Cloud chemistry during HCCT-2010: Mono- and dicarboxylic acids

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Hill Cap Cloud Thuringia 2010 (HCCT-2010) was a complex field campaign on aerosol cloud interaction, performed at Mount Schmücke in central Germany in September and October 2010. Cloud water was sampled on a tower, 20 m above ground, using different cloud water collectors: The Caltech Active Strand Cloud Water Collector (CASCC2, [*Demoz et al.*, 1996]) sampled bulk cloud water with a 50 percent droplet size cut (D_{50}) of 3.5 µm and a one hour time resolution. A 3-stage version of the CASCC [*Raja et al.*, 2008] was applied to sample size-resolved cloud water with D_{50} of 22, 16, and 4 µm diameter for stages 1, 2, and 3, respectively. Additionally, a 5 stage collector [*Moore et al.*, 2002] was used with D_{50} of 30, 25, 15, 10, and 4 µm for stages 1 to 5. Due to the lower amounts of cloud water available in the different droplet size classes, the multistage collectors usually sampled 2-hourly (3-stage) and 4-hourly (5-stage) cloud water samples.

In addition to the liquid cloud water samples, droplet residuals and interstitial particles were collected on filters downstream of a counterflow virtual impactor (CVI) and an interstitial inlet (INT) [*Mertes et al.*, 2005]. The samples were analysed for short-chain mono- and dicarboxylic acids (C1-C5) using capillary electrophoresis with indirect UV detection. Additionally, a suite of longer-chain (C5-C10) functionalised carboxylic acids, i.e. acids with an additional functional group (hydroxy-, oxo-, or nitro-group) were determined by a relatively new technique based on hollow-fibre liquid phase microextraction and capillary electrophoresis – mass spectrometry.

The concentration ranges of short-chain carboxylic acids are given in Figure 1. Formic and acetic acid usually showed the highest concentrations, followed by oxalic acid. The concentrations of longer-chain functionalised acids are generally 1-2 orders of magnitude lower. Many of the compounds are reported for the first time in cloud water samples.

The dataset will be discussed with regards to cloud microphysical and meteorological parameters. For the short-chain acids, results from size-resolved cloud water sampling will be presented as well. Additionally, the phase partitioning of the most abundant short-chain diacids, obtained from the CVI and INT filters, will be discussed.

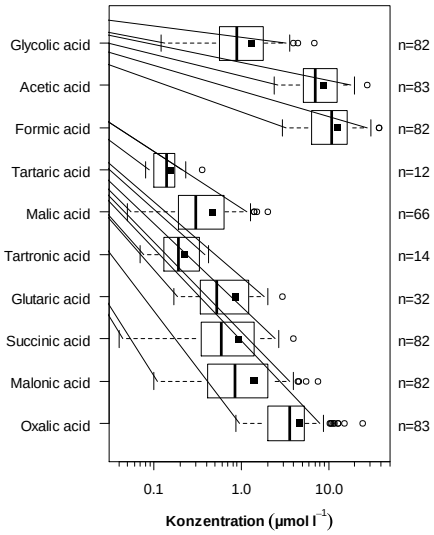

Figure 1: Concentrations of short-chain carboxylic acids

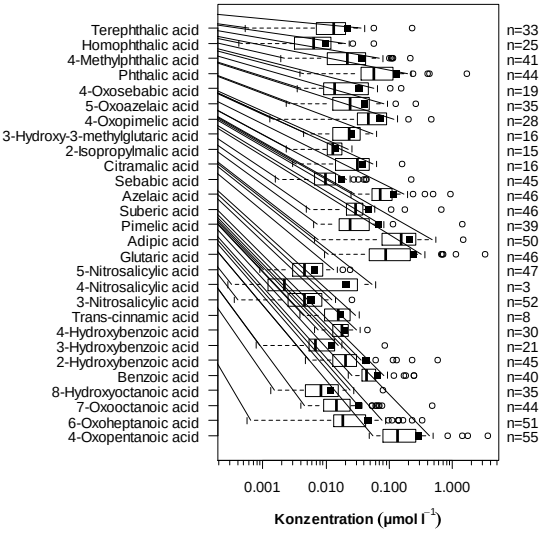

Figure 2: Concentrations of longer-chain acids

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