

## ***Interactive comment on “Are the effects of vegetation and soil changes as important as climate change impacts on hydrological processes?” by Kabir Rasouli et al.***

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Response to comments on HESS-2019-214-RC2

Referee #2

The paper addresses a very relevant topic with high scientific and applied implications. Used methodology is robust and results of high interest. However, I agree with reviewer 1 that the paper is very difficult to be read because of excessive information on the one side, and because current structure is currently unclear. I think it is necessary to select more the information and to facilitate to readers the lecture. Once this will be achieved,

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it will be a great contribution for the Journal and most important to the field of mountain hydrology.

\*\*\*\*\*AC: We have rewritten the manuscript to make the presentation of a complex study easier to follow. The structure of the manuscript has been simplified and the terminology changed to a simpler and more consistent form. We have modified most of the figures to improve clarity and consistency of the presentation.

Specific comments.

-The abstract is not very informative now, it does not inform about the sign and magnitude of predicted changes.

\*\*\*\*\*AC: Addressed in the revision. Extraneous material has been removed and the focus placed on describing the simulated effects of changes in climate, vegetation, and soils.

-Line 9. I would not say "seldom studied" Impact of climate-vegetation changes on hydrology have been widely studied in many areas; the most novel of the study is to focus on snow dominated basins.

\*\*\*\*\*AC: Addressed in the revision. We have emphasized that the novel aspect of this study is snow dominated mountain basins. See line 9 in the revised manuscript.

-Line 14. Not sure if "but" is appropriate here. I would say ...SWE "and" increased evapotranspiration.

\*\*\*\*\*AC: The word "but" was changed to "and".

-Line 16. It is not stated before that soils have been also perturbed.

\*\*\*\*\*AC: Addressed in the revision. Text regarding soils in the Introduction has been rewritten and made clear.

- Introduction needs better organized. The literature review are mixed with the objec-

tives. I would detail the objectives at the end of the section.

\*\*\*\*\*AC: Addressed in the revision.

- Paragraph in lines 45-50 needs to be better organized.

\*\*\*\*\*AC: Addressed in the revision.

-Lines 57-60 are highly repeated with previous paragraph.

\*\*\*\*\*AC: Addressed in the revision.

-Lines 65-80 can be moved to methodology. - Can you incorporate in Figure 1 the applied changes to soils?

\*\*\*\*\*AC: Addressed in the revision. The text was moved to the Methods section, and the changes applied to the soils have been added to Figure 2 [previously Figure 1].

- Line 157- "changed" instead of "changes".

\*\*\*\*\*AC: Corrected.

- I would convert lines 185-200 into a table. -Section 2.3. Did you perturbed T and P, or all the variables?

\*\*\*\*\*AC: Thanks for this excellent suggestion. We changed these lines into the new Table 2.

We did perturb P and T and kept relative humidity constant to allow vapour pressure to change with warming. Text was added to the method to make the reader aware of this fact. Also, we note in the text that no change were assumed in the rest of the parameters such as wind as the RCM outs for these variables were highly uncertain for the present climate.

- Figure 1 is absolutely necessary to understand methodology, may be you can use a similar template to provide a fast view of the most important hydrological changes at each site and under different environmental changes.

\*\*\*\*\*AC: In Figure 2 [formerly Figure 1] we added the modelled change in the snow water equivalent (SWE) under climate change scenario into Figure 2. Because we have eight scenarios, including the present climate-vegetation-soil, and six parameters for each scenario (Peak SWE, timings, annual runoff, etc.), it is not easy to show the results on a figure similar to Figure 1.

- Many parts of Results are in reality discussion. I would separate better the contents or I would create a results and discussion section.

\*\*\*\*\*AC: Addressed in the revision. Discussion text has been moved from the Results to the Discussion.

-Line 219. Turkey's test should be presented in Methods section.

\*\*\*\*\*AC: Addressed in the revision. A new paragraph was added to the Methods to describe the test. See lines 195 - 204 in the revised manuscript.

-Line 298. It is interesting to see snow cover insensitive to vegetation when many studies point out the opposite.

\*\*\*\*\*AC: We have emphasized this more strongly in the revision.

- I do not see the point of a section 3.2 about snow characteristics when 3.1 also presents changes on snow.

\*\*\*\*\*AC: We are of the opinion that these two sections cover very different aspects and chose not to combine them so as to bring out important results.

- Are the hypsometry of the three catchments similar or different? how this may affect the results?.

\*\*\*\*\*AC: We have shown range of elevation and other physiographic characteristics of the basins in Figure 2 and we discussed the similarities and differences between the basins, which are provided in section 2.1 Study areas and data sources. We acknowledge that there might be some uncertainties in the results due to the different charac-

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teristics of the basins, but they are the classic basins for their regions and so we have to use what nature has provided and what research organisations have instrumented.

We have work in progress on the impact of hypsometry that will further address the reviewer's point.

- MCRB is the only with predicted deforestation; is this the reason why snow is the most resilient to CC? - Are normal the very low values of sublimation in WC and RC?

\*\*\*\*\*AC: We also expect deforestation in Reynolds Mountain as shown in Figure 2 (lower panel) where sage replaces different types of trees.

- Are normal the very low values of sublimation in WC and RC?

\*\*\*\*\*AC: We have not modified the manuscript in response to this comment, but higher elevations in Marmot Creek are very cold and snowcover period is longer there and a moderate warming does not affect the snow at these elevations (Rasouli et al., 2019a), but it does affect snow at low elevations similar to the deforestation effect.

Total annual sublimation to some extent depends on the annual snowfall and peak SWE. We have less snowpack in Wolf Creek, so we expect lower sublimation in Wolf Creek over an annual cycle and large sublimation in Marmot Creek as it has the highest snow accumulation among the three sites and is subject to Chinook winds.

-I hope my comments will result useful when preparing the revised manuscript.

\*\*\*\*\*AC: We appreciate your very helpful comments. Addressing your comments and suggestion has helped us prepare a much impr

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