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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Cloud microphysics and aerosol indirect effects in the global climate model ECHAM5-HAM" *by* U. Lohmann et al.

Anonymous Referee #4

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The paper describes coupling a double-moment cloud microphysics scheme to the ECHAM5 size-resolved aerosol model. The paper is generally well written and the conclusions are clear. The paper is within the scope of ACP. In my view it should be published after some minor alterations.

General Comments

The demonstration of improved model skill between ECHAM5 and ECHAM4 in predicting vertical aerosol profiles seems a bit weak. The paper only shows one vertical aerosol profile over a polluted continental region (Fig. 3). Is it possible to show profiles over other regions (e.g., remote marine) and other times of year? Without further comparison with observations the statement "This results in much better agreement with

observed vertical profiles of black carbon and aerosol mass mixing ratios than with the previous version ECHAM4" seems overstated. I would recommend that this statement is removed from the abstract or further evidence is included to support it.

Some of the figures are quite difficult to interpret which in places makes the paper a little hard to follow. It should be possible to replot some of these (see specific comments below).

Specific Comments

I couldn't find definitions for some of the variables used in the paper. Page 4, Line 105: Define Q_{nucl} Page 5, Line 120: define W(overbar)

Page 4, Line 106: Confirm that this is aerosol dry radius.

Page 5, Line 123: Is there observational evidence for setting the cloud drop number concentrations to 40 cm^{-3}? If so where is this from.

Page 5, Line 141:22 I do not fully understand the meaning of "in the spirit of statistically based cloud parameterizations". Is it possible to clarify this?

Page 5, Line 131: Are other anthropogenic emissions (e.g., SO_2) the same between the different model runs?

Page 14: Is the main reason for improved representation of UTLS aerosol concentrations aerosol nucleation and subsequent growth? The black carbon profiles show the same behaviour (higher concentrations in the ECHAM5 compared to ECHAM4) suggesting it might be more due to changes in transport and deposition.

Figure 2: Define whether it is radius or diameter > 0.035 μm.

Figure 4-6: These figures are a quite difficult to interpret. It might make the comparisons easier to remove the observations panel and instead plot the observations on the same panels as the model results. Or having a separate panel for TWC/LWC/IWC (for Fig 4) and plotting all model simulations and observations on the same panel.

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Fig 8, caption. Should it be "This diagnostic is not available from ECHAM5"?

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