

Interactive comment on “The role of flood wave superposition for the severity of large floods” by Björn Guse et al.

Anonymous Referee #1

Received and published: 19 September 2019

This paper analyses flood wave superposition at 37 confluences in four large river basins across Germany and assesses its role in the severity of flood events. It concludes that flood wave superposition is not the driving factor in the severity of floods for most basins analysed in this study.

Overall, I found the paper to be well-written, with a clear set of well-justified analyses supported by some nice figures. The work represents a useful contribution to better understanding the processes that shape the severity of floods across Germany and Austria and I am looking forward to the future work identified by the authors in the conclusions of their study (particularly in terms of different storm tracks which I think would add a lot to this study).

I have some suggestions to improve the reproducibility of the study (so that other re-
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searchers could more easily apply the methodology to other regions) and strengthen the discussion section of the paper. I also noticed that there is no ‘data availability’ or ‘code availability’ sections at the bottom of the paper - the dataset could be a useful resource for other researchers, can you clarify whether the annual maximum flood series could be made available for each of the gauges or if they are available already?

Please see my more detailed comments below:

Main Comments

1. Section 2.2 – there are a lot of methodological choices in this section that are not well justified/explained. For example, why choose 2% as a threshold for the tributary catchment size? How did you define ‘a close distance’ between the three gauges (Line 12-13) – did you set a threshold, what is the greatest distance you allowed? This needs to be better justified as these catchment choices affect your results and also affects the ability of other researchers to reproduce your methodology.

2. I had to re-read Section 3.1 quite a few times to understand exactly how you derived the flood peaks – it would be useful to include a figure which shows an example of event start point, end point and corresponding maximum flows for each of downstream, upstream and tributary gauges (perhaps you could add this to Figure 3?).

3. While the results were well discussed in Section 4, there was almost no reference to the wider literature or discussion of the limitations. This needs to be strengthened for the paper to be published. In particular

a. How does this work fit in with the previous flood wave superposition studies you address in the introduction? Does your analysis agree with theirs?

b. The paper needs a broader discussion of the use of daily data for the analysis and how the results could change with hourly data – this is mentioned a few times throughout the text but is not discussed in detail

c. The applicability of the methodology to other regions – while I like the classifications,

they seem to be quite subjective. Did you use any quantitative thresholds/rules to assign these classifications or were they based on expert judgement from the plots you produced?

d. There is no recognition of the quality of the flow data or the discharge uncertainty in these results – the most severe flows can be heavily biased due to rating curve errors. It would be good to acknowledge this in the text as these impacts are gauge specific, vary significantly in time and could impact the results, particularly when ordering by event size.

Minor Comments

1. P3 L14 – I was confused by the ‘and data resampling’, do you mean data resampling of the catchment elevation? How was it resampled?
2. P12 L25. I think you should say here that ‘Flood wave superposition is not the major driver for flood peak occurrence downstream of most confluences analysed in this study’, as there may be other catchments where this is the case (and this is still a relatively small sample of gauges).
3. Figure 3 – It would be more useful to show ‘real examples’ from the flow timeseries for each of the four case studies rather than the stylised examples which are not overly clear.
4. Figure 4 – can you add a legend denoting the colours for the different time lags, you state in the caption that grey corresponds to zero lag, but it is not clear what the blue and red colours relate to. Alternatively can you add to the figure caption that blue means the tributary peak arrives earlier and red vice versa.
5. Figure 6 and 7 – what are the units for discharge? These should be included in the axis labels.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2019->

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