Gauge Undercatch

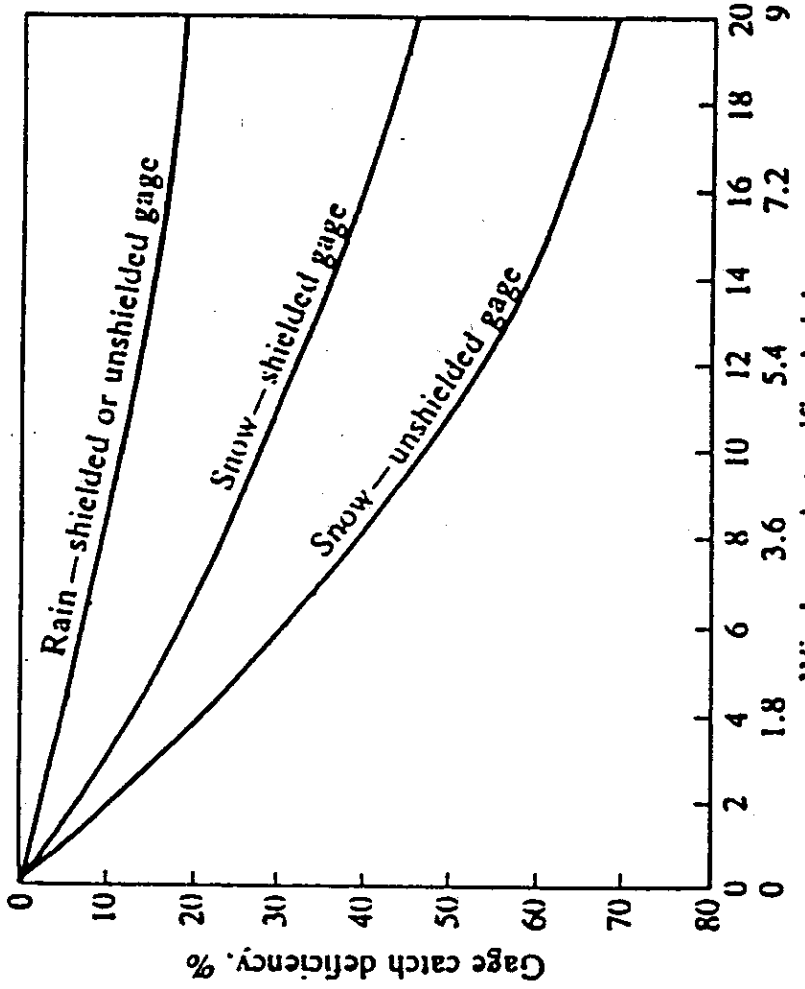


FIGURE 4.16 Effect of wind speed on the catch of precipitation gages. Source: L.W. Larson and E.L. Peck, "Accuracy of Precipitation Measurements for Hydrologic Modeling," *Water Resources Res.*, 10(4):859, 1974. Copyright by the American Geophysical Union.

Estimating Basin Areal Average Precipitation

Areal Precipitation

For a control volume (e.g., basin) with area A:

$$P_A = \frac{1}{A}\int_A P(x)dx$$

A discrete approximation to the integral is:

$$P_A \approx \sum_{i=1}^{n} w_i P_i$$

P_i is precipitation at the *i-th* gage

w_i is the weighting factor

Thiessen Polygon Method

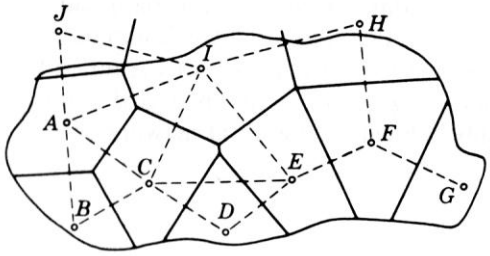
Define area A_i closest to each gage. Let:

$$w_i = \frac{A_i}{A}$$

The areas closest to each gage are the polygons formed by the perpendicular bisectors of the lines joining adjacent gages.

The steps for creating the polygons are:

1. Plot stations on a map (drawn to scale)
2. Connect adjoining stations (dashed)
3. Construct perpendicular bisectors (solid)
4. Measure area within the basin for each gage
5. Multiply gage precipitation by area (A_i)
6. Sum and divide by total area (A)



Station	Thiessen area mi²	Precipitation, in	Product, mi² in.
A	72	3.50	252
B	34	4.46	152
C	76	4.28	325
D	40	5.90	236
E	76	6.34	482
F	92	5.62	517
G	46	5.20	239
H	40	5.26	211
I	86	3.86	332
J	6	3.30	20
Total	568	47.72	2766

$$\text{Average precipitation} = \frac{\Sigma \text{ Product}}{\Sigma \text{ Area}} = \frac{2766}{568} = 4.87 \text{ in.}$$

FIGURE 2.3
Thiessen network.

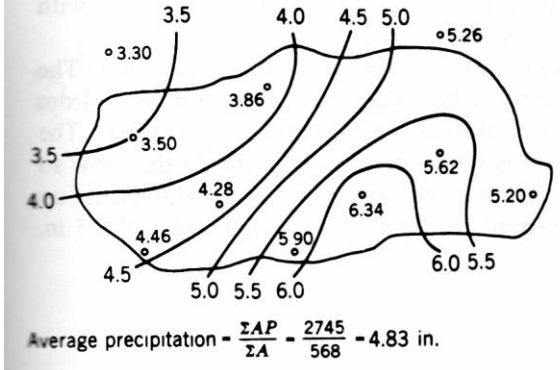
Isohyetal Method

Draw contours of equal rainfall amounts (isohyets). Measure the area between each contour A_j. Let:

$$w_j = \frac{A_j}{A}$$

The steps for creating the isohyetal map and determining the areas A_j are:

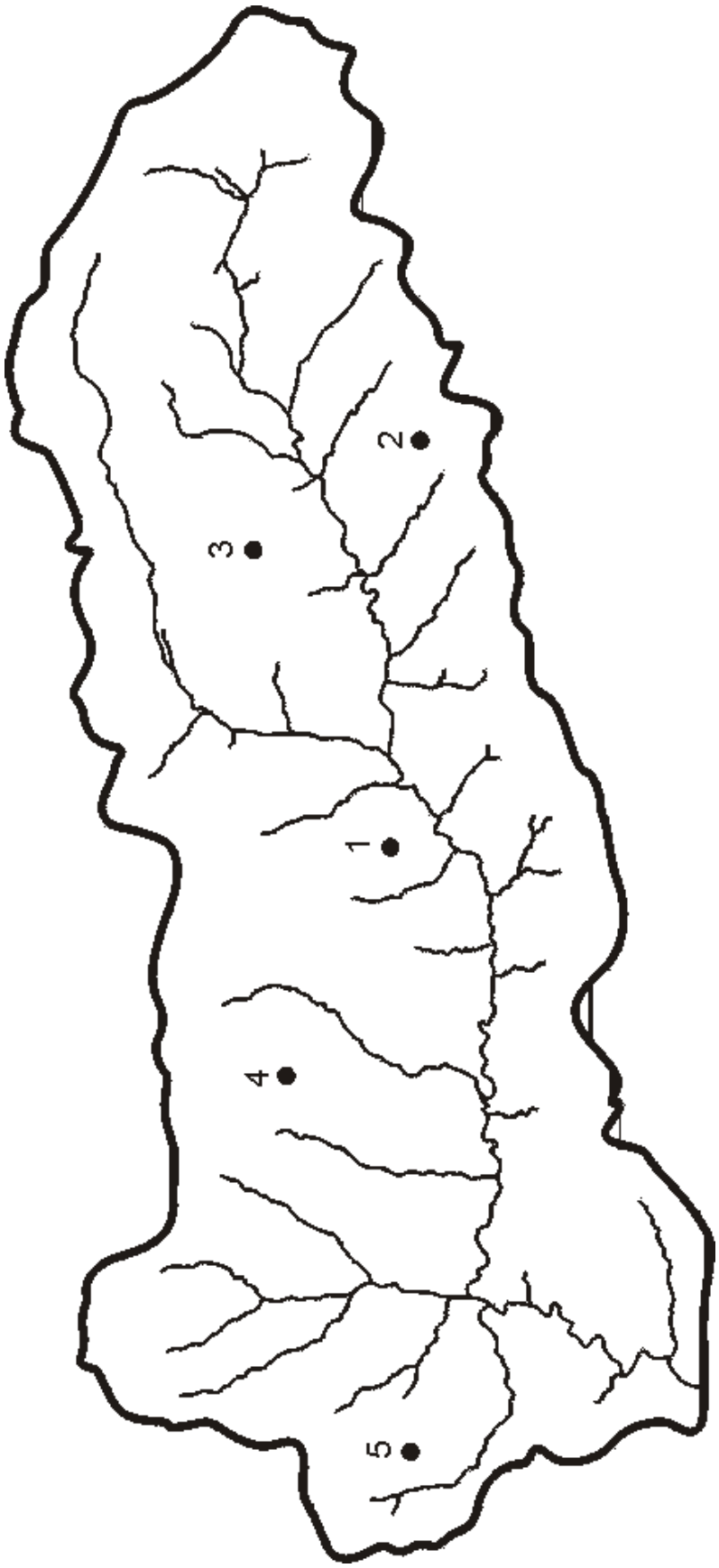
1. Plot stations on a map (drawn to scale)
2. Draw contours of equal precipitation (isohyets)
3. Measure area in basin between each contour
4. Multiply area (A_j) by the average of the contour (isohyet) values (P_j)
5. Sum and divide by total area (A)



Isohyets	Area between isohyets, mi²	Average precipitation, in	Product $A \times P$ mi² in.
3.0			
	19	3.45	66
3.5			
	106	3.75	398
4.0			
	102	4.25	434
4.5			
	60	4.75	285
5.0			
	150	5.25	788
5.5			
	84	5.75	483
6.0			
	47	6.20	291
6.5			
Total	568	—	2745

$$\text{Average precipitation} = \frac{\Sigma AP}{\Sigma A} = \frac{2745}{568} = 4.83 \text{ in.}$$

FIGURE 2.4
An isohyetal map.


2
3
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