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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Cloud-scale model intercomparison of chemical constituent transport in deep convection" *by* M. C. Barth et al.

Anonymous Referee #3

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This paper describes an intercomparison between 8 different high-resolution cloud-chemistry models regarding their description of transport and chemical processing of 6 chemical compounds. The results are evaluated versus observed cloud properties and concentrations of CO, O3 and NOx. The study is interesting and well written and pin points a few processes that are of key interest to include for accurate simulation of CO, O3 and NOx. However, the study also shows the clear need of more observations in the vicinity of deep convection of reactive compounds (such as HNO3, H2O2 and CH2O) and simultaneous observations of cloud microphysical properties and chemistry. I recommend the paper for publication after addressing the following minor comments/questions on the manuscript.

Specific comments:

Page 8040, lines 3-4: How sensitive are the model results to the chosen initial perturbation of 3C and the number of warm bubbles? In figure 3, doesn't the observations point more towards using two warm bubbles? In relation to this, does the choice of the location of the transect T1 in Figure 3 for the models have any impact on the results shown in Figures 5, 6 and 11? How large is the variability of the chemical compounds (see also comment on Table 3)?

Page 8041-8051, model descriptions: The contents of the various model descriptions are not always consistent. Tables 1 and 2 give a good overview, but the specific items are not always discussed in the text for each model. For example, for the models that are listed in table 1 as "no radiation" models, I assume there is some radiation module in the models, it's just that it isn't interactive? It would be interesting to know how the radiation is described in these models and what is assumed for closing the radiation calculations. I'm also wondering for the "aerosol models", what is assumed for the initial aerosol distribution?

Page 8054, line 28: I'm not so sure I agree on the conclusion that "all models do a good job transporting these passive tracers to the anvil". The UMd/GCE model simulates too low CO concentrations (and too high O3) 10 km downwind and too high concentrations 50 km downwind. Is this just a result of the choice of the transects? Or time variability?

Page 8055, NOx comparison: Why does the RAMS model show such low NOX values despite the included L(NOx) mechanism?

Page 8056, lines 9-14: For the models with a prescribed diameter for ice, how much would this diameter have to be changed in order to give a reasonable agreement with observations? Is it within reasonable numbers?

Page 8058, lines 17-20: This sentence is not completely clear to me, do all models show an underestimate of the CO flux if a correction of the mass flux is made or only all models within the 33% error?

ACPD

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Figure 7: For clarification, include in the figure text that the location of the cross section is similar to the location of T2.

Table 3: The star is missing in the figure text to explain the NOx flux for the observations

Table 3: What is included in the numbers for mean and std deviations on the last row of the table? Is this for all models? I think it would be more interesting to see the mean and std dev for all individual models and for the observations in order to get some estimate of the variability.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 8035, 2007.