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Branch enclosure BVOC flux measurements from Fagus sylvatica L. in a natural forest environment: preliminary results

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Natural ecosystems, such as forests, are known to be important sources of non-methane volatile organic compounds (NMVOCs). Oxidation of these biogenic VOCs (BVOCs) in the presence of nitrogen oxides can result in net ozone formation and the low-volatility oxidation products may contribute to secondary organic aerosol formation and/or growth. As a result BVOC emissions can have a negative effect on air quality and human health. In the commonly used emission algorithms [Guenther et al., 1995], leaf temperature and photosynthetic photon flux density (PPFD) are the driving variables for BVOC emissions. However, in order to better explain the variability over time of BVOC emissions for a given tree species, the most recent emission algorithms, such as MEGAN [Guenther et al., 2006], also consider other driving variables such as phenology, temperature and light history.

To validate these new emission algorithms, dynamic branch enclosure BVOC flux measurements have been performed on an adult Fagus sylvatica L. tree in a natural forest environment under ambient PPFD and temperature conditions. Branches at different levels in the canopy were accessible from a 35 m high measurement tower. The cuvette air was analysed on-line with a hs-PTR-MS instrument, which was located in a log cabin at the bottom of the tower.

Ion signals related to monoterpenoid compounds (m/z 81 and 137), isoprene (m/z 69), acetone (m/z 59) and methanol (m/z 33) have been measured continuously with the PTR-MS during several phenological periods, from bud-break to senescence. The data show high monoterpenoid emission rates in spring which gradually decrease until leaf fall.

Furthermore, monoterpenoid emissions from shaded leaves in the lower layers of the canopy were found to be negligible compared to those from sunlit leaves in the upper layer of the canopy.

Effects of light and temperature history on monoterpenoid emissions from Fagus sylvatica L. will be discussed and compared with results obtained in a growth room under controlled conditions of light and temperature.

Guenther et al., J. Geophys. Res. 100 (1995) 8873-8892.
Guenther et al., Atm. Chem. Phys. 6 (2006) 3181-3210.

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