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Development of Regional Flood Frequency Relationship using L-Moments for South Bihar/Jharkhand

Rakesh Kumar, C. Chatterjee, Sanjay Kumar, A. K. Lohani and R. D. Singh

ABSTRACT

For planning and design of various types of water resources projects, estimation of flood magnitudes and their frequencies has been engaging attention of the engineers the world over since time immemorial. Whenever, rainfall or river flow records are not available at or near the site of interest, it is difficult for hydrologists or engineers to derive reliable flood frequency estimates directly. In such a situation, the regional flood frequency relationships or the flood formulae developed for the region are one of the alternative methods which provide estimates of design floods especially for small to moderate size catchments.

In this study, annual maximum peak flood data of 22 gauging sites lying in the states of Bihar/Jharkhand have been used. The states of Bihar/Jharkhand comprises of alluvial plains of Indo-Gangetic basin and Kaimur-Chotanagpur Santhal Pargana plateau. Catchment areas of these sites vary from 11.7 to 3171 square kilometers. Mean annual peak floods of these sites vary from 29.15 cumec to 1293.20 cumec. Comparative regional flood frequency analysis studies have been carried out using some of the commonly used frequency distributions viz. Extreme Value (EV1), General Extreme Value (GEV), Normal, Log Normal, Pearson Type-III (PT-III), Generalized Logistic (GLO), Exponential, Generalized Pareto (GPA), and Wake by, based on L-moments approach. L-moments of a random variable were first introduced by Hosking (1986). They are analogous to conventional moments, but are estimated as linear combinations of order statistics. Hosking (1986, 1990) defined L-moments as linear combinations of the PWMs. In a wide range of hydrologic applications, L-moments provide simple and efficient estimators of characteristics of hydrologic data and of a distribution's parameters (Stedinger et al., 1992). Based on the L-moment ratio diagram and ZDISI statistics criteria, Pearson Type-III (PT-III) distribution has been identified as the robust distribution for the study area. For estimation of floods of various return periods for the gauged catchments of the study area, the regional flood frequency relationship has been developed using the Pearson Type-III (PT-III)

distribution based regional flood frequency curves derived by utilising the L-moments approach. For estimation of floods of desired return periods for the ungauged catchments, the regional flood formula has been developed by coupling the regional flood frequency curves of the L-moments based Pearson Type-II1 distribution and regional relationship between annual maximum peak flood and catchment area. Thus, for estimation of floods of various return periods for the gauged catchments, the derived regional flood frequency relationship may be employed; whereas, the developed regional flood formula or its graphical representation may be used for estimation of floods of desired return periods for the ungauged catchments of study area.