Practical 01

GROUNDWATER GLY 265
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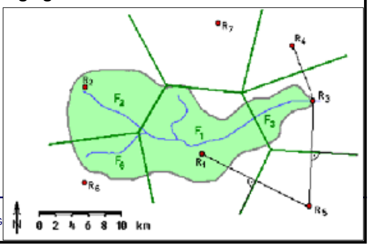
Determining Precipitation

- **Average depth of precipitation** or rainfall over a drainage basin is **essential** for water-budget studies!
- Data are generally measurements of precipitation at several points throughout the drainage basin.
- If rain gage network is of **uniform** density: Arithmetic average of point-rainfall data

Thiessen Method

- Based on a weighing factor for each rain gage based on the size of the area (area of influence, irregular polygons) within the drainage basin which is closest to the rain gage.

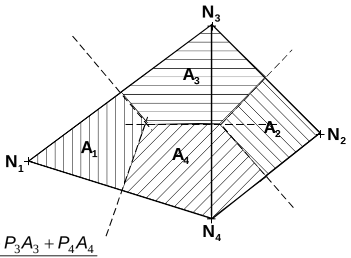


Thiessen Method

1. Draw rain gage network on a map of the drainage basin
2. Connect adjacent (closest) stations by a network of lines
3. Draw a perpendicular line at the midpoint of each line connecting two stations (bisector)
4. Extensions of perpendicular bisectors build polygons around each station
5. **Weigh** each datum with the **surface area** of the polygon containing the datum and calculate global sample statistics

Thiessen Method

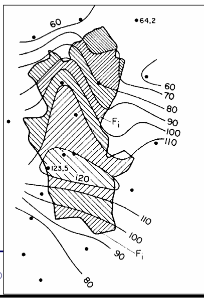
- Thiessen Polygons:



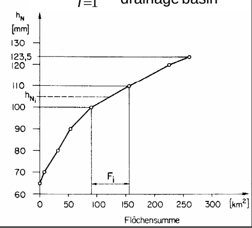
$$\overline{P} = \frac{\sum P_i A_i}{\sum A_i} = \frac{P_1A_1 + P_2A_2 + P_3A_3 + P_4A_4}{A_1 + A_2 + A_3 + A_4}$$

Isohyetal Method

- Influence of topography on precipitation can be taken into account:



$$\overline{P} = \sum_{i=1}^{n} \frac{A_i}{A_{\text{drainage basin}}} P_i$$



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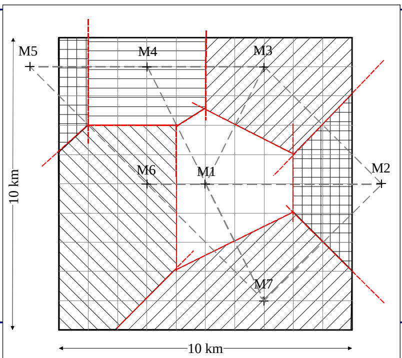
Isohyetal Method

1. Average depth of precipitation P_i over the area A_i bounded by adjacent isohyets is the mean of the bounding isohyets.
2. The average depth of precipitation of the catchment is the weighted average based on the relative size of each isohyetal area:

$$\overline{P} = \sum_{i=1}^{n} \frac{A_i}{A_{\text{drainage basin}}} P_i$$

Isohyets must be redrawn and areas remeasured for each analysis!

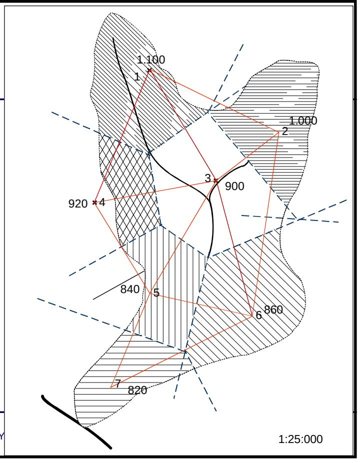
Exercise 1



Exercise 1

- Volume NQ = 1.102,3 * 103 [m3/km2] * 100 [km2] = 1,1 * 108 m3
- Prec. Yield Nq= 1,1 * 108 * 103 / 100 * (365*24*60*60) [l/s*km2] = 34,95 l/s*km2

Exercise 2



Exercise 2

- **Arithmetic average :** 739.2 mm
- NQ = 739.2 * 103 [m3/km2] * 7.5 [km2] = 5.544 * 106 m3
- Nq = 5.544 * 108 * 103 / 100 * (365*24*60*60) [l/s*km2]
  = 23.4 l/s*km2
- **Thiessen**
- PQ = 736,4 * 103 [m3/km2] * 7,5 [km2] = 5,523 * 106 m3
- Pq = 5,523 * 106 * 103 / 7,5 * (365*24*60*60) [l/s*km2]
  = 23,4 l/s*km2
- **Isohyetal method**
- NQ = 720,7 * 103 [m3/km2] * 7,5 [km2] = 5,405 * 106 m3
- Nq = 5,405 * 106 * 103 / 7,5 * (365*24*60*60) [l/s*km2]
  = 22,8 l/s*km2