

Create a New 3D Model in GM-SYS 3D Modelling

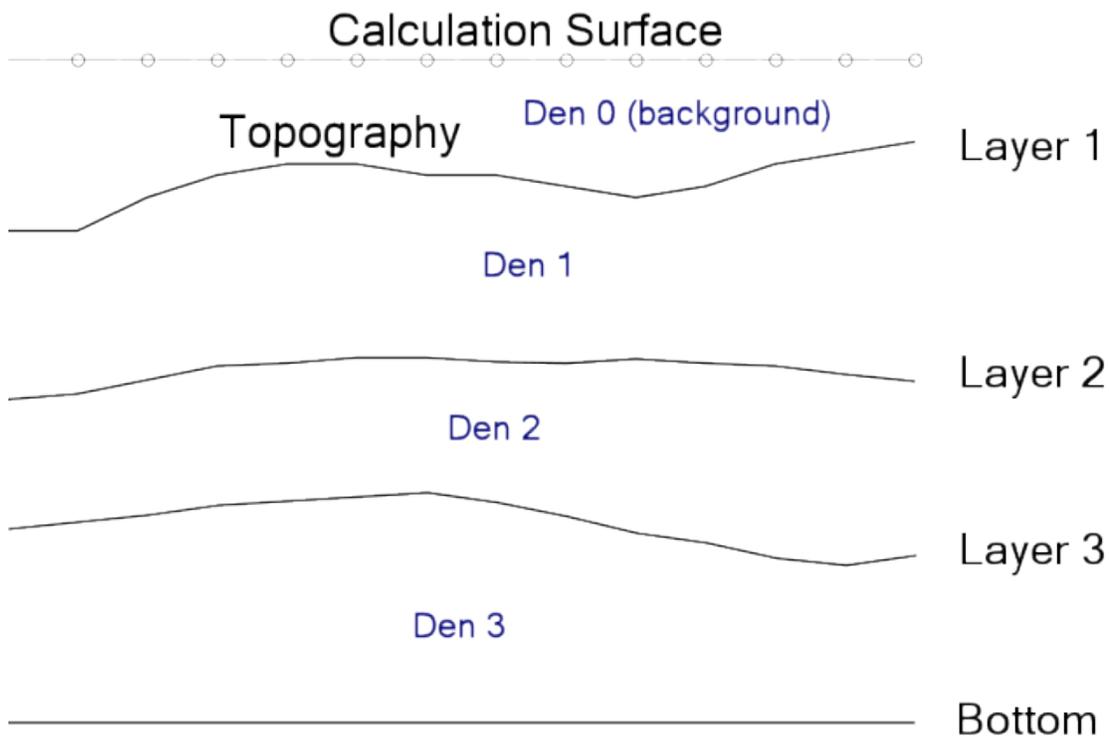
A GM-SYS 3D model describes a volume of earth, extending from a top surface (usually topography or sea level) to a specified bottom elevation. The horizontal extents of a model are defined by selecting an index grid or voxel, from which the horizontal cell size, number of samples, projected coordinate system, and horizontal units of the model are copied. The model volume may then be divided into sub-horizontal layers of differing physical properties by importing relief elevation grids that each represent the top of a layer. Layers tops may be partially or completely coincident, causing a layer to be zero thickness where coincident, but they may never cross.

Each layer in a model may be assigned different values for each supported physical property (density, susceptibility, remanent magnetization, and velocity) in order to build a realistic 3D representation of the property distributions within the Earth. Layer density may be specified using either a constant density, a vertical density gradient, a laterally-varying density distribution, or a distribution that varies in three dimensions. Layer susceptibility may be specified using either a constant susceptibility and remanent magnetization, or a laterally-varying susceptibility distribution. Layer velocity may be a constant.

In order to calculate the response of the model, you must add a gravity and/or magnetic survey defining how and where the response should be calculated. A survey defines the location of the calculations, appropriate background field information, and optionally may include observed data components.

3D Model Example

The image below illustrates a three layer gravity model. Each layer description includes a grid defining the elevation of the top surface and a density parameter describing the density distribution in the material below the top surface.



Create a New 3D Model

A GM-SYS 3D model represents a 3D volume of the earth with defined density and magnetic properties. This volume may be subdivided into areas of differing properties to create a realistic representation of the property distributions in the Earth. You may configure gravity and/or magnetic surveys to calculate the response of the model at a specific times and locations.

You will need an index grid or voxel that defines the location, (X,Y) dimensions, cell sizes, distance units in a defined Projected Coordinate System, and the rotation of your model. The index grid or voxel is the template for defining the (X,Y) footprint of your model, but does not need to be part of your model.

Create a New 3D Model

- To begin, open Oasis montaj and create a new workspace.
Verify that the GM-SYS 3D menus and toolbar are loaded.



More than one model may be open in the workspace.

To Create a New GM-SYS 3D Model

1. From the *GM-SYS 3D* menu, select **New 3D Model** The *New Model (1/2)* dialog will appear.

2. Select whether you are creating a **Depth** model (vertical axis is elevation) or a **Time** model (vertical axis is time).
3. Specify a new *Model name*.
By default, the model is saved in the current workspace directory, but you may save the model anywhere on your system.
4. Select whether to derive the model Geometry (X, Y) from an "index" **Grid** or a **Voxel**.
The horizontal "footprint" of the model – number of cells, dimensions, coordinate system, orientation, and distance units – will be the same as that of the selected file.
5. Depending upon the previous selection, specify an existing *Geometry grid* or *Geometry voxel*, either by selecting from the list of files in the workspace or by browsing to locate the file.

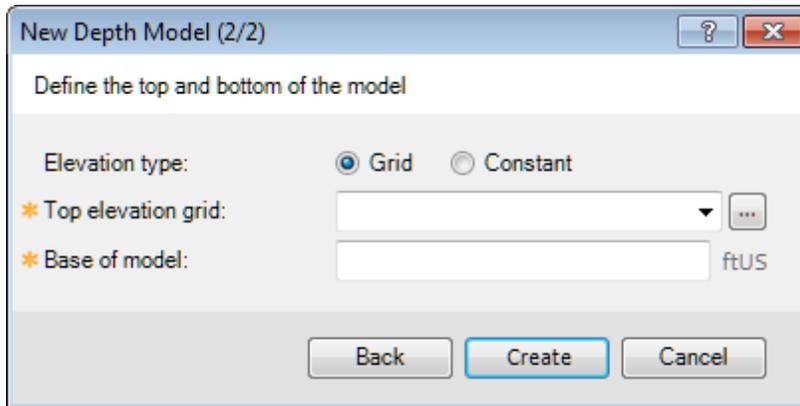
The *Model Geometry* information will be displayed in the lower part of the dialog. If the parameters are not consistent with a 3D model – e.g. cell sizes in X and Y are not the same – an error indicator will prompt you to pick another grid or voxel.

- When satisfied with this information, click **Next** to continue. Depending on your choice of model type, the *New Depth Model (2/2)* dialog or the *New Time Model (2/2)* dialog will appear.

 *Certain options (adding survey or DDT) are only allowed for Depth models.*

To Build a Depth Model

- If you are building a Depth model, the *New Depth Model (2/2)* dialog will appear.



You must define the top and bottom surfaces of the model volume. Together, these define a 3D volume in space that will contain the GM-SYS 3D model.

- Select how you want to define the top of the model, using either a *Grid* or a *Constant* elevation. By default, **Grid** will be selected. The grid selected must completely cover the model footprint with valid data. If an index grid was specified in the previous dialog, it will appear here by default.
- If you select **Grid**, specify the *Top elevation grid* for the model from the list, or browse to find one.
- If you select **Constant**, specify the constant top elevation for the model.
- Specify the elevation of the *Base of model*, in the units specified. Try to set this value lower than the deepest layer you intend to include in your model.
- If you are satisfied with these settings, click **Create** to create the new Depth model and open it in Oasis montaj.

To Build a Time Model

1. If you are building a Time model, the *New Time Model (2/2)* dialog will appear.

You must define the properties of the seismic datum.

2. Specify a constant *Datum elevation*, in the units specified. This is the elevation that represents T=0 in the model.
3. Specify the *Velocity units* to be used in this model. All velocity values are assumed to use these units.
4. Specify the *Datum velocity* – the velocity of the material between the datum and the first Time horizon – in meters per second.
5. Select which *Time units* are represented by the time horizon grids.
6. If you are satisfied with these settings, click **Create** to create the new Time model and open it in Oasis montaj.



When the model is created, it will open as a document in Oasis montaj. The model is saved as a model file <model>.geosoft_gmsys3d, an XML metadatafile <model>.geosoft_gmsys3d.xml, and a model folder <model>.geosoft_gmsys3d.data.

Post-Model Creation

Any subsequent grid or voxel (georeferenced data) that is selected to represent a part of the model - whether surface elevation, gravity measurement, or density distribution, etc. - will always be reprojected and resampled to match the index parameters provided when the model is created. Thus, all input data must be properly georeferenced (i.e. have a valid coordinate system defined) prior to import.

For each data type, there is a threshold of acceptable coverage, below which the input will be rejected. If the coverage is acceptable, but not complete, dummies in the grid or voxel will be automatically filled on import.



The distance units for the model are defined by the units specified in the Index grid or voxel projected coordinate system. All other inputs to the model that are not explicitly defined are assumed to use these same distance units in X, Y, and Z.

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