



LAYER

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1 Program Description

Introduction

This documentation describes the LAYER program module that can be used with EM Vision. LAYER is a forward modelling program and accommodates almost all surface EM survey configurations. LAYER can simulate up to 20 individual stratified layers both with real and complex earth properties.

EM Vision makes use of a number of modelling algorithms to accommodate different EM datasets and survey situations. Each algorithm can be purchased individually or collectively. The documentation available to describe and operate each module is presented individually. This manual relates only to the LAYER program.

Modelling within EM Vision can take one of two forms depending on the complexity of the modelling requirement, the simplicity of the algorithms available and the model types. Increasing model complexity usually results in increased computation times. This means that two modes of operation are necessary.

- Some algorithms can be implemented to operate interactively. Computed responses from these modelling algorithms is fast enough that a model can be created, response calculated and displayed in a few seconds or minutes. Examples of these programs include PLASI, OZPLTE and SPASYM.
- Where computation times are longer (typically some minutes or even hours), the modelling algorithms are implemented to operate remotely from EM Vision. Control and user feedback is provided to EM Vision while the program executes but the user can continue with other operations while the modelling executes in the background. Examples of these programs are GRENDL and LAYER.

Program LAYER

Description

The LAYER program is a fast multi-layer forward modelling algorithm developed by Messrs F. Sugeng and A. Raiche at CSIRO during the early 1990's. The program was first released to sponsors of the AMIRA modelling

project in 1991. The program is large in terms of requirements for system resources but is flexible, fast and accurate.

LAYER is a program designed to operate with a variety of field survey configurations (including downhole) and on single or multiple TEM readings using a forward approach. The program computes the voltage (dB/dt) response of up to twenty horizontally layered half-spaces. The layers can have complex earth properties. The basement layer is assumed to extend infinitely in depth. All layers extend infinitely in a lateral direction. The program assumes a rectangular transmitter loop excited by a bi-polar square waveform with exponential rise-time and ramp turnoff.

Limitations of LAYER

A number of limitations apply to the general operation of LAYER. These are:

- The program is computationally intensive and therefore can be slow to model complex soundings with a large number of layers. The program has been implemented using the Generic Model Interface to enable other operations to be undertaken while modelling continues.
- Memory requirements for the program are high. LAYER will not operate in less than 16 megabytes of available memory. 24 megabytes is a realistic minimum memory restriction, but the program operates more efficiently with little disk operation when 32 megabytes of RAM is available.
- Complex earth (Cole-Cole) parameters can be implemented but their use adds a level of complexity that slows computation significantly.

LAYER has an upper limit of twenty layers for a model. This parameter is set both in the LAYER program but also in the MCF file (refer to *MCF Files*).

- The operation of LAYER is best run in 32-bit mode. This operational mode is optimally suited, and is supported under the Windows[®] 95, Windows[®] 98 or Windows NT[™] environments. Refer to *MCF Considerations* for additional details.

Implementation of LAYER

LAYER is based upon frequency domain, integral equation computation theory (Sugeng and Raiche, 1990). This approach computes scattering currents from separate current gathering and vortex potentials. Conversion of the frequency to

time domain have used matrix algorithms designed by the CSIRO Mathematical Geophysics Group.

The time domain response is computed by first calculating the frequency domain response from 0.1 Hz to 100 kHz at an interval of six frequencies per decade. A cubic spline interpolation of the imaginary component of the magnetic field is used to represent the frequency domain response over the entire spectrum.

The time domain magnetic fields are computed using digital filter coefficients that have been derived from the fast Hankel transform algorithm of Johansen and Sorensen. A spline is fit to the time domain magnetic fields and the dB/dt computed using the spline coefficients. This is then convolved with the source function to give the field voltages (by area * dB/dt).

Operation of LAYER

Within EM Vision, access to LAYER is through the Generic Model Interface. Refer to the section describing the *Generic Model Interface* for additional information and operation of batch operated modelling programs. Where the Generic Model Interface is adopted, control of the modelling is passed from EM Vision to the model algorithm under control of specification control files (MCF Files).

MCF Considerations

As described, an MCF control file is required for the correct operation of LAYER. Refer to the *MCF Files* for the purpose and usage of MCF control files.

Windows[®] 95/98 (and NT) Operation

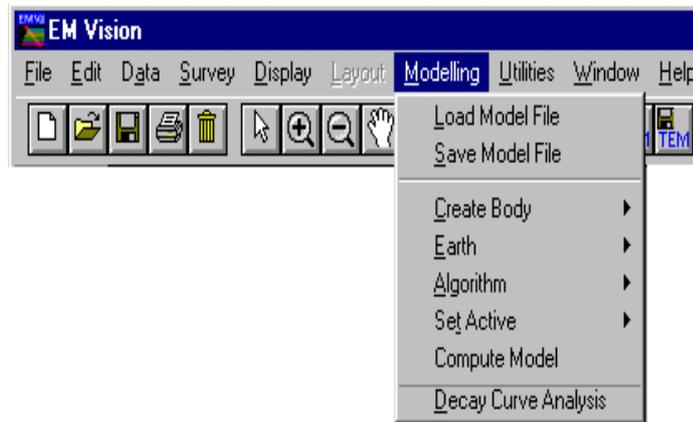
LAYER operation using an MCF control file under Windows[®] 95, Windows[®] 98 and Windows NT[™] is relatively simple. A LAYER.MCF file is required in the \MCF directory (as installed), and a path directed to this directory by the MCFDir parameter in the EMVIS.INI defaults file (refer to *The EMVIS.INI Defaults File*). An example of an appropriate MCF file is shown below:

```
[Interface]
Algorithm      = Layer
Description    = Layer: Multi layer forward modelling.
ModelClass     = Forward
DataType       = TEM
Executable     = c:\encom\emvision\LAYER32.EXE
```

```
ExeType          = WIN32
StatusPoll       = 0.5
StatusAbort      = 1200
```

Note that the Executable parameter refers directly to the LAYER executable (called LAYER32.EXE) and the ExeType specifier instructs EM Vision to initiate LAYER in 32-bit mode.

LAYER Operation



Modelling menu of EM Vision.

As for all modelling in EM Vision, a number of preparatory steps must be taken before a model response can be computed. These steps are sequentially listed in the Modelling menu. Initially, a modelling operation requires a profile (or station) display, a representation of the earth structure, plus the assignment of channels and stations to compute response.

Data can be loaded from a saved model file (Load Model File menu item) or, after creation, a model can be saved by using the Save Model File menu item.

Earth Option

The Earth option of the EM Vision Modelling menu is used to define the Earth structure and assign its properties. Various Earth types are required to satisfy the many host environments that can be modelled. In some instances, discrete body types such as plates can be contained in a homogeneous host, while in other cases a layered Earth can be simulated. The methodology of defining an Earth Type and then the Properties of the earth force a logical model definition on the user.

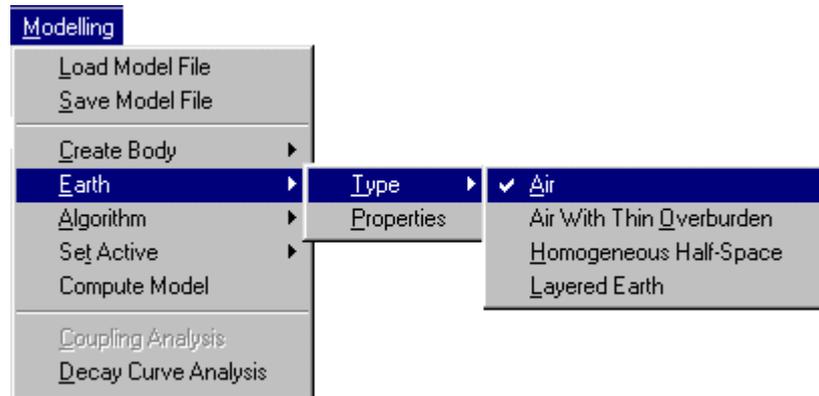
Note

Unless the correct information is specified for the model type, Earth host and defining parameters, LAYER is not accessible and appears 'greyed' out in the **Model>Algorithm** menu option. Refer to the *Non Accessible Program* section for more information.

When selected, the Earth option provides two alternatives - Type and Properties. Initially, Type should be selected to define the specific Earth host type to be modelled.

Earth Type

Options available from the Earth Type option are as shown below:



Modelling and host definition menus.

Only two Earth types can be used with LAYER. These are the homogeneous (single layer) half-space and the layered earth.

Homogeneous Half-Space

This Earth type assumes a single, conductive earth volume lying beneath the survey area. The earth host has a definable resistivity. No complex resistivity parameters are available for use with LAYER when a Homogeneous Half-Space option is selected. A Layered Earth type can have complex earth models defined. The extent of the half-space is assumed infinite horizontally as well as vertically (depth) and the top of the half-space lies at the surface of the earth.

Layered Earth

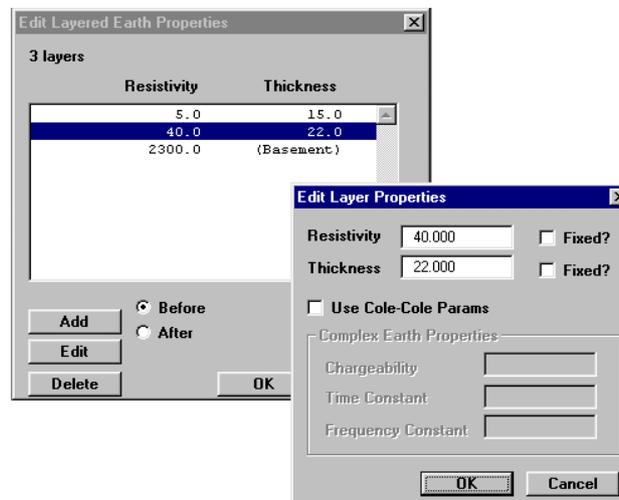
A Layered Earth model is comprised of a series of horizontal, stratified layers each of definable thickness and electrical property. The layered earth model can simulate a homogeneous half-space if only one layer is specified but usually more than one is defined. The extent of the layers is infinite laterally and defined by the thickness parameter vertically. The bottom layer is assumed to represent basement and so has resistivity properties but no thickness definition.

A maximum of twenty layers can be defined for LAYER. Individual layers can be defined by thickness (which cumulatively represents depths to the top and bottom surfaces) and resistivity. Complex Cole-Cole earth parameters can be assigned to each layer.

Earth Properties

The Properties option is available from the Earth item of the Modelling main menu. This feature is used to define the properties used by the various Earth Types (see *Earth Type*). The dialog to control the various parameters of a layered earth will be displayed after selecting the Properties item.

For defining a **Layered Earth** model, a dialog controls the entry, editing and properties of the individual layers. The layers are presented within a scroll list as shown in the dialog below.



Editing the Layered Earth model

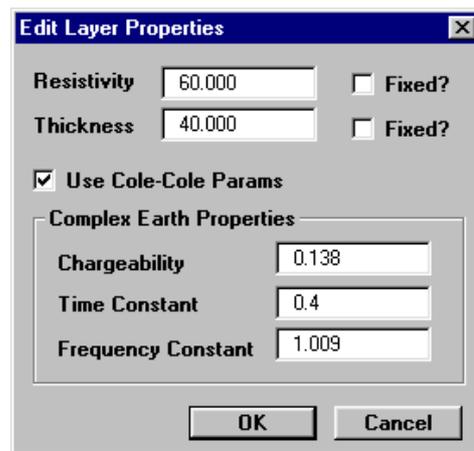
When the dialog is initially displayed, EM Vision creates a single layer that it refers to as basement. Note that no Thickness property is assigned to the bottom, basement layer of the list.

At the base of the dialog are three push buttons that control the creation, deletion and editing of layers. Associated with the **Add** push button are two options for **Before** and **After**. These options enable creation of a new layer before (shallower) or after (deeper) than the layer highlighted.

Note

It is not possible to create a layer after or below the basement layer.

Any layer that is highlighted can be edited by selecting the **Edit** push button. An alternative means of directly selecting and editing a layer is to position the cursor over the layer and double click the left mouse button. By either of these methods, an editing dialog for the selected layer is presented.



Editing dialog for layers including Cole-Cole parameters

The resistivity and thickness can be edited on this dialog. Since LAYER is a forward modelling program, the Fixed option for modifying layer properties is not applicable. This feature only applies to inversion modelling.

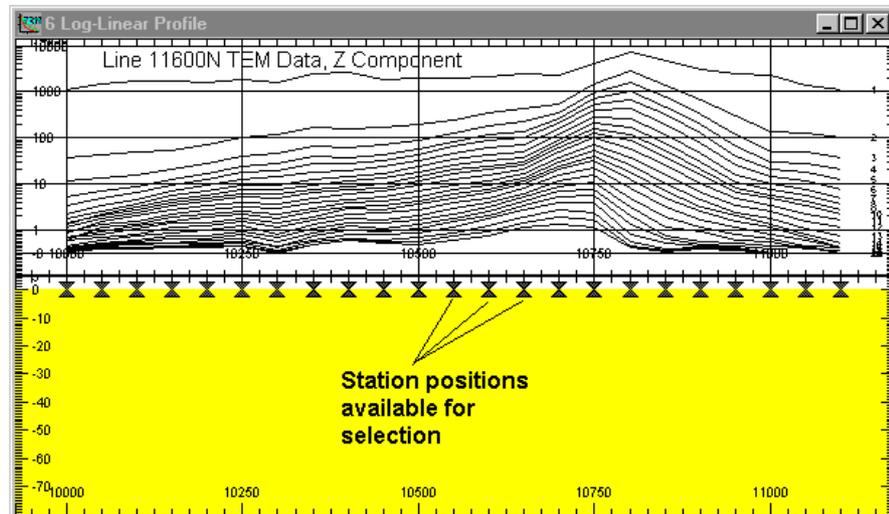
The **Use Cole-Cole Params** option is available for LAYER. Complex resistivity Cole-Cole parameters are optional and in most cases are not applicable unless specific information relating to the complex resistivity and frequency dependence of the defined layers is known. This information is typically made available from IP surveys or laboratory sample analyses. Refer to *Complex Resistivity* for additional information.

The use of Cole-Cole parameters relates to the frequency dependence of rocks. Frequency dependence of EM soundings is typically evidenced by the presence of negative values being recorded in field data. Rock conductivities are often weakly frequency dependent between excitation frequencies of 0.1 and 10,000 Hz. Rocks with this dependence are referred to as 'dispersive' (Smith, 1988). Qualitatively, the strength of the frequency dependence is the 'polarizability', a quantity which can be given a number of quantitative definitions. Commonly the polarizable dependency is measured over a frequency range of 0.1 to 10 Hz by the frequency domain induced polarization (IP) technique.

Setting Individual Station Properties

It is possible to set the properties of each station individually. Consequently, when the cross-section is displayed beneath a profile, the locations of the reading positions is displayed as an 'X' symbol. The purpose of this is to enable individual graphical selection of readings so their associated properties can be defined.

To set individual reading properties, display the profile and cross-section (see *Cross-Section Displays*). When the initial display is presented and the Layered Earth model type is specified, the cross-section area has 'X' marker symbols at each station location. An example of this is shown below:



Example cross-section initial layered earth model

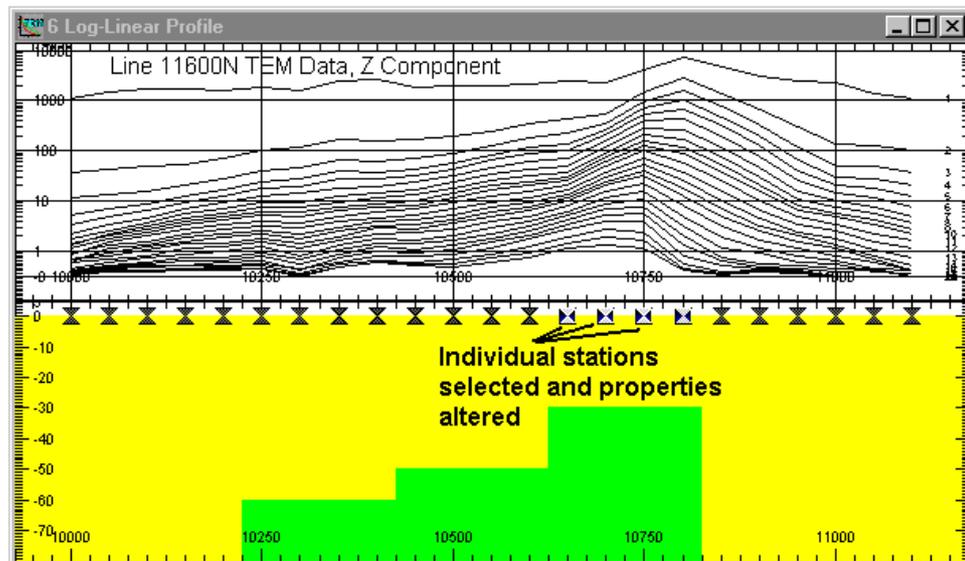
Select individual readings by positioning the cursor over the marker symbol and clicking the left mouse button. Control of the marker symbols is described in the *Setting Individual Station Properties* section. If more than one reading location is to be selected, press the **SHIFT** key while positioning and selecting. To define the earth properties of the selected layers, select the **Properties** button on the toolbar or use the Properties icon. When this is done, the Edit Layer Properties dialog is displayed (as described above).

An alternative and more interactive method of configuring individual stations is to double left click on selected stations. This action will display a drop-down menu with a number of options (including the Properties option). Refer to the *Setting Individual Station Properties* section

Note

Sometimes it is difficult to select a marker symbol when the host layer in background is also present. To overcome this, press the **CTRL** key while positioning the cursor and using the left mouse button to choose a specific reading. If multiple readings are to be selected, you can use both the **CTRL** and **SHIFT** keys with the left mouse button.

Also of help in selecting symbols increasing the track space above the symbols. Increase the maximum Earth Section thickness using the Profile Configuration dialog (see *Profile Window Configuration*).



Cross-section with modified individual reading properties

Edit the layer properties as required for the various stations. When this is completed, modelling of programs (such as LAYER) treats each station computation independently and therefore use the individual station properties to compute the theoretical response.

Note

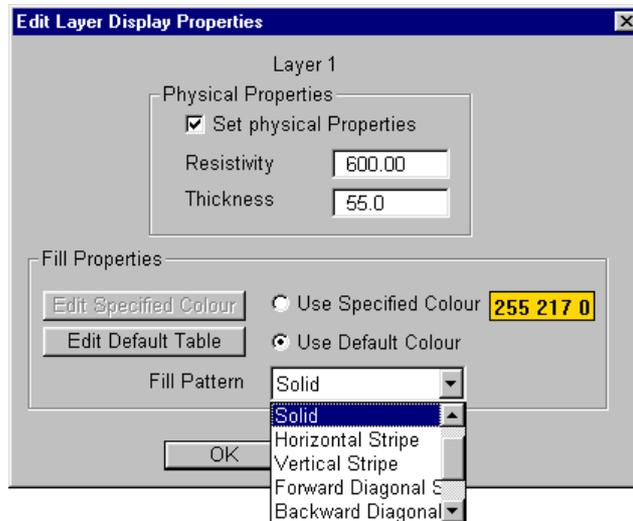
If modelling a reading taken at only one station location, it is not possible to display a profile of the data. The response can be viewed in a Decay display format if required. The initial creation of a layered earth model is done by creating the layers within the Earth Properties option without a display of the earth cross-section.

Controlling the Presentation of Layers

The sections on *Earth Properties* and *Setting Individual Station Properties* describe the method of specifying a layer's thickness and resistivity properties. The appearance of layers, both on the screen and in hardcopy can also be controlled by allocating colours or patterns to specific resistivities.

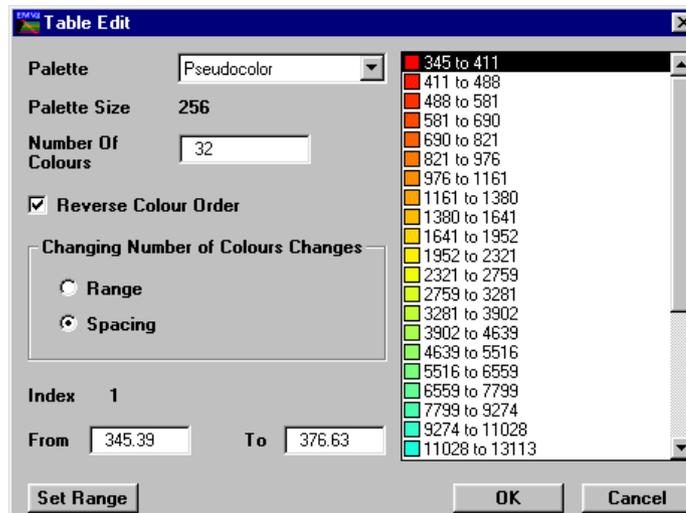
To graphically alter the properties or colour of a layer, move the cursor over the desired layer and double click the left mouse button. A dialog indicating the layer colour and the properties is displayed. The properties can be altered by editing the values displayed.

The colour of a layer is indicated in the central indication box of the dialog and within this are Red:Green:Blue colours indicating the mix of primary colours used to display the layer. This Default Colour can be altered by selecting the **Use Specified Colour** button. When activated, this button causes the **Edit Specified Colour** push button to be available. Selecting this button provides a dialog enabling you to modify the layer colour as required.



Editing the property or display attributes of layers

Control of the palette and the range of resistivities which can be presented is made available by the **Edit Default Table** push button. This button is activated by selecting the **Use Default Colour** option. When the activated table button is pressed a dialog that enables mapping of resistivities to various colours is displayed:

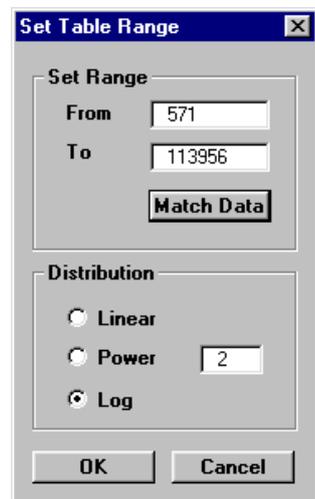


Editing layer resistivity colour mappings

Standard colour palettes can be used to map the presentation colours of various layer resistivities. The **Palette** option specifies the standard palette files stored in the directory specified by the LUTDir parameter of the EMVIS.INI file (see *The EMVIS.INI Defaults File*). Note that these palettes are identical to the format used by ER Mapper (refer to *the ER Mapper Reference Manual* for details on look-up table specifications).

Palette sizes are typically composed of 16 or 256 colours and the number of colours derived from the palette is definable. The actual mapping of colours from the palette is seen on the right of the dialog in a scrollable list with the associated resistivity ranges. The list is made up of ‘from and to’ resistivity pairs which can be controlled specifically in the ‘From’ and ‘To’ entry fields. To modify a resistivity range for a specific colour mapping, position the cursor over the required colour entry and highlight it by clicking the left mouse button. The ‘From’ and ‘To’ resistivity range can then be altered in the entry fields.

If you wish to re-map the entire resistivity range to comply with a specific resistivity range, select the **Set Range** button.



Dialog to control the range and look-up table for colour mappings

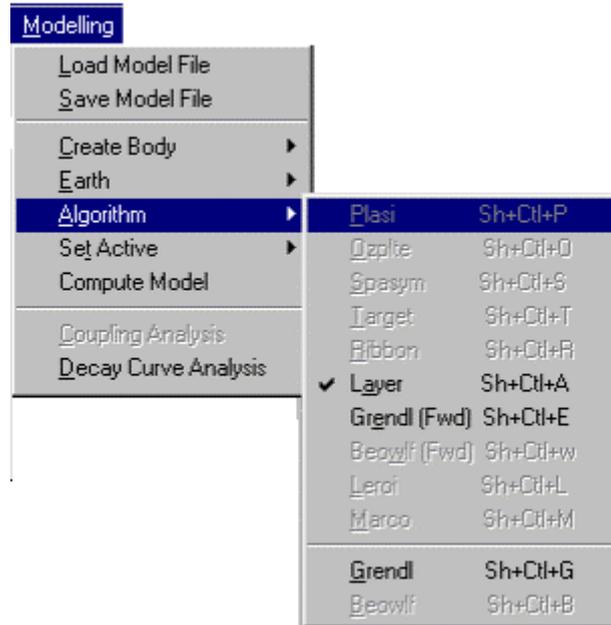
The upper and lower resistivity range can be defined and the distribution method of mapping the resistivity range across the colour mappings can use one of three methods:

- Linear distribution from highest to lowest resistivity.
- Power distribution of a definable power.

- Logarithmic distribution

The **Match To Data** button assigns the maximum and minimum data values derived from the data or resistivity range.

Algorithm Option



The Algorithm option in the Modelling menu is used to select LAYER.

All implemented modelling programs are contained in the displayed menu list but not all algorithms has been made accessible. When a program is not available or is not correctly configured, its entry on the Algorithm menu list will not be highlighted and therefore not available.

Even if a program is installed, access may be denied by EM Vision if an incorrect survey configuration or instrument combination has been set.

Note

In the event that **NO** algorithm option, or the algorithm required is **not** available for selection when you think it should be, refer to section on *Non Accessible Algorithms*.

A dialog will confirm selection of the LAYER algorithm.

Set Active Option

The modelling process involves creation of a model, data and survey definition and selection of an algorithm. The only remaining step prior to initiating LAYER is to define over which delay channels and readings the modelling operates. This is done by the Set Active option of the Modelling menu.

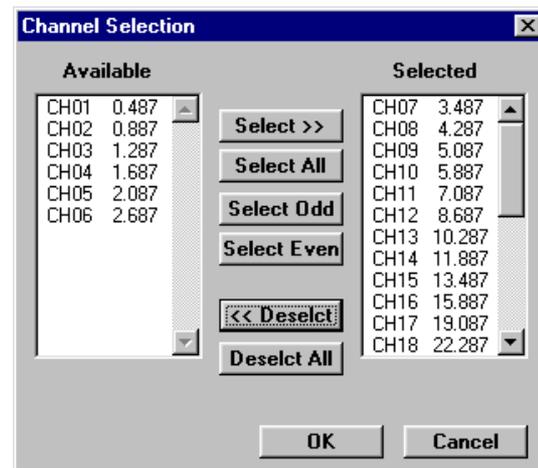
Modelling computations can be restricted to user defined delay channels and data readings. Channels and readings available for modelling are referred to as active. The Set Active option provides the facility of making channels and data stations inactive.

Note

By default, EM Vision makes all data initially active.

Setting Channel Activity

The Set Active option for channels will present the Channel Selection dialog as below. Nominate the channels to be modelled by taking into account any early time noise or response behaviour which is uncharacteristic of expected decays. Similarly, late time noise can be derived from instrumentation, geological and cultural sources.

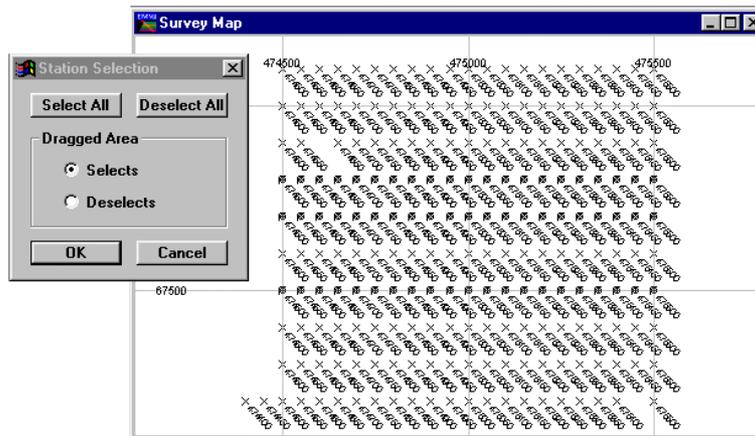


Channel selection dialog

The channels on the right scroll list is regarded as active for the applied modelling.

Setting Station Activity

Defining which data readings are to be modelled is controlled by the Set Active Stations option. When selected, a dialog accompanied by a survey map of the available station locations is displayed. Initially all readings will be highlighted indicating their active state. Within the dialog you can **Select All** or **Deselect All** readings. Also within the dialog you can use the cursor to **Select** or **Deselect** stations to be active. To use this method, choose one of the two options and then move the cursor to the survey map. When the left mouse button is pressed and the cursor moved a dashed rectangle will be drawn.



Station selection for modelling

When the mouse button is released, all the readings enclosed alters their activity state to match that set in the dialog.

To reverse the activity of individual stations, despite the **Dragged Area** selection, you can position the cursor over a reading and then click the left mouse button. This technique will toggle the activity state of the station.

Compute Model

Once the data, survey, algorithm and model have been defined and the desired channels and data readings made active, LAYER can be initiated. EM Vision can execute the program by selecting the Compute Model option of the Modelling menu, or by pressing the **Compute** button on the Tools toolbar.

LAYER uses the Generic Modelling Interface to operate and so is executed externally from EM Vision. In these cases, an icon appears in the Windows

status bar that indicates EM Vision has initiated the program in an external portion of memory.

WARNING

LAYER is a large program that requires large amounts of RAM memory to load and execute. On machines having only 16 megabytes of RAM, the program may take 1-2 minutes to load before commencing to operate (depending on machine speed). No progress will be noted in the slider bar while this is happening. On machines with increased memory, loading and compute times are much faster.

After the program has loaded, operational progress of modelling is indicated by a slider bar with a percentage of completion. In cases where LAYER is to be halted during execution, the progress bar has a **Cancel** push button. If you select this button, the program will abort. After the program is aborted, response results to that point will be available and should display in the profile window.

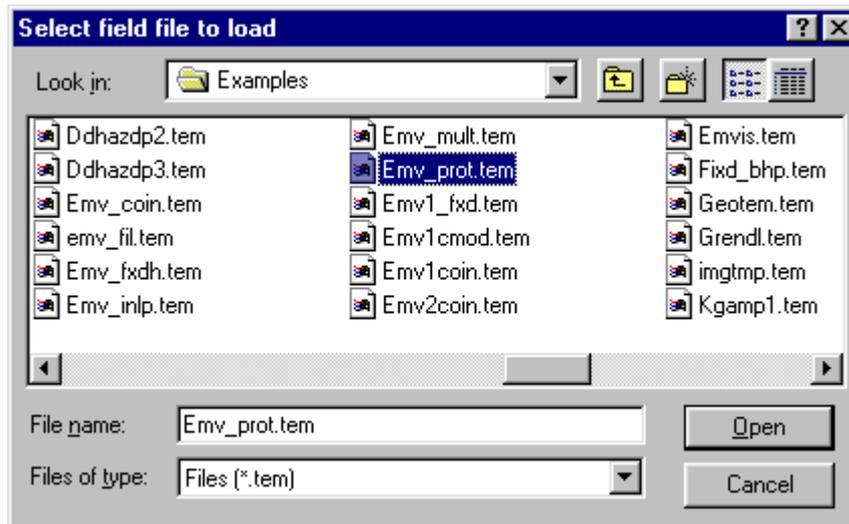
Once a program has been halted, modifications to the model, channel and station activity can be made and the program re-initiated. Halting and re-executing the program can be undertaken any number of times.

2 LAYER Tutorial

Following is a brief tutorial to explain the normal method of operating LAYER. The dataset to be used for this exercise is supplied with EM Vision and is called EMV_PROT.TEM. The file will be read into the EXAMPLES subdirectory during installation of EM Vision. The object of the modelling is to gain information of the background response that can be used to isolate a localised conductor within the survey area. The tutorial is presented as a number of steps. Within each step, some additional information is provided to assist you in understanding alternative analysis or display options.

Step 1 - Import the data

Import the EMV_PROT.TEM data file using the **Data>Open Field Data** option as shown below:

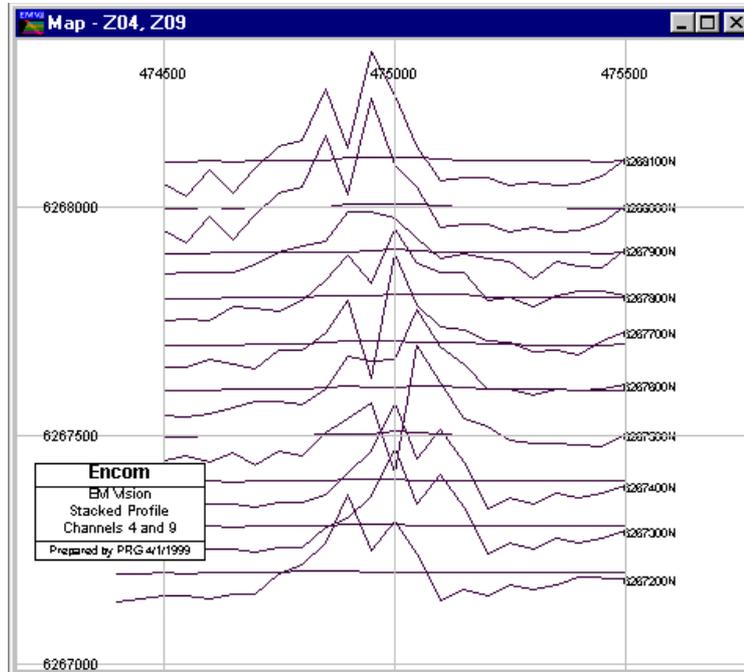


File access dialog for tutorial.

The data will be read (indicated by a progress bar) and then an explanatory dialog describing the data is presented. The data file has been acquired along a number of east-west traverses using a Protem 47 EM transmitter-receiver system cycling at 250Hz. The data uses the in-loop survey mode with a receiver of 31.7 square metres. The transmitter loop has an area of 2,500 square metres.

Step 2 - Examine the data by stacked profile

The data should be displayed initially to examine the survey results and select a line for modelling. Select the **Display>Stacked Profile** option and nominate an early and a late time channel for display (e.g. Channels 4 and 9).

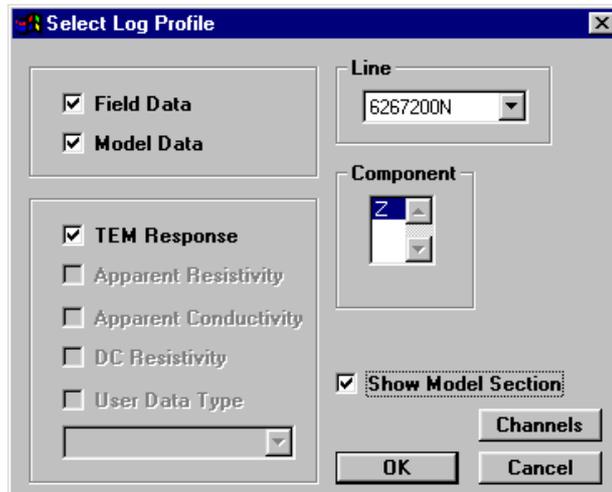


Display of data for channels 4 and 9 by stacked profiles

Since a background response is to be simulated, a survey line with a reduced local anomaly effect is to be chosen. The most southern line (Line 6267200N) is used.

Step 3 - Display the line as a profile

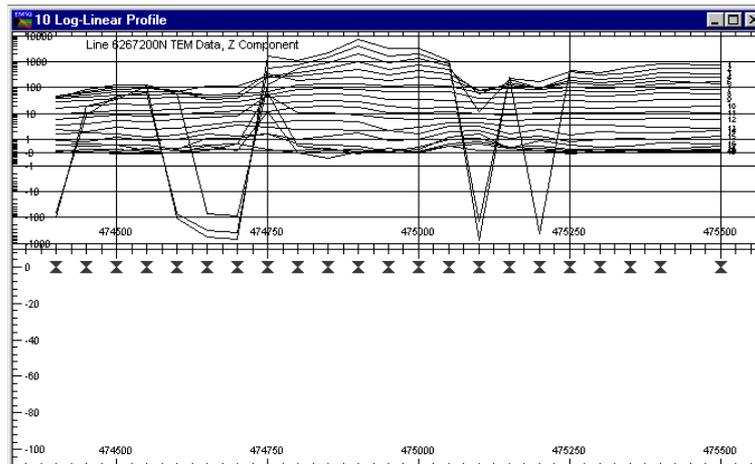
For modelling, the selected line is to be displayed as a profile in either a log-linear, linear-linear or predefined style. Select the **Display>Profile >Log-Linear** option. To present the profile with a section area beneath, the **Show Model Section** checkbox needs to be enabled.



Profile control/selection dialog and earth section option.

It is also advisable to enable the **Model Data** checkbox, since as LAYER creates theoretical responses, these will then automatically be added to the display.

Once these items have been selected and **OK** pressed, the display is presented.



Log-linear profile with model section area beneath.

In the above display, an empty section beneath the data to be used for modelling is provided. Note that the early channels of the data, (Channels 1-3) have spurious noise and for modelling, these channels will need to be set inactive to compare with the observed data.

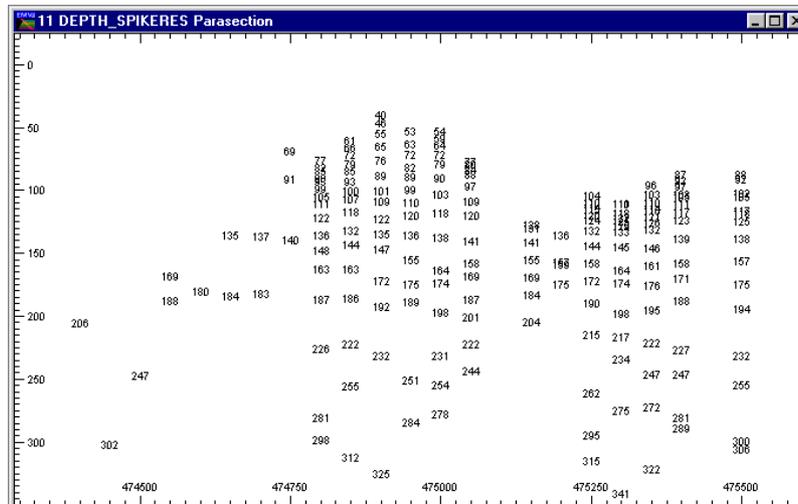
Step 4 - Obtain an estimate of the resistivity section

In some circumstances, you will have some idea of the earth resistivity and how many layers will adequately represent the electric section. This information may be known from IP studies, DC soundings or a general knowledge of the regional resistivity. Often these ideas are satisfactory to develop a suitable initial 'seed' model.

If you do not have an understanding of the electric section, a good guide can be derived from the resistivity computation operations provided in the Operations option of the Data menu item. Select this, and choose Apparent Resistivity. Either the Raiche/Spies (asymptotic formula) or the Spiker algorithm can be used to compute the apparent resistivity. A benefit of the Spiker formula is that an indication of depth is also computed.

One of the best graphical methods to display the computed results is by using a text presented pseudosection. To present the apparent resistivities in this way, choose the **Display>Pseudosection** option and nominate the Spiked Resistivity data to be displayed with a vertical (Y axis) scale of Pseudo-Depth.

When you select the **OK** button, the pseudosection displays but, by default, be presented with a colour or shaded image of the apparent resistivities. By positioning the cursor in the window and clicking the right mouse button, the Pseudosection configuration dialog is presented. On this, enable the Style to be **Text** only. A new display similar to that below is presented.



Pseudosection with text display of apparent resistivities

If the numbers are too small or overpost each other, again display the configuration dialog and reduce the vertical depth range to expand the resistivity values. For this dataset, a good setting is with a depth range between 0 and 400 metres.

From the displayed values, note that the shallow values are typically of medium to high resistivity (approximately 1500-2500 ohm.metres), the central values decrease to 1000-1500 ohm.metres and then at deeper levels they again increase, in some instances to 10,000-20,000 ohm.metres.

This presentation provides an initial guide to the resistivity structure along the profile. A three layer model is indicated with similar resistivities to those described above.

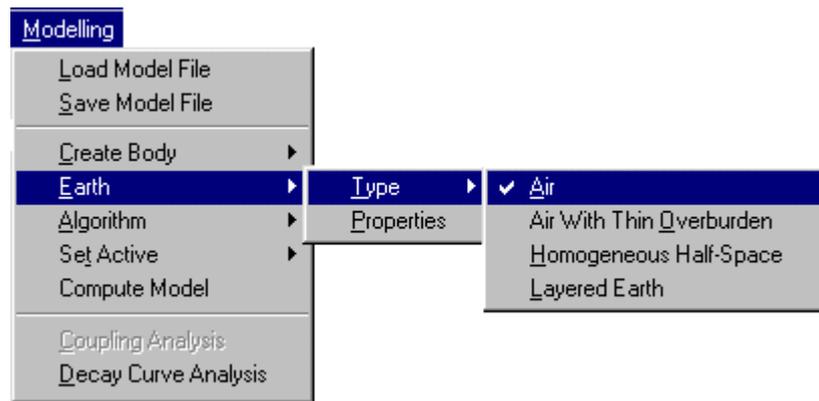
Step 5 - Define the Earth Type

The Earth option of the Modelling menu is used to define the Earth Type and assign its properties. Various Earth types are available to satisfy the many host environments that can be modelled. For LAYER, the only Earth Types available are the Homogeneous Half-Space and Layered Earth.

Note

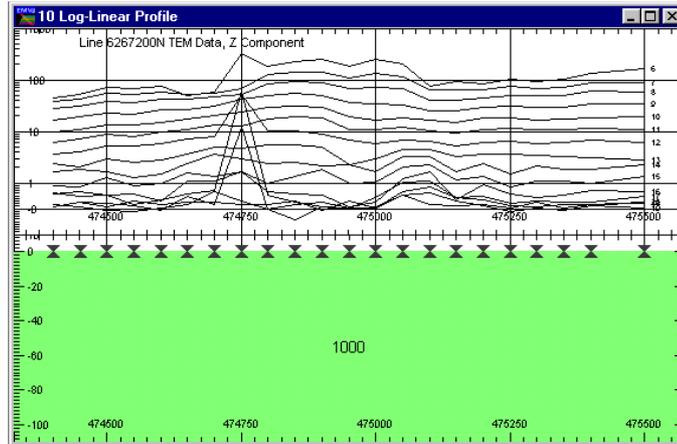
Unless the correct information is specified in terms of model type, Earth host and defining parameters, the LAYER algorithm will not be accessible and appears 'greyed' out in the **Model>Algorithm** menu option.

For this dataset, the Earth Type should be set to Layered Earth.



Modelling menu and host menu items.

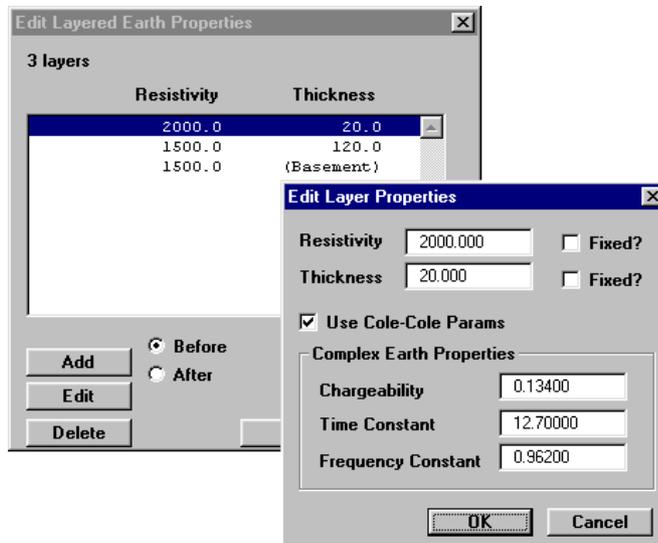
When the Layered Earth option is set, if a cross-section profile is displayed, the station locations and a single basement 'half-space' layer is drawn as:



Profile with basement layer and reading locations (X-symbols)

On the surface of the basement layer are a number of 'X' marker symbols. These locations mark the position of each individual reading for this profile. Configuring the style and type of marker symbol is possible from the Profile configuration dialog (use the **Display Style** button).

Step 6 - Defining the Layer Properties



Adding and editing Layered Earth properties

As indicated by the Spiker algorithm results, a three layer model is best suited with resistivities similar to those entered. Additional layers and individual resistivity properties can be added. When this is done, the dialog describes the existing layer properties of Thickness and Resistivity (initially for only the Basement layer). To add layers, select the **Add** push button and enter new resistivity and thickness properties. When adding a layer, it is added either before or after the highlighted layer depending on the **Before** or **After** button selected.

After a layer has been created, it can be edited by either highlighting it in the Edit Layered Earth Properties dialog and selecting the **Edit** push button, or positioning the cursor over the desired layer and double clicking with the left mouse button.

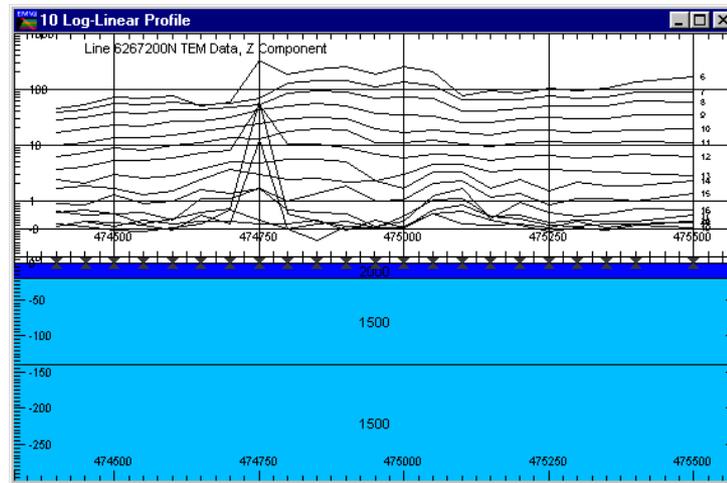
A layer can be removed by highlighting it and then pressing the **Delete** push button.

Note

Complex resistivity properties can be entered into the Properties option dialog if required. These can only be enabled if the LAYER algorithm is enabled. Refer to Step 9 for selection of the algorithm to enable Cole-Cole parameters to be entered. When available, enable the **Use Cole-Cole Params** option to access the entry fields.

Step 7 - Modifying Layer Properties and Colour

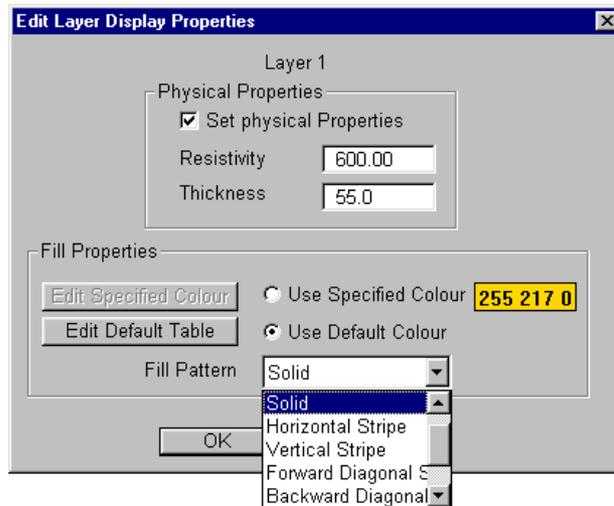
After defining a number of layers, the properties and appearance of each layer can be altered graphically. In the example here, three layer resistivities and thickness are shown. The bottom layer represents the basement and so has infinite thickness.



Three layers of different resistivity and thickness properties

To graphically alter the properties or colour of a layer, move the cursor over the desired layer and while positioned there, double click the left mouse button. A dialog indicating the layer colour and the properties is displayed. The properties can be altered by editing the values displayed.

The colour of a layer is shown in the central box of the dialog and within this are Red:Green:Blue colours indicating the mix of primary colours used to display the layer. This Default Colour can be altered by selecting the **Use Specified Colour** button. When activated, this button will cause the **Edit Specified Colour** push button to be available. Selecting this button provides a dialog enabling you to modify the layer colour as required.



Dialog for graphically editing a layer's properties

An alternative method of controlling the appearance of layers is to use the **Use Default Colour** option. This method enables the selection of specific colours to resistivity ranges. Refer to the section on *Controlling Individual Layer Appearances* for more information

Step 8 - Controlling Layers of Individual Stations

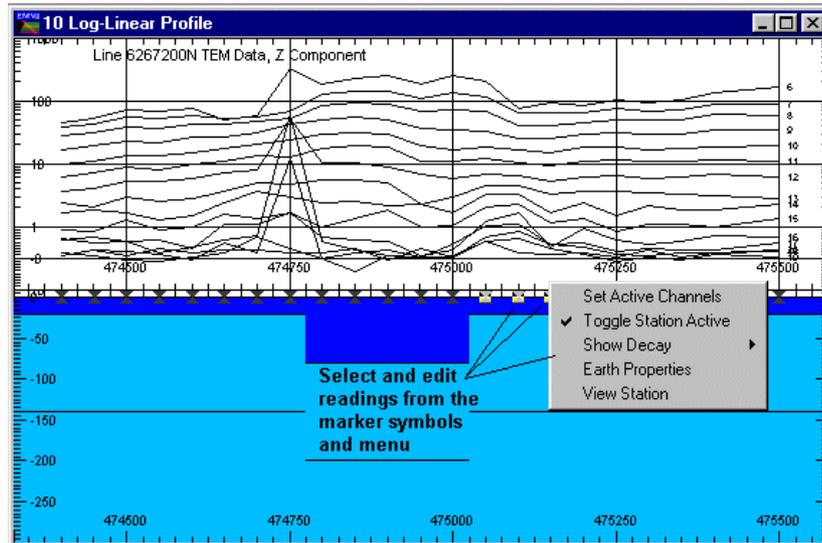
LAYER operates on single TEM soundings and their response individually before moving to the next active reading. The individual sounding models will act as different layered earth model in a LAYER model operation.

To set the properties of a single sounding independently of surrounding stations, use the marker symbols that appears along the top surface of the uppermost layer. Position the cursor over the marker symbol for the required station and click the left mouse button. The symbol will be highlighted when selected. If difficulty is experienced in selecting the symbol, press the CTRL key and click the left mouse button.

Once selected, the standard Earth Properties dialog can be displayed by pressing the **Properties** push button or icon on the Toolbar. An alternative approach is to double left mouse click the station(s) once selected. This action will display a drop-down menu that enables a greater range of options than is available from the Toolbar or icons. Options available are for the selected stations only.

Note

If a grouping of stations are to be modelled with different layer properties from other readings, these station **X** symbols can be grouped by positioning the cursor above the first reading required and then, with the SHIFT key held down, select the other required stations in the group. They can be selected from any location on the profile. As before, if difficulty is experienced in selecting individual station marker symbols (**X**), use the CTRL key as well as the SHIFT key.



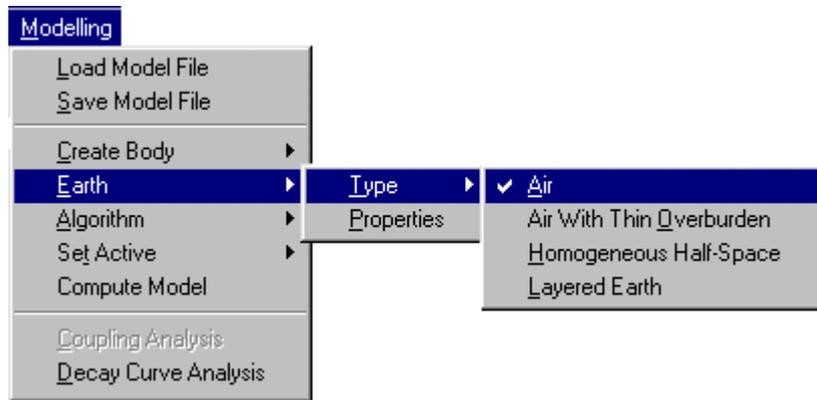
Cross-section with modified individual reading properties

Note

When only a single TEM sounding is available, it is not possible to display the data in profile form. In this case you can display the data as a single station decay and then create a layer model from the menu option of **Modelling>Earth>Properties**.

Step 9 - Define the Algorithm

Once the earth model is defined (see Steps 6-8), the next step is to nominate LAYER as the modelling algorithm. To set the algorithm, select **Modelling>Algorithm**. The following menu appears.



Modelling and host menu.

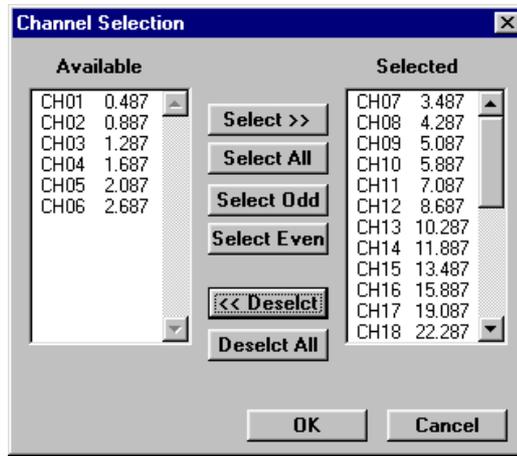
Many algorithm names are not available for selection. If the algorithm you require (LAYER) is not available, refer to the section on *Controlling Algorithm Access* and the *Algorithm Option* of the main EM Vision Manual. Some typical causes of an algorithm not being available include:

- Algorithm option not purchased or licensed.
- Inappropriate survey configuration for algorithm required.
- Incorrect settings of the Generic Model Interface. For details of this refer to the *Generic Model Interface*.

Step 10 - Controlling Which Channels to Model

By default, LAYER models all data channels available. If early or late time noise is present in the data being modelled, it is often a good idea not to model the noisy channels. This was the case with this data, and so Channels 1-3 should be set inactive. Using the **Modelling>Set Active>Channels** option it is possible to ‘turn off’ certain channels whose response is not to be computed.

When the option is selected the standard channel selection dialog is presented.

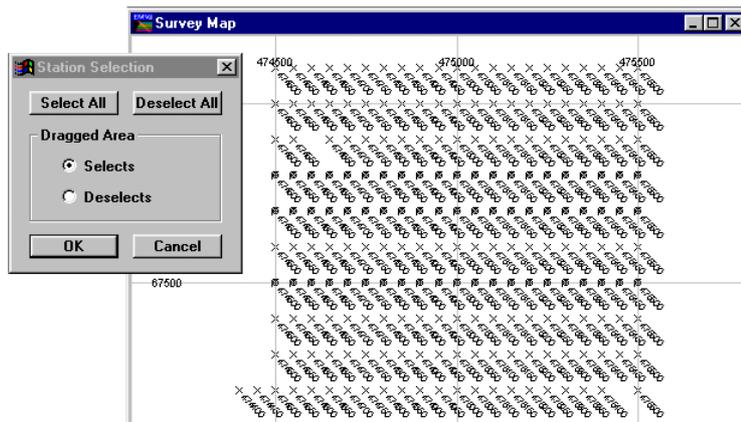


Channel selection dialog for channel activity

Refer to the section on *Standard Operations* for details on selecting and deselecting channels.

Step 11 - Controlling Which Stations to Model

The LAYER program models station responses individually. This means that you can control which stations you wish LAYER to calculate responses. Control is provided by the **Modelling>Set Active >Stations** option. When selected the option presents a dialog accompanied by a survey map of the data loaded as shown below. Using the dialog options, individual or groups of stations can be selected as being 'active'. Stations that are highlighted are deemed to be active.



Setting stations to be active for modelling

It is possible to drag a rectangle over one or more stations and select them as active or inactive, depending on the setting of the dialog. To do this, position the cursor where appropriate and then press the left mouse button while moving the mouse. A rectangle is created and all stations contained in this is selected. For this example, set only the stations of line 6267200N to be active.

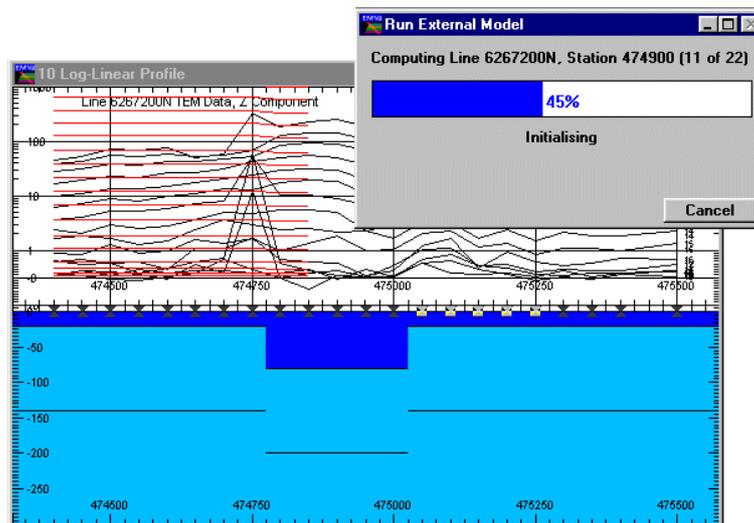
Step 12 - Computing a LAYER Model

After creating a model and setting the activity and algorithm appropriately, you can initiate a LAYER model Run. This can be done in one of two ways:

1. Press the **Compute** push button on the Toolbar or icon.
2. Select the **Modelling>Compute Model** option from the menu.

When LAYER is initiated, a progress bar is displayed as the program computes the individual station responses. The program will examine stations ahead of the current one being computed and only computes those with different layer properties. This inbuilt feature ensures that the forward computation operates efficiently and repeat computations are not performed.

As responses are derived, the progress bar is updated but also the model response will be displayed (assuming the Model Response option was enabled during the profile display).



Forward model with modelled and observed responses

The program will continue executing until all stations and channels are completed. If required, you can terminate a program run early by selecting the **Cancel** button.

Step 13 - Saving (or Loading) a Computed Model

Prior to, or after running LAYER, it is a wise policy to save the created model. Use the **Modelling>Save Model File** (or Load Model File) option to write or retrieve a model file. By default, EM Vision model files have the file extension .MOD. Once saved, these ASCII files become a valuable resource.

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