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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Understanding and constraining global secondary organic aerosol amount and size-resolved condensational behavior" *by* S. D. D'Andrea et al.

Anonymous Referee #1

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In the manuscript by D'Andreae et al., the influence of secondary organic aerosol formation on aerosol number size distributions is investigated by a series of sensitivity test made using a global aerosol model with detailed aerosol microphysics. The paper is very clearly written and thereby easy to follow. I do not find any scientific or technical errors in the paper. Since the topic investigated in this paper is highly relevant for modeling and understanding both global and regional SOA formation, and ultimately atmospheric cloud condensation nuclei production, I am in favor of accepting this paper for publication after some revisions explained in more detail below.

First of all, I do not think that the title of the paper correctly reflects its contents. The

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investigation does contribute to understanding and constraining size-resolved condensation behavior but, in my opinion, it does relatively little to constrain the secondary organic aerosol amount. I suggest that the author consider modifying the title somehow.

Second, I do not fully understand why the considered particle size regimes vary from section to section. For example, in sections 3.1 and 3.2 authors have chosen N3, N10, N40 and N80, which is fine when investigating changes in both nucleated particles and CCN. However, in model-measurement comparison N3 has been dropped of and N150 is used instead. The Abstract and Conclusions sections discuss only particles larger than 40 nm (N40), providing only a partial view on the results obtained from the whole analyses.

Finally, I think that the authors should discuss, and preferably also provide some guidance for, future model development and model-measurement comparisons regarding atmospheric SOA formation. How would the authors prioritize large-scale model development aiming to improve the SOA treatment when considering the balance between accuracy and computationally costs? Which other quantities, besides aerosol number size distribution, should be compared when evaluating SOA models and which kind of comparisons are feasible at current state and near future?

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 18969, 2013.