Major comments

We thank the reviewer for their helpful comments that helped to improve the clarity of the paper.

Comment 1: Title

I didn't get how the cluster events are identified (section 2.2.2). The authors cite Kopp et al 2021, which I looked at, but actually I still don't fully get it. Anyway this is an important variable of the study and I think the article should be self-sufficient.

We suggest rephrasing this important paragraph as follows: "*We identify extreme precipitation cluster events over 21-day time windows with the algorithm of Kopp et al. (2021) (see their Figures 3 and 4). Starting from the declustered binary extreme event series, the first step is to calculate the 21-day moving sum of extreme event counts. In a second step, we select the 21-day period with the largest event count (i.e., the highest number of extreme events), if that count is larger than 2. Otherwise, no clusters are found and the algorithm stops. In the case of multiple 21-day periods with the same extreme event count, the one with the largest precipitation total is selected first. In the third step, we remove from the binary event series the extreme events that occur in the selected 21-day period. The algorithm is then run again from the first step onwards to identify the next cluster event. This procedure avoids any overlap between cluster events. The choice of the 21-day time window is well-suited to quantify clustering at sub-seasonal timescales, and is generally consistent with the length of observed cluster episodes that led to major floods in Switzerland (see introduction). Results do not differ significantly for slightly shorter or longer (2-4 weeks) windows (see also Kopp et al. 2021).*"

Comment 2

I got confused with the analysis of flood days: how is it possible to get 5 days exceeding the 99th quantile within 10 days (Figure 9)? This is very unlikely: there are on average 3.65 exceedances per year.

Daily discharge series exhibit strong autocorrelation, particularly in the extremes. This is due to the catchment response time being longer than that of precipitation. Exceedances of the 99th percentile are therefore not randomly distributed, and sequences of multiple exceedances over short time periods are not uncommon.

Comment 3

Finally, there are many figures for a quite short article. Some figures are little commented (e.g., those of section 3.3) and perhaps they could be omitted to make it more concise (not mandatory).

We suggest merging Figures 4 and 5.

Specific comments

title : « impacts » is confusing because it relates to social sciences

We propose "*A climatology of sub-seasonal temporal clustering of extreme precipitation in Switzerland and its links to extreme discharge*".

l 38 and others: Tuel and Martius 2021 is in review so I coulnd't check

The paper was just published in Weather and Climate Extremes and is available at https://www.sciencedirect.com/science/article/pii/S2212094721000426.

l 111 : please consider explaining the declustering procedure (and its goal) in short

We suggest expanding this sentence as follows: "*As the individual weather systems associated with extreme precipitation may sometimes last for several days, we remove the short-term temporal dependence in the occurrence of extreme precipitation events by applying a standard runs declustering procedure (Coles 2001) with a run length of 2 days, well-suited for Switzerland (Barton et al. 2016). The goal of the declustering is to remove short-term dependence and to identify independent events. This procedure is for example applied prior to a peak-over-threshold statistical analysis. The declustering merges extreme events that are separated by less than 2 days into a single event.*"

l 124 : « at least half of the n values » : is it the same « n » as the window size above ? (I don't think so). Do you consider all time scales between e.g. 5-15 days ? (i.e. 5, 6, 7, … , 15 days)

It is not the same "n" and to avoid confusion we suggest replacing the variable by "w". As you say, for each time interval, we do look at all values in the interval. To make that clearer we suggest the following revision: "Clustering significance is assessed for two intervals of *w* values, characteristic of sub-seasonal timescales: 15-25 and 25-35 days. Clustering is said to be significant for a given interval if it is significant for at least half of the *w* values in that interval."

all of section 2.2.2 : unclear to me even with Kopp et al. Please clarify.

We suggest the following revision to make this part easier to follow: "*We identify extreme precipitation cluster events over 21-day time windows with the algorithm of Kopp et al. (2021) (see their Figures 3 and 4). Starting from the declustered binary extreme event series, the first step is to calculate the 21-day moving sum of extreme event counts. In a second step, we select the 21-day period with the largest event count (i.e., the highest number of extreme events), if that count is larger than 2. Otherwise, no clusters are found and the algorithm stops. In the case of multiple 21-day periods with the same extreme event count, the one with the largest precipitation total is selected first. In the third step, we remove from the binary*

event series the extreme events that occur in the selected 21-day period. The algorithm is then run again from the first step onwards to identify the next cluster event. This procedure avoids any overlap between cluster events. The choice of the 21-day time window is well-suited to quantify clustering at sub-seasonal timescales, and is generally consistent with the length of observed cluster episodes that led to major floods in Switzerland (see introduction). Results do not differ significantly for slightly shorter or longer (2-4 weeks) windows (see also Kopp et al. 2021).
We then characterize clusters of precipitation extremes with two metrics related to their potential impact. The first is the average contribution of cluster periods to seasonal precipitation. This contribution increases with the frequency and total precipitation of cluster periods. The second metric is the frequency of cluster periods during extreme 21-day precipitation accumulations. It gives an idea of how often cluster periods are responsible for extreme precipitation accumulations, a frequent trigger of flood events in Switzerland (Froidevaux et al. 2015)"

section 2.2.3 « flood days » may be confusing → heavy discharge days ?

Indeed, the word "floods" was confusing and we replaced it by "extreme discharge" throughout the paper.

l 138 : I guess (L,N) should be (N,L)

The order was indeed reversed – now corrected!

l 141 : please add a subsection here
l 148 « This seasonality… end of paragraph → please consider moving it into the discusion section

We moved this paragraph away from the results section since it was essentially a discussion of already existing knowledge, illustrated by Figures 2 and 3.

l 160 : « floods are rare » : it's actually hard to tell because the color scales are different in Figs 2 and 3. Please consider merging these two figures and using the same color range.

We now use the same color range for the two figures (0-100%).

Section 3.2: I missed it because I didn't get the definition of clusters

We hope the proposed revision for section 2.2.2 is now clear enough.

l 227 : « not very different between clustered and non-clustered extremes » : actually the y-scales are different and we can read quite different values for the two cases (about 0.7 vs 0.4). Please consider using the same y-scale.

The comparison between clustered and non-clustered extremes should be done on each panel separately (the two panels correspond to different daily discharge thresholds: 95th and 99th percentiles).

l 267 : « runoff regime » : please clarify

We refer to pluvial regimes here, which we will specify in the revision.

l 61 : brackets

Corrected.

l 81 : 63 → 93

There was confusion about the catchment number in the original manuscript. We suggest making it clearer that we are using two distinct sets of catchments: a hydrological partitioning of the whole of Switzerland that includes 63 (not necessarily gauged) catchments, and one with 93 gauged catchments which we use in the discharge analyses. The reason why we use these two sets is that the second does not cover the whole country. For completeness and to make it easier to compare results of the clustering and discharge analyses, we will add figures to the appendix showing the clustering results for the 93-catchment set. We added a subsection to the data section to highlight this point:
"*We average RhiresD data over a hydrological partitioning of Switzerland that consists of 63 catchments with a mean area of 900 km^2 (see Figure 4). Catchment-scale aggregation is useful to identify the occurrence of high-impact heavy precipitation events, and also to smooth RhiresD data to a lower resolution more consistent with its effective resolution. Though we could also use the set of 93 gauged catchments, this set does not cover the whole of Switzerland. Consequently, we opt for a countrywide partitioning of 63 larger catchments (for which no discharge observations are available). To be comprehensive and to help with the comparison of results, we also show in appendix the results obtained for the 93-catchment set.*"

l 82 : smooth

Corrected.

l 104 : as as

Corrected.

l 105 « all-day percentiles » : confusing to me all-day // monthly

'all-day' meant that the percentiles were calculated from all the days in the corresponding month and not just from the wet days. We can reformulate as follows: "*For each dataset,*

precipitation extremes are defined on a monthly basis as days when daily accumulated precipitation exceeds its 99th percentile of the corresponding month. For instance, January precipitation values are measured against the January 99th percentile. The percentiles are calculated using all days (both with and without precipitation)."

l 160 « floods » → please specify « in Jura »

Good point.

l 240 : IVT acronym

Sorry for that oversight. IVT stands for 'Integrated Vapour Transport'. We propose to reformulate the sentence as follows: "*During winter, extreme precipitation events in northern Switzerland usually occur in connection with extreme integrated water vapour transport with convergence onto the orography, for instance linked to atmospheric rivers.*"

l 263 flood risk → hazard

Good point.

Fig 1 : please locate Ticino, Jura, … (also all the Swiss maps are elongated)

All figures were updated with a Mercator projection. We also added a second panel to Figure 1 showing Switzerland's main geographical regions referred to in the main text: Jura, Plateau, Alps and Southern Alps (and we now avoid referring to the "Ticino region"; instead we talk about the Southern Alps).

Fig 2 , 3: please specify the seasons a,b,c,d

Sorry for the oversight, the captions should include (a) DJF, (b) MAM, (c) JJA and (d) SON.