EGPD, second-order regular variation and disaggregation

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Abstract

In hydrology, the computation of return levels is usually performed in a twofold manner, by modelling separately high values and the bulk of the distribution. Such an approach has two issues: the models used to deal with each part of the distribution may not be consistent with the other, and finding a systematic method to choose an optimal threshold between those two regimes often proves difficult. The extended generalized Pareto distribution (egpd) proposed by Naveau et al. (2016) treat these two issues by replacing the dividing cutoff (threshold section) with a smooth transition from low to high values. While being compliant with extreme value theory, the mathematical second order properties of this egpd remains unknown. In particular, this probability aspect represents a key element in rainfall aggregation modeling, say from sub-hourly to weekly, and consequently, in the computation of the well known Intensity-Duration-Frequency (IDF) curves used in flood risk designs. In this context, we propose sufficient conditions for the egpd to possess the second-order regular variation property. We will also explain how these mathematical findings play a practical role in convolution. Adding positive random variables with heavy tails is a fundamental operation within any multi-scale (either in time or space) rainfall stochastic weather generators (SWG). This novel understanding of aggregation should help practitioners to improve or test existing rainfall SWGs.

Keywords: egpd, second, order regular variation, aggregation, POT method

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