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Settling-velocity specific SOC distribution on hillslopes

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The net effect of soil erosion by water, as a sink or source of atmospheric CO_2, is determined by the spatial (re-)distribution and stability of eroded soil organic carbon (SOC). The depositional position of eroded SOC is a function of the transport distances of soil fractions where the SOC is stored. In theory, the transport distances of soil fractions are related to their settling velocities under given flow conditions. Yet, very few field investigations have been conducted to examine the actual movement of eroded soil fractions along hillslopes, let alone the re-distribution pattern of SOC fractions.
Eroding sandy soils and sediment were sampled after a series of rainfall events along a slope on a freshly seeded cropland in Jutland, Denmark. All the soil samples were fractionated into five settling classes using a settling tube apparatus. The spatial distribution of soil settling classes shows a coarsening effect immediately below the eroding slope, followed by a fining trend at the slope tail. The δ13C values of soil fractions were more positive at the footslope than on the slope shoulder or at the slope tail, suggesting enhanced decomposition rate of fresh SOC input at the footslope during or after erosion-induced transport. Overall, our results illustrate that immediate deposition of fast settling soil fractions and the associated SOC at footslopes must be appropriately accounted for in attempts to quantify the role of soil erosion in terrestrial carbon sequestration. A SOC erodibility parameter based on actual settling velocity distribution of eroded fractions is needed to better calibrate soil erosion models.