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Atmospheric Measurement Techniques Discussions

Interactive comment on "A method for sizing submicrometer particles in air collected on formvar films and imaged by scanning electron microscope" *by* E. Hamacher-Barth et al.

Anonymous Referee #1

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This study presents a method to measure the size of submicrometer atmospheric particles collected on the copper grids with formvar film using SEM. Using secondary electrons emitted from the particles when interact with electron beam at low voltage, the authors established a method to quantify the size distribution of atmospheric particles collected on the TEM grids by an electrostatic precipitator. The authors use polystyrene latex spheres for calibration and use measurements of size distribution by TDMPS for comparison with two particle samples collected during ASCOS. Furthermore, the authors stated that the determined size and morphology of particles can be related to transformation processes.

Overall, this is a well written paper, easy to follow and read. The subject of this paper is to provide a useful technique to obtain statistical information for off-line particle measurements by electron microscopy with a reasonable instrumental time. It is important and appropriated for publication in this special issue. However, I have a main concern about the novelty of this method. The automated analysis of submicron particles by computer controlled SEM has been established in the last decade which the authors might have also noticed (for example, Poelt et al., 2002, Scanning vol. 24, 92-100). What are the improvements as compared to the currently available methods? The authors should elabrate and demonstrate the significant improvements of this method. Thus, I would suggest for publication as a technical note after revision.

Major comments:

1, as stated above, I suggest the authors demonstrate clearly the advantages or improvements of this method. A literature discussion of previous methods or studies on automated methods based on SEM is also needed.

2, As for some particles, such as organic dominated particles, these won't yield many secondary electrons, especially using low accelerating voltages and beam currents similar to these used in this study. This may cause significant underestimation of the size and number of particles for particles less than 50 nm. Also, for these small particles, it is truly hard to get stigmatism right when imaging the particles which may contribute the error in circularity and elongation determination. Why do you measure the size distribution on particles smaller than 100 nm using SEM when you have in-situ, real time, measurements by TDMPS? The morphology of the particles below 50 nm may not change from 20 to 50 nm. It will be more informative to provide size resolved morphological parameters for the sample A and B (Table 2) similar to Table 1.

3, In the conclusion, lines 20-24, Page 5424, and related discussions in the text, the authors stated that "the latter has shown to be very useful in providing information on possible aerosol transformation processes. . .". I agreed in part of this statement,

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the size distribution and morphology of particle can provide some information for the aging processes. But, more careful evaluations should be discussed to draw further conclusions, such as lines 20-27, page 5421. In this study, the authors may need to discussion on the effects of sampling (coalescences and impaction of particles on the TEM grids) and the nature of particles (liquid, solid, or viscous) on the size distribution and morphology observed by SEM (discussion in page 5421, lines 14-20). In addition, without further evidences, such as X-ray analysis (composition), how could you confirm that the microgel led to the size differences in sample A and B?

Minor comments:

Page 5402, line 4, I suggest "The method allows the observation of submicrometer particles down to 20 nm in diameter collected on the substrates." Or similar statements that somehow show that you can detect very small particles.

Page 5402, line 25, how about the particles serving as ice nuclei, which could be important to mixed phase clouds in polar regions. I suggest add few sentences on this implication.

Page 5405, line 2, should be "(SEM)"

Page 5405, lines 22-23, are the images token in automated mode? If yes, how do you make sure that when move to different grids, it is still on focus and with good contrast and brightness settings. These are crucial for particles smaller than 100 nm. In this section, I suggest the authors add few sentences how to obtain the representative particle population because it really depends how the particles were collected and distributed on the grids.

Page 5406 lines 24-25, why use 40%?

Page 5413-5414, I feel that the main part of this section is redundant and can be shortened. The authors should keep this section short and relate it to the focus of this paper.

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Page 5413, line 22, “OOne” should be “One”.

Page 5415, line 7, the Figs.13 and 14 appear here prior to Figs 9-12, it seems a little bit strange. I suggest the authors change the order of the figures or move this part of discussion in the later sections.

Page 5416, line 22, “undergoe” should be “undergo”?

Page 5417, lines 1-14, it is not very clear to me how the circularity and elongation were determined for halo particles. Did you only consider the core particle?

Page 5432, as discussed above, it may be useful to calculate these parameters as a function of size, for example, in few groups, below 50, between 50 and 100, and above 100 nm? Also indicate the particle numbers analyzed for each group.

Pages 5445-5446, I suggest change the font size for the labels and x,y axsis, make it larger.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 5401, 2013.