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The Influence of Soil Erosion on Carbon Dynamics at Millennial Scale

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Previous research has shown that soil erosion leads to a carbon sink at short time scale, which is derived from the discovery that depositional sites on arable land still contain (nearly) all the carbon that was deposited there by tillage and water erosion over the last 60 years. However, there is still little knowledge about the dynamics of deposited carbon as well as the role of soil erosion on carbon dynamics at longer time scales. By applying a spatially distributed erosion-sedimentation model, the long-term soil redistribution pattern within a small agricultural catchment could be quantified, and the colluvium deposition rate over the past thousands of years was further constrained by available 14C-dating data.

The results derived from the water erosion model were used as input for a model simulating soil organic matter dynamics through the soil profile: this model was calibrated using detailed measured soil carbon profiles, both on the slope and at colluvial sites. By doing so we could obtain a first insight about the influence of soil erosion on carbon dynamics at millennial scale. Apart from the decomposition rates for the carbon in colluvia derived from the model, we also conducted incubation experiments on a selected number of core samples. Data such as carbon content, delta 13C, carbon quality and grain size of the incubated samples were combined with the measured respiration rate to discuss relevant factors that may control the mineralization of deposited carbon in colluvia at millennial scale.