

Title: BVOC emission measurements at ICOS station Norunda

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Abstract:

The ecosystem-atmosphere flux of biogenic volatile organic compounds (BVOCs) has important impacts on tropospheric oxidative capacity and the formation of secondary organic aerosols, influencing air quality and climate. In the Northern hemisphere, this is particularly true in boreal forests, where BVOC emissions often dominate over anthropogenic sources of VOC.

Here we present measurements of the concentrations and fluxes of BVOCs in a boreal forest located at the ICOS station Norunda in Sweden, collected using proton transfer reaction mass spectrometry (PTR-MS). These long-term PTR-MS measurements were collected at six heights (4m, 8.5m, 13.5m, 19m, 24.5m, and 33.5m) on the station flux tower over several periods during 2014 to 2016. Ozone concentrations were simultaneously measured in conjunction with these PTR-MS measurements at the six sampling heights. The main BVOCs investigated with the PTR-MS were isoprene, monoterpenes, methanol, acetaldehyde, and acetone. Ozone fluxes were determined using eddy measurements collected from sonic anemometers on the station flux tower, and BVOC fluxes were investigated using Lagrangian dispersion theory in the canopy. The distribution of BVOC sources and sinks in the forest canopy was explored using several dispersion matrix methods. The canopy resistance and deposition velocities for ozone and the BVOCs were investigated, and the results for isoprene and monoterpene emissions were found to agree well with several standard BVOC emission algorithms.

These results will have importance for refining the parameterization of ecosystem-atmosphere interactions in atmospheric chemistry models and constraining BVOC emission estimates in boreal regions in the future.