Simple IDF Estimation Under Multifractality

A. Langousis (1), D. Veneziano (1), C. Lepore (2) and P. Furcolo (2)

(1) Dept. of Civil and Environmental Engineering, MIT, Cambridge, 02139, MA, U.S.A., (2) Dipartimento di Ingegneria Civile, University of Salerno, Fisciano, SA 84084, Italy (andlag@mit.edu / Fax: 440-756-2310 / Phone: 617-407-0059)

We study the extremes generated by a multifractal model of temporal rainfall and propose a practical method to estimate the Intensity-Duration-Frequency (IDF) curves. The model represents rainfall as a sequence of independent and identically distributed multiplicative cascades of common duration D. This simple model was previously found to be adequate for IDF analysis. Here we show how the IDF curves produced by the model can be accurately approximated by simple formulas and use these approximations to propose a practical IDF estimation procedure. 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. The proposed approach has several advantages over conventional methods that directly fit parametric IDF models to the annual rainfall maxima. One is that fitting the multifractal model to the entire record (as opposed to using only the annual maxima) confers stability and robustness to the estimated IDF curves. For example, sensitivity to using a fraction of the historical record (down to 5 years) and to including/excluding outlier years is much smaller than in conventional methods. Another advantage is that the shape of the IDF curves needs not be externally specified but is determined by the fitted model.