Atmospheric Measurement Techniques Discussions

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Reply on RC3

Stavros Amanatidis et al.

Author comment on "Efficacy of a portable, moderate-resolution, fast-scanning differential mobility analyzer for ambient aerosol size distribution measurements" by Stavros Amanatidis et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-59-AC3, 2021

The authors would like to thank the reviewer for their constructive feedback on this paper. Our point-to-point response to the reviewer’s comments is listed below.

1) We agree with the reviewer that this is an important question that needs to be addressed in more detail. This present paper, however, focuses on reporting the efficacy of the moderate-resolution Spider DMA in measuring ambient size distributions, rather than the process of DMA design & optimization, which was (in part) presented in a previous publication (Amanatidis et al, 2020). Thus, even though this is indeed a topic of interest for the authors, it is outside of the scope of this present work.

Minor comments:

a) We have included additional details on the finite element modeling in the supplementary material, including a schematic of the Spider geometry used in the modeling (Figure S1), as well as a figure with particle trajectories over the voltage scan (Figure S2).

b) Shorter injection interval (i.e., larger number of particles simulated over the scan) was employed for smaller particles to capture in sufficient detail the additional (Brownian) motion along the trajectories of those diffusive particles.

c) We agree with the reviewer that the Wiedensohler approximation employed might differ from the actual charge probability generated by the soft X-ray charge conditioner. The device used here was a prototype charge conditioner that was developed recently at Caltech, but has not yet been fully characterized. We employed the Wiedensohler correlation as an approximation to the actual charge distribution. Since both instruments sampled the aerosol from the same charge conditioner, the conclusions drawn from the comparison presented in this paper are not affected.

d) We present a comparison between the parameters of the upscan and downscan transfer functions in the supplementary material, Figure S3.

e) Figure S3 in the supplementary material presents a more quantitative comparison between the height, width, and area of the upscan and downscan transfer functions.

f) We included additional details on the smoothing employed to the raw counts data in the revised manuscript (Section 2.5).

g) Due to the variability of the size distribution over this transient event, and the different time resolution of the two instruments, it is not straightforward to make a conclusive comparison that would explain such subtle differences. We have, however, investigated whether the low resolution of the Spider DMA could potentially be a limitation in capturing bimodal distributions similar to those shown in Figure 6; based on our preliminary analysis, this was not the case. This is also supported by observing the shaded light blue area in panel b, that represents the variability of the size distribution over the averaging interval, which shows that the Spider data included scans where the 1st mode of the distribution was distinguishable.

h) Corrected in the revised manuscript.