Copulas and extreme storm structure

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Copulas represent a new powerful tool for investigating multivariate phenomena. The advantage of using the mathematics of copulas is that the dependence structure can be separated from the marginals: therefore, any marginals of interest in a given application can be coupled with any type of dependence. This gives the possibility to improve the descriptive power and the efficiency of many of the models presently used in geophysics. In addition, it is often possible to simplify the calculations, and derive results which would not be achievable without adopting a copula approach.

In this work we present a storm model based on the mathematics of copulas. Three fundamental variables are considered: the storm average intensity, the storm wet duration, and the dry period between successive storms. A case study is presented where these variables are shown to be non-independent and heavy-tailed, and feature an extreme behavior: therefore, in order to model the storm dynamics, suitable Generalized Pareto laws are coupled via a proper copula. As a conclusion, our model includes, simplifies and generalizes many of the approaches already present in literature.