Geophysical Research Abstracts,
Vol. 11, EGU2009-8570, 2009
EGU General Assembly 2009

The Weidenbrunnen spruce forest (Fichtelgebirge, Germany): Vertical concentration and flux profiles of non-reactive (CO2, H2O) and reactive (NO, NO2, O3) trace gases

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From 05^{th} of June to 11^{th} of July 2008, the second Intensive Observation Period (IOP-2) of the EGER project (ExchanGE processes in mountainous Regions) was conducted at the spruce forest site "Weidenbrunnen" (Fichtelgebirge/ Germany). The project is focused on the role of process interactions among the different scales of soil, in-canopy and atmospheric exchange processes of reactive and non-reactive trace gases and energy. Within that framework, tower-based vertical profiles of both reactive (NO, NO_2, O_3) and non-reactive (CO_2, H_2O) trace gas mixing ratios were measured in and above the spruce forest canopy (mean canopy height: 23 m).

Measurements were performed continuously by two identical but independently operating analyzing units, one for in-canopy (at 0.005, 0.03, 0.1, 0.3, 0.9, 3, 10 and 16.5 m above ground) and the other for above-canopy intake levels (at 16.5, 20.5, 25, and 31.5). Accompanying measurements comprise vertical profiles of wind speed, air temperature, momentum, sensible and latent heat, global and photosynthetic active radiation, as well as the NO_2 photolysis rate.

During IOP-2, we observed NO mixing ratios between 0.2 ppb and 5.1 ppb at the forest floor (0.005 m) not showing a diurnal trend. Above the canopy (31.5 m) NO mixing ratios ranged between 3.4 ppb (day) and ~0.01 (night). At forest floor and above canopy, the NO_2 mixing ratios were between 0.3 ppb - 9.2 and 0.7 ppb - 15.5 ppb, respectively. O_3 mixing ratios varied at the forest floor between 56.9 ppb (day) and 5.8 ppb (night) and above the canopy 79.3 ppb (day) and 22.4 ppb (night).

In our contribution we will focus on (a) detailed quality assessment of the concentration data (temperature dependency of analysers, side-by-side measurements with other systems, response tests, accuracy and detection limits), (b) evaluation of time scales of turbulent mixing and chemical reactions (to elucidate whether or not chemical transformations of the NO-O_3-NO_2 triad had a noticeable effect on their vertical flux divergence), (c) determination of vertical profiles of CO_2, H_2O, NO, NO_2, and O_3 by application of a new numerical flux-gradient algorithm (considering NO-O_3-NO_2 transformations).