Atmos. Chem. Phys. Discuss., 12, C2916–C2919, 2012
www.atmos-chem-phys-discuss.net/12/C2916/2012/

Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "Contribution of sulfuric acid and oxidized organic compounds to particle formation and growth" *by* F. Riccobono et al.

J. Pierce (Referee)

jeffrey.robert.pierce@gmail.com

Received and published: 24 May 2012

Review of "Contribution of sulfuric acid and oxidized organic compounds to particle formation and growth" by Riccobono et al.

This paper examines the role of sulfuric acid and SOA in nucleation and the growth of these particles. Most interestingly, it shows evidence of strong influence of sulfuric acid on the SOA condensation rates onto the smallest particles. This is an extremely important finding.

The paper expands on the experiments of Metzger et al. 2010 by including direct measurements of sulfuric acid vapor and by including alpha-pinene oxidation in the experiments.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

I feel that overall the methods and analysis are solid, and the paper is written well. The results certainly are a very important contribution to the field of aerosol science. I believe that this paper should be published in ACP once several comments have been addressed.

General comments/suggestions:

A common way for global aerosol microphysics models to treat SOA condensation is to assume that SOA is non-volatile and to condense the SOA mass proportionally to aerosol Fuchs-corrected surface area. It would be extremely useful to use the results of these experiments to improve our assumptions of the size-dependent SOA condensation. A straightforward way to do this would be to calculate from the experiments how the SOA condensation deviates from the surface-area assumption as a function of size. For example, the smallest particles may condense at a rate that is 1/100 of the surface area assumption, but this may approach 1 at larger sizes.

I realize that you cannot directly determine this since you do not know the gas-phase concentrations. However, you do have the gamma-factor (the enhancement of growth due to SOA). Since H2SO4 condenses the to Fuchs-corrected surface-area, the gamma-factor would be constant with size if SOA was also condensing evenly across the Fuchs-corrected surface area. Thus, I can estimate the size-dependent SOA condensation profile somewhat by eye by looking at the size dependence of the enhancement factor, however, the variation between experimental conditions makes it difficult to do by eye.

If it would be possible to have this fit size-dependent condensation curve to have the observed dependence on sulfuric acid concentration, this would be even better, and we could calculate the global importance of the organic/sulfuric-acid interaction!

Specific comments/suggestions:

P11354 L3-5: Please move the Pierce et al., 2011 reference here (rather than it being

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

cited just below), and please add “Pierce, J. R., Leaitch, W. R., Liggio, J., Westervelt, D. M., Wainwright, C. D., Abbatt, J. P. D., Ahlm, L., Al-Basheer, W., Cziczo, D. J., Hayden, K. L., Lee, A. K. Y., Li, S.-M., Russell, L. M., Sjostedt, S. J., Strawbridge, K. B., Travis, M., Vlasenko, A., Wentzell, J. J. B., Wiebe, H. A., Wong, J. P. S., and Macdonald, A. M.: Nucleation and condensational growth to CCN sizes during a sustained pristine biogenic SOA event in a forested mountain valley, Atmos. Chem. Phys., 12, 3147-3163, doi:10.5194/acp-12-3147-2012, 2012.” Also, please cite papers out of Kuang et al. 2011 here (already cited later in the paper).

P11354 L7: Pierce et al., 2011 does not use a global model, please cite “Pierce, J. R. and Adams, P. J.: Uncertainty in global CCN concentrations from uncertain aerosol nucleation and primary emission rates, Atmos. Chem. Phys., 9, 1339-1356, doi:10.5194/acp-9-1339-2009, 2009.

P11359 L14: The intercept with the y-axis in figure 2 is at N=1 cm-3, not N=0 (though the line is essentially flat at this point, so I’m guessing it doesn’t really change between 1 and 0 cm-3.

P11360 L11: I’m guessing that you fit to a log-gaussian (log-normal distribution) not a linear gaussian distribution?

P11363 L5-24: Since you don’t actually do any kinetic calculations of SOA condensation, it may be more clear to remove this discussion. I spent time looking through the paper trying to find where these calculations were used.

P11365 L25-28: What was the source of error in the H2SO4 lifetime? Was it error in the calculation of the condensation sink? The accommodation coefficient? Wall losses?

P11368 L15: Regarding the acidity, I assume no experiments were performed where ammonia was added?

Figures 6 and 7: You present H2SO4 as a concentration, but a-pinene as an oxidation rate. Would anything change if you presented the alpha-pinene oxidation rate divided

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

by the condensation sink (which would give a something proportional to the NucOrg concentration, at steady state), or is this irrelevant since the condensation sink is tiny at these initial stages of growth, and the NucOrg concentrations will be growing rapidly during this time period?

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 11351, 2012.

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper