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Modelling carbon cycling on an eroding hillslope: the effect of carbon quality and environment

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A large amount of soil organic carbon (SOC) is laterally redistributed by global agricultural erosion. At the landscape scale SOC is found to display spatial variability with eroding areas depleted of SOC and depositional areas enriched in SOC. However, understanding of the effect of soil redistribution on the quality and recalcitrance of SOC is still poor. This study utilizes C pool data derived from soil fractionation to optimize a multi-pool C model. The C model is further combined with a soil redistribution model to evaluate the effect of soil erosion on hillslope scale C budget at long-term scales. Our model is able to reproduce the pattern of C pools with the depositional locations enriched in recalcitrant C pools due to the preferential mineralization of labile pools of the deposited SOC. Optimized parameters show that the vertical decline of mineralization due to changes of environment with depth is more important than the decline due to C quality variation. Model simulations show that soil redistribution on the hillslope results in a C sink under the equilibrium state. The C sink strength is affected by factors such as soil erosion intensity and sediment delivery ratio. In order to better understand the SOC dynamics on an eroding hillslope requires taking into account the effects of variability of C quality and environment.