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Hydrology and Earth System Sciences Discussions

Interactive comment on "Controls on hydrologic similarity: role of nearby gauged catchments for prediction at an ungauged catchment" *by* S. Patil and M. Stieglitz

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Author Response to Referee #2:

We thank Referee #2 for reviewing our manuscript. Below we address the questions raised by the referee:

RC = Referee comment AC = Author comment

1) RC: The authors frame the use of proximity to select a donor catchment in the context of transferring hydrologic model parameters from gauged to ungauged catchments

(pp. 9325-9326); however, the experiment design does not test the use of proximity for this purpose.

AC: We did not intend to give an impression that this paper deals with transfer of model parameters. In the introduction section, we mention numerous information transfer schemes that exist in the literature, and model parameter transfer is one of them. In the revised manuscript, we will modify the language to explicitly state that our method pertains to the transfer of streamflow values and not model parameters.

2) RC: I do not think the authors can make any statements about the use of proximity in transferring calibrated model parameters from an ungauged to a gauged location (p. 9337, lines 18-20).

AC: The statement that Referee #2 refers to is in the conclusion section and is speculative in nature. Our results do not directly deal with transfer of model parameters to ungauged catchments. However, we strongly believe that the geographic patterns of streamflow similarity (Fig 3 in the paper) could be a good starting point to think about this issue.

In the revised manuscript, we will modify the language such that the speculative nature of our comment is explicitly stated.

3) RC: My second technical question relates to the method used to estimate streamflow at ungauged catchments. Could the authors provide some justification as to why this method was used? If the streamflows were all standardized by drainage area before weighting the flows, are you not actually testing the drainage-area ratio method (the assumption that flow per unit area between the ungauged and donor catchments are equivalent)?

AC: The referee is correct. The streamflows were standardized before performing distance-weighted interpolation. When only 1 donor is used, our method is exactly the drainage-area ratio method. However, we wanted to implement a streamflow trans-

fer approach that incorporates multiple donor catchments. As shown in our results (Fig 2 in the paper), there is a clear advantage in using multiple donors (vs. single donor) since it permits a better characterization of spatial variability near an ungauged catchment.

We regret that the drainage-area ratio method was not referred to and cited in the original version of the manuscript. In the modified manuscript, we will be able to provide citations referring to the drainage-area ratio method and also state our rationale for modifying that method to include multiple donors.

4) RC: I also wonder if the use of multiple catchments is confounding the interpretation of the results. The decision as to how many streamgauges to use in the weighting seems to add an additional layer to the analysis. How can you separate the effects of multiple donor catchments from the effects of distance given that the average distance between 5 donor catchments in the southwestern US will be quite different than in the northeastern US? I think this complicates your conclusions in section 4.3, which might be more easily explored if each site only had one donor.

AC: We don't think that using multiple donor catchments complicates our conclusions. Focusing only on the average distance from 5 nearest catchments can lead to misinterpretation. However, to avoid this confusion, we also provided a plot (Figure 5b in the paper) showing the relationship between NS and the distance from nearest donor. The nearest donor will have the highest weight in the interpolation scheme and therefore, maximum influence over predictability at an ungauged catchment.

Both the plots (Figure 5a and 5b in our paper) show a similar decreasing trend in the relationship between distance and NS (i.e., NS increases when distance decreases). However, both plots also show that there is considerable scatter in this relationship. This suggests that while distance does seem to play a role in predictability at ungauged catchments, distance alone cannot explain the observed predictability patterns. Additional analysis of streamgage density (section 4.4) further supports this insight gained

from section 4.3.

5) RC: With respect to the goodness of fit methods, were the logarithms of the streamflows taken before computing the NSE values? If not, your NSE values may be swamped by the fit of the high streamflow values. This effect could be mitigated by the authors' use of scaled streamflows but I would check to be sure that the NSE values reflect the fit across all streamflow values.

AC: We did not take the logarithms of the streamflows before computing the NSE values. To our knowledge, NSE of log Q values is typically used as an optimization objective function in low flow hydrology (since log values increase the emphasis on low flows and decrease the emphasis on high flows). Even though the problem with NSE (mentioned by the referee) is well acknowledged in the literature, it is still the most widely recognized metric. Therefore, we think that the hydrologic community can better appreciate our results through NSE values.

6) RC: Additionally, you note in the methods section and in the graphics that the WBE was also used as a metric to test goodness of fit but only NSE is discussed in the text (except section 4.2). I would add some sentences about the WBE metric throughout the results or remove it from the manuscript.

AC: We agree with the referee. Our initial rationale for presenting the WBE metric was to show that similar predictability patterns are obtained when using metrics other than NSE. However, our main focus in the subsequent analyses and discussion is on the NSE metric. Therefore, the result showing WBE does appear redundant later in the paper.

In the revised manuscript, we will remove the WBE metric result.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 9323, 2011.