



Frequency analysis via copulas: Theoretical aspects and applications to hydrological events

G. Salvadori (1) and C. De Michele (2)

(1) Dipartimento di Matematica, Università di Lecce (gianfausto.salvadori@unile.it), (2)
DIIAR - Politecnico di Milano (carlo.demichele@polimi.it)

In this paper we provide a general theoretical framework exploiting copulas for studying the return periods of hydrological events; in particular, we consider events depending upon the joint behavior of two nonindependent random variables, an approach which can easily be generalized to the multivariate case. We show that using copulas may greatly simplify the calculations and may even yield analytical expressions for the isolines of the return periods, both in the unconditional and in the conditional case. In addition, we show how a new probability distribution may be associated with the return period of specific events and introduce the definitions of sub-, super-, and critical events as well as those of primary and secondary return periods. An illustration of the techniques proposed is provided by analyzing some case studies already examined in literature.