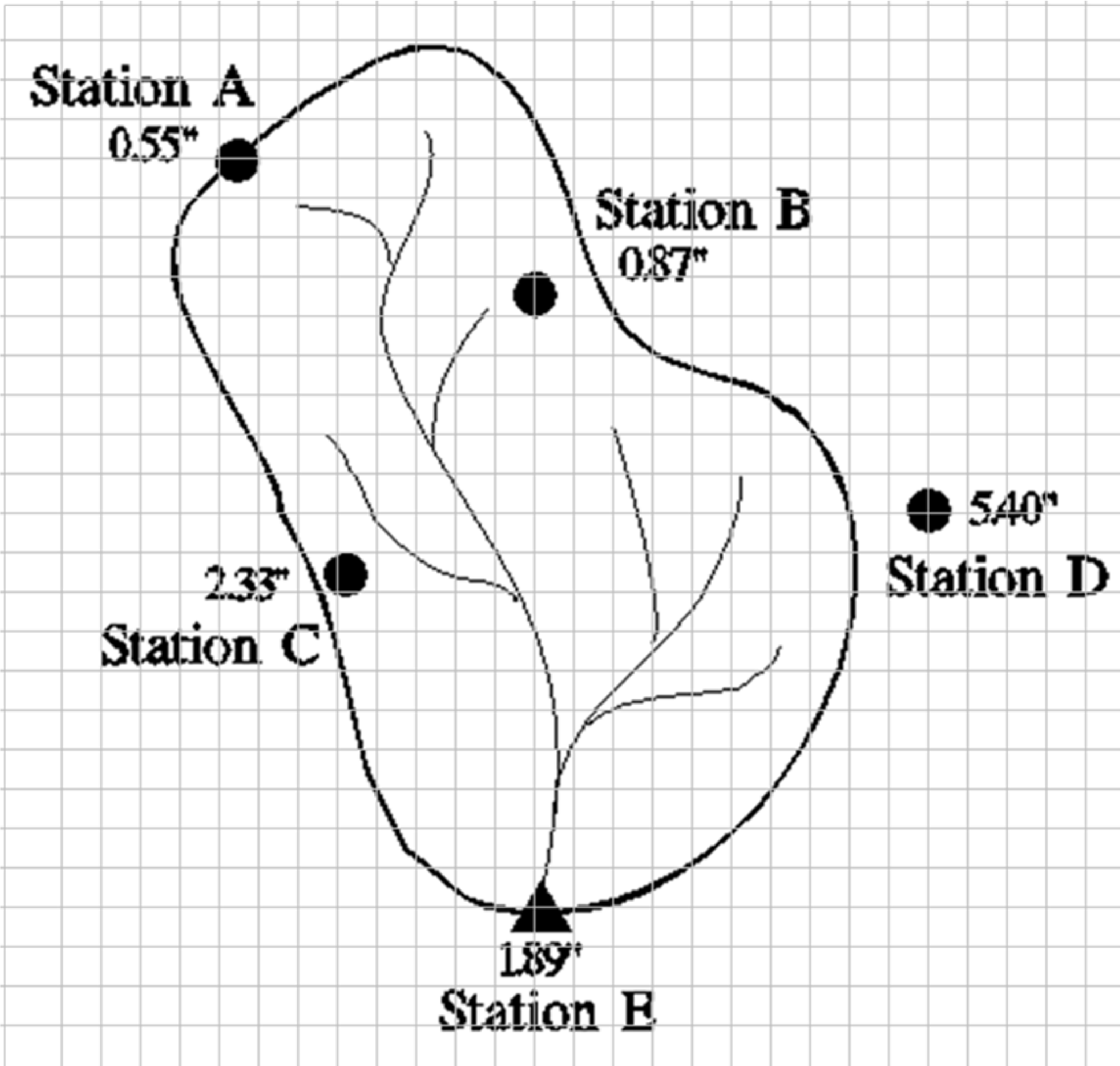
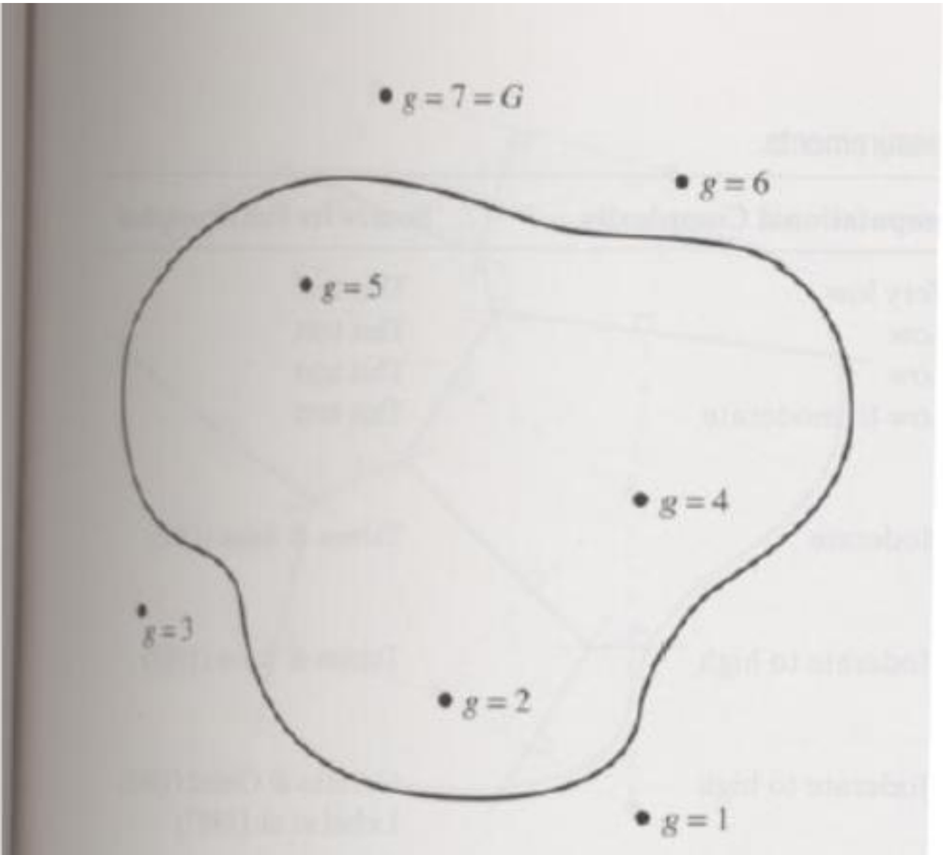

Station A
0.55"
Station B
0.87"
5.40"
Station D
2.33"
Station C
1.89"
Station E

Creating areal averages from point measurements

2. Thiessen polygons

$$\text{EUD} = \sum_{i=0}^{n} \frac{A_i}{A_T} P_i = \frac{A_1}{A_T} P_1 + \frac{A_2}{A_T} P_2 + \frac{A_3}{A_T} P_3 + \ldots + \frac{A_n}{A_T} P_n$$

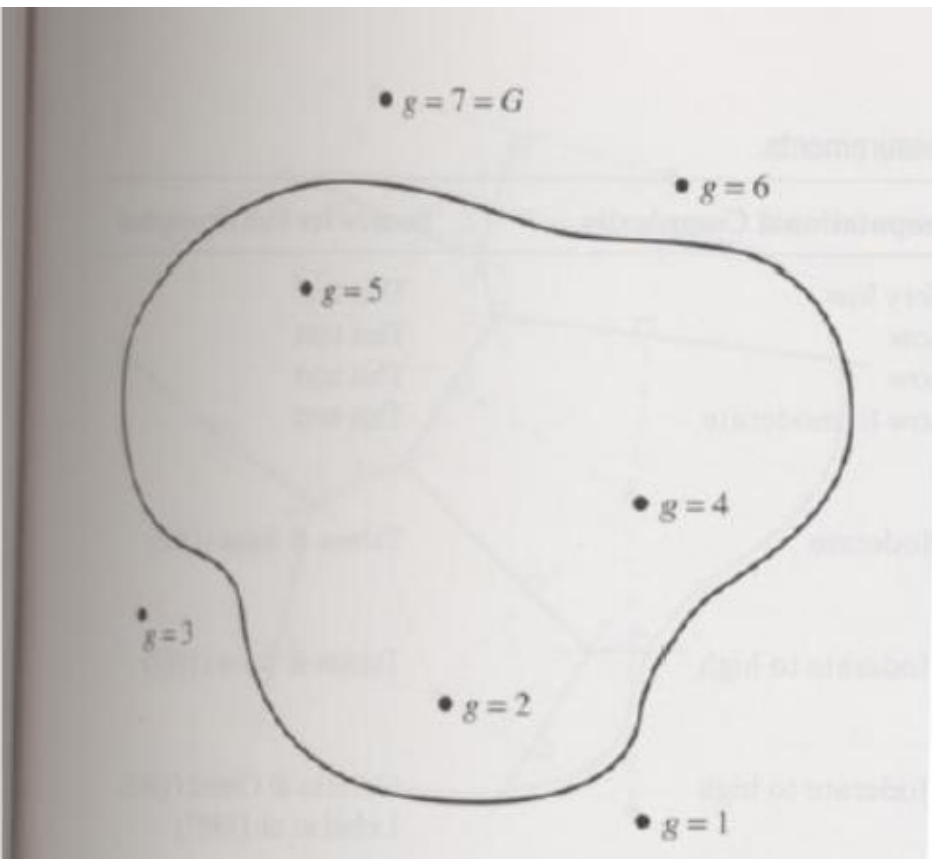


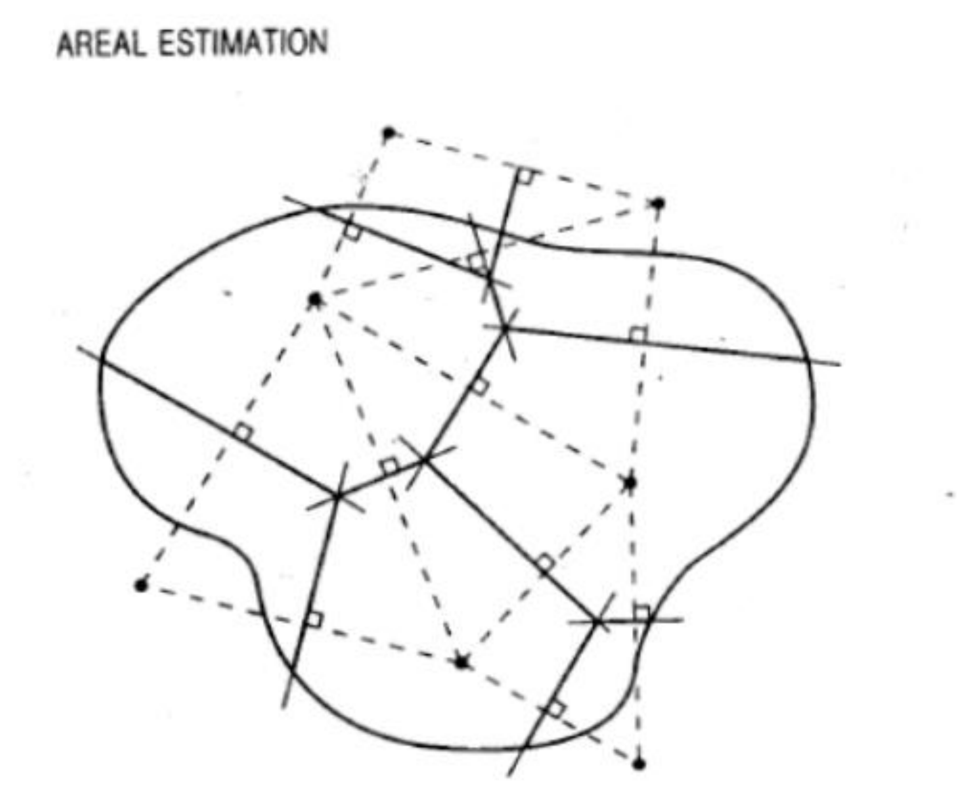
1. Draw straight lines between closest adjacent gauges.
2. Perpendicular bisectors of those lines are the sides of irregular polygons that define the area corresponding to each gauge.
3. Can incorporate rain gauges outside the watershed.
4. Challenge is calculating the areas of the polygons.

Creating areal averages from point measurements

2. Thiessen polygons

$$\text{EUD} = \sum_{i=0}^{n} \frac{A_i}{A_T} P_i = \frac{A_1}{A_T} P_1 + \frac{A_2}{A_T} P_2 + \frac{A_3}{A_T} P_3 + \ldots + \frac{A_n}{A_T} P_n$$





Creating areal averages from point measurements

Step 1: draw lines that connect rain gauges to nearby rain gauges

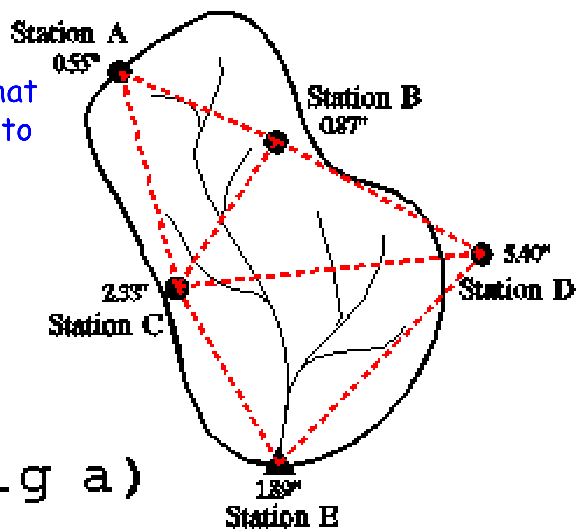


Fig a)

Step 2: draw perpendicular bisectors on these lines. These bisectors, along with boundary of watershed, forms boundaries of individual Thiessen polygons

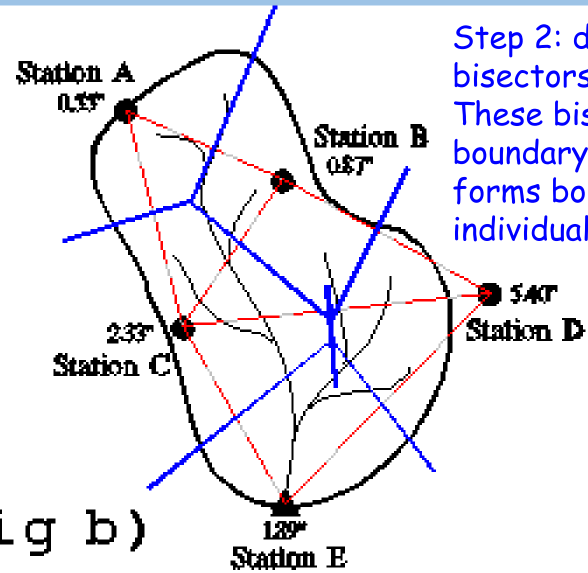


Fig b)

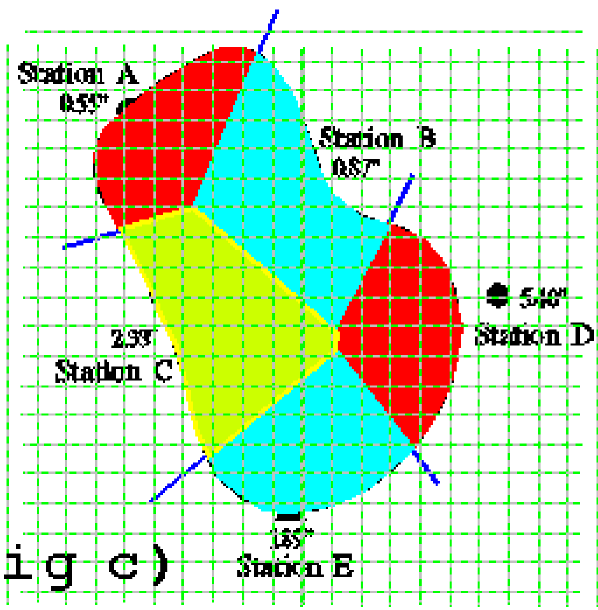


Fig c)

Step 3: calculate area of individual Thiessen polygons

Step 4: Apply formula

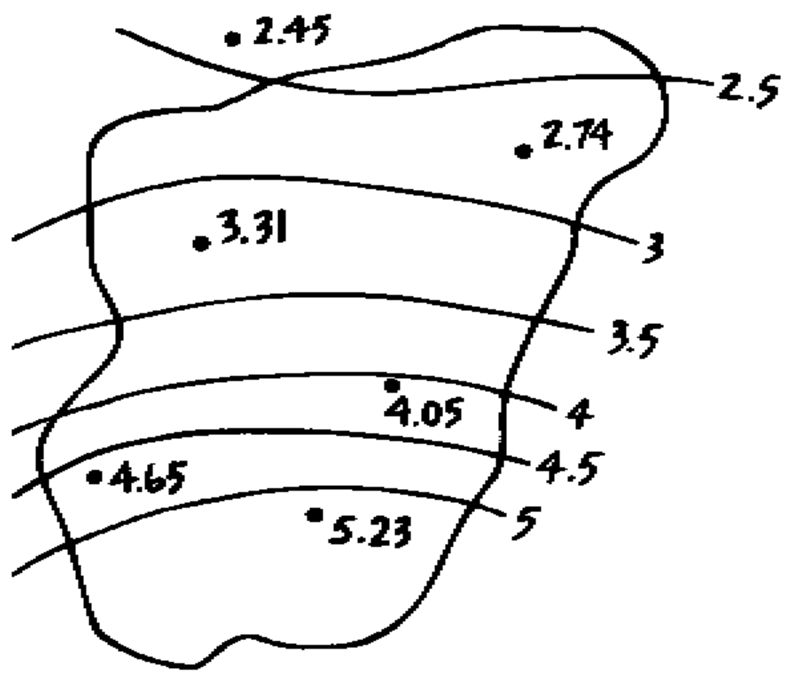
Creating areal averages from point measurements

3. Isohyetal method

$$\text{EUD} = \sum_{i=0}^{n} \frac{A_i}{A_T} P_i = \frac{A_1}{A_T} P_1 + \frac{A_2}{A_T} P_2 + \frac{A_3}{A_T} P_3 + \ldots + \frac{A_n}{A_T} P_n$$

1. Instead of drawing polygons, isohyets (lines of equal rainfall) are drawn for the watershed.

2. Take average precipitation between isohyets and multiply by the area between the isohyets then find the total for the watershed.



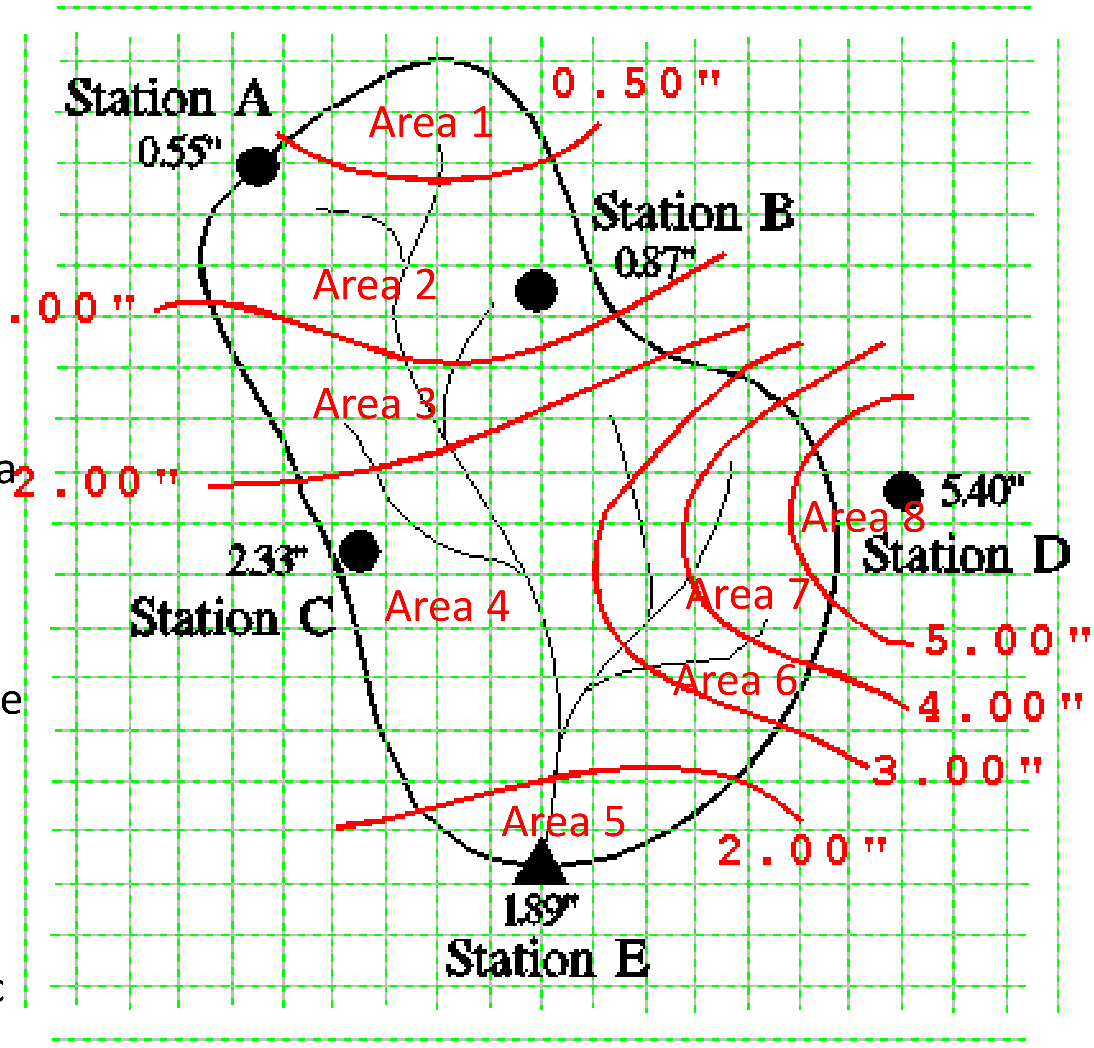
Creating areal averages from point measurements

In this case you can ignore the stations after you've drawn the isohyets.

1. Count the total number of boxes making up your watershed (including any that are more than half in watershed!)
2. Now count the boxes to find the area in between each isohyet line.
3. To make the calculation sum up:

$$\frac{\text{Area x}}{\text{Total area}} * \text{average of isohyets either side}$$

E.g. Area 1/total area * 0.5" +
Area 2/total area * ((0.50"+1.00")/2) +
Area 3/total area * ((1.00"+2.00")/2) etc



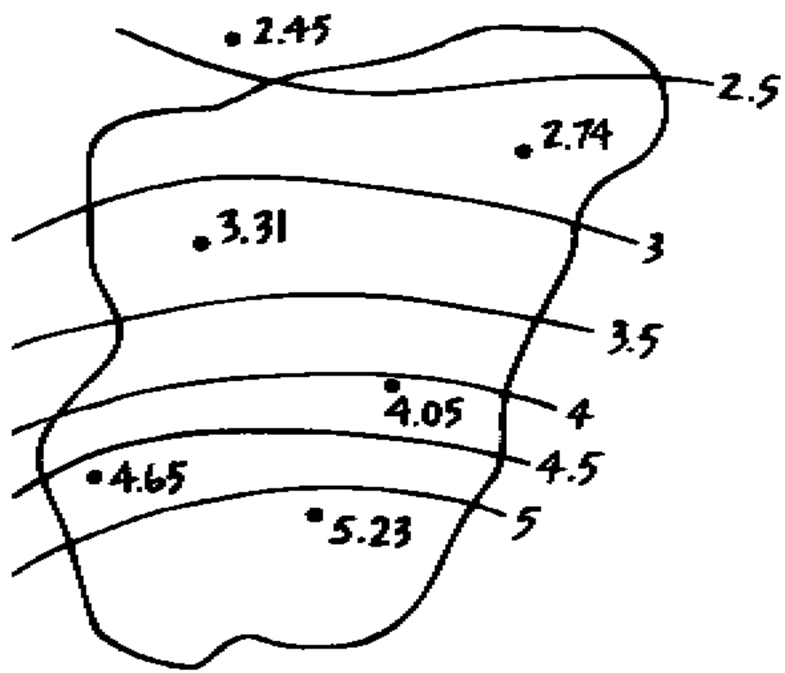
Creating areal averages from point measurements

3. Isohyetal method

$$\text{EUD} = \sum_{i=0}^{n} \frac{A_i}{A_T} P_i = \frac{A_1}{A_T} P_1 + \frac{A_2}{A_T} P_2 + \frac{A_3}{A_T} P_3 + \ldots + \frac{A_n}{A_T} P_n$$

Allows hydrologists to consider topography. Gives better estimate than other methods.

But accuracy depends on accuracy of isohyets and so density of the gauge network. Somewhat subjective and different for each storm so time-consuming.



Creating areal averages from point measurements

4. Hypsometric method

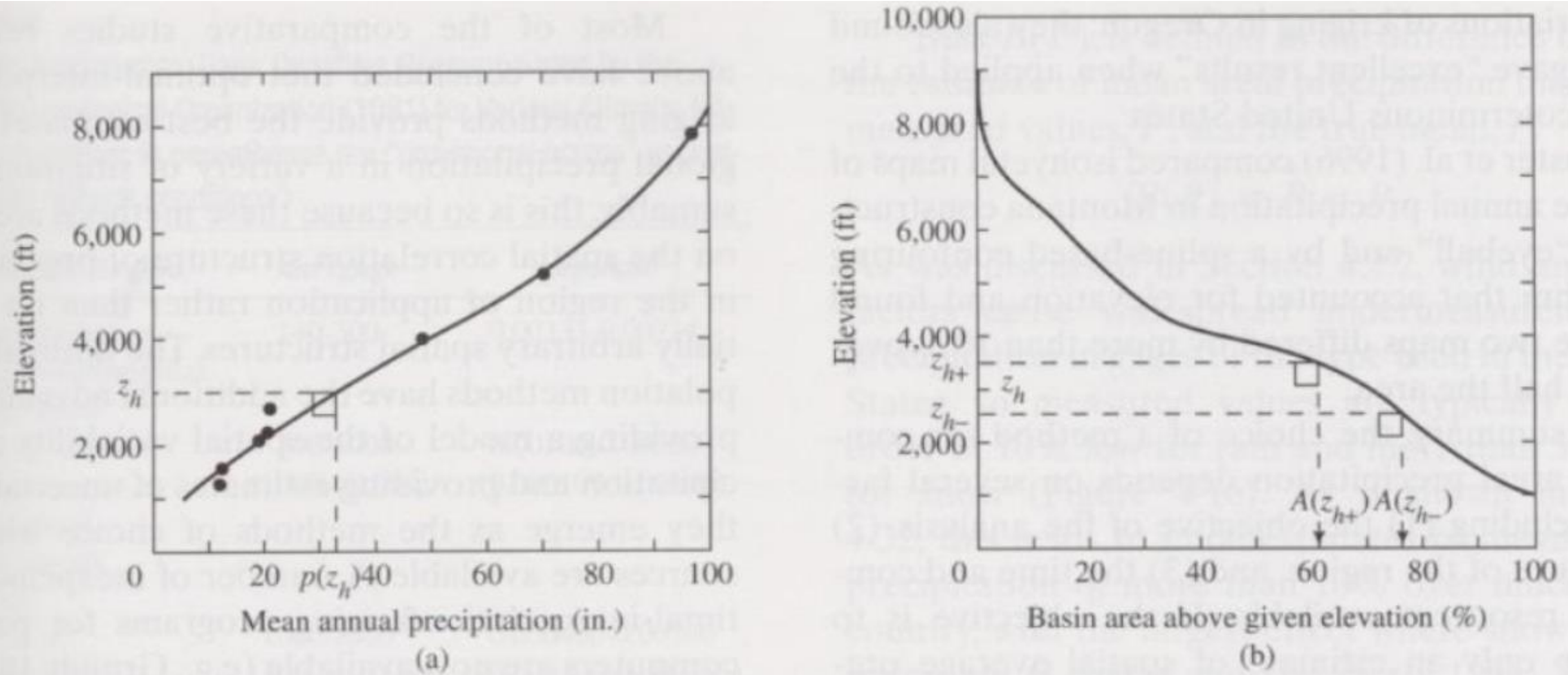


FIGURE 4-28
Application of the hypsometric method to the Delta River watershed, central Alaska (Dingman et al. 1971). (a) The estimated relation between mean annual precipitation and elevation. (b) The hypsometric curve. z_{h-} and z_{h+} are boundaries of elevation increment, $A(z_{h-})$ and $A(z_{h+})$ are areas above given elevations, and $a_h = [A(z_{h-}) - A(z_{h+})]/A$. Other symbols as defined in text.