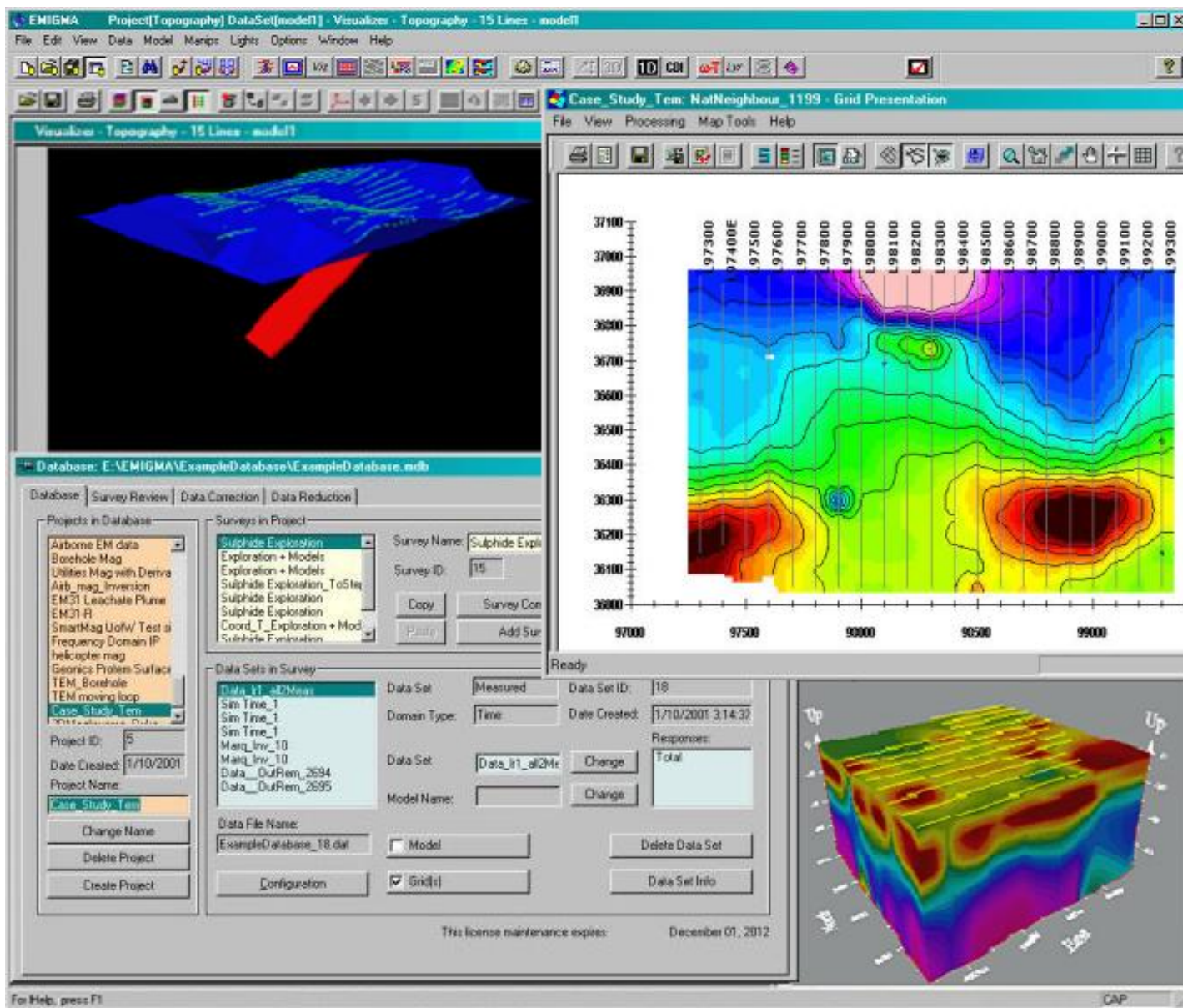


EMIGMA



EMIGMA Overview

EMIGMA – Database Version

Database Design Objectives

- Reduce user's time required for modelling and data analyses
- Enhance data analyses capabilities
- Improve ability to report on work and to recover interpretations at later dates
- Integrate all tools into one platform
- Include data editing, compression, filtering and processing
- Allow large datasets to accommodate airborne, marine and towed ground surveys
- Provide a framework for inversion tools and their integration with simulation tools

EMIGMA database structure

EMIGMA – Database Structure

EMIGMA is designed both for data analyses as well as a high level of integration of all interpretation, forward modelling and inversion tools.

As such, it requires a broader capability than simpler database applications.

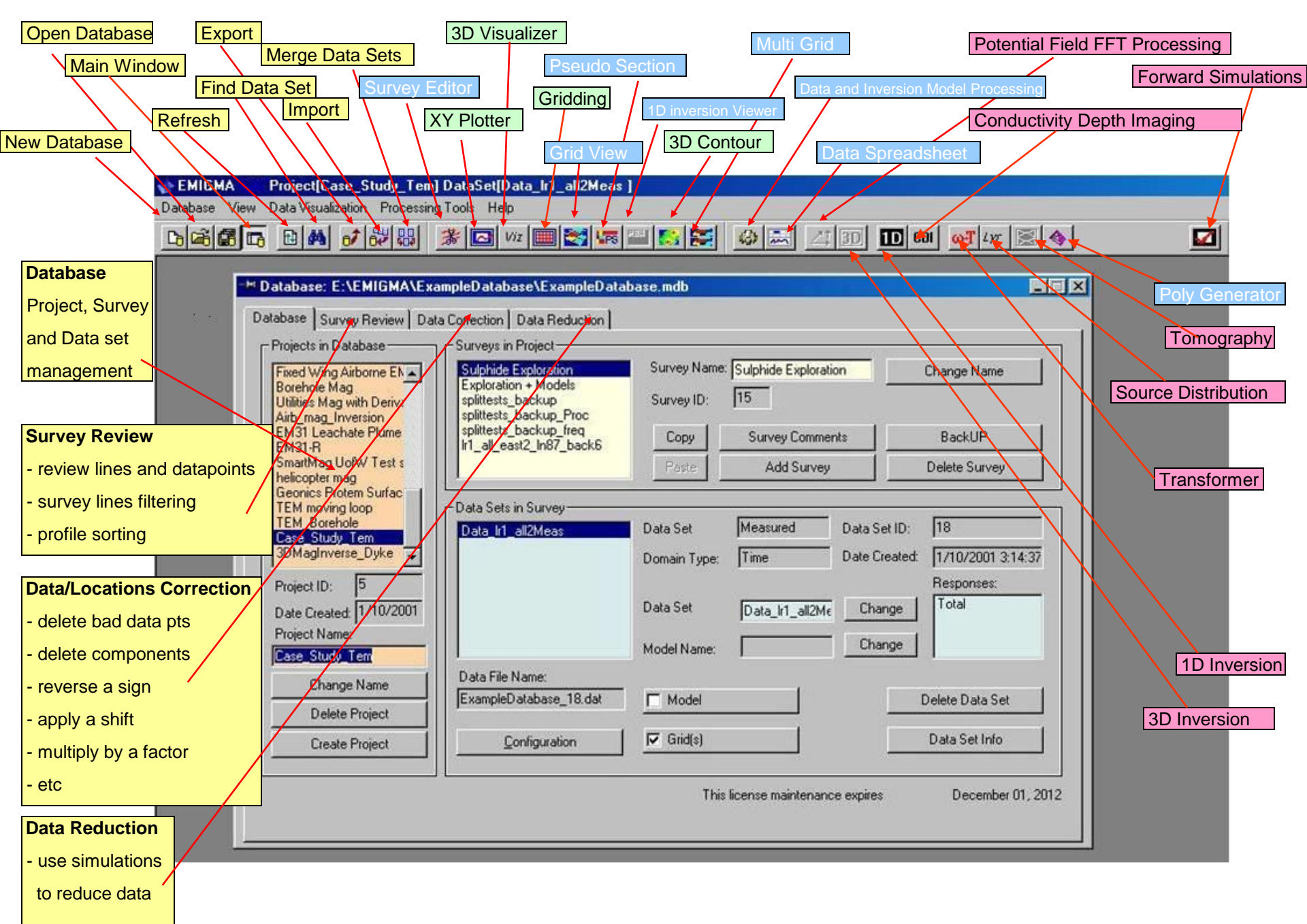
Each new database should be given its own directory. In that directory, there will be

- an EMIGMA database consisting of a single *.mdb file plus
- associated flat files (these are in ASCII format)

These are named “ N.dat ” – one file for each dataset inside the database. The filename for each dataset is given on the main EMIGMA interface when it is selected.

- associated subdirectories
- a) MODELS – inversion models (*.pex, *.mag, *.grv, *.res)
 - ASCII files containing the inversion models
- b) Griddata – *.dat - (binary files)
- c) PlotSetting – default settings for plotter and Grid Contour
- d) Polyhedron – all polyhedra for the database are stored here. If the poly files are imported from another source then a copy is kept here for the purpose of this database
- e) SurveyComments - *.pxt – available and editable from the main database interface
- f) Temp – this is a temporary folder used by EMIGMA to store auxiliary information
- g) Log – inversion logs are kept here for recovery of inversion settings
- h) Simul - storage of Greens function arrays

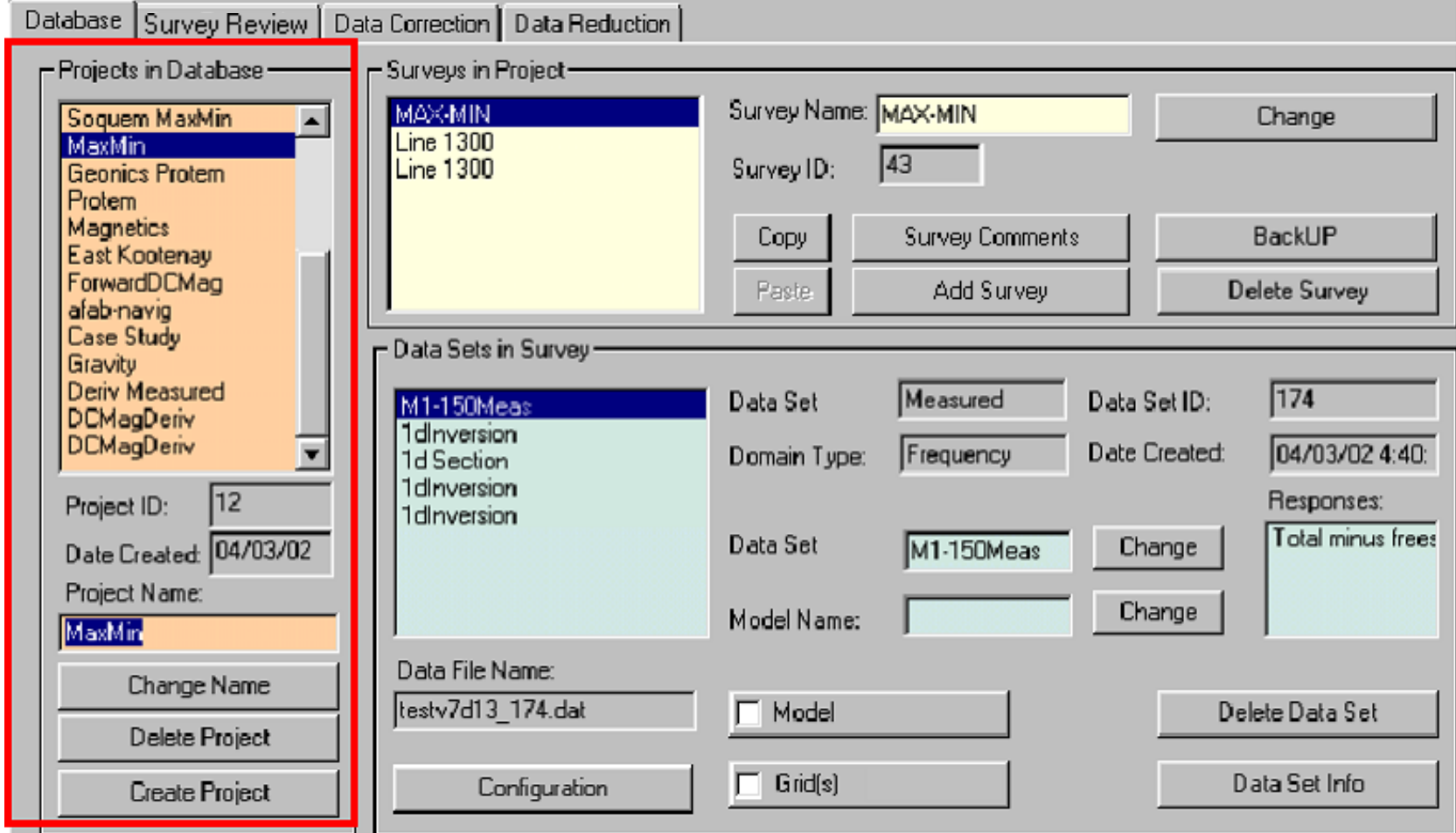
All of this structure is known to the application and need not be managed by the user. But when sending the database to another user, remember to .zip up the entire directory structure retaining the full folder information. EMIGMA V8.5 introduced a feature allowing you to export and zip directly for transfer.



Data Organization

The user can easily generate many files in a modelling or inversion exercise thus the models are organized in the database structure to make recovery of the interpretation status easy at a later time.

Multiple datasets and models can be contained in a single database file. Multiple organizational levels are provided allowing for a variety of organization criteria depending on the user's preference. As examples, the user may organize by interpretation project, data type or simply organize all data and projects in one master database. The user may organize in a single project (one organizational level in the database file) several data sets for more ready analyses of the different data types and integration of models between data types.

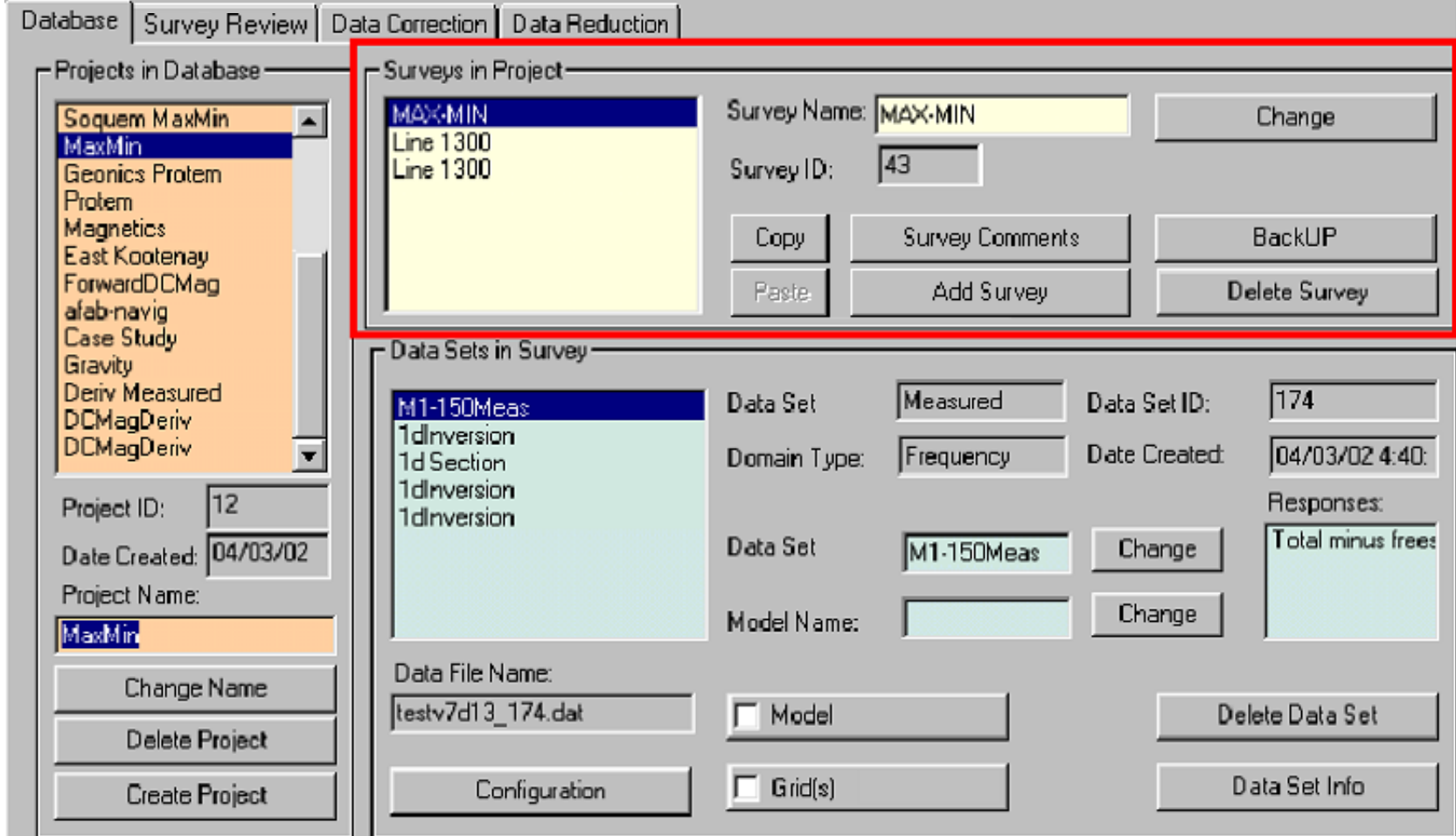


Projects in Database First level of Project management

Change Name - the Project Name can be changed at any time by typing in the Project Name and selecting the Change Name button.

Delete Project - Projects can be deleted by selecting the Project, then selecting the Delete project button.

Create Project - Create a New Project by selecting the Create Project button.



Surveys in Project Second level of Project Management.

Survey Name – rename your surveys at any time by typing the new name and selecting Change

Survey Comments – enter and store notes about your survey.

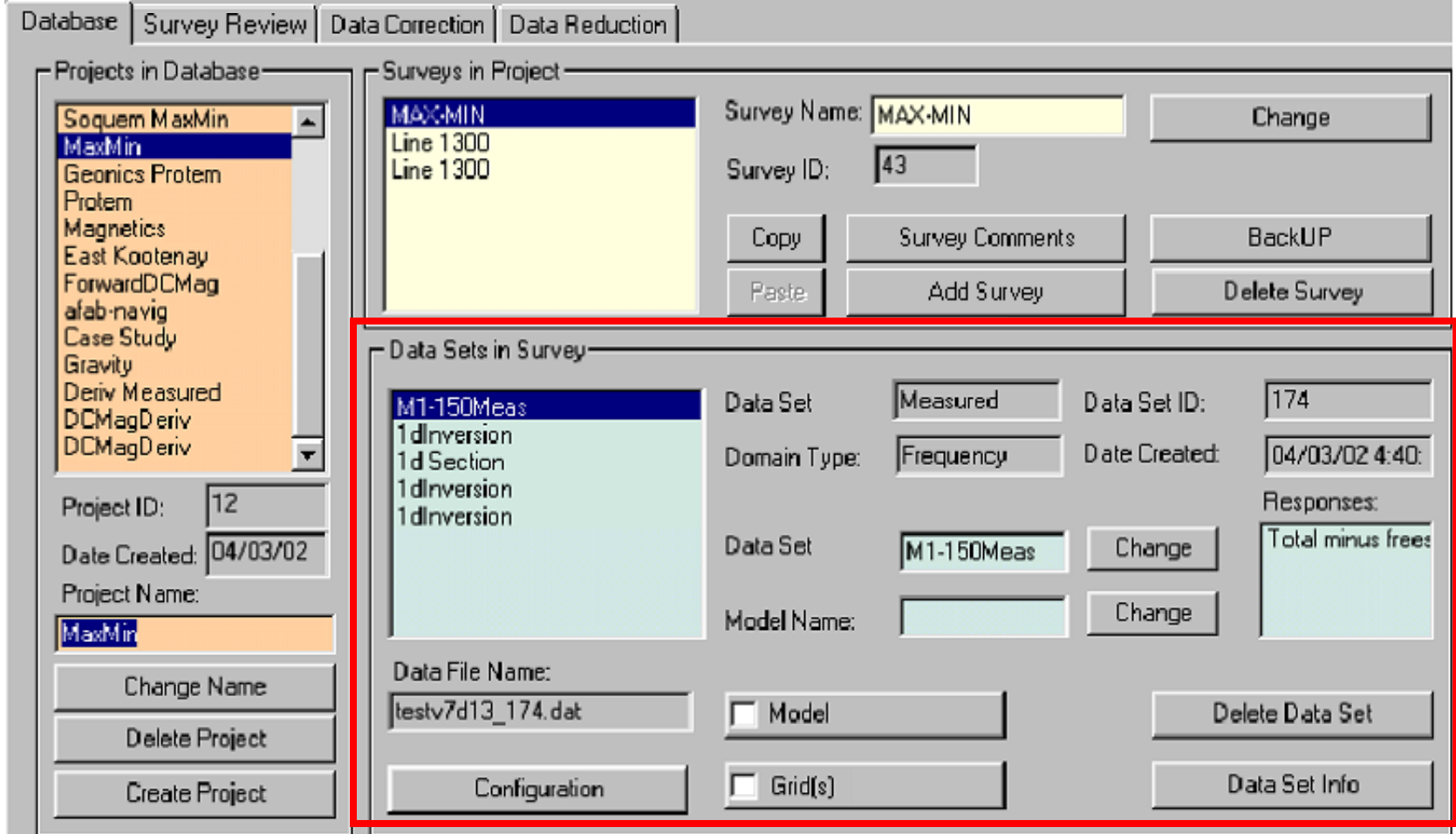
Add Survey – generate a new synthetic survey.

Backup – generate a duplicate of your Survey including all Data Sets.

Delete Survey – delete a Survey at any time by selecting survey and selecting the Delete Survey button

Copy – places the selected survey on the EMIGMA clipboard

Paste – adds the survey on the EMIGMA clipboard to the current project



Data Sets in Survey Third level of Project Management.

Data Set – displays whether the data is Measured (or field) data, Simulated Data or Processed

Domain Type – displays whether the data is Frequency domain, Spectral domain, Time domain or Static domain

Change Name - the Data Set name can be changed at any time by typing in the new name and selecting the Change Name button.

Model Name – a second identification string for your data set allows you to record additional details about your Data Set

Configuration – View and Modify configuration information concerning your survey

Model – View and modify information about your model, import a poly file, import topography, etc.

Grid(s) – Grid management tool - contains all grids generated for this data set.

Database Menu



Database View Data Visualization Processing Tools Help

Database tools to manage your database *.mdb files. Allows you to create a new database file, open an existing database file, import data into the database, export data from the database, search for a data set, merge data sets and exit the EMIGMA program

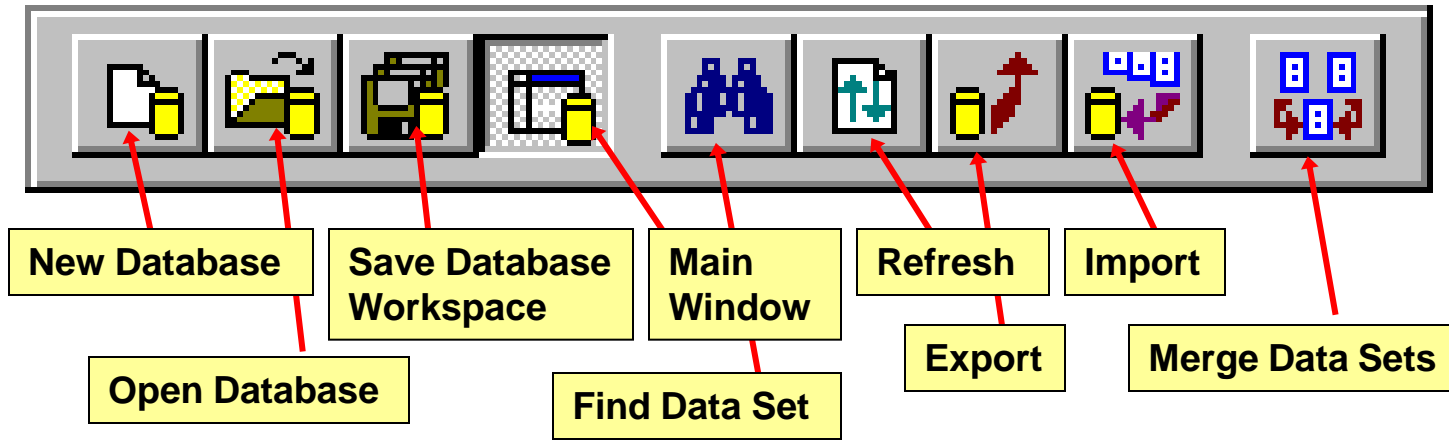
View tools to manage your view options in EMIGMA including toggle display of the toolbars, status bar, and database colour.

Data Visualization allows you to view and display your data in various ways for analysis or reports

Processing Tools an extensive collection of tools to process the data in your surveys

Help displays online help topics, EMIGMA program version, license details and status, download the most current EMIGMA updates

Database Tools



New Database Open a new database file (*.mdb) into the EMIGMA program.

Open Database Open an existing database file (*.mdb) into the EMIGMA program.

Find Data Set A tool to locate a particular data, inversion or grid set by date and EMIGMA data type

Save Database Workspace Stores currently opened plots so that they can be opened again automatically the next time EMIGMA is launched

Main Window Toggles display of the main Database window.

Refresh Updates display of datasets in database

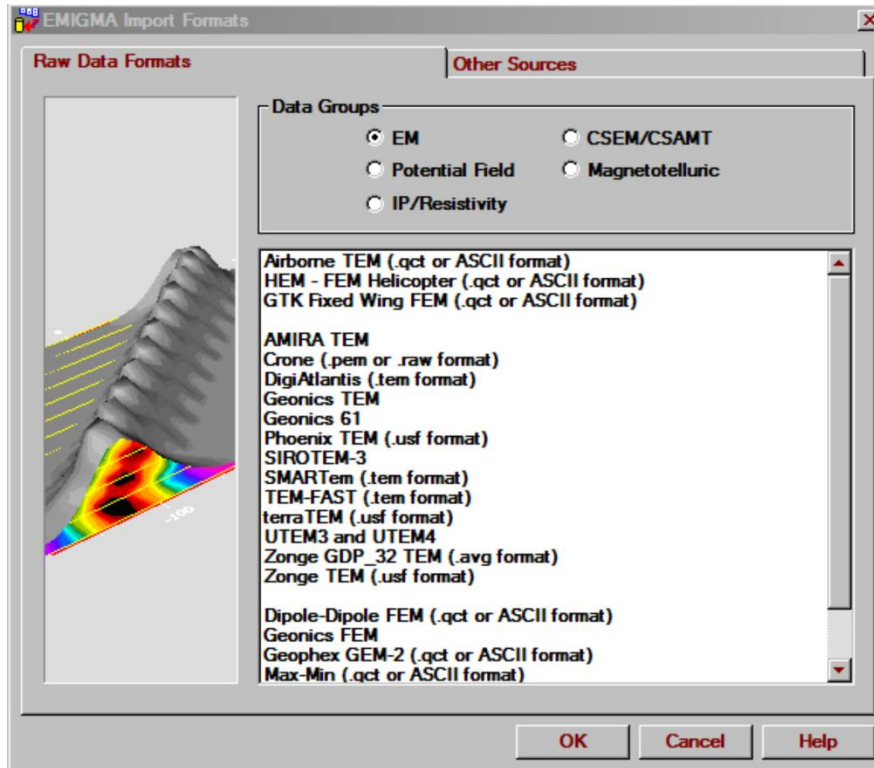
Import Suite of data imports to bring your data into the database.

Export Export your measured, simulated or inverted data to an .xyz file, to another database or to QCTool, GeoTutor and Geosoft applications.

Merge Data Sets A tool to merge two data sets from the same project but different surveys into one data set. For example, merge data from different days



Data Imports



Import Utilities A suite of imports are available which allow you to bring your measured data into the database in either the manufacturers file format, as an ASCII columnar data file or .qct format.

Manufacturers Data Format Enables you to bring measured data into the database in the manufacturers standard file format.

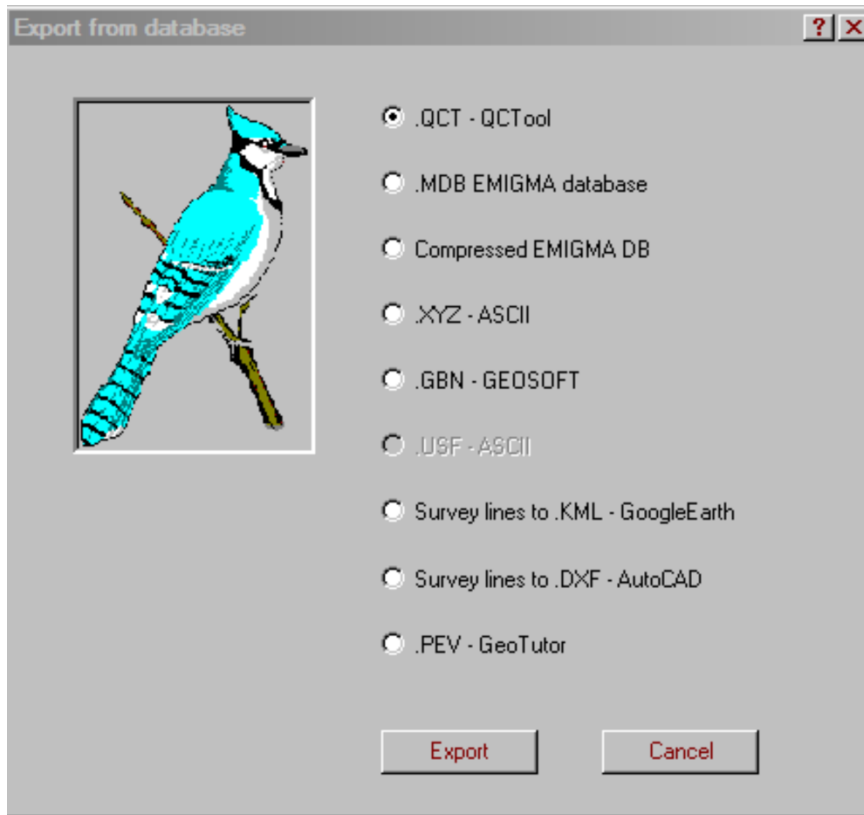
.qct Format: QCTool is a very extensive and inexpensive product for processing and quality control. Many data types may be imported via this format. Import of .gdb files is accomplished by first importing .gdb to .qct. We highly recommend first importing your data to QCTool, perform whatever processing is required and import the final .qct file to EMIGMA. A suitable QCTool license is included with any EMIGMA purchase.

ASCII Format Enables you to bring measured data into the database in a ASCII columnar data format. Column labels are required for the program to recognize the data channels. If you don't have headers or want to modify the headers to our labels which can be read automatically by EMIGMA, an header editing tool is available in the import.

Other Sources Enables you to import data from our GeoTutor application or from another EMIGMA.



Export from database



QCT- QCTool - export data whether survey data, processed data or model data to a .qct file.

.mdb EMIGMA database - enables transfer of information from one database to another including data, models, inversion grids, 2D grids, etc

Compressed EMIGMA db: allows the user to export entire projects and surveys with models, grids and inversions to a compressed .mdb to relay to colleagues

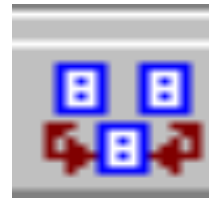
XYZ-Ascii: export data to Ascii columnar files

.GBN – exports data to a .gbn file. Suggest exporting to Qctool and there converting to .GBN

.USF – export 1D inversions to .usf format

.kml and .dxf exports are also provided in Survey Editor

.pev file – EMIGMA V6 format



Merge Datasets

Data Sets Merge

Surveys in Project:

- Line 7E All
- nov05_L9E
- nov04_L9E
- Line 9E_All
- Measured Time
- nov05_L11E
- nov06_L11E
- Line 11E all
- Line 11E all edit
- nov07_L13E
- Measured Time
- Line3E_L5e All
- Line3E_L5e L7E All
- Line3E_L5e L7E L9E All
- Line3E_L5e,L7E,L9E,L11E All
- Line3E_L5e,L7E,L9E,L11E,L13E All
- Line3E_L5e,L7E,L9E,L11E,L13E All_edit
- Line3E_L5e,L7E,L9E,L11E,L13E All_tx_Av
- Line3E_L5e,L7E,L9E,L11E,L13E All_tx_Av
- East Lines CP Avg
- East Lines CP Avg Basis

Show Only Measured

Data Set 1: Line 9E_All/Measured Time (+S)
Number of Profiles: 1 Simulated Attached

Data Set 2: nov07_L13E/Measured Time (+S)
Number of Profiles: 1 Simulated Attached

Result Data Set

Profile Order

Keep data in separate profiles

Merge data into one profile

Set Profile Link Table

Keep locations separate

Sort Locations by

Survey Name: Line 9E_All

Data Set Name: Measured Time

Domain Type: Time

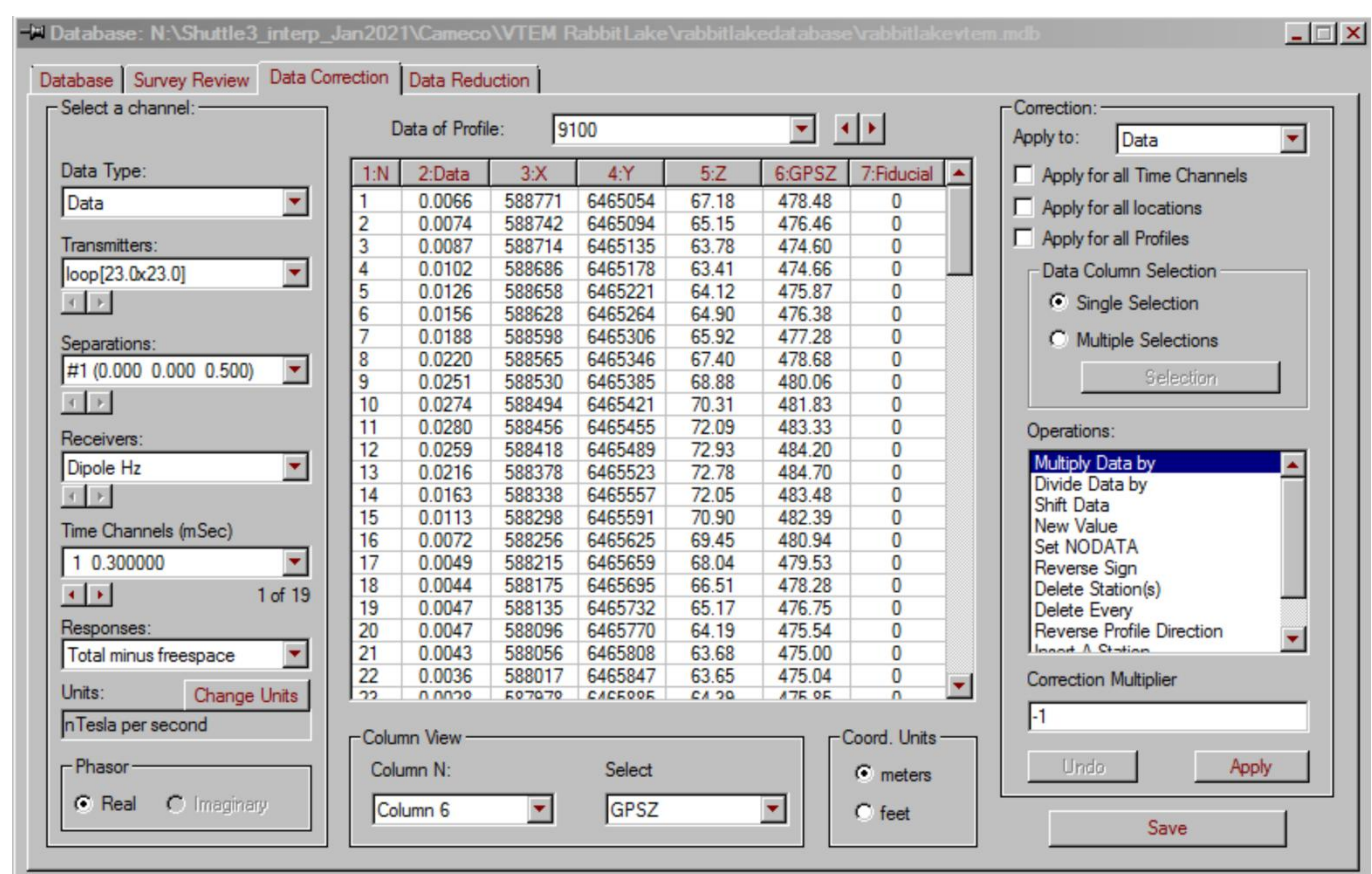
Data Set Type: Measured

Merge Exit Help

Merging: In some cases, individual parts of a survey are imported and sometimes processed before merging. If receiving survey data daily, one can import and process daily and merge later.

Similarly, if you wish to invert only sub-portions of a survey, you may merge the results later.

Data Correction



Some features:

Remove a receiver

Multiply or Shift data values

Insert new data values

Coordinate editing including GPS Z and FID

Display statistics information

Column View

defines the columns that are displayed.
Select a channel:
Select the Data Type, Transmitter, Receiver, Time Channel or Frequency, Response and Phasor of the data to correct

Correction Apply to

You can choose to apply to some or
-all time channels
-all locations
-all profiles

Operation Examples

Select From
-Multiply Data
-Shift Data
-New Value
-Delete Points
-Delete Every
-Delete Frequency
-Delete Transmitter

-Divide Data
-Set NODATA
-Reverse Sign
-Reverse Profile Direction
-Delete Time Channel
-Delete Receiver
-Delete Separation

Once you are satisfied with your corrections, select **Save**.

Data Reduction

Database: N:\Shuttle3_interp_Jan2021\RockGeo\March 2022 IP data\IronRock_IP_db\IronRock_IP.mdb

Database | Survey Review | Data Correction | Data Reduction

First Data Set: Measured Time

Second Data Set: target

Type Data Set: Measured

Type Data Set: Simulated

Fields: Total

Fields: Total, Incident, Freespace

Create Processed Data Set in the current Survey

Operation: Field Subtraction

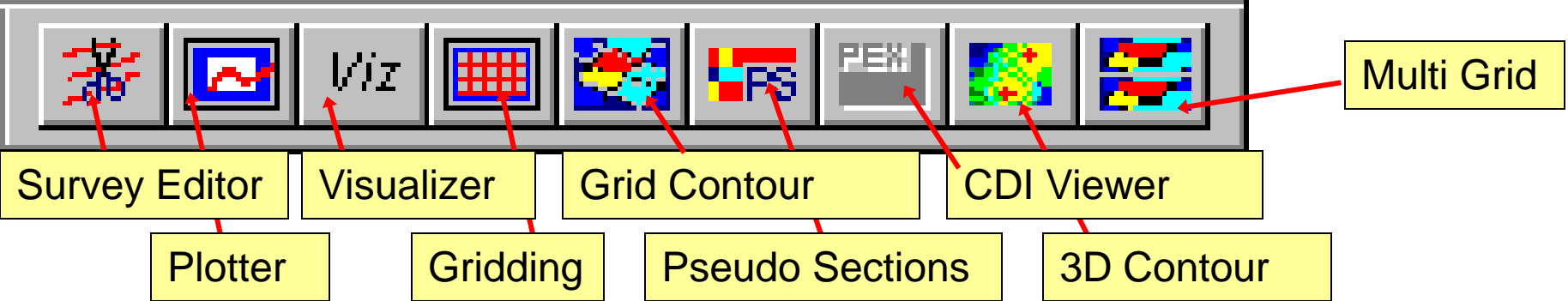
Result Field: Total minus freespace

Apply

This application allows the generation of results associated with simulations. For example, you could add the results of two models or you can remove model results from data to view the residual more accurately.

Once you are satisfied with your corrections, select **Apply**.

Accessing Data - Display Tools



Data Display Tools:

3D Visualizer State-of-the-art 3D Visualization and model building tool for viewing your data (measured, modelled and inverted) in 3D space, as profiles, vectors, true 3D surfaces or contoured surface with your 3D structure representation. Allows detailed analyses of anomaly position, shape and amplitude. View up to three data channels. Plot data from multiple models against each other or against field data. Step between models.

Viewing inversion grids and 3D Euler solutions

Gridding Creates a grid using one of a variety of interpolation techniques. The resulting grid can be viewed in the Grid Contour, MultiGrid and EM Contour tools.

Plotter Comprehensive XY Plotter for plotting your data, decays, positions and fiducials. Automated plotting. Plot to scale, multiple plots per page and save plotting defaults for rapid plotting of model suites.

3D Contour Display gridded data as a 3D surface. 3D volume contours of your 1D and 3D inversions with

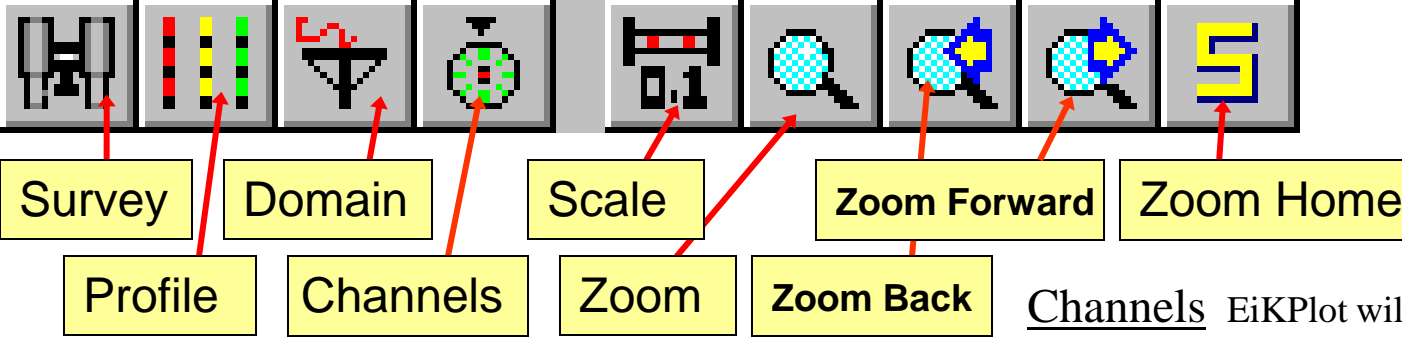
section cutting tools. **Grid Contour** Display the data from grids created with the gridding tool. With graphical tools to view data positions and values. Contouring, map Underlays, , make a registered map

Multi Grid Display up to four grids at the same time.

Pseudo Sections Display a pseudo section by plotting data versus frequency, time or separation depending on the type of data.

CDI Viewer Display data sets created with 1D Inversion and CDI processor.

Survey Editor Graphically view data and edit the locations and transmitters in the survey. Delete stations, lines or sections of survey. Display data point by point, map underlays, map construction, underlay models, edit transmitter locations, etc



2D Plotter

Survey Allows you to choose multiple data sets to plot

Profile Allow you to select a single profile to plot when you have multiple profiles. The Profile Selection window will open automatically. Either select the profile you would like to plot or select multiple profiles to look at all of the profiles.

Domain Allows you to switch between the normal profile display and a decay or spectrum display or to switch between electric and magnetic fields if contained in the same survey.

Channels EiKPlot will generally display your data plot automatically. To modify the data channels plotted, select the channels button, or simply double click on the white space inside the plot. Click on the first white box under Plot #. Click on the yellow question mark under field. Select the fields you would like to plot. Select measured or simulated data. Use fields available to view data contained in the file, and select from the X, Y, Z or total fields.

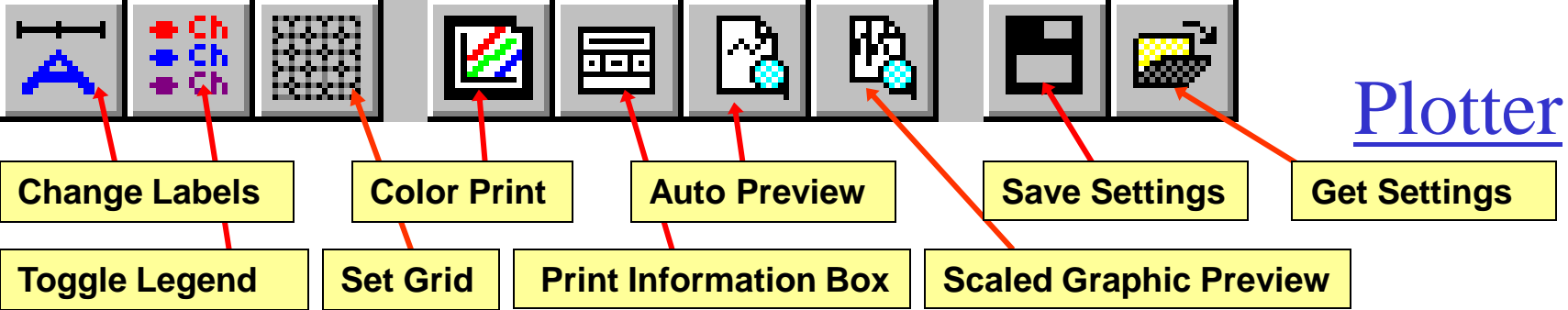
Scale Allows you to adjust the maximum and minimum settings for the X and/or Y axis. You can also adjust the units from fixed to exponential and change the axis to log scale or descending. Select the Scale button, or double click on the axis you would like to rescale.

Zoom To zoom in on your data, select the zoom button and click and drag to select the area you would like to zoom in on.

Zoom Forward Zooms in to the next available zoom level.

Zoom Back Zooms out to the previous zoom level.

Zoom Home Auto scales the plot using all positions on the profile.



Change Labels Title and axis labels can be adjusted. Their font size can also be adjusted.

Toggle Legend Turns the legend on or off.

Set Grid Turns grid on or off. The grid spacing is determined by the increment of each axis.

Color Print When selected, the plot will be printed in colour, otherwise, the plot will be printed in black and white.

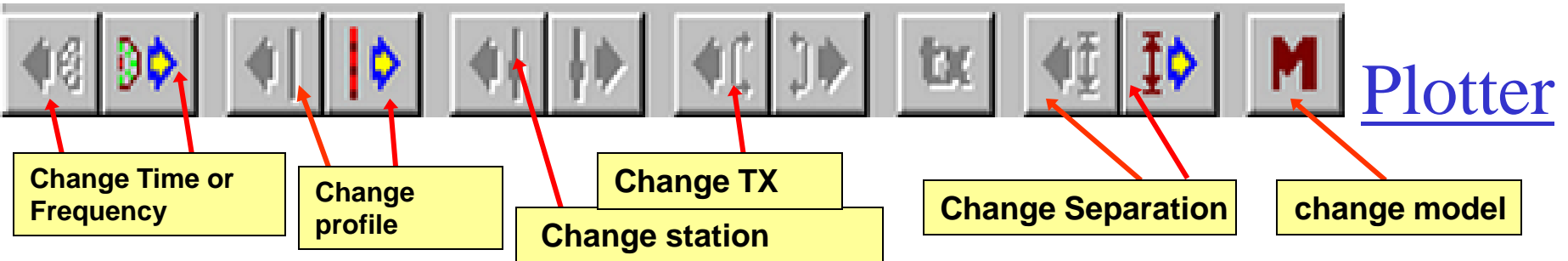
Print Information Box Adds a box of user defined information to your hardcopy.

Auto Preview Displays a preview of the hardcopy.

Scaled Graphic Preview Displays a preview of the hardcopy with a user defined scale.

Save Settings Allows you to save the defaults of your plot as a .plt file.

Get Settings You can then get the default setting files the next time you open this file, or any other model that has the same Tx-Rx configuration. This allows for rapid plotting of a number of models. For example, you could run a suite of models in batch mode, adjusting your layered earth, target positions, conductivity or size. Then plot the first model and save the default settings. Then open the next file and simply get the .plt files. The graph will be plotted for you automatically.



Change Time or Frequency If A/C data, steps between time windows or frequencies

Change Profile Steps up and down the profile list

Change station: When in decay, separation, or spectrum display, steps up and down the stations

Change TX If the survey contains multiple surveys, then steps between transmitters

Change Separation: If the survey, is a moving system where TX and RX move together and if there are multiple separations between TX and RX, then this steps between separations

Models: If you have loaded multiple models with your data, and data and simulated data are both displayed in the plotter, then you may step between models to provide a rapid visual analyzer of model to data comparisons.

3D Visualization



3D Visualizer

Print

Toggle Anomalies

Insert Prism

Import model

Toggle Layers

Toggle Data

Toggle Profiles

Copy Prism

Split Layer

Toggle TX

Print Prints image in 3D visualizer using your windows print driver. The background will be printed white. The image can also be saved to a 3D .pdf by selecting File and then Save Image

Toggle Layers Turns layer display on when pressed and off when released.

Toggle Anomalies Turns anomaly display on when pressed and off when released.

Toggle Data Turns data display on when pressed and off when released.

Toggle Profiles Makes profiles visible when pressed and invisible when released.

Toggle Transmitters Toggles visual display of transmitter(s)

Insert Prism Model building tool to insert an LN Prism, ILN Prism or EikPlate. Once prism is inserted you can modify its size, position, orientation and conductance with the properties interface.

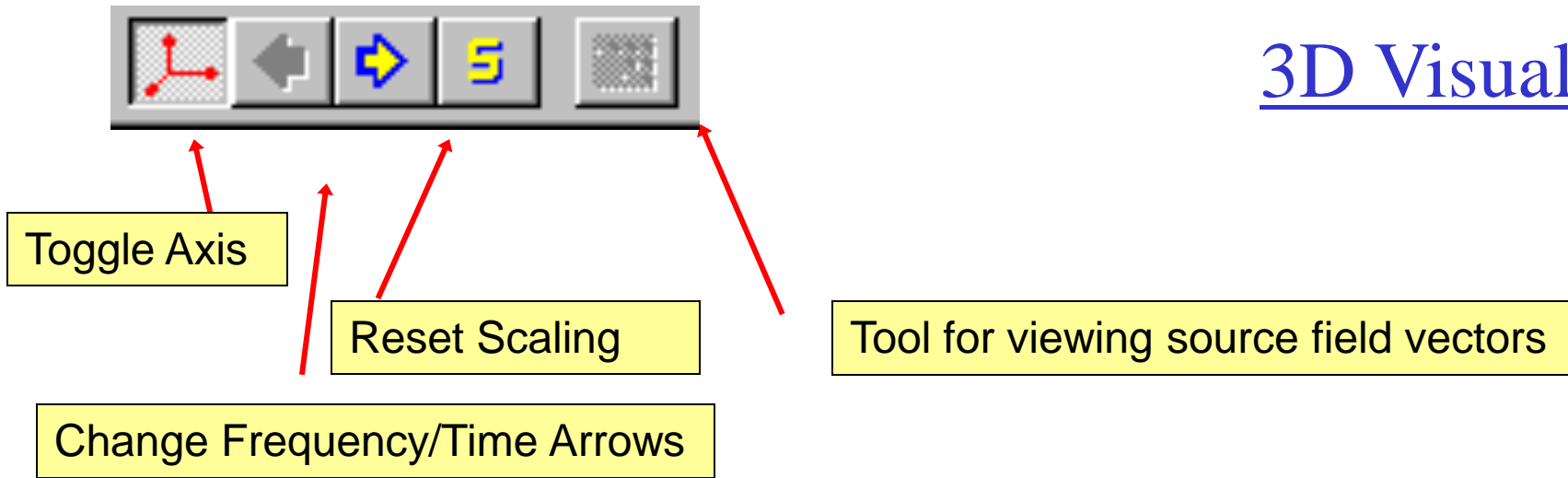
Import model Allows you to import anomalies (prisms plates or polyhedra) from another dataset in your database,

Copy Prism Creates a copy of the prism that is highlighted.

Split Layer

Splits the highlighted layer in half.

3D Visualizer



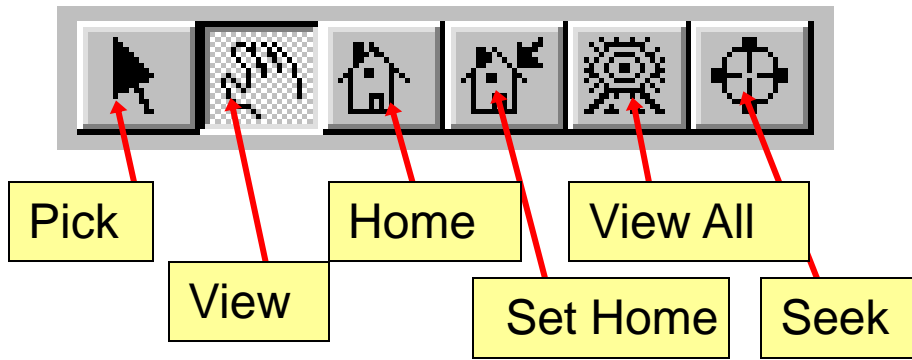
Toggle Axis Turns on axis when pressed (default). To turn display of axis off, release button.

Change Frequency or Time Windows Arrows

Allows you to step forwards and backwards through your frequencies or time channels.

Reset Scaling Auto scales your data to fit the screen

3D Visualizer



Pick Select Cursor. Use the arrow picking tool when selecting and object for modification in the Visualizer.

View Manipulate Cursor. Use the hand viewing tool when modifying the view of your model in the Visualizer, for example, when you are zooming or rotating.

Home Returns your view to the default home view.

Set Home Allows you to set a new home view,

View All Rescales your view so that the whole model can be seen on the screen

Seek Allows you to seek, or select a position, and then centres that position on the screen.

Save to Database

When you have finished defining your model,
Save to Database



Show data

3D Visualizer

Select Data

Measured Data Simulated Data

Measured Static base7

Data Type: Data

Response: Total

Phasor: STATIC

Transmitter: BEARTH

Receiver: BDIPOLE

Separation: []

Scale: [] Const Auto

Rx Comp & Projection

X 3D Vector

Y X Direction

Z Y Direction

T Z Direction

Show Surface

Gradient:

App Resistivity

Chargeability

Derivative

MT Settings

Zxx Zxy Tx

Zyx Zyy Ty

Rotation: [0] Apply

Plot data for

Data Set 1

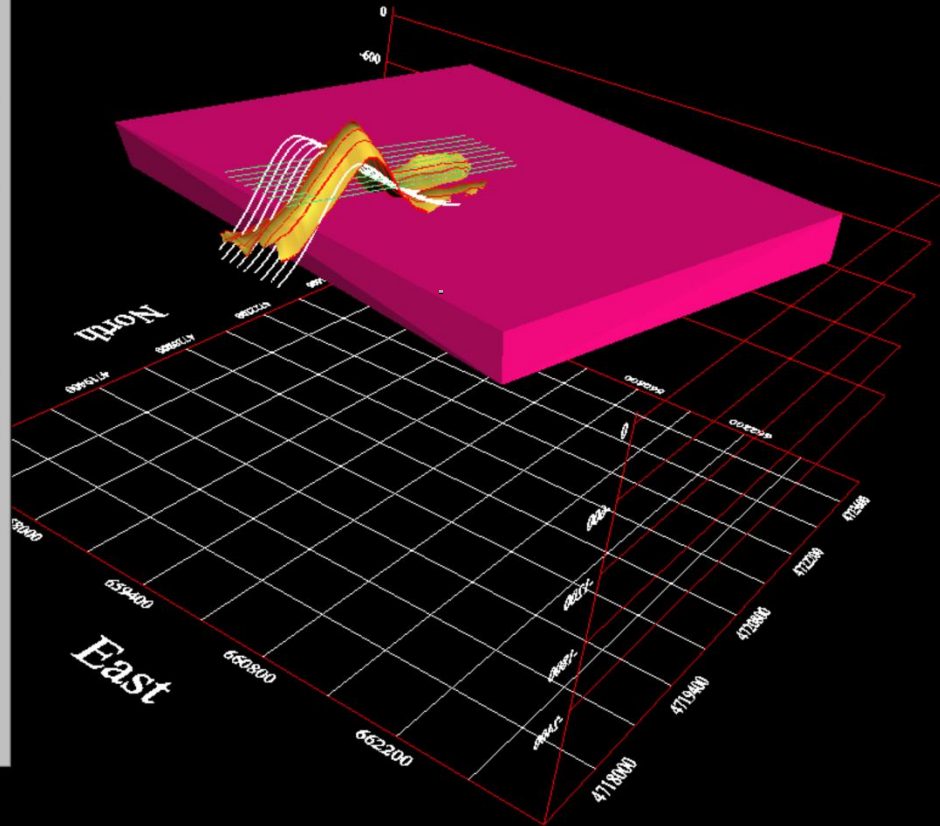
Data Set 2

Data Set 3 (Data Set 1 - Data Set 2)

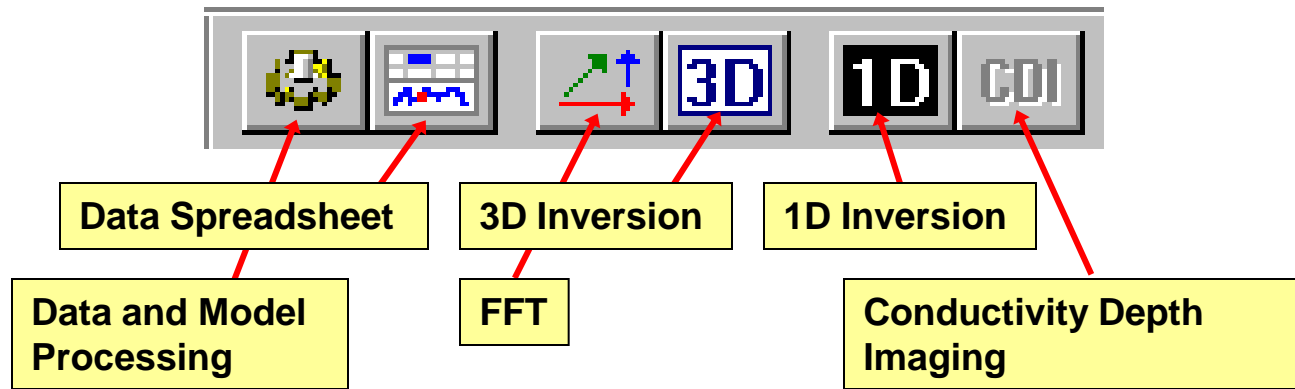
Change settings for

Data Set 1

Data Set 2



Processing Tools



Data Spreadsheet Plot and correct data. Features trend removal and tie-line corrections. Note, the tie line corrections in QCTool are much better than those in EMIGMA

Data and Model Processing

A large suite of tools including filtering, gradient removal, sorting, data decimation, profile merging, coordinate translation, converting units, averaging duplicates, rotate vector data, merging and sorting profiles, etc. As well, inversion model processing and exports.

FFT A series of FFT and DFT tools for potential fields processing, such as derivative, upward/downward continuous, wave length filtering, RTP

Conductivity Depth Imaging

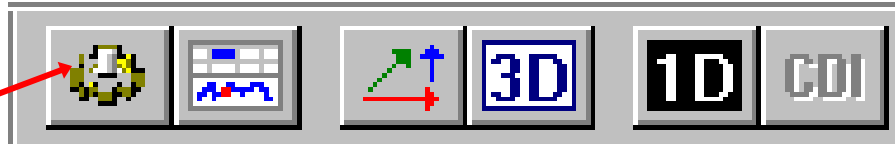
Apparent Resistivity Inversions and Apparent Depth sections of your EM data.

1D Inversion 1D Inversions of your multi-line FEM, TEM, Resistivity, MT and CSEM data. Generates 3D volume models which can be viewed in the Contour tool with section cutting capabilities.

3D Inversion Full 3D inversions of your magnetic, gravity, CSEM and resistivity data. Generate 3D volume models which can be viewed in the Visualizer with section cutting capabilities.

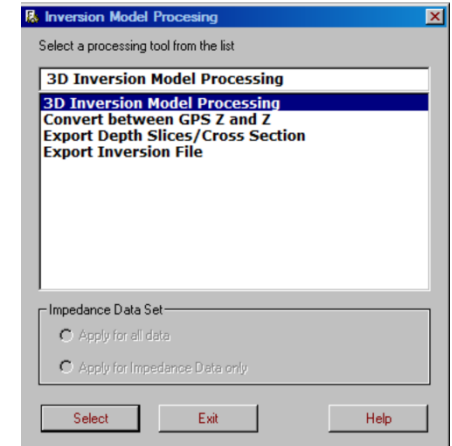
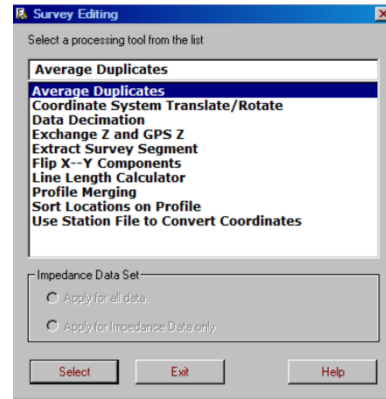
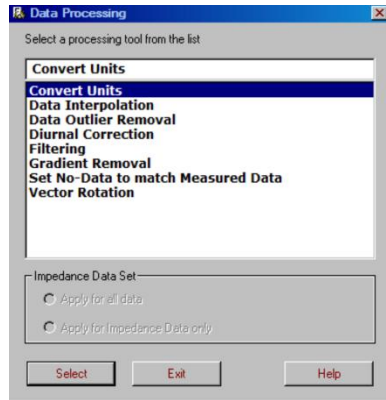
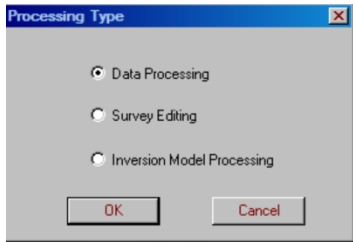
Includes Euler solutions, Werner solutions and inversion for magnetization vectors.

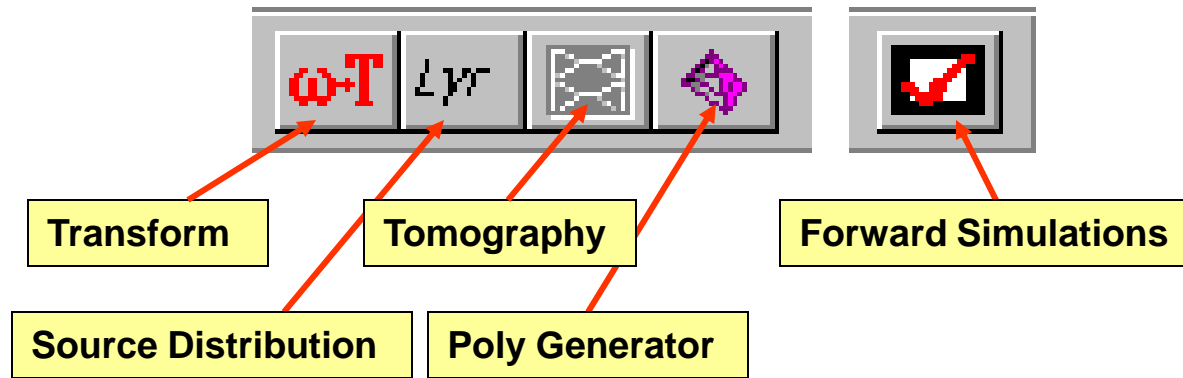
Data and Model Processing



Data and Model Processing

A large suite of tools including filtering, gradient removal, sorting, data decimation, profile merging, coordinate translation, converting units, averaging duplicates, rotate vector data, merging and sorting profiles, etc. As well, inversion model processing and exports.





Transform Time domain surveys are first simulated in then Frequency domain and then automatically transformed to time domain in EMIGMA. For manual transformation users can generate the frequency domain response and then run the Transform tool.

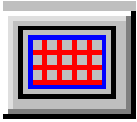
Tomography Cross-hole EM and IP tomography tool for licensed clients only.

Forward Simulations Performs simulation of a model or models

Poly Generator Creates various geometric shapes for models that can be later simulated including topography models

Source Distribution Generates a set of vectors describing the EM field of the transmitter that can be viewed in the visualizer.

Gridding



Gridding – EMIGMA grids can contain multiple data

Before contouring your data you need to grid your data first. Select your dataset and then select the Gridding button.

The screenshot shows the '3D interpolation' dialog box with the following settings:

- Data:** Survey Bounds. Data Number: 127124, Min X: 332000, Min Y: 6072621, Min Z: 34.526298, Profile Number: 31, Max X: 342000, Max Y: 6078632, Max Z: 123.61419.
- Interpolation:** Select Data: Data, GPSZ, Z. Select Components: 1. Tx - LOOP Rx - Hx Sep(0.0 0.0 0.5), 2. Tx - LOOP Rx - Hz Sep(0.0 0.0 0.5). All Components is checked. Responses: Total - Freespace.
- Method:** Natural Neighbour.
- Max Iteration:** 0. **Resolution factor:** 1000.
- Derivative Information:** Set to zero (selected), Estimate, Use Input, dX, dY, dZ (unchecked).
- Grid:** Grid Setting, Load Grid, Z - level: 49.02.
- Remove Extrapolated Points:** Checked. Spatial Radius: 152.45. Slow (unchecked), Fast (selected).

Buttons at the bottom: INTERPOLATE, Cancel, Help.

Select Data and Components

Method Select your gridding algorithm from the list: Natural Neighbour, Delauney Triangulation, Thin Plate Spline or Minimum Curvature. Select Grid Settings to define your grid.

Load Grid Copies the settings from an existing grid

Remove Extrapolated Points With this option activated, a grid point will not be included if no data can be found within a specified spatial radius.

Profile Viewer

Activated by clicking the Grid Setting button on the Gridding tool's main page. Displays your profiles and allows you to define the parameters of your grid.

You can control the X and Y orientation and whether the extreme points of your profile are shown.

Input Bounds You can use the whole survey for the input bounds or you can adjust the boundaries, either through the interface, or by clicking and dragging the blue input box. Controls also provided to set the grid angle. If you make an error, you can reset the grid.

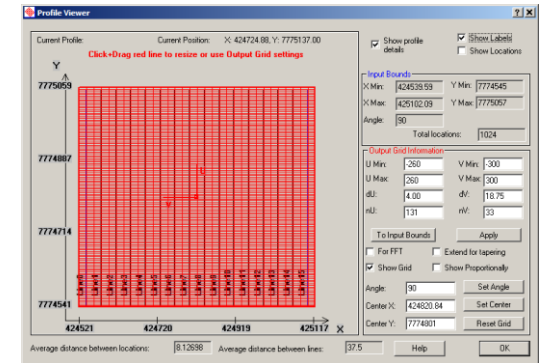
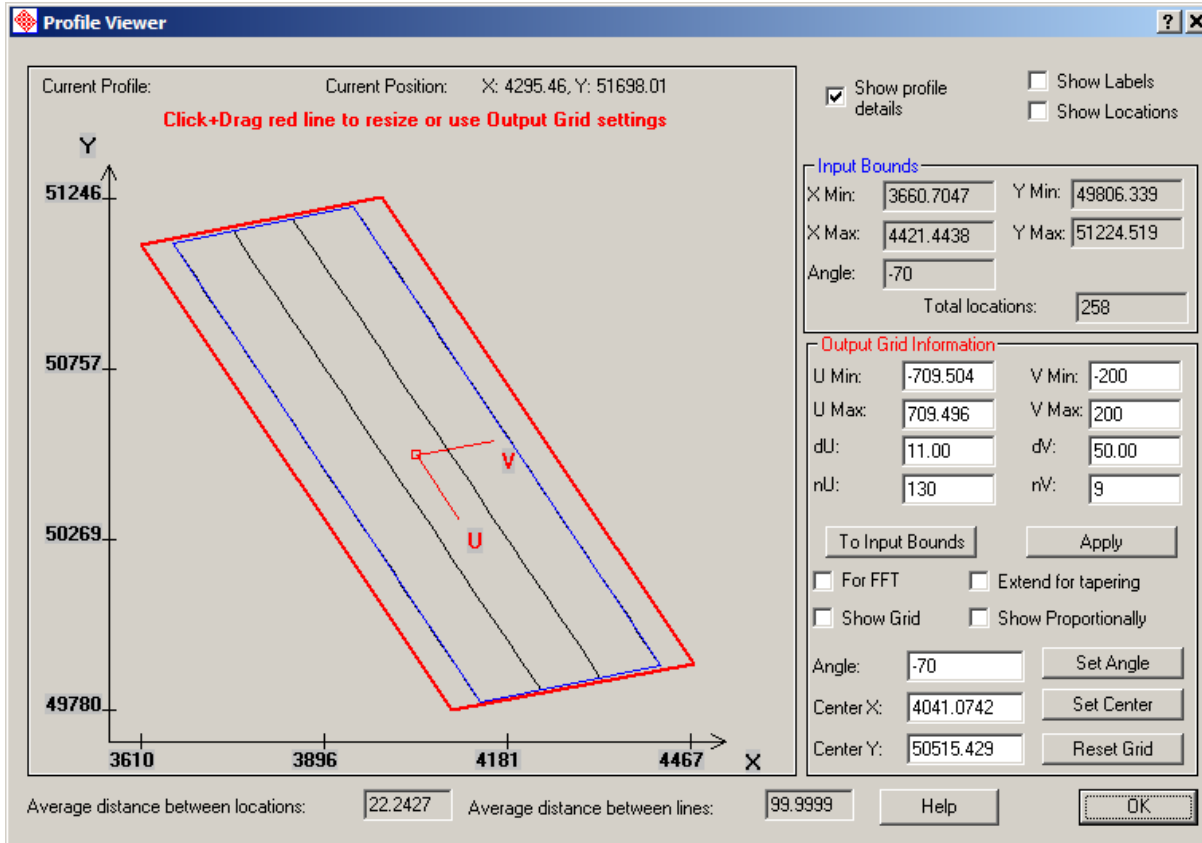
Gridding

Output Grid Likewise you can set the output grid by defining the U and V Minimum and Maximum (where U is the output X and V is the output Y), or by clicking and dragging the red output box (can be superimposed with the blue box). To define the grid resolution, set the width of the grid cells in the X and Y directions by setting dU and dV or set the number of grid cells by defining nU and nV.

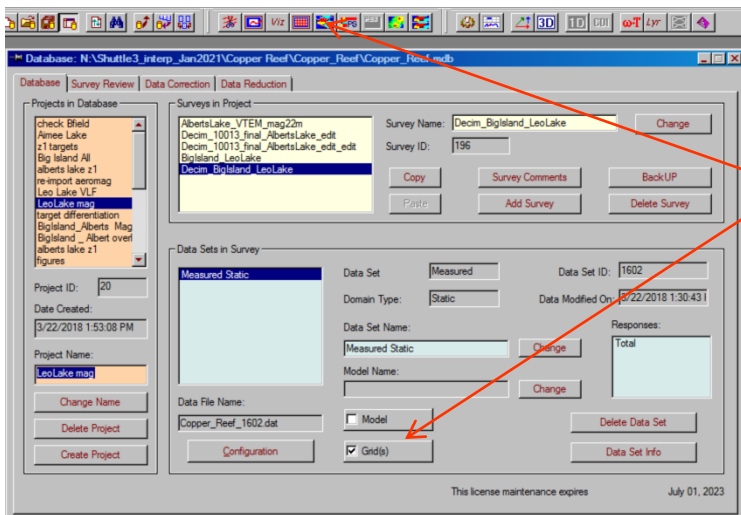
To display the grid, turn on Show Grid. The grid will be auto scaled to fit the screen. To display the grid proportionally, use the Show Proportionally.

Use For FFT to customize the grid for use with the FFT tool.

You can also set the angle, centre X and centre Y. If you make a mistake use the reset grid button.

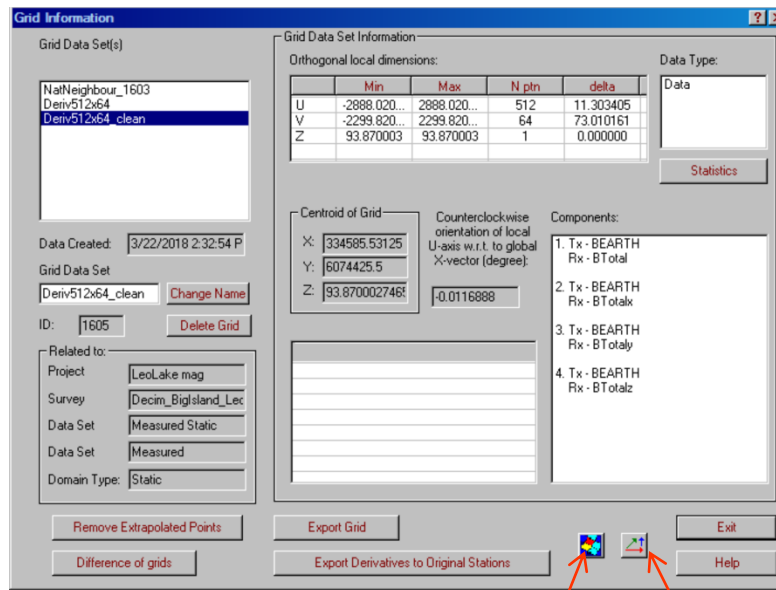


Gridding and Mapping



Grid Storage

All grids are stored to the subdirectory /GridData, linked to the database and can be viewed either through the “Grids” interface or opening GridContour.



Grid Information

Selecting Grids opens the Grid Information dialogue. This lists the grids available for the particular data set and the contents and characteristics of the grid.

Remove Extrapolated Points: deletes extrapolated vertices

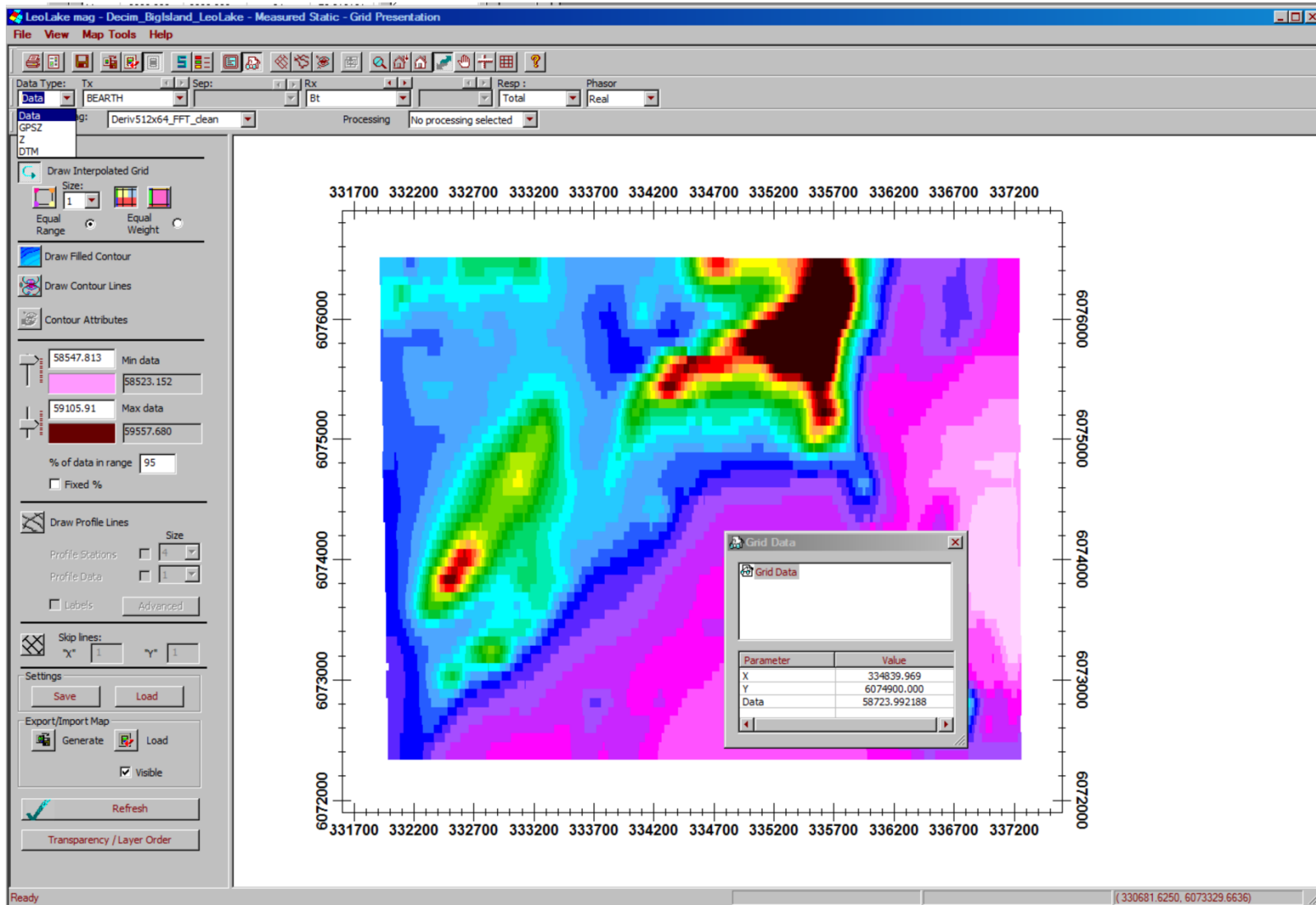
Difference of grids: Allows the subtraction of one grid from another. For example, to remove deep structure from the origin data grid

Export Grid: exports out of the database to other formats

Export Derivatives to Original Stations: creates a new dataset containing the derivatives at the original stations.

Open Grid in Mapping Tool Perform FFT

Grid Presentation Tools



This grid contains Btotal, dB/dx, dB/dy, dB/dz, GPSZ and altimeter data(Z) and calculated Digital Terrain Model. Initially, grid is not interpolated

Technical Documents Included on your EMIGMA CD-ROM is a suite of tutorials, presentations, technical abstracts and manuals. Most of these materials will be copied to your machine during installation.

*.\EMIGMA\Documents

\Manual

\Tutorials

\Technical

These files are also available by clicking on the Downloads page at <http://www.petroseikon.com/resources/index.php>

Technical Support

Support Department

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Feedback Your comments and feedback are always welcome and are helpful in making a better product for all users.

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