THESIS

DEVELOPMENT OF ENVELOPE CURVE FOR JHELUM RIVER BASIN

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ABSTRACT

Floods are one of the most common hazards all over the world, which result in a huge loss of people life, property and livestock. The magnitude and nature of floods are different at different locations and time periods. Some floods develop slowly, while others rapidly called flash floods which can develop in a very short time. Additionally, floods can be local, impacting a neighborhood or community, or very large, affecting entire river basins and multiple states. Pakistan is also a vulnerable country to flooding. Pakistan has been faced 17 major floods since 1947 which result in danger to life and property of thousands of people. Different techniques are being used for flood estimation and mitigation. Frequency analysis, Probable Maximum Flood (PMF) approach, Empirical formulae and Rational method are the most commonly used method for flood estimation studies all over the world. All of these methods have their own limitations. Envelope curve can also be used for the estimation of floods within a catchment. It is a graphical representation of maximum flood peaks versus catchment area.

Envelope curve is very quick method for the estimation of floods which has occurred in a certain area of the catchment. The study of largest floods observed in Pakistan is very important to calculate the maximum flood that can be occurred in a river basin. In present study Indus and Jhelum River basins were selected for the development of envelope curves. The maximum peak discharges observed at gauging stations in the selected regions were plotted versus the basin area to obtain an envelope curve such that the entire observed flood discharges lie below this curve. Envelope curve which was developed for Indus and Jhelum River basins can be used for the estimation of flood peak that can be occurred in these river basins. So Indus Jhelum envelope curve provides an upper bound value of flood within this catchment. Envelope curve results were also compared with PMF studies and it concluded that envelope curve estimated 56% less flood

discharge as compare to PMF estimated by MJV (Mangla joint venture) consultant. Whereas SCS unit hydrograph method estimated 37% less PMF values as compare to MJV study. The results of envelope curve were compared with those of the maximum probable flood estimates. These estimates that correspond to very low probabilities of exceedance (return period of the order 10000 year) were in the average 35% larger than those given by the envelope curve for US (costa, 1987). Indus Jhelum envelope curve provided an upper bound value for each gauging station present in these river basins which was used as supplementary information in a distribution function. By this approach, the estimation of discharge for higher return periods seems to provide more realistic discharge estimation for higher return periods. As it is clear from results that Log-Pearson III distribution crossed the upper bound most of the time whereas at some stations it estimated very low values of discharges even for higher return periods as compare to other distributions. A large variation was seen in Log-Pearson III results. So it is not fit for Indus and Jhelum River basins. On the other hand, Ghumbel distribution estimated suitable results and it didn't cross the upper bound envelope curve most of the time. So Ghumbel is best fit distribution for Indus and Jhelum River basins. Comparison between Indus Jhelum envelope curve and Danube River basin envelope curve show that Danube River basin envelope curve gives smaller values of maximum discharges than Indus Jhelum envelope curve for all catchment areas.