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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The role of organic condensation on ultrafine particle growth during nucleation events" *by* D. Patoulias et al.

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1. *This manuscript introduces a new version of a previously-published aerosol dynamic model and applies it to two environments in order to get new insight into the role of organic vapor condensation in the growth of small particles formed by atmospheric nucleation. The paper is original, scientifically sound and relatively well written. There are a few issues (see below) that required some rewriting of the text. After these minor modifications, I recommend accepting this paper for publication in ACP.*

We do appreciate the positive assessment of our work.

2. *The description and discussion of chemical aging reactions needs to be improved*

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in the manuscript to avoid confusion. The authors use the terms "OA aging" or "SOA aging" (in one place even "biogenic aging" which is definitely incorrect) for reactions that essentially convert gaseous semi-volatile organic vapors to less volatile ones. In that respect, it is not really OA or SOA that ages but their precursors. I understand that the commonly used terminology is not well established, yet there is a clear danger that the readers not familiar with this topic misunderstand "OA aging" to mean e.g. heterogeneous reactions taking place in the particulate phase. I encourage the authors to reconsider the used terminology (e.g. "aging of SOA precursors" or something like that) are rewrite parts of the text accordingly. It might also worth considering combining sections 2.5 and 2.6 to explain the series of processes leading to SOA formation in one package (what happens in gas phase, how this leads to partitioning and SOA formation).

Following the reviewer's suggestion we define and use the term "chemical aging of SOA precursors" consistently throughout the revised manuscript. Furthermore, we combined sections 2.5 and 2.6 in one section and also added more text to describe in more detail the processes leading to SOA formation in this model application.

3. *Another issue that requires some rewriting is related to the representativeness of the results. The authors state that they simulate a "typical" day with nucleation in two locations (page 30772). What is meant by "typical" here? Based on the figures, the authors have selected one day from these two locations and compare their simulations results to those two days in their analysis. This sounds like two case studies, provided that the model input corresponds to the conditions met during those two days. When comparing observed and simulated nuclei growth rates (section 4.1), the authors talk about typical growth in Hyytiala (why not to compare to the growth rate on the simulated day?), while they do not define at all what is meant by the observed growth rate of 5 nm/h in Finokalia. Is this 5 nm/h the average growth rated observed during some campaign(s) in Finokalia, or growth rate that was observed in the simulated day? In summary: are these real cases studies or some mixture between real cases and*

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"average behavior" observed at the two sites?

We have re-written this part to avoid any misunderstandings. We have used the following process to obtain the characteristics of a typical nucleation event day in Hyytiala in April 2007 and in Finokalia in May 2008. We have first found the days with observed particle formation and growth. We have then averaged the measurements during these days generating in this way the meteorological and chemical characteristics of an "average" nucleation day for the specific periods in the two locations. For the parameters for which measurements were not available, but were needed for the model input, (e.g. OH concentration) we followed the same process using the predicted values from the 3-D chemical transport model PMCAMx. Therefore we do not choose specific days to simulate but rather try to simulate a "representative" nucleation day. In this way, we compare our results (e.g., for the growth rate) to the average growth rates and their corresponding ranges observed during this period. We do explain this process in detail in the revised manuscript.

4. *Related to the previous comment, the authors provide several conclusions that appear general even though in reality they are based on the simulated two cases. For example, by reading the abstract one easily gets the impression that the given numbers (45 percent contribution of nuclei growth and 13 percent and 25 percent increases in CCN concentrations) are generally valid for those two locations. This should be corrected to avoid confusion or misunderstandings.*

This is a valid concern and it is not our intention to over-generalize our conclusions. These are clearly applicable to nucleation days in the two locations during the simulated periods. We have qualified the corresponding conclusions in the abstract and the conclusions section to avoid misinterpretation of our findings.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 30761, 2014.