Peer review for "Hydrology and Earth System Sciences"

Stochastic simulation of reference rainfall scenarios for hydrological applications using a universal multifractal approach

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Overall review comment:

This paper presents the use of universal multifractal to generate ensembles of rainfall time series that recreates the Intensity (I), Duration (D), and Frequency (F) of rainfall time series, commonly used in the design of storm-water infrastructure. This paper may become an essential contribution to the literature body of stochastic simulations of rainfall time series. However, I found two pitfalls in the paper: (1) There is no clear definition of the research gap (including connections to previous works), and (2) Even though the paper assesses their methodology, the discussion about the results is almost non-existent. I hope my comments provide a road map to improve the important contribution done by the authors. Below there is a detailed description of my concerns.

Major suggested comments:

1. The research gap is vague. The authors must address the following questions. Why is it important to explore universal multifractals in rainfall datasets? Have studies been using this technique in rainfall datasets before? What are the challenges of using stochastic techniques and/or multifractals to reconstruct rainfall time series?
2. The ambiguity in the research gap is also reflected in the research objective: Line [57] states, "*The objective of this paper is to simulate region specific reference rainfall scenarios which could be used as realistic inputs (..) to hydrological models for optimally designing storm-water management infrastructures*." This needs to be more specific. What method will be used? Will this be compared to a reference? Also, the objective elucidates "*hydrological models for optimally designing*"; however, the paper does not address optimal design at all. Readers may believe that the paper explores the use of universal multifractal for optimal designs for specific water-related infrastructure. However, the paper covers a general procedure for estimating ensembles of rainfall time-series, but it does not cover applications and consequences for engineering design.
3. There is no discussion section! The authors go from results to conclusions, omitting key discussions that will strengthen the overall contribution of their work. Here are some general pointers that I feel are relevant to find in the discussion section. 1) How are the results compared with the previous literature? Are the scaling parameters similar to previous studies? What are possible connections in the difference of scaling parameters between the three site studies? What are possible strategies to expand this methodology to spatial correlated rainfall datasets? What are potential limitations in the application of this

methodology? How feasible is this methodology to represent rainfall structure in large spatial scales? How can the spatial scale and limitations on this methodology affect the design of water-related infrastructure?

Minor suggested comments:

1. [75] Add reference for MeteoFrance
2. [110] Small sample size? Be more specific. What would be an ideal sample size?
3. [Figure] Figure 1 is not mentioned in the document
4. The term “resolution” is ambiguous throughout the text. Does it refer to time or space? Probably time.