

GLY 4822, Assignment 7

We wish to simulate temporal changes in the confined aquifer heads between two reservoirs (shown below). Assume the aquifer is 100 m long, has a T of $0.02 \text{ m}^2 \text{ min}^{-1}$, and a storage coefficient of 0.002. The head is initially uniform at 16 m (i.e., the initial condition is $h|_{x,0} = 16 \text{ m}$) and drops to 11 m at $x = 100$ at time 0 (i.e., the boundary conditions are $h|_{0,t} = 16 \text{ m}$ and $h|_{100,t} = 11 \text{ m}$).

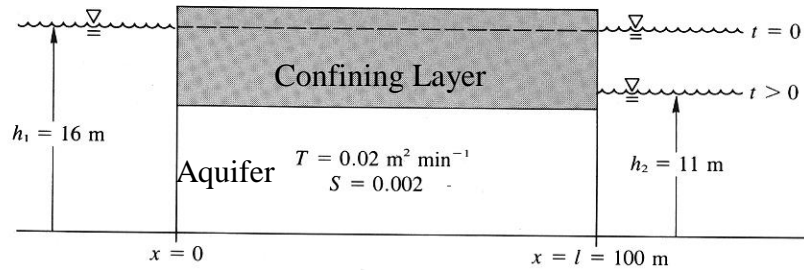


Figure 1. Wang and Anderson, 1982. *Introduction to Groundwater Modeling*. W. H. Freeman and Company, San Francisco. 237 pp.

1. Create a spreadsheet to solve the 1-D transient ground water flow equation using the explicit method we discussed in class. Plot head versus distance for at least 4 different times including one time near steady state that show the changes in the head profile with time. Plot time versus head for 1 point at $x = 50 \text{ m}$. Indicate the value of the stability parameter in your solution. Label all axes.
2. Use MODFLOW to solve the same problem.

Set the x and y spacing appropriately for the number of cells to get the correct total size. Similarly the thickness and K values must be adjusted so that $T = 0.02 \text{ m}^2 \text{ min}^{-1}$. Make sure that the model top elevation is below the minimum head expected in the problem. Put in the correct storage coefficient: if you use original MODFLOW in Groundwater Vistas, S is the storativity S we discussed in class. If you use MODFLOW 2000 or newer, S is the specific storage S_s , which can be defined by $S = S_s b$, just as the transmissivity is $T = K b$.

Under Model, Modflow, Package Options, Basic, turn off the steady state option and change the time units to minutes and the space units to meters. Under Block Centered Flow, make the top (only) layer confined. Put in the initial heads. Then, under Model, Modflow, Stress Period Setup, choose appropriate duration and number of time steps bearing in mind the steady state is reached in about 400 minutes. In my experience but for unknown reasons, total time ("Period Length") 600 minutes and 600 time steps ("No. Time Steps") doesn't work with the default 1.2 multiplier. Almost anything else does; like 600 and 500 is fine, 600 and 300 is adequate. For easier comparison with your spreadsheet model, you might consider setting the time step multiplier to 1 after you have a working solution.

Under Model, Modflow2000, Stress Period Types, choose transient. Put in the boundary conditions.

Collect profiles of head for at least the 4 times you considered in Problem 1 and compare your results with your spreadsheet model on the same charts. Add a monitoring well that measures head as a function of time at $x = 50$ m and plot with the comparable results from Problem 1. In your discussion, compare the results from a 'profile' and from the monitoring well with the results of the spreadsheet model from Problem 1.