



Hydroxyl radical measurements in a boreal forest during HUMPPA-COPEC 2010

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The HUMPPA-COPEC intensive field campaign took place in summer 2010 as collaboration between the Max Planck Institute for Chemistry and the University of Helsinki in order to investigate the summertime emissions and photochemistry in a boreal forest. Measurements of OH and HO₂ radicals were conducted in a 40-year-old pine dominated forest (*Pinus Sylvestris L*) at the SMEAR II station, located in Hytiälä, Southern Finland. Simultaneous side by side measurements of hydroxyl radicals were conducted at the start of the campaign with two instruments using chemical ionization mass spectrometry (CIMS) and laser induced fluorescence (LIF) within the forest.

In order to investigate the radical chemistry at the ecosystem-atmosphere interface, the LIF instrument was moved to the top of a 20m tower, just above the canopy, following the comparison.

OH concentrations above canopy during daytime were up to a factor of three higher than inside the forest. During nighttime, when the photolytic sources of OH vanish, both OH instruments (CIMS & LIF) showed similar values, but still detected significant amounts of hydroxyl radicals.

Comprehensive measurements including observations of many VOCs and the total OH reactivity were conducted to increase our understanding of atmospheric self-cleaning processes based on detailed analysis of production and loss processes of the hydroxyl radical in a coniferous forest, using direct calculations as well as a box model.

A production rate of about $6 \times 10^6 \text{ molec cm}^{-3} \text{s}^{-1}$ is needed to explain the OH measured during nighttime. The sum of all non-photolytic production rates calculated from measured species, however, accounts only for about 20% of the necessary total OH production, i.e. a large OH source is missing during nighttime. Under daylight conditions the OH budgets within and above the canopy show a lack of understanding, too. Especially in the early afternoon hours the known OH sources are insufficient to close the budget.

The OH measurements will be presented together with the detailed analysis of the HO_x budget. The ozonolysis of unmeasured VOCs, as well as enhanced HO_x recycling are potential candidates to explain the missing OH production.