Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 8, 5715-5729, 2008
www.atmos-chem-phys.net/8/5715/2008/

Hygroscopicity of the submicrometer aerosol at the high-alpine site Jungfraujoch, 3580 m a.s.l., Switzerland

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Abstract. Data from measurements of hygroscopic growth of submicrometer aerosol with a hygroscopicity tandem differential mobility analyzer (HTDMA) during four campaigns at the high alpine research station Jungfraujoch, Switzerland, are presented. The campaigns took place during the years 2000, 2002, 2004 and 2005, each lasting approximately one month. Hygroscopic growth factors (*GF*, i.e. the relative change in particle diameter from dry diameter, D_0, to diameter measured at higher relative humidity, RH) are presented for three distinct air mass types, namely for: 1) free tropospheric winter conditions, 2) planetary boundary layer influenced air masses (during a summer period) and 3) Saharan dust events (SDE). The *GF* values at 85% RH (D_0=100 nm) were 1.40±0.11 and 1.29±0.08 for the first two situations while for SDE a bimodal *GF* distribution was often found. No phase changes were observed when the RH was varied between 10–90%, and the continuous water uptake could be well described with a single-parameter empirical model. The frequency distributions of the average hygroscopic growth factors and the width of the retrieved growth factor distributions (indicating whether the aerosol is internally or externally mixed) are presented, which can be used for modeling purposes.

Measurements of size resolved chemical composition were performed with an aerosol mass spectrometer in parallel to the *GF* measurements. This made it possible to estimate the apparent ensemble mean *GF* of the organics (GF_{org}) using inverse ZSR (Zdanovskii-Stokes-Robinson) modeling. GF_{org} was found to be ~1.20 at a_w=0.85, which is at the upper end of previous laboratory and field data though still in agreement with the highly aged and oxidized nature of the Jungfraujoch aerosol.

Final Revised Paper (PDF, 2573 KB) Discussion Paper (ACPD)

Citation: Sjogren, S., Gysel, M., Weingartner, E., Alfarra, M. R., Duplissy, J., Cozic, J., Crosier, J., Coe, H., and Baltensperger, U.: Hygroscopicity of the submicrometer aerosol at the high-alpine site Jungfraujoch, 3580 m a.s.l., Switzerland, Atmos. Chem. Phys., 8, 5715-5729, 2008. Bibtex EndNote Reference Manager