Editor Comments and Author Responses

The authors would like to thank the editor for the comments and suggestions. The editor comments are provided below in black and our response in green.

1. The authors made some considerable improvements to the manuscript, based on the comments by the reviewer. The reason why the authors choose to compare their model with an older version of DigiBog seems justified, however, this seems better explained in the response to the reviewer than in the manuscript. The main reason to compare to the older version of DigiBog is to compare MPeat2D with a model that does not simulate poroelasticity. This should then also be the main point. So, I suggest to carefully revise lines 322-334.

We added more explanations related to the use of the earlier version of DigiBog for comparison purposes (**lines 319-330**). We chose this model version of DigiBog because it has similar characteristics to MPeat2D, including the flat and impermeable substrate with the symmetric assumption of peatland growth, and it does not simulate the influence of poroelasticity on the peatland behaviour. This model maintains the annual increments and layer properties without lumping the layers for numerical efficiency into larger averaged layers, which could lead to more stable numerical calculations. The bulk density and active porosity are constant throughout the simulation time, but hydraulic conductivity is allowed to change because of the decomposition process. The peat volume can only change as a result of the mass lost and there are no volume changes due to the deformation of the peat in this model. Consequently, this model version of DigiBog provides sufficient tests of the effect of removing poroelasticity, while still assuming reasonable values of hydraulic conductivity, bulk density and active porosity.

2. While it seems justified to compare to the older version of DigiBog, I guess many readers would like to see a discussion on the differences between MPeat2D and the latest version of DigiBog. This is somewhat discussed in lines 325-333, but focus mainly on the reasons why MPeat2D is not compared with the latest version of DigiBog. I would be interested to read a discussion (in the Discussion section) on the differences between the two models, even though they were not compared with each other in this study. So why would anyone use MPeat2D instead of the latest version of DigiBog, or the other way around? This might be related to the discussion in lines 325-

333, but I'm sure that there are other reasons, as well. I suggest to remove or significantly reduce lines 325-333 and discuss these two models in the Discussion section, for instance in subsection 5.2.

We agree to add the explanation about the differences between MPeat2D and the latest version of DigiBog in the Discussion section (**lines 580-586**) and remove the comparison between these two models in the Model implementation section. The comparison of MPeat2D with the more recent DigiBog versions (e.g., Young et al., 2017, 2019, 2021) shows some differences in the model formulation and parametrisation. MPeat2D allows the bulk density, active porosity, and hydraulic conductivity to change as a consequence of internal feedback mechanisms through the deformation of peat pore space. Contrastingly, the more recent DigiBog versions employ empirical relationships to model the variation of hydraulic conductivity and assume constant values of bulk density and active porosity during the development process of the peatland. MPeat2D captures the spatial variability of the plant functional types composition, which affects the loading and rate of peat production, while the more recent DigiBog version ignores this factor in the model formulation. However, the more recent DigiBog version includes the parameters of mineral soil and water ponding thickness, which are omitted by the MPeat2D.

References

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