Optimum Number of Rain Gauges

Optimum number of rain gauges for a catchment from the coefficient of variation of the rainfall at existing stations and the allowable error in mean rainfall.

Method: Classical engineering hydrology relations

Input parameters

Unit system: SI

Parameter	Value	Unit
Rainfall, station 1	820.00	mm
Rainfall, station 2	650.00	mm
Rainfall, station 3	720.00	mm
Rainfall, station 4 (0 = none)	900.00	mm
Rainfall, station 5 (0 = none)	1,020.0	mm
Rainfall, station 6 (0 = none)	0	mm
Allowable error in mean rainfall	10.000	%

Calculated results

Parameter	Value	Unit
Mean rainfall	822.00	mm
Coefficient of variation	17.763	%
Optimum number of gauges	4.0000	
Additional gauges	0	

Notes for this case

• The number of gauges needed for the mean rainfall to be within an error ε is N = (C_v/ε)², where C_v is the coefficient of variation (sample standard deviation over mean) of the rainfall at the existing stations. An error of 10 % is usual. The World Meteorological Organization also gives minimum densities for flat, hilly and mountainous areas; at least 10 % of gauges should be self-recording.

Formula and method

$$C_v = \frac{\sigma_{n-1}}{\bar{P}}, \quad N = \left(\frac{C_v}{\varepsilon}\right)^2$$

Variables

P_1	Rainfall, station 1	m
P_2	Rainfall, station 2	m
P_3	Rainfall, station 3	m
P_4	Rainfall, station 4 (0 = none)	m
P_5	Rainfall, station 5 (0 = none)	m
P_6	Rainfall, station 6 (0 = none)	m
ε	Allowable error in mean rainfall	-
$\bar{P}$	Mean rainfall	m
C_v	Coefficient of variation	-
N	Optimum number of gauges	-
$N-n$	Additional gauges	-

Method and standards

Rain gauge network.

Assumptions and limits

- Station rainfall over the same period.

References

Classical engineering hydrology relations

Report details

Report reference	FCC-R088-67JJ (the same inputs always give the same reference)
Generated	23 November 2026, 17:50 UTC
Calculator	Optimum Number of Rain Gauges
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/civil/hydraulics/rain-gauge-network-density

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.