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Seasonal changes in soil water repellency and their effect on soil CO_2 fluxes

Emilia Urbanek and Khalid Qassem
Swansea University, Geography, Swansea, United Kingdom (e.urbanek@swansea.ac.uk)

Soil water repellency (SWR) is a seasonally variable phenomenon controlled by moisture content and at the same time a regulator of the distribution and conductivity of water in the soil. The distribution and availability of water in soil is also an important factor for microbial activity, decomposition of soil organic matter and exchange of gases like CO_2 and CH4 between the soil and the atmosphere. It has been therefore hypothesised that SWR by restricting water availability in soil can affect the production and the transport of CO_2 in the soil and between the soil and the atmosphere.
This study investigates the effect of seasonal changes in soil moisture and water repellency on CO_2 fluxes from soil. The study was conducted for 3 year at four grassland and pine forest sites in the UK with contrasting precipitation. The results show the temporal changes in soil moisture content and SWR are affected by rainfall intensity and the length of dry periods between the storms. Soils exposed to very high annual rainfall (>1200mm) can still exhibit high levels of SWR for relatively long periods of time. The spatial variation in soil moisture resulting from SWR affects soil CO_2 fluxes, but the most profound effect is visible during and immediately after the rainfall events.

Keywords: soil water repellency, CO_2 flux, hydrophobicity, preferential flow, gas exchange, rainfall