Modelling a Probability Distribution for Extreme Rainfall Events in Colombo, Sri Lanka

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Abstract: Modelling of extreme rainfall events is the fundamental part of flood hazard estimation. Establishing a probability distribution to represent the precipitation depth at various durations has long been a topic of interest in hydrology, meteorology and others. The objective of this paper is to fit a probability model to describe the frequency variation of annual extreme rainfall events in Colombo region in order to predict the probability of occurrence and return periods. Annual extreme rainfall events for a period of 110 years (1900-2009) have been used for the analysis. Early study into the distribution of daily rainfall has identified the Two Parameter Gamma, Log Normal, Two Parameter Log Normal, Three Parameter Inverse Gaussian, Generalized Extreme Value, Gumbel Max, Log Pearson Type III and Pearson Type V distributions as the most likely candidate distributions. As such, these eight probability distribution models were considered in this study. Model parameters were estimated using by the maximum likelihood method. The comparative assessment of the explanatory ability of each model was based on the graph of cumulative distribution function combined with the empirical distribution function, Kolmogorov-Smirnov test and Q-Q Plot. On the basis of these comparisons, it is concluded that the Log Pearson Type III distribution is the most appropriate distribution for describing the annual maximum daily rainfall events in Colombo. The fitted model has been efficiently used to estimate the probability of occurrence and return periods for various return levels. The model reveals that for the 200mm or more of annual maximum daily rainfall return period is seven years and 4 months with 95% confidence interval (6.27, 8.91). In similar manner, the paper concentrated on developing models for extreme rainfall events during the four seasons of a year. Relevant estimates of probability of occurrence return periods and its corresponding confidence intervals for extreme rainfalls are reported against return levels.

Keywords: Maximum Rainfall, Frequency Analysis, Log Pearson Type III Distribution, Probability of Occurrence, Return Periods