The PetRos EiKon News

News from ***PetRos EiKon*** Incorporated

April, 1997

NEW EMIGMA RELEASE SOON TO BE AVAILABLE !

...3D Data Representation and Multiple Plates Now Available!

.....Polyhedras on the way!

Bringing you one step closer to reality... View your data and your model in 3D as surfaces, as vectors or as profiles.....What better way to compare your results than in Real 3D Space!

3D Data Representation:

i3D VisRD can now display both field and modelled data from files in the PetRos EiKon' extended Geosoft file format (now the standard file format for all **EMIGMA** outputs). Data imports are now available for many systems with more on the way, allowing the user to automatically reformat their data for our system. If the import routine that you need is not available, we'll customize one to your specifications.

Data comparison and analyses has never been easier or more versatile. Choose from our flexible, easy-to-use X-Y plotter to view measured or modelled data along a profile or choose **i3D VisRD** to view multiple channels across all profiles within the physical context of your model.

Three data viewing modes are provided with i3D VisRD:

1) **The Amplitude Graph**: This graph is an extension of the usual two-dimensional, X-Y graphs produced by such tools as EiKPlot. Instead of being restricted to viewing data on only one profile and one plane; data for every profile is shown. This view is much like other visualization applications but with some additional functionality (Figure 2).

2) **The Surface Graph**: This variation of the amplitude graph takes the given data for each profile and interpolates it to form a continuous surface over the model (Figure 1). While lacking some of the accuracy of other modes, the surface graph emphasizes general trends and extremes. Especially when the amount of data is large enough to make discrete profile viewing confusing. The data need not be collected or simulated on a regular grid.

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3) **The Vector Graph**: The vector graph shows each data at all receiver locations as a vector in the correct component direction (X, Y, or Z). The user may also combine separate components of the same channel into two- or three-dimensional vectors. This mode is most useful for viewing trends in borehole data.

FUTURE DEVELOPMENTS:

EiKPlot Integration: The visualizer can offer insight into the general trends of the data while the plotter is still the best way to see "the numbers". We are currently working on adding a link to the Plotter within the Visualizer which will allow the user to select and directly plot the data on a profile from within the visualizer, offering the user both a global and a local perspective.

Field Derivation: Data which are not explicitly contained in the data file can often be derived from the given data. Such things as converting In-phase and Quadrature data to Amplitude and Phase data. Other examples are MT impedances and parameters. This capability, which is already mostly available in EiKPlot, will soon be added as an option to i3D VisRD.

CAD Imports and Direct Polyhedra Modelling:

At this time, two of our principle developments are the importing of CAD drawings and the visual representation and discretization of polyhedra within the visualizer tool. In the near future, we will be linking these two developments to allow the user to interpolate 2D CAD drawings into 3D structures as polyhedra and then model the polyhedra directly using our rapid LN and ILN algorithms.

Introducing Multiple Plates

Until recently, VHPLATE was restricted to modelling only a single plate. You can now use multiple plates to construct your model. At this stage, the scattered response is simply the individual responses of the plates superposed, i.e. the plates are not interacting. However, the full interaction is not far off.

The following example models a massive sulphide response to the Max-min system (moving, M_z dipole-H_z dipole). In this case, a frequency of 3555 Hz was used with a transmitter-receiver separation of 100 m. Plate 1 is 150m x 40m and is dipping at 15°. Plate 2 is 20m x 100m and is striking at 90° and dipping at 20°. Plate 3 is 200m x 50m and striking 10°. All three plates are equally conducting (conductance 2000S). The hostrock is a simple 5000 Ohm.m halfspace. The simulated surface data: Hz is the

horizontal coplanar response continuously normalized (by percent) to freespace (in-phase). See Figure 2.

Multiple scattering: The superposed response is valid for multiple targets in the far-field regime of one another. For a model with multiple scatterers (such as the one presented here) the effect of interaction (to first order) can be estimated as follows. To simplify matters, consider a two plate model, and imagine a receiver at a location internal to the first plate. The receiver is hit with the host field (the field that would be received at this location in the absence of both scatterers) plus a first order backscatter from the second plate (which is the scattered field sensed at the receiver location inside the first plate in its absence). The total field bombarding the first plate is hence the background field plus the (first order) backscatter from the second target, and it is this field that is used to calculate the internal scattering currents inside the first plate (and hence the secondary response at the physical receivers.) Of course, the situation is reversed for the second plate, whose effective incident field is the host response plus backscatter from the first plate. The size of the first order backscattered terms (compared to the host field at the target) gives a good indication of the importance of interaction. A simple way to evaluate these terms is to replace one of the scatterers with a series of profiles and compare the host and secondary fields. In the near future, V5 of **EMIGMA** will compute these interactions for arbitrary combinations of scatterers.

More Induction Results: The Twisted Prism

This section reports on some more results obtained using a new theory for improved induction developed at PetRos EiKon. The LNPRISM algorithm (as it is currently implemented in **EMIGMA V4**) is accurate only when the scatterers are energized in a current channelling mode or when the excitation is weakly inductive (the response to a strong inductive coupling tends to be underestimated). Our new theory provides an extension to inductive modes while retaining the speed ,i.e., O(N) complexity, of the LNPRISM technique (Habashy et. al.). (Please see PetRos EiKon's Sept 96 newsletter: Focus on Induction).

The following inductive test model was based upon the Lac Volant massive

sulphide target in Sept-Îles, Quebec. Recently, PetRos EiKon was contracted to interpret a high power Crone deep EM survey (time domain, fixed loop). This was the first real interpretation project to which the new algorithms were applied and successfully we might add. (For a more detailed look at this project, you may request a copy of a submitted SEG extended abstract - Parker et al)

The data response, termed the Lac Volant anomaly is modelled here. It was determined that this target, which can be represented by a 175m, 30m, 20m prism, was dipping in opposite directions at opposite ends of the prism as if it had been clutched at both ends and twisted along its north axis. To simulate this twisted phenomenon, two prisms of opposing dip are used. Both prisms are 87.5m x 30m x 20m. The euler angles of Prism 1 (in degrees) are -104.5,-20.32,0 and Prism 2 are -284.5,-30.43,0. Both prisms are equally conducting (conductivity 25 S/m) and in-loop. The loop is 500m x 400m (square). The hostrock is a resistive halfspace (5000ohm-m). The spectrum incorporates a frequency range from 7 Hz to 18,700 Hz and a skip ratio of 4. The simulated surface data is two component: Hx, Hz transformed to time domain. Figure 3 shows the HZ response for channels: 1 (0.09 msec) channel 11 (1.235 msec) and channel 15 (3.499 msec).

Multiple scattering: In the present two prism model, the scatterers interact to produce a response. This type of interaction gives the same response from two equally conducting prisms placed flush on identical faces as from the corresponding single prism, i.e., it is equivalent to internal multiple scattering. The ILN algorithm accounts for internal multiple scattering to first order, and this technique has been demonstrated to work well for multiple targets in the near field regime of each other, i.e., not necessarily in direct contact. In the far field, however, this representation of multiple interaction is not correct; see the three plate model above for more details on conventional far field multiple scattering techniques.

Look Forward to:

✔ **PEInteract** - full interaction between plates, prisms and layered earth.

✔ **1D Dipole-Dipole Inversion:** Invert your Max-Min and EM34 data. Soon we will be adding Moving Loop-Dipole systems and MT inversions.

✔ **Magnetotelluric Tools:** Magnetotellurics is slowly becoming fully integrated into **EMIGMA**. Convert your .edi files for Decompositions and export your decompositions to .EDI. Convert your simulations for Decomposition and to .EDI files for import into Geotools. Soon, we will offer full 3D viewing of your data, data parameters and simulated data along with your models.

LEASE EMIGMA

EMIGMA at your finger tips ✌

EMIGMA has never been more accessible. 3D TEM and FEM Forward Simulation is now available for lease at very reasonable rates. Add to your lease license conveniently by phone. **Reap the Rewards:** Fifty percent of all leasing costs will be put towards later purchases of software. Please contact Danielle Parker for leasing rates.

✎ACADEMIC VERSIONS ✎:

We are currently offering academic licenses of **EMIGMA** to academic institutions at prices you can afford. Pleas contact Danielle Parker for a price list or to discuss your needs.

Hints to running EMIGMA successfully:

➪ It is recommended that you run **EmigmaV414** and **FORWARDV515** from a "Command Prompt" window or an "MS-Dos Prompt" window. Both windows are found through the "START" menu. The advantage being that error messages are left in the window making troubleshooting easier.

➪ Always make sure you have enough free space (at least 40 Megabytes) on your disk before running **EMIGMA**.

➪ FsemtrsV3 outputs information messages while it is running. In some of the older versions of FsemtrsV3 running on Windows 95, the first message (detected Spectral Form…Beginning Interpolation…) hides as an icon at the bottom of your screen. If you do not see an information message appear, look for and click ok to this message. The program waits for a response before proceeding. Note this problem has been corrected and will not appear on new installations.

Notice: New Functionalities are now Keyed

The Visualizer is keyed to both your software dongle and your hard drive on all new installations. As such you will need a password to upgrade both your dongle and hard drive. Also keyed to your dongle are our new ILN-PRISM algorithms and PEImports. If you are licensed for these tools passwords, update software and instructions will be provided to you. Please contact Danielle Parker if you need any assistance.

EAEG Geneva in Spring - See You There

Ross Groom and Ian Murray will both be presenting papers at the EAEG May 27-29. They would welcome the opportunity to meet with any interested parties. Please call to schedule a time.

Look for our homepages on the Internet at **Web Site:**
http\\ourworld.compuserve.com\homepages\PetRosEiKon