

***Interactive comment on* “Stochastic generation of spatially coherent river discharge peaks for large-scale, event-based flood risk assessment” by Dirk Diederer et al.**

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Received and published: 20 August 2018

At the request of the author I have copied a series of questions and answers from a private correspondence relating to the manuscript: Stochastic generation of spatially coherent river discharge peaks for large-scale, event-based flood risk assessment

Q1. You used 25 years of data to form the dependence. Do you think there are limitations from this? I.e. should we expect that there are many more types of events (footprints for instance) that will be missed and therefore, incapable of being represented in the model outputs? I often find people ask about this due to the interest in ‘black swan’ events.

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A1. We go beyond observations by extrapolation of values only. We do not go beyond in terms of footprint, since the statistics are applied to particular locations. We are planning to vary (and extrapolate) spatio-temporal footprints. We may address this in my next paper (precipitation) or the one after (compound).

Q2. As I understand it, you use the NR method to find peaks at individual sites. You then split the 25-year timeseries into 21-day bins, essentially taking the largest peak (or max non-peak if no peak is present) from all sites during that bin to represent that 'event' peak. This provides you with a consistent number of events per year that is defined by your choice in bin size (21 days in this instance). Does this mean that there is no minimum magnitude used when defining an 'event' at a given site in the observed data?

A2. The NR method is based on fluctuations, so does not yield events with a minimum magnitude (as POT does). - See the next question (or the paper again) for clarification on the procedure.

Q3. Linked to the above – is it likely that within an event bin there might be 2 independent storm systems leading to flooding, and given the method, result in i. spurious correlations, and ii. an underestimate of the number of independent events taking place?

A3. Per location: - When we apply NR to the 298 locations, we get a different number of events at each location. So we cannot cast all peaks into a matrix. To match the peaks: - We apply NR to each pixel in the network. - We track discharge waves (river basin events). - To the EU events (time windows) we assign entire tracked discharge waves, based on the first time entry of the event (in which time window it falls). - Per EU event we only keep the entire tracked discharge wave with the largest discharge value (somewhere). Cheating: - From EU events, we extract the peaks at the 298 locations. This yielded an incomplete matrix (see Table 1). - This means that per column (i.e. per location), we have to fill gaps with 'auxiliary' (dummy) values and drop peaks when

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there are multiple candidate peaks for an entry. - In my personal opinion (Dirk), unless statisticians come up with a way to handle incomplete matrices, this is a dead end for the combination of an event-based approach and descriptors (e.g. peaks) per location. Therefore, in my next analysis, I will not be working with descriptors per location.

Q4. You open with a discussion about the importance of antecedent conditions in flood event generation, but I am not entirely clear how that is represented in your model? If you do address this then you could really hammer this home as that seems to me to be something that these sorts of approaches often struggle with.

A4. We do not address antecedent conditions. Maybe we should drop the mention of it in the introduction, since we do not address it and we might be raising false hopes. Or maybe we shouldn't drop it, since I guess it is important enough to be mentioned. Let's see what the reviewers think.

Q5. Did you look at the role of seasonality in the dependence? Do you think it would make much difference to the results?

A5. - We do not address seasonality. - More generally, there is a full stationarity assumption, which can be challenged in many ways (seasonality, trends, human interference in the system, etc.). - We only focussed on large-scale, spatial dependence.

Q6. RE: defining marginal distributions - Does infilling the 'missing peaks' have an impact on the return period estimation of gauge timeseries? If so do you have any idea of how significant it might be? Also, was there much variation in the optimal marginal threshold across sites, and if so, do you think applying an individual marginal threshold to each site would make much difference to your results?

A6. - It does indeed affect the marginal distributions, and thus the return levels. We could analyse this effect, but the marginal distributions are not the main focus of this work. - Since we did not focus on the marginal distributions we just applied the marginal threshold by quantile. It could definitely be improved by finding optimal thresholds per

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location. - Just to mention, we filled the gaps to be able to capture the dependence structure. I think we would not be able to capture the (entire) dependence structure without filling the gaps. Therefore, the effect on the dependence structure would be very hard to analyse.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2018-231>, 2018.

