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Scaling Properties of the IDF Curves and Characteristics of the Rainfall Process: Investigation and Modelling

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The purpose of the present study is to analyze the IDF curves of the rain gauge stations in a region by means of a scaling invariance based model. The model is based on an approximate evaluation of the exceedance probability of multifractal measures (rainfall intensity in this case) and represents an extension of the model presented by Veneziano and Furcolo (2002). In its current form this model is able to describe the IDF curves behaviour also for durations and return periods that do not strictly belong to either of the asymptotic regimes (i.e. very short duration or very large return period, see Veneziano and Furcolo, 2002). The model in the end is dependent on 3 parameters: 1) a parameter Δn which represents an appropriate level of the bare process in order to approximate the dressing factor probability distribution; 2) the mean value of the rainfall process; 3) a duration parameter D_{max}, which represents the outer limit of the scaling behaviour of the process. The application regarded 14 rain gauge stations and 24 years of recorded data in the Arno River Basin. For each station, the parameters C_β and C_{LN} of a β-lognormal multifractal model were estimated. Δn value was individuated by fitting the theoretical distribution given by the model to the marginal distribution of rainfall intensities, obtained by a semi-analytical procedure (Veneziano and Furcolo, 2003). The average intensity was calculated directly from the data; D_{max} value resulted from a fitting procedure based on the comparison of the empirical IDF curves with the theoretical results of the model. The results showed some relations between the parameters of IDF model and those of the multifractal model of the rainfall process; these relations are consistent with the expected physical characteristics of the rainfall process within the region considered. This particular model extension seems, in the end, a promising tool for regional analysis of extreme rainfall distribution.