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Hygroscopic growth and activation of HULIS particles: experimental data and a new iterative parameterization scheme for complex aerosol particles

M. Ziese[1], H. Wex[1], E. Nilsson[2], I. Salma[3], R. Ocskay[3], T. Hennig[1], A. Massling[1], and F. Stratmann[1]

[1]Leibniz-Institute for Tropospheric Research, Permoser Strasse 15, 04318 Leipzig, Germany

[2]Lund University, Department of Nuclear Physic, P.O. Box 118, 221 00 Lund, Sweden

[3]Eötvös University, Institute of Chemistry, P.O. Box 32, 1518 Budapest, Hungary

Abstract. The hygroscopic growth and activation of two HULIS (HUmic LIke Substance) and one Aerosol-Water-Extract sample, prepared from urban-type aerosol, were investigated. All samples were extracted from filters, redissolved in water and atomized for the investigations presented here. The hygroscopic growth measurements were done using LACIS (Leipzig Aerosol Cloud Interaction Simulator) together with a HH-TDMA (High Humidity Tandem Differential Mobility Analyzer). Hygroscopic growth was determined for relative humidities (RHs) up to 99.75%. The critical diameters for activation were measured for supersaturations between 0.2 and 1%. All three samples showed a similar hygroscopic growth behavior, and the two HULIS samples also were similar in their activation behavior, while the Aerosol-Water-Extract turned out to be more CCN active than the HULIS samples. The experimental data was used to derive parameterizations for the hygroscopic growth and activation of HULIS particles. The concept of ρ_{ion} (Wex et al., 2007a) and the Szyszkowski-equation (Szyszkowski, 1908; Facchini, 1999) were used for parameterizing the Raoult and the Kelvin (surface tension) terms of the Köhler equation, respectively. This concept proved to be very successful for the HULIS samples in the saturation range from RHs larger than 98% up to activation. It was also shown to work well with data on HULIS taken from literature. Here, different atmospheric life-times and/or different sources for the different samples showed up in different coefficients for the parameterization. However, the parameterization did not work out well for the Aerosol-Water-Extract.

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