

Lecture Note – 4

Computation of average rainfall

1. *Arithmetic mean method*

$$\bar{P} = \sum_{i=1}^n P_i / n$$

Where,

\bar{P} = Average precipitation depth (mm)

P_i = Precipitation depth at gage i (within the topographic basin) (mm)

n = Total number of gages within the topographic basin

Arithmetic mean method is satisfactory,

→ if the gages are uniformly distributed over the area,

and

→ if the individual gage measurements do not vary greatly about the mean

2. Thiessen polygon method

→ If some gages are more representative, relative weights may be assigned to the gages in computing the average.

→ The Thiessen polygon method assumes that at any point in the watershed, the rainfall is the same as that of the nearest gage. So the depth recorded at a given gage is applied out to a distance halfway to the next station in any direction.

→ The relative weights for the each gage is determined from the corresponding areas of application in a Thiessen polygon network. The boundaries of the polygons are formed by the perpendicular bisectors of the lines joining adjacent gages.

→ If there are n gages; the are of the watershed is A , the area within the watershed assigned to each gage is A_i , and P_i is the rainfall recorded at gage i ; the average precipitation for the watershed is,

$$\frac{1}{A} \sum_{i=1}^n A_i P_i \quad \text{where,} \quad A = \sum_{i=1}^n A_i$$

→ Thiessen polygon method is more accurate than arithmetic mean method (advantage).

→ It is inflexible, because a new Thiessen polygon network must be constructed each time if there is a change in the gage network.

3. Isohyetal method

→ Isohyets (i.e. the lines of equal rainfall) are constructed using observed depths at rain gages.

$$\frac{1}{A} \sum_{i=1}^n A_i P_i \quad \text{where, } A = \sum_{i=1}^n A_i$$

Where,

A_i = Area between each pair of isohyets with watershed

P_i = Isohyetal cell average precipitation

n = Number of isohyetal cells

A = Area of the watershed

→ Isohyetal method is more flexible than Thiessen polygon method (advantage).

→ A fairly dense network of gages is needed to correctly construct the isohyetal map.