# GLY 5828, Assignment 2:

1. Describe *Q, q, K, T, b*, Darcy's law (in both the *K* and *T* forms), and mean pore water velocity. Include dimensions where appropriate using *M, L, T* for mass, length, and time respectively.

2. If the Biscayne Aquifer has a transmissivity of $10^6$ gpd/ft (gallons per day per foot) and the seaward gradient is $10^{-4}$, what is the discharge to the sea (in gallons per day) over 20 miles of beach? Assume no pumping and no impact of salt water intrusion.

3. Derive the 1-D Poisson governing equation for steady groundwater flow. Show all steps, note all assumptions.

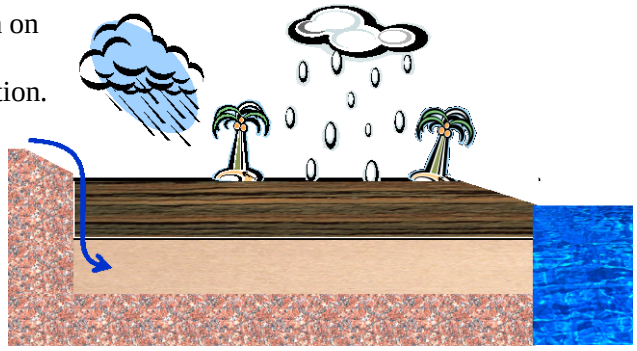
4. Beginning with the 1-D Laplace equation ($\frac{\partial^2 h}{\partial x^2} = 0$), write a general expression for *h*(x). This is relevant to a system without recharge and hence no 'source term'. Using the boundary conditions *h*(0) = 0 m and *h*(100) = 1 m, solve for the constants in your general expression and write and plot the specific solution. Also solve using DSolve and NDSolve in Mathematica. Using a transmissivity of 10 $m^2$ $d^{-1}$, solve the water balance for the system.

5. Repeat 4 but change the BCs to $dh/dx|_{x=0} = 10^{-3}$ and *h*(100) = 1. Write out and plot the solution. Also solve using DSolve and NDSolve in Mathematica. Solve the water balance for the system.

6. Repeat 4 but use the 1-D Poisson equation ($\frac{\partial^2 h}{\partial x^2} = -\frac{R}{T}$) with *R/T* = 0.001. Also solve using DSolve and NDSolve in Mathematica.

7. Using a transmissivity of 10 $m^2$ $d^{-1}$, and a recharge rate of **0.01**m $d^{-1}$, together with the boundary conditions $dh/dx|_{x=0}$ = **$-10^{-2}$** and h(100) = 1 m, solve for the constants in your general expression and write and plot the specific solution to this boundary value problem. Prove that the solution satisfies the boundary conditions. Plot a graph of *h(x)*.

This problem corresponds to the situation shown on the right. A constant head reservoir at *x* = 100 maintains the aquifer boundary head at that location. The aquifer is confined by shale above and by granite below. The aquifer receives recharge through the upper confining layer. In this case, a constant flux of water is also added through the boundary at *x* = 0; physically, this might represent the recharge of the aquifer by streams draining the granitic highlands to the west.



Show that the applied recharge (+ the constant boundary flux) is equal to the respective ground water discharge (computed from Darcy's law as demonstrated in class) for Problem 7.