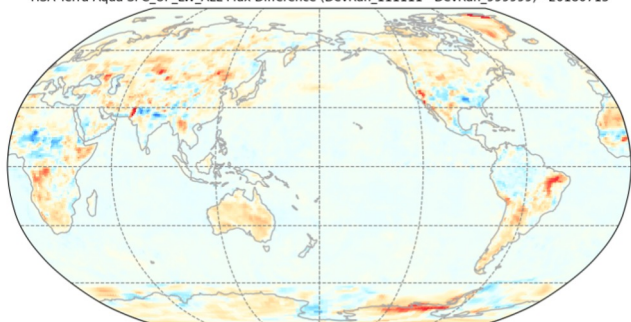
Diff Stats	Mean	StdDev	Mean Abs Difference
Global	-0.7706	2.4263	1.8183
60-90N	-0.8166	2.157	1.3181
30-60N	-1.9873	1.7319	1.2351
0-30N	-1.9916	1.697	1.1981
0-30S	-0.1794	2.3799	1.8121
30-60S	0.1928	2.7212	1.9231
60-90S	0.3398	1.4318	1.1518

Snow/Ice Statistics

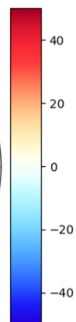
Diff Stats	Mean	StdDev	Mean Abs Difference
Global	2.0713	8.5242	6.363
60-90N	-0.552	9.1823	6.8356
30-60N	1.9016	8.454	6.2583
0-30N	--	--	--
0-30S	--	--	--
30-60S	--	--	--
60-90S	6.7714	4.4966	3.6579

July All-Sky Surf LW Up (w/ GEOS-IT – FP-IT)

TISA Terra-Aqua SFC_UP_LW_ALL Flux Difference (DevRun_111111 - DevRun_999999) - 20180715



FF SFC_UP_LW_ALL Flux - Wm^{-2}



Global Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	0.4558	4.8404	3.124
60-90N	2.6394	4.4932	3.1847
30-60N	2.1239	5.3822	3.7888
0-30N	-0.6762	4.6533	2.457
0-30S	-0.0877	4.6375	2.8057
30-60S	-0.5363	2.2672	1.1776
60-90S	2.6195	7.0734	5.2586

Land Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	2.5901	6.9393	5.1399
60-90N	2.8004	4.305	3.2776
30-60N	3.3341	6.6321	4.829
0-30N	0.4513	7.6833	5.3946
0-30S	3.7198	7.4844	6.1353
30-60S	3.454	4.9894	4.2688
60-90S	4.0499	6.5	4.9848

Ocean Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	-0.9836	1.3433	0.9172
60-90N	0.6914	1.6645	1.1771
30-60N	0.5105	2.1131	1.6092
0-30N	-1.2703	0.9657	0.7409
0-30S	-1.5402	0.8372	0.6215
30-60S	-0.9322	0.9449	0.7003
60-90S	-0.3856	0.8113	0.5746

Snow/Ice Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	2.8504	6.9813	5.0604
60-90N	3.3105	5.5042	3.7406
30-60N	3.4584	5.058	4.403
0-30N	--	--	--
0-30S	--	--	--
30-60S	-0.5793	7.022	5.1913
60-90S	2.8197	7.3907	5.5166

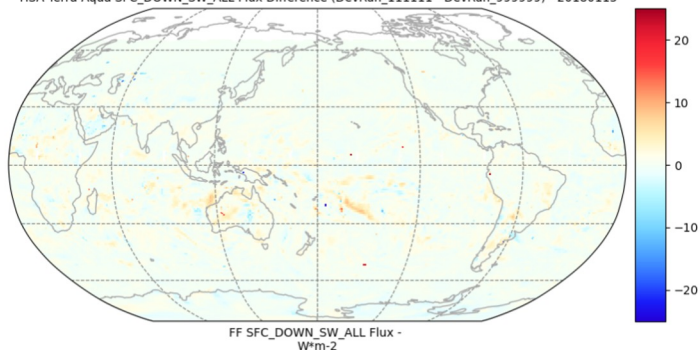


Assessing GEOS-IT: All-Sky Surf SW Down Differences (Jan, Jun 15, 2018)

Jan All-Sky Surf SW Down (w/ GEOS-IT – FP-IT)

Units: $W m^{-2}$

TISA Terra-Aqua SFC_DOWN_SW_ALL Flux Difference (DevRun_111111 - DevRun_999999) - 20180115



Global Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	0.3256	1.2395	0.6406
60-90N	0.0069	0.104	0.0559
30-60N	0.0906	0.5979	0.2957
0-30N	0.3564	1.3674	0.6076
0-30S	0.6011	1.6551	0.9283
30-60S	0.3453	0.9664	0.6055
60-90S	-0.1186	0.7356	0.5311

Land Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	0.3892	1.4859	0.7375
60-90N	0.0224	0.1725	0.0886
30-60N	0.1038	0.5725	0.3273
0-30N	0.3553	1.1154	0.7458
0-30S	0.7061	2.2209	0.9846
30-60S	0.638	1.8765	1.0129
60-90S	-0.0323	0.6355	0.4463

Ocean Statistics

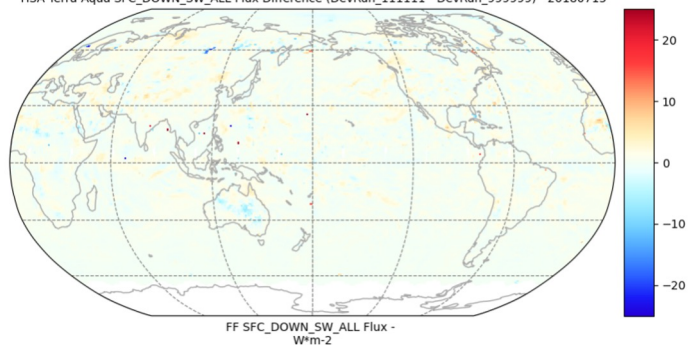
Diff Stats	Mean	StdDev	Mean Abs Difference
Global	0.3686	1.1725	0.6223
60-90N	0.0064	0.0643	0.0433
30-60N	0.1675	0.3832	0.2686
0-30N	0.3566	1.4832	0.535
0-30S	0.5611	1.378	0.9057
30-60S	0.3201	0.8386	0.5641
60-90S	0.0455	0.4541	0.3335

Snow/Ice Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	-0.1166	0.7924	0.3992
60-90N	0.0047	0.0957	0.0535
30-60N	-0.0629	0.8574	0.28
0-30N	--	--	--
0-30S	--	--	--
30-60S	--	--	--
60-90S	-0.2578	0.8872	0.6803

July All-Sky Surf SW Down (w/ GEOS-IT – FP-IT)

TISA Terra-Aqua SFC_DOWN_SW_ALL Flux Difference (DevRun_111111 - DevRun_999999) - 20180715



Global Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	0.3463	1.3742	0.6158
60-90N	0.2525	1.4276	0.8214
30-60N	0.5452	1.1358	0.7648
0-30N	0.3732	2.1917	0.726
0-30S	0.3601	0.864	0.5889
30-60S	0.1551	0.3576	0.2343
60-90S	-0.0103	0.2188	0.0727

Land Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	0.4401	1.2656	0.8032
60-90N	0.3522	1.6706	0.9287
30-60N	0.6271	1.2434	0.851
0-30N	0.4247	1.2375	0.7941
0-30S	0.292	1.135	0.7551
30-60S	0.1985	0.672	0.4263
60-90S	-0.0241	0.1411	0.0741

Ocean Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	0.3111	1.4428	0.5094
60-90N	0.2302	0.8498	0.5164
30-60N	0.4303	0.9533	0.631
0-30N	0.3459	2.5569	0.687
0-30S	0.3861	0.7331	0.5279
30-60S	0.1525	0.3094	0.2145
60-90S	0.0183	0.0868	0.0572

Snow/Ice Statistics

Diff Stats	Mean	StdDev	Mean Abs Difference
Global	0.0499	0.8537	0.5145
60-90N	0.0523	0.9926	0.7184
30-60N	2.2652	1.8424	1.3928
0-30N	--	--	--
0-30S	--	--	--
30-60S	0.0127	0.3117	0.1875
60-90S	-0.0246	0.272	0.0822



FLASHFlux TISA Validation: V4A vs V4B

Comparison Daily Averaged Surface LW (left) and SW (right) of v4A (top) and v4B (bottom) (Oct – Dec 2022)

Both downwelling fluxes show very similar statistics between v4A and v4B:

- LW RMS's: ~6%
- SW RMS's: ~25%

