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Water and solute balances of erosion-affected Haplic Luvisols using high precision weighing lysimeter data

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Under intensive agricultural use, soil landscape development leads to more-or-less eroded areas reflecting an erosion-induced spatial differentiation of soil types. This is a general problem in regions with soil erosion such as hilly loess soil regions or hummocky ground moraine soil landscapes. The water flow and solute transport is affected by soil-crop interactions depending on properties of differently-developed soil horizons. The objective was to analyze and compare the measured water and solute balance for differently-eroded Haplic Luvisols. All results were based on high precision weighing lysimeters filled with intact soil monoliths. Differences in seepage water drainage of about >76 % between most and least eroded soils indicated erosion-induced spatial differentiation in the water balance of the same soil type. Cumulative drainage was ranging between 190 L m-2 (Standard Haplic Luvisol) and 290 L m-2 (Most eroded Haplic Luvisol) over 2.5 years (04/2011-10/2013). Due to more or less similar concentrations of dissolved organic carbon (DOC) of 4.8 $\pm$ 0.5 mg L-1, and of dissolved inorganic carbon (DIC) of 61.5 $\pm$ 5.3 mg L-1, for the lysimeter bottom at140 cm soil depth, results suggest leaching was predominantly affected by water fluxes. The export of dissolved carbon ranged from 1.5 $\pm$ 0.3 g m-2 for DOC and 16.1 $\pm$ 2.5 g m-2 for DIC over the period of 2.5 years. Effects of erosion-affected pedogenesis could be related to leaching rates. Element leaching, in particularly phosphate, indicated occasionally occurrence of preferential flow. Results suggest that water and solute balances are depending on the degree of erosion-induced soil profile modifications. Hence for the landscape scale analysis, not only the distributed soil types but also erosion-induced modifications with a single soil type should be considered for quantification of the landscape water and solute balances.