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Potential fate of eroded SOC after erosion

Liangang Xiao, Wolfgang Fister, Philip Greenwood, Yaxian Hu, and Nikolaus J. Kuhn
University of Basel, Physical Geography, Environmental Sciences, Basel, Switzerland (wolfgang.fister@unibas.ch)

Globally, soils contain more than three times as much carbon as either atmosphere or terrestrial vegetation. Soil erosion moves soil organic carbon (SOC) from the site of soil and SOC formation and to depositional environments. There some SOC might be sequestered. Combined with dynamic replacement at the site of erosion, the effect can significantly influence the carbon cycle. However, the fate of SOC moved by erosion has been subject to an intense controversy. Two opposing views prevail: erosion may contribute to SOC mineralization during transport and thus act as a source for atmospheric CO_2; the burial of SOC, on the other hand, can be seen as a sink while dynamic replacement maintains SOC at the eroding site and thus increase the C-stocks in soils and sediments. The debate suffers from a lack of information on the distribution, movement and fate of SOC in terrestrial ecosystems. This study aims to improve our understanding of the transport and subsequent fate of the eroded soil and the associated SOC. The research presented here focused on the SOC content and potential transport distance of erode soil. During a series of simulated rainfall soil eroded on crusted loess soils near Basel, Switzerland, was collected. The sediment was fractionated according to its settling velocity, with classes set to correspond to either a transfer into rivers or a deposition on slopes. The soil mass, SOC concentration and cumulative CO_2 emission of each fraction were measured.

Our results show that about 50% of the eroded sediment and 60% of the eroded SOC are likely to be deposited on the slopes, even during a high rainfall intensity event. This is 3 times greater than the association of SOC with mineral particles suggests. The CO_2 emission of the eroded soil is increased by 40% compared to disturbed bulk soil. This confirms that aggregate breakdown reduces the protection of SOC in aggregates. Both results of this study show that taking (i) the effect of aggregation on SOC redistribution and (ii) the subsequent CO_2 emission during the transport have to be considered to achieve a reliable assessment of the effect of soil erosion on the global C-cycle. They also indicate that our current balances may underestimate the CO_2 emission caused by soil erosion.