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Measurements of hygroscopic growth and activation of atmospheric aerosol with LACIS

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LACIS, the Leipzig Aerosol Cloud Interaction Simulator, is a laminar flow tube with thermostated walls. It was built to study the hygroscopic growth and activation of aerosol particles (Stratmann et al. (2004)). For studies of the hygroscopic growth, i.e. for measurements of the equilibrium diameters at different relative humidities (RH), values up to 99% RH can be adjusted stable and reliably in LACIS (Wex et al. (2005)). The activation of aerosol particles, i.e. the dynamic growth of the particles into cloud droplets, can be studied at super-saturations of some per mill up to several percent. In the flow tube, the relative humidity or alternatively the maximum super-saturation is adjusted with the dew point temperatures of the aerosol and sheath air which pass through the tube on one side, and with the wall temperature on the other side. For both types of measurements, the size of the grown particles is measured at the end of the LACIS flow tube with a new optical system which was designed and built for LACIS (Kiselev et al. (2005)). Additionally, the grown sizes are simulated with a computational fluid dynamics code (Fine Particle Model, a user defined function of FLUENT6). Measured and modeled values were compared for aerosols of known composition and growth behavior, namely sodium chloride and ammonium sulfate. For both salts, measured and simulated values are in good agreement, if the non ideal behavior of the solutions is accounted for in the model. Measured and modeled values are in good agreement with literature (Tang (1996), Tang and Munkelwitz (1994)). In a further step, the hygroscopic growth of atmospheric aerosol particles at high relative humidities up to 99% is measured. Also, measurements of the activation of atmospheric aerosol particles at super-saturations of 0.3% and 0.6% will be presented.

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