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Interactive comment on "Tropospheric aerosol size distributions simulated by three online global aerosol models using the M7 microphysics module" *by* K. Zhang et al.

Anonymous Referee #2

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The manuscript presents an inter-comparison of three global aerosol models, which include that same aerosol microphysical module. This manuscript is of interest to researchers using these global aerosol models presented in this paper, since it identifies the differences in the atmospheric aerosol size distributions resulting from treatment of aerosol processes and transport. Nevertheless, the problem with the manuscript is that it does not identify the reasons for the differences between the model results. I suggest publishing the manuscript after more effort is put into identifying the reasons for the inter-model discrepancies.

Specific comments: - One reason for the discrepancies between the model results and

observations have been stated to be "probably caused by the fixed mode variance in the mathematical formulations used in the modal approach in the three models". Would it be possible to make simulations using different mode widths. How sensitive are the results to the mode width, if for example coarse mode width is changed from 2.0 to 1.8 (which is said in Summary to be the observed width in China adjacent seas)?

- Another main reason for discrepancies is said to be differences in emission parameterizations. The sea salt emission parameterizations appear to be very similar in the models. Nevertheless, in Section 6.2, the reason for the underestimation of accumulation model particle number concentrations in ECHAM5-HAM is suggested to be caused by the sea salt emission parameterizations. This should be fairly easy to verify by feeding identical inputs typical to the remote oceans to the emission modules and comparing the number fluxes obtained from the parameterizations. Have the 10 meter wind speeds between the different models been compared? Could this explain the discrepancy?

- In section 4.4, it is said that diagnostics for aging of the insoluble particles are not available. Wouldn't it be fairly straight forward to calculate the rate of insoluble particles converted from insoluble to soluble modes?

- From this manuscript it is a bit difficult to distinguish which discrepancies are caused by model meteorology and which are caused by aerosol processes. Comparing the radiative properties of aerosols to e.g. satellite data would shed some light on how much wind driven online emissions (dust and sea salt) differ for different models.

Technical comment: - In Table 3, nucleation, condensation, and coagulation overlap

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