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Interactive comment on "Human amplified changes in precipitation-runoff patterns in large river basins of the Midwestern United States" *by* Sara A. Kelly et al.

Anonymous Referee #2

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This paper analyses observed changes in streamflow patters in four large basins of the Midwestern Unites States, and investigate their association with changes in climate (precipitation and evapotranspiration) and changes in land-use and land-cover, specifically the increasing cultivation of soybean and corn enhanced by artificial drainage. By analysing 79 years (1935 - 2013) of precipitation, streamflow, artificial drainage, and cultivation data, the authors provide a comprehensive statistical time series analysis to identify breakpoint years that could show relations between changes in magnitude and trends of the variables. Also, through the application of a simple water budget, the changes in basin storage are associated to changes in climate or in land-cover affecting streamflow response. The study concludes that artificial drainage as part of large

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agricultural development in the Midwestern US amplifies the changes in rainfall-runoff response because of an increased hydrologic connectivity and a reduced storage in the basin.

The paper is interesting, and the analysis is extensive and well structured, so it should be suitable por publication after revisions. Although the authors have reported a reduction in word count with respect to a previous version, some parts of the document could be paraphrased and made more concise. Overall, the methods applied are robust and the results are well described and presented. However, there are two issues that, I think, need to be attended by the authors, which are the reasons for recommending revisions and re-review:

Major comments:

- The results section is an extensive description of the figures and tables, but less of an actual discussion and analysis. For example, the authors present all the numbers for each individual catchment repeatedly, but they don't compare these results with similar studies or discuss them in a broader context for interpretation. As this section is the main and longest part of the paper, after such a comprehensive exposition of results, the reader may feel disappointed not to find an equivalent discussion and interpretation of results. I would suggest to divide the section between Results (from a purely descriptive perspective only) and Discussion and Interpretation (extending on the current last section) to highlight better the value of this study and the findings. The closing Conclusions section could be short and concise as well.

- The study uses 7 metrics to analyse the streamflow regime, but it is not clear how and why these indices were selected. The literature is quite extensive with respect to hydrological indices to characterise and analyse streamflow features and alterations. See for example: Olden and Poff (2003); and Ochoa-Tocachi et al. (2016) for a list of indices used extensively in hydrological studies. The metrics (indices) depend on the streamflow attributes that the study is investigating, and ideally able to represent

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different parts of the hydrological response (independent, non-redundant) to provide more holistic views. The paper mostly focuses on streamflow magnitude, but there are other attributes (frequency, duration, timing, and flashiness) of flows that could be of interest. Lastly, it is not clear how the several streamflow gauges were used or, at least, the value of using several gauges in contrast to the downstream outlet only is lost.

Specific comments:

P1L27: See other attributes of streamflow: magnitude, frequency, duration, timing, flashiness.

P2L8-12: This is an example of a long sentence that could be divided or reduced.

P2L15: Specify if the term runoff refers to overland flow or total streamflow.

P2L21: Try not to cite articles not published yet.

P3L6: Although the term "artificial drainage" is used several times in the first subsection, it is only defined at this point. Maybe you could move the definition to the first time the term is mentioned.

P3L18: As part of another long sentence, it is unclear if the phrase between the commas ", at least for well drained soils (Hamilton et al., 2015)," refers to a study that does not show a reduction in ET, or if this is a condition for the following studies that report such reduction.

P5L3: The acronym PRISM is used here, but only introduced in the next section. Try to define acronyms the first time they are mentioned.

P5L21: When referring to tile installation, clarify that it is the "ANNUAL installation (or installation RATE) [which] has increased from 3 miles in 1999 to 1,924 miles in 2015".

P6L4: Generally the acronym for land-use and land-cover changes is (LUCC). However, as this term is widely used across the paper, check what is the most common term in the literature for your potential readers, if you want to keep LULC change as it

is.

P9L11: As the authors mention, when fo»0, the Morlet wavelet is simplified. Is the value of fo=0.849 considered much greater than 0?

P18L3-8 and P18L27-P19L2: These two groups of sentences should not be part of the results but of the methods as they explain how the figures must be read. This is an example of how the results section could be shortened.

P21L3: Flashiness (and flashy) is actually an attribute of streamflow, so no quotation marks are needed. The term "rate of change" of flows can also be used. Check the comment on the selection of metrics.

References:

Olden, J. D., and N. L. Poff (2003), Redundancy and the choice of hydrologic indices for characterizing streamflow regimes, River Res. Appl., 19(2), 101 - 121, doi:10.1002/rra.700.

Ochoa-Tocachi, B. F., W. Buytaert, and B. De Bievre (2016), Regionalization of land-use impacts on streamflow using a network of paired catchments, Water Resour. Res., 52, 6710 - 6729, doi:10.1002/2016WR018596.v

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