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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Calibration and measurement uncertainties of a continuous-flow cloud condensation nuclei counter (DMT-CCNC): CCN activation of ammonium sulfate and sodium chloride aerosol particles in theory and experiment" *by* D. Rose et al.

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We would like to thank Referee #3 for the positive remarks and constructive comments on our discussion paper, which are highly appreciated and will be taken into account upon manuscript revision. Responses to individual comments are given below.

1) Temperature difference inside the CCNC column

Indeed, the temperature difference between the entrance and the middle of the column ($\Delta T_a = T_2 - T_1$) is a little larger than the temperature difference between the middle and

the exit of the column ($\Delta T_b = T_3 - T_2$). However, as Referee #3 already pointed out, the instrument calibration is based on the temperature difference between the entrance and the exit of the column ($\Delta T = T_3 - T_1$), and the instrument software internally adjusts the temperatures T_1, T_2, and T_3. From the instrument manual and referenced scientific papers it does not become clear, how the temperatures are adjusted and how the instrument could be calibrated with regard to $\Delta T_a = T_2 - T_1$. If this were possible, it might enable more precise calibrations and flow model calculations. With more information from the instrument manufacturer, these aspects should be further investigated in future studies. In the revised manuscript we will include this information.

2) Flow model calculations

From our understanding, the CCNC flow model equations and parameterizations given by Lance et al. (2006) for the mapping of thermal efficiency and supersaturation (Eqs. 15 and 16) refer specifically to a CCN column of 0.5 m length and to a temperature difference ($\Delta T = T_3 - T_1$) rather than to a length-independent temperature gradient. We think that some of the parameters ($B_1 - B_5$ and/or $A_1 - A_{13}$) may have to be adjusted to run this model with ΔT_a instead of ΔT. In any case, flow model calculations that are based on ΔT_a instead of ΔT and aimed at extrapolating the results of experimental calibrations to different operating conditions would make sense only if ΔT_a instead of ΔT were used by the instrument software. Nevertheless, the nonlinear temperature profile in the CCNC might be a reason for inconsistencies between our calibration and flow model results, as suggested by Referee #3. These aspects will be addressed in the revised manuscript.

3) CCN efficiency curves

Indeed the CCN efficiency spectra shown in Figure 2a are real measurement data and not normalized to one. Following the procedures and terminologies outlined in our discussion paper, however, there is no need to normalize these curves to one, because in our fit function (Eq. 1) D_{50} is defined as the particle diameter at which the

ACPD
7, S4127–S4129, 2007

EGU

fit function reaches half its maximum value. It is not the diameter at which CCN/CN = 0.5 (see section 2.3). Therefore, the D_{50} values of our discussion paper can be regarded as the critical dry particle diameters for CCN activation and are not biased. Nevertheless, we are planning to adjust the terminology in the revised manuscript to avoid potential misunderstandings.

References

Lance, S., Medina, J., Smith, J. N., and Nenes, A.: Mapping the Operation of the DMT Continuous Flow CCN Counter, Aerosol Sci. Technol., 40, 242-254, 2006.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 8193, 2007.