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# Simulating the effects of erosion on organic carbon dynamics in agricultural soils

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Soil erosion in croplands has a strong impact on global carbon (C) cycle. Assessment of erosional effects on soil organic carbon (SOC) dynamics in agricultural soils suffers from the difficulty of distinguishing the erosional effects and complex interaction processes between erosion and C cycling. To simulate the effects of soil erosion, a plots experiment including six erosion levels (0, 5, 10, 20, 30, and 40 cm eroded) was conducted for seven years (2012-2018). The erosion levels were simulated using artificial soil profiles created by mixing soils from different layers in the original soil profile (never eroded) in a certain proportion. Subsequently, based on the field observations during 2012-2018, the SOC dynamics of each experimental plot were simulated by using a process-oriented C cycle model (denitrification-decomposition (DNDC)) to quantify the effects of erosion on SOC dynamics. The measurements at the beginning of the plots experiment showed that simulated erosion resulted in the depletion of SOC with an average reduction rate of 9.7% per 10 cm of soil loss; SOC in eroded soils recovered after seven years of cropping, the declining slope of the SOC measured in 2018 was 3.0% per 10 cm of soil loss, suggesting that dynamic replacement had occurred. Model simulation results indicated that soil erosion could reduce the C inputs from crop residue by lowering soil productivity; soil heterotrophic respiration in eroded soils was restricted due to the lower initial SOC content. As a result, the simulated overall SOC stock in eroded soils was restored after erosion stopped because of the lower C output. These results indicated that SOC loss at eroding sites was caused mainly by lateral transport rather than enhanced decomposition. The fate of the displaced SOC within catchments is key to assess the net impacts of soil erosion on SOC dynamics at a large scale.