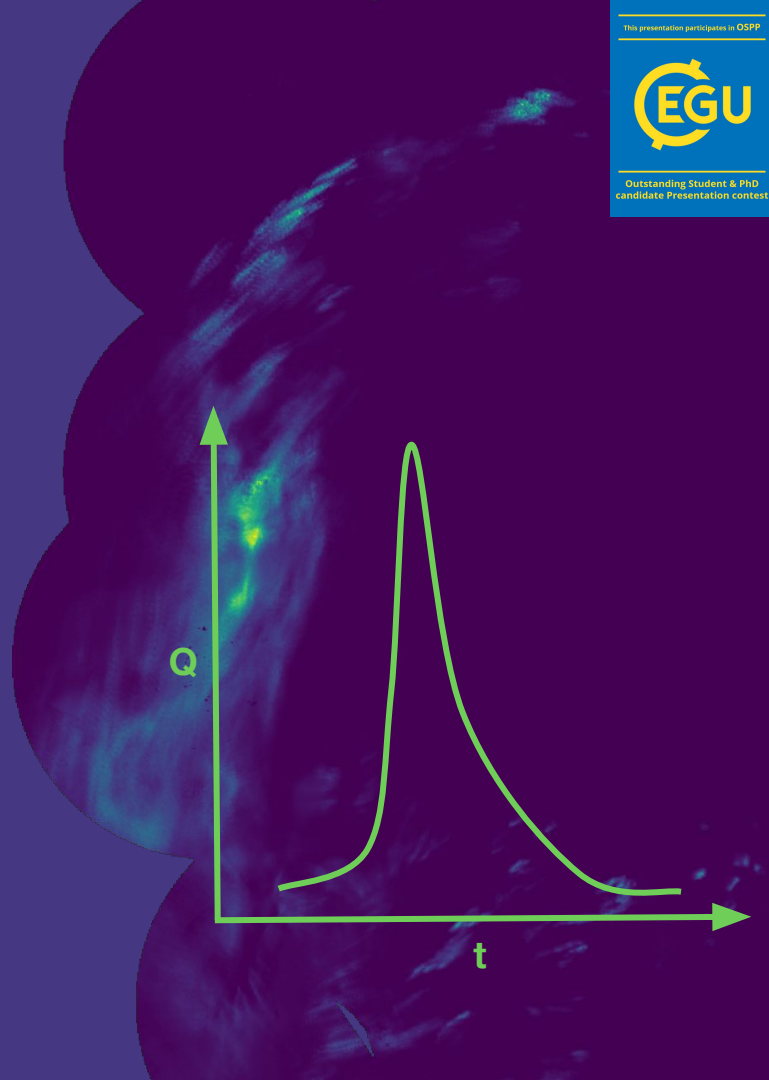
Downward counterfactual analysis of historical rainfall events in Germany

28 April 2023
Paul Voit, Maik Heistermann



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Natural Hazards and Risks in a Changing World
Universität Potsdam
DFG Deutsche Forschungsgemeinschaft

Motivation

HPE = **H**eavy **P**recipitation **E**vent

What if ….

- an **HPE** would have happened where I live?
- the impact of this **HPE** could have even been worse?

Fig. 1: Precipitation, “Bernd” 14 July 2021 17:50, RADKLIM

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Approach

Extracting historical HPEs from radar data (RADKLIM) using the xWEI[1]

Spatially moving historical HPEs to other locations and modelling quick surface runoff (flash floods)

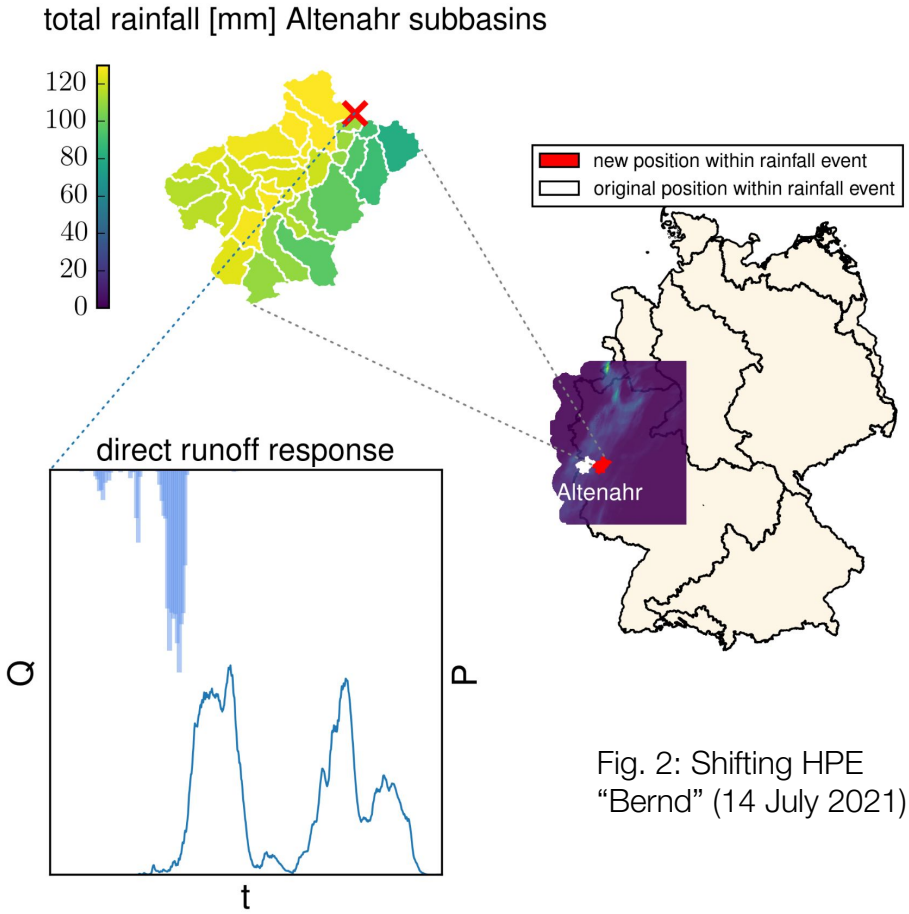

Fig. 2: Shifting HPE "Bernd" (14 July 2021)

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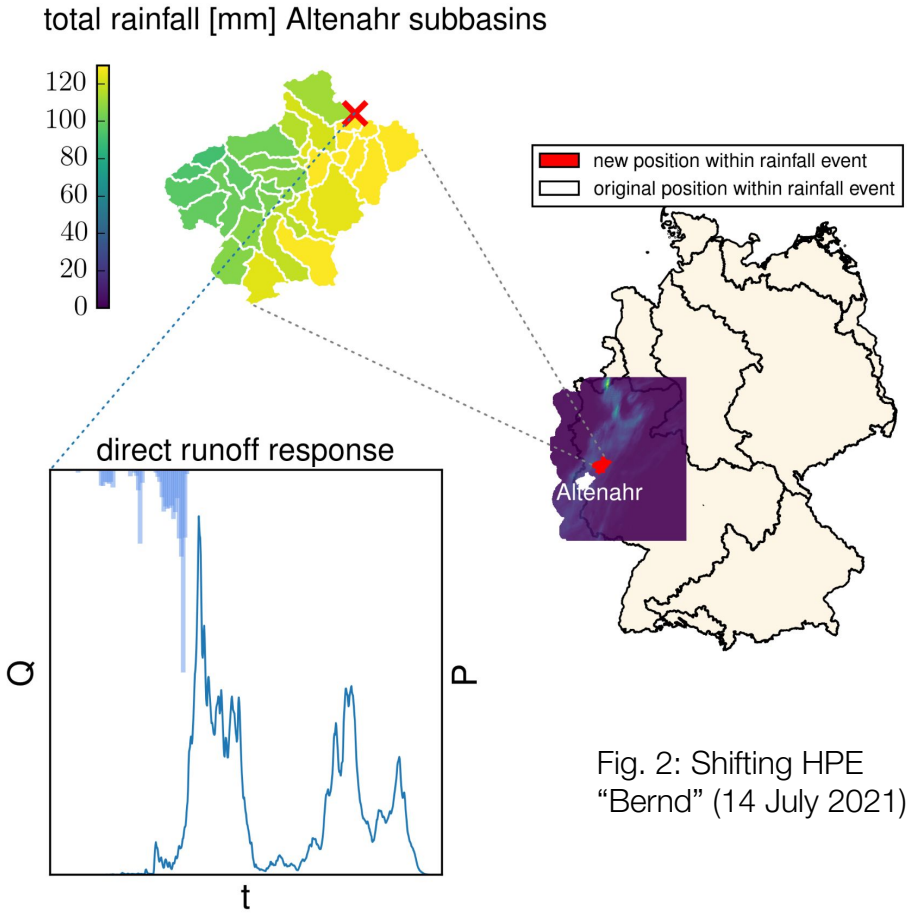

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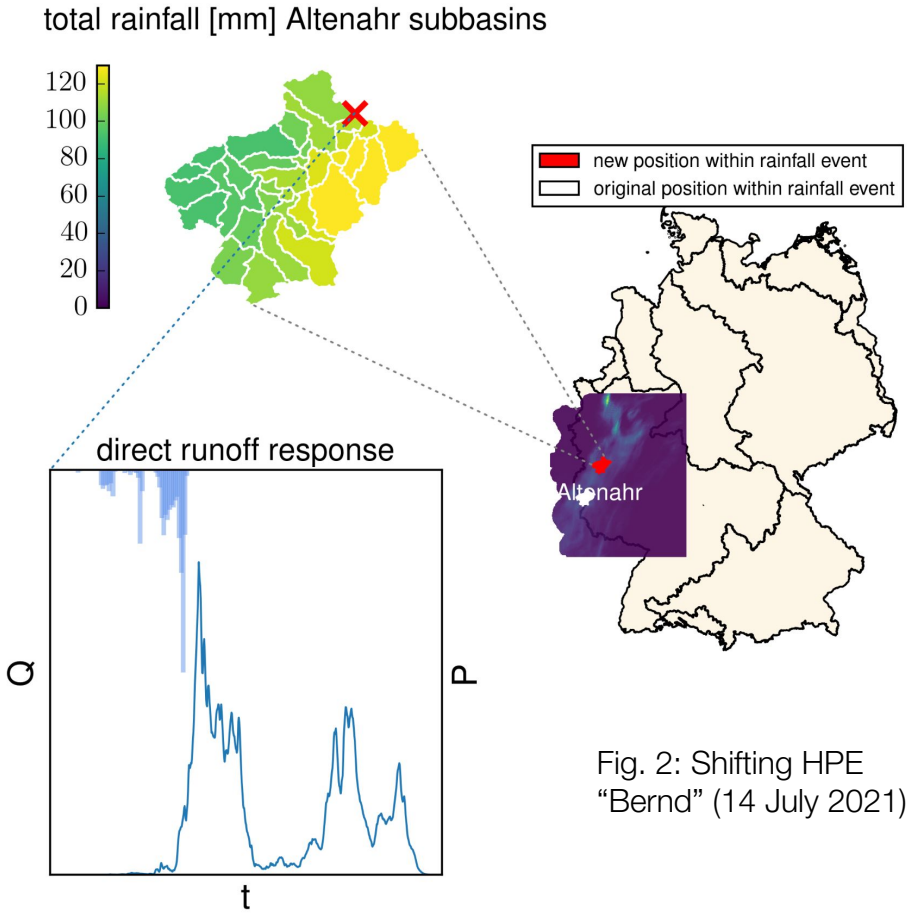

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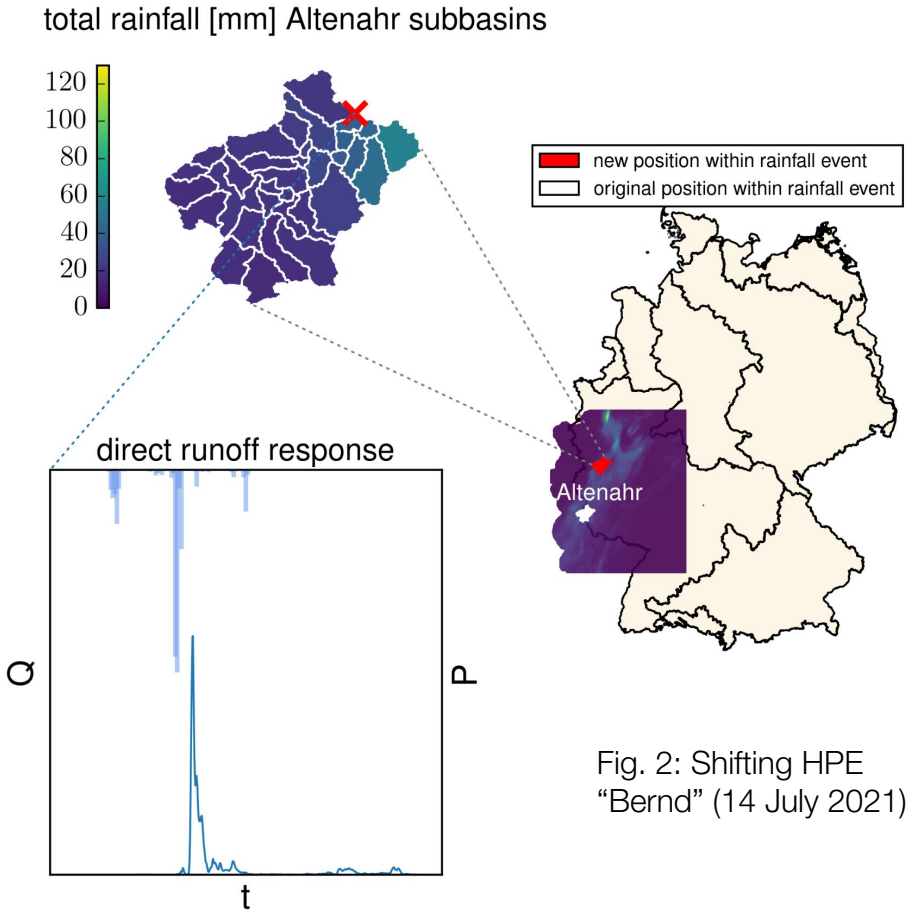

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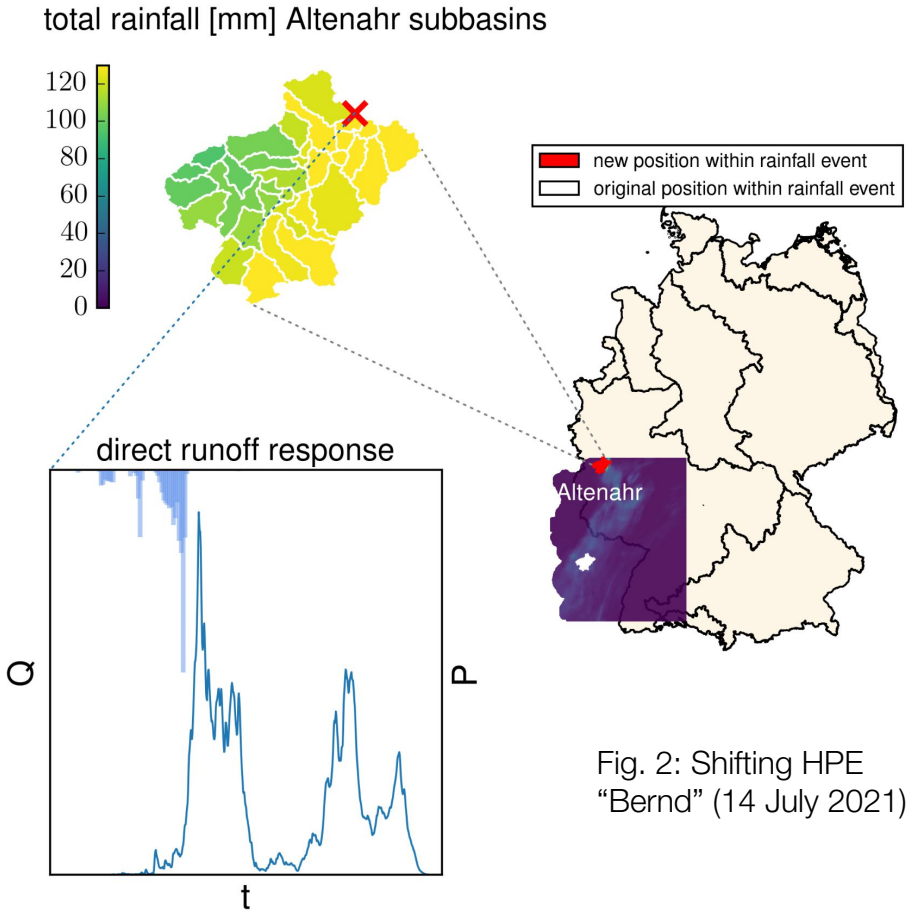

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Spatio-temporal characteristics of rainfall are decisive for peak discharges

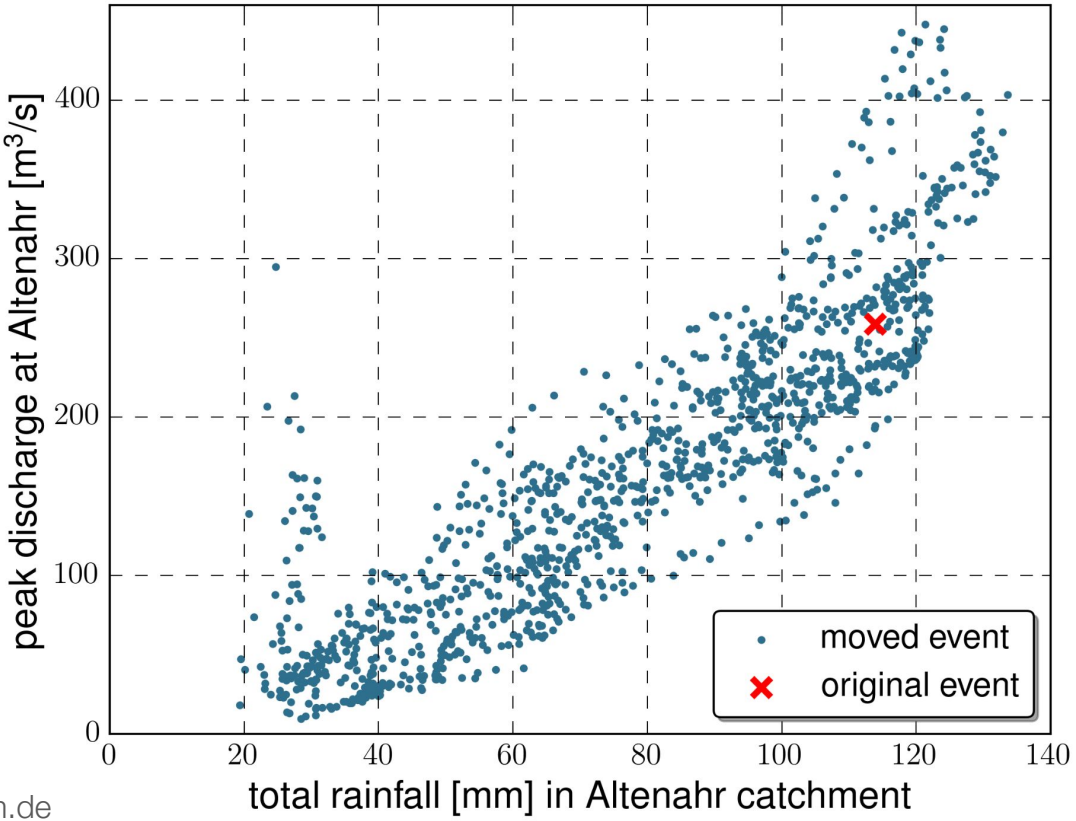

Fig. 3: Peak discharges at Altenahr for shifted rainfall event cases

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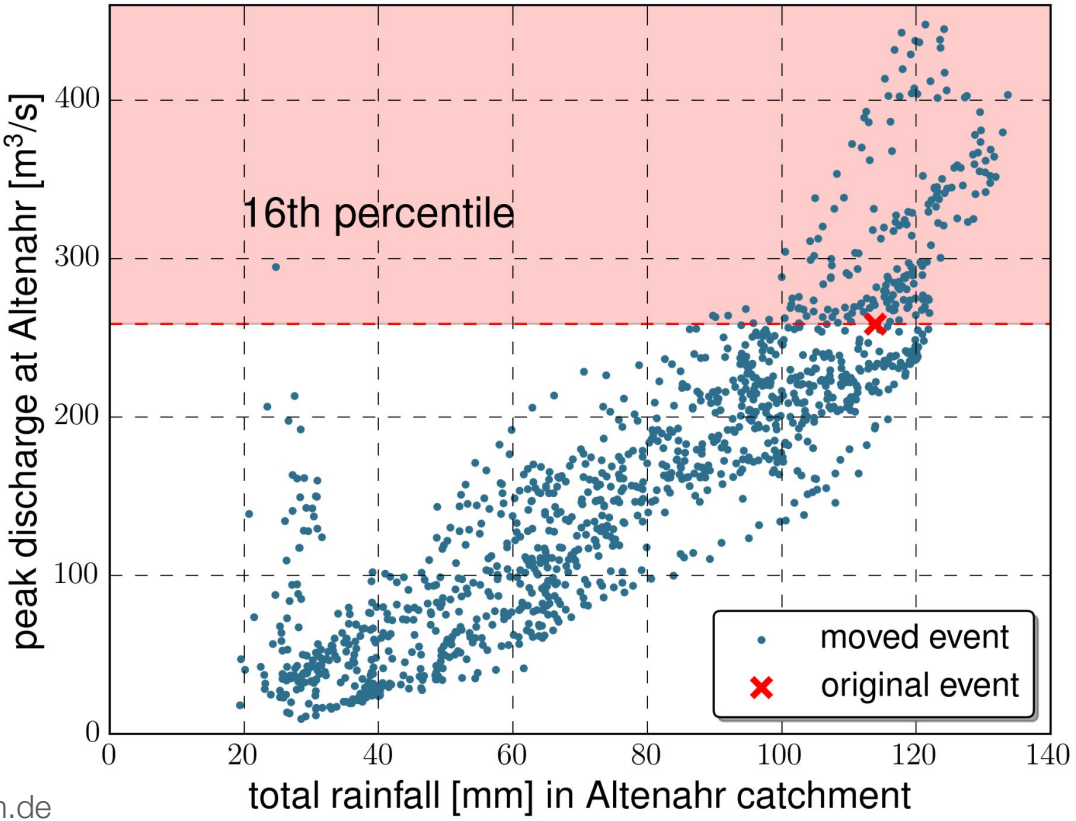
Model suggests that the impact in Ahrweiler could have been even worse



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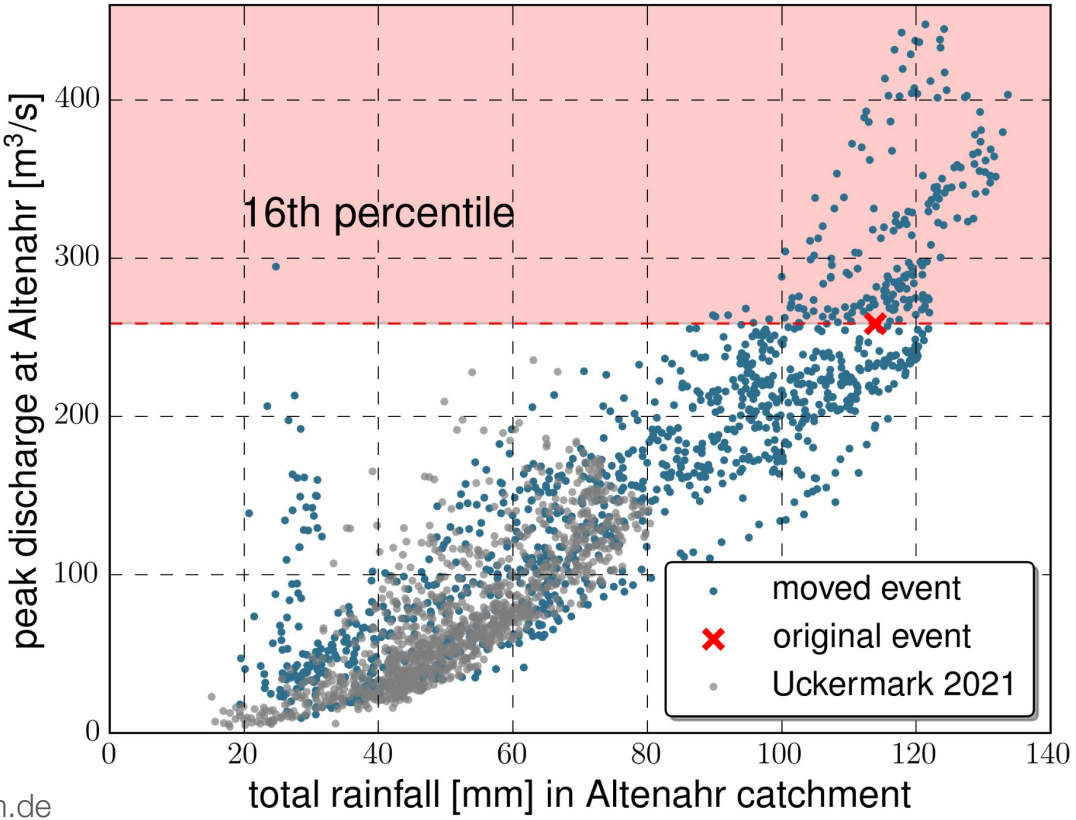
Moving another event to Altenahr catchment



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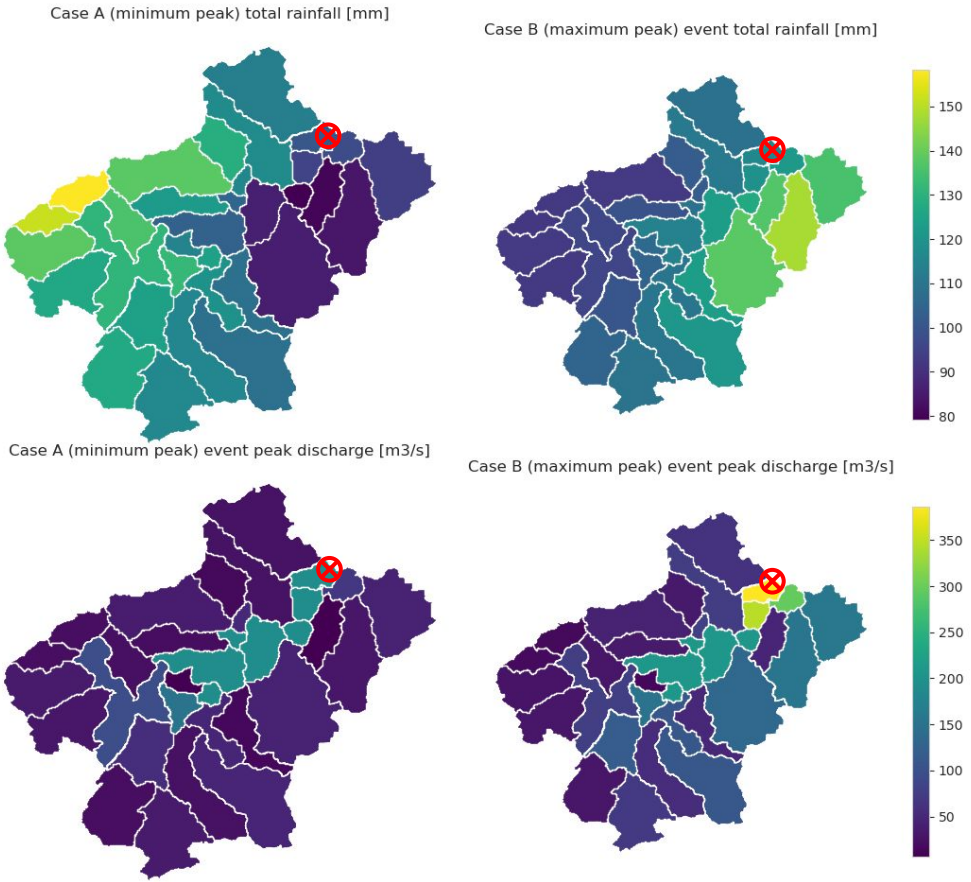
Different Peaks - same total rainfall



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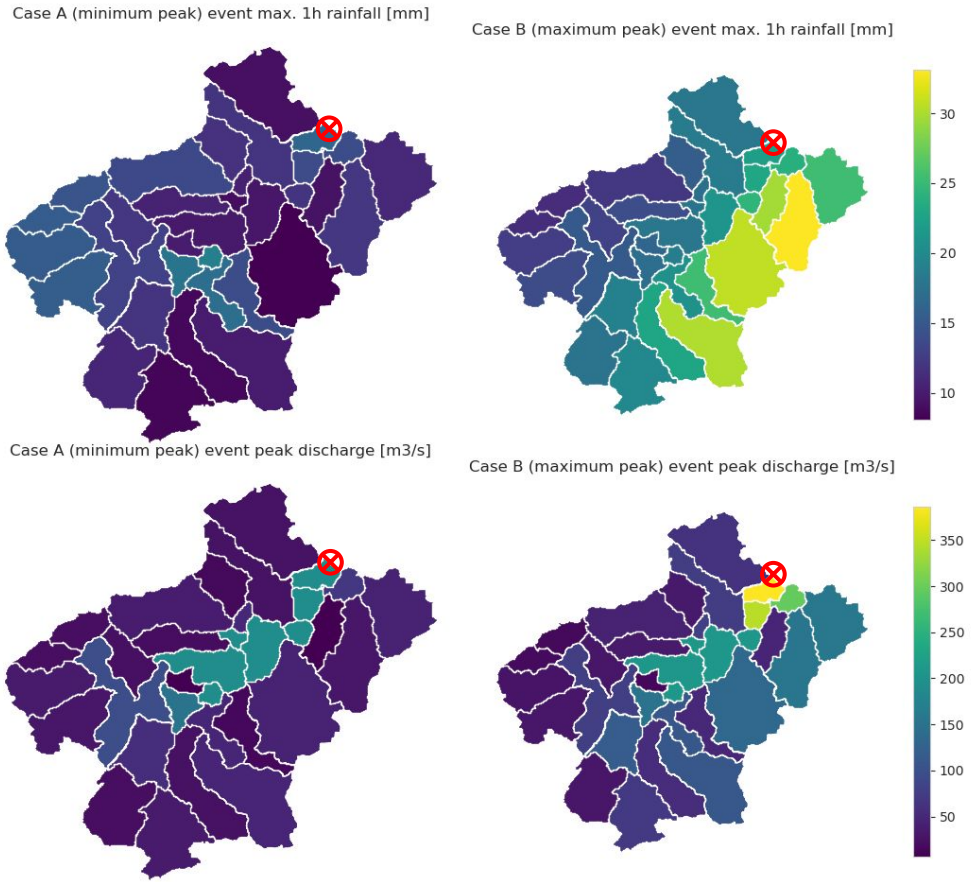

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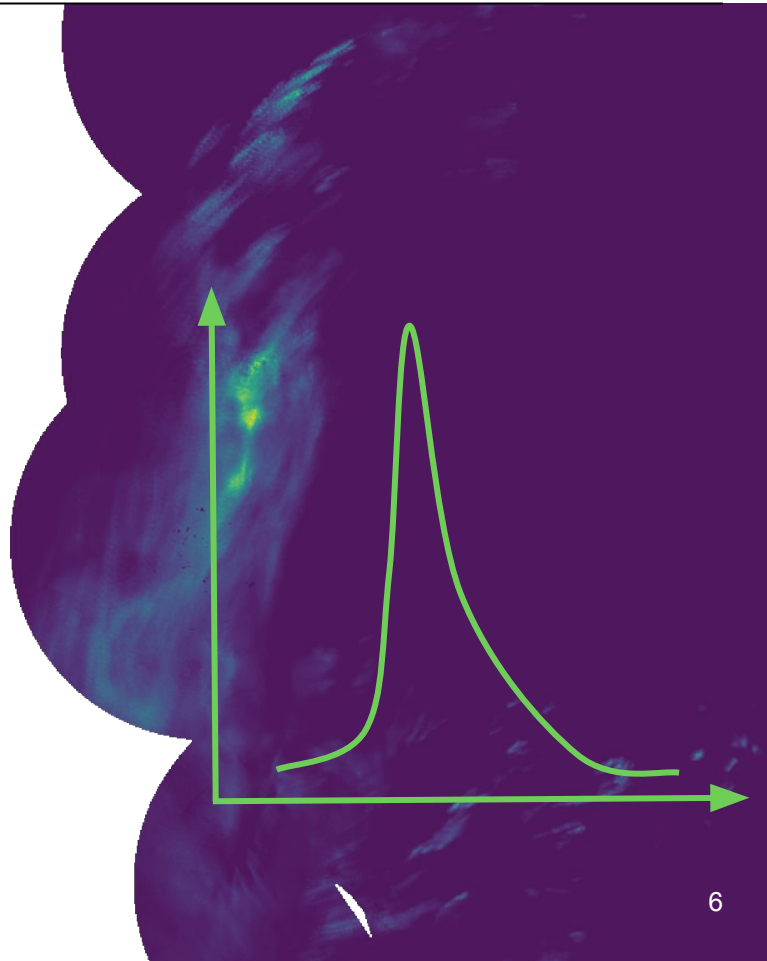
Application

- using historical HPEs as benchmarks for disaster risk management
- detect flash flood prone hot spots
- study the interactions between spatio-temporal characteristics of rainfall events and catchment characteristics



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Thank you!

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[1]Voit, Paul, and Maik Heistermann. "A new index to quantify the extremeness of precipitation across scales." *Natural Hazards and Earth System Sciences* 22.8 (2022): 2791-2805.

Lengfeld, K., Voit, P., Kaspar, F., & Heistermann, M. (2023). “Brief communication: On the extremeness of the July 2021 precipitation event in western Germany”. *Natural Hazards and Earth System Sciences*, 23(3), 1227-1232.