

Encom ModelVision v12.0 Release for real geological solutions

September 2012

Forward Modelling Support for Magnetic Anisotropy

Most rocks exhibit slightly anisotropic magnetic susceptibility, but the degree of anisotropy is generally insufficient to significantly influence the form of magnetic anomalies. Some important exceptions which often exhibit strong magnetic anisotropy include banded iron formations and some rocks and ores that contain pyrrhotite with a strong preferred orientation. In rocks that have substantial magnetic anisotropy the susceptibility varies significantly with the field direction and in general, the magnetisation is not parallel to the applied field. The resultant magnetisation direction rotates away from the inducing field vector and you can use resultant magnetisation inversion to check for its possible existence.

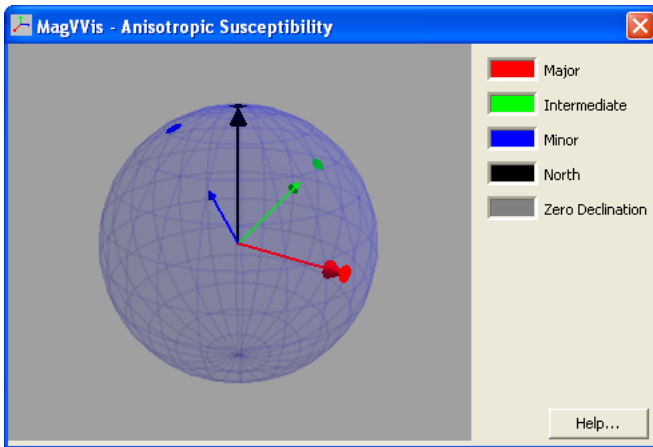
We note that you cannot distinguish the presence of magnetic remanence from magnetic anisotropy, but you may be able to use local geological knowledge to infer the existence of anisotropy.

You can use ModelVision to explore the influence of anisotropy especially on drilling targets at depth where the rotation of the field can have a significant impact on depth estimation. We have added forward modelling support for magnetic anisotropy for all body types so that you can investigate the influence anisotropy can have on your interpretation in relevant geological domains. Anisotropy can be used as a fixed parameter during inversion.

The screenshot shows the 'Body Properties' dialog box with the 'Anisotropy' radio button selected. The 'Label name' is 'Jurassic'. The 'Density (bg 2.67)' is 2.770000. The 'Susceptibility' is 0.0318301 SI. The 'Convert Body' button is active, and 'Tabular' is selected. The 'Spatial' radio button is selected. The 'X', 'Y', and 'Z' coordinates are 5000.0, 5000.0, and 200.0 respectively. The 'View' button is visible. The 'Active' checkbox is checked. The 'Associated Channels' section has 'Delete' and 'Display' buttons. The 'Next Body' section has '6 facets' and navigation buttons. The 'Anisotropy' checkbox is checked. The 'Axis 1' section has 'k1' (0.0351460), 'Decl k1' (256.0), and 'Incl k1' (19.0). The 'Axis 2' section has 'k2' (0.0339540), 'Decl k2' (148.0), and 'Incl k2' (40.0). The 'Axis 3' section has 'k3' (0.0106490), 'Decl k3' (5.0), and 'Incl k3' (43.0). The 'Apply' button is visible.

Anisotropy panel in the Body Properties dialogue.

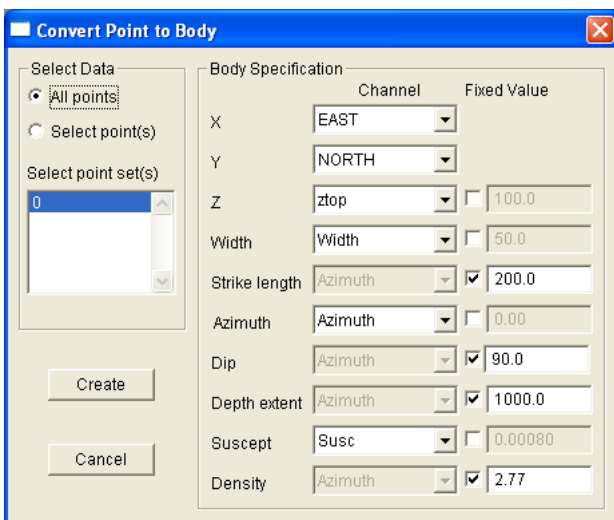
The anisotropy axes are orthogonal and ModelVision checks your data entry for errors and prompts you to check the values. Use the View button for a 3D perspective view of your values.



Learn more about magnetic anisotropy with the supplied tutorial.

Create Solid Models from Point Data

ModelVision has a new model import capability that enables you to convert imported 3D attributed data points to tabular bodies and allocate parameters from the attributes. The data must be first imported as a point data type into memory before conversion.



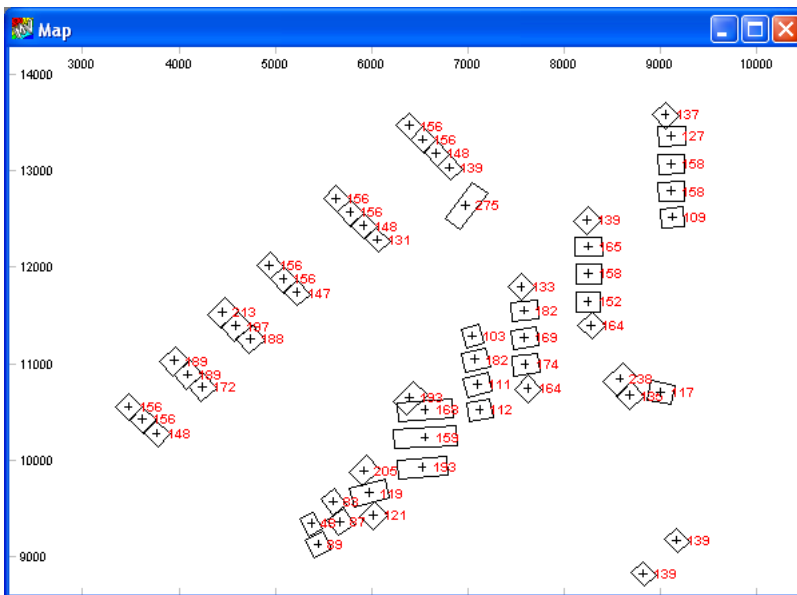
Point to Body conversion dialogue.

The dialogue provides you with flexibility to assign a point data field to a specific body parameter and when that parameter is not available in the data field list, you can assign a fixed value. In general you will not have input parameters for strike length, depth extent or azimuth.

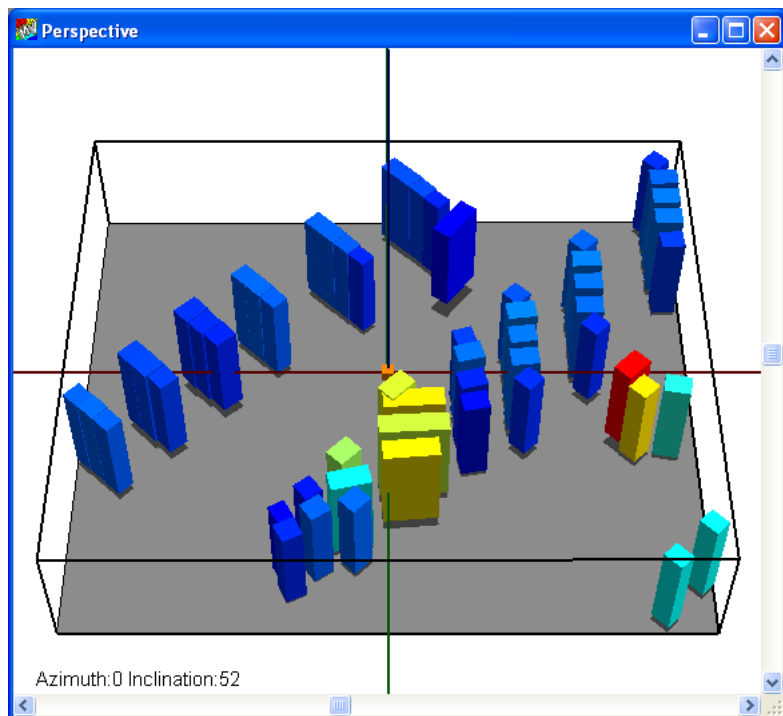
Automated applications based on the Euler 3D, Naudy, Werner deconvolution and other methods produce solutions that have implicit geological interpretations as solid geological units. For example the Naudy and Werner deconvolution methods produce parameters that are equivalent to tabular bodies.

The Euler method produces a structural index which can be interpreted in terms of a sphere (3), vertical pipe (2) or dyke (1). For the sphere you could assign small fixed values for the strike length, width and depth extent to ensure it looks like a point source. The vertical pipe would have small strike length and width values, but a greater depth extent.

With this new tool you have a way to evaluate third party automated processing tools by validating their responses against the original data. You would use inversion to balance the magnetic properties and then you can check the integrity of the output. Of course this process has always been part of the AutoMag option for ModelVision where any solution can be converted to its equivalent model.



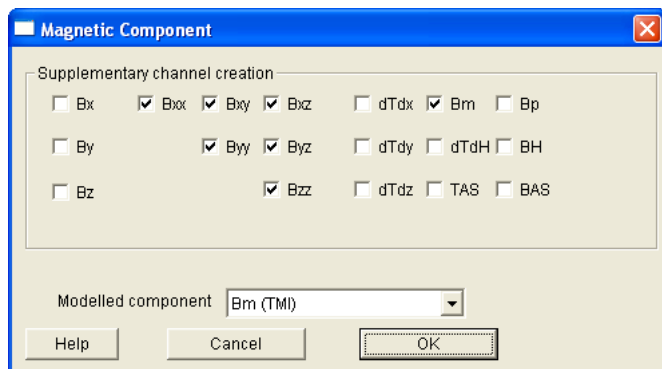
Example map point display with converted tabular bodies.



3D perspective view of the converted points.

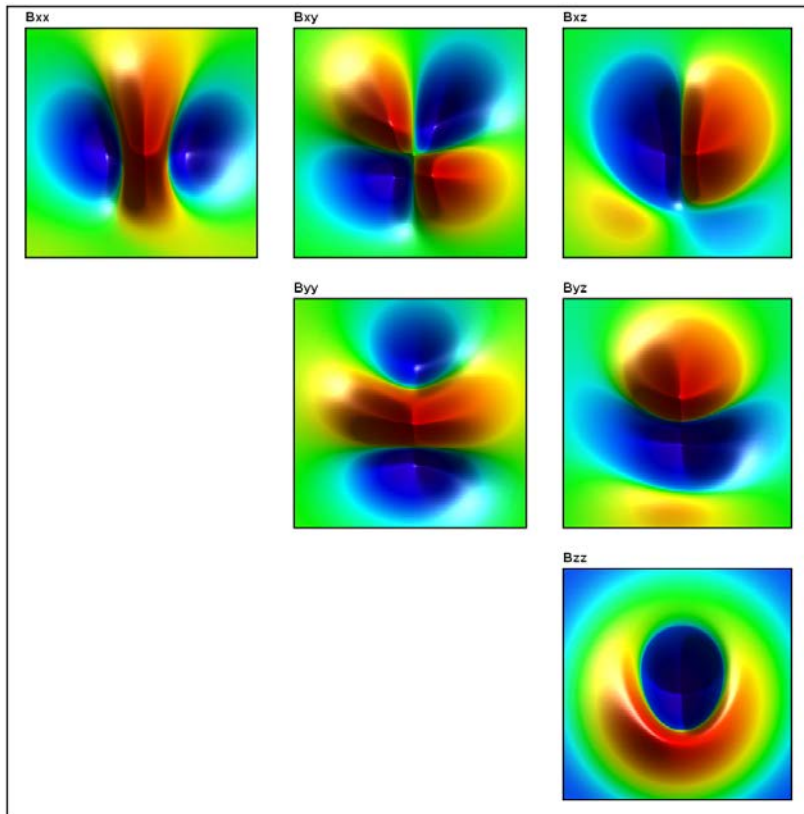
Export Multi-banded Grids

When working with multi-channel data such as gravity or magnetic tensors it is preferable to export the grid data in a single grid file for use in other applications like Encom PA or ER Mapper. The Grid Modelling dialogue allows you to select any permutation of computed grids from the available 18 possible channels.



Magnetic component selection dialogue for grids.

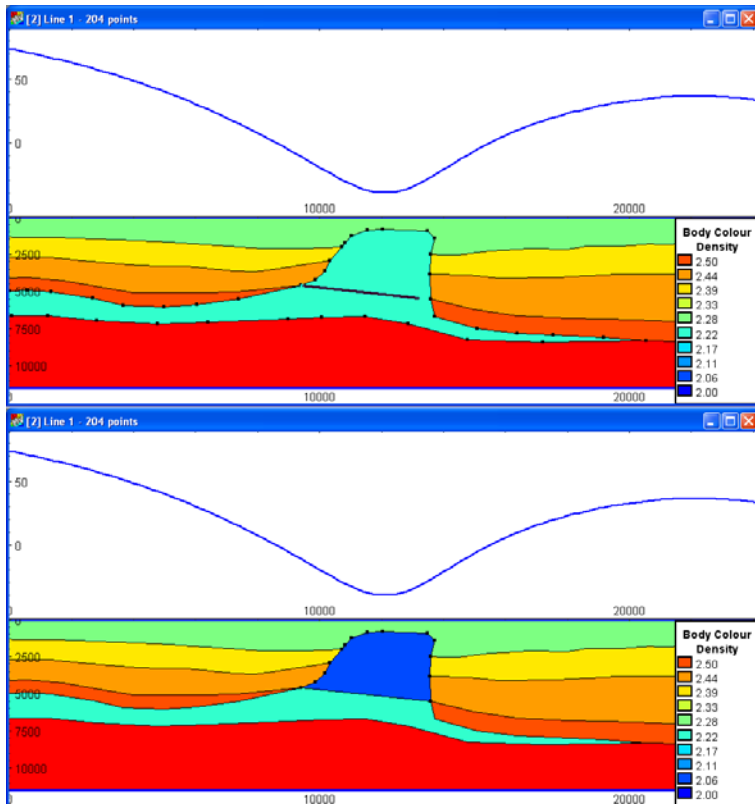
This process makes it simpler for visualisation and processing as shown in the example multi-component tensor image below.



Example tensor display in Encom PA of model grids generated by ModelVision.

Polygon Splitting Tool

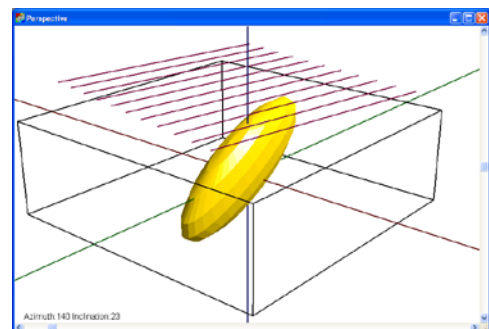
The new polygon splitting toolbar button allows you to subdivide individual polygons or polygons within polygroups. This makes it much simpler when working with complex polygonal sections in mine planning and basin modelling applications.



Example salt dome being split into two parts for assignment of different densities.

Joint Inversion for Ellipsoid Targets (IOCG)

The ellipsoid body type has been added to the list of body types supported by joint inversion. The ellipsoid model is an important body type because it is well suited to modelling IOCG related deposits like those discovered at Tennant Creek. The ellipsoid model has an analytic solution for induced magnetisation, remanent magnetisation, anisotropic magnetic susceptibility and demagnetisation. As many IOCG deposits have a very high magnetic susceptibility, then demagnetisation needs to be considered when designing drill targets.

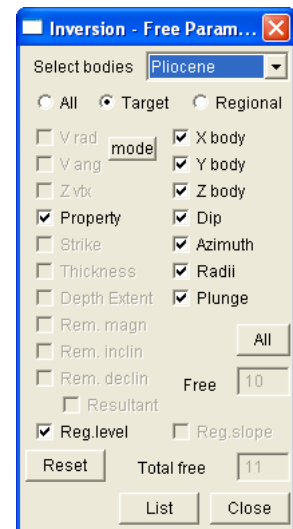


With ModelVision, you can now use the joint inversion with gravity gradiometer data or cross-wing magnetic data to better resolve the depth, dimensions and attitude of a deep IOCG deposit. You can use both methods together in the form of cooperative inversion as IOCG deposits usually have a high density and high magnetic susceptibility. This process is applied sequentially to each data type using the same model for each joint inversion.

DC Regional now in Single Channel Joint Inversion

We developed joint inversion to help you interpret multi-channel data such as the gravity gradiometer and magnetic gradiometry and these sensor data don't require a regional field to be subtracted during modelling. However, we have found the inversion engine is so good at converging in complex situations, we have decided to support the use of a DC offset for the regional during inversion.

In Release 12, the **Reg. level** check box is now enabled for joint inversion. Internally, the regional inversion is applied as the first part of a two stage process. It uses the current model parameters and then determines the optimum position of the DC regional. The new regional is then fixed while the free parameters are inverted. The regional will be progressively adjusted as you rerun each inversion while the **Reg. level** box is checked. If you want to fix the regional at a specific level, then you can still do this from the Data dialogue accessed from the joint inversion toolbar.



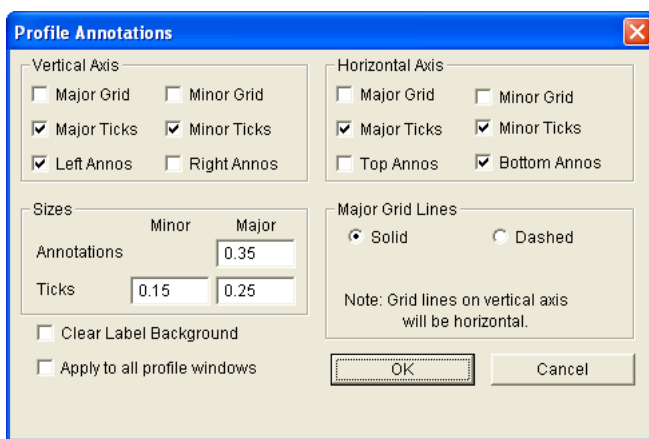
Improved Resultant Magnetisation Inversion using Joint Inversion

Tensor Research recently presented some breakthrough research on the remote determination of magnetic remanence using a combination of resultant magnetisation inversion and polar wander data. The methodology relies on the inversion of the resultant magnetization vector amplitude and direction along with the target geometry. You can find out more about this interesting new work under the web page heading Recent Developments on <http://www.tensor-research.com.au/home>.

Tensor Research found that joint inversion performed the procedure much more efficiently than standard inversion, but in Release 11 you had to adjust the DC offset manually when working with total magnetic field data. With Release 12, you can apply the DC offset directly as part of the interpretation process, thus speeding up the recovery of resultant magnetisation vectors from total magnetic field data.

Other Improvements

We have added new controls for the cross section and map annotation styles that are now accessible from the layer control menus. Previously, these annotation sizes were set in the Setup menu that was accessed via the main File menu and you could not change the settings while a map or section was open. Since different annotation sizes are required for reports, publications and slideshows, you previously had to reopen the section or map and redo the complete structure of the display. Now you can do this on the fly via the Axis annotation control in the associated Layer Table.



Profile Annotation dialogue access via the Layer Control

We are always working on code that you never see in trying to improve the results in the widest range of geological situations. One area is the forward modelling code which is often reviewed for possible problems related to near singularities in computations which may occur in certain combinations of body geometry and sensor positions. We have recently done an extensive revision to all the body types, with a special focus on the ellipsoid code which is used widely for modelling IOCG deposits.