

Quadpatch Grid Exporter

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Introduction

The QuadpatchGridExporter is a utility application for generating MODFLOW-USG unstructured discretization files (DISU) and MODPATH Version 7 unstructured grid files (MPUGRID) for unstructured quadpatch grids. The quadpatch grids are defined by specifying a traditional structured MODFLOW basegrid and an associated array of grid cell refinement values. The QuadpatchGridExporter combines the basegrid and the grid cell refinement data to produce smoothed quadpatch grids and their associated MODFLOW-USG DISU and MODPATH-7 MPUGRID files. An option also is provided to export the unstructured grid cell polygons as ESRI shapefiles for use in graphics display applications. Basegrid and refinement data are provided by a simple text-based grid definition file. An example is provided in the “test” directory that accompanies the application. A brief description of the input is provided below. Users can use the example grid definition as a model that can be modified to generate their own unstructured quadpatch grids.

Example Grid Definition File

The grid definition file used to produce the unstructured grid for the MODPATH-7 example_2 problem is shown below. The data is arranged in a block format. The mudflow_grid block defines the basegrid. The quadpatch block defines the refinement data that will be applied to the cells in the basegrid to produce the quadpatch grid.

```
modflow_grid block  
(basegrid data)  
  
begin modflow_grid  
  length_unit = foot  
  rotation_angle = 0  
  x_offset = 0  
  y_offset = 0  
  nlay = 3  
  nrow = 21  
  ncol = 20  
  delr = constant 500  
  delc = constant 500  
  top = constant 400  
  bottom layer 1 = constant 220  
  bottom layer 2 = constant 200  
  bottom layer 3 = constant 0  
end modflow_grid  
  
quadpatch block  
(grid cell refinement data)  
  
begin quadpatch  
  smoothing = full  
  refinement layer 1 = array_file example_2_refinement.dat  
  refinement layer 2 = array_file example_2_refinement.dat  
  refinement layer 3 = array_file example_2_refinement.dat  
end quadpatch
```

Figure 1. Grid definition file (example_2.dfn) used to generate the grid used in MODPATH-7 example_2.

modflow_grid block input

The *modflow_grid* block contains the following data items:

length_unit – length unit used by MODFLOW specified either as foot or meter.

nlay, nrow, and ncol – layer, row, and column dimensions of the basegrid.

delr and **delc** – one-dimensional arrays specifying grid cell spacing along rows (*delr*) and along columns (*delc*) in the basegrid.

top – two-dimensional layer array specifying top elevation of layer 1.

bottom – three-dimensional, layer-based array specifying the bottom elevation of layers 1 through *nlay*.

rotation_angle, x_offset, and y_offset – transform data that allow the grid to be oriented to specific georeferenced coordinates if desired. The rotation angle is measured in the positive counterclockwise direction relative to the positive x-axis. The *x_offset* and *y_offset* values specify the offset location of the x-y origin for the transformed grid. For an untransformed grid, the rotation angle and the x and y offsets are all equal to 0. The origin of the untransformed grid is located at the lower-left corner of the basegrid. These transform variables are not used by MODFLOW or MODPATH. They are provided simply to allow MODPATH output to be transformed and plotted in a specific orientation if necessary. For the purpose of documentation, the *QuadpatchGridExporter* records these data items in comment lines at the beginning of the MPUGRID file.

The individual data items can appear in any order within the block.

quadpatch block input

The *quadpatch* block contains the following data items:

smoothing – option for smoothing the specified grid cell refinement data when generating the *quadpatch* grid. The smoothing option should always be specified as “full”. The “full” smoothing option adjusts the grid refinement values so that no the maximum difference in refinement level between adjacent grid cells is equal to 1 for all grid cells. Smoothed grids have the characteristic that a grid cell only can be connected to 0, 1, or 2 adjacent cells across any horizontal face and 0, 1, or 4 adjacent cells across its bottom and top faces.

refinement – three-dimensional, layer-based array specifying grid cell refinement level data.

The individual data items can appear in any order within the block.

Input format

Scalar and other single-value data items are specified as:

`variable_name = variable_value`

If the `variable_value` is a text item, it does not need to be enclosed by quotation marks unless it contains spaces.

One-dimensional and two-dimensional layer arrays can be specified as a single constant value or an array of values using the following syntax:

To assign a single constant value to all elements of the array:

```
variable_name = constant variable_value
```

To assign an array of values, the values must be read from a separate file that is specified by the syntax:

```
variable_name = array_file filename
```

The file containing the array values must reside in the same directory as the grid definition file. All one- and two-dimensional array data is read as a one-dimensional series of comma- or space-separated values. As many lines as necessary can be used to specify the array data.

Three-dimensional layer-based arrays are specified as a series of layer data items.

To assign a single constant value to all the elements of a specific layer, the following syntax is used:

```
variable_name layer layer_number = constant variable_value
```

To assign an array of values for the elements of a specific layer, the following syntax is used:

```
Variable_name layer layer_number = array_file filename
```

Running QuadpatchGridExporter

The QuadpatchGridExporter is a Microsoft Windows application. It consists of an executable file (QuadpatchGridExporter.exe) and several dynamically-linked library (DLL) files. No special installation is required. The files can be placed anywhere provided that the executable file and all the DLL files are located in the same directory.

To run QuadpatchGridExporter, double click on the executable file in Windows explorer. After the application window appears, select the Browse button to select a grid definition file. Then select the output options you want and click the Export files button. The status of the export operations is displayed in the text box at the bottom of the application window. The DISU, MPUGRID, and shapefile output files generated by the application will be created in the same directory as the grid definition files.