Geophysical Research Abstracts
Vol. 17, EGU2015-15156-1, 2015
EGU General Assembly 2015

Fast recovery of carbon fluxes in beech saplings after drought

Carola Blessing (1), Matti Barthel (1), Lydia Gentsch (2), and Nina Buchmann (1)

(1) Institute of Agricultural Sciences, ETH Zurich, Zurich, Switzerland, (2) Chair of Bioclimatology, Georg-August University of Göttingen, Göttingen, Germany

Drought is known to down-regulate above and belowground gas-exchange and to slow down carbon transport from shoot to the soil/root system of beech (*Fagus sylvatica* L.). However, given more frequent drought spells in a future climate, the resilience of beech to drought will also depend on the speed and magnitude of recovery of above and belowground carbon fluxes. In a climate chamber study with beech saplings, we measured shoot and soil CO_2 fluxes and their carbon isotope signature during drought and consecutive recovery using laser spectroscopy. We aimed to determine the speed of recovery from drought after re-watering and to assess the coupling between above and belowground gas-exchange and carbon isotope fluxes at natural abundance during drought and subsequent recovery. CO_2 fluxes responded strongly to drought; photosynthesis was decreased by 34%, soil respiration (during light) by 41% and stomatal conductance by 65%. Despite this drastic decrease in gas-exchange, carbon fluxes recovered within few days after re-watering – faster for aboveground physiological variables (four days) compared to soil respiration (seven days) – pointing towards a resilient behaviour of beech saplings to drought. Moreover, the drought response in soil respiration was better explained by stomatal conductance (R^2=0.8) rather than photosynthesis (R^2=0.62). Consequently, stomatal conductance, and thus water-mediated processes, played a pivotal role driving the coupling of above and belowground CO_2 fluxes. Further, drought caused photosynthetic isotope discrimination to decrease by 8‰ which in turn was reflected in a significant increase in δ^{13}C of recent photoassimilates (1.5-2.5 ‰), and could be also traced to δ^{13}C of soil respiration, which increased by 1-1.5 ‰). However, the coupling between the isotopic signatures of above and belowground carbon fluxes (R^2=0.15) was less pronounced compared to the coupling of above and belowground gas-exchange (R^2=0.8). In summary, our measurements highlight a fast recovery of beech saplings from drought and the strong coupling between above and belowground processes under drought and recovery with parallel responses of shoot and soil CO_2 fluxes and their carbon isotope composition at natural carbon isotope abundance.