



Evaluating Water Vapor in the NCAR CAM3 Climate Model with RRTMG/McICA using Modeled and Observed AIRS Spectral Radiances



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1. Overview

Objectives:

- Evaluate water vapor and temperature simulation in two versions of CAM3 by comparing modeled and observed cloud-cleared AIRS spectral radiances.
- Use spectral differences to verify comparisons between modeled water vapor and temperature and observed fields retrieved from AIRS radiances.

Models:

OSS: Optimal Spectral Sampling model developed at AER was used to simulate clear sky AIRS radiance spectra in CAM3.

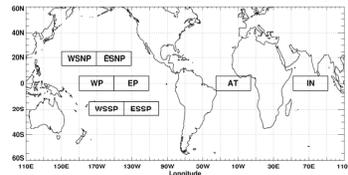
RRTMG/McICA: ARM-supported LW and SW radiative transfer model developed at AER for application to GCMs. **RRTMG has been fully reformatted and modified to use McICA and will be available on AER's radiative transfer web site (rtweb.aer.com) in April 2007.**

CAM3: NCAR Community Atmosphere Model version 3.0

Data:

AIRS: L1B radiance spectra and L3 retrieved temperature and water vapor for January and July 2004 were used. Cloud-cleared AIRS radiances were selected as spectra with 943 cm^{-1} brightness temperature within 5 K of local AIRS-retrieved sea surface temperature.

2. Geographic Regions Analyzed



3. Summary

Spectral plots at right show regional differences between modeled clear sky AIRS radiances simulated by two versions of CAM3 (one using NCAR radiation and one using RRTMG/McICA) and observed cloud-cleared L1B AIRS radiances.

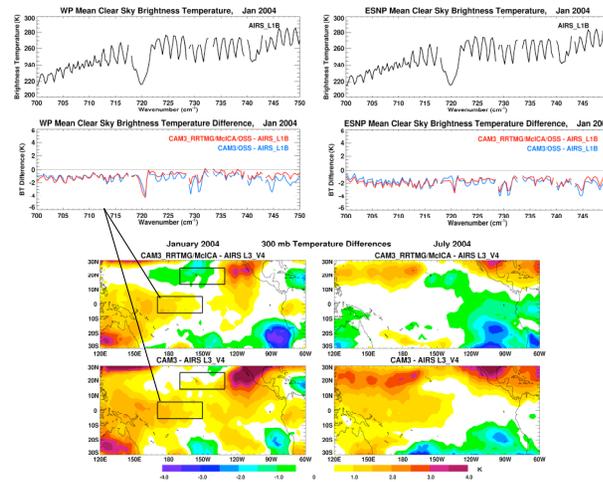
Color contour plots at right show differences between modeled temperature and water vapor fields simulated by the two versions of CAM3 and temperature and water vapor fields retrieved from AIRS radiances.

Brightness temperature (BT) differences of up to 2 K in spectral band relevant to tropospheric **temperature** (700-750 cm^{-1}) are generally smaller than differences seen relative to the retrieved temperatures in contour plots.

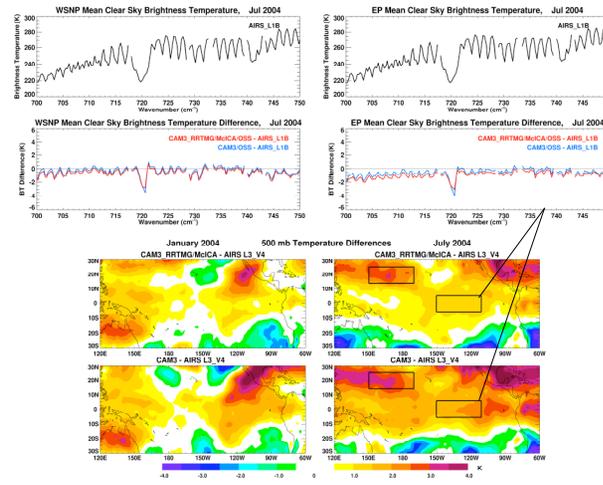
Brightness temperature differences of up to 8 K in **water vapor** band (1340-1580 cm^{-1}) show large moist biases in CAM3 and are of same sign as percent differences in water vapor relative to retrieved water fields in all regions.

BT differences are sensitive to the choice of **radiation** model in some regions.

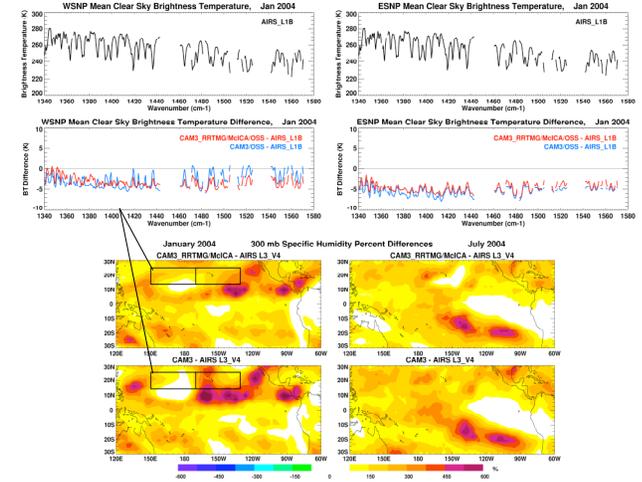
4. Model & Data Temperature Comparison, 300 mb



5. Model & Data Temperature Comparison, 500 mb



6. Model & Data Water Vapor Comparison, 300 mb



7. Model & Data Water Vapor Comparison, 500 mb

