Cloud chemistry during the HCCT-2010 hill cap cloud experiment

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Clouds represent important media for chemical reactions in the atmosphere. Uptake of gases and dissolution of cloud condensation nuclei (CCN) constituents lead to a complex composition of their aqueous phase. A multitude of possible reactions can take place and modify the chemical composition and thus ultimately the physical properties of aerosol particles after cloud dissipation.
To improve our understanding of aerosol cloud interactions and cloud chemistry, the 'Hill Cap Cloud Thuringia 2010' (HCCT-2010) field campaign was performed the Schmücke in the Thuringian forest of Germany in September/October 2010. The campaign setup consisted of an upwind, an in-cloud, and a downwind site.
A large pool of instrumentation was installed at all three sites to physically and chemically characterize incoming air masses, the different cloud phases, and the residual aerosol after cloud passage.
At the in-cloud site, four Caltech Active Strand Cloud Water Collectors (CASCC2, DEMOZ ET AL., 1996) were operated to sample large volumes of bulk cloud water for chemical analysis. In addition, a 3-stage collector (RAJA ET AL., 2008) and a 5-stage collector (MOORE ET AL., 2002) were deployed to study size the size-resolved composition of cloud droplets. To complement the liquid cloud water samples, droplet residuals and interstitial particles were sampled downstream of a counterflow virtual impactor (CVI) and an interstitial inlet (INT) using filters and two aerosol mass spectrometers (AMS). Many different organic and inorganic compounds were analyzed from the cloud water samples
Within this contribution, results will be presented related to the following main topics: i) bulk cloud water chemical composition and factors controlling solute concentrations in bulk cloud water, ii) scavenging efficiencies of aerosol constituents both within the cloud as well as related to upwind concentrations, and iii) droplet size resolved cloud water composition and factors controlling the observed solute concentration droplet size distributions.

References

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