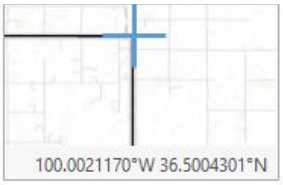
GIS in Water Resources

Solution to Exercise 1

Fall 2018

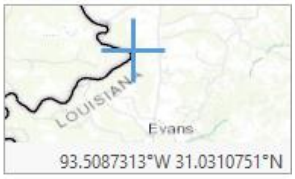
(1) Find the Latitude of the most Northern and Southern locations in Texas and the Longitude of the most Western and Eastern locations in Texas. What is the North-South extent in degrees of Latitude? What is the East-West extent in degrees of Longitude? Measured in Decimal Degrees, is Texas wider than it is taller or the other way around?

Solution: The most extreme points of Texas are shown below. The North-South extent is 10.6635°Latitude. The East-West extent is 13.1385 °Longitude. Texas is wider than it is taller.



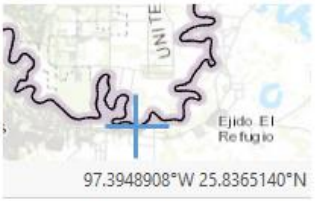
36.5000 °N

106.6472 °W



93.5087 °W

Width = 106.6472 – 93.5087
= 13.1385 °Longitude



25.8365 °N

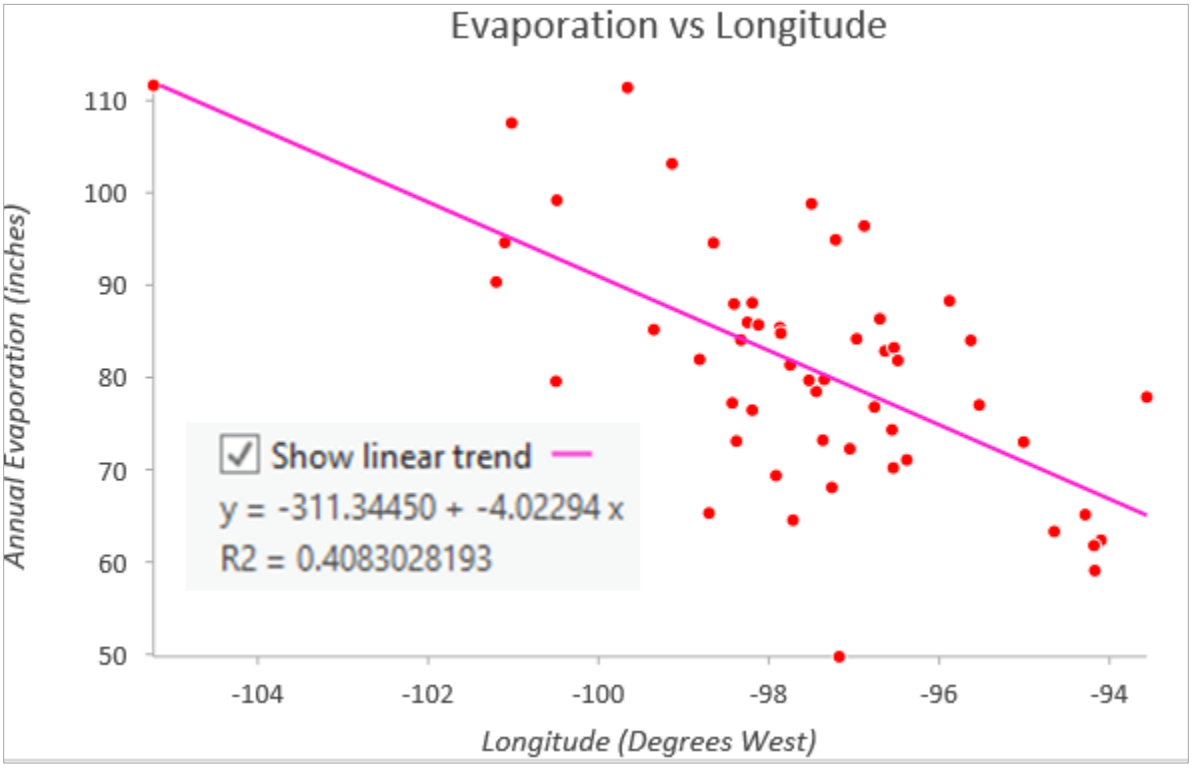
Height = 36.5000 – 25.8365
= 10.6635 °Latitude

(2) Use the values for Longitude of the most Western and most Eastern locations in Texas to make an estimate of Pan Evaporation at those locations. By how much does the expected pan evaporation increase as you go from East to West in Texas? Why is this so?

Solution: The chart prepared for evaporation vs longitude in Exercise 1 yields a best-fit line Y = -311.3445 – 4.02294X , where Y = annual pan evaporation in inches and X is longitude in decimal degrees. Hence, for Westernmost point in Texas, X = - 106.6472, and Y = -311.3445 – 4.02294 * (-106.6472) = 117.69 inches, and similarly for the Easternmost point in Texas, the estimated pan evaporation is computed to be Y = -311.3445 – 4.02294 * (-93.5087) = 64.84 inches. Hence the difference between these two quantities is 117.69 – 64.84 = **52.85 inches**.

Location	**Longitude**	**Estimated Pan Evaporation**
Westernmost Point	- 106.6472	**117.69**
Easternmost Point	- 93.5087	**64.84**

Pan evaporation increases as you go West because the land is dryer, the air temperatures are higher, skies are clearer, so there is more heat energy available to support the latent heat of vaporization.



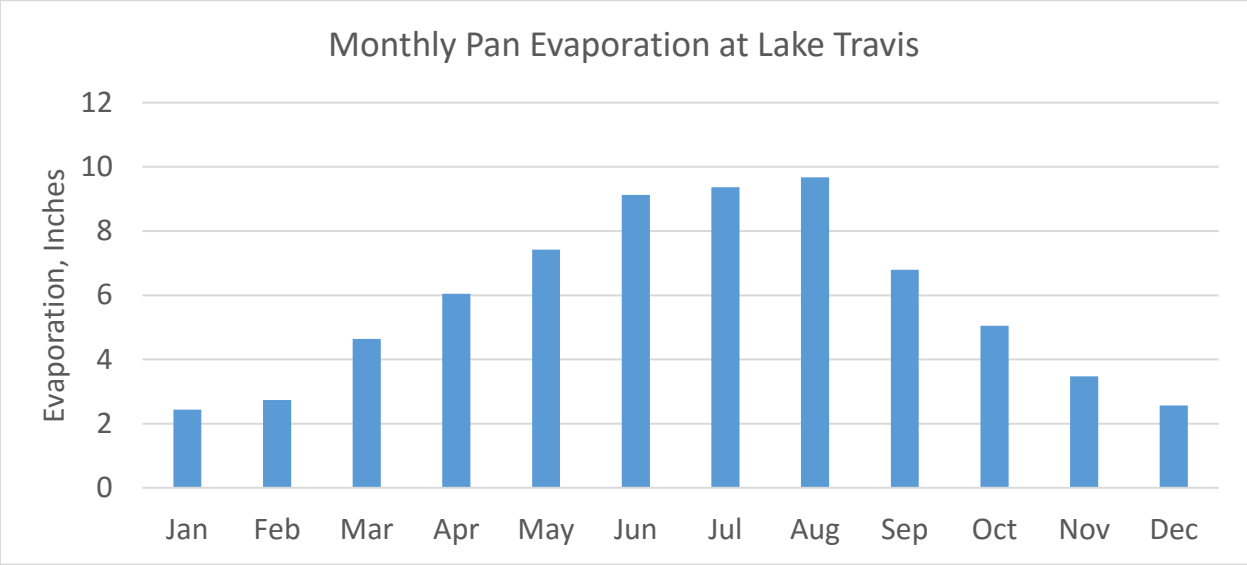
(3) Prepare a chart of the monthly distribution of pan evaporation at one of the evaporation sites. What is the ratio between the pan evaporation in the largest month compared to the smallest month?

Solution: Here are the monthly mean pan evaporation data for Lake Travis

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.43375	2.7375	4.64375	6.0475	7.41875	9.12625	9.36875	9.67125	6.7925	5.04625	3.47625	2.5675

The maximum value is 9.67 inches in August and the minimum is 2.43 inches in January. Hence the ratio of the maximum to the minimum is 9.67/2.43 = 3.97, so pan evaporation in August is approximately four times what it is in January at Lake Travis. Our lakes lose lots of water to evaporation in the summer!

Here is the chart of monthly evaporation at Lake Travis:

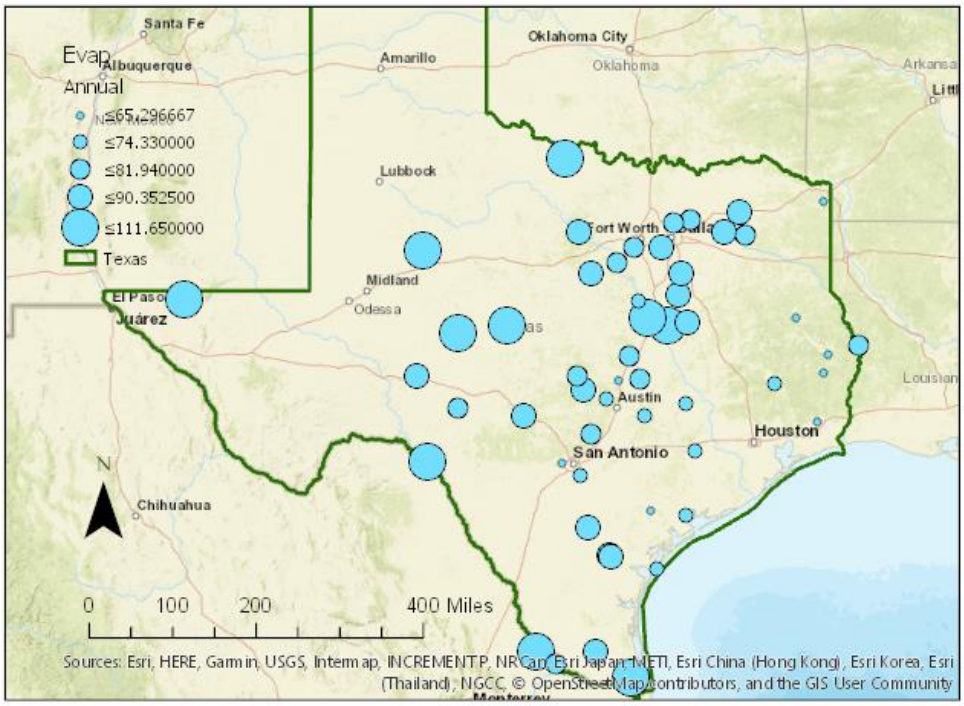


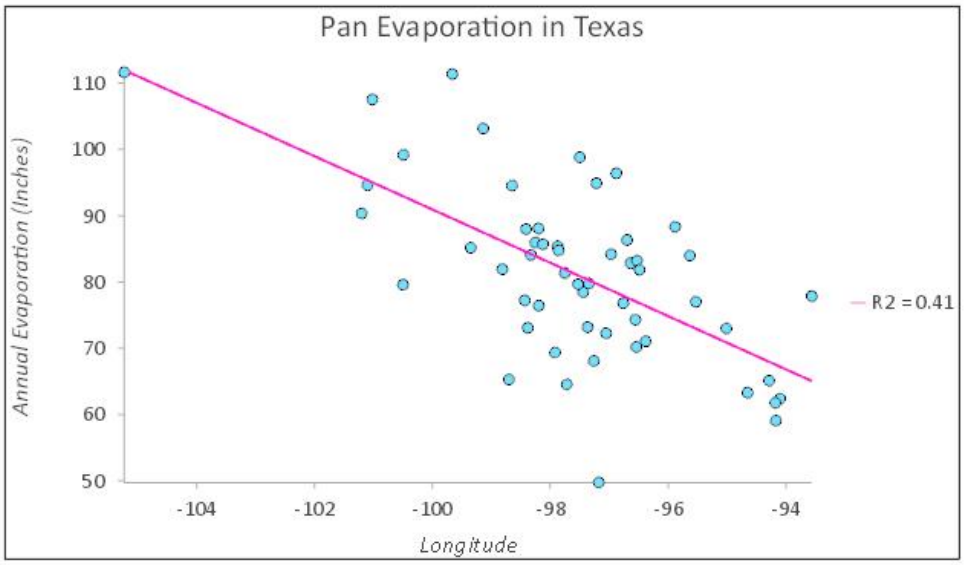
(4) Prepare an ArcMap map layout in it showing a map of Texas with evaporation gages, coupled with a graph showing evaporation data plotted from the gages. In the presentation of information on maps and charts it is important to include sufficient labeling detail so that the information can be clearly and unambiguously interpreted. You should include a scale bar to indicate distance, a north arrow to indicate direction and labels or legends with units wherever they are needed to interpret map or quantitative values. Let's see some nice cartography!!

Solution: On the next page is the layout that I prepared at the time I created the exercise. I have added a legend to the layout.

Pan Evaporation in Texas

David R. Maidment, 5 Sept 2018





(5) *Provide the web link for your map so that I can view your map online. Your URL should be similar to the following: https://arcg.is/1aaKGH Be careful that there is no space at the end of the web address.*

Solution: here is the map that I created in setting up the exercise that is accessible at the link *https://arcg.is/1aaKGH*