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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Deep convective clouds at the tropopause" *by* H. H. Aumann and S. G. DeSouza-Machado

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The paper is informative and opens up many areas for further research and investigations. Having AIRS with many IR sounding channels creates an excellent opportunity to benefit from some spectral properties to study different objects such as deep convective systems discussed here. I have some suggestions that to my opinion can improve the paper:

1) Throughout the paper temperature less than 225k or 235k is attributed to deep convective clouds. For example on page 16483, the last 3 lines, it is stated: "The label "Deep Convection" has been given to a wide range of objects identified by various thresholds, from cloud tops colder than 235 K, to 1×1 degree areas where the rain rate exceeds 1.6 mm/hr (Zelinka and Hartmann, 2009)."

The second part (where the rain rate exceeds 1.6 mm/hr) seems reasonable. While the first part deserves a reference, it can be argued that thick anvils (or thick cirrus clouds) are not deep convective systems but can show up very cold (even less than 220k in window channel say bt961). So, having single brightness temperature is not enough to separate between deep convective clouds and thick cirrus (or anvil) clouds. This issue needs to be discussed and indeed could be a new research to use AIRS spectral data to distinguish between the two systems (deep connectives and anvils). Also, using geostationary satellites, there are few studies (e.g., Behrangi et al. 2010, and Adler and Negri, 1988) that try to look at the cloud patch as oppose to individual field of views (or pixels) to separate cold cirrus and deep convective clouds using some extracted textural features from neighboring pixels. These two papers listed below could be acknowledged if the authors would like to have some discussions along what I argued (maybe at the discussion section).

Adler, R. F. and A. J. Negri, 1988: A satellite infrared technique to estimate tropical convective and stratiform rainfall. Journal of Applied Meteorology, 27, 30-51.

Behrangi, A., K. Hsu, B. Imam, and S. Sorooshian, 2010: Daytime Precipitation Estimation Using Bispectral Cloud Classification System. Journal of Applied Meteorology and Climatology, 49, 1015-1031.

2) Page 16486 line 18 to the end of the paragraph. This paragraph is based on misconception of the role of the 235K threshold in the GOES precipitation index (GPI) algorithm. A 210K threshold for the AIRS data (equivalent to (bt1231-bt712<-2K) corresponds to an extreme event in a single AIRS footprint. The GPI rain rate algorithm assigns a constant precipitation rate 3 mm/hr for every pixel having a brightness temperature less than 235K (Arkin and Meisner 1987). The main objective of GPI is to be used for climate studies and for a time-space domain that is large enough. For example 2.5x2.5 degree longitude/latitude as short as 1 hr (Richards and Arkin , 1981). There is no inconsistency. The entire paragraph could be deleted.

ACPD

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Arkin, P. A. and B. N. Meisner, 1987: The relationship between large-scale convective rainfall and cold cloud over the Western-Hemisphere during 1982-84. Monthly Weather Review, 115, 51-74.

Richards, F., and P. Arkin, 1981: On the relationship between satellite observed cloud cover and precipitation. Mon. Wea. Rev., 109, 1081–1093.

3) Please spell out NCEP, AFGL, TIGR, EOS, AMSU where they appear for the first time.

4) In section 2, it would be useful to include the coordinates for the region of study.

5) There are few sentences that to my opinion deserve a reference: a) Line 1, page 16478, after MeteoSat Sounder; b) Page 16478, the last 3 lines before Section 2. If no reference exists, I suggest to briefly explaining why the difference between window channels at 961cm-1 and 790 cm-1 provide additional insights into optical depth and the location of the cloud-top relative to the tropopause.

6) I see 6 September 2010 (page 16480, line 11), 6 September 2006 (page 16482 line 11), and 6 September 2002 (caption for Figure 1). Please make them consistent.

7) I suggest panels (a) and (b) in Figure 1 become consistent in scale. This facilitates comparing the panels in the figure, the same for Figure 2. Also please remove the description of the colors in x label. The description should be in the figure's caption. I am not sure what are g>20 and b>10 ?

8) Figure 3 (both panels): y label shows 30 hpa while in the text I see 40 hpa (e.g., page 16481, line 9). Please make sure the two numbers are consistent.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 16475, 2010.