G572 Group Project Spring 2022

This semester, we will be creating maps (and perhaps an animation? Time will tell) of chloride accumulation originating from road salt applications in the shallow aquifers of McHenry County. This will be conducted in three phases:

1) Model development (Part 1 Due 4/5)
2) Model troubleshooting, calibration, and preparation of chloride data (Part 2 Due 4/15)
3) Solute transport - chloride (Part 3 Due 5/4)

Key Downloads:

1) Groundwater Vistas 7: Environmental Simulations Incorporated - Groundwater Modeling Software Specialists (groundwatermodels.com)
    a. This is used to read McH_only_shallow2_no_noflow.gwv
2) A GIS interface of your choosing (I will be using ArcGIS but can provide guidance on QGIS or even Python if you prefer)

Group Project Part 1: Due 4/8

You will serve as lead on the development of one of three MODFLOW packages. Collaboration is strongly encouraged since every student will face similar difficulties.

1) By 4/8, you should set goal to prepare a file to be read into FloPy. Specifically, you should ensure that FloPy reads in this file and writes the appropriate MODFLOW package. It is not essential that the MODFLOW model successfully runs at this stage; just that files are written

While not necessary to complete by 4/8, you should set a goal to make significant progress on updates to the Wiki page on GitHub:

2) For your specific package, create a tab on the Wiki page and discuss:
    a. The specific MODFLOW package used to add data to the model
    b. A summary of the data (either in map or time series form)
    c. Uncertainties in the data
    d. Source of the data (in this case, it will always be Meyer et al. 2013: IDEALS @ Illinois: Groundwater Simulation Modeling and Potentiometric Surface Mapping, McHenry County, Illinois)

In addition to your package, you should select one of three background topics and create a tab for this in GitHub. Background topics should include:

1) Discussion of the geology in McHenry County
2) Water supply and ecological concerns in McHenry County
3) A discussion of water level and water quality monitoring in McHenry County

Additional Material for Part 1

This year, Daniel will create the river and drain packages to represent surface water boundary conditions in the model. This work will be featured during the Thursday workshops and available for students who are unable to attend live. Students will develop three packages following similar methodologies:

1. Add **hydraulic conductivity** to the 10 layers of the model; use "hydraulic_conductivity.shp"
    a. The student responsible for developing this package should also make at least three maps (layer 1, layer 9, and an intermediate layer) to highlight the geology of the model
    b. The student working with geology should create a few north-south cross sections from the Groundwater Vistas model. (these can just be screenshots)
2. Add **top of layer one and bottom of all 10 layers** to the model; use "top_layer1.shp" and "bottom_alllayers.shp" for this analysis
    a. The student should create a map of land surface (top of layer 1) and the bedrock surface (top of layer 10)
    b. The student working with geology should create a few east-west cross sections from the Groundwater Vistas model. (these can just be screenshots)
3. **Current Pumping** in the model; use "pumping_wells.shp" for this analysis. Only one stress period is needed (current pumping); we will be running a steady state flow simulation for this analysis.
    a. The student should create a map of current pumping in the shallow aquifer
    b. The student should also create a time series of pumping in the model. Hint: The model simulation starts in 1863. The length of each time step/stress period in days can be found in the groundwater flow model (Groundwater Vistas) under the menu: Model>MODFLOW>Stress Period Setup.

All values are in units of feet and days. This means that hydraulic conductivity is in units of ft/day, elevations are in units of feet above mean sea level, and pumping is in units of ft^3/day.

You can view the Groundwater Flow Model by downloading Groundwater Vistas 7 from Environmental Simulations Incorporated - Groundwater Modeling Software Specialists (groundwatermodels.com)