I. HYDROLOGICAL EXTREMES

Natural disasters refer to hazardous activities damaging both resources and lives. There are different types of natural disasters such as floods, storms, tsunamis, earthquakes, etc. Over the course of its billions-year history, the earth has seen several natural disasters frequency analysis

Frequency analysis, regression analysis, and screening of time series are the most common statistical methods of analyzing hydrologic data. Frequency analysis is used to predict how often certain values of a variable phenomenon may occur and to assess the reliability of the prediction.

1.1 Flood Estimation

Flood estimation is one of the topics of engineering hydrology in which analysis of floods will be carried out. Flood estimation will be carried out based on the precipitation occurring in the catchment. Flood analysis is required to know the prevailing flood conditions for a particular catchment basin.

1.2 Flood-Peak Estimation

A flood is an unusually high stage in a river, usually the level at which the river overflows its banks and inundates the adjoining area. The design of bridges, culvert waterways, and spillways for dams and the estimation of the score at a hydraulic structure are some examples wherein flood-peak values are required. To estimate the magnitude of a flood peak, the following alternative methods are available:

1. Rational method
2. Empirical method
3. unit-hydrograph technique
4. Flood-frequency studies

1.Rational Method

The most realistic way to use the Rational Method is to consider it as a statistical link between rainfall frequency distribution and runoff. As such, it provides a means

of estimating the design flood of a certain return period, with the rainfall duration equal to the concentration time.

If $t_p \geq t_c$

$$Q_p = (1/36) \; k \; P_c \; A$$

Where,

- Q_p = Peak discharge in m^3/sec
- P_C = Critical design rainfall in cm/hr
- A = Area catchment in hectares
- K = Coefficient of runoff.
- t_D = Duration of rainfall
- t_C = Time of concentration

1.2 Empirical Formulae

(a) Dickens Formula (1865)

$$Q_p = C_D \; A^{3/4}$$

Where,

- Q_p = Flood peak discharge in m^3/sec
- A = Catchment area in km^2.
- C_D = Dickens constant, $6 \leq C_D \leq 30$.

(b) Ryes formula (1884)

$$Q_p = C_R \; A^{2/3}$$

Where,

- C_R = Ryes constant
- = 8.8 for the constant area within 80 km from the cost.
- = 8.5 if the distance of area is 80 km to 160 km from the cost.
- = 10.2 if the area is Hilley and away from the cost.

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(c) Inglis Formula (1930)

$$Q_P = \frac{124A}{\sqrt{A+10.4}} \simeq 123\sqrt{A}$$

Where

- A = Catchment area in Km^2.
- Q_P = Peak discharge in m^3/sec

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