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Carbonyl compounds in boreal coniferous forest air in Hyytiälä, Southern Finland

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Abstract. A variety of C₁-C₁₂ carbonyl compounds were measured in the air of a boreal coniferous forest located in Hyytiälä, Southern Finland. 24-hour samples were collected during March and April in 2003 using DNPH (2,4-dinitrophenyl hydrazine) coated C₁₈-cartridges and analyzed by liquid chromatography-mass spectrometry (LC-MS).

Altogether 22 carbonyl compounds were quantified. The most abundant carbonyls were acetone (24-hour average 1340ng/m³), formaldehyde (480ng/m³) and acetaldehyde (360ng/m³). Concentrations of monoterpene reaction products nopinone (9ng/m³) and limona ketone (5ng/m³) were low compared to the most abundant low molecular weight carbonyls. Trajectory analysis showed that highest concentrations of carbonyls were measured in the air masses coming from the East and the lowest in the air masses cycled long time over Scandinavia. The total concentration of carbonyl compounds in Hyytiälä in March/April 2003 was much higher than the concentration of aromatic hydrocarbons and monoterpenes in April 2002.

Scaling the concentrations against reactivity with the OH-radical showed, that in spite of relatively low ambient concentrations higher molecular weight aldehydes contribute significantly to the total OH-reactive mass of carbonyls. The impact of carbonyl compounds on OH-radical chemistry is important. Contribution of carbonyls as an OH sink is comparable to that of NO₂ and higher than monoterpenes and aromatic hydrocarbons.

Lifetimes of the measured carbonyls with respect to reactions with OH radicals, ozone (O₃), and nitrate (NO₃) radicals as well as photolysis were estimated. The main sink reactions for most of the carbonyl compounds in Hyytiälä in springtime are expected to be reactions with the OH radical and photolysis. For 6-methyl-5-hepten-2-one and limona ketone also reactions with ozone are important. The sources of carbonyl compounds are presently highly uncertain. Based on the comparisons with urban concentrations the direct anthropogenic emissions are not as important as secondary biogenic and anthropogenic sources or primary biogenic sources in Hyytiälä.

[Final Revised Paper](#) (PDF, 302 KB) [Discussion Paper](#) (ACPD)

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