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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

Anonymous Referee #2

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This paper presents a study of overshooting top problem associated with deep convections that reach the tropopause using satellite infrared sounder data. The topic is of great importance as deep convective clouds serve as an important pathway for transporting chemicals vertically, and probably play a central role in sending tropospheric materials into the stratosphere in the case of penetrating overshooting. The technique discussed in this paper may potentially be useful for retrieving the overshooting top properties globally. However, the paper in its present form is difficult to follow, as the other reviewer has already pointed out. The authors are experts in this field and seem to forget that most readers are not familiar with even the physical principles working behind these techniques. I recommend that the authors completely rewrite the paper as suggested below. The most important point of rewriting is to emphasize the physics behind the technique, not just the numerical details. A few examples: 1. Show an

example figure to explain what "inverted spectrum" is.

2. Explain why it is useful to use AIRS, AMSU and AMSRE data together? What are the pros and cons of these instruments?

3. Why would DW, DT and DC tell us about the cloud top properties as claimed? Any possibly errors and biases?

4. A typical example of hard-to-understand sentence is "The mean DC for clouds which satisfy the (DT< -2) conditions is +1 K with standard deviation of 0.65 K (Table 2), but is close to 2K for lower cloud tops" (P. 16485, 4th line). What are the physics behind these numbers? Do they make the retrieved cloud top height less? More? Etc. There are many sentences like this in the paper. Perhaps you want to consider putting the detailed retrieval processes in an appendix?

Some specific comments:

1. Line 10, P. 16477: The AMS Glossary defines an overshooting as a protrusion of cloud top above the equilibrium level, so it doesn't necessary mean that the OC is in the stratosphere, nor does it indicate that it forces water vapor into the stratosphere (see Holton et al., 1995, Rev. of Geophysics, 403-439). It's better to change "force water vapor" to "has the potential to force".

2. A recent paper (Setvak et al., 2008: Atmospheric Research, 89, 170-180) also used the BTD technique to retrieve water vapor in LS. It may be worthwhile to compare with their study.

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