Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 10, 1759-1771, 2010
www.atmos-chem-phys.net/10/1759/2010/

Emissions and ambient distributions of Biogenic Volatile Organic Compounds (BVOC) in a ponderosa pine ecosystem: interpretation of PTR-MS mass spectra

S. Kim[1,2], T. Karl[2], A. Guenther[2], G. Tyndall[2], J. Orlando[2], P. Harley[2], R. Rasmussen[3], and E. Apel[2]

[1]Advanced Study Program, National Center for Atmospheric Research Boulder, CO, USA

[2]Atmospheric Chemistry Division, National Center for Atmospheric Research, Boulder, CO, USA

[3]Oregon Graduate Institute, Beaverton, OR, USA

Abstract. Two proton-transfer-reaction mass spectrometry systems were deployed at the Bio-hydro-atmosphere interactions of Energy, Aerosols, Carbon, H_2O, Organics and Nitrogen-Southern Rocky Mountain 2008 field campaign (BEACHON-SRM08; July to September, 2008) at the Manitou Forest Observatory in a ponderosa pine woodland near Woodland Park, Colorado USA. The two PTR-MS systems simultaneously measured BVOC emissions and ambient distributions of their oxidation products. Here, we present mass spectral analysis in a wide range of masses (m/z 40^+ to 210^+) to assess our understanding of BVOC emissions and their photochemical processing inside of the forest canopy. The biogenic terpenoids, 2-methyl-3-butene-2-ol (MBO, 50.2%) and several monoterpenes (MT, 33.5%) were identified as the dominant BVOC emissions from a transmission corrected mass spectrum (PTR-MS), averaged over the daytime (11 a.m. to 3 p.m., local time) of three days. To assess contributions of oxidation products of local BVOC, we calculate an oxidation product spectrum with the OH- and ozone-initiated oxidation product distribution mass spectra of two major BVOC emissions at the ecosystem (MBO and β-pinene) that were observed from laboratory oxidation experiments. The majority (~76%) of the total signal in the transmission corrected PTR-MS spectra could be explained by identified compounds. The remainder are attributed to oxidation products of BVOC emitted from nearby ecosystems and transported to the site, and oxidation products of unidentified BVOC emitted from the ponderosa pine ecosystem.

Final Revised Paper (PDF, 346 KB) Discussion Paper (ACPD)

Citation: Kim, S., Karl, T., Guenther, A., Tyndall, G., Orlando, J., Harley, P., Rasmussen, R., and Apel, E.: Emissions and ambient distributions of Biogenic Volatile Organic Compounds (BVOC) in a ponderosa pine ecosystem: interpretation of PTR-MS mass spectra, Atmos. Chem. Phys., 10, 1759-1771, 2010. Bibtex EndNote Reference Manager