MAKERERE UNIVERSITY

STATISTICAL MODELLING OF EXTREME FLOODS IN CENTRAL AND SOUTHERN UGANDA

BY

KATARATAMBI DAVID

B. ENG. CIVIL (HONS) (KYU)

A DISSERTATION SUBMITTED TO THE DIRECTORATE OF RESEARCH AND GRADUATE TRAINING IN PARTIAL FULFILMENT FOR THE AWARD OF MASTER OF SCIENCE IN CIVIL ENGINEERING DEGREE OF MAKERERE UNIVERSITY

JUNE 2012

Abstract

Extreme floods can cause substantial damage including death of humans and animals and information about their magnitudes and frequency is needed to manage and mitigate their impacts. Statistical tools are therefore required to model them. The main objective of this study was achieved by: i) compiling and screening flood data, ii) identifying appropriate statistical distributions, iii) generating regression models and regional frequency curves, and iv) producing the flood risk map.

Twenty eight sites from central and southern Uganda with records of annual maximum discharge data and having an average record length of thirty two years were used. L-Moments and their corresponding L-Moment Ratios were used to determine statistical distributions. Multiple Regression Analysis (MRA) was used to develop regression models, and frequency curves were determined by plotting ratios of annual maximum floods (AMF) to mean annual flood (MAF) versus the recurrence intervals of the floods. Homogeneous regions were identified basing on similarity of catchment characteristics and in order to produce a flood map, Arc-GIS and digital elevation model (DEM) of the sites were used.

Results show that Generalised Pareto (GPA) and Generalised Logistic (GLO) were the suitable statistical distributions for the study area. On the other hand, regression models indicated poor performance as depicted by their low values of coefficients of determination while the regional flood frequency curves indicated higher coefficients of determination and could therefore be useful in flood analysis. The flood map produced indicates significant flooding extent. In conclusion, whereas the Generalised Pareto and the Generalised Logistic distributions were suitable for characterising floods, regional frequency curves could be useful in estimation of flood magnitudes and their corresponding return period.