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# Unravelling the influence of soil erosion on the within-field vertical heterogeneity of SOC stock and stability

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Intensified agro-management since the green revolution (from halfway the 20th century) significantly increased soil erosion and its associated lateral fluxes of soil properties within agricultural catchments. During this relatively short period of time considerably large amounts of fertile topsoil have been removed from erosional sites and have accumulated in depositional zones. As a consequence, the associated three dimensional spatial distribution of SOC has been modified significantly, especially within croplands under conventional tillage. As on the one hand erosion affects the stability of soil organic matter (i.e. breakdown of soil aggregates during transport process) and on the other hand organic carbon in depositional zones is assumed to be stored in stable environments, the increased within-field differences in SOC probably cause a major change in regional SOC dynamics. Nevertheless, the variability of SOC at smaller scales in complex terrain driven by soil erosion, such as stable subsoil carbon buried in depositional areas, is still rather understudied and is not (well) represented in current regional C estimates. In the present study we aim to unravel the variation in quantity and quality of SOC depth distributions along typical hillslope transects under cropland (Devon, UK) and to relate these to soil redistribution rates and variations in C input, i.e. below and above ground biomass productivity. The radionuclide isotope Caesium-137 (137Cs) was used as proxy for soil erosion. SOC stability has been studied in a depth specific context by running long-term incubation experiments. Moreover, the effect of potential increased C input has been tested by applying different rates of glucose additions on some of the incubated soil samples. The results show contrasting vertical patterns in SOC stock and stability depending on the rate and type of erosion. For example, sites characterized by deposition due to water erosion (i.e. footslope) have much higher SOC values near the surface, but show a fast decline with depth, while sites characterized by deposition due to tillage erosion (i.e. most concave position) have moderated SOC surface values that stay constant until a depth of 50 cm. The above ground biomass productivity is most linked to water erosion, since we found lowest above ground biomass at the steepest slope position and the highest above ground biomass at the foot slopes. Furthermore, root biomass in the most concave section is significantly higher as compared to any other topo-position. Respiration experiment results show that in the top 10 cm C release rates are highest at the footslope (i.e. depositional area) and lowest at the plateau. For both 30-40 and 60-70 cm layers, C release rates of all topo-position are comparable, except at the most convex position, where almost no C release was measured. Considering the glucose addition experiment, this picture is remarkably different as here footslope areas show to be the most stable environments for the freshly added C (lowest C release). The present study improved our understanding of the influence of lateral transport processes (erosion) on the within field vertical heterogeneity in SOC stock and stability and can be considered as a first step to refine 3D spatial and temporal models of SOC dynamics at regional scales.