

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
<https://doi.org/10.5194/hess-2022-102-RC1>, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on hess-2022-102

Anonymous Referee #1

Referee comment on "Assessing runoff sensitivity of North American Prairie Pothole Region basins to wetland drainage using a basin classification-based virtual modelling approach" by Christopher Spence et al., Hydrol. Earth Syst. Sci. Discuss.,
<https://doi.org/10.5194/hess-2022-102-RC1>, 2022

Summary Comment: The topic of the paper is important and timely, however, the methods were extremely hard to follow. There was a lot of important information and clarifying details that were missing from the Methods section. The model calibration and evaluation was weak, and a discussion of the sources of uncertainty in the approach needs to be added.

Abstract – please add the spatial extent of the study

Line 22 – change “were” to “being” evaluated, or revise.

Line 153 – Since Spence et al. 2022 is still in review, please clarify how this effort is distinct from this prior effort. Is the application of the model to a new catchment class the only difference?

Lines 171-172 – is the data that is shown in Figure 1 an output from Spence et al 2022 or from Wolfe et al 2019 or another source? It is hard to tell.

Figure 1 – Indicate or clarify what the actual extent of the model and simulated data is? Or clarify in the text that the theoretical model was forced with 4 different climate datasets. If this was the case, what was the size of the simulated basin?

Lines 183-185 – add some basic information on the land cover, slope, elevation, and soil

type, what is the spatial resolution and source of these datasets? Was land cover assumed to be stable or non-changing over the modeling effort, other than changing drained wetlands to agriculture?

Line 193 – clarify what size HRUs are used.

Lines 197-201 – Why not use actual wetland datasets instead of artificially created ones? There are some existing efforts by Amani et al. and Mahdianpari et al. for instance.

Line 202 – What DEM was used to route runoff? Were any manipulations/changes made to the DEM to condition it hydrologically?

Lines 207 – Please just list the actual source of the wetland extent data, instead of pointing to another publication, which did not generate a wetland dataset from what I can tell.

Lines 211-216 – So no actual data on drainage was used? How did the simulated drainage account for drainage already present? Or was this assumed to not be relevant since the wetlands were simulated as well? It was also difficult to tell what the term “drainage” was referring to. In the U.S. PPR, drainage is usually installed under the ag fields, although historically ditches were also used to drain wetlands. Was drainage simulated by “removing” wetlands or just increasing the rate at which water left the wetland. This is important to clarify.

Table 1 – A lot of these parameters are not explained. The routing length is the length from where to where? Is this the average length? The LAI values seem weirdly low...why are the 0.001 in a grassland, cultivated field and shrubland? And the woodland also seems low, a LAI of ~1.5-3 would make more sense here. Look at an example paper to more appropriately parameterize these such as Asner et al. 2003, Global synthesis of leaf area index observations: implications for ecological and remote sensing studies: Global leaf area index. Depending on how the model is set up, this could influence the model findings.

Line 230 – what is the spatial resolution of the precipitation data, is it station data given that it is collected only at 4 locations?

Line 252 – if 1965-2006 was used to assess model behavior, what years were used to train and calibrate the models? And if actual discharge was used, how did you guys account for the influence of existing land use and wetlands on the discharge values?

Table 3 – where are these gages? Can these be added to figure 1?

Line 279-280 – where is the St. Denis NWA in relation to the study area?

Lines – 286 – I still can't quite tell where you guys ran this simulation – across the entire pothole till? just within or near the catchments in table 3? So I can't tell what the distance is between these ponds and the modeled area, but since the climate stations used are spread across Canada, I have to assume that there are thousands of miles between some of the simulated areas and the ponds, consequently the pond depths are only compared to 1 climate forcing, but this doesn't seem adequate given that the focus of the paper is on changes in simulated wetland extent and corresponding changes in discharge.

Section 2.6 – please clarify how the 4 scenarios differ....so bottom-to-top for example...wetlands were drained sequentially from the basin outlet toward the headwater streams? Was any attention paid to whether the wetland was near- or connected to a stream, or geographically isolated from the stream network in the scenarios?

Line 328 – add a comma between mean and minimum

Line 383 – what was the distance between the N. Battleford climate and the ponds?

Lines 395-399 – what figure are these results reflecting?

Figure 3- Did the 4th location not have gage data? And since the contributing areas were of different sizes, would it make more sense to normalize the x-axis, so annual discharge per contributing area? Otherwise the Brandon comparisons really look all over the place. Also please add these value in as a table so there is some quantitative way to compare.

Figure 7 – make the font size larger, it was difficult to read this figure.

Discussion – the discussion does a nice job of contextualizing the results with the findings of others but please add a paragraph discussing the limitations of the modeling approach and sources of uncertainty given the input datasets, and limited manner that the model performance was evaluated.

Comment – please revisit how the term “drainage” is used throughout the paper (e.g. line 659) since the term drainage typically refers to the movement of water through a watershed, but here it is mostly used to refer to the action of draining wetlands.