ANALYSIS OF MULTI-DAY EXTREME RAINFALL EVENTS IN KELANI RIVER BASIN

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Floods, one of the major disasters in Sri Lanka occur not only due to a single daily rainfall but due to multiday rainfall events. Thus, to safeguard the properties, analysis of the multiday rainfall events is more relevant than analysis of one-day rainfall events. The objective of the research is to identify the temporal rainfall pattern in the Kelani River upper catchment (using Canyon, Castlereigh, Laxapana, Norton and Hatton - Meteorological stations) for conducting rainfall frequency analysis using data from the annual maximum (AMAX) series. The preparation of the data series is done by using the Block Maxima tool and the trend pattern is identified with the Mann-Kendall test. Then selected potential candidates for frequency analysis using the L-moment method and selected the best fit distribution by using the goodness of fit test. The final outcome is to identify the Extreme rainfall values for different return periods.

According to Manne Kendal test results, all series have increasing trends but they are not significant, except for Norton PX3D which has a significant increasing trend. Hatton Kotagala PX3D has a decreasing trend that is not significant. For all AMAX series skewness is positive, In the kurtosis for all AMAX series except PX2D and PX3D in the Canyon, its tails are longer and wider, and often its central peak is higher and sharper(leptokurtic). For AMAX series PX2D and PX3D in the Canyon, its tails are shorter and narrower, and often its central peak is lower and broader (platykurtic). Gamma (G), Lognormal (LN), and Weibull (EV3) were selected as potential candidates for frequency analysis. From KS test results Gamma distribution fitted to 46% of the series, while Lognormal and Weibull fitted to 27% of the series. The maximum PX1D is 440 mm in 1989 at Laxapana and for the PX2D series, the maximum value is 831 mm in 1989 at Laxapana. It was observed that the maximum PX3D is 924.7 mm in 1989 at Laxapana. The average ratio between 3-day maxima to 1-day maxima is 2.1 and the ratio of 2-day to 1-day becomes 1.9. This finding greatly helps to estimate PX2D or PX3D in the context of engineering design when there is a lack of data. It is seen that there is an increasing trend at all stations except Hatton-Kotagala PX3D. However, a significant increasing trend was detected at Norton PX3D at a 5% level of significance. For all other stations, AMAX shows no significant trends. In general, it can be argued that the Kelani River Upper catchment has an increasing trend but is not significant for annual maximum rainfall series of one day, two days and three days at a 5% level of significance. The Gamma distribution is the best-fit distribution for most of the one-day annual maximum rainfall series. However, for two-day and three-day series all three distributions - Gamma distribution, Lognormal distribution, and Weibull distribution can be considered as equal. In low return periods such as 25 years and 50 years there is no such difference in return levels. However, for larger return periods, the discrepancy is higher. The accuracy and reliability of the results can be further improved by increasing the length of records and the number of gauging stations. If four- or five-day events are considered in the analysis, a better idea about the extreme events can be obtained and how they combined with the flooding condition. These results can be used for flood mitigation projects, for statistical estimation of probable maximum precipitation, better models of risk and damage can be developed from multi-day extreme rainfall events and flooding.

Keywords: Kelani River; extreme rainfall; multi-day; frequency distribution

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