A coupled field and modelling study on aerosol cloud interaction : The AFO 2000 projects FEBUKO and MODMEP

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The FEBUKO/MODMEP research cluster performed within the AFO 2000 programme intends to improve the understanding of tropospheric multiphase processes and especially the interaction of aerosols and clouds with special emphasis on organic particle constituents. Field experiments on aerosol and cloud chemistry and physics, model development and model application are combined to investigate chemical and physical transformation of particles within a cloud passage.
The main focus of the FEBUKO field studies is to lay the groundwork for the further development of tropospheric cloud chemistry models, which may also serve as the basis for mechanism development for the tropospheric aqueous aerosol. A complex experimental data set was provided by two field campaigns. In MODMEP the development is directed towards a cloud module which combines a complex multiphase chemistry with detailed microphysics. The description of both is given by means of a high resolution size-resolved drop spectrum.
The FEBUKO experiments at the three research sites in the Thüringer Wald (Goldlauter, Schmücke and Gehlberg) were carried out in the autumn of 2001 and 2002, respectively, to characterize the aerosol and cloud water with respect to their chemical composition and physical properties (Figure 1). The speciation of organic components was one of the most important tasks for the different size classes of the particle phase and in cloud water. The air masses of the experimental region are of anthropogenically influenced origin and were subsequently (Gehlberg) exposed to biogenic emissions on their way from the Rhein-Main area to the Thüringer Wald.

For a better description of organic chemistry simulations with the CAPRAM 2.4 and CAPRAM 3.0 mechanisms are conducted. CAPRAM 3.0 consists of CAPRAM 2.4 (MODAC mechanism) coupled to the CAPRAM organic extension which considers the oxidation of organic compounds with up to four carbon atoms. Simulations with an air parcel traveling from the luff site passing through the Schmücke hill capped cloud to the lee site aim at a better understanding of chemical modifications of the particle ensemble upon a single cloud process under real field conditions.

A compilation of the main findings of this concerted effort on the study of aerosol-cloud interaction will be given comprising experimental results from physical and chemical measurements and complex model development.

An outlook will be given. The CAPRAM mechanism line will be continuously updated and last, but not least, the Schmücke hill-capped cloud experimental site is ready for further focused ground based aerosol-cloud interaction experiments with special emphasis on organics under real conditions and hence complementary to more specialized laboratory experiments.