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Development of Rainfall Nomograph for Parbhani

U N Karad, B B Tapdiya, B W Bhuibhar, S R Harkal and S S Kendra
Department of Agricultural Meteorology, Marathwada Agricultural University, Parbhani - 431 402 India

Knowledge of rainfall intensity, with respect to duration and frequency is required for estimation of runoff and design of soil conservation and runoff disposal structures. Nomograph provides the most handy tool for determination of intensity by avoiding the repeatative solutions of the mathematical expressions. Nomograph and mathematical equations for rainfall intensity, duration and frequency have been developed for Parbhani,a drought prone area in India.

Parbhani is one of the district of Marathwada region in Maharastra State. Rainfall data of 14 years (1977-1990) duration in the shape of hyetograph, collected at Department of Agricultural Meteorology, MAU, Parbhani, were analysed for the present study. The alignment charts were prepared considering frequency (Return period), duration and rainfall intensity as sugeggested by Luzadder (1964).

The relationship developed between these three variables is as follows

$$I = \frac{7.454 \cdot T^{0.1551}}{(t + 0.5)^{0.8524}} \text{ cm h}^{-1}$$

in which,

I = rainfall intensity, cm h^{-1}

T = return period, years and

t = duration, hours.

On the basis of this relationship nomograph for Parbhani (Fig 1) was prepared. From this nomograph, rainfall intensity for any desired duration and for 10 to 100 year frequency could be read for the Parbhani. Observed rainfall intensity values

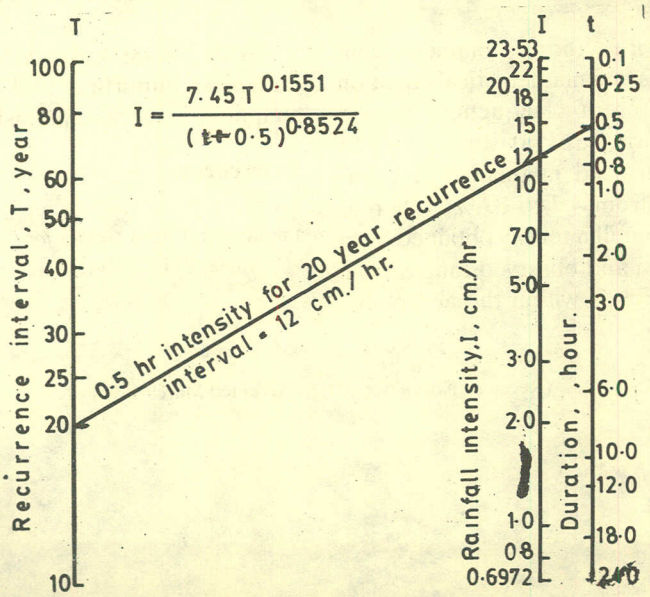

Fig. 1. Intensity duration return period nomograph for parbhani

Table 1 *Comparison among calculated, nomographic and observed intensities of rainfall and their deviation.*

Frequency years		Duration (min)						
		15	30	60	120	360	720	1440
10	i_{cal}	13.61	10.65	7.54	4.84	2.16	1.23	0.69
	i_{nomo}	13.50	10.70	7.40	4.85	2.25	1.30	0.69
	i	14.0	9.85	6.65	4.70	2.15	1.28	0.72
	δ	–2.78	8.12	13.38	3.61	0.46	–3.9	–4.16
	δ_{nomo}	0.81	0.46	1.89	0.41	–0.04	–5.38	0.0
20	i_{cal}	15.15	11.86	8.39	5.43	2.40	1.37	0.77
	i_{nomo}	15.0	12.0	8.45	5.35	2.45	1.50	0.76
	j	15.5	11.10	8.35	5.40	2.42	1.46	0.82
	δ	–2.25	6.84	0.47	0.55	–0.82	–6.16	–6.09
	δ_{nomo}	0.01	–1.16	–0.71	1.49	–2.04	–8.66	1.31
50	i_{cal}	17.47	13.67	9.67	6.26	2.77	1.58	0.89
	i_{nomo}	17.25	13.60	9.75	6.20	2.70	1.65	0.85
	i	17.95	12.25	8.85	6.45	2.80	1.80	–0.94
	δ	–2.67	11.59	8.04	–2.94	–1.07	+12.22	–5.31
	δ_{nomo}	1.27	0.51	–0.82	0.96	2.59	–4.24	4.70

Where, i_{cal} = Calculated intensity of rainfall (cm h^{-1}) from developed equations of the particular station.
i_{nomo} = Observed intensity of rainfall (cm h^{-1}) from nomographs of the particular station.
i = observed intensity (cm h^{-1}) from the probability charts of the particular station.
δ = Per cent deviation of observed values from the probability charts from those calculated by the developed equations.
δ_{nomo} = Per cent deviation of nomographic values from those calculated by developed equations.

were compared with those obtained from nomographic solutions and mathematical equation developed for different frequency period (Table1). Maximum deviation between nomographic solutions and mathematical equations (nomo) ranges from 4.7 to 8.6%. Whereas deviations between rainfall intensity obtained from mathematical equation and observed ranges from 12.22 to 23.33% , which is within the acceptable limit.

This nomograph serves as a time saving device and most important tool because of quickness, simplicity in use and precision in results.

References

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