Geophysical Research Abstracts
Vol. 14, EGU2012-4838, 2012
EGU General Assembly 2012

Effects of drought on forest soil structure and hydrological soil functions

K. Gimbel, H. Puhlmann, and M. Weiler

IHF - Institut für Hydrologie, Albert-Ludwigs-Universität Freiburg, Germany (katharina.gimbel@hydrology.uni-freiburg.de)

Climate change is predicted to severely affect precipitation patterns across central Europe. Soil structure is closely linked to the activity of soil microbiota and plant roots, which modify flow pathways along roots, organic matter and water repellence of soils. Through shrinkage and fracturing of soil aggregates, soil structure is also responding to changing climate (in particular drought) conditions. We investigate the possible effects on biogeochemical and hydropedological processes in response to predicted future reduced precipitation, and the interaction of these processes with the biodiversity of the forest understorey and soil biota. The hypotheses of this study are: (i) drought causes a change in soil structure, which affects hydrological soil functions (water infiltration, uptake and redistribution); (ii) changes in rooting patterns and microbial community composition, in response to drought, influence the hydrological soil functions. To test our hypotheses, we built adaptive roofing systems on nine sites in Germany, which allow a flexible reduction of precipitation in order to achieve the long-term minimum precipitation of a site. Here we present first measurements of our repeated measuring/sampling campaign, which will be conducted over a period of three years. The aim of our experiments is to analyze soil pore architecture and related flow and transport behaviour with dye tracer sprinkling experiments, soil column experiments with stable isotope (deuterium, oxygen-18) enriched water, computed tomography at soil monoliths ($\sim$70 l) and multi-step outflow experiments with 100 ml soil cores. Finally, we sketch our idea how to relate the observed temporal changes of soil structure and hydrological soil functions to the observed dynamics of hydrometeorological site conditions, soil moisture and desiccation as well as changes in rooting patterns, herb layer and soil microbiotic communities. The results of this study may help to assess future behavior of the plant-soil-water-microbiology-system and may help to adjust models to predict future response to different precipitation patterns as well as help coping with existing and future emerging challenges in forest management.