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Small scale variability of transport and composition of dissolved organic matter in the subsoil

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Dissolved organic matter (DOM) is the most mobile fraction of carbon in the soil and connects the carbon-rich topsoil with the subsoil where translocated OM may get stabilized. The water flux in soil is highly heterogeneous, both temporarily and spatially. We, therefore, hypothesize that at high flow velocities, DOM can bypass possible mineral binding sites and microorganisms, thus leading to less degraded DOM under high flow velocities.
To address this question, we investigated water and DOM fluxes in situ using segmented suction plates (4 x 4 segments on 24 x 24 cm) installed into three soil observatories at three depths (10 cm, 50 cm, and 150 cm) in a Podzolic Cambisol under Beech (Fagus sylvatica) near Hannover, Germany. To follow the transport of carbon from the litter layer through the soil, an in situ 13C-labelling experiment has been conducted in January 2015. Concentration of dissolved organic carbon (DOC) and DOM composition was analyzed using high temperature combustion and photometric methods.
The amount of transported DOC decreased by ca. 80% from 10 to 50 cm depth and by 40% from 50 to 150 cm depth. Different flow patterns existed at the centimeter scale, which were stable over time for individual suction plate segments. The specific UV280 nm absorbance of DOM decreased with increasing soil depth. This indicates a selective loss of aromatic compounds. The influence of different flow regimes on the DOM quality became apparent in the subsoil samples (>50 cm depth) showing a correlation of increasing UV280 nm absorbance with increasing water flux. Together with juvenile DO14C up to 150 cm depth this can be an indication for the importance of preferential flow on carbon transport to subsoil.