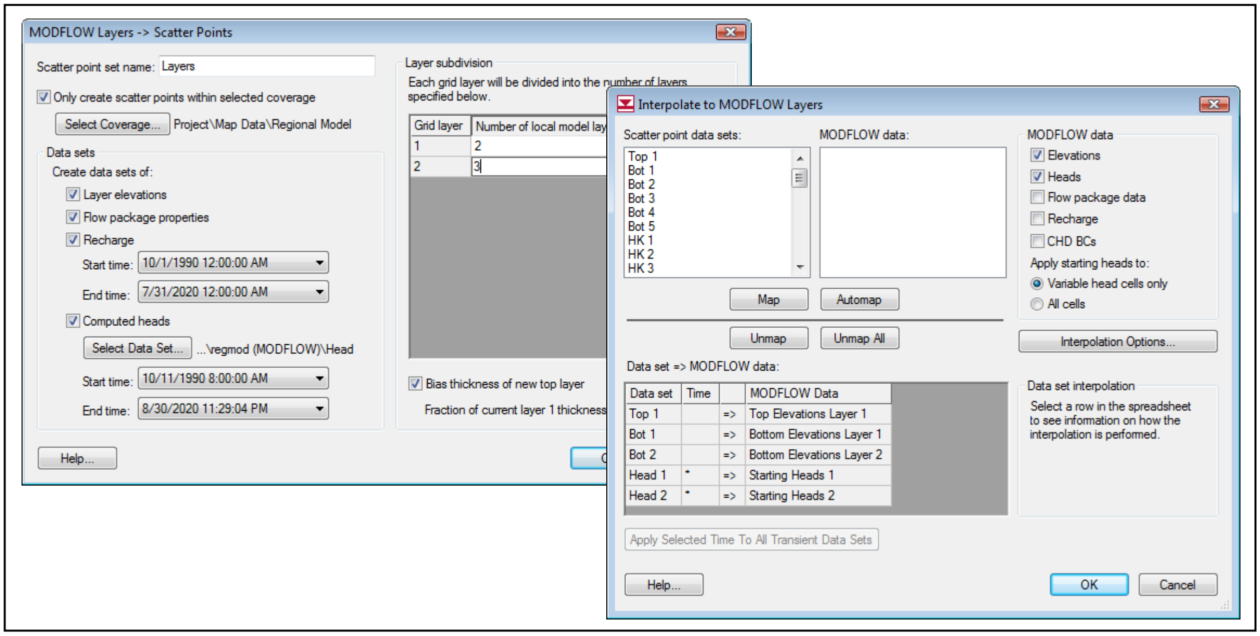
GMS

v. 9.2

GMS 9.2 Tutorial

MODFLOW – Regional to Local Model Conversion, Transient

Create a local model from a regional model using convenient tools provided in GMS



Objectives

Use the convenient tools provided in GMS to perform the steps involved in a typical regional to local model conversion. This tutorial uses a transient model. A steady state example is provided in the *MODFLOW – Regional to Local Model Conversion, Steady State* tutorial.

Prerequisite Tutorials

- MODFLOW - Regional to Local Model Conversion, Steady State.

Required Components

- Grid
- Geostatistics
- Map
- MODFLOW

Time

- 30-60 minutes

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1 Contents

2 Introduction

The *MODFLOW – Steady State Regional to Local Model Conversion* tutorial describes the basic Regional to Local conversion methods. You should complete that tutorial prior to completing this one. This tutorial uses the same model as the one in the steady state tutorial with the exception that in this tutorial the model is transient. The background information and model description have been omitted from this tutorial because they can be found in the steady state tutorial.

2.1 Outline

This is what you will do:

1. Open a regional conceptual model.
2. Convert the layer data to a scatter point set.
3. Build a local conceptual model and create a 3D grid.
4. Map the conceptual model to a MODFLOW simulation.
5. Interpolate the layer data.
6. Run MODFLOW.

3 Getting Started

Let's get started.

1. If necessary, launch GMS. If GMS is already running, select the *File* | *New* command to ensure that the program settings are restored to their default state.

4 Reading in the Regional Model

The first step in the model conversion process is to build a regional model. Since the focus of this tutorial is primarily on the conversion process, we will read in a previously constructed model.

1. Select the *Open* button .
2. Locate and open the file entitled **Tutorials\MODFLOW\reg2loc\regmod.gpr**.

We are now viewing the top layer of the two layer model. You may wish to use the arrow buttons in the *Tool Palette* to view the bottom layer. The wells are located in the bottom layer. When you are finished, return to the top layer.

This model was constructed using the conceptual model approach. The boundary of the local site is indicated with a red rectangle.

The project we imported includes the solution for the regional model. You should see contours of computed head.

5 Converting the Layer Data to a Scatter Point Set

The first step in converting the regional model to a local model is to convert the MODFLOW layer data to a 2D scatter point set.

1. Select the *3D Grid Data* folder in the *Project Explorer*.
2. Select the *Grid* | *MODFLOW Layers → 2D Scatter Points* command.
3. Change the *Scatter point set name* to **Regional Data**.
4. Toggle **on** *Only create scatter points within selected coverage*
5. Click the *Select Coverage…* button.
6. Select the *Scatter points* coverage under *Regional Model* and click *OK*.
7. Toggle **on** *Bias thickness of new top layer*.
8. In the spreadsheet on the right, change the *Number of local model layers* for grid layer 1 to **2** and grid layer 2 to **3**.

9. Toggle **on** *Layer Elevations, Flow package properties, Recharge, and Computed heads*.

10. Click the *Select Data Set …* button, select the *Head* data set under *regmod (MODFLOW)* and click *OK*.

Your dialog should look like this.

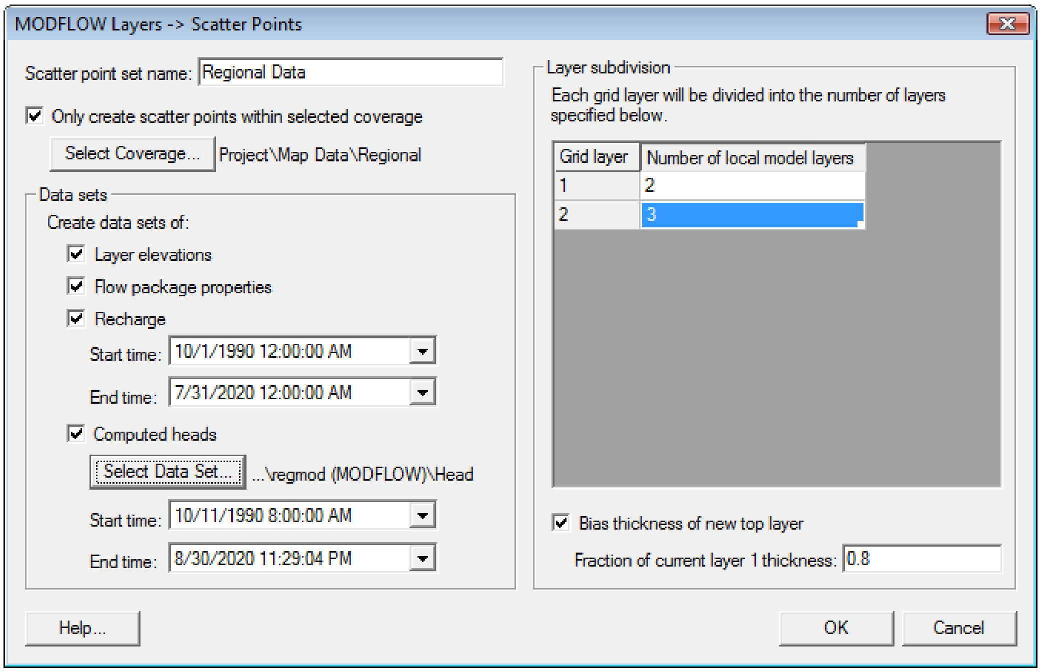

Figure 1. MODFLOW Layers -> Scatter Points dialog.

11. Select the *OK* button to exit to the main screen.

You should see a set of scatter points appear at the location of the cell centroids. This scatter point set has a data set for the computed heads, recharge, hydraulic conductivity, and the top and bottom elevations of the model layers.

6 Building the Local Conceptual Model

The simplest way to build the local model is to create a conceptual model in the *Map* module. To do this, we will create a new conceptual model.

1. Right-click on the *Map Data* folder  in the *Project Explorer* and select *new conceptual model* command.

2. Change the name to **Local Model** and select *OK*.

6.1 Creating a New Coverage

Next, we will create a new source/sink coverage.

1. Right-click on *Local Model* item in the *Project Explorer* and select the *New Coverage* command.
2. Change the *Coverage name* to **local ss**.
3. In the *Sources/Sinks/BCs* list, turn on **Layer Range** and **Specified Head (CHD)**.
4. Change the *Default layer range* to be 1 to 5.
5. Select the *OK* button.

6.2 Creating the Boundary Arcs

Next, we will create the boundary arcs. First, we need to zoom in on the local site model:

1. Select the *Zoom* tool .
2. Drag a box around the local site boundary (the red rectangle).
3. Select the *local ss* coverage in the *Project Explorer* to make it the active coverage.

Create the boundaries as follows:

4. Select the *Create Arc* tool .
5. Create one arc to form a rectangle on top of (or close to) the red rectangle in Figure 2. If you don't see the red rectangle, you need to toggle on *Annotation Data* in *Project Explorer*.

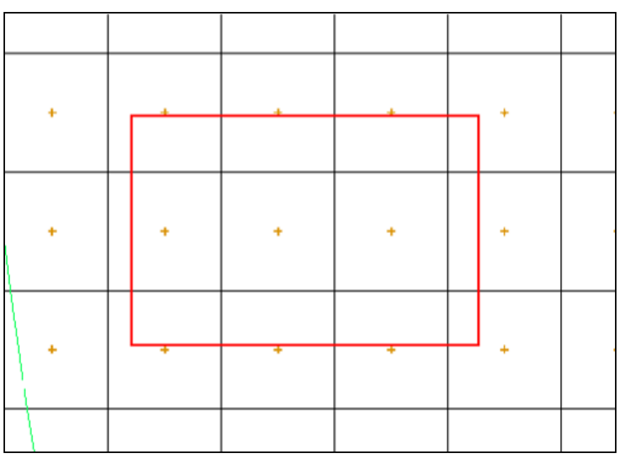

Figure 2. Arcs to be created on boundary of local model.

6.3 Building the Polygon

Next, we will use the arcs to build a polygon defining the model domain.

1. Select the *Feature Objects | Build Polygons* command.

6.4 Marking the Specified Head Arcs

The next step is to mark the specified head boundaries.

1. Select the *Select Arcs* tool.
2. Select the boundary arc of the model.
3. Select the *Properties* button.
4. In the spreadsheet change the *Type* to **spec. head (CHD)**.
5. Select the *OK* button.

7 Creating the Local MODFLOW Model

We are now ready to convert the conceptual model to a grid model. First, we will create a new grid frame that fits the local model.

1. In the *Project Explorer* right-click on the empty space and then, from the pop-up menu, select the *New | Grid Frame* command.
2. Right-click on the *Grid Frame* in the *Project Explorer* and select the *Fit to Active Coverage* command from the pop-up menu.
3. If desired, you can use grid frame tool to position the grid frame to better match the local grid boundary.

7.1 Creating the Grid

Next, we will create the grid.

1. In the *Project Explorer* right-click on the *Grid Frame* and select the *Map To | 3D Grid* command.
2. Select *OK* to confirm deletion of the existing grid and the MODFLOW data.
3. In the *Create Finite Difference Grid* dialog, enter **60** for the number of cells in the x direction, **40** for the number of cells in the y direction, and **5** for the number of cells in the z direction.

4. Select *OK* to create the grid.

You should see a grid appear. You can zoom in to examine the grid.

5. Select the *Zoom* tool.

6. Drag a box around the grid.

7.2 Creating a New MODFLOW Model

Next, we will inactivate the exterior cells.

1. Select the *3D Grid Data* folder in the *Project Explorer*.

2. Select the *MODFLOW | New Simulation* command.

3. In the *MODFLOW Global / Basic Package* dialog, select *Packages* button and toggle **on** *Time var. spec. head (CHD1)* and *Recharge (RCH1)*.

4. Select *OK* to return to *MODFLOW Global / Basic Package* dialog.

5. Switch model type to *Transient* and select *Stress periods* button.

6. Make sure the *Use dates/times* option is turned on.

7. Change the *Number of stress periods* to **7**.

8. Enter the following times and number of time steps for the stress periods:

	Start	*Num time steps*
1	**4/15/1991 12:00:00 AM**	**3**
2	**4/20/1991 12:00:00 AM**	**4**
3	**4/30/1991 12:00:00 AM**	**6**
4	**5/20/1991 12:00:00 AM**	**10**
5	**7/19/1991 12:00:00 AM**	**20**
6	**10/17/1991 12:00:00 AM**	**30**
7	**4/15/1992 12:00:00 AM**	**40**
End	**12/1/1993 12:00:00 AM**	

9. Select the *OK* button to exit the *Stress Periods* dialog.

10. Select the *OK* button to exit the *Global Package* dialog.

7.3 Inactivating Cells

1. Select the *Map Data* folder in the *Project Explorer.*

2. Select the *Feature Objects | Activate Cells in Coverage(s)* command from the menu. If the arcs match the grid boundary closely, you may not see any cells

inactivated. If, however, the grid extends significantly beyond the arcs, some cells will be inactivated.

7.4 Mapping the Properties

Next, we will convert the MODFLOW data to the grid.

1. Right-click on the *Local Model* conceptual model in the *Project Explorer* and select the *Map to* | *MODFLOW/MODPATH* from the menu.

2. Select *OK* at the prompt to map *All applicable coverages*.

8 Interpolating the Layer Data

The final step in the conversion process is to interpolate the regional data from the scatter points to the MODFLOW layer arrays.

1. Right-click on the *Regional Data s*catter set in the *Project Explore*r, and select the *Interpolate To* | *MODFLOW Layers* command.

2. Toggle **on** *Flow package data*, *Recharge*, and *CHD BCs*.

3. Click the *Automap* button. GMS will automatically map data sets to MODFLOW layers.

4. Select the *OK* button.

It will take a few moments for GMS to interpolate from the scatter points to the MODFLOW arrays. Now that we're done using the scatter points, lets turn them off to make it easier to see the grid.

5. Uncheck the box in the *Project Explorer* next to the *2D Scatter Data* folder .

9 Saving and Running the Local Model

We are now ready to save the MODFLOW model and run the simulation.

1. Select the *3D Grid Data* folder in the *Project Explorer*.

2. Select the *File* | *Save As* command.

3. Save the project with the name **locmod**.

To run MODFLOW:

4. Select the *MODFLOW* | *Run MODFLOW* command.

5. When the simulation is finished, select the *Close* button.

You should see a set of head contours that closely resemble the head contours from the regional model. At this point, the local flow model is complete and the injection and extraction wells could be added for the pump and treat simulations.

10 Conclusion

This concludes the *Transient Regional to Local Model Conversion* tutorial. Here are the things that you should have learned in this tutorial:

- The *Grid | MODFLOW Layers → 2D Scatter Points* command converts your MODFLOW elevation, flow package properties, recharge, and computed heads data into scatter points.

- The basic steps for doing Regional to Local model conversion in GMS are:

    1. Generate the regional model and compute a solution.

    2. Use the *MODFLOW Layers → 2D Scatter Points* command to create the scatter point set with the layer and head data from the regional model.

    3. Create the 3D grid for the local scale model.

    4. Interpolate the heads and layer data values from the scatter points to the MODFLOW layer arrays for the local scale model.