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Discussions

Interactive comment on "Impact of model developments on present and future simulations of permafrost in a global land-surface model" *by* S. E. Chadburn et al.

Anonymous Referee #2

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Comments The scientific problems discussed in this paper are relevant to the scope of journal The Cryosphere. Authors discuss the results of the improvement of permafrost dynamics simulation within JULES. In order to assess the potential carbon-climate feedback under future atmospheric warming more realistically, authors included additional processes to simulate dynamics of permafrost within JULES. Authors also have been using the extended from 3 to 10 m soil column with 28 layers in total, with an improved implementation of organic matter and representation of bedrock 50 m layer to increase of inertia of the heat transfer process.

The methodology is sound and the assumptions are identified. It is a good paper and I think the publication of this kind of paper could be timely and beneficial for researchers

working in the same field, as well as for many other researchers conducting a wide spectrum of environmental studies. I have a few comments to improve the already good manuscript.

Authors extended soil column to 10 m in depth, thus increase the inertia of heat transfer in simulation. Representation of bedrock additionally to strengthen this effect. However, it is not clear in which case the bedrock representation process is switched on or off? Authors also mentioned no zero heat flux at the lower boundary of the soil column. Is it treat only the extended with bedrock column or to 10 m deep "ordinary soil column" as well as? If so, in spite of the reduction of the active layer thickness, produced by the improved JULES version the overestimated values of the active layer thickness comparing with active layer monitoring sites (Fig.3) could explained by this circumstances. How many layers the bedrock column contains?

Figure 5 has no indexes a, b, c, referred in the text.

It is not clear for me what kind of modification to the snow scheme was done and how it is integrated with the soil column. It should be explained in text. How the snow properties are simulated? I think it is very important part of the manuscript, because near-surface permafrost strongly depend on snow pack and even sometimes snow defines does permafrost exist at some location or does not.