



## **Linking soil hydrology to rainfall probability - which conditions can produce a 100-year flood event**

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In particular in small watersheds, discharge records are usually not available to derive an extreme value statistics to predict flood peaks for a specific return period. Regionalization approaches or simple rainfall-runoff models including extreme values for duration-intensity rainfall characteristics and runoff coefficients are often used to predict flood peaks under those conditions. However, sprinkling experiments and infiltration experiments demonstrated that the initial soil moisture can strongly influence runoff generation but is usually not explicitly considered. Even if it is considered, it is not implemented into a clear probability concept linking the exceedance probability of rainfall duration, amount and initial soil moisture conditions. We have developed such a framework depending on the joint probability of soil moisture and rainfall and used the process-based rainfall-runoff model RoGeR that was extended to a water balance model to predict the probability of soil moisture and linking this to overland-flow and subsurface flow generation assuming different scenarios of soil moisture and rainfall properties. All selected combination result in a joint probability with a return period of 100 year, but are based on different probabilities for rainfall amount, duration and initial soil moisture. The framework was set-up for a distributed model with a spatial resolution of 5x5m and for watershed up to 10 km<sup>2</sup>. We analysed the results for different watersheds and could show, that different combinations produce the highest flood volume and flood peak. Various temporal and spatial pattern and properties control this dependency. However, we could clearly demonstrate that only the combined consideration of factors affecting flood generation and its implementation into a statistical framework allow to predict floods with a chosen return period for small watersheds where different runoff generation mechanisms occur simultaneously.