

Interactive comment on “Process-oriented modelling to identify main drivers of erosion-induced carbon fluxes” by F. Wilken et al.

Anonymous Referee #1

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Dear Editor and Authors,

The manuscript entitled “Process-oriented modeling to identify main drivers of erosion-induced carbon fluxes” has coupled a process-oriented multi-class sediment transport model with a carbon turnover model, with the aim to identify the main driving factors of erosion-induced C fluxes in two different catchments. The manuscript is of good novelty, and insightfully points out the potential relevance of soil aggregation levels and inter-field capacity in catchment-scale soil–carbon redistribution. Apart from identifying the dominant effects of tillage erosion in vertical C fluxes, the authors also notified the potential influences of episodic erosion events in lateral C fluxes, especially in catchments of highly varying topographic features. From my side, there are only two major comments, and a couple of minor suggestions.

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Major comments:

1. While the authors did a good job in isolating erosion-induced C fluxes from the entire vertical C fluxes, all the fluxes were mainly based on erosional and depositional sites through dynamic replacements via monitoring yields and manure inputs (excuse me if I misunderstood you). The potential C fluxes during transport could arguably also play a role in vertical C fluxes, especially when taking aggregation levels into account. The de-/re-aggregation processes occurring during transport, and the accordingly induced mineralization and encapsulation, could potentially skew the overall C balances in individual catchments (see literature: Billings et al., 2010; Hu et al., 2016; etc.). To better justify the implication of this study, it would be nice to add some discussions on the possible impacts of mineralization during transport

2. The tillage component in the modeling set of this study is mainly adapted from a model derived from topography and tool-specific tillage erosion coefficients. Just out of curiosity, does it take into account for seasonal coincidence of tillage practices and rainfall frequency? For instance, is it possible that the tillage/water erosion effects to be enhanced when bare soil after tillage practices in spring receives frequent rainfall events (no need to be heavy)? Will these coupling effects have impacts on lateral and vertical C fluxes? Is it possible to be accounted for in current or future modeling settings?

Minor comments:

1. Just a personal suggestion, not a request, it may be better to some include some keywords in the manuscript title to reflect your key findings.

2. Better to have consistent terms when coming to “inter-field” or “intra-field” connectivity. 3. Page 10, from L7 to L11: it is just too long a sentence. Better to split into two.

Literature:

Billings SA, Buddemeier RW, de Richter BD, van Oost K, Bohling G (2010) A simple method for estimating the influence of eroding soil profiles on atmospheric CO₂. *Glob Biogeochem Cycles* 24:1–14. doi:10.1029/2009GB 003560 Cambardella

Hu Y., Berhe A.A., Fogel M.L., Heckrath G.J., Kuhn N.J. (2016) Transport-distance specific SOC distribution: Does it skew erosion induced C fluxes? *Biogeochemistry*, 128 (3), 339-351: DOI 10.1007/s10533-016-0211-y

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