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Semi-continuous measurements of mono- and sesquiterpene concentrations in Boreal Forest

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Volatile organic compounds (VOCs), especially isoprene and monoterpenes, but also some sesquiterpenes, are emitted from boreal forest. In the atmosphere they react rapidly with hydroxyl radical, nitrate radical and ozone thus participating in the complex atmospheric chemical processes forming ozone and new particles.
In-situ gas chromatographic - mass spectrometric measurements of mono- and sesquiterpenes in ambient air were conducted at the SMEAR II station (Station For Measuring Forest Ecosystem-Atmosphere Relations 61o51'N, 24o18'E, 181 a.s.l) in Hyytiälä, southern Finland. Between October 2010 and October 2011 at least one week was measured every month by taking 60 minute samples every other hour.
During the winter months concentrations of monoterpenes (MTs) were low, very often below detection limits (< 1 ppt). In spite of faster sink reactions maximum concentrations (MT sum 520 ppt) were measured in summer due to larger emissions during a growing season. The main monoterpene in early winter was camphene followed by α-pinene, p-cymene and Δ3-carene, but during other months and already in February α-pinene had highest concentrations followed by Δ3-carene. Sesquiterpenes had a summer maximum (4 ppt), but small amounts of sesquiterpenes were also measured in winter. The main sesquiterpene measured was isolongifolene and the other sesquiterpenes occasionally detected were α-humulene, alloaromadrendrene and longicyclene. In summer there was also one unknown sesquiterpene having the highest concentrations.
In winter monoterpene concentrations did not have any diurnal cycle, but after March maximum concentrations were measured during the night and minimum during the day. Emissions are known to be highest in the middle of day or afternoon, but increased mixing and faster photochemical reactions lower the concentrations in daytime. Also sesquiterpenes have clear diurnal variability with maximum at night in summer.