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A regional frequency analysis of extreme rainfall events over Southern France

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Reliable estimates of extreme rainfall events are required for several hydrological purposes. However, the reliability of statistical inference tools based on Extreme Value Theory is poor when applied to short time series. These well-established statistical procedures are relevant only when applied to relatively long data records. Therefore, regional estimation methods that "trade space for time" by including several at-site data records in the frequency analysis are efficient tools to improve the reliability of extreme quantile estimates. Regional frequency analysis methods also allow for the estimation of extreme rainfall quantiles in sites with no data. However, all regionalization procedures require an extra step: the construction of homogenous regions. For this critical step, an original neighbourhood-type approach which provides a specific statistically homogeneous region for each site of interest is proposed in the present study. Both the Hosking and Wallis heterogeneity measure, based on L-moment ratios, and the non-parametric Anderson and Darling homogeneity test, are applied there within. A pooling scheme is also proposed to avoid the effects of intersite correlation. This regionalization method based on an index-value type procedure is applied to extreme rainfall events of Southern France. This study uses 1219 daily rainfall stations belonging to the French Weather Forecast rain gauge network: 601 stations have more than 20 years of daily data and 222 stations more than 50 years (from 1950 to 2008). A calibration-validation procedure was performed to evaluate the descriptive and predictive accuracy and the robustness of this regionalization method. Finally, this study provides a comparison between local and regional estimation methods for mapping Southern France extreme rainfall events.