

Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC1  
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## Comment on nhess-2021-93

Anonymous Referee #1

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Referee comment on "A climatology of sub-seasonal temporal clustering of extreme precipitation in Switzerland and its links to extreme discharge" by Alexandre Tuel and Olivia Martius, Nat. Hazards Earth Syst. Sci. Discuss.,  
<https://doi.org/10.5194/nhess-2021-93-RC1>, 2021

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### General comment

Tuel and Martuis 2021 analyze gridded precipitation data sets with regard to the clustering of days with high precipitation sums and assess the impact on flooding in 93 Swiss catchments. It is an interesting study that has the potential to become a valuable contribution to flood hazard research. However, there are a few points that need clarification. In the following, a list of comments that should be addressed before the manuscript is considered for publication.

### Major comments

#### Comment 1: Title

"...and its impact" As far as I can see, you only assess the importance of clustering with regard to streamflow peaks. What are the other impacts? In the discussion you mention "surface impact", but still do not specify.

#### Comment 2: Persistent floods

For large parts of the manuscript, I was not sure what you mean by 'persistent floods'. Please consider to explain this earlier in the manuscript (introduction?) with one or two sentences. The definition only is given in section 2.2.3, but the term is used a couple of times before already. Furthermore, I am a bit confused about the definition itself. I did not fully understand it yet, I think. The 99th percentile means that 1 % of the values/days get selected. Doesn't it on an annual level mean that (depending on how you estimate the percentiles; how do you sample them by the way?) you only have 3-4 flood days per year? How can there then be 10 flood days in a 30 day period then? And how is it possible that  $L < N$ ? Isn't  $L$  a time period in days and  $N$  the number of flood days in this time period? Please clarify. Another question in this regard: When does a year start and end in your case? Do you consider the hydrological year for Switzerland? Consider to change the section title in 2.2.3 to 'Persistent flood events'. Is there a specific reason why you choose the 99th and the 95th percentile? You refer to these events as 'floods'. However, runoff above the 95th percentile on an annual basis does not necessarily cause flooding. On 5 % of the days this value ( $\sim 18$  days every year) is crossed, right? Please consider to

pick up this point in the discussion section.

### **Comment 3: Catchments**

I am somehow missing a better overview on the catchments investigated. Something like a table (or overview graph?) summarizing information on gauge locations, names, catchment areas, discharge data availability,...Please provide more information on how you selected this set of catchment? Why does it fit to your type of analysis? Why do you need catchments with glacial, nival and pluvial regimes? Also I do not see what time frame was considered for the different watersheds. It is a bit confusing that in Fig.1 DEM and catchments have both black lines as boundaries. Also some catchments reach outside the DEM/Switzerland. There the DEM does not cover. River gauges usually are marked with reversed triangles, I think. Maybe you can color the catchment areas according to their mean elevation?

### **Comment 4: Comparison precipitation data sets**

The comparison of different gridded data sets is an interesting point of your study and should be already mentioned in the objectives at the end of the introduction. I think it could be interesting to see maps of Ripley's K value (Fig. 6 with K on grid level) of the different data sets in their original resolution. Please consider to try such a figure.

### **Comment 5: Scheme for methods**

In my opinion, a scheme depicting your approach on how to detect temporal clusters in precipitation/discharge would help the reader to understand the methods faster and easier. Please explain in more detail how you calculate percentiles on a monthly basis for precipitation. Do you take only days with rainfall into account or all days (also the days with no rain)? I do not really get the selection of timescales presented Page 4 Line 123. Please consider to extend the explanation on the timescale 5-15 etc. Also consider to compare your precipitation clusters to regular precipitation accumulation periods presented in Froideveaux et al 2015: <https://doi.org/10.5194/hess-19-3903-2015>. What is the difference? Is the performance in explaining flooding better?

### **Comment 6: Structure**

There is a bit of a mix between results and discussion, I think (see specific comments). The structure of the discussion could follow the result section. Would make it easier to read, I think. In the discussion, you focus a lot on physical interpretation (4.1). However, I am not sure whether your study provides enough new information that allow to support/challenge any of those hypothesis. There is no need to remove it, but maybe focus more on the discussion of your actual analysis. In line 291 and following you discuss flood risk. You do not address exposure and vulnerability at all. You only provide information on the hazard component, I think. Please specify what new insights your study provides with regard to flood hazard. Fig. 13: Please provide information on this in the method section, present in results and discuss later.

### **Specific comments**

Page 1 Line 9: "...magnitudes decrease more slowly after clustered events"

Compared to what other type of events?

Page 3 Line 70: "[...] scale of  $\approx 1000 \text{ km}^2$  catchments covering the whole of Switzerland."

How many catchments? Please consider to rephrase this sentence.

Page 3 Line 72-73: This description of the outline is not necessary in my view. You follow the typical structure and section titles are clear.

Page 3 Line 81: "63 catchments"

It is 93, right?

Page 4 Line 104: remove "as"

Page 5 Line 140: Please consider to add the subsection 3.1 Seasonality of heavy precipitation and floods at the catchment scale

Figure 2: What are panels a-d? Please clarify in figure caption.

Page 5 Line 145: "Extreme precipitation events"

60 % of precipitation events means that 60 % of the values above the 99th percentile are located in a season, right? Please consider to explain again what your definition of 'extreme precipitation event' is.

Page 5 Line 148-154: This is discussion already, I think. Please consider moving this information into the discussion section.

Page 6 Line 2: [...]due to heavier?

Page 6 Line 159: "combination of saturated of frozen soil"

Where can I see this in your analysis? Please focus on the presentation of your results here and discuss later.

Page 6 Line 160: "floods"

Values above the 99th percentile are not floods. Isn't high runoff values better?

Page 6 Line 162: Where is the "Ticino area"?

Page 6 Line 165-168: Please consider to move this paragraph into the discussion section. Focus on your results here

Fig 4 and 5: You have a lot of figures. Isn't it possible to combine those to figures? E.g., significant areas full color and not significant one stripes?

Page 6 Line 183-184: Please consider to move this into the discussion section. Focus on the presentation of your results here.

Paragraph 3.2

I find it hard to read this paragraph. The metrics used should be described in the method section already. Why do you select those metrics? You jump a lot between figures here, I think. Please try to organize the result sections better, so it is easier to follow.

Page 7 Line 207: "Unsurprisingly"?

Page 7 Line 209: Start new sentence here.

Page 7 Line 214-216: Please concentrate on the description of your results here. Discuss later.

Page 7 Line 219: "20-30 %"

This seems low to me. What about the rest?

Page 7 Line 220: "The occurrence [...]"

Move to discussion?

Page 8 Line 221-225: This is a key sentence of your study, I think.

Page 8 Line 240: What is "IVT"?

Page 8 Line 249: What is "PV"?

Section 4.2 title: Replace "flood risk" with "flooding"?

Page 9 Line 264: Where do you show the analysis on "major floods"?

Page 9 Line 266: "runoff regimes at lower elevation"

You mean pluvial-type rivers? Rainfall-dominated? You say rainfall is important in rainfall-dominated rivers?

Page 9 Line 184: needs to be focus of further research?

Page 10 Line 300: Why is the same water level in winter more damaging than in summer?

Page 10 Line 307: "Clustering is most significant over the Alps in winter."

Why?

Figure 9: How/Why do you calculate the average cumulative precipitation quantile?

Figure 10: Describe panel b) in figure caption.