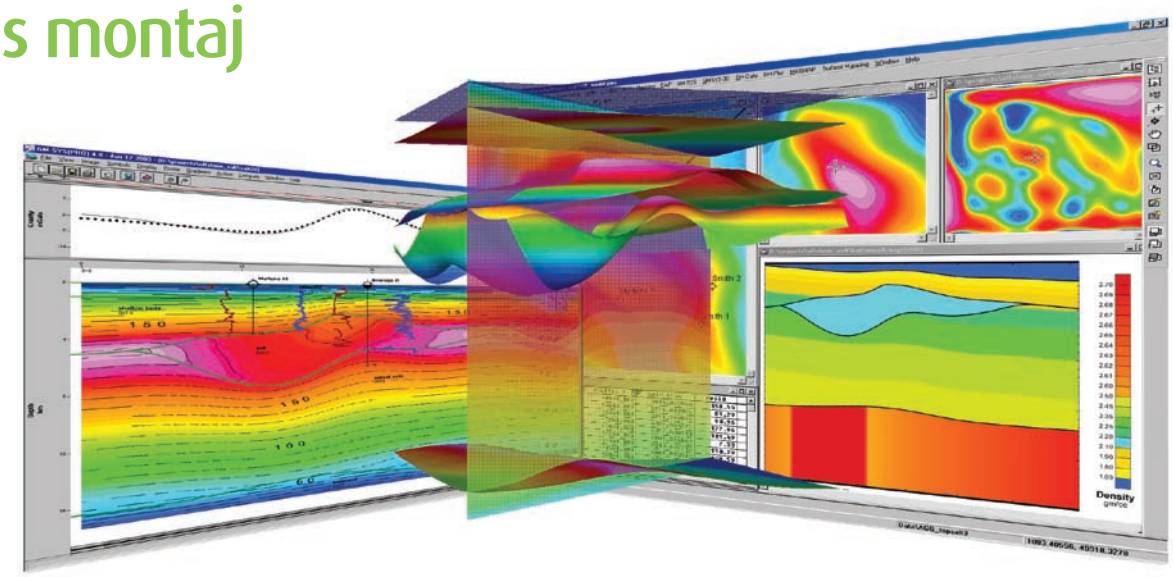
GEOSOFT
Oasis montaj



GM-SYS 3D Modeling

montaj Extension developed by Geosoft

GM-SYS 3D is 3D gravity and magnetic modeling software for surface-oriented models, developed as an extension for Oasis montaj™. The extension allows geoscientists to model complicated three dimensional subsurface structures of any size or scale.

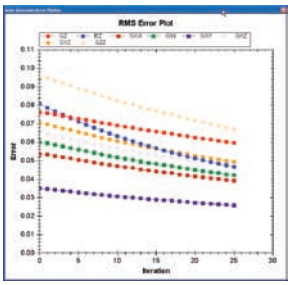
GM-SYS 3D, which requires MagMap, utilizes frequency-domain calculations based on Parker's algorithm (Parker, 1972). The software's efficient calculations and superior memory management within Oasis montaj mean there is no limit to the size or number of grids used in GM-SYS 3D models.

The GM-SYS 3D model structure is defined by one or more stacked horizon grids. Each horizon grid defines the top of a layer, while each layer-parameter (density, susceptibility, or remanent magnetization) may be specified by a constant or a laterally-varying grid. Models may include a vertical depth-density relationship relative to one of the model horizons, which may be applied to any layer in lieu of a constant density or laterally-varying grid. GM-SYS 3D can also calculate the gravity and magnetic response of models represented by 3D voxel grids.

Joint Inversion

Utilize all your subsurface geology with Full Tensor Gravity Gradient Joint Inversion

Full tensor gravity gradient joint inversion has been added to montaj GMSYS 3D gravity and magnetic modeling. The inversion algorithm, described by Jorgensen and Kisabeth (2000), was licensed from ConocoPhillips. It can jointly use any combination of the gravity gradient tensor components plus magnetic and normal gravity to constrain the inversion. Users can specify weighting factors for each of the eight possible data constraints. The RMS mis-fit is displayed at each step so that users can monitor the progress of the inversion and stop it at any time.



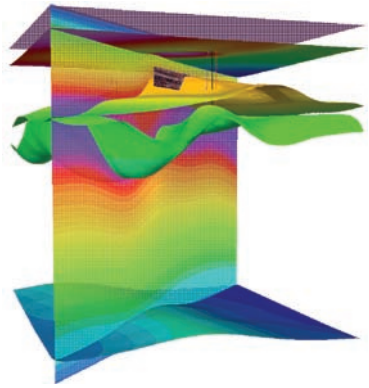
Use GM-SYS 3D to:

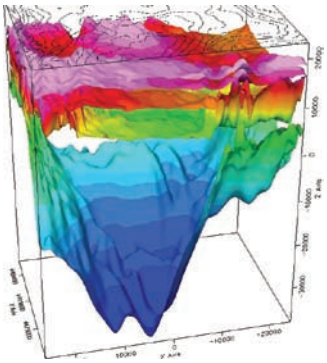
Calculate the gravity and magnetic response grid for any size model. Gravity and magnetic calculations automatically generate response and error grids, instantaneously highlighting discrepancies. The model is then edited until the response grids match the measured grids.

Remove the gravity effect of known geology to highlight the gravity response of unknown structure (e.g., gravity stripping).

Edit models to exactly your specifications, using inversion and other tools. Editing features enable to user to create any number of extremely irregular layers of almost any conceivable shape. View models at any angle and from any position both inside and outside the model. Thoroughly examine any portion of the model, and intelligently direct the modeling process.

Speed up the modeling process and help to constrain variables, using a variety of import and export features. Profile models may be imported to create beginning models. Seismic bitmaps and other images, SEG-Y seismic grids, horizons, depth picks and well log data can also be imported both to help create a model and constrain variables. Profiles can also be extracted and compared to profiles based on seismic data, cross sectional balancing models or other sources.





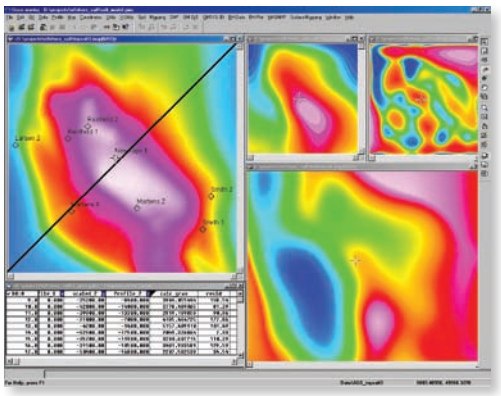
GM-SYS 3D in Action

Integrating GM-SYS 3D into the Oasis montaj environment encourages a multifaceted approach to modeling and visualization. Models may be constrained by borehole data, seismic reflection and refraction surveys, outcrop maps, density-depth relationships, etc. This example shows a relatively simple 3D "salt" model including boreholes, a seismic section, and a vertical density section in the Oasis montaj 3D Viewer. 2D visualization techniques include Plan View maps of horizons and anomalies, a linked GM-SYS® Profile Model (corresponding to the vertical density section), and a 2D Profile map revealing the vertical density gradient in the sediments and lateral density variation in the basement.

A 3D visualization of the Silent Canyon caldera region, Nevada. The model is modified from Blakely et al., 2000. The model includes an existing density-depth profile from earlier studies. The basement horizon is constrained using digital geology, multiple seismic reflection lines, hydrocarbon- and geothermalexploration wells, and groundwater well logs.

GM-SYS Profile Modeling compatibility

You may extract GM-SYS Profile models seamlessly from within GM-SYS 3D. Select a 2D map on which you wish to draw the profile. Select the "Extract 2D GM-SYS Model" option from the 2D Modeling submenu. The dialog will automatically be populated with the correct anomaly and structure grid names. Just draw your profile and your model will be opened in GM-SYS with the appropriate layer names, layer parameters, and a linked cursor.



Oasis montaj workspace showing 2D representations of the "salt" model, including constraining boreholes and 2D Profile model locations plotted on the" top of salt" horizon, and the inverted "base of salt" horizon.

Technical References:

Parker, R.L., 1972, The rapid calculation of potential anomalies: Geophysical Journal of the Royal Astronomical Society, v.42:315-334.

Blakely, R.J., Langenheim, V.E., and Ponce, D.A., 2000, Summary Of Geophysical Investigations Of The Death Valley Regional Water-flow Modeling Project, Nevada and California: U.S. Geological Survey Open-File Report 00-189.

Key Functionality

- Forward and inverse gravity and magnetic calculation routines.
- Ability to display models as individual 2D horizon maps, arbitrary 2D profiles, and dynamic 3D visualizations.
- Interactive grid editing tools, and a toolbar for quick access to the most commonly used GM-SYS 3D functions.
- Build a "Time" model using seismically-derived time horizons and velocities, then convert this directly to a "Depth" model.
- Load cross section grids of density and susceptibility values directly into 3D views. Users can write GM-SYS 3D models to Geosoft voxels, UBC or GOCAD.

In addition, GM-SYS 3D users have access to the full suite of Oasis montaj™ plotting, projection, grid manipulation and filtering routines. Inversion options include structural relief, lateral parameter variation, and (constant) parameter optimization, utilizing constraints from wells, outcrop, seismic horizon, and other sources.

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