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Multifractal modelling of rainfall time series

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The literature produced in the last thirty years about the high space-time variability of rainfall deals with the development of stochastic models capable of representing the non-linearity and intermittence of rainfall to downscale information on rainfall fields to spatial and temporal scales useful for hydrological models, i.e. transferring to finer scales the information on rainfall observed or forecasted at large scales.

Traditionally, these models are based upon point processes (e.g. Waymire and Gupta, 1981, Rodriguez-Iturbe et al., 1986). However, this approach may involve a large number of parameters in modelling the process, leading to several problems in parameter estimation.

Another approach to this problem is based on the empirical detection of some regularities in hydrological observations, such as the scale-invariance properties of rainfall (e.g. Lovejoy and Schertzer, 1985). These models assume a power law dependence of all statistical moments on the scale of aggregation. Scaling properties can provide simple relationships to link the statistical distribution of the rainfall process at different spatial and temporal scales, in the ranges of which the power-low assumption can be verified (Marani, 2003).

This work focuses on the analysis of the scaling properties of rainfall time series from a high density rain gauge network covering the Rome's urban area. The network consists of 24 sites, and the gauge record at each site has 10-minute time resolution and about 16-year length (1992-2007). The aim of the study is the identification of temporal scaling regimes, their ranges of validity, and the evaluation of the corresponding scaling properties.

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