GEWEX Radiative Flux Assessment (RFA) Update

Presenter: Takmeng Wong (NASA LaRC)

Oversight Committee: Atsumu Ohmura (ETH), Ehrhard Raschke (U. of Hamburg), William Rossow (NASA GISS), Paul Stackhouse (NASA LaRC) and Bruce Wielicki (NASA LaRC)

~75 assessment participants (TOA, surface, and both)

Local Contributors: Lin Chambers (LaRC), Takmeng Wong (LaRC), Laura Hinkelman (UW), Dave Doelling (LaRC), J. Colleen Mikovitz, Taiping Zhang, Danny Mangosing, Yan Chen, Michele Nordeen (SSAI), Juliet Pao, Walter Baskin, Churngwei Chu, Sherry King, Penny Oots, Nancy Ritchey, Tomeka Watkinson and others (ASDC)

CERES Science Team Meeting

Newport News, Virginia

6-8 May, 2008

Radiative Flux Assessment Overview

- **Purposes:**
  - **Assess our current understanding and capability to**
    - ***derive TOA and surface radiative fluxes from analysis of satellite observations***
    - ***validate these fluxes with surface observations***
    - ***simulate these fluxes with models and assimilation***
  - **Assess uncertainties and outstanding issues in flux estimation, particularly long-term variability**
    - ***sources include satellite calibration, input data sources, and assumptions (particularly in regards to spatial and temporal gap filling)***
    - ***Compare surface fluxes to surface based measurements***
    - ***intercompare existing data products***
    - ***identify largest uncertainties and needs***
  - **Report methods and uncertainties to be useful for future IPCC reports on long-term data uncertainty.**
  - **Develop climate system observation requirements for radiative fluxes and compare to current product accuracies.**
  - **Assess GCM and reanalysis products.**

GEWEX RFA Activities to Date

- 1st Workshop held (Oct. 2004 - Zurich, Switzerland)
  - Discussed issues
  - Developed pieces of draft document
  - Assigned TOA and surface groups
- 2nd Workshop held (Feb. 2006 - Williamsburg, VA)
  - Refined document outline
  - Defined surface/TOA actions and goals
  - Assigning authors
- 3rd Workshop held (June 2007 - New York City, NY)
  - Results discussed
  - Preliminary conclusions discussed relevant to document
  - Deadlines set for draft documents
- Fine-tuning data archive, finalizing data analysis and assembly of draft report (Current Stage)

GEWEX-RFA Data Archive

To date, data have been submitted from:

- ASRB
- BSRN
- CAVE
- CERES (ERBE-like, and SRBAVG)
- DLR ISIS
- ERBE (ERBE Scanners and Nonscanner)
- GFDL CM 2.1
- HIRS IR (OLR only)
- ISCCP-FD
- ScaRaB
- NASA/GEWEX SRB
- U. Maryland SRB (Z. Li and R. Pinker)
- U. Oregon Surface Sites (>20 years)
- Monthly hourly satellite data at selected 15 surface sites
- NCEP/R2, ERA-40, Adjusted CERES SRBAVG-GEO

Also non-standard surface data from Chuck Long.

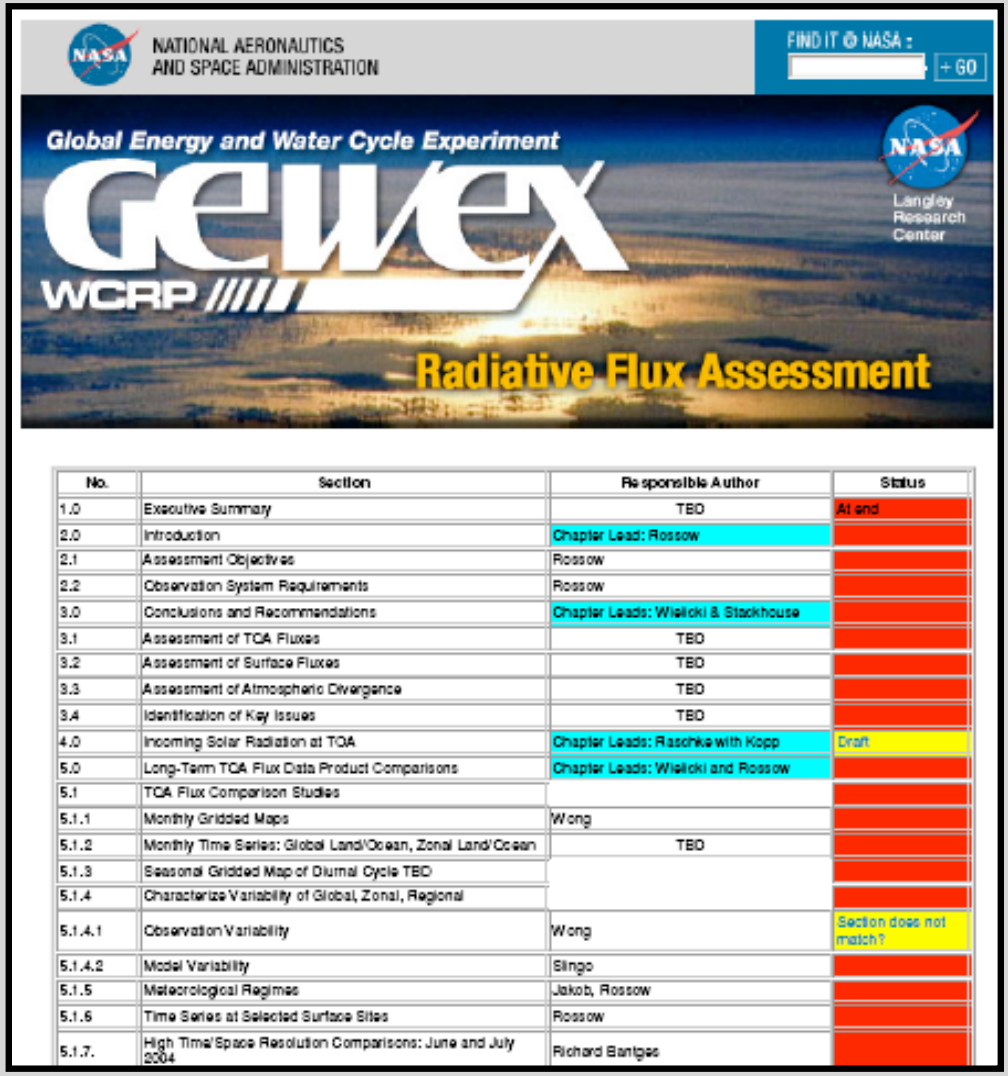
GEWEX-RFA Results To Date

- Smith et al., 2006: ERB calibration intercomparison
- Raschke et al., 2006, GRL: SRB, ISCCP TOA comparison
- Zhang et al., 2006a,b: Near-surface meteorological and radiative properties
- Wong et al, 2006 => ERBE, HIRS, ISSCP-FD time series
- Loeb et al. (JClim, 2007): CERES/Terra vs. ISCCP-FD, CERES/Terra vs. SeaWiFS PAR, and CERES/Terra vs. CERES/Aqua.
- SRB/CERES/ISCCP teams: Various intercomparisons
- Roesch et al. (not published): Sensitivity of monthly averages to treatment of data gaps
- Hinkelman et al. (not published): Preliminary time series analysis
- Freidenreich: GFDL model results vs. ISCCP-FD
- Schaaf: Surface albedo studies

Recent GEWEX-RFA Activities

- ROSES 2007 GEWEX-RFA proposal fully funded for FY08; part-time support for Chambers (PI), Wong, and Hinkelman
- Working with chapters leads to assemble draft report and moving the RFA project through its final phase
- Setting up draft report webpage and Google group for easier exchange of draft report information
- Added new monthly hourly satellite dataset at 15 surface sites for diurnal cycle comparisons
- Adding NCEP/R2, ERA-40, and adjusted CERES SRBAVG-GEO data to the RFA archive
- Updating inter-comparisons of regional TOA fluxes with new GEWEX-RFA datasets

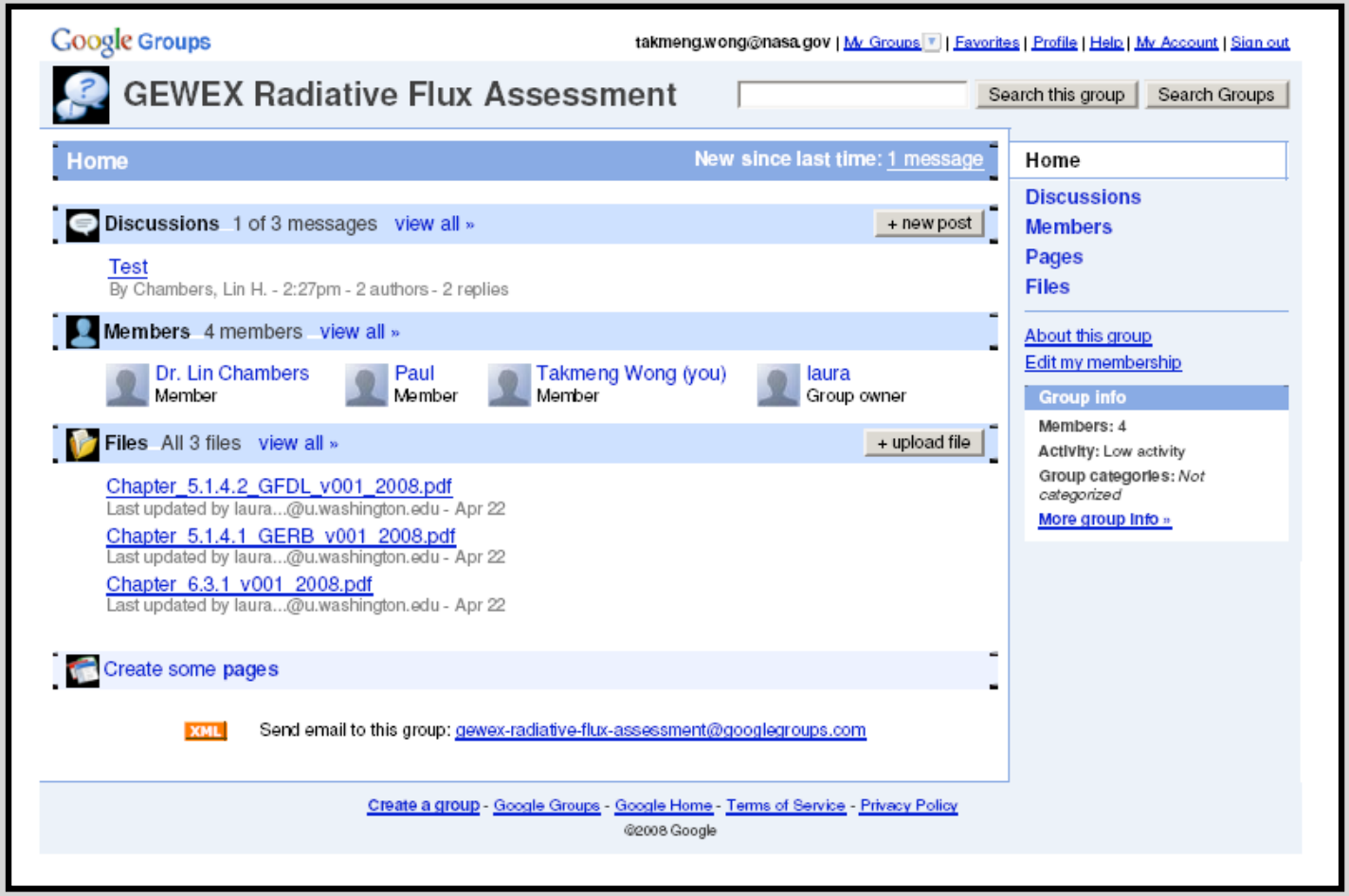
GEWEX-RFA Draft Report Website



No.	Section	Responsible Author	Status
1.0	Executive Summary	TBD	At end
2.0	Introduction	Chapter Lead: Rossow	
2.1	Assessment Objectives	Rossow	
2.2	Observation System Requirements	Rossow	
3.0	Conclusions and Recommendations	Chapter Leads: Wielicki & Stackhouse	
3.1	Assessment of TOA Fluxes	TBD	
3.2	Assessment of Surface Fluxes	TBD	
3.3	Assessment of Atmospheric Divergence	TBD	
3.4	Identification of Key Issues	TBD	
4.0	Incoming Solar Radiation at TOA	Chapter Leads: Raschke with Kopp	Draft
5.0	Long-Term TOA Flux Data Product Comparisons	Chapter Leads: Wielicki and Rossow	
5.1	TOA Flux Comparison Studies		
5.1.1	Monthly Gridded Maps	Wong	
5.1.2	Monthly Time Series: Global Land/Ocean, Zonal Land/Ocean	TBD	
5.1.3	Seasonal Gridded Map of Diurnal Cycle TBD		
5.1.4	Characterize Variability of Global, Zonal, Regional		
5.1.4.1	Observation Variability	Wong	Section does not match?
5.1.4.2	Model Variability	Slingo	
5.1.5	Meteorological Regimes	Jakob, Rossow	
5.1.6	Time Series at Selected Surface Sites	Rossow	
5.1.7.	High Time/Space Resolution Comparisons: June and July 2004	Richard Bantges	

- Listing of all sections
- Name of each section
- Responsible authors
- Status of each section
- Color coded for easy reading
- Archive of all old draft versions

GEWEX-RFA Google Group



- **Easier access for our international participants; solving on-going problems associated with NASA computer security requirements**

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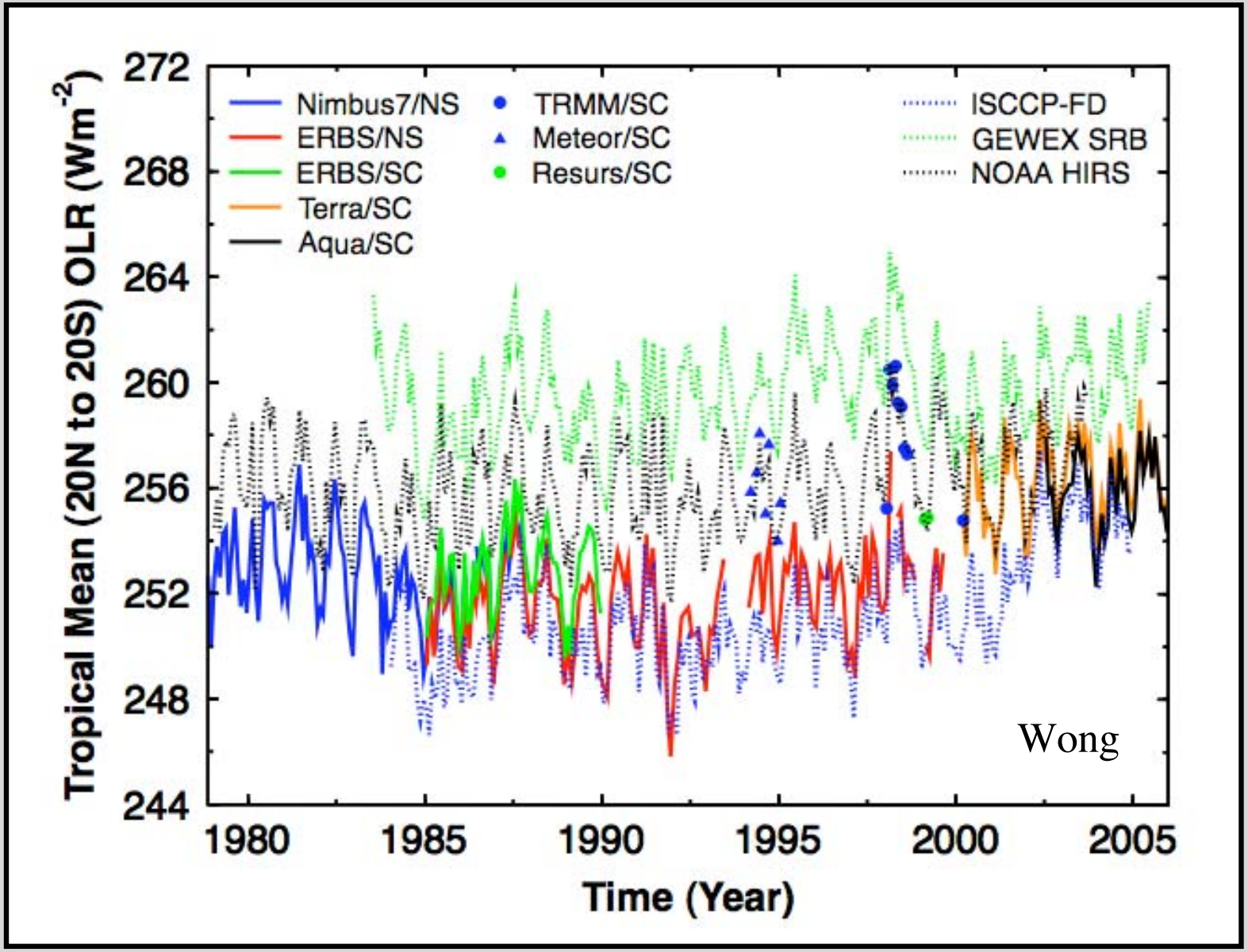
Tropical OLR Intercomparisons



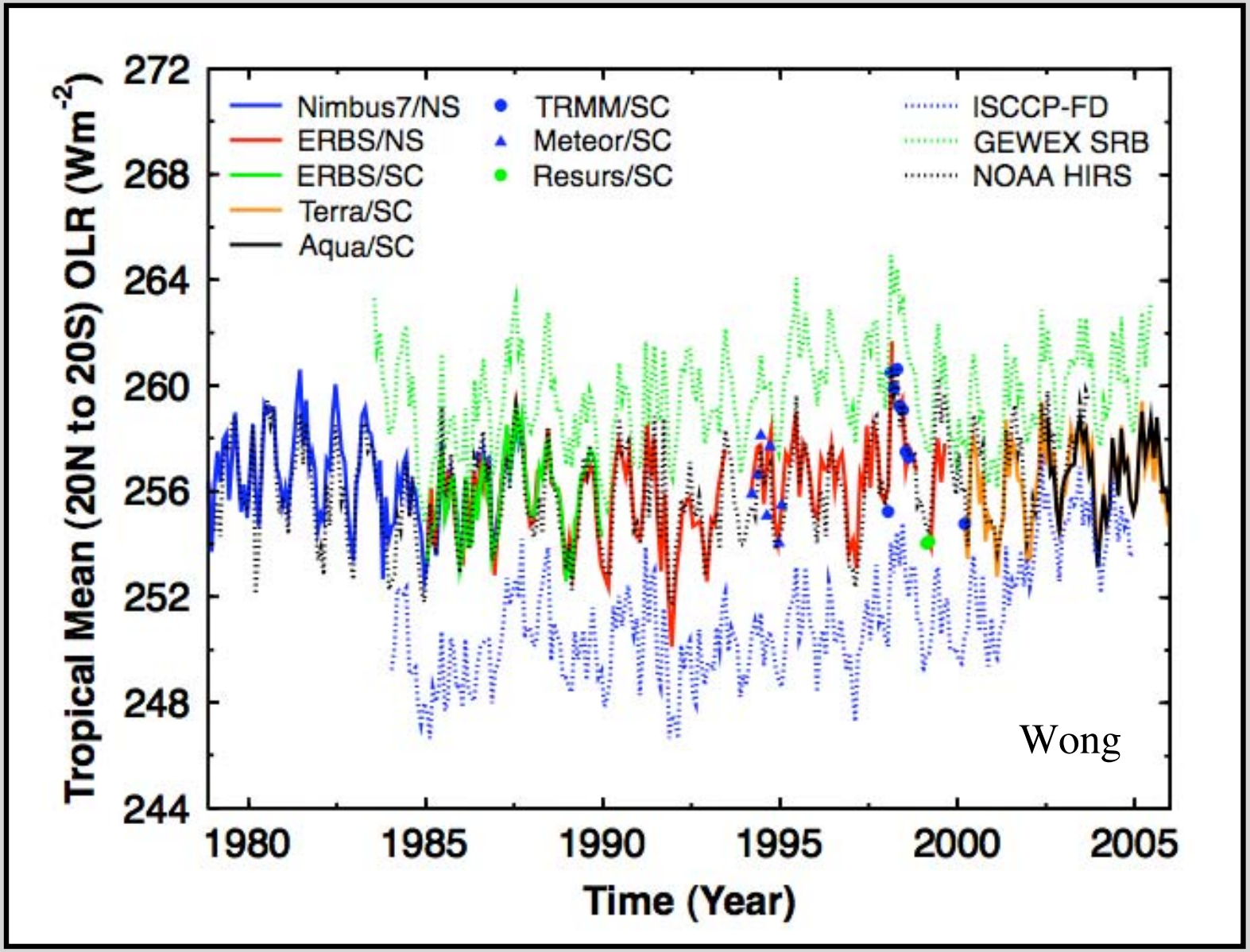
Anthropogenic radiative forcing of climate is ~ 0.6 Wm^{-2} per decade

Goal ~ 0.15 Wm^{-2} per decade

1.2 Wm^{-2} calibration accuracy: current best capability (e.g. CERES)

Current spread 5 - 10 Wm^{-2}; Narrows After 2001

Tropical OLR with Broadband Overlap Adjustment

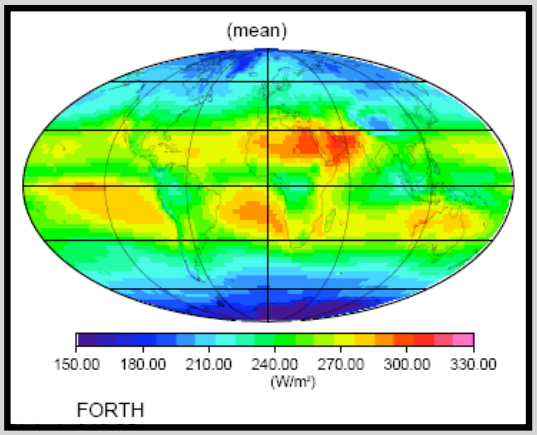


Proposed adjustment uses overlap points from TRMM/Terra/Resurs, TRMM/ERBS-NS, ERBS-NS/SC, and Nimbus7-NS/ERBS

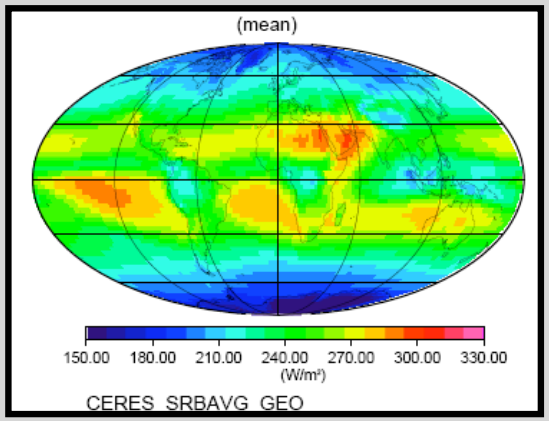
Total change to ERBS/Nimbus nearly 5 W m^{-2}

Annual Mean LW Fluxes

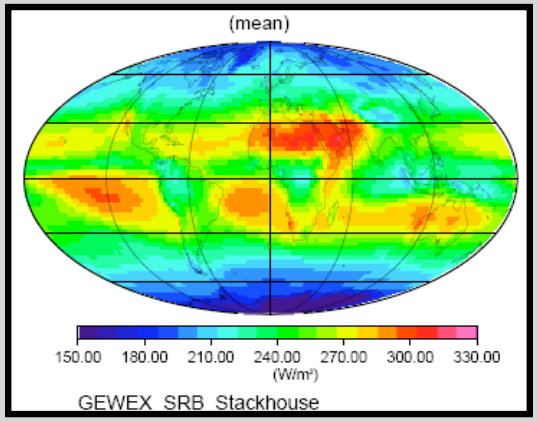
FORTH



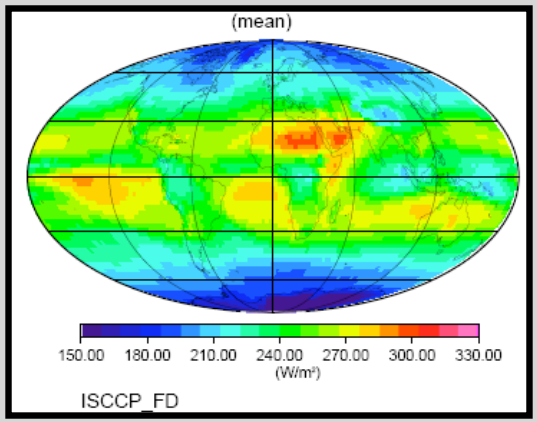
CERES SRBAVG GEO



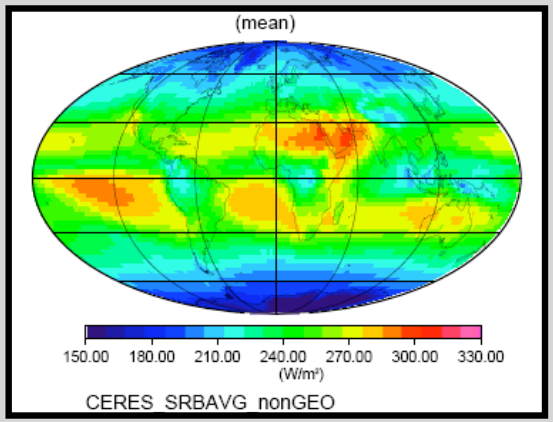
GEWEX SRB/LaRC



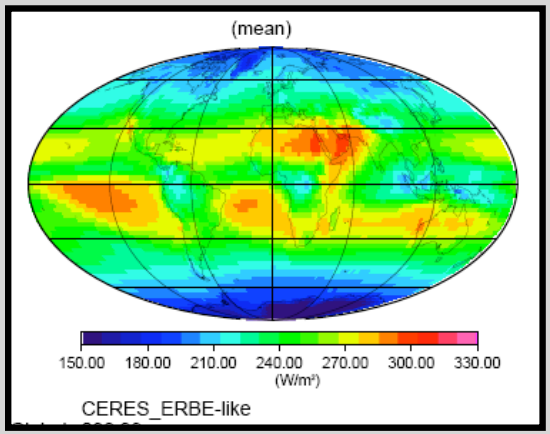
ISCCP-FD



CERES SRBAVG NONGEO



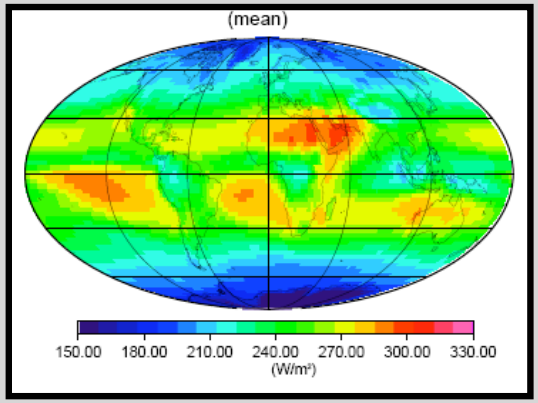
CERES ERBE-LIKE



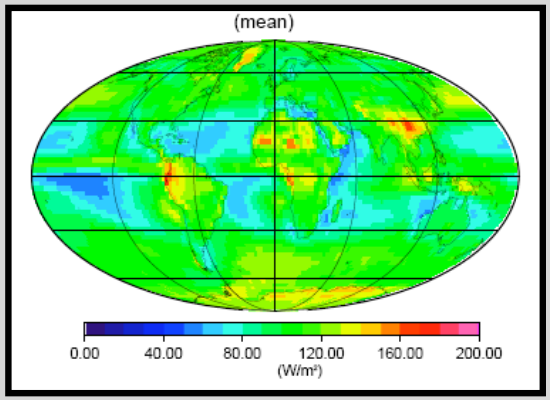
Data Period: 3/2000 to 10/2005

Multi-Dataset Ensemble Mean

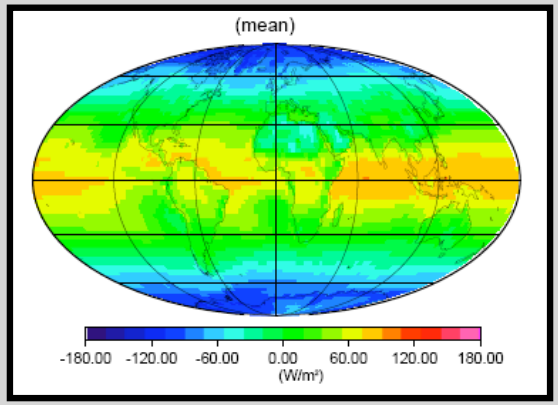
LW



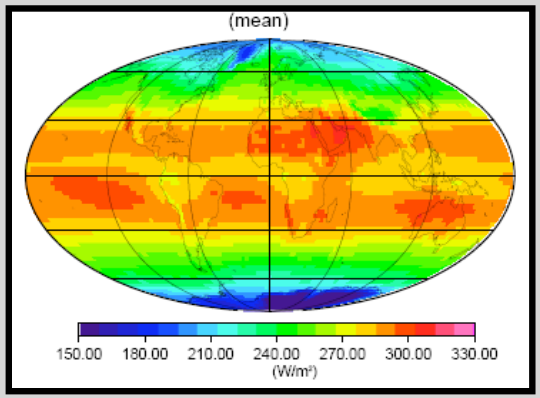
SW



Net



Clear LW



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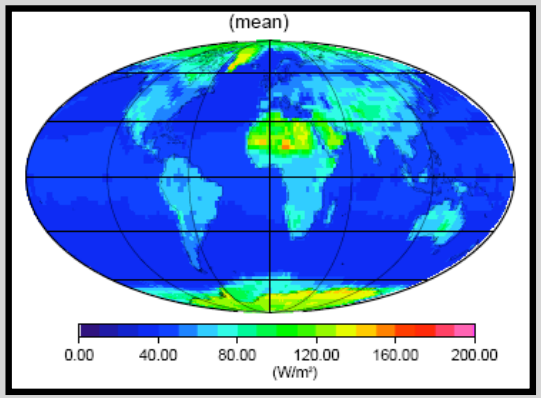

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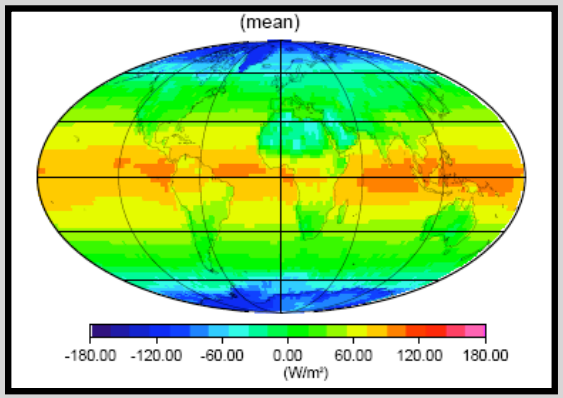


Data Period: 3/2000 to 10/2005

Annual Global Mean TOA Budget

	Mean	Range
Solar In.	341.0	339.5, 341.8
LW	238.8	236.2, 240.6
SW	99.8	96.8,107.0
Net	4.4	-0.9, 8.3
CLW	266.2	263.3, 266.9
CSW	51.8	49.3, 54.3
CNet	24.9	19.9, 28.6

Data Period: 3/2000 to 10/2005

GEWEX-RFA TOA Global Mean Comparison (Relative to CERES SRBAVG GEO)

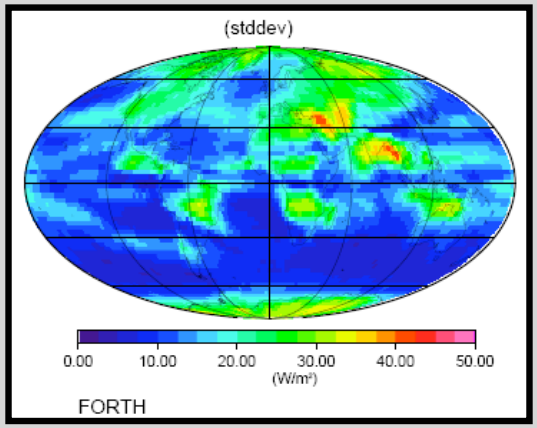
	CERES SRBAVG GEO	CERES SRBAVG NonGEO	CERES ERBE-like	GEWEX SRB LaRC	ISCCP FD	FORTH	GEWEX SRB UMC
LW	237.2	0.6	1.8	3.4	-1.0	2.9	N/A
SW	97.9	-1.1	0.9	3.9	7.8	9.1	0.0
Net	6.5	0.5	-2.3	-7.4	-6.5	1.9	N/A
CLW	264.2	2.3	2.7	3.9	-0.9	N/A	N/A
CSW	51.6	0.0	-2.4	1.9	2.7	N/A	N/A
CNet	27.7	-2.7	0.9	-7.8	-3.5	N/A	N/A

GEWEX-RFA TOA Tropical Mean Comparison (Relative to CERES SRBAVG GEO)

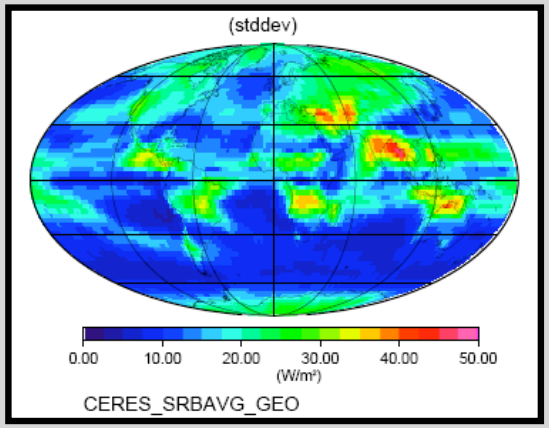
	CERES SRBAVG NonGEO	CERES ERBE-like	GEWEX SRB LaRC	ISCCP FD	FORTH	GEWEX SRB UMC
LW	1.0	2.3	5.4	-0.4	6.2	N/A
SW	-1.8	-1.8	5.2	8.8	4.4	-0.2
Net	0.8	-0.4	-10.1	-8.2	-9.6	N/A
CLW	2.3	2.7	3.9	-0.9	N/A	N/A
CSW	0.0	-2.4	1.9	2.7	N/A	N/A
CNet	-2.7	0.9	-7.8	-3.5	N/A	N/A

Monthly Variability, LW Fluxes

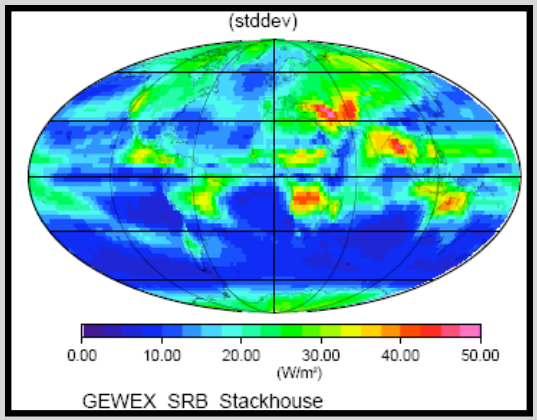
FORTH



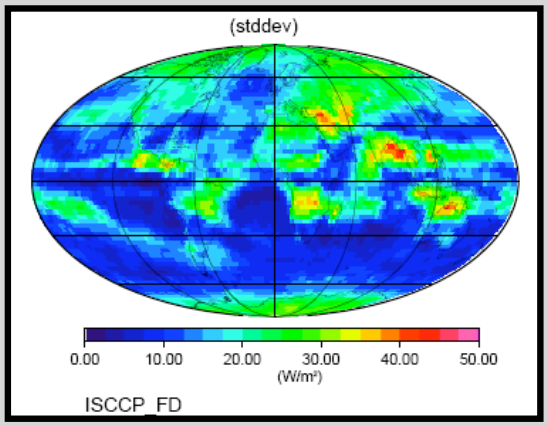
CERES SRBAVG GEO



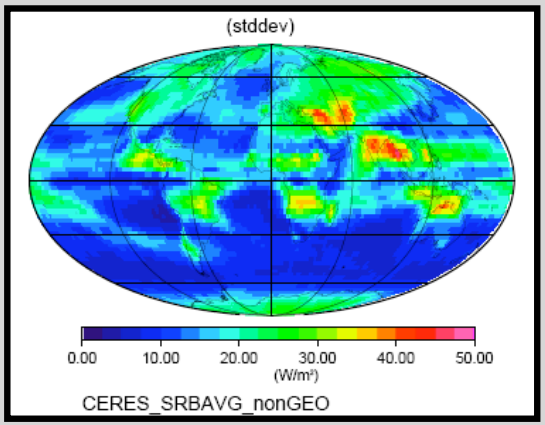
GEWEX SRB/LaRC



ISCCP-FD



CERES SRBAVG NONGEO



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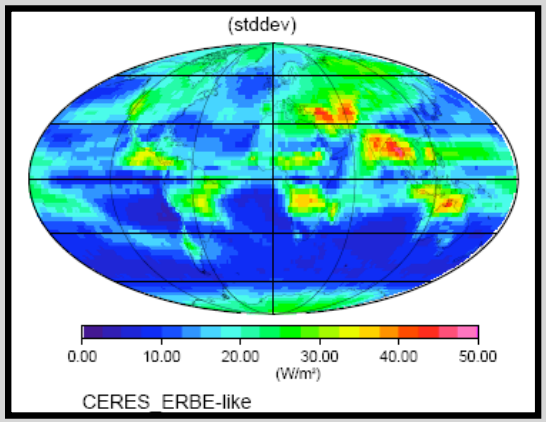
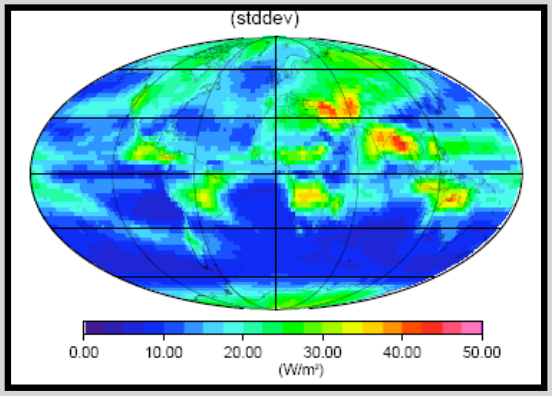


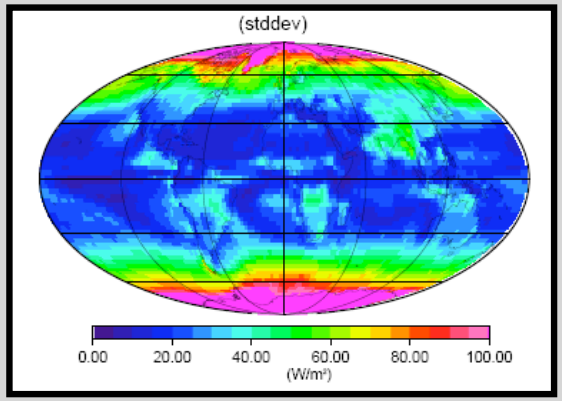
Data Period: 3/2000 to 10/2005

Monthly Variability, Ensemble Mean

LW



SW



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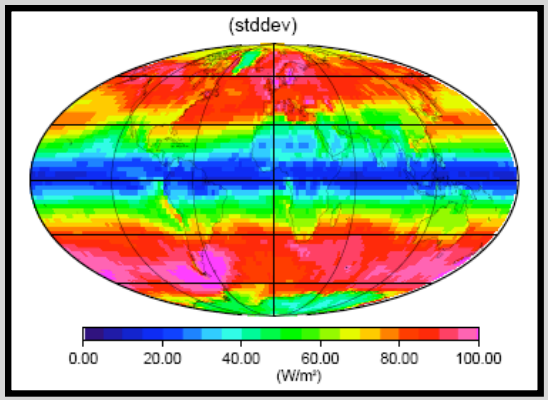
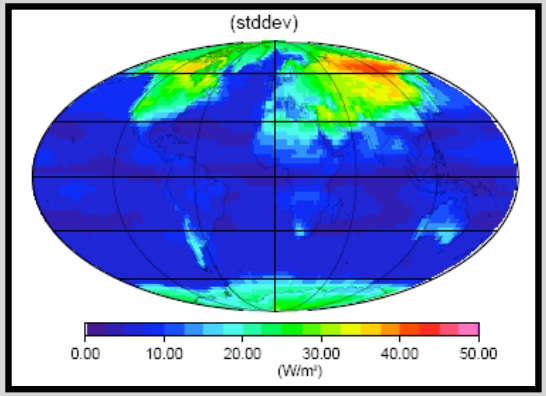
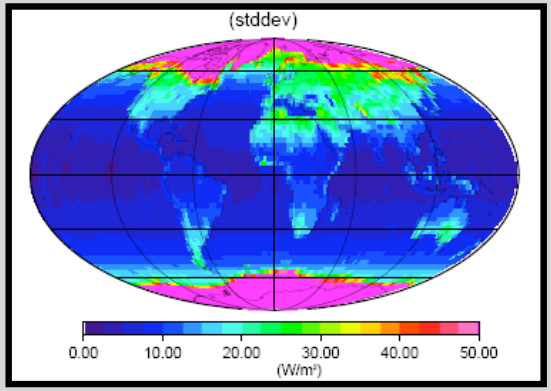


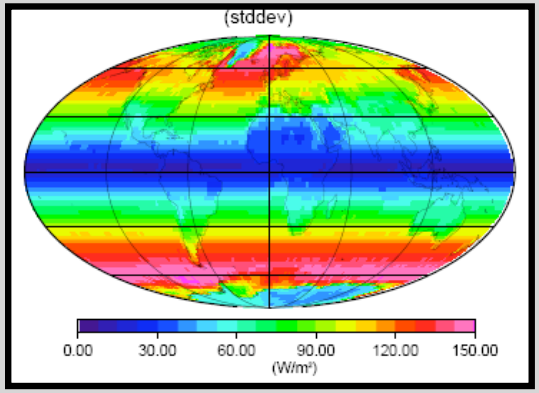
Clear LW



Clear SW



Clear Net



Data Period: 3/2000 to 10/2005

Global Mean Monthly Variability

	Mean	Range
Solar In.	98.2	97.0, 101.4
LW	15.9	15.1, 16.9
SW	37.9	34.4, 39.2
Net	63.2	61.6, 64.3
CLW	10.8	9.7, 10.7
CSW	18.7	15.5, 18.9
CNet	77.0	76.2, 79.3

Data Period: 3/2000 to 10/2005

Radiative Flux Assessment Next Steps

- Fine-tuning Data Archive and Finalizing Data Analysis
  - Continue submittal of missing data products (NCEP/R2, ERA-40, and Adjusted CERES SRBAVG-GEO)
  - Continue data evaluation; cross comparisons; different time and space scales
  - Collection, posting, discussion of analysis results
- Continue assembly of Radiative Flux Assessment Draft
  - Solicit participant results and analysis for posting
  - Exchange information via Google group and RFA website
  - Coordinate analysis with chapter leaders; assemble chapters with submitted results
- Collaborative draft assessment report (Summer, 2008)
- Final document (to follow)