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A copula-based downscaling methodology of RCM precipitation fields

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Many hydrological studies require long term precipitation time series at a fine spatial resolution. While regional climate models are nowadays capable of simulating reasonable high-resolution precipitation fields, the long computing time makes the generation of such long term time series often infeasible for practical purposes. We introduce a comparatively fast stochastic approach to simulate precipitation fields which resemble the spatial dependencies and density distributions of the dynamic model. Nested RCM simulations at two different spatial resolutions serve as a training set to derive the statistics which will then be used in a random path simulation where fine scale precipitation values are simulated from a multivariate Gaussian Copula. The chosen RCM is the Weather Research and Forecasting Model (WRF). Simulated daily precipitation fields of the RCM are based on ERA-Interim reanalysis data from 1971 to 2000 and are available at a spatial resolution of 42 km (Europe) and 7 km (Germany). In order to evaluate the method, the stochastic algorithm is applied to the nested German domain and the resulting spatial dependencies and density distributions are compared to the original 30 years long 7 km WRF simulations. Preliminary evaluations based on QQ-plots for one year indicate that the distributions of the downscaled values are very similar to the original values for most cells. In this presentation, a detailed overview of the stochastic downscaling algorithm and the evaluation of the long term simulations are given. Additionally, an outlook for a 5 km and 1 km downscaling experiment for urban hydrology studies is presented.