Geophysical Research Abstracts
Vol. 13, EGU2011-2231-2, 2011
EGU General Assembly 2011

Hydroperoxide and formaldehyde measurements over a boreal coniferous forest in Hyytiälä, Southern Finland during the HUMPPA summer campaign 2010

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Hydroperoxides and formaldehyde play a crucial role for the oxidation capacity of the atmosphere by mediating the budget of HO_x.

Gas-phase hydrogen peroxide (H_2O_2), organic hydroperoxides (ROOH) and formaldehyde (HCHO) were determined above the canopy of a boreal forest (21 m) from Mid-July to Mid-August 2010 during the HUMPPA (Hyytiälä United Measurements of Photochemistry and Particles in Air) field campaign, which aimed at studying the impact of a large suite of biogenic emissions on photochemistry. The site is located in a boreal coniferous forest in Hyytiälä (Southern Finland), that was influenced by unpolluted air from the north and pollutant transport from the south (anthropogenic emissions and biomass burning plumes).

Mixing ratios of hydrogen peroxide and organic hydroperoxides were measured in-situ via a commercial instrument (Model AL2021, Aero-Laser GmbH, Garmisch-Partenkirchen, Germany), just as formaldehyde by a similar device (Model AL4021, Aero-Laser, Garmisch-Partenkirchen, Germany).

The meteorological conditions were characterized by an exceptional warm summer, high humidity, changing wind directions and high radiation. In clean periods, mixing ratios of hydrogen peroxide followed diurnal variations as expected for photochemically controlled species. Peak values in orders of 500 pptv were reached by midafternoon, while lowest values around 150 pptv were observed in the early morning, presumably due to dry deposition during nighttime. Mixing ratios of organic hydroperoxides could only be estimated due to instrumental limitations, but followed qualitatively. Formaldehyde also showed a similar behavior during daytime (peaks 170, lows 100 pptv) and also increases up to 150 pptv in the evening, possibly caused by nighttime chemistry.

Pollution events, especially Russian biomass burning plumes in the second half of the campaign, were indicated by very high carbon monoxide (CO) up to 440 ppbv and also showed highly enhanced mixing of hydrogen peroxide (2 ppbv) and formaldehyde (6 ppbv).