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Abstractions from Precipitation Formulas

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List of 30 Abstractions from Precipitation Formulas

Abstractions from Precipitation

Infiltration Indices

W-Index

1) Duration of Rainfall Excess given W Index

Open Calculator

fx $$t_e = \frac{P - R - I_a}{W}$$

ex $$4h = \frac{118cm - 48cm - 6.0cm}{16cm}$$

2) Initial Losses given W-Index

Open Calculator

fx $$I_a = P - R - (W \cdot t_e)$$

ex $$6cm = 118cm - 48cm - (16cm \cdot 4h)$$

3) Total Storm Precipitation when W Index

Open Calculator

fx $$P = (W \cdot t_e) + R + I_a$$

ex $$118cm = (16cm \cdot 4h) + 48cm + 6.0cm$$

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4) Total Storm Runoff given W Index

Open Calculator

fx $$R = P - I_a - (W \cdot t_e)$$

ex $$48\text{cm} = 118\text{cm} - 6.0\text{cm} - (16\text{cm} \cdot 4\text{h})$$

5) W-Index

Open Calculator

fx $$W = \frac{P - R - I_a}{t_e}$$

ex $$16\text{cm} = \frac{118\text{cm} - 48\text{cm} - 6.0\text{cm}}{4\text{h}}$$

Φ-Index

6) Duration of Rainfall Excess given Total Runoff Depth

Open Calculator

fx $$t_e = \frac{P - R_d}{\varphi}$$

ex $$4.301075\text{h} = \frac{118\text{cm} - 117.88\text{cm}}{0.0279}$$

7) Duration of Rainfall from Rainfall Hyetograph

Open Calculator

fx $$D = N \cdot \Delta t$$

ex $$18\text{h} = 6 \cdot 3\text{h}$$

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8) Phi Index for Practical Use

Open Calculator

fx $$\varphi = \frac{I - R_{24\text{-}h}}{24}$$

ex $$0.027917 = \frac{0.8\text{cm/h} - 0.13\text{cm}}{24}$$

9) Phi Index given Total Runoff Depth

Open Calculator

fx $$\varphi = \frac{P - R_d}{t_e}$$

ex $$0.03 = \frac{118\text{cm} - 117.88\text{cm}}{4\text{h}}$$

10) Precipitation given Total Runoff Depth for Practical Use

Open Calculator

fx $$P = R_d + (\varphi \cdot t_e)$$

ex $$117.9916\text{cm} = 117.88\text{cm} + (0.0279 \cdot 4\text{h})$$

11) Pulses of Time Interval from Rainfall Hyetograph

Open Calculator

fx $$N = \frac{D}{\Delta t}$$

ex $$7 = \frac{21\text{h}}{3\text{h}}$$

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12) Rainfall Intensity for Phi Index of Practical Use

Open Calculator

fx $$I = (\varphi \cdot 24) + R_{24\text{-h}}$$

ex $$0.7996\text{cm/h} = (0.0279 \cdot 24) + 0.13\text{cm}$$

13) Runoff for Phi Index for Practical Use

Open Calculator

fx $$R_{24\text{-h}} = I - (\varphi \cdot 24)$$

ex $$0.1304\text{cm} = 0.8\text{cm/h} - (0.0279 \cdot 24)$$

14) Runoff to Determine Phi Index for Practical Use

Open Calculator

fx $$R_{24\text{-h}} = \alpha \cdot I^{1.2}$$

ex $$38.2541\text{cm} = 0.5 \cdot (0.8\text{cm/h})^{1.2}$$

15) Time Interval of Rainfall Hyetograph

Open Calculator

fx $$\Delta t = \frac{D}{N}$$

ex $$3.5\text{h} = \frac{21\text{h}}{6}$$

16) Total Direct Runoff Depth

Open Calculator

fx $$R_d = P - (\varphi \cdot t_e)$$

ex $$117.8884\text{cm} = 118\text{cm} - (0.0279 \cdot 4\text{h})$$

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Modelling Infiltration Capacity

Infiltration Capacity Equation

17) Darcy's Hydraulic Conductivity given Infiltration Capacity

Open Calculator

fx $$k = f_p - \left(\frac{1}{2}\right) \cdot s \cdot \frac{t^{-1}}{2}$$

ex $$14.75\text{cm/h} = 16\text{cm/h} - \left(\frac{1}{2}\right) \cdot 10 \cdot \frac{(2\text{h})^{-1}}{2}$$

18) Darcy's Hydraulic Conductivity given Infiltration Capacity from Philip's Equation

Open Calculator

fx $$k = \frac{F_p - \left(s \cdot t^{\frac{1}{2}}\right)}{t}$$

ex $$2.928932\text{cm/h} = \frac{20\text{cm/h} - \left(10 \cdot (2\text{h})^{\frac{1}{2}}\right)}{2\text{h}}$$

19) Equation for Infiltration Capacity

Open Calculator

fx $$f_p = \left(\frac{1}{2}\right) \cdot s \cdot t^{-\frac{1}{2}} + k$$

ex $$6.465534\text{cm/h} = \left(\frac{1}{2}\right) \cdot 10 \cdot (2\text{h})^{-\frac{1}{2}} + 2.93\text{cm/h}$$

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20) Infiltration rate by Horton's equation

Open Calculator

fx $$f_p = f_c + (f_0 - f_c) \cdot \exp(-(K_d \cdot t))$$

ex $$19.44491\text{cm/h} = 15\text{cm/h} + (21\text{cm/h} - 15\text{cm/h}) \cdot \exp(-(0.15 \cdot 2\text{h}))$$

21) Kostiakov Equation

Open Calculator

fx $$F_p = a \cdot t^b$$

ex $$20.08183\text{cm/h} = 3.55 \cdot (2\text{h})^{2.5}$$

22) Philip's Equation

Open Calculator

fx $$F_p = s \cdot t^{\frac{1}{2}} + k \cdot t$$

ex $$20.00214\text{cm/h} = 10 \cdot (2\text{h})^{\frac{1}{2}} + 2.93\text{cm/h} \cdot 2\text{h}$$

23) Sorptivity for Cumulative Infiltration Capacity is from Philip's Equation

Open Calculator

fx $$s = \frac{F_p - k \cdot t}{t^{\frac{1}{2}}}$$

ex $$9.99849 = \frac{20\text{cm/h} - 2.93\text{cm/h} \cdot 2\text{h}}{(2\text{h})^{\frac{1}{2}}}$$

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24) Sorptivity given Infiltration Capacity

Open Calculator

$$s = \frac{(f_p - k) \cdot 2}{t^{-\frac{1}{2}}}$$

$$36.96754 = \frac{(16\text{cm/h} - 2.93\text{cm/h}) \cdot 2}{(2\text{h})^{-\frac{1}{2}}}$$

Green-Ampt Equation (1911)

25) Capillary Suction given Infiltration Capacity

Open Calculator

$$S_c = \left(\frac{f_p}{K} - 1\right) \cdot \frac{F_p}{\eta}$$

$$9.230769 = \left(\frac{16\text{cm/h}}{13\text{cm/h}} - 1\right) \cdot \frac{20\text{cm/h}}{0.5}$$

26) Cumulative Infiltration Capacity given Green-Ampt Parameters of Infiltration Model

Open Calculator

$$F_p = \frac{n}{f_p - m}$$

$$20\text{cm/h} = \frac{40}{16\text{cm/h} - 14}$$

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27) Darcy's Hydraulic Conductivity given Infiltration Capacity from Green-Ampt Equation

Open Calculator

$$K = \frac{f_p}{1 + \frac{\eta \cdot S_c}{F_p}}$$

$$13.91304\text{cm/h} = \frac{16\text{cm/h}}{1 + \frac{0.5 \cdot 6}{20\text{cm/h}}}$$

28) Green Ampt Equation

Open Calculator

$$f_p = K \cdot \left(1 + \frac{\eta \cdot S_c}{F_p}\right)$$

$$14.95\text{cm/h} = 13\text{cm/h} \cdot \left(1 + \frac{0.5 \cdot 6}{20\text{cm/h}}\right)$$

29) Infiltration Capacity given Green-Ampt Parameters of Infiltration Model

Open Calculator

$$f_p = m + \frac{n}{F_p}$$

$$16\text{cm/h} = 14 + \frac{40}{20\text{cm/h}}$$

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30) Porosity of Soil given Infiltration Capacity from Green-Ampt Equation

Open Calculator

fx $$\eta = \left(\frac{f_p}{K} - 1\right) \cdot \frac{F_p}{S_c}$$

ex $$0.769231 = \left(\frac{16\text{cm/h}}{13\text{cm/h}} - 1\right) \cdot \frac{20\text{cm/h}}{6}$$

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Variables Used

- **a** Local Parameter a
- **b** Local Parameter b
- **D** Duration *(Hour)*
- f_0 Initial Infiltration Capacity *(Centimeter per Hour)*
- f_c Final Steady State Infiltration Capacity *(Centimeter per Hour)*
- f_p Infiltration Capacity at Any Time t *(Centimeter per Hour)*
- F_p Cumulative Infiltration Capacity *(Centimeter per Hour)*
- **I** Intensity of Rainfall *(Centimeter per Hour)*
- I_a Depression and Interception Losses *(Centimeter)*
- **k** Hydraulic Conductivity *(Centimeter per Hour)*
- **K** Darcy's Hydraulic Conductivity *(Centimeter per Hour)*
- K_d Decay Coefficient
- **m** Parameter 'm' of Infiltration Model by Green-Ampt
- **n** Parameter 'n' of Infiltration Model by Green-Ampt
- **N** Pulses of Time Interval
- **P** Total Storm Precipitation *(Centimeter)*
- **R** Total Storm Runoff *(Centimeter)*
- $R_{24\text{-}h}$ Runoff in Cm from 24h Rainfall *(Centimeter)*
- R_d Total Direct Runoff *(Centimeter)*
- **s** Sorptivity
- S_c Capillary Suction at Wetting Front
- **t** Time *(Hour)*

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- t_e Duration of Rainfall Excess *(Hour)*
- **W** W-Index *(Centimeter)*
- **α** Coefficient Depending on Soil Type
- **Δt** Time Interval *(Hour)*
- **η** Porosity
- **φ** Φ-Index

Constants, Functions, Measurements used

- Function: **exp**, exp(Number)
  Exponential function
- Measurement: **Length** in Centimeter (cm)
  Length Unit Conversion
- Measurement: **Time** in Hour (h)
  Time Unit Conversion
- Measurement: **Speed** in Centimeter per Hour (cm/h)
  Speed Unit Conversion

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- **Precipitation Formulas**

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