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Regional scale characterization of the topographic control on soil organic carbon spatial distribution

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The influence of geomorphology on the spatial distribution of soil organic carbon (SOC) has been studied for a large range of scales and conditions. The larger SOC stocks found in dry valleys and concave footslopes of the Belgian loam belt have been explained jointly by the transfer of sediments along the slope and the reduced decomposition rate of buried organic matter. While erosion effect on SOC has been simulated at the hillslope scale, it is generally not considered in SOC inventories and prediction models at regional scale. However, more precise large scales inventories are demanded by the carbon modelling community. The goal of this paper is to characterize the relative importance of geomorphology on the SOC horizontal and vertical variability across whole agricultural region. The large historic dataset of soil horizons Aardewerk together with 147 recently sampled profiles was exploited for cost efficiency reasons. Mean profiles for different soil properties classes were compared. Various topographic indices were computed from a digital elevation model, and their potential to predict SOC content at different depth was quantified using multiple regression and terrain morphologic classification. Both dataset were able to show differences in mean SOC profile among soil properties classes, but only the new profiles dataset shows a clear relationship between SOC content and topographic indices. The various errors in then historic data set (e.g., positioning errors) may explain these limitations. This study thus brings in evidence the major control of topography on SOC vertical distribution in a region where observed heterogeneities for other commonly involved factors are limited. However, the large amount of unexplained variability still limits the usefulness of SOC content spatial prediction and should be addressed by alternative spatial methods.