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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Wetlands inform how climate extremes influence surface water expansion and contraction" *by* Melanie K. Vanderhoof et al.

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Reviewer #1: General Comments: Overall, the authors address an interesting comparison in how differences in geomorphology can influence landscape surface-water responses in different ecoregions. This paper is well written and important for the field of wetland ecohydrology in the Midwestern USA. The analytical methods and statistical tools show a compelling story that the PPR contains a higher concentration of depressional basins than the NP and therefore surface water in the PPR responds very strongly to changes in climate. Most of my suggestions are areas where the authors can clarify and citations they can add to give the reader a better understanding of

climate shifts in the region. Response: Thank you for your thoughtful comments which are addressed below.

Specific Comments Comment: Your paper alludes to other studies that looked at the relationship between surface water and climate, but you do not cite a recent paper from the PPR. It would be helpful to cite this paper especially in your discussion about shifts in climate patterns: McKenna, O.P., Mushet, D.M., Rosenberry, D.O., LaBaugh, J.W. Evidence for a climate-induced ecohydrological state shift in wetland ecosystems of the southern Prairie Pothole Region. Climatic Change (2017) 145: 273. https://doi.org/10.1007/s10584-017-2097-7 L363-373 Response: We have added this reference as recommended.

Comment: please clarify why climate variables are included in stage 2 of the analysis, I would think that they would be in the first stage for developing the SWCR. Response: To clarify, in Stage 1 we related Precipitation – Potential Evapotranspiration (PET) (aggregated over the previous 9 months) to inundation, so climate variables were directly used to derive the SWCR. Only multidecadal climate normals (averaged over 1989-2013) were used as independent variables in the stage 2. We added the following text to clarify, "Multi-decadal climate normals were included to test for the potential effect of a climate gradient across the study area."

Comment: L471-472 how is a metric regarding amount of surface area disconnected from stream network an independent variable? Isn't this overlapping with the definition of DCW? Response: We apologize for the confusion. It is the proportion (%) of DCW water, so the variable is attempting to get at whether watershed storage is dominated by disconnected wetlands or connected wetlands. As discontinuous waters are often small, depressional wetlands, they may or may not comprise a substantial amount of the total storage capacity across the watershed. We added the following text to clarify, "We included the proportion (%) DCW was of total surface water as a proxy of the relative distribution of water storage across the watershed between riparian and non-riparian water bodies."

Comment: I would like to see something in the discussion about table 7 regarding differences in DCW vs CCW area in NP and PPR. When controlling for wetland density are there significant differences between proportion of DCW vs CCW in NP as compared to PPR? This would help specify some of the discussion points in L501-511. Response: We do continue to see more water being added to DCW even after controlling for wetland density. We have added further discussion of this to the Discussion section.

Comment: Table 5 seems pretty raw and could be moved to appendix. Especially since Table 8 and Table 9 are giving more advanced analyses on significant independent variables Response: We have moved Table 5 to the Appendix (now Table A2) and correspondingly renumbered the remaining tables.

Comment: Is it fair to use the Missouri River in Fig 5 to represent PPR? At the very least you need to specify which examples came from PPR and which came from NP in fig. 5 legend. Missouri River seems to be the border between the two regions. Response: Figure 5 was meant to show the difference in patterns of expansion between DCW (wetland density) and CCW (lakes and floodplains). It was not mean to represent the PPR vs NP. To clarify this we have added several new references to Figure 5 in the text to indicate this.

Comment: The final models from Table 9 need to be used more in the discussion especially building on how CCW and DCW responses may change in the face of climate and land-use change Response: We have modified the Discussion section, especially its organization, and in particular the Conclusion section to more adequately address this comment, in particular how responses relate to climate and land-use change.

Comment: Why in Figure 6 are Yellowstone River and tributaries so responsive to climate as compared to other CCW and DCW sites in NP? Also, isn't Devils Lake naturally a DCW and it is only CCW because of pumping into Sheyenne River? Response: These are good questions. In regards to Yellowstone River and its tributaries, I suspect

the climate signal was clear because this path/row had relatively low wetland density (see Figure 6A), and the rivers were of such a size that as they started to fill up/widen, they began to be more consistently mapped by Landsat. However, this is mostly speculation so I haven't added this to the text. In regards to Devils Lake, you are correct, however we used the intersection of water with the NHD lines to define stream connected consistently. We recognize that in certain cases, this means stream lines may or may not connect to downstream waters.

Comment: L70-73 long and confusing sentence, consider re-wording or breaking up. Response: We broke this sentence into 2 sentences.

Comment: L541-552 This paragraph seems unnecessary. Either give more context or remove. Response: We heavily modified this paragraph and better contextualized it with the model results. As annual minimum depth to water table was a significant variable in the DCW SWCR model we feel that it is important to retain discussion of this variable.

Comment: Fig 6 legend should read "DCW SWCR" and "CCW SWCR" Response: We have updated the figure as recommended.

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