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Quantification of selected biogenic precursor compounds for particles in the atmosphere of Germany

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Emissions of volatile organic compounds (VOC) and nitric oxides (NO) from biogenic sources play an important role in the chemistry of the atmosphere in particular in rural areas. They are key compounds in the photochemical cycle and contribute to particle formation as well as the change of particles chemical and physical properties. Biogenic VOC (BVOC) are much more reactive as anthropogenic VOC impacting the trace gas composition of the atmosphere more strongly on local / regional scales. Therefore, BVOC must be treated in any numerical chemistry-transport-model (CTM). One of the key issues in sound air quality modelling is the correct quantification of the emissions on different temporal and spatial scales.

The BVOC emission modelling with the semi-empirical eBVOC model and the NO soil emission modelling approach with the process-oriented biogeochemical PnET-N-DNDC is presented. Both models can employ meteorology data provided by numerical weather prediction models (NWP) for calculating BVOC emissions from forests and other vegetation as well as NO emissions from soils (forests and agriculture). A Geographical Information System (GIS) and relational database management system (RDBMS) – based system coupled to the models provides all necessary input data, and utilizes parallel computing on a high performance computer cluster, WEB services and event driven multitasking and networking for calculating and visualisation of emissions.

The results of temporally and spatially highly resolved regional BVOC and NO inventories for Germany and Europe are shown. It is highlighted that during specific episodes and at specific locations the emission variability is as high as 150% compared to the average. With a sensitivity analysis on the effect of different input parameters on the accuracy of the results, factors contributing most to the uncertainty of emission estimates are identified.