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# An overview of the Cloud and Aerosol Characterization Experiments (CLACE) conducted at a high alpine site in the free troposphere

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Intensive measurement campaigns were conducted at the at the high alpine research station Jungfraujoch (JFJ, 3580 m asl; 46.55$^o$N, 7.98$^o$E) in Switzerland. These Cloud and Aerosol Characterization Experiments (CLACE) are designed to investigate the chemical composition of aerosol particles, their hygroscopic properties and their interaction with clouds. A main focus is the investigation of the aerosol-cloud interaction processes in mixed-phase clouds. The results are expected to contribute to a better understanding of the indirect effect of aerosols on climate.

The campaigns take advantage of the outstanding feature of the high altitude research station Jungfraujoch allowing for ground-based in situ sampling of mixed phase clouds. State-of-the-art instrumentation was employed to characterize the aerosol size distribution (SMPS, OPC), size segregated chemical composition (AMS), hygroscopicity (H-TDMA), cloud condensation nuclei (CCNC), cloud microphysics (PVM, FSSP, CPI, ADA), and particle morphology (ESEM, formvar replicas). Different inlets are used for these instruments: A heated inlet (25 deg C) designed to evaporate

cloud constituents at an early stage of sampling (i.e. sampling both cloud residual and interstitial particles), an interstitial inlet operated with a PM2 cyclone impactor and an ICE-CVI (Counterflow Virtual Impactor) inlet designed to sample residual particles of small ice crystals. Differencing the response downstream of the different inlets provides insight in the fractionation of aerosol particles between the cloud phase and the interstitial phase.

An overview of major results from the latest CLACE campaigns (winter of 2004 and of 2005) will be presented. One finding is that in mixed phase clouds the activated fraction of aerosol particles is strongly dependent on the relative fraction of ice in the cloud. This is explained by the Bergeron-Findeisen process, which describes the effect of a water vapour flux from liquid droplets to ice crystals. The lower the ambient temperature, the more liquid droplets evaporate and a higher fraction of CCN is released back to the interstitial aerosol phase. Another result is that the aerosol at the Jungfraujoch is mostly internally mixed, with only one hygroscopic mode with modal growth factor around 1.5 in winter and 1.3 in summer, reflective of the larger boundary layer influence in summer.