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Multivariate stochastic generation of daily streamflows considering climate change

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For the optimal planning and derivation of operation rules for multi-purpose reservoir systems very long time series of daily streamflows are required. Stochastic streamflow models can provide these data. While stochastic generation of monthly time series is state of the art, the synthesis of daily flows at multiple sites is still a challenging task. Recently, nonparametric k - nearest neighbor resampling techniques have been applied successfully for the generation of daily streamflows at multiple sites. The objective of this study to employ k-nn resampling for the simulation of multivariate daily streamflows under changed climate conditions.
Observed daily streamflows are resampled conditioned on observed and simulated climate variables from regional climate models considering past and future scenarios. The resampling is done in a three step-procedure: 1) annual or biannual flows for an index station representing the flow sum over all considered gauges are generated; 2) the flow sum is spatially disaggregated by resampling station flow proportions from observed data; 3) the individual annual/ biannual flows for all gauges are temporally disaggregated to daily data by resampling daily flow proportions.
The method is applied for a reservoir system in the Harz mountains in Germany comprising five streamflow gauges with long daily observations. Climate data from observations and from the regional climate models REMO and WETTREG are used for conditioning. The method is parsimonious, easy to understand and very fast. It simulates all observed statistics well and provides significant change signals concerning future flows. Problems are the restricted ability of the technique to model values not seen in the observations, which however concern only single extreme daily and monthly values.