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Monoterpenes and isoprene in urban air in Helsinki, Finland

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There are lots of natural trees and other vegetation in many cities. However, trees emit biogenic volatile organic compounds (BVOCs). These compounds are not toxic themselves, but they are very reactive and can therefore affect on atmospheric chemistry even at relatively low concentrations. In the presence of nitrogen oxides (NO_x) they form ozone and their reaction products may take part into new particle formation.
Sources, concentration levels and effects of isoprene and monoterpenes on local atmospheric chemistry were studied in urban background air in Helsinki, Finland. Ambient air concentration measurements were conducted using an in-situ gas chromatograph with a mass spectrometer at an urban background station station SMEARIII (Station for Measuring Ecosystem-Atmosphere Relations III, 60o12′N, 24o58′E, 26 m a.s.l.) during different seasons in 2011.
Highest concentrations of isoprene and monoterpenes were measured in summer (990 ng m-3), but concentrations were clearly above detection limit also in winter (230 ng m-3). The concentrations of aromatic hydrocarbons were higher during all seasons, but reactivity scaled concentrations showed that also isoprene and monoterpenes have a strong influence on local atmospheric chemistry in urban air. High contribution of isoprene and monoterpenes to the reactivity was detected also at other background site in Helsinki and in a residential area close to Helsinki.
Winter concentrations of BVOCs followed the diurnal pattern of the aromatic hydrocarbons and traffic. Due the height of the measurement site (fifth floor of a building) highest concentrations in summer were measured in the early morning when mixing started. After that concentrations decreased when photochemical reactions started to play a role.
In winter and spring the urban background concentrations were higher than in a forested site in Finland indicating anthropogenic sources of isoprene and monoterpenes. Source estimates obtained by Unmix multivariate receptor model showed that traffic and wood combustion are main local contributors to the measured concentration levels in winter, spring and November, but in July and October biogenic sources are dominating.