

Geohydrology Laboratory -- Precipitation Frequency Analysis

+++++REPORT DUE START OF CLASS WEDNSDAY FEBRUARY 19 +++++

Today's lab will introduce you to the analysis of precipitation data. We will be examining the monthly and yearly records of Boston, Burlington, and Mt. Mansfield precipitation for the past 40 to 172 years. These data can be obtained from several sources including the National Weather Service, the World Wide Web, and some privately distributed CD's AND FOR THIS LAB, OUR WEB SERVER. As an aside...you'll be getting more practice using Excel.

1. As a group, we need to analyze precipitation data. Burlington data need to be analyzed month by month. The precipitation data are in a spreadsheet found on the class web page, "useful data..." ALL 12 MONTHS OF BURLINGTON DATA MUST BE ANALYZED AND THE YEARLY TOTALS FOR BURLINGTON AND MANSFIELD NEED TO BE ANALYZED. THIS IS A TOTAL OF 14 PLOTS. Each person should do one.

Once you have opened the spreadsheet, save it in a file entitled "**PRECIP-THE MONTH.**" **back in the Geohydro class folder** (THIS IS SO EVERYONE CAN SHARE THE DATA). You can then manipulate your file as you wish. Use Excel to calculate a mean, median, standard deviation, minimum and maximum value FOR EACH MONTH AND FOR THE YEARLY TOTALS. Save the spreadsheet again with these values clearly visible.

2. Use Excel to generate a graph of precipitation as a function of year for your precipitation record. Print the graph. **MAKE SURE TO TITLE THE GRAPH SO THAT YOU WILL RECOGNIZE IT AFTER IT PRINTS.**

3. Use Excel to sort your data by amount. Assign each year a rank in an adjacent column. Rank the years from lowest to highest and give the year with the lowest precipitation the rank of 1. Use Excel to calculate the cumulative probability that precipitation will be less than each yearly value. Make a probability plot for each record on the supplied probability graph paper (DOWNLOAD AND PRINT THE PDF FOR THIS PAPER). We will post these graphs on the board outside Paul's office for all to use. Use your probability plots to calculate the median and standard deviation of your precipitation records. Compare these values to those generated by Excel. They should be similar! For help, see problem 2-2 on page 76 of Dunne and Leopold.

Remember -- $\text{probability} = \text{rank of year} / (\text{number of years observation} + 1)$

4. ONCE AGAIN! Make sure to save your data to a file (WELL TITLED...as **PRECIP-THE MONTH.**) in the **precip stats lab** folder in geohydrology. Each of you can then examine data for other months of the year, yearly totals, as well as other locations.

5. Before leaving lab, hand in the two graphs. I will post them on the board outside my office so that you can refer to them when preparing your report. Extra copies are always available from the computer files.

Report (Due FEBRUARY 19):

EACH PERSON OF SMALL GROUP should make a summary table of the data that include relevant precip statistics for each month of the year in Burlington. Include this table with your report.

Each person should prepare a one-page summary describing the precipitation patterns for BURLINGTON. You may choose to append several relevant figures. Your summary should consider explicitly:

1. What is the variability of precipitation in Burlington on a month to month and year to year basis. Which month has the widest variance in precipitation amount? Which month has the least variance? Why? **CONSIDER VARIANCE IN BOTH ABSOLUTE AND PERCENTAGE TERMS.**
2. On average, what are the wettest and driest months of the year in Burlington?
3. Is there a long-term trend in precipitation amounts for Burlington?
4. If you could wait a thousand years, what would you expect to be the lowest and highest annual precipitation totals for Burlington? for Mt. Mansfield?
6. Compare the annual precipitation records for Burlington and Mount Mansfield. How and why do they differ? **REFERENCE WORK YOU HAVE DONE IN OTHER LABORATORIES FOR THIS CLASS.**
7. Is there any change in the amount of precipitation over time (i.e., can you detect nay climate change or instrumental bias in your records)?

EXTRA CREDIT

The precipitation record for Boston is 172 years long, while the records for Burlington and Mt. Mansfield are 82 and 40 years long, respectively. Can the Boston record be used as a good predictor of precipitation amounts in Burlington or Mt. Mansfield further back in time than their existing records (i.e.. how much precipitation was received in Burlington in January of 1859)? Make a graph and explain your rationale from a physical point of view.