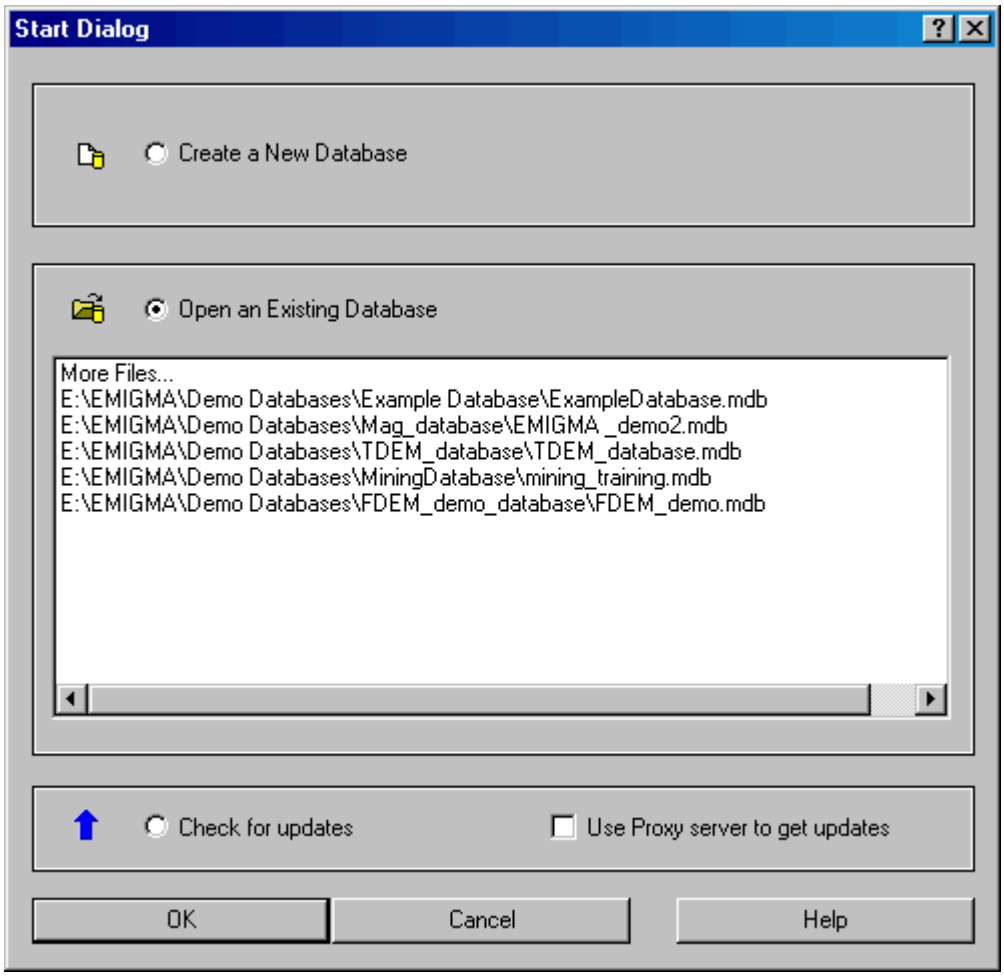
EMIGMA V10.x –教程 Tutorial

EMIGMA 中的正演建模 Forward Modelling in EMIGMA

入门 Getting Started

`Start -> Programs -> EMIGMA 10 -> EMIGMA 10`

创建新数据库 - 选择创建新数据库
To **Create a New Database** - Select **`Create a New Database,`**
浏览保存新数据库文件的路径并为其命名
Browse for the path to save your new database file and give it a name.



要打开现有数据库 -
选择打开现有数据库，然后从列表中选择您的数据库或通过选择更多文件…浏览您的数据库文件。
To **Open an Existing Database** - Select **`Open an Existing Database`** and either choose your database from the list or browse for your database file by selecting **`More Files`**….

创建或访问调查　　Creating or Accessing a Survey

要执行建模，您必须在数据库中构建调查。 创建调查时，EMIGMA 将所有必需的参数存储在数据库中。
因此， 一旦创建，用户不再需要指定数据系统或调查配置。 此外， 根据调查参数，EMIGMA
知道要使用哪种算法。
To perform modeling, you must have a survey constructed in your database. When creating a survey, EMIGMA stores all of the required parameters inside the database. Thus, once created, the user no longer needs to specify the data system or the survey configuration. Additionally, depending on the survey parameters, EMIGMA knows which algorithms to use.

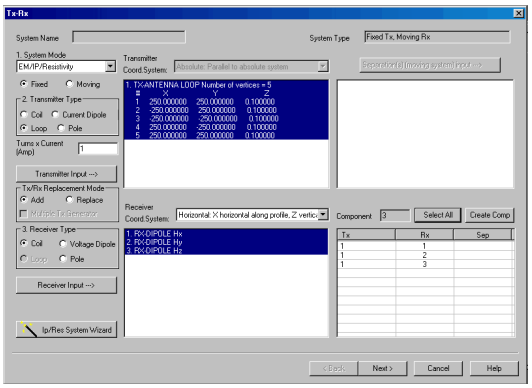
您可以通过多种方式创建调查。
如果您打开一个数据库，那么您可能已经有许多可用的调查，并且可以直接使用或修改它们。
您可以创建一个全新的假设调查，或者您可以导入数据并通过导入过程定义调查并将其保存到数据库中。
You may create a survey in a number of ways. If you open a database, then you may have numerous surveys already available and they can be used directly or modified. You may create an entirely new hypothetical survey or you may import data and through the import process, the survey is defined and saved to the database.

<u>创建一个新的综合调查。　　Create A New Synthetic Survey</u>.

在现有项目中，选择添加调查，然后选择系统模式
In an existing project, select Add Survey, then select the System Mode

EM/IP/Resistivity
Gravity
Magnetics
MT
MMR
CSAMT (with 3D source)
Land CSEM
ZTEM
VLF or VLF-R

根据系统模式，允许使用某些类型的发射器和接收器，并且根据系统模式 – 允许固定发射器或移动 Tx-Rx
Depending upon the System Mode, certain types of transmitter and receivers are allowed and depending upon the System Mode – Fixed Transmitter or a Moving Tx-Rx is allowed



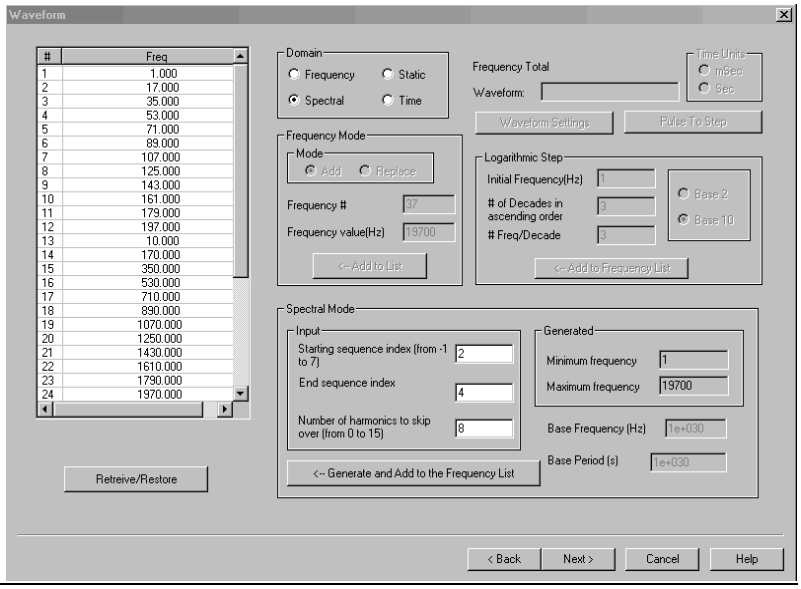
变送器类型　　Transmitter Types
Coil –使用电或磁的点源
a point source is used which is either electric or magnetic
Loop –闭环　　closed loop
Current Dipole –选定长度和几何形状的线电流源
wire current source of selected length and geometry
Pole – for IP or Resistivity –
在选定的距离和位置处具有返回极点的点源
point source with a return pole at a selected distance and location

接收器类型　　Receiver Types
Coil –使用电或磁点接收器　　a point receiver is used which is either electric or magnetic
Voltage Dipole –如果在导电材料中，则带有接地端的电流线
a current wire with grounded ends if in conductive material
Pole – for IP or Resistivity –在选定的距离和位置处带有杆的点接收器
a point receiver with a pole at a selected distance and location

匹配 Tx、Rx 和间隔（如果定义了移动系统。对于某些测量，并非所有发射器都具有所有接收器
Matching Tx's, Rx's and separations (if a moving system are then defined. For some surveys not all transmitters have all receivers.

Click **Next>**

波形选择 ***Waveform Selection***



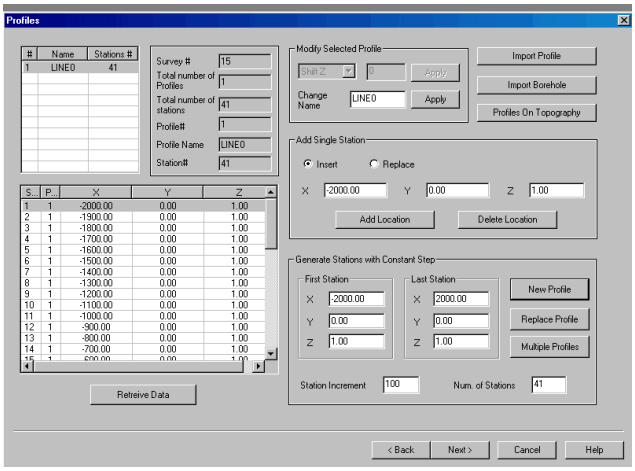
您将在此处选择是要计算频域模型、静态 (DC) **模型**还是时域调查。
Here you will select whether you wish to calculate a Frequency Domain model, a static (DC) model or a Time Domain survey.

如果选择时域，您必须首先指定一个频谱调查，该调查将计算必要的频率来计算您的时域模型，这取决于基频和所需的上带宽。（**参**见转换手册）
If selecting Time Domain you must first specify a spectral survey which will compute the necessary frequencies to compute your time domain model which depends upon base frequency and the desired upper bandwidth. (*see Transform manual*)

Click **Next>**

配置文件选择 ***Profiles Selection***

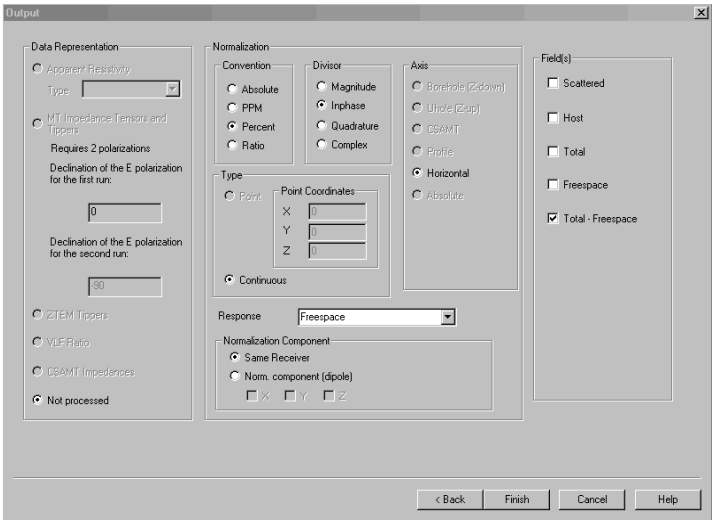
现在您将被要求创建组织成配置文件的数据站。
您可以创建个人配置文件或使用多配置文件界面来选择整个调查网格。Now you will be requested to create your data stations organized into Profiles. You may create individual profiles or utilize the Multiple Profile interface to select an entire survey grid.



有专门的工具可以导入剖面图或钻孔。 There are specialized tools for importing profiles or boreholes.
Click **Next>**

输出选择 *Output Selection*

现在将要求您选择所需的输出类型
Now you will be requested to select the type of output that you require.



上例中是标准偶极-**偶极移**动阵列的选择。 这里的数据将归一化为主场的同相并以百分比为单位进行计算。 输出字段是 Total-Freespace，标准化是连续的（在每个数据点），并且归一化到与数据相同的组件的自由空间。
In the example above is the selections for a standard dipole-dipole moving array. Here the data is to be normalized to the Inphase of the primary field and computed in units of Percent. The output fields are Total-Freespace and the normalization is Continuous (at each data point) and to the freespace of the same component as the data.

此选择对于可以计算所有字段的建模很重要。
This selection is important for modeling where all of the Field(s) can be computed.

特殊数据表示由计算自动提供
Special **Data Representation** are provided by computation automatically

Magnetotelluric Impedances and Tippers
ZTEM Tippers
CSAMT impedances
VLF ratios

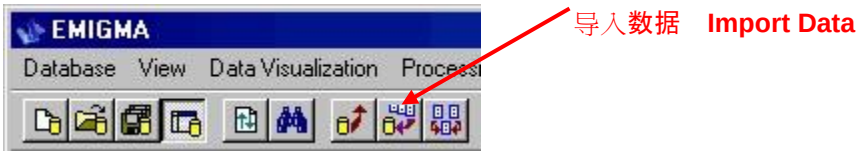
在 Spectral Surveys **的特殊情况下，不允**许选择。 该软件会自动计算任何类型的 TEM **数据（无**论是磁数据还是电数据）可能需要的所有响应。
In the special case of Spectral Surveys, no selection is allowed. The software automatically computes all response that may be required for any type of TEM data whether magnetic or electric.

Click **Finish >**

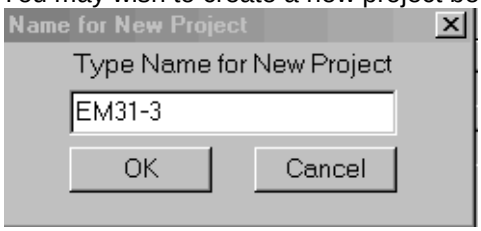
现在，您将进入模型选择。
This now takes you to the model selection.

See **ModelGui**

导入数据 Importing Data

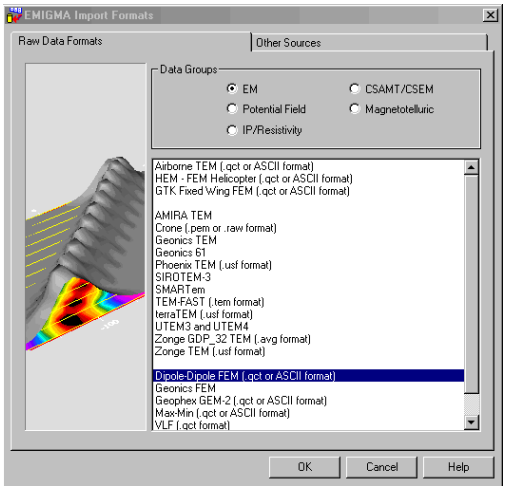


您可能希望在导入之前创建一个新项目
You may wish to create a new project before importing.



Click **OK**

从数据组中选择要从结果列表中导入的数据类型
Select from the **Data Groups** the type of data you want to import from the resulting list.
在这里，我们将以 EM31-3 **数据**为例
Here, we will utilize EM31-3 data as an example.



Click **OK**

按照出现的页面上的步骤进行操作。
使用"帮助"按钮来指导您。
Follow the steps on the pages that appear.
Use the HELP button to guide you.

数据库组织 Database Organization

组织 Organization

多个数据集、模型、反演、网格等可以包含在一个数据库文件中。
提供了多个组织级别，允许根据用户的偏好使用各种组织标准。
例如，用户可以通过解释项目、数据类型来组织，或者简单地将所有数据和项目组织在一个数据库文件中。
用户可以在单个项目（数据库文件中的一个组织级别）中组织多个数据集，以便更容易地分析不同的数据类型和数据类型之间的模型集成。

Multiple datasets, models, inversions, grids, etc. 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 database file. 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.

数据库中有三个层次的组织 There are three levels of organization in the Database:

1) 数据库中的项目 Projects in Database
2) 项目调查 Surveys in Project
3) 调查中的数据集 - 测量、模拟和反演数据集位于此处。Data Sets in Surveys - measured, simulated and inversion data sets sit here.

您可以更改任何项目、调查或数据集的名称，也可以删除任何项目、调查或数据集。
You can change the name of any Project, Survey or Data Set and you can also delete any Project, Survey or Data Set.

配置 Configuration

可以查看和修改配置文件、频率/波形、发射器/接收器和输出部分中的大部分测量属性。
Most properties of the Survey that are in the profile, frequency/waveform, transmitter/receiver and Output sections can be viewed and modified.

模型 Model

棱镜/板/多面体和层部分可以在这里访问和修改。
The Prisms/Plates/Polyhedra and Layers sections can be accessed here and modified.

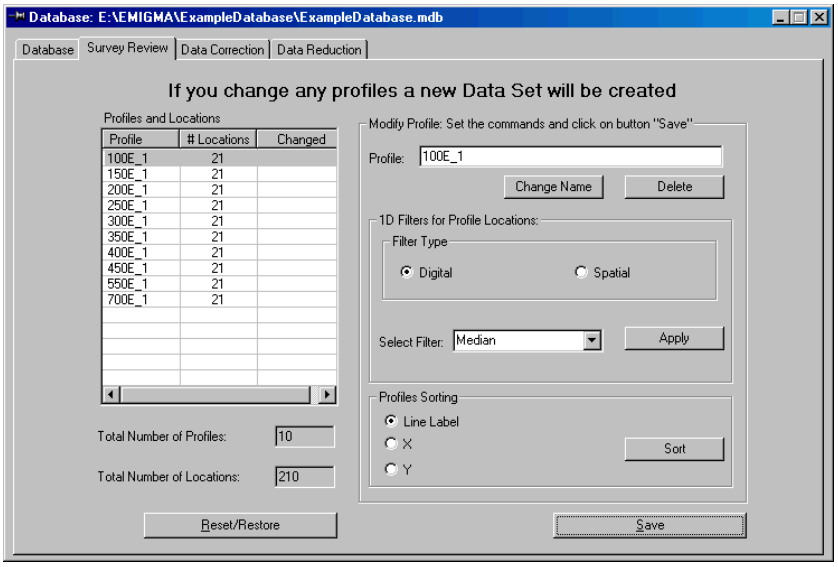
网格 Grids

查看附加到数据集的网格。 将网格导出为不同的格式。 也可以在网格上执行某些类型的处理。
View the grids that are attached to data sets. Export the grids to different formats. It also possible to perform some types of processing on grids.

调查审查页面 Survey Review Page

选择配置文件
使用光标选择一个或多个配置文件。
按住 shift 键可选择多个配置文件。
选定的个人资料
将出现在“修改配置文件”框中。

。Selecting profiles
Use your cursor to select a profile or multiple profiles. Hold down the shift key to select multiple profiles. Selected profile(s) will appear in the Modify Profile box.



配置文件排序： **Profile Sorting:**
如果您的配置文件以非连续顺序导入，您可以按行标签、X 或 Y 位置对配置文件进行排序。
If your profiles are imported in a non-sequential order, you may Sort the profiles by Line label, X or Y position. CLICK SORT.

重置/恢复： **Reset/Restore:**
如果您进行了要撤消的更改，则可以恢复原始配置文件
If you make a change that you want to undo, you can restore your original profiles.

删除配置文件： **Deleting a Profile:**
选择一个或多个配置文件并选择删除按钮
Select one or more profiles and select the **`Delete`** button

更改配置文件名称： **Changing a Profile Name:**
如果您对与配置文件关联的标签不满意，请从列表中选择它，输入新名称并单击更改名称
If you are not happy with the label associated with a profile, select it from the list, enter a new name and click **Change Name**

配置文件位置的 1D 过滤器： **1D Filters for Profile Locations:**
配置文件的位置可以通过过滤器发送以调整位置。 有许多不同的数字和空间滤波器可供使用。
这尤其适用于拖曳测量
The locations of a profile can be sent through a filter to adjust the location positions. A number of different digital and spatial filters are available. This is particularly for towed surveys.

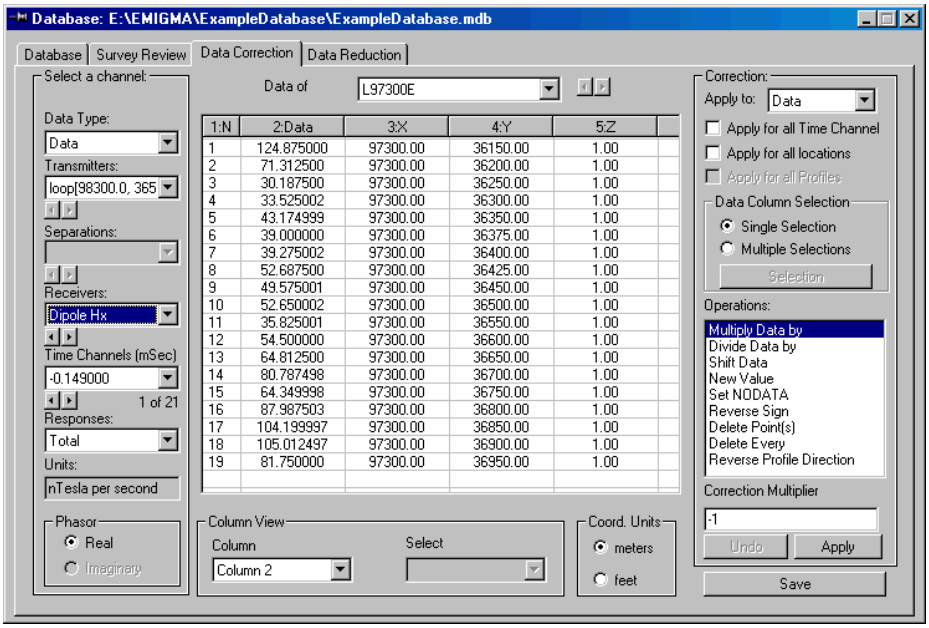
数据修正页面 Data Correction Page

数据校正页面允许您编辑数据值以及 X、Y、Z、GPSZ 和 FID 值。
The Data Correction Page allows you to edit the data values as well as the X, Y, Z, GPSZ and FID values.

列视图 **Column View**
定义显示在该视图中的列。
defines the columns that are displayed in this view.

选择数据通道：
To select a data channel:
选择要校正的数据类型、
发射器、接收器、时间通道或频率、
响应和相量
Select the Data Type, Transmitter, Receiver, Time Channel or Frequency, Response and Phasor of the data to correct

更正：选择哪一列
Correction: Select which column
适用于： **Apply to:**
您可以选择申请部分或全部
-时间频道/频率-**位置** -**个人**资料
You can choose to apply to some or all
-time channels/frequencies, locations,-profiles



Data Column Selection
When “Multiple Selections” is chosen, the changes will apply to only the specified channels

操作： **Operations:**

选择自
-**乘以数据** -删除频率
-**划分数据** -删除接收器
-**班次**资料-删除变送器
-**新**值 -删除分隔
-设置NODATA -删除时间通道
-**反**转符号 -删除错误通道
-删除点 -删除每个
- **反**转剖面方向

Select From
-Multiply Data
-Divide Data
-Shift Data
-New Value
-Set NODATA
-Reverse Sign
-Delete Points
- Reverse profile direction
-Delete Frequency
-Delete Receiver
-Delete Transmitter
-Delete Separation
-Delete Time Channel
-Delete Error Channels
-Delete Every

如有必要，指定用于操作的值。
例如。 乘数据操作的修正乘数。
Specify the value used for the operation, if necessary.
E.g. **Correction Multiplier** for the **Multiply Data** operation.

Click **`Apply`**

完成后，选择保存
Once complete, select **`Save`**

EMIGMA 的数据库设计允许所有工具完全集成并共享/访问数据库中的数据。 因此，无需打开和保存平面文件。一旦创建了数据库 .mdb 文件，也无需保存它。 EMIGMA 会随着更改不断更新 .mdb 文件。
The database design of EMIGMA allows all tools to be fully integrated and to share/access the data in the database. Thus, there is no need to open and save flat files. There is also no need to save a Database .mdb file, once it has been created. EMIGMA continuously updates the .mdb file as changes are made.

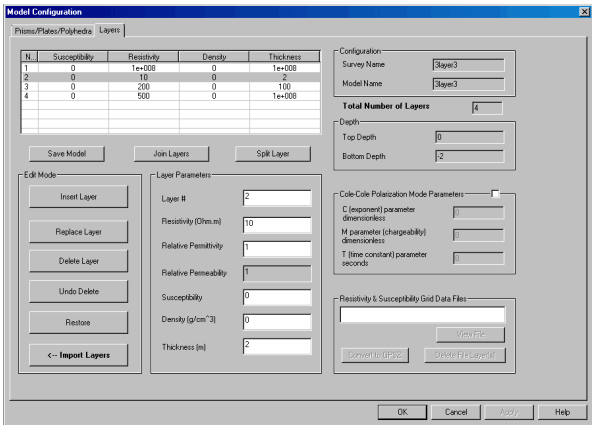
建筑模型 Model Building

EMIGMA 中几乎所有正向建模（对模型的模拟响应）都基于积分方程 (IE) 技术。
在下面的段落中，将描述大多数不同的算法。
Almost all forward modeling (simulated response to a model) in EMIGMA is based upon an Integral Equation (IE) technique. In the paragraphs below most of the various algorithms will be described.

在 EMIGMA 中有多种构建模型的方法。 最直接的方法是通过 Modelgui。
There are several ways to build models in **EMIGMA. The most direct method is through the Modelgui.**

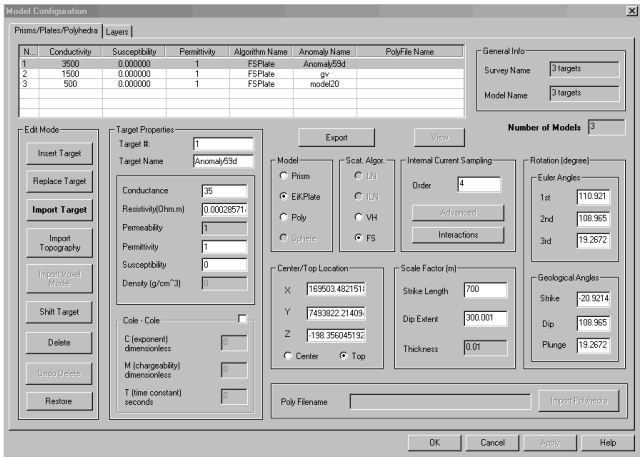
通过主数据库页面上的模型按钮访问此功能。 访问该函数时，提供了两个接口。 分层背景界面中的第一个对所有 EM 应用程序都至关重要，但可用于磁性和重力
This capability is accessed through the Model button on the main database page. When this function is accessed, two interfaces are provided. The first in the layered background interface critical to all EM applications but can be used for both magnetics and gravity.

图层 Layers



层可以定义为电阻率、厚度、介电常数、磁化率和密度。 此外，可以通过设置适用于所有 EM 建模的 Cole-Cole 参数使层可极化。
默认情况下，顶层是空气层，但可以为海洋或地下等其他应用设置合适的参数。 例如，对于海底调查，可以将顶层设置为海水的电导率。
Layers can be defined for the resistivity, thickness, electrical permittivity, magnetic susceptibility and density. Also, the layers can be made polarizable through setting Cole-Cole parameters which is applicable for all EM modeling. The top layer is an air layer by default but can be set with suitable parameters for other applications such as marine or underground. For example, for surveys on the seabed one might set the top layer to be the conductivity of sea water.

插入图层：Insert Layer: 设置所需的层数及其参数，然后 **Insert Layer**
Set the required layer number and its parameters and then **Insert Layer** into the stack.
替换图层：Replace Layer: 选择所需图层，更改其参数，然后 **Replace Layer**
Select the required layer, change its parameters and then **Replace Layer** into the stack.
删除图层：Delete Layer: ：选择需要的图层，然后删除图层
Select the required layer, and then **Delete Layer** to remove from the stack.
您可以从数据库中的另一个调查导入图层。 导入图层
You can Import Layers from another survey in the database. **Import Layers**



Modelgui 中的另一个选项卡用于插入/编辑/删除 3D 异常。
The other tab in Modelgui is for the insertion/editing/deletion of 3D anomalies.

薄片（板）： *Thin-Sheets (plate):*

提供了两种算法。 FS（自由空间）和 VH。
这两种算法都允许通常用于走向长度和倾角范围的两个空间参数（长度和深度范围）和作为电导（电导率 x 厚度）的强度。 可以使用多个板，但 FS 和 VH 不能在一个模型中混合使用。

板的位置通过其顶部或中心定义。 如果板的一个边缘与地面水平 (z=0)，则顶部点是顶部边缘的中心。
如果板的表面平行于地面，则中心点就是该表面的中心。 这些定义对于板和棱镜是常见的。

板块（或棱柱）的方向通过 3 个角度（欧拉角）定义，
为方便起见，这些角度在地质学上被解释为走向角、倾角和切入角。 倾角不是真正的地质倾角，而是第三欧拉角。

FS（自由空间）算法：这是一种仅假定归纳响应的算法。 该算法可以以两种方式使用。
一种方式是在时域中直接建模，假设理论波形具有无限带宽，另一种方式（默认）具有系统的定义带宽。
两种方法都包括背景分层的响应，但不计算背景和板之间的相互作用。 该算法基于 Annan 的数学发展，但计算与旧的 UofT 算法无关。 算法精度由介于 1（偶极）和 11 之间的本征函数（本征电流）的数量（阶数）指定。
您可以使用更高的本征函数，但它们往往会在 11 以上变得不稳定。

VH算法：这是一种基于Walker理论发展的算法。 该算法计算板与宿主中感应电流的相互作用以及感应响应。
如果板处于导电背景中，则应使用此算法。 板上电流的采样被限制在 441 个点。 当板的纵横比 (L/W) 变高时，主要会看到该算法的局限性。

There are two algorithms provided. FS (freespace) and VH. Both algorithms allow two spatial parameters (length and depth extent) normally used for strike length and dip extent and a strength as conductance (conductivity x thickness). Multiple plates can be used but FS and VH cannot be mixed in one model.
The location of the plate is defined through either its Top or Centre. If one edge of the plate is level to the ground surface (z=0) then the Top point is the center of the top edge. If the surface of the plate is parallel to the ground surface then the Center point is the center of this surface. These definitions are common for plates and prisms.
The orientation of the plate (or prisms) is defined via 3 angles (Euler angles) and for convenience these are interpreted geologically as Strike, Dip and Plunge angles. The plunge angle is not a true geological plunge but is rather the third Euler angle.
FS (freespace) algorithm: This is an algorithm which assumes an inductive response only. The algorithm can be used in two manners. One manner is the direct modeling in time domain which assume a theoretical waveform with infinite bandwidth and the other (default) with a defined bandwidth of the system. Both methods include the response of the background layered but no interaction between the background and the plate is computed. This algorithm is based on the mathematical development of Annan but the computation bears no relation to the old UofT algorithm. The algorithms accuracy is specified by the number (order) of eigenfunctions (eigencurrents) between 1 (dipolar) and 11. You can use higher eigenfunctions but they do tend to become unstable above 11.
VH algorithm: This is an algorithm is based upon the theoretical developments of Walker. The algorithm computes the interaction of the plate with the induced currents in the host as well as the inductive response. This algorithm should be used if the plate is in a conductive background. The sampling of the currents on the plate are restricted to 441 points. The limitation of this algorithm is primarily seen when the aspect ratio of the plate (L/W) becomes high.

棱镜： Prisms:

该算法允许使用一个或多个直棱镜。 棱镜的位置和方向与板一样定义，但除了深度和宽度外，还定义了厚度。
棱镜原语提供了 2 种算法，LN（局部非线性）和 ILN（感应 LN）。
两者都是计算积分方程解（二级领域）的快速技术。 LN 技术可用于范围广泛的 EM
技术，但也可用于计算完整解而不是像其他代码那样计算传统弱解的磁力测量。 对于
EM，与背景相比，棱镜可以是导电的或电阻性的，具有异常的介电常数、磁化率和极化效应 (Cole-Cole)。
如果棱镜是磁性的，则计算出的响应既是电流通道响应，也是静磁效应。 因此，该算法适用于电阻率和 IP
测量、大多数长距离接地电流源测量（即 CSAMT、CSEM）、MMR、MIP 和许多 TEM 应用。 对于
TEM，它适用于电阻结构、弱导体、极化效应和导电背景中的结构。 ILN 在 LN 上提供了一些增强的感应响应。

This algorithm allows the use of one or multiple rectilinear prisms. The prism locations and orientations are defined as with the plates but in addition to depth and width, a thickness is defined. There are 2 algorithms provided with prism primitives, LN (Localized NonLinear) and ILN (inductive LN). Both are rapid techniques for computing the integral equation solution (secondary fields). The LN technique can be used for a wide range of EM techniques but also for magnetic surveys where it computes the full solution and not the traditional weak solution as with other codes. For EM, the prisms can be conductive or resistive compared to the background, have an anomalous electrical permittivity, magnetic susceptibility and polarization effects (Cole-Cole). The response computed is both the current channelling response as well as the magneto-static effect if the prism is magnetic. Thus, this algorithm is appropriate for resistivity and IP surveys, most long ground current source surveys (i.e. CSAMT, CSEM), MMR, MIP and for many TEM applications. For TEM, it is suitable for resistive structures, weak conductors, polarizable effects and structures in conductive backgrounds. The ILN provide some enhanced inductive responses over the LN.

互动： Interactions:

虽然通常在数值 EM
技术中，假设身体和细胞之间的相互作用是通过使用一般数值技术自然发生的，但实际上这不会发生，因为每个细胞的自相互作用决定了计算精度 . 单个物体的 LN 技术不受此问题的影响，因为运算符在分析上包括物体内的当前相互作用。
身体之间的相互作用是另一回事。 一般来说，如果不是所有代码，在许多代码中，2 个分离的主体不会相互作用。 这是 LN
技术的一个好处，因为它允许扩展交互，并且这些交互的有效性已经在很大程度上得到了测试。

While, generally in numerical EM techniques, it is assumed that the interaction between bodies and cells is assumed to take place naturally by the use of a general numerical technique, in practice this does not occur as the self interaction of each cells dominates the computation accuracy. The LN technique for a single body is not affected by this issue as the operator analytically includes current interactions within a body. Interactions between bodies is another matter. Generally speaking in many if not all codes, 2 separated bodies will not interact. This is one benefit of the LN technique in that it allows extensions for interaction and the effectiveness of these interactions has been tested to a great extent.

注意：磁力和重力测量中的棱镜：在 DC 测量中，可以分析计算棱镜的响应，这是 EMIGMA 中默认提供的方式。 对于磁学，有 2 种解析解，一种是更传统的弱散射，不考虑 B 具有零发散，另一种是考虑所有控制方程的完整解。

Note: Prisms in magnetic and gravity surveys: In DC surveys, the response of a prism can be calculated analytically which is the manner provided by default in EMIGMA. For magnetics, there are 2 analytic solutions, one being the more traditional weak scattering which does not consider B to have zero divergence and the other the full solution considering all the governing equations.

电流和感应散射：（简介） Galvanic and Inductive Scattering: (*a brief introduction*)

简单来说，在 EM 激发下的结构可以在几种不同的物理现象下被激发以重新散射/反向散射/产生二次场。 首先，在我们 25 年的解释经验中最常见的是，发射器在背景材料中感应的电流与异常相互作用。
这由电荷描述，并由电阻率、渗透率、介电常数和极化特性的变化决定。
在检测强导体时最普遍的第二种现象是由源磁场与导体表面相互作用引起的感应。 这是由电导率和渗透率的变化引起的。
另一个经常被忽略的影响是当源场基本上是静态的而目标是可渗透的。 这只是高斯定律的结果。 因此，这发生在低频 FEM 数据的同相和 TEM 数据的开启时间期间。 LN 算法可以处理这些现象，除非感应很强。 ILN
算法的目的是尝试增加感应响应的范围。 然而，它并不意味着非常强的感应，而只是适度的感应。

In simple terms, a structure under an EM excitation can be excited to re-scatter/backscatter/produce a secondary field under several different physical phenomena. First, and the most common in our 25 years of interpretation experience, is when the currents which are induced in the background materials by the transmitter interact with the anomaly. This is described by charges and is governed by variations in resistivity, permeability, permittivity and polarization characteristics. The second phenomena which is most prevalent in detecting strong conductors is induction caused by the magnetic fields from the source interacting with the surfaces of the conductor. This is caused by conductivity and variations in permeability. Another effect often ignored is when the source field is essentially static and the target is permeable. This is simply the result of Gauss' law. Thus, this happens in the inphase of low frequency FEM data and during the on-time in TEM data. The LN algorithm can handle of these phenomena except when induction is strong. The purpose of the ILN algorithm was to attempt to increase the range of inductive responses. However, it is not meant for very strong induction but merely moderate induction.

多面体：　　Polyhedras:

对于 LN 和 ILN 算法以及磁力和重力模型的算法，棱镜可以推广到更任意的形状。
这些形状可以通过多种方式获得，我们将在此举例说明。

For the LN and ILN algorithms as well as the algorithms for magnetic and gravity models, the prisms can be generalized to more arbitrary shapes. These shapes can be obtained in a variety of manners and we will give some illustrations here.

a) 将棱镜转换为多面体并在可视化器中进行编辑：在这种情况下有两个常见的过程。
在第一种情况下，棱镜被浸入，转换成多面体，然后将顶部切下规定的深度，以表示异常结构的常见地质改造。
其次，将棱镜转换为多面体，然后使用可视化工具中的多边形编辑工具修改棱镜以符合所需的形状。

Converting a prism to a polyhedra and editing in the Visualizer: There are two common procedures in this case. In the first, case, the prism is dipped, converted to a polyhedra and then has the top sliced off a prescribed depth to represent a common geological modification of an anomalous structure. Second, the prism is converted to a polyhedra and then the poly editing tools are utilized in the visualizer to modify the prism to conform to the shape required.

b) 导入多面体：在这种情况下有三个常见的过程。 **在第一种情况下，合成多面体是使用** EMIGMA **主工具**栏上的多边形生成工具构建的。  此处提供了广泛的功能，并且此工具中提供了帮助。 第二种方法是导入 CAD 文件。 Poly Generate 工具中也提供了这些功能。 第三种方法是导入地形图，它在 PolyGenerate 中可用，但也可以直接在 Prisms/Plates/Polyhedra 上使用

Importing a polyhedra: There a three procedures which are common in this case. In the first case, a synthetic polyhedra is built using the Poly Generate tool on the main EMIGMA toolbar.  There is a wide range of capabilities available here and help is provided within this tool. The second method is to import a CAD file. These capabilities are also provide in the Poly Generate tool. The third method is to import topography which is available in PolyGenerate but also directly on the Prisms/Plates/Polyhedra

c) 样本点：软件获取样本数量，并有自己的规则来确定多面**体中**这些样本点的分布位置。
Sample points: The software takes the number of sample and has its own rules as where to distribute these sample points within the polyhedra.

领域　　Spheres:

该算法是从德拜球体展开定理发展而来的，但并不局限于传统地球物理学文献中的少数几项。
这是一种非常通用、准确的算法，但仅限于偶极发射机。 如果您需要使用此算法，请联系我们以获得更多帮助。
该算法应该很容易收敛，代码限制在最多 200 次谐波

This algorithm is developed from Debye's expansion theorem for a sphere but is not limited to only a few terms as in conventional geophysical literature. It is a very general, accurate algorithm but is limited to dipole transmitters. Please contact us for more assistance if you require to use this algorithm. The algorithm should converge readily with the code restricted to a maximum of 200 harmonics.

使用不同算法混合目标：可以在模型中混合棱镜和多面体的任意组合。 VH 板也可以添加到这些组合中。 FS 板必须单独运行，但可以在后处理中使用其他算法添加到其他模型中。

Mixing Targets with Different Algorithms: Any combination of prisms and polyhedra can be mixed in a model. VH plates can also to added to these combination. FS plates have to be run separately but can be added to other models with other algorithms in post processing.

***棱**镜和多面体的内部采样：　　Internal Sampling for Prisms and Polyhedra:*

与任何其他数值技术一样，需要某种网格采样。 对于 IE（积分方程）技术，只需要考虑内部二次源，因此只对对象内部进行数字化（网格化）。 在普通的 IE 技术中，计算交互矩阵，然后将该矩阵（散射矩阵）反转以计算二次源。 对于 LN 和 ILN，已经设计了一种技术（Habashy 等人、Groom 和 Walker、Alvarez 和 Groom 等）来直接计算二次电流和磁极化矢量。 然后通过绿色函数简单直接地利用这些次要源来计算接收器的次要测量值。 内部采样允许用户选择使用多少内部源，从而使他们能够研究解决方案的收敛性。

As in any other numerical technique some sort of grid sampling is required. For IE (integral equation) techniques only the internal secondary sources need be considered and thus only the inside of the object is digitized (gridded). In normal IE techniques, an interaction matrix is computed and then this matrix (scattering matrix) is inverted to computed the secondary sources. For the LN and ILN, a technique has been devised (Habashy et al, Groom and Walker, Alvarez and Groom, etc) to compute the secondary currents and magnetic polarization vectors directly. These secondary sources are then utilize simply and directly through the greens functions to calculate the secondary measurements at the receivers. The internal sampling allows the user to select how many internal sources are utilized and thus enable them to study the convergence of the solution.

LN和ILN是一种积分方程技术。 这些技术计算由模型中的棱镜引起的次级内部电流和磁场源。
如果没有详细说明多个采样点，则根据纵横比分布这些点。 否则，用户可以通过“高级”按钮根据需要指定采样。
通常，解决方案将与样本点收敛，但如果样本点太靠近其中一个角点，则解可能会发散。
这个结果是理论上预测的，但我们不会在这里进入这个主题。 对于 ILN 算法，解决方案对于强归纳和大量样本点都不稳定。
使用该算法时必须仔细检查解决方案与样本点数量的稳定性。

LN and ILN are a integral equation techniques. Such techniques calculate the secondary internal current and magnetic sources caused by the prisms in the model. If a number of sample points is prescribed without details then the points are distributed according to the aspect ratios. Otherwise, the user may prescribe the sampling as desired through the Advanced button. Generally, the solution will converge with sample points but may diverge if a sample point becomes too close to one of the corners. This result is predicted by theory but we will not enter this subject here. For the ILN algorithm, the solution is not stable for strong induction nor for large number of sample points. Use of the algorithm must be done with care checking for the stability of the solution with the number of sample points.

棱镜和多面体的相互作用： Interactions for Prisms and Polyhedra:

没有为平板算法提供目标之间的相互作用，但为棱镜和多面体提供了 3 种类型的相互作用。
在几乎所有的仿真算法中，每个目标的自相互作用项在计算中占主导地位，并且目标之间的相互作用丢失。
为了克服这个典型的数值计算问题，我们开发了交互功能，以确保目标之间的正确交互。
No interaction between targets is provided for the plate algorithms but there are 3 types of interaction provided for prisms and polyhedra. In almost all simulation algorithms, the self interaction terms of each target are dominant in the calculations and the interactions between targets is lost. To overcome this typical numerical computation issue, we have developed interaction capabilities that ensure proper interaction between targets.

Superposition: 没有计算相互作用，总响应是各个目标的总和
no interactions calculated and the total response is the sum of the individual targets
Far Field: 目标并不近，但它们分散的场会从每个目标产生额外的反应。
the targets are not close but their scattered fields produce an additional reaction from each target.
Near Field: 目标很近，二次电流或磁极化在目标之间流动
the targets are close and secondary currents or magnetic polarizations flow between targets.

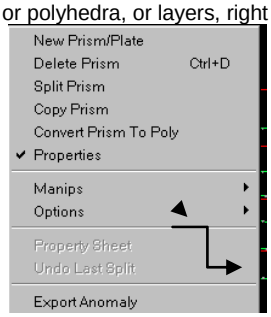
可视化 VISUALIZATION

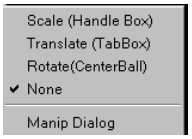
Viz 在可视化工具（3D VisRD）中构建和编辑模型。 选择数据集并选择 Viz 图标。
您可以选择多个数据集以检查不同模型的变化或启用模型构建与您的数据。 我们建议您观看我们的 EMIGMA 介绍视频。
Build and edit models in the Visualizer (3D VisRD). Select the Data Set and choose the Viz icon. You may select multiple data sets in order to examine variations in different models or to enable model building versus your data. We would suggest viewing our EMIGMA introduction video.

这里有许多基本控件。 There are a number of basic controls here.

从最左边第 6 个开始 Starting from 6th from the far left,
" 显示数据 Show Data", " 切换配置文件 Toggle Profiles", " 切换发射器 Toggle Transmitter(s)",
" 创建新异常 Create New Anomaly", " 进口异常 Import Anomaly", " 复制棱镜（聚） Copy Prism (poly) ",
" 分割层 Split Layer", " 切换轴 Toggle Axes", " 到下一个时间窗口或频率 To next time window or frequency",
" 后窗或频率 Back window or frequency", " 规模数据 Scale data", " 显示源场分布 Show Source Field Distribution",
" 拾取（拾取一个对象并给出视图中某个位置的坐标 Pick (pick an object and gives coordinates of a location in the view)",
" 手动控制（旋转、缩放） Hand controls (rotation, zooming) ", " 回家 To Home", " 设为首页 Set Home",
" 满量程 Full Scale", " 飞涨 Zoom"

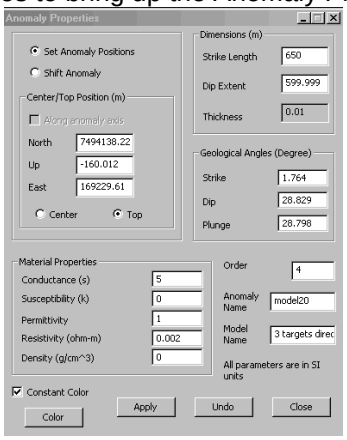
然后您可以选择棱镜、平板或多面体，或图层，右键单击
You can then select the prism, plate or polyhedra, or layers, right click





- (additional tools)

并选择“属性”以打开“异常属性”窗口
and select Properties to bring up the Anomaly Properties window.



在此窗口中，您可以修改异常的位置、方向和属性，并在应用后在 3D 可视窗口中查看结果。
From this window, you can modify location, orientation, and attributes of the anomaly and upon Apply see the result in the 3D visual window.

您可以从当前数据库中的数据集中导入模型、多面体和地形。
You can import models, polyhedras, topography from datasets in your current database.

此外，还可以使用鼠标右键或其他功能，例如复制、拆分、旋转、扩展目标。
您还可以通过数据库页面上的模型按钮构建或修改模型
Additionally on the right mouse or other capabilities such as copying, splitting, rotating, extending targets.
You can also build or modify models through the Model button on the Database Page.

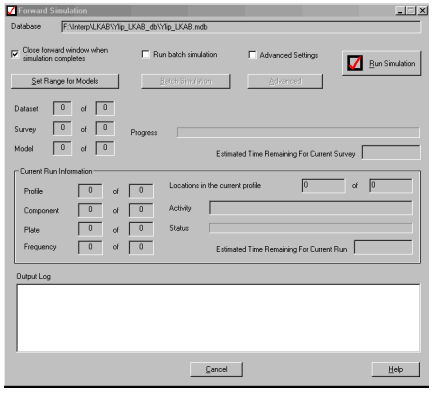
重要的 IMPORTANT -在 Vizrd **中**进行更改后，请确保在运行模拟之前保存到数据库以更新数据库。
如果您不保存到数据库，您的更改将不会更新。
Once you have made your changes in Vizrd, be sure to **`Save to Database`** to update the database, before running a simulation. If you do not Save to Database, your changes will not be updated.

模拟 Simulation

选择“运行模拟”图标（红色复选标记）并按照说明进行操作。
您可以选择覆盖选定的数据集或创建新的数据集。 **将**显示模拟模式窗口

Select the Run simulations icon (red checkmark) and follow the directions. You can choose to overwrite the selected Data Set or create a new Data Set. The Simulation Mode window will be displayed.

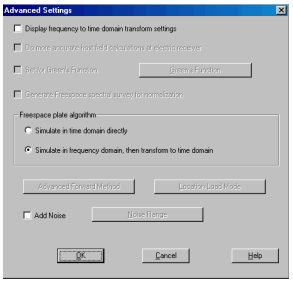
该接口为超级引擎提供控制，超级引擎控制实际计算合成响应的模块。



它在中间部分和底部的白框中提供进度报告，这些信息对我们的开发人员很有用。
This interface provides controls to the super-engine which controls the modules which actually compute the synthetic responses. It provides progress reports in the middle section and in the white box to the bottom, information useful to our developers.

高级设置允许您对默认模拟进行调整。 这些增强取决于算法。
但是，主要问题是允许控制转换以查看，
控制在任何子运行中模拟的站点数量以控制内存，
为井下发射器设置绿色函数网格，添加噪声并最终控制 FS 算法 正如刚才提到的。

The Advanced Settings allows you to make adjustments to the default simulation. These enhancements depend on the algorithm. But, the main issues are to allow the controls for the transform to view, control the number of stations simulated in any sub-run to control memory, set a grid of greens functions for downhole transmitters, add noise and finally to control the FS algorithm as mentioned above.



Run Batch Simulation：打开一个窗口，允许您输入要在后台运行的多个模型。 使用此工具的想法是，您可以在 ModelGui 或 Visualizer 中创建/编辑多个模型，并将这些模型保存到单独的数据集中。 然后，批处理模式将在后台为您运行所有这些模型，并将结果保存到数据库中供以后检查。
Run Batch Simulation: opens up a window which allows you to input multiple models to be run in the background. The idea with this tool is that you can create/edit multiple models either in ModelGui or in the Visualizer and save these models to individual datasets. Batch mode will then run all of these models in the background for you and save the results to the database for later examination.

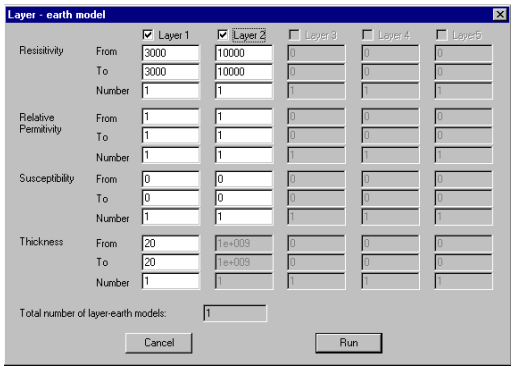
After the Survey is loaded and any advanced settings made, select the **`Run Simulation`** button within the Forward Simulation window. Note that you can cancel a simulation in the middle of a calculation should this be required.
加载 Survey 并进行任何高级设置后，在 Forward Simulation 窗口中选择 Run Simulation 按钮。
请注意，如果需要，您可以在计算过程中取消模拟。

模型套件生成（模型的设置范围） Model Suite Generation (*Set Range for Models*)
选择一个数据集，单击模拟检查，然后选择设置模型范围
Select a dataset, click the Simulation Check and then select *Set Range of Models*

有2种选择，Layers和Plates,
您可以定义一套模型来自动构建和运行。
选择模型的设置范围 - 选择层或板。 未来会增加棱镜套件生成
There are 2 choices, *Layers and Plates*,
You can define a suite of models to build and run automatically.
Choose **`Set Range for Models`** - Select Layers or Plate. Prism suite generation will be added in the future.

分层地球模型 – Layered Earth Models –

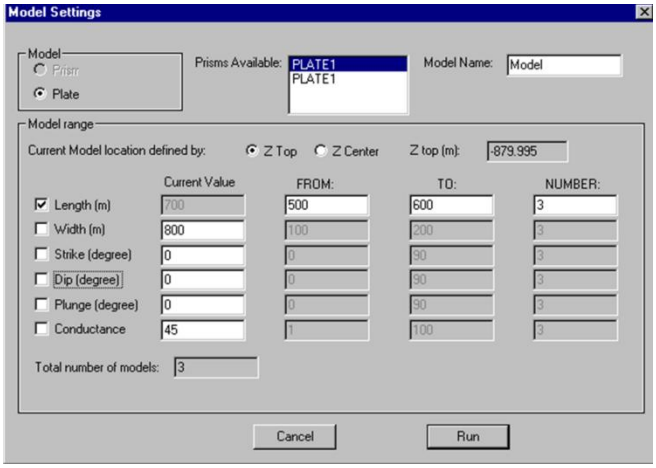
最多允许 5 个参数范围，要修改的层数取自起始数据集。
您可以设置每一层的电阻率、相对介电常数、磁化率和厚度（底层厚度设置为无限厚以接近基底）。Up to 5 parameter ranges are allowed, and the number of layers to modify is taken from the starting Data Set. You can set the Resistivity, Relative Permittivity, Susceptibility and Thickness of each layer (thickness of bottom layer is set to be infinitely thick to approximate the basement).



板块套房　　Plate Suites –

您必须从包含板块的数据集开始，才能构建板块模型套件。 目前，您只能在模型套件中使用一个盘子。
如果数据集中有多个板，则选择一个板开始。 您可以改变长度、宽度、走向、倾角、倾角和电导。 参考位置可以是 Z 顶点或 Z 中心点。
用于模拟的算法将取决于为所选板设置的算法。

You must start with a Data Set that contains a Plate in order to build suite of plate models. Currently you are allowed only one plate in the model suites. If there are multiple plates in the data set, then select one plate to begin. You can vary the length, width, strike, dip, plunge and conductance. The reference position can be either Z Top point or Z Centre point. The algorithm utilized for simulation will depend upon the algorithm set for the plate elected.



模型运行完成后，将有一组新数据集，可以像任何其他模型模拟一样查看或分析这些数据集
Upon completion of the model runs, there will be a set of new datasets and these can be viewed or analyzed as with any other model simulation.

数据表示　　Data Representation

3D可视化 3D Visualization

网格演示　　Grid Presentation

XY绘图XY Plotting -

伪秀　　Pseudo Show

3D轮廓　3D Contouring

PEX展　　PEX Show

调查编辑 Survey Editor

多重网格　　Multi Grid

网格化和插值 Gridding and Interpolation

数据电子表格　Data Spreadsheet

获得许可的人可以在 EMIGMA 中访问的其他工具
Other tools accessible in EMIGMA for those who are licensed

CDI 电导深度成像 Conductivity Depth Imaging

Lyr 源码分发 Source Distribution

X孔层析成像 XHole Tomography

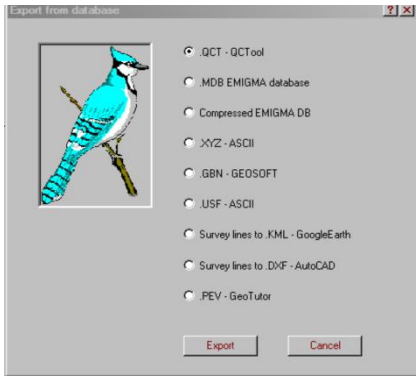
ω-T 频率到时域变换（手动变换控制）Frequency to Time Domain Transform (manual transformation controls)

3D 3D 磁学、重力、电阻率、CSEM、CSAMT、MT 反演
3D Magnetics, Gravity, Resistivity, CSEM, CSAMT, MT Inversion

1D 1D FEM、TEM、电阻率、CSEM、CSAMT 和 MT 反演工具
1D FEM, TEM, Resistivity, CSEM, CSAMT and MT Inversion Tools

导出数据 Exporting Data

导出数据 **Export Data**



将数据集导出到 Export a data set to a

- QCTool **文件**
- EMIGMA **数据**库 database
- • 压缩数据库 Compressed database
- ASCII **文件**
- USF ASCII
- GEOSOFT **文件**
- • 测量线至 GoogleEarth KML file
- • 测量线至 AutoCAD DXF file
- GeoTutor **文件**