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Size-resolved measurements of cloud condensation nuclei (CCN) in polluted continental air near the megacities Beijing and Guangzhou, China

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CCN properties were measured at regional background sites ∼60 km northwest of the mega-city Guangzhou in southeast China, and ∼40 km south of the mega-city Beijing. The measurements were part of the "Program of Regional Integrated Experiments of Air Quality over the Pearl River Delta" intensive campaign (PRIDE-PRD2006, July 2006), and of the "Campaigns of Air Quality Research in Beijing" (CAREBeijing-2006, August 2006). In both 30-day measurement campaigns, a wide range of different types of air masses and meteorological conditions were encountered, including very high pollution events from local biomass burning during PRIDE-PRD2006.

CCN concentrations and efficiencies were measured as a function of particle diameter and water vapor supersaturation using a DMT-CCN counter (Roberts and Nenes, 2005, Rose et al., 2007). The diameter at which 50% of the particles are activated (D_{50}) and related parameters were determined and analyzed. For supersaturations in the range of 0.07-0.87%, the average values of D_{50} were in the range of 197-41 nm in PRIDE-PRD2006 and 187-45 nm in CAREBeijing-2006. These values are about 20-30% higher than those of pure ammonium sulfate, i.e., the particles were significantly less CCN active than ammonium sulfate. Depending on the supersaturation

level, the D_{50} values and related CCN properties exhibited strong temporal variability and pronounced diurnal cycles at both measurement sites.

In PRIDE-PRD2006 these cycles can be explained through the formation of a nocturnal boundary layer with continued nocturnal surface emissions into this layer, followed by the daytime break-up of this layer and its mixing with the overlying residual layer.

During the 4-day local biomass burning event of the PRIDE-PRD2006 campaign, the ability of particles to act as CCN was significantly reduced. The D_{50} were $\sim$30% larger than during the rest of the campaign, and the CCN efficiency spectra were much broader, indicating that the aerosol contained a large fraction of externally mixed hydrophobic particles that had been freshly emitted. The measurement results suggest that local and regional aerosol emissions may have a large impact on cloud droplet formation in both the Pearl River Delta and Beijing regions.

References

Roberts, G. C. and Nenes, A.: A Continuous-Flow Streamwise Thermal-Gradient CCN Chamber for Atmospheric Measurements, Aerosol Sci. Technol., 39, 206-221, 2005.

Rose, D., Frank, G. P., Dusek, U., Gunthe, S. S., 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. Discuss., 7, 8193-8260, 2007.