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Modelling of spatio-temporal correlation structure of daily precipitation – an Austrian example

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Understanding the spatial and temporal correlation of rainfall is of pivotal importance for assessing regional hydroclimatic hazard, and for addressing problems like confluences or joint probability of flood waves. Furthermore, if one aims to simulate precipitation as the input for long term rainfall–runoff simulations, the correct reproduction of the observed rainfall spatial and temporal correlations is necessary to adequately model important hydrological features, like antecedent soil moisture conditions before extreme rainfall events.

In this work, we present a modification of the model presented by *Bardossy and Platte (1992)*, where precipitation is modeled on a station basis as a mutivariate autoregressive model (mAr) in a Normal space, and then transformed to a Gamma-distributed space. The spatial and temporal correlation structures are imposed in the normal space, allowing for a different temporal autocorrelation parameter for each station, and simultaneously ensuring the positive-definiteness of the correlation matrices for both the mAr errors, and the Normal-space rainfall. The calibration of the spatial and temporal correlation parameters is performed with a focus on extremes, trying to reproduce the variograms of a series of relevant rainfall events over the last 50 years in the region of interest (Tirolean Alps in Austia), as well as intensity-duration-frequency curves aggregated at different spatial and temporal scales.

Bardossy, A., and E. J. Plate (1992), Space-time model for daily rainfall using atmospheric circulation patterns, Water Resour. Res., 28(5), 1247–1259, doi:10.1029/91WR02589.