Hill Cap Cloud Thuringia 2010 (HCCT-2010) – Overview and first results

D. van Pinxteren[1], W. Birmili[1], B. Fahlbusch[1], W. Fomba[1], A. Grüner[1], T. Gnauk[1], Y. Iinuma[1], S. Mertes[1], K. Mildenberger[1], M. Merkel[1], C. Müller[1], K. Müller[1], L. Poulain[1], G. Spindler[1], S. Henning[1], M. Schäfer[1], F. Stratmann[1], A. Tilgner[1], K. Weinhold[1], H. Wex[1], R. Wolke[1], A. Wiedensohler[1], W. Zhijun[1], S. Borrmann[2], E. Harris[2], A. Roth[2], J. Schneider[2], B. Sinha[2], I. George[3], D. Heard[3], L. Whalley[3], B. D'Anna[4], C. George[4], M. Müller[4], D. Amedro[5], C. Fittschen[5], C. Schoemaker[5], J. Collett[6], T. Lee[6], and H. Herrmann[1]

[1]Leibniz-Institut für Troposphärenforschung, 04318 Leipzig, Germany
[2]Particle Chemistry Department, Max Planck Inst. for Chemistry, 55128 Mainz, Germany
[3]School of Chemistry, University of Leeds, Leeds LS2 9JT, Great Britain
[4]IRCELYON, UMR 5256 CNRS/Université Lyon1, 69629 Villeurbanne Cedex, France
[5]University of Lille, UMR CNRS-USTL 8522, 59655 Villeneuve d'Ascq, France
[6] Department of Atmospheric Science, Colorado State University, Fort Collins, CO 80523, USA

Keywords: aerosol cloud interaction, physical and chemical properties, multiphase chemical processes.
Presenting author email: dominik@tropos.de

Clouds play a crucial role for physical and chemical processes in the atmosphere. Lagrangian-type field experiments where an orographic cloud is used as a natural flow-through reactor provide a basis for studying such processes. Several such hill cap cloud experiments were conducted in the past with the most recent ones being the FEBUKO campaigns in 2001 and 2002 at Mt. Schmücke in Thuringia, Germany (Herrmann et al., 2005).

In September/October 2010 another Lagrangian-type cloud experiment was conducted to study aerosol cloud interaction at Mt. Schmücke, with a special focus on highly time-resolved online instrumentation that was not available during the times of the previous studies.

Three measurement sites were installed: An upwind site, which served for the characterisation of incoming air masses, an in-cloud site on the Schmücke summit, and a downwind site, where under appropriate meteorological conditions air masses after their passage through a hill cap cloud could be studied. A scheme of the area with the 3 sites is given in Figure 1.

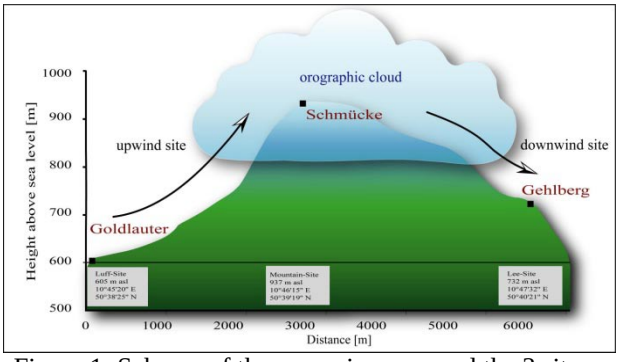

Figure 1: Scheme of the campaign area and the 3 sites.

The valley sites were equipped with a comprehensive suite of instrumentation, including gas monitors, VOC and OVOC samplers, PTR-MS, FAGE, SMPS, APS, HTDMA, CCNC, MAAP, CPC, mist chambers, filter samplers, impactors, MARGA, PILS, AMS, and a ceilometer, to determine the physical and chemical state of the aerosol upwind and downwind of the cloud. At the in-cloud site the cloud droplets were collected using bulk and multi-stage cloud water collectors. The HOx budget was determined by a FAGE and the interstitial and droplet (residual) phase were sampled behind an interstitial inlet and two CVIs applying SMPS, OPC, PSAP, aerosol mass spectrometry (AMS, ALABAMA), filters and OVOC samplers. The liquid water content was measured by a PVM and the droplet size distribution by a FSSP.

Samples from the discontinuous instruments (filters, impactors, cloud collectors, etc.) were analysed for their chemical composition, including among others: inorganic ions, OC/EC, WSOC, WSON, organic acids, sugars, organic carbonyl compounds, trace metals, and soluble metals in different oxidation states (Fe(II)/Fe(III)).

Tracer experiments were performed by releasing an inert chemical gas at the upwind site and studying its distribution in the Schmücke area within a reasonable time interval (1 hour). These data, together with an in-depth local and regional classification of the meteorological conditions during cloud events, allowed for an identification of time periods, where a connected air flow between the three sites can be assumed, i.e. representative air masses were sampled before, during, and after a cloud passage.

A comparison of the physical and chemical properties of the aerosol within these air masses, especially from the online instruments, led to interesting preliminary insights in various scientific areas such as aerosol processing through clouds, chemical cloud composition, or the influence of clouds on the radical oxidants budget. First results, especially from the chemical measurements, will be given in this contribution.

H. Herrmann et al. (2005) *Atmos. Environ.* **39**, 4169.