Measuring Spatial Dependence amongst Precipitation Maxima

P. Naveau (1), A. Guillou (2), D. Cooley (3) and J. Diebolt

(1) Laboratoire des Sciences du Climat et de l'Environnement, IPSL-CNRS, France, (2) Laboratoire de Statistique Théorique et Appliquée, Paris VI, France, (3) Colorado State University and National Center for Atmospheric Research, CO, USA and (4) Université de Marne-la-Vallée, CNRS, France

While the spatial structure of the mean behavior of most spatial processes can be well modeled by the scientific and statistics communities, our understanding of how to measure the spatial dependence among extreme events is still unclear and incomplete from a statistical perspective. In this paper, we focus on modeling pairwise dependence of temporal maxima, say annual maxima of precipitation, that have been recorded in space, either on a regular grid or at irregularly spaced locations like weather stations. The construction of our estimators stems from the variogram concept which has been one of the pillars of the field of geostatistics. The asymptotic properties of our pairwise dependence estimators are established by taking advantage of empirical processes properties. The performance of our approach is illustrated by a few simulations and also by the treatment of a real data set. In addition to bringing new results about the asymptotic behavior of copula estimators (the latter are linked to first order variograms), one main advantage of our approach is to propose a simple and powerful connection between Extreme Value Theory (EVT) and geostatistics.