Unit 14 Applications Physical Hydrometeorology

1. All students: The water balance of an aquifer and its change in storage S can be summarized by the following equation

$$\frac{dS}{dt} = \text{P} - \text{ET} - \text{R} - \text{pumping}$$

   Here P, ET, and R are precipitation, evapotranspiration, and runoff loss to rivers, respectively, which technically are fluxes of unit length cube per time (e.g. km^3/yr). You can also use the equation in terms of per unit area which would lead all fluxes and dS/dt having units of water depth per time (e.g. m/yr, mm/yr). Over the last 100 years, water was taken from the aquifer for irrigation, and domestic use. Apply an flux-based estimate. Hint: How would you determine each flux in and out of the aquifer? Then calculate the change in S. How would the results differ when you consider fluxes in units of cube per time vs. units of water depth per time? In terms of the components of the water balance equation, discuss why and how the level of the water table varies throughout the year when the aquifer is in a climate zone with warm dry summers (monthly mean temperature of warmest month $<20^oC$) and warm winters (monthly mean temperature of coldest month $>0^oC$) and rain mostly in winter? You may access relevant data from the web if you feel this is helpful.
   Graduate students: Use a volumetric approach using groundwater well data given for task #1 in the unit 14 excel spread sheet. Hint: The change in storage is indicated by the height in water.

2. All students: Use the well data observed at three different sites in a similar region that are listed for task 2 in the unit 14 spread sheet. Plot the data as a function of time and compare the recharge and discharge of the wells. Discuss temporal changes in terms of the water cycle. Does the groundwater table decrease over the time frame of available data? What would the change mean for the unsaturated zone?