

Interactive comment on “Assessing the Impacts of Hydrologic and Land Use Alterations on Water Temperature in the Farmington River Basin in Connecticut” by J. R. Yearsley et al.

Anonymous Referee #1

Received and published: 3 June 2019

As outlined by the authors, the study aims to better predict the impact of reservoirs and riparian cover on water temperature using the coupled DHSVM-RMB modeling system and to assess the usefulness of the modeling system to aid in watershed planning. The authors conducted four simulations (baseline, removal of dams, removal of riparian buffers, and removal of dams and riparian buffers) and evaluated how water temperature dynamics changed across these scenarios. Overall, results indicated that larger reservoirs were providing a cooling effect downstream of outlets and that riparian shading also provided a cooling effect on water temperature. However, there appears to be another aspect of the manuscript which focuses more on the use of state-space models. But this section on state-space models is not currently well aligned with the

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reservoir and riparian buffer component of the model and detracts from the readability.

As currently written, I recommend this work to be considered for publication with major modifications as outline below. While the inclusion of the reservoirs in the RMB model is novel, the authors need to make the manuscript considerably more focused to be considered for publication.

General: Per the title, this manuscript appears to use a water temperature model to simulate the impacts of reservoirs and riparian cover on water temperature dynamics. However, the introduction does not appear to cover these topics in much detail, but rather spends most of the text outlining the use of state-space models. While the description of state-space modeling is interesting, this reviewer would like to see the introduction adapted and to focus more on the ways in which reservoirs and riparian cover alter steam temperature dynamics and how this manuscript will address this.

General: The method used to estimate riparian vegetation characteristics (outline on page 4) seem lacking in text detail and potentially very error prone (i.e. someone manually using Google streets to record tree heights for hundreds of miles of stream). The authors state that Google street view was used to estimate canopy height by comparing vegetation to nearby features, such as telephone poles. The reviewer feels this is a very subjective method, which would need some type of validation approach before it should be uses in a published study. Additionally, how to tree height estimates for zones where there is not Google street view available, i.e. headwaters?

General: Pertaining to results shown in Figure 8, where water temperatures are classified into cold, cool, and warm. Why does Scenario 2 (subplot B) having different conditions above reservoirs compared to the baseline condition (subplot A). It seems that some small streams above reservoirs change from being cold in the baseline condition to be cool. It is hard for the reviewer to find a justification for this output. For example, why would removing a reservoir tens of kilometers downstream impact upstream headwater temperatures. This potential error puts into question the other results. Please

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consider re-checking the model structure and output to ensure this is not an error.

General: The role of riparian shading seems to be completely missing from the discussion. Since this was one of the two perturbed characteristics of the system, the findings should be discussed.

Specific:

Page 2, paragraph 1: This paragraph seems out of place for the second paragraph in the introduction. The reviewer would prefer to see more background into the topic being addressed in the manuscript before jumping into some of the technical details of the modeling.

Page 3, line 22: Please consider providing some explanation/criteria for why the seven large reservoirs were thought to significantly modify the thermal regime of the basin. For example, do the outlet works of these reservoirs allow water to be drawn from different depths and thus one could have cold hypolimnion water being released during the warm summer period?

Page 4, lines 16 and 17: Please consider indicating what method was used to re-scale the 30 m data to 150 m.

Page 5, line 17: Please clarify why only gage CT-15844 was used to fit the relationship and applied to all other gages. How valid is the assumption that these parameters are representative of the headwaters? It would be preferred to see how much variability there is in the parameters across gages to better understand how this variability might impact headwater temperature inputs.

Page 6, line 3: How valid is the assumption that volume remains constant during the simulation period (multiple years)? For example, in reservoirs functioning as a flood control mechanism, one would think that their volume would change over a period of a year. Please consider adding some text to justify this assumption or address how it is a limitation in the modeling in the discussion section.

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Page 9, line 23: This paragraph reads like it belongs in the methods sections. Please consider re-ordering.

Page 10, line 3: Text starts with 'similar to their approach'. Please be more specific.

Page 10, line 4: Since the reviewer/reader does not have access to Table 3 in Beauchene et al. (2014), the authors should consider a different way of referencing this table as currently it is not helpful to the reader.

Page 10, line 17: Please consider opening the discussion with a paragraph that better orients the reader to the main goals/methods of the manuscript and the primary findings. As it currently reads, the first paragraph of the discussion seems to point to limitations in the modeling, which would be better suited later in the text.

Page 11, line 8: This paragraph does not belong in the discussion, it is merely restating general ideas about state-space model and water temperature dynamics. Consider placing somewhere other than the discussion or re-write to relate the work performed in the manuscript to other research and future efforts.

Page 11, line 15: Similar comment to Page 11, line 8.

Page 11, line 26: A paragraph needs at least 3 sentences. Additionally, this paragraph seems only partially thought out.

Page 12, line 16: The statement that about diurnal variation is difficult to assess in Figure 5 which sometime spans multiple years (i.e. diurnal variation cannot be seen). Consider generating new plots with shorter time periods if the authors wish to discuss this modeling issue in the discussion.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2019-94>, 2019.

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