

# Improving spatial prediction at ungauged basins with spatial copula framework

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The process generating flood depends on basin characteristics and meteorological conditions. Consequently, geographically close gauged stations are not necessarily similar in a hydrological sense. Prediction at ungauged basin (PUB) using spatial methods should then be performed on alternative spaces where small distance between basin characteristics implies similar hydrological behaviour. In practice, flood quantiles usually have a log-log relation with the basin characteristics. For traditional kriging methods, these transformations create a bias at the original scale and provide suboptimal predictions. Alternatively, copulas provide a flexible framework in which the spatial dependence may be specified separately from the regional distribution of flood quantiles. The notion of spatial copula formalizes the geostatistical approach in the copula framework. In practice, it provides a full probabilistic model where more general response surface can be specified. More importantly, the spatial copula approach offers an easy formulation of the predictive distribution, for which unbiased and optimal predictions can be obtained. The spatial copula methodology is tested on a set of hydrometric stations located in Southern Québec, Canada. The performance of PUB using spatial copulas is then compared to the results obtained by traditional kriging methods. For this dataset, the investigated methodology leads to improved predictions over other traditional kriging methods. Additionally, the spatial copula model is able to account for a non-constant variability across the physiographical space.

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