Interactive comment on "Detection and Explanation of Spatiotemporal Patterns in Late Cenozoic Palaeoclimate Change Relevant to Earth Surface Processes" *by* Sebastian G. Mutz and Todd A. Ehlers

Anonymous Referee #1

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Review of the manuscript entitled "Detection and Explanation of Spatiotemporal Patterns in Late Cenozoic Palaeoclimate Change Relevant to Earth Surface Processes" submitted to Earth System Dynamics Discussions by Sebastian G. Mutz and Todd. A. Ehlers.

Overall rating: to be accepted with minor revisions General Comments: the manuscript deals in a very concise way with the description and application of a methodology that combines geographical clustering with discrimination analysis, to detect and explain differences in different past climates. The study is in general thorough and very well

structured.

Scientific significance: the study shows a methodology applied to the issue of climate change induced changes in Earth surface processes. 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. But generally speaking this methodology and the way how the results are interpreted and illustrated is a substantial contribution for the scientific community and fits to the topics of ESD.

Scientific Quality: the methodology is valid and robust and the results are well discussed. The results are discussed against the broader picture of state of the art knowledge of climatic differences between the respective time slices. References are appropriate. Some additional plots giving valuable information for the evaluation of the results are found in the supplementary material.

Presentation Quality: the text is very well structured and the methodology and the results are very clearly explained in detail. The figures are clear and very well readable, very well structured and the figure captions do extensively explain details. The amount of figures is sufficient. I'm not a native speaker, but according to my knowledge the use of the English language is appropriate.

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).

- 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.

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

- 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?

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

- Line 230: given by the models

- Line 461: impacts on physical weathering

- Discussion: please mention more often in the discussion where the different named regions are situated (e.g. mountains, lowlands etc).

- Conclusion: line 543: please do not only mention k, but also what it means (climate anomaly clusters?) here, since there is people around reading only the conclusions and the abstract. . ..

- Line556: . . .coincide with decreases in . . ...

- 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!).