Geotexera

GEOPHYSICAL MODELLING AND INVERSION (CONSULTING SERVICES & SOFTWARE) FOR MINERAL, METAL, OIL&GAS, WATER, ENVIRONMENTAL AND GEOTECHNICAL EXPLORATIONS

We Reconstruct Geological Structures From Geophysical Data Using Modelling And Inversion On Unstructured Meshes

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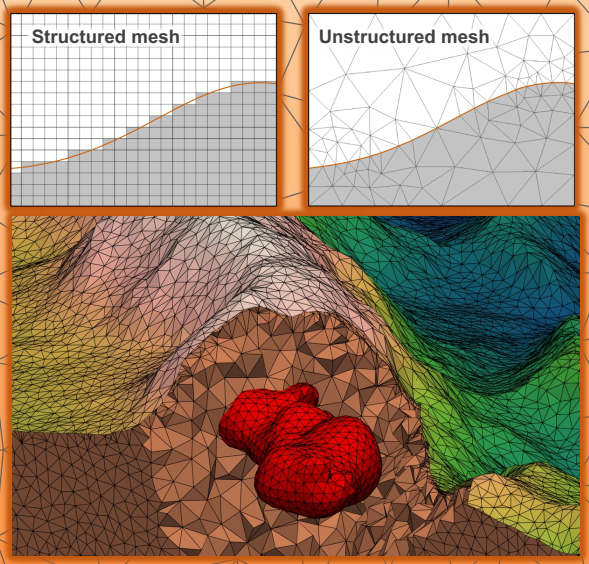

Our software (MAGNUM) uses unstructured meshes for geophysical modelling and inversion. Unlike conventional structured meshes which use rectilinear cells to model 3D subsurface structures, the unstructured meshes use tetrahedral cells that allow high-resolution topography, geological contacts/surfaces, and borehole information to be exactly added to the models to increase the accuracy of the results.

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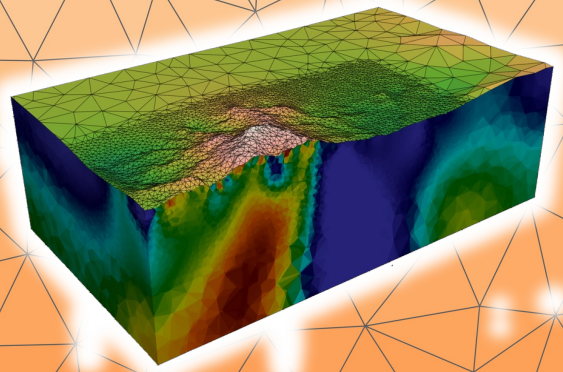
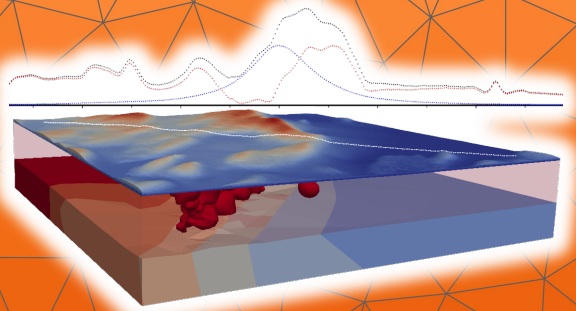


GEOPHYSICAL INVERSION

is the process of estimating the values of geological model parameters (such as size and depth) from geophysical data. Simply put, an inversion can reconstruct geological structures from geophysical data.



FORWARD MODELLING

is a method of synthetizing geophysical data from an earth model. It can be done to investigate the size and contribution of geological structures in geophysical data especially before geophysical surveys.

Our Software (MAGNUM) Works With Different Methods Including The Following Ones:

Geophysical methods:
- Magnetic (TMI, amplitude & vector-components)
- Gravity
- Gravity gradiometry
- Seismic refraction (first arrival travel-times)
- Magnetotelluric (ground and airborne)
- Muography
- IP and DC resistivity
- Electromagnetic (ready in 2023)

Inversion types:
- Mesh-based
- Surface geometry
- Lithological

Inversion techniques:
- Various regularization measures:
  - rotated smoothness axes
  - total variation
  - L_p-norms (e.g., L_1 & L_2)
- Local and global optimizations
- and more…

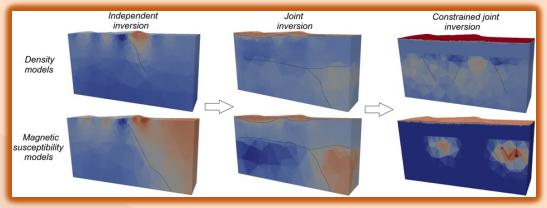
Inversion approaches :
- Independent
- Joint (5 methods)
- Cooperative
- Constrained (bounds and reference model)
- Clustering
- MVI
- and any combination of them!

and more…!

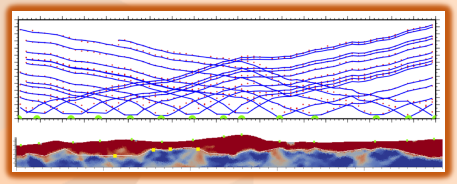
(For more information and more projects, please visit our website or email us)

SOME OF PROJECTS (EXAMPLES):

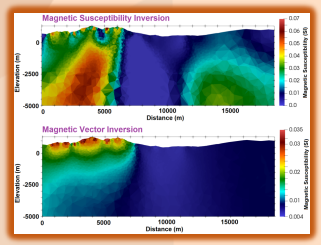
Gravity and Magnetic Inversions:
Independent inversions of gravity and magnetic data are becoming more common at interpretation. However, we believe that joint inversions can significantly improve the results, especially after applying constraints.
(Figure/Project: McArthur Region, Canada)



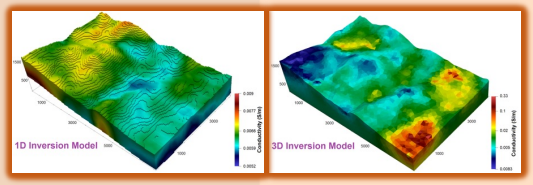
Tomography and Seismic Refraction Inversion:
Tomography and the inversion of seismic refraction data give us a seismic velocity model of the subsurface. To obtain sharp boundaries between geological structures in the reconstructed model, we use advanced methods such as clustering in the inversion.
(Figure/Project: Millennium Region, Canada)



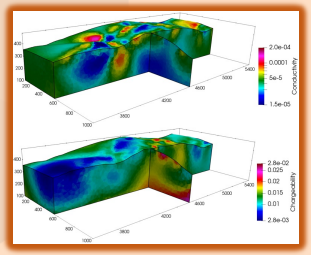
Inversion and Magnetic Remanence:
The interpretation of magnetic data can be complicated because of the presence of magnetic remanence. However, inverting magnetic data for subsurface magnetization (magnetic vector inversion) as opposed to magnetic susceptibility (magnetic susceptibility inversion) can be a potential solution.
(Figure/Project: Ecuador)



Topography Effect in Geophysical Data:
The difference between 2D (or 1D) and 3D inversion results can be significant, especially when we have topography effects in geophysical data. This figure (from one of our projects) shows that our advanced 3D inversions (using unstructured meshes) perfectly dealt with the topography effect in electromagnetic data (the 3D inversion result is consistent with geology).
(Figure/Project: Ecuador)



3D Inversion of IP and DC Resistivity Data:
3D inversion of IP and DC resistivity data using unstructured meshes will improve the accuracy of results by incorporating high-resolution topography (and/or geological surfaces) into the models. Models (in the figure) show a correlation between the zones of high chargeability and the known gold mineralization.
(Figure/Project: NL, Canada)



Gravity Gradiometry Terrain Correction using 3D Forward Modelling:
Gravity gradiometry data can be strongly affected by topography. To eliminate this effect, a terrain correction using 3D forward modelling on unstructured meshes is a better method than old conventional methods (the Fourier-based approaches) as it incorporates accurate topography as a means of more accurately computing the terrain correction.
(Figure/Project: SK, Canada)