

**Development of MODIS-CERES NB  
to BB Radiance Regressions For Use  
in Aerosol Radiative Forcing Studies**

# MOTIVATION

Develop and use pre-defined NB to BB radiance regression coefficients together with MODIS radiances and CERES ADMs to generate radiative fluxes for aerosol forcing studies.

# METHODOLOGY

- CERES SSF Data
  - MODIS radiances (0.63, 1.64, 0.86  $\mu\text{m}$  channels) - clear portion
  - Cloud-free Broadband FAPS over ocean (use CERES cloud mask)
  - March 2000 - December 2003
- Formulation of Regressions
  - multi-channel regression fits

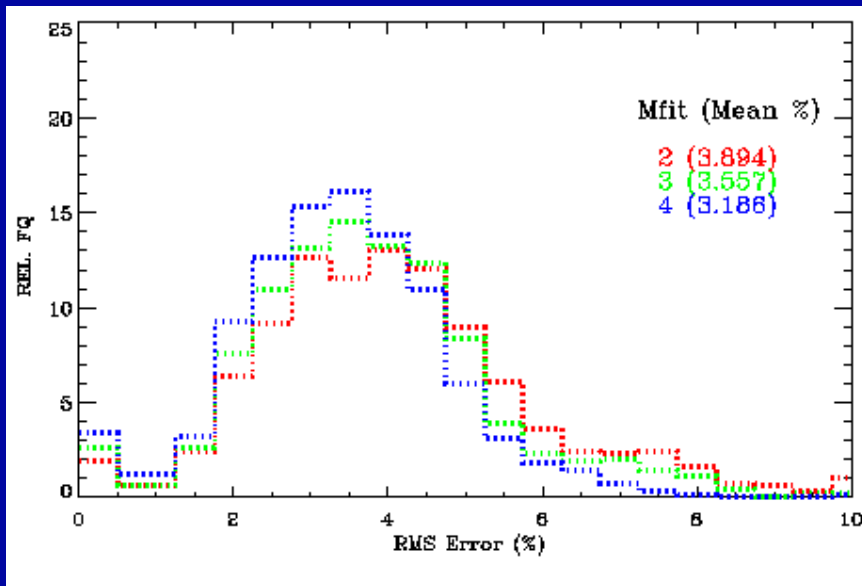
$$BB = a_0 + a_1 * I(0.63) + a_2 * I(1.64) + a_3 * I(0.86)$$

- function of viewing geometry  $\rightarrow \Delta\text{SZA}=10^\circ, \Delta\text{VZA}=10^\circ, \Delta\text{RAZ}=20^\circ$
- independent of  $\tau_{\text{aer}}$
- Monthly Sets of regression coefficients
- Sun glint, imager coverage  $> 99.9\%$ , surface area coverage = 100%

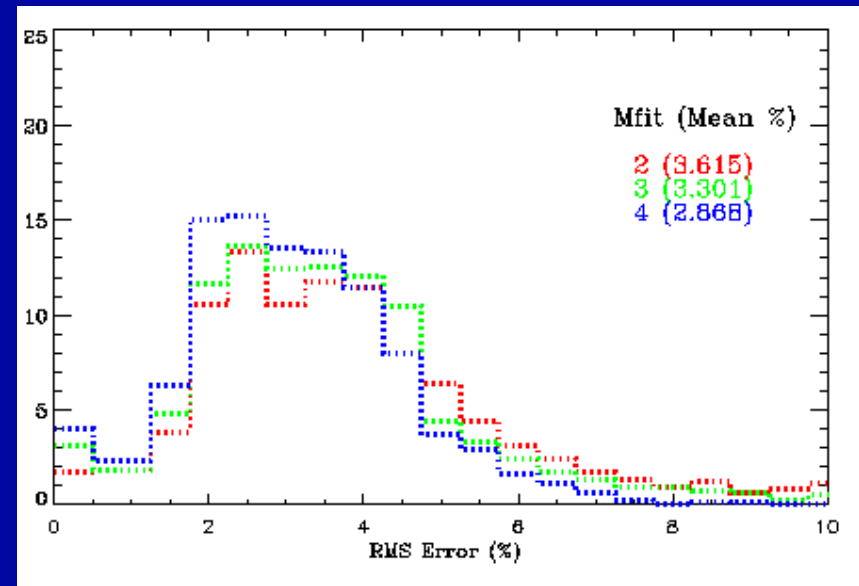
# Summary of Work and Results

- Bias and RMS Errors are presented relative to the mean CERES BB radiance.
- Monthly NB-BB regression coefficients were developed to account for seasonal variations.
- Instantaneous broadband radiances can be determined with an accuracy of 2-5% using the NB-BB regression coefficients.

# FQ of RMS Errors (Relative to Mean BB Radiance) For NB-BB Regressions for 2001-02

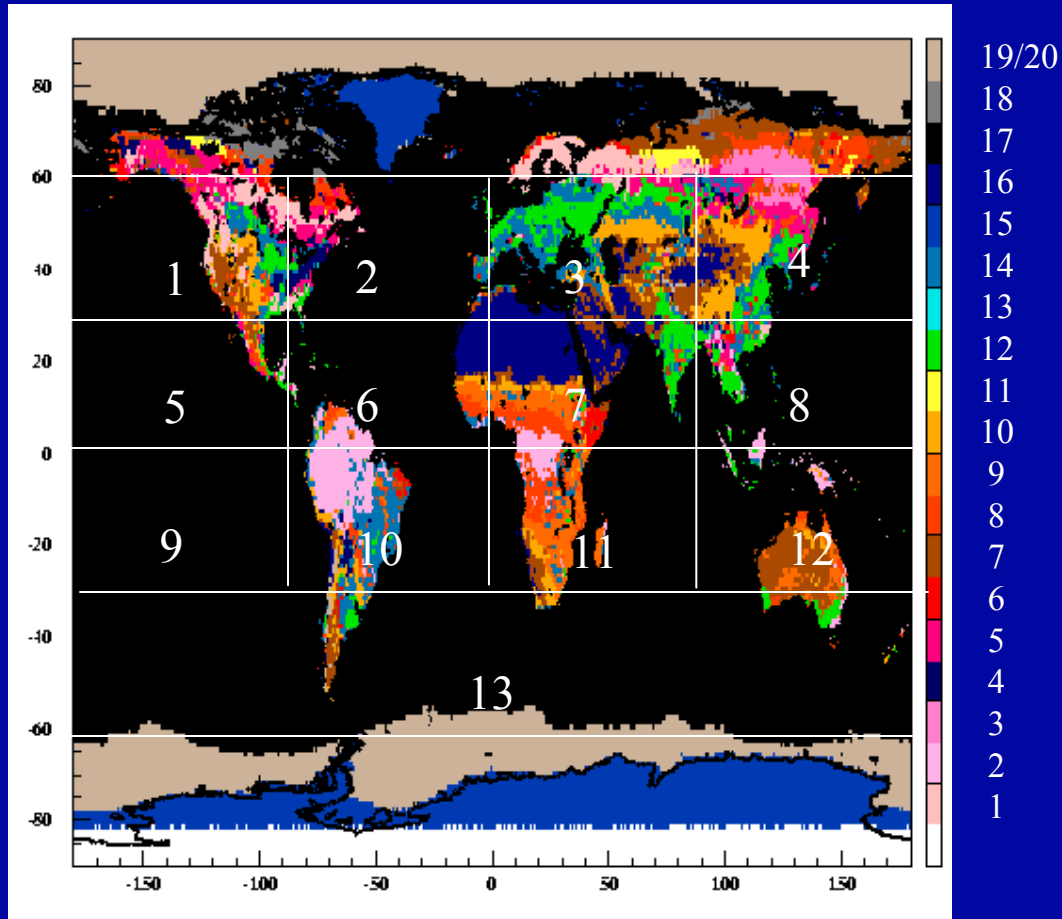


2001

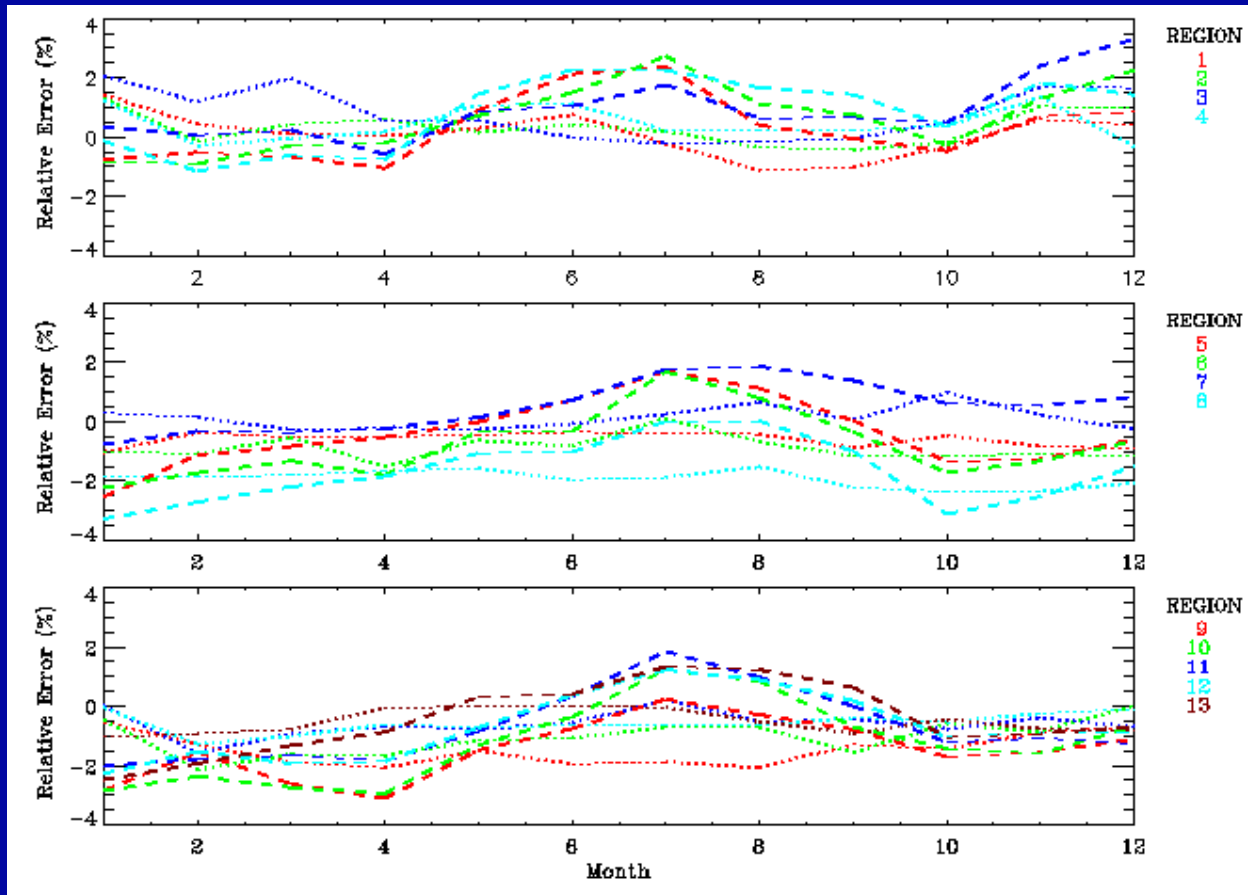


2002

# STRATIFICATION BY REGION

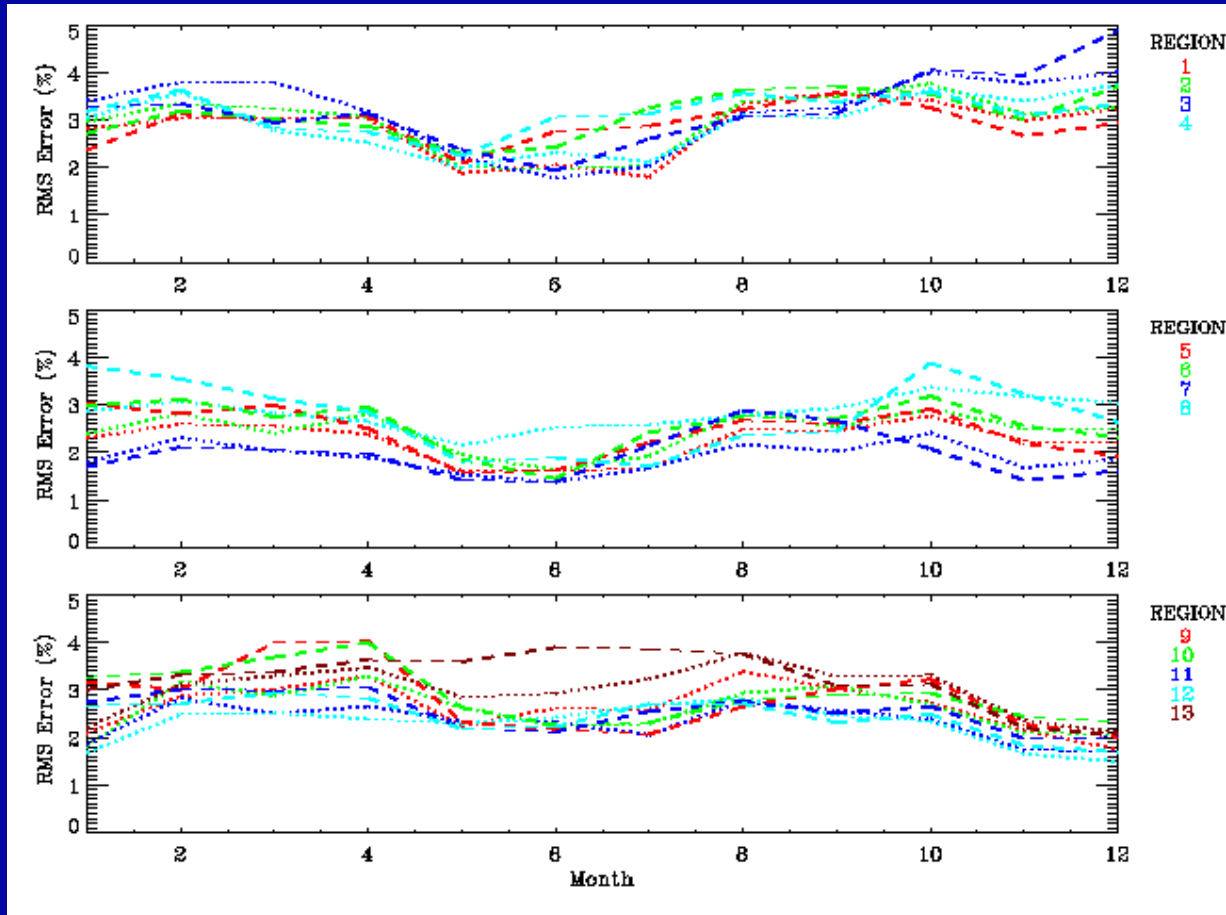


# Regional Relative Errors for 2001 (Monthly vs. One-Year NB-BB Regression)



..... Monthly  
----- 1-Year

# Regional RMS Errors for 2001 (Monthly vs. One-Year NB-BB Regression)



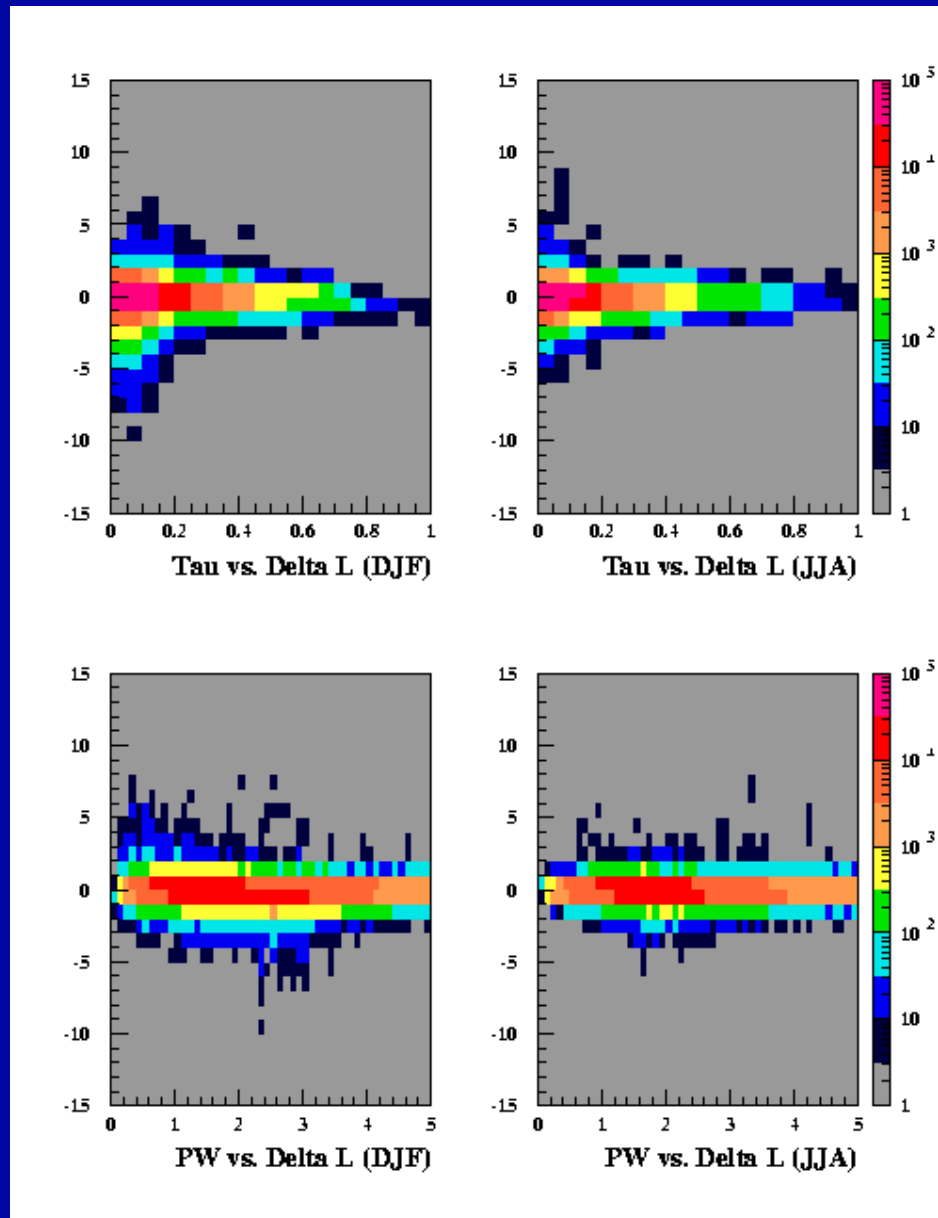
..... Monthly  
----- 1-Year



## Dependence on PW and $\tau_{\text{aer}}$ (Summary Continued)

- Although the regression coefficients were not developed as a function of aerosol optical depths (insufficient dynamic range to define regressions), there doesn't appear to be a systematic dependence of the errors on  $\tau_{\text{aer}}$ .
- There also does not appear to be a dependence on PW.

# Instantaneous $\Delta L_{SW}$ (BB Estimate - CERES) vs. $\tau_{aer}$ and PW



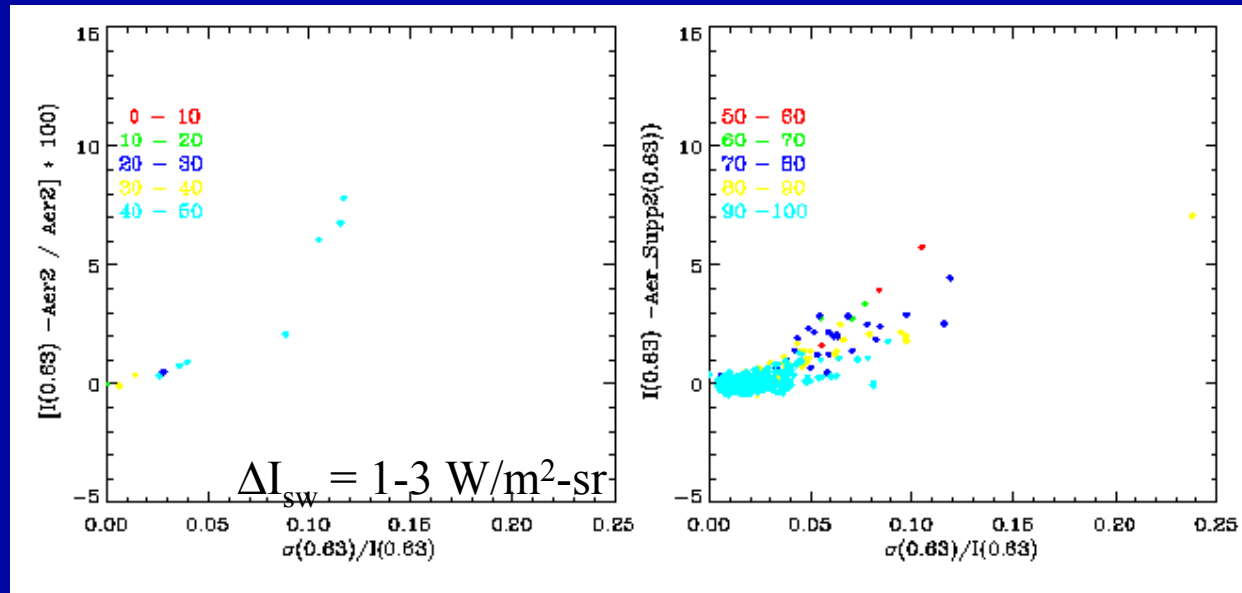
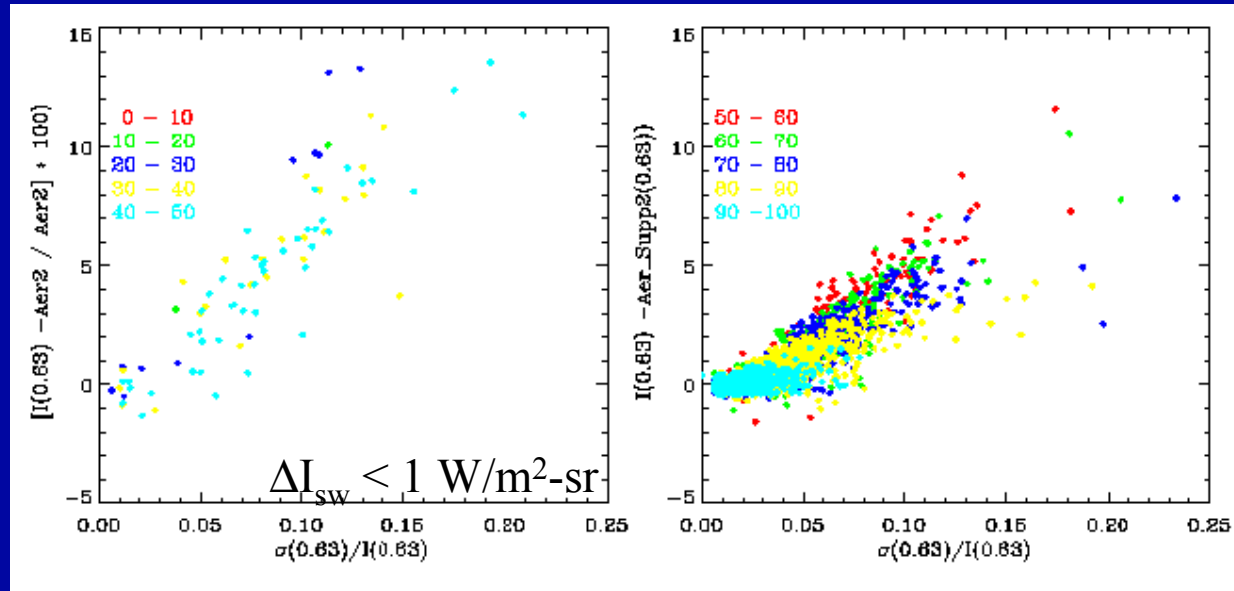
# MODIS - Ignatov/Stowe Cloud Mask Comparisons

## (Summary Continued)

- $[I(0.63) - I(\text{IgnSt}:0.63) / I(\text{IgnSt}:0.63)]$  vs.  $\sigma(0.63)/I(0.63)$   
for FOVs that have been identified as cloud free by  
the CERES cloud mask

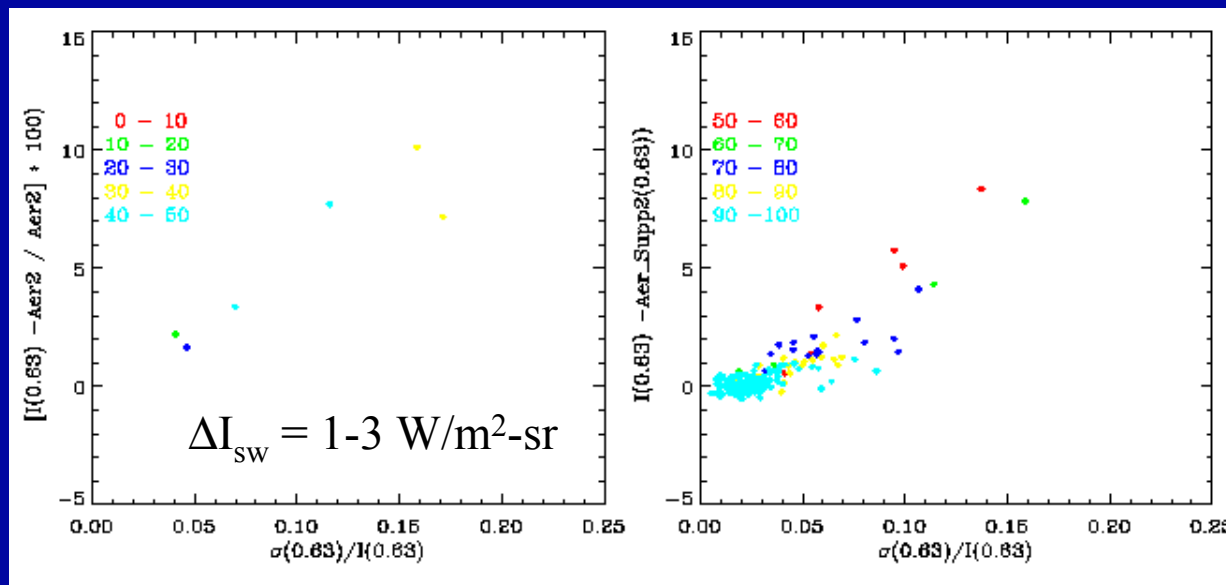
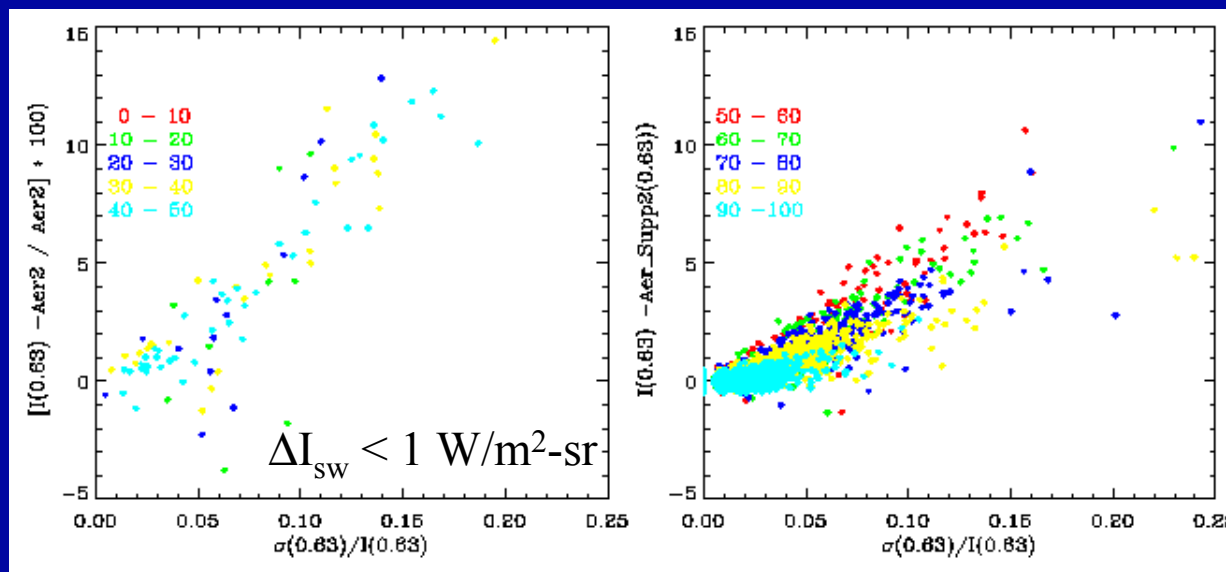
# $[(I(0.63) - \text{Aero\_supp}_2) / \text{Aero\_supp}_2] \times 100\%$ vs. $\sigma(0.63) / I(0.63)$

February 2001



# $[(I(0.63) - \text{Aero\_supp}_2)/\text{Aero\_supp}_2] \times 100\%$ vs. $\sigma(0.63)/I(0.63)$

August 2000

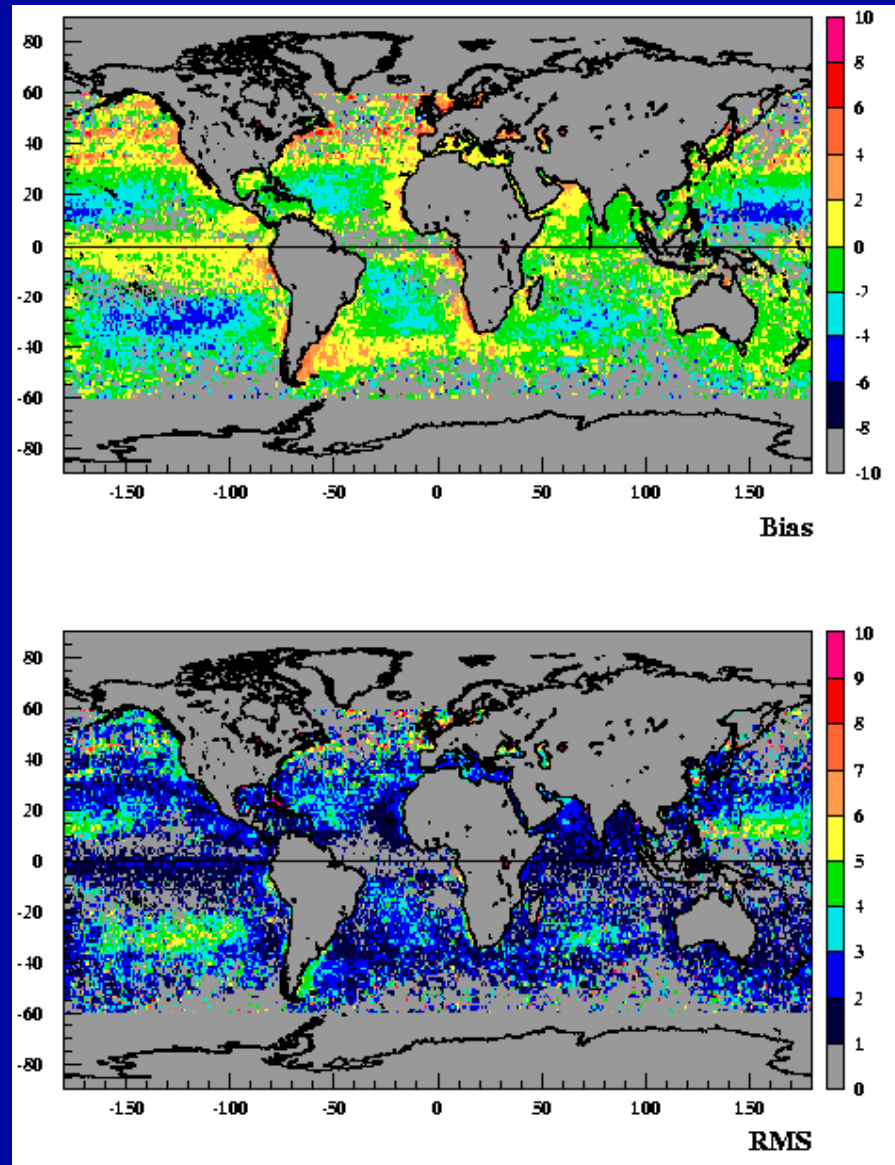


# Regional Relative Bias/RMS Errors

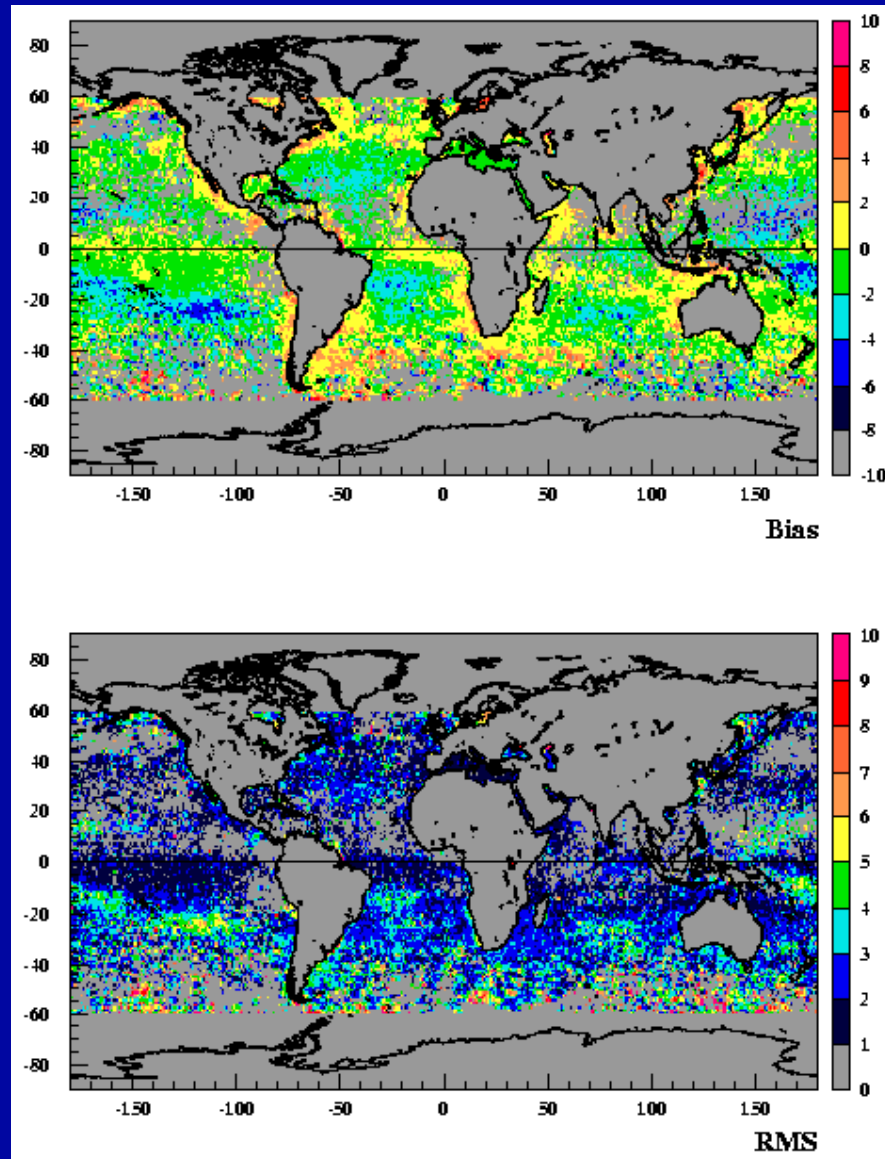
## (Summary Continued)

- To increase the accuracy of the estimated radiances, radiances were interpolated from adjacent bins while applying the regression coefficients at the corresponding adjacent bins. Additionally, a sampling constraint ( $N > 10$ ) is implemented when using the NB-BB coefficients to estimate BB radiances.

# Radiance Relative Bias and RMS Errors for DJF 2000-01

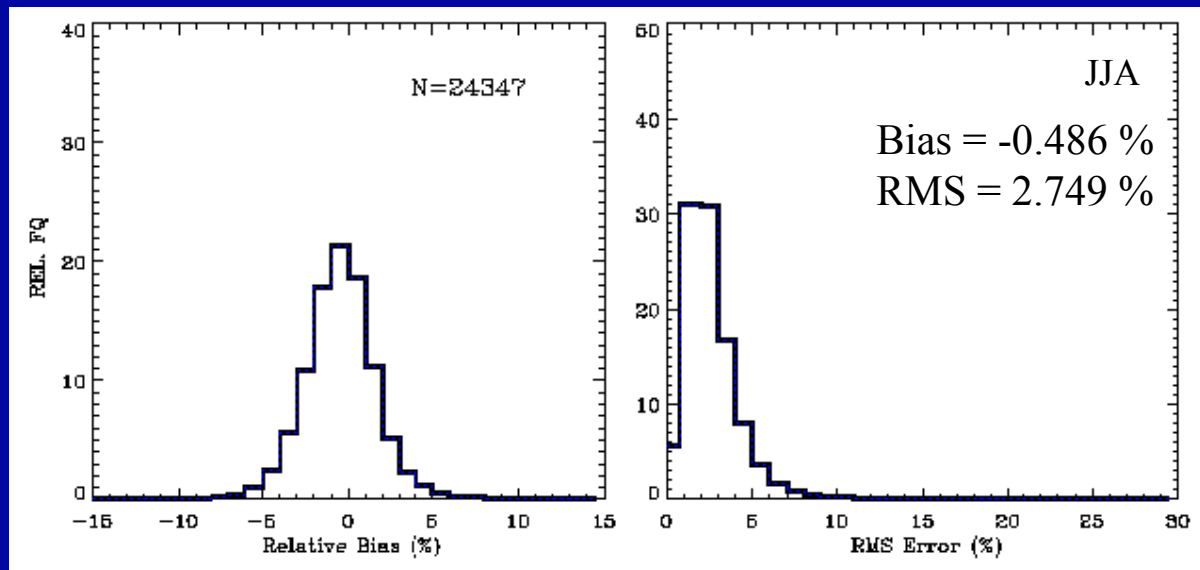
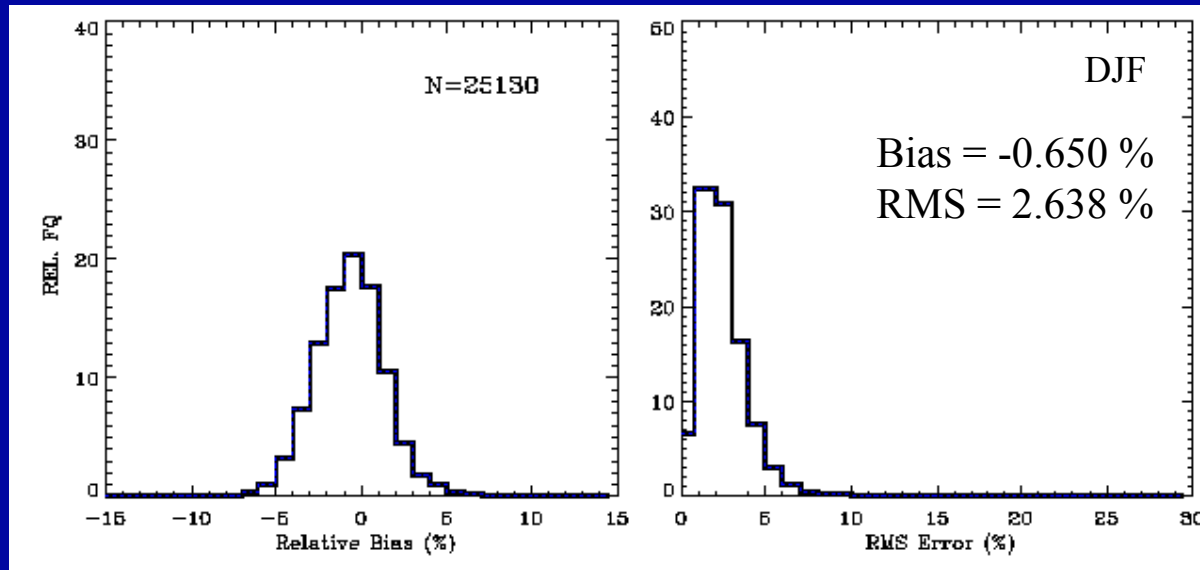


# Radiance Relative Bias and RMS Errors for JJA 2000

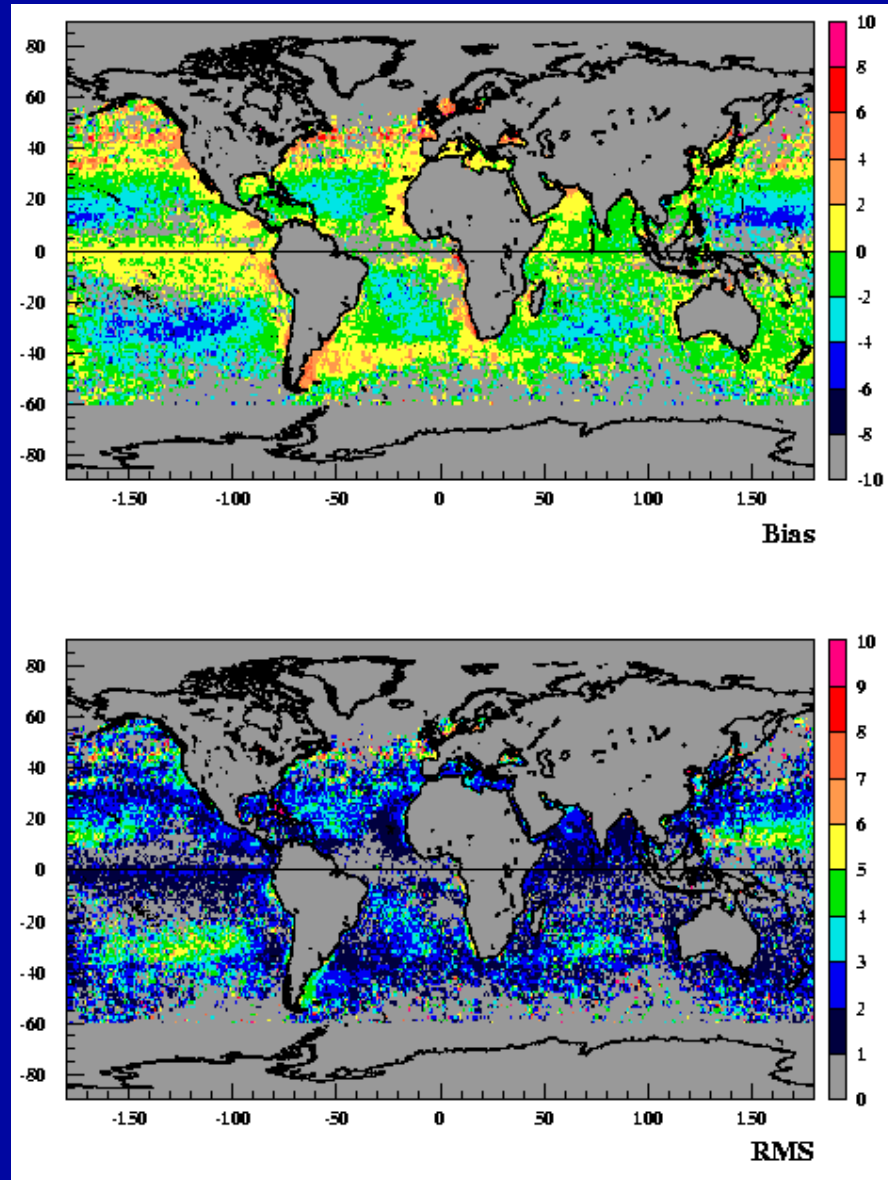




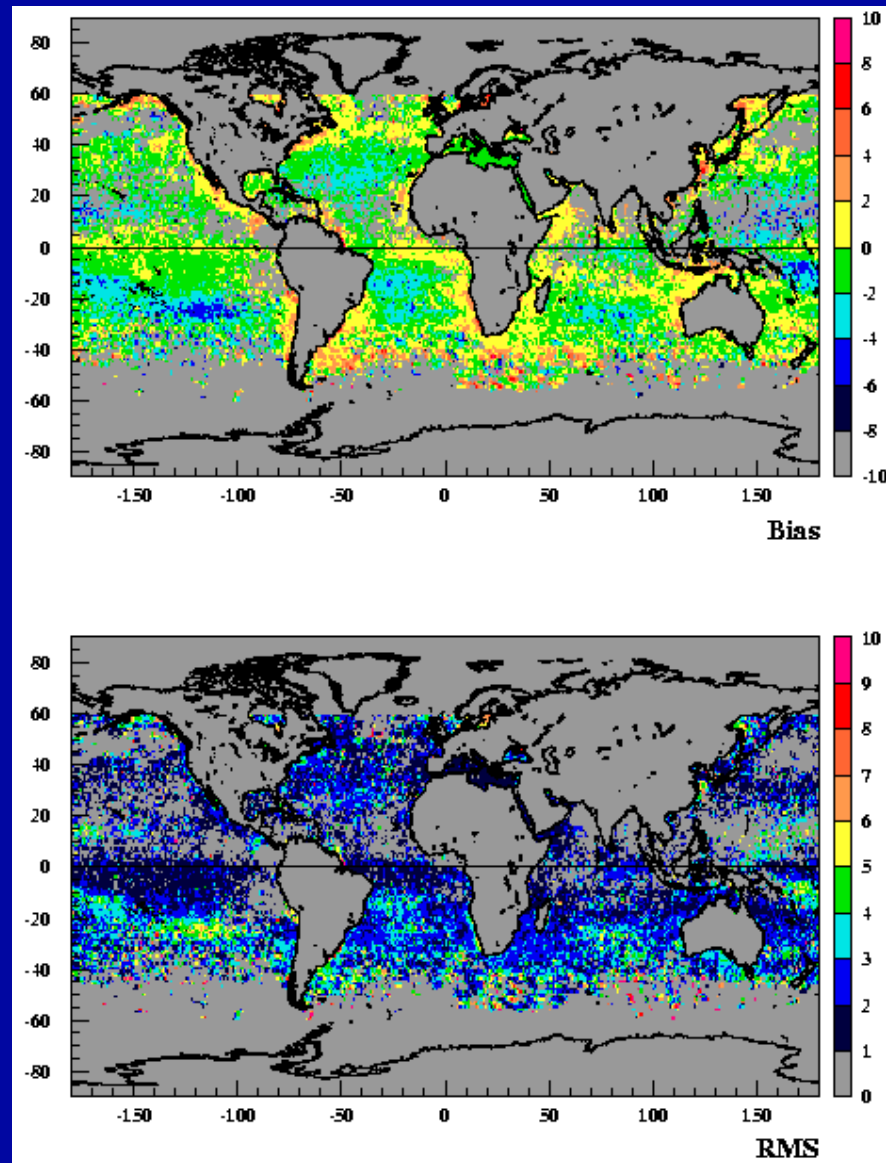
# FQ of 1° Regional Relative Bias and RMS Errors



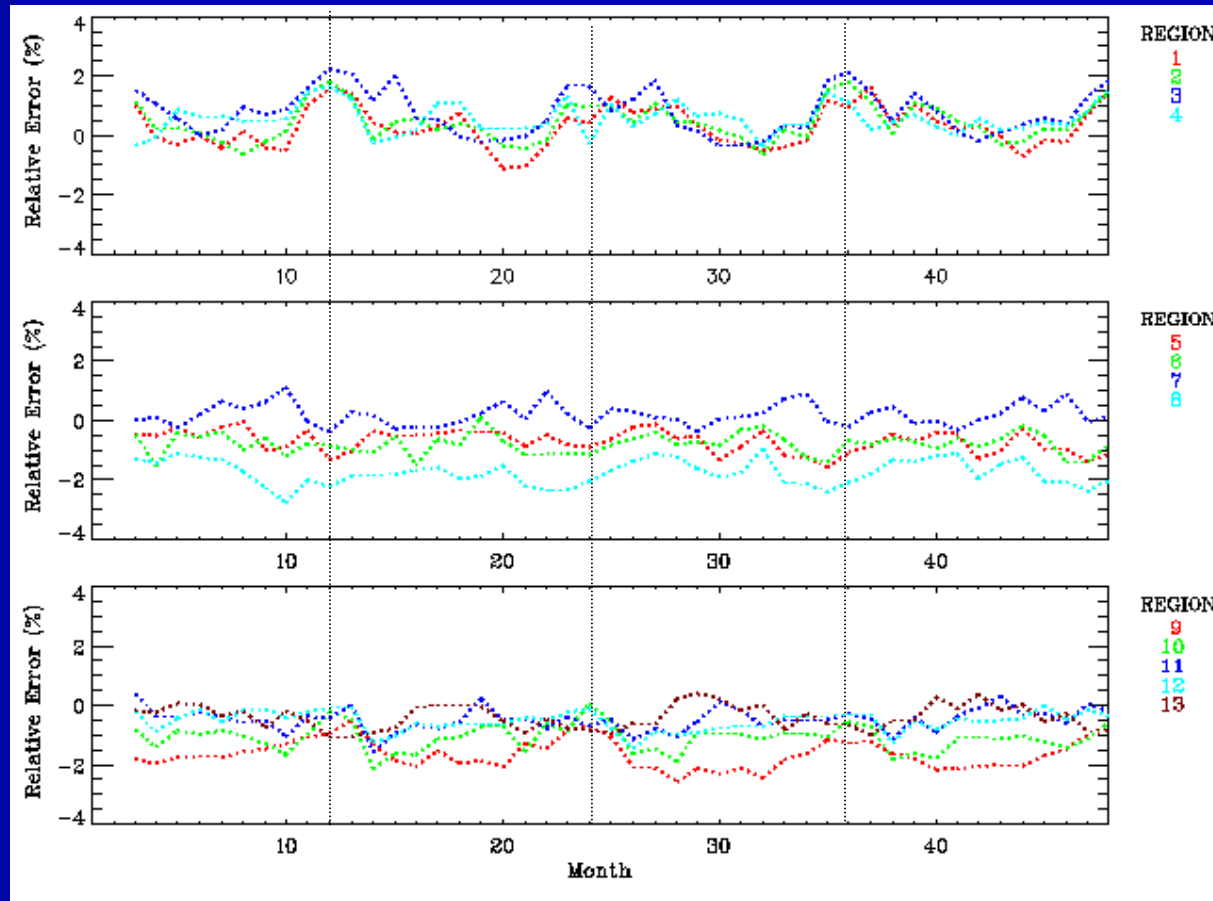
# Radiance Relative Bias and RMS Errors for DJF 2000-01 (Aerosol Ret)



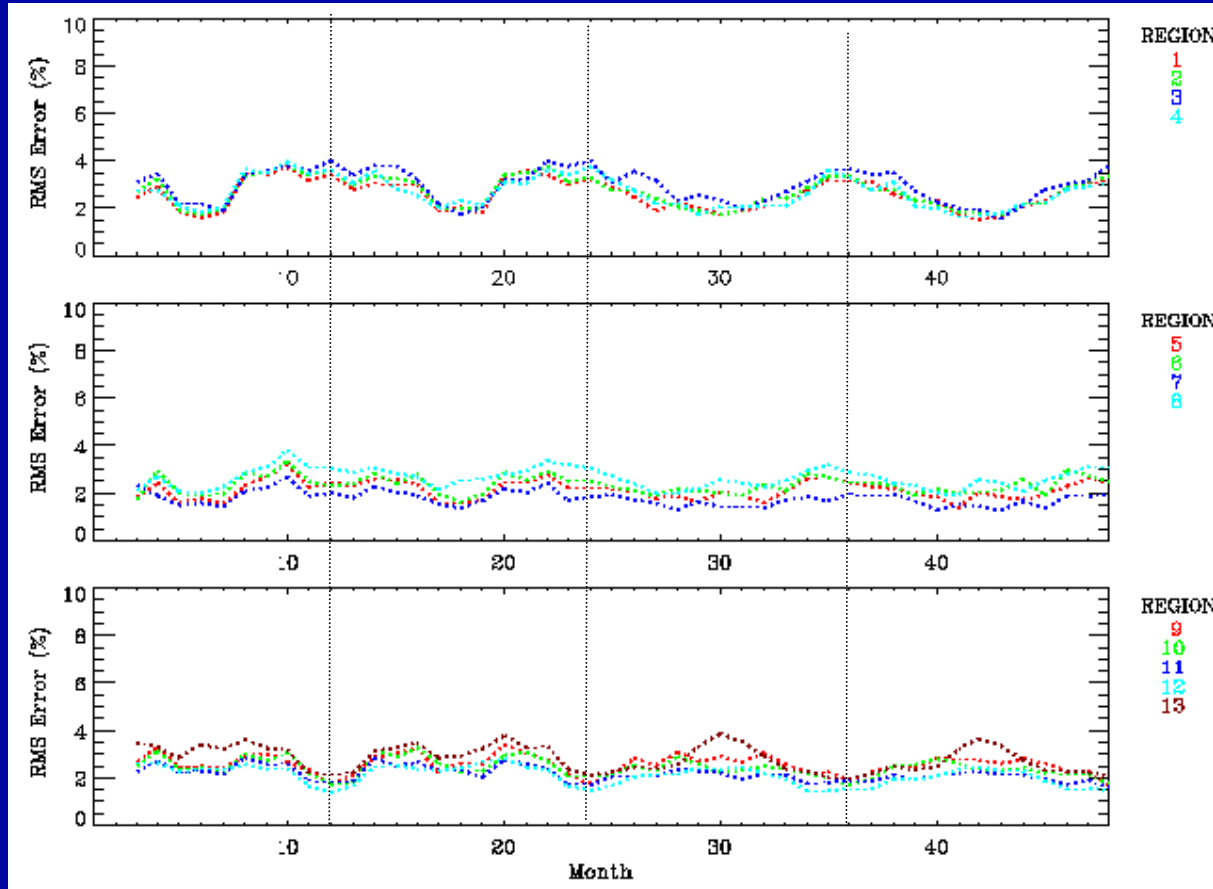
# Radiance Relative Bias and RMS Errors for JJA 2000 (Aerosol Ret)



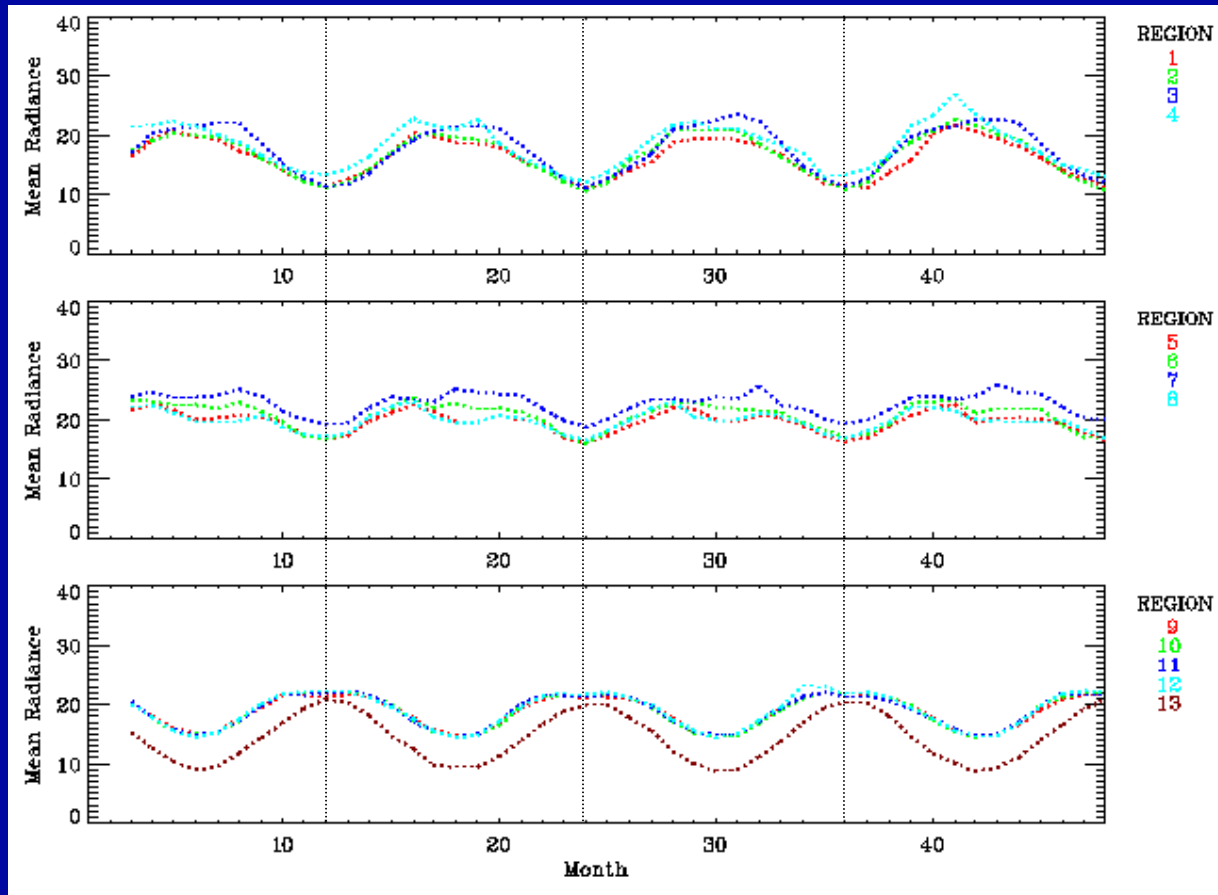
# Regional Radiance Relative Errors (%) for Mar 2000 - Dec 2003 (Channels 0.645, 1.64, 0.86 $\mu\text{m}$ )



# Regional Radiance RMS Errors (%) for Mar 2000 - Dec 2003 (Channels 0.645, 1.64, 0.86 $\mu\text{m}$ )



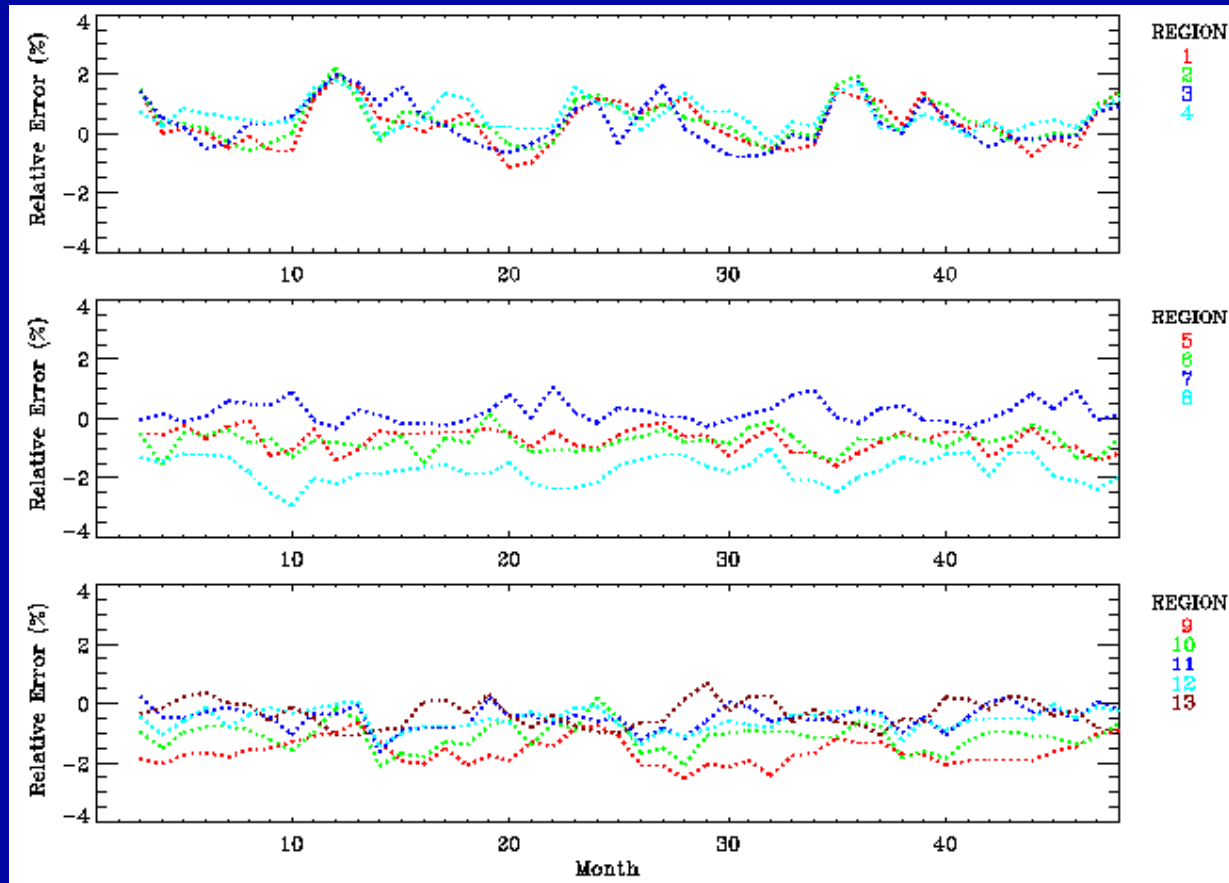
# Regional Mean Radiance for Mar 2000 - Dec 2003



# Regional Relative Bias/RMS Errors Using Channels 0.64 and 1.64 (Summary Continued)

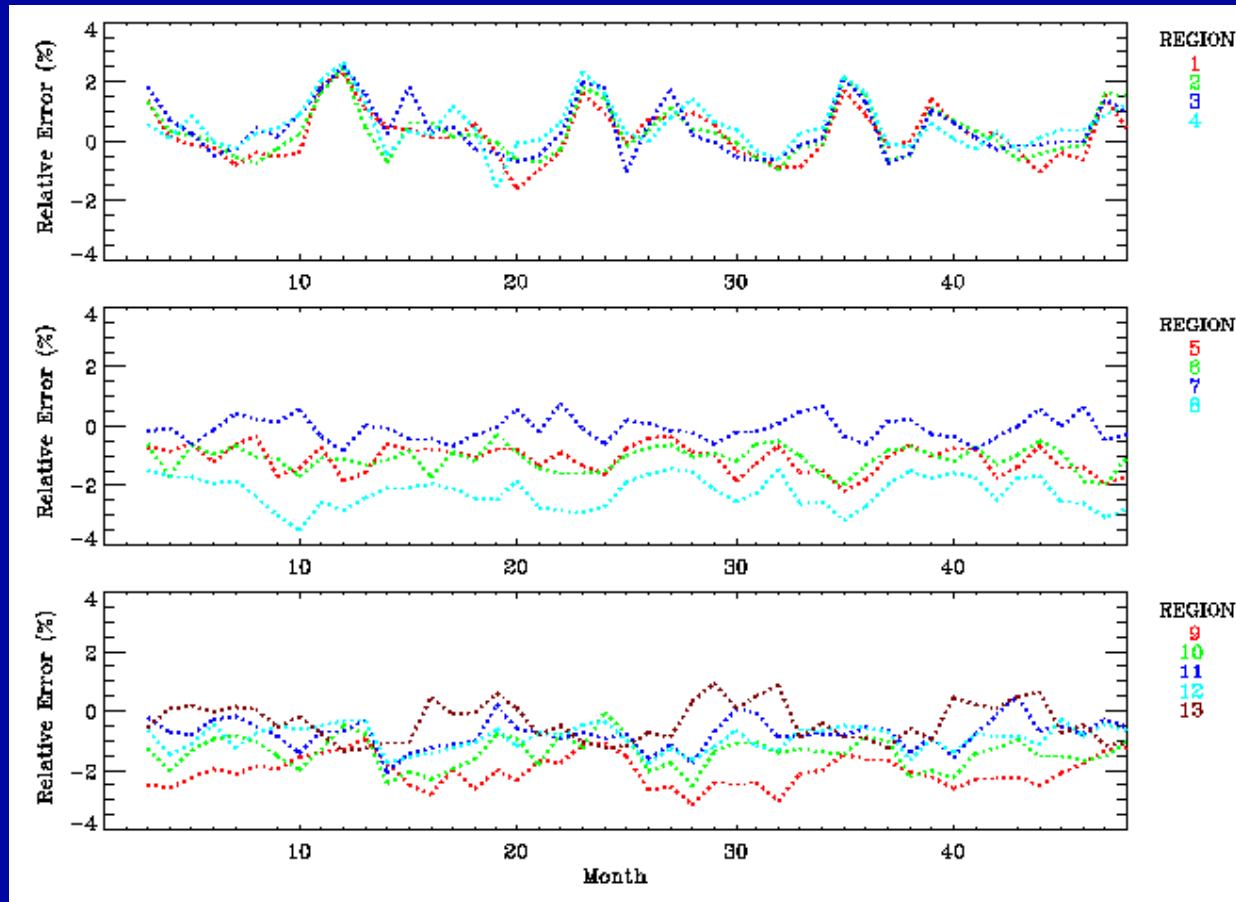
- MODIS Channels and Ignatov-Stowe 0.65 and 1.64
- Aerosol retrieval checks made
- CERES cloud mask is used to identify cloud cover (clear sky only) for MODIS vs. Ignatov-Stove runs

# Regional Radiance Relative Errors (%) for Mar 2000 - Dec 2003 (MODIS Channels 0.645, 1.64 $\mu\text{m}$ )

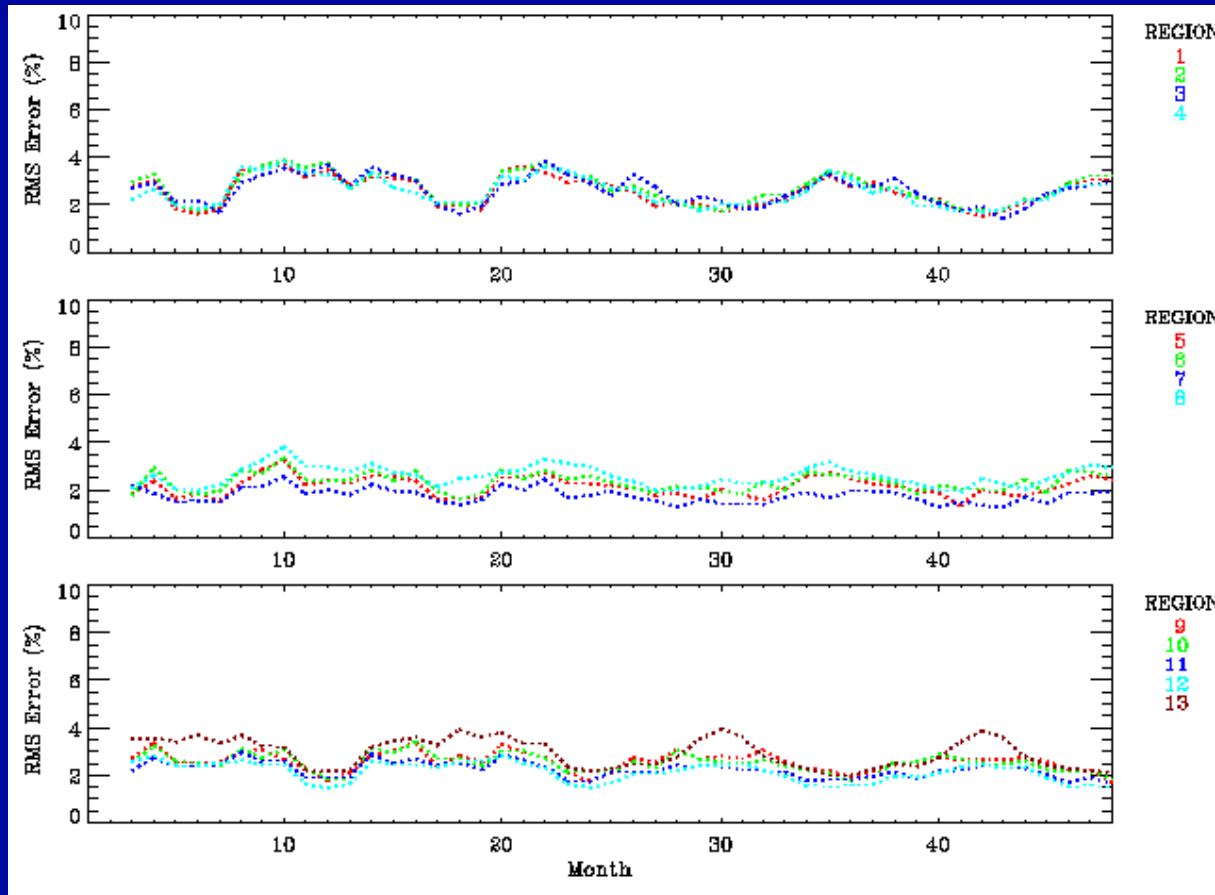




# Regional Radiance Relative Errors (%) for Mar 2000 - Dec 2003 (Ignatov/Stowe Channels 0.645, 1.64 $\mu\text{m}$ )



# Regional Radiance RMS Errors (%) for Mar 2000 - Dec 2003 (MODIS Channels 0.645, 1.64 $\mu\text{m}$ )



# Regional Radiance RMS Errors (%) for Mar 2000 - Dec 2003 (Ignatov/Stowe Channels 0.645, 1.64 $\mu\text{m}$ )

