

## ***Interactive comment on “Watershed classification for the Canadian prairie” by Jared D. Wolfe et al.***

**Jared D. Wolfe et al.**

jared.wolfe@usask.ca

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### Response to Referee #2 - Summary

We greatly appreciate Referee #2's comments and feedback on our study. Please see our response to Referee #1 for suggestions shared among reviewers. Referee #2 provided a number of useful insights on the classification procedures and suggestions to appeal to international audiences. In particular, defining of terms related to prairie hydrology was suggested under “Specific Comments” (e.g., 1, 11, and 12) and we will take these into account as we revise the manuscript. We also appreciate the reference to Addor et al. (Comment 28) as an example of a classification study with an international context. We will consider appropriate strategies to make section 3.5 more applicable to international audiences, such as a map of ecoregion, and locations named in the section.

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Referee #2's insights into clustering approaches and classifying watersheds is very valuable. Comments related to the clarification in methods can be improved on by adding details into this sections as per the suggestion by reviewers. The referee suggested that readability of the manuscript might be improved if the data sources and methods are separated into two sections. Readability might also be enhanced via a figure/diagram to show the workflow of the classification procedures. We agree that these suggestions offer improvement and will re-structure accordingly. Although a full explanation of the CCA method is beyond the scope of the paper, we will reference key literature or studies for readers interested in a more detailed description.

A useful suggestion from Referee #2 was to relate classes to patterns in observed data to evaluate usefulness of the method. We appreciate the reference to the GSIM archive (Do et al. HESSD), which offers useful procedures for comparing classification methods. We have access to the HYDAT dataset, which was used in the Do et al. study for Canadian data. We will consider comparing data from stations that are relatively undisturbed and reliable time series. An issue with the Prairies is that many reference hydrological stations are confined to main river systems and not necessarily represented of the behaviour of wetland-dominated (Pothole Classes), or more arid classes with low effective areas (Interior Grasslands Class). This complication informs why we chose to focus on predicting depression size distribution (Fig. 8) with observed data. We will evaluate the applicability of some independent data sources, (e.g., HYDAT, wetland remote-sensed data) to compare our classes.

Another set of suggestions concerned added clarification on the use of climate dataset (e.g., 7-10, 13). In particular, we thank the reviewer for the suggestion to consider changing fraction of precipitation as snowmelt and reference to Knoben et al. 2018. We agree that inclusion of this parameter is and likely valuable for the Prairies. We focused solely on precipitation and ET because these variables were available at the temporal length and spatial extent for the study. Given the limitations of the dataset we used (as alluded to by Referee #1), calculating parameters at a seasonal scale

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might introduce more uncertainty, and thus was not included here. However, fraction of snowfall should be considered in future iterations provided the data is available at a suitable spatial resolution.

Referee #2 provided a number of technical suggestions. Suggestions include discuss the limitations in the HydroSHED dataset (4), which would be a useful addition to our manuscript due to the limitation in SRTM data accuracy in the context of the Prairies. We will provide a discussion of this concern. They also identified incidences of regional terms, such as “pothole” and metrics like Lw/Lo, where the significance might not be obvious to those not familiar with the area. We will give attention to those terms, and provide definitions where necessary.

We will also address the other useful technical comments provided in order to strengthen the clarity of our manuscript.

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