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Hazard assessment of widespread precipitation over low mountain ranges

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Orography exerts a major influence on precipitation during certain events and climatologically. For widespread precipitation, both the intensity and the spatial distribution of precipitation are mainly determined by orographically induced vertical motions. Extreme events like the devastating floods in Germany at the rivers Elbe (2002), Danube (1999), or Rhine (1993) are mostly related to orographic precipitation and runoff processes. Due to the high variability of precipitation over complex terrain, the determination of reliable precipitation fields from sparsely distributed point measurement stations is an essential issue for hydrological as well as hazard assessment purposes.

To get spatially high resolved precipitation fields, a diagnostic model for orographic precipitation was developed. It is based on linear theory for 3-D mountain overflow and includes several parameterization schemes for precipitation processes. Over a mesoscale domain in Southwest Germany comprising the low mountain ranges of Black Forest, Swabian Alb and Vosges (F), model simulations were performed.

For the estimation of the hazard potential, information of both the rain sums and their probability are necessary in high spatial resolution. For this purpose, model simulations with a high horizontal resolution of 2.5 km x 2.5 km were performed from all extreme events between 1971 and 2000. At each grid point in the model domain, a statistical extreme value distribution was fitted to simulated orographic precipitation from all events. This yields total precipitation sums for defined statistical return periods that can be used for the assessment of the hazard potential of widespread precipitation.