

THE RETURN PERIOD OF FLOOD FLOWS

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Introduction. Engineers have used various interpolation formulas to represent the observed distribution of flood discharges. These formulas are sometimes constructed *ad hoc* for a given stream, and have no general meaning. Most of them are rather complicated.¹ Some authors have tried to introduce upper and lower limits to the discharges, even though it is doubtful that such limits exist. Others have introduced the third and fourth moments of the distribution, in spite of the fact that these numerical values are subject to large errors. For some formulas it is impossible to give a meaning to the constants; different formulas applied to the same stream give rather contradictory results; and consequently there is considerable confusion. For example, Slade [20] has stated that "the statistical method in whatever form employed is an entirely inadequate tool in the determination of flood frequencies." According to Saville [19] "the engineer should satisfy himself that he has used an adequate number of methods, whether mathematical, graphic or otherwise, which have real support from either theory or experience, and then form his own judgement."

The main reason for this situation is that these studies have little or no theoretical basis. The author believes it possible to give exact solutions, exactitude being interpreted from the standpoint of the calculus of probabilities [10]. Our solutions are simply the consequences of a truism: "The flood discharges are the largest values of the discharges." The present study is but an explanation of this statement.

Many American authors start with a statistical function, which we call the return period of floods. Therefore we shall first analyse the notion of return period and show how it can be derived as a consequence of the concept of distribution. We then give a short résumé of the theory of largest values. The discharge, and in consequence the flood discharge, is considered as an unlimited statistical variable; it is not necessary to determine its distribution. We are justified in representing the observed distribution of flows by one of the theoretical distributions of largest values. The distribution we choose contains only two constants, and both have a clear hydrological meaning. The numerical values are calculated by the method of moments.

¹ In recent years many articles discussing this topic have been published by the American Society of Civil Engineers and the American Geophysical Union [8]. A review of some of the proposed formulas is given in the Water Supply Paper 771 [17].