

Interactive comment on “Measurements of particle masses of inorganic salt particles for calibration of cloud condensation nuclei counters” by M. Kuwata and Y. Kondo

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We acknowledge the reviewer for useful comments and acknowledging the worth of the study.

General Comment: Kuwata and Kondo (2009) report high precision measurements of the particle mass of mobility selected ammonium sulfate and sodium chloride aerosol particles used for the calibration of cloud condensation nuclei counters (CCNC). As described and discussed in several earlier studies, neither NaCl nor (NH₄)₂SO₄ particles are completely spherical when generated by atomization. Thus the mobility equivalent diameter of such particles is usually not equal to the volume or mass equivalent

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diameter which is needed for determining the effective supersaturation in the CCNC by Köhler model calculations. With the effective densities or shape factors of NaCl and (NH₄)₂SO₄ particles given in this paper, Kuwata and Kondo (2009) provide important data for the precise calibration of a CCNC, which is essential for measuring CCN with high accuracy. Moreover, the authors compare different Köhler models used to calculate the supersaturation in the CCNC and come to the conclusion that the Pitzer model is the most suitable one. The findings are important for the calibration of CCNC instruments and for the comparison of CCNC measurement results, and they re-confirm and complement the findings of related earlier studies. Several of the key messages are similar/equivalent to those of Rose et al. (2008), and as detailed below, the authors should specify more clearly, in which way their findings and messages re-confirm, complement and extend those of Rose et al. (2008). Apart from not properly considering related work, the manuscript is well written, and I recommend publication in ACP after the following comments and suggestions for correction/improvement have been addressed.

Comment: P. 4656, L. 6-9: This statement is incomplete/incorrect. Please mention that Rose et al. (2008) have shown that the shape factor of NaCl particles may vary between 1.0 and 1.08 depending on the conditions of particle generation (drying). See Rose et al. (2008), Sects. 3.8 and 4.

Reply: We changed the corresponding sentence as follows: “Rose et al. (2008) have suggested that the shape factor of NaCl particles varies between 1.0 and 1.08 based on the measurements of CCN activities of NaCl particles. We have measured this quantity more accurately using a more direct method.”

Comment: P. 4663, Sect. 4.2: Fig. 5 also shows that eff increases and χ decreases with dme . This may be worth mentioning and discussing in the text.

Reply: We acknowledge that it is worth mentioning the point if the trend is significant. However, considering the variations of each experiment RUNs, it is not clear if the trend

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is significant or not. Therefore, we did not mention the point.

Comment: P. 4664, L. 25-26: importance of NaCl morphology for CCN calibration experiments. Please reference Rose et al. (2008) who had explicitly emphasized this message in their abstract and conclusions.

Reply: We referred to the paper.

Comment: P. 4665-4666, Sect. 4.3 and Tab. 5: The results of Kuwata and Kondo (2009) confirm that the calculation of water vapor supersaturation in a CCNC depends strongly on the applied Köhler model, in particular on the applied parameterization of water activity. The calibration with NaCl and (NH₄)₂SO₄ particles led to the same results only when Pitzer models (Archer, Clegg et al., Pitzer and Mayorga) and equivalent parameterizations of water activity were used. Köhler models in which the water activity parameterization is based on data of hygroscopic growth up to RH=95

Reply: We inserted the following sentence into the section 4.3. "These trends are the similar to that of Rose et al. (2008)."

Technical comments P. 4659, Eq. 9 and 10: Please use SI units or conversion factors with consistent units. The factor 1000 probably means 1000 g kg⁻¹?

Reply: Yes. As far as we know, it seems to be more common to use these definitions, rather than employing the following set of equations:

$$\ln a_w = -\nu m M_w \psi$$

$$m = m_s / M_{smw}$$

(e.g., Robinson and Stokes, 2002; Kreidenweis et al. 2005). Thus, we still use the definition.

Comment: P. 4659, L. 19: "... are summarized" instead of "... is summarized"

Reply: We corrected it.

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Comment: P. 4660, L. 7: ".... a maximum value" instead of ".... the maximum value"

Reply: We corrected it.

Comment: P. 4669, L. 9: ΔT is not the gradient but the temperature difference along the CCNC column; Note that a gradient should have the unit K.m⁻¹ rather than K.

Reply: We changed the description as follows. "temperature difference along the CCNC column".

P. 4670, L. 3: this line is without context

Reply: We changed the description as follows: " $\nu v_m + \nu x$ (for a salt compounds written as $M v_m X \nu x$)"

Comment: P. 4679-4683: Tables: Please indicate units in standard table format, i.e., next to or underneath each of the quantities (symbols) specified in headline, first column or caption of each table.

Reply: We changed the format.

Comment: P. 4679, Tab. 1: units for Ms are missing

Reply: We added the unit.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 4653, 2009.

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