

## PMP ESTIMATION BY STATISTICAL METHOD— A WORD OF CAUTION

1. An attempt has been made to sum up the views of various experts on the estimation of Probable Maximum Precipitation (PMP) by statistical technique. It is felt that statistical PMP estimates may not give as accurate results as those obtained by the conventional meteorological analysis.

2. Hershfield (1961) gave a statistical method of obtaining Probable Maximum Precipitation (PMP) of a given station having long period of rainfall data. He gave the following formulae for PMP estimation of a station :

$$\bar{X}_{\text{PMP}} = \bar{X}_n + S_n K_m \quad (1)$$

$$K_m = (\bar{X}_m - \bar{X}_{n-1})/S_{n-1} \quad (2)$$

where,  $\bar{X}_n$  — The mean of the annual maximum rainfall series of a given station for a given duration,

$S_n$  — The standard deviation of the annual maximum rainfall series of that station having rainfall data of  $n$ -year period,

$K_m$  — The frequency factor which is empirically obtained by Eqn. (2),

$X_m$  — The highest rainfall recorded in a given duration during the  $n$ -year period, and

$\bar{X}_{n-1}$  &  $S_{n-1}$  — Mean and standard deviation of the annual maximum series after excluding the highest rainfall value (*i.e.*,  $X_m$ ) from the series.

Subsequently, Hershfield (1965) after finding that  $K_m$  varies inversely with  $\bar{X}_n$ , modified the approach and obtained individual  $K_m$  values for a station for

different durations from 5 min to 24 hrs as a function of the mean annual series. Using Eqns. (1) and (2) and modified Hershfield (1965) technique, PMP can be worked out for any station having long period of rainfall data. In late sixties, Myers (1967) stated that Hershfield's method is a concise and convenient way of getting an approximate answer when the initial ignorance of the quantity to be estimated is great.

3. In India, as the rainfall data is available for over 3000 stations for periods varying from 75 to 100 years, Hershfield's method came handy for obtaining PMP of individual stations and preparation of generalised charts of PMP for one-day duration. Recently, 1-day duration PMP atlases for the country have been prepared by India Meteorological Department (IMD 1988) and Indian Institute of Tropical Meteorology (IITM 1989) separately utilizing the long period rainfall data.

4. As per the WMO (1986) manual for estimation of PMP, the Hershfield's statistical method tends to yield values of PMP which are lower than those obtained from the conventional methods like DAD envelopment, storm transposition, etc.

5. Considering the drawbacks in the statistical method, the Office of Hydrology, U.S. National Weather Service, Washington, D.C. and Canada does not consider the statistical method as a valid measure of PMP. They only use the statistical method to get an approximate estimate of PMP for a specific location. In England normally 10,000-year rainfall values are considered equivalent to PMP while in South Africa PMP based upon Francou-Rodier method is normally employed. China and Australia use modified USA approach while Norway uses a modified British approach. It has been observed that at present no country is exclusively using the Hershfield statistical method for obtaining PMP estimates, but at the same time there is no one universally accepted procedure of obtaining PMP. WMO (1986) manual on PMP, however, recommends procedures developed by the Office of Hydrology, U.S. National Weather Service since mid-thirties of this century.

7. A recent study by Lin and Vogel (1993), revealed that the number of years is a function of the deviation from the mean of the extreme rainfall event.

They found that it requires a long-period, at least 150 years or more, of rainfall data in order to obtain a reliable estimate of PMP at a point. The other disadvantage with this method is that it does not provide any information about areal or temporal distribution of PMP, which is not the case with the conventional method.

8. It is, therefore, concluded that statistical estimation of PMP, may be used with caution and care.

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