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Applying transport-distance specific SOC distribution to calibrate soil erosion model WaTEM

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Slope-scale soil erosion, transport and deposition fundamentally decide the spatial redistribution of eroded sediments in terrestrial and aquatic systems, which further affect the burial and decomposition of eroded SOC. However, comparisons of SOC contents between upper eroding slope and lower depositional site cannot fully reflect the movement of eroded SOC in-transit along hillslopes. The actual transport distance of eroded SOC is decided by its settling velocity. So far, the settling velocity distribution of eroded SOC is mostly calculated from mineral particle specific SOC distribution. Yet, soil is mostly eroded in form of aggregates, and the movement of aggregates differs significantly from individual mineral particles. This urges a SOC erodibility parameter based on actual transport distance distribution of eroded fractions to better calibrate soil erosion models.
Previous field investigation on a freshly seeded cropland in Denmark has shown immediate deposition of fast settling soil fractions and the associated SOC at footslopes, followed by a fining trend at the slope tail. To further quantify the long-term effects of topography on erosional redistribution of eroded SOC, the actual transport-distance specific SOC distribution observed on the field was applied to a soil erosion model WaTEM (based on USLE). After integrating with local DEM, our calibrated model succeeded in locating the hotspots of enrichment/depletion of eroded SOC on different topographic positions, much better corresponding to the real-world field observation. By extrapolating into repeated erosion events, our projected results on the spatial distribution of eroded SOC are also adequately consistent with the SOC properties in the consecutive sample profiles along the slope.