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Atmospheric
Chemistry
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Discussions

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

Anonymous Referee #2

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The manuscript, "Contribution of sulfuric acid and oxidized organic compounds to particle formation and growth," by Riccobono et al., builds upon the results presented by the same group in Metzger et al. (Metzger et al. 2010 in refs). Both papers describe new particle formation studies conducted in the PSI Teflon film environmental chamber, in which mixtures of SO2, NOx, water vapor, and VOCs are added to the chamber and exposed to light from Xenon lamps that reproduce the solar spectrum. The current manuscript presents direct measurements of sulfuric acid using CIMS, which was a weakness in the 2010 study. In addition, the current manuscript presents a novel approach to measuring size distribution growth rates that appears to be more accurate. Overall this is an excellent contribution to the body of work on the contribution of organics to nanometer-sized aerosol growth. I recommend publication once the authors have addressed one major question, and a number of minor ones.

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The main question that I have regards the authors' approach to calculating gamma. For the data shown in Figure 6, I understand that data from all experiments are used. It seems that the authors have color coded the amount of reacted a-pinene, but (according to Table 1), some of the experiments that go into the data plotted here were conducted with no SO2, whereas some had up to 5 ppb SO2. Varying the SO2 in this way will have a large impact on the growth rate due to sulfuric acid, and therefore on the calculated gamma (from Fig 5 it appears that the difference between 5 ppb and no SO2 is about 2 orders of magnitude in sulfuric). would it be possible to present the data in such a way that sulfuric acid does not vary? For example can you create separate plots for "no SO2" and "5 ppb SO2" cases? This would be valuable also in comparing the observed gamma values to those reported in the real atmosphere.

Some minor points/questions/grammatical corrections that I wished to have addressed are as follows (page/line number precedes each point).

In section 2.1.3: Since one of the major achievements of this work to so improve on the leading edge method of determining growth rates from SMPS measurements, perhaps the authors should acknowledge that other techniques exist for accurately determining size-resolved growth rates. One notable example is from the measurement of size-dependent charged fractions (Yli-Juuti et al. 2011; Iida et al. 2008).

11352/22: "particles" should be singular

11353/23: perhaps it is appropriate to give some credit to the work of Weber et al. in the 1990s for their seminal work in measuring gaseous sulfuric acid and demonstrating its role in new particle formation, e.g., (Weber et al. 1996). While one might correctly argue that the Kulmala et al (2004) review cites the earlier work, I feel quite strongly that seminal discoveries ought to be credited.

11354/6: change "i.e." to "e.g."

11354/12: Why is "respectively" used in this sentence, since it cannot be ruled out that

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both sulfuric and organics can play a role in both formation and growth?

11355/24: Why is Paulsen et al. cited for the SMPS? Is this is a unique home-built instrument that is described in that paper? Otherwise it is probably more appropriate to cite Wang and Flagan (1990).

11356/19: delete “respectively” here

11356/23: “generates” should not be plural

11371/9: please define what is meant by “TSI-type” . . . is this in fact a TSI model 3085 nano-DMA, or one build to identical specifications?

11372/9: Why was it not possible to calibrate both instruments using the same calibration apparatus? Were the CIMS instruments run at the same time, or during different times?

References cited.

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Iida, K., M. R. Stolzenburg, P. H. McMurry, and J. N. Smith, 2008: Estimating nanoparticle growth rates from size-dependent charged fractions: Analysis of new particle formation events in Mexico City. Journal of Geophysical Research-Atmospheres, 113.

Weber, R. J., J. J. Marti, P. H. McMurry, F. L. Eisele, D. J. Tanner, and A. Jefferson, 1996: Measured atmospheric new particle formation rates: Implications for nucleation mechanisms. Chem. Eng. Comm., 151, 53-64.

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