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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Beaver dam influences on streamflow hydraulic properties and thermal regimes" *by* Milada Majerova et al.

Anonymous Referee #2

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This study aims to extend our understanding of the spatial stratification of thermal regimes in streams. It examines the role of geomorphic unit classification and beaver dam complexes on select stream hydraulic properties, which are used to explain observations of high variability in stream thermal regime. To do this, studied was Curtis Creek in northern Utah, which beaver re-colonized in 2009. Concluded in the manuscript was that "geomorphic units within beaver dam complexes exhibit highly unique thermal responses in part due to the variability in flow velocities and depths" (L404). Honestly, this was one of the most clearly written phrases in the manuscript. If true, this manuscript would provide a meaningful contribution to the literature. The problem for me is that I was unable to assess the validity of this conclusion from the material presented. I recommend the authors focus their revisions to the manuscript around this idea, and

describe clear objectives/hypotheses to evaluate/test it. I think much of the density of the manuscript stems from an attempt to capture variations in stream temperature resulting from geomorphic stratification, stream depth and velocity distributions and also beaver dam influences of the geomorphic template – all at varying spatial scales. It caused me to lose focus of the main new insights generated by this study. And, it has led me to recommend rejecting publication of this manuscript in HESS, at least until substantial improvements are made.

Substantial comments: a) The introduction section lacks clear focus and clear questions to drive the research. The authors nicely lay out evidence for spatial stratification in stream temperature regimes. They also argue in the introduction that beaver dams add hydraulic diversity to streams but that their influence on stream temperatures is uncertain as results from previous studies have been contradictory. I was expecting that statement to be followed by some key outstanding questions. Instead, it was simply stated that many questions remain on how to relate different stream temperature responses to varying channel complexity and stream hydraulic properties, especially for streams with beaver living in them. So, I was left confused at the end of the Introduction as to the goal of the study. I ended up thinking that the focus of this manuscript was on characterizing temperature regimes across a range of stream geomorphic units (in a stream that just happens to be beaver habitat), rather than a study of beaver dam influences on stream energetics (as the title suggests). I recommend the authors rethink their focus and write a more compelling introduction that lays out specific gaps in understanding and questions that relate to those gaps. Specially, I think the Introduction needs to be re-worked to more clearly outline how beaver-mediated changes to stream geomorphic structure are unique (or not) from channel complexities found in streams lacking beaver, and why such differences might lead to unexpected impacts on the temperature regime (if that is to be the focus). I do think there is merit in using the geomorphic template to explain thermal heterogeneities in streams, and that such an approach is likely to resolve some of the contradictory findings of the impact of beaver dams that exists in the literature.

b) There is inadequate description of the in-field configuration of the temperature sensors (paragraph starting at L124). Were the loggers placed in some sort of radiation shield to prevent direct solar heating? Were any manual temperature measurements made to ensure solar heating was not occurring? Were the sensors installed at a consistent stream depth? I also think it would be useful to report the expected measurement uncertainties here.

c) How were the simulated depth and velocity distributions (L152) verified and validated? The main conclusions from this manuscript are based on the model producing accurate and credible results.

d) How much difference would an underestimate of stream depth of 0.056 m (from the modeling; L189) likely make to classification of the geomorphic unit type given the small differences in depth thresholds between the classes (classification rules are provided at L165)? I see high potential for mis-classification of geomorphic units. I think disclosure of some of the uncertainties regarding the research design would only serve to strengthen the manuscript. Without such disclosures, it is hard to assess the validity of the conclusions reached.

e) It is useful to present an overall picture of variations in stream temperatures at each geomorphic unit, as was done starting at L258. In addition, I am wondering if there were differences in the diel stream temperature variability among geomorphic units or across the beaver complexes?

f) Section 5.1 – I see this as useful information, but it is not a point worthy of analysis in the overall finding of this research. It is commonly known that small differences in the choice of Manning's n can have a large impact on simulated streamflows. So, I recommend removing this paragraph from the Discussion section, and adding the key components of it into the Methods section.

g) Section 5.2 of the Discussion misses an excellent opportunity, in my view, as it focuses on the least meaningful aspect of the analysis. Instead, what I think is needed

here is a discussion of the how beaver damming impacts the geomorphic classification of the channel, and a linkage of that to stream velocities and depths. Are the changes in channel hydraulics that beaver damming creates well described by geomorphic forms present in channels without beavers? What I am asking is are stream velocity and depth distributions in beaver dammed reaches similar to those in un-dammed reaches, and, how do the differences that occur play out in the thermal regime of the various components of a stream? I think a much more effective Discussion will be guided by a strengthen description of the research goal and objectives in a revised Introduction.

Detailed comments: 1) Plant names should be italicized, for example, willow species should read Salix spp. on L100 with the Salix italicized.

2) Generally, the manuscript needs a thorough grammar edit. Also needed is a consistent style of in-text citation.

3) L217-220: It is cumbersome to read and compare the depth and velocity values for each geomorphic unit as text, given the number of values. I recommend placing these values in a table to facilitate reader understanding.

4) L248: Please provide statistical evidence to support the existence of a warming trend of 1C during the day and a net cooling of 0.5C during the night.

5) L319: Reflects variation of what in the reach – structural unit variations?

6) L340: So, how do DOC concentration and turbidity affect the thermal regime? How important were these factors at Curtis Creek?

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