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Copula-Based Interpolation and Simulation of Precipitation Fields

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The knowledge of the spatio-temporal distribution of precipitation is crucial to improve the understanding of the regional water cycle. So far precipitation fields derived from atmospheric models still suffer from large errors when it comes to reproducing the correct spatio-temporal distribution of rainfall fields. Usually stochastic precipitation fields conditioned on observations are more reliable.

In our approach we derive precipitation fields with the copula-based method of random mixing. In a first step we generate different observation types, here rain gauge and microwave link measurements, from a virtual reality of the Neckar catchment (VR). These virtual observations mimic the advantages and disadvantages of the real observations. Rain gauges provide a high-quality information for a specific measurement point but their spatial representativeness is often rare. Microwave links, e. g. from commercial cellular operators, on the other hand can be used to estimate line integrals of near-surface rainfall information but they provide a very dense observational system. The precipitation fields of this stochastic interpolation, respectively simulation, are constrained on both, the point and line information.
By using the virtual observations instead of real ones, we are able to compare the interpolated fields with the original fields. This allows us to evaluate the statistical precipitation fields in a very detailed manner in respect to the spatial and temporal resolution.

In a further step we will use this method to simulate precipitation fields constrained on real observations, which could be used for example as input data for surface-subsurface models or hydrological models.