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Poster Session I. Aerosol-cloud interactions

CLOUD WATER COMPOSITION IN RELATION TO THE DROPLET SIZE DISTRIBUTION AND CLOUD BASE ALTITUDE

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INTRODUCTION/EXPERIMENTAL

In autumn 1998 a field measurement campaign has been carried out at Mt. Brocken, Germany (1142 m a.s.l.). The measurement of cloud physical characteristics like **L**iquid **W**ater **C**ontent (PVM 100), cloud droplet spectra (FSSP 100) and the detection of the cloud base altitude (ceilometer) as well as the observation of cloud type and the calculation of air mass transport pattern (backward trajectories) were operated by the BTU Cottbus under different cloud conditions. Simultaneous cloud droplets have been collected by isocinetic one and two stage active cloud water collectors (two droplet classes D>10 μm, 10 μm<D<5μm). Interstitial aerosols were collected by a combination of filter and cascade impactor. At the same place inside clouds the droplets with diameter D>5μm were collected by a **C**ounterflow **V**irtual **I**mpactor (IFT-Leipzig) and for the collection of interstitial aerosols also filters have been used.

RESULTS

At the October 8th 1998 we measured at Mt. Brocken summit under cloud conditions similar observed earlier (Wieprecht *et al.* 1995, Moeller *et a.l* 1996). In the morning the cloud base was detected about 500m below the Mt. Brocken summit. With sun rise and increasing temperature the cloud base altitude increased continuously (Fig. 1). At about 18:00 CET the cloud base arrived the level of the Mt. Brocken top (location of measurement station). For the next five hours we were able to measure the droplet spectra and to collect cloud water and interstitial aerosol near cloud base. At this day we noticed a strong anti-correlation between the liquid cloud water content of the cumulus clouds (Cu Sc fra) and the altitude of the cloud base (Figure 1 and 2). After 18:00 the cloud type changed to strato-cumulus (Sc op) and the cloud base altitude started to decrease.

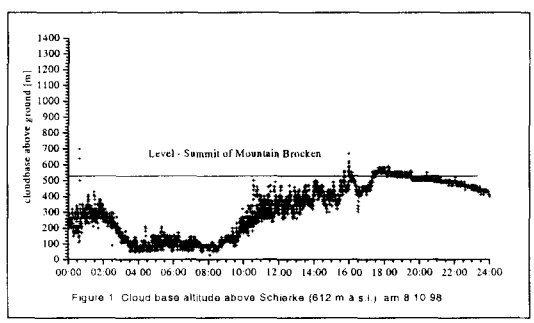

Figure 1. Cloud base altitude above Schierke (612 m a.s.l.) am 8.10.98

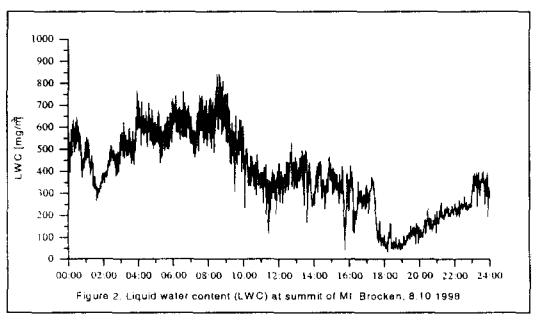

Figure 2. Liquid water content (LWC) at summit of Mt. Brocken, 8.10.1998

During the time of cloud base lifting (10:00– 16:00) we found in the collected cloud water (one stage impactor) an approximately linear increase of the soluted mass (product of LWC and ion concentration) of nitrate, sulphate and ammonia. This process may be caused by the activation of interstitial aerosol, which were composed by the high soluble ammonia nitrate or ammonia sulphate. The averaged droplet number concentration per cm^3 air volume increased from 450 at 10:00 to 530 at 16:00. In opposition to this sodium and chloride show a more conservative behaviour, with only slight change in their soluted mass.

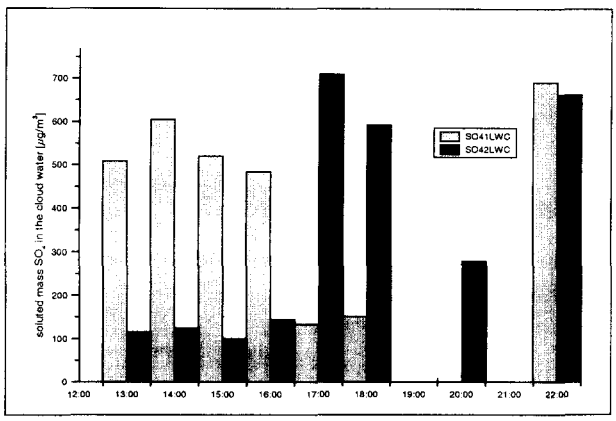

Figure 3: Soluted mass of sulfate in the cloud water collected by the two stage sampler (droplet diameter range 5 µm<D<10 µm and D>10 µm)

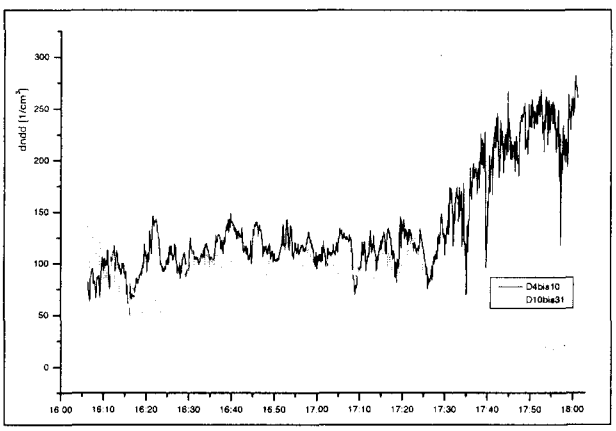

Figure 4: Drolet number concentration in the two droplet diameter ranges of the two stage cloud water collector

process for the change of the soluted mass in the cloud water.

A more detailed view gives Fig. 3 about the distribution of the soluted sulphate mass in the two cloud collector fractions of smaller (5 µm>D>10 µm) and bigger droplets (D>10 µm). From 18:00 to 20:00, when the mean droplet diameter changed from 13,6 µm to 6,5 µm, no cloud water was collected in the collector stage for bigger droplets and a high amount of soluted sulphate mass therefore was found in the fraction of small droplets. In the time before 17:00 five times more soluted mass of sulphate was found in the fraction of bigger droplets then in the smaller one.

Fig. 4 gives an indication that the change in the amount of soluted mass of sulphate is directly connected with the changing number concentration of droplets in the two sizes. When the cloud base arrived the Mt. Brocken summit at 17:20 the droplet number in the range 10 µm <D< 32 µm decreased rapidly, whereas the number of small drops (5-10 µm diameter) increased more than twice from 100 to 250 per cm^3. Therefore the activation of interstitial aerosol near cloud base was the main

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