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Estimating the regional impact of BVOC emissions on air quality using a biochemistry-based model

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Emission of volatile organic compounds from biogenic origin (BVOC) has been found to be in the same order of magnitude as on-road traffic emissions. Since BVOC are generally highly reactive they are expected to considerably influence air quality, e.g. ozone concentration, depending on climate conditions and air chemistry composition. The determination of BVOC emission is therefore of utmost importance in regional air chemistry modelling, particularly when extended areas of highly emitting vegetation species are present.

However, the uncertainty of estimating BVOC emission is still large. Therefore, a biochemistry-based model has been developed that describe isoprenoid emission on the leaf scale depending on local climate and climate history (SIM-BIM2, Grote et al. 2006). This model has been linked to a canopy model in order to describe stand scale emissions depending on leaf area index, foliage distribution, and leaf age structure. Finally, the linked canopy-emission model has been coupled to a regional climate and air chemistry model (MCCM, Grell et al. 2000). The coupled model system is used to simulate air chemistry composition during a summer episode for a test region of several thousand km^2 in southern Spain, where highly emitting oak species are dominating. The simulation has been carried out with present climate data as well as data from climate change scenarios.

The preliminary results show that the impact of BVOC emission on air quality, in particular ozone concentration, is indeed considerably. The effect is largest during warm summer episodes and in the vicinity of extended forest areas. With increasing temperatures as assumed in climate change scenarios BVOC emission is expected to increase, causing a larger impact on ozone formation in the future.