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

Anonymous Referee #2

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Wang et al. reviewed and presented a comprehensive study about current methods to evaluate the particle wall-loss rate in CMU smog chambers. Particle wall-loss correction in smog chamber is a very important topic and can be applied by the chamber community in both experimental data interpretation and chamber simulations. This manuscript is well organized and very informative. But I found several parts confusing, which have to be clarified before considering for publication. Here are my comments:

General comments:

1. About k_c. My understanding of the difference between k_c and k_a is that (correct me if I am wrong): the coagulation-corrected k_c is actually the inherent particle wall-loss rate, which reflects the effect of all physics other than coagulation inside the chamber; while the apparent k_a is the synergistic effects of diffusion, gravity, eddy intensity, coag-

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ulation, and even charge, among which coagulation can be isolated to derive k_c. Then it is very confusing when the experimental data is corrected by k_c: should coagulation effect be counted? For example, to clarify that coagulation is important in particle number concentration decay but not in volume concentration decay in Fig. 2, I think k_c-corrected curve does not count coagulation (Eq. (6)), otherwise, it should overlap with k_a-corrected curve. How about in other cases? I thought the right way to perform particle wall-loss correction was to insert the derived coagulation-free k_c into the general dynamic equation to get the right particle number concentration. The authors may want to clarify this point in the revised manuscript.

2. About SOA correction. How are the particles deposited on wall treated in the SOA correction? Are they still acting as a condensation sink of VOC molecules or just removed from the system during the correction? It looks like that Eq. (7) treats the deposited particles the same as suspended particles. Moreover, what time does V_s refer to? The beginning of the injection of seeds or the beginning of the SOA experiment? These points should be clarified in the revised manuscript.

Specific comments:

1. In Section 2, what are sampling rates in both 12 m^3 and 1.5 m^3 chambers? Are there any significant volume changes during the experiment, especially for 1.5 m^3 chamber?

2. What is the scanning time of SMPS? How does this reconcile with the coagulation correction algorithm, i.e., is the time step the same as SMPS scanning time? Or is the time step just 15 min as mentioned in Line 196? More details should be included in Section 3.1.1.

3. In Section 4.1, notes should be added that the particle number concentrations in Exp. 1 and Exp.2 have ~ 1 order of magnitude difference, thus coagulation effect is more significant in the small chamber.

4. The authors may want to replace Fig. 3 with Fig. 1S. There are no uncertainties

in Fig. 3 but Fig. 1S has. Also, I suggest changing the name of legends. Is the first number referring to the experiment times? Over the past four years, is the chamber renewed? If so, is there any effect? This should be clarified.

5. In Figure 4b, the number distribution may be more straightforward than the volume distribution to explain the difference between k_1, k_2, and k_3. It will be beneficial to mention in the caption that Figure 4c is from Period 1.

6. Figures 6&7 are very similar to Figures 6&7 in Wang et al. (2018, https://doi.org/10.5194/acp-18-3589-2018). I am not sure if this is allowed in the policy of EGU publication. Since Figures 6&7 are from the same authors, I guess it is fine. In addition, it will be beneficial to mention about the conversion from D_{va} to D_p in Section 4.4 as in Wang et al. (2018).

7. In Figure 8, which k_c is more representative of the condition inside the chamber?

8. The authors may want to replace Fig. 9 with Fig. 3S, or mention in the manuscript that Fig. 3S has uncertainties.

9. The authors may want to pay attention to a just accepted manuscript in AS&T (https://www.tandfonline.com/doi/abs/10.1080/02786826.2018.1474167) on the similar topic as in Sections 4.5 and 4.6.

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