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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 #1

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convection on the water content of the TTL and lower stratosphere from Cloud Resolving Model simulations" by Grosvenor et al.

The paper reports a numerical study of a case of troposphere stratosphere exchange (TSE) over Brazil that indicates hydration of the lower stratosphere by convective overshoots.

Comparison between 2D and 3D simulations suggest that 3D framework is required for such numerical studies. Whereas the literature offers many discussions on the advantage of 3D for simulating deep convection, the present study would be the first one concerning TSE. Sensitivity tests indicate that a polluted air results in a larger moistening of the lower stratosphere due to a reduced sedimentation of ice crystals. The paper is rather long but would worth publication in ACP. However I have a major concern on the comparison with radar observation. First, the method to calculate the radar reflectivities has to be described. Second, the comparison with radar is hopeless as the radar detects an organized convective system with several plumes while the model simulates a single warm bubble. These two points should be considered before publication.

Specific comments
p7278, l5. Write HIBISCUS (instead of HIBISUCS!)
p7278, l7. Longitude of Bauru should be given.
p7278, l16. The sentence "Moistening is produced in all cases, convective vigour is not a factor in whether moistening or dehydration is predicted" is misleading. Without any doubt a shallow convection will have no moistening effect on the water vapour in the lower stratosphere.
p7278, l16. The wavelength of the S-band of the radar would be given precisely (around 10 cm, I presume). To what the 10-dBz echo top corresponds? Does it mean that a significant content of graupel backscatters the radar signal? Which one? Do other hydrometeors contribute to reflectivities?
p7283, section on the CRM. It is stated that the model allows supersaturation. So how does it work? A few sentences on the conversions parameterized in the ice scheme would help.
p7285, l21. Again, what is the significance of the 20-dBZ threshold in terms of hydrometeor contents?
p7286, l7. An indication of CAPE for each warm bubble used to initiate convection

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should be given to quantify the vigour of convection. What about eh wind profile used for the simulations?
p7287, l29. The longer time for which the 40 dBZ contour was reached should be given.
p7289, l8. It is written that "the model may be predicting too many particles of high mass", but it should be also due to an overestimation of the density of the particles. How are calculated the reflectivities? What kind of hydrometeors do you take into account? What about the particle distributions? And what are the dielectric properties?
p7292, l5. As reflectivities are due to precipitating hydrometeors, it should written that the "cases show qualitatively similar precipitating hydrometeor contents" rather than clouds (that are made of non-precipitating hydrometeors).
p7292, l25. It is difficult to be convinced of the "reasonable agreement" between observed and simulated reflectivities as the axes and the colour scales in Figs. 5 and 7 are different.
p7293, l16. I was not able to read the minimum values in Fig. 8. Please give the values.
p7293, l22. "Considerable amounts of ice". What are the amounts? It would be of interest to show the cloud envelope. Does this suggest some failures in the representation of ice by the microphysics scheme?
p7297, l28. The cross sections in Fig. 13 should be zoomed in the region of interest.
p7298, l29. "inaccuracies in the model microphysics". The discrepancies with the radar reflectivities can be also due to drawback in the dynamics (with no mixing enough) or in the calculation of the reflectivities (see comment for p7289, l8).
p7299, 1st par. Snow also contributes to reflectivities.
p7300, l5. typo.
p7312, l26. What are "more natural techniques"?

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

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