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Comment on nhess-2022-225

Anonymous Referee #1

Referee comment on "A multi-disciplinary analysis of the exceptional flood event of July 2021 in central Europe. Part 2: Historical context and relation to climate change" by Patrick Ludwig et al., Nat. Hazards Earth Syst. Sci. Discuss.,
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The manuscript by Ludwig et al. is part II of two papers discussing an exceptional flood event in 2021 in Central Europe. Part II's goals are manifold: it discusses precipitation and discharge records and valley morphology in historical context and potential future flood events in storyline and in projection approaches. The paper is interesting to read. But it is also very long, sometimes a bit difficult to read, and it is not obvious what is the new take-home message. The manuscript seems to have taken advantage of perspectives, methods, and simulations available at the Karlsruhe Institute of Technology and merged them into one text. This is my main concern. The manuscript should better explain

(a) why precipitation, discharge, and valley morphology are discussed in one paper and what is to be learned from this (it discusses these aspects more or less independently),

(b) why the future climate is discussed with PGW and with high-resolution projections (KIT-KLIWA), but the discussion of advantages and disadvantages concerning telling something about floods in Central Europe is lacking ("KIT-KLIWA ... confirms the CC-scaling" is about all; are the PGW experiments needed if anyway only the well-known C-rates are applied to obs. data in runoff simulations?), and

(c) what can be learned for other catchments worldwide (concerning climate change, land use, methods or whatever - why a scientific paper and not a report?).

In some places the wording should be clarified, or minor mistakes corrected:

line 16: "scales to first order"? Does it mean it is between 1/10 and 10 times the CC-rate?

l32: "Europe in the last half-century" - last 50 years?

l35-39/40 could be deleted.

l55: perhaps "A key aspect is a deeper analysis of the 2021 flood event taking a ... perspective"?

l73: "GCMs (usually 100 to 200 km)" should be more specific. HiResMIP or paleMIP models have very different grid spacings.

l94: PGW is also imprinted on the lateral boundary forcings, I assume?

l171: "Therefore, ..." - please explain

l210 vs l747: GWL of present-day is 0.46 K or 1.09 K

l265: It should be better explained why you can assume that the LAERTES-EU data provides independent 12500 years of data?

l298: "in total" - delete?

Fig 3: bubble 13 cannot be seen.

l372: "However ..." - this is a statement for the conclusion

l655: "The second type ... scaring ... changing the boundaries ...". Please, reformulate.

l703: "precipitation intensities" or do you mean the daily mean amounts discussed above?

l722: "... found no observed ..." - observed but not found?

l772: "basically" - reformulate, please

l786: here you refer to the spatial information in the PGWs not used in the hydrological modelling? In what respect shall the new simulations help? In understanding the 2021 event?