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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Stratospheric water vapour and high climate sensitivity in a version of the HadSM3 climate model" *by* M. M. Joshi et al.

Anonymous Referee #2

Received and published: 24 April 2010

Review of Joshi et al, "Stratospheric water vapour and high climate sensitivity in a version of the HadSM3 climate model"

This paper investigates a pair of simulations in the HadSM3 climate mdoel that pertrub the convective scheme and result in significantly enhanced stratospheric water vapor. This is analyzed to be the cause of the enhanced climate sensitivity. The paper is brief, and needs substantiation on several points before it is suitable for publication in Atmospheric Chemisty and Physics. As noted below: a more substantial humidity climatology and a temperature climatology needs to be presented with a discussion of the mechanisms for water vapor transport into the stratosphere, how they differ and which runs are realistic in order for this study to be a complete picture. Since the current treatment is brief, there is plenty of space for that in this manuscript.

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Discussion Paper

Several general comments can be made:

1. The paper needs some substantiation in points. The base climatology of stratospheric water vapor in the STD case should be shown, and this should include the UTLS region for STD and LEP cases

2. I am perplexed why no explanation for the increase in water vapor in the runs is given. In STD and LEP simulations, what is the mechanism for water entering the stratosphere? This is necessary to make a reliable determination of whether the model is reasonable or now.

Is enhancement in H2O in the UTLS due to changes in the cold point tropopause temperature? What is the cold point temperature difference between the runs (STD 1 & 2, LEP 1 &2)? Is there convection above the cold point or not? Is the annual cycle of water vapor in each of the 4 simulations reasonable? Why or why not?

3. There is now a literature of model diagnostics in the UTLS through the Chemistry-Climate Model Validation (CCMVal) project, and a recent report on coupled chemistry climate model performance in the UTLS region is now available. This should be used as a guide to understand better the mechanism for regulating stratospheric water vapor in the runs.

Specific Comments:

p6244, L20: Show STD1 & STD2 water vapor distributions. I would recommend also showing a zonal mean equatorial time-height plot (A 'tape recorder' plot) from both STD and LEP runs.

P6244, L22: what is the change in q between STD1 & STD2?

P6245, L7: "Fig 1, grey dashed line" what does this refer to?

P6245,L7-12: Show the entire UTLS in the plot: i.e.: down to the extratropical tropopause at say 300hPa at least. Also, temperature and cold point temperature

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should be shown as noted above.

P6245, L13-17: show the radiative forcing (at least zonal mean in latitude). Is this tropopause or TOA?

P6246, L17: Please add a few more sentences of description of the Webb 2006 method. The current text is not interpretable without the Webb paper now. I am not familiar with the method and have no idea what you are doing in the rest of the paragraph.

P6248, L22: as noted, further work needs to be done here to examine mechanisms for the water vapor increase. Temperature and cold point temperature, and convective heights need to be examined.

Fig 1: Caption should state that values are in PPMV. Include a color bar for both panels.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 6241, 2010.