

Modeling Hydrologic Extremes in Stationary and Non-stationary Environments via Copulas and SDEs



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Monday, April 28, 2008
133 Rosenau
11:00 am

Abstract:

In many hydrologic problems several are the random variables that play a significant role, and such variates are generally not independent. The following examples are paradigmatic: (i) different combinations of rainfall intensity and storm duration may generate storms showing quite different characteristics; (ii) the river management may strongly depend upon the joint features of flood peak and flood volume; (iii) the characterization of droughts requires the joint analysis of duration-magnitude-intensity, (iv) the accuracy of flood frequency regionalization estimates is influenced by the presence or not of the spatial dependence among maximum annual flood peaks. Therefore, it is often of fundamental importance to be able to link the marginal distributions of different variables in order to obtain a joint law describing the main features of natural events both in stationary and non-stationary environments. In general, the development of multivariate probability models (and, in particular, of multivariate Extreme Value distributions) has been limited by mathematical difficulties in generating consistent joint laws with “ad hoc” marginals. Many of these problems can be solved introducing the concept of Copulas and the theory of stochastic differential equations (SDEs). In this presentation some recent advances in hydrological modelling exploiting Copulas and stochastic differential equations are presented and discussed. Applications to hydrological data are illustrated.

Bio:

Carlo De Michele, Assistant professor of Hydrology and Water Resources at the Department of Environmental, Hydraulic, Infrastructures and Surveying Engineering, Politecnico di Milano, Italy. His research interests cover: Hydrological extremes, Multivariate extreme value distributions in hydrology, Scaling issues in hydrology; Climate change impact on hydrologic cycle; and Ecohydrology. His scientific activity includes 24 Publications on ISI journals and 1 Book “Extremes in nature: an approach using copulas” (Springer) in the period 2001-2007. Editor of HESS Journal. Reviewer of several International Journals. Convenor and co-convenor of several EGU (European Geosciences Union) sessions. Member of the Technical Committee for the Hydrological Sciences Section of EGU.