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Atmospheric Chemistry and Physics Discussions

Interactive comment on “Aerosol hygroscopicity and CCN activation kinetics in a boreal forest environment during the 2007 EUCAARI campaign” *by* K. M. Cerully et al.

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The authors would like to thank Dr. Rose for the valuable comments that have improved the manuscript. A point by point answer to them follows

Sect. 2.2, p 15037

1.) You write that the supersaturation in the CCNC is held constant over a period of 3 min. Every 36 s the particle size is changed (first 20 s discarded, 16 s data recording), so that you are able to select 5 different particle sizes. When do you allow the supersaturation in the CCNC to get settled? From experience in lab and field experiments, I know that the supersaturation in the CCNC usually requires a certain settling time until it reaches the set value (Rose et al., 2008: "Shifting from one supersaturation level to another requires approximately 0.5–3.5 min, depending on the size of the step. . . ") and other studies have come to the same conclusion (e.g., Moore et al., 2010). Since you increase the supersaturation in steps of 0.2 % I would expect a settling time of ∼2 min. If you start your measurements immediately after the supersaturation change, how can you be sure that the supersaturation in the instrument is as high as you assume?

This is an excellent comment. Supersaturation in the instrument was carefully documented and examined for transients. For the 20 nm data, the first particle size measured after each step in supersaturation were discarded both due to the fact that full activation was not reached, and, due to transients in instrument supersaturation. This allowed approximately 56 seconds (36 seconds for the 20 nm data plus the additional 20 s discarded during the 40 nm measurement) after each 0.2% step in supersaturation before recording the 40 nm data. This proved to be sufficient for instrument supersaturation to reach its setpoint.

For the largest shift in supersaturation (∼1.7%) from the highest to the lowest supersaturation, one would indeed expect a much larger settling time to reach the desired supersaturation setpoint. It has been added to the manuscript that an additional 3 minutes were allowed after switching from the highest to lowest supersaturation and data collected at the lowest supersaturation were discarded in order to allow sufficient time for the instrument supersaturation to reach the setpoint. Therefore, the first supersaturation at which data were used was ∼0.25%.

2.) Why do you need to discard data measured at 20 nm and 100 nm? I understand that for 20 nm particles you might not reach full activation with your highest supersaturation, but for 100 nm particles I would expect that you can observe a full spectrum from zero to full activation.

20 nm particles were discarded because full activation was not reached and also due to transients affecting supersaturation (see response to question 1). At the highest *instrument supersaturations, 20 nm particles had not always activated and therefore a full spectrum could not be obtained. For example, using a* κ *of 0.20 (the average* κ *found for 40 nm particles during the campaign) 20 nm particles require a supersaturation of around 3.0* $\%$ *to activate, which is well above the measured supersaturations in this campaign. 100 nm particles activate at very low supersaturations and therefore the beginning of the sigmoid could not be resolved Again, using a* κ *of 0.22, the average* κ *found for 80 nm particles, 100 nm particles require 0.26* $\%$ *to activate, which is very close to our lowest instrument supersaturation. While in some cases 100 nm data can be fit, we feel that it would not be representative of the aerosol, as it would correspond only to the subset of less hygroscopic particles*

3.) Please clarify at which flow rates you operated your instruments. If you run both the DMA and the CCNC with 1 L min-1 aerosol flow, there seems no flow left for the CPC.

Thank you for pointing this out. Dilution flow is introduced directly following the DMA before splitting to the CFSTGC and the CPC. As the DMA is operating with $\sim$*1 LPM sample flow and the CFSTGC and CPC require 1 LPM each, 1 LPM of particle-free dilution flow is added. This clarification has been added to the text.*

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 15029, 2011.

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