Comment on wcd-2022-54
Anonymous Referee #2

Referee comment on "What distinguishes 100-year precipitation extremes over Central European river catchments from more moderate extreme events?" by Florian Ruff and Stephan Pfahl, Weather Clim. Dynam. Discuss.,
https://doi.org/10.5194/wcd-2022-54-RC2, 2022

For five Central-European catchments, authors study the characteristics of extreme precipitation events, mainly from the viewpoint of their causal atmospheric conditions. The study is focused on extreme events with the return period of areal daily precipitation total over 100 years, which the authors compare with a set of events of lesser intensity. For this, they use an innovative approach based on the processing of outputs from the ECMWF ensemble system.

In general, I find the study very interesting, innovative and well-written. Thus, I recommend it for publication in WCD after revisions with respect to the following comments.

Since operational outputs from the ECMWF model are used, I am not sure of the homogeneity of the input data (i.e. whether there was no major change in the model settings during the considered decade). This question needs to be discussed in more detail than only presenting time series of extreme percentile values of daily precipitation totals (S1). It would be necessary to verify whether the extreme events analyzed in the study were randomly distributed within the entire set of model outputs.

On the scale of large Central-European catchments, extreme precipitation events producing large floods regularly last more than one day. Authors mention this fact in conclusions but it is not enough in my opinion. Because accumulation of precipitation is a crucial factor of river floods, it should be mentioned already in the introduction as well as in the discussion at least. It could also happen that two days of extreme precipitation follow one after another in the dataset (as it was e.g. in July 1997) – in such a case,
atmospheric conditions are certainly very similar on both days and it could influence the results.

Moreover, extreme events usually affect more than one of the studied catchments (as e.g. in August 2002) but there is no mention of it in the article. It could be actually interesting and useful to have a 5x5 table giving the frequency of such events, with additional comments of possible cases when even more than two catchments were hit.

Finally, authors distinguish between MEPEs and LEPEs to present what makes the events really extreme; however, there are also events with return periods between 50 and 100 which are worth noting in my opinion. Do they exhibit any "transitional patterns" between MEPEs and LEPEs?

Detailed comments:

I. 17-20: The March/April 2006 flood was not due to an extreme precipitation event; it was a typical snow-melt flood, with the melting process accelerated by the rain-on-snow process.

I. 21: The sentence seems to mean that each of the mentioned flood events had such a large impact. Is it truth? I guess that less people died at least in March/April 2006 because snow-melt floods use to be well predicted in general.

I. 28: In my opinion, the situation described is for Donau in Passau, not Elbe in Dresden – please, check Merz et al. (2014) again.

I. 42: The surface cyclogenesis is due to the upper-level circulation, not vice versa. Thus, I suggest to change the beginning of the sentence as follows: “With such an upper-tropospheric configuration, ... is often associated.”

I. 184: It should be mentioned that only a rather small part of the whole Danube catchment is considered.

I. 315: It is not clear whether the presented values are maximum values reached during
the maximum event in each catchment or mean values calculated from the MEPEs. I fully agree that the highest values in the Weser/Emms region are due to the rather small area. To compare the catchments, it would be fine to present also maximum pixel values – I guess that the ranking of the catchments would be very different in this case.

Fig. 2a: I guess that the non-zero correlations between the entire daily time series of ensemble members could be due to the seasonal distribution of daily precipitation totals. Thus, the correlation analysis for two main seasons (DJF, JJA) would probably prove the independence of data better than the presented one.

Fig. 2c: I do not fully understand why there is only one simulated total over 40 mm in comparison with REGEN and E-OBS but at least four of them in case of HYRAS. I guess that the simulated precipitation is the same for all datasets, so there should always be three marks at the same height in the graphs here and in S2.

Fig. 4: I find these results really interesting because extreme floods at Rhine, Weser and Ems usually appear in winter. Thus, it would be interesting to compare the monthly distribution of simulated extreme events with the monthly distribution of historical events, if there are data for this at least for some basins (it would be particularly interesting for the Rhine basin, where less extreme events extend into the cold part of the year).

Fig. 8: I agree that the differences between MEPEs and LEPEs in 500 hPa geopotential height and SLP are less significant for Elbe, but what about the horizontal gradients of these variables? This is in my opinion much more important factor influencing the extremeness of subsequent precipitation.

Technical comments:

Terms “database” and “dataset” should be written as single words in my opinion.

If more than one MEPE or LEPE is considered, I recommend to use the abbreviations in the form MEPEs or LEPEs, respectively.

I. 20: “when” should be written instead of “where”;
I. 285: “known” should be written instead of “know”;

I. 432: “catchment” should be written instead of “catchments”;

I. 479 and 481: “on the day” should be written instead of “at the day” in my opinion;

Caption of Fig. 3: I suggest to mention already at the beginning of the caption that it is for all MEPEs but only in Danube catchment.

Caption of Fig. 5: Because it is rather long, I would prefer if you start with a general sentence like “Composites of atmospheric conditions 12 hours after MEPEs started in the Danube catchment”, followed by detailed description of individual maps.

Fig. 6: The color scale should have the same intervals as in Fig. 5a.

Please, check titles of all referenced journals if they are correctly written (l. 656 – Monthly Weather Review; l. 631 – Quarterly Journal of the Royal Meteorological Society should be without the subtitle).

Final comment: because the supplement is online only, it could be longer – readers would certainly appreciate graphs and maps for all considered catchments.