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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 #3

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General Comments

In this manuscript the authors present the new ATRAS sectional model for aerosol microphysics that keeps track of the aerosol number concentrations, size distribution, and black carbon (BC) mixing state. ATRAS simulate new particle formation, BC aging, and secondary organic aerosol (SOA) processes. The number of bins used to simulate BC mixing state is variable. In this manuscript the authors compare results from simulations with a different number of size bins for BC mixing state in order to assess the effect of a treatment of BC mixing state on the radiation effect of aerosols and on CCN condensation. Additionally, the authors performed simulation excluding new particle

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Interactive Discussion
Discussion Paper

formation (NPF) and SOA processes, to assess the importance of NPF and SOA on CCN concentrations.

This is an interesting manuscript, which presents a very valuable model. I do not have any major critique, but I do have some minor comments.

1 - The discussion of the results is very interesting, but I feel that it lacks some clear and definite conclusion. In particular, after comparing all these simulations with different treatment of BC mixing state, which configuration would the authors suggest? Are 10 bins necessary? I assume that this would be a major limitation for applications to global models.

2 - All results of 3D variables are shown at 1 km altitude. How do vertical profiles look like?

3 - I suggest including more description of the SOA processes included, instead of referring only to previous studies. How is SOA transformed into OA? And is SOA a primary emission, or is it calculated from terpene emission? Is organic chemistry included?

4: is organic material from SOA considered hydrophilic?

Specific Comments

P10664 L2-4: Does this mean that this configuration uses in total 256 bins?

P10664 L5: No BC is emitted as internally mixed. Does this make physical sense? Some aging might be faster than the model time-step (how long is the model time-step?). Would a different choice for emissions make a large difference?

P10666 L26: Does the choice of binning make any difference in the results? Why are the intervals 0.2-0.5 and 0.5-0.8 not as well resolved as the others?

P10669 L5: In the simulations without SOA processes, is OA from primary emissions?

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P10670 L5: It would be useful to see maps of BC, SOA and NPF. SOA is more important in the SE Asia for CCN concentrations: is it because SOA emissions are higher, or because the processes are somehow more efficient? And, in the latter case, what would be the reason?

P10670 L12: I am confused by figure 6b. M01 and M01_S are overlapping, M01_N has more OA than M01_S. Is it correct? I don't understand how that can be.

P10671 L2: Fig. 7 does not show local changes, only the regional and time average, hence it does not show what the authors say in this sentence.

P10671 L16: when the authors say "overestimation" and "underestimation" they mean with respect to M10_SN. I think it is worth to repeat it, or it seems that they are compared to the real world, i.e. observations. Is there a way to compare these numbers to data?

P10672 L11: does the lens effect saturate after a certain coating thickness?

Technical Comments

P10665 L14: eliminate "during"

P10676 L5: change "complicate" into "complicated"

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