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A general system to simulate air chemistry processes within biosphere canopies

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A a model to describe the exchange and transformatio of reactive gases within the canopy of vegetation, i.e. a forest stand, has been developed. The model uses the RADM2 mechanism (Stockwell et al. 1990) which is commonly used in air quality simulations. The model is embedded in a biosphere-modelling framework (MoBiLE) that provides the microclimatic and physiological boundary conditions. Thereby, microclimate is derived from field measurements, weather generator, or climate model output, and physiological conditions (i.e. leaf area and foliage distribution) are dynamically simulated throughout the year. The modelling system aims in estimating the fate of different biosphere emissions from the ground (i.e. NO) and the canopy (i.e. isoprene and monoterpenes) and the net emission rate of these substances at the upper boundary of the biosphere. It will also be used to make more accurate predictions of air pollution impacts as for example from high ozone concentrations. Furthermore, since the air chemistry mechanism accounts for the degradation of biogenic VOC‘s within the canopy, the model is expected to supply more realistic net emissions of all relevant trace species concentrations at the top of the canopy to be further used as lower boundary conditions in air quality models.

We present the implementation of the new model, demonstrate the sensitivity to climatic and physiological boundary conditions and show an evaluation for a coniferous forest stand using a comprehensive data set.