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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The global impact of supersaturation in a coupled chemistry-climate model" *by* A. Gettelman and D. E. Kinnison

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We are preparing a revised manuscript to answer the concerns of the reviewer and of all reviewers. Below we make some general points, and then respond directly to the reviwer's concerns. The replies discuss changes we will make to a revised version of the manuscript which we will send to the editor.

In general, we agree that we should better describe the supersaturation scheme, despite this being a sensitivity study. We have spent some time and rewritten our description of the supersaturation scheme, including adding an additional figure that illustrates the performance of the scheme relative to recently published observations of relative humidity and supersaturation. This was a point raised by several of the reviewers, and we acknowledge it could have been clearer. There were also one or two mistakes in the description (such as the thresholds for condensation) that we have corrected.

In addition, we highlight that this really is a sensitivity study, and not a detailed treatment of supersaturation, which is beyond the scope of this paper. We are attempting a sensitivity study to look at the chemical, dynamical and radiative effects of supersaturation, not a detailed physical study of how supersaturation should be properly represented. We will highlight this better in the revised text to avoid confusion

We have further made changes to the manuscript to clarify various points raised by the reviewers. These points are valuable for clarifying several confusing points, and we thank the reviewers for their time and effort.

Replies to General Comments:

1. We have substantially modified the description of the scheme.

2. We have clarified the discussion by specifically referring to the grid-box averaged and in-cloud quantities.

3. We have clarified the discussion by noting that we have classified clouds using categories from the International Satellite Cloud Climatology Project (ISCCP). It is not possible to look at sub-visible clouds in the analysis.

4. The change is significant, and a consequence of the changes in lower tropospheric humidity (total precipitable water). We have noted this in the revised text.

5. We have analyzed the cloud forcing from the runs to determine the uncertainty in these quantities and reported it. Uncertainty to changes in cloud forcing is +\- 0.3 Wm-2 based on the standard deviation of the inter-annual variation in the two cases.

6. The radiation change causes changes in the lower stratosphere above this region. We have clarified this in the text.

Replies to Specific Comments:

We have made all the changes suggested with the following notes:

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9) We have added a reference to the specific TEM equation numbers in Andrews et al 1987

17) Figures: Regarding the size of the figures, we can provide figures in whatever size is appropriate for the clarity of the final version. They certainly can be made larger if necessary. We will work with the ACP production editors on final formatting and size. Some of the sizing is due to constraints in the ACPD template formatting.

We have also changed the units to be consistent on all the figures. This affects figure 7-10 (old figures 6-9). In addition, figure 8 (old figure 7) has been reworked with different contour intervals to make it less of 'a mess'. We think this is a more readable figure now.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 12433, 2006.