

Clim. Past Discuss., author comment AC2
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Reply on RC2

Woon Mi Kim et al.

Author comment on "Statistical characteristics of extreme daily precipitation during 1501 BCE–1849 CE in the Community Earth System Model" by Woon Mi Kim et al., Clim. Past Discuss., <https://doi.org/10.5194/cp-2021-61-AC2>, 2021

We would like to thank you for your feedbacks and comments. We greatly appreciate the time and effort you dedicated to revise our manuscript, which helped us to improve our presentation. you can find our responses (in bold) to your comments below.

Major comment:

1) Main suggestions is related to the link between temperature and extreme precipitations. Whereas the manuscript focused on the external drivers of extreme precipitation and on the impact of natural modes of climate variability, one question that probably will come to the mind of many readers is whether or not warm decadal (or multidecadal periods) generally are accompanied by more intense daily precipitation extremes. The introduction indicates that, for the future, the Clausius-Clapeyron equation does suggest that for future warming mean and extreme precipitation should increase. Can we see that relationship already in the past in this simulation ? How large should the 'warm' or cold regions be so that the temperature impacts extreme precipitation (e.g. whole hemispheres or continents) ? If yes, would it be worth to investigate this link in climate reconstructions, as far as proxies for extreme precipitation might be found ?

Thanks very much for your suggestion. We will repeat the GEV analysis using the global and hemispheric averaged mean temperature anomalies as covariates for extreme precipitation. We plan to use the temperature anomalies at monthly time scale in other to make the time resolution of this variable coherent with other modes of internal variability. The new result will be included in the revised manuscript.

Minor comments:

2) 'Although, eruptions alter both the intensity and frequency of extreme precipitation,.'
Change Although to However

In the revised version, we will modify the respective sentence as: "Tropical volcanic eruptions affect extreme precipitation more clearly on the short term up to a few years, altering both the intensity and frequency of extreme precipitation. In this study, it is noted that more apparent changes are found in the frequency than the intensity of extreme precipitation."

3) 'Extreme daily precipitation, which often causes devastating flood events, is a complex phenomenon due to its rare occurrence and short-lived nature'. I guess that this are not necessarily the reasons why extreme precipitation is a complex phenomenon. These may, however, be reasons why it is difficult to analyse extreme precipitation.

We will modify “complex phenomenon” to “difficult phenomenon to study”.

4) ' When the sample size is small and the estimated ξ is negative, there is a bias in the estimation of ξ towards a larger standard error (Blender et al., 2017)'

This sentence could be a bit confusing at first sight. I guess that here 'sample size' refers to the number of exceedances (?), but some readers would rather interpret 'sample size' as the total number of data (above and below the threshold). In any case, this sentence is not clear to me, since in both cases the 'sample size' would be the same for all grid-cells: either 1% of the available data (threshold set at the 99% percentile) or the all the available data. So why do some grid-cells have a smaller sample size than others?

Thanks for your point. As you said, the “sample size” means the number of exceedances, but after these exceedances being de-clustered to guarantee the statistical independence among the values as mentioned in lines 166 - 171. Although in the beginning every cell has the same 5% or 1% of their total number of data, the de-clustering method can reduce these numbers at each grid points up to 40% as shown in the extremal indices on Figs. 6 and 7. In the revised manuscript, we will change the word “sample size” as “number of exceedances” and also reformulate the corresponding sentence to clarify better about the errors in negative shape parameters.