Cloud influence to local aerosol chemical composition during the Hill Cap Cloud Thuringia 2010

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The impact of orographic clouds to the local aerosol chemical composition was measured during the Hill Cap Cloud Thuringia 2010 (HCCT-2010) field campaign, which took place in September/October 2010 at the Schmücke mountain ridge in the Thuringia forest (Germany). The main objectives of the HCCT-2010 project were to assess the effects of clouds on particle composition, gas phase oxidant budget, changes of hygroscopic properties and activation of aerosol particles. Three sampling sites were equipped: one on the top of the Schmücke Mountain, where clouds were sampled, and two valley stations located upwind and downwind of the summit. In total, four Aerodyne ToF-AMSs were deployed during the campaign. One at each valley station and two at the summit station: one downstream of a Cloud Virtual Impactor (CVI) for droplet residual analysis and one to measure interstitial particles. Based on air mass trajectories, gas tracer experiments and meteorological parameters, it is possible to identify periods during which the air mass of the three stations were connected. The overflow periods were divided in two subsections corresponding to the presence of cloud at the summit station (Full Cloud Events, FCE) and to the absence (Non Cloud Events, NCE) of cloud at the summit station. For these two categories of connected flow, the AMS results were compared in order to follow the cloud induced modification of the aerosol chemical compositions as well as modification of the chemical size distribution.

AMS results were successfully compared according to instrumental uncertainties and possible particle lost and dilution effects between the stations during the NCE periods and bulk chemical composition measured at the three stations show similar mass fraction. The comparison of the two valley stations is presented in Figure 1. Because the results measured at the three stations during NCE events were comparable, the same approach could be directly used to investigate aerosol cloud interaction and influence of clouds to local particles. Figure 1 also shows the first results of the comparison between the upwind and downwind station during several FCE periods. The scatter plots suggest a possible change on the bulk chemical composition of the particles corresponding to a small decrease of the particulate nitrate fraction as well as a tiny increase of sulfate. Details on the aerosol changes during the different cloud events including a comparison of the organic components as well as chemical size resolved will be presented.

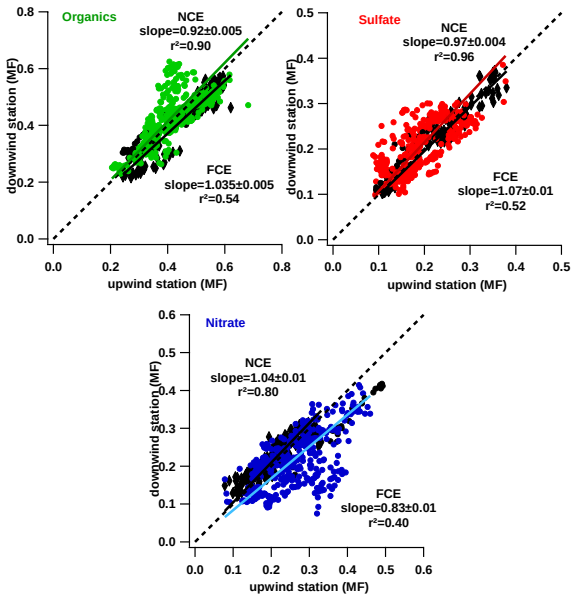

Figure 1: Scatter plots of the organics, sulphate and nitrate mass fraction measured at the upwind and downwind stations during NCE (black) and FCE (color). Regression slopes were calculated using orthogonal linear fitting.