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Geoscientific
Model Development
Discussions

Interactive comment on "Modeling anthropogenically-controled secondary organic aerosols in a megacity: a simplified framework for global and climate models" *by* A. Hodzic and J. L. Jimenez

Anonymous Referee #1

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The intention of this paper is to provide a parameterization for SOA to be used in simplified models. The parameterization includes emission of an anthropogenic and biomass burning SOA parent hydrocarbon that is spatially distributed like CO and biogenic SOA from isoprene, terpenes, and sesquiterpenes. The role of acid-enhanced and anthropogenic-enhanced biogenic SOA are examined.

Given the intention of the paper to provide a simplified framework and the ability of the parameterization to predict SOA it is recommended that the authors refocus their paper on validation of the parameterization and remove the conclusions regarding the lack of

an anthropogenic control on biogenic SOA. The model setup seems too coarse/lumped to resolve any anthropogenic enhancement to biogenic SOA.

Comments regarding model set-up: The conclusion that an anthropogenic enhancement of biogenic SOA does not exist seems circular. The model input parameters are set in such a way that a biogenic enhancement may not be predicted. First, the emission of VOCA/CO is set to the observed ratio of SOA/deltaCO in aged air. This assumption implies that VOCA is the primary, if not only, source of SOA. The emission and aging of VOCA seem to be set in such a way that they should reproduce SOA concentrations, leaving little room for biogenic hydrocarbons to contribute. Secondly, the rate constants for reactions 11-14 in Table 1 may be set arbitrarily low. As these reactions are not fundamental kinetic reactions and are intended to represent a coarse scale process, the rate constants are highly uncertain. If the rate constants for 11-14 are set low, then the model will naturally predict that there is no biogenic enhancement from the enhancement test. The importance of biogenic SOA may also be underestimated in the Lane et al. 2008 test since it reverts to older ISOP + OH low-NOx SOA yields.

Figure 5 along with other statements (pg 889) in the manuscript indicate that the acid-catalyzed SOA pathway, as represented by homogeneous reaction with SO2, does not do a good job in predicting the spatial or temporal pattern of SOA. Although SO2 may be an attractive species for use in a global model since it is primary, the particle phase acidity should be better represented by the secondary product sulfate. Many global models have at least sulfate aerosol if not ammonium as well. This information would provide a better measure of particle acidity and may lead to better diurnal variation and spatial distribution.

Missing information: The conclusion that the model does not show an anthropogenic enhancement of biogenic SOA should be removed. In addition to the comments about the reasoning being circular, a model that only matches observed concentrations within 30% may not have the skill to predict a biogenic enhancement of SOA. Furthermore,

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the model is missing known anthropogenic enhancements to biogenic SOA: 1. Table 2 shows the same SESQ SOA yields under high- and low-NOx conditions. Ng et al. 2007 have demonstrated that sesquiterpenes have higher yields under high-NOx conditions. 2. Table 2 shows that high-NOx isoprene photooxidation results in substantially less SOA than high-NOx conditions. New work indicates that isoprene SOA yields are the same, if not higher, under high-NOx conditions compared to low-NOx conditions [Chan et al. 2010].

Additional questions and comments How do the authors reconcile measurements of modern carbon, which indicate Mexico City OA is 61-77% modern C, and model predictions that predict a small role for biomass burning and biogenic hydrocarbon SOA?

It is not clear in the title or abstract if the lumped SOA precursor is meant to include biogenic SOA. Conclusion #1 indicates that the proposed parameterization is an emission rate relative to CO and an oxidation rate of that precursor without any mention of how biogenic SOA is treated. Please state early in the manuscript whether the lumped precursor is intended to include biogenic SOA or not.

Figure 4 is missing some a, b, c labels.

The purple line in Figure 5 is labeled as Hodzic OPT and Henze and Seinfeld 2006 yields. Please clarify.

Typo in title “controlled”

References

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Interactive comment on Geosci. Model Dev. Discuss., 4, 869, 2011.