Adv. GW Modeling – MF2015 – Tidal estuary exercise AdvGW\_tidal – Time Series and Observations

This model represents highlands bordered by a tidal estuary. The model has 3 layers representing an upper aquifer, confining bed, and lower aquifer. The grid is 15 rows by 10 columns. The length unit is feet and the time unit is days. Each cell is 500 ft × 500 ft. The estuary is represented by GHB boundaries in column 10. Two rivers cross the area from left to right. Recharge is “zoned” by the use of three Recharge-Package input files (outlined in orange in the illustration). Pumping wells are in blue, observation wells are in black, and a proposed well is red.

Use Excel to plot the first 4 days of the tidal time series provided in tides.ts.

1. Open a new blank workbook in Excel.
2. In the Data menu, select “From Text” in the “Get External Data” section.
3. In the “Import Text File” window, navigate to the exercises\AdvGW\_tidal folder, and change the file type selector to the “All Files” option.
4. Select the tides.ts file and import it. Select the Delimited option, and on the next screen, check the Comma box and click Finish.
5. Select the Excel cells from the line that has “# time” and “stage” to the end of the data (columns A and B) and on the Insert menu in the Charts section, select Scatter and “Scatter with Straight Lines”.
6. Double-click on the horizontal axis to bring up the Format Axis window, and fix the Maximum at 4 days.

Run the AdvGW\_tidal model as provided using AdvGW\_tidal.bat and plot hydrographs for observation wells h3-13-9 and h3-12-8. The observation utility of MODFLOW-2015 generates comma-separated-values (.csv) files. Excel thinks .csv files are Excel files, so they can just be opened by Excel—no need for the import procedure if the file extension is csv. Plot the first 4 days’ worth of simulated values for these two observations (use MF2015 output file head\_hydrographs.csv). Compare the shape of the hydrographs with the tidal stage. How and why do they differ?

Add details and modifications:

1. The original model omitted a small cove which needs to be added to the model. The cove occupies two cells at row 10, column 9 in layers 2 and 3, and is connected to the estuary and experiences the same tides. Edit AdvGW\_tidal.ghb to add two GHB boundaries with properties assigned like neighboring GHB cells (in the same layer). Define boundname for each so that the continuous GHB observations defined in AdvGW\_tidal.obs will include the new GHB boundaries in the appropriate observations. (Boundname Estuary-L2 is for flow from layer 2 and Estuary-L3 is for layer 3.) Be sure to increase Maxbound. Run the model.
2. A new well has been constructed in layer 3, row 9, column 6. Pumping at this well is according to time series well\_6\_rate in time-series file well\_rates.ts. Edit AdvGW\_tidal.wel to add this well to stress periods 2, 3, and 4. Make up your own values for auxiliary variables var1, var2, and var3. Provide the new well with boundname “well\_6”. Run the model. Find pumping rates as simulated for well well\_6 in the model listing file AdvGW\_tidal.lst.
3. Revise the recharge rate for recharge zone 2 by editing recharge\_rates.ts to add option “SFAC 1.2”. The value entered for SFAC multiplies all values in a time series. Run the model and note the change in the “RECHARGE ZONE 2” budget entries.
4. Add an observation corresponding to a gain-loss investigation for River 1 (closer to the top of the illustration) in the cells in columns 8, 9, and 10 of row 5.
   1. Edit AdvGW\_tidal.riv to specify “riv1\_lower” as the boundname for each of these 3 cells.
   2. Edit AdvGW\_tidal.obs to add an observation named “rv1-lower” in the block that starts “BEGIN SINGLE riv\_obs.csv”. Use type=RIV, time=25, and instead of layer, row, and column, enter “riv1\_lower”.
   3. Run the model and open riv\_obs.csv to see that the simulated value for the 3-cell reach has been written.
5. (Optional) If time allows, define a continuous observation for “riv1\_lower”.
   1. Edit AdvGW\_tidal.obs to add an observation named “rv1-lower-cont” in the block that starts “BEGIN CONTINUOUS riv\_flows.csv”
   2. Use type=RIV and instead of layer, row, and column, enter “riv1\_lower”.
   3. Run the model and open riv\_flows.csv to see that it now includes the new continuous observation.

