The NASA/GEWEX Surface and TOA Radiation Budget Dataset (Release-3.0)

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Presentation Outline

1. Input data and algorithm description
2. Geographical distributions and global means of multi-year averages
3. Validation of surface fluxes with BSRN ground-based measurements
4. Comparisons of TOA fluxes with ERBE and CERES measurements
5. Response to transient/interannual phenomena of the period
6. Summary and concluding remarks

Background

- Produced under the GEWEX SRB Project at NASA LaRC
- Release-3.0 Period: July 1983 – December 2007 (24.5 years)
- Input Data: Cloud properties derived from ISCCP-DX data
  on 3-hourly basis and 1x1 grid
  Meteorological profiles from GEOS-4
  Column ozone from TOMS, TOVS, and SMOBA
- Algorithms: Fluxes derived with two sets of algorithms
  GEWEX and Parameterized
- Validation Data: From BSRN, SURFRAD, WRDC (GEBA), etc.
- Data Availability: Entire dataset and ancillary information at:
  eosweb.larc.nasa.gov/PRODOCS/srb/table_srb.html

Algorithms

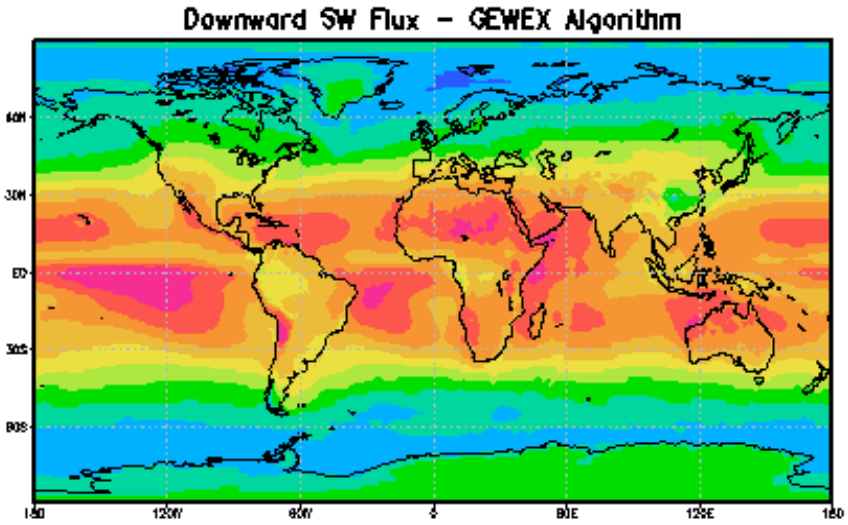
Shortwave Algorithms (0.3-5.0 micron)

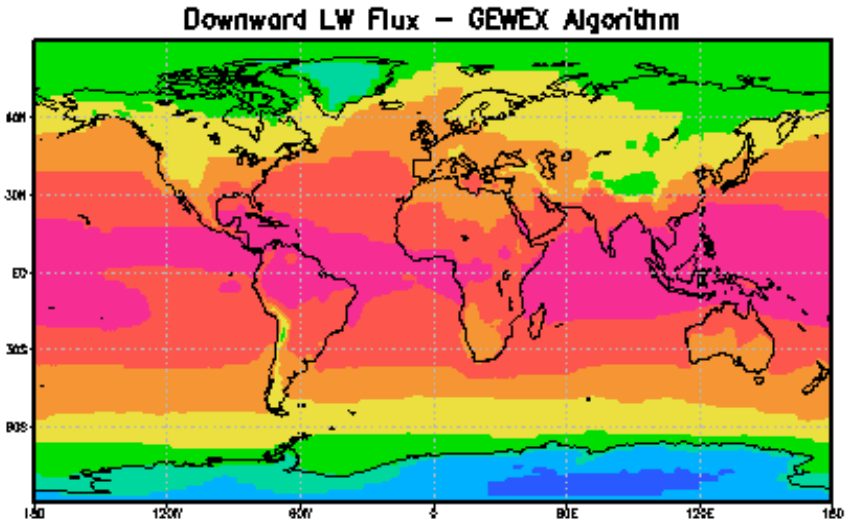
1. GEWEX SW (Pinker-Laszlo 1992) with numerous improvements: NB-BB conversion of ISCCP radiances to TOA fluxes. Results: 3-hourly daily, monthly/3-hourly, and monthly TOA and surface fluxes.
2. Parameterized SW (Gupta *et al*. 2001): Daily average fluxes derived from empirical fits of gaseous/aerosol extinction. Results: Daily and monthly surface fluxes.

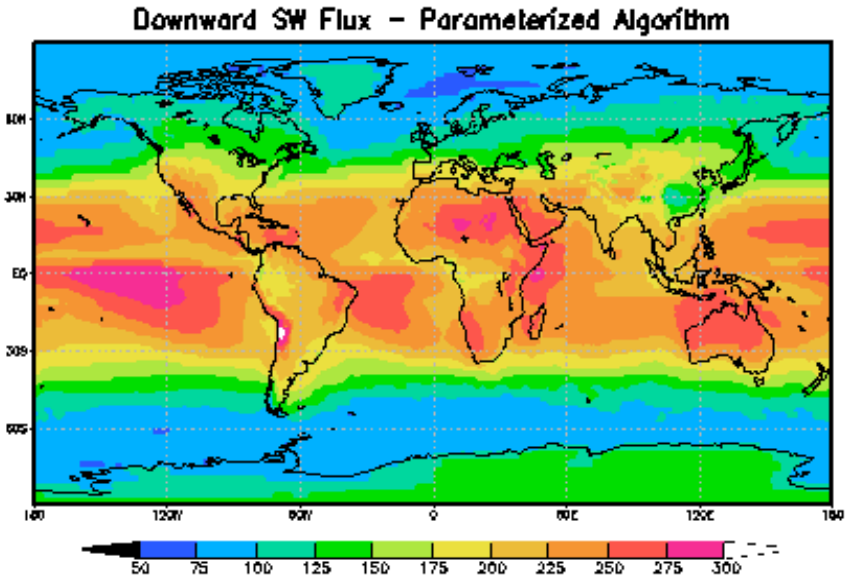
Longwave Algorithms (> 5.0 micron)

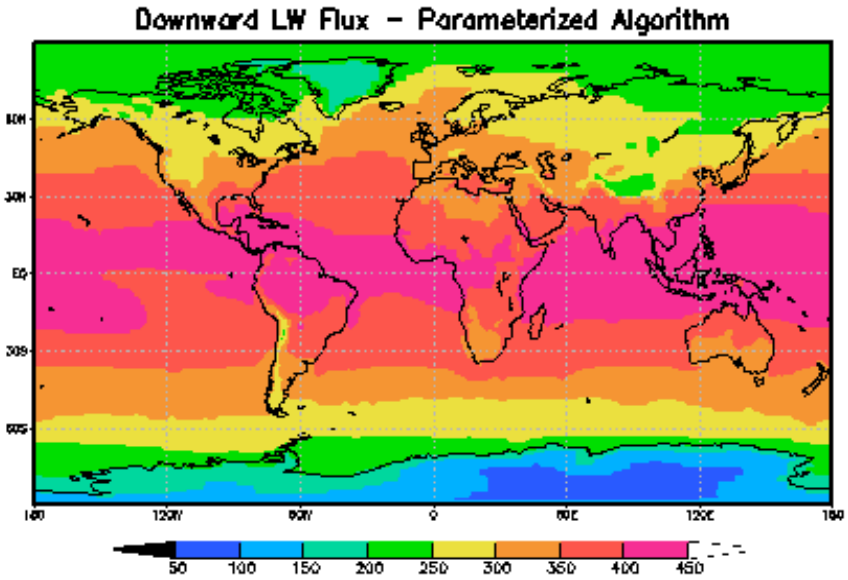
1. GEWEX LW (Fu *et al*. 1997) with numerous improvements: Delta 2/4 stream LW model, maximum/random cloud overlap, new IR parameterization for ice clouds and new water vapor continuum. Results: 3-hourly, daily, monthly/3-hourly, and monthly fluxes.
2. Parameterized LW (Gupta *et al*. 1992): RT based parameterizations for clear and cloudy downward LW fluxes. Results: 3-hourly, daily, monthly/3-hourly, and monthly surface fluxes.

Surface Fluxes – 24-Year Averages







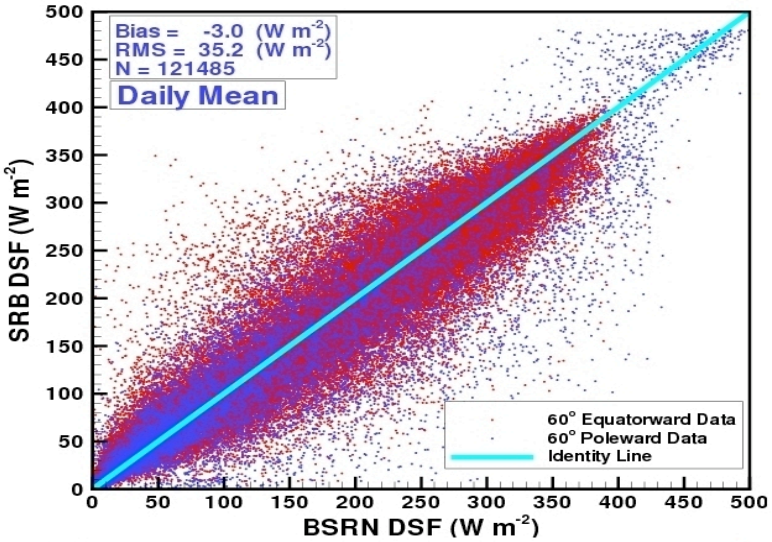


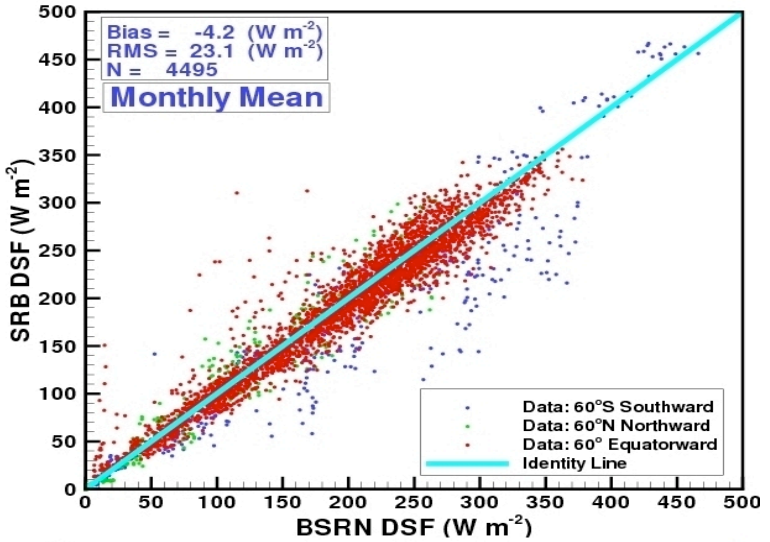
Multi-Year Global Average Surface Fluxes

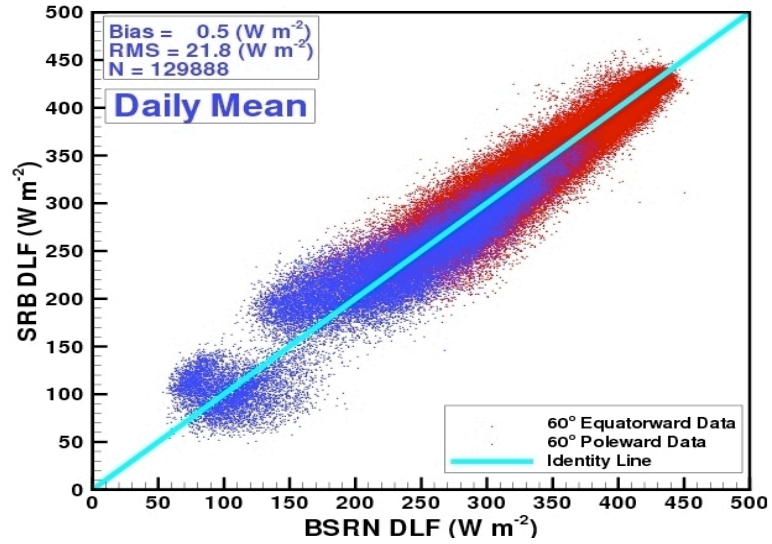
Parameter	Ohmura & Gilgen (1993) *GEBA Surf. Obs.*		Trenberth et al. (2009) CERES and Models		Zhang & Rossow (2004) *21-Year Mean (1984-2004)*		NASA/GEWEX SRB Release 3.0 (NASA LaRC) *24-Year Mean (Jan 1984 - Dec 2007)*			
							GEWEX		Parameterized	
	Flux	% F_0	Flux	% F_0	Flux	% F_0	Flux	% F_0	Flux	% F_0
SW Down	169.0	49.4	184.3	53.9	188.9	55.4	188.6	55.2	182.1	53.3
SW Net	142.0	41.6	161.2	47.2	165.7	48.5	166.6	48.7	159.5	46.7
LW Down	345	100.9	333.0	97.6	344.2	100.6	343.9	100.6	347.5	101.7
LW Net	-40.0	-11.7	-63.0	-18.5	-49.7	-14.5	-52.6	-15.4	-51.2	-15.0
Total Net	102.0	29.8	98.2	28.7	116.0	34.0	114.0	33.3	108.3	31.7
SW CRE	--	--	--	--	-58.9	-15.5	-58.9	-17.2	-61.0	-17.8
LW CRE	--	--	--	--	31.2	8.6	33.5	9.8	34.3	10.0
Total CRE	--	--	--	--	-27.7	-6.9	-25.4	-7.4	-26.7	-7.8

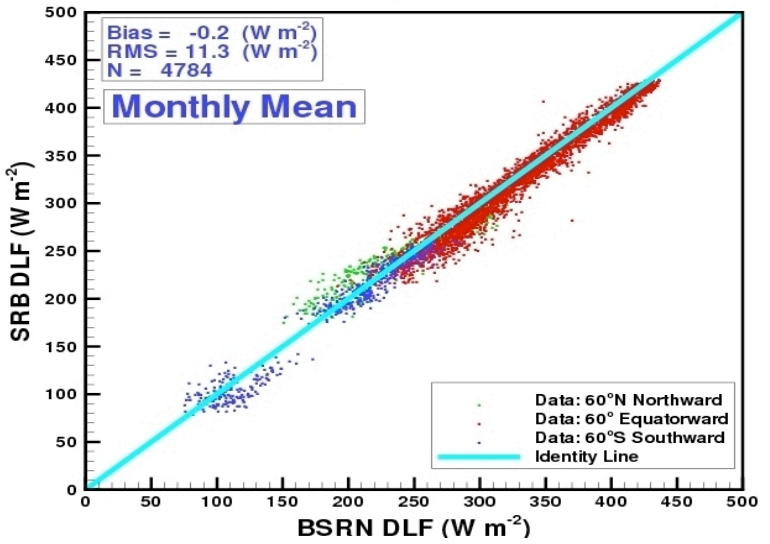
$F_0 = S_0/4$; S_0 = 1365 Wm^{-2} for Trenberth et al. and 1367 Wm^{-2} for all others

Validation of Surface Fluxes With BSRN Data
16 Years (1992 – 2007)

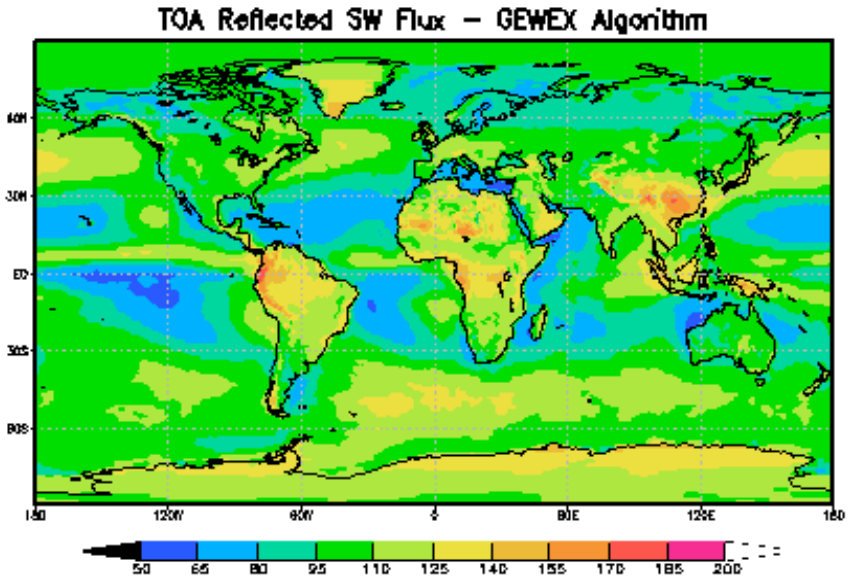


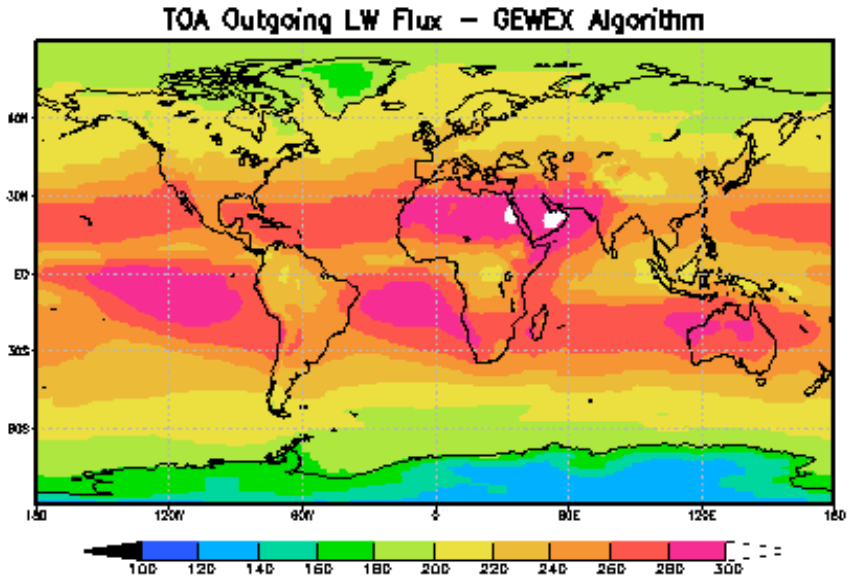






TOA Fluxes – 24-Year Averages





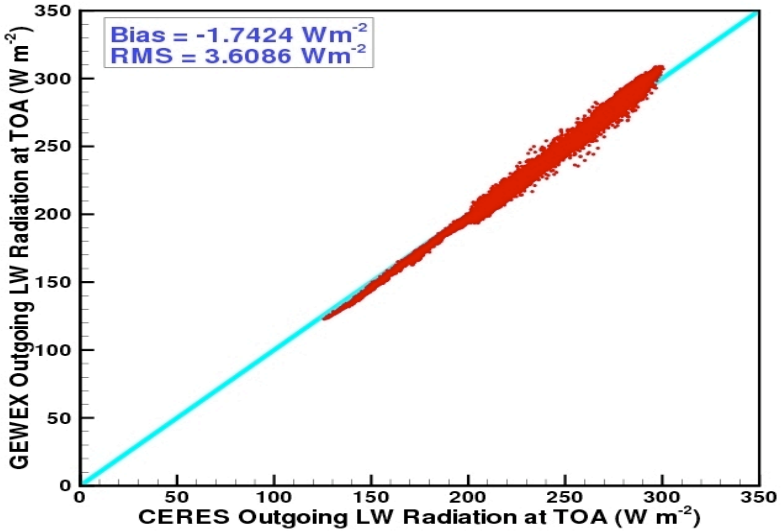
Global Multi-Year Average TOA Fluxes

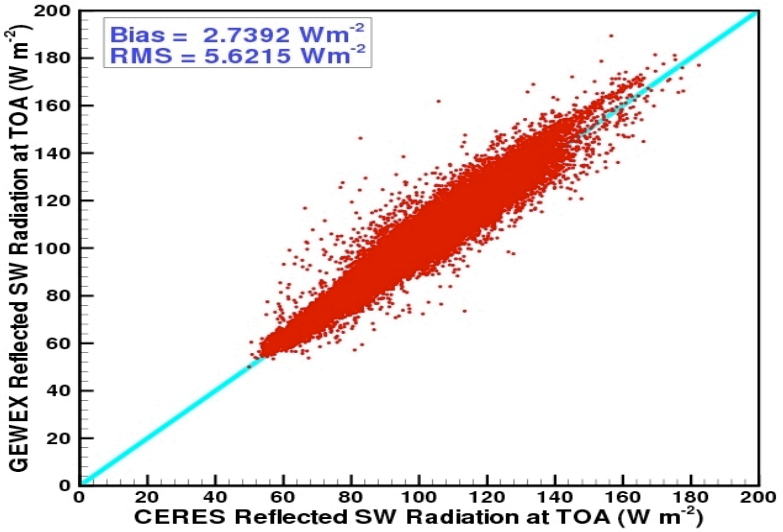
Parameter	Trenberth et al. (2009) CERES and Models		Zhang & Rossow (2004) *21-Year Mean (1984-2004)*		CERES EBAF Edition-2.6r (Loeb et al. 2009) *11-Year Average (Mar 2000 – Feb 2011)*		NASA/GEWEX SRB Release 3.0 (NASA LaRC) *24-Year Average (Jan 1984 – Dec 2007)*	
	Flux	% F_0	Flux	% F_0	Flux	% F_0	Flux	% F_0
Incoming Solar	341.3	100.0	341.8	100.0	340.2	100	341.8	100.0
Reflected Solar	101.9	29.8	105.4	30.8	99.7	29.3	101.5	29.7
Absorbed Solar	239.4	70.1	236.4	69.2	240.5	70.7	240.4	70.3
SW CRE	--	--	-50.2	-14.7	-47.3	-13.9	-47.5	-13.9
All-Sky OLR	238.5	69.9	234.3	68.5	240.4	70.7	237.9	69.6
Clear-Sky OLR	--	--	260.3	76.1	266.0	78.2	265.3	77.6
LW CRE	--	--	26.0	7.6	26.3	7.7	27.4	8.0
Total Net	0.9	0.3	2.1	0.6	0.1	0.0	2.5	0.7

$F_0 = S_0/4$; S_0 = 1365 Wm^{-2} for Trenberth et al. and 1367 Wm^{-2} for all others

Comparison of GEWEX TOA Fluxes With CERES EBAF

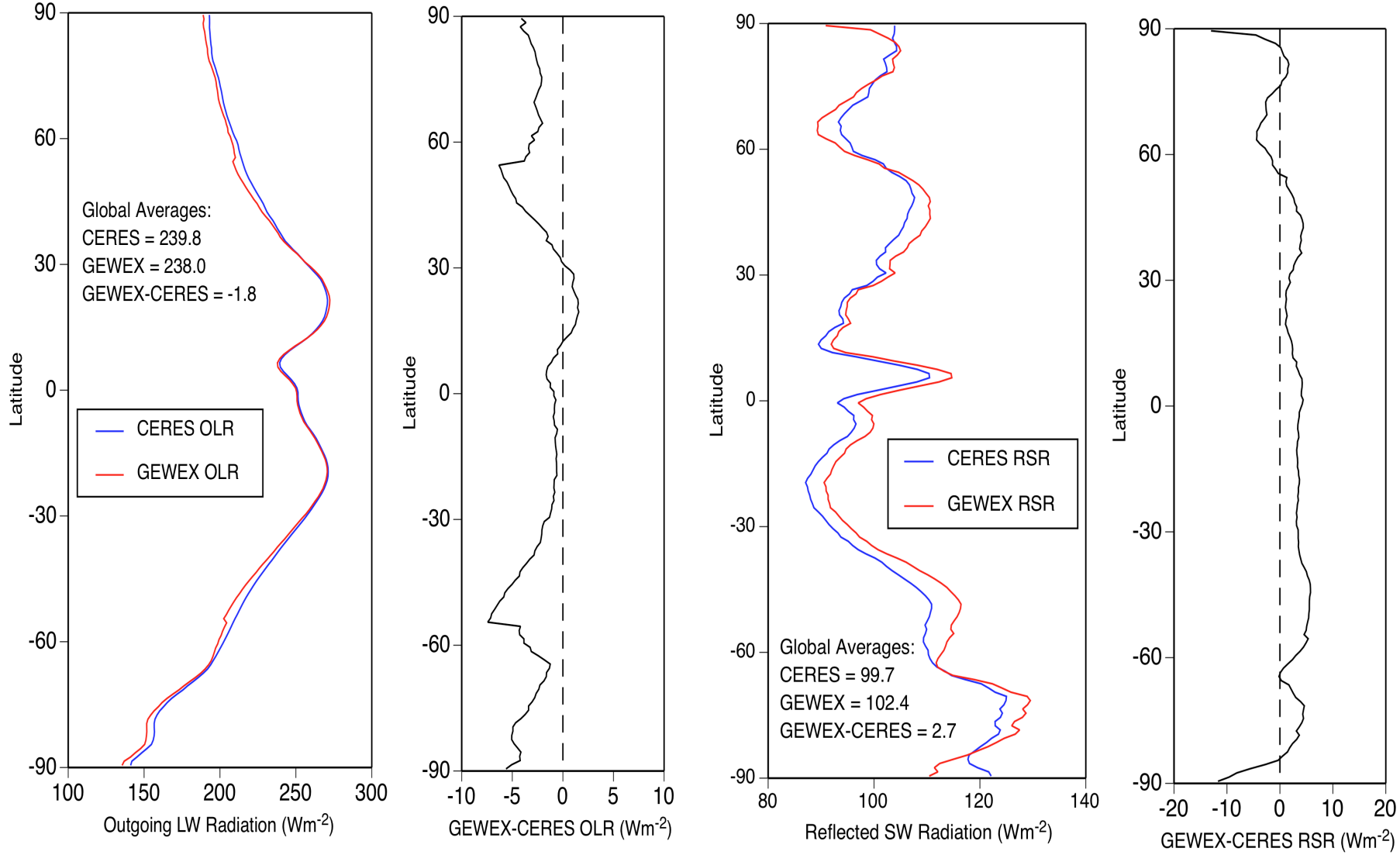
7-Year Averages (Jan2001 – Dec2007)





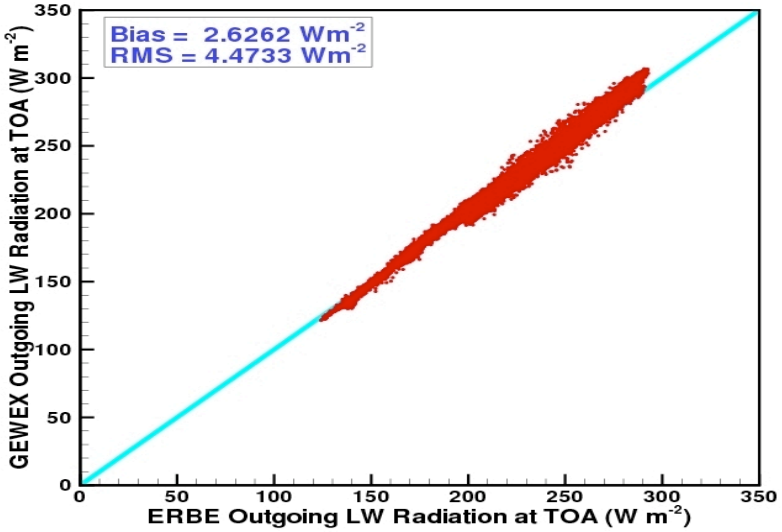
Zonal Comparison of GEWEX Fluxes With CERES EBAF

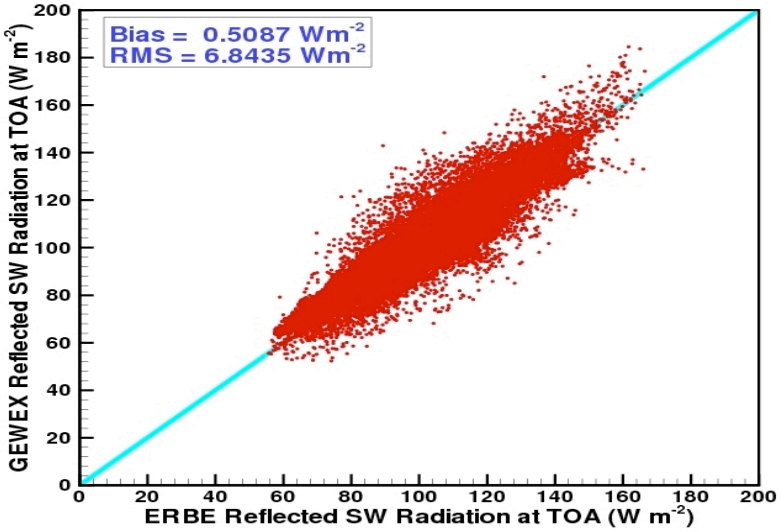
7-Year Averages (Jan2011 – Dec2007)



Comparison of Gridded GEWEX TOA Fluxes With ERBE

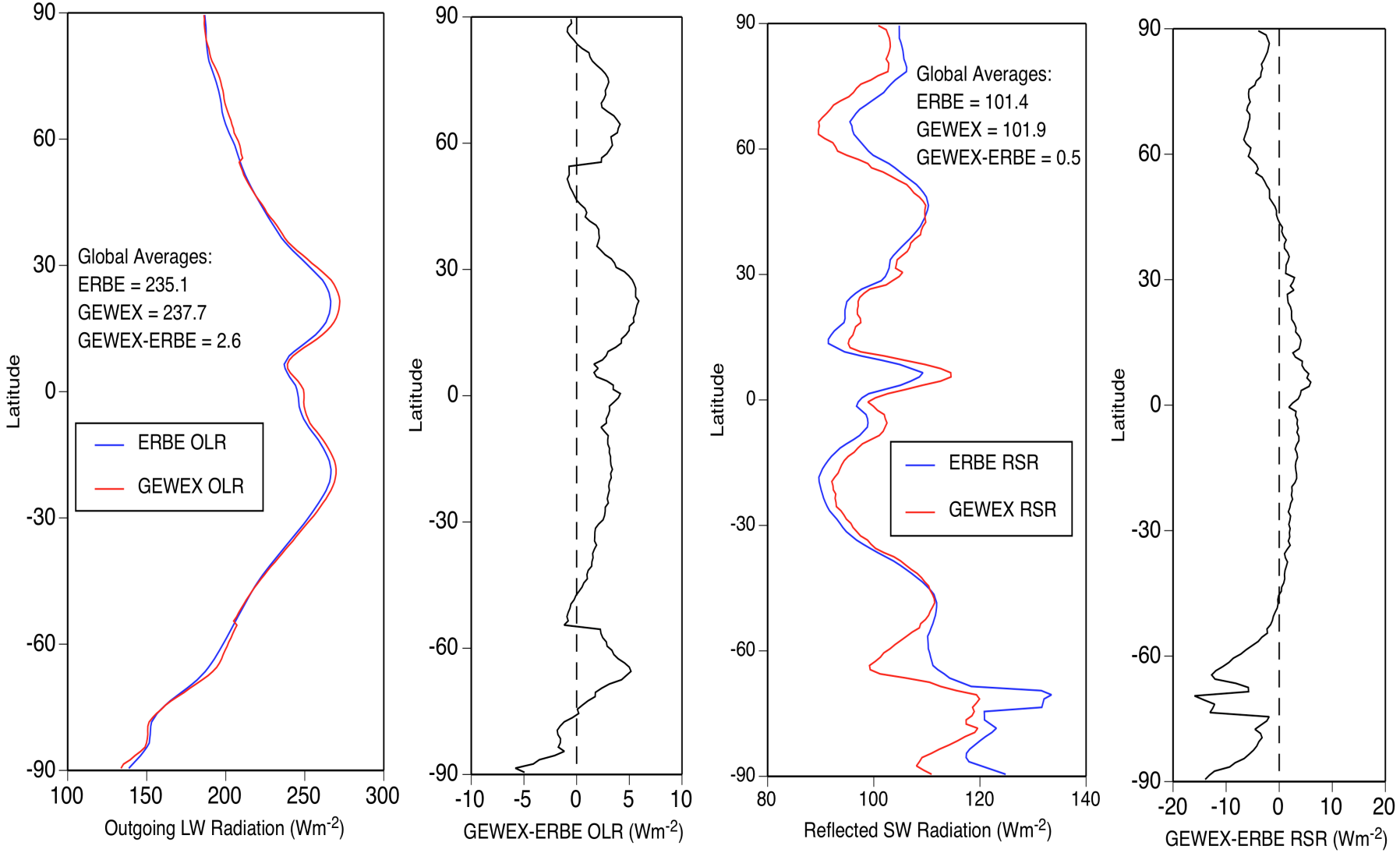
4-Year Averages (Feb1985 – Jan1989)



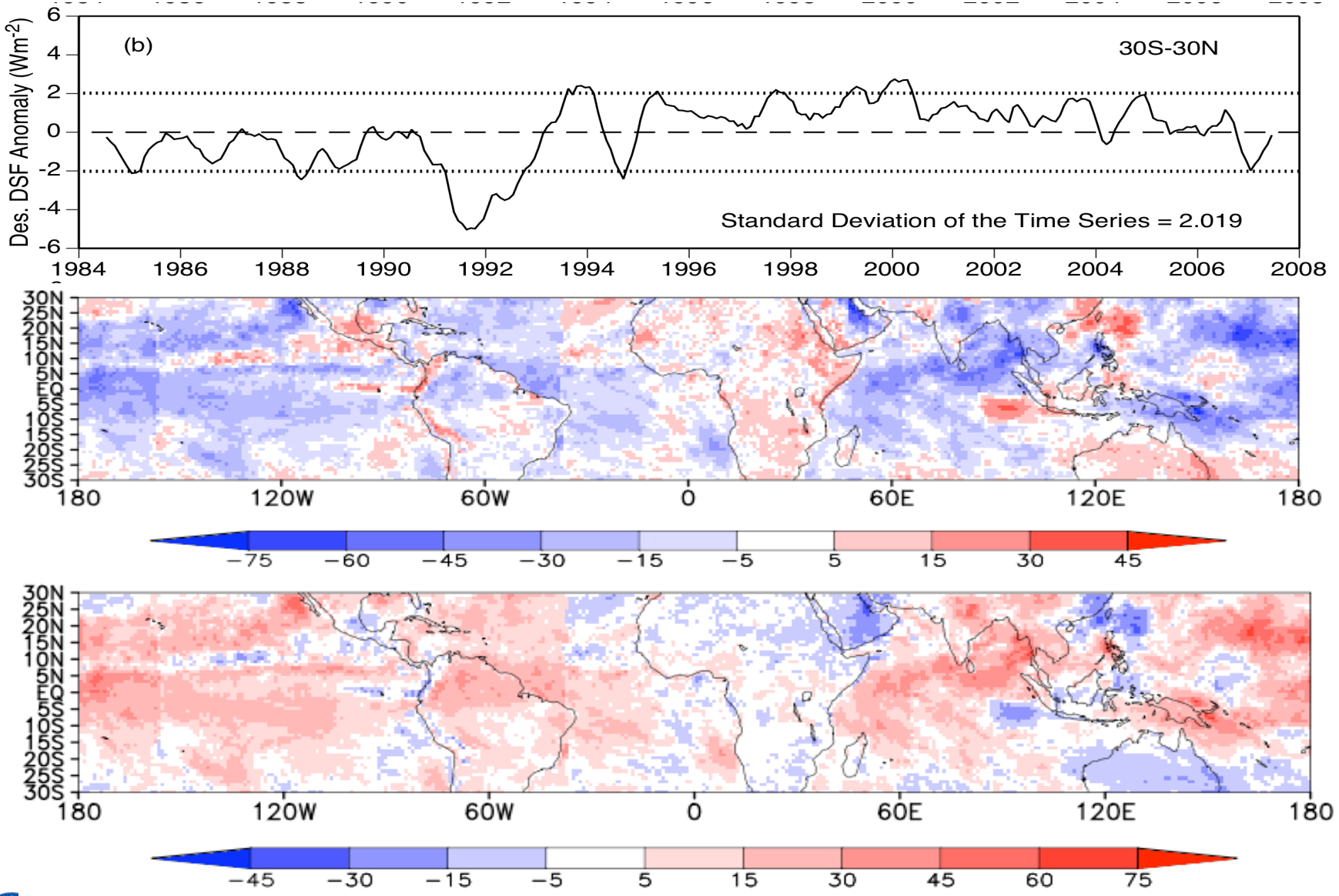


Zonal Comparison of GEWEX TOA Fluxes With ERBE

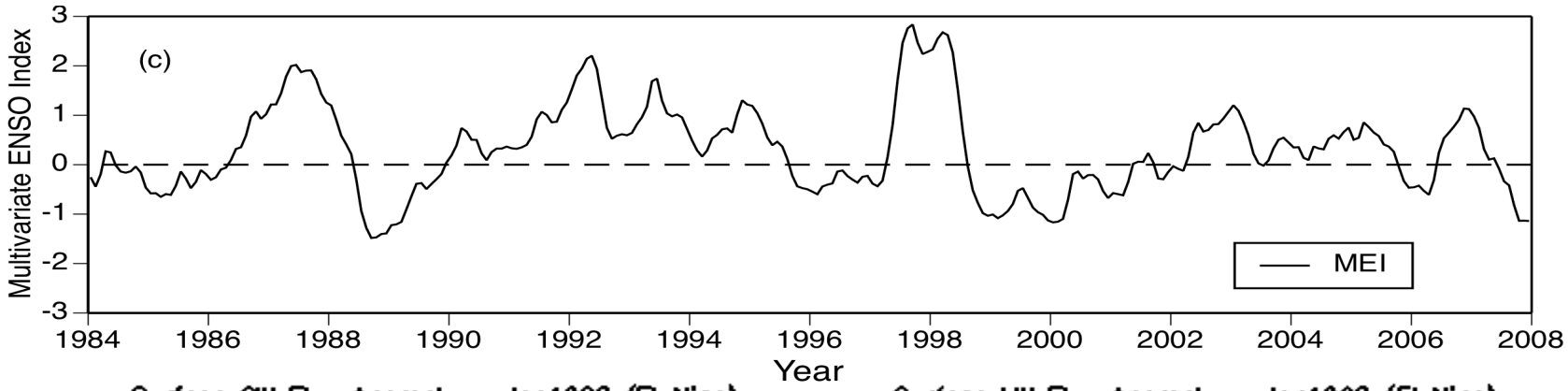
4-Year Averages (Feb1985 – Jan1989)

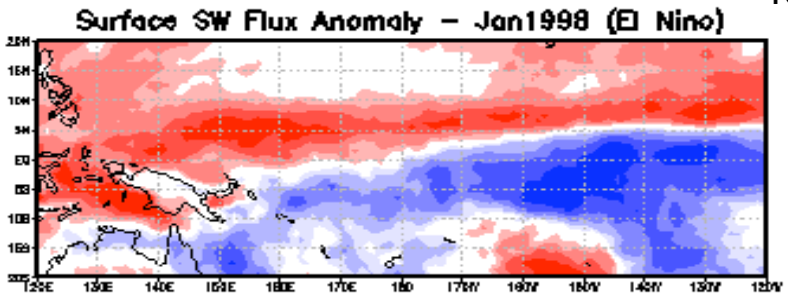


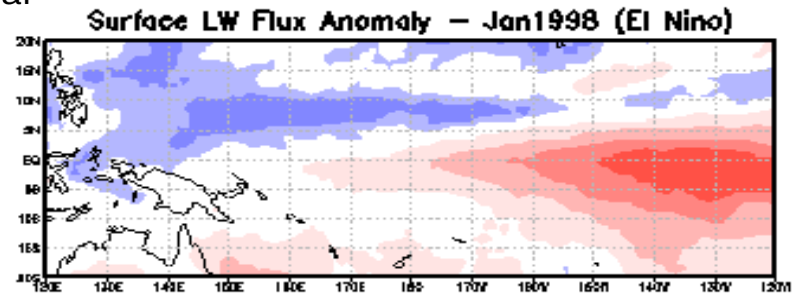
DSF and RSR Anomalies – Mt. Pinatubo (Aug 1991)

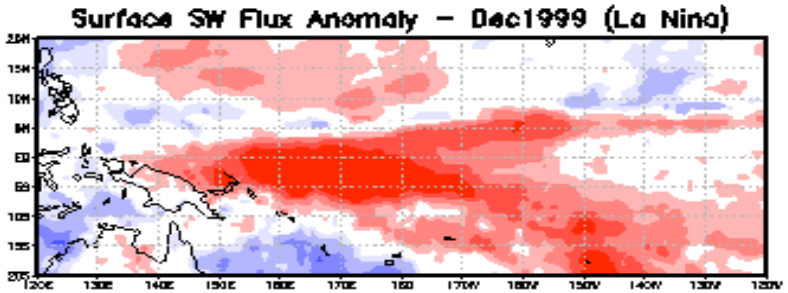


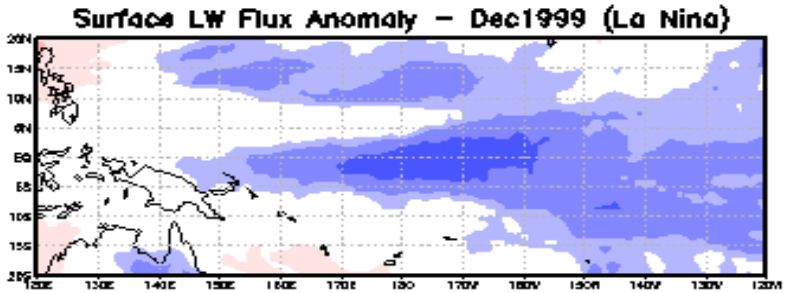
Response to El Nino (Jan1998)/La Nina (Dec1999)

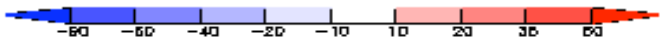


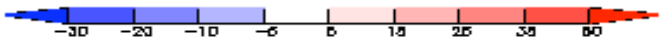




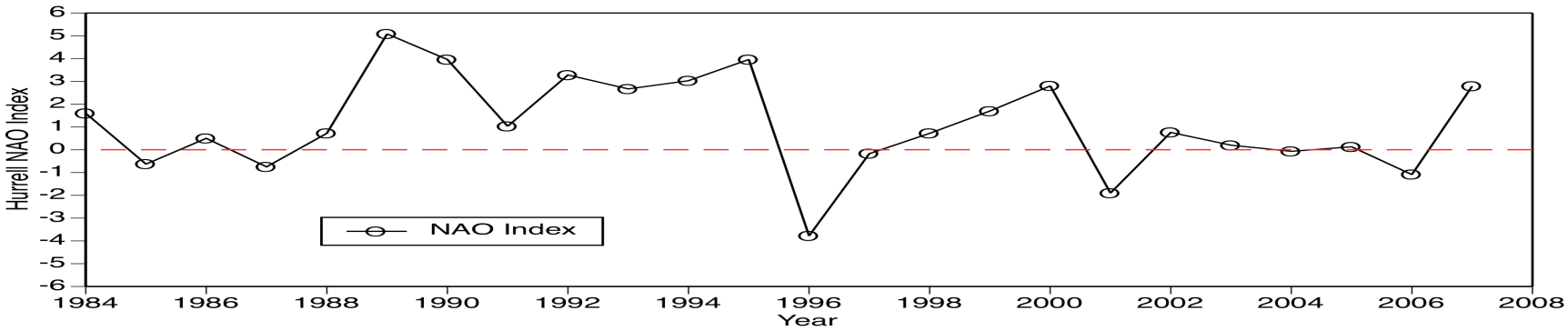


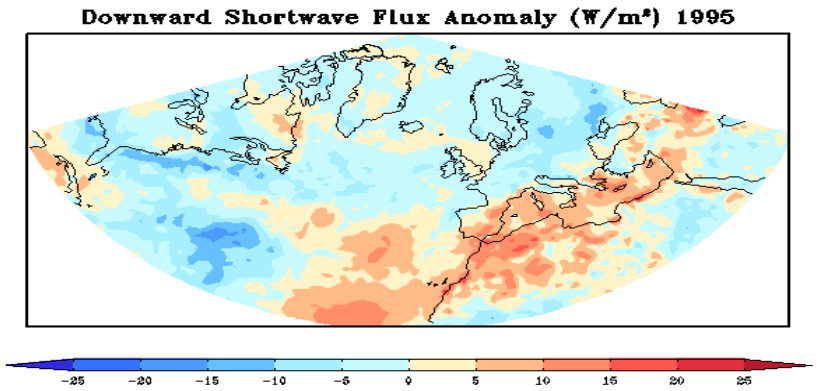


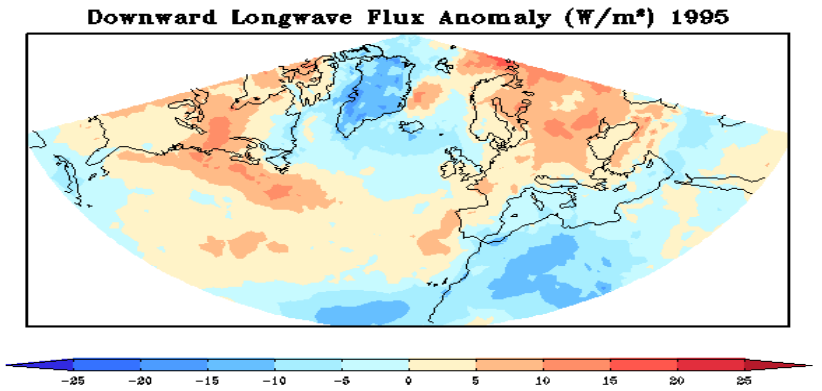


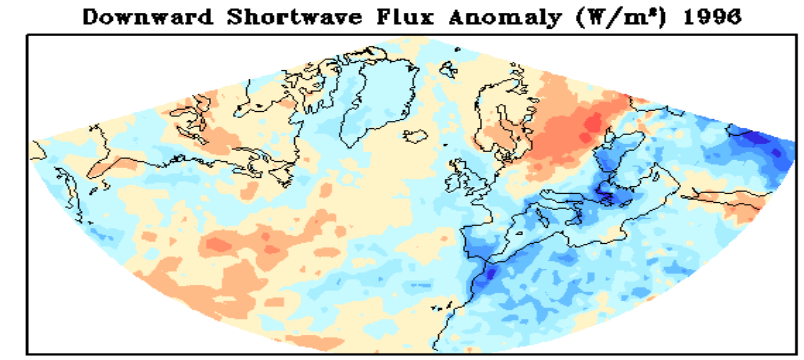


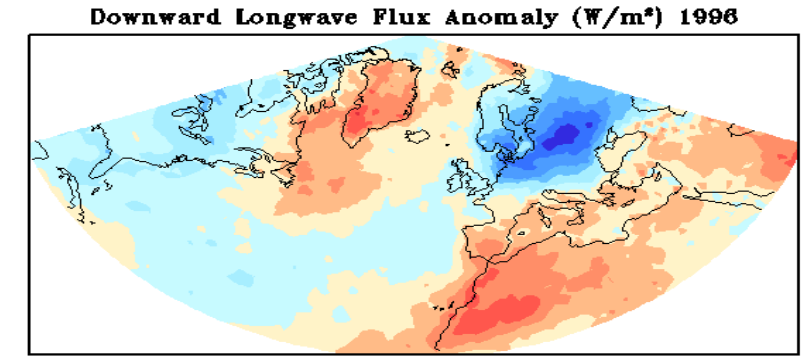
Response to North Atlantic Oscillation







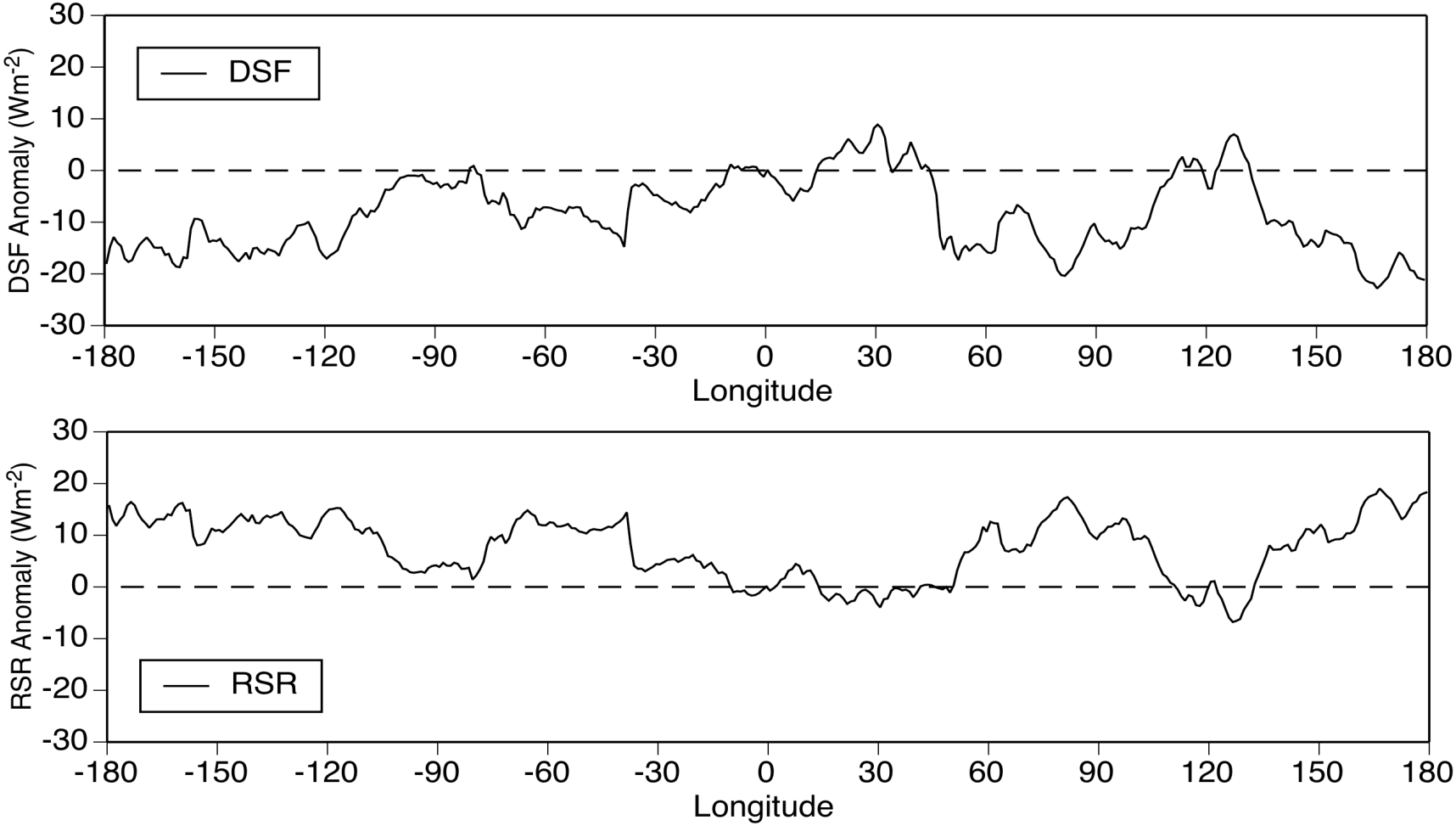




Summary and Concluding Remarks

- GEWEX/SRB Release-3.0: A 24.5 year dataset of surface and TOA radiative parameters
- Derived with two sets of algorithms and satellite and reanalysis inputs
- Surface parameters show good agreement with other satellite projects and with BSRN measurements on daily and monthly average basis. Bias: within ±5 Wm^{-2} for SW and within ±1 Wm^{-2} for LW.
- TOA parameters show good agreement with ERBE and CERES satellite measurements. Bias: within ±3 Wm^{-2} for both SW and LW on monthly average basis.
- Surface and TOA parameters show desired response to interannual phenomena (volcanic eruption; El Nino/La Nina; NAO)
- Data available to the worldwide science community from Atmospheric Science Data Center, NASA/LaRC

Back up slide



Meridional averages (30S-30N) of Downward SW and Reflected SW fluxes as a function of longitude demonstrating transition boundaries between geostationary satellites.