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Combined soil warming and drought manipulation: Effects on forest soil respiration and its components

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Since soil respiration is a major flux in the global carbon cycle, potential global warming effects have received great attention. Field soil warming studies focused on the difference in soil respiration under actual and elevated soil temperatures. Accordingly, we warmed the topsoil of a mature spruce-beech forest by 4°C compared to the actual soil temperature during the growing seasons since 2005. While soil warming initially increased soil respiration by $\sim$ 40%, a slight decrease in the response to warming was observed during the last two years. However, besides rising soil temperature, decreasing precipitation during summer is predicted for the northern Alps (Austria). Additionally to soil warming, we simulated a one-month summer drought by exclusion of throughfall water during July 2008 and 2009. In the combined treatment, the induced summer drought partly (2009) or completely (2008) offset the increase by soil warming on soil respiration.
We used the radiocarbon signature (delta 14C) of soil respiration to assess the response of the autotrophic (rhizosphere) and heterotrophic (decomposition of SOM) components of soil respiration. The separation between autotrophic and heterotrophic components is fundamental since autotrophic soil respiration is closely related to actual C uptake by photosynthesis while changes in the decomposition of SOM provides information on the sink/source strength of soils for atmospheric CO2 under changing climatic conditions.
The development and composition of microbial biomass on all treatment plots was analysed. Microbial biomass C showed distinctive seasonal development with lowest biomass during winter. The treatments did not cause significant effects on microbial biomass. Even under induced drought, microbial biomass C of the topsoil remained in the range of the control plots. Ongoing PLFA analysis will show if the microbial composition was altered by the treatments. Results on the response of microbial biomass, soil respiration and its components to the manipulations will be presented at the conference.