

Lesson 19: Streamflow Prediction Rainfall Excess Prediction Using the ϕ -Index

Given

- Incremental rainfall hyetograph
- $\phi = 0.6$ in/hr
- Watershed area $A = 1$ mi²

Find

- Incremental rainfall excess (P_e)
- Effective storm duration (t_r)
- Depth (r_d) and volume (V_d) of direct runoff
- Infiltration (rate f and incremental accumulation F)

Time (hours)	Incr. P (in)	i (in/hr)	ϕ (in/hr)	i_e (in/hr)	Incr. P_e (in)	f (in/hr)	Incr. F (in)
0							
	1.0	0.5	0.6	0.0	0.0	0.5	1.0
2							
	2.0	1.0	0.6	0.4	0.8	0.6	1.2
4							
	4.0	2.0	0.6	1.4	2.8	0.6	1.2
6							
	1.0	0.5	0.6	0.0	0.0	0.5	1.0
8							
	8.0				3.6		4.4

Effective duration (t_r)

$$t_r = 4 \text{ hours (from hour 2 through 6)}$$

Depth of direct runoff (r_d)

$$r_d = \sum P_e = 0.8 + 2.8 = 3.6 \text{ inches}$$

Volume of direct runoff (V_d)

$$\begin{aligned} V_d &= r_d A \\ &= (3.6 \text{ in})(1 \text{ mi}^2)(640 \text{ ac/mi}^2)/(12 \text{ in/ft}) \\ &= 192 \text{ ac-ft} \end{aligned}$$