

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2  
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## Comment on hess-2021-186

Anonymous Referee #2

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Referee comment on "Assessing hydrological sensitivity of grassland basins in the Canadian Prairies to climate using a basin classification-based virtual modelling approach" by Christopher Spence et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-186-RC2>, 2021

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Overall, Spence et al. did a fantastic job presenting the development and application of a Region-wide hydrological model used to test the sensitivity of Prairie water budgets to changes in precipitation and temperature that are expected in the future. The manuscript is extremely well written and easy to follow with ample justification and explanation of the limitations of their modeling approach. This study also sets the stage for future modeling studies as well.

In the future it would be very interesting to compare seasonality changes with actual GCM outputs rather than using the delta method to enact changes in precipitation and temperature on historical records. These seasonality changes will especially be important for your peak SWE and runoff estimates. Also, in the discussion you allude to the fact that land use and land cover has also been changing. It would be very valuable to use this modeling approach to quantify climate and land-use change synergies and simultaneous combined impacts on hydrology in the future.

L15 remove "land management scenarios" as you only looked at responses to changes in precipitation and temperature across one ecoregion.

L192 Please explain your wetland complex configuration in a bit more detail. Where does the 46 wetlands come from? In L344-347 the results are presented in the context of wetland density and commenting on the relatively dense drainage networks coupled with small wetland densities. How are the wetland densities dealt with in the model? See the two citations below for very recent evidence that including an areal estimate of wetland depressions within your HRU can improve streamflow discharge estimates like those in Figure 5.

L366 Please quantify "reasonable simulations of streamflow" using some comparison of means

L368 see previous comment regarding the use of "good agreement"

Rajib, A., Golden, H. E., Lane, C. R., & Wu, Q. (2020). Surface depression and wetland water storage improves major river basin hydrologic predictions. *Water Resources*

Research, 56, e2019WR026561. <https://doi.org/10.1029/2019WR026561>

Golden, H. E., Lane, C. R., Rajib, A., & Wu, Q. (2021). Improving global flood and drought predictions: integrating non-floodplain wetlands into watershed hydrologic models. *Environmental Research Letters*.

In your data availability statement please provide links to the data