Review of "Errors in Nanoparticle Growth Rates Inferred from Measurements in Chemically Reacting Aerosol Systems"

General comments

In this study uncertainties in particle growth rates are investigated using model simulations. More specifically, the authors study how significantly the particle growth rates determined using different methods deviate from the growth rate due to vapor condensation. They show that this difference is largest in the system where the growth is collision–controlled and vapor concentrations are high, in which case the growth due to coagulation becomes significant. In the presence of sink due to pre-existing particles and evaporation, the coagulation growth is less significant and thus also the difference between the measured growth rate and the condensation growth rate is smaller.

The study seems scientifically sound and the presented results are interesting to the scientific community as the growth rate methods discussed in the manuscript are generally used when analyzing particle size distribution data. Therefore, I recommend the manuscript for publication in ACP after the authors have considered the comments listed below and the comments presented by Referee #1.

Specific comments

P1, L1: This study does not actually discuss the errors in nanoparticle growth rates but the difference between the measured growth rate and the growth rate caused by vapor condensation. These are separate issues because the growth due to collisions of small clusters (coagulation growth) is also real growth. Please modify the manuscript to make this clear (title, abstract, conclusions, and rest of the text).

P1, L18–20: It may be confusing for the reader to state that in the presence of pre-existing particles coagulation is reduced. You could make this clearer by writing, for example, "by reducing growth due to coagulation". The difference between coagulation losses of small particles due to pre-existing larger particles and coagulation growth caused by collisions of small clusters should be made clearer also elsewhere in the manuscript.

P2, L25: Instead of "growth", I would suggest writing here "condensation and evaporation" as all the other processes are also mentioned separately.

P2, L28: Removal of molecular species from a cluster cannot really be called "growth". Also, when discussing particle growth, it would be good to specify which size range is meant.

P2, L38–39: The difference between coagulation scavenging and the growth due to coagulation should be made clear also here. For example, writing "it is worthwhile to treat growth due to condensation and coagulation separately" would make this more understandable. In addition, although coagulation scavenging is rather well understood, the contribution of collisions of molecular clusters to the growth is not.

P2, L45: Please add references here for previous observations on GR.

P3, L56: GR is usually determined by linear fitting to diameter vs time data, instead of looking only at the difference between two sizes.

P3, L58: This method has also been applied in several studies for sub-3 nm particle size distribution data not measured by CPC batteries.

P3, L71: Please add a reference when discussing previous work. Also, this paragraph could fit better in the beginning of the introduction as it provides the general motivation of this work.

P3, L79: You should made it clear already here that you define GR_{true} so that it is GR only due to vapor condensation.

P3, L82: GR_{true} is defined in a different way by Kontkanen et al. (2016) and therefore using the same name for it is misleading.

P4, L103–116: The description of the model and model simulations could be slightly more detailed. The reader should understand the model without a need to look at the earlier publications.

P4, L119: Although using dimensionless parameters certainly has its benefits, it makes comparison between these results and experimental observations or previous simulations difficult. Therefore, also mentioning the values of corresponding dimensional variables (e.g. number concentration, diameter, GR, loss rate) for some of the key results (either in the text or in the figures) would be beneficial.

P7, L199: The fact that the particle growth rate due to condensation and evaporation is higher when there is evaporation in the system is difficult to understand.

P8, L230: Could you add a short explanation why different representative sizes follow this order?

P8, L238: Instead of referring to Eq. (6), could you explain the reason for higher GR?

P8, L242: This is now slightly unclear. Do you mean that the growth is first slow and then it accelerates?

P8, L245: What do you mean by using quotation marks with ‘slow’?

P8, L248: Some of the measured GRs are in the beginning of the simulation lower than GR_{true}. This means that if evaporation rate was very high, the difference between GR_m and GR_{true} could possibly be larger than in the collision-limited case which is said to correspond to the case with “the maximum possible error”.

P9, L253: But there seems to be even higher values at sizes lower than [10, 15]?

P9, L262: How does the coagulation sink depend on particle size in your simulations? When stating the range of $\sqrt{L}$ used in the simulations, it would be useful to mention the corresponding range for the dimensional variable.

P9, L274: This result sounds counterintuitive. Would the situation change if higher values of $\sqrt{L}$ were used? Does this situation correspond to the situation in the atmosphere? The collision-limited case probably occurs in the atmosphere in polluted environments where losses due to pre-existing particles are very high.

P11, L318–319: This conclusions is unclear as it is stated that GR_{true}/GR_m both becomes closer to unity and increases due to evaporation.

Technical comments

P1, L18: Please add “that” after “show.

P6, L179: There is no need to repeat the name of the author twice.

P6, L182: Check the subscript.

P6, L188: Pleas add an en dash to show the range (also elsewhere).

P7, L215: Remove “of”.

P8, L231: Please add “that” after “indicate”.

P8, L248: Check the subscripts.

P9, L275: Please add “that” after “Note”.

Figure 1: Please also mention what $d_{p,min}$ stands for in the figure caption.