Atmospheric Chemistry and Physics Discussions

Interactive comment on "A study of the effect of overshooting deep convection on the water content of the TTL and lower stratosphere from Cloud Resolving Model simulations" *by* D. P. Grosvenor et al.

Anonymous Referee #2

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This paper presents results of a sensitivity study of the injection of water substance into TTL and lower stratosphere by overshooting deep convection using both 2-D and 3-D cloud resolving models. Water vapor is the most important greenhouse gas in the atmosphere and its variation in the TTL and stratosphere has great implications on the global climate. Hence the subject is an important one.

The paper is clearly written albeit a bit long. I recommend that the paper be accepted for publication in ACP subject to the following suggested revision/clarifications.

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1. As indicated above, the paper is rather long. May be the authors can trim some of the very detailed discussions on the 2-D vs. 3-D results? While it is nice to have such detailed comparison between these two sets of results, I have already been convinced half way into the reading that 3-D is better than 2-D and am wondering whether or not some of such comparisons can be done in form of a table instead of detailed descriptions.

2. The fairly large disparity between the horizontal and vertical resolution is a concern (2000m vs. 75~125m). Wouldn't this cause a problem in the advection results in the CRM? Some discussions of this and its possible impact on the results are probably necessary (although I am not requiring a full sensitivity study).

3. CRMs using hot bubble technique normally requires a spin-up time which depends on the model scheme. The results in early time steps (say before 15 or 20 min) are often disregarded as these do not necessarily reflect the stable characteristics of the cloud being simulated. It is desirable that the authors discuss the spin-up properties of the model used here.

4. P. 7297, 2nd paragraph: "The increases in total water were mainly due to increase in water vapour"–presumably this comes from the ice parameterization scheme used. If the scheme produces fairly large ice crystals, then of course most of them fall out. On the other hand, it is also possible that the ice crystals produced at such low temperatures are very small and they can be injected into the TTL and LS directly. Perhaps a few sentences about the ice size distribution are in order here.

5. Most of the comparisons with observation were based on radar reflectivity features. The S-band radar echo mainly reflects distributions of large hydrometeors (e.g., raindrops, graupel, large snow flakes) but not smaller ice particles. Are there other types of data (e.g., satellite) that can be used for the comparison purpose?

6. Caption of Fig. 6 (P. 7730) should indicate that this is the 3-D simulation result.

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7. Some figures have such small fonts in the axes that are very difficult to read (e.g., fig. 7, 13, 15, 18, 21). Larger fonts should be used.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 7277, 2007.

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