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Water erosion processes selectivity on soil organic carbon mobilization: factors, mechanisms and spatial scale influence.

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A wide range of soil organic carbon (OC) erosion rates have been reported around the world ($\sim$0.0005-3 t ha^{-1} yr^{-1}). Up to date, factors affecting organic carbon mobilization have been assumed to operate parallell to those of soil erosion, linking OC to the soil fine fraction, and studies have been conducted mainly in agricultural sites and on fine scales ($<$1 ha). The complexity of the erosion processes of OC becomes evident, not only along the three defined stages (detachment, transport and deposition) and the factors that interact with the physical and chemical nature of OC in each of them, but also because they are confined in different temporal and spatial scales, questioning the suitability of comparing (and upscaling) findings amongst regions. Although most of the factors affecting OC mobilization are common to soil loss, the direction of their effect is not always the same. For instance as rainfall intensity, rainfall amount and runoff increase, soil loss increases but OC content in the mobilized sediments declines. Further, factors that are very important for OC enrichment or total mobilization at fine spatial scales become secondary or almost negligible as the scale increases and vice versa. Significant correlations have been established between soil loss and OC loss (ρ=0.973 and ρ=0.751 with p=0.01 for single events and rates, respectively) and initial soil OC content and OC enrichment ratio (EROC) (ρ=-0.442, p=0.01), based on a large set of published data. While soil loss rates and drainage area show a negative correlation (ρ=-0.580, p=0.01), no such has been found for OC loss rates, suggesting that the different physical properties of OC and their association to the fine mineral fractions make their deposition more difficult than gross mineral sediments.