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Seasonal variation of nitrogen oxides, ozone and biogenic volatile organic compound concentrations and fluxes at Norway spruce forest

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Dynamics of nitrogen oxides (NO_x) and ozone concentration and their depositions were investigated on the Norway spruce forest at Bily Kriz experimental station at the Silesian Beskydy Mountains (north-eastern part of the Czech Republic). Both NO_x and ozone concentration and fluxes were modelled for the whole season and covering thus different climate conditions. Data were recorded for three consecutive years and therefore deeper analyses were performed.

During the summer 2014 BVOC field campaign was carried out using proton-transfer-reaction-time-of-flight-mass-spectrometry (PTR-TOF, Ionicon Analytik GmbH, Innsbruck, Austria) and volatile organic compound of biogenic origin (BVOC) were measured at the different levels of tree canopies. By the same time BVOC were trapped into the Tenax tubes (Markes International Ltd., UK) and put afterwards for thermal desorption (Markes Unity System 2, Markes International Ltd., UK) to GS-MS analysis (TSQ Quntum XLS triple Quadrupole, Thermo Scientific, USA). Thus data of different levels of canopies together with different spectra of monoterpenes were obtained. Interesting comparison of both methods will be shown. It was the first BVOC field campaign using PTR technique at any of the forest in the Czech Republic.

Highest fluxes and concentrations were recorded around the noon hours, represented particularly by monoterpenes, especially α-pinen and limonene. Other BVOCs than monoterpenes were negligible. Variation of fluxes between different canopies levels was observed, highlighting difference in shaded and sun exposed leaves. Sun leaves emitted up to 2.4 nmol m-2 s-1 of monoterpenes, while shaded leaves emitted only up to 0.6 nmol m-2 s-1 when measured under standard conditions (irradiance 1000 μmol m–2 s–1; temperature 30°C).

We discuss here the importance of the most common Norway spruce tree forests in the Czech Republic in bi-directional exchanges of important secondary pollutant such as ozone and nitrogen oxides, their production and deposition and interaction with BVOCs at low nitrogen oxides polluted area. Forests of Beskydy Mountains could play a key role in pollutants removal because of closeness to highest ozone and aerosol polluted area of the Czech Republic – Ostrava region, where heavy industry is located.