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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Bounce behavior of freshly nucleated biogenic secondary organic aerosol particles" *by* A. Virtanen et al.

Anonymous Referee #1

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General and specific comments

Virtanen et al. (Nature, 467, 824-827, 2010) have published evidence that biogenic SOA particles can exist in a solid phase in the size range >30 nm. They deduced the physical state of the particles by investigating particle bounce properties utilizing electrical low pressure impactor (ELPI). In the present paper, they extend their analysis to particles <30 nm. They conclude that particle bounce clearly decreases with decreasing particle size in sub 30 nm size range, and that this decrease might be related to different material characteristics. Nonetheless, they cannot categorically exclude the possibility that the small particle size by itself causes the decrease of particle bounce probability. Compared with Virtanen et al. (2010) little new insight is gained in this follow-up publication. The experimental and evaluation procedure is difficult to under-

stand without consulting Virtanen et al. (2010). It is not clear whether experiments and data are taken from Virtanen et al. (2010) or whether new results are presented:

The experiments 1 and 2 summarized in Table 1 seem to be the same as experiments 1 and 2 of Virtanen et al. (2010) summarized in Table S1. If this is the case, it should be clearly stated. This would imply that the present study just attempts a new evaluation of already published data.

Fig. 1 of the present paper presents the same results as Fig. S1 of Virtanen et al. (2010). It shows the ELPI current distributions measured by smooth and porous substrates of a particle size distribution peaking at 100 nm. For the present study, a comparison of SMPS and ELPI current results for a size distribution peaking at 30 nm or even lower would be more conducive.

The description of Fig. 2 (caption and text) does not explicitly state whether measurements with different size limitations are shown or whether the same measurements are evaluated in two different ways. I presume that the filled circles are obtained using eq. 3 of Virtanen et al. (2010) and the open circles are obtained with eq. 3 of the present paper and both curves rely on the same experimental data?

Eq. 3 of Virtanen et al. (2010) and eq. 3 of the present paper present crude estimates of the fraction of particles that bounced: in eq. 3 of Virtanen et al. (2010) the currents measured in the stages having cut-off diameters <30 nm and the back-up filter are considered as excess current, in eq. 3 of the present paper only the current measured at the back-up filter is treated as excess current. The authors mention on page 9324 that a sophisticated impactor flow field model is under construction. It would be beneficial if the conclusions attempted in this study could rely already on a more reliable and exact treatment of excess currents due to particle bounce. Reference measurements with ammonium sulfate and amorphous polystyrene should be extended to geometric mean particle diameter of 30 nm and lower to exclude that the small particle size by itself causes the decrease of particle bounce probability.

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I therefore suggest that the authors postpone the publication of this paper until the impactor flow field model is available and/or reference measurements for the small particle sizes allow more definite statements regarding the particle phase.

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