Edition 4.2 EBAF (surface)
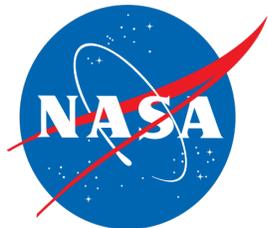
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[2]Science System & Applications Inc.

CERES Science Team Meeting
April 26-28, 2022

Edition 4.2 EBAF process (surface irradiances)

- Bias correction of upper tropospheric (200 hPa to 500 hPa) temperature and humidity is based on MERRA-2 and AIRS L3 (possibly with CLIMCAPS) differences
  - Revision of radiative kernel is TBD
- Cloud fraction correction is based on MODIS and CALIPSO/CloudSat difference
- Radiative kernels used for Lagrange multiplier are produced with MODIS clouds and MERRA-2
- Climatological irradiance correction is applied to Terra only and NOAA-20 only periods.
- Temperature and humidity diurnal cycle (MERRA-2), and solar zenith angle change are considered. Only missing diurnal cycle is cloud diurnal cycle.

Two underlying assumptions in producing noGEO EBAF

Basing concept of noGEO EBAF is that TOA and surface irradiances consist of climatological mean and anomalies. The difference of irradiances derived from Terra, Terra+Aqua and NOAA20 is caused by the difference in climatological means.

Assumptions are:

1) Terra+Aqua noGEO provides correct regional monthly mean surface irradiance (not necessarily have a correct cloud diurnal cycle, Edition 4.1 Syn provides diurnal cycle).

2) noGEO (Terra only, Terra+Aqua, and NOAA20) provides correct anomaly variabilities.
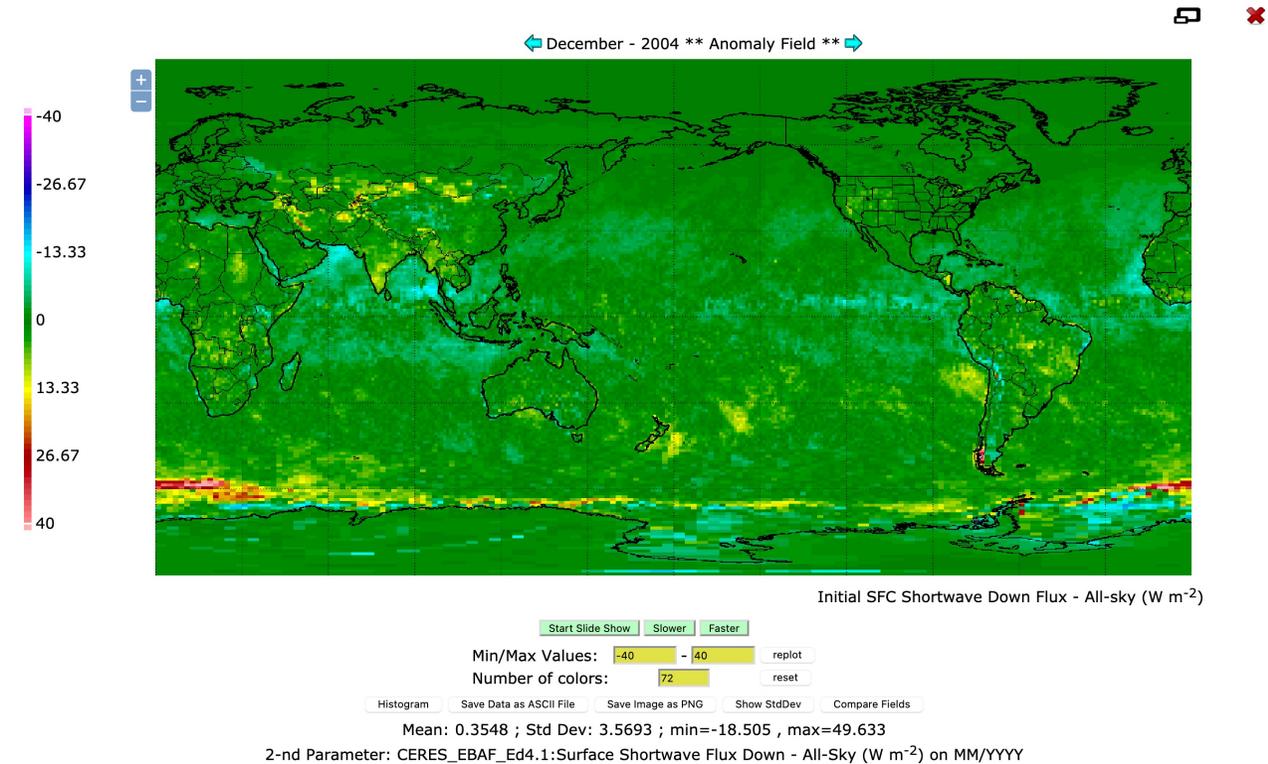
Does Terra+Aqua noGEO give correct monthly mean SW irradiances?

Difference of shortwave downward irradiance from Terra+Aqua SYN noGEO and Edition 4.1 EBAF
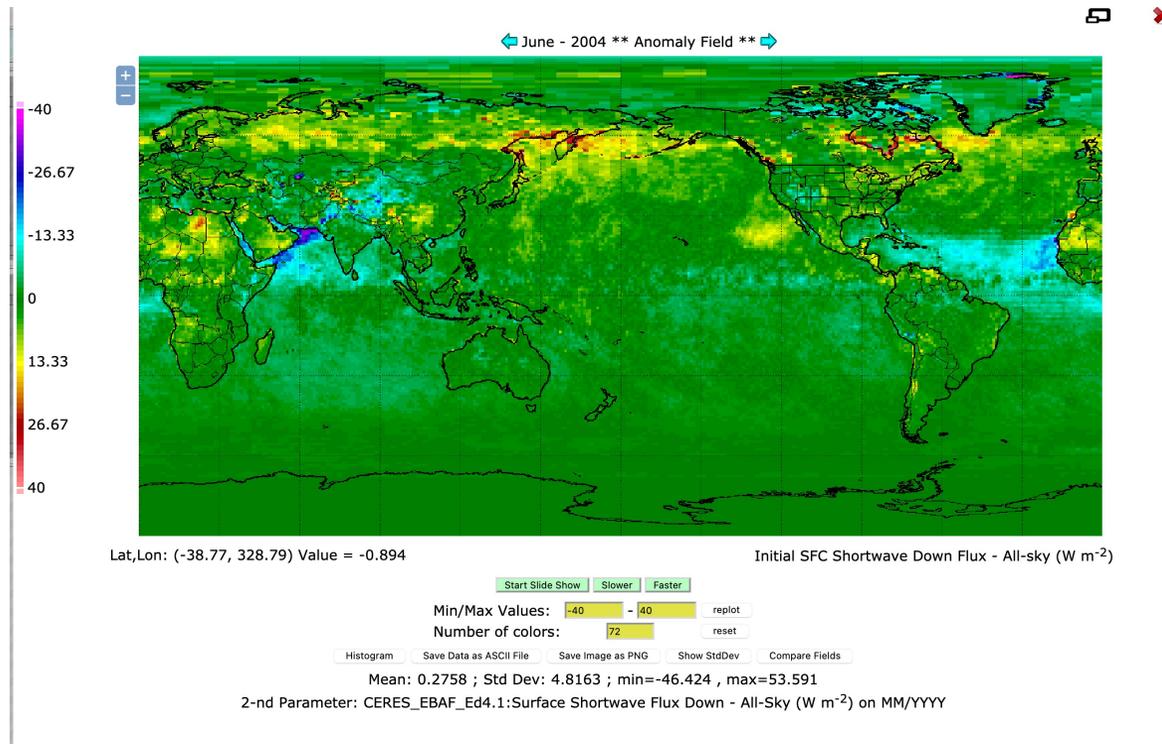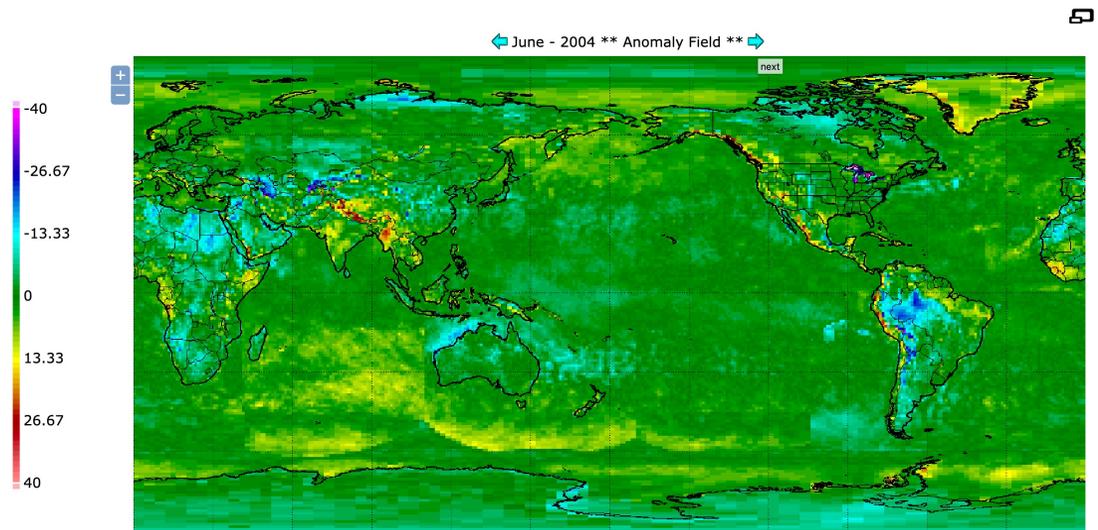
June 2004

December 2004

Does Terra+Aqua noGEO give correct monthly mean LW irradiances?

Difference of longwave downward irradiance from Terra+Aqua SYN noGEO and Edition 4.1 EBAF

June 2004

December 2004

Lat,Lon: (89.99, 264.08) Value = 7.670
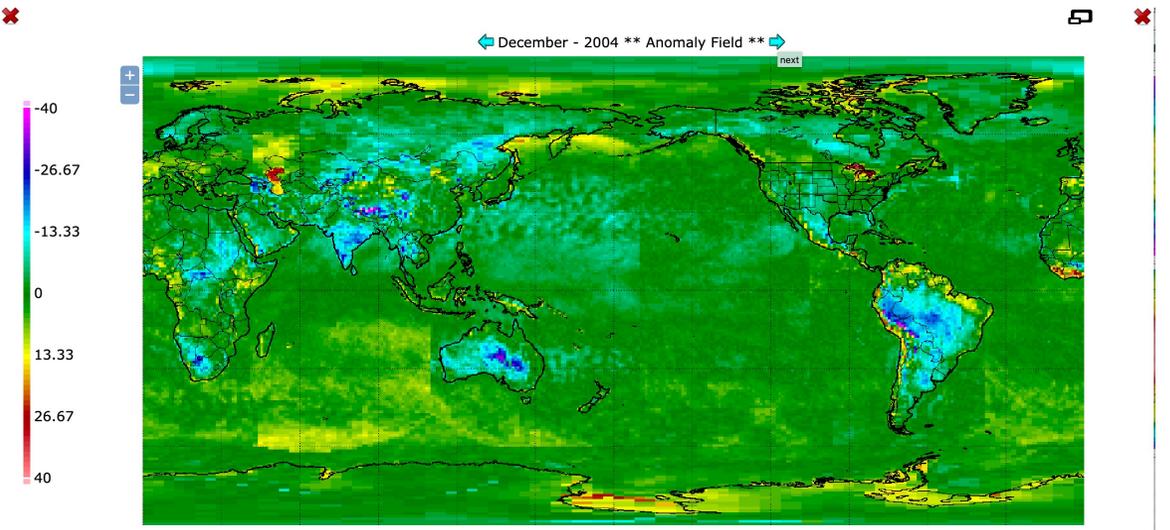
Initial SFC Longwave Down Flux - All-sky (W m⁻²)

Mean: 0.5528 ; Std Dev: 4.8017 ; min=-47.244 , max=39.758
2-nd Parameter: CERES_EBAF_Ed4.1:Surface Longwave Flux Down - All-Sky (W m⁻²) on MM/YYYY

Lat,Lon: (-3.63, 329.45) Value = 0.213

Initial SFC Longwave Down Flux - All-sky (W m⁻²)
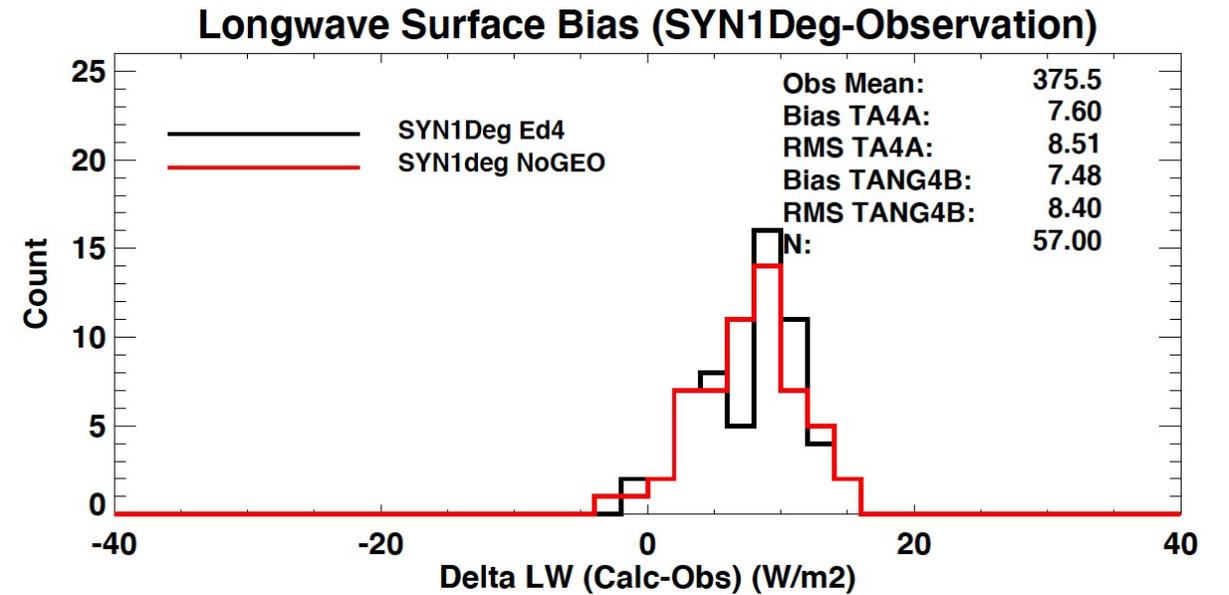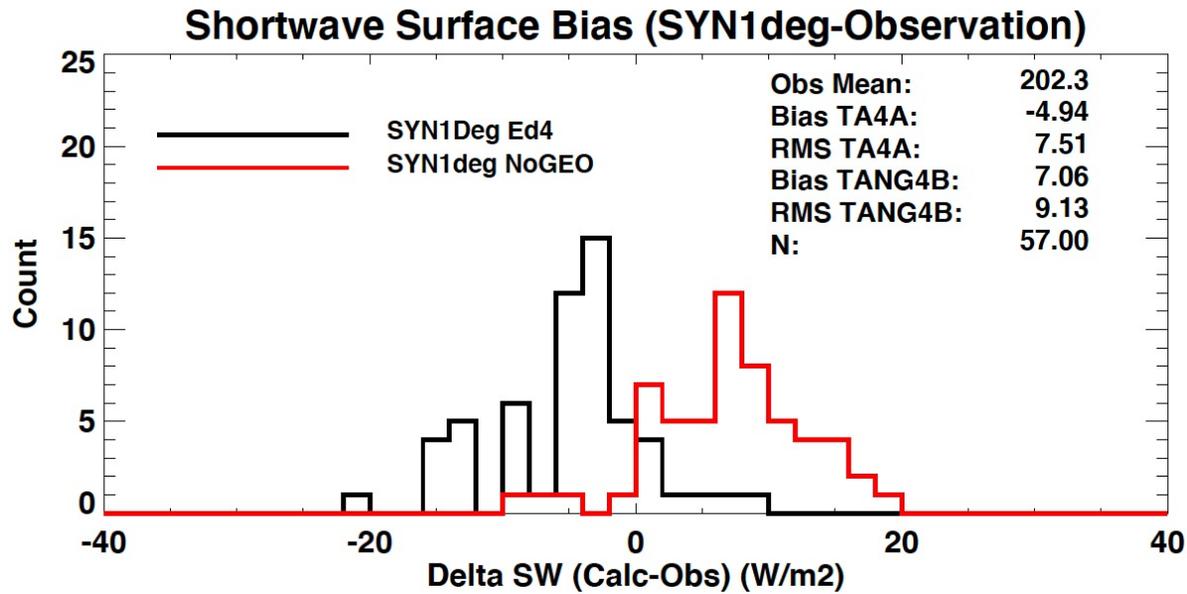
Mean: 0.1922 ; Std Dev: 5.2207 ; min=-56.356 , max=37.209
2-nd Parameter: CERES_EBAF_Ed4.1:Surface Longwave Flux Down - All-Sky (W m⁻²) on MM/YYYY

Cloud, SW & LW diurnal cycles at WHOI stratus buoy

Cloud

ΔSW

LW
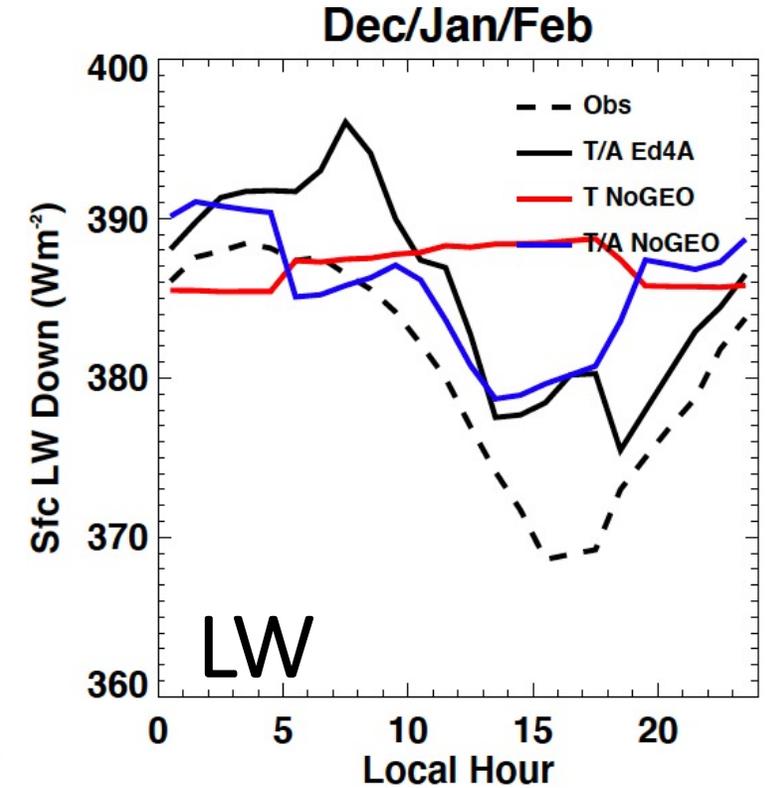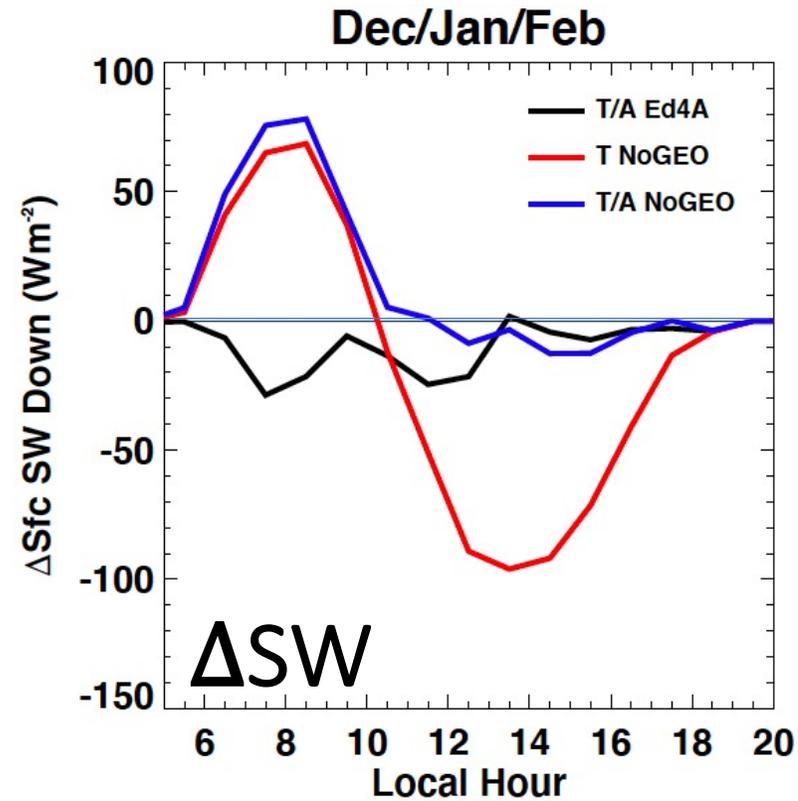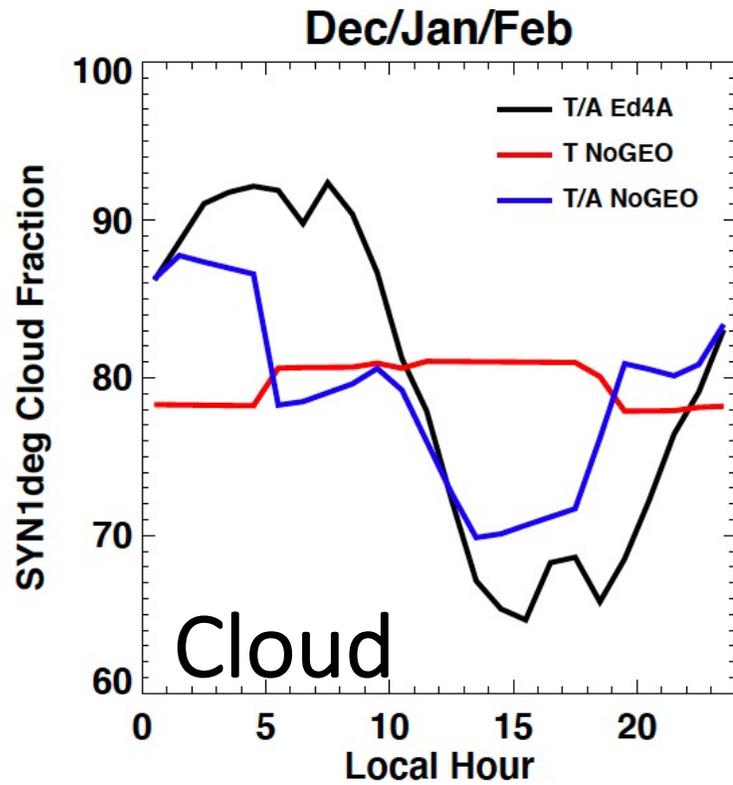
Comparison with monthly mean observed downward surface irradiance

WHOI Stratus Buoy

Monthly mean flux difference table

	Downward Shortwave (Wm-2) Uncertainty (12 Wm^{-2} land, 11 Wm^{-2} ocean)			Downward Longwave (Wm-2) Uncertainty (10 Wm^{-2} land, 5 Wm^{-2} ocean)		
	Obs. mean	T+A noGEO	T+A+GEO (SYN 4A)	Obs. mean	T+A noGEO	T+A+GEO (SYN 4A)
WHOI stratus buoy	202.3	7.1 (9.1)	-4.9 (7.5)	375.5	7.5 (8.4)	7.6 (8.5)
ARM E13	189.7	0.9 (7.2)	0.4 (3.6)	335.2	-6.9 (9.0)	-2.3 (5.1)
Alice Spring Australia	259.9	4.3 (8.2)	2.1 (6.7)	360.7	-4.2 (6.8)	-0.7 (8.3)
De Aar, South Africa				315.2	-7.2 (8.6)	-0.8 (5.6)
Table mountain CO				187.6	3.1 (11.8)	-3.0 (10.5)

Numbers in parenthesis are RMS

Regional anomaly time series, downward shortwave

Blue: Terra only, Red: Terra+Aqua, Green Aqua only
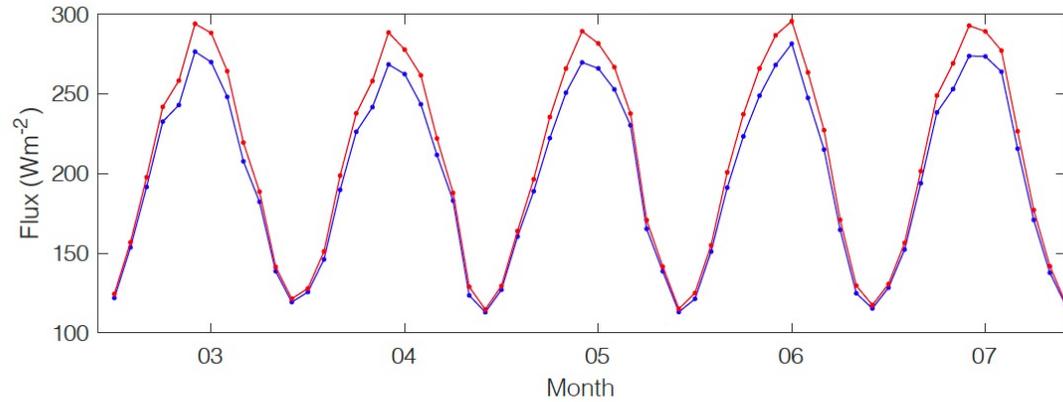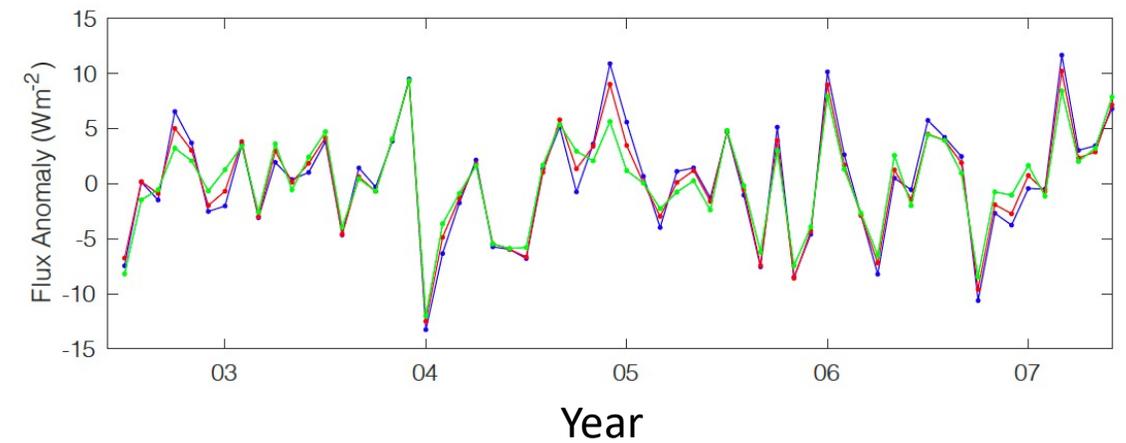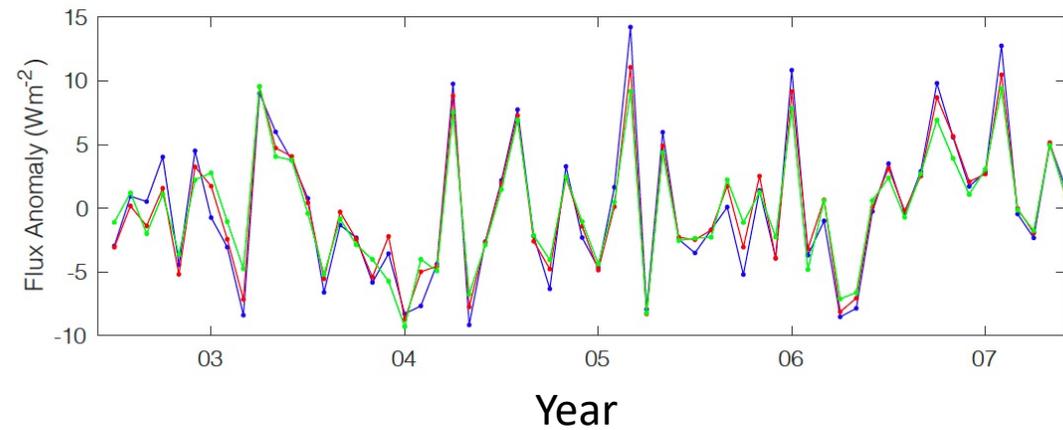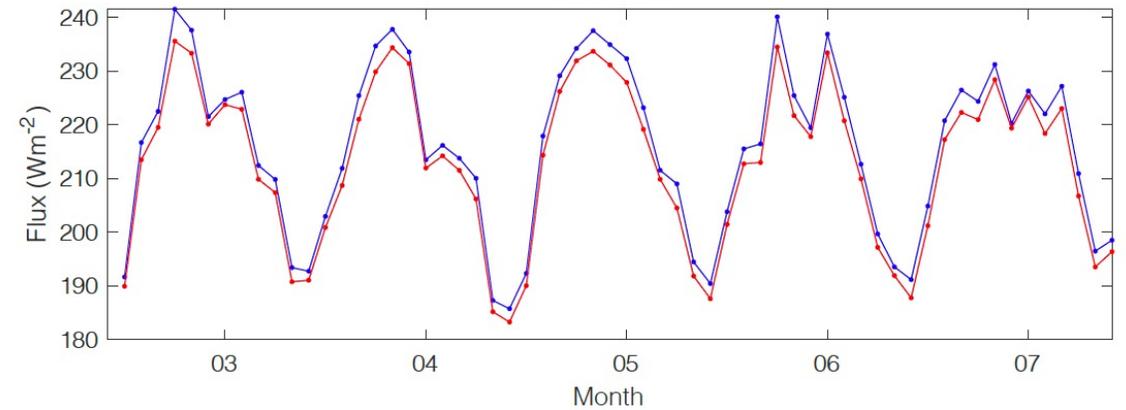
Regional anomaly time series, downward longwave
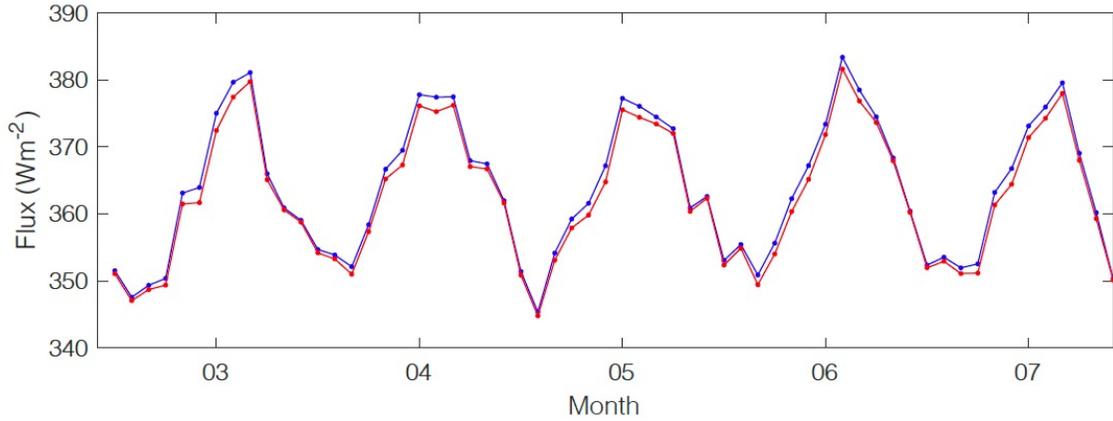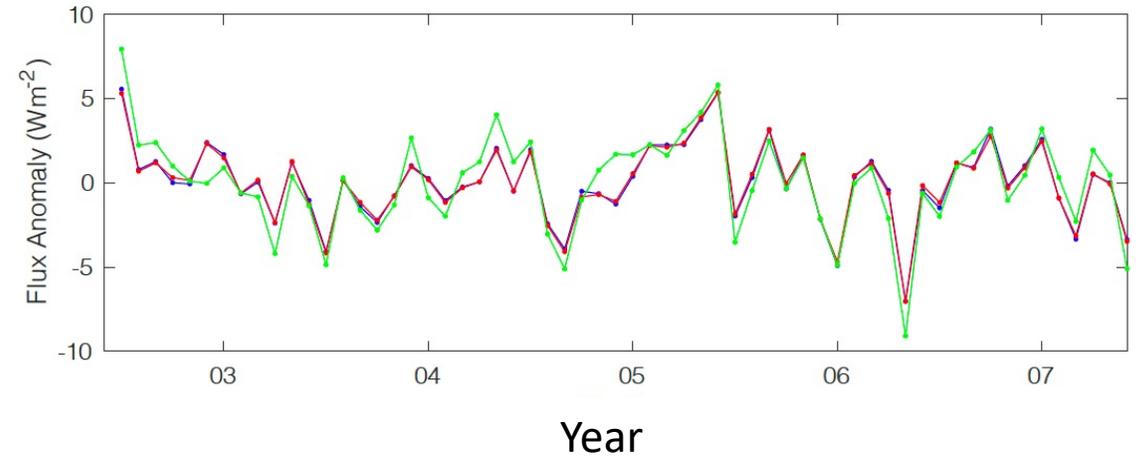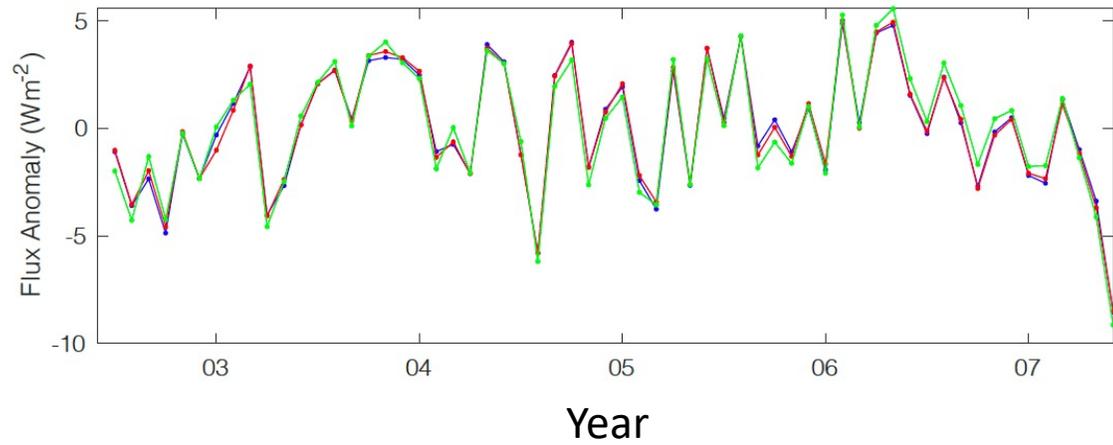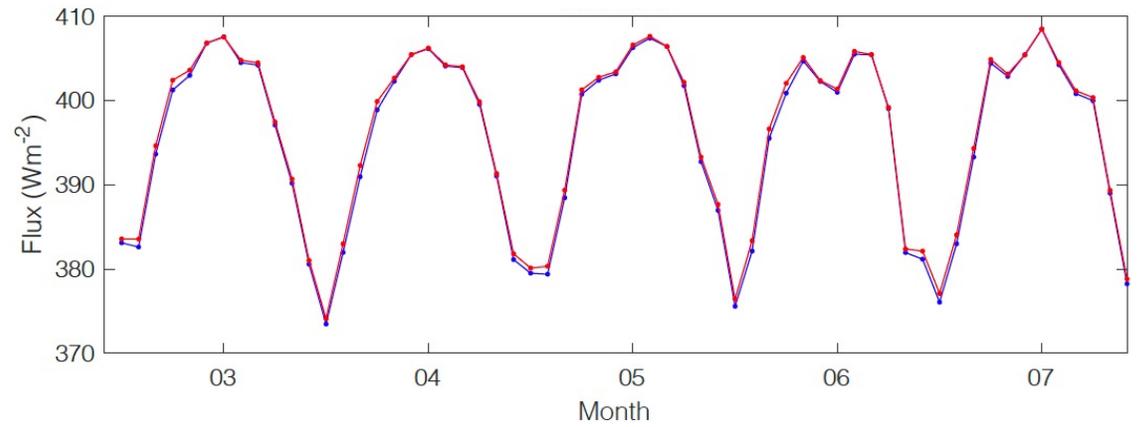
Blue: Terra only, Red: Terra+Aqua, Green Aqua only

Aqua only was produced with GEOS-5.4.1

Summary

- Although cloud diurnal cycles are not captured by Terra+Aqua (stratocumulus region), monthly mean is not significantly biased compared with Terra+Aqua+GEO Edition 4.1 SYN.

- Regional anomaly time series derived from Terra only and Terra+Aqua agree well.

- Afternoon satellite can provide continuation of regional surface irradiance anomalies.