Mean Annual Precipitation in Inches, U.S.A.
Estimating Average Precipitation in a Watershed

• Three Methods
  – 1. Arithmetic Average Method
  – 2. Thiessen Method
  – 3. Isohyetal Method
Arithmetic Average Method

- Calculate the average of the precipitation records from all the rain gages in a watershed (include any on the watershed boundary as well)
- Best to have the gages distributed throughout the watershed (unfortunately, not always the case in real life)
- Use only the rain gages within and on the watershed boundary - not those outside the boundary - to calculate the average
Thiessen Method

- Advantage: allows for the uneven distribution of rain gages

- Steps:
  1. Plot all gage locations on a map of the watershed (can include gages outside of the watershed if they are nearby)
  2. Draw straight lines connecting the gage sites
  3. Draw perpendicular lines through the midpoint of each line. Now each gage is near the center of a polygon whose size varies according to the spacing between gages
  4. Calculate area of each polygon
  5. Calculate the percent of total area in each polygon. Divide the area of each polygon by the total area of the watershed and multiply by 100
  6. Each gage precipitation total is multiplied by its polygons percentage of area - this gives you the adjusted precipitation of each polygon
  7. Sum the adjusted precipitation values for all the polygons to find the average rainfall in the basin

- Method assumes that precipitation varies linearly between rain gages. This is not always the case.
Isohyetal Method

- In Greek, iso means equal and hyet means rain
- An isohyet is a line of equal rainfall
- An isohyetal map shows lines of equal elevation drawn the same way that a topo map is drawn
- Between isohyet lines is a given change in precipitation (isohyet interval - similar to a contour interval)

Steps:
1. Plot all gage locations on a map of the watershed, including gages that are nearby but not in the watershed
2. Plot isohyets on the map at a given interval. Estimate locations of isohyets based on rain gage values (interpolate between points to find where the isohyets are located)
3. Find the average precipitation between isohyets
   - This would be the average of 2 adjacent isohyets

Example: Average between the 1 and 2-inch isohyets would be \((1+2) / 2 = 1.5\)
Example: Ave between the 2 and 3-inch isohyets would be \((2+3) / 2 = 2.5\) in

4. Find the area of the map between the adjacent isohyets
5. Multiply the area between the isohyets by the average precipitation between them and sum these values to calculate the average precip over the watershed