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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Development of an aerosol microphysical module: Aerosol Two-dimensional bin module for foRmation and Aging Simulation (ATRAS)" *by* H. Matsui et al.

Anonymous Referee #1

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This manuscript introduces a new aerosol microphysical module, its implementation in the WRF chem model, and its application to East Asia. The new microphysical model combines the state-of-the-art treatment of three major processes relevant to atmospheric aerosol populations: new-particle formation, ageing of particles containing black carbon, and secondary organic aerosol formation. The paper is well-written, scientifically sound, and of appropriate length. The paper addresses a few scientifically interesting questions based mainly on sensitivity analysis. The paper would become even stronger in case the authors would discuss shortly 3 issues explained below, perhaps in a short yet separate subsection before summary and conclusions.

Issues recommended to be discussed:

1. Needed accuracy of aerosol microphysical simulations. The statement given in lines 16-18 on page 10661 is very strong. While a more detailed description of aerosol microphysics is likely to increase the accuracy of a simulation, it is still unclear how detailed description is necessary in various atmospheric applications. As a compromise between bulk approaches and very detailed approaches, such as the model framework introduced here, many large-scale models use currently a modal approach to represent the aerosol size distribution and allow a simplified treatment of aerosol mixing state.

2. Model evaluation. Model evaluation presented in this paper was very crude, which is understandable. However, I would like the authors to provide some recommendations on how to evaluate detailed aerosol microphysical models in large-scale applications. What quantities should be looked at? How can one demonstrate, by comparing with measurements, that this kind of a very detailed model is essentially better than e.g. a modal model?

3. Areas requiring further development in large-scale modeling. Based on our current scientific knowledge, how should one develop aerosol microphysics models further? Do this and other existing large-scale models miss some major processes altogether, or should some processes treated in more detail and how? As one example, do the recent findings about extremely low-volatile organic vapours have any implication on how atmospheric new-particle formation and SOA formation should be treated in large-scale models. There are probably many other examples like this.

Minor/technical issues

The present tense in section 4 sound a bit strange. Perhaps past tense would be more appropriate.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 10659, 2014.