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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Cloud processing, cloud evaporation and Angström exponent" *by* G.-J. Roelofs and V. Kamphuis

Anonymous Referee #2

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Review of G. Roelofs and V. Kamphuis 'Cloud processing, cloud evaporation and Angström exponent'

General comments: The authors of this paper use a parcel model with detailed cloud and aerosol microphysics to simulate the evolution of the aerosol size distribution, the aerosol optical thickness and the Angström exponent during the formation and re-evaporation of a cloud. The Angström exponent is found to be increased by cloud processing in clean marine clouds, but the effect is weaker for a different initial aerosol size distribution, chemical composition and a different maximum LWC. From the results conclusions are drawn on in how far the Angström exponent can be used as a proxy for the cloud processing of aerosols, and the results are compared to observations of the Angström exponent in the twilight zone around clouds.

This is an interesting and generally well written paper. To my knowledge, no other modeling study has looked at the connection between cloud processing and the Angström exponent, and this is an important contribution for the bridge between aerosol modeling and aerosol retrievals from satellites. However, I was sometimes missing the thread and did not get what is intended to be the main message of the paper. The abstract and introduction should make clear what the aims of the parcel model studies are - to test whether the Angström exponent can be used as a proxy of cloud-processed aerosol? To simulate conditions similar to the 'twilight zone', or at least to use the results to help interpretation of Koren et al.'s results? To learn something about the use of satellite data? What is the initial hypothesis behind this paper? I recommend reorganizing the abstract, introduction (and conclusions, with taking up the initial question again) in this respect.

Specific comments:

- It would be nice to give the definition of the Angström exponent somewhere in the introduction, along with its typical values under different conditions.
- P. 12696, l. 26: Stier et al. (2005) do not simulate activation of aerosols and the aerosol indirect effect. Rather give a reference to a different GCM which treats aerosol indirect effects here.
- P. 12698, l. 17: defined by one or more lognormal modes'. Do you mean 'initially defined'? In Figure 2, they do not look lognormal after cloud processing anymore, and furthermore it would be unclear to me why you would need the bins.
- P. 12699, l. 11: Is this size distribution derived from any measurements? Please give a reference.
- Why is the aerosol prescribed as 80% ammonium bisulfate + 20% insoluble, and not any sea salt, as would be expected in a marine environment?

ACPD

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Interactive Comment

- You calculate the Angström exponent from the simulated optical thicknesses at 533 and 855nm (please confirm). Is this the same as what is done in satellite retrievals? Does it matter? Please comment.
- P. 12702, l. 6ff: It would be helpful to have a plot like Fig. 1 (d) with the evolution of the Angström exponent in all sensitivity studies (a bundle of spaghetti lines), in order to give the reader a quick overview over the possible scenarios.
- P. 12702, l. 7: Is this sensitivity study meant to represent more polluted aerosol? Please comment here (not only in the conclusions).
- P. 12704, l. 28: Please comment on why the Angström exponent reported by Koren et al. is much higher. As they did not only investigate pristine marine areas, but also the Amazon forest and polluted continental regions, the comparison has to be accompanied by a note of caution.
- P. 12705, l. 5: I find it difficult to imagine (even in theory) how the Angström exponent can be used to choose pixels with optimally unprocessed aerosol. Can you go into more detail here? Do you mean that pixels with a small value of alpha should be preferred?

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 12721, 2008.