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The activity of mixed organic /inorganic/water aerosols and the spacial distribution of individual substances resulting from their efflorescence

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Since chemical and radiative effects of atmospheric aerosols are size and phase related, they are strongly influenced by the ambient relative humidity (RH) due to water absorbing hygroscopic components, changing both particle diameter and wavelength dependent refractive indices. Therefore, the assessment of the net effect on chemistry and/or climate for a given atmospheric particle load will critically depend on the level of scientific understanding regarding the phase behaviour of complex organic/ inorganic aerosols.

The influence of organic substances such as dicarboxylic acids on the deliquescence behaviour has been subject of numerous studies over the past years. In this work a number of different mixtures comprising ammonium sulphate (AS) and different dicarboxylic acids (glutaric acid, maleic acid, malonic acid, succinic acid, and oxalic acid) have been used in Raman scanning experiments to study the spacial distribution of substances in the crystalline aerosol formed from the efflorescence process of internally mixed ternary ammonium sulphate / dicarboxylic acid / water aerosols. The results give intriguing insights into the complexity of the behaviour of highly supersaturated ternary organic/inorganic solutions and reveal substantial differences in the spacial distributions of organic and inorganic crystalline substances resulting from the efflorescence of these originally internally mixed systems. The relevance of these findings for the interpretations of the complex, concentration dependent phase behaviour of organic/ inorganic aerosols will be discussed.

Modelling the behaviour of these complex solution aerosols frequently involves calculations of interactions between individual ionic components. In order to quantify these impacts the ammonium salts for a number of dicarboxylic acids have been synthesised and their thermodynamic behaviour has been elucidated with the surface aerosol microscope (SAM) setup. The results have been used to test and validate critical parameters of the aerosol inorganics model (AIM). In this work we present activity measurements for aqueous aerosols containing these organic ammonium salts as well as a comparison of AIM model data and experimental results.