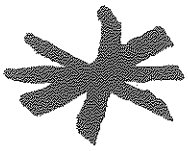

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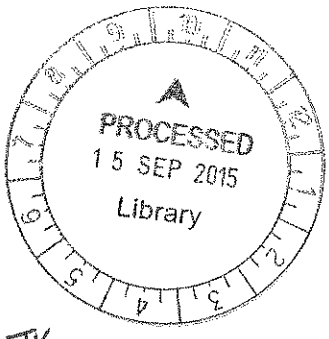
COMPARATIVE STUDY OF FLOOD FREQUENCY METHOD ON SELECTIVE RIVERS

Wai Jun Xian
BEng (Hons) in Civil Engineering

Project Supervisor: Prof. Dr. Khin Maung Win
Dr. Deepak Tirumishi Jada

Final Year BEng Project
2014/2015



DECLARATION

I, the undersigned, hereby declare that this report is my own independent work except as specified in the references and acknowledgements. I have not committed plagiarism in the accomplishment of this work, nor have I falsified and/or invented the data in my work. I am aware of the University regulations on Plagiarism. I accept the academic penalties that may be imposed for any violation.

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ABSTRACT

This present study consisted of study of four commonly used probability distribution function namely: Gumbel Extreme Value Type I, Log-Normal, Log-Pearson Type III, and Pearson Type III distribution and hence carry out flood frequency analysis using the studied probability distribution functions on three selected rivers namely: Kelantan River, Perak River, and Pahang River. Historical discharge data for the selected rivers are obtained from DID Malaysia in Malaysia. The parameter of all distributions function used in this study are estimated using method of moment. Two goodness-of-fit-test: chi-square test and Kolmogorov-Smirnov test are conducted in order to study how well the distribution fits with the historical data. Moreover, the extreme flood value of the selected river with return period of 5, 10, 25, 50, 75, and 100 are computed in this study as well. Three software namely "Easyfit" which developed by Mathware , "HEC-SSP" which developed by US Army Corps of Engineers and "Microsoft Excel" which developed by Microsoft Corporation are used in present study to assist in computing data, cross-checked results obtained before presenting, fitting the distribution functions as well as carry out goodness-of-fit test.

ACKNOWLEDGEMENT

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Besides that, special thanks directed to the Department of Irrigation and Drainage (DID), Malaysia, for preparing and providing the data. Last but definitely not the very least, I indebted to all of my family members who has given me support throughout my academic years and all of my fellows friends. Thanks you very much

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LIST OF SYMBOLS AND ABBREVIATIONS

DID - Department of Irrigation and Drainage of Malaysia

EV1 - Gumbel's Extreme-Value Type I distribution / Gumbel distribution

N - Normal distribution

P3 - Pearson Type III distribution / 3-Parameter Gamma distribution

LP3 - Log-Pearson Type III distribution

LN - Log-normal distribution

EV2 - Gumbel's Extreme-Value Type II

KS - Kolmogorov-Smirnov

CS - Chi-Square

GLO - Generalized Logistic distribution

GEV - Generalized Extreme Value distribution

GPA - Generalized Pareto distribution

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

1.1 Background of Study

Flood has been the most common natural disaster in Malaysia which happen almost annually during the monsoon season around October to March. This natural disaster can bring serious damage in terms of life, property and economic due to interruption of commercial activity. The Department of Irrigation and Drainage (DID) of Malaysia has implementing both structural and non-structural flood mitigation plans in stages since year 1971 after a disastrous flood incident which resulted in a loss more than RM 200 million and 61 peoples have died.

For effective flood mitigation plan, knowing the magnitude and probable frequency of recurrence of floods are important as they are necessary to the proper engineering design of hydraulic structure such as dams, bridges, culverts, levees and other structures for managing and control of flood water movement purpose. Dalrymple (1960) has mentioned frequency of floods with varying magnitude must be considered by engineer in designing the hydraulic structure's size/strength, location and also for feasibility study.

As floods are extreme complex hydrological event which governed by the law of chances, comprehensive use of probability theory and frequency analysis are needed to interpret and evaluate the event (Yevjerich, 1972). The most common approach used for investigation of historical flood data is flood frequency analysis. Flood frequency analysis is a technique which used to develop a frequency curve to represent the

magnitude of floods to its frequency of occurrence through the use of probability distribution function. (Chow et al., 1988).

There are numerous frequency distribution functions have been adopted to analysis the hydrological data successfully such as: Gumbel's Extreme-Value Type I distribution (EV1), normal distribution (N), Pearson Type III distribution (P3), Log-Pearson Type III distribution (LP3), Log-normal distribution (LN), and etcetera. According to Bedient (2008), the most commonly used probability distribution functions for the estimation of extreme flood values have been the normal distribution (N), Log normal distribution (LN), Pearson Type III distribution (P3), and Log-Pearson Type III distribution (LP3).

In this present study, the focus area is to perform a comparative study of the flood frequency methods using EV1, LN, LP3, and P3 distributions function on selective rivers in Malaysia, and hence recommend the probability distribution function which best fit to the river's observed flood-flow historical data. The estimated extreme flood value derived from the flood frequency analysis can be used in hydraulic design located along the rivers and also for effective flood plain management.

1.2 Problem Statement

Knowledge of magnitude and probable occurrence of flood is crucial for engineering design hydraulic structure and effective flood management. The Department of Drainage and Irrigation (DID) of Malaysia has published a hydrological procedure which named Hydrological procedure No.4 (HP4) contributed by Ong (1987) as a guideline to determine the magnitude and frequency of floods in Peninsular Malaysia. The procedure carried out flood frequency of each individual station based on Gumbel's Extreme-Value Type I distribution (EV1) with parameters estimated by method of moment.

However, different probability distribution and fitting methods are used in different countries with different climates and topography. Bedient et al. (2008) said that there is no one statistical distribution is best optimal to be used for all individual

river around the world. For instance, U.S Interagency Advisory Committee on Water Data (1982) has recommended that LP3 is the optimal distribution for flood frequency analysis in U.S.A while Natural Environment Research Council (1975) has recommended Gumbel's Extreme-Value Type II (EV2) distribution for flood frequency analysis in Great Britain.

Based on the comparative study of the flood frequency analysis using different probability distributions function on annual maximum flood series of selective rivers in Malaysia, the distribution which gives the best fit to the historical flood data of each of selected rivers should be determined. Moreover, the extreme flood values at the selected rivers will be computed as well. The computed extreme flood value can be used in hydraulic design located along the rivers and also for effective flood plain management. Hopefully the results in this study could contribute benefit in knowledge of applied flood frequency analysis in Malaysia.

1.3 Aim of Study

To compare various commonly used frequency distribution function on selected rivers in Malaysia and determine which frequency distribution function is optimal.

1.4 Objectives of Study

The objectives of present study are

i) To perform flood frequency analysis with various probability distribution function on selective rivers in Malaysia.
ii) To identify which probability distribution function is optimal for flood frequency analysis on selective rivers in Malaysia using goodness-of-fit test.
iii) To predict the extreme flood values on selective rivers in Malaysia.