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Interactive comment on "Numerical modelling of permafrost spring discharge and open-system pingo formation induced by basal permafrost aggradation" *by* Mikkel T. Hornum et al.

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We would like to thank Referee#2 for a very constructive and thorough review that will help improve the quality of our manuscript. In this answer, we reply broadly to the general and major comments. We look forward to addressing the review in greater detail in a revised version of our manuscript.

We are very pleased to read that Referee#2 acknowledge our work as impressive and its use of many different data sources. Further, the Referee#2's view is that the manuscript has room for improvement when it comes to clarity and readability, and a number of specific changes to the manuscript are suggested. We agree that the

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Discussion paper

manuscript would benefit from the majority of the suggested changes and so, we will be pleased to abide by these in the revised manuscript.

Point-to-point reply to major comments:

1. In the revised manuscript, we will strive to use a clearer and more concise writing and further explain terms and concepts when needed.

2. We will reorganize the manuscript closer to a traditional structure as suggested.

3. Table captions will be provided in the revised manuscript.

4. We agree that adding a description of the model simulations in the method section would improve the overall readability and we will include such in the revised manuscript.

5. We will improve the explanation of the groundwater model simulations and their results according to the following:

- A descriptive overview of the model simulations and model will be added to the methods section as also suggested in comment 4.

- A description of how the 3 kyr was drawn with particle back-tracking will be provided and it will be stated that their significance is to visually illustrate slow groundwater velocities.

- Referee#2 is not sure which equivalent recharge rates (REq) were used for which scenario of the groundwater model. We read this confusion as due to a misunderstanding that the subzones of the groundwater model were run individually ("it is stated that each of the 12 zones were run with a different REq"). This was not the case (without specific reference to the text, we can also not find this statement in our manuscript). Instead, the entire surface of the model domain was assigned with the maximum, intermediate or minimum estimates of the REq rate as calculated from heat transfer model results (Fig. 6c). As illustrated on Fig. 6c, the maximum, intermediate or minimum REq value was not uniform, but decreased in the inland direction, and each subzone was thus

assigned with the relevant REq rate. As indicated by the y-axis on Fig. 7 and as stated in the text (Old version, L381-382) this resulted in three different total inflow rates of water to the groundwater model. In the revised manuscript, we will also express this clearly in the caption for Fig. 7.

- Referee#2 suggests that Fig. 7 is simplified and split up to several different figures. In our answer to Referee#1 (posted in the interactive discussion forum: https://www.the-cryosphere-discuss.net/tc-2020-7/), we presented a simplified version of Fig. 7. In order to ease comparison between the different scenarios, we would like to keep them in the same figure unless the editor agrees with Referee#2 that splitting it up is better.

With some insignificant exceptions, we will happily correct our manuscript according to the minor changes suggested by Referee#2.

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