



Multifractality and Practical Estimation of Extreme Rainfall

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Two important research directions have marked the recent use of multifractals in rainfall modeling and extreme rainfall analysis. One is the shift of focus from the asymptotic scaling properties of the intensity-duration-frequency curves to exact extreme distributions under non-asymptotic conditions. The second is a more sparing use of multifractality in modeling, to reflect the limits of scale invariance in rainfall. Both trends have made the results more relevant to hydrologic applications.

Here we consider three rainfall models with limited multifractal properties, which are simple, robust against outliers, and require only a few years of rainfall data. The models use the classical notions of exterior and interior process, respectively for the variation of rainfall intensity at (approximately) synoptic and sub-synoptic scales. The exterior process is non-scaling and differs in the three models, whereas the interior process is stationary multifractal in all cases.

The fact that rainfall is not a simple multifractal process should increase the complexity of its representation and parameter estimation. However, focus on what is important for rainfall extremes keeps the models simple and appropriate for engineering application.

We discuss the estimation of model parameters and the calculation of return-period values, and present an application to a 24-year rainfall record from Florence, Italy. All models produce IDF curves that are consistent with the empirical ones and provide similar extrapolations for return periods longer than the duration of the historical record. Sensitivity to using a fraction of the historical record (down to 5 years) is relatively small.