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Can we predict surface water flood damage by precipitation alone?

Daniel B. Bernet, Simona Trefalt, Andreas P. Zischg, Rolf Weingartner, and Olivia Martius

Institute of Geography & Oeschger Centre for Climate Change Research & Mobiliar Lab for Natural Risks, University of Bern, Bern, Switzerland (daniel.bernet@giub.unibe.ch)

In Switzerland, almost every second flood damage claim is likely not associated with a fluvial flood, but with a surface water flood. With increasing population and wealth along with climate change, we can expect that damages caused by surface water floods will increase further in the future. Nevertheless, relatively little is known about the drivers and influencing factors of this highly relevant natural hazard.

In order to increase the understanding and predictability of surface water flood damage, we focus on precipitation as the main driver of surface water floods. We analyze the characteristics of insurance claims' triggering rainfall events and test simple thresholds. For that matter, we exploit a data base of more than 13'000 damage claims, which were caused by surface water floods between 2005 and 2013 and which report at least the date and the exact location of the damage. The precipitation is inferred from a blended radar and rain gauge data set provided by MeteoSwiss that has a high temporal (hourly) and spatial (1 km x 1 km) resolution. For each grid cell where at least one damage was registered, we extract the precipitation data, separate individual rainfall events, and identify all rainfall events that triggered the respective damage claims. Thereafter, all precipitation events are characterized by maximum precipitation intensity, total accumulated precipitation, and antecedent precipitation, among other variables.

The triggering rainfall events' characteristics do not exhibit clear patterns in absolute terms. However, when comparing them with all respective events with no registered damage, we see that most claims are associated with high percentile values of maximum intensity and/or high total accumulated precipitation. At the same time, the other investigated variables do not seem to have a similar relevance. Using binary pattern performance measures, we identify that a combined exceedance threshold of the 99th percentile for both the maximum intensity and the total accumulated precipitation results in the best performance of this simple threshold model.