

# Statistical Modelling of Spatial Extremes

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## Summary

The areal modelling of the extremes of a natural process such as rainfall or temperature is important in environmental statistics; for example, understanding extreme areal rainfall is crucial in flood protection. This article reviews recent progress in the statistical modelling of spatial extremes, starting with sketches of the necessary elements of extreme value statistics and geostatistics. The main types of statistical models thus far proposed, based on latent variables, on copulas and on spatial max-stable processes, are described and then are compared by application to a dataset on rainfall in Switzerland. Whereas latent variable modelling allows a better fit to marginal distributions, it fits the joint distributions of extremes poorly, so appropriately-chosen copula or max-stable models seem essential for successful spatial modelling of extremes.

**Keywords:** Annual maximum analysis; Bayesian hierarchical model; Brown–Resnick process; Composite likelihood; Copula; Environmental data analysis; Gaussian process; Generalised extreme-value distribution; Geostatistics; Latent variable; Max-stable process; Statistics of extremes

**Running Head:** Modelling of spatial extremes

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