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## Aerosol hygroscopicity at high (99 to 100%) relative humidities

C. R. Ruehl<sup>1</sup>, P. Y. Chuang<sup>1</sup>, and A. Nenes<sup>2</sup><sup>1</sup>Earth & Planetary Sciences, University of California, Santa Cruz, USA<sup>2</sup>Earth & Atmospheric Sciences, Georgia Institute of Technology, Atlanta, USA

**Abstract.** The hygroscopicity of an aerosol strongly influences its effects on climate and, for smaller particles, atmospheric lifetime. While many aerosol hygroscopicity measurements have been made at lower relative humidities (RH) and under cloud formation conditions (RH>100%), relatively few have been made at high RH (99 to 100%), where the Kelvin (curvature) effect is comparable to the Raoult (solute) effect. We measured the size of droplets at high RH that had formed on particles composed of one of seven compounds with dry diameters between 0.1 and 0.5  $\mu\text{m}$ . We report the hygroscopicity of these compounds using a parameterization of the Kelvin term, in addition to a standard parameterization ( $\kappa$ ) of the Raoult term. For inorganic compounds, hygroscopicity could reliably be predicted using water activity data (measured in macroscopic solutions) and assuming a surface tension of pure water. In contrast, most organics exhibited a slight to mild increase in hygroscopicity with droplet diameter. This trend was strongest for sodium dodecyl sulfate (SDS), the most surface-active compound studied. The results suggest that, for single-component aerosols at high RH, partitioning of solute to the particle-air interface reduces particle hygroscopicity by reducing the bulk solute concentration. This partitioning effect is more important than the increase in hygroscopicity due to surface tension reduction. Furthermore, we found no evidence that micellization limits SDS activity in micron-sized solution droplets, as observed in macroscopic solutions. We conclude that while the high-RH hygroscopicity of inorganic compounds can be reliably predicted using readily available data, surface-activity parameters obtained from macroscopic solutions with organic solutes may be inappropriate for calculations involving micron-sized droplets.

[Final Revised Paper](#) (PDF, 3196 KB) [Discussion Paper](#) (ACPD)

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