

## The fate of soil organic carbon during water erosion

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A better understanding of how water erosion influences the redistribution of soil organic carbon (SOC) and which processes are involved is sorely needed to unravel the role of soil erosion for the carbon (C) budget from local to global scales. Particularly, the role of transport processes on C mineralization and the contribution of dissolved organic C to the C budget are largely unknown.

We present a study in which the total carbon budget of a loess soil under water erosion was determined using climate-controlled rainfall simulation experiments in the laboratory. We measured fluxes of SOC, dissolved organic C (DOC) and CO<sub>2</sub>. We characterized different C fractions in soils and redistributed sediments using density fractionation and determined C enrichment ratios (CER) in transported and deposited sediments along the experimental flume.

Erosion, transport and subsequent deposition resulted in a significantly higher CER of the sediments exported ranging between 1.3 and 4.0. In the exported sediments, C content of particulate organic C (POC, C not bound to soil minerals) and mineral-associated organic C (MOC) were both significantly higher than those of non-eroded soils indicating that water erosion resulted in losses of C-enriched material both in forms of POC and MOC. The averaged SOC fluxes as particles (4.7 g C m<sup>-2</sup> yr<sup>-1</sup>) were 18 times larger than DOC fluxes. Cumulative emission of soil CO<sub>2</sub> slightly decreased at the erosion zone while increased by 56% and 27% at the transport and depositional zone, respectively, in comparison to non-eroded soil. Disruption of macro-aggregates was identified as the main process responsible for the observed preferential redistribution of labile particulate organic C. Overall, CO<sub>2</sub> emission was the predominant form of C loss contributing to about 90.5% of total erosion-induced C losses in our 4-month experiment. However, only 1.5 % of redistributed C was mineralized highlighting that the C sink induced by deposition is much larger than previously assumed. Our study also underlines the importance of C losses by particles and as DOC for understanding effects of water erosion on the C balance at the interface of terrestrial and aquatic systems.