Geophysical Research Abstracts,
Vol. 10, EGU2008-A-00607, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-00607
EGU General Assembly 2008

Effects of an artificial Summer Drought on the relative Contributions of new and old Carbon to the CO_2-Efflux of Swiss Grassland Soils

O. Joos (1), F. Hagedorn (2), R. Siegwolf (3), M. Saurer (3), A. Heim (1) & M.W.I. Schmidt (1)

(1) University of Zurich, Department of Geography, Switzerland (ojoos@geo.uzh.ch), (2) Swiss Federal Institute for Forest, Snow and Landscape Research, WSL Birmensdorf, Switzerland, (3) Paul Scherrer Institute, PSI Villigen, Switzerland

Current climate models predict an increase in the frequency of hot and dry summers (Schaer et al., 2004). In grasslands summer drought might affect the carbon cycle, including soil respiration and the carbon transfer from litter to the soil. In this study we used ^{13}C-depleted biomass to i) investigate the effect of simulated drought on plant and soil carbon dynamics in Swiss grasslands, and ii) for the first time we have attempted to separate the fresh litter respiration and the total soil respiration in grassland.

The experimental sites were located in grasslands at three research stations at 400 m, 1000 m and 1900 m a.s.l.. We measured i) total soil CO_2-efflux every 2-4 weeks at each station and ii) $^{13}CO_2$-efflux biweekly at 400 m a.s.l., after having applied 0.7 kg m^{-2} of ^{13}C-depleted biomass. Drought was simulated with rainfall shelters for 10-11 weeks, excluding about 150-300 mm of rainfall from the plots in 2007.

Our first estimates of soil respiration rates (298-461 mg C m^{-2} h^{-1} on the controls) during the growing season fell within the range reported for grasslands, which is 52 mg C m^{-2} h^{-1} (Norman et al., 1992) to 497 mg C m^{-2} h^{-1} (Bremer et al., 1998). The simulated drought significantly reduced the total soil CO_2-efflux by approximately 21 % at 400 m, 23 % at 1000 m and around 38 % at 1900 m a.s.l.. The decline in soil respiration under drought conditions found here is consistent with results from CO_2-

efflux measurements across Europe during the extreme heat wave in summer 2003 (Ciais et al., 2005). For the first time the effect of drought on the contribution of fresh litter to the total soil CO_2-efflux in grasslands was determined using ^{13}C-depleted biomass. The 10 week artificial summer drought reduced CO_2-efflux from fresh litter by 48 % over the whole growing season at 400 m a.s.l..

Our data showed that summer drought reduced the soil respiration, especially the new biomass respiration. However, for a complete ecosystem carbon budget we need additional data covering several growing seasons, including e.g. changes in biomass quantity and quality, total ecosystem respiration and DOC fluxes .

REFERENCES

Bremer et al. 1998: Response of soil respiration to clipping and grazing in a tallgrass prairie. Journal Environmental Quality 27, 1539-1548.

Ciais et al. 2005: Europe-wide reduction in primary productivity caused by the heat and drought in 2003. Nature 437, 529-533.

Norman et al. 1992: Soil surface CO_2 fluxes and the carbon budget of a grassland. Journal Geophysical Research 97, 18845-18853.

Schaer et al. 2004: The role of increasing temperature variability in European summer heatwaves. Nature 427, 332-335.