Flood Frequency Analysis of Annual Maximum Stream Flows for Kuantan River Basin

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Abstract. Precise stream flow forecasting is essential in water management. Effective usage of flow estimates gives considerable assistance to water resources planning. In this study, five common distribution models, namely Generalized Extreme Value (GEV), Generalized Pareto (GP), Log-Pearson 3, Weibull (3P), and Log-normal were employed to identify the most appropriate probability distribution and to forecast the streamflows for the Kuantan River Basin. Yearly peak flow data from the Bukit Kenau station from 1977 to 2013 was used in the study. The best-fitted distribution model was evaluated using the Kolmogorov-Smirnov (K-S) goodness-of-fit test (GOF). The results show that Generalized Extreme Value (GEV) is the best-fitted flood distribution model, with a P-value of 0.997, followed by the Generalized Pareto, Log Pearson (3), Weibull, and Log-normal. The estimated peak flow values for 5, 10, 25, 50, 100, 200, 500 and 1000-year ARIs were 1569 m^3/s, 1984 m^3/s, 2560 m^3/s, 3030 m^3/s, 3535 m^3/s, 4080 m^3/s, 4868 m^3/s, and 5521 m^3/s respectively. The results of the peak flow for different ARIs might benefit future flood models and risk assessments conducted in this area of study.

INTRODUCTION

In recent years, there has been considerable interest in characterizing flood behavior in data-scarce areas due to the increasing number of high-profile flood events [1]. This has generated interest in the development of end-user models for emergency response, re-insurance, aid, and development. However, the lack of globally available discharge estimates is preventing these technologies from being used. One of the most fundamental issues in catchment hydrology is estimating high flows in unmeasured catchments.

The analysis of flood frequency can be defined as an approach without dimensions which utilizes probability distributions derived from the historic records of peak discharge taken at many riverside gauge stations. This data is used to connect the extent of extreme events to how frequently they occur [2]. Deriving the flood frequency curve using probability distribution functions is the most widely used statistical method in hydrology. It is a promising and straightforward way to address this problem [3]. Several studies have found that flood frequency and magnitude are increasing in various places around the world [4]. Flood frequency study was undertaken by Rahman et al. [5] with the aim of selecting the distribution models best suited to fit the data for the yearly maximum flood levels in Australia. Their study involved the leading 15 probability distributions, as recommended by experts. These were as follows: normal, two-parameter lognormal (LN2), three-parameter lognormal (LN3), two-parameter gamma (G2), Pearson 3, Gumble EV1, GEV, LP3, exponential, Weibull, generalized logistic (GL), logistic, five-parameter Wakeby (WAK5), four-parameter Wakeby (WAK4), and GPA. The researchers used four goodness-of-fit tests: the Akaike information criterion, the Anderson–Darling test, the Bayesian information criterion, and the Kolmogorov–Smirnov test. The outcome was the identification of the three leading distribution models which are the log-Pearson 3, Generalized Extreme Value (GEV), and Generalized Pareto distributions. Guru and Jha [6] used the data from the flood series of Annual Maximum (AM) and Peak over Threshold (POT) when conducting an analysis of flooding in

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