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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Tropospheric aerosol microphysics simulation with assimilated meteorology: model description and intermodel comparison" *by* W. Trivitayanurak et al.

Anonymous Referee #1

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W. Trivitayanurak et al. present an implementation of sectional aerosol model TOMAS into chemical transport model GEOS-CHEM. Results from one-year simulation are compared against field observations and two other models, namely GISS GCM-II' and GLOMAP. Paper is generally well written, but a few issues have to be discussed.

It is important for a global model to have the ability to simulate "full chemistry", and it is reasonable to use this method when comparing to observations. I think however, that for the model intercomparison, similar oxidant fields for each model would suit better, since there are already a number of other differences in the models. If simulations are done with different fields, there could be a few words about possible differences caused

by these fields.

In section 4 (and Fig. 5) comparison with observations shows a clear underprediction of CN at latitudes 15S-60S. It is pointed out that this could be due to sea-salt emission or the lack of carbonaceous aerosols, and that addition of carbonaceous would only have a minor effect. The sea-salt emissions of GEOS-CHEM are already higher than those in other two models (Table 2), still GEOS-CHEM has generally lowest CN in this comparison. Is the sea-salt emission parameterization the main error source, or is there another source of CN that is missing?

Why are the GEOS-CHEM results for year 2001 and GLOMAP results for year 2006? It is a good idea to include a GCM with its own meteorology in the comparison, but for CTM comparison the use of different meteorological fields takes away the benefit of using a CTM. In addition, the used meteorological fields should be from the year when most of the observational data was collected.

Since nucleation can significantly increase atmospheric CN and CCN especially in remote areas, it would be beneficial to include detailed nucleation scheme in a global model. The nucleation treatment presented in the paper is based on rather old nucleation rate calculations, and could easily be replaced with for example Vehkamäki et al. (JGR, 2002) binary sulphuric acid-water nucleation parameterization, that can be used for a wide range of atmospheric conditions (0.01%$<$RH$<$100% vs. Jaecker-Voirol and Mirabel with 20%$<$RH$<$100%).

Figures 6 e-f present an interesting result: for the Antarctica region, GLOMAP seems to predict a magnitude more of CN than GEOS-CHEM, but a magnitude less of CCN(0.2%). It was not mentioned if GLOMAP CN in this figure includes the nucleation mode (1-10 nm) particles, which would partly explain the figure.

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