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Abstract

OC/EC, WSOC, and single organic compounds in size segregated aerosol particles from recent IfT field experiments

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In order to investigate the behavior (i.e. emission, formation, modification, deposition) of airborne aerosol particles showing possible climatic influences or health implications, a series of field experiments was performed by IfT during the last years. This includes experiments in a coniferous forest area of the Fichtelgebirge with prevailing biogenic emissions, multiphase cloud passage experiments at the Schmücke summit in the Thuringian Forest, source apportionment experiments at different locations in Saxony or measurements in a city street canyon. Additionally long time particle measurements and special measurement campaigns at the semi rural research station Melpitz were performed. Moreover primary source investigations (lignite burning stove, biomass burning) as well as model chamber experiments were carried out.
Besides the PM_{10}, $PM_{2.5}$ or PM_1 sampling in most cases size segregated impactor particle sampling was performed using five stage BERNER low pressure impactors and, very recently, a MOUDI/Nano-MOUDI system with overall 14 stages. The ranges of BERNER and MOUDI sampling were 0.05 - 10 µm and 0.01 - 18 µm particle diameter, respectively.
OC/EC was analyzed using a thermographic method similar to the German VDI guideline and without an optical correction for possible charring processes. This method participated at stage I and II of the Carbon Shoot Out comparison experiment. The results show that a possible overestimation of EC in comparison to optical corrected values cannot be excluded, but there is no evidence for the correctness of one of the methods. Ultimately all different OC/EC separation methods remain operationally.
Analysis of single organic compounds was carried out partly size segregated using Curie-Point-Pyrolysis-GC-MS for less polar compounds, partly from PM_{10} or $PM_{2.5}$ high volume filters using a method including solvent extraction and derivatization followed by GC-MS. Identified organic compounds include alkanes, fatty acids, PAHs, dicarboxylic acids, oxidation products of the terpenes and others. Currently a new method for analysis of polar organic compounds with a curie point pyrolysis GC/MS system using derivatisation reactions is being developed. This method will allow the detection and possibly the quantification of polar compounds like sugars, fatty acids and phenols.
Most important results of selected field experiments will be presented and discussed, e.g.:

The AFO 2000 project BEWA focused on emission and reactions of biogenic volatile organic compounds in a deciduous forest with respect to the modification of particles in and above the canopy as well as by day and by night. A number of particulate primary and secondary organic compounds were found and their occurrence discussed.

The AFO 2000 project FEBUKO will improve the understanding of tropospheric multiphase processes and especially the interaction of aerosols and clouds with an emphasis on organic particle constituents. For this purpose the passage of a well characterized air parcel through an orographic cloud at the summit of the mountain Schmücke (937m asl) was observed. Results of size segregated chemical particle analysis, cloud water analysis and gas phase measurements provide insights in the occurring processes. Particles in cloud droplets could be analyzed for its carbon content in contrast to interstitial particles to give information on CCN activation. The content of WSOC in cloud water is examined in connection with the OC fraction of upwind site particles to see cloud processing of the carbonaceous fraction. Model simulations initiated on the basis of real measurement values were helpful to understand the complex events.

Highly size-segregated particle measurements using MOUDI/nano-MOUDI were performed in projects investigating the situation in a street canyon or at a busy city square. In these cases the chemical composition of the ultra fine Nano-MOUDI stage particles was of special interest.

Main findings of the different campaigns with regards to organic particle composition aare discussed.