Education evenings 2018

Practical introduction
to groundwater modelling

Computer exercises
04 02 Troubleshooting exercises

Purpose

These exercises should

- ✓ get you started with troubleshooting,
- ✓ and provide you with more insight into the ModelMuse concepts.

Checking the “Troubleshooting” section in the ModelMuse help might be useful.

Exercise 01

- ✓ Open model named “04-02_troubleshooting-exercises_01.mmZLib”.
- ✓ Note that the Well package is active and that there is an object that is supposed to define a well.
- ? However, if you colour the grid with the well pumping rate, no wells are coloured. Why is that?

Answer

- In the object, the Z coordinate is set to “Model_Top + 1.” which is above the top of the model.
- The Grid Value dialog box can help with diagnosing this problem. If you display it and check the check box to display the 3rd-dimension coordinate of the selected object, the Z-coordinate is always listed as “not assigned” regardless of which layer is selected. This indicates that the object does not intersect the grid.

Exercise 02

- ✓ Open model named “04-02_troubleshooting-exercises_02.mmZLib”.
- ✓ Note that the Well package is active and that there is an object that is supposed to define a well.
- ? However, if you colour the grid with the well pumping rate, no wells are coloured. Why is that?

Answer

- The starting and ending times for the well are 0 and 1. However, the stress period ends at time zero.
- When you color the grid, you will get a warning that the end of the last stress period is zero and the last defined time is 1.

Exercise 03

- ✓ Open model named “04-02_troubleshooting-exercises_03.mmZLib”.
- ✓ Colour the grid with the *Kx* data set.
- ✓ Note that there are four objects that are supposed to each set a different value of *Kx.*
- ? Why do the *Kx* values all appear to be the same?

Answer

- The four objects all set the values of Kx for layer 2. The selected layer is layer 1.
- The fact that all the cells were blue (instead of green) is a clue that the values are not all the same even though you don't see any cells that aren't blue. When everything is the same value, the color from the middle of the color scale will be used to color the cells.

Exercise 04

- ✓ Open model named “04-02_troubleshooting-exercises_04.mmZLib”.
- ✓ Colour the grid with the *Kx* data set.
- ✓ Note that there are four objects that are supposed to each set a different value of *Kx.*
- ? Why do the *Kx* values all appear to be the same?

Answer

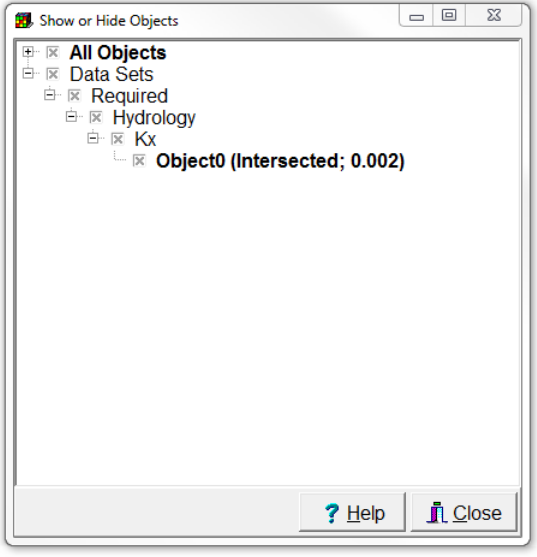
The Grid Value dialog box can help with diagnosing this problem. The explanation says “set using parameters via the formula: 0.001”. Recall that when MODFLOW uses parameters to set the value of a data set, you can’t use objects to set the value of that data set directly. Thus, when determining the value of Kx, the 4 objects have no effect. However, you could use objects to set the values of the multiplier and zone array associated with an object.

Exercise 05

- ✓ Open model named “04-02_troubleshooting-exercises_05.mmZLib”.
- ✓ Colour the grid with the *Kx* data set.
- ✓ Note that the single object in this model is supposed to set the values of *Kx* for every cell in the grid.
- ? However, in the middle layer, *Kx* is set by the default formula. Why is that and what can you do about it?

Answer

In the Show or Hide Objects dialog box, note that the object is marked with the word “Intersected” instead of “Enclosed”. That means it sets the values of cells that it intersects. The edges of the object are outside the grid so they don’t intersect the middle layer. The formulas for the top and bottom of the object are “Model_Top” and “Lower_Aquifer_Bottom”. That causes the top of the object to be at the top of the grid and the bottom of the object to be at the bottom of the grid. Thus the object intersects the top and bottom layer but it doesn’t intersect the middle layer.

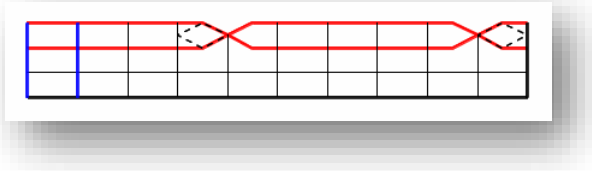


Exercise 06

- ✓ Open model named “04-02_troubleshooting-exercises_06.mmZLib”.
- ✓ Colour the grid with the *Kx* dataset.
- ✓ Note that the object is supposed to set *Kx* for all the cells it encloses.
- ? However, there is a group of cells inside it whose values are set by the default formula. Why is that?

Answer

The Grid Value dialog box can help with diagnosing this problem. When you place the cursor over one of the cells where the object is working as it should, it says that the top of the object is at 0 and the bottom is at -10. However, In the cells where the object isn't working right, it says that the top of the object is at -10 and the bottom is at 0. The top of the object is below the bottom of the object. For an object to enclose anything, its top must be above its bottom. When we look at the formulas for the higher and lower Z-coordinates, they are "Model_Top" and "Upper_Aquifer_Bottom". Those seem OK so the problem must be with the Model_Top and Upper_Aquifer_Bottom data sets. Color the grid with the Model_Top data set and you will see that the area where Kx isn't set right, the elevation of Model_Top is different. When we place a cursor over this area, the Grid Value dialog box gives as an explanation "Enclosed by Object0 with formula: -10". If we display the Show or Hide Objects dialog box, we find that Object0 is hidden. When we display and edit it, we find that it sets Model_Top and Upper_Aquifer_Bottom to -10 and 0 respectively. The front view of the model looks like this where the layers top and bottom are reversed.



Exercise 07

- ✓ Open model named “04-02_troubleshooting-exercises_07.mmZLib”.
- ✓ Note that the Well package is active and that there is an object that is supposed to define a well.
- ? However, if you colour the grid with the well pumping rate, no wells are coloured. Why is that?

Answer

When you color the grid you get an error message that says “No boundary conditions assigned to the WEL: Well package because the object does not set the values of either enclosed or intersected cells.” When we double-click on the object, we see that the error message is correct.

Exercise 08

- ✓ Open model named “04-02_troubleshooting-exercises_08.mmZLib”.
- ✓ Note that the Well package is active and that there is an object that is supposed to define a well.
- ? However, if you colour the grid with the well pumping rate, no wells are coloured. Why is that?

Answer

The object is in layer 2. In the MODFLOW Layer Groups dialog box, you will see that layer 2 is a non-simulated layer. You can only have wells in simulated layers.

Exercise 09

- ✓ Open model named “04-02_troubleshooting-exercises_09.mmZLib”.
- ✓ Colour the grid with the *Kx* data set.
- ✓ Note that there are two objects in this model that are supposed to set the value of *Kx*.
- ? However, only one of them appears to have an effect. Why is that and what can you do about it?

Answer

The Grid Value dialog box can help with diagnosing this problem. When the mouse is over a cell enclosed by the inner object, the explanation it gives for the value of Kx is "Enclosed by OuterObject with formula: 0.0003". The Rearrange Objects dialog box lists the objects from back to front Inner_Object is listed before OuterObject so OuterObject overrides value set by Inner_Object. You can drag the rows in the Rearrange Objects dialog box to fix the problem. You drag rows by clicking on the gray area to the left of the row and dragging.

Exercise 10

- ✓ Open model named “04-02_troubleshooting-exercises_10.mmZLib”.
- ✓ Colour the grid with the *Kx* data set.
- ✓ Note that this model uses three parameters to define the distribution of *Kx*. Each parameter uses a zone array. The parameters have values of 0.0001, 0.0002 and 0.0003.
- ? However, the calculated values of *Kx* are 0.0001, 0.0003 and 0.0005. Why is that and what can you do about it?

Answer

Recall that when parameters are used, zone arrays determine where each parameter is applied and then zone arrays further modify the value applied to an individual cell. None of these parameters use multiplier arrays so they are not an issue. The problem must be with the zone arrays. Recall that if no multiplier arrays are used, the value applied to a cell is the sum of the values of all the parameters that apply to a cell. To get the value we are getting, more than one parameter must apply to some cells. Try coloring the grid with each of the Zone arrays. HK_Par1_Zone and HK_Par2_Zone look OK but the HK_Par3_Zone and HK_Par2_Zone overlap. Object3 is used to define where HK_Par3_Zone is true and it uses the formula "If(HK_Par1_Zone, False, True)". The formula should be If((HK_Par1_Zone OR HK_Par2_Zone), False, True). Actually, the formula could be made simpler by eliminating the If function: "NOT(HK_Par1_Zone OR HK_Par2_Zone)"

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Questions? Found an error?
Please contact B. Rogiers at brogiers@sckcen.be.