

Reviewer #1

As far as I am aware this is the first manuscript examining the effects of changes to spatial rainfall patterns under climate change. I believe this is a very important contribution because, as interesting rainfall changes are, it is the on-ground impacts that are really of key importance. Some small comments below (suggestions are at the authors discretion).

We thank the reviewer for their time and effort and for their appreciation of our work.

Minor comments:

Section 4.2: I got a bit confused here because I thought case 3 could be either where mean rainfall increases by 3% or 7%. I only realized what case 4 was in Section 5.2. Can “case 4” be added to Figure 1 and the cases (1-4) be labelled in Table 1?

It is a good suggestion - the labels for cases 1 to 4 will be added to Table 1. Adding the line of case 4 in Figure 1 will make the figure less clear due to the overlaps of the new line with some of the original lines.

I don't entirely agree with there just being two options for spatial rainfall downscaling (i.e. CPM or rain-temperature sensitivities). Some authors use stochastic methods (Bordoy and Burlando, 2014) others use RCMs directly with varying convective parametrizations which will affect the results (Li et al., 2018).

The study by Bordoy and Burlando suggests a methodology to downscale rainfall at a sub-hourly scale and for multiple locations, without considering the storm internal structure of rainfall at small scales as discussed in this paper. The work by Li et al. is interesting and relevant as it discusses the potential use of RCMs to explicitly represent some of the rainfall properties in space, although at coarser scales than discussed in this paper. We will add a reference to the study by Li et al.

Line by line:

Title: add “spatial structure” somewhere?

We will modify the title following the suggestion of the reviewer. The new titled will be: “Temperature effects on the spatial structure of heavy rainfall modify catchment hydro-morphological response”.

Page 1, Line 11: “small-scale resolution . . .”

Page 3, Line 16: “The second option” -> “An alternative”

Page 4, Line 6: “on the hydro. . .”

Page 9, Line 13: “is simulated” -> “can be simulated” (because later you choose one method)

Figure 5 caption: “km” -> “m”

Page 13, Line 5: “corresponds” -> “corresponding”

Figure 8 caption: “black” -> “grey”?

Page 19, Line 9: “demonstrate” -> “demonstrated”

Page 19, Line 19: Section “4.4”

Page 21, Line 4: “by small-scale changes in the rainfall spatial structure. . .”

Page 21, Line 33: “A viable alternative presented here is . . .”

Page 23, Line 10: Add the words “under climate change” before “as was done here”?

We thank the reviewer for pointing on typos and suggesting text edits. All issues will be resolved in the revised manuscript.

Page 12, Line 15: Could you add the domain to Figure 5?

The simulated domain will be added to Figure 5.

Page 15, Line14-18: Could this be moved up to follow the first sentence in this section? Just fits better with the point made in the first sentence.

We prefer to retain the structure of this section as it is, namely discussing first the example of the impacts of changing the mean areal intensity on the peak streamflow and sediment yield and at the end discussing the impacts emerging from changes in the rainfall peak intensity.

Page 16., Line 18: 10% of what?

From the reference total sediment yield. The information will be added to the text.

Figure 9: could add zero, zero guide lines

Guidelines will be added to the figure, as suggested.

Page 18, Line 17: “considerably increased”. Feels like this result is interesting and could easily be included in Table 4?

We agree. We will add the results in Table 4, as suggested.

Page 22, Line 7: You use 10 stochastic replicates – could mention this here.

Thank you for this suggestion, the text will be revised to mention that 10 stochastic realizations were used.

Figure S3: can you add to the legend if this is an example of a stratiform or convective storm?

The example is of a stratiform storm. This will be added to the figure caption.

Finally, we would like again to express our deepest thanks to the Associate Editor and to the two reviewers who have helped us to significantly improve the paper.

Sincerely,

Nadav Peleg, Chris Skinner, Simone Fatichi and Peter Molnar