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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Towards closing the gap between hygroscopic growth and activation for secondary organic aerosol: Part 1 – Evidence from measurements" *by* H. Wex et al.

H. Wex et al.

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Answer to Referee 1:

The authors thank the Referee for his kind comments.

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Your comment: Authors have chosen to present modelling results in the different paper. Personally I would have preferred one manuscript containing both measurements and modelling. As the current manuscript does not include any results of solubility or non-ideality, I would leave mentioning of those out of the abstract.

Our response: We removed those statements from the abstract.

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Your comment: The main comment is the lacking discussion on the applicability of the presented results on atmospheric conditions. As shown in Duplissy et al (2008) paper, the mass of formed SOA might affect the properties of SOA. With small SOA masses hygroscopic growth factors and CCN activity agreed in their study. How does the results of this study compare on that?

Our response: Concerning the applicability of the present results to atmospheric conditions, we added the following text (at the end of the Discussion section, p. 17, line 7 ff): " ... . However, organic aerosol mass concentrations in different experiments we conducted varied from 3 to 1000 micro g/m3, but we did not observe significant changes in LACIS- or CCNc-derived hygroscopicities. This is consistent with the observation of King et al. [2009], who examined a-pinene/O3 (dark ozonolysis) particles that were internally mixed with ammonium sulfate, and who only observed an effect on hygroscopicity at mass concentrations that were lower than those achieved in our study. The extent to which different compounds (differing in their functional groups) were present in SOA in our experiment, as compared to SOA examined in Duplissy et al. [2008] or present in the atmosphere, can depend on the actual precursors and on the conditions under which SOA formation and subsequent aging takes place. Nevertheless, our work clarified the origin of the previously often reported gap between low hygroscopic growth and good CCN activity of laboratory produced SOA particles. It raises a note of caution for future atmospheric studies by pointing out that assuming a constant hygroscopicity over the whole range from water sub- to super-saturation might be erroneous."

In general, to achieve more realistic conditions we make the following note: the SOA generation system as used in our study cannot generate aerosol mass concentrations less than 3 micro g m-3. To achieve such low organic aerosol concentrations the use of seed particles becomes necessary as was demonstrated by King et al. (2009) in ACPD. Although it is possible to retrieve organic aerosol hygroscopicity from such data through

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mixing rules, it is necessary to then separate mass loading effects from non-ideal, i.e. non-ZSR, mixing effects. Thus there are considerable experimental challenges to accomplish atmospherically relevant mass loadings. This is further complicated by the challenge to more accurately simulate the SOA chemistry under laboratory conditions. Such simulations will require more accurate control over NOx, HOx, and other VOCs that are present in the atmosphere but not, or in the wrong proportions, in the reactor. Also it will be necessary to include multi-generational evolution of the SOA composition. These effects are clearly beyond the scope of this study and will hopefully be addressed in future studies on the subject.

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Your comment: There are few typos, like ”ACCNET” in acknowledgements, and ”The Kelvin verus the Raoult term in the Kequation” in the reference list.

Our response: We carefully proof-read the manuscript and eliminated typographical and grammatical mistakes.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 955, 2009.