第Ⅱ部門

Selection of distribution function in regional flood frequency analysis of Nepal

DPRI, Kyoto University Student Member ○Binaya Kumar MISHRA
DPRI, Kyoto University Fellow Kaoru TAKARA
DPRI, Kyoto University Member Yasuto TACHIKAWA

1. Introduction

Flood of a specified return period (also called design flood) need to be estimated in design of various hydraulic structures, flood protection works, and in planning for flood plain use. Conventional flood frequency analysis is used to estimate design flood at the site where long records of observed flood data is available. However, in most cases, location with historical data does not coincide with the site of interest or the available records become too short to make meaningful inferences.

Regional flood frequency analysis can estimate design flood at the sites with no historical data or of short historical data. Among the various method of regional flood frequency analysis, index flood method (Dalrymple, 1960) is most popular. The index flood procedure includes three major steps: identification of hydrologic homogeneous region, selection of regional frequency distribution and estimation of index flood (scale factor).

In the previous study, the first step i.e. identification of hydrologic homogeneous regions inside Nepalese territory was made. This study attempts to select best-fit distribution function for each identified regions. The study starts with collection and screening of historical flood data. L-moment technique (Hosking and Wallis, 1997), which is less biased to sample size, is proposed in selection of regional distribution function.

2. Data screening

Basic assumptions in any flood frequency analysis are historical data being homogeneous, stationary and free of outliers. Gauge stations having long record of observed data and drainage boundary not lying over two hydrologic regions were selected. This resulted selection of 53 gauge stations, among which 51 nos. were found with 10 or more years of annual instantaneous maximum discharge, in selection of regional distribution function. Each gauge station's data was checked for stationarity and homogeneity (assumption that the whole dataset come from the same distribution) at 5% significance level as discussed in Mann and Whitney (1947). Test for outlier was performed at 5% significant level as discussed by Grubbs (1969) and Grubbs and Beck (1972).

3. Selection of regional distribution

A record length of at least 10 or more years with adequate spatial representation of gauge stations is expected to give suitable selection of regional distribution function. The previous study identified 5 hydrologic homogeneous regions inside the Nepalese territory. One of the identified regions was found with only two gauge stations. In addition, these two stations were found with only 5 years of historical data. The present study intends to supplement the discharge records by using historical rainfall data on GIS-based runoff analysis system (ArcCN) in this region. Afterward, the L-moment ratio diagram and Z-statistics are used for selecting the best-fit-distribution.

The L-moment ratio diagram (Fig. 1) is a graph

between L-kurtosis and L-skewness and can be used to select a suitable probability distribution for a region. Theoretical curves of various distributions (*generalized logistic, generalized extreme value, generalized normal, Pearson type 3 and generalized Pareto*) as well as the regional L-skewness and L-kurtosis are plotted on same graph to select the best-fit-distribution. The Z-statistics judge how well the L-moment ratios of the fitted distribution match with the regionally averaged L-moment ratios. The distribution giving the minimum |Z| is considered the best-fit distribution.

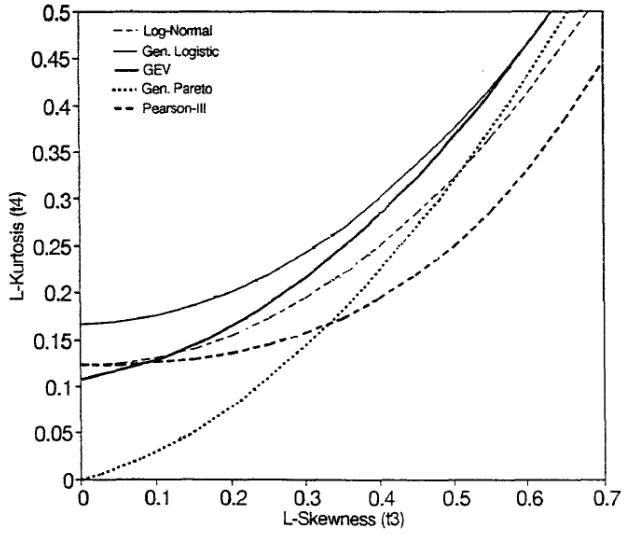

Fig.1 L-moment ratio diagram (skewness vs. kurtosis)

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