



EGUsphere, referee comment RC3
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Comment on egusphere-2022-181

Andres Peñuela Fernandez (Referee)

Referee comment on "Does soil thinning change soil erodibility? An exploration of long-term erosion feedback systems" by Pedro V. G. Batista et al., EGU sphere,
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In this manuscript the authors study the effect of soil truncation/thinning in the evolution of the annual soil erosion rates over 500 years. For this purpose, they used a parsimonious soil erosion model and 265 profiles in different locations in UK. They considered in the simulations the change in soil properties as subsurface layers get exposed as a consequence of the removal of the soil surface by soil erosion. In order to isolate the effect of soil truncation, factors usually considered as variables, such as climate, land cover and topography, are considered as constant. First of all, I would like to congratulate the authors for a very interesting paper and for developing a simple but effective method to consider long term soil truncation in soil erosion modelling. In general, I think that the manuscript is well written and structured.

- My one major concern is that one of the equations applied is wrong. The error is Eq. 6, this equation should be multiplied by LD, in other words, the KE of LD should be proportional to the annual LD, the same way as the KE of DT is proportional to the annual DT (Eq. 4). This error was already present in the original publication of RMMF model (Morgan, 2001) and has propagated to the MMMF model, equation 7 in Morgan and Duzant (2008) and other models including PSYCHIC (Davison et al., 2008) and SERT (López-Vicente et al., 2013). These KE equations were originally proposed by Brandt (1990) where they present two equations of kinetic energy per mm ($\text{J m}^{-2} \text{mm}^{-1}$) of LD:

$$E = 8.95 + 8.44 \log I$$

and of DT:

$$E = 15.8 \text{ PH}^{0.5} - 5.87$$

So, they need to be multiplied by the volume of rainfall (mm), LD and DT respectively, to obtain the KE (J m^{-2}). Hopefully this correction won't change much the main results and conclusions. This error was previously corrected in some studies (Choi et al, 2017; Peñuela et al., 2018; Sterk 2021) however this error in the formulation of the RMMF and MMMF models was only pointed out by Peñuela et al (2018). To avoid further propagation of this error, I also encourage the authors to highlight in the manuscript the need to correct it when applying either RMMF or MMMF models and when developing new models based on them.

- How is the soil truncation calculated from SL? Can you further explain this? I think that while the formulation of the MMMF model is well described, it would be very helpful for other researchers interested in applying this method in their models to show explicitly the equations used to consider the effect of soil truncation.

- Something that I missed in this study is an analysis of temporal evolution of the influence of soil truncation, in particular I would be very interested in knowing more about when this influence starts to be significant. It would be very useful for modellers to have an idea of under what circumstances, in particular number of years simulated, soil truncation should be taken into account or not. For example, if I do a 100-year simulation, should I include the effect soil truncation? While the results of this study cannot be generalized to other regions, I think that this can provide a first attempt to set recommendations, at least in UK, of when soil truncation should be considered depending on the number of years simulated.

- In the Discussion, please include a paragraph evaluating the performance of the model and the SL values simulate. Please include references of studies of measured annual soil loss in agricultural fields, in particular winter cereal, in UK, for instance Evans et al 2016 and Boardman 2013, and compare them to the simulated soil loss, are they similar or in the same order of magnitude?

Minor comments:

- Please justify in the manuscript the 20cm plough/mixing depth considered for the simulations.

- Can you please further develop the justification of using the MMMF model, for example, why is it important "its ability to simulate multiple erosion subprocesses" for this study? And that it is parsimonious?

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