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Investigation of exchange processes at a forest edge – clearing interface with a horizontal mobile measuring system

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The gradients of characteristic atmospheric quantities are immense at the transition from a dense forest to an open clearing, with major effects on meteorological parameters and exchange processes. Trace gas measurements could help to identify possible effects at the forest edge.
In the joint effort of the third intensive observation period (IOP3) of the EGER project (ExchanGE processes in mountainous Regions, DFG PAK 446), the diurnal cycles of energy, water, and trace gases in the soil-vegetation-atmosphere boundary-layer system of a disturbed forest ecosystem were studied in June/July 2011. As a result of the hurricane "Kyrill" the dense spruce forest at the FLUXNET site (DE-Bay) at Waldstein-Weidenbrunnen in the Fichtelgebirge Mountains (North-Eastern Bavaria, Germany) has a more than 100 m wide clearing, and the focus of this experiment was the energy and matter exchange at the edge between the forest and the clearing.
To obtain more information about horizontal gradients in this heterogeneous forest ecosystem, a Horizontal Mobile Measuring System (HMMS) was built. The HMMS measures - in addition to meteorological quantities (temperature, humidity and short/long wave radiation) - trace gases (ozone and carbon dioxide). Whereas tower measurements have a problem attaining a sufficient spatial resolution, this could be achieved with the HMMS. The transect of the HMMS passes 75 m in the dense spruce forest and 75 m on the open clearing vertical to the forest edge. The HMMS works fully automatically on a railroad system installed one meter above the ground. Relevant for the HMMS measurements are flux measurement points installed above the forest canopy (canopy height: 27 m) and under the forest canopy, and in the clearing along a transect parallel to the HMMS system and perpendicular to the forest edge.
The poster will show the measuring system and its technical data, as well as a typical daily cycle of the four radiation fluxes, temperature, humidity, and the concentrations of carbon dioxide and ozone with a horizontal spatial resolution of less than 1 m.