Important Water Budget Equation for a Catchment Formulas PDF

Formulas
Examples
with Units

List of 20
Important Water Budget Equation for a Catchment Formulas

1) Catchment Area given Peak Discharge in Jarvis formula Formula

Evaluate Formula

Formula

$$A = \left(\frac{Q_p}{C}\right)^2$$

Example with Units

$$0.0005\,\text{m}^2 = \left(\frac{4\,\text{m}^3/\text{s}}{177}\right)^2$$

2) Change in Storage of Water in Catchment Formula

Evaluate Formula

Formula

$$S = \Delta S + \Delta Sm + \Delta Ss$$

Example with Units

$$18\,\text{m}^3 = 7\,\text{m}^3 + 6\,\text{m}^3 + 5.0\,\text{m}^3$$

3) Continuity equation for water balance Formula

Evaluate Formula

Formula

$$\Delta s = Q - V_o$$

Example with Units

$$5\,\text{m} = 30\,\text{m}^3/\text{s} - 25\,\text{m}^3$$

4) Ground Water Storage given Storage of Water in Catchment Formula

Evaluate Formula

Formula

$$\Delta S = S - \Delta Ss - \Delta Sm$$

Example with Units

$$7\,\text{m}^3 = 18\,\text{m}^3 - 5.0\,\text{m}^3 - 6\,\text{m}^3$$

5) Mass Outflow given Change in Mass Storage Formula

Evaluate Formula

Formula

$$V_o = Q - \Delta s$$

Example with Units

$$25\,\text{m}^3 = 30\,\text{m}^3/\text{s} - 5\,\text{m}$$

6) Mass Outflow Rate given Change in Mass Storage Formula

Evaluate Formula

Formula

$$Q = \Delta s + V_o$$

Example with Units

$$30\,\text{m}^3/\text{s} = 5\,\text{m} + 25\,\text{m}^3$$

7) Mean Annual Flood proposed by Natural Environment Research Council Formula

Evaluate Formula

Formula

$$Q_{mean} = C_{NERC} \cdot A_{NERC}^{0.94} \cdot SF^{0.27} \cdot S_C^{0.16} \cdot SO^{1.23} \cdot RSMD^{1.03} \cdot (1 + a)^{-0.85}$$

Example with Units

$$25.045\,m^3/s = 0.0315 \cdot 7.6^{0.94} \cdot 5.5^{0.27} \cdot 8.7^{0.16} \cdot 8.9^{1.23} \cdot 49.2^{1.03} \cdot (1 + 24\,m^2)^{-0.85}$$

8) Precipitation in Rainfall Runoff Relationship Formula

Evaluate Formula

Formula

$$P = S_r + L$$

Example with Units

$$50\,mm = 0.05\,m^3/s + 49.95\,m^3$$

9) Rainfall Runoff Relationship Formula

Evaluate Formula

Formula

$$S_r = P - L$$

Example with Units

$$0.05\,m^3/s = 50\,mm - 49.95\,m^3$$

10) Runoff Losses in Rainfall Runoff Relationship Formula

Evaluate Formula

Formula

$$L = P - S_r$$

Example with Units

$$49.95\,m^3 = 50\,mm - 0.05\,m^3/s$$

11) Soil Moisture Storage given Storage of Water Formula

Evaluate Formula

Formula

$$\Delta Sm = S - \Delta Ss - \Delta S$$

Example with Units

$$6\,m^3 = 18\,m^3 - 5.0\,m^3 - 7\,m^3$$

12) Surface Water Storage given Storage of Water in Catchment Formula

Evaluate Formula

Formula

$$\Delta Ss = S - \Delta Sm - \Delta S$$

Example with Units

$$5\,m^3 = 18\,m^3 - 6\,m^3 - 7\,m^3$$

13) Hydrological Continuity Equation Formulas

13.1) Daily Groundwater Inflow Formula

Evaluate Formula

Formula

$$V_{ig} = V_{os} + V_{og} + E_L + \Delta S_L + T_L - P - V_{is}$$

Example with Units

$$5\,m^3/s = 2\,m^3/s + 4\,m^3/s + 1958\,mm + 70\,mm + 22\,mm - 50\,mm - 3\,m^3/s$$

13.2) Daily Precipitation from Water Budget Continuity Equation Formula

Evaluate Formula

Formula

$$P = V_{os} + V_{og} + E_L + \Delta S_L + T_L - V_{is} - V_{ig}$$

Example with Units

$$50\,\text{mm} = 2\,\text{m}^3/\text{s} + 4\,\text{m}^3/\text{s} + 1958\,\text{mm} + 70\,\text{mm} + 22\,\text{mm} - 3\,\text{m}^3/\text{s} - 5\,\text{m}^3/\text{s}$$

13.3) Daily Seepage Outflow Formula

Evaluate Formula

Formula

$$V_{og} = P + V_{ig} + V_{is} - V_{os} - E_L - \Delta S_L - T_L$$

Example with Units

$$4\,\text{m}^3/\text{s} = 50\,\text{mm} + 5\,\text{m}^3/\text{s} + 3\,\text{m}^3/\text{s} - 2\,\text{m}^3/\text{s} - 1958\,\text{mm} - 70\,\text{mm} - 22\,\text{mm}$$

13.4) Daily Surface Inflow into Lake Formula

Evaluate Formula

Formula

$$V_{is} = V_{og} + V_{os} + E_L + \Delta S_L + T_L - P - V_{ig}$$

Example with Units

$$3\,\text{m}^3/\text{s} = 4\,\text{m}^3/\text{s} + 2\,\text{m}^3/\text{s} + 1958\,\text{mm} + 70\,\text{mm} + 22\,\text{mm} - 50\,\text{mm} - 5\,\text{m}^3/\text{s}$$

13.5) Daily Surface Outflow from Lake Formula

Evaluate Formula

Formula

$$V_{os} = P + V_{is} + V_{ig} - V_{og} - E_L - \Delta S_L - T_L$$

Example with Units

$$2\,\text{m}^3/\text{s} = 50\,\text{mm} + 3\,\text{m}^3/\text{s} + 5\,\text{m}^3/\text{s} - 4\,\text{m}^3/\text{s} - 1958\,\text{mm} - 70\,\text{mm} - 22\,\text{mm}$$

13.6) Daily Transpiration Loss Formula

Evaluate Formula

Formula

$$T_L = P + V_{is} + V_{ig} - V_{os} - V_{og} - E_L - \Delta S_L$$

Example with Units

$$22\,\text{mm} = 50\,\text{mm} + 3\,\text{m}^3/\text{s} + 5\,\text{m}^3/\text{s} - 2\,\text{m}^3/\text{s} - 4\,\text{m}^3/\text{s} - 1958\,\text{mm} - 70\,\text{mm}$$

13.7) Equation for Daily Lake Evaporation Formula

Evaluate Formula

Formula

$$E_L = P + \left(V_{is} - V_{os}\right) + \left(V_{ig} - V_{og}\right) - T_L - \Delta S_L$$

Example with Units

$$1958\,\text{mm} = 50\,\text{mm} + \left(3\,\text{m}^3/\text{s} - 2\,\text{m}^3/\text{s}\right) + \left(5\,\text{m}^3/\text{s} - 4\,\text{m}^3/\text{s}\right) - 22\,\text{mm} - 70\,\text{mm}$$

13.8) Increase in Lake Storage in day Formula

Evaluate Formula

Formula

$$\Delta S_L = P + V_{is} + V_{ig} - V_{os} - V_{og} - E_L - T_L$$

Example with Units

$$70\,\text{mm} = 50\,\text{mm} + 3\,\text{m}^3/\text{s} + 5\,\text{m}^3/\text{s} - 2\,\text{m}^3/\text{s} - 4\,\text{m}^3/\text{s} - 1958\,\text{mm} - 22\,\text{mm}$$

Variables used in list of Water Budget Equation for a Catchment Formulas above

- **a** Area of Lakes or Reservoirs *(Square Meter)*
- **A** Catchment Area *(Square Meter)*
- A_{NERC} Area
- **C** Coefficient
- C_{NERC} Constant C
- E_L Daily Lake Evaporation *(Millimeter)*
- **L** Runoff Losses *(Cubic Meter)*
- **P** Precipitation *(Millimeter)*
- **Q** Outflow Rate *(Cubic Meter per Second)*
- Q_{mean} Mean Annual Flood *(Cubic Meter per Second)*
- Q_p Peak Discharge *(Cubic Meter per Second)*
- **RSMD** RSMD
- **S** Storage of Water *(Cubic Meter)*
- S_C Slope of the Catchment
- S_r Surface Runoff *(Cubic Meter per Second)*
- **SF** Stream Frequency
- **SO** Soil Type Index
- T_L Daily Transpiration Loss *(Millimeter)*
- V_{ig} Daily Groundwater Inflow *(Cubic Meter per Second)*
- V_{is} Daily Surface Inflow *(Cubic Meter per Second)*
- V_o Mass Outflow *(Cubic Meter)*
- V_{og} Daily Seepage Outflow *(Cubic Meter per Second)*
- V_{os} Daily Surface Outflow *(Cubic Meter per Second)*
- **Δs** Change in Mass Storage *(Meter)*
- **ΔS** Change in Groundwater Storage *(Cubic Meter)*
- ΔS_L Increase in Lake Storage in a Day *(Millimeter)*

Constants, Functions, Measurements used in list of Water Budget Equation for a Catchment Formulas above

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

- **ΔSm** Change in Soil Moisture Storage *(Cubic Meter)*
- **ΔSs** Change in Surface Water Storage *(Cubic Meter)*

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