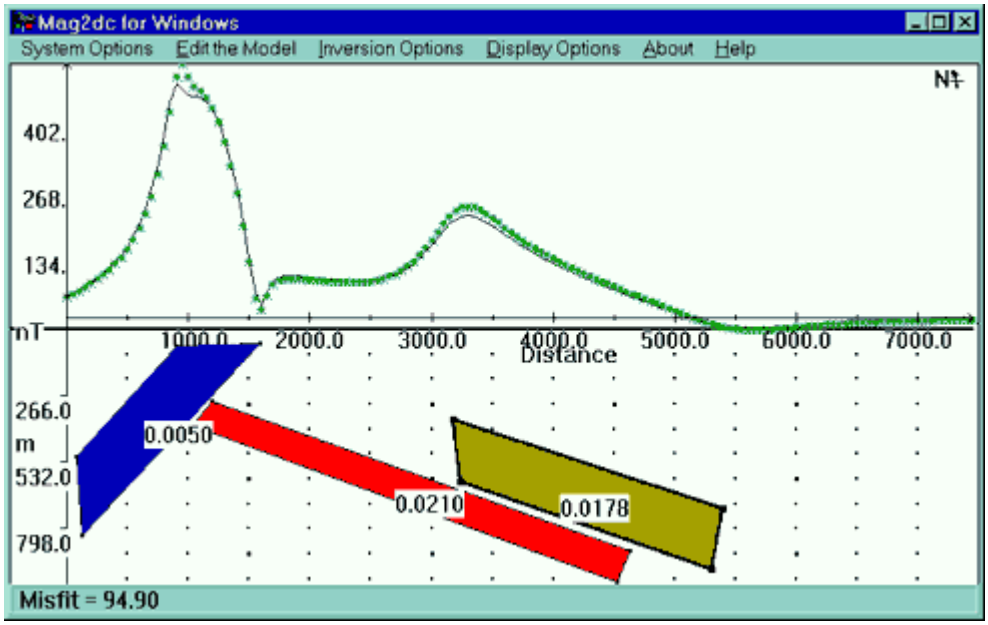
MAG2DC

(http://www.geoafrica.co.za/reddog/gc/mag2dc/mag2dc.htm)

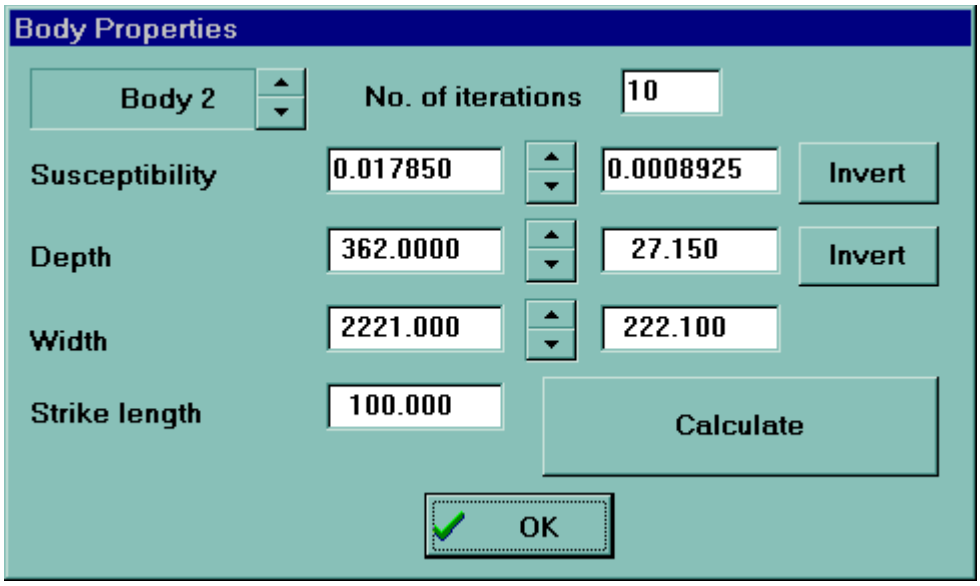
Forward and inverse modeling on magnetic data

Mag2dc for Windows allows the forward modeling and inversion of magnetic data. Maximum emphasis has been placed on the ease of use of the program. A sample model is shown below :



The bodies making up the model have their susceptibilities displayed on them. They are also coloured according to the susceptibility values, with cold colours representing low values and hot colours representing high values. A grey scale may also be used. The bearing of the profile is shown by the compass in the upper right corner.

To change any property of a body, except its shape or remanence, just double-click on it with the mouse. The following dialog box will then appear :



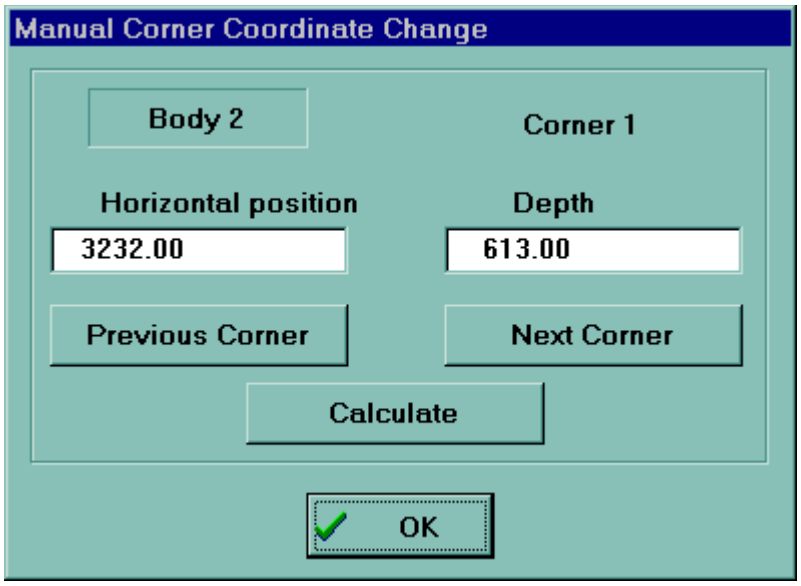
The body number is shown at the upper left of the dialog. To change the properties of the next body in the model, press the + button next to it. Pressing the - button will similarly move to the previous body.

There are several ways to change most body properties. For example, to change the susceptibility, enter the new value then press the Calculate button. The model will then be recalculated and redrawn. Alternatively, pressing the + button next to the susceptibility value will add the increment shown in the box alongside to the susceptibility, then calculate and update the model. The - button will similarly decrement the susceptibility and update the model. The increment/decrement amount may be changed as desired. The other way to modify the susceptibility is to press the Invert button ; the susceptibility will then be modified mathematically so as to give a better fit to the field data. This is an iterative process, and the inversion will proceed for 10 iterations. More sophisticated inversion options are described below.

Changing the Shape of a Body

This may either be done interactively with the mouse, or by entering the numerical values of the coordinates of the body corner. Changing the corner position with the mouse involves selecting the corner by clicking on it, then clicking on the new position. This may be performed continuously until the user is happy with the body shape.

Alternatively the numerical coordinates of the corner may be entered directly. If that option is selected then the following dialog box will appear :-



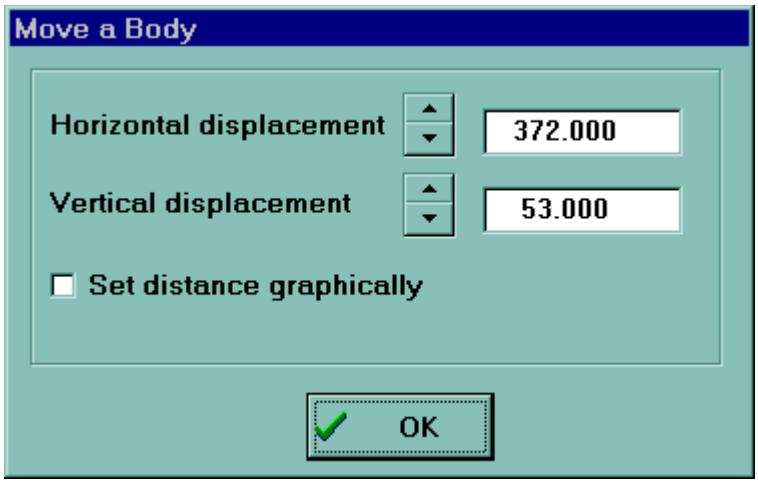
The body number is shown at the upper left, and the corner number at the upper right. The coordinates of the corner are shown. To change the body shape, enter the new coordinates, then press the Calculate button to update the model. To move to the next corner, press the Next button, or use the Previous button to get to the previous corner.

In addition, the corner of one body may be linked to the corner of another, so that when the position of one is altered the position of the second moves with it. This is very useful when bodies abut onto one another.

Body corners may be added (or deleted), up to a maximum of 50 corners per body. Adding a body may also be done either by drawing the body onscreen with the mouse, ot by entering the corner coordinates numerically. Body coordinates may also be read in from an ASCII file on disk.

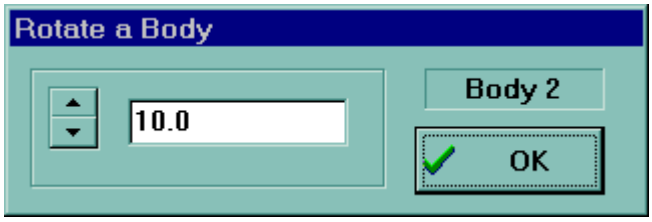
Moving, Copying, or Rotating a Body

Moving, copying , or rotating a body is done interactively. For example, selecting the Move option will bring up the following dialog :



Selecting the + button next to the Horizontal Displacement option will move the body by the distance shown and update the model. Selecting the - button will move the whole body back by the same distance. The depth of the body may be similarly altered. Alternatively, if the Set Distance Graphically checkbox is selected, then the body may be picked up by the mouse and dragged onscreen to its new position.

Copying a body proceeds in an exactly similar manner to moving a body. Rotating a body uses the dialog below :

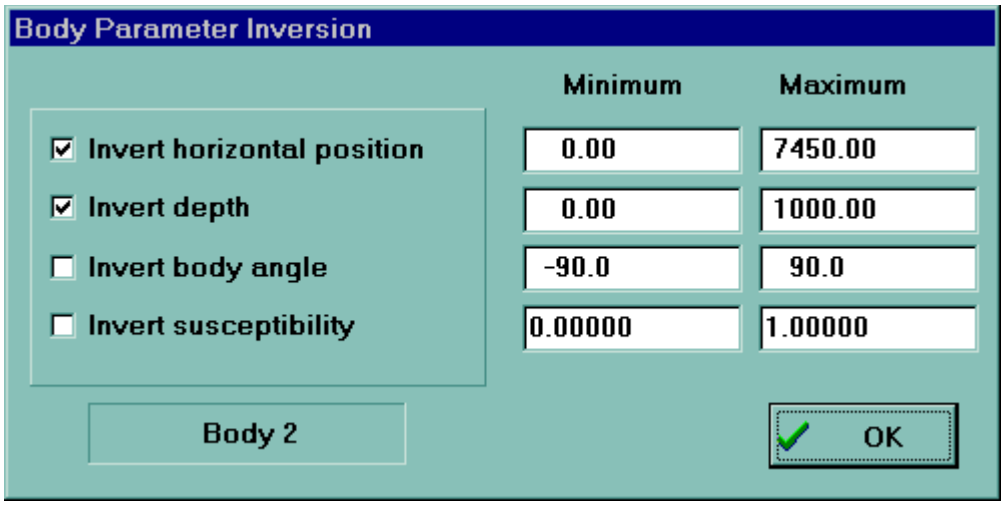


Inverting a Model

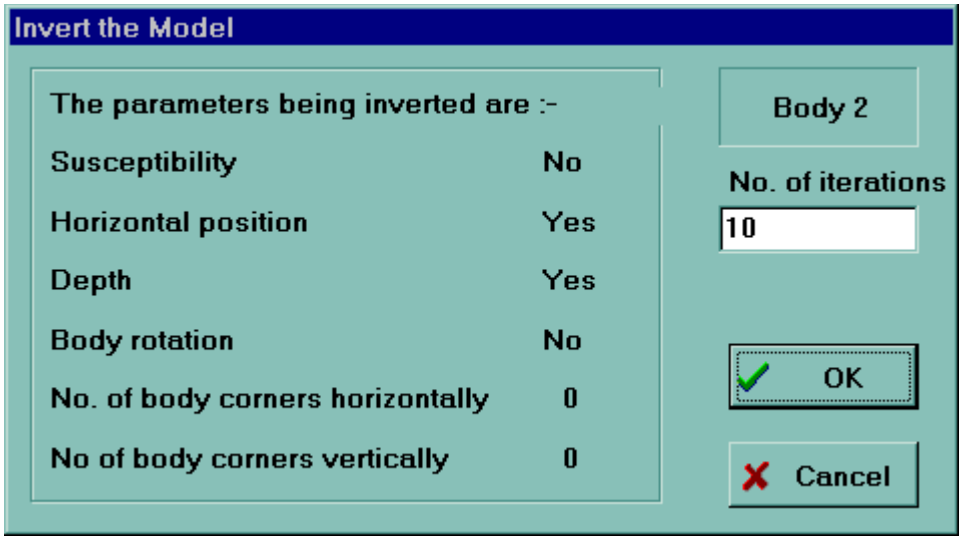
The inversion options are split into two categories ; those that affect the whole body, such as its susceptibility, and those that involve changing the shape of the body. A total of 10 parameters may be inverted simultaneously, where a parameter is a body depth or width, or the depth or horizontal position of a corner.

Whole Body Inversion Parameters

This option calls up the following dialog box :



The susceptibility, position and angle of rotation of the body may be inverted simultaneously. Limits may be set on the possible values of each parameter. Once the desired parameters have been selected, then the inversion itself may be started :

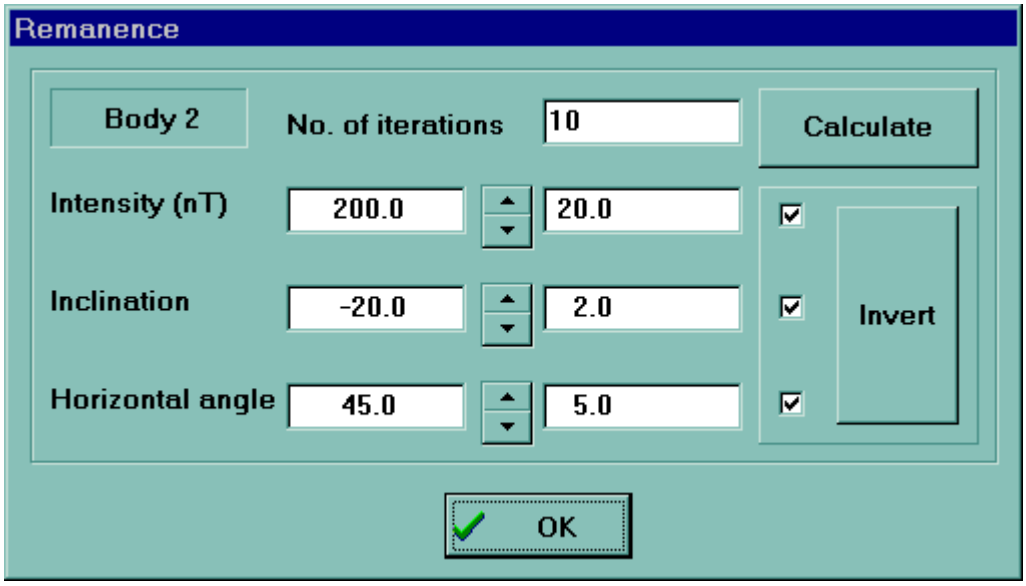


The parameters being inverted are displayed, and the number of iterations may be entered. During the inversion the least-squares error will be displayed. The inversion may be interrupted at any time by a mouse click.

Body Shape Inversion Parameters

Each body corner may be inverted either horizontally, vertically, or both at once. Horizontal and vertical arrows on the corner indicate the desired inversion parameters during selection by the mouse.

Remanent Inversion

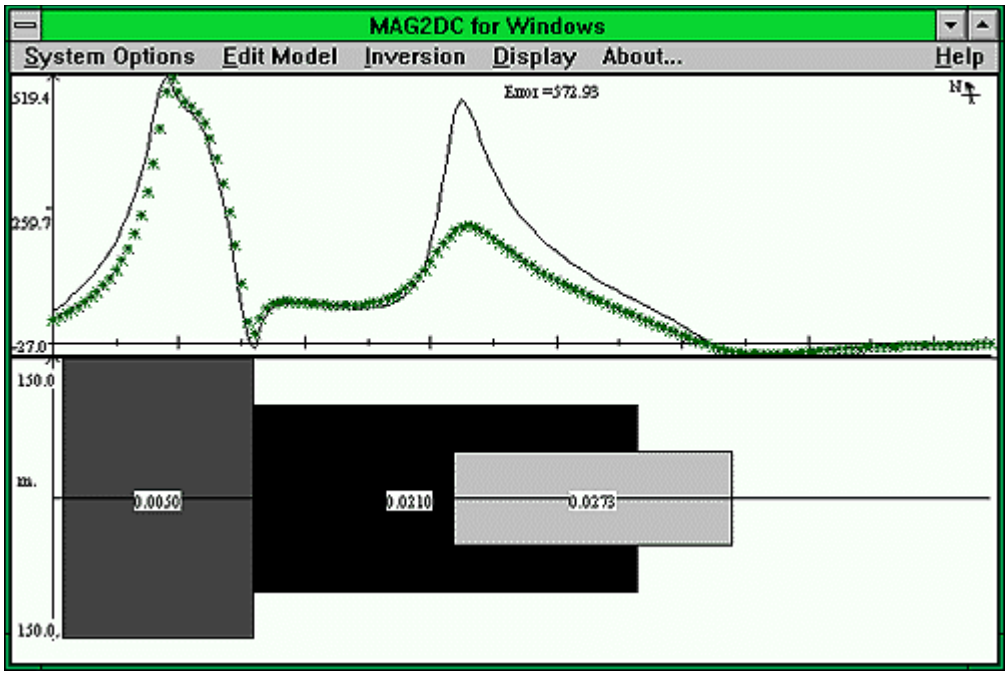


The remanence of a body may be entered directly, if palaeomagnetic information is known, or inverted to find the optimum solution.

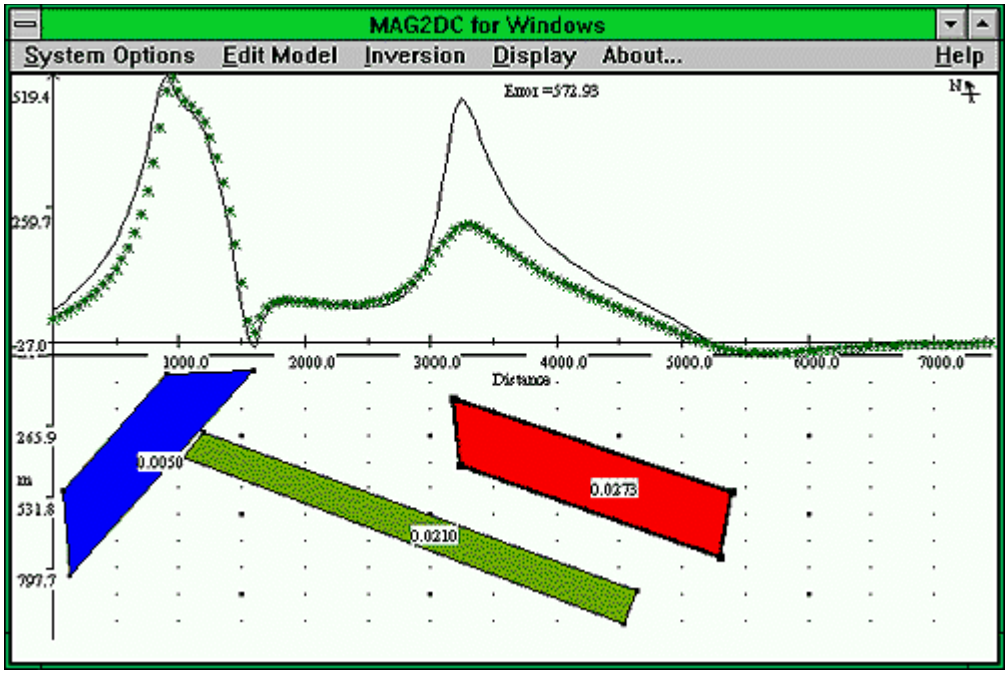
Display Options

There are many ways to display the model and the field data. Some of the main ones are described below.

Plan View
The differing strike lengths of the bodies in the model may be view from above, as shown below :



Drawing a Grid over the Model
A grid may be overlain on the model, to aid with the placement of bodies. If needed, body vertices can be 'snapped' to the grid points.

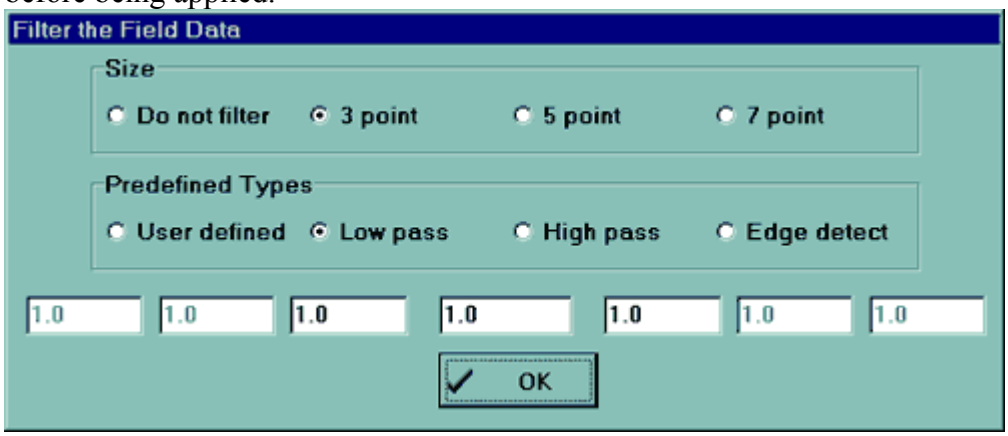


Zooming In and Out
The view of the model may be expanded by zooming in at any point. This may be done either by drawing a 'rubber-band' box using the mouse, or by entering the coordinates of the horizontal and vertical coordinates of the display area

numerically.

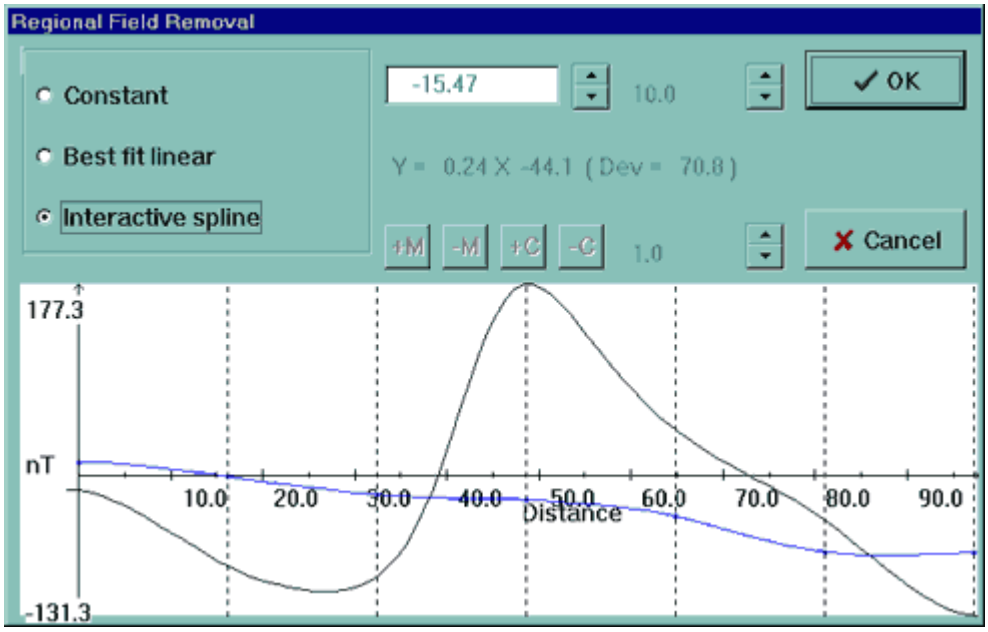
Modifying the Field Data

There are several ways in which the field data may be modified. For example:
Filtering the Data
Noisy field data can be smoothed by the application of a 3, 5, or 7 point moving average filter. The filter weights may be set, which also allows gradients and edges to be calculated. Different filter parameters may be tested interactively before being applied.



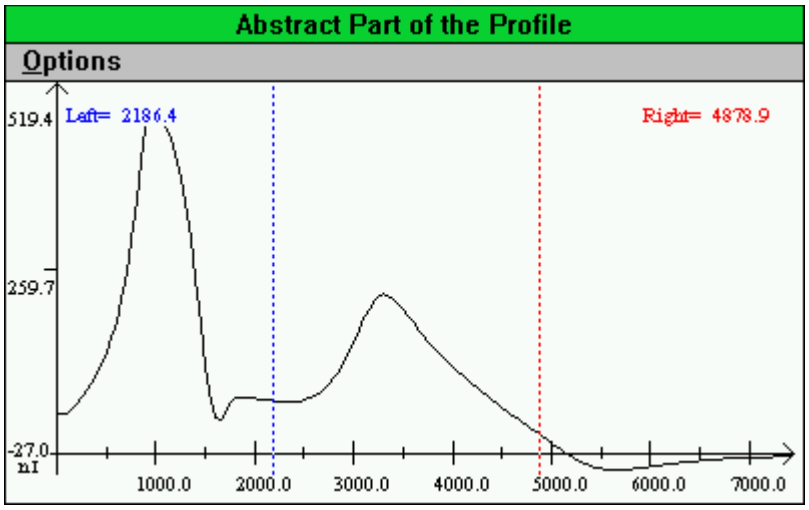
Modifying the Regional Field

A linear regional field can be removed from the data. Use the left mouse button to set the field value at the left side of the profile, and the right button to set the value at the right side.



Abstracting Part of the Profile

If a long profile exists, it may be desired to select different sections for modelling on different days. This is trivial to perform with Mag2dc ; the left mouse button selects the left boundary of the data to be worked with, and the right button selects the right boundary.



Help

Full Windows hypertext help is available on all features of Mag2dc.

Software Specifications

Maximum number of data points : 650
Maximum number of bodies per model : 16
Maximum number of corners per body : 50

Output supported to : ASCII, HP-GL, DXF