Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2017-658-RC1, 2017

Interactive comment on "Resolving nanoparticle growth mechanisms from size- and time-dependent growth rate analysis" *by* Lukas Pichelstorfer et al.

Anonymous Referee #1

Received and published: 20 September 2017

Pichelstorfer et al. proposed two methods to estimate the growth rate of sub-10 nm particles during new particle formation (NPF) events. These two independent methods are both derived from aerosol general dynamic equation. They can both provide size- and time-resolved particle growth rate. The validity of these two methods were tested using a simulated NPF event. Both method reconstructed relative good size-resolved growth rates when admitting acceptable uncertainties. These two methods together with the appearing time method were also compared in a controlled chamber study. This study is sound and solid. The reported methods serves as powerful approaches to analyze the subsequent growth after nucleation. In addition, this manuscript nicely summarized previous studies on growth rate estimation.

Printer-friendly version

Discussion paper

I have one major concern about the TREND method and a few minor comments to be addressed before its publication.

Major:

Although it was not clarified, essentially these is another assumption in the TREND method: particles grow monotonously by diameter such that after a short interval (tj+1 – tj), the increase caused by condensational growth can be determined by the diameter increase in the same size region. This assumption is reasonable for the simulate NPF event and the chamber study for testing and the relatively negligible effect of coagulation are evident as inferred from Appendix D. However, for NPF events in polluted atmosphere, i.e., where the coagulation scavenging effect is a major (or the dominant) factor, the feasibility of the TREND method should be carefully considered. That is, does coagulation scavenging contribute a considerable (e.g., >30%) part to the observed growth rate in urban environment (e.g., Beijing)?

Minor:

1) The determination or selection of the number of m in the TREND method should be clarified. For example, what is the exact value of m in this study? And what is the suggested range for m if provided with the particle size bins?

2) There is no need to introduce number-volume distribution in the INSIDE method. Particles are referred as volumes in the software, however, using particle diameter will help to simply the derivation. 3) It should be dN/dlogdp rather than dn/dlogdp in Eq. 9.

4) Please consider discussing why in both chamber studies the observed GR peaks around 5 nm.

5) Line 14 in page 8, the manuscript states that "good agreement is observed for all the three possible appearance time method measurements." As illustrated by Fig. 4(c), however, the GR estimated using the TREND method is more than 3 times that estimated using the appearance time method.

6) “Panel A neglects coagulation while panel B considers coagulation. (line 5 in page 15, Appendix C)” It is difficult to understand where and how coagulation was neglected.

7) Both the simulated and the observed GR are too large compared to the reported GR in the real atmosphere. The relative importance of the coagulation effect is suppressed in such conditions. Current analysis, such as those in Appendix C & D does not indicate that the coagulation scavenging effect in the real atmosphere can be adequately considered or reasonably neglected in the TREND method. The authors should clarified this.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-658, 2017.

Printer-friendly version

Discussion paper