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Organic carbon mobilization in the slope-bed connection through different erosion processes

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Soil organic carbon (OC) mobilization due to erosional processes can have consequences regarding CO_2 emission or sequestration. OC can be mineralized (emitted as CO_2 to the atmosphere) during detachment, transport and deposition of soil particles, or buried in depositional settings, where it can also be stabilized. The contradicting results in the published literature in the last decade point towards a lack of information concerning OC dynamics in relation to different erosion processes at different spatial scales. The objective of this work was to characterize the quantity and type of erosion OC mobilized by the different erosion processes identified at a catchment scale with respect to the original soils where they came from.

With the purpose of analysing the type (labile or stable) and quantity of organic carbon (OC) mobilized by different erosive processes identified at the slope-bed connection, the erosion deposits of gullies, sheet erosion, bank erosion and tillage erosion were studied in a small catchment (10 ha) and compared to the characteristics of the catchment soils. Selectivity of particles upon soil detachment and transport in the different processes was associated to different OC content in the deposits (from more to less OC concentration: tillage>gully>interrill>gravitational-bank erosion). OC was predominantly found in a stable form (mineral associated organic carbon) and accounted for 77% (± 15) of total organic carbon in sediments. Further, sediment OC enrichment ratio was in all cases below unity (∼0,40 ±0,26) in spite of a slight increase in the finer soil texture fractions (those associated with OC) in the deposits. These results were attributed to sediment transport, not only suspended, but also due to other transport processes important at catchment scales, with coarser and less OC enriched particles; as well as to the exposition of sediments in the sampled deposits that favoured mineralization. The geomorphological analysis revealed active fluvial dynamics where detachment and transport processes were predominant and where natural sinks (alluvial bars, depositional basins, wetlands) or even artificial ones (hydraulic works), that would favour deposition and sediment burial, were missing.