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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A detailed aerosol mixing state model for investigating interactions between mixing state, semivolatile partitioning, and coagulation" *by* J. Lu and F. M. Bowman

Anonymous Referee #1

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This paper describes a new method for modeling size and composition of aerosol particles while capturing the mixing state of the aerosol. The model is applied to an idealized five-component system, and the results show that the mixing state can affect the partitioning of semivolative organics. While models similar to the one presented exist in principle, this model is unique as aerosol can move not only from less to more mixed populations, but also from more mixed to less mixed populations given a certain mixing criteria is fulfilled. This ensures that a population termed as "mixed" contains appreciable amounts of several species.

Resolving aerosol mixing state is a very relevant topic in aerosol modeling, and I rec-

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Interactive Discussion

Discussion Paper

ommend the paper for publication. The paper fits well into the scope of ACP, and it shows interesting results on the potential impact of mixing state on the partitioning of semivolatiles. My main point of concern with the manuscript is the quality of the model description. Since this paper is introducing a new sectional approach, more precise mathematical expressions should be given. Another point of concern is how useful this model framework would be for treating more realistic scenarios that comprise more species. I will address specific points in the remainder of my review.

1. What are the variables in this model and which equations are actually solved in the model? It is not clear if the model equations are cast in terms of volume or number, or if both moments of the distribution are tracked. Page 426, line 6 suggests that the model solves for number and component volume, while page 428, line 15 suggests that n_Nk,t is deduced from v_Nk,t.

2. Page 427, lines 5-10: The example states how mass can be transferred from population AB to A. What happens to the mass of B in this case, or in other words is the mass of the components conserved in this example?

4. Figure 3: I assume that the results shown in this figure are for the last day of simulation (size distributions don't change over the course of the day?), please add this information to the caption.

5. Figure 2 and 3: The figure legend uses "INORG" whereas the text uses "INERT".

6. Table 1: What particle sizes are assigned to the INERT, PO1 and PO2 emissions?

7. Figure 3 and Figure 4 table 3: The bulk mass and the 1D mass size distributions are useful information, however they don't reveal the information on the mixing state which seem critical to me given that the point of this method is to resolve mixing state. Figure 4 gives some idea about the composition of the different particle populations, but here the size information is missing. Therefore, it would be helpful to add another figure that shows the size distributions of the individual particle populations.

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8. The number of aerosol populations scales according to eqn 6. For how many components is this method expected to be computationally feasible?

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 417, 2010.

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Interactive Comment