Geophysical Research Abstracts
Vol. 17, EGU2015-11694, 2015
EGU General Assembly 2015

Soil column study on transport properties, DOC and particle leaching at plateau and slope positions in an erosion-affected arable landscape

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In a hummocky ground moraine arable soil landscape, soil structure and properties are undergoing gradual changes depending on the degree of soil erosion at the different slope positions. This study examined effects of such changes on solute dispersion, particle mobilization, and DOC leaching for a Luvisol with clay migration characteristics in comparison with a strongly eroded Regosol. Percolation experiments through intact soil columns (20 cm diam., 20 cm high) were carried out under unsaturated flow conditions on 3 Luvisol depths (including Ap, E and upper Bt horizons) and 2 Regosol depths (including Ap and CBkg horizon). Dispersion coefficients, D, were determined by fitting analytical solutions of the convection-dispersion equation and the mobile-immobile transport model (program CXTFIT) to the breakthrough curves (BTCs). The D values were in the range from 15 to 24 cm2 d-1 for the Luvisol horizons and from 23 to 30 cm2 d-1 for the eroded Regosol horizons at pore water velocities between 6.0 and 8.9 cm d-1; and could be related to pore and aggregate structures of individual horizons. The largest variability in the BTCs was observed for the E horizon (20-40 cm depth) of the Luvisol, which included a plow pan (Ap-E horizon). Leaching of DOC and particles was highest from the clay depleted E horizon of the Luvisol; particle leaching was negligibly small for all Regosol horizons. Results suggest that soil erosion not only affected the pedological structure of the landscape, but also the water and solute movement within the landscape by gradual changes of the solid matrix composition and the soil pore structures.