

Modeling Extremes with the Spatial Vine Copula

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Multivariate Gaussian distributions lack the ability to reflect different dependence structures and yield only weak joint tail dependencies. Vine copulas are widely used in the field of financial mathematics to overcome these issues but cannot be parametrized in terms of distances.

We developed a *spatial vine copula*, that flexibly takes the varying distances of local neighbourhoods into account. A canonical vine is used where the unobserved location is the driving variable. In order to adjust the vine copula for different neighbourhood configurations, the first tree is modelled through a bivariate spatial copula that changes over distance. The bivariate spatial copulas might not only change in terms of their strength of dependence, but also the copula's family, which represents the dependence structure, may change. The upper vine trees are modelled in the default canonical vine configuration. Vine truncation techniques, to reduce the quadratically growing number of involved bivariate copulas with respect to the size of the spatial neighbourhood, may be applied. Thus, a *spatial vine copula* can be used to flexibly model local neighbourhoods of spatial random fields.

In the current work the data on gamma does rates published in the Spatial Interpolation Comparison 2004 and an artificial data set, both including extremes, are used. The effect of different modelling choices such as sizing of neighbourhoods, marginal fit and spatial vine copula design are compared. Hence, insights in strength and limitations of this approach are gained. Using the widely studied radioactivity data set allows a comparison of the spatial vine copula with a large variety of interpolation approaches. Depending on the configuration and the applied criterion, the interpolation based on a spatial vine copula ranges from the middle to one of the best approaches within the set of techniques that initially participated in the spatial interpolation comparison exercise 2004.