Gross and Net Precipitation

- The net (excess) precipitation that contributes directly to surface runoff is equivalent to the gross precipitation minus losses to interception, evaporation, depression storage, and infiltration
- The relation between excess precipitation Pe and gross precipitation P is: Pe = P – Σ losses

Areal Precipitation (mean precipitation over an area)

لتخمين كمية المطر الكلية الساقطة على مساحة كبيرة، فمن الضروري تحويل قراءات المقاييس المنفردة إلى متوسط عمق على تلك المساحة.

- It is important to know the areal distribution of precipitation
- In general, an average depth for the watershed is determined and used
- For this, point precipitation readings are utilized to develop average precipitation depth over an area
- There are different methods for finding the areal average rainfall for an area of interest

1- The Arithmetic-Mean Method

- This is the simplest method of determining the areal average rainfall
- The average rainfall depth for an area is found by computing the average of the depth values for all the gages using the following formula:

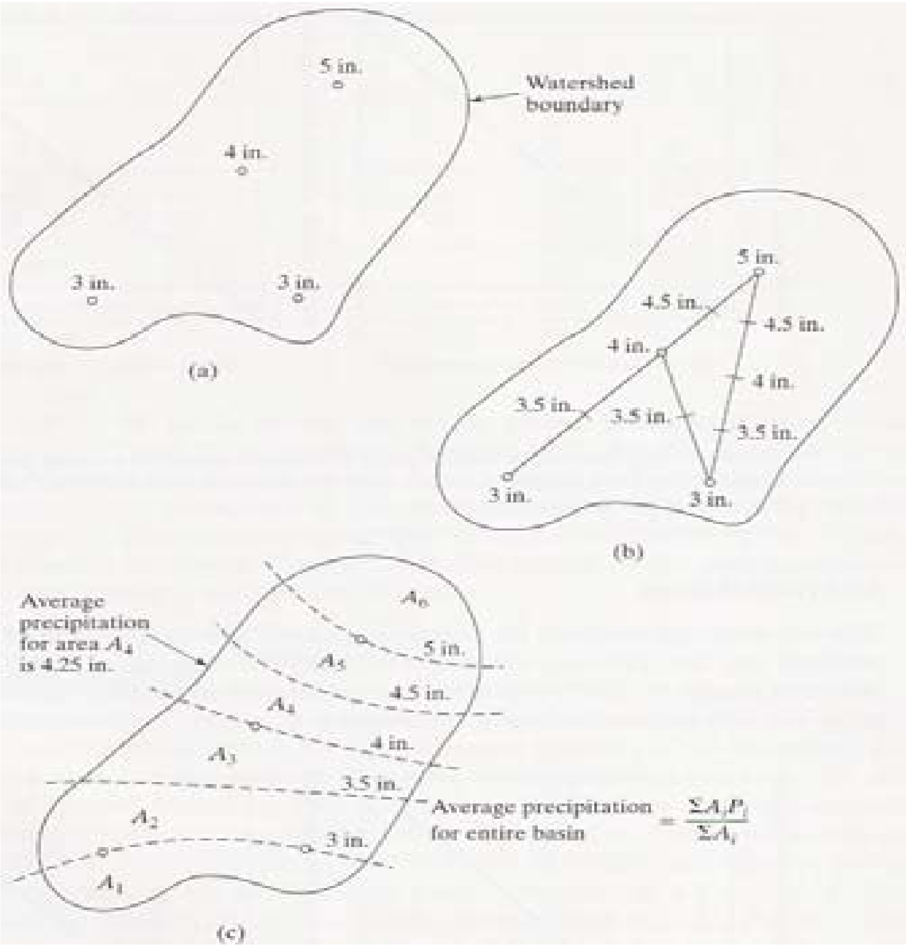
$$\bar{P} = \frac{1}{n} \sum_{i=1}^{n} (P_i)$$

where n is the number of gages and P_i is the rainfall recorded at gage i

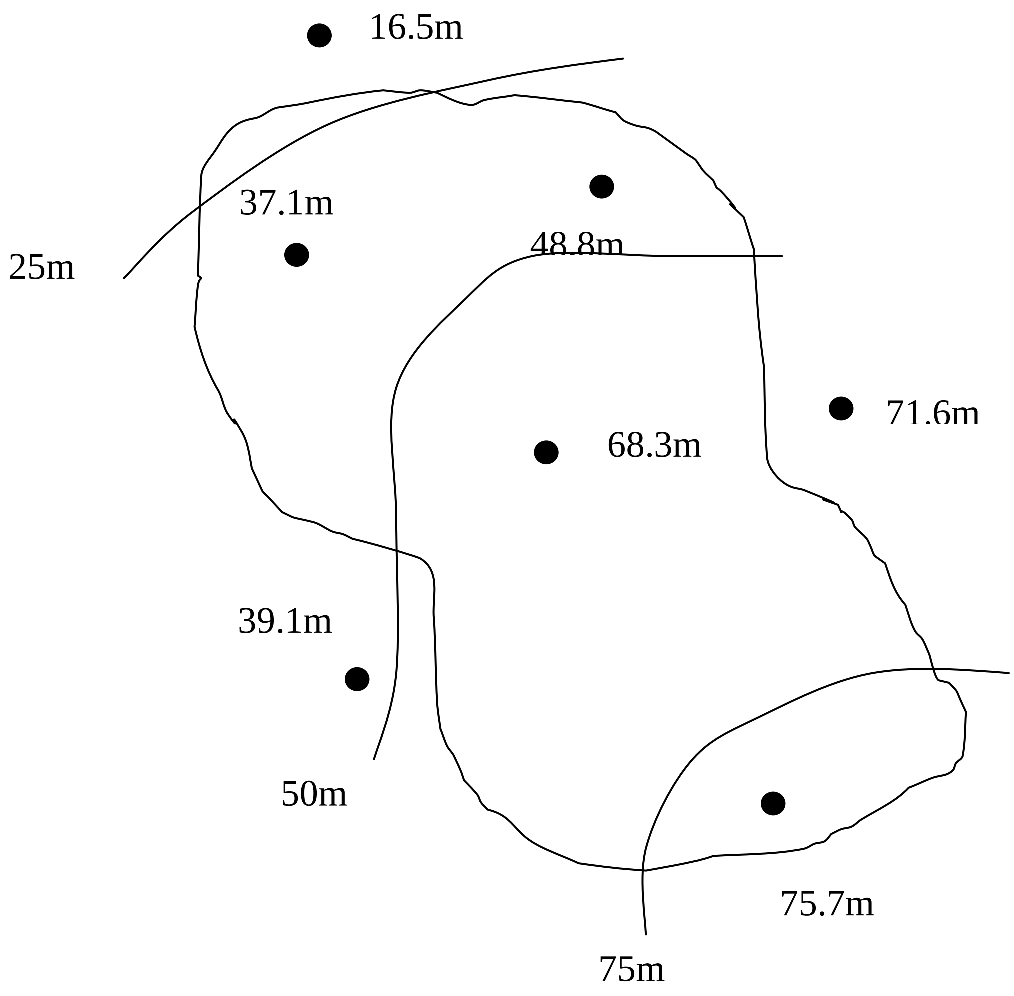
2- The Isohyetal Method (most accurate method)

- The isohyetal method is based on interpolation between gauges
- Plot the rain gauge locations and record the rainfall amounts
- Interpolation between gauges is performed
- Rainfall amounts at selected increments are plotted
- Identical depths from each interpolation are then connected to form isohyets (lines of equal rainfall depth)

تتلخص هذه الطريقة في رسم خطوط تساوي المطر (Isohyets) على خريطة المنطقة الموقع عليها محطات القياس وسمك المياه المتساقطة عند كل محطة. هذه الخطوط تشكل توزيعا ذا دقة كبيرة للمياه المتساقطة على المنطقة.



Example:



Isohyets	Area enclosed (Km^2)	Net area (Km^2)	Average rainfall (mm)	Rainfall volume (km^2.mm)
>75	82	82	80*	6560
75-50	892	810	62.5	50625
50-25	1459	567	37.5	21262.5
<25	1621	162	20*	3240
				∑81687.5

P= (81687.5/1621)=50.4 mm

3- Thiessen Method

- The area is subdivided into subareas using rain gauges as centers
- The subareas are used as weights in estimating the watershed average depth
- The Thiessen network is fixed for a given gauge configuration, and

polygons must be reconstructed if any gauges are relocated

$$\mathbf{P= (\sum A_i * P_i) / \sum A_i}$$

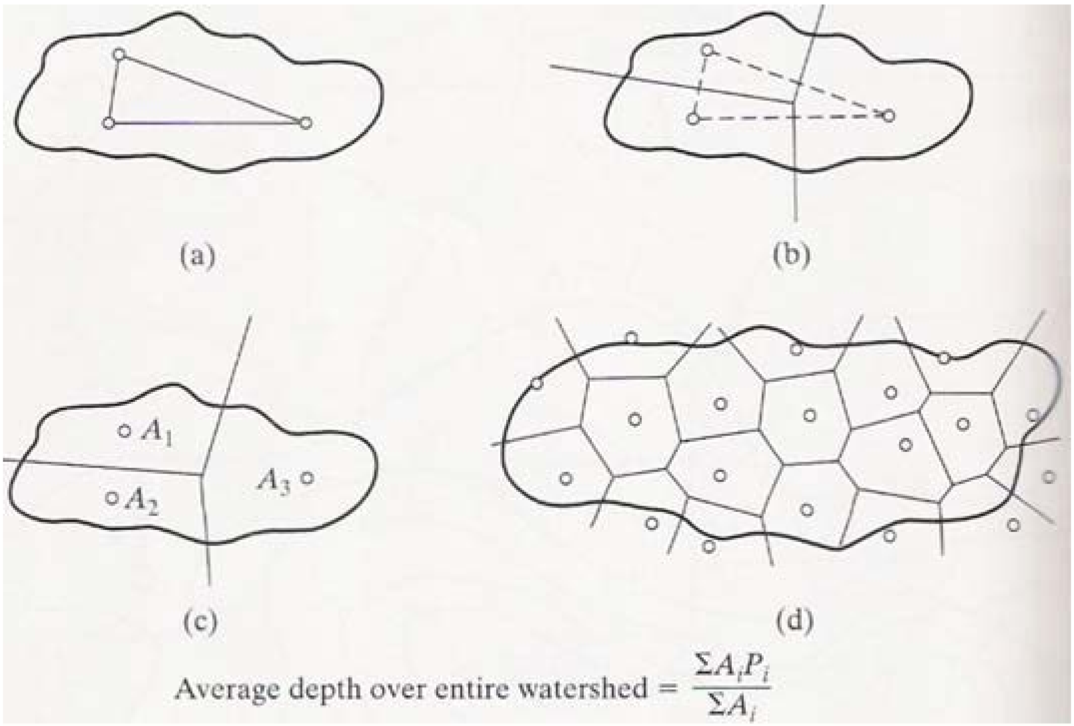
$$\mathbf{P=\sum_{i=1}^{M} P \frac{A_i}{A}}$$

Where:

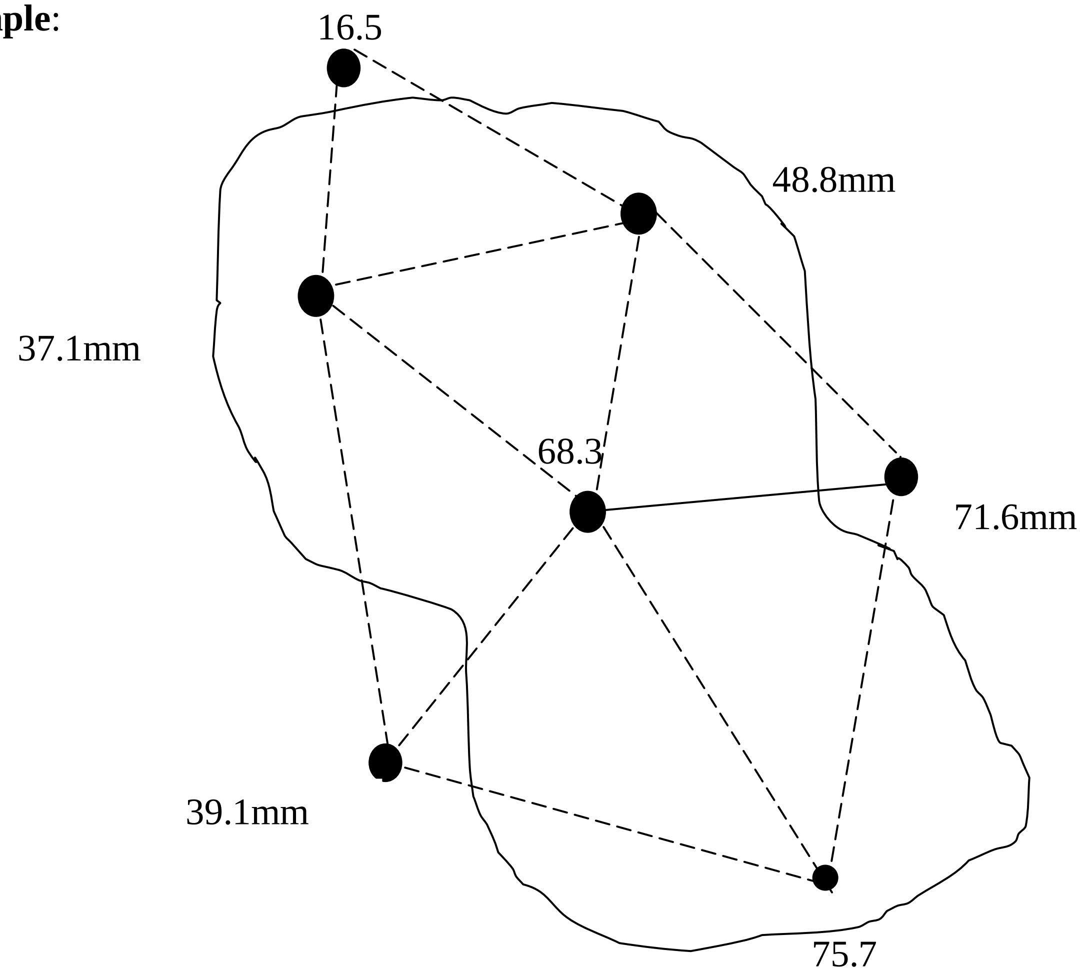
p= Average depth over entire watershed

A = total area, Ai = area for station i , M = total stations

$\frac{A_i}{A}$ is called the weightage factor for each station



Example:



No.	Rain fall (P_i), (mm)	a_i, (km^2)	% Total area $=a_i/A$	P_i*% Total area
1	16.5	119	7	1.2
2	37.1	308	19	7
3	48.8	308	19	9.3
4	68.3	324	20	13.7
5	71.6	162	10	7.2
6	39.1	130	8	3.1
7	75.7	275	17	12.9
	∑P=357.1	1626	100%	∑54.4

P=54.4 mm
P=(357.1/7)=51 mm by arithmetic mean method