

Response to the reviewer's comments

A millennium of arable land use – the long-term impact of water and tillage erosion on landscape-scale carbon dynamics

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We are grateful for the advice and thank the reviewer for his/her suggestions. Please see the detailed answers to the reviewer's comments in the text below. Thereby, the original comments of the reviewer are written in blue and our reply in black and italics.

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Reviewer #2 (Anonymous):

Öttl et al. explored the long-term impact of water and tillage erosion on landscape-scale carbon dynamics based on a modified version of the spatially explicit soil redistribution and carbon (C) turnover model SPEROS-C. Moreover, the model parameterisation uncertainty was estimated. The results indicate that in young moraine areas, SOC patterns and dynamics are substantially affected by tillage-induced soil redistribution processes, and it was estimated that after 1000 years of arable land use, SOC redistribution by tillage and water erosion results in a landscape-scale C sink of up to 0.66‰ per year. The MS is well-written and should be of interest to readers of SOIL. I have two suggestions that may improve the manuscript.

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We thank the reviewer for these supportive comments.

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First, more details should be provided in Methods, so the readers are easily able to understand the paper, e.g., how the data was obtained and the models constructed.

We will carefully revise the methods and add more details where needed.

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Second, in Figure 6, while a significant correlation was observed, however, there are still spaces to improve prediction accuracy (R^2). Moreover, if the data is suitable for regression analysis? e.g., if the residuals of the regression line are normally distributed?

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It is not our goal to improve the prediction accuracy, but to check the plausibility of the model results that is illustrated by Figure 6. The R^2 in Figure 6 has an illustrative character to show that spatial patterns of the results are in agreement with observations, i.e. the modelling approach results in low (high) topsoil SOC values at landscape positions where we also find low (high) observed topsoil SOC. We randomly chose two agricultural fields for which recent SOC observation data was available and subsequently modelled 1000 years of soil redistribution and SOC dynamics. These two fields have an individual management and soil redistribution history that remains widely unknown as we just have general information about the history of land use in this region. Hence, a sound prediction of spatial patterns that we can observe in the landscape is from our point of view very satisfying with respect to a modelling period of 1000 years.