Author response to the interactive comment RC1 by an anonymous referee.

In the text below, the authors respond to the comments given by referee 1. The comments of the referee are given as plain text, while the authors response is given in *italic*.

Comments

Although the manuscript could be published in its present form, I recommend a minor revision to make reported results reproducible and to clarify the concept of the work. Below are my reflections that authors might find useful as a source of ideas for improving the manuscript. Are this data available from authors? Or is there any plan to make these data open for re-use? I recommend to add a brief section about data availability if authors are planning to make data open or available under some conditions.

It is the intention of the authors to make the soil coring dataset (i.e. coordinates of soil corings and stratigraphy) available by adding the data to the article as supplementary material. A short section on supplementary data will be added to the manuscript.

Which numerical method did authors use for solving the Eq (1)? I recommend to add a phrase directing a reader to the article where the numerical method used for solving the Eq (1) is described.

The numeric scheme used to discretize the Boussinesq equation consists of a first-order upwind finite difference scheme for the advection component and a forward in time – centred in space finite difference scheme for the diffusion component. This numerical method is, for instance, well described in Campforts & Govers 2015 (Campforts, B. & Govers, G., Keeping the edge: A numerical method that avoids knickpoint smearing when solving the stream power law., Journal of Geophysical Research: Earth Surface, 2015). We will update the manuscript to add this reference.

It seems to me that the changes in hillslope topography resulted from peat accumulation do not affect the water storage (S (x)) given by Eq (1), because this equation takes into account only the bedrock slope (i(x)) which is not affected by peat accumulation. If my understanding is correct, then S(x) is the maximum water storage that could be achieved under given climatic conditions and the bedrock slope (i(x)).

The model used by authors is based on the concept of impeded drainage [1-3] suggesting that geomorphological conditions (i.e. bedrock slope) determine the maximum peat depth under given climatic conditions. Therefore, it would be interesting to see if there is a significant correlation between

the measured peat depth (averaged over the transect) and the bedrock slope (averaged over the transect). The lack of significant correlation may suggest that the observed range of variations in the bedrock slope does not lead to a dramatic difference in the S (averaged over the transect).

There is indeed a relationship between the bedrock slope and the peat thickness measurements both for the individual coring locations as for the mean values per transect (see figures below). There is a clear decrease in the maximum observed peat thickness with increasing bedrock slope, or, thick peat layers cannot be found on steeper slopes. However, the large scatter indicates that thin peat layers or even the absence of a peat cover can be found for all slope values.

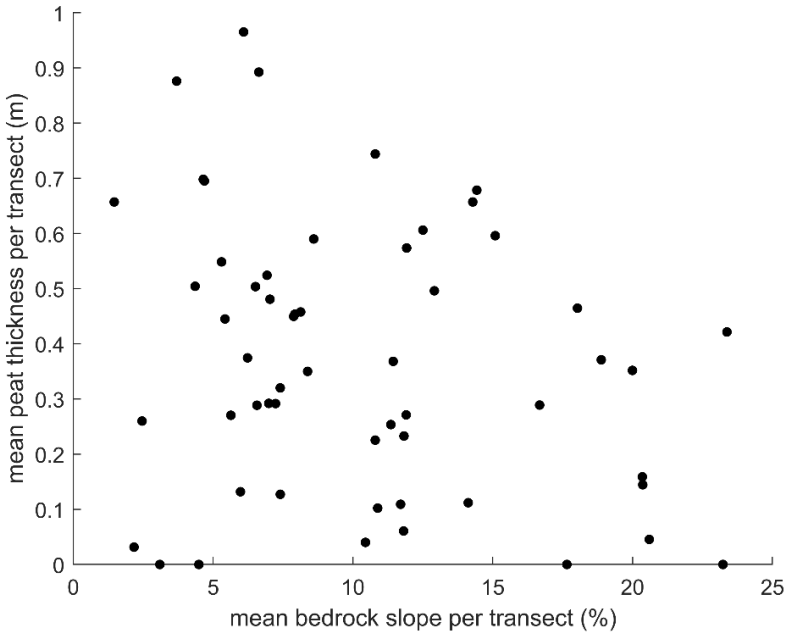

Figure 1: Scatterplot of the mean peat thickness per hillslope transect as a function of the mean bedrock slope per hillslope transect.

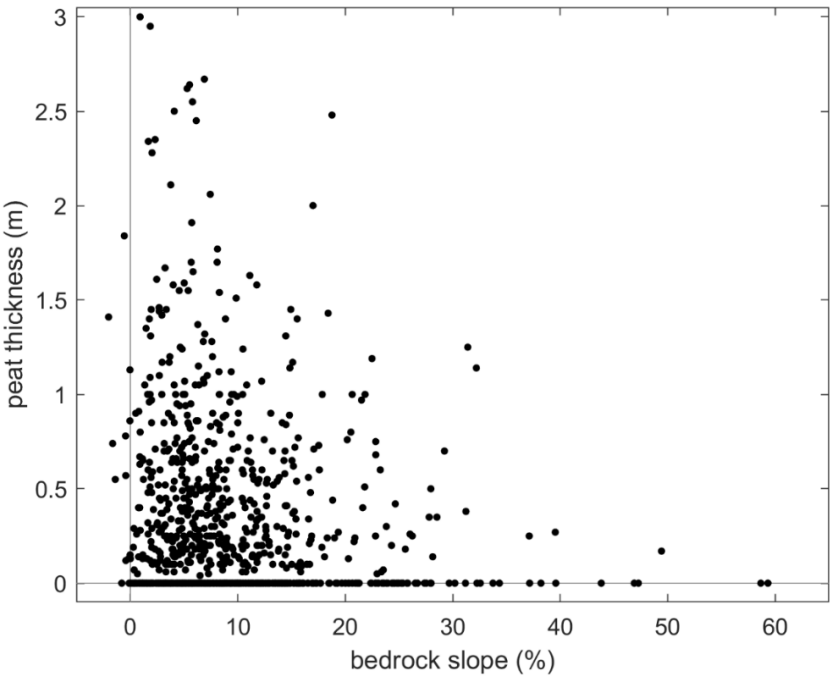

Figure 2: Scatterplot of the measured peat thickness per coring location as a function of the bedrock slope.

Suggested references by the referee

[1] Ingram, H.A.P.: Size and shape in raised mire ecosystems: a geophysical model. Nature 297, 300–303, 1982.

[2] Clymo, R. S.: The Limits to Peat Bog Growth, Philos. Trans. R. Soc. B Biol. Sci., 303(1117), 605–654, doi:10.1098/rstb.1984.0002, 1984.

[3] Alexandrov, G. A., Brovkin, V. A. and Kleinen, T.: The influence of climate on peatland extent in Western Siberia since the Last Glacial Maximum, Sci. Rep., 6, doi:10.1038/srep24784, 2016.

The authors thank the reviewer for suggesting additional literature. These references provide useful information for updating the introduction section of the manuscript.