Review Paper on Flood Frequency Analysis

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Abstract- Estimates of flood discharge with various probabilities of exceedance are needed for a widerange of engineering problems: examples are culvert and bridge design and construction in major projects. At a site with long flow series, these estimates may be derived by statistical analysis of the measured floods. Alternatively the storm magnitude for an appropriate duration, areal coverage and return period may be converted into the flood of a given return period using a rainfall-runoff model. In order to derive the probability of occurrence of any flood event, the frequency distribution, which can best describe the past characteristics on the magnitude and the probability of occurrence of such floods, must be known. This involves the determination of the best flood frequency model, which can be fitted to the available historical record.

Keywords – Exeedance, Magnitude.

I. INTRODUCTION

Knowledge of the magnitude and probable frequency of recurrence of floods is necessary to the proper design and location of structures such as dams, bridges, culverts, levees, highways, waterworks, sewage disposal plants, and industrial buildings. An engineer often must design a structure which may not be damaged or destroyed by occasional floods of varying magnitude. The frequency with which such damage may occur must be considered in determining the size or strength of the structure, its location, or the feasibility of building it at all. The problem is an economic one, involving computation of the total annual cost of maintaining a structure of a given design compared to the cost for other designs.

The use of the flood-frequency method has met some criticism, largely because it has been abused. The method has little place in determining maximum limits of flood design, that is, "the maximum possible flood." With the ordinary streamflow record of 25-year length, errors of sampling introduce large errors in judging the magnitude of the greater floods. However, if properly computed and conservatively interpreted, flood-frequency analysis is a valuable hydrologic tool. The subject attracts many students of hydrology and it has benefited by their extensive writings.

Fisher and Tippett (1928) developed frequency distributions of maximum values, sub- FLOOD-FREQUENCY ANALYSES 3 sequently applied by Gumbel (1945a) to floods. Hazen (1930) published a general treatise on the determination of frequency and magnitude by the use of logarithmic skew-frequency curves.

Jarvis (1936) edited a comprehensive source book on flood frequency containing chapters by Saville (p. 398-420) on the methods of Fuller, Foster, Hazen, Goodrich, and Slade; by Slade (p. 421- 432) giving an analysis of the errors

inherent in calculations of the mean, coefficient of variation, and the coefficient of skew with small samples; by Horton (p. 433-450) presenting his integral-frequency formula, in which flood magnitudes always continue to increase as the recurrence interval increases, but they increase towards a finite limit, not towards infinity; and by Bernard (p. 451-461), who discusses the determination of flood flow by the unit-hydrograph method.

Gumbel (1941) presented a paper on the return period of flood flows. Powell (1943) introduced the Gumbel method to engineers. Kinnison and Colby (1945) correlated peak discharges with measurable drainage-basin characteristics..

II. LITERATURE REVIEW

Universal Journal of Environmental Research and Technology
I
2013 Volume 3, Issue 6: 677-684
Frequency Analysis of Flood Flow at Garudeshwar Station in Narmada River, Gujarat, India
Khan Mujiburrehman
This paper presents a frequency distribution study on maximum monthly flood data in Narmada River at Garudeshwar station using widely used frequency distributions for periods from 1949 to 1979. The Normal, Lognormal, Log pearson type III and Gumbell extreme value type I are proposed and tested together with their single distributions to identify the optimal model for maximum monthly flood analysis. The selected model will be determined based on the minimum error produced by some criteria of goodness of-fit (GOF) tests. The results indicated that Normal distribution is better than the other distributions in modeling maximum monthly flood magnitude at Garudeshwar station in Narmada River. Hence frequency curve at Garudeshwar station is derived using Normal distribution method. However these results can vary between the flow gauge stations which are strongly influenced by their geographical, topographical and climatic factors. The following study can be used by planning and designing engineers for deciding the dimension of hydraulic structures such as bridges, dams, canals ,levees , and spillways etc. This study can be further extended into preparation of flood forecasting techniques and flood inundation maps for Narmada River.

IOSR Journal of Engineering (IOSRJEN)
Flood Frequency Analysis of Upper Krishna River Basin catchment area using Log Pearson Type III Distribution
B. K. Sathe,M. V. Khire,R. N. Sankhua
Research Scholar, CSRE, IIT-Bombay Corresponding author Associate Professor, CSRE, IIT-Bombay,

In this study, a flood frequency analysis of Upper Krishna River basin in India is carried out by Log-Pearson Type-III probability distribution method. This method is a statistical technique for fitting frequency distribution data to predict the flood for a river at some site. In Upper Krishna River The annual peak flood series data for 10 years varying over period 1965 to 2010 for 7 important stations such as Karad ,Warna, Arjunwad, Kurundwad, Warungi, Terwad, Sadagli are analysed.out of these seven stations Arjunwad and Kurundwad river gauging stations are important for flash flood point of view. The probability distribution function was applied to return periods (T) of T = 2 yrs, 5yrs, 10yrs, 25yrs, 50yrs, 100yrs and 200 yrs commonly used in for engineering design of hydraulic structures. These values are useful for hydraulic design of structures in the catchment area and for storm water management .The model relates the expected discharge to return period for all tributaries of Upper Krishna River basin.

International Journal of Research in Engineering and Technology
Flood Frequency Analysis Of River Kosi, Uttarakhand,India Using Statistical Approach
Saurabh Sah, Jyothi Prasad

In the present study, flood frequency analysis has been applied for river Kosi in Uttarakhand. The river Kosi is an important tributary of Ganga river system, which arising from Koshimool near Kausani, Almora district flows on the western side of the study area and to meet at Ramganga River. The annual flood series analysis has been carried out to estimate the flood quantiles at different return period at Kosi barrage site of river Kosi. The statistical approach provided a significant advantage of estimation of flood at any sites in the homogenous region with very less or no data. In the at –site analysis of annual flood series the Normal, Log normal, Pearson type III, Log Pearson type III, Gumbel and Log Gumbel distribution were applied using method of moments . From the analysis of different goodness of fit tests, it has been found that the Log Gumbel distribution with method of moment as parameters estimation found to be the best-fit distribution for Kosi River and other sites in the region. It is recommended that

the regional parameters for Kosi Basin may be used only for primary estimation of flood and should be reviewed when more regional data available.

International Journal of Computational Engineering
Flood Frequency Analysis of River Subernarekha, India, Using
Gumbel's Extreme Value Distribution
Dr. Manas Kumar Mukherjee

Estimation of Peak Flood Discharge for a desired return period is a pre-requisite for planning, design and management of hydraulic structures like barrages, dams, spillways, bridges etc. In this paper, a mathematical model has been developed between Peak Flood Discharge and Return Period using Gumbel's Extreme Value Distribution. The model will give reasonable estimate of Peak Flood discharge for any desired value of T, without any instrumentation and expensive and time consuming field work. Peak Discharge is a potential tool for designing important hydraulic structures like Concrete Gravity Dam, Weir, Barrage, and Bridge across the river, Guide bank etc. Moreover, the Stage corresponding to any given value of Peak Discharge can readily be ascertained by developing Rating Curves following the procedure given by the Author as referenced below. This Stage will be helpful in maintaining Danger Level Flood of the river Subernarekha. Emergency evacuation may be adopted by propagating well advanced 'Flood Warning' that may save thousands of lives from the fury of flood, may be put in place.

International Journal of Sciences:
Basic and Applied Research(IJSBAR)
Flood Frequency Analysis for JiyaDhol River of Brahmaputra Valley
Luna Moni Das, Zahid Husain Qureshi
Flood frequency analysis is an important mathematical modelling technique in determining the return period of the probability of witnessing a particular discharge in a river, especially a peak discharge. Floods as periodic events in a river basin are associated with high discharge. In flood frequency analysis the annual peak discharge in a river is fitted in different probability distributions. Three important statistical methods, most commonly used in flood frequency analysis, are - Gumbel's Extreme Value Distribution, Log Pearson Type III Distribution and Log Normal Distribution. In this paper, 40 years' (i.e., 1973 to 2012) annual peak discharge series of the JiyaDholriver has been tried to fit in the above mentioned frequency distribution models and the best distribution model(s) for the basin has been identified with the help of D-Index test. The JiyaDhol river basin is one of the most flooded river basins in the Brahmaputra valley of Assam (India). Floods cause heavy loss of life and property in the flood seasons (i.e., usually the monsoon season) in Lakhimpur and Dhemaji Districts of the north bank of the Brahmaputra valley in Assam. The selection of best probability distribution method in the studied river basin with the recent available records will definitely help the planners and administrators to estimate the major flood events and save life and property accordingly.

International Conference On Water Resources, Coastal And Ocean Engineering
Flood Frequency Analysis Of Tel Basin Of Mahanadi River System, India Using Annual Maximum And Pot Flood Data
Nibedita Guru, RamakarJha

Flood frequency analysis indicates the catchment characteristics, water availability and possible extreme hydrological conditions like floods and droughts at various locations of any river system. Such studies have been done in the past using long term annual maximum flood series for early warning, preparedness, mitigation and reduction of any kind of disasters. In the present study, Annual Maximum (AM) flood series and Peak over Threshold (POT) flood series were used to carry out flood frequency analysis for Tel basin of Mahanadi river system, India. The POT values were considered based on (a) commonly used standard practice and (b) flood values damaging the downstream areas and causing disaster in Mahanadi river system, India. To recognize the anomalies in tail behavior of the flood frequency distribution and for selecting appropriate flood frequency distributions, Quantile-Quantile plots (Q-Q plots) were used. The analysis was carried out for flood series data of two gauging stations Kesinga (upstream) and Kantamal (downstream) of Tel basin, Mahanadi river system, India for the years 1972-2009. Fourteen different flood frequency distributions were tried for am and Pot flood series data for 31 years for Kesinga and 38 years for Kantamal. The results obtained using Generalized Pareto (GP)

distribution shows better results for AM flood data series with all goodness of fit tests. However, for POT flood data series LogNormal (3P) distribution showed best results followed by GP distributions with all goodness of fit test. The distributions most suitable for POT data sets are same for the distribution being used globally for flood forecasting

American Journal of Civil Engineering
Flood frequency analysis by probability and stochastic method for Padma River, Bangladesh
Raihan Khan Opu, Abdullah Al Masum, Ringkon Biswas, Samiul Islam

In most of the practical cases, Flood frequency analysis is carried out due to the safe design of hydraulicstructures. This paper represents the result of Flood frequency analysis for Padma River at Hardinge Bridge station. The Flood frequencies of 2, 5, 10, 20, 50, 100, 200, 300, 400, 500 and 1000 year Floods was analyzed by probability methods develop by Gumbel, Powell, VenTe chow as well as Stochastic methods. The analysis was carried out for the duration of 13 years ranges from 2000 to 2012. This research aims to compare four methods of Flood frequency analysis to find the optimum method in terms of safe design of hydraulic structures. From the comparison between four methods the Gumbel and stochastic method may be recommended for designing and locating hydraulic structures.

Regional Flood Frequency Analysis
For Philippine Rivers
Leonardo Q. Liongson
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Regional flood frequency analysis has long been recognized as useful in providing statistical relationships for the transfer of flood frequency information from one river basin to another within the same homogeneous region, in order to augment data and improve estimates of annual flood magnitudes in the latter basin. This paper describes the regional study made on the annual maximum flood series of selected Philippine rivers situated in two water resources regions in northern Luzon, the largest island of the Philippines. Rivers with sufficiently long flow records were selected, and their sample means and higher moments were computed. Within each region, the flood index method is applied wherein the scaled data of annual flood values divided by the sample mean annual flood, $Q(T)/Q_{mean}$, are plotted versus the return period, T, or equivalently the reduced variate, $y = -\ln(-\ln(1-1/T))$. Regression equations are developed to relate the mean annual flood, Q_{mean}, and other statistical moments to the basin properties such as basin area, A. The regional equations obtained for the Philippine rivers are also compared with similar equations developed in other countries of the Asia-Pacific region. Computations of probability weighted moments (PWMs) yield graphs of L-moment ratios which give indications of distribution functions such as generalized extreme-value distribution (GEV) which are expected to give a good fit to the data samples.

IV.CONCLUSION

To have proper results for magnitude of floods and frequency of floods on given data
To calculate the intensity of flow of water during extreme flood
To know about the flow profiles of the water
To be able to decide the type of structure to be constructed
To have proper information about flow of water before construction of any structure in the water body

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