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Hydrology and Earth System Sciences
Discussions

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 #1

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This paper reports hydrological analysis from four river basins, in the ∼20,000 – 70,000 sqr km range in area, in the upper Midwest. The study is designed to investigate the role of climate and land use and land cover (LULC) change on water balance. Streamflow data are used from outlet of relatively large basins. In each basin spatially and temporally averaged PRIMS precip data are used. For annual water balance and storage change discussions evapotranspiration (ET) from Livneh et al (2013) VIC model results are used.

Overall the paper is very long and lacks focus. At least one-third or more of the text can be cut. For example a relatively long paragraph is devoted to sediment and bank erosion and so on (pages 2, 3) which can be cut. Study site descriptions are particularly

very long.

I did not find the conclusions very strong in the end. While there is some clear changes in streamflow characteristics (e.g., flashiness) as impacted by both LULC and climate change, much of the hydrological impact of LULC, tile drainage, and climate change may be occurring at much smaller scales in this region. If streamflow data from subwatersheds were used the study would have sampled from a greater variability of climate and LULC change. I wonder why the authors studied this local problem at such a large scale. This manuscript could have been a lot stronger if a range of watershed sizes were studied and the role of spatial averaging were shown.

I have some concerns using the Livneh et al (2013) ET product. In the application of the annual water balance equation, the ET product should come from a model that uses the influences of the changes in LULC and title drainage on water balance and ET calculations (e.g., Frans et al., 2013). If Livneh data is not driven by annual changes in LULC and tile drainage their ET product would not be suitable for making these inferences on LULC and tile drainage impact on changes in storage of the watershed. Because given P and Q are from data, the storage change calculations reported in Table 4 is directly result of ET estimates.

The paper also repeatedly mentions the fact that Livneh et al over estimates ET. This should be more clearly discussed. Where was this over estimation, under what LULC, and why a single number was used to correct ET estimates in all the river basins used in this work?

I don't think reducing 17% of Livneh et al ET for a more conservative budget makes a lot of sense unless justified at select locations from Ameriflux data or over available data in the watersheds. Alternative approach would be running VIC with the detailed LULC change data used in this study..? If the tile drainage influence on water balance is significant not parameterizing it in VIC may lead to higher ET.

Table 4.. I'm skeptical about these water balance values. Several issues needs to be

justified:

1. the changes are reported as cm/year.. These don't seem to be right and I suspect the authors mean cm per century. I see up to 90 cm/year values as precip change..

2. most increase in precip is from june to september in the region. this would increase ET compared to post 1970s. wouldn't reducing ET 17% take away this additional ET from wetter conditions.

3. If drainage and LULC change was not represented in the ET model, how can you conclude that storage changes may be attributed to artificial drainage.. Of course one could make all sorts of arguments but at the end of the day these would remain as speculations. In addition, the storage change values are so small that given the uncertainty in P and Q measurements and interpolation errors in space and time as well as the uncertainties in ET estimates would easily lead to 10% or more uncertainty in the storage change estimatesâĂŤe.g., Dingman second edition page 15, estimation of ET uncertainty. I would either remove this part or talk more about the role of uncertainties in the estimation of storage change.. Plus at the annual and mean annul scales changes that occur in space and time could cancel out each other and reporting these numbers at the scale of these large river basins may not mean much for management purposes.. Regional modeling papers that varied LULC and drainage conditions over space and time have discussed the effects of averaging in water balance in this region.

Conclusion reads as though the paper was largely written to study the effects of tile drainage.

Overall, there is a tone of a relatively large term paper. Sections are not well connected, and the narrative does not flow well, interrupted with details of study sites and text and tangential topics. There is awkward wording throughout the paper eg.,– "trends observed are relatively correct" what does this mean are there also relatively incorrect trends. I suppose this should do something about the statistical significance of trends.

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