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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 #2

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(General Comments) An intercomparison of meteorological convective cloud model coupled with chemical model is not an easy task, and even more difficult to include deep cloud-based meteorological model for the model intercomparison study. I found the paper interesting although it is rather unfortunate that there exist no new interpretations emerging from this paper except for a few results like the role of lightening in convective cloud. Some results (i.e., soluable species) shows big discrepancies from each model, but it is still unclear that which one is more significant to these discrepancies, among clouds parameterization, hail characteristics, treatment of gas-phase to convective cloud, and other aqueous-phase related dissociations. Sometimes these factors are believed to be causing compensating error. Nevertheless this exercise can be informative or, at least, guide the modelers to choose appropriate convective model

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or microphysics among the existing models and treating the various chemical models. Therefore publication of this manuscript would be helpful to the community

(Specific comments) -It would be one of the challenging tasks to simulate the deep convection cloud requiring high resolution of time and space. However, the worldwidely used community meteorological models such as MM5 or Eta model were not found in this model intercomparison study. The reason should be briefly addressed if any. - i.e.,O3(total) = O3(g) + O3(aq) + others, and it should be clarified somewhere in paper that all of chemical species for intercomparison was gas phase. - Although this lightening induced NOx emission is likely to be highly variable both temporally and spatially, NOx emission by lightening is an important process in this study but no quantitative rate was addressed. Probably maximum rate or roughly order of magnitude needs to be addressed here. -Page 8040 : Each of the eight models was described but need to be consistent. For example C. Wang model only describes radiation scheme but not found others. At least number of gas or aqueous chemical reactions and species involved in chemical model should be identified for discussion. In table 1, at least horizontal and vertical resolution, horizontal grid structure (i.e., Arakawa-B) need to be summarized to help readers understand for simulation of deep convection. -Caption of Fig.1 c) is confusing. It says that the points are NO mixing ratios and the Lines are NOx mixing ratios. If lines are not initial profile but NOx mixing ratio itself, the levels of NO and NOx are nearly equal, and sometimes NO$>$NOx in a certain level. Please check. Also note the unit of Pmol/mol was indicated in the text, but unit (Nmol/mol) was plotted in Fig. 1c). -Fig.11, for WRF-Aqchem, the case without lightening-produced NOx emission was not found in Fig. 11 but discussed in the text.

(Technical corrections) -i.e., 3.3 UMd/GCE (A, B, C) should be -$>$ (A, B, and C). - Typographical corrections; finetedifference -$>$finite difference -P8053: first paragraph: Horizontal resolution vs. contributing to the anvil width: All employed 1km horizontal resolutions except for only Umd/GCE (employed 2 km grid spacing). Therefore probably difference of vertical resolution seemed to contribute more to the difference of

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soluble species.. -Cohan et al. ->Cohan et al.(1999) -Check the unit: designated as (2-s), (2 s) etc.

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