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The effect of aggregation onto the fate of eroded carbon

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The effect of soil erosion on the global Carbon (C) cycle as source or sink is subjected to intense debate. The controversy is mostly due to the lack of understanding of the fate of transported SOC from the source of erosion to the eventual site of deposition. The fate of eroded carbon is strongly influenced by the settling velocities of the eroded fractions and the corresponding transport distance and site of deposition. Some erosion/deposition models already include the settling velocity of particles to evaluate the sediment delivery and quality. However, the settling velocity distribution in these models were either based on grain size (e.g. the EUROSEM model) or several arbitrary number of size classes (e.g. the WEPP model and the Hairsine-Rose model). Most soil is eroded in form of aggregates, or at least aggregates are present in the sediment, which affects the settling velocity and C content of the eroded soil. Without considering the effects of aggregation on sediment movement and C content, the extent of mineralization of deposited C as well as the transfer of organic C to aquatic systems is likely to be incorrect.

To identify the effect of aggregation on the fate of eroded SOC, a rainfall simulation was carried out on two soils. The eroded sediments were then fractionated by a settling tube apparatus according to their likely transport distance after erosion. Weight, total organic carbon (TOC) and respiration rate of the sediment in each class were measured.The results of the experiments show that the portion likely to be deposited in the landscape carried 41.46 % of the total SOC and released about 54.07% of the total CO_2 emission. The portion likely transferred into rivers contained only 17.49 % of the total SOC and produced only 9.15 % of the total CO_2 emission. These results indicate that 1) most of the eroded SOC was incorporated in coarse aggregates; 2) Erosion was prone to accelerate SOC mineralization; 3) The deficiency of erosion models that apply grain size rather than effect aggregate size, which often lead to over-prediction of clay in sediment fractions or under-prediction of sand and silt fractions. Based on these results, future research will include long-term observation of sediment respiration of as well as accounting for the effects of transport processes in a real field environment.