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Regional estimation of extreme hydrological events using the partial duration series method

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A general framework for regional analysis and modelling of extreme hydrological events is presented. The model is based on the partial duration series (PDS) method that includes all events above a threshold level in the analysis. In the PDS model the average annual number of exceedances and the mean value and L-coefficient of variation of the exceedance magnitudes are considered as regional variables. A generalised least squares (GLS) regression model that explicitly accounts for intersite dependence and sampling uncertainties is applied for evaluating the regional heterogeneity of the PDS parameters. For the parameters that show a significant regional variability, the GLS model is subsequently adopted for analysing the potential of describing the variability from physiographic and climatic characteristics. In addition, a split-sample regionalisation technique is applied for analysing the potential of dividing the region into more homogeneous sub-regions according to the physiographic and climatic characteristics. For determination of a proper regional parent distribution L-moment analysis is used for discriminating between different candidate distributions. The resulting regional model can be used for estimation of extreme hydrological events and associated uncertainties at an arbitrary location in the region. For illustration, the regional PDS model is applied to two cases: (i) a regional flood frequency analysis in New Zealand using daily streamflow records from 48 catchments in the South Island, and (ii) a regional analysis of extreme rainfalls in Denmark based on high-resolution rainfall data from 66 stations.