

Reply to RC1

We thank the referee for his/her review and constructive comments. Original review comments are shown in **black** while our replies are provided in [blue](#).

This paper studies drivers of flooding and flood change in the Geul River catchment (Netherlands). Better understanding the drivers of flood change is a very topical subject and this paper produces a useful contribution on this topic. It especially stands out by providing a more in-depth insight than many large-sample studies (involving many catchments at once) have managed to provide on this topic, while still providing methodologies and insights that can be more widely adopted in understanding drivers of flood and flood change. However, at the same time, the paper seems to suffer from one major issue. I personally recommend the publication of this after this can be addressed meaningfully.

“Major comments”

The consideration of antecedent wetness as a flood driver relies on a threshold API value (exceeding 1). This API index is based on antecedent precipitation and does not take any evaporative processes into account. The latter seems somewhat problematic as soil wetness in this region tends to be very seasonal (as ET is low in winter and high in summer) which very likely causes the strong seasonality in maximum flow and flood events (see e.g. Figure 3) but which is not visible in any of the considered flood drivers. Therefore it seems that the importance of soil wetness does not reflect soil wetness in this paper, but reflects relative wetness compared to what is normal for that part of the season (which is not relevant to the study?). This problem likely causes a strong bias in all results and thus the overall conclusions.

[Answer:](#) The primary concern highlighted pertains to the exclusion of evaporative processes in the Antecedent Precipitation Index (API) utilized for evaluating initial catchment conditions. The simple question is: “Is API a reliable indicator for soil wetness for this study region year-round, or is its meaning seasonally dependent?”. To investigate this, the simple 30-day before an event effective rainfall (precipitation minus potential evaporation from the Maastricht station) was calculated instead of the simple API, and Fig. 5 from the manuscript was reproduced (see Fig. R1 below), expressing Q_{\max} in mm/day this time.

Larger offsets are visible in the summer half-year events and the overall correlation is low (as in the initial analysis), however, the correlation between the P_{99} and P_{MD} events and the Q_{\max} (purple markers and reported correlation value) is maintained (Fig. R1), which is in line with the original analysis. Only 7/49 Q_{\max} events occurred in summer and 6/7 summer Q_{\max} events are in the P_{99} and P_{MD} events, so the calculated correlation includes them. In addition, the top five floods remain “higher” compared to other events. Thus, we believe that our main conclusions are not biased. We will include this analysis in the revised version of our manuscript.

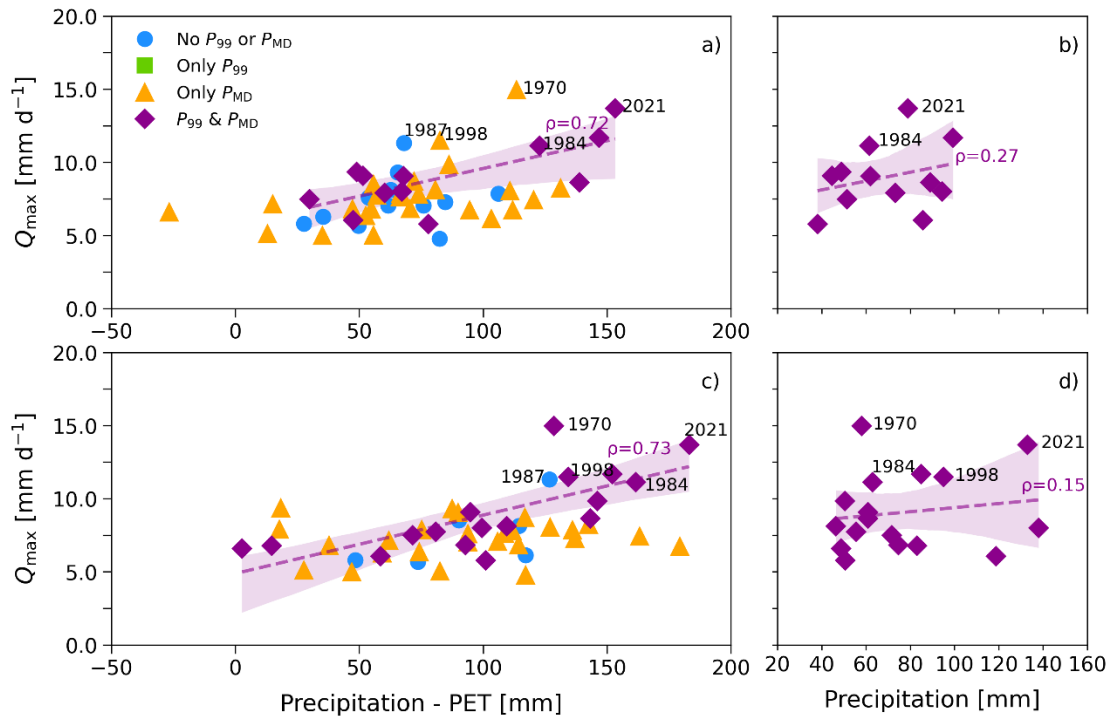


Figure R1 Annual maxima events (Q_{max}) and their 30-day pre-event effective rainfall at Maastricht (a) and Vaals (c), including their preceding extreme indicators. The top five floods during the study period are shown with their year of occurrence. The dashed purple line represents the linear fit, using the least squares approach, between the effective rainfall of the high flow events preceded by P_{99} and P_{MD} and their respective Q_{max} values. The total (four-day) precipitation versus Q_{max} is also presented for these events at Maastricht (b) and Vaals (d). The shaded area shows the 95% confidence intervals for the fits and the Pearson's correlation coefficients (ρ) are also reported.

“Minor comments”

- It seems like the statement “Results suggest that extreme 24-hour precipitation cannot solely lead to floods.” is unlikely but not physically impossible. Therefore, I recommend rephrasing “cannot”.
- L15: “Unprecedented precipitation” seems like a bold statement when it’s not specified for example since the observational record started, or some clause that determines the period over which we talk.
- L33: this statement could, in addition, be supported by some other publications that show the importance of antecedent wetness in other places.
- Fig 2. Check the label of “Feb”.
- L144: “all-4day” misspelled?
- I’d recommend (but maybe this is just personal taste you can ignore) to start the results paragraph with a sentence that summarizes the result. This would make it easier for a reader to focus on when reading the details in the figure that follows. This essentially applies to each new paragraph in the results.

Answer: We thank the reviewer for the several minor comments. These will be addressed in a point-by-point response whilst preparing a revised version of our manuscript.