

Improving Quantile Estimates of the Neyman-Scott Rainfall Model

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1. Introduction

In previous studies, the Neyman-Scott rectangular clustered Poisson model, NSM here for brevity, has been used to generate synthetic rainfall from existing historical records. Among the more recent applications of this model were focused on the block maxima (annual or monthly maximum hourly and daily rainfall) values of the NSM synthetic output. Specifically, the NSM parameters were obtained to preserve the mean, variance and autocovariances of the historical records with the fundamental understanding that the block maximum will be preserved. To improve the match, the parameter search was extended to the third moment or skewness of the historical record. It is in this light that the authors propose the use of a different maximum rainfall definition to affect a parameter search that directly includes the rainfall maximum values within the rainfall records.

2. Peaks Over Threshold Maxima

Unlike previous studies, an improvement of the NSM is sought here under the Peaks Over Threshold (POT) definition. According to this definition, a maximum occurs when rainfall exceeds or peaks over a set threshold, regardless of the number of peaks within a block of time. This was done because an interesting feature of the synthetic data generated by NSM appears in Figure 1. This data came from a previous study in which the above-mentioned moments from 16 years of hourly rainfall records were used to generate synthetic data that closely match the block maxima.

Figure 1 plots the frequency of occurrences over the August record that exceeds a set threshold against several threshold values. It is noticeable that the data at the hourly level

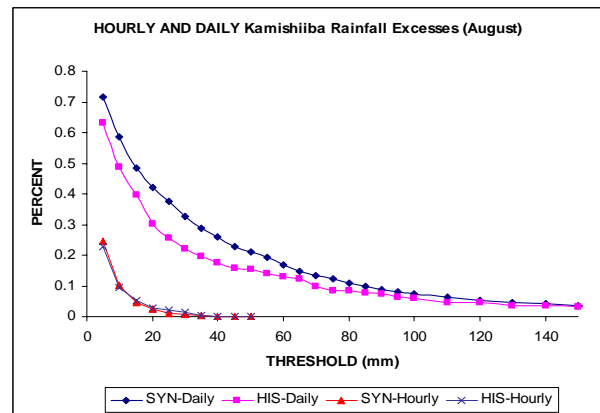


Fig. 1: Peaks Over Threshold Maxima of synthetic and historical maxima taken from Kamishiiba rainfall records.

match while the daily data does not. In particular, the frequencies of the synthetic 24-hour data always exceed the historical counterpart. However, since this past application did not use the information available in Fig. 1 to identify the NSM parameters, it would be reasonable to expect a poor match.

3. Methodology

A new equation that renders the count of peaks over a threshold in terms of the NSM parameters is being derived by the authors. As of this writing, the authors found a formulation that connects the counts of exceedances by a Poisson process. The connection of the single parameter of this counting process to the storm origin parameter and cell displacement parameter is the current target in this study. As a secondary objective, the ideal combination of moments and this new equation that should be used in the parameter search should be determined. It is hoped that with the inclusion of this new equation, estimates of the NSM parameters that consistently preserve the POT maxima at several hours of aggregation can be obtained.