

Dear Manuela Brunner, dear anonymous referee,

We would like to thank you – again – for your detailed and constructive comments, questions and suggestions. Below, we provide our responses as direct answers to each comment and point out the changes made to the manuscript.

We hope that this will be to your satisfaction.

Best, Lena Katharina Schmidt on behalf of all authors

I thank the authors for addressing most of my previous review comments. I think that the readers will now better understand what has been done in this study. My main critique this time is that uncertainty should be embraced more. More specifically, the first two subsections of the discussion on future changes is based on the median change. However, as seen in Figure 10, none of these changes seem to be significant and remain within the uncertainties. This is a common challenge in hydro-geomorphic climate change studies and should be properly acknowledged to avoid overinterpretation. However, if this point is addressed and the minor comments below, I think this study is ready for publication in HESS. I congratulate the authors on their work.

Answer: Thank you for pointing out that we did not specify in the discussion, that we are referring to the ensemble mean of annual SSY of all models. We corrected this to avoid confusion. However, with respect to your point about changes not being significant: In section 3.4.1 we described that the trends in the ensemble means are negative and highly significant for all RCPs (see table 6), that trends in mean annual SSY of most individual models (26 of 31 at gauge Vent and 30 out of 31 at gauge Vernagt) are negative and significant, and that even the 99th percentiles show significant negative trends at both gauges (except for RCP4.5 at gauge Vent which is close to zero and not significant). We think this misunderstanding might result from the figure description of figure 10, so we adapted it to avoid confusion (it shows the mean of all models as a thick line and the min and max of the individual models for each year).

L10: I would say either “yet” or “so far”

Answer: thank you, we have changed this.

L64: What do you mean by “capture”? Identifying, monitoring, modelling,...?

Answer: What we mean is that it is difficult to capture in process-based models. We have changed it to “model”.

L159-163: This seems repetitive as there’s a similar argument around L110 in the into. Please consider cutting.

Answer: Thank you, we agree that it is similar to line 110. However, it is more detailed here (which ML approaches exactly etc.), and we believe it is an important point to make (i.e. why we chose this approach based on the existing literature) – especially since we expect that most readers will not actually read both the methods and the introduction in detail.

L181: I may be wrong but isn’t it problematic to have day of the year as input when doing climate change impacts? This makes sense for stationary climate, e.g. to account for seasonal hysteresis, but wouldn’t it affect your results strangely when there are seasonal shifts in other drivers (e.g. discharge)?

Answer: Thank you for this interesting question. We would argue that using DOY is necessary, because in this way the model can distinguish between e.g. the same volume of discharge in spring, summer and autumn (which will likely have different effects on sediment export), and likely not problematic since it is not the only predictor. However, we also mention around line 603 that if the relation between the predictors and sediment export shifts fundamentally (e.g. as glaciers disappear), the model cannot capture this as this effect is not present in the training data.

L196: can you provide mean temperature too?

Answer: Thank you, we added this information.

L220: for examples

Answer: Thank you, we changed this.

L233: Please check what in-text citation should look like. Usually Hanzer et al. (2018). You use without year here and year within commas in L223

Answer: Thank you for pointing this out, we have corrected this.

L237: I think “cannot” is more formal than “can not”

Answer: Thank you, we have corrected this.

Figure 10: Please use labels a)-d), it's also easier to refer to in the text. Please also mention why the >2070 is faded

Answer: Thank you, we have added the labels and improved the figure description.

Figure 11: Please also use labels and I think the title of the lower should be “Vent”

Answer: Thank you for pointing this out, we have corrected this and added labels.

L509: what does 1/3 to ½ mean? Is this the uncertainty or just an visual estimate? Consider using calculated percentage.

Answer: Thank you for pointing out that this was confusing, we decided to eliminate that part of the sentence.

L511: to me it still looks like onset of sediment export still is in May, although at a higher rate in future

Answer: Thank you, we have adapted the description.

L516: I suggest putting the figure in the appendix instead of “not shown”

Answer: Thank you, we have added the figure to the appendix.

Figure12: please specify in the caption that this if this is the mean of all climate-model chains

Answer: Thank you, we have specified this.

L524: the discussion is missing subsection numbers

Answer: Thank you, we added them.

L525-529: In my opinion the discussion doesn't need such a summary and rather fits the abstract or conclusion – up to you if you want to keep it.

Answer: Thank you, we would like to keep it since we do not expect most readers to read the entire

paper carefully, so that this short summary might be nice to have.

L558-560: the conclusion of this is that the emissions are not the biggest uncertainty, but the internal climate variability is dominating. This is known to be important for climate modelling (<https://doi.org/10.1007/s00382-010-0977-x>), but has also been shown to be important for erosion/sediment modelling (<https://doi.org/10.1007/s00382-010-0977-x> or <https://doi.org/10.1029/2020JF005739>). I suggest you cite one of those.

Answer: *Thank you for this important comment, we have cited the two papers (two of the links point to the same paper).*

L668: please specify the influence of what is negligible

Answer: *Thank you, we have specified this.*

L570-671: maybe “hydro-geomorphic” instead of “hydro-sedimentological”?

Answer: *Thank you, we have changed this.*