<u>**Homework 4a: Green River Lowlands Recharge**</u>

<u>**Due February 23rd**</u>

The Green River Lowlands is a heavily irrigated aquifer in northwestern Illinois. The Conceptual Hydrogeologic Model for the Green River Lowlands is that the upper aquifer (the Tampico) is separated from the lower aquifer (the Sankoty) by a clay aquitard. Please use this report (Burch 2004) for some additional context on the region.
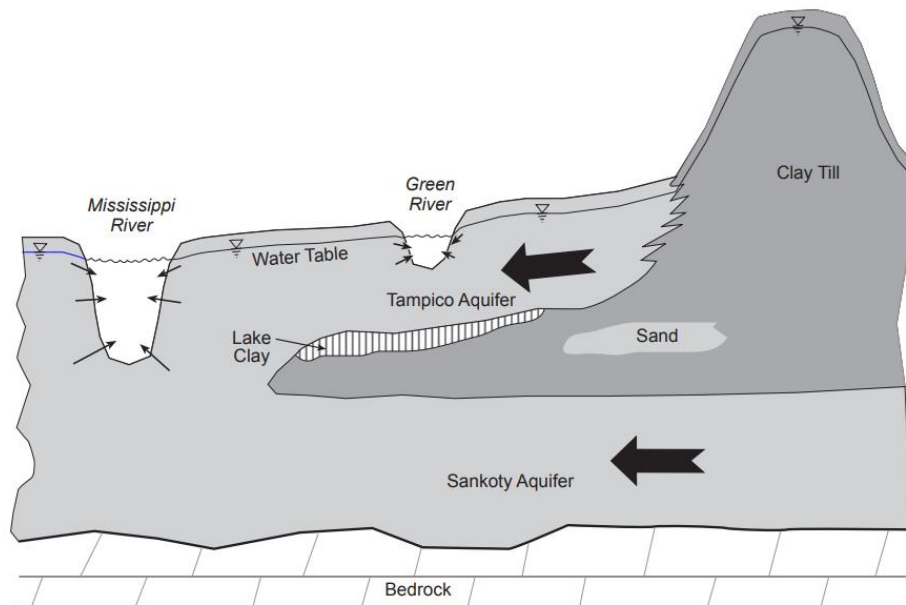
In this assignment, you are going to **create a Jupyter Notebook and use Python** to investigate a few hydrogeological issues.

In all analyses of groundwater levels, only use transducer data.

<u>***Recharge to the Tampico Aquifer:***</u>

First, let's consider water infiltrating from precipitation events into the Tampico aquifer (recharge). I recommend using Whiteside-91H for this analysis. You can link to the .csv from this page: https://www.isws.illinois.edu/groundwater-science/groundwater-monitoring-well-networks/green-river-lowlands-monitoring.

1) Estimate annual recharge (in inches) in 2017, 2018, 2019, and 2020 in the Green River Lowlands using the Water Table Fluctuation Method.
2) Calculate annual precipitation (in inches) in 2017, 2018, 2019, and 2020 in the Green River Lowlands. I recommend using Daily Precipitation Data from Walnut, IL. You can order this data from NOAA @ https://www.ncdc.noaa.gov/cdo-web/datasets/GHCND/stations/GHCND:USC00118916/detail. **When you submit your assignment, please be sure to include the original csv file that you download from NOAA.**
3) Create a table (you can manually type this into a Markdown cell) comparing recharge and precipitation in 2017, 2018, 2019, and 2020.

Leakage to the deeper Sankoty Aquifer:

A smaller fraction of water leaks to the Sankoty Aquifer. Unfortunately, because of the impact of the irrigation wells and uncertainties in storage, we are not able to use the Water Table Fluctuation Method to calculate this leakage. Instead, use the following to estimate leakage to the deeper aquifer

- Use Darcy's Law, where h1 = the Tampico Head and h2 = the Sankoty Head. Use monthly averages at the paired wells Whiteside-91H and Whiteside-91G.
- Assume an aquitard thickness of 10 ft.
- Assume a vertical conductivity of the aquitard of 0.0001 ft/day.

Once you have calculated leakage to the Sankoty (in inches per month), plot along with monthly precipitation and recharge to the Tampico at Whiteside-91G/H. Include a legend, title, and axes labels. Limit the time range plotted from the start of 2017 to the end of 2020. Plot the y-axis on a semilog scale (you will need to do a google search to determine how to do this). If all goes well, your plot should look similar to the one on the bottom of the page (except the time ranges will be different):

Discussions

Write 1-2 paragraphs discussing the relationship between recharge, precipitation, and leakage that you observed.