Responses to referee comments

We thank the two referees for their constructive suggestions. In the following referee comments are typed in bold fonts, our responses in a regular font, and changes made in the texts in an italic font. The page and line numbers in our responses refer to those in the marked copy of the revised texts.

Referee 1

p.1, l.9: Be more specific about "the prairies" in this first line. Specifying Canadian would be helpful.

We acknowledge the statement was unclear. The reference to Canadian prairies was added (p.1, l.10).

p.2, l.6: Semi-arid and arid is one component of this but a key factor in the Canadian Prairies is the presence of low permeability tills and clays. I think this might be important when considering where else these results can be applied.

p.2, l.12-13: Again, geology is an important consideration when comparing mountainous environments versus the Canadian Prairies. Mountainous areas of Canada are dominated by thin soils and fractured bedrock in some areas and extensive alluvial fans in others. The Canadian Prairies have thick till and clay sequences.

p.11, l.1: There is no description of prairie soils in the manuscript and there should be. A paragraph on soils and geology somewhere in the paper would be quite helpful.

We agree that it is important to specify reasons for the low infiltrability of surficial sediments in the prairies. The segment was re-phrased accordingly (p.2, l.21-23).

p.7, l.15: Is the lack of hydraulic response due to a lack of infiltration or due to unsaturated conditions, which might lessen hydraulic diffusion?

The soil under SE1 depression is relatively close to saturation all year round as indicated by the prompt water table responses to precipitation events. A sentence has been added to clarify this (p. 8, l.5-6).

p.9, l.7: Why is the data not shown? It would be useful to allow the reader to form their own judgements on the data.

We acknowledge the need to avoid giving personal judgements instead of showing data. To address this issue the R^2 value was added to the sentence (p.10, l.7) to allow reader to evaluate strength of correlation between variables. While the figure was not added, the corresponding data are available as part of supplementary material for the article.

p.11, l.4-6: Was pore blockage actually observed or is this inferred?

We have added "possibly" to emphasize the inference (p.12, l.23). The processes related to flow through frozen at the study sites are to be described in a separate manuscript currently in preparation, which uses data from the soil sensors.

p.11, l.23-27: The idea that midwinter melt leads to more infiltration and less runoff is a key finding of this study. The paper would be more impactful if this conclusion was

placed in the context of other studies that have examined this issue. I am thinking specificially of a Owor et al. (2009, ERL) and earlier ideas on climate change leading to more runoff and drier soils presented by Trenberth et al (2003, BAMS).

p.12, l.7: Was the future climate for the prairies ever discussed? A brief discussion of this issue could help to frame the importance of this work.

We agree about the need to give a broader (i.e. beyond snowmelt) context for the study findings. To address this we have added the following paragraphs (p.13, l.8-17).

The observed effect of melt timing on the hydrological processes can be compared to the sensitivity of the latter to precipitation characteristics. Several hydrological processes are more sensitive to the precipitation intensity and frequency than to its amount (Owor et al., 2009; Trenberth et al., 2003). Similarly, hydrological implications of midwinter melts can be linked to changes in the in intensity and frequency of meltwater release during snowmelt.

The importance of midwinter melts is likely to be amplified by the ongoing climate change. The current climate trends in the Canadian prairies suggest increasing likelihood of midwinter melts as decrease in number of consecutive frost days outstrips decrease in total number of frost days (Vincent et al., 2018), making periods favourable to snowpack preservation increasingly intermittent. This trend is likely to continue due to projected increase in winter temperatures throughout Canadian prairies (Shepherd and McGinn, 2003). The change is likely to be the most pronounced in the areas outside "Chinook belt" rarely affected by midwinter melts under the present climate.