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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Cloud and aerosol effects on radiation in deep convective clouds: comparison with warm stratiform clouds" *by* S. S. Lee et al.

Anonymous Referee #2

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General comments:

The manuscript contains interesting aspects about aerosol effects on cloud radiative forcings from shallow and deep convective clouds. However, there are a few aspects which need further discussion.
Firstly, the authors restrict their simulations to 2D. Given the complex interactions between microphysical and dynamical feedbacks in the context of convective clouds it is questionable whether the simulations satisfy the goal proposed by the authors on page 5 namely to conduct physically realistic simulations. The potential implications of this

restriction for the general outcome of this work should be discussed.
Secondly, the authors do not discuss the role of ice crystal shape in their simulations. However, the ice crystal shape is a function of temperature and ice supersaturation (Pruppacher and Klett, 1997) and is an important aspect for radiative interactions. At least, the authors should investigate to what extent the conclusions drawn in this manuscript could be affected by assumptions of the ice crystal geometry.
Thirdly, the findings of the manuscript are not summarized very well and are not sufficiently put into context with the results of similar studies such as Lohmann and Diehl (2006) and Lohmann (2008).
Finally, the manuscript would benefit from being more concise and from avoiding repetitions. Furthermore, the style of the manuscript needs modifications to improve the flow of the manuscript and its general appeal.

Specific comments:

- The introduction section is rather long and contains many repetitions and technical explanations which may be better suited for a model description section (e.g., the paragraphs starting at line 132 until the end of the introduction). Here, my suggestions is to shorten this section drastically and merge some of the discussion with a model description section in order to make the introduction more concise and more appealing to read.
- P.4, l.89: The double-moment microphysics parameterization for stratiform clouds has been extended to convective clouds in the ECHAM5 model. This is described in the recent work of Lohmann (2008) which should be discussed in this context.
- P.7, l.170: What is the motivation for reducing the aerosol mass instead of the aerosol number by a factor of 10 in the low-aerosol runs? Please explain.

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- P.8, l.202: Why the restriction to 2D? Please explain what the consequence of this restriction would be also in view of the scientific goal identified on p. 5, l. 128: Physically realistic simulations.
- P.9, l.247: Are black carbon aerosols considered? If so, why do black carbon aerosols not act as cloud condensation nuclei? Please explain.
- P.10, l.278: This sentence is confusing. Do you only consider the indirect aerosol effects but not the direct aerosol effect? Do you account for dynamical feedbacks due to radiative interactions? Please clarify and reformulate the sentence.
- P.15, l.417: The larger cloud water in the high aerosol run may also be due to a decrease of rain as indicated by figure 3c. Thus, the reduced efficiency of the warm-phase collection processes may be more relevant here than the increase in condensation or deposition. This should be analyzed and discussed.
- P.15, l.419: The authors should discuss what the height of the cloud base and the freezing level is in the simulations. This information may help to understand why e.g. the cloud liquid water extends to the surface in figure 4a.
- P.16, l.450: It may be helpful to see vertical profiles of the latent heat flux and to investigate whether the loss in rain water is due to enhanced evaporation which subsequently intensifies downdrafts in the convective cloud.
- P.16, l.455: Figure 5a,b indicates that the convective mass flux is stronger for deep clouds than for shallow clouds which is straightforward. However, the relative contribution of the aerosols seems to be fairly similar in the deep and the shallow convective case. Maybe the author can comment on this.

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Technical comments:

The manuscript contains a series of grammatical and typographic errors which disturb the flow of the manuscript and make it sometimes difficult to read. Furthermore, repetitions within sections or from section to section should be avoided to improve the flow of the manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 15291, 2008.

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Interactive Comment