CERES Monthly Averages Products from CERES vs GEWEX SRB and other datasets

CERES Science Team Meeting

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CERES and SRB Teams

Purpose and Objectives

- Preliminary look at putting CERES Surface fluxes in global and historic context
  - Monthly global, zonal, and gridded averages
  - Monthly variability against surface measurements

Data Sets Distinctions

- CERES SARB ZAVG (FM1 Terra Beta 3)
  - Modified Fu/Liou tuned/untuned to CERES TOA
  - MODIS aerosol optical depths; MATCH mixtures
  - GEOS-4 skin temperatures over water; retrieved clear-sky land
- CERES SOFA SRBAVG (FM1 Terra Beta 3)
  - Model B SW using (Gupta et al): instantaneous, ERBE TOA albedo, parameterized aerosols
  - Model B LW (Gupta et al): GEOS-4 skin temp.
- NASA/GEWEX SRB SW v2.8, LW v2.5
  - SW (modified Pinker/Laszlo algorithm): ERBE ADM/NBBB, ISCCP radiances and cloud fraction, retrieved surface albedo w/ assumed spectral shape based on surface type, cloud and aerosol amount determined to balance TOA albedo
  - LW (modified Fu/Liou): GEOS-4 skin-T over water and cloudy land (>50%), emissivity corrected ISCCP retrieved skin-T over land (<50%), random overlap for high/middle/ low layers, cloud amount and thickness from ISCCP

Data Sets Considered

- NASA/GEWEX SRB QC SW v2.5, LW v2.5
  - SW (Staylor/Gupta): daily averaged only, ISCCP radiances, MATCH aerosols, Terra TOA albedos
  - LW (Gupta): GEOS-4 skin temp., ISCCP clouds
- ISCCP FD
  - SW and LW RT (Zhang et al)
  - ISCCP cloud inputs, random high/middle/low cloud overlap, inhomogeneity correction, TOVS meteorology w/ boundary layer parameterization, Tegen et al aerosols.
- NCEP LW

SRB Analysis: Global Energy Cycle

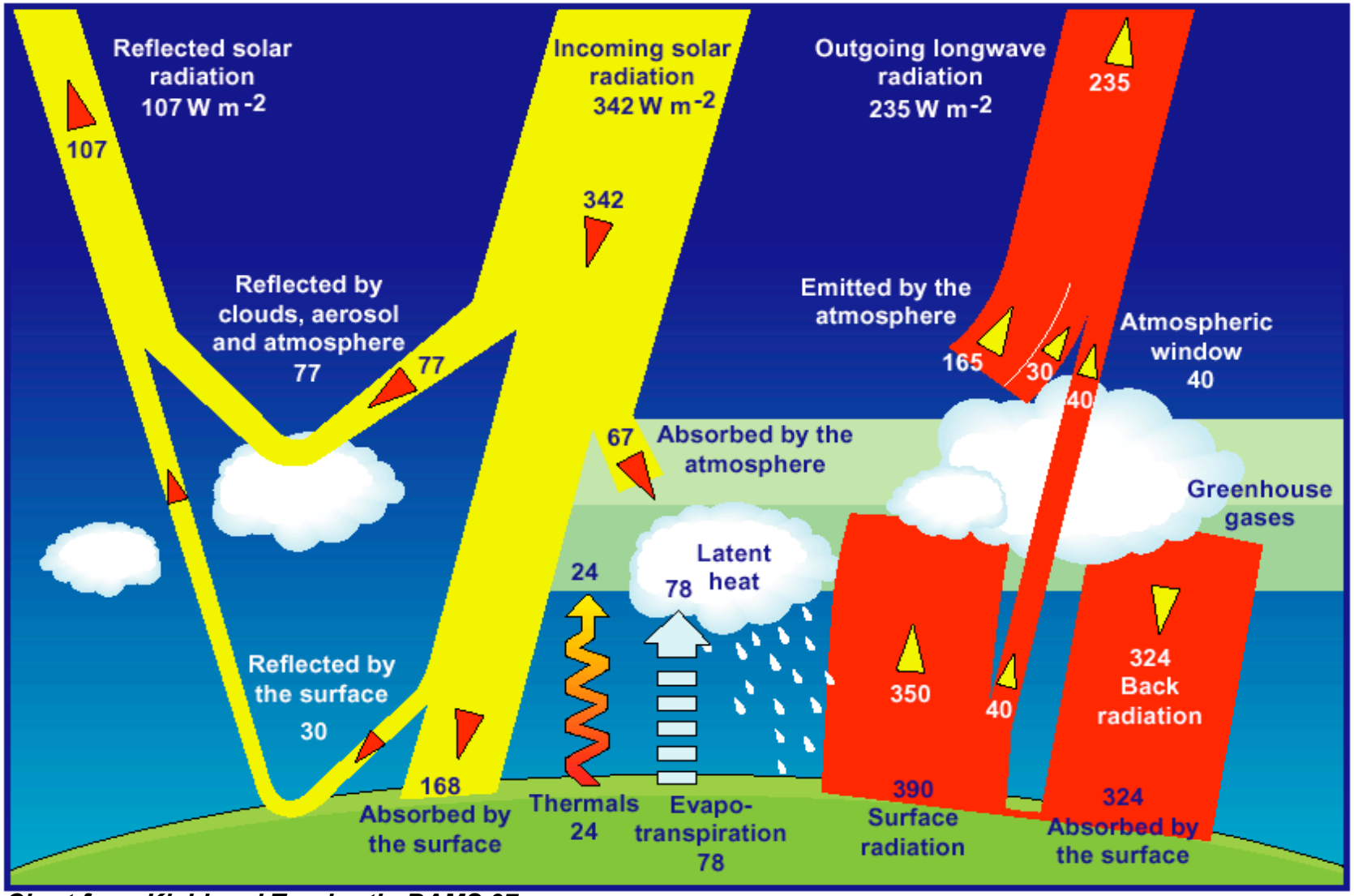


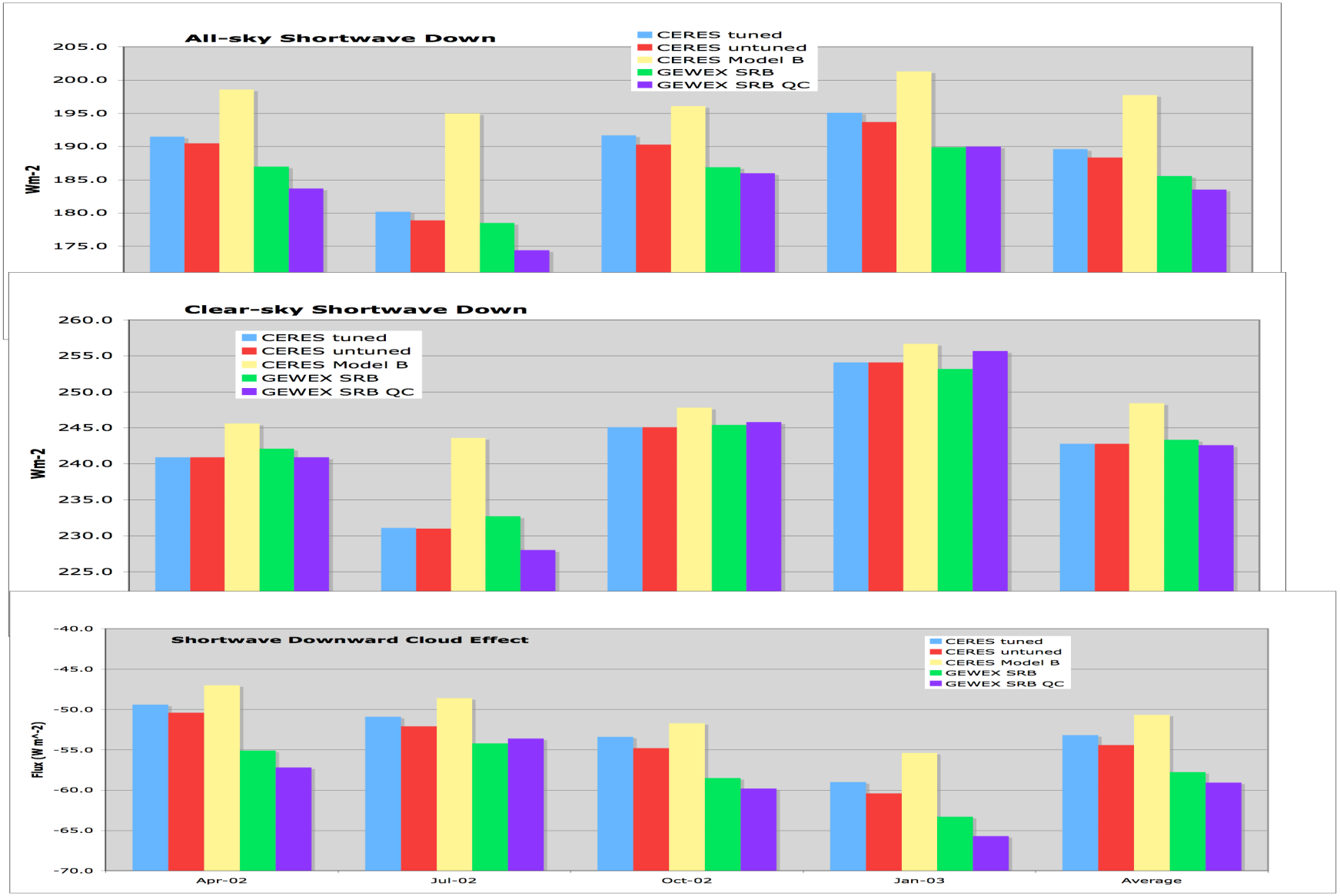
Chart from Kiehl and Trenberth, BAMS 97

Global Multi-Year Averages

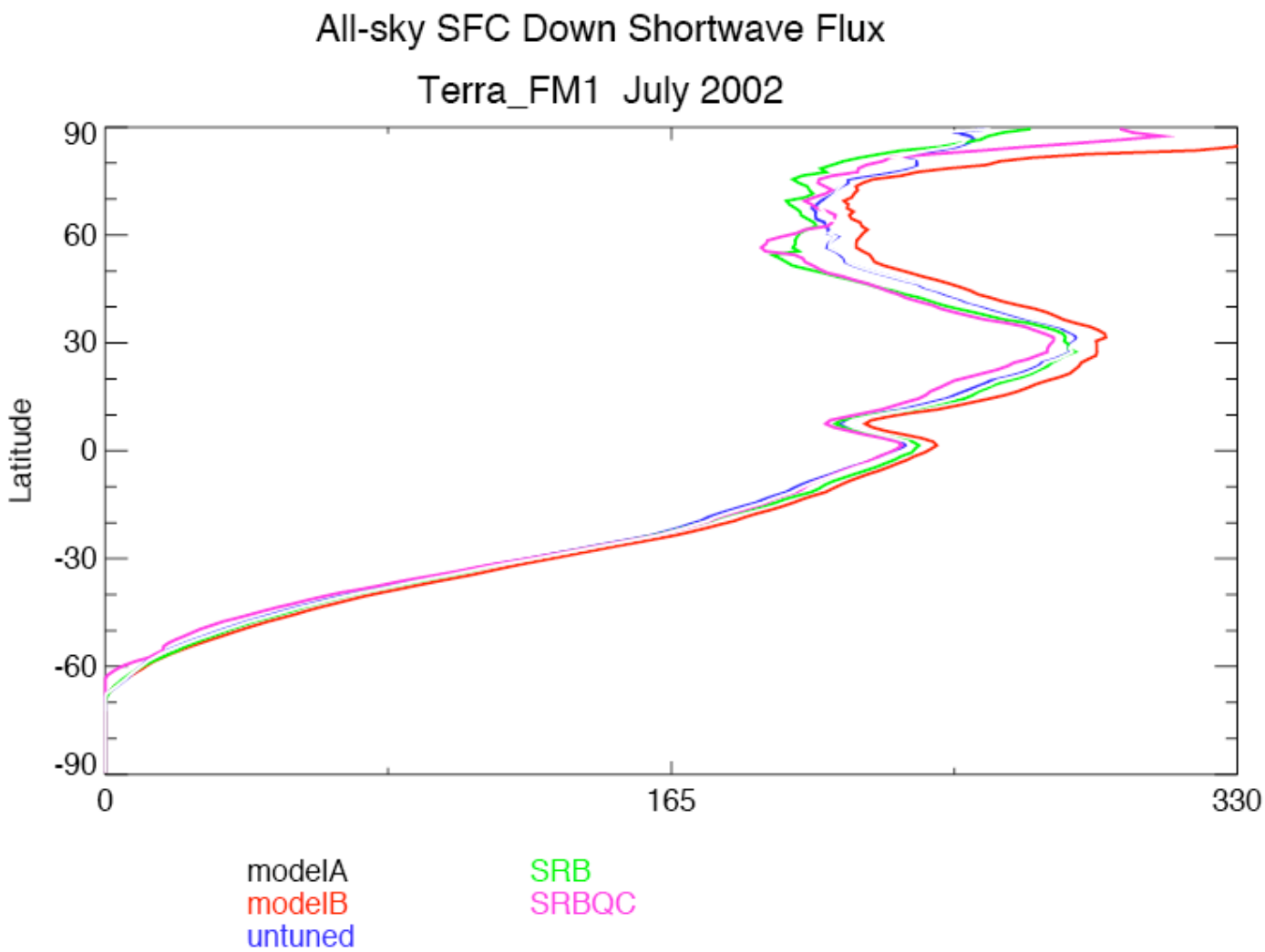
Parameter	Ohmura & Gilgen (1993) *GEBA Surf. Obs.*		Kiehl and Trenberth (1997) ERBE/ CCM3		Zhang & Rossow (2004) *21-Year Mean (1984-2004)*		NASA/GEWEX SRB Release 2.5/2.8* (NASA LaRC) *22-Year Mean (July 1983 - June 2005)*			
							SW, LW		SW, LW QC	
	Flux	% F_0	Flux	% F_0	Flux	% F_0	Flux	% F_0	Flux	% F_0
SW Down	169.0	49.4	198	57.9	189.2	55.4	186.6	54.6	183.7	53.8
SW Net	142.0	41.6	168	49.2	165.9	48.5	165.0	48.3	161.0	47.1
LW Down	345	100.9	324	94.8	343.8	100.6	343.1	100.4	348.7	102.0
LW Net	-40.0	-11.7	-66	-19.3	-49.6	-14.5	-53.0	-15.5	-50.0	-14.6
Total Net	102.0	29.8	102	29.8	116.3	34.0	112.0	32.7	111.0	32.5
SW CRF	--	--	--	--	-53.0	-15.5	-56.1	-16.4	-59.2	-17.3
LW CRF	--	--	46	13.5	29.5	8.6	35.3	10.3	34.3	10.0
Total CRF	--	--	--	--	-23.5	-6.9	-20.8	-6.1	-24.9	-7.3

** Normalized to $S_0 = 1367\ W\ m^{-2}$; ($F_0 = S_0/4$)*

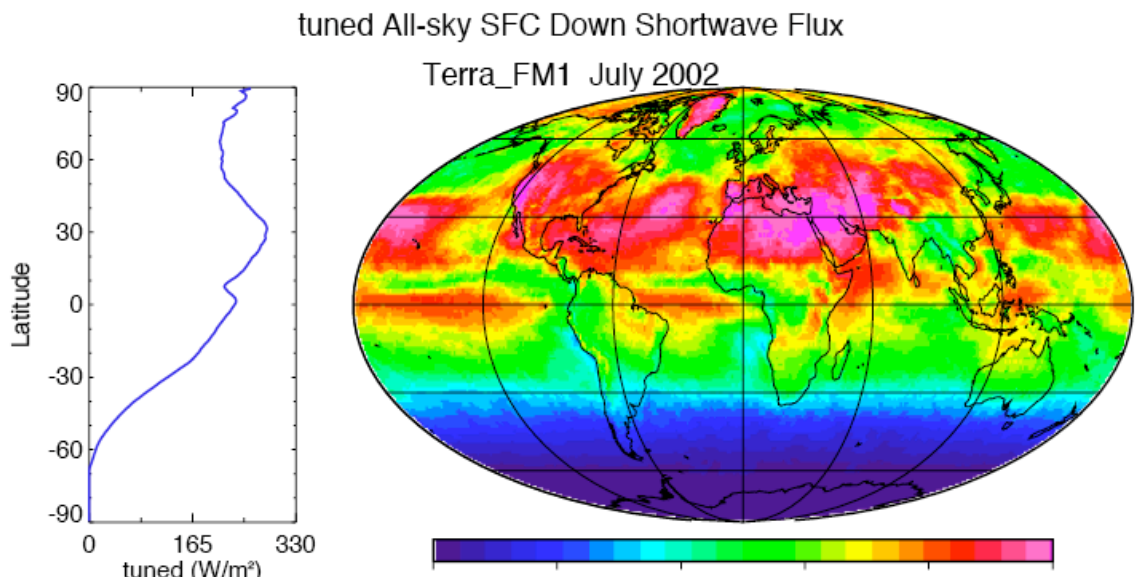
Global Averaged SW Surface Fluxes

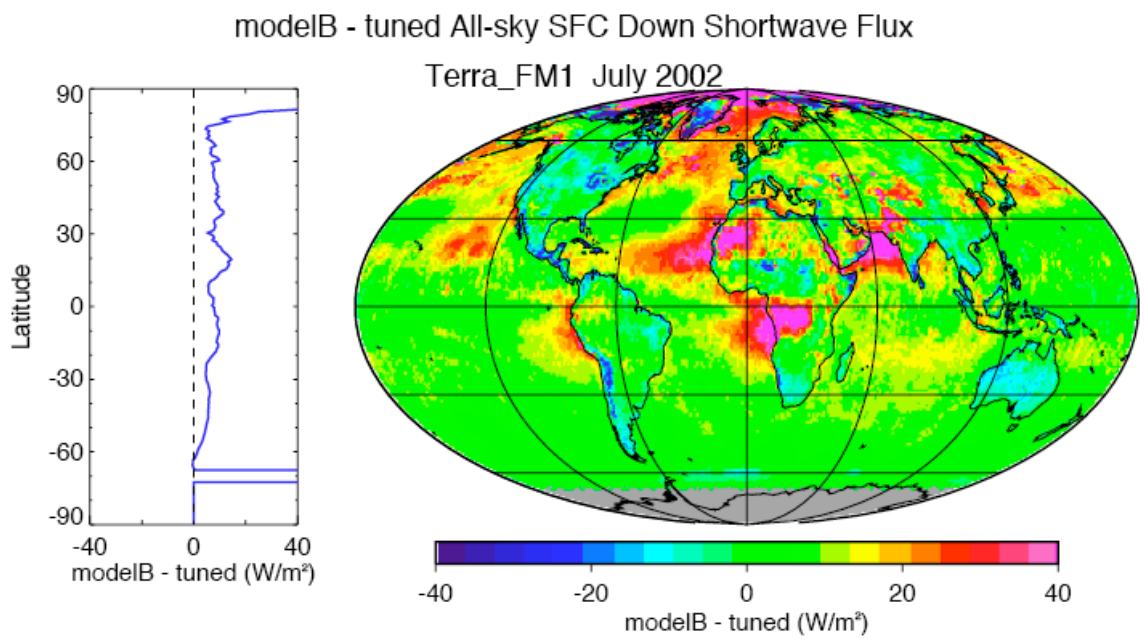


Zonal Average SW Down

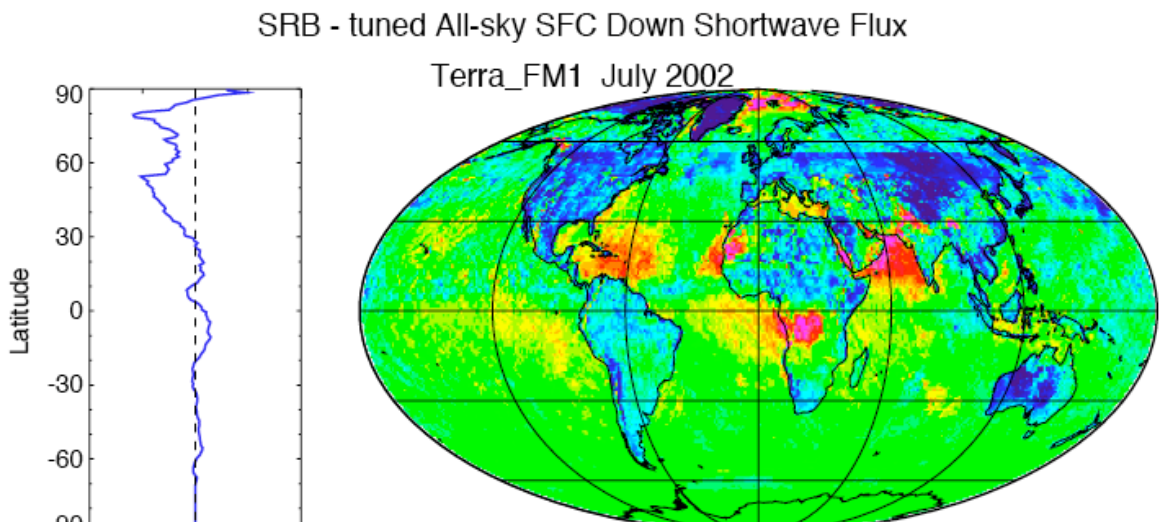


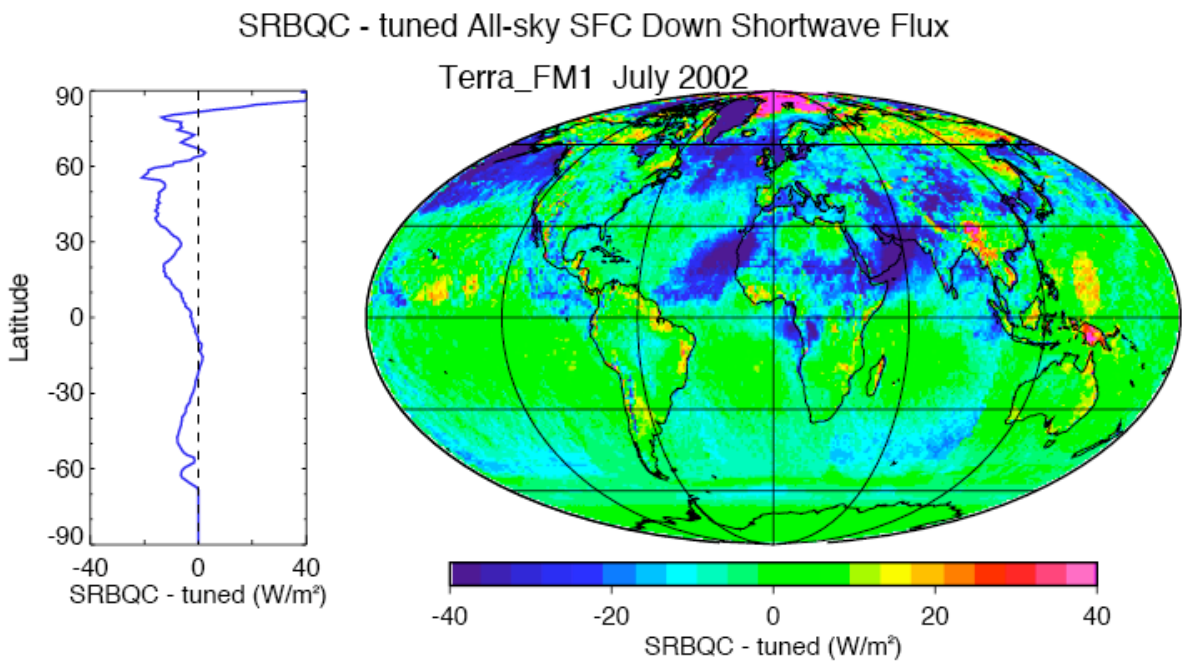
SW Surface Down



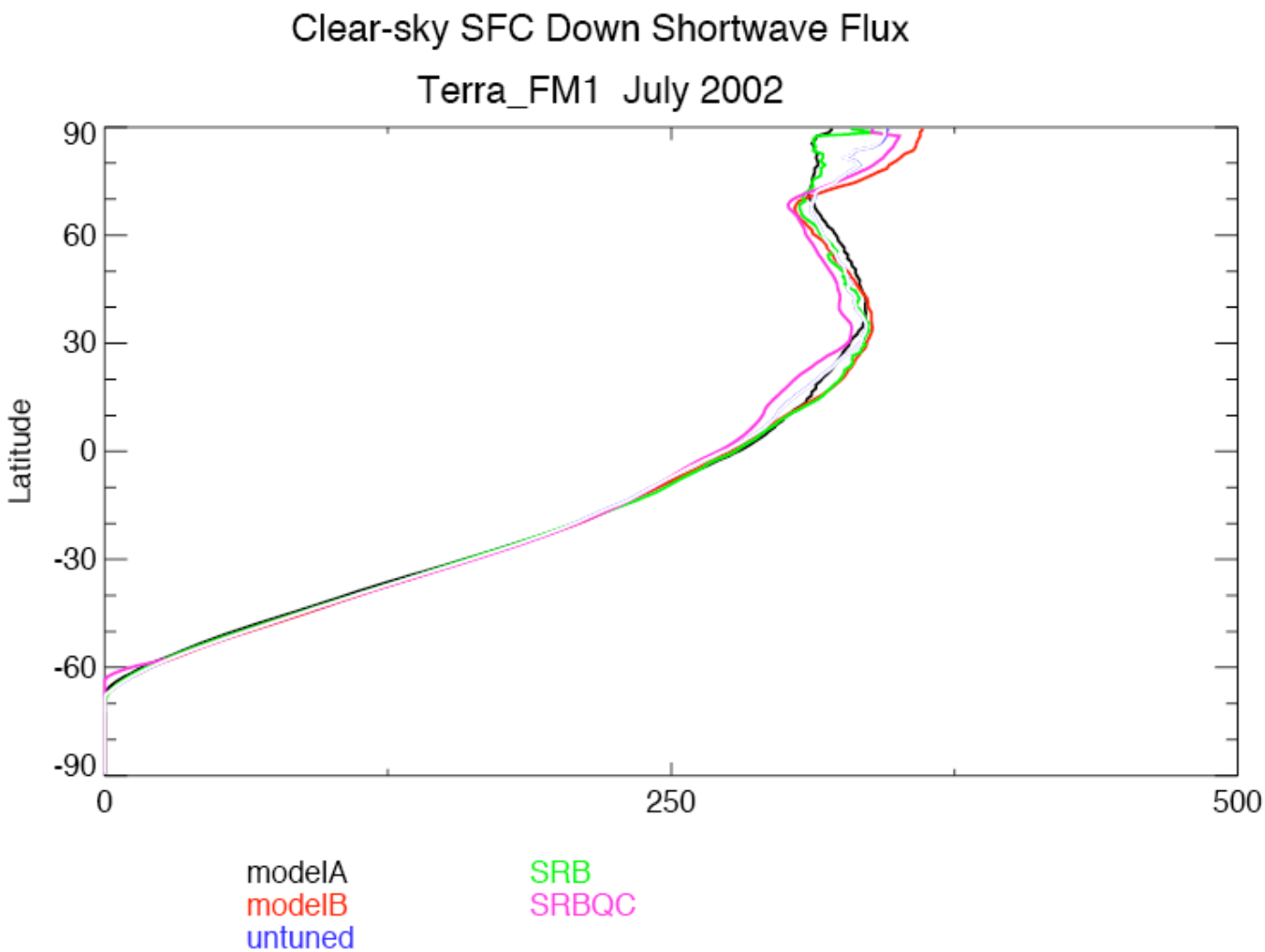


SW Surface Down

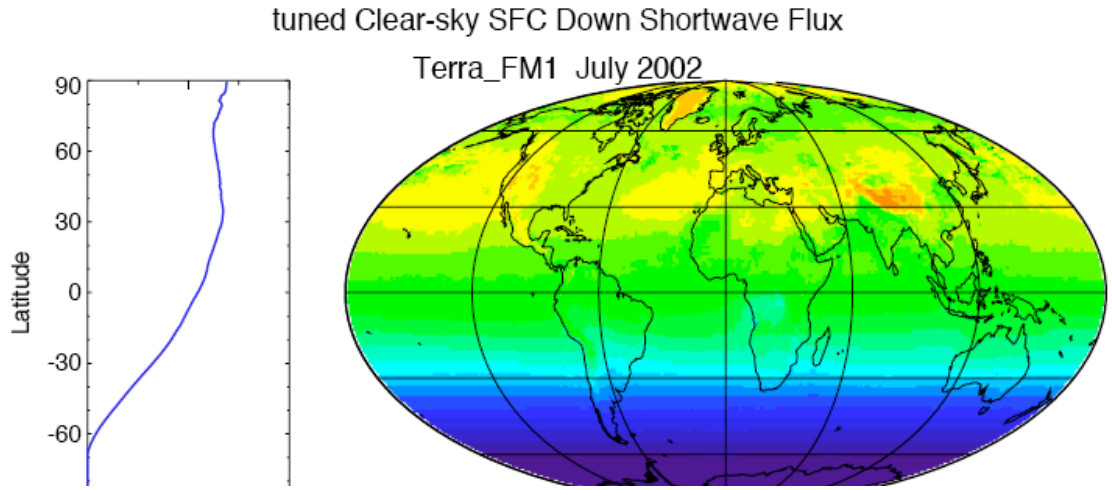


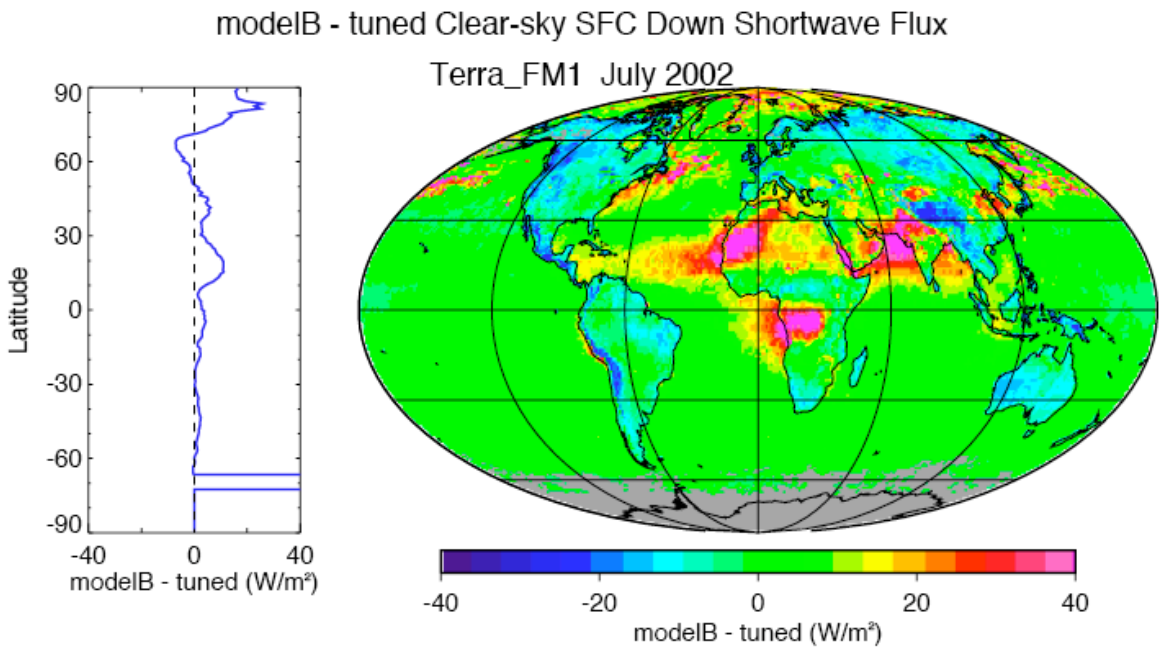


Zonal Average SW Clear-Sky

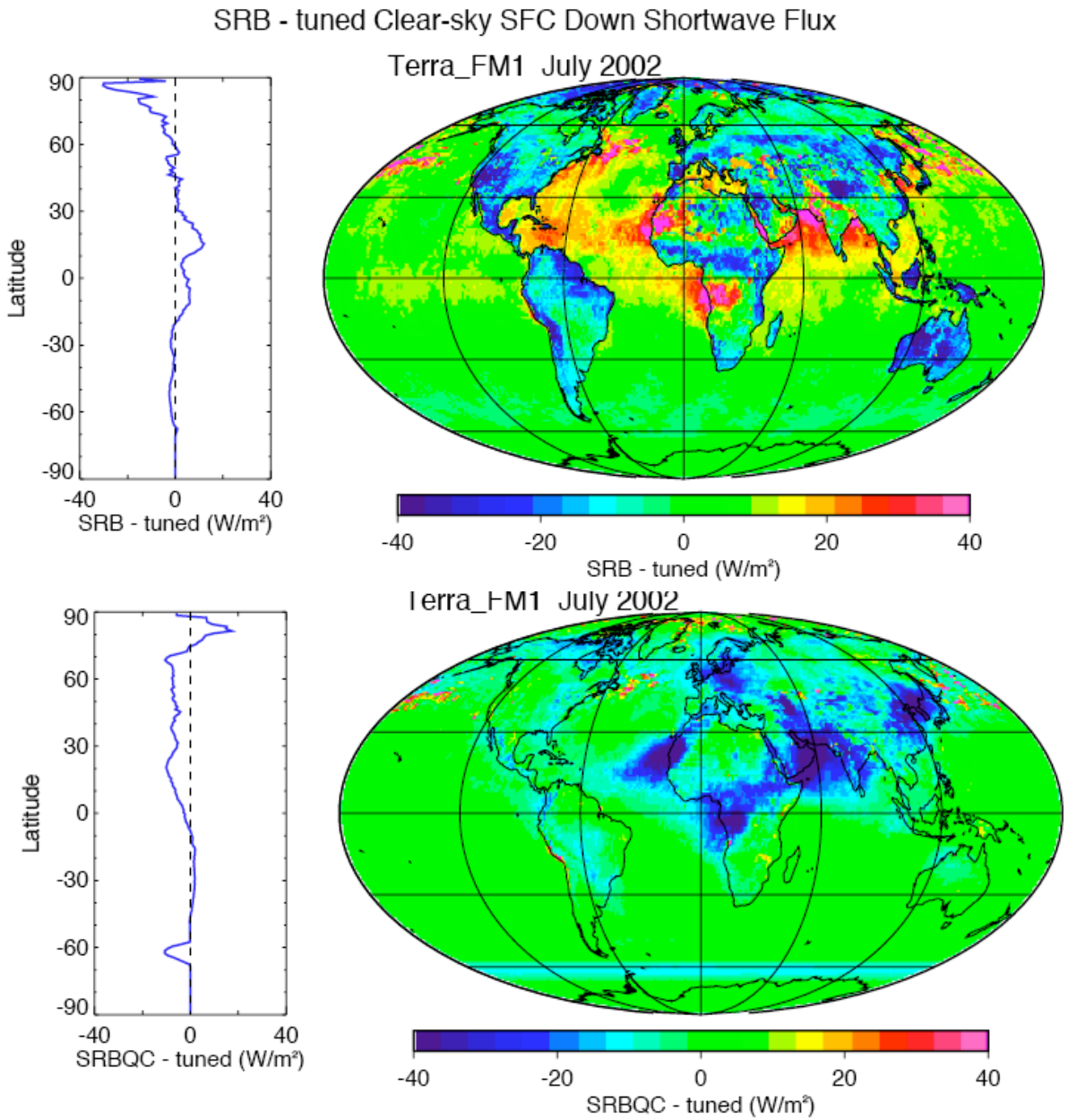


SW Surface Clear-sky Down

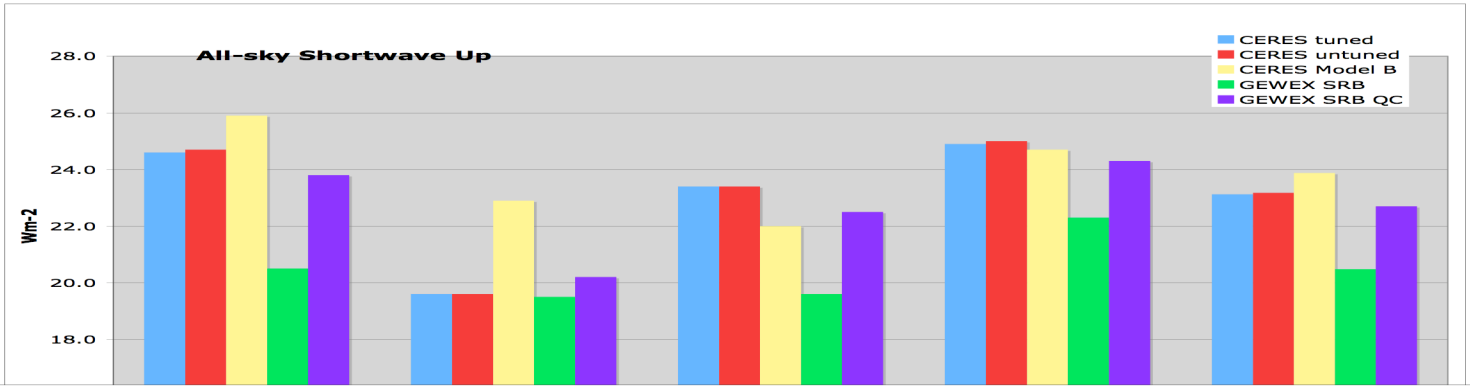


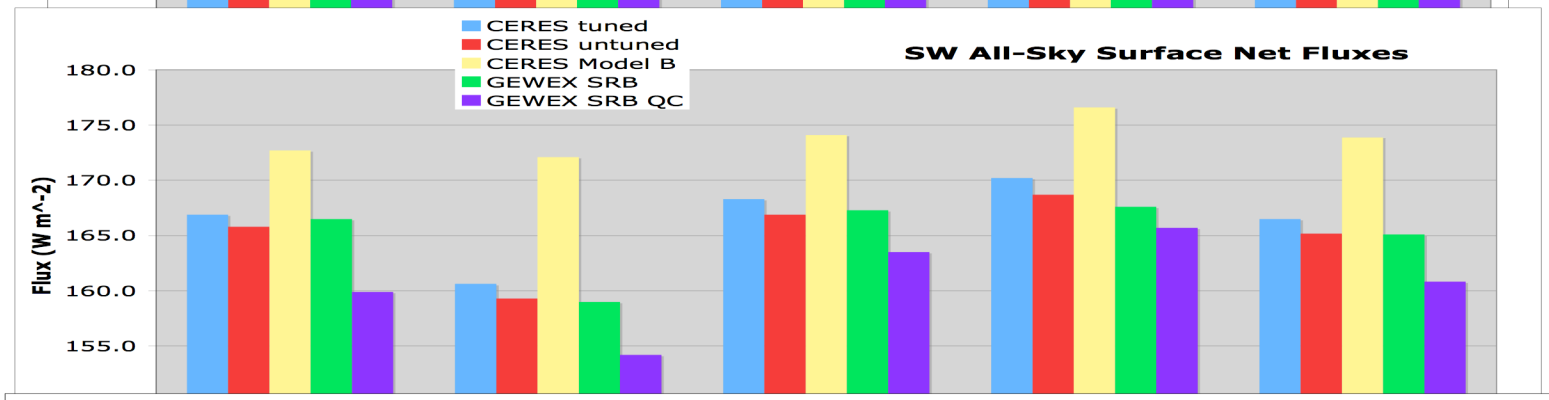


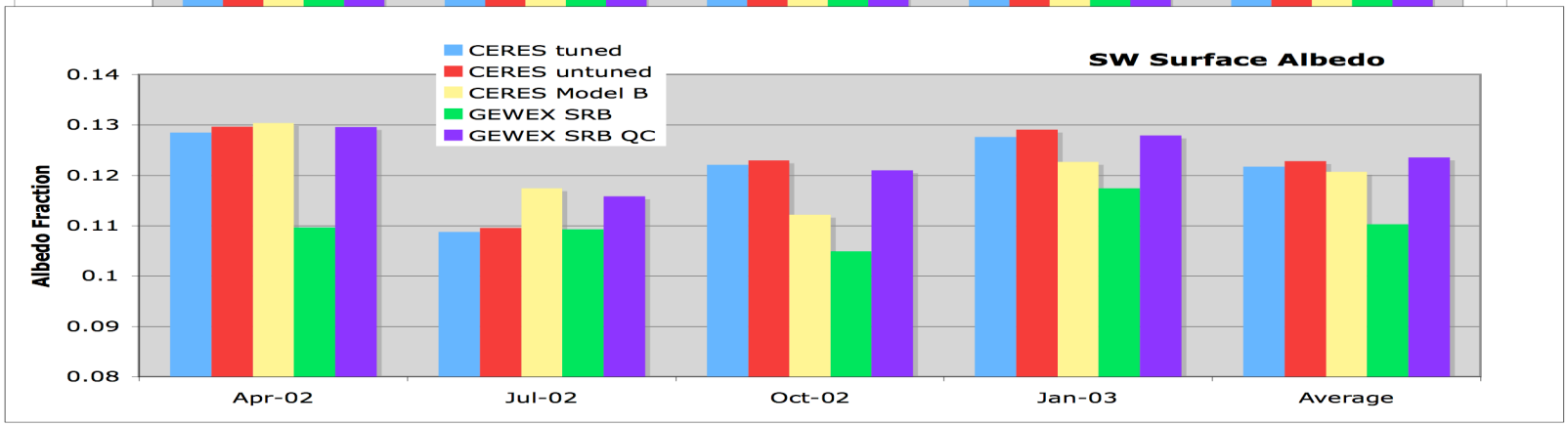
SW Clear-sky Down



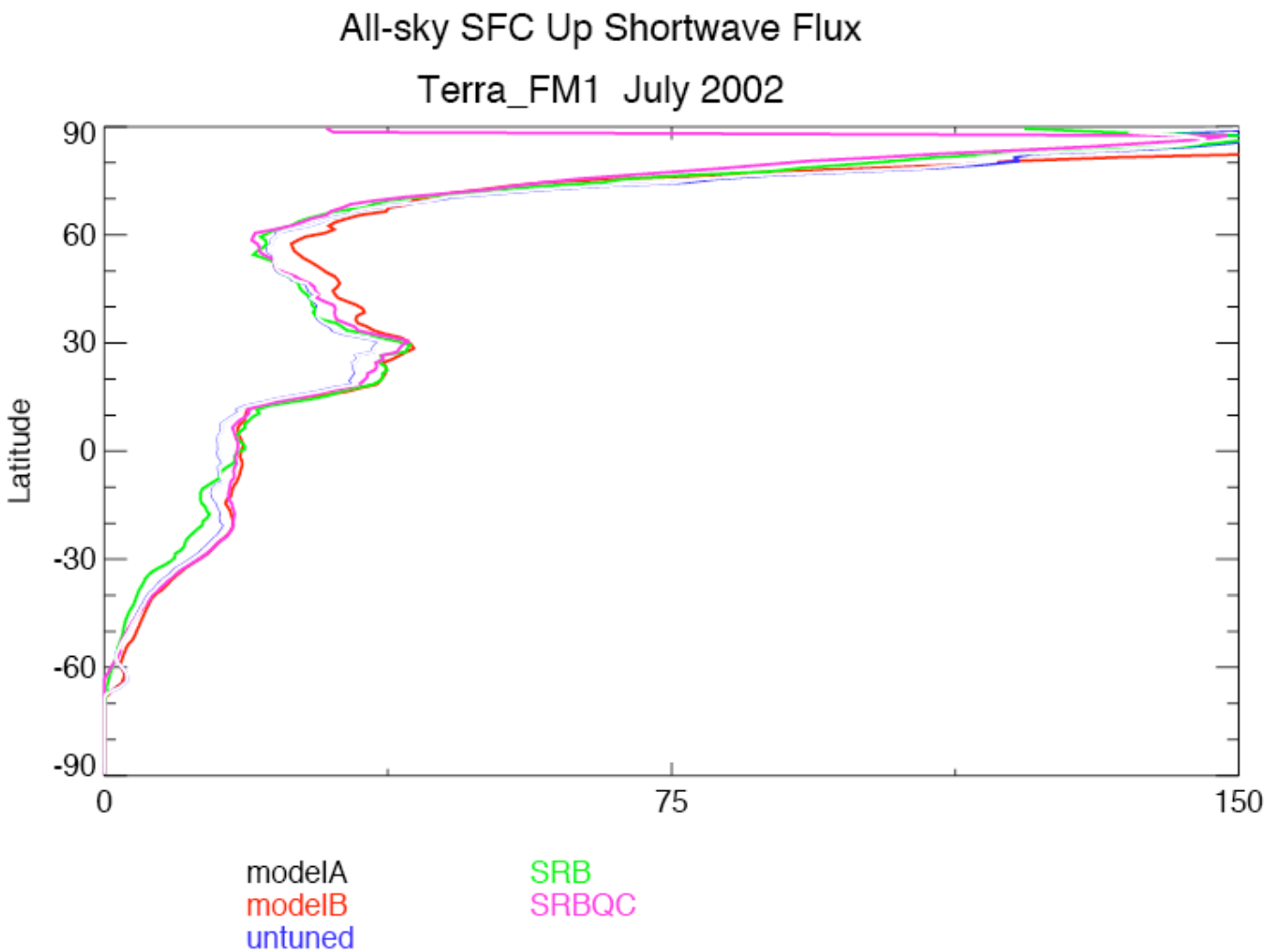
Global Average SW Surface



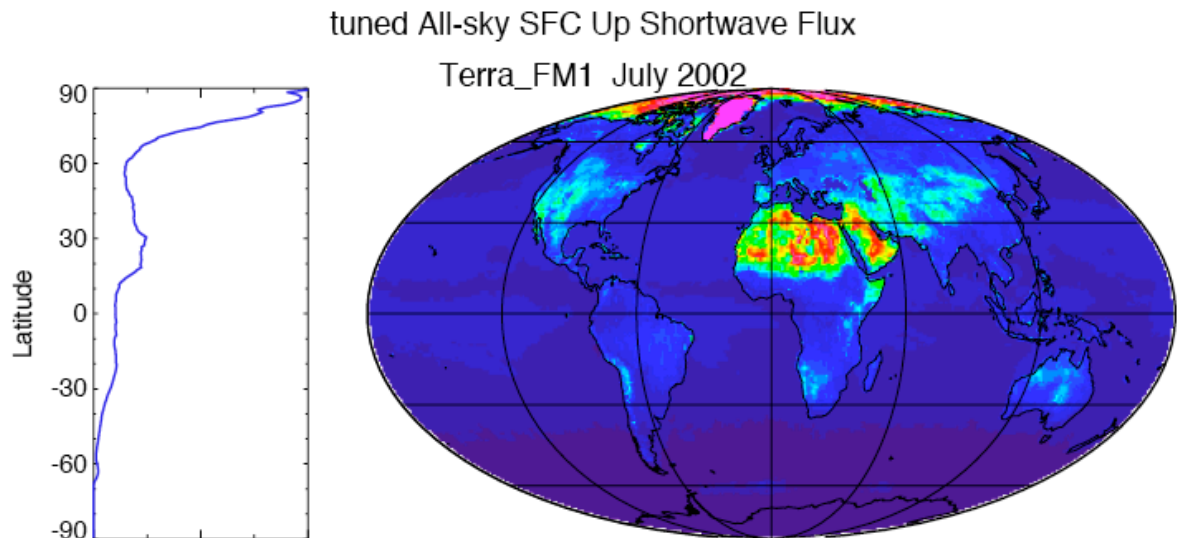


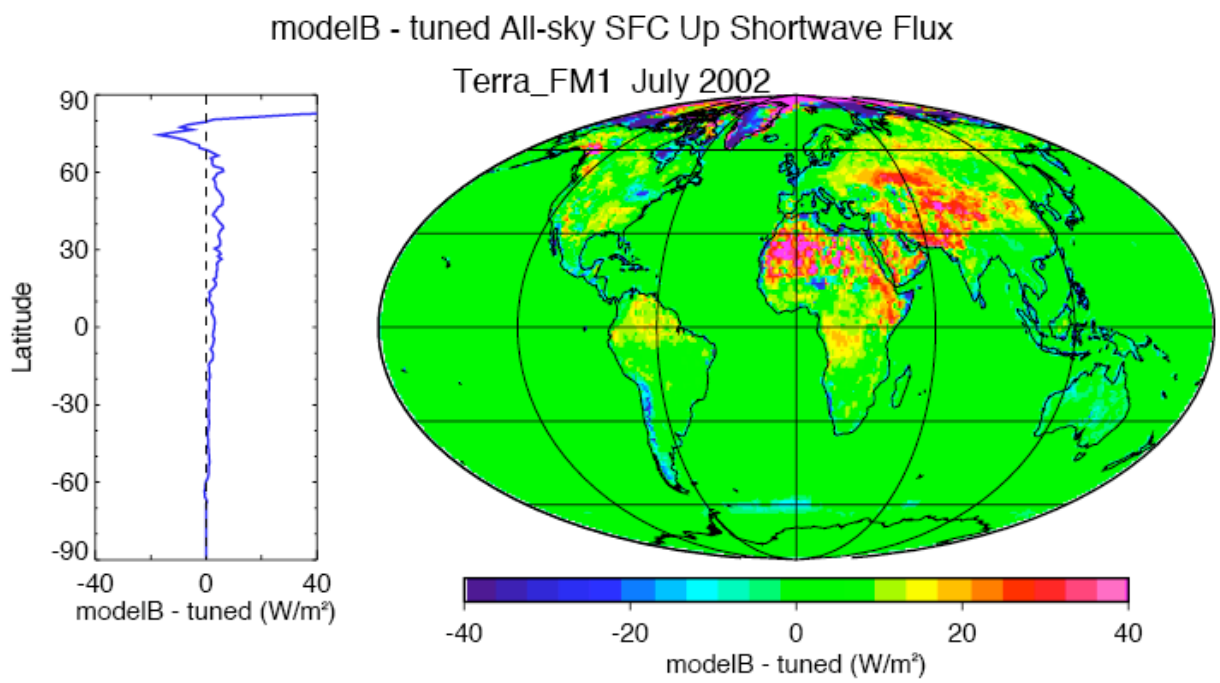


Zonal Average SW

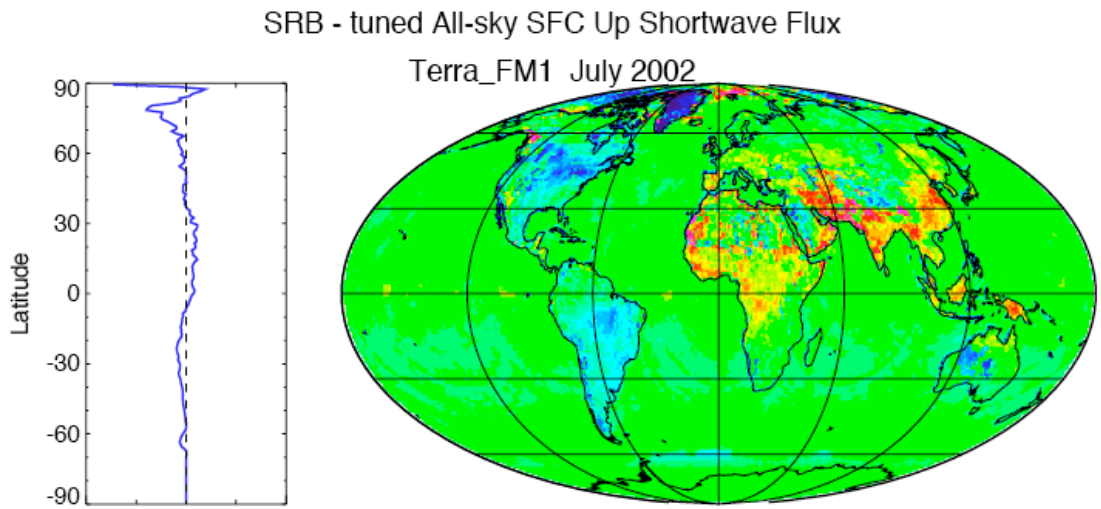


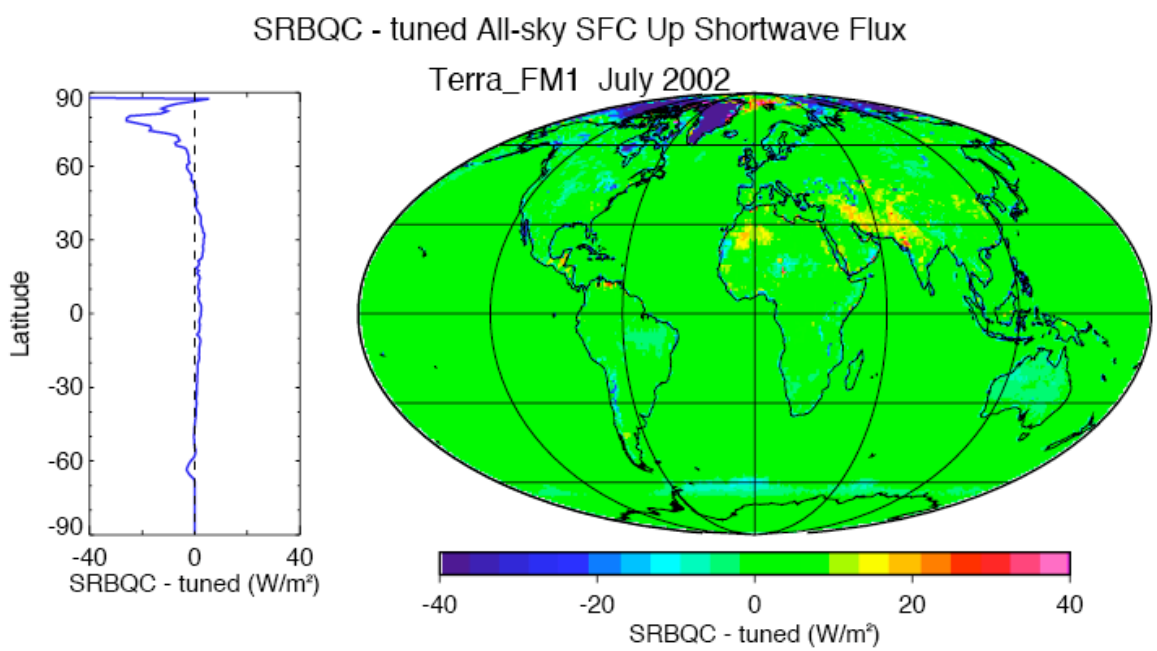
SW Upward Fluxes



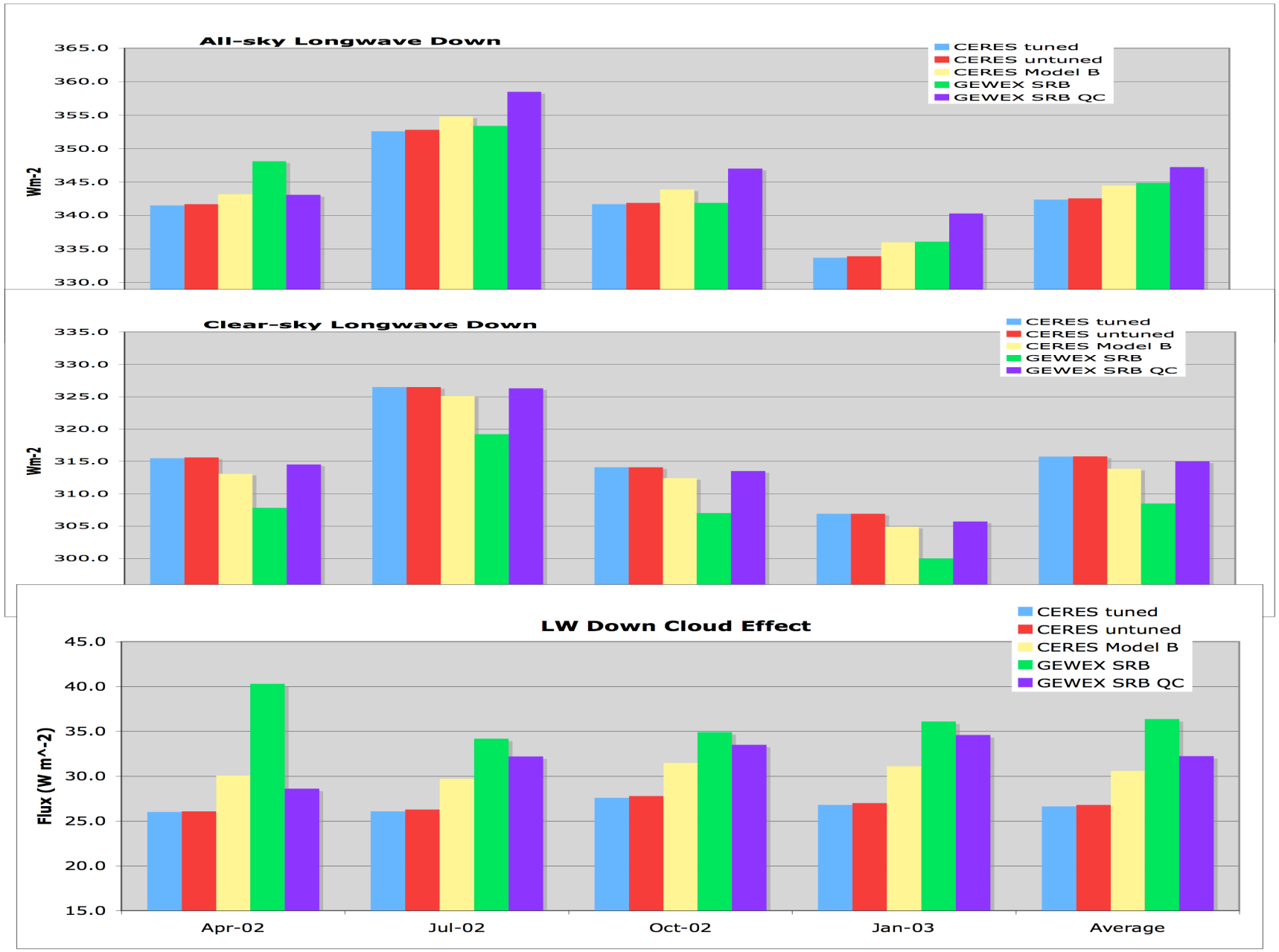


SW Upward Fluxes

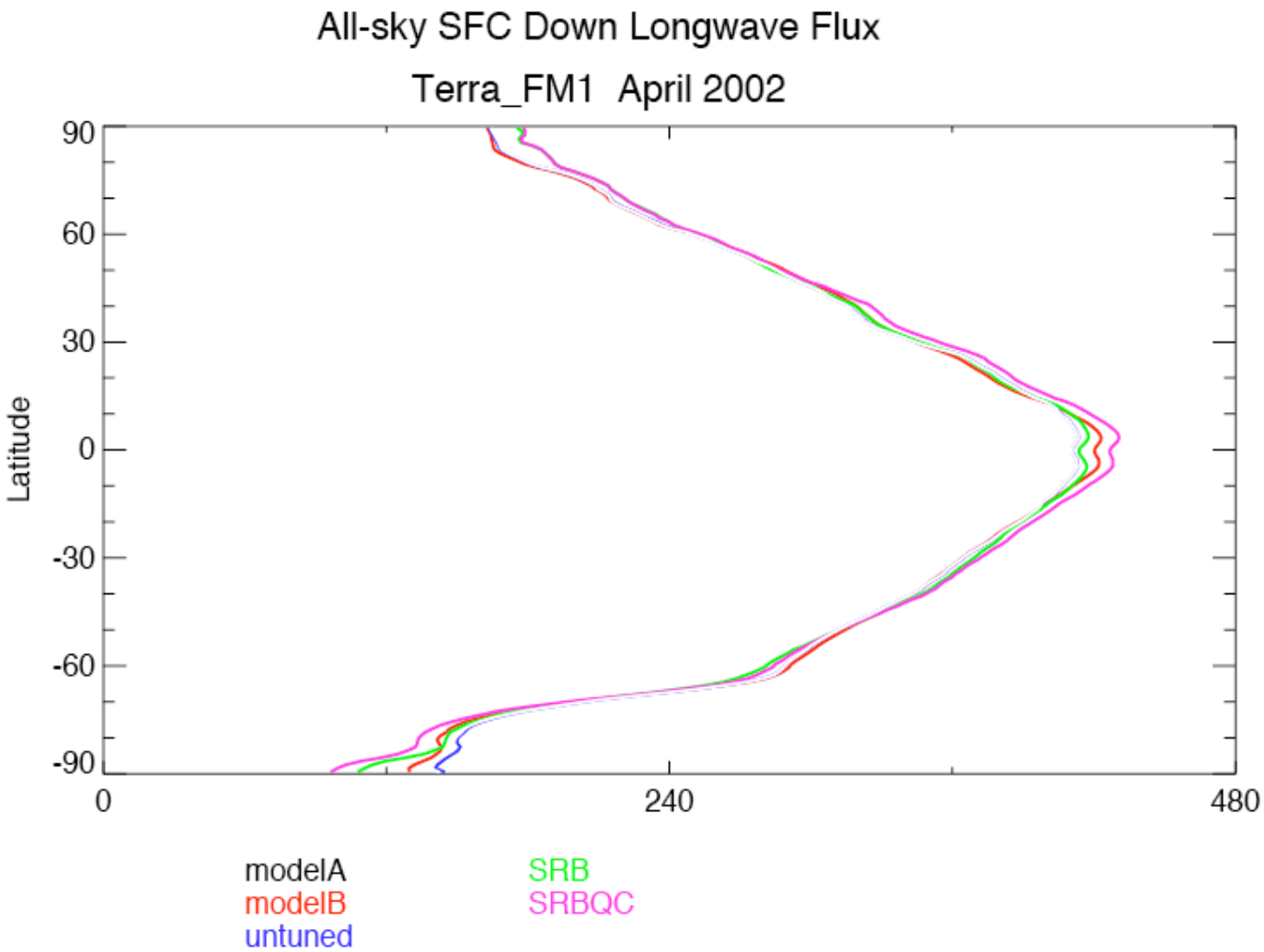




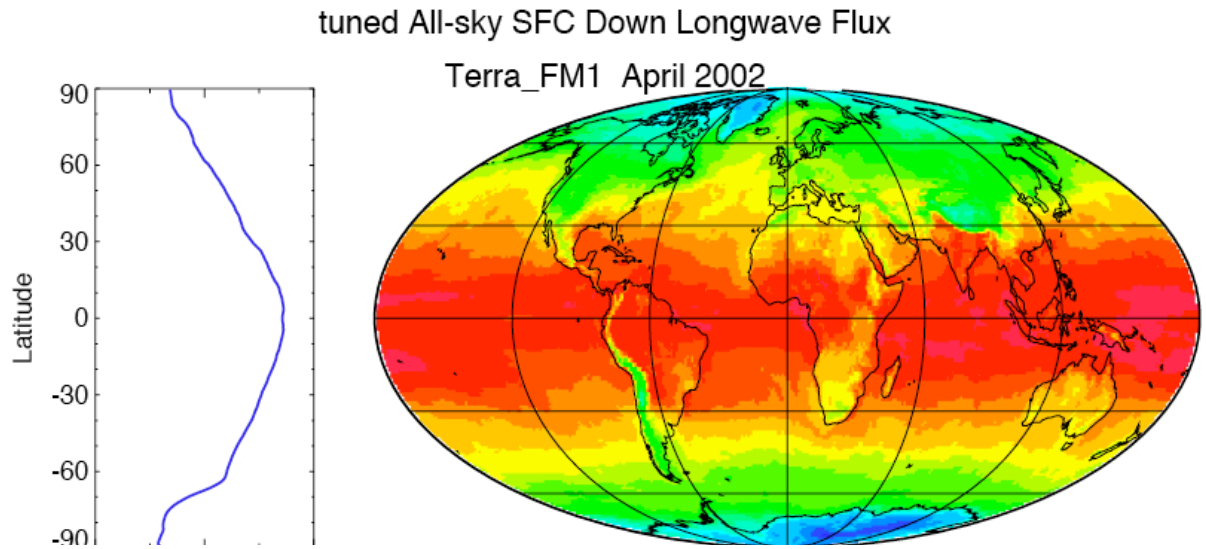
LW Globally Averaged Fluxes

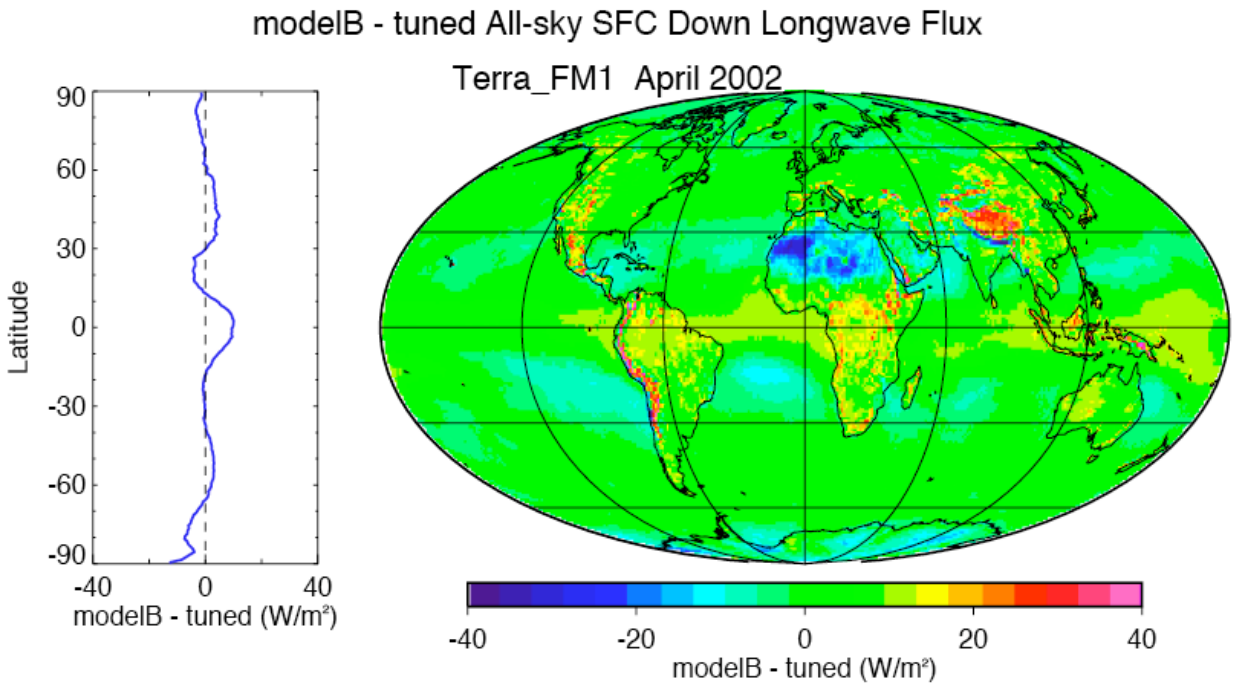


Zonally Averaged LW

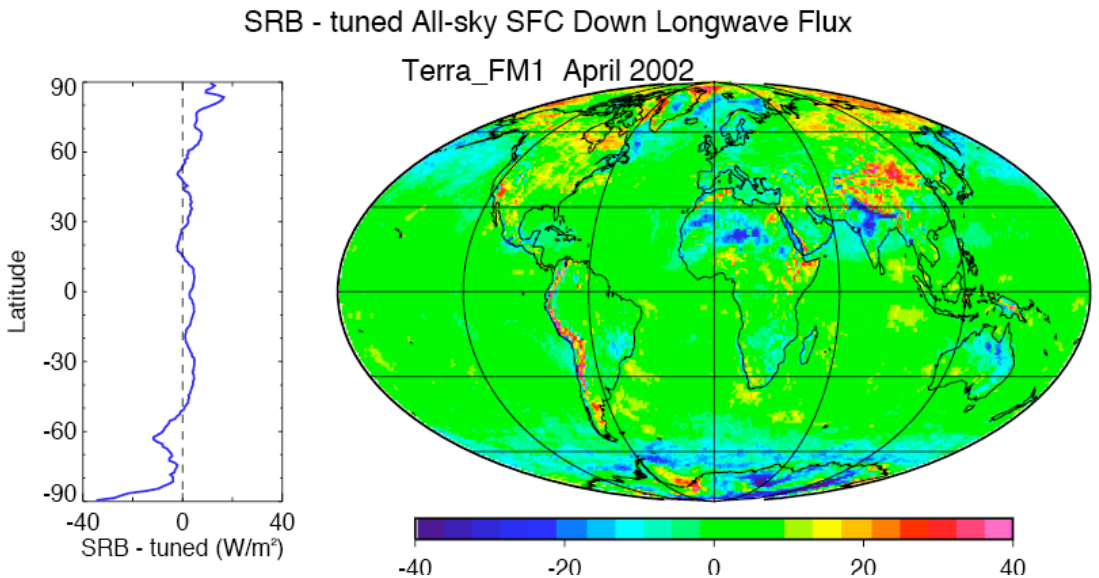


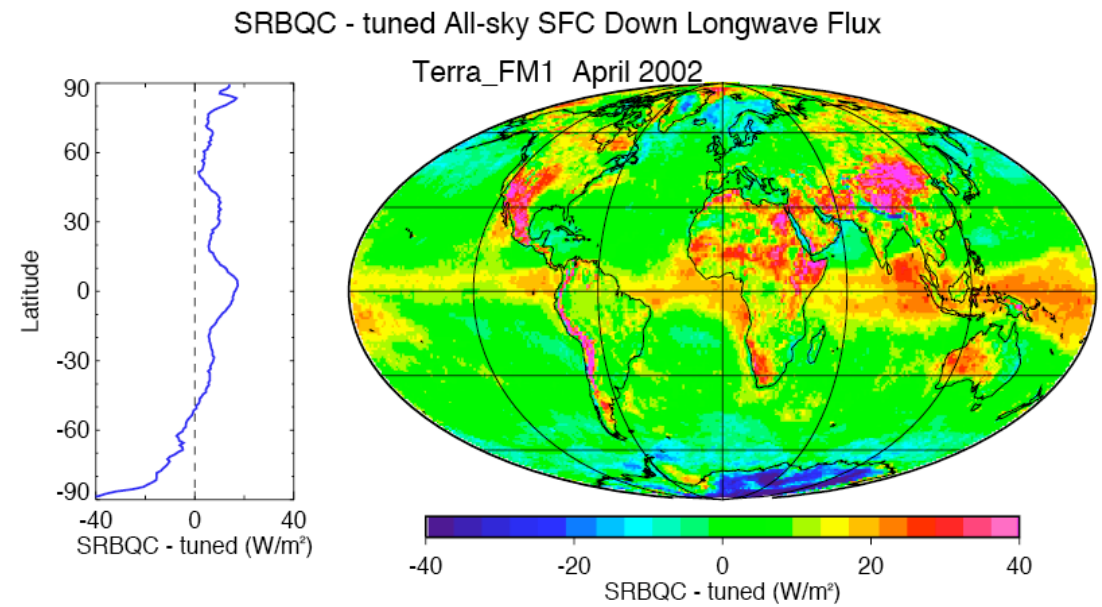
LW All-Sky Down



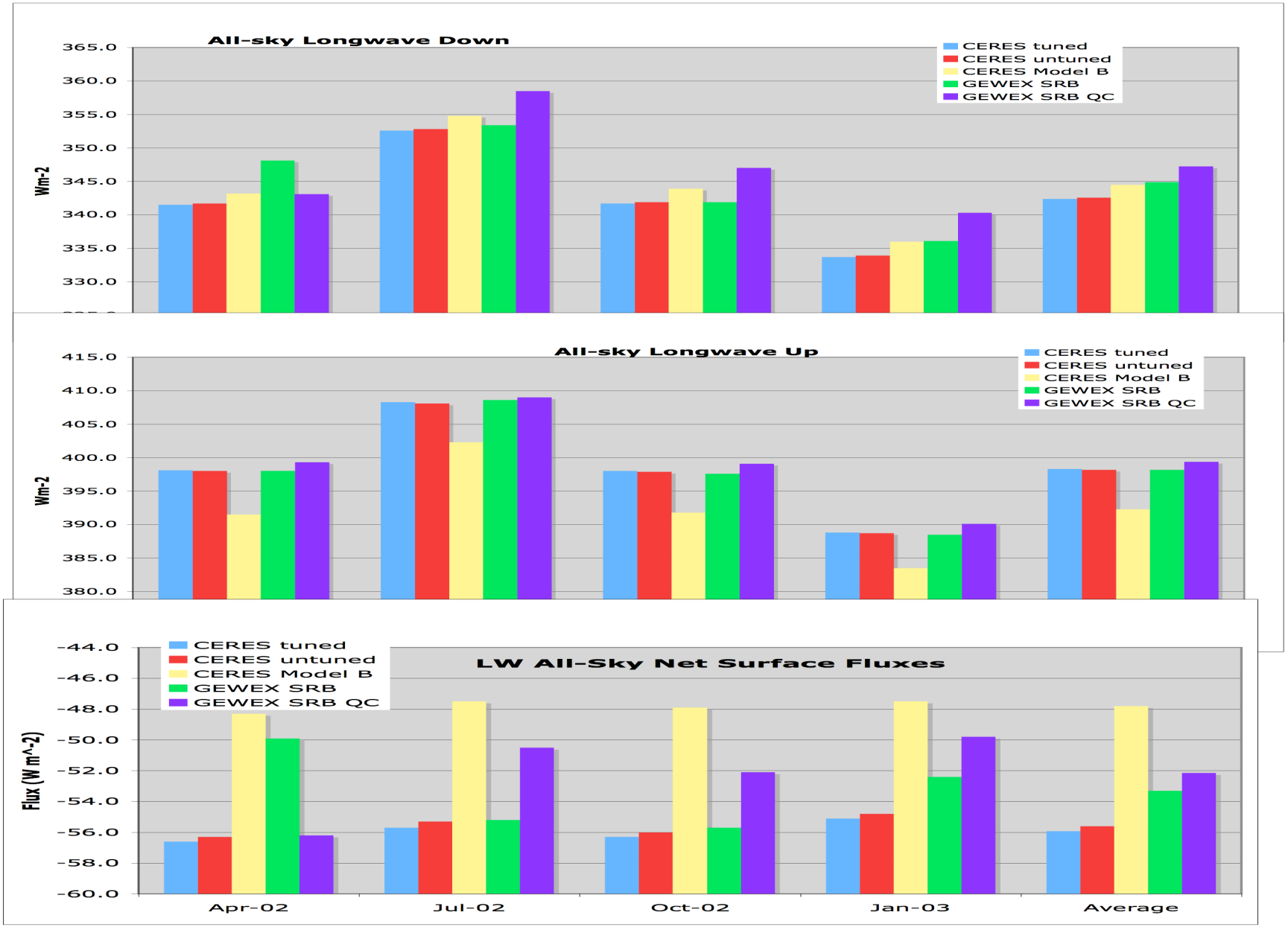


LW All-Sky Down

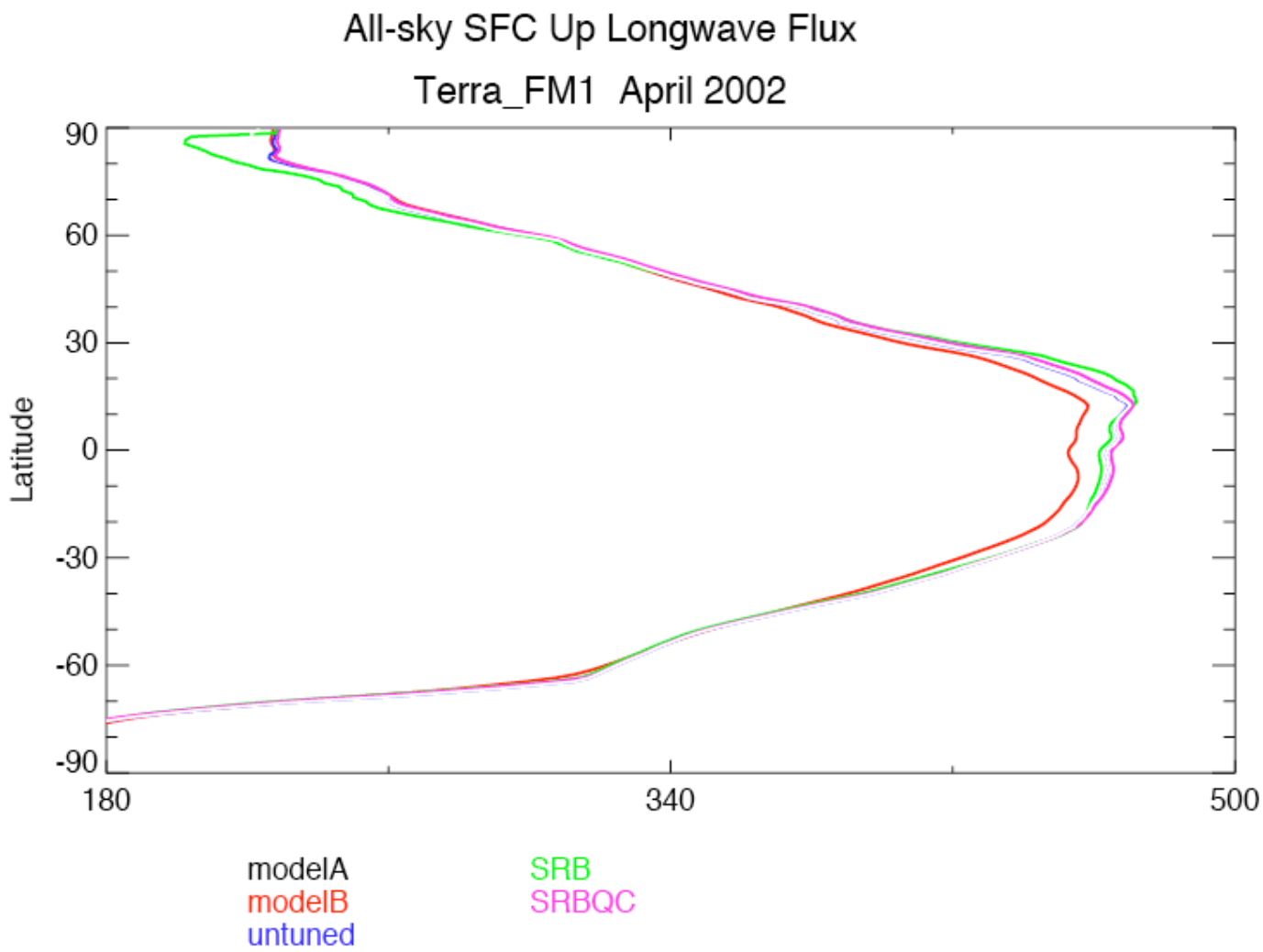




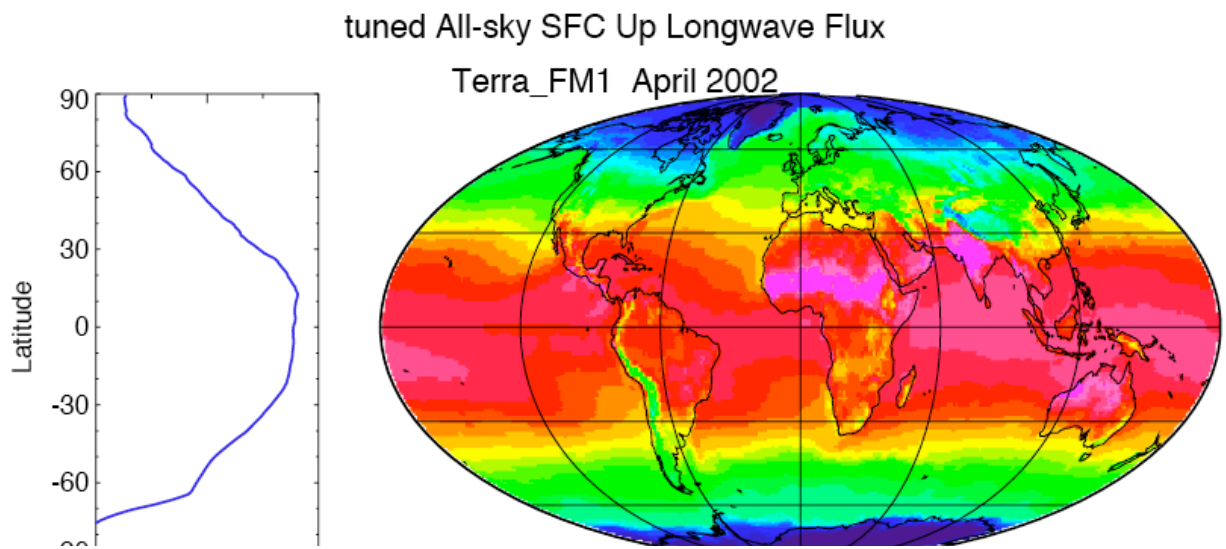
LW All-sky Fluxes

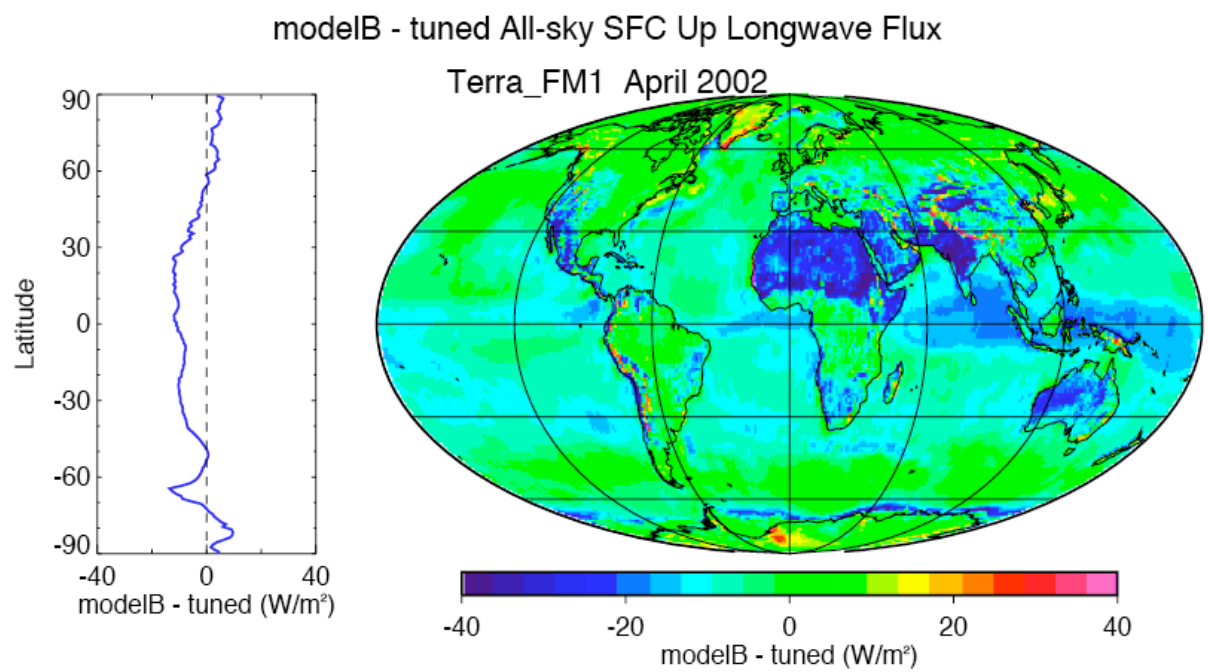


LW Upward Fluxes

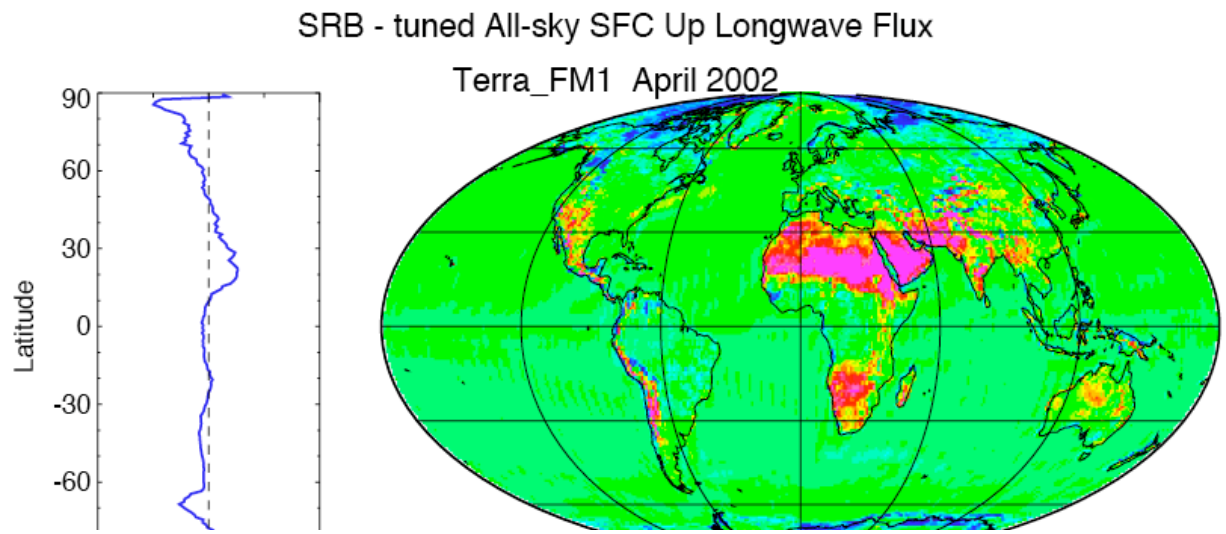


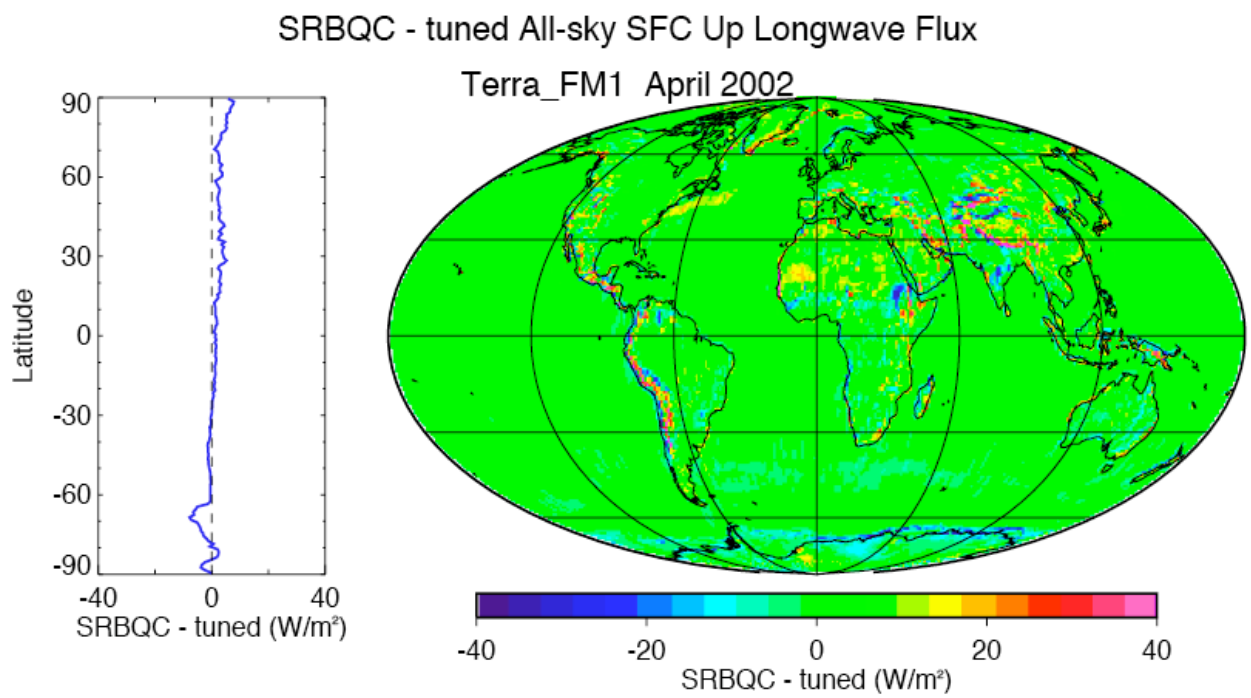
LW Upward Fluxes





LW Upward Fluxes

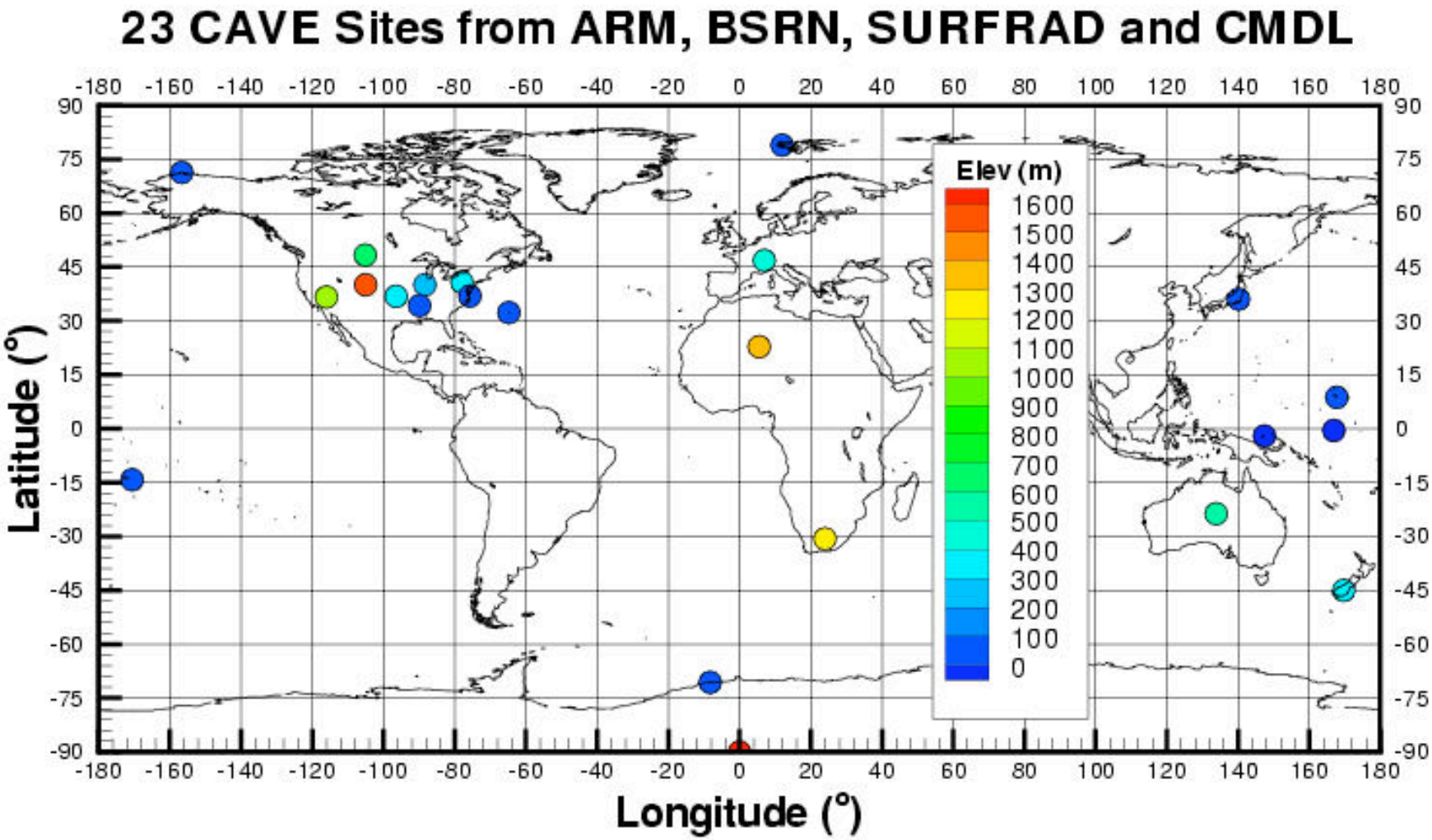




Result Summaries

- Global Means relatively consistent and denote changes from Kiehl/Trenberth
  - SW Down: 198 183-192
  - SW Up: 30 19 - 23
  - SW Net: 168 163 - 167
  - SW CRF - -53 - -59
  - LW Down: 324 342 - 347
  - LW Up: 390 398 - 400
  - LW Net: -66 -52 - -56
  - LW CRF 46 26 - 32
- However, zonal and regional differences dependent upon various inputs. Some of these differences even on zonal averages were > 40 W m^-2

Monthly Averaged Site Analysis



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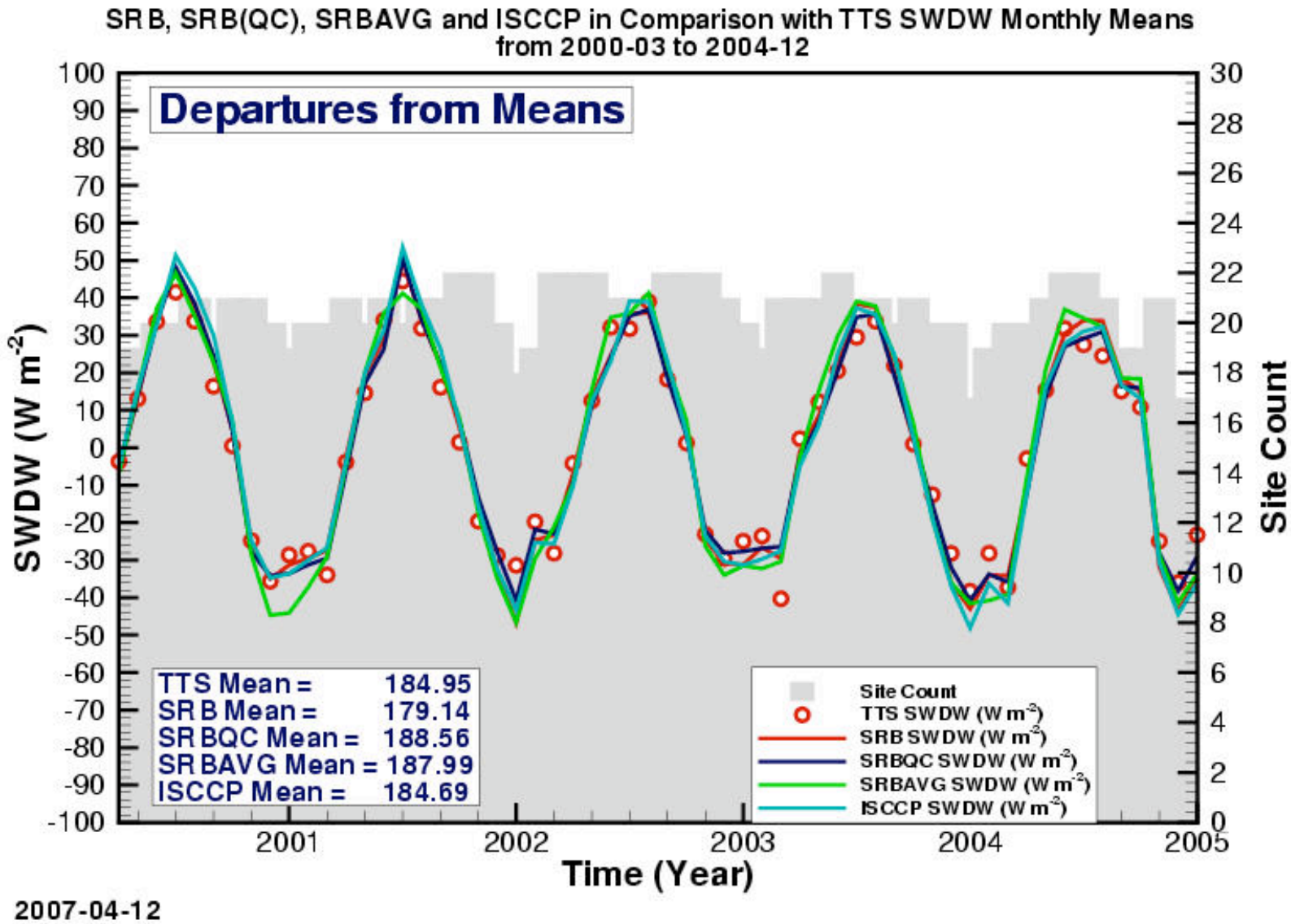

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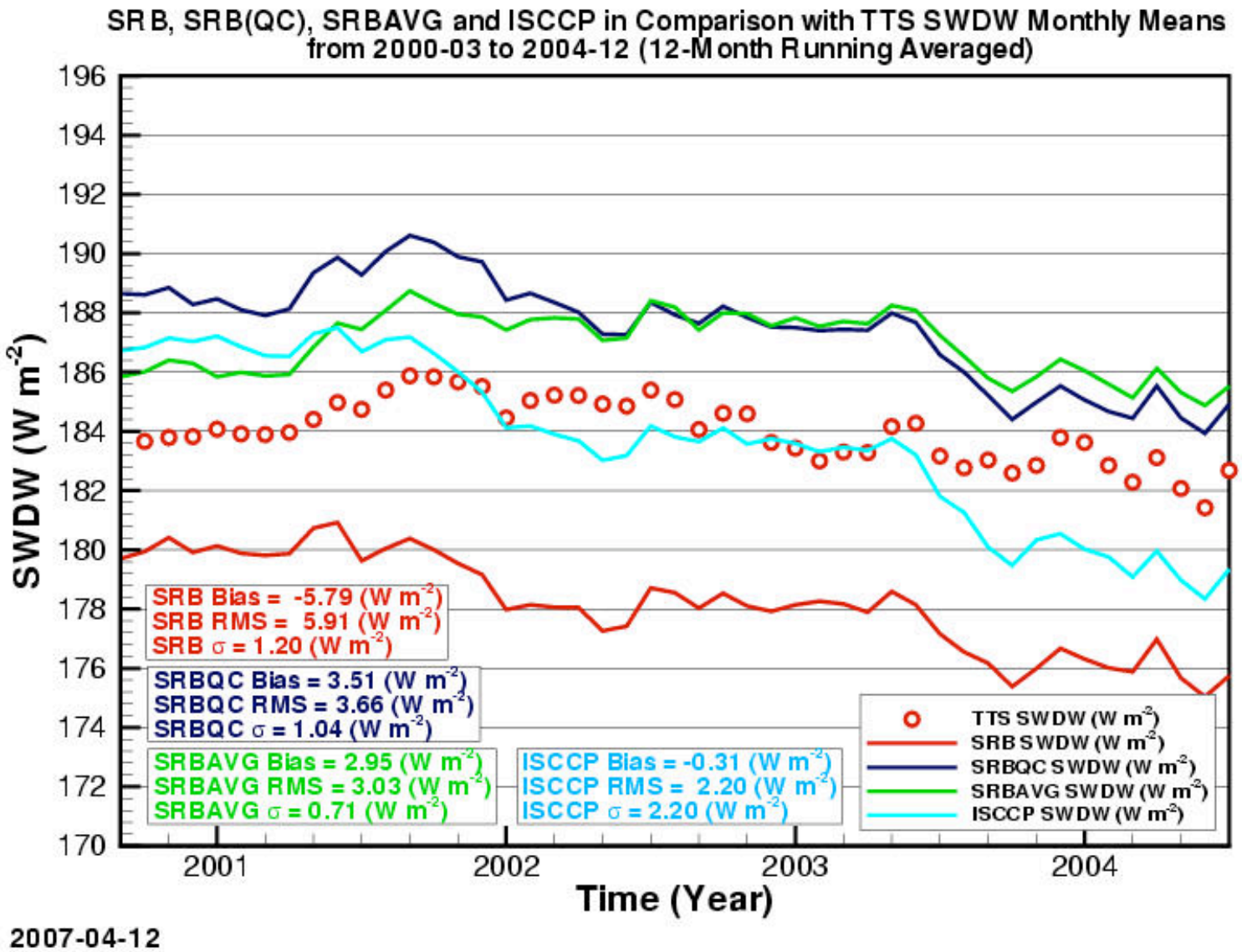

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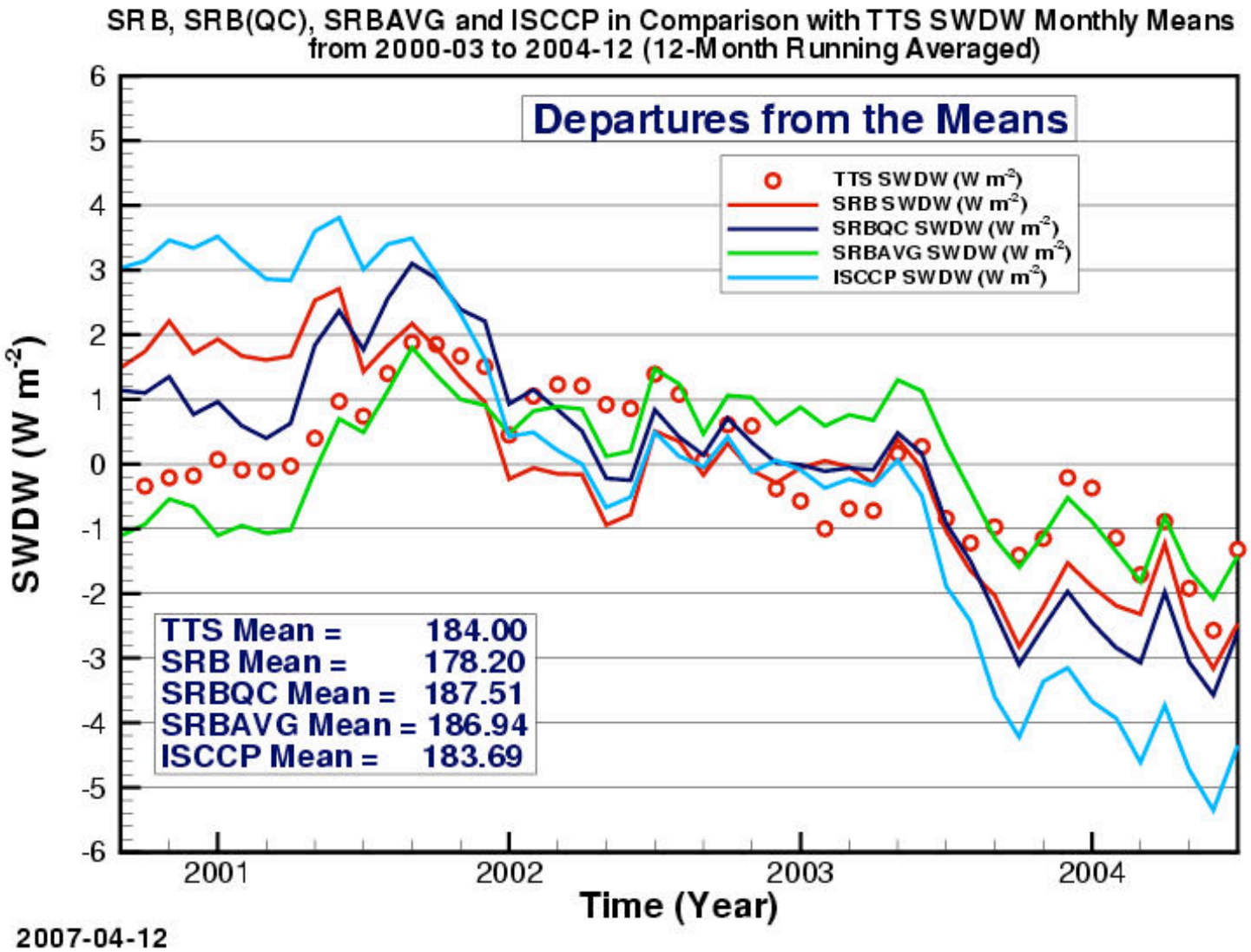
Monthly Averaged Site Analysis



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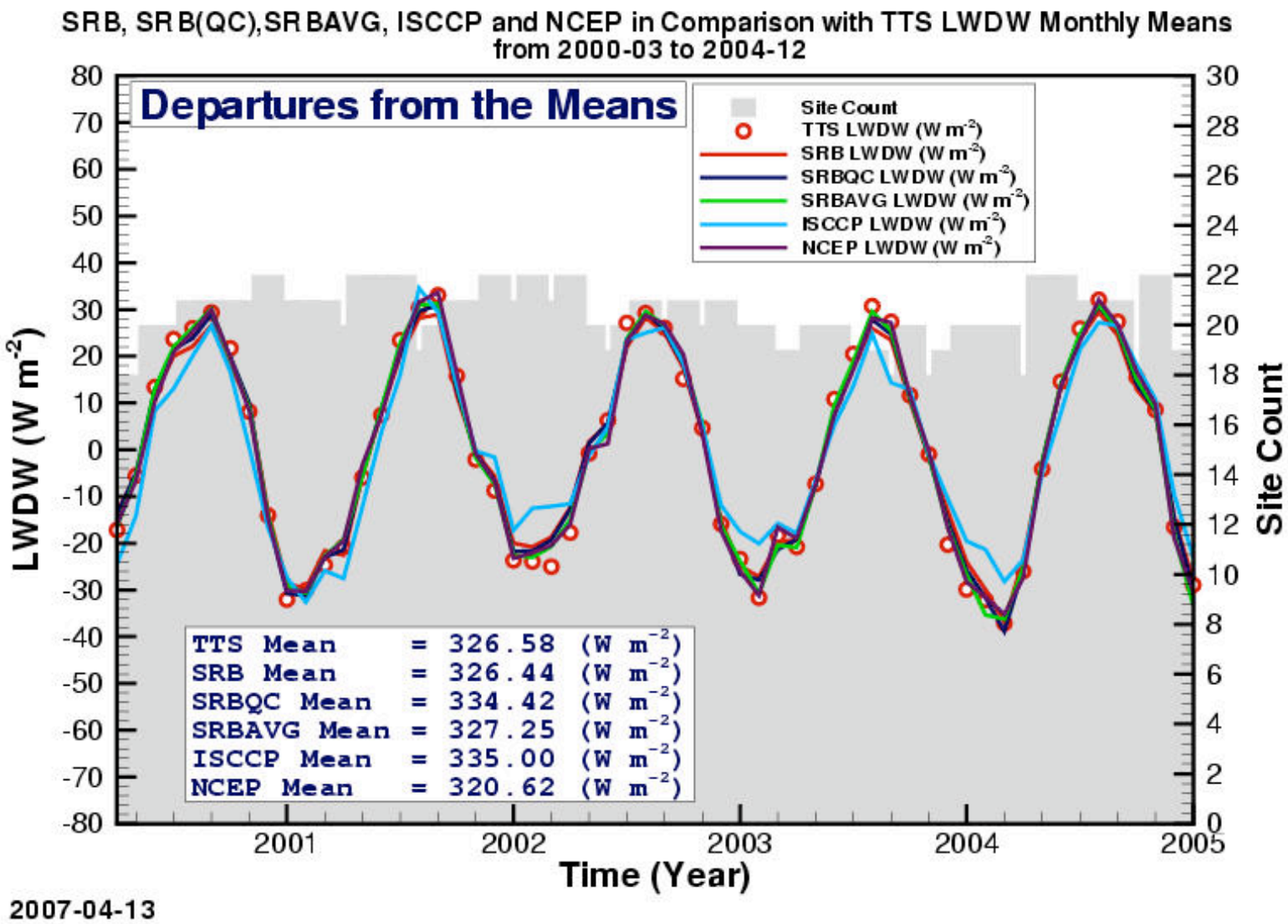

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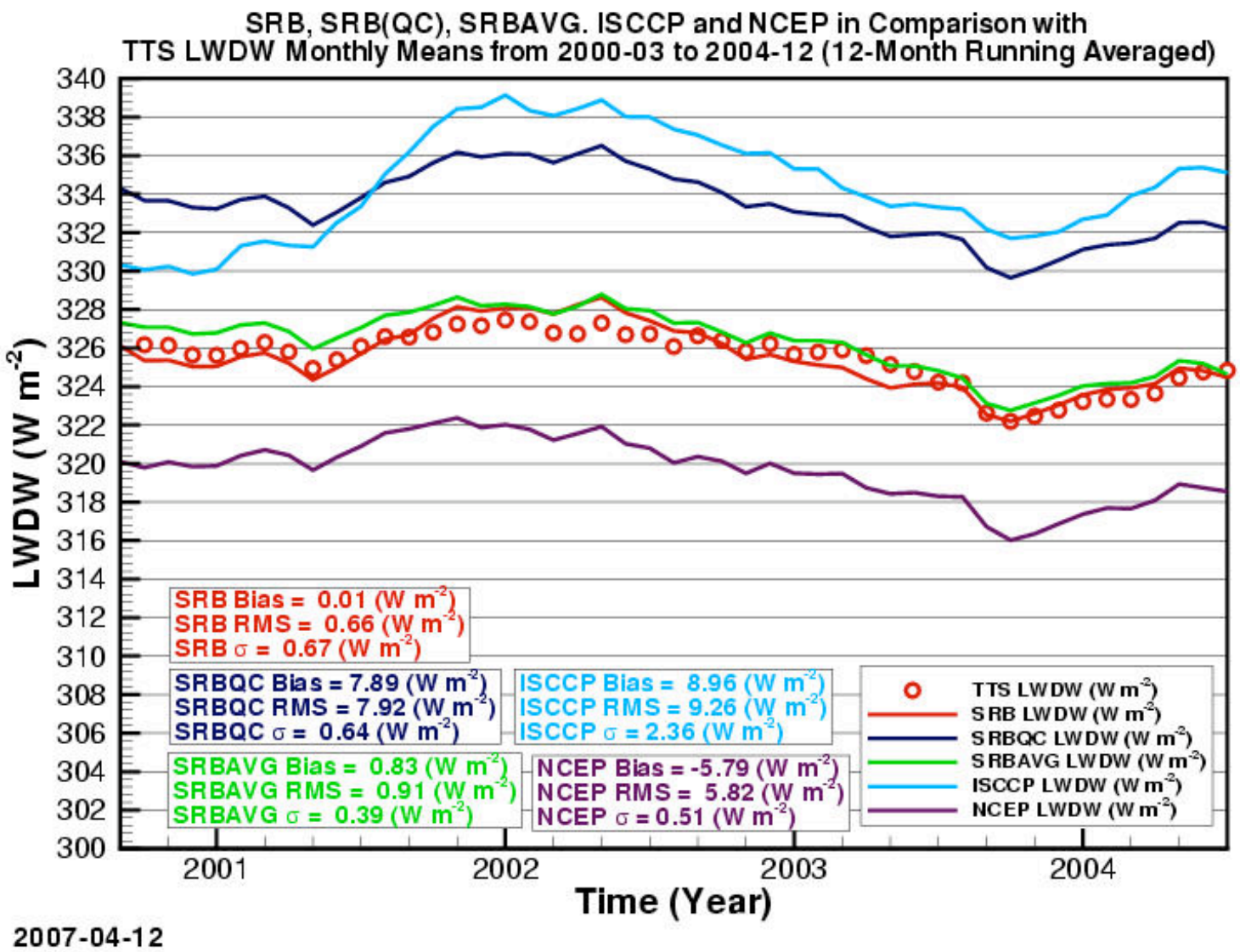

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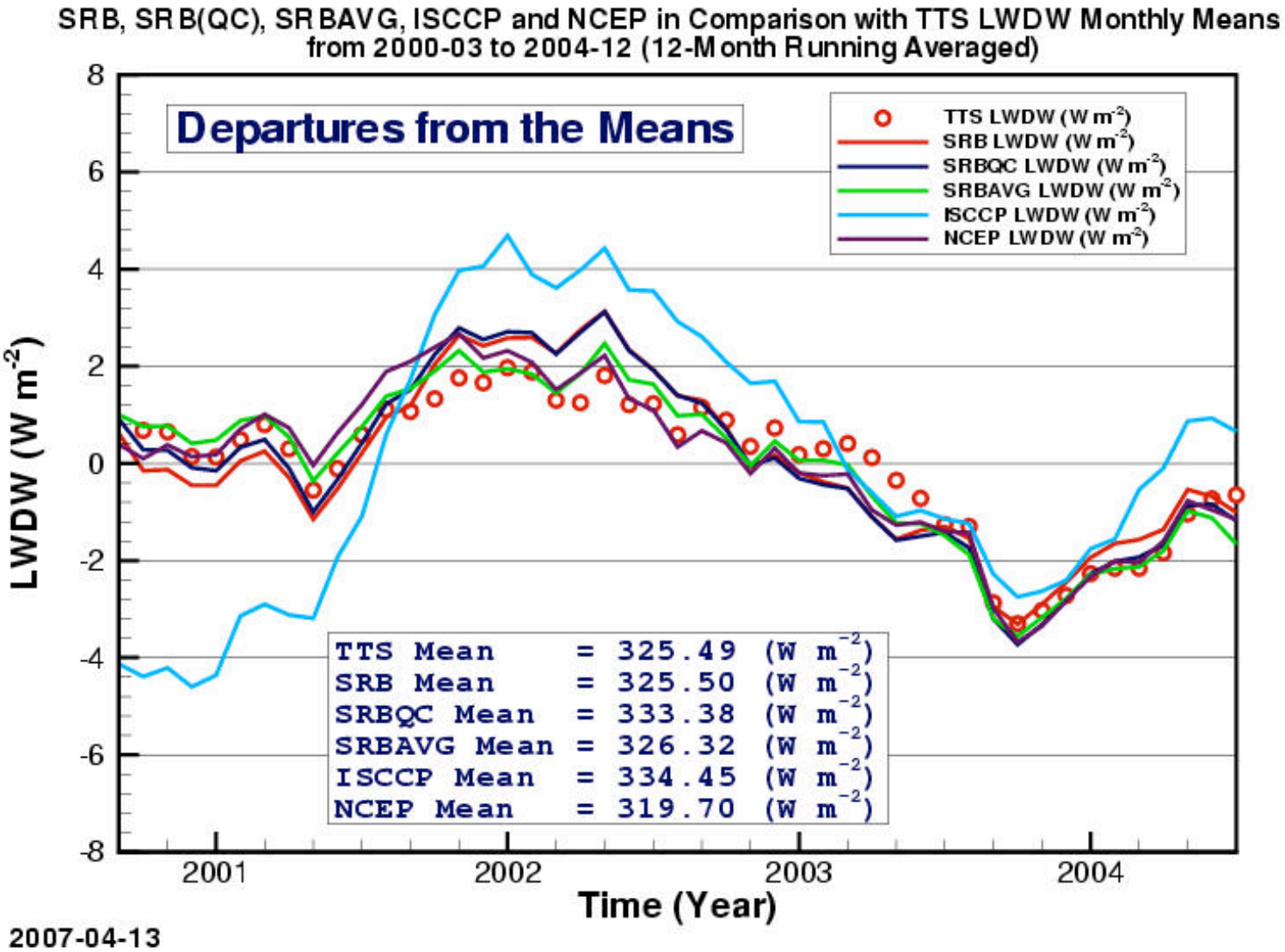

Conclusions for Variability

- SRBAVG fluxes and anomalies agree very well with surface measurements for both SW and LW
- SW 12 Month running mean std dev vary from 0.71 for SRBAVG, about 1 for SRB algorithms and 2.2 for ISCCP SW.
- LW results agree much better for all algorithms except for ISCCP where TOVS operational temperature and moisture algorithm was changed.
  - Std dev vary from 0.39 - 0.67 W m^-2 for all algorithms except ISCCP FD at 2.4 W m^-2

Backup Slides

Energy Budget from SRB

The Earth's Energy Budget

[Kiehl and Trenberth (1997) - Revised Numbers from GEWEX/SRB]