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Interactive Comment

Interactive comment on "Effects of aerosol organics on cloud condensation nucleus (CCN) concentration and first indirect aerosol effect" *by* J. Wang et al.

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"Effects of aerosol organics on cloud condensation nucleus (CCN) concentration and first indirect aerosol effect" by Wang et al. is a very interesting study, and we would like to compliment the authors on their achievements.

The paper presents a nice set of aircraft measurements, and a convincing case of CCN closure with aerosol chemical composition data.

With regard to the collection and presentation of CCN data, however, we would like to ask for clarification of the measurement procedures and results along the following lines.

Water vapor supersaturation is the primary variable inducing and determining the CCN activation of aerosol particles in the atmosphere as well as CCN field measurements and laboratory experiments. Recently, Rose et al. (2008) have demonstrated that:

(a) The effective water vapor supersaturation in a continuous-flow CCN counter (DMT-CCNC) as applied in this study depends strongly on the operating conditions (pressure, temperature, flow rate) and needs to be carefully calibrated with reference aerosols and Köhler model calculations. The applicability of flow models for calculating the water vapor supersaturation in such instruments also depends on experimental calibration (non-ideal temperature offset, etc.), and the model results can deviate substantially from measurement results (up to 40% and more), especially at low supersaturation.

(b) The water vapor supersaturation values inferred by Köhler model calculations depend strongly on the type of Köhler model and on the water activity parameterization and other parameters applied in these calculations. Specifically, the critical water vapor supersaturation values calculated for ammonium sulfate particles, which are usually used for reference and calibration, can deviate by up to 20% or more from the most accurate models available.

Therefore, the CCN measurement results presented in Wang et al. (2008, Figs. 6 and 7, etc.) depend strongly on the operating conditions and calibration of the CCN counter. The manuscript, however, provides practically no information about these aspects.

It is not clear if and how the pressure, temperature and flow rate were kept constant at the different flight levels. A pressure reduction by ∼150 hPa (corresponding to ∼2 km difference in altitude) would decrease the effective supersaturation in the DMT-CCNC from 0.22% to ∼0.17%, which would have a strong effect on the calculation of critical diameters of CCN activation (several tens of nm) and on the predicted CCN concentrations. On the other hand, a temperature reduction by ∼5 K would increase the effective supersaturation by ∼8% (relative). For more information about measured and modeled effects of varying operating conditions on the effective supersaturation in

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the DMT-CCNC see Rose et al. (2008).

Neither statistical nor systematic error estimates are given for the nominal supersaturation value of 0.22% in Wang et al. (2008). Without such information, however, it is hard to evaluate and appreciate the reliability of the presented results.

Thus, we would like to ask the authors to include much more information about the determination, regulation, and uncertainty of water vapor supersaturation in the applied CCN counter, and to refer to related studies addressing these issues such as Rose et al. (2008).

Diana Rose and Ulrich Pöschl

Reference:

Rose, D., Gunthe, S. S., Mikhailov, E., Frank, G. P., Dusek, U., Andreae, M. O., and Pöschl, U.: 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, Atmos. Chem. Phys., 8, 1153-1179, 2008.

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