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Modeling pairwise dependencies in precipitation intensities

M. Vrac (1), P. Naveau (1) and P. Drobinski (2)

(1) Laboratoire des Sciences du Climat et de l'Environnement, IPSL-CNRS, (2) Laboratoire de Météorologie Dynamique, IPSL-CNRS

In statistics, extreme events are classically defined as maxima over a block length (e.g. annual maxima of daily precipitation) or as exceedances above a given large threshold. Although these definitions allow the pratictioners (e.g. hydrologists, flood planners) to apply the univariate Extreme Value Theory (EVT) to their time series of interest, they have two main drawbacks. Firstly, working with maxima or exceedances implies that a lot of observations (those below the chosen threshold or the maximum) are completely disregarded. Secondly, this univariate modeling does not take the spatial dependence into account. Nearby weather stations are considered as independent, although the reality generally shows otherwise.

To start addressing these two issues, we suggest a new statistical bivariate model that takes advantages of the recent advances in multivariate EVT. Our model can be viewed as an extension of the non-homogeneous univariate mixture originally proposed by Frigessi *et al.* (2002). The latter can model the entire range of precipitation (not only the largest values) and the absence ofwithout the usual arbitrarily fixed large threshold to define exceedances. This mixture is adapted and broadened to the joint modeling of bivariate precipitation recordings. The performance and flexibility of this new model are illustrated on simulated and real precipitation data. If time allows, this model will be inserted into a statistical downscaling context.