Review Cross-scale characteristics of extreme precipitation events under climate change

The authors analyse the effect of climate change on the cross-scale extremity of precipitation events using the COSMO-CLM convection permitting model and the xWEI. They introduce two different analyses based on different fits of the dGEV, which aim to account for evolving rainfall characteristics. Generally, I think that it makes sense to assess extreme precipitation events across scales with metrics such as the xWEI, especially if the aim is to understand hydrological impacts. While it is a good idea to split the analysis into two different dGEV fits, the study has several shortcomings, which are listed below. In my opinion, the study, in its current version, does not meet NHESS standards.

Major comments

1. The study only uses one dataset. COSMO-CLM, as you and Rybka et al. (2023) state (line 94 ff.), is biased:

The performance of the convection-permitting simulation in terms of spatial distribution and intensity is in agreement with both observational datasets ***for extreme precipitation with durations greater than 12 hours****. Higher return periods for daily extreme precipitation show larger differences, but still providing good estimates. Referring to rainfall durations below 12 hours, an overestimation of the convection-permitting simulation is evident. In addition to that, the convection-permitting simulation produces a broader distribution for hourly and 6-hourly extreme precipitation referring to a higher spatial variability over Germany (Rybka et al., 2023).*

The study should use an ensemble of CPMs to diminish uncertainties in the analysis. It is not common to base a study about climate change on only one simulation.

2. Selection of extreme events: The authors select extreme events using the CatRaRE framework introduced by Lengfeld et al. (2021). Extreme events are selected based on the WEI. This procedure might lead to missing events that are more extreme across spatio-temporal scales.

3. The study lacks depth and novelty. It seems that with recent AI coding clients this study could be realized without much effort. The methods, namely the framework to select extreme events, the calculation of the xWEI and the dGEV, are established, and at least the code for the xWEI and the dGEV is publicly available. For this reason, I believe it would be appropriate that the study is extended to an ensemble of CPMs.

4. Limitations are not discussed enough: Fitting the dGEV to 30 years of data leads to a high uncertainty. 30 years are not representative for a selection of extreme events. This should be stated clearly in the limitations. Where did you cap the return periods? Did you check the fits that resulted from the dGEV (e.g. the shape parameter)?

5. Climate change might affect different regions of Germany differently. However, the xWEI is only comparable within the same spatial domain because it is based on return periods that are adapted to local conditions. Using Germany as a whole as the spatial domain might conceal important signals of change.

Minor comments

line 114: The statement that Voit and Heistermann (2022) used the object-detection algorithm of Lengfeld et al. (2021) appears to be incorrect. As stated later in the manuscript (l. 193), a 200 x 200 km bounding box was used there for the calculation of the xWEI.
Figure 4: Please make the markers in the legend larger so the colors are easier to distinguish.

line 244: *The most pronounced change occurs only once (Figure 6), namely between the past (1971–2000) and the subsequent periods.* Could this be a data artifact?

line 297 ff.: *Rybka et al. (2023) confirmed that COSMO-CLM at convection-permitting scale projects stronger precipitation intensities for future scenarios, particularly on sub-daily timescales.*

Doesn't this finding contradict your results?

References

Lengfeld, K., Walawender, E., Winterrath, T., and Becker, A.: A catalogue of radar-based heavy rainfall events in Germany derived from 20 years of data, Meteorol. Z., 30, 469–487, https://doi.org/10.1127/metz/2021/1088, 2021.

Rybka, H., Haller, M., Brienen, S., Brauch, J., Früh, B., Junghänel, T., Lengfeld, K., Walter, A., and Winterrath, T.: Convection-permitting climate simulations with COSMO-CLM for Germany: analysis of present and future daily and subdaily extreme precipitation, Meteorol. Z., 32, 91–111, https://doi.org/10.1127/metz/2022/1147, 2023.