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Interactive comment on "An inverse modeling procedure to determine particle growth and nucleation rates from measured aerosol size distributions" *by* B. Verheggen and M. Mozurkewich

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The paper describes a new modelling approach to derive the aerosol growth and nucleation rate from the evolution of measured aerosol size distributions. This is an interesting study and it represents a clear step forward in nucleation and growth analysis.

The paper is very clearly written, well structured, and overall the presentation is good. Each subsection is introduced with some sentences to help the reader to understand

the procedures and considerations of the authors. Although it is a fairly long paper all sections are interesting and important and because the paper is structured into numerous subsections the reader can follow the argumentation. Hardly any corrections of style or spelling are necessary. Overall this is an excellent paper and I recommend it for publication but the authors might want to consider the following comments:

Major comment:

The scientific community would have the highest benefit from this new modeling procedure if the computer code were included in a supplement or even better if it could be downloaded as a program. This would certainly mean that this new approach is actually used by numerous other groups involved in the analysis of aerosol nucleation in lab/chamber studies as well as for atmospheric measurements. This would then also lead to increased citation of the paper. I strongly encourage to make the code available, for example, in a similar way as done by Modgil et al., J. Geophys. Res., 110, D19205, doi:10.1029/2004JD005475.

Minor comments:

p1689, l.7: "but it does not allow for any VARIATION in the size dependencies of the coagulation constants". Here it would be helpful for the reader if you clarify the sentence by stressing the fact that size dependence of the coagulation constants is considered, it is just not varied by the fitting procedure.

p.1689, l.11: The authors state that "Coagulation with particles smaller than the minimum detectable radius is not included in the determination of the growth rate, because their concentration is not known". Later on, the concentration of these very small particles is calculated to derive the nucleation rate (e.g. Fig. 4). It could be considered to use these calculated concentrations to recursively also include the coagulation of these very small particles to increase the accuracy of the model results.

p1698 l.10-12: how does the conventional average growth rate, derived from fitting

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a curve through the banana contour plot, compare with the (average) growth rates derived from the inverse modelling?

Section 4.2.: The authors state that other experiments at Calspan were also analysed with this modelling procedure (e.g. p1698, l. 17). Do you get consistent/identical results for C_diff and C_coag from these other experiments. It would be important to know in how far these two parameters are reproduced by repeated experiments.

p1708, l.7: The predicted H2SO4 concentration could also be compared to the newer parametrization by the Kulmala group (Vehkamäki, et al., J. Geophys. Res., 107, 4622, 10.1029/2002JD002184, 2002).

equation 28: remove one bracket between h and r_m.

equation B3: index should be "total" not "coag".

The caption of Figure 2 should also contain information on the SO2 injected at 10:55 and it should state that only half the lights were turned on at 11:09 and the other half was added at 11:59.

Figure 4 shows the modelled size distribution below the minimum measurable diameter. From these calculations also the concentration of particles at the critical cluster radius which is assumed to be 0.5 nm is derived and used for the calculation of the nucleation rate (p1701, l. 14). It would be important to see the Figure extended to this size of 0.5 nm. It seems that the uncertainty in the concentration N_0.5 becomes very large for these small sizes. This uncertainty should be discussed.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 1679, 2006.