

The Critical Importance of BSRN to Quantify the Uncertainties and Improve the NASA/GEWEX SRB Fluxes and Resulting Impacts

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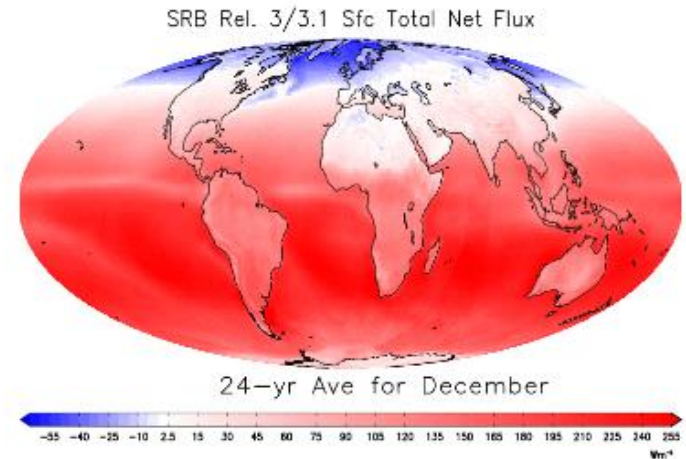
SRB Objectives:

- **Fuse observations** of clouds, aerosols, atmospheric constituents, and surface properties consistently in time and space to estimate the key components of the surface and TOA radiative fluxes for long-time periods (exceeding 30 years)
- **Explore** these data sets to describe the long-term mean & variability of the surface and TOA radiative budgets and their dependencies
- **Provide** these data products to scientific and applied science users
- **Collaborate** with other global GEWEX projects to improve integration and promote the understanding of these energy components in the context global heat and water budgets

NASA GEWEX Surface Radiation Budget

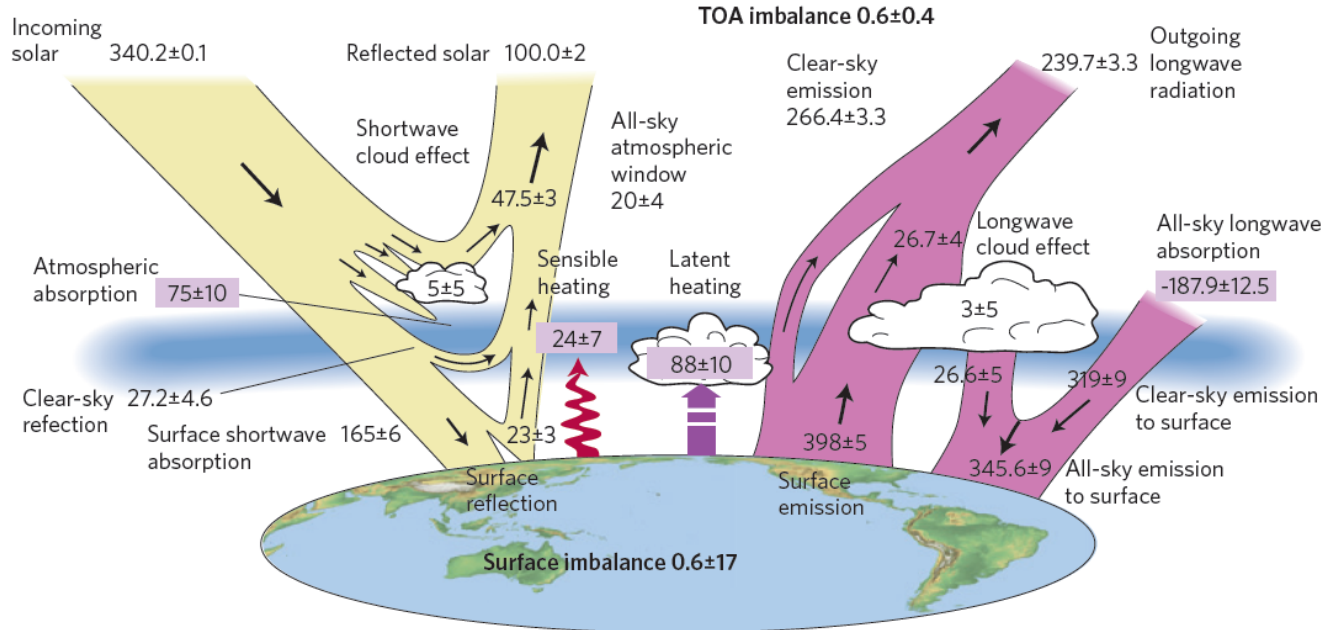
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NASA GEWEX Surface Radiation Budget

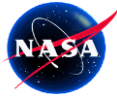


<http://gewex-srb.larc.nasa.gov>

- Global energy balanced with uncertainties
- EBAF assumed to adjust TOA net
- Precipitation assumed to be higher than GPCP
- Surface imbalance +/- 17 W m⁻²



Stephens et al (2012, Nature GeoScience, 23 September 2012)



Examples of SRB Usage



Regional SRB Projects and Climatology

- Southern Ocean (Luo et al., '15)
- Specific geostationary satellites (Albarelo et al., '15, Müller et al., '15, Posselt et al., '14, Zhang et al., '14)
- Specific continental-scale areas (Cattiaux et al. '15, Gianotti and Eltahir '14, Pessacq et al., '14, Gao et al., '15, Wang et al., '14, Zhang & Liang, '14)
- Mediterranean basin study (Pyrina et al., '15 Nabat et al., '14)
- Alaska (Ueyama et al., '14)

Global Earth Radiative Budget and Clouds

- Atmospheric energy budgets and variability (Ma et al., '15, Stephens et al., '15, Zhang et al., '15)
- CERES comparisons (Kato et al., '13, Rutan et al., '15, Pan et al., '15)
- Global surface albedo estimations: Qu et al., '15, He et al., '14)
- Ocean heat budget (Wong et al., '14)

Water and Energy Cycle

- Closure studies (Robertson et al., '14)
- Monsoon (Hu and Duan, '15, Kothe et al., '14)
- Global evapotranspiration (Long et al., '14, Yao et al., '14)
- North China drought (Zhang et al., '15)
- River basin water and energy balance (Tatsumi and Yamashiki, '15, Yang et al., '15)
- Tanzania (Armanios and Fisher '14)
- Global soil moisture/precipitation: Guillod et al., '15)
- Radiation/energy balance of snow (Lapo et al., '15)

Interdisciplinary Research Projects

- Solar cooking in Sahel (Newton et al., '14)
- Solar energy (Mazurek '14)
- Global gross primary production (Cai et al., '14)
- Global lake surface temperatures (Sharma et al., '15)
- Agricultural modeling (Ruane et al., '15)

Energy Applied Science

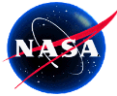
- Solar panel resource and citing
- Solar hot water heating
- Solar street lighting
- Solar walls
- Building energy modeling

Agricultural Usage

- Crop modeling
- Land use
- Irrigation modeling

Human and Animal Disease

- Bipolar disease onset
- Infestation vectors



Current SRB Release 3 Data Products



(Spatial Resolution: 1° x 1°; 7/83 – 12/07)

Data Types	Model Name	Temporal Resolution	Parameters
SW	GEWEX SW (Pinker/Laszlo) (v3.0)	3-hourly, Monthly Averaged 3-hourly, Daily and Monthly Averaged (UTC and local sun time)	All-sky: Surface down, up, PAR down; TOA Down, Up Clear-Sky: Surface Down, Up; TOA Up
	LPSA (Staylor/Gupta) (v3.0)	Daily, Monthly	All-sky: Surface Down, Net, and Albedo Clear-sky: Surface Down
LW	GEWEX LW (Fu/Liou/Stackhouse) (v3.1)	3-hourly, Monthly Averaged 3-hourly, Daily and Monthly Averaged	All-sky and clear-sky: TOA up; Surface Up and Down
	LPLA (Gupta) (v3.0)	3-hourly, Monthly Averaged 3-hourly, Daily and Monthly Averaged	All-sky Surface Downward, Net; Cloud Radiative Forcing
Input Property	CLDPROPS	3-Hourly	Surface emissivity, skin temperature, atmospheric profile; cloud phase, fraction, optical depth and LWC

Note: The LPSA and LPLA algorithms are also used in CERES Surface-Only



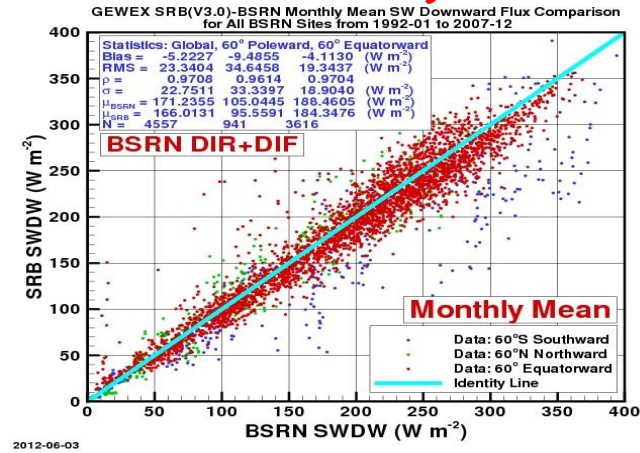
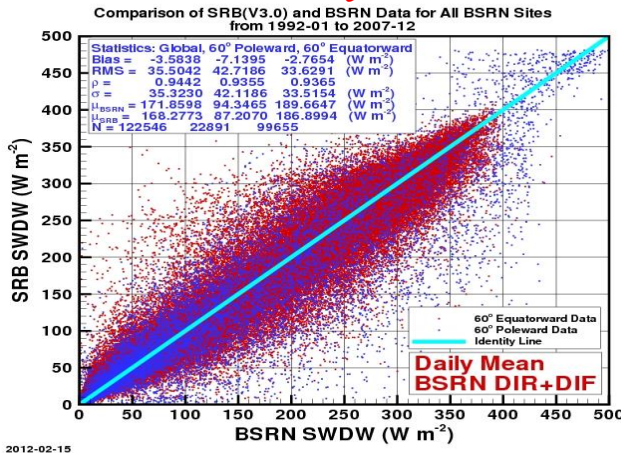
SRB(V3.0)-BSRN SW Daily and Monthly Mean Comparisons



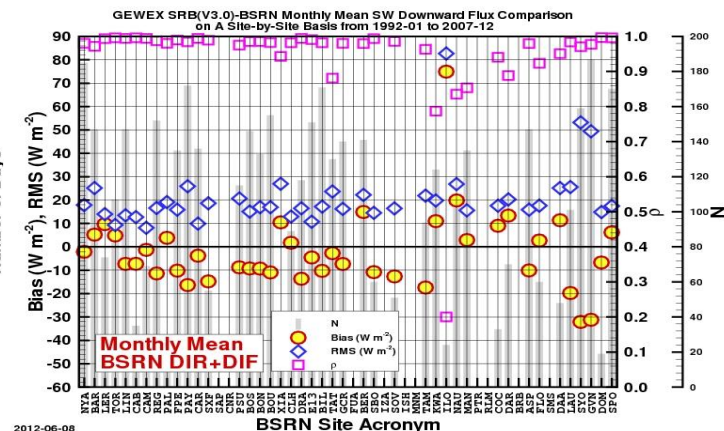
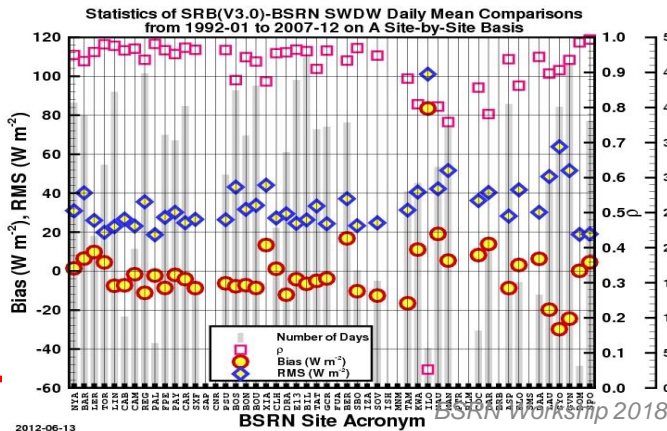
Daily

Monthly

Large Ensemble
(all times,
all sites)



Site-by-site
Ensemble
(all times,
each sites)



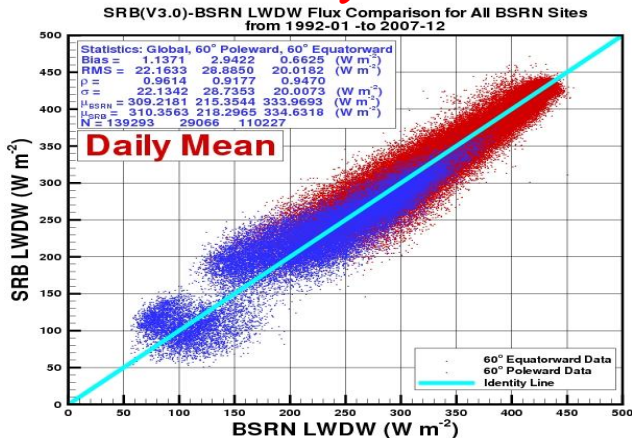


SRB(V3.0)-BSRN LW Daily and Monthly Mean Comparisons

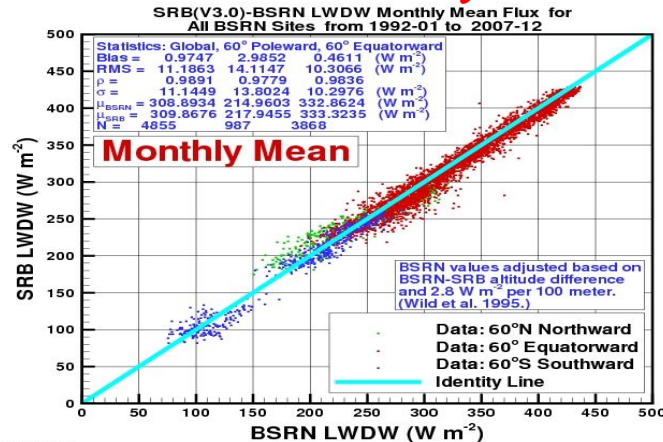


Large Ensemble
(all times,
all sites)

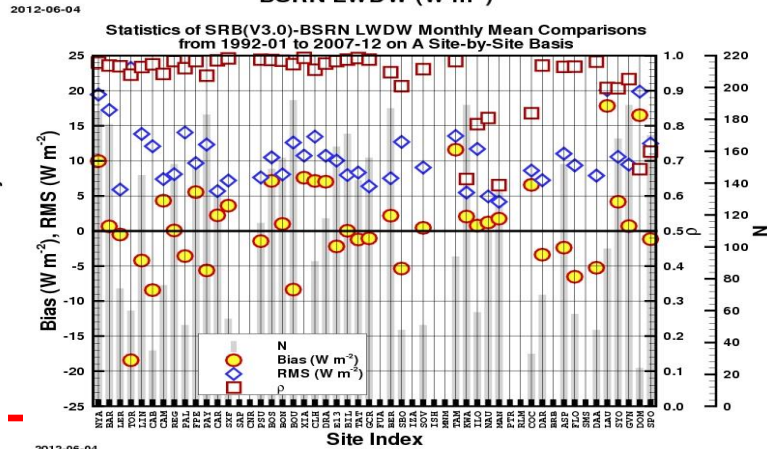
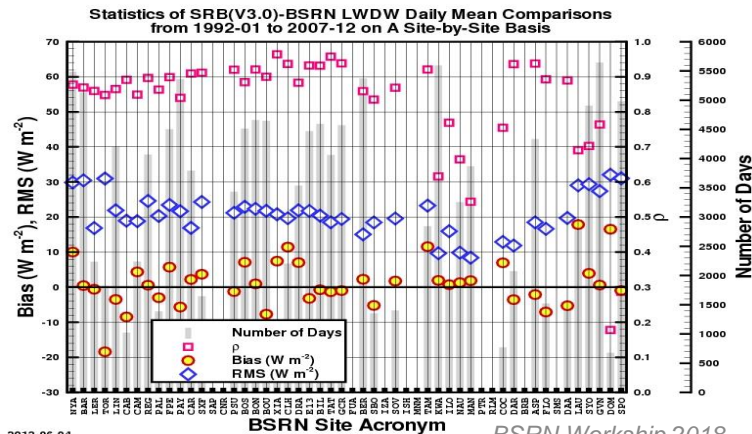
Daily

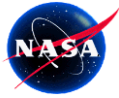


Monthly



Site-by-site
Ensemble
(all times,
each sites)





GEWEX SRB(V3.0)-BSRN Comparison

Bias/(RMS) from 1992-01 to 2007-12

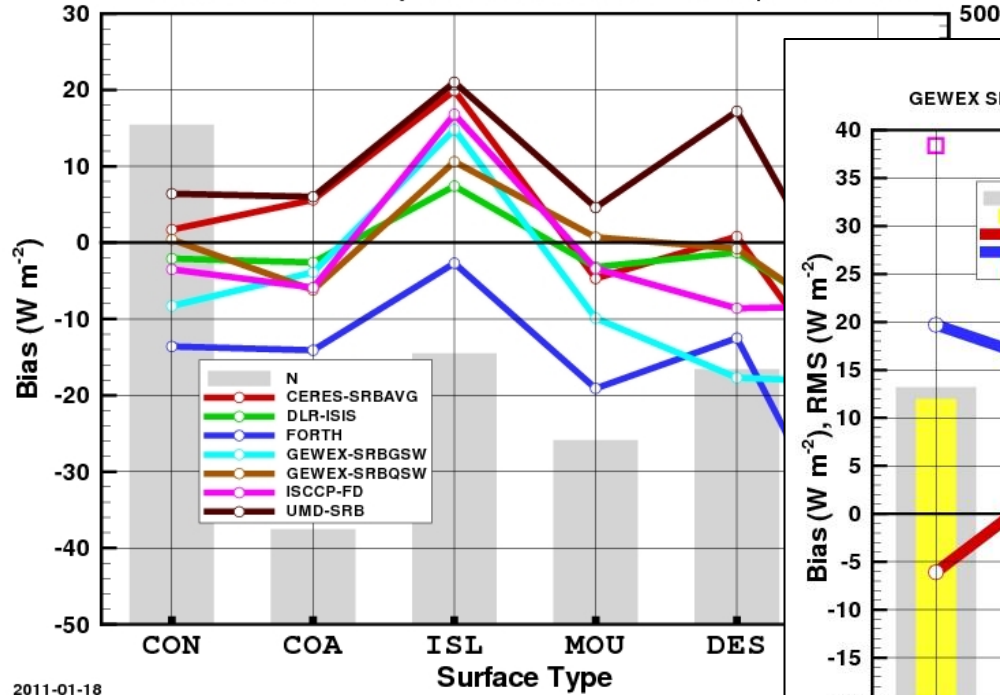
Model	3-Hourly (W m ⁻²)	Daily (W m ⁻²)	3-Hourly- Monthly (W m ⁻²)	Monthly (W m ⁻²)
GEWEX SRB GSW(V3.0)	-6.99 (88.32)	-3.58 (35.50)	-8.81 (47.43)	-5.22 (23.34)
GEWEX SRB GLW(V3.0)	1.25 (30.50)	1.13 (22.16)	0.89 (13.75)	0.97 (11.18)

BSRN data from <http://bsrn.awi.de/> as of 2011-08-22.

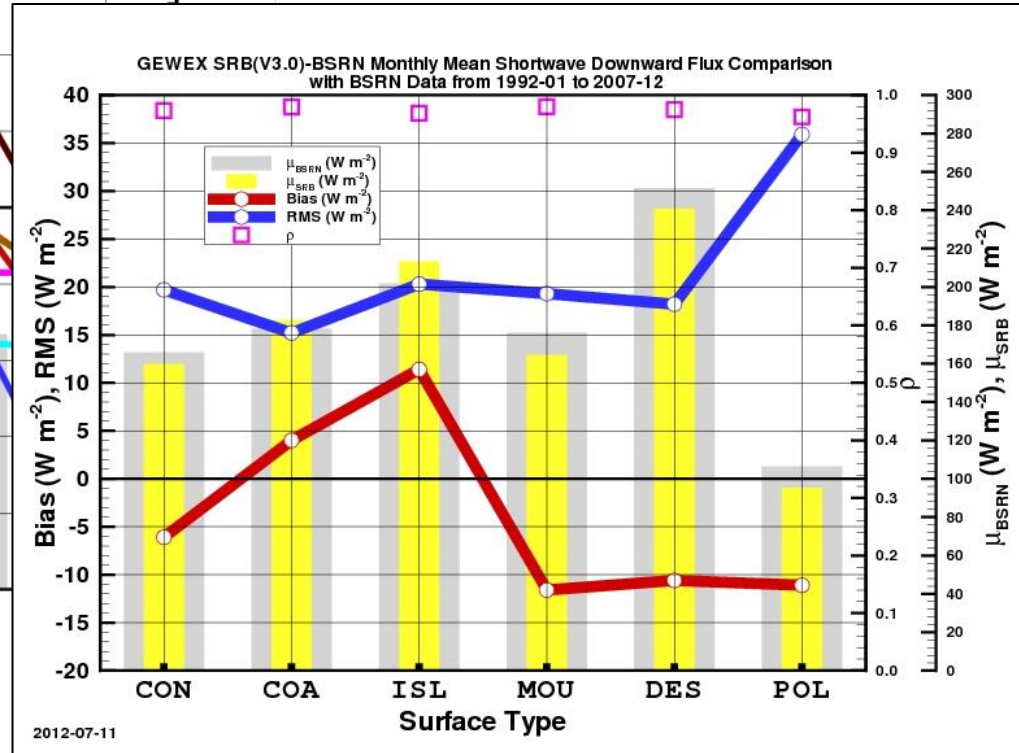
BSRN measurements must be of consistent quality on a site by site basis to enable this sort of analysis

RFA Report Chapter 6: Fig. 6.7

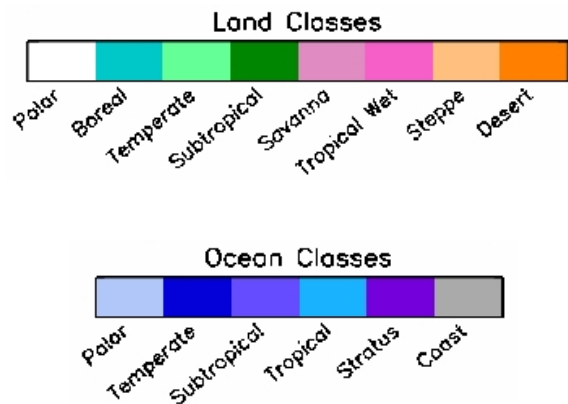
GEWEX RFA-BSRN Monthly Mean Shortwave Downward Flux Comparison Statistics



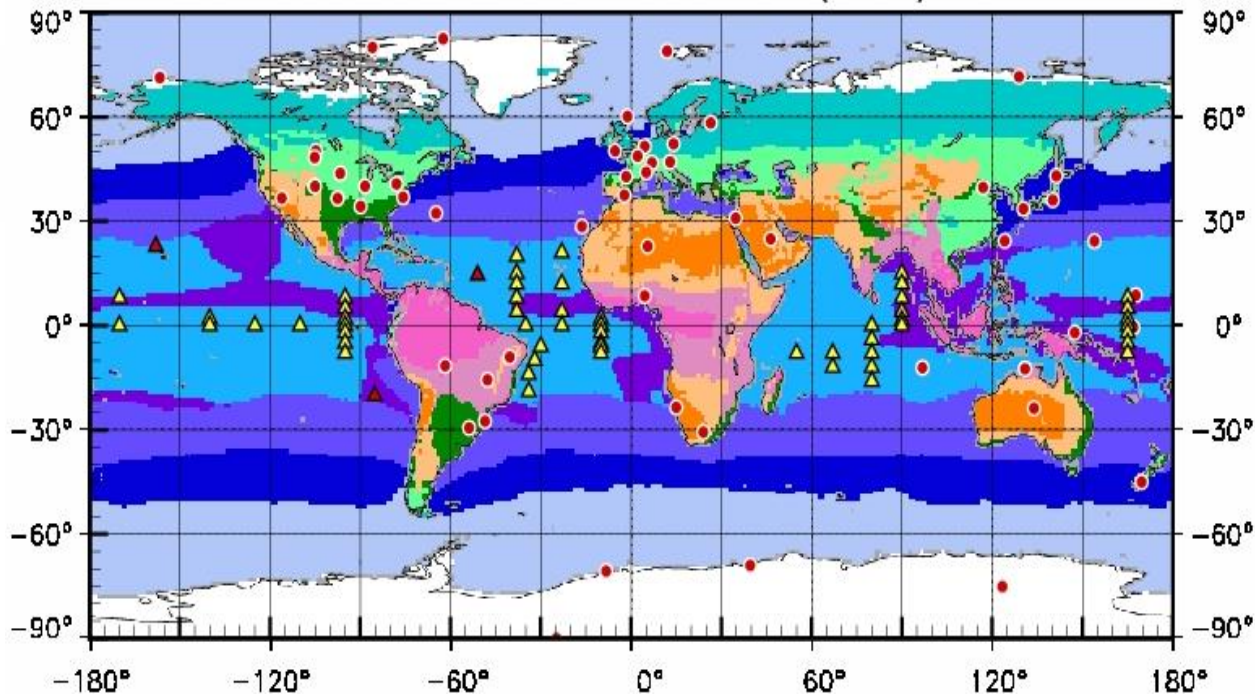
2011-01-18



2012-07-11



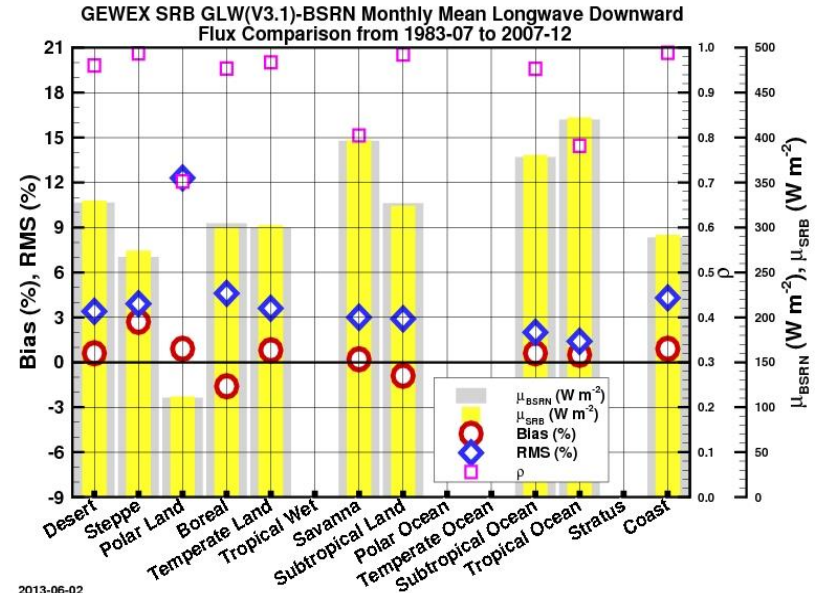
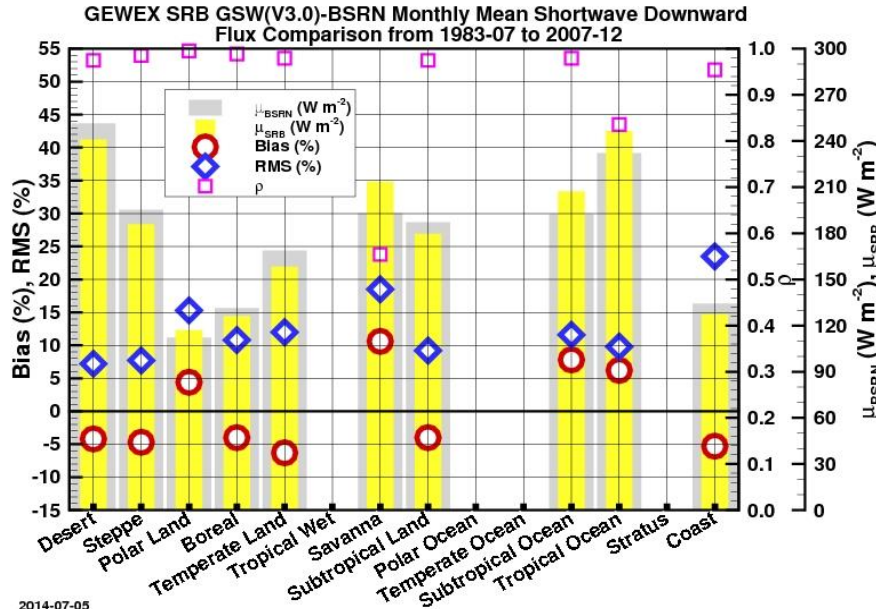
Triangles: 55 PMEL Buoys (YELLOW) & 3 WHOI Buoys (RED)
Circles: 59 Baseline Surface Radiation Network (BSRN) Sites

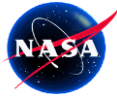


BSRN Differences by Climate Type

SW Differences

LW Differences

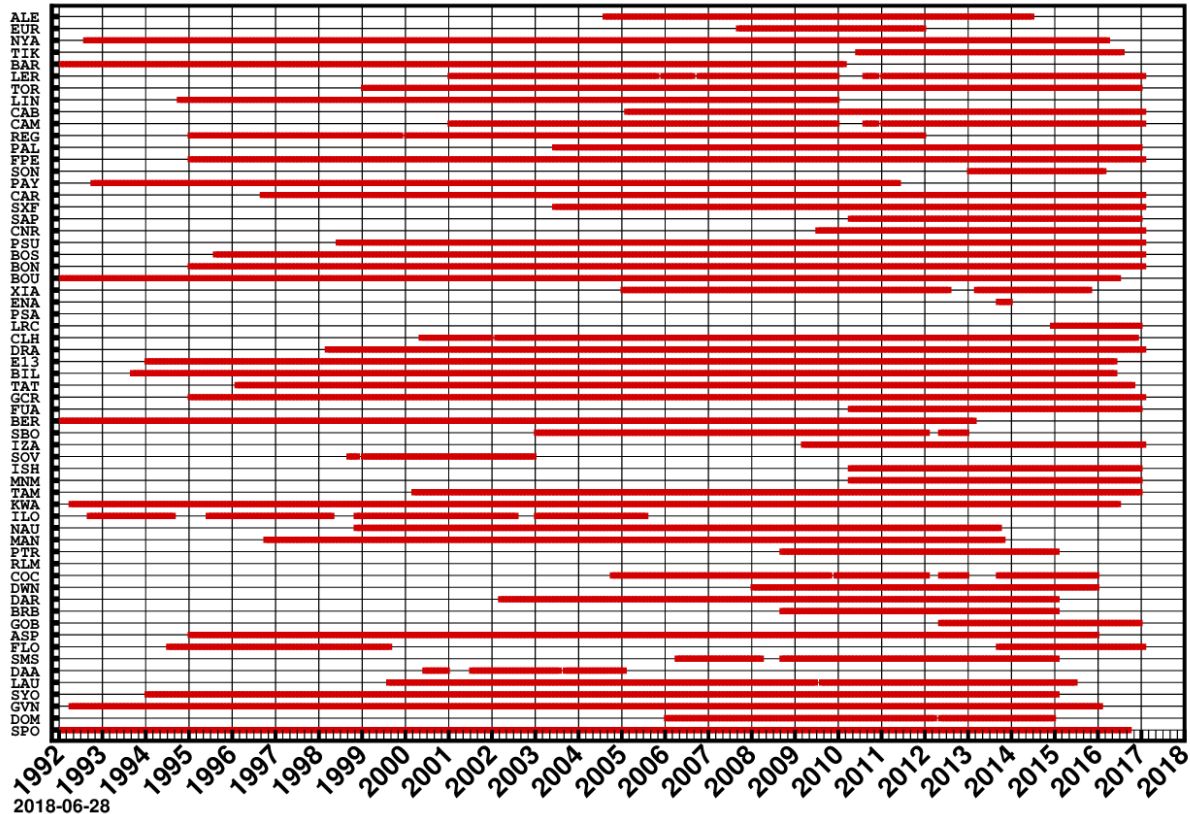




Long-Term Consistency Critical

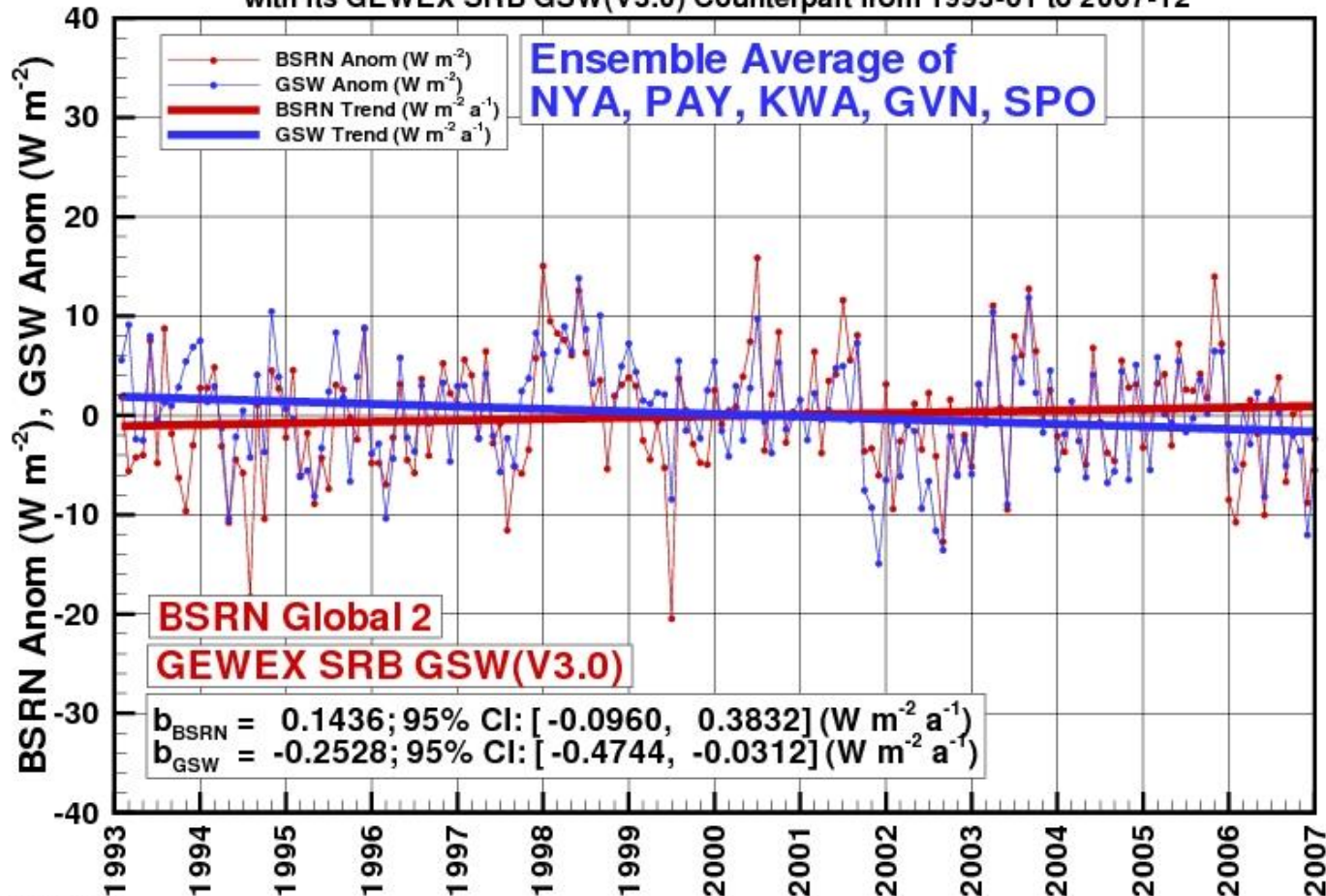


9688 Available Site-Months of BSRN Data from 61 Sites as of 2017-02-10



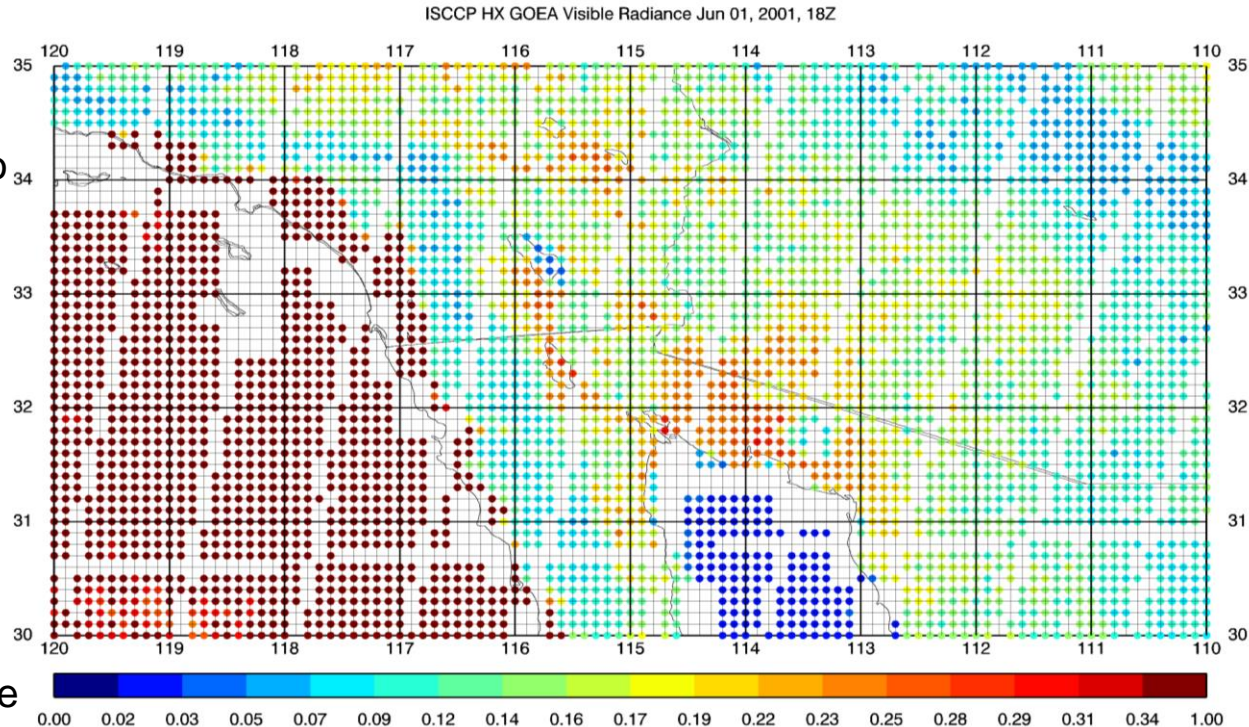
2018-06-28

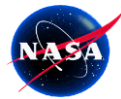
Trend of Deseasonalized Ensemble Average of 5 BSRN Sites in Comparison with Its GEWEX SRB GSW(V3.0) Counterpart from 1993-01 to 2007-12



ISCCP HX is being reprocessed (production based at NCEI)

- Uses all 10 km pixels with no subsampling
- Revised calibration using MODIS and Heidinger (et al)
- Pixel 3-hourly, 1x1 3-hourly, and 1x1 monthly data products
- nnHIRS: Gridded & filled data set using T, q retrieval (Shi et al.)
- New surface type maps
- Revised & extended snow/ice
- Extended O3



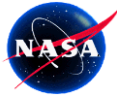


SRB (R4) Annual Averages Fluxes for 2007



*Global
annual
averaged
fluxes for
2007*

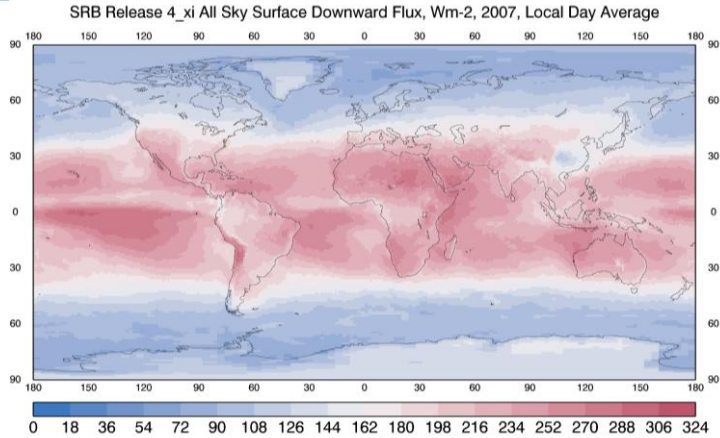
Flux Component	Rel 3.0	Rel 4_xi (NEW algorithm, NEW inputs – HXS V01)	CERES Syn1Deg (Ed. 4A)	CERES EBAF (Ed 4.0)
Surface total down	186.1	184.7	187.8	186.5
Surface down diffuse	104.1	100.0	105.7	--
Surface clear-sky down	247.6	239.8	242.5	244.1
Surface pristine-sky down	258.5	252.1	253.0	--
Surface albedo	0.131	0.133	0.136	0.143
Surface net	163.5	161.8	166.9	164.6
Surface Cloud Radiative Effect	-61.5	-55.1	-54.6	-57.6
TOA Up	104.4	100.6	99.6	99.0



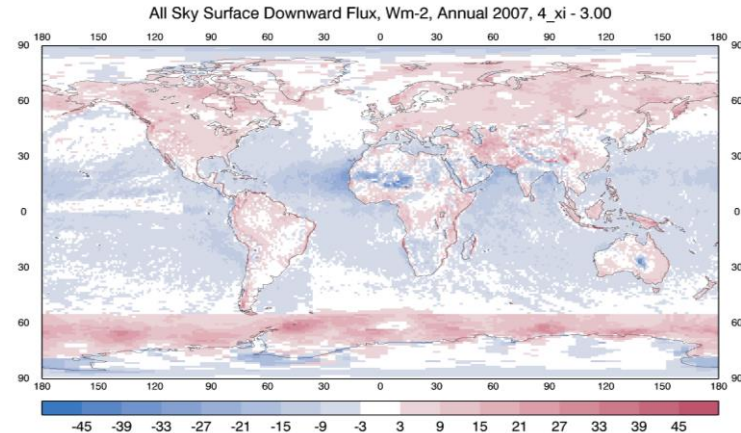
Annual SW Surface Down Fluxes for 2007



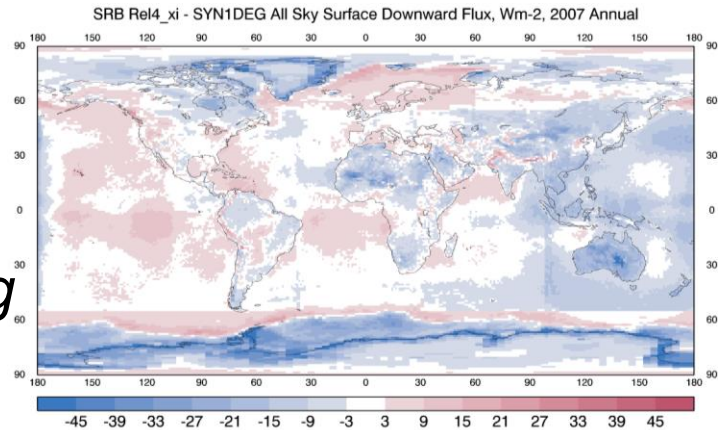
SW
R4
Down



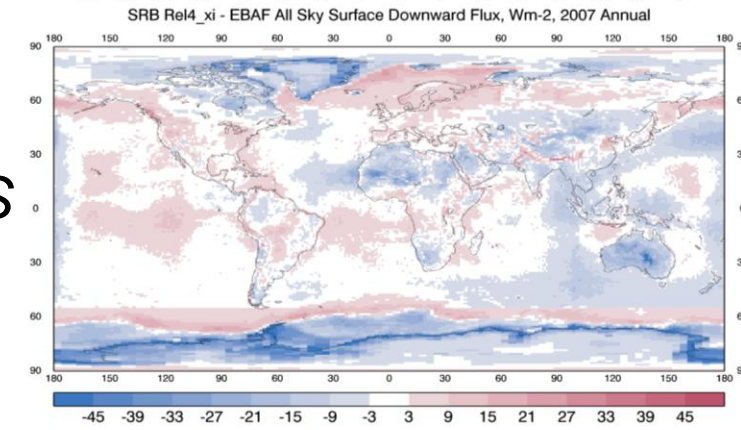
R4 -
R3

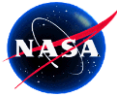


R4 -
CERES
Syn1Deg
Ed4A



R4 -
CERES
EBAF
Ed4



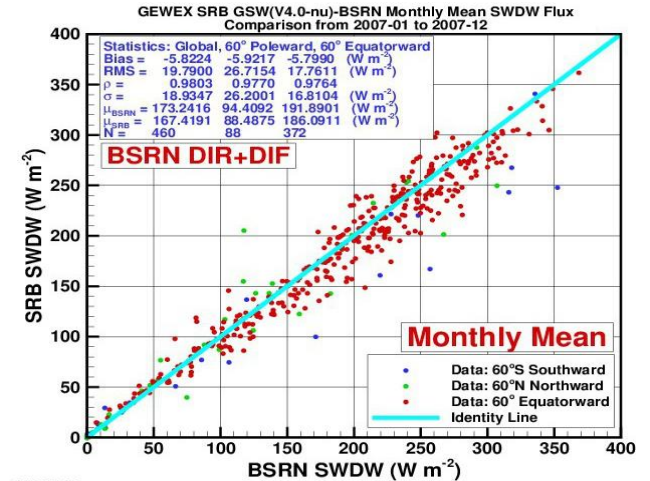


SW Surface Down Validation

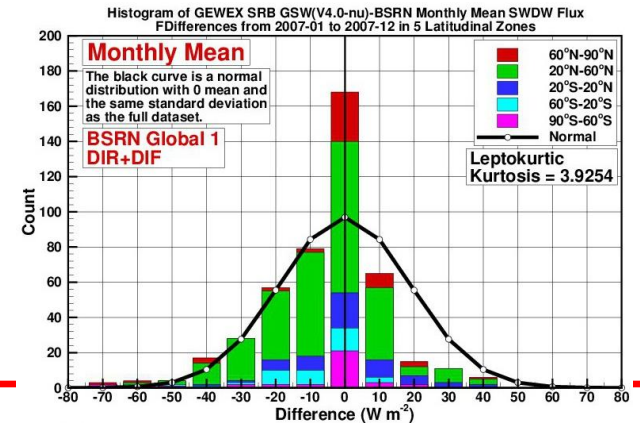


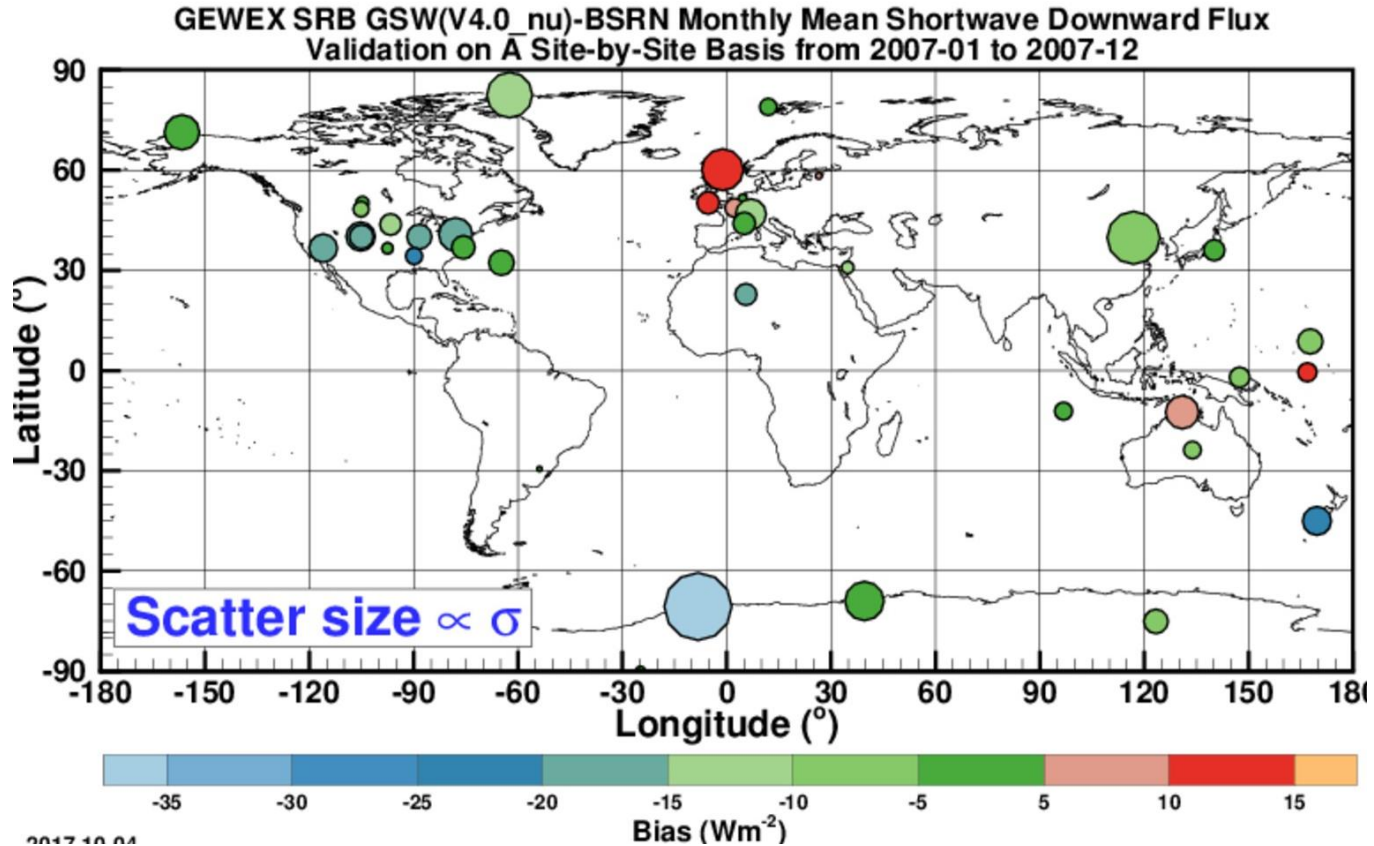
GEWEX GSW-BSRN monthly mean shortwave downward flux comparison statistics for the period from 2007-01 to 2007-12.

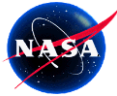
Version	Bias	RMS	ρ	σ	μ_{GSW}^*	N
GSW(V3.0)	-8.45	24.05	0.9717	22.54	164.78	460
GSW(R4.0 iota)	-6.28	20.38	0.9793	19.41	166.95	460
GSW(V4.0_nu)	-5.82	19.79	0.9803	18.93	167.41	460
GSW(V4.0_omnicron)	-4.95	18.63	0.9822	17.98	167.57	467
CERES EBAF(E2.8)	-4.79	16.52	0.9863	15.83	168.44	460
CERES EBAF(E4.0)	-5.07	16.26	0.9868	15.46	167.44	467
CERES SYN1deg(V3A)	-2.13	16.11	0.9858	15.98	171.11	460
CERES SYN1deg(V4A)	-5.27	15.97	0.9875	15.09	167.25	467



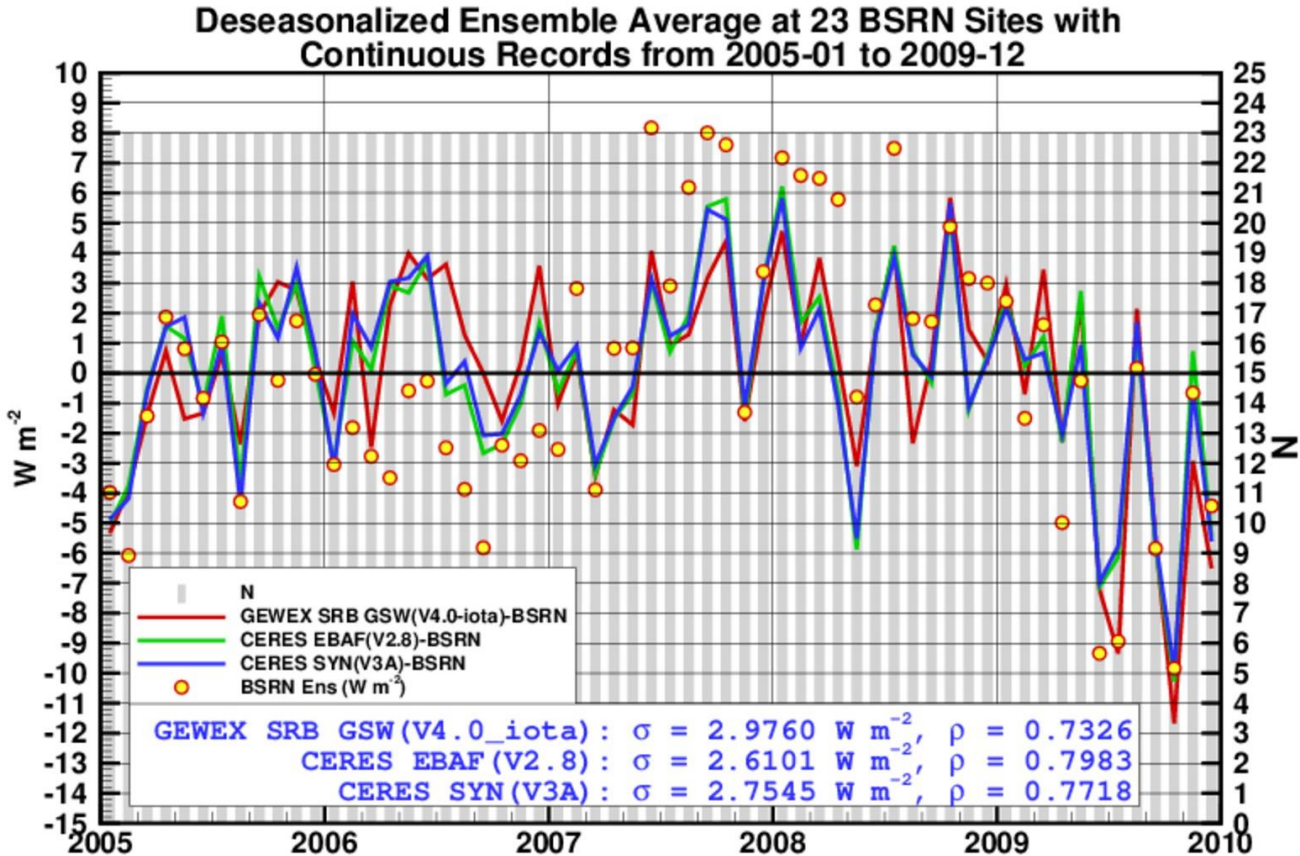
2017-09-22

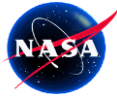




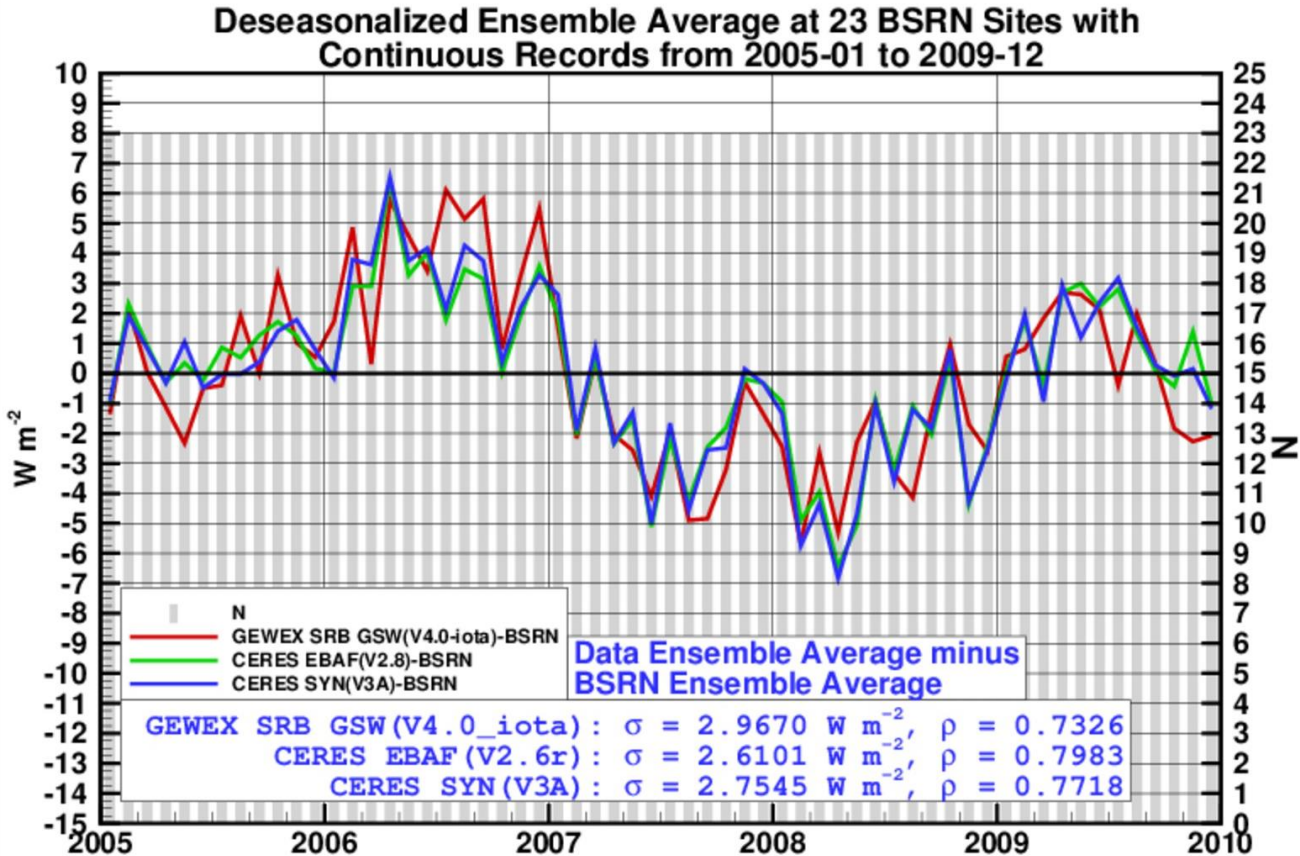


Long-term Variability: Ensemble Anomalies



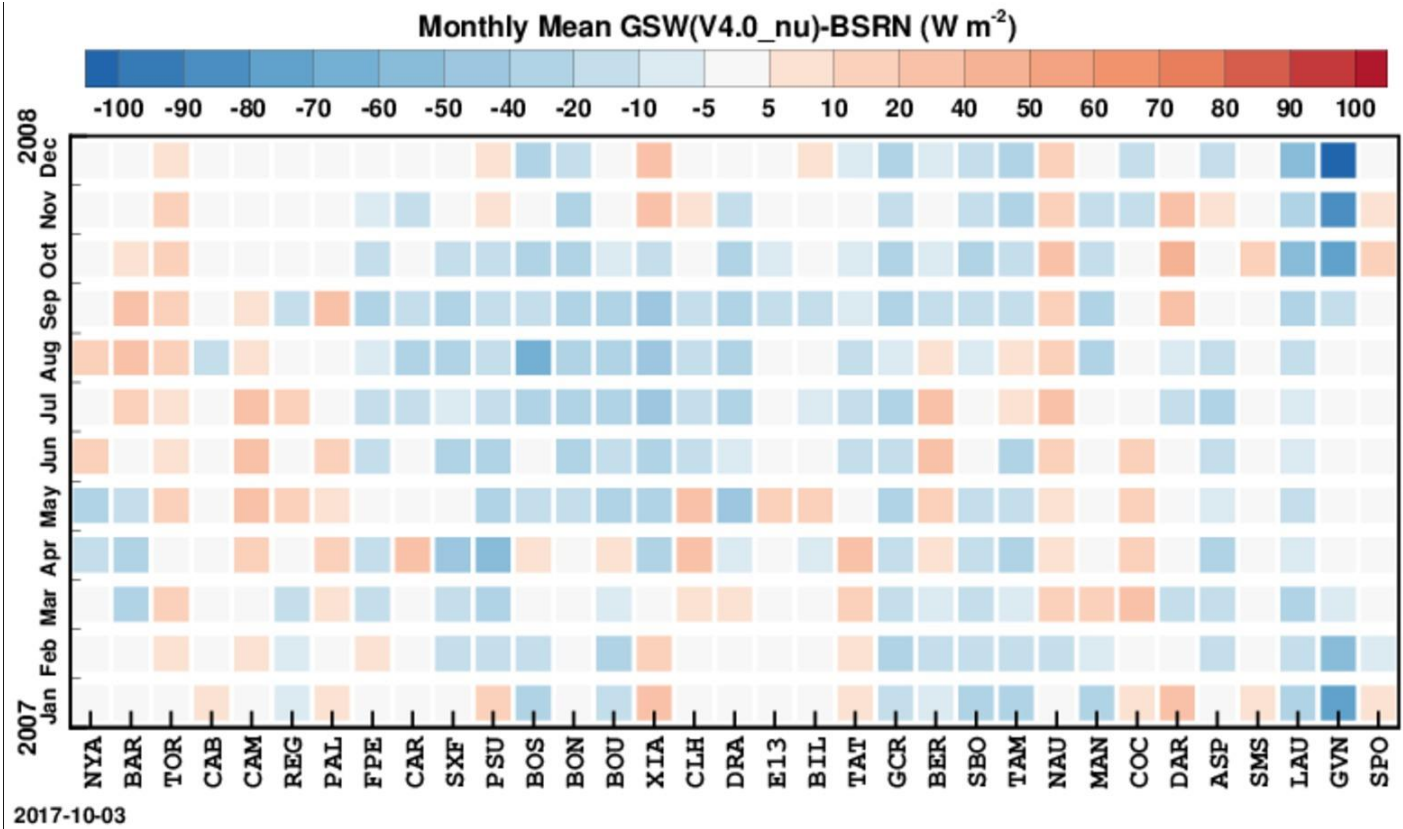


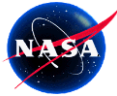
Long-term Variability: Ensemble Anomalies



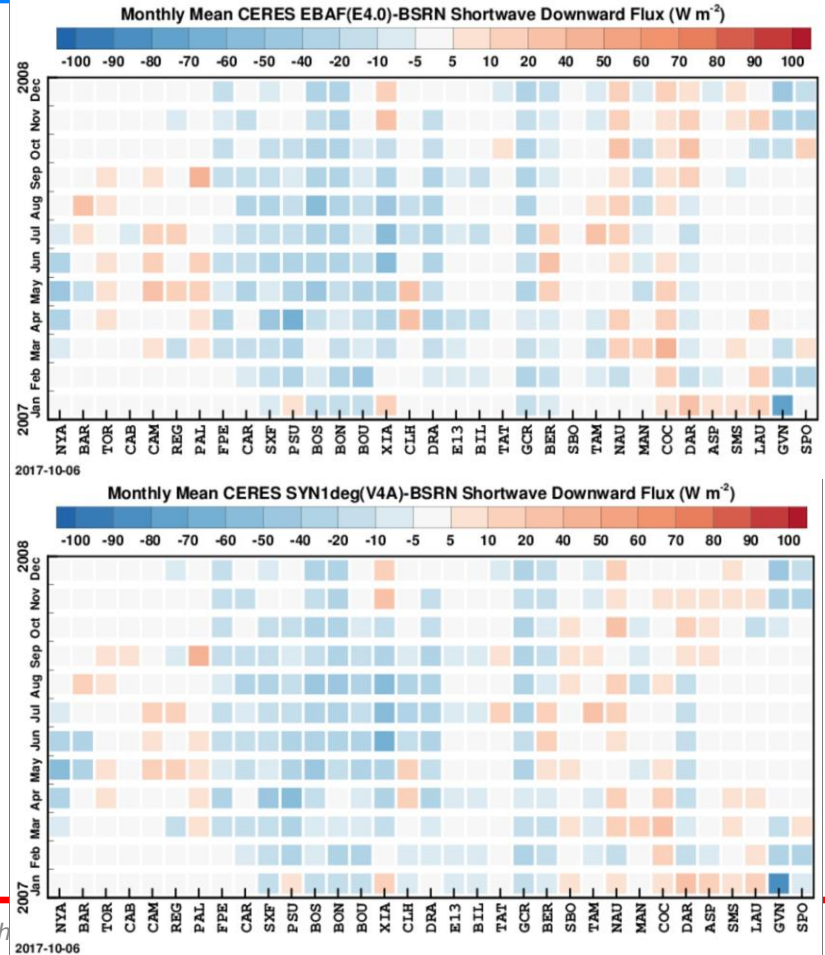
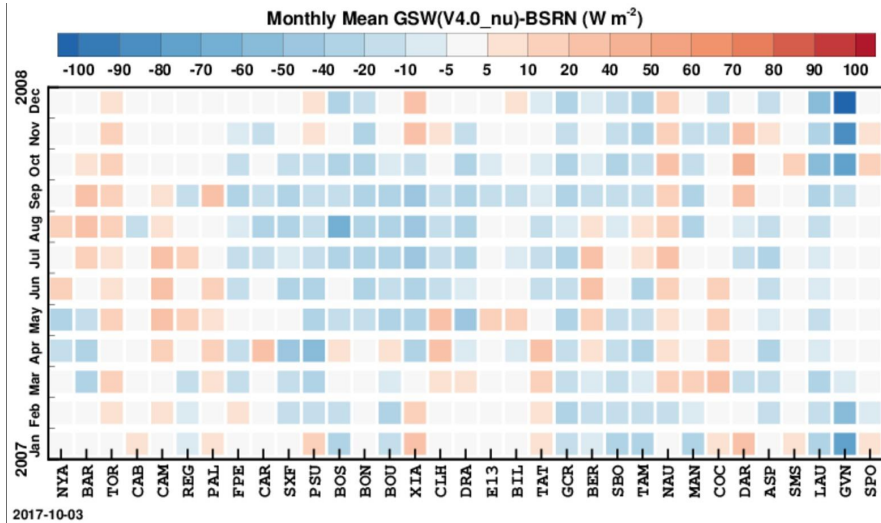


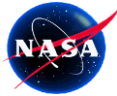
Annual Cycle by Site: Surface SW (Rel 4) Bias





Annual Cycle by Site: SW (Rel 4) & CERES Bias





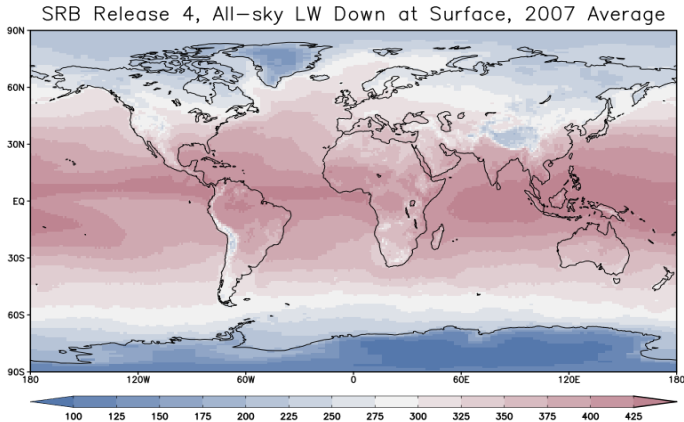
Annual Average LW Fluxes for 2007



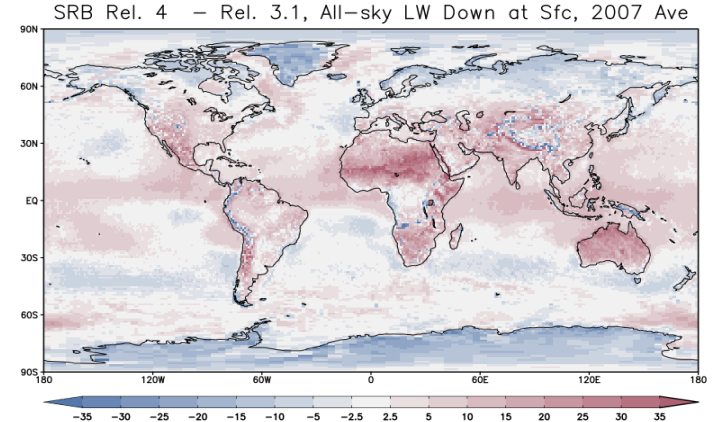
*Global
(tropical)
annual
averaged
fluxes for
2007*

Parameter	Rel 3.1 GEOS-4/DX	Rel. 4 nnHIRS/HX	CERES SYN 1-deg Ed. 4A	CERES EBAF Ed. 4
All-sky Sfc Down	344.8 (404.5)	347.6 (411.0)	346.9 (406.3)	344.8 (405.9)
Clear-sky Sfc Down	311.4 (383.4)*	316.3 (392.0)	318.1 (390.5)	314.2 (388.3)
Pristine-sky Sfc Dn	--	314.9 (390.6)	315.9 (389.0)	--
All-sky Sfc Up	398.3 (459.1)	400.4 (461.0)	397.8 (457.8)	398.6 (458.1)
All-sky Sfc Net	-53.5 (-54.6)	-52.7 (-50.0)	-50.8 (-51.7)	-53.8 (-52.2)
Sfc CRE	33.4 (21.1)	31.3 (19.0)	28.8 (15.7)	30.6 (17.5)
OLR	238.3 (256.6)	235.1 (254.5)	238.6 (255.7)	240.56 (257.4)
Clear OLR	265.3 (285.9)*	263.8 (285.7)	262.5 (282.8)	268.4 (290.6)
Pristine-sky OLR	--	265.1 (287.0)	263.2 (284.1)	--
TOA CRE	-27.0 (-29.3)	-28.7 (-31.2)	-23.8 (-27.1)	-27.8 (-33.2)

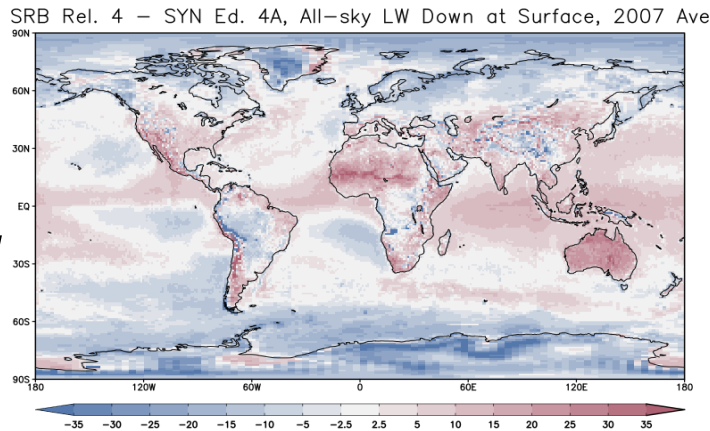
SW
R4
Down



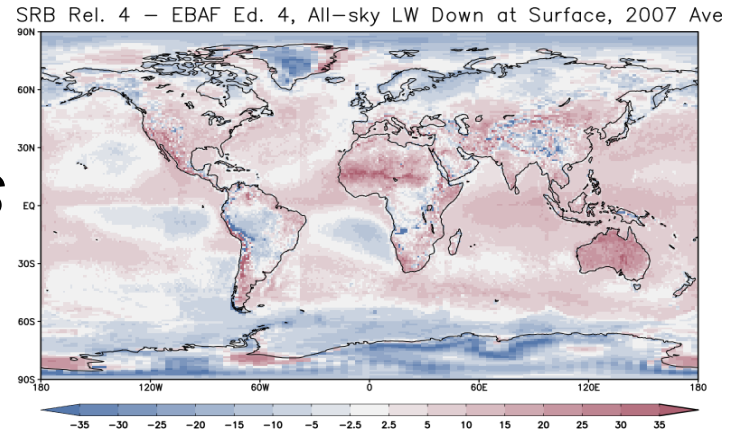
R4 -
R3

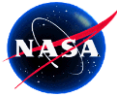


R4 -
CERES
Syn1Deg
Ed4A



R4 -
CERES
EBAF
Ed4

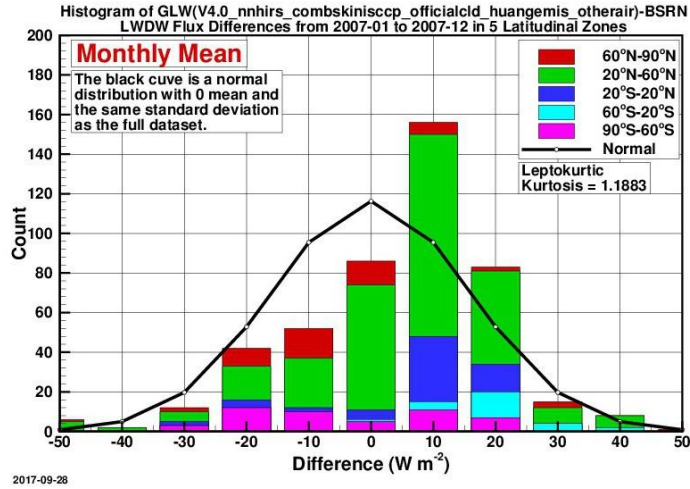
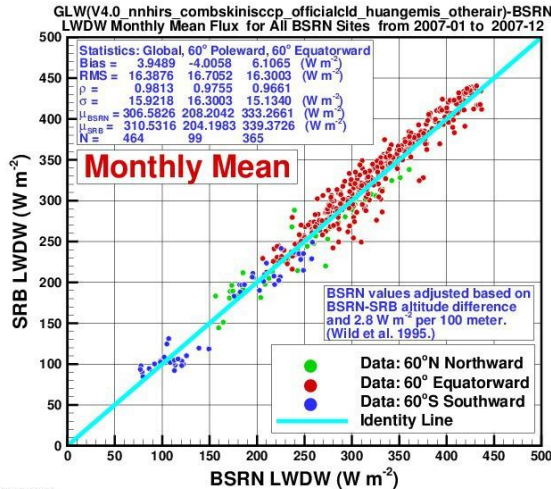


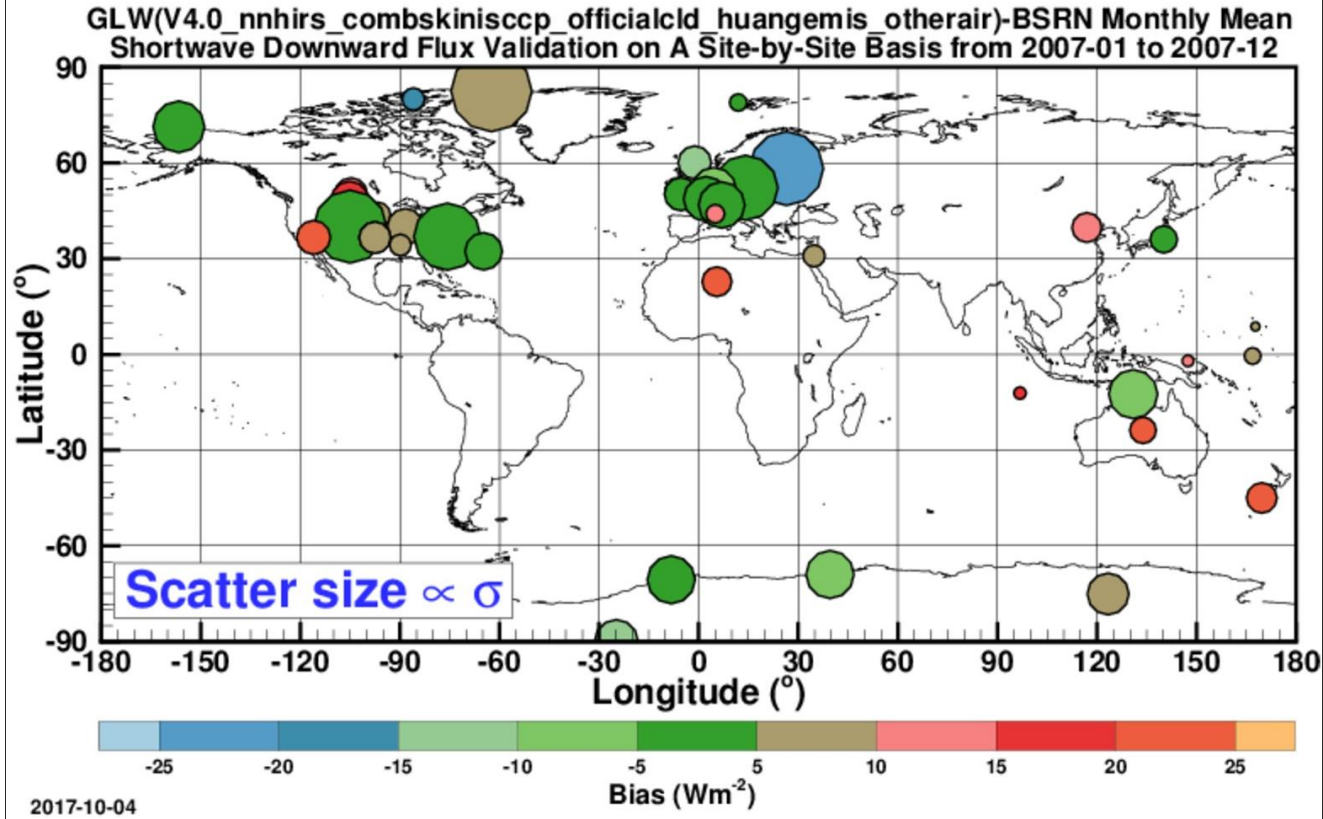


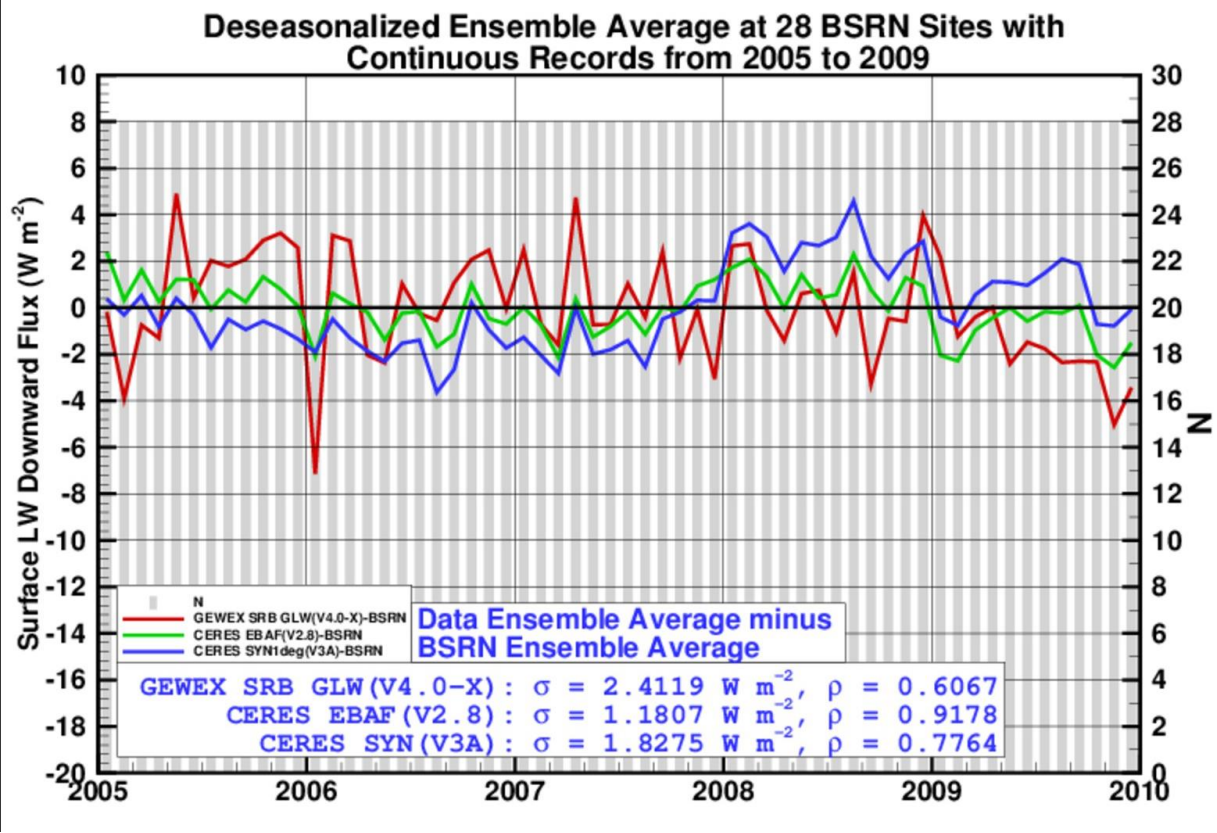
Monthly GLW vs BSRN measurements

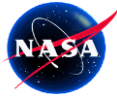


Version	Bias	RMS	ρ	σ	μ_{GLW}	N
V3.1	1.49	12.30	0.9882	12.23	308.08	464
V4.0_g4_g4tsclrskin_dxclcd	4.88	13.75	0.9870	12.86	311.46	464
V4.0_merra2_comskin_betaclcd	5.21	13.78	0.9871	12.77	311.79	464
GLW 4 IP (nnHIRS, HXS v1, PLST, SSST)	3.94	16.38	0.9813	15.92	310.53	464
CERES EBAF(E2.8)	1.01	10.02	0.9922	9.98	308.12	464
CERES EBAF(E4.0)	0.76	10.00	0.9922	9.98	307.87	464
CERES SYN1deg(V3A)	-3.66	10.29	0.9927	9.62	303.44	464
CERES SYN1deg(V4A)	2.85	10.28	0.9923	9.89	309.96	464

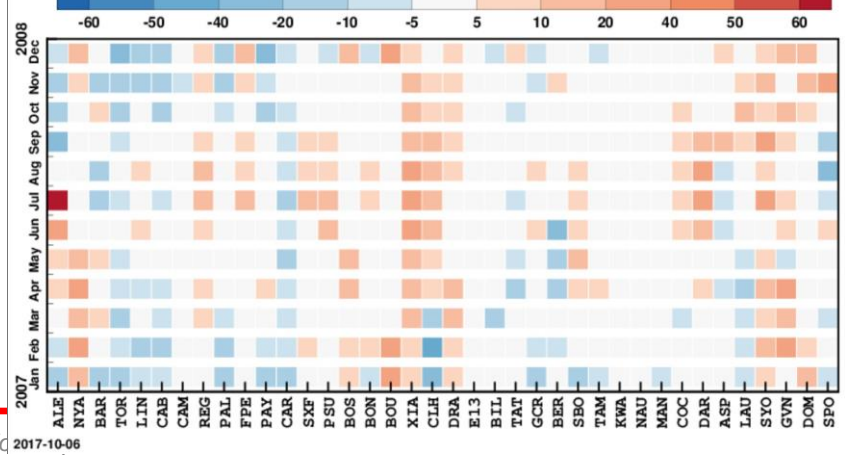
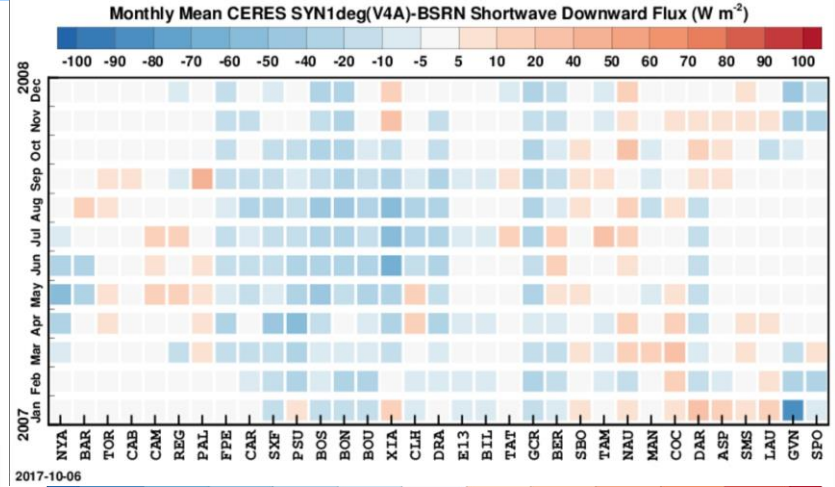
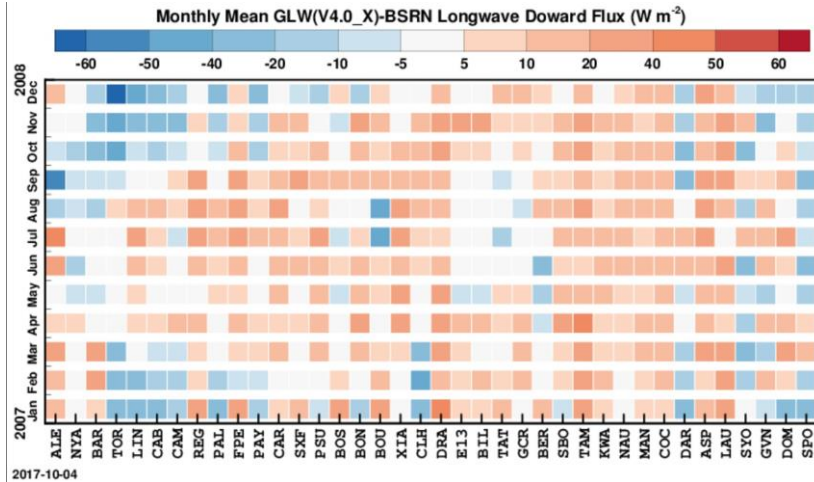






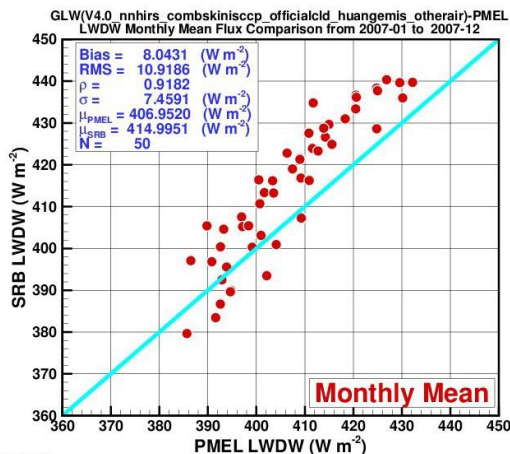
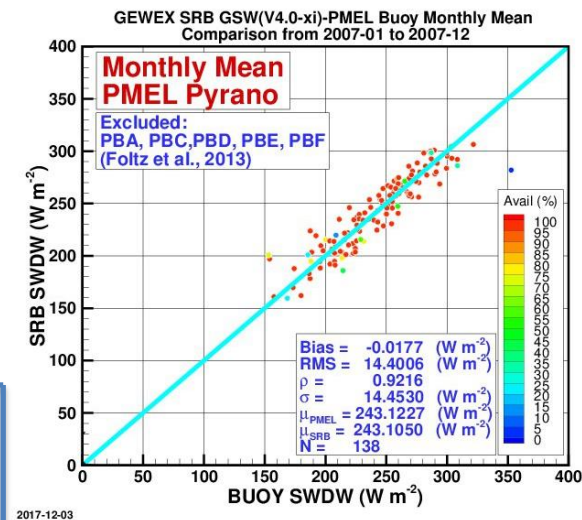


GLW Annual Differences by Site



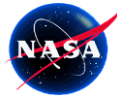
Ocean Buoy SW Validation (PMEL)

Version	Bias	RMS	ρ	σ	μ	N
GSW (V3.0)	7.76	17.02	0.9132	15.20	250.88	138
GSW(V4.0_nu)	0.47	14.29	0.9225	14.34	243.60	138
GSW (V4.0-xi)	-0.02	14.40	0.9216	14.45	243.11	138
GSW(V4.0_omicron)	-0.52	15.32	0.9114	15.37	242.59	138
CERES EBAF(E4.0)	1.97	12.34	0.9451	12.23	245.10	138
CERES SYN1deg(V4A)	-0.86	11.80	0.9506	11.81	242.26	138



Monthly Averaged GLW vs. Buoy Measurements

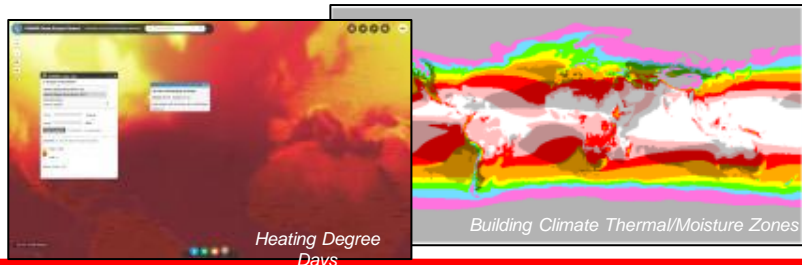
Version	Bias	RMS	ρ	σ	μ_{DATA}	N
V3.1	-0.07	6.17	0.9342	6.23	406.88	50
GLW 4 IP (nnHIRS, HXS v1, PLST, SSST)	8.04	10.91	0.9182	7.45	414.99	50
CERES EBAF(E4.0)	0.99	3.80	0.9581	3.70	407.94	50
CERES SYN1deg(V4A)	0.85	3.70	0.9567	3.64	407.80	50



High Quality SRB Leads to Societal Benefits via POWER Web Portal (GIS-enabled)



- Using ArcGIS architecture to geospatially enable entire POWER data archive for access to growing Applied Science users.
- **Increased spatial/temporal resolutions: SRB, CERES FLASHFLUX – Solar, GMAO MERRA-2/GEOS 5.12.4; ½ x ½ Spatial resolution, Near Real Time Daily Time Series, 30 Year Climatological Averages**
- **Complete API service (data order using URL) – allows for data to be repeatedly requested using a script or from within a user analysis program**
- **New capabilities providing data in ASCII, CSV, geoJSON, NetCDF4, ICASA, GeoTiff and ArcGIS Image Services**

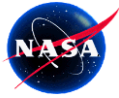


Energy Related Building Zones & Design Conditions

Energy Related Building Climate Zone & Design Conditions

Climate Indicators & Data Products for Future National Climate Assessments

Focuses upon expanding and improving the provision of building climate zones, climate design and other data parameters relevant to energy usage and efficiency in geospatial formats more accessible to the building and renewable energy industries



- **SRB and BSRN:**
 - BSRN critical for validation of products at various temporal averages
 - BSRN distribution of sites critical for improved assessment for physics of given regions; ensemble analysis by climate type reveals characteristic features
 - BSRN longevity critical long-term evaluation and assessment
- **GEWEX SRB Rel 4-IP**
 - HXS cloud rendering testing/assessment ongoing; cloud base biases, cloud detection over ice surfaces
 - Re-assess new sources of land/ocean PBL temp/hum; contrast with nnHIRS
 - Produce 15 year 1x1 data set 1998-2012 to maximize overlap with CERES and NASA NEWS data sets for error and uncertainty assessment
 - Long-term goal: Re-process 30+ years at $\frac{1}{2} \times \frac{1}{2}$ resolution
 - Use BSRN and other measurements to provide data quality information

<http://gewex-srb.larc.nasa.gov>

1. Atmospheric Science Data Center (main archive):

https://eosweb.larc.nasa.gov/project/srb/srb_table

2. POWER Applied Science (climatological, monthly, daily; GIS formats)

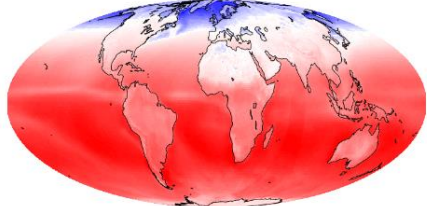
<https://power.larc.nasa.gov>

NASA GEWEX Surface Radiation Budget

Home Documentation Data Education and Applications Related Activities

NASA GEWEX Surface Radiation Budget

SRB Rel. 3/3.1 Sfc Total Net Flux



24-yr Ave for December

-55 -40 -25 -10 2.5 30 45 60 75 90 105 120 135 150 165 180 195 210 225 240 255 Wm^{-2}

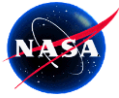
The Global Energy and Water Exchanges (GEWEX) is an integrated program of research, observations, and science activities with the goal of providing data sets to support accurate predictions of global and regional climate change. Research in the areas of Earth radiation budget, hydrometeorology, and modeling/prediction contribute to meeting the goal of GEWEX.

The NASA/GEWEX SRB project is a major component of the GEWEX radiation research. The objective of the NASA/GEWEX SRB project is to determine surface, top-of-atmosphere (TOA), and atmospheric shortwave (SW) and longwave (LW) radiative fluxes with the precision needed to predict transient climate variations and decadal-to-centennial climate trends.



Extras





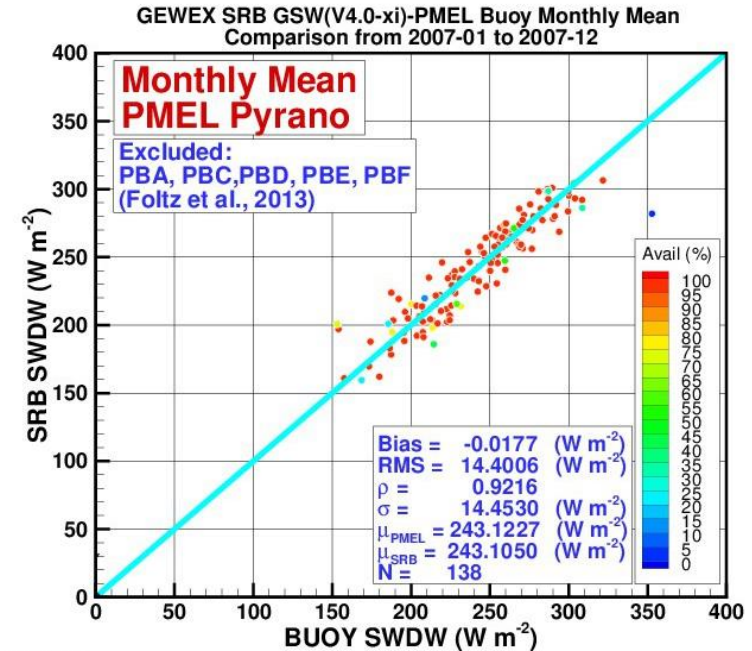
Talk Outline



- Introduction: WCRP, GEWEX, ISCCP, SRB and BSRN
- GEWEX SRB Overview
 - Old to New
- BSRN Usage
 - Ensemble long-term
 - Ensemble time series
 - Regional/Site
- Surface measurement needs:
 - Pygeometer standard?
 - Climate type distribution
 - Longer time series
 - Ocean buoy standards?

Ocean Buoy SW Validation (PMEL)

Version	Bias	RMS	ρ	σ	μ	N
GSW (V3.0)	7.76	17.02	0.9132	15.20	250.88	138
GSW(V4.0_nu)	0.47	14.29	0.9225	14.34	243.60	138
GSW (V4.0-xi)	-0.02	14.40	0.9216	14.45	243.11	138
GSW(V4.0_omicron)	-0.52	15.32	0.9114	15.37	242.59	138
CERES EBAF(E4.0)	1.97	12.34	0.9451	12.23	245.10	138
CERES SYN1deg(V4A)	-0.86	11.80	0.9506	11.81	242.26	138

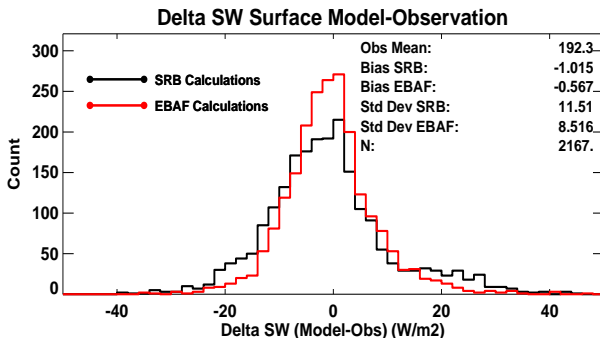
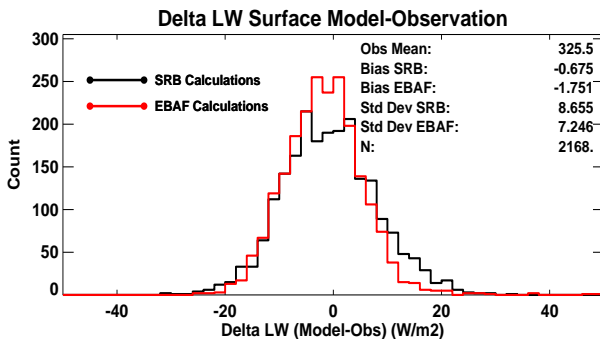




SW Land & Ocean Validation

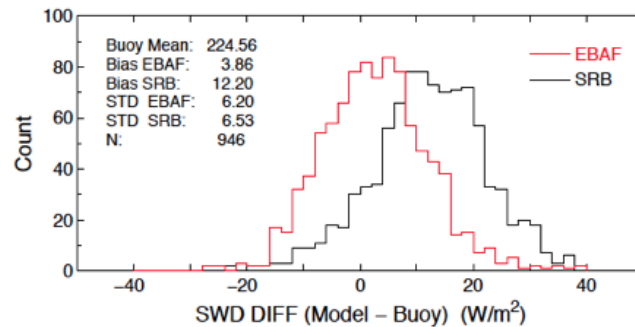
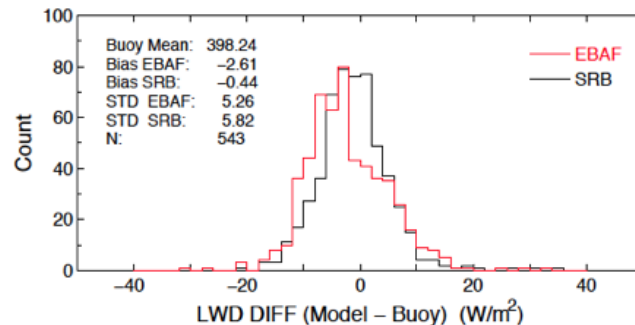


BSRN Land (2001-2007)

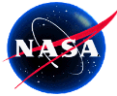


Rutan, CERES Team

Ocean Buoy Networks (2001-2007) (from Weller & Yu, WHOI)



Kato et al., 2013



Forthcoming SRB Release 4 Data Products

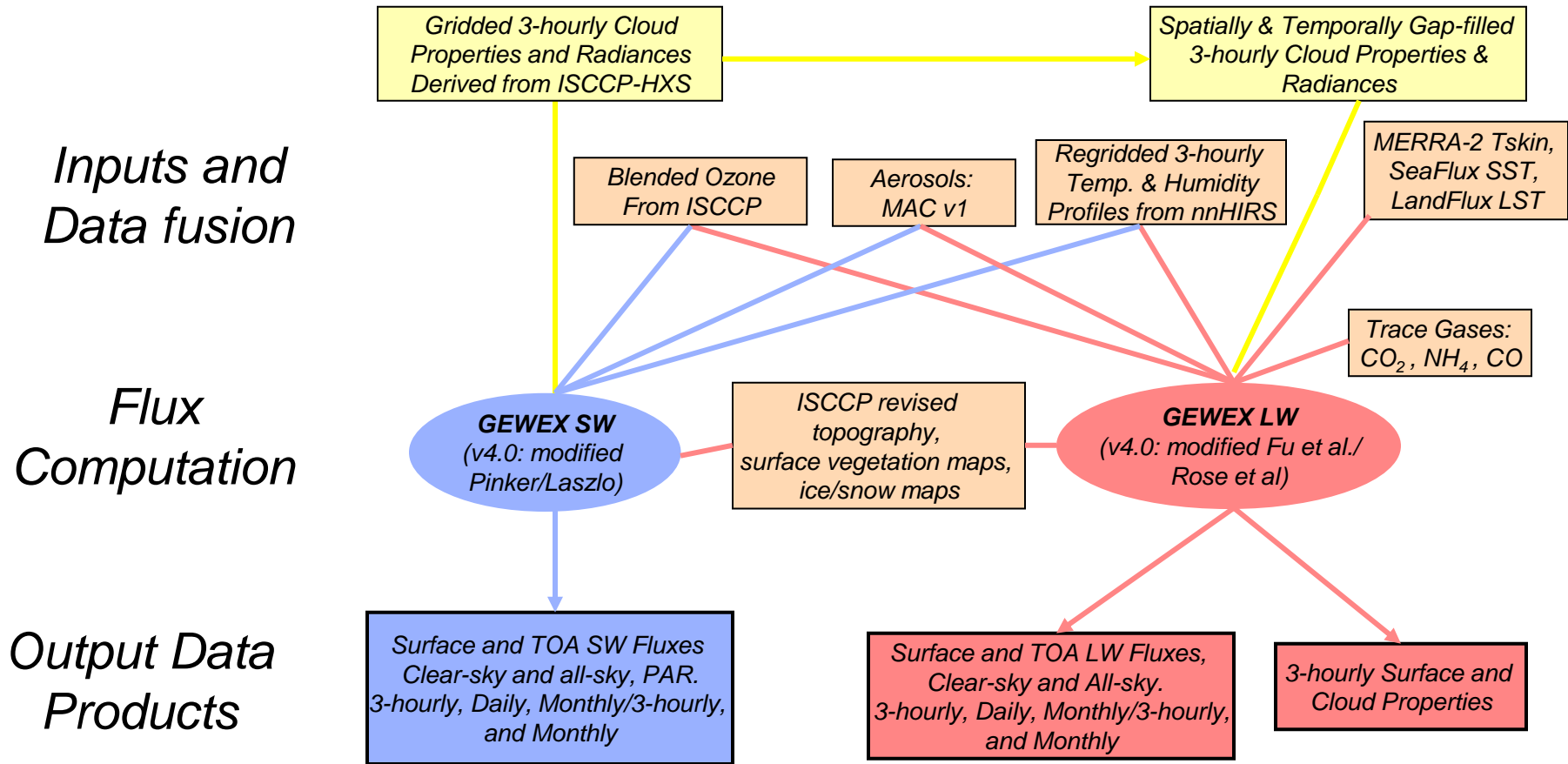


(Spatial Resolution: 1°x1°, 7/98–12/12; ½°x½°, 7/83–12/15ff)

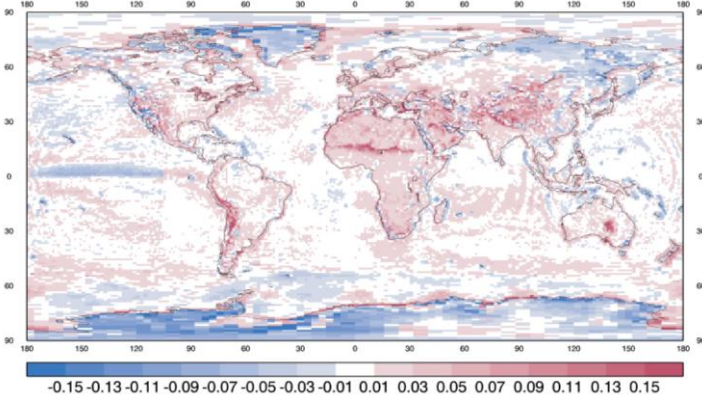
Data Types	Model Name	Temporal Resolution	Parameters
SW	GEWEX SW (Pinker/Laszlo) (v4.0)	3-hourly, Monthly Averaged 3-hourly, Daily and Monthly Averaged (UTC and local sun time)	All-sky: Surface down, up, down direct and diffuse, PAR down, direct, diffuse; TOA Down, Up
			Clear-Sky: Surface Down, Up; PAR down; TOA Up
			Pristine-sky: Surface down, up; TOA up
LW	GEWEX LW (Fu/Liou/ Stackhouse) (v4.0)	3-hourly, Monthly Averaged 3-hourly, Daily and Monthly Averaged	All-sky: Surface Up and Down; TOA up
			Clear-sky: Surface Up and Down; TOA up
			Pristine-sky: Surface Up and Down; TOA up
Input Properties	Cloud, Aerosol and Surface Properties	3-Hourly	Surface emissivity, skin temperature, atmospheric profile; cloud phase, fraction, optical depth and LWC



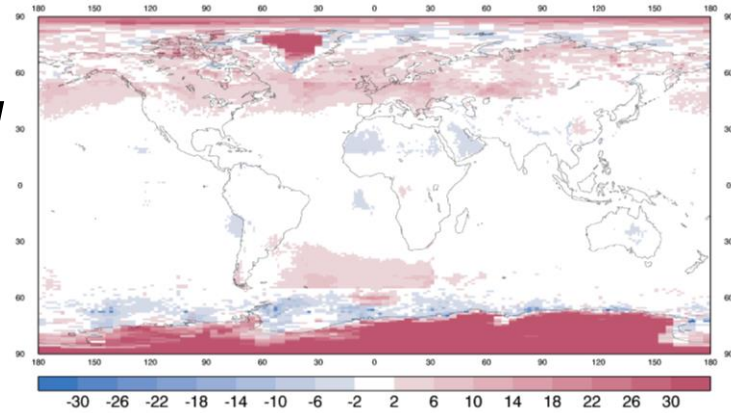
SRB (Rel 4) Integrated Product Data Flow



Cloud Fraction (HX-DX)

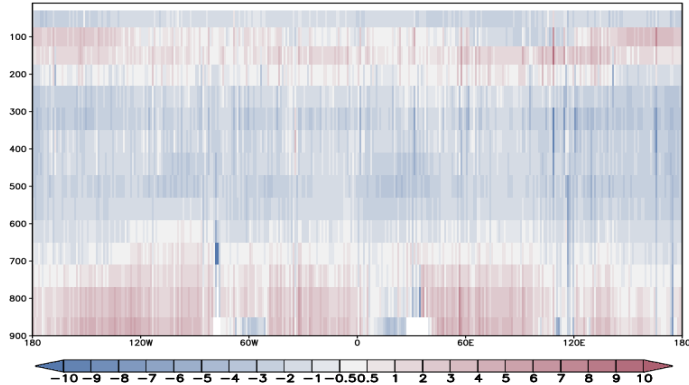


Cloud Optical Depth (HX-DX)

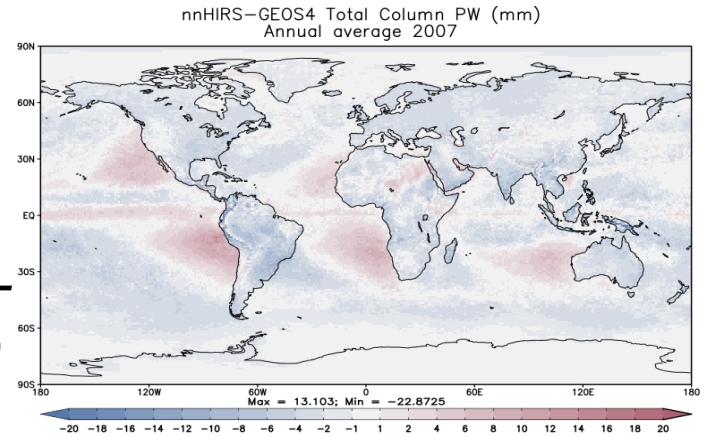


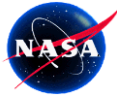
ISCCP nnHIRS Sep2015 - GEOS-4 Profile Temperature X-section for latitude 0.5 Jan 2007 monthly ave

Temperature Profile (nnHIRS-GEOS4)



Precipitable Water (nnHIRS-GEOS4)

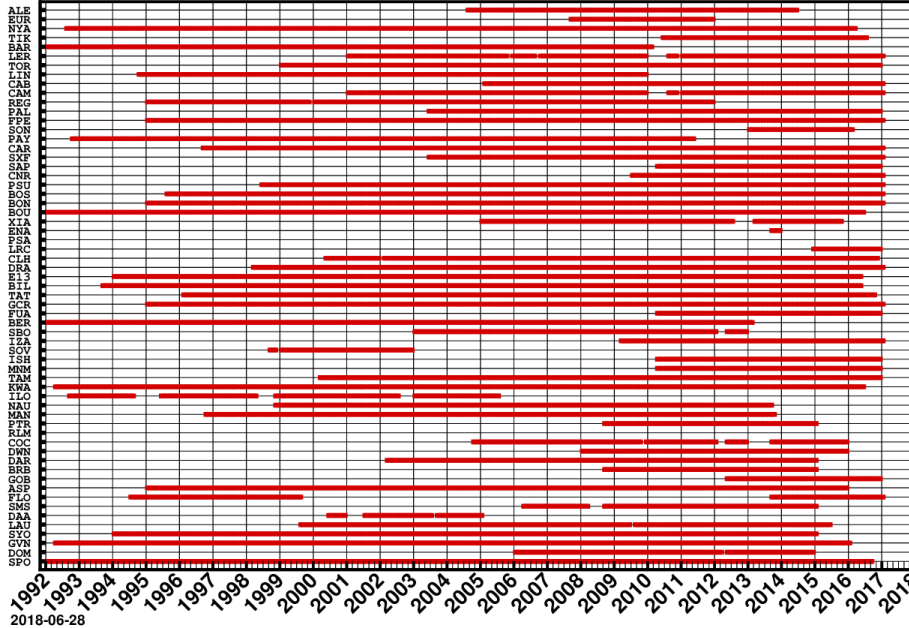




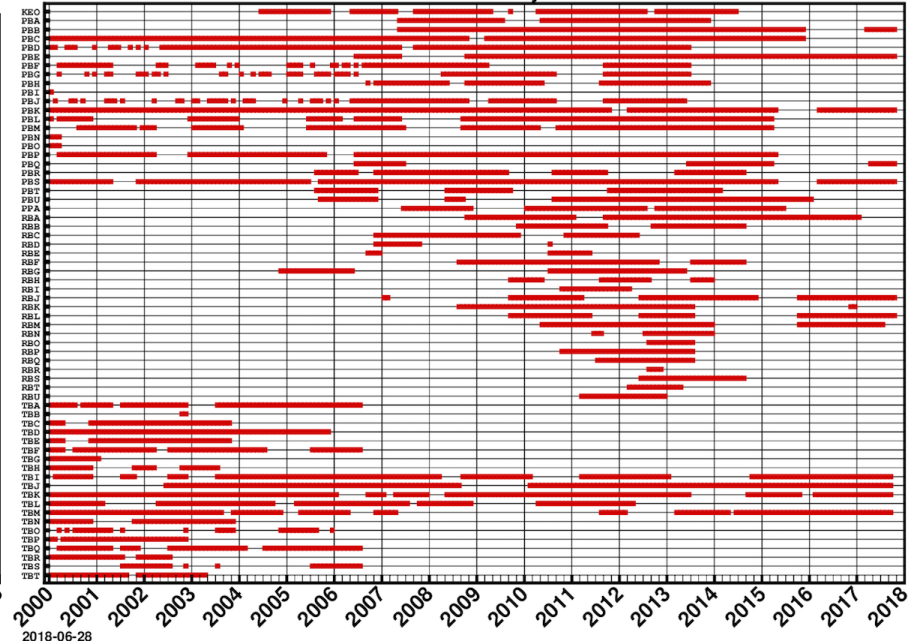
Long-Term Consistency

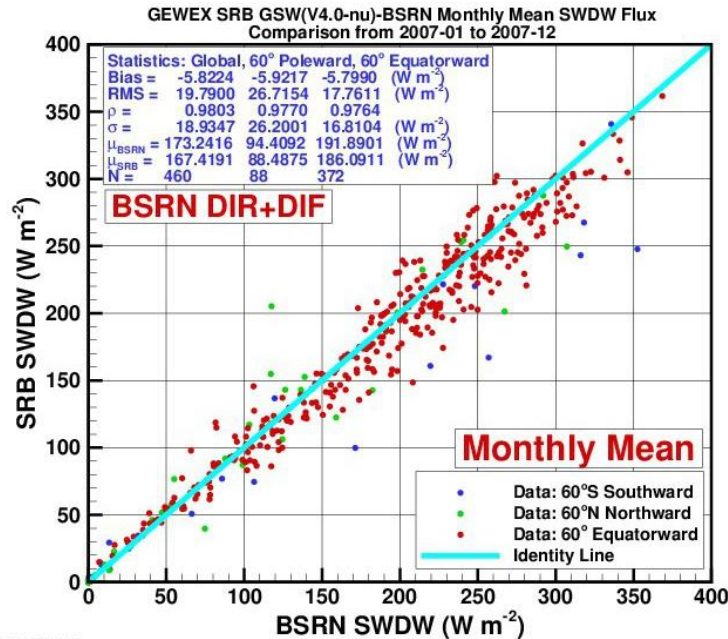


9688 Available Site-Months of BSRN Data from 61 Sites as of 2017-02-10

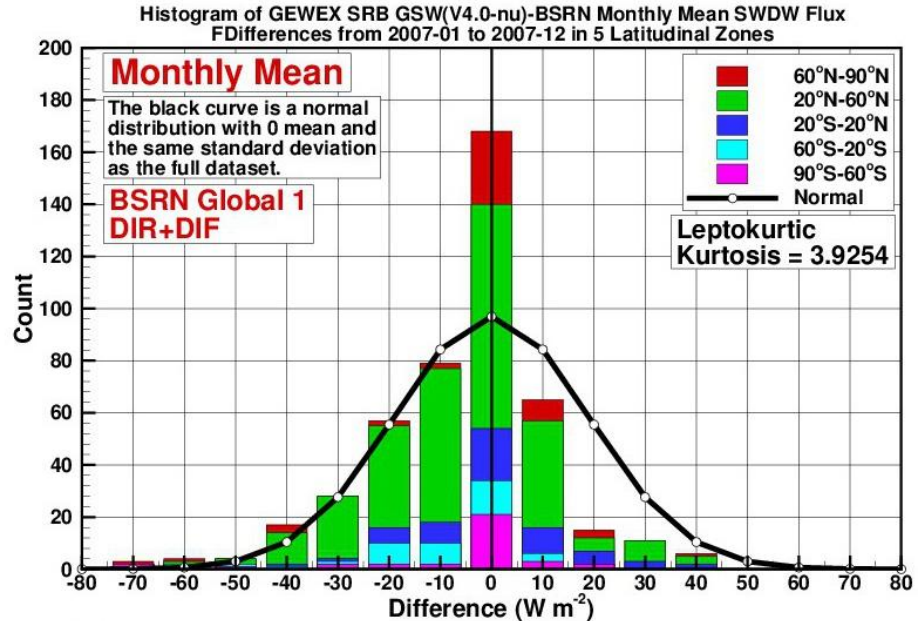


4389 Available Buoy-Months of PMEL Buoy Data from 2000-01 to 2017-10
Based on 3-Hourly Data

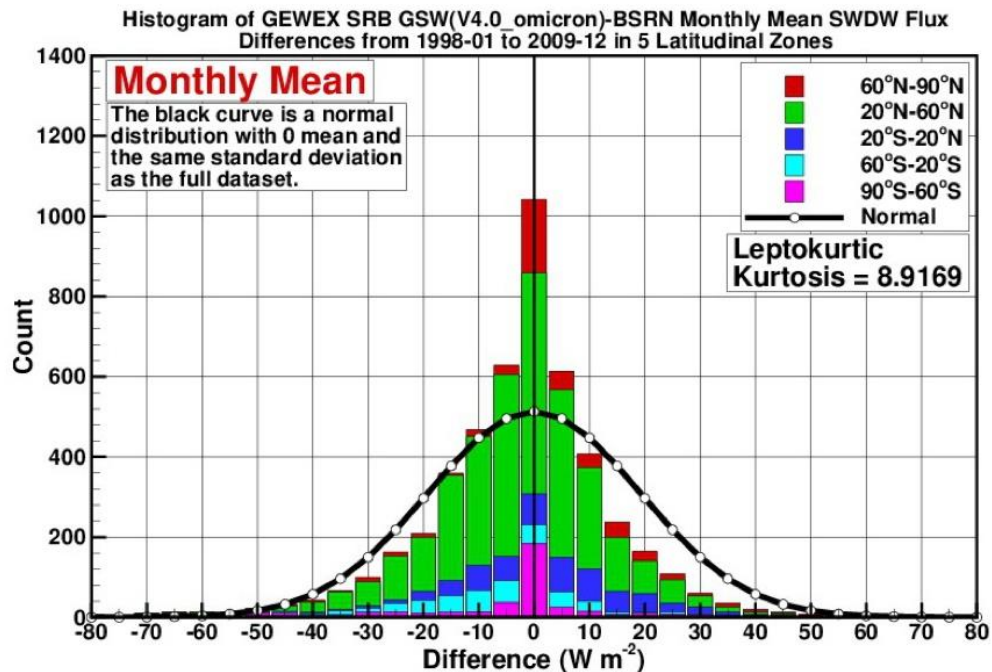
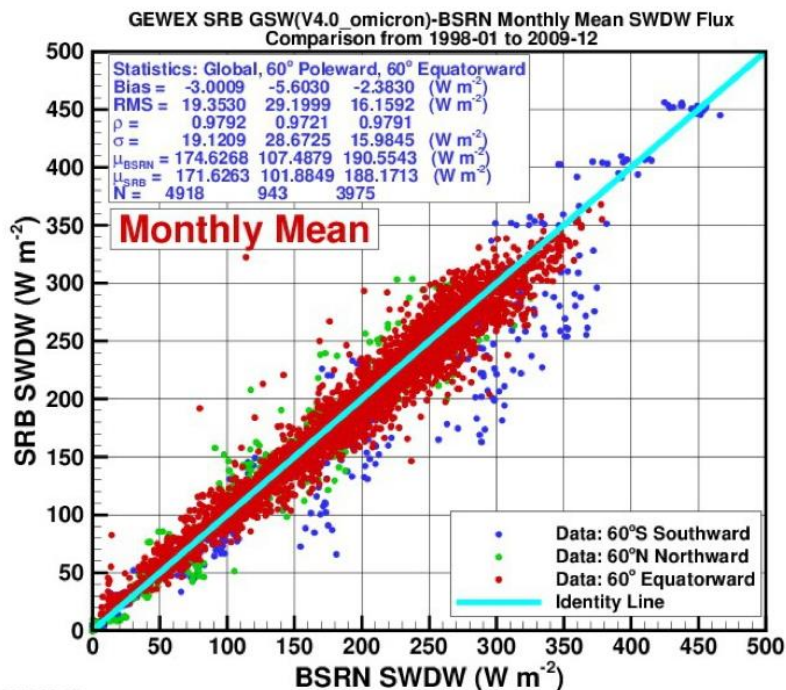




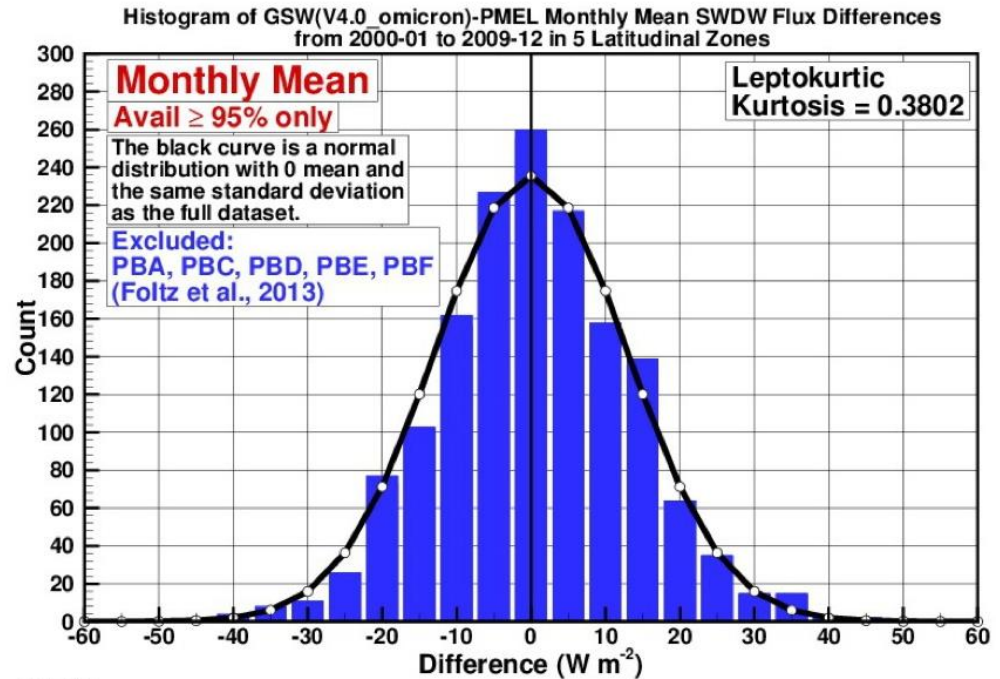
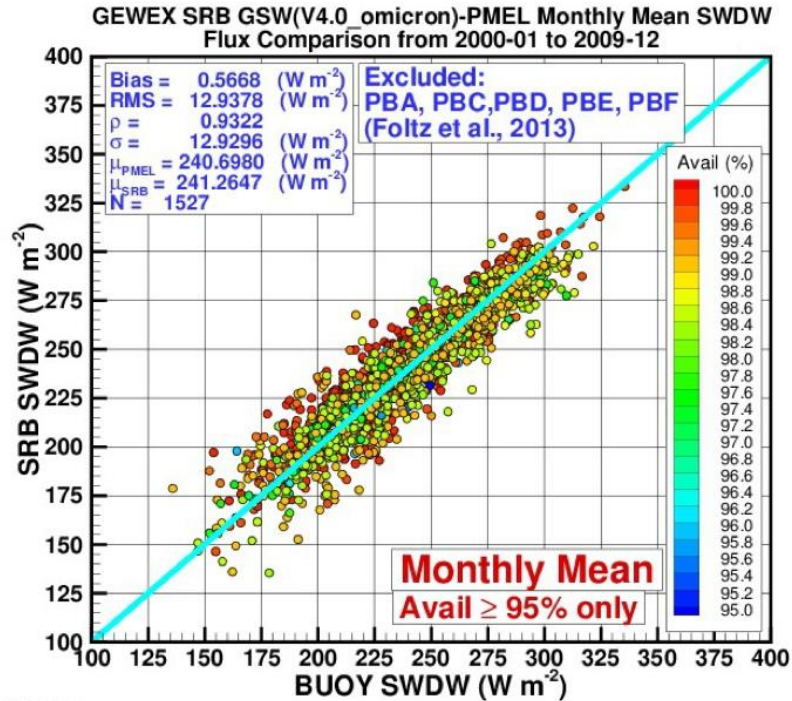
2017-09-22



2017-09-22



2018-03-27



Measurements screened for inconsistent sites using Foltz et al., 2013

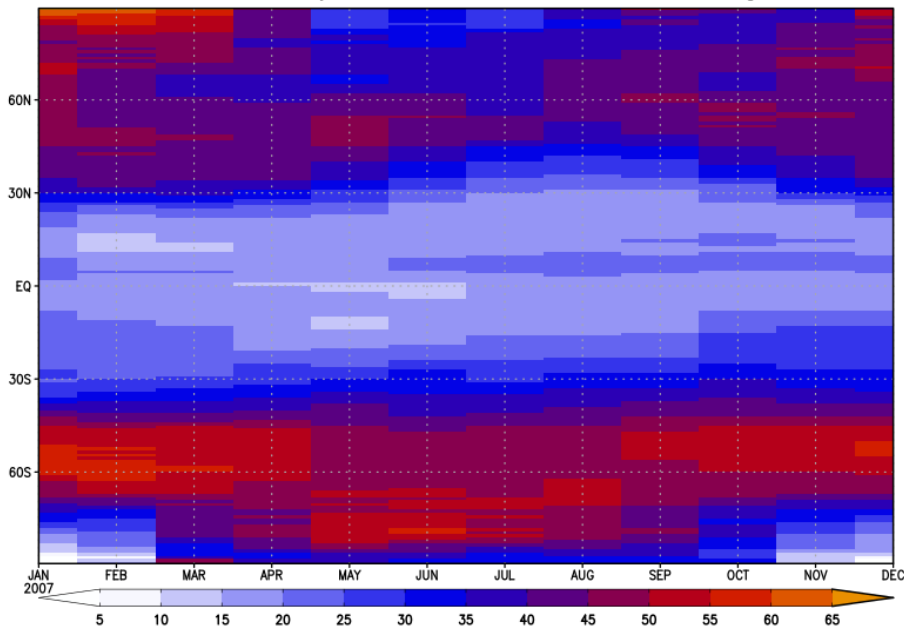


Annual Cycle Surface Cloud Radiative Effect



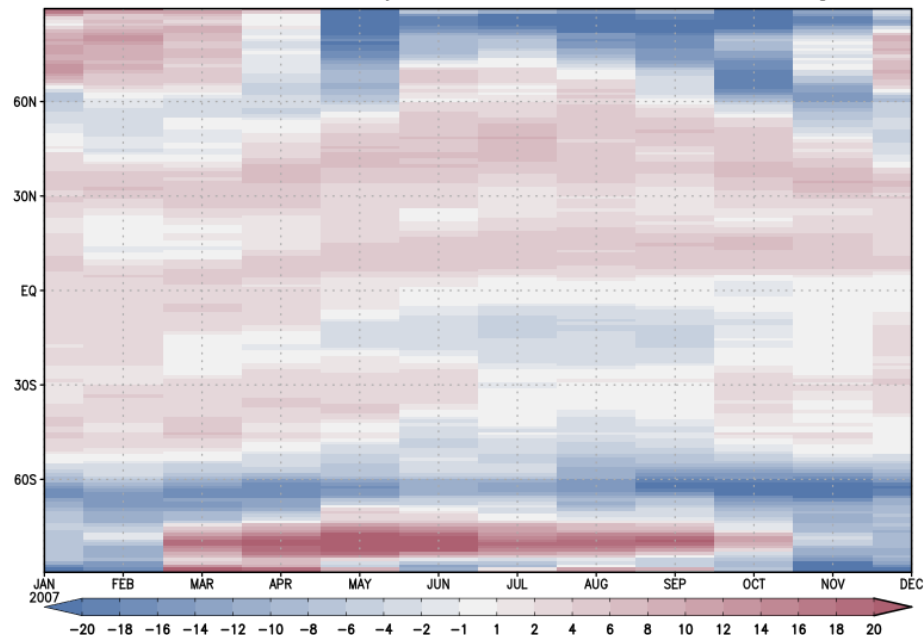
SRB R4 LW CRE

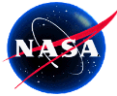
SRB Rel. 4 All-sky LW CRE at Sfc: Month Average 2007



SRB R4 LW – EBAF Ed4 LW CRE

SRB – EBAF Ed. 4 All-sky LW CRE at Sfc: Month Average 2007



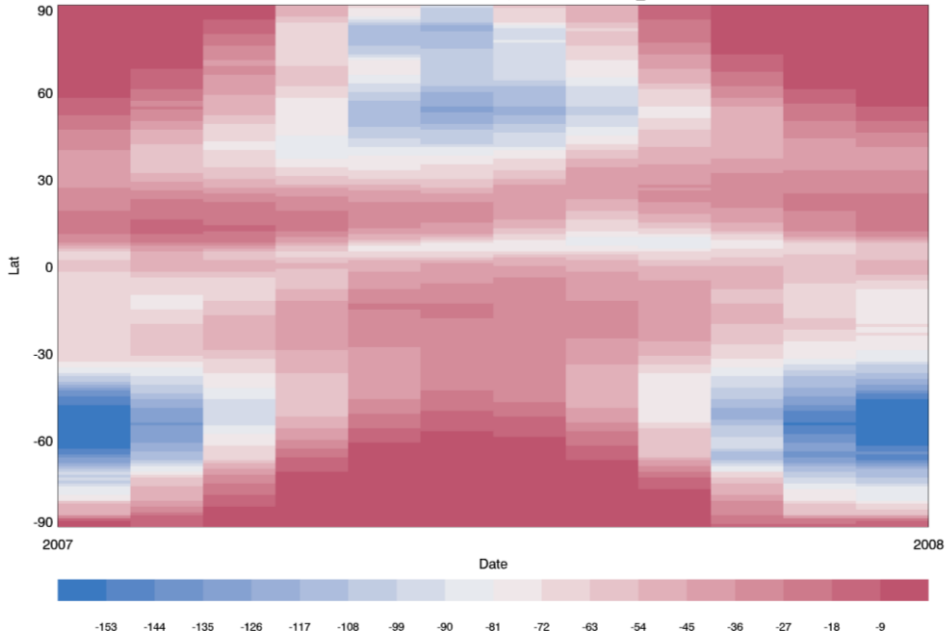


Annual Cycle Surface SW Cloud Radiative Effect



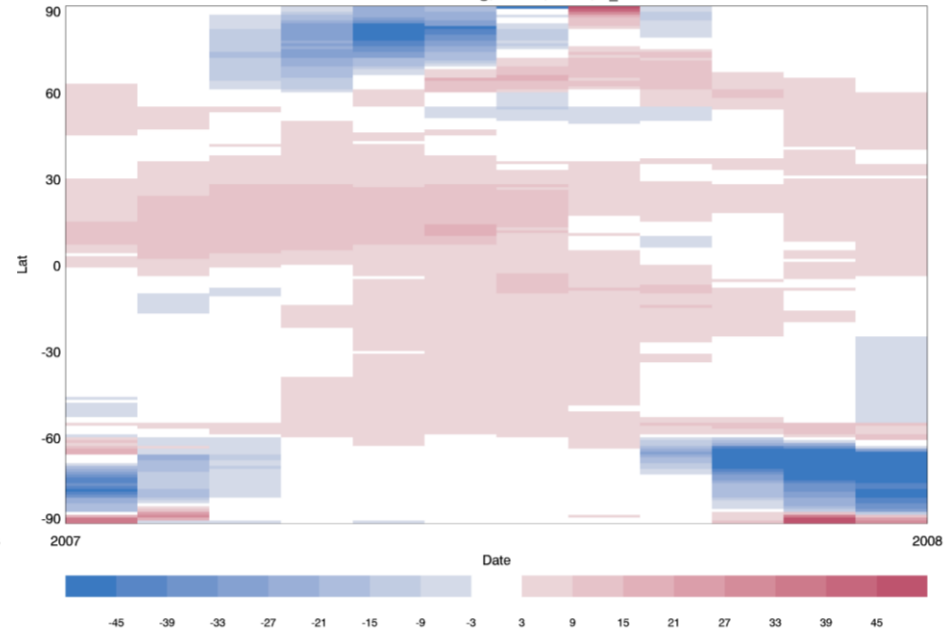
SW R4 Sfc CRE

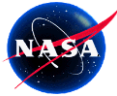
Cloud Radiative Forcing, Wm⁻², 2007, 4_xi



SW R4 – EBAF SW Ed4 Sfc CRE

Cloud Radiative Forcing, Wm⁻², 2007, 4_xi - EBAF



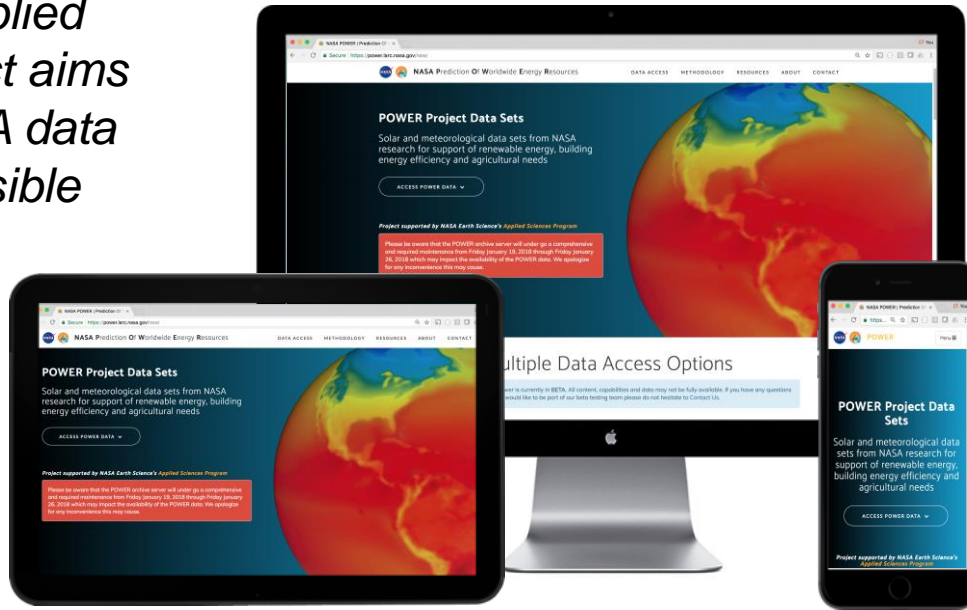


New POWER/SSE (v8, GIS) Expands Accessibility with Web Services



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

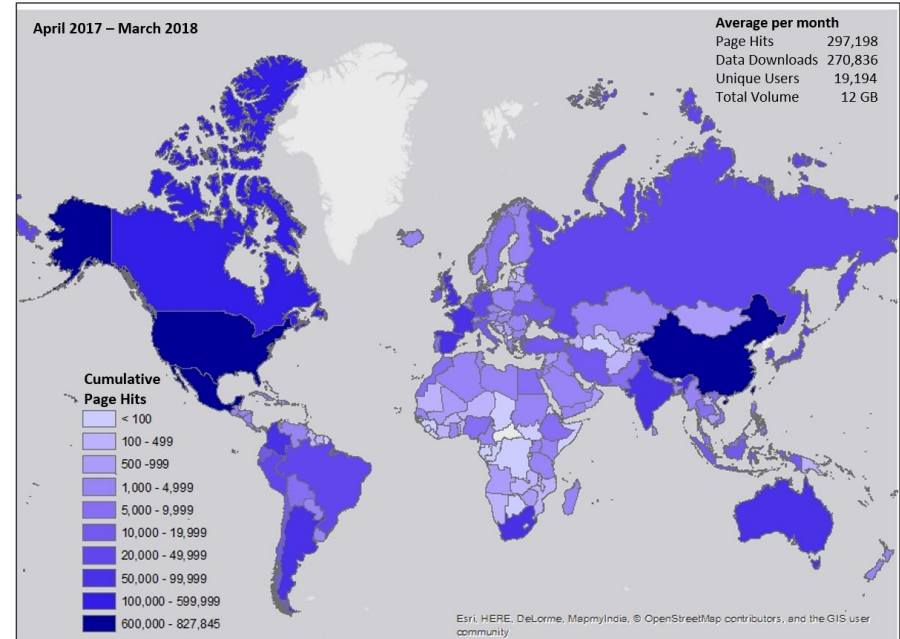
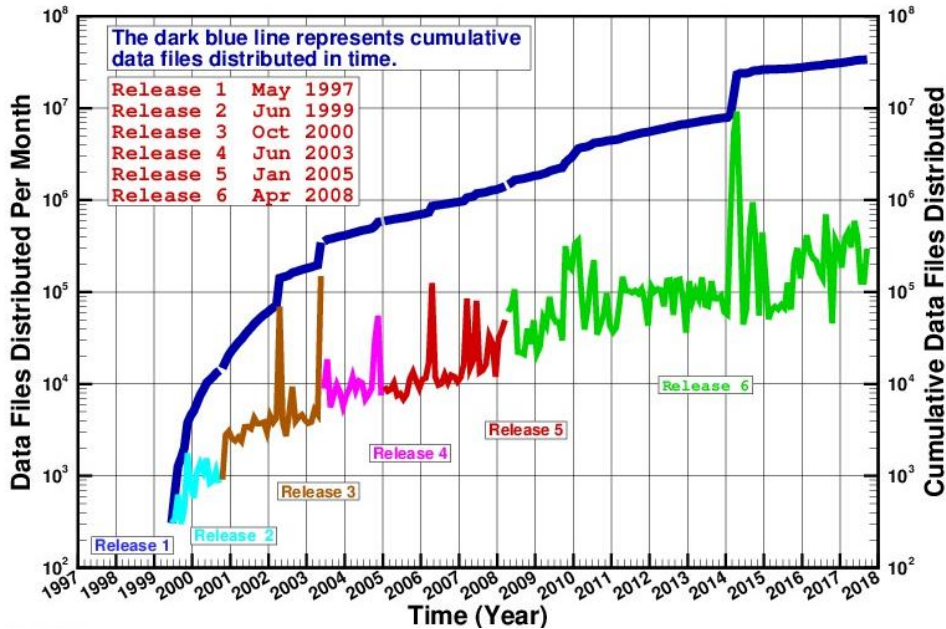


Website is a Responsive Platform for Desktop, Tablet, and Smartphone

Updated data sets with future updates more easily implemented, documented and validated

POWER web site now in live: <https://power.larc.nasa.gov>

SSE User History (Climatology only)



Last 12 months: averaged 271K data orders and 19K users per month

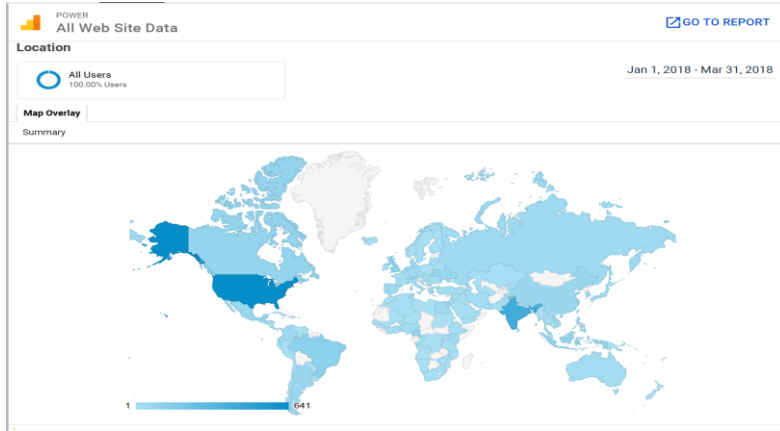
"SSE is by far the highest used data at ASDC", ASDC User Services



POWER (old SSE) Users from All Over the World



POWER-GIS Beta Usage Distribution Q1 2018



Country	Acquisition			Behavior			Conversions		
	Users	New Users	Sessions	Bounce Rate	Pages / Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
	2,942	2,776	4,734	72.33%	1.72	00:02:28	0.00%	0	\$0.00
	% of Total: 100.00%	% of Total: 100.11%	% of Total: 100.00%		Avg For View: 1.72	Avg For View: 00:02:28	Avg For View: 0.00%	% of Total: 0.00%	% of Total: (\$0.00)
	(2,942)	(2,777)	(4,734)	(0.00%)	(0.00%)	(0.00%)	(0.00%)	(0)	(\$0.00)
1. United States	641	616	1,128	71.99%	1.62	00:02:22	0.00%	0	\$0.00
	(21.99%)	(22.19%)	(23.53%)					(0.00%)	(0.00%)
2. India	403	372	623	76.40%	1.45	00:01:30	0.00%	0	\$0.00
	(13.64%)	(13.40%)	(13.16%)					(0.00%)	(0.00%)
3. Brazil	117	109	179	71.51%	1.52	00:02:24	0.00%	0	\$0.00
	(3.96%)	(3.93%)	(3.78%)					(0.00%)	(0.00%)
4. United Kingdom	105	99	146	76.71%	1.53	00:01:21	0.00%	0	\$0.00
	(3.55%)	(3.57%)	(3.08%)					(0.00%)	(0.00%)
5. Indonesia	94	90	150	68.67%	1.69	00:02:38	0.00%	0	\$0.00
	(3.18%)	(3.24%)	(3.17%)					(0.00%)	(0.00%)
6. Cameroon	88	80	162	54.94%	1.99	00:04:43	0.00%	0	\$0.00
	(2.98%)	(2.89%)	(3.42%)					(0.00%)	(0.00%)
7. Canada	83	77	126	69.84%	6.95	00:03:34	0.00%	0	\$0.00
	(2.81%)	(2.77%)	(2.66%)					(0.00%)	(0.00%)
8. Mexico	66	64	76	80.26%	1.41	00:01:22	0.00%	0	\$0.00
	(2.23%)	(2.31%)	(1.61%)					(0.00%)	(0.00%)
9. China	63	60	84	79.76%	1.32	00:01:01	0.00%	0	\$0.00
	(2.13%)	(2.16%)	(1.77%)					(0.00%)	(0.00%)
10. Argentina	62	57	241	55.19%	2.09	00:11:34	0.00%	0	\$0.00
	(2.10%)	(2.05%)	(5.09%)					(0.00%)	(0.00%)

Rows 1 - 10 of 128

POWER/SSE Monthly Data Request Metrics for FY2018 (POWER-GIS Beta/v1 on-line Dec 2017)

Number of API and/or Data Requests/Month	Q4 2017	Q1 2018	Apr/May 2018
Current SSE (on EOSWEB, via POWER)	259,483	208,498	285,175
SSE-GIS App (on ASDC-GIS, via POWER)	413	422	817
POWER Old Website	770	981	1,065
POWER New website + DAV (beta)	43	784	2,611
POWER API (Beta) total URL hits	13,026	46,902	103,184
Total Agroclimatology Community	8,888	5,622	25,084
Total Surface Meteorology and Solar Energy (SSE) Community	3,544	35,983	62,302
Total Sustainable Buildings	594	5,296	15,674
Total Monthly Data Requests All Sites	286,762	304,488	495,910

Transitioning from POWER/SSE old to POWER-GIS