Response to Review #2

It is a very well written and important paper which reveals a significant bias in MODIS upper tropospheric water vapor channel. I recommend to publish this paper with very minor corrections.
How about other channels on MODIS? Do you expect SRF shifts in those as well?

Tobin et al. (2006) assessed all MODIS infrared channels by transforming the AIRS high-spectral information to the MODIS low resolution bands. It is noted that uncertainties of these determinations range from near 0 K for window region bands to as large as 0.2 K for other bands except water vapor and temperature sounding channels (i.e.: 6.8, 7.3, 13.7, 13.9, and 14.2 μm channels) which show scene temperature dependence with higher degree of uncertainties. These are now mentioned.

Tobin, D. C., Revercomb, H. E., Moeller, C. C., and Pagano, T. S.: Use of Atmospheric Infrared Sounder high–spectral resolution spectra to assess the calibration of Moderate resolution Imaging Spectroradiometer on EOS Aqua, J. Geophys. Res., 111, D09S05, doi:10.1029/2005JD006095, 2006.

Specific comments:
Inter-calibration using SNO method: It may not be a problem for inter-calibration whether the instruments are seeing water vapor or surface if the two instruments see the same target at the same time, but this often not the case and the surface can be highly inhomogeneous in the polar regions where SNOs usually occur.

Thanks for the comment. Although the SNO method (Cao et al., 2005) should work in theory and provide calibration results with little ambiguity. However, because satellites overpass with each other over cold and dry polar regions, the SNO-driven results represent only a small portion of the dynamic ranges of water vapor channel TB, leaving another difficulty in interpreting results (e.g. Shi et al., 2008). Because of this reasoning, we focus on the biases shown only over the tropical low latitude regions where dynamic ranges are large enough to assess the calibration status. This is addressed in the Introduction.

Cao, C., Xu, H., Sullivan, J., McMillin, L., Ciren, P., and Hou, Y.-T.: Intersatellite radiance biases for the High-resolution Infrared Radiation Sounders (HIRS) on board NOAA-15, -16, and -17 from simultaneous nadir observations, J. Atmos. Ocean. Tech., 22(2), 381-395, doi:10.1175/JTECH1713.1, 2005.
Shi, L., Bates, J. J., and Cao, C.: Scene radiance-dependent intersatellite biases of HIRS longwave channels, J. Atmos. Oceanic. Technol., 25(12), 2219-2229, doi:10.1175/2008 JTECHA1058.1, 2008.

A 5 degree angle difference at the end of scan/disc can result significant difference in brightness temperature. Therefore it is desirable to use near nadir measurements for this kind of inter-calibration studies.

We agree that 5 degree difference in viewing angle used for TB match-ups can cause increased uncertainties in particular at the scan edge. Although it is not clearly mentioned, by limiting the analysis domain within the area of 30°N-30°S and 110°E-170°, most of viewing angles are smaller than 30 degree, as shown in viewing angle map centered at EQ and 140°E

(Figure A). A sensitivity test was taken to examine TB difference between at viewing angles of 25 degree and 30 degree -- Figure B. It is indicated that the TB difference is about 0.35K at around 30 degree. Considering that 5 degree difference applies to 35 degree angle alike, and assuming this procedure introduces random scattered patterns, it suffices to say that it is safe to deduce the bias conclusion if viewing angle difference of 5 degree is allowed for match-ups within 30 degree viewing angle. We address this issue in the revised version.
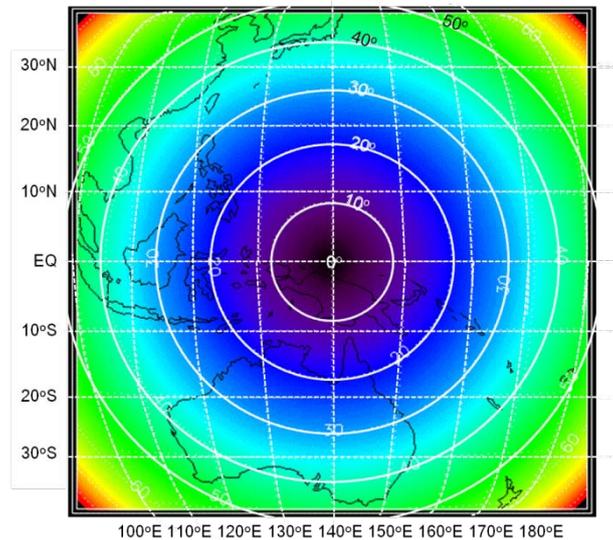
Fig. A. Distribution of viewing angle for MTSAT-1R centered at (EQ, 140°E)
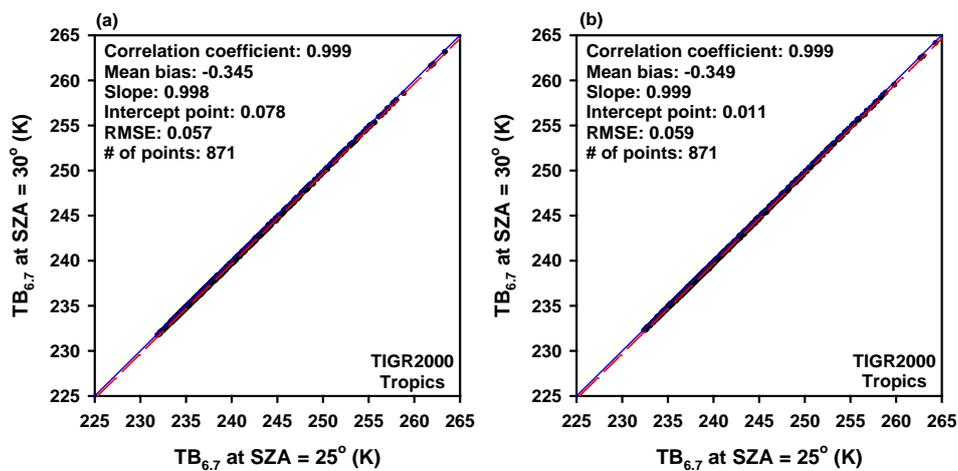
Fig. B. (a) MTSAT-1R WV TB and (b) MODIS WV channel TB simulations with TIGR profiles at viewing zenith angles (SZA) of 25 degree (x-axis) and 30 degree (y-axis).

It would be good to show the plots and statistical parameters for 11 cm^{-1} shift in SRF. Also, why 11 cm^{-1}? Did it give the best fit? Bit more details on this will be good.

Another reviewer also suggested to provide more detailed explanation about the effect of 11 cm^{-1} shift in SRF on the correction. Following the reviewer's suggestion, a new plot is made to show the effect of spectral shift on the brightness temperature. Figure 5 is included in the revised version.
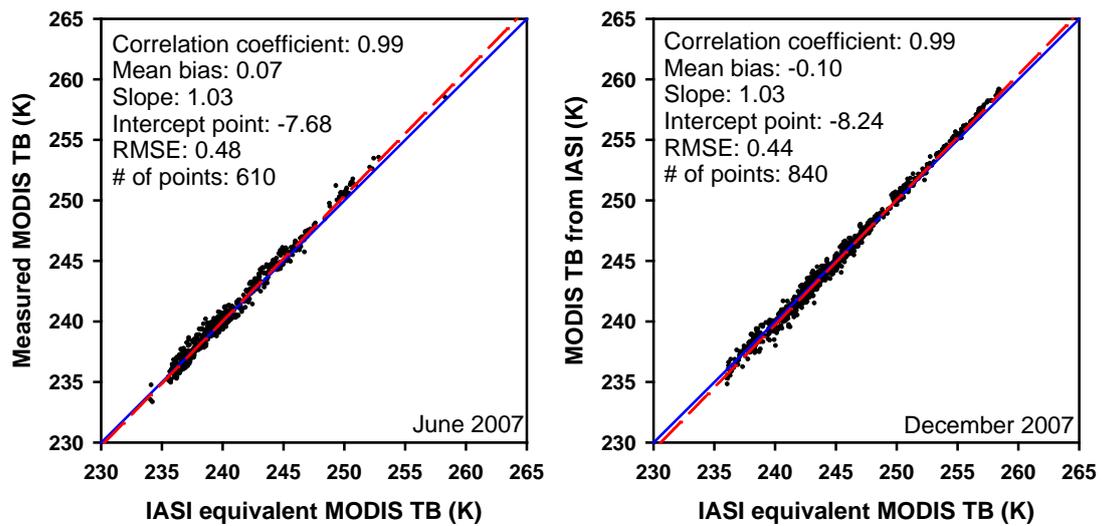
Fig. 5. Scatter plots of measured MODIS and IASI equivalent MODIS brightness temperatures for June 2007 (left) and December 2007 (right) after the spectral shift of the response function by +11cm⁻¹.