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Title: Summertime total OH reactivity measurements from boreal forest during HUMPPA-COPEC 2010.

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Abstract: Ambient total OH reactivity was measured at the Finnish boreal forest station SMEAR II in Hyttälä (Latitude 61°51' N; Longitude 24°17' E) in July and August 2010 using the Comparative Reactivity Method (CRM). The CRM - total OH reactivity method - is a direct, in-situ determination of the total loss rate of hydroxyl radicals (OH) caused by all reactive species in air. During the intensive field campaign HUMPPA-COPEC 2010 (Hyttälä United Measurements of Photochemistry and Particles in Air - Comprehensive Organic Precursor Emission and Concentration study) the total OH reactivity was monitored both inside (18 m) and directly above the forest canopy (24 m) for the first time. The comparison between these two total OH reactivity measurements, absolute values and the temporal variation have been analyzed here. Stable boundary layer conditions during night and turbulent mixing in the daytime induced low and high short-term variability, respectively. The impact on total OH reactivity from biogenic emissions and associated photochemical products was measured under "normal" and "stressed" (i.e. prolonged high temperature) conditions. The advection of biomass burning emissions to the site caused a marked change in the total OH reactivity vertical profile. By comparing the OH reactivity contribution from individually measured compounds and the directly measured total OH reactivity, the size of any unaccounted for or "missing" sink can be deduced for various atmospheric influences. For "normal" boreal conditions a missing OH reactivity of 58%, whereas for "stressed" boreal conditions a missing OH reactivity of 89% was determined. Various sources of not quantified OH reactive species are proposed as possible explanation for the high missing OH reactivity.

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