

PERFORMANCE OF THE AIRS/AMSU AND MODIS SOUNDINGS OVER NATAL/BRAZIL USING COLLOCATED SONDES: SHADOZ CAMPAIGN 2004-2005



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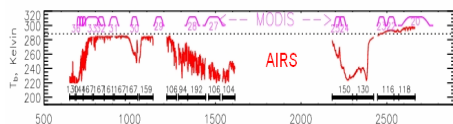
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ABSTRACT

The purpose of this work was to analyze the performance of the AIRS/AQUA sounding system (physical-statistical retrieval code) and of the MODIS/AQUA (statistical retrieval code) to retrieve atmospheric profiles of temperature and moisture over Natal (northeast region of Brazil) during the SHADOZ (Southern Hemisphere Additional OZonesondes) campaign along 2004 and 2005. The atmospheric profiles retrieved by both inversion models were compared with the collocated radiosonde data ("ground truth") considering satellite retrievals within a 100 km radius around the sounding site. The bias and the Root Mean Square error (RMS) of deviations were assessed for the whole available data of the campaign. The results showed that temperature profiles retrieved with both sounding systems (AIRS and MODIS) have a bias lower than 1K, with a slight degradation near the ground level. In the troposphere the AIRS soundings showed lower RMS error (lower than 1.5K) compared with MODIS retrievals (about 3K near the ground level) for all pressure levels below 200 hPa. Concerning moisture profiles, the results showed that the MODIS and the AIRS profiles have a slight negative bias for pressure levels below 800 hPa, lower than 2g/kg. In addition, both of them had similar RMS in the troposphere with better performance to AIRS/AMSU mainly near the surface (below of 700 hPa).

REMOTE SOUNDINGS

Remarkable progress has been achieved during the last two decades in retrieving atmospheric profiles by means of passive infrared sensors. Recent efforts have been concentrated on the development of sensors with high spectral resolution. The AIRS (Advanced Infrared Sensor) is the first operational instrument with these characteristics (Amumann et al., 2003). Concerning temperature and moisture profiles, it exhibits substantial improvements when compared with previous instruments. The AIRS sensor was launched onboard EOS-PM (AQUA) satellite in May 2002, together with microwave sensors (AMSU). The AIRS provides radiances in 2378 channels, yielding significant increase of information about radiative emission/absorption of many secondary gases in Earth's atmosphere. In addition, the AQUA satellite has on board the "Moderate Resolution Imaging Spectroradiometer" (MODIS) sensor. This instrument is a scanning spectroradiometer with 36 visible (VIS), near-infrared (NIR), and infrared (IR) spectral bands between 0.645 and 14.235 μm (King et al., 1992). While the MODIS is not per se a sounding instrument, it does have many of the spectral bands found on the High resolution Infrared Radiation Sounder (HIRS) currently in service on the polar orbiting NOAA TIROS Operational Vertical Sounder (TOVS). Thus it is possible to generate profiles of temperature and moisture from the MODIS infrared radiance measurements.



Simulated AIRS brightness temperature.

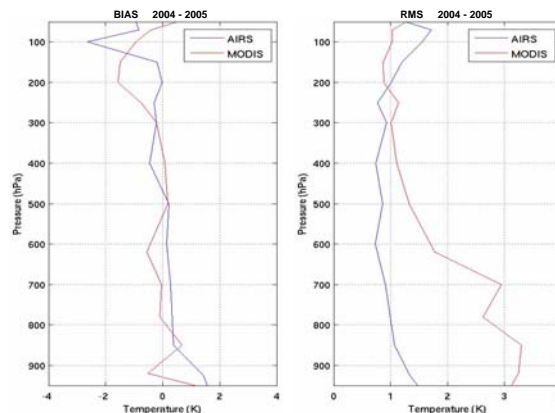
It was analyzed the performance of the AIRS/AMSU and the MODIS systems to recover atmospheric profiles of temperature and moisture over Natal-RN (Brazil) during the SHADOZ experiment along 2004-2005. A set of 35 radiosondes coincident with the AQUA satellite overpass matches have been selected to provide preliminary validation. The atmospheric profiles retrieved by both inversion models were compared with the radiosonde data ("ground truth") of the campaign, considering satellite retrievals within a 100 km radius around the sounding site (18 UTC). The bias and RMS of deviations were assessed for the whole available data of the campaign. The computation of statistics for all the cases was derived for 1km layers.



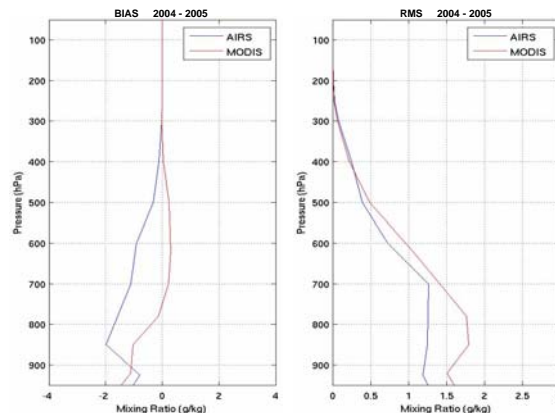
Validation sites of the "SHADOZ" campaign.

RESULTS

The results of the preliminary intercomparisons between satellite retrievals and radiosondes show a good agreement to AIRS/AMSU temperature profiles, with values of the RMS about 1K, excepted for a slight degradation at the surface and above of 200hPa. For the MODIS sensor the RMS reach values bigger than 2K below of 600 hPa (3.5K near the surface). Concerning the moisture profiles, both of them have RMS lower than 2g/kg, with better performance to AIRS/AMSU near the surface (below of 700hPa). The results are similar to the RMS found over land for Kim et al. (2004), Fetzer et al. (2005) and Divakarla et al. (2006). In general, the MODIS broadband spectral resolution provides only modest information content regarding vertical profiles. However the MODIS products in integrated vertical layers can be use together with other satellite measurements in numerical weather prediction models in the regions where conventional meteorological observations are sparse (Seemann et al., 2003). Future work will focus on validation for all sites of the SHADOZ campaign.



Bias and RMS between the temperature retrievals and radiosondes.



Bias and RMS between the mixing ratio retrievals and radiosondes.

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