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Geoscientific Model Development Discussions

Interactive comment on "Aerosol microphysics modules in the framework of the ECHAM5 climate model – intercomparison under stratospheric conditions" *by* H. Kokkola et al.

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Reply to Referee #2

We thank the Referee for the review of the paper. However in our opinion, the manuscript is relevant for publication in GMD and also is also of interest for researchers using other GCM models than ECHAM. The reason for this is that the manuscript shows the importance of describing the shape of the aerosol size distribution in large scale models when simulating extreme conditions such as volcano eruptions of geo-engineering by artificially produced sulphate in the stratosphere. As pointed out in the manuscript, simulations on the estimated climate effects of sulfate geoengineering

often use a simplified description for the aerosol size distribution. Furthermore, the microphysical modules presented here are not only used in ECHAM5. M7 is used in the the ESM MESSy, the CTM GLOMAP and the CCM UKCA, SALSA is being implemented in the CTM MATCH and the CTM SILAM.

Also, the methods used in modal and sectional approaches that are well established in typical atmospheric conditions can result in inaccuracies in such extreme conditions because the size distribution in heavily modified by microphysical processes. Since these methods (e.g. fixed width of the modes in the modal approach) are also used in other large scale models, the information given by this manuscript is relevant.

Furthermore, as already mentioned by the Referee, we present a new method for the time integration in M7 which can be used also in other modal aerosol microphysics models to have a significant improvement in the accuracy of the model when long time step lengths are used.

As the aims and scope of GMD is as follows:

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- Geoscientific model descriptions, from box models to GCMs
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- Papers describing new standard experiments for assessing model performance, or novel ways of comparing model results with observational data
- Model intercomparison descriptions, including experimental details and project

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protocols.

According to this our manuscript should be relevant for publication in GMD.

Specific comments

2) Some of the physical conclusions in section 6 (i.e. effects of radial resolution in sectional modules) are not new and were already discussed in previous papers in the literature (for example Weisenstein et al., JGR, 1998; Weisenstein et al., SPARCassessment, 2006; Larsen, DMI technical report, 1991).

- We are aware of this and the reason that these conclusions are mentioned were not intended to represent new findings, but to state the characteristics of the modules used in this intercomparison. We will remove then unnecessary conclusions (e.g. page 234, last sentence of the first paragraph)

3) References to other works appeared in the literature on the use of aerosol modules in global atmospheric models are missing (section 1: "Introduction").

- We will include discussion on such work to Introduction (e.g. Weisenstein, D. K., Penner, J. E., Herzog, M., and Liu, X.: Global 2-D intercomparison of sectional and modal aerosol modules, Atmos. Chem. Phys., 7, 2339-2355, 2007).

Interactive comment on Geosci. Model Dev. Discuss., 2, 209, 2009.