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Rainfall interpolation and simulation in hilly and mountainous regions using spatial copulas

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Precipitation is strongly influenced by topography, but this effect is different depending on the temporal scale under consideration. While for annual sums the dependence is highly significant for shorter aggregations the dependence becomes statistically insignificant. In order to ensure that the interpolation and the spatial simulation of daily precipitation does not destroy the dependence on higher temporal aggregation scales a copula based approach is suggested. Topography is included in the approach as a covariate with a event based copula relating it to precipitation. Stations with zero precipitation are considered as inequality constraints. A Maximum Likelihood estimation is developed for the parameter estimation. Examples from a dense observation network containing more than 1200 stations with a record of 40 years in South-West Germany illustrate the methodology.