Tillage induced soil and organic carbon redistribution in different landscapes

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Tillage drives soil movement in cultivated fields. Soil organic carbon, together with the mass of soil, is redistributed over landscape by tillage. Whilst the pattern of soil organic carbon redistribution is not determined by the pattern of soil loss alone because tillage introduces the subsoil into surface layer, which could cause dilution, or burial of the surface soil down to the sub layer. In this study, we use an exponential model to simulate tillage translocation process, by which to demonstrate tillage-induced soil and organic carbon redistribution in four different landscape forms: plane slope, symmetric hill, asymmetric hill and irregular hill. We found that the pattern of soil erosion was determined by the landscape properties, the change of slope gradient, alone and tillage direction has no significant effect on it, whilst both tillage direction and landscape properties have strong effect on organic carbon redistribution. Under one-direction-tillage, the pattern of organic carbon loss shifted away from the soil loss pattern and significant organic carbon loss was found nearing the start-boundary. Sub-layer Organic carbon content was considerably high nearing the end-boundary due to the burial of surface soil. Under alternative-tillage, the organic carbon loss pattern matched up with the soil loss pattern very well. Nearing both boundaries, organic carbon was found enriched in the sub-layer due to surface soil burial. The results of the irregular hill showed that fine-scale features drives the pattern of soil redistribution and has strong effect on organic carbon redistribution as well.