Estimation of Design Floods in Ungauged Catchments Using a Regional Index Flood Method. A Case Study of Lake Victoria Basin in Kenya

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Abstract
Reliable estimation of flood magnitudes corresponding to required return periods, vital for structural design purposes, is impacted by lack of hydrological data in the study area of Lake Victoria Basin in Kenya. Use of regional information, derived from data at gauged sites and regionalized for use at any location within a homogenous region, would improve the reliability of the design flood estimation. Therefore, the regional index flood method has been applied. Based on data from 14 gauged sites, a delineation of the basin into two homogenous regions was achieved using elevation variation (90-m DEM), spatial annual rainfall pattern and Principal Component Analysis of seasonal rainfall patterns (from 94 rainfall stations). At site annual maximum series were modelled using the Log normal (LN) (3P), Log Logistic Distribution (LLG), Generalized Extreme Value (GEV) and Log Pearson Type 3 (LP3) distributions. The parameters of the distributions were estimated using the method of probability weighted moments. Goodness of fit tests were applied and the GEV was identified as the most appropriate model for each site. Based on the GEV model, flood quantiles were estimated and regional frequency curves derived from the averaged at site growth curves. Using the least squares regression method, relationships were developed between the index flood, which is defined as the Mean Annual Flood (MAF) and catchment characteristics. The relationships indicated area, mean annual rainfall and altitude were the three significant variables that greatly influence the index flood. Thereafter, estimates of flood magnitudes in ungauged catchments within a homogenous region were estimated from the derived equations for index flood and quantiles from the regional curves. These estimates will improve flood risk estimation and to support water management and engineering decisions and actions.

Keywords
Flood magnitude;
Regionalization