Dear Joris,

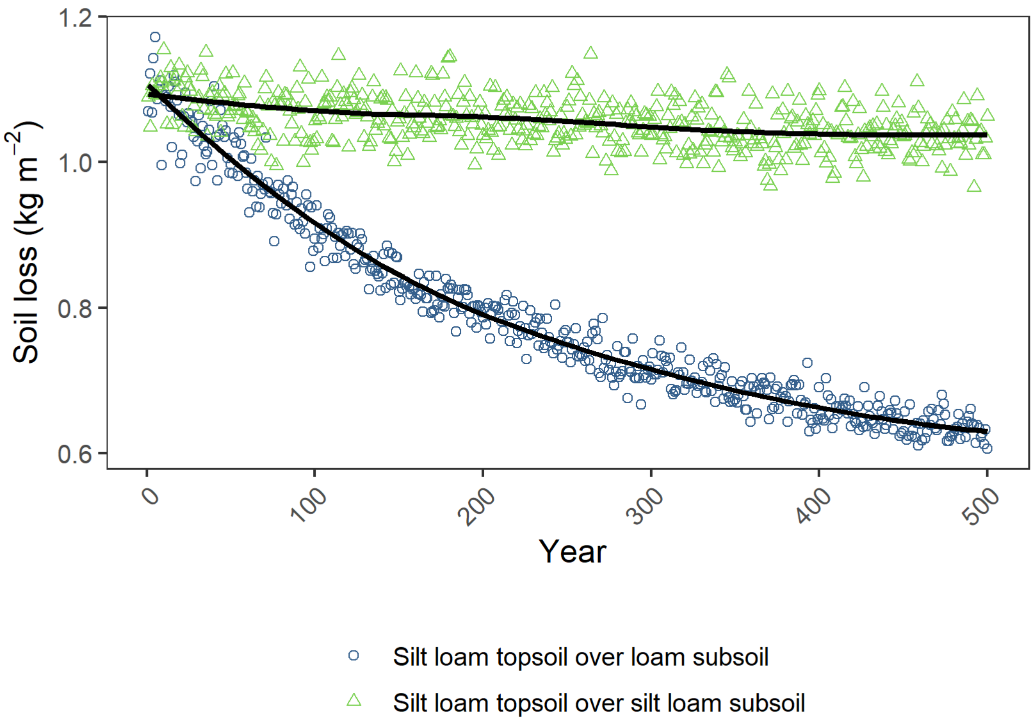
Thank you very much for your comments, we highly appreciated you taking the time to look at the manuscript. We believe the referee suggestions will highly improve our model/paper.

Below we respond to your comments and explain how we plan to address them in our manuscript revisions. Please note that your comments are displayed as bullet points followed by an author response (AR).

- In general, the manuscript is very well written and accompanied by clear figures. I think that the model experiment is very useful and gives some interesting insights on the feedback between soil thinning and soil erosion rates. However, I have the feeling that the implications for soil erosion modelling may be a bit overstated. The authors apply a 500-year simulation period, which generally speaking is much longer than normally applied in soil erosion modelling studies, which mostly apply a decadal time period. The results show that over this 500-year simulation period there are some notable changes in soil erosion rates, however, when focusing on the first few decades, the changes are negligible. Of course, as the authors point out in the Discussion section, there are some processes that are not accounted for by the MMF model, which may affect the results, also in the first few decades. But still, I doubt if the results of this study have significant implications for soil erosion modelling. The authors may agree or disagree with this, but I welcome to the authors to discuss this point somewhere in the manuscript.

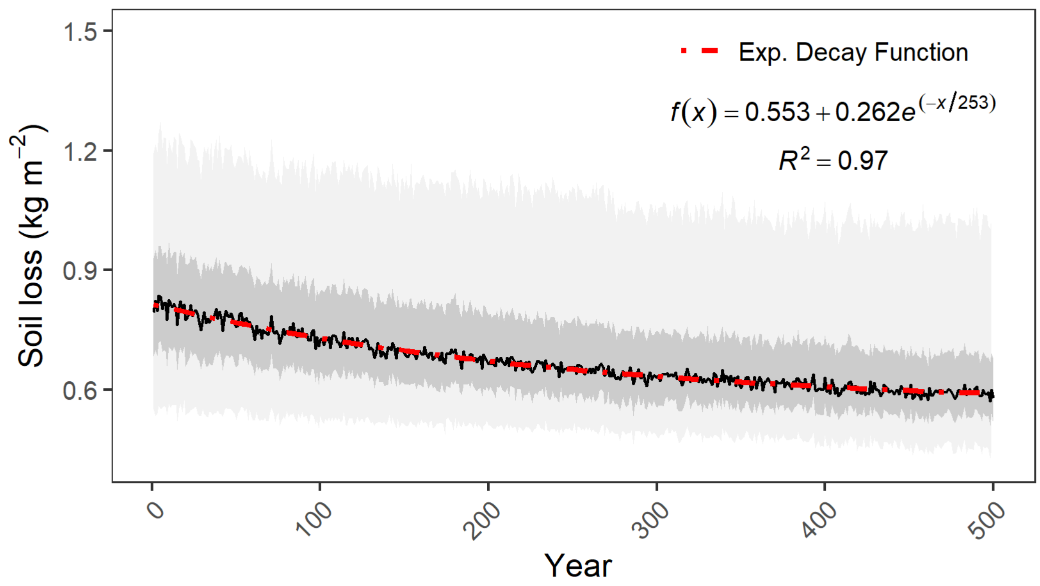
AR: We are glad you generally appreciated the manuscript. Moreover, thanks for pointing out the issue with the time scales, which was also highlighted by another referee (Andres Peñuela). Both of your comments actually led us to revise our model code, as we realised the long time taken for erosion feedbacks systems to develop could be an indication that the model was not sufficiently addressing the effects of particle size selectivity. We then noticed our initial code only updated soil parameters once the plough layer reached a different underlying subsoil horizon (e.g., once the Ap is thinner than the plough layer and you start ploughing into an E, B, or C horizon). However, since the model simulates selective particle size removal, and because bulk density and soil moisture at field capacity are estimated via soil-texture-dependent PTFs, we should have been updating these properties for every time step – even when the plough layer depth is thinner than the soil upmost horizon. In this case, fresh material from the upmost soil horizon would be incorporated to the eroded plough layer, following a soil loss/truncation timestep.

These changes in the model code, alongside with the corrections regarding leaf drainage kinetic energy suggested by Andres Peñuela, led to some important changes in our results. For instance, the model now simulated a decelerating trend in 98 % of the soil profiles, due to a progressive decrease in silt contents and an increase in stone cover, even for the profiles with silty subsoil horizons. That is, with the new and improved model formulation, the supply of erodible material from the substrata being incorporated into the plough layer was not sufficient to accelerate soil losses over time, but rather to keep it somewhat constant. Contrarily, the profiles with decreasing silt contents in their lower horizons had steeper decreases in erosion rates, even in a matter of decades:



Soil erosion trends over 500 years of model simulations for two representative profiles from the UK SOILPITS dataset. Coloured symbols are the median of the simulations per year, and the solid lines are local regression functions adjusted from the data.

With the new results we could characterise the temporal evolution of the soil losses (for all soil profiles combined) using an exponential decay function. Based on this function, we calculated that, on the median, erosion rates declined in 6 % over the first 50 years of the simulations, and 10 % over the first 100 years.



Soil erosion trends over 500 years of model simulations for the profiles from the UK SOILPITS dataset. The dark solid line represents the median of all profiles and simulations, whereas the dark- and light-grey shaded areas are 50 % and 95 % prediction intervals.

From our understanding, these differences are relevant for erosion projections, which, for instance, look at the soil erosion responses to climate change in the next 50 or 70 years. The erosion feedback systems we simulated might also be important for modelers trying to hindcast the influence of land use change on erosion rates over the last century. Govers et al. (2006) also simulated an exponential decay in sediment production from arable hillslopes over a 50-year period following land use intensification, due to a rapid emergence of a soil with high stone cover, which further highlights the importance of considering erosion-induced changes in soil loss projections/hindcasts. It is also worth pointing out that our simulations provide a rather conservative scenario, as erosion rates in the UK are rather low compared to many other regions of the world (Benaud et al., 2020).

Perhaps the new results we would like to present and discuss in the revised manuscript will be more convincing regarding the relevance of erosion feedback systems for soil erosion modelling. In any case, we propose to include a discussion on the topics mentioned above, and to be more nuanced in any particular statements you might have found overreaching. In particular we propose to remove the sentence: "*To date, this soil erosion feedback system has* *been largely overlooked in soil erosion models, which might have led to spurious estimates of long-term erosion rates.*"

- Line 205: Table 2 shows the parameter values used in the Monte Carlo simulation. I'm not sure if this is really important, but if you would calculate the ground cover occupied by the number of stems (i.e. stem area times number of plants per unit area = (0.025**2 * pi) * 250) then I arrive at a value of around 0.49, while the ground cover is assumed 0.3.

AR: Thanks for mentioning this, we hadn't noticed such discrepancy in the suggested parameter values. The model now calculates the ground cover using the number of plants per unit area and the diameter of plant stems, in order to avoid any inconsistencies.

Benaud, P., Anderson, K., Evans, M., Farrow, L., Glendell, M., James, M., Quine, T., Quinton, J., Rawlins, B., Rickson, J. and Brazier, R.: National-scale geodata describe widespread accelerated soil erosion., Geoderma, 371(September 2017), 114378, doi:10.1016/j.geoderma.2020.114378, 2020.

Govers, G., Van Oost, K. and Poesen, J.: Responses of a semi-arid landscape to human disturbance: A simulation study of the interaction between rock fragment cover, soil erosion and land use change, Geoderma, 133(1–2), 19–31, doi:10.1016/j.geoderma.2006.03.034, 2006.