

# The NASA/GEWEX Surface Radiation Budget: First Look at Next Generation Data Product

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# Outline

1. Describe NASA/GEWEX SRB product
2. Discuss new ISCCP HXS inputs
3. Show sample SRB shortwave product with new inputs, compare with current released SRB version
4. Discuss improvements in forthcoming release, incorporating these new inputs and several important algorithm enhancements



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# SRB Web Site

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

The screenshot shows the homepage of the NASA GEWEX Surface Radiation Budget (SRB) project. At the top left is the NASA logo. To its right is the text "NATIONAL AERONAUTICS AND SPACE ADMINISTRATION". On the far right is a link "+ Visit NASA.gov". Below this is the "Global Energy and Water Cycle Experiment" (GEWEX) logo, which includes "WCRP" and a globe icon. To the right of the logo is a circular emblem for "SURFACE RADIATION BUDGET" featuring a sun, clouds, and a satellite. To the right of the emblem is the text "SURFACE RADIATION BUDGET". A horizontal menu bar below the logo contains links for "Home", "SRB Data Products", "Examples of SRB Data", and "Access SRB Data".  
  
On the left side, there are three vertical menus:

- Data**: "Access Data", "Data Format", "SRB Data Products" (which is highlighted), and "Examples SRB Data".
- Documentation**: "About SRB", "About GEWEX", "Global Geometry/Resolution", "Parameter Accuracy/Validation", "GEWEX/SRB Methodology", "SRB Publications", and "Acknowledgments Please".
- Related Links**: "Atmospheric Science Data Center", "LaRC Science Directorate", "Science Mission Directorate", "International Satellite Cloud Climatology Project (ISCCP)", "Global Energy and Water Cycle Experiment (GEWEX)", "Earth Radiation Budget Experiment (ERBE)", and "SRB Team Site (limited access)".

  
The main content area features a world map titled "NASA/GEWEX Surface Radiation Budget (SRB) Project" showing "SRB Rel. 3.0 TOA Total Net Flux, 24 Year Average for Jan". The map uses a color scale from blue (-225) to red (175). Below the map is a descriptive text block:

The Global Energy and Water-cycle Experiment (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.

At the bottom right, there is a small "AMSRad13" logo and a blue "X" icon. In the bottom left corner, there is a small NASA logo and the date "Sep 2".

# SRB Release 3 Data Products

(Spatial Resolution:  $1^{\circ} \times 1^{\circ}$ ; 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

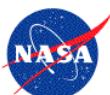


Joint GEWEX GDAP and GHP Meeting



# Algorithm improvements for Release 4.0

	Release 3.0	Release 4.0 Baseline	Release 4.0
Radiative bands	5	5	18
Aerosol composition	One land aerosol, one ocean	One land aerosol, one ocean	Variable asymmetry parameter and single scatter albedo permitted
Input aerosol	MATCH modal optical depth, monthly climatology	MATCH modal optical depth, monthly climatology	Max-Planck Aerosol Climatology, with variable optical depth and composition through product time period (1983-present)
Clouds	ISCCP DX; Liquid clouds assumed	ISCCP HX; Liquid clouds assumed	Liquid and ice clouds allowed based on ISCCP input



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# Newly recalibrated ISCCP HX product

Previous ISCCP DX product is subsampled to 30km, allowing 10-15 pixels per one degree grid box.

ISCCP is now producing (public release coming) a fully recalibrated H product, with 8km pixels, allowing over 100 pixels per grid box at nadir

Enhanced resolution allows more continuous values of cloud fraction

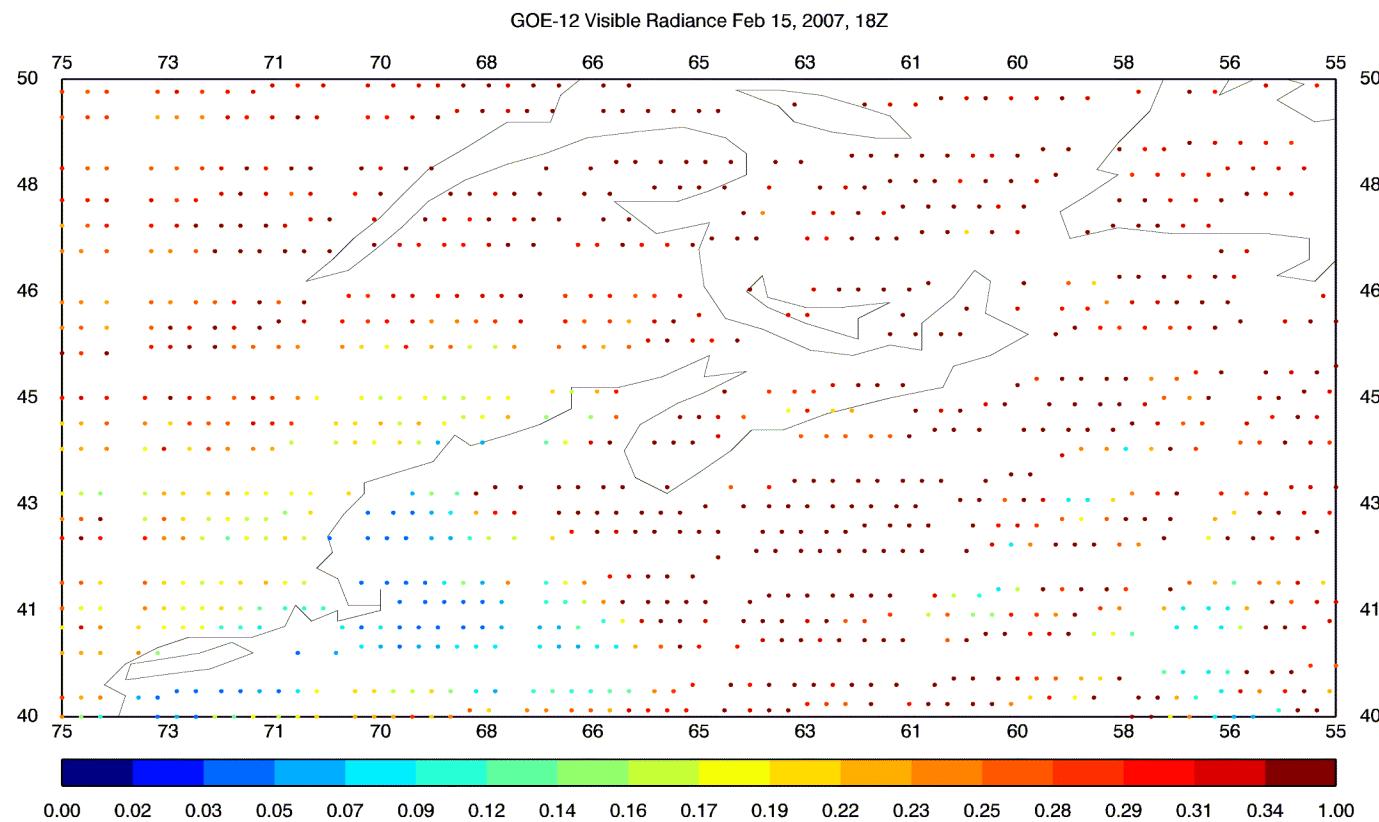


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# Visible radiance, ISCCP DX

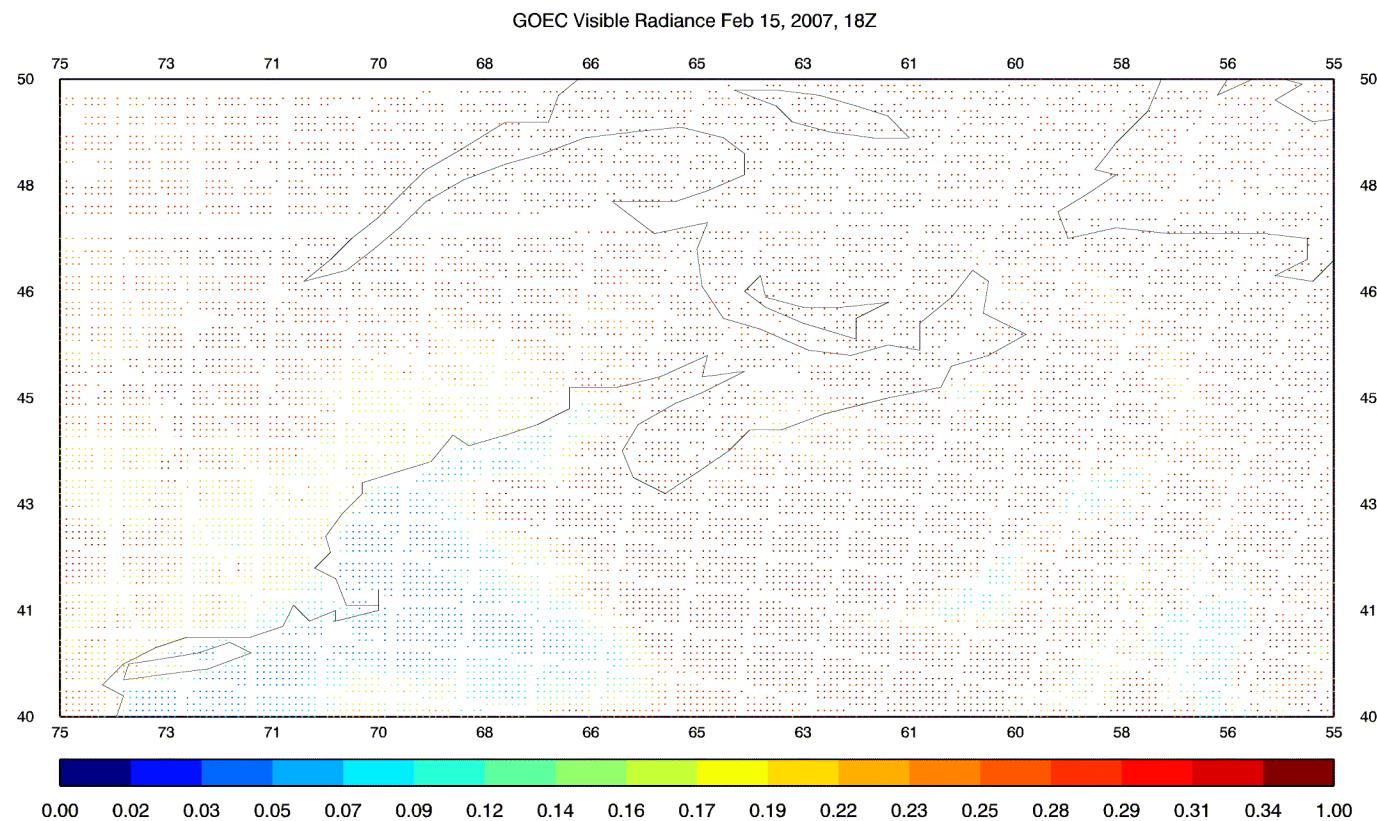


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# Visible radiance, ISCCP HXS

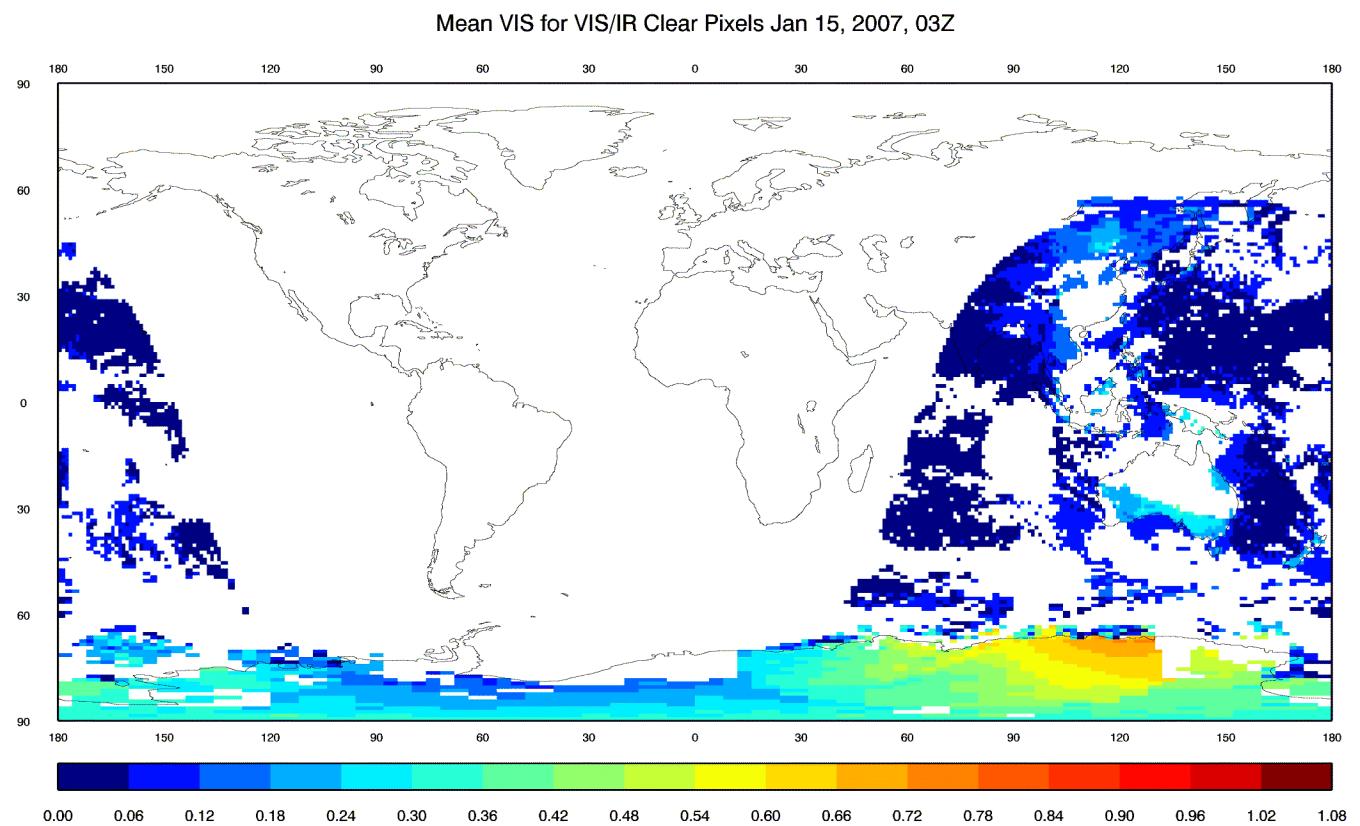


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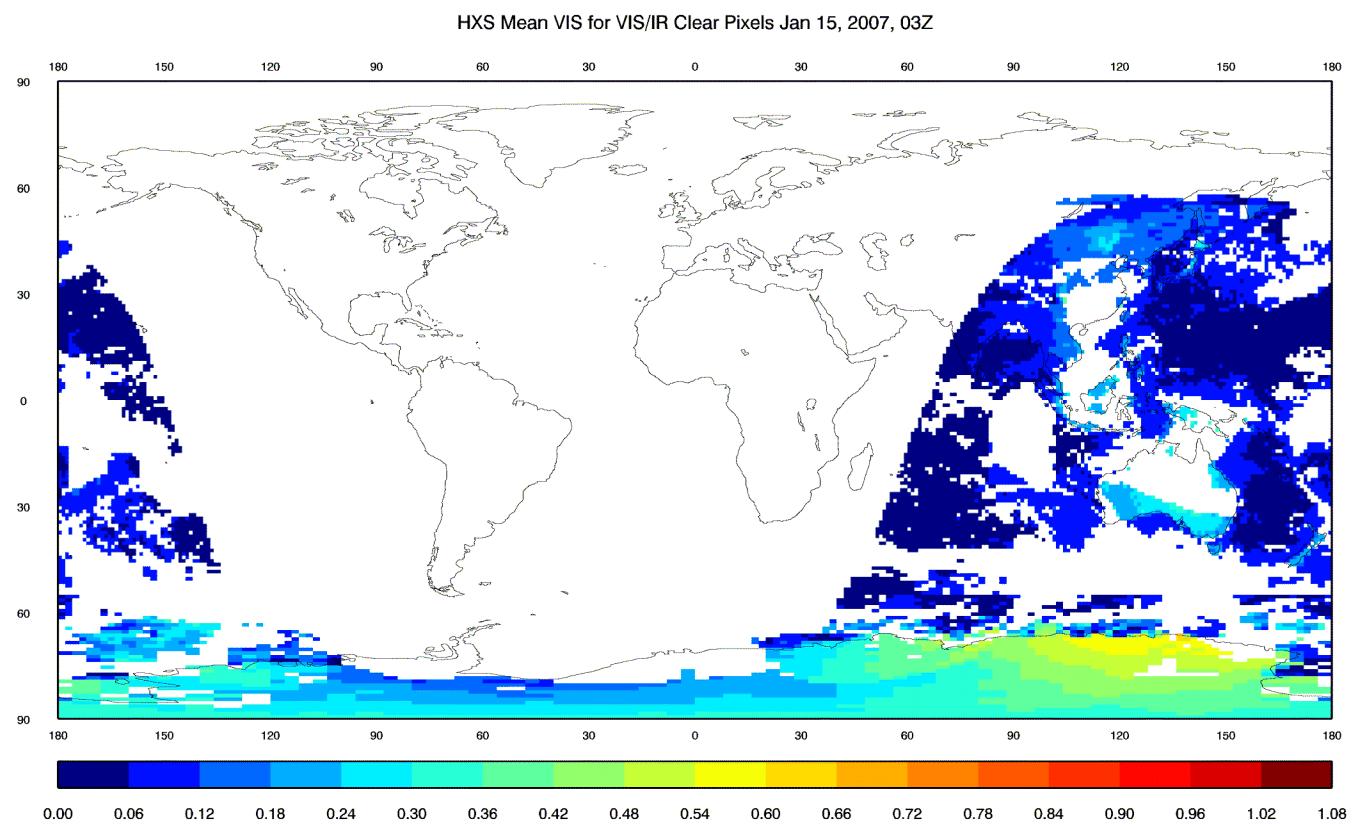
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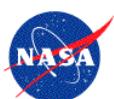
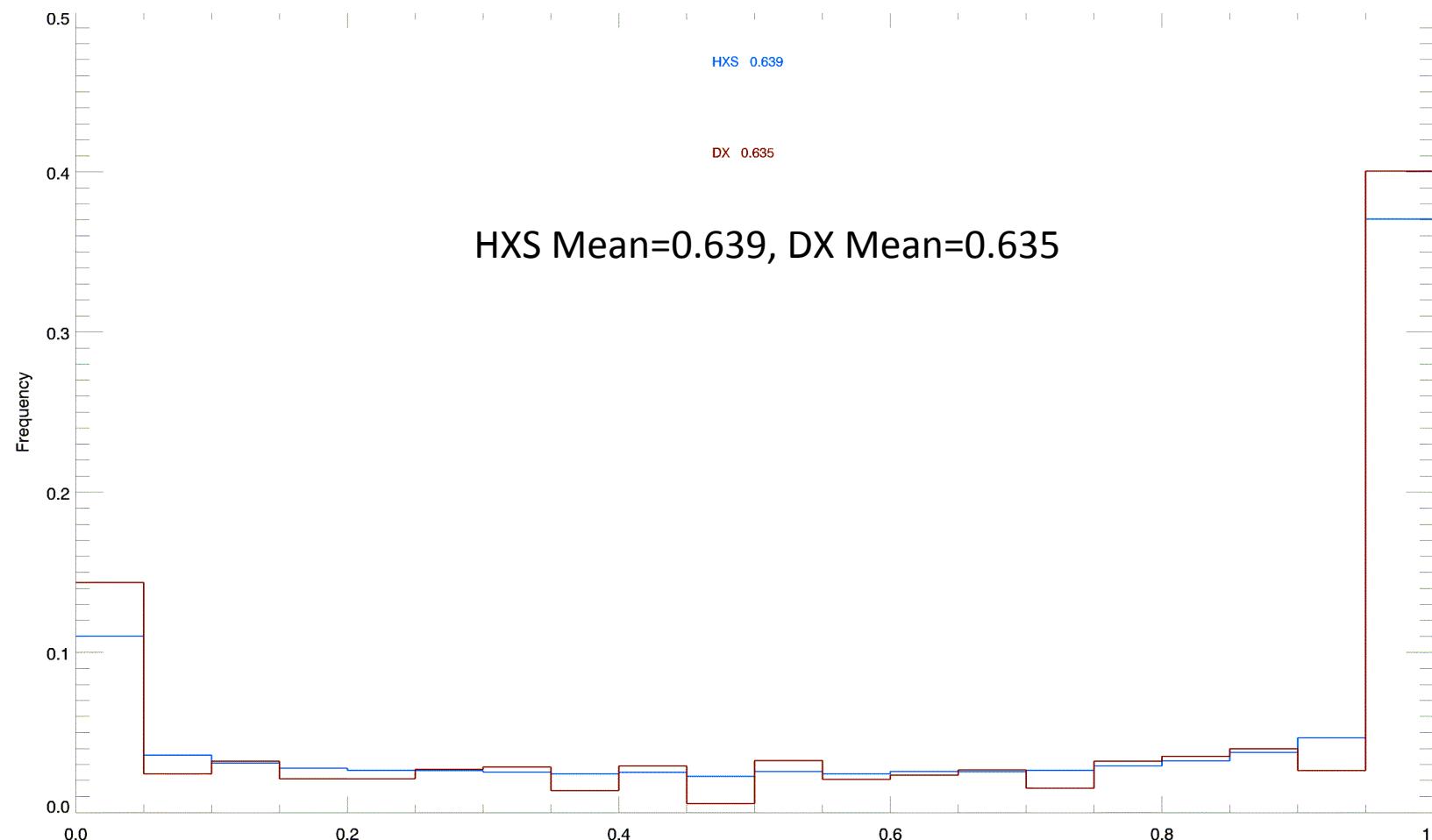
# Gridded and averaged ISCCP DX Clear Radiance



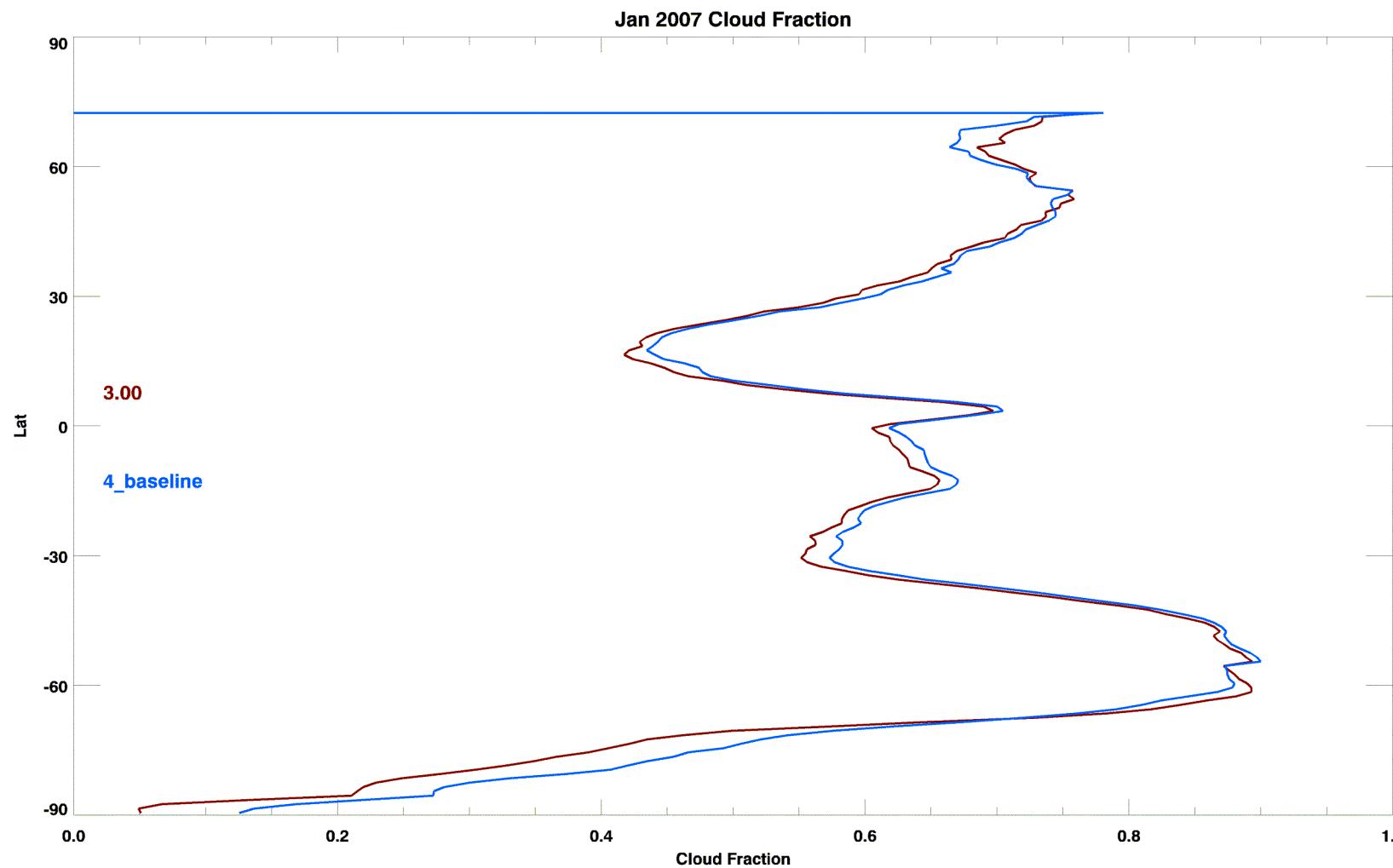
# Gridded and averaged HXS VIS Clear Radiance



# Jan 2007 Monthly Cloud Fraction Histogram



# Zonal Average Jan 2007 Cloud Fraction

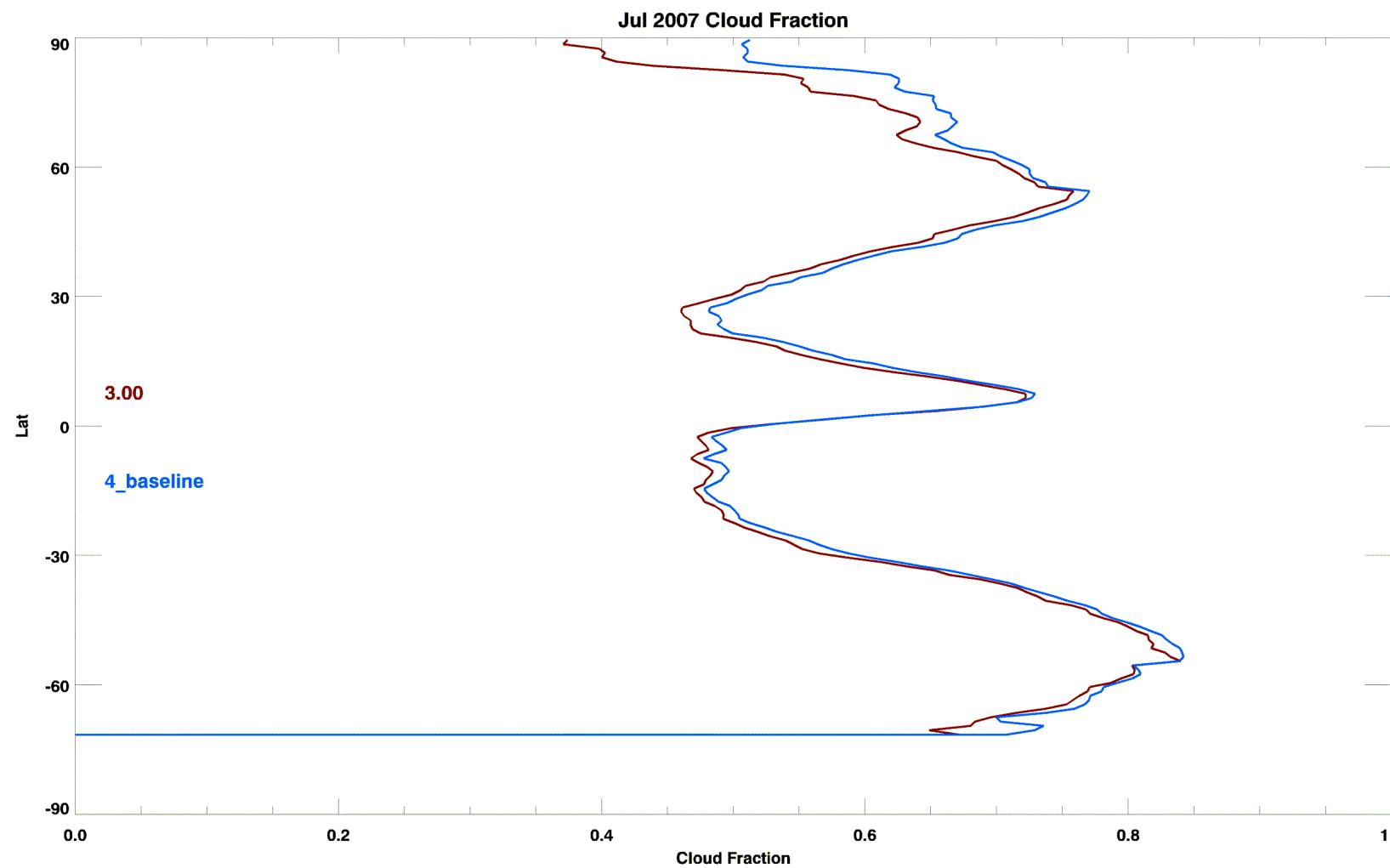


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# Zonal Average Jul 2007 Cloud Fraction

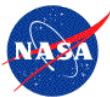
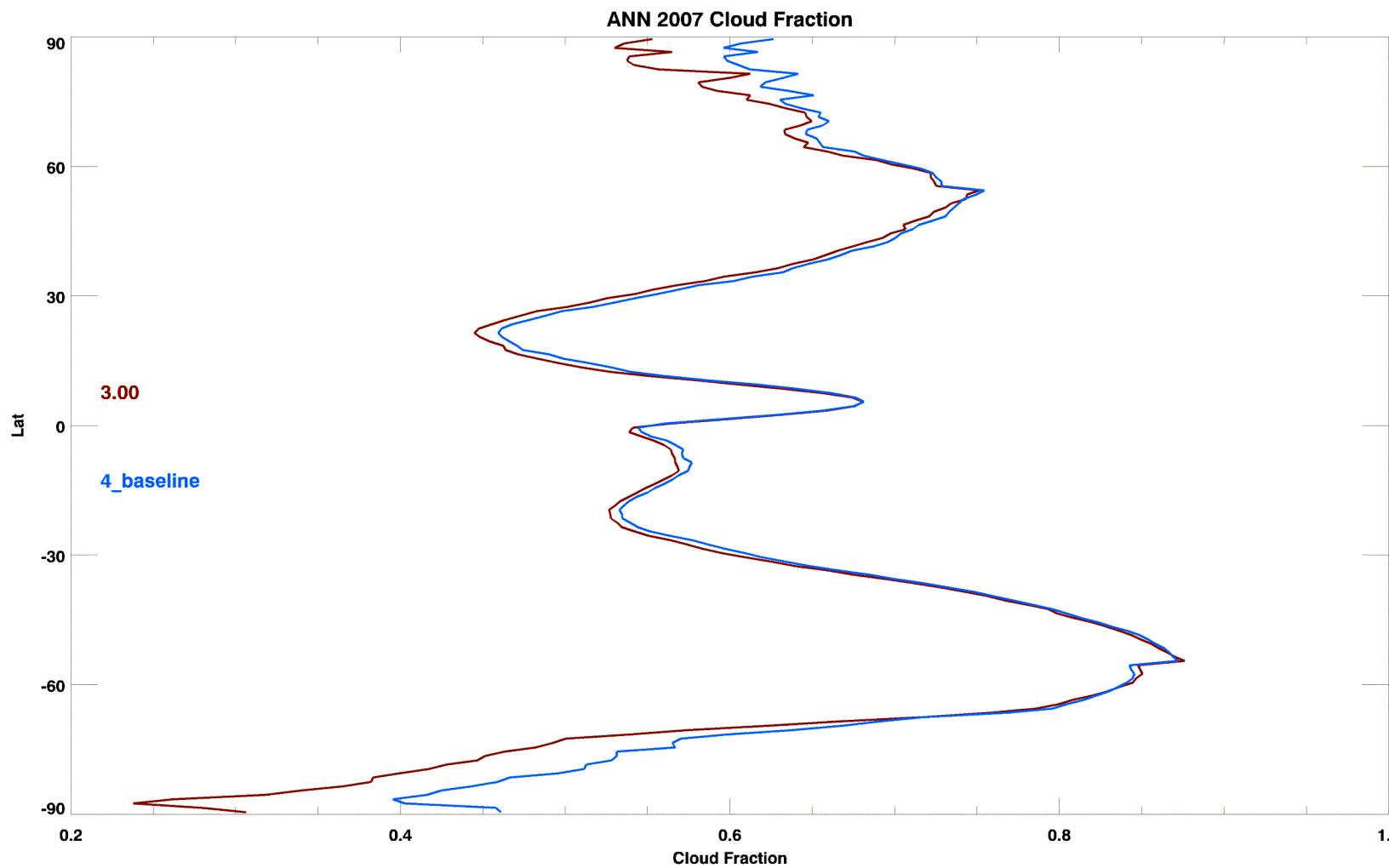


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# Zonal Average Annual Cloud Fraction

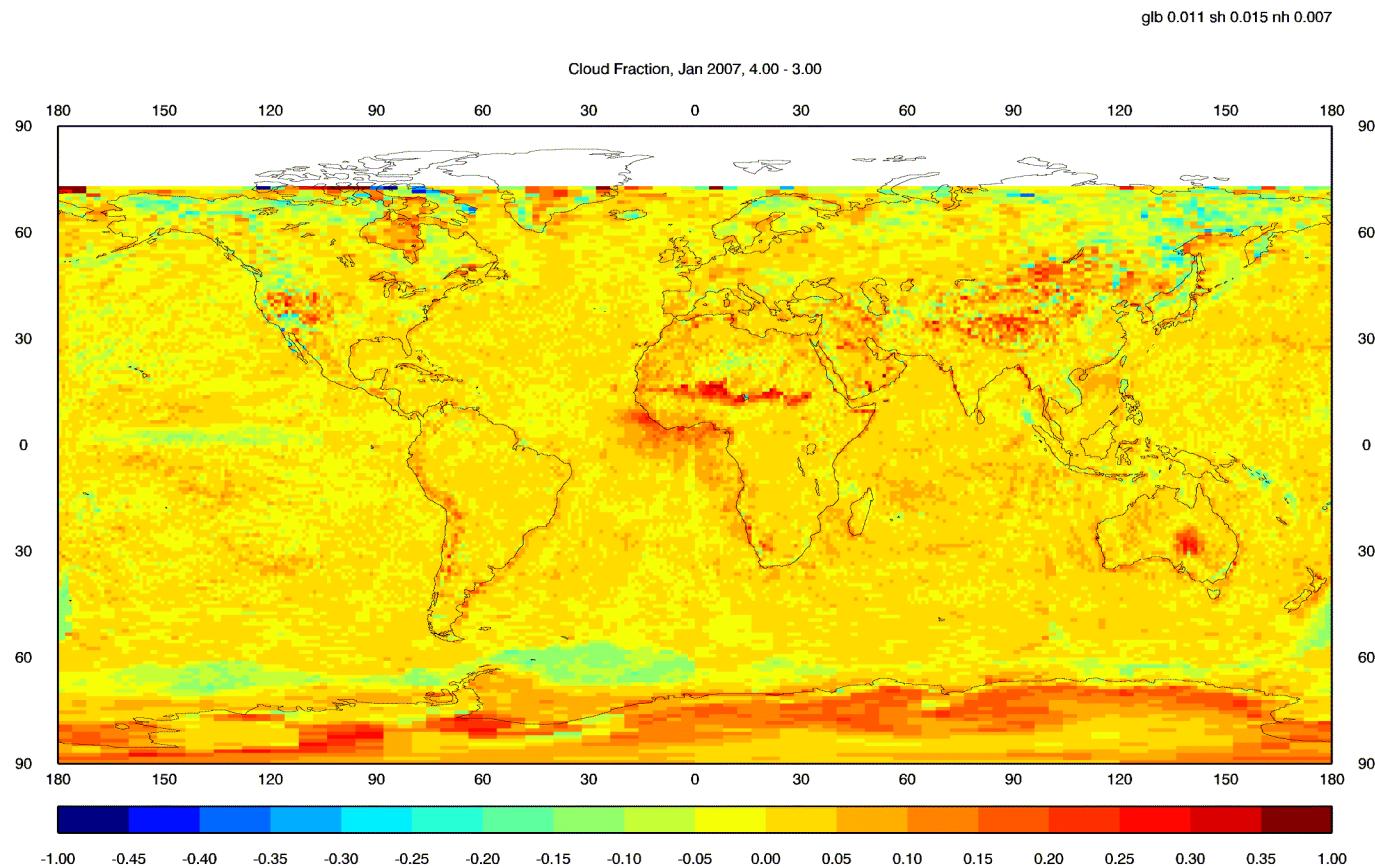


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# January 2007 cloud fraction difference, HXS-DX

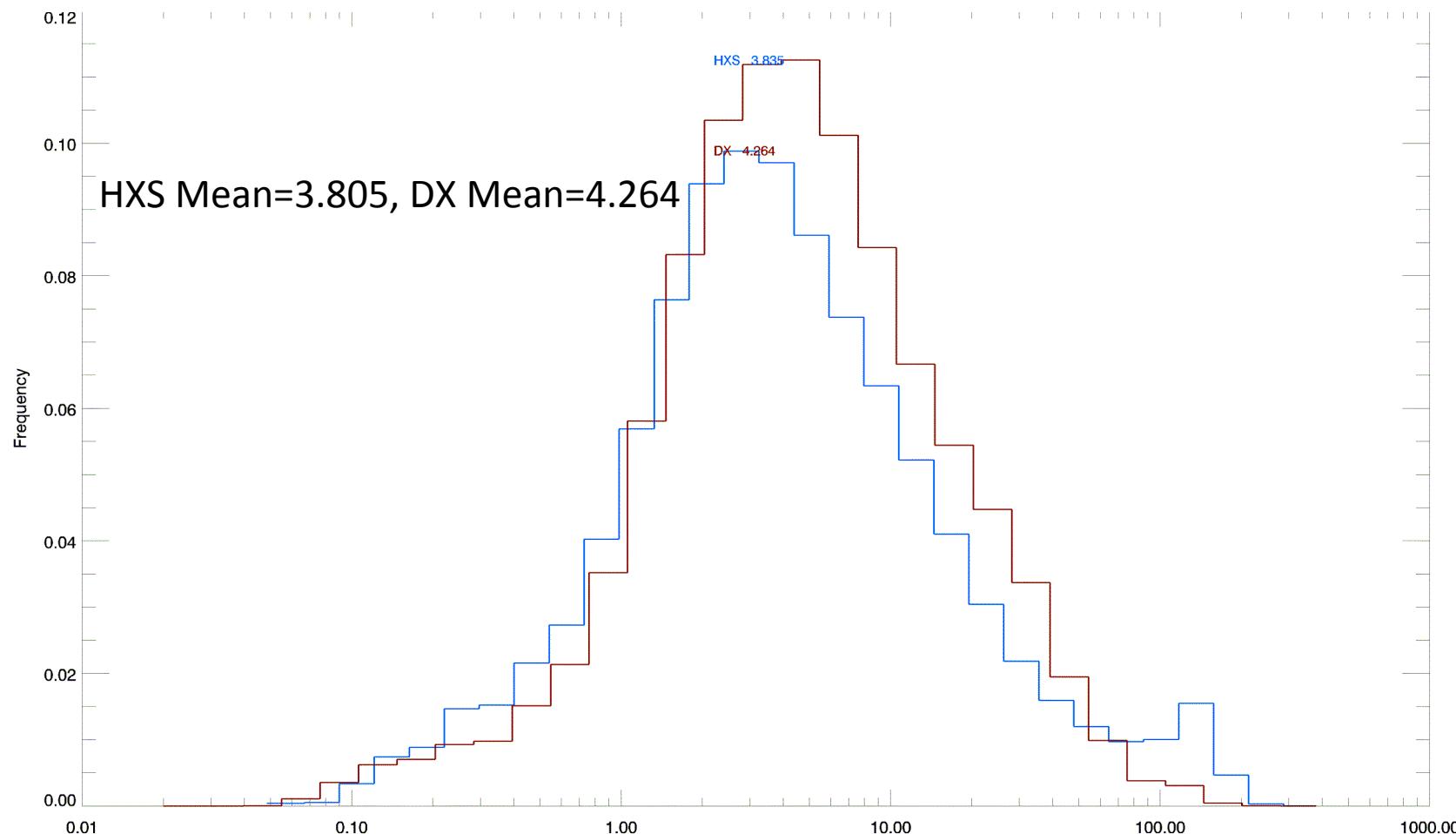


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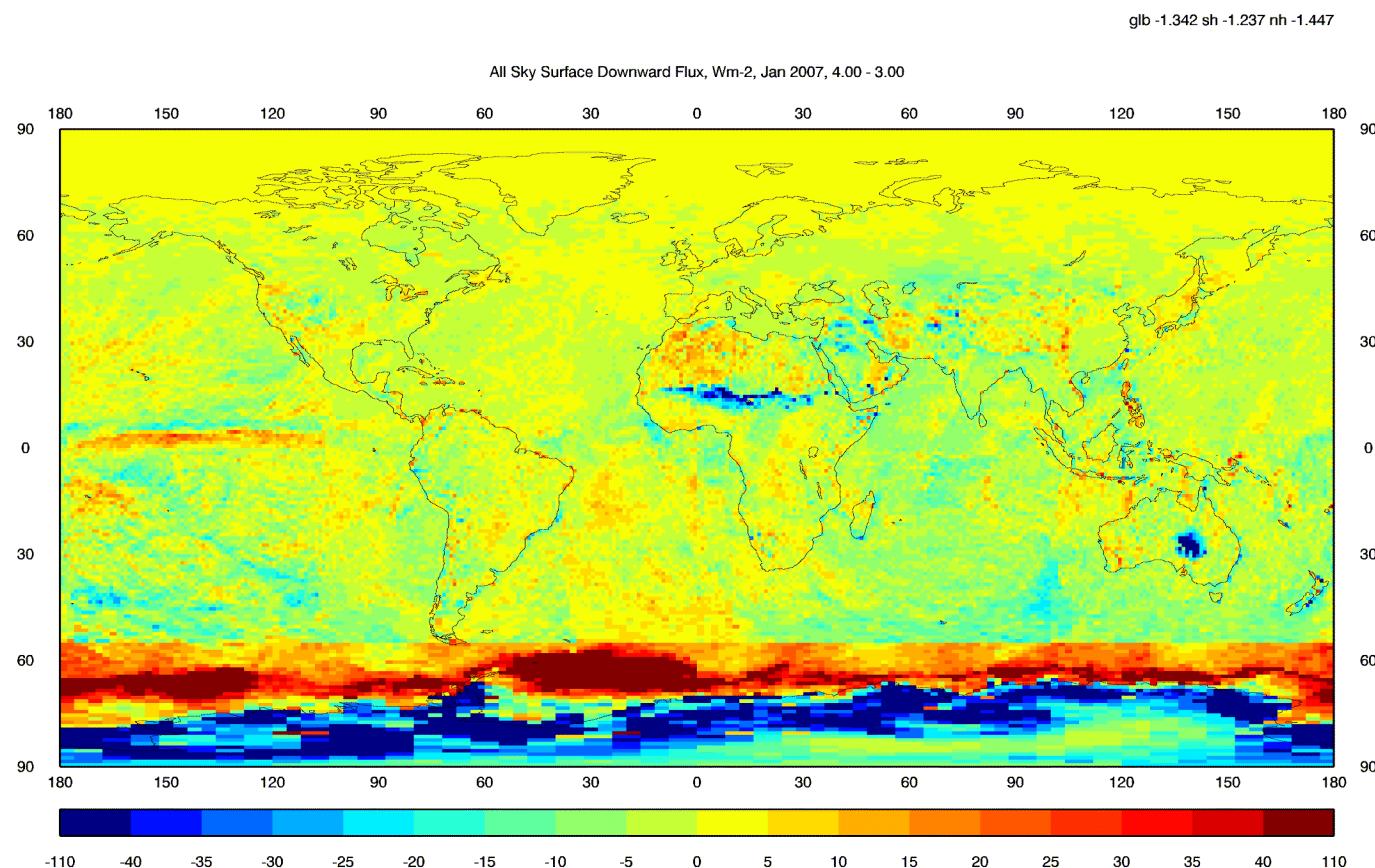
# Log average Cloud Optical Depth, January 2007



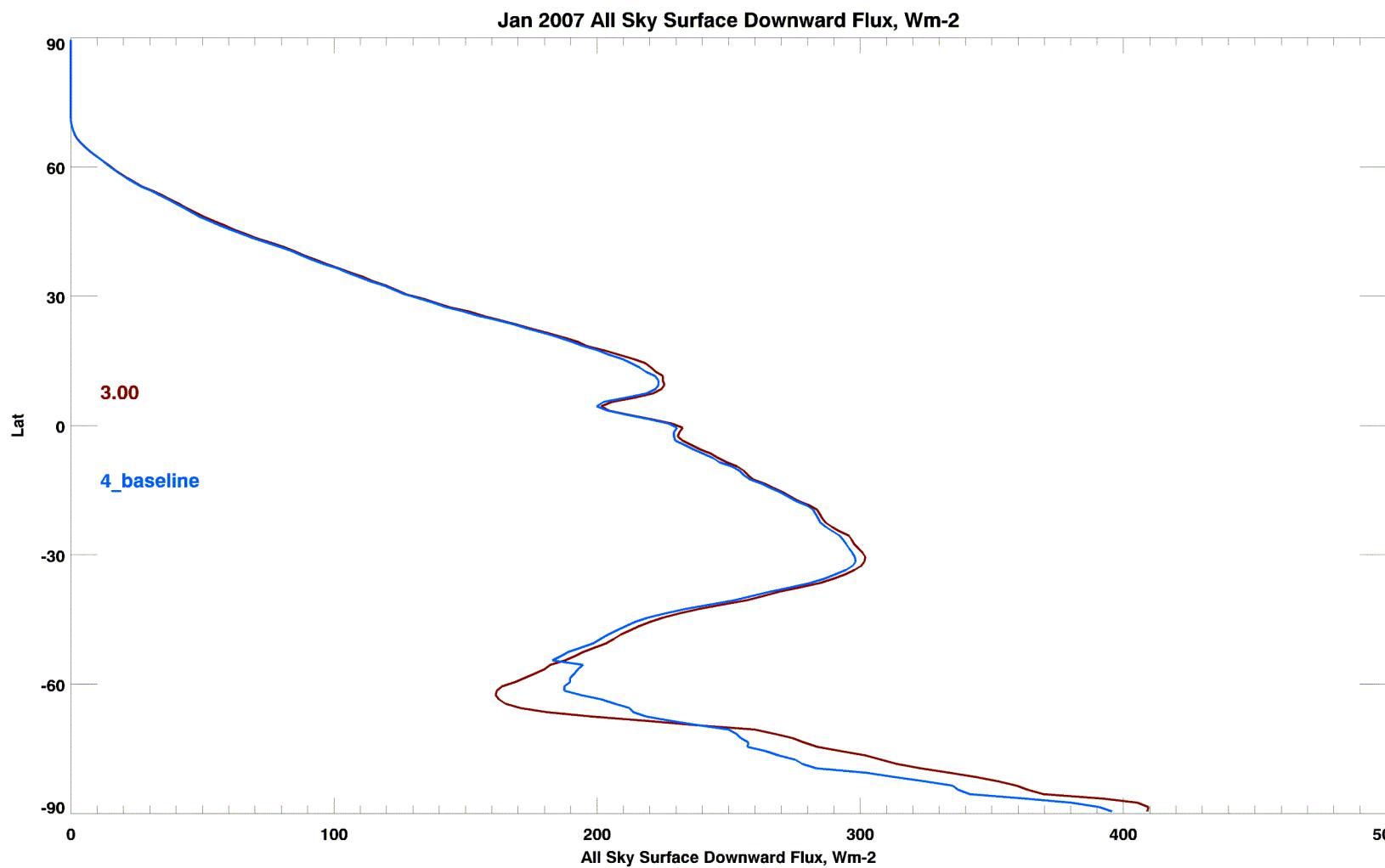
**GEWEX**  
WCRP



# Rel 4\_baseline – Rel3, January 2007, surface down flux



# Zonal Average Surface Downward Flux, Jan 2007

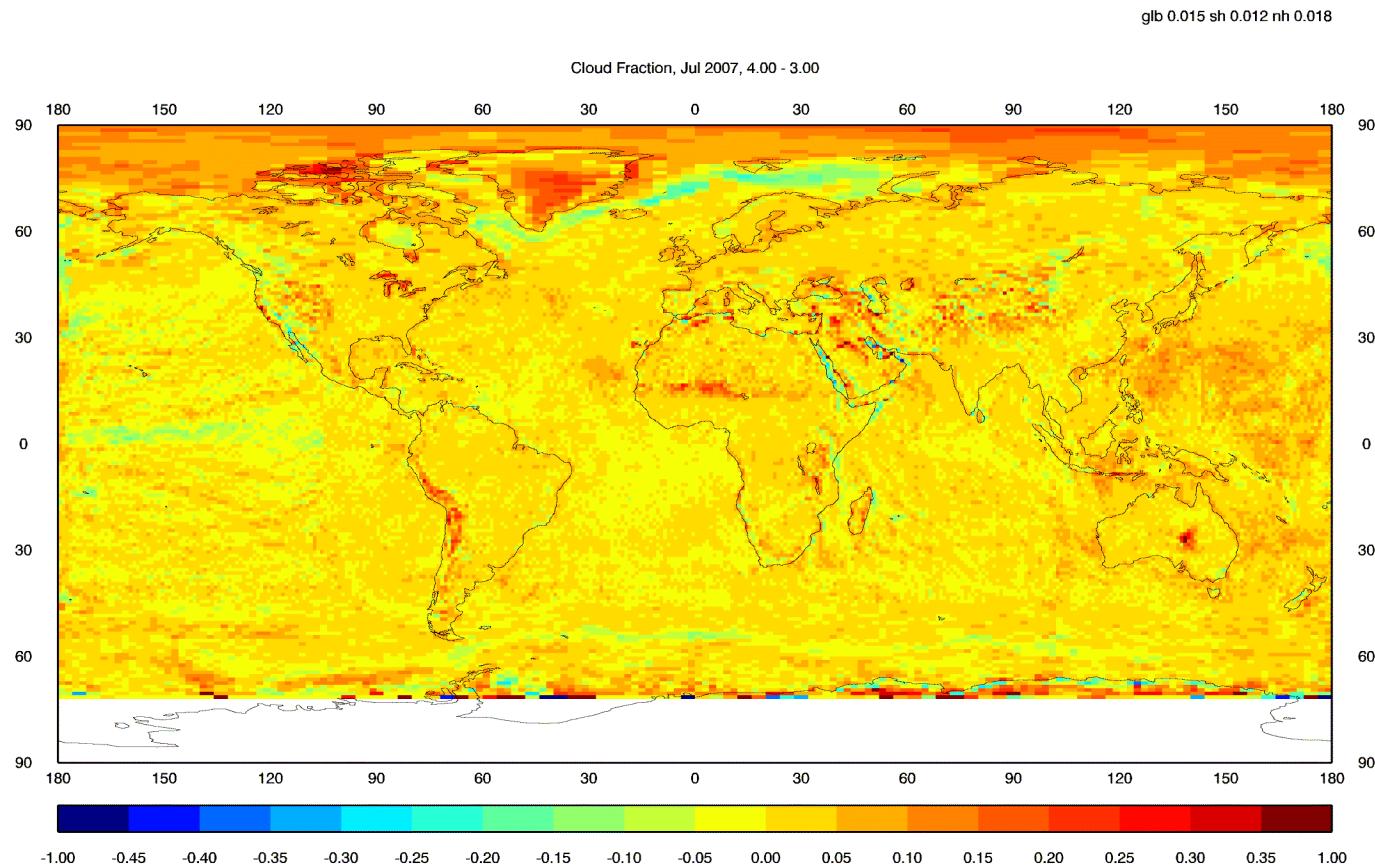


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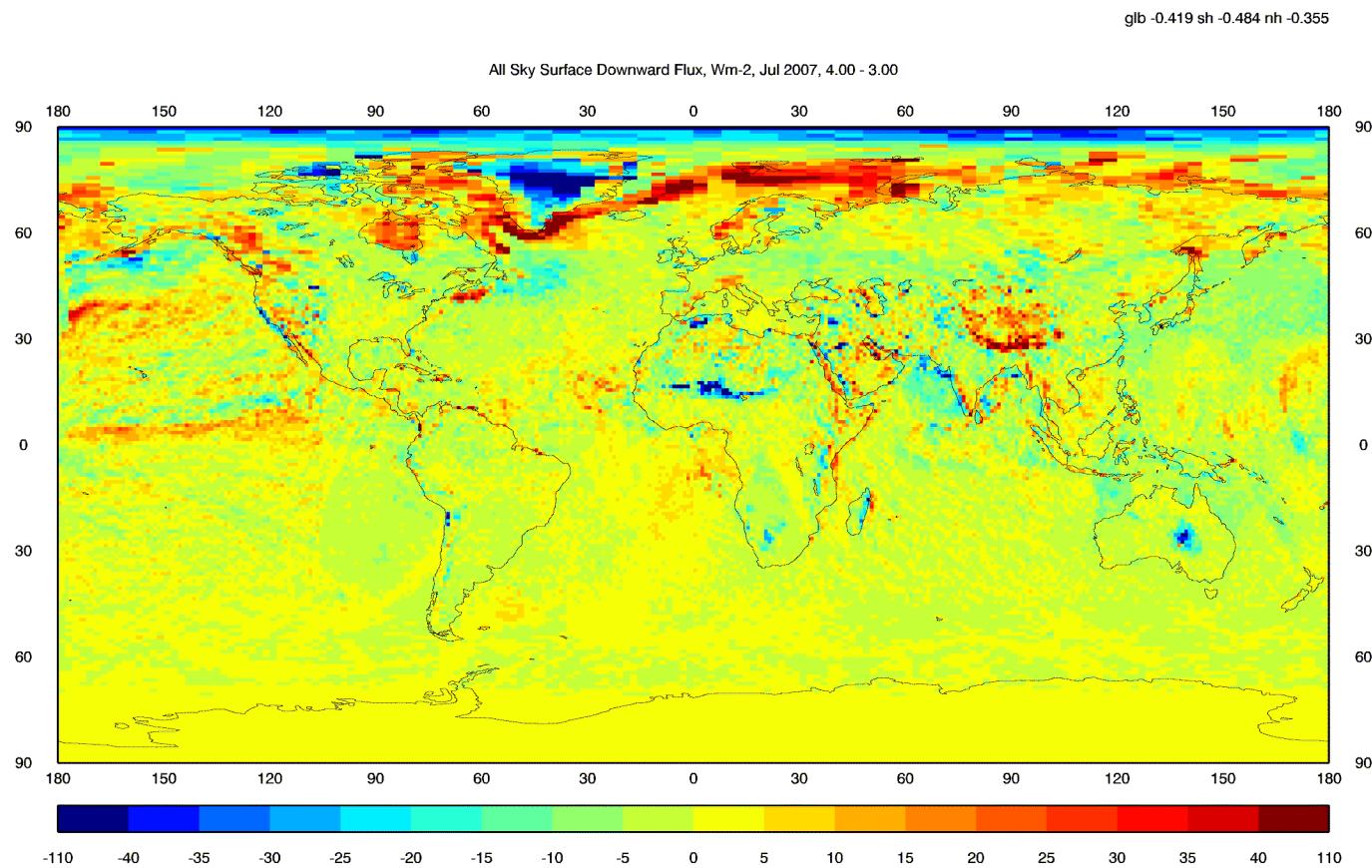
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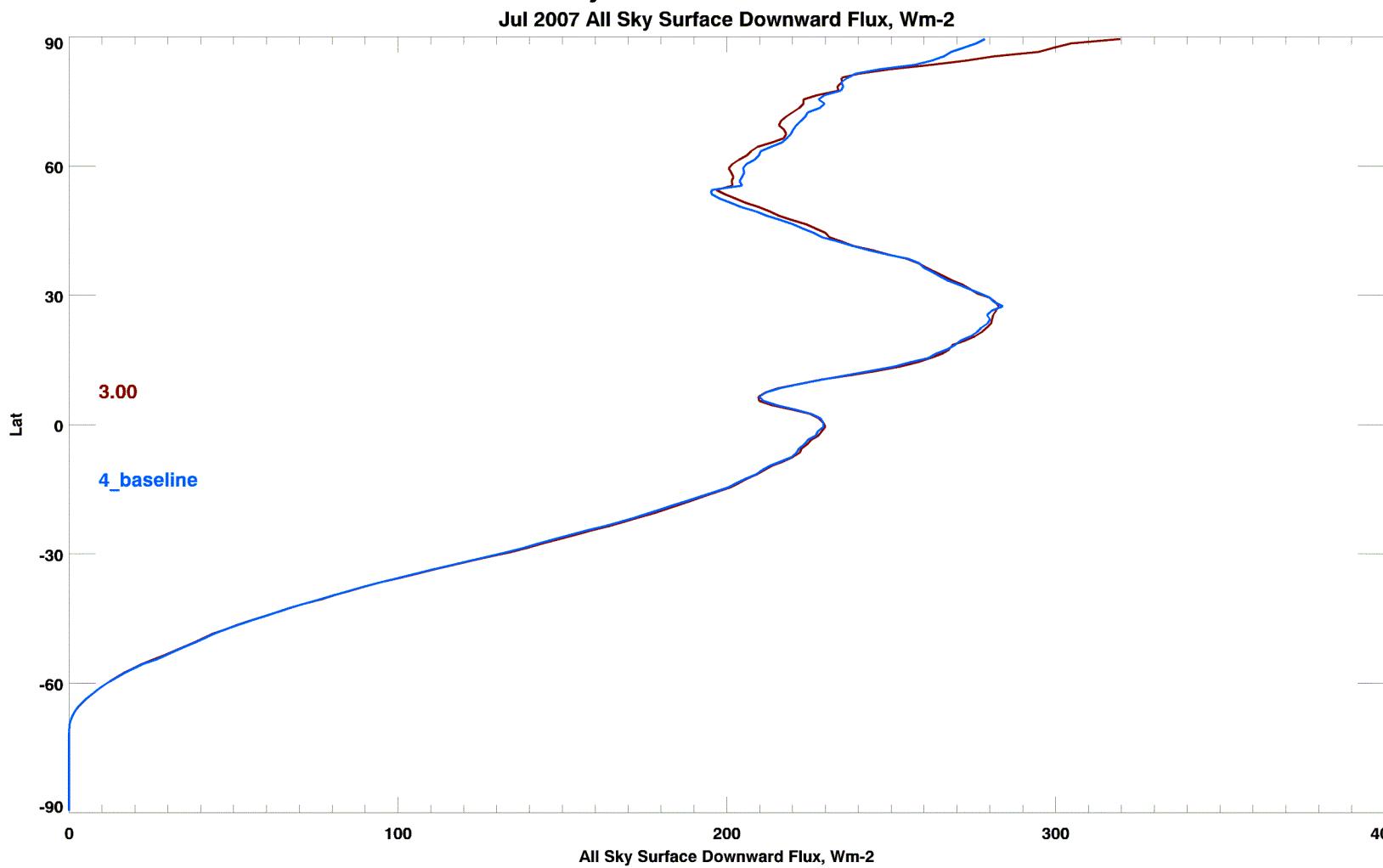
# Jul 2007 cloud fraction difference



# July 2007, surface down flux difference



# Zonal Average Surface Downward Flux, Jul 2007

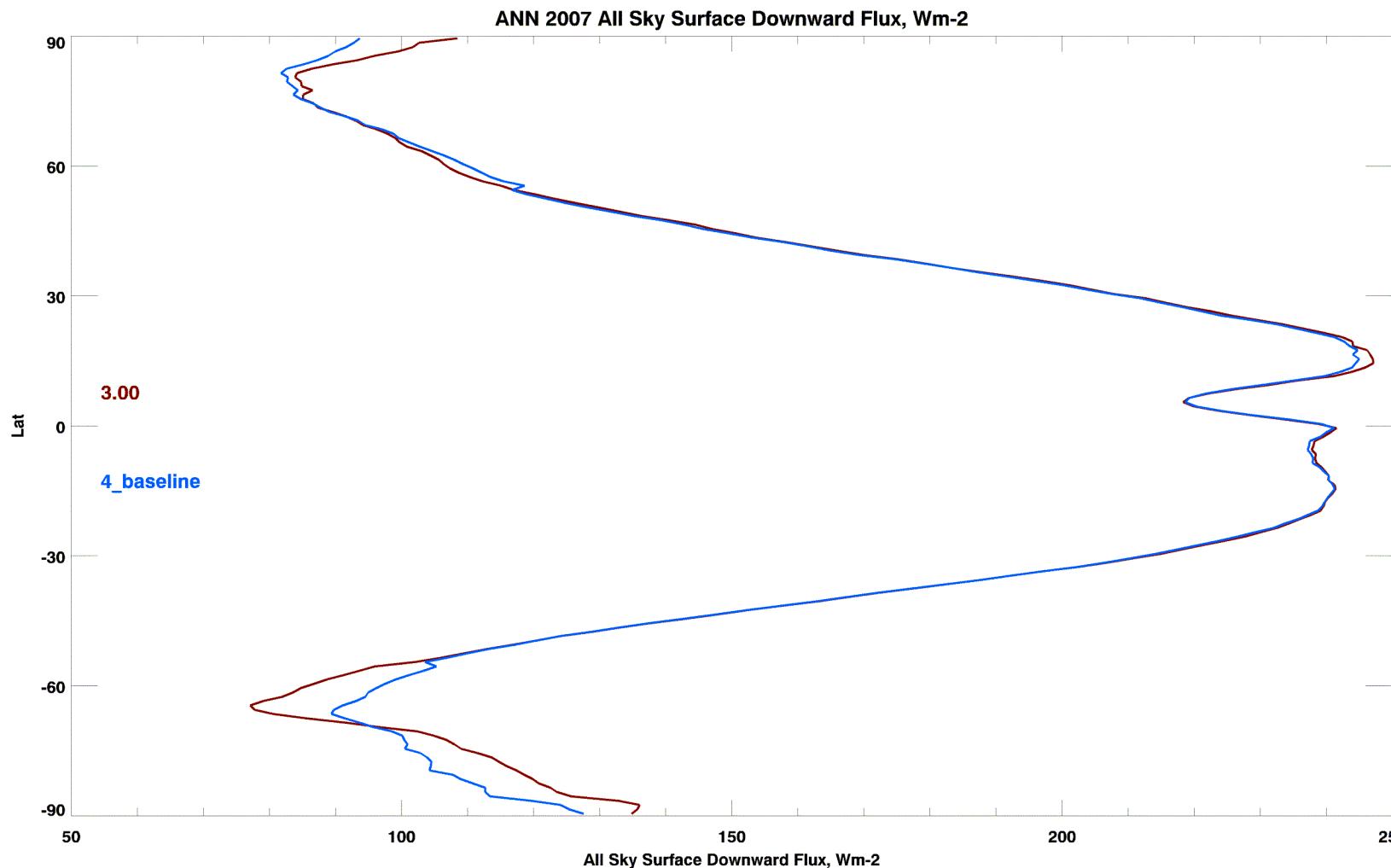


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# Zonal Average Surface Downward Flux, ANN 2007



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# Annual averages, Rel4\_baseline vs Rel3, year 2007

GSW 2007 Annual averages			
Field	Rel3.0	Rel4_baseline	Diff
TOA down	341.832	341.832	0
TOA up	104.355	104.186	-0.168
TOA albedo	0.3267	0.3265	-0.0002
Clr TOA up	55.335	55.721	0.385
Pristine TOA up	51.95	52.154	0.204
Srf down	186.129	186.071	-0.058
Srf up	22.609	22.373	-0.236
Srf albedo	0.1305	0.1322	0.0016
Clr srf down	247.661	246.785	-0.876
Diffuse srf down	104.071	105.796	1.726
Pristine srf down	258.522	258.473	-0.049
Atm abs	73.958	73.948	-0.0099
Cld frac	0.6235	0.6334	0.00985
Cld tau	17.222	15.824	-1.398
Cloud rad forcing	-61.533	-60.715	0.8177
Aerosol tau	0.1866	0.2042	0.0176



# Monthly averages Rel4\_baseline vs Rel3, 2007

	January 2007			July 2007		
	Rel 3	Rel4_base	Difference	Rel3	Rel4_base	Difference
Surface Down	189.18	187.84	-1.34	181.41	180.99	-0.45
Surface Up	24.41	24.23	-0.18	20.86	20.58	-0.28
Surface albedo	0.129	0.129	0	0.115	0.114	-0.001
TOA up	113.14	114.13	0.99	96.43	96.60	0.17
TOA albedo	0.337	0.341	0.004	0.308	0.309	0.001

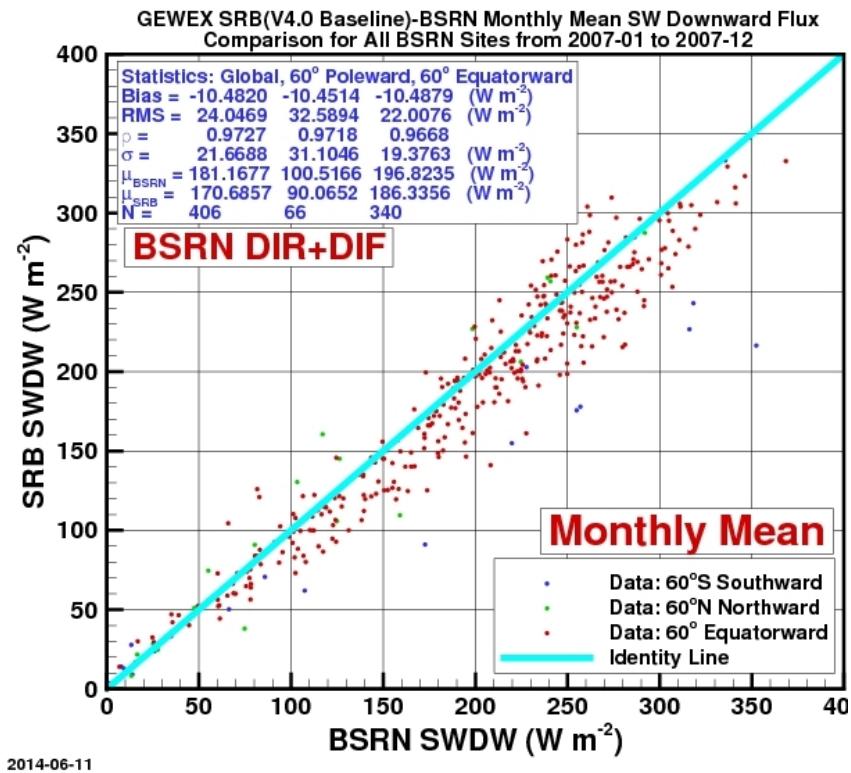
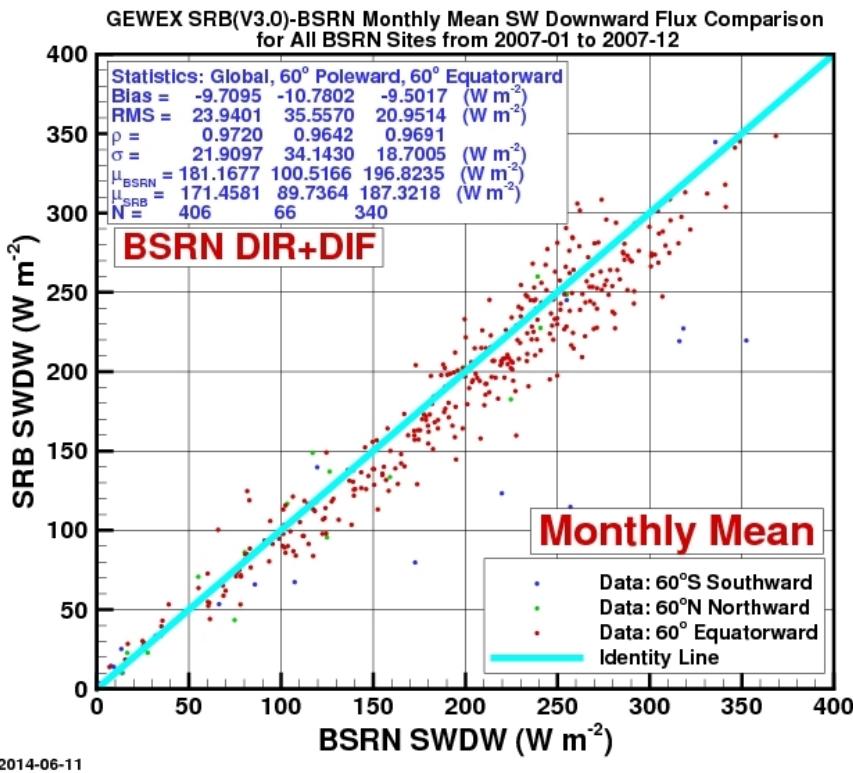


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# Monthly validation against BSRN

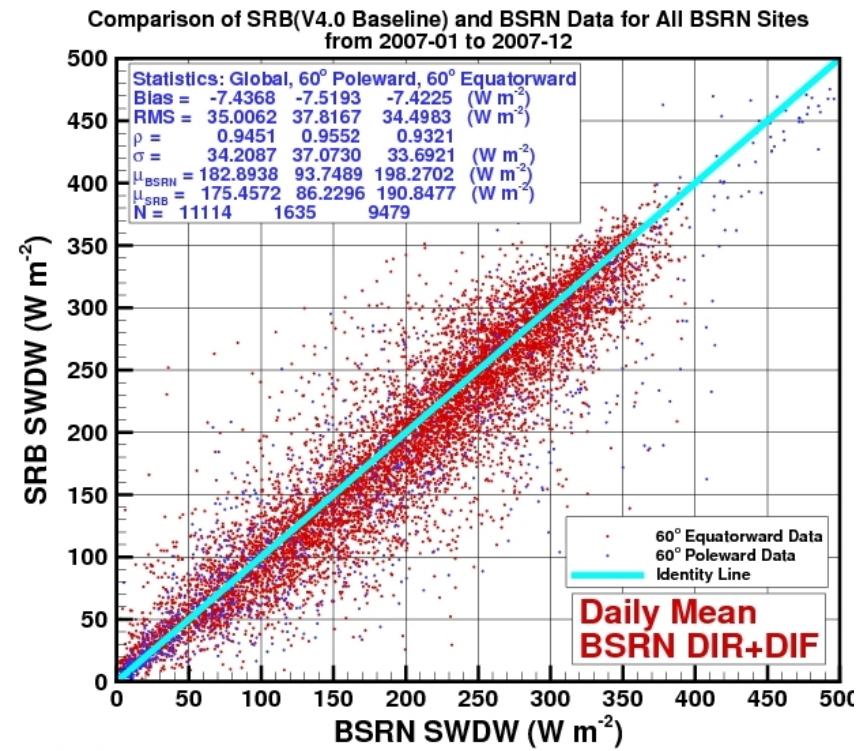
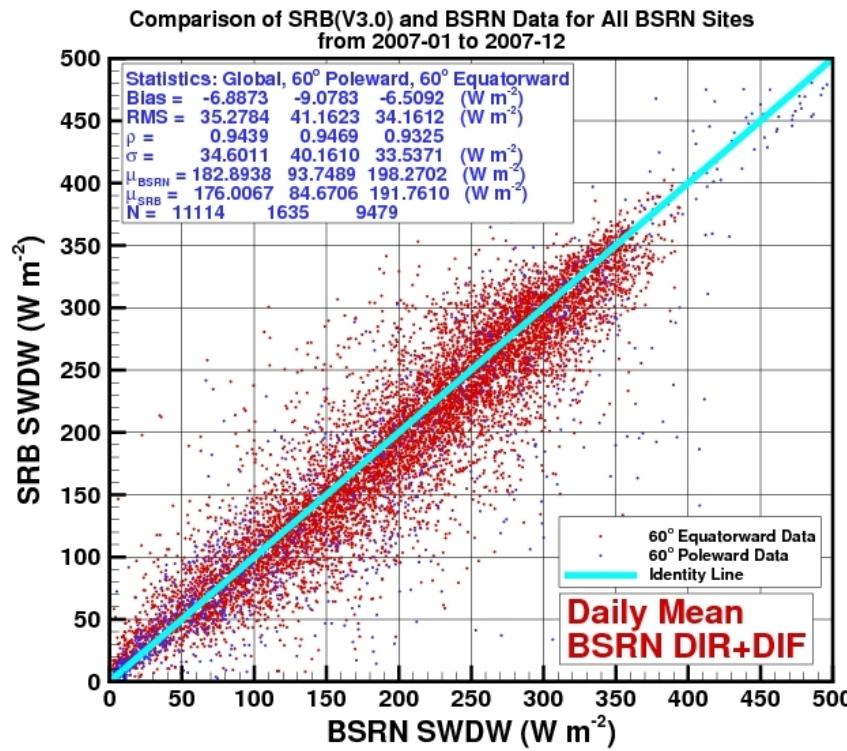


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# Daily validation against BSRN

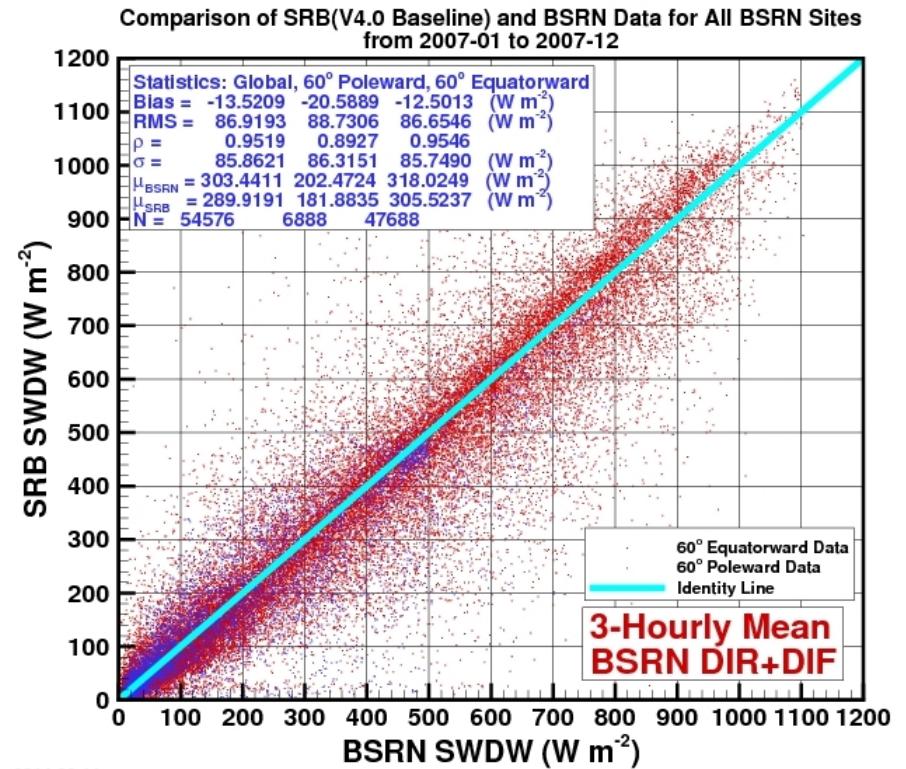
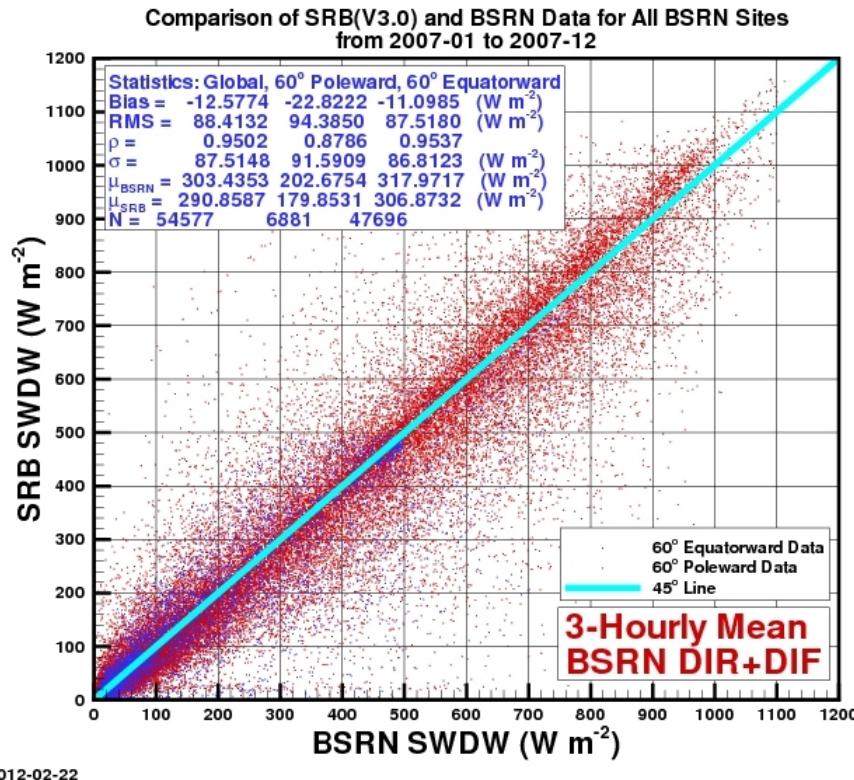


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# 3-hourly validation against BSRN



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# Discussion

- ISCCP HXS recalibration produces considerably more cloud over ice surfaces
- Also more clouds over deserts and mountains
- These differences drive SRB surface shortwave fluxes lower in areas of increased cloud
- Global average differences are small
- Bias and RMS numbers vs BSRN are improved in polar regions, worsened slightly elsewhere



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# Improvements to come: Release 4.0

- 5 bands improves to 18, all new radiative lookup tables based on Fu-Liou
- Variable aerosol composition based on Max-Planck Aerosol Climatology (with historical anthropogenic estimates)
- Ice cloud and water cloud differentiation
- To be released late 2014 or early 2015, depending on ISCCP delivery



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# Backup slides



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# NASA/GEWEX SRB: Overview

The energetic interaction between the atmosphere and the earth-surface is the key interface for climate and life.

3-Hourly Global  
Clouds & Surface

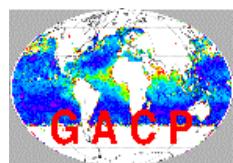


Global,  $1^{\circ} \times 1^{\circ}$ ,  
3-Hourly  
Surface  
Radiation

6-Hourly Global  
Meteorology



Global Aerosols  
& Smoke

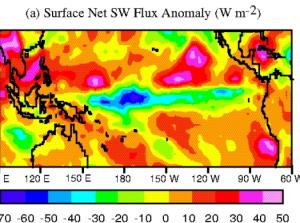


Atmospheric and Oceanic  
Climate and Weather Models  
(3-hourly, daily, monthly)

Global Surface Hydrology  
(Monthly 3-hourly, Monthly)



Regional Inter- and  
Intra-annual variability  
(monthly, monthly 3-hourly)



NASA Applications  
Renewable Energy



Radiation and Aerosols  
Branch, Atmospheric Sciences  
NASA Langley Research Center

**GEWEX**  
WCRP //

