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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Nucleation mode growth rates in Hyytiälä during 2003–2009: variation with particle size, season, data analysis method and ambient conditions" *by* T. Yli-Juuti et al.

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<General Comments> Authors know well about what information DMPS, BSMA, and AIS can provide, and combine these information appropriately to analyze size dependent GR. The methods to obtain GR used in this study are sound and practical, and authors give carefully thought conclusions based on their statistical analysis. This work can be considered as one important step towards the standardizing the method to obtain GR from particle size distribution and ion mobility distribution among research community in this field. It is a bit unfortunate that authors could not find yet a clear relation between growth rates and oxidation products of biogenic gaseous species. It

is highly encouraged that authors continue their investigation along this direction and quantify the contribution of biogenic species on particle growth in the atmosphere.

<Specific Comments>

Page 21277 Equation 6. The value of k_H2SO4 is not given.

Page 21280 Line 5. "On the other hand, the method is not very sensitive to size dependent process. . ." This statement does not seem consistent with what stated in line 16-20. In line 16-20 authors state that scavenging, which is size dependent, tends to overestimate GR obtained by this method.

Page 21280, Line 19-21 "this GR calculation may fail as the moments of maximum concentration would be shifted in time due to particle loss. . ." It is recommended that authors provide a bit more information so that readers can understand the authors' arguments. How about something like this? "CS generally increases with time after nucleation starts. Younger particles would be depleted more than older particles when they reach the same size, which tends to distort the profile of concentration vs time to earlier time."

In addition, concentration of condensing vapor (therefore GR) can also change with time during NPF period. Authors can qualitatively discuss how the time dependence in true GR can alter the GRs estimated by the maximum concentration method.

Page 21282, Line 24-26 "if the condensation sink stays constant in time. . .." Including the effects of scavenging and self-coagulation as a part of maximum-concentration-method seems to require similar calculations done in mode-fitting method. The maximum concentration method does not seem to be more advantageous than mode-fitting method when one try to account for scavenging and self-coagulation.

Page 21283, Line 1-3 It is clear that maximum concentration method is much more useful if dN/dlogDp vs Dp at given time measured by BSMA or AIS are limited in relatively narrow size range therefore no distinctive peak can be seen in the measured

particle size distributions (PSD). However, if dN/dlogDp vs Dp at given time measured by DMPS data show a distinctive PSD mode shifting with time in >5nm range the mode-fitting method seems more reliable since the procedure to account for coagulation and scavenging are already well-established by Stlozenburg (2005).

Page 21285, Line 22-25. It is recommended that authors emphasize somewhere in the text that "different instruments" means not only different instruments (i.e., AIS, BSMA, DMPS) but also operating under different polarity modes.

Page 21286, line 8-10 Author can comment whether these differences are potentially caused by the inaccuracies in the calibration of voltage-mobility relation of AIS or not.

Page 21286, Title 3.3.2 should be changed from “the effect of electrical charge” not just “charge”.

Page 21287, Line 20-26. The relation between median difference and relative difference is not clear since a definition of relative difference in this context is not clearly stated. It is recommended that authors graphically show and compare the distributions of relative standard deviations among different measurement techniques and different GR calculation methods. I believe that it is one of the important conclusions in this paper.

Page 21288, Line 3-5 There seems to be at least two ways to interpret difference in GR seen in Figure 6a. (1) Particles grew fast below 10nm then slowed down at larger sizes. As a result PSD accumulated above 10nm. If this is true the maximum-concentration-method can be more effective way to measure GR. (2) Altitude of air-mass where the nucleation started to occur was greater than the sampling height. The air-mass slowly mixed into the sampling height while particles grew up to 10nm during the mixing. If this is true mode-fitting method is more effective way to measure GR since the peak diameters of PSD are not affected by air-mass-movements. Since the idea of "faster growth rate at smaller sizes" stated in (1) is inconsistent with those observed by AIS or BSMA. Scholars in this field including myself would think (2) sounds more natural

therefore inclined toward (2).

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 21267, 2011.