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Scaling properties of rainfall time-series in the urban area of Rome

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The rainfall fields exhibits a high space-time variability which generates a large degree of uncertainty in modelling the process, thus causing lack of accuracy in many key hydrological problems, such as the forecasting of floods and the management of water resources. The large amount of literature produced in the last thirty years about this issue deals with the development of stochastic models able to represent the non-linearity and intermittence of rainfall in order to perform the downscaling process, i.e. transferring to finer scales the information on rainfall observed or forecasted at large scales.
Traditionally, these models are based upon point processes in both the time (e.g. Waymire and Gupta, 1981) and the space-time domain (e.g. Rodriguez-Iturbe et al., 1986). Although this approach is cluster-based so as to model the physical structure of rainfall, its application may involve an inconvenient mathematical complexity and a large number of parameters, leading to several problems in parameter estimation.
Another approach to this problem is based on the empirical detection of some regularity in hydrological observations, such as the scale-invariance properties of rainfall (e.g. Lovejoy and Schertzer, 1985). Models following this approach are based upon the assumption of a power law dependence of all statistical moments on the scale of aggregation. That means 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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