

On Modeling and Prediction of Multivariate Extremes

with applications to environmental data

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Abstract

This thesis consists of three papers. In the first paper we concentrate on bivariate modeling of extremes and investigate the accuracy of a new concept for modeling bivariate threshold exceedances. We compare the accuracy of prediction regions of the proposed exceedance model with well-known models, assuming wide range of parameters. It turns out that the proposed model performs well in the cases when the association between the original time series reaches a certain level and in some cases its performance is better than the most common ones.

The second paper is concerned with recent validation techniques for copula models. Here we apply models to real three dimensional wind speed data and point out what kind of difficulties can possibly arise in dimensions higher than 2. It turns out that not only finding a reasonable model becomes much more complicated, but to choose a proper method which is capable of detecting errors of the fitted copula models is also a major challenge.

In the third paper we propose a new field of application of copulas. Here we present a tool for finer assessment of stationary time series models based on non-parametric inference on autocopulas, which are the copulas of the original and the lagged series. This way we explore the interdependence structure within the time series by copulas, which makes possible to adapt many useful procedures from copula theory to detect differences between certain time series models. After a simulation study the proposed methods are applied to models which have been fitted to a river discharge dataset.

Keywords: Multivariate extreme value models, Copula models, Comparative study, Autocopulas, Environmental applications.

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