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Bayesian Markov Chain Monte Carlo approach to regional flood frequency analyses involving extraordinary flood events at ungauged sites

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This contribution proposes a method for using major flash flood events occurred at ungauged catchments to reduce the uncertainties in estimating regional flood quantiles. The method is based on standard regionalization methods assuming that the flood peak distribution rescaled by a site-dependent index flood is uniform within a homogeneous region. A likelihood formulation and a Bayesian Markov Chain Monte Carlo (MCMC) algorithm are used to infer the parameter values of the regional distributions. This statistical inference technique has been selected for its rigorousness – various hypotheses are explicitly formulated in the likelihood function, its flexibility as for the type of data that can be treated, and its ability to compute accurate estimates of the confidence intervals for the adjusted parameters and for the corresponding flood quantiles.

The proposed method is applied to two data sets from Slovakia and the South of France that consist of series of annual peak discharges at gauged sites and estimated peak discharges of extreme flash flood events that have occurred at ungauged sites. The results suggest that the confidence intervals of the quantiles can be significantly narrowed down provided that the set of ungauged extremes is the result of a comprehensive sampling over the selected region. This remains valid, even if the uncertainties in the estimated ungauged extreme discharges are considered. The flood quantiles estimated by the proposed method are also consistent with the results of site specific flood frequency studies based on historic and paleoflood information.

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