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Downscaling of Monsoon Precipitaion in Poyang Basin, China, using a Generalized Pareto Distribution

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A new statistical downscaling for extreme precipitation events will presented. We designed a mixture model containing a logistic regression and a linear model of a generalized Pareto distribution (GPD) to model the exceedance rate of precipitation over a critical value and associated extreme return levels, respectively.

This method is illustrated by an example of daily precipitation measurements in the Poyang Basin (China). The East Asian Summer Monsoon (EASM) dominating the climate in the Poyang catchment strengthens the moisture transport and causes extreme precipitation events in the region. As a consequence to the heavy rainfalls flood events occur often in late summer. As covariates for the linear models large scale circulation pattern of ECMWF 40 year Re-analysis (ERA-40) are used.

The procedure is separated into two steps: First the patterns of covariates relevant to the EASM are estimated by Principal Component Analysis (PCA) of a extended region around Poyang. To detect heavy rainfalls patterns of circulation, moisture and convection are of major interest. The temporal evolutions of the patterns are the pool of potential predictors for the linear models. As a second step the parameters of the mixture model are estimated. A successive logistic regression chooses the predictors improving the model out of the pool. This model provides information about the exceedeance rate of precipitation over a threshold. Finally a successive linear model of a GPD is performed in the same way as the logistic model to gain information about the distribution of precipitation above the threshold. Additionally the selection of predictors and their associated patterns provides further insights to the dynamics of the EASM.

Furthermore an outlook of an application is given. The temporal evolution of the detected patterns in A1B climate simulations of 21st century are used as an input to the mixture model. This provides an estimate of the extreme value distribution GPD with respect to future climate change.