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Precipitation Formulas

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List of 19 Precipitation Formulas

Precipitation

1) Correction Ratio in Test for Consistency of Record

Open Calculator

fx $$C.R = \frac{M_c}{M_a}$$

ex $$1.333333 = \frac{1.2}{0.9}$$

2) Depth of rainfall given volume of rainfall

Open Calculator

fx $$d = \frac{V}{A}$$

ex $$20\text{mm} = \frac{50\text{m}^3}{25\text{m}^2}$$

3) Dredge or Burge Formula

Open Calculator

fx $$Q_p = 19.6 \cdot \frac{A_{catchment}}{(L_b)^{\frac{2}{3}}}$$

ex $$4.060117\text{m}^3/\text{s} = 19.6 \cdot \frac{2.0\text{m}^2}{(30\text{m})^{\frac{2}{3}}}$$

4) Total Runoff over Catchment

Open Calculator

fx $$Q_V = S_r + I + B + C$$

ex $$19.11\text{m}^3 = 0.05\text{m}^3/\text{s} + 2\text{m}^3/\text{s} + 16.96\text{m}^3/\text{s} + 100\text{mm}$$

5) Volume of rainfall

Open Calculator

fx $$V = A \cdot d$$

ex $$50\text{m}^3 = 25\text{m}^2 \cdot 20\text{mm}$$

Maximum Intensity-Duration-Frequency Relationship

6) Duration given Maximum Intensity

Open Calculator

fx $$D = \left(\left(K \cdot \frac{T_r^x}{i_{max}}\right) - a^n\right)^{\frac{1}{n}}$$

ex $$3.012085\text{h} = \left(\left(4 \cdot \frac{(150)^{1.5}}{266.794\text{cm/h}}\right) - (0.6)^3\right)^{\frac{1}{3}}$$

7) Maximum Intensity in General Form

Open Calculator

fx $$i_{max} = \frac{K \cdot T_r^x}{(D + a)^n}$$

ex $$266.794\text{cm/h} = \frac{4 \cdot (150)^{1.5}}{(2.42\text{h} + 0.6)^3}$$

8) Return Period given Maximum Intensity

Open Calculator

fx $$T_r = \left(\frac{i_{max} \cdot (D + a)^n}{K} \right)^{\frac{1}{x}}$$

ex $$150 = \left(\frac{266.794\text{cm/h} \cdot (2.42\text{h} + 0.6)^3}{4} \right)^{\frac{1}{1.5}}$$

Measurement of Precipitation

Radar measurement of Rainfall

9) Intensity of Rainfall given Radar Echo Factor

Open Calculator

fx $$i = \left(\frac{Z}{200} \right)^{\frac{1}{1.6}}$$

ex $$1.6\text{mm/h} = \left(\frac{424.25}{200} \right)^{\frac{1}{1.6}}$$

10) Radar Echo Factor using Intensity

Open Calculator

fx $$Z = 200 \cdot i^{1.6}$$

ex $$424.2501 = 200 \cdot (1.6\text{mm/h})^{1.6}$$

11) Radar Measurement of Rainfall

Open Calculator

fx $$P_r = \frac{C_{radar} \cdot Z}{r^2}$$

ex $$2.12125 = \frac{2.00 \cdot 424.25}{(20000\text{mm})^2}$$

Preparation of Data

Test for Consistency of Record

12) Corrected Precipitation at any Time Period at Station 'X'

Open Calculator

fx $$P_{cx} = P_x \cdot \frac{M_c}{M_a}$$

ex $$16\text{mm} = 12\text{mm} \cdot \frac{1.2}{0.9}$$

13) Corrected Slope of Double Mass Curve

Open Calculator

fx $$M_c = \frac{P_{cx} \cdot M_a}{P_x}$$

ex $$1.2 = \frac{16\text{mm} \cdot 0.9}{12\text{mm}}$$

14) Original Recorded Precipitation given Corrected Precipitation at any Time Period

Open Calculator

fx $$P_x = \frac{P_{cx} \cdot M_a}{M_c}$$

ex $$12\text{mm} = \frac{16\text{mm} \cdot 0.9}{1.2}$$

15) Original Slope of Double Mass Curve given Corrected Precipitation

Open Calculator

fx $$M_a = \frac{P_x \cdot M_c}{P_{cx}}$$

ex $$0.9 = \frac{12\text{mm} \cdot 1.2}{16\text{mm}}$$

Probable Maximum Precipitation (PMP)

16) Duration given Extreme Rainfall Depth

Open Calculator

fx $$D = \left(\frac{P_m}{42.16}\right)^{\frac{1}{0.475}}$$

ex $$2.419968\text{h} = \left(\frac{641.52\text{mm}}{42.16}\right)^{\frac{1}{0.475}}$$

17) Extreme Rainfall Depth

Open Calculator

fx $$P_m = 42.16 \cdot D^{0.475}$$

ex $$641.524\text{mm} = 42.16 \cdot (2.42\text{h})^{0.475}$$

18) Statistical Approach of PMP by using Chow's Equation

Open Calculator

fx $$PMP = P + K_z \cdot \sigma$$

ex $$59.01\text{mm} = 49.7\text{mm} + 7 \cdot 1.33$$

Raingauge Network

19) Optimum number of rain gauge stations

Open Calculator

fx $$N = \left(\frac{C_v}{E}\right)^2$$

ex $$2.777778 = \left(\frac{10}{6}\right)^2$$

Variables Used

- **a** Coefficient a
- **A** Area of Accumulated Rain *(Square Meter)*
- $A_{catchment}$ Catchment Area *(Square Meter)*
- **B** Baseflow *(Cubic Meter per Second)*
- **C** Channel Precipitation *(Millimeter)*
- C_{radar} A Constant
- C_v Coefficient of Variation of Rainfall
- **C.R** Correction Ratio
- **d** Depth of Rainfall *(Millimeter)*
- **D** Duration of Excess Rainfall in Hours *(Hour)*
- **E** Allowable Degree of Error
- **i** Intensity of Rainfall *(Millimeter per Hour)*
- **I** Interflow *(Cubic Meter per Second)*
- i_{max} Maximum Intensity *(Centimeter per Hour)*
- **K** Constant K
- K_z Frequency Factor
- L_b Length of Basin *(Meter)*
- M_a Original Slope of Double-Mass Curve
- M_c Corrected Slope of Double-Mass Curve
- **n** Constant n
- **N** Optimum Number of Rain Gauge Stations
- **P** Mean Precipitation of Annual Maximum Values *(Millimeter)*

- P_{cx} Corrected Precipitation *(Millimeter)*
- P_m Extreme Rainfall Depth *(Millimeter)*
- P_r Average Echo Power
- P_x Original Recorded Precipitation *(Millimeter)*
- **PMP** Probable Maximum Precipitation *(Millimeter)*
- Q_p Peak Discharge *(Cubic Meter per Second)*
- Q_V Runoff Volume *(Cubic Meter)*
- **r** Distance to Target Volume *(Millimeter)*
- S_r Surface Runoff *(Cubic Meter per Second)*
- T_r Return Period
- **V** Volume of Rainfall *(Cubic Meter)*
- **x** Coefficient x
- **Z** Radar-Echo Factor
- **σ** Standard Deviation

Constants, Functions, Measurements used

- Measurement: **Length** in Millimeter (mm), Meter (m)
  Length Unit Conversion
- Measurement: **Time** in Hour (h)
  Time Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Area** in Square Meter (m^2)
  Area Unit Conversion
- Measurement: **Speed** in Centimeter per Hour (cm/h), Millimeter per Hour (mm/h)
  Speed Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion

Check other formula lists

- Abstractions from Precipitation Formulas
- Area-Velocity and Ultrasonic Method of Streamflow Measurement Formulas
- Discharge Measurements Formulas
- Indirect Methods of Streamflow Measurement Formulas
- Losses from Precipitation Formulas
- Measurement of Evapotranspiration Formulas
- Precipitation Formulas
- Streamflow Measurement Formulas

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