Geophysical Research Abstracts
Vol. 16, EGU2014-5378, 2014
EGU General Assembly 2014

Measurements of cloud condensation nuclei (CCN) at the high-alpine site Jungfraujoch during CLACE-6 (2007)

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As part of the CLACE-6 campaign we performed size-resolved CCN measurements for a supersaturation range of S=0.079% to 0.66% at the high-alpine research station Jungfraujoch, Switzerland, in March 2007. The derived effective hygroscopicity parameter κ describing the influence of particle composition on CCN activity was on average 0.23 – 0.30 for Aitken (50 – 100 nm) and 0.32 – 0.43 for accumulation mode particles (100 – 200 nm). The campaign average value of κ =0.3 is similar to the average value of κ for other continental locations. When air masses came from southeasterly directions crossing the Po Valley in Italy, particles were much more hygroscopic ($\kappa \sim 0.42$) due to large sulfate mass fractions. The κ-values obtained at S=0.079% exhibited a good negative correlation with the organic mass fractions derived from PM1 aerosol mass spectrometer (AMS) measurements. Applying a simple mixing rule the organic and inorganic mass fractions observed by the AMS could be used to reproduce the temporal fluctuations of the hygroscopicity of accumulation mode particles quite well. We show how during a cloud event the aerosol particles were activated as cloud droplets and then removed from the air by precipitation leaving behind only a small amount of accumulation mode particles consisting mainly of weakly CCN-active particles, most likely externally mixed unprocessed soot particles.