Response to RC1 (Anonymous Referee 1)

We thank the anonymous referee for the time and effort they spent on reading, reviewing and commenting our manuscript. We were able to improve the manuscript by following their suggestions and thinking and acting on their comments. In this communication, we highlight our responses in blue.

It does not get entirely clear which part of the methodology can be considered as original to this manuscript. It would be good to clarify that.

The individual components of the whole procedure are established methods, but the combination of methods was tailored specifically to the scientific problem at hand. We made sure to clarify this in the methods section (L136-138), and mention examples of where else this chain of processing may be used in the discussion (L677-687) .

Minor comments:
- Abstract: in the abstract the authors mention tipping points in what I consider the motivation of the research. This, in my opinion is misleading (even though the method might be used for that purpose) since the rest of the manuscript is not about tipping points. Better mention the effects on land surface processes like erosion already as motivation in the abstract (like it is done nicely in the introduction).

We thank the reviewer for noticing and highlighting this inconsistency and agree. We now omit the mention of tipping points and focus the reader on surface processes/erosion from the beginning.

- For the motivation, as well as in the discussion section it could be mentioned that this methodology might be pretty useful regarding the effects of future climate changes and the impacts on Earth surface processes.

This is an excellent point and may remove barriers for climate impact researchers to apply a similar method for future climate change. We make a note of that in our manuscript now (L125-127 and L677-678).

- Introduction line 70: Please do not call modern pre-industrial, since there is distinct differences and this might lead to confusions

We thank the reviewer for raising this very valid point and made sure we do not mix those two up throughout the entire manuscript.

- Introduction lines 79/80: it is not entirely clear to me why you mention uplift histories here. Could you maybe clarify that? Could that methodology help to re-evaluate uplift histories?

We thank the reviewer for pointing this out. We originally mentioned uplift histories, because reconstructions and interpretations of erosion histories impact the refinement of uplift histories. We realise now that the mention of uplift histories is confusing at this point in the manuscript and omitted it.

- Paragraph 2.3./line 202: add "climate" to "Each variable" => "Each climate variable"
This has been corrected.

- Line 230: given by the models
This has been corrected.

- Line 461: impacts on physical weathering
This has been corrected.

- Discussion: please mention more often in the discussion where the different named regions are situated (e.g. mountains, lowlands etc).
We added more such descriptive terms to the discussion when we mention specific regions/clusters (e.g. L554, 576, 590).

- Conclusion: line 543: please do not only mention k, but also what it means (climate anomaly lusters?) here, since there is people around reading only the conclusions and the abstract:
This is a very good point. We instead write "assigned number of anomaly clusters" (L659), but still mention k in brackets to help those who have read the entire manuscript make that connection more easily.

- Line556: coincide with decreases in
This has been corrected.

- Conclusion: It would be good to mention future applicability of the method like using it for the investigation of other physical processes or other time slices (give examples!).
We thank the reviewer for the suggestion. We mention at the end of the discussion that the presented methods may be applied to future climates. Additionally, we give a possible example of method transfer to a different research field and highlight the important conditions of merited use of the method. (L677-687)