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Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the robustness of aerosol effects on an idealized supercell storm simulated with a cloud system-resolving model" *by* H. Morrison

Anonymous Referee #1

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Review of "On the robustness of aerosol effects on an idealized supercell storm simulated with a cloud system-resolving model" by Hugh Morrison

In this manuscript aerosol effects on an idealized supercell storm are investigated by use of ensemble simulations. By performing many simulations with modifications of the microphysics scheme and/or the initial condition the robustness or uncertainty of the results is investigated. This systematic approach is a very valuable extension of previous studies. The paper is very well written and I recommend that the manuscript should be published after some revision.

My main criticism concerns the choice of the ensemble members. The author decided

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to modify the microphysics scheme by turning off individual processes, their latent heat release or by making very strong modifications of particle properties (e.g. setting the fall speed of hail equal to that of snow). Such simulations are interesting to investigate the importance of those processes as it is discussed in the paper, but the disadvantage is that all these model perturbations are very unrealistic and the scheme is deteriorated. Therefore the spread of such an ensemble does not represent the uncertainty of the simulations, but is just a measure of the sensitivity to some quite arbitrary and unrealistic perturbations of the model physics. I would strongly recommend to include, in addition to the model configurations of Table 1, another ensemble which makes an attempt to quantify the uncertainty of the microphysics scheme within some realistic range. This would include parameters like the particle densities and the corresponding fallspeed-size relations, the particle size distribution assumptions (e.g., shape parameter of the Gamma distribution), the collision and sticking efficiencies of ice particles, and assumptions on freezing probabilities and ice nucleation. In addition, the KK autoconversion/accretion scheme could be replaced, e.g., by the Berry and Reinhardt or Seifert and Beheng schemes to test the uncertainty due to this choice.

If the author is unwilling to perform these additional simulations, it should at least be made very clear in the text that the spread of the ensemble, e.g., as shown by Fig. 8, is not a representation of the model uncertainty.

Some more comments:

- The new review by Tao et al. (2012, Review in Geophysics, 50) should be included as a additional reference.

- The aerosol effect on supercells including the sensitivity to wind shear has also been investigated by Seifert and Beheng (2006). Interestingly, they found a similar weakening of the supercell storms, e.g., about 10-20 % reduction of accumulated precipitation between pristine and polluted, as it was later found by Lebo and Seinfeld (2012) using their bin microphysics schemes.

ACPD

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Interactive Comment

Minor and technical comments:

- The plots look like they have been processed as bitmap (GIF or PNG) instead of vector graphics (PS or EPS).

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 10493, 2012.