

EOSC 454 Tutorial 0

MeshTools3D, Grav3D, gm-data-viewer notes

1 TA Contact Information

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2 Introduction

The gravitational and magnetic responses for simple geometric objects can be determined analytically. Complex geologic structures can be simulated by adding together several smaller objects. Today we will be using *GRAV3D* and *MAG3D* to perform the forward model calculations for simple structures, and the *MeshTools3D* utility program to create models.

By the end of this tutorial you should feel comfortable creating and editing models, as well as viewing results of the forward calculations.

Software we will cover today:

meshtools3D Build and visualize 3D block models

magfor3D Perform the forward calculation on a susceptibility model to generate magnetic data (part of MAG3D).

gzfor3D Perform the forward calculation on a density model generate gravity data (part of GRAV3D).

gm-data-viewer View data as a color contour plot and generate line profiles.

The forward model calculations produce the results we would expect to measure at the surface of the earth based on the model created with *MeshTools3D*.

3 Creating the Model and Mesh

Start the *MESHTOOLS3D* application. Use the **FILE->Create Mesh** menu to create a new mesh. Specify (-200, -200, 0) for the top southwest corner, (20,20) for Cell Width, and (400,400) for the length. Click **Save** and enter a filename to save the mesh.

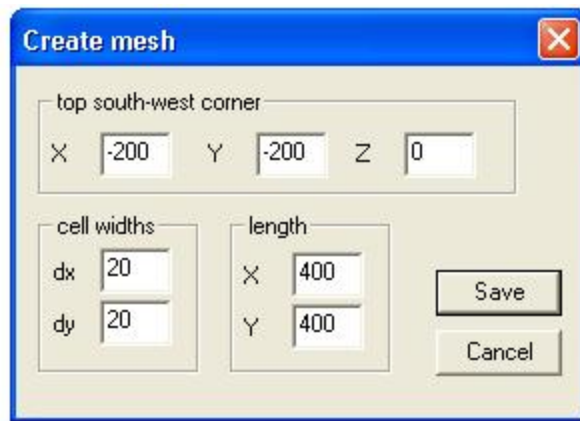


Figure 1: Create Mesh Dialogue Box

Tip: Do not use any spaces in the file or directory names.

The vertical thickness of the cells is chosen automatically. Note how the Z size of the cells grows larger for deeper cells. This can be altered by editing the mesh file by hand.

4 Create the Model

Use the **EDIT->Add Blocks** menu to add model cells within the mesh. Create a single block with a value of 0.5 (g/cc for gravity, and susceptibility for magnetics). Use the slider bars to move the block around the mesh. Note that you can still manipulate the viewing of the mesh to make it easy to place. Type in the coordinates of (-20,-20,-60) and (20,20,-80) for the cell. Click the **set** button to set those coordinates for the block, and then click the **Add** button to add the prism. Type 'r' in Meshtools to reset the colorbar. Go to **FILE->SAVE AS** and save the model. **Make sure the model file or directory name do not contain spaces.**

4.1 Using and Navigating MeshTools3D

By holding down the right mouse button and panning the mouse, the model can be rotated in real time. By holding down the left mouse button you can extract information about the model, try this by clicking on the cell which was added in the previous step. The plus(+) and minus(-) key can be used to zoom in and out of the model.

Features of MeshTools3D you may also find useful are:

- **View->Labels** to add labels to the coordinate axis.
- **View->Mesh Stats** to get information about the mesh geometry.
- **View->Reset Scale** to reset the colorbar of the model.
- **Cut-Planes** combined with SHIFT and the UP/DOWN arrows to view inside the model. Use the **WESNTB** buttons to define the cut-plane from which you are viewing.

5 Calculating the Forward Model

Click go to the **Forward Model** to perform the forward calculations. Use the default magnetic inclination, declination and field strength for now when performing the magnetic forward calculation.

The *data spacing* values can be modified to change where the data is gathered above the model, and *height above surface* changes the elevation at which the data is gathered.

Tip: gravfor3d.exe and magfor3d.exe need to be in the same directory as the MeshTools3D application. The maximum mesh size is 16,000 cells and the maximum number of data points is 400.

6 Viewing the Data

Now that the data has been calculated, it can be viewed with gm-data-viewer (it should pop-up automatically after the forward calculations are complete). You should see a color contour plot of the gravity or magnetics data, and a color bar to the side. By dragging a line on the plot you can bring up a line profile of the data. A nice feature is **Options->Min/Max** which will show you the maximum and minimum values in the data set, and allows you to change the values to adjust the contour plot.