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Parameterized isoprene and monoterpene emissions from the boreal forest floor: Implementation into a 1D chemistry-transport model and investigation of the influence on atmospheric chemistry

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Volatile organic compounds (VOCs) are emitted from the biosphere and can work as precursor gases for aerosol particles that can affect the climate (e.g. Makkonen et al., ACP, 2012). VOC emissions from needles and leaves have gained the most attention, however other parts of the ecosystem also have the ability to emit a vast amount of VOCs. This, often neglected, source can be important e.g. at periods where leaves are absent. Both sources and drivers related to forest floor emission of VOCs are currently limited. It is thought that the sources are mainly due to degradation of organic matter (Isidorov and Jdanova, Chemosphere, 2002), living roots (Asensio et al., Soil Biol. Biochem., 2008) and ground vegetation. The drivers are biotic (e.g. microbes) and abiotic (e.g. temperature and moisture). However, the relative importance of the sources and the drivers individually are currently poorly understood. Further, the relative importance of these factors is highly dependent on the tree species occupying the area of interest.

The emission of isoprene and monoterpenes where measured from the boreal forest floor at the SMEAR II station in Southern Finland (Hari and Kulmala, Boreal Env. Res., 2005) during the snow-free period in 2010-2012. We used a dynamic method with 3 automated chambers analyzed by Proton Transfer Reaction - Mass Spectrometer (Aaltonen et al., Plant Soil, 2013). Using this data, we have developed empirical parameterizations for the emission of isoprene and monoterpenes from the forest floor. These parameterizations depends on abiotic factors, however, since the parameterizations are based on field measurements, biotic features are captured. Further, we have used the 1D chemistry-transport model SOSAA (Boy et al., ACP, 2011) to test the seasonal relative importance of inclusion of these parameterizations of the forest floor compared to the canopy crown emissions, on the atmospheric reactivity throughout the canopy.