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Atmospheric Measurement Techniques Discussions

Interactive comment on "Particle Wall-loss Correction Methods in Smog Chamber Experiments" *by* N. Wang et al.

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The authors present results of an experimental/modeling study aimed at evaluating the effects of particle wall loss on measurements of SOA yields, and providing recommendations for the best approach for correcting for these losses. Data acquired from chamber studies conducted over a period of 3 years were analyzed using a modified version of a model developed by Nah et al. (2017) with SMPS measurements of size-dependent seed particle wall loss at the beginning and end of experiments. Results indicate that the corrections are sensitive to particle size distributions, coagulation, and static charge that can accumulate on Teflon chambers during maintenance or experiments. The results provide quantitative insights into the consequences of wall loss, which are helpful for getting a sense of when and by how much different factors can in-

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fluence corrections. I think the manuscript is concise and clearly written, and is a useful addition to the growing literature on this topic, which can sometimes be confusing. I recommend it be published in ACP after the following minor comments are addressed.

We address the various comments of the reviewer below. Our responses (regular font) and corresponding changes in the paper follow each comment (in italics).

Specific comments:

(1) *It would be useful to be clear in the Conclusions how this study, the results, and the conclusions compare to those of Nah et al. (2017), which seemed to be pretty comprehensive. The inclusion here of the effect of chamber disturbances is new, and the multi-year data, but it is not clear to me what else is.*

We agree with the reviewer that one of the major contributions of the present work is the conclusion that a Teflon chamber can be in different states and its corresponding wall losses can have different quite different magnitudes, size dependence, and time variability. The second is the evaluation of a range of particle wall-loss correction methods, showing that most of them work reasonably well when the chamber is in its undisturbed state, but that multiple wall loss-characterization periods (before and after an experiment) are needed if the chamber has been disturbed. Finally, it is the realization that some of the differences among results of past studies may be simply due to a change in the state of the chamber that was not noticed. We have added these points in the discussion of the main results of the paper.

(2) *There does not seem to be a discussion of how well the sulfate tracer method is expected to work under different conditions. The correction for organic/sulfate ratio seems related, but is not obviously the same as correcting an SOA yield. Since this method is often used, and it is much easier than the one recommended here (as long as one has an AMS), it would help to provide more quantitative comments on this method and the uncertainties that can be achieved for certain types of size distributions.*

The main conclusion is that the sulfate tracer method, together with most other methods, performs reasonably well as long as the chamber is in its undisturbed state. In that case the dependence of the wall loss rate constant on particle size is relatively weak in the size ranges used in these SOA experiments and the errors introduced by assuming similar loss rate constants are usually less than 10 percent for the yields. The corresponding error for a chamber in its disturbed state depends both on the shape of the loss rate constant function as a function of size, on the differences of the size distributions of the organics and sulfate, and on the location of these distributions relative to the loss rate constant curves. As the size distributions are evolving during an experiment so does the error. We have performed a few tests for losses corresponding to a disturbed chamber and the errors for the yields were of the order of 20-30 percent. However, it is difficult to generalize these results to other chambers or situations. The errors could be higher in some extreme cases or actually lower when they partially cancel each other. A correction similar to the one used here (taking into account the size-dependent losses and the size distributions of OA and sulfate) should be performed in this case of a disturbed chamber as a safeguard against the worst case scenarios. We have added a few sentences about this issue in the revised paper.

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