# Working with GEM-2 FEM Data in IX1D v 3 – A Tutorial

Version 1.0

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### First Load the Data

🛣 Interpex 1-D Sounding Inversion [Sakhalin 🛛 📖 🗖 🔀				
File Edit View Create Profile Batch Help				
New I Open	15 👳 🛉 👔			
Save Save_As				
Load IXR files				
Import	ASCII Data File 🔸			
Export I	ASCII Model File			
Print	XYZ Data File  Frequency EM Data			
– Exit	USF Data File			
	Station locations			
	Well Log File			
Import Frequency E	M Data profile from XYZ file			

#### Select Import/XYZ Data File/Frequency EM Data from the File Menu

### Select a GEM-2 XYZ File

ASCII XYZ-Forn	nat Data File				? 🗙
Look jn:	🗀 GEM		•	🗢 🗈 💣 📰 <del>-</del>	
My Recent Documents Desktop	GEM-2.XYZ				
My Documents					
My Computer					
My Network Places	File <u>n</u> ame:	GEM-2A.XYZ		•	<u>O</u> pen
	Files of type:	ASCII XYZ-Format Data File		•	Cancel

#### GEM-2 data values are in percent, GEM-2A data values are in ppm

## **Select Columns to Import**

🛣 XYZ File Columns 🛛 🔀
Column for Easting: 🚺 🛨 Column for Elevation: 0 🕂 Column for Data: 3 🕂
Column for Northing: 2 🗧 Column for Profile: 2 🗧 Columns to skip: 0 🗧 🔿 Percent
🗆 Start Reading at Row: 2 🐳 🗖 Stop Reading at Row: 3099 🐳 📀 ppm
/COIL SEPARATION: 1.66 METERS /FREQUENCIES: 1050 2010 4170 8010 12090 15990 21030 LINE GEM-2-1 X Y 1050Hz_l 1050Hz_Q 2010Hz_l 2010Hz_Q 4170Hz_l 4170Hz_Q 8010Hz_l 8010H; 1,0,780.22,6472.2,2029.9,11942,6000.3,22303,14298,36992,24725,50705,34205,58487,46729,69 1,1,760.08,6295.3,1937.1,11441,5581.8,21909,13872,37477,23249,49391,33408,59306,45117,67 1,2,701.58,6066.3,1850.5,11258,5276.1,20981,13200,35596,22262,48539,31547,57211,42012,66 1,3,694.7,5774.8,1748.6,10542,4967.5,20672,12165,34037,20854,46086,29158,56367,40004,638 1,4,661.39,5590.7,1699.3,10229,4726,19281,11720,32633,19457,45504,27997,53756,37999,6362 1,5,596.69,5108,1502.9,9364.2,4130.4,17338,10004,30646,16888,40991,24223,48882,33900,586 1,6,572.97,4886.6,1451.9,8713.8,3898.4,16437,9441.4,28334,15844,38848,22246,47614,31214,5 1,7,531.13,4537.4,1367.3,8273.6,3603.8,15645,8470.9,26983,14554,36684,20010,44054,28227,5 1,8,516.46,4170.5,1272.8,7398.4,3416.6,14450,8026.1,24608,13133,32968,18496,41067,25042,4 1,9,493.15,3760.7,1213.3,6848.2,3179.4,13005,7189,22480,12058,30739,16601,36974,22337,438 1,10,463.5,3466.4,1127.7,6074.6,2885.2,11550,6449.7,19913,10597,26623,14846,32864,19737,3
OK Cancel Set Start Row Set Stop Row

Be sure to make the correct selection for data units: Percent or ppm (parts per million).

Note that for Percent, data values will be on the order of 1-10 or so, while for ppm, the data values will be on the order of tens of thousands.

Columns in data file consist of East, North and Data. Profile (station) coordinate is the same as Northing. There are no elevation data. Note that three lines have been added to define coil separation, frequencies and to trigger data read via the LINE keyword. These lines are necessary to read the file.

## **Select the Profile for Display**

🛣 Interpex 1-D Sour	nding Inversion	n [GEM-2	]	
<u>F</u> ile <u>E</u> dit <u>V</u> iew Create	Profile <u>B</u> atch H	Help		
1 2 6 2 6	5 m 🔶 🗈	9 2		
no sounding selected no profile selected				
E: 0.9	N: 6.2	Profile: GEM	-2-1	

Point at the profile line displayed on the map and click it to display the profile data



## **Select a Sounding from Profile**



Point at a sounding (say, the center one) and click to select it for display and interpretation

### **Determine Approximate Resistivity**

🛣 Interpex 1-D Sounding Inversion [GEM-2-100006				
File Edit View Calculate Help				
New Model	🚑 🔳 🖩 🗁 📥 🗾 🏂			
Delete Sounding				
Save	GEM-2-100006			
Save As	+			
Import 🕨				
Export •				
Print				
Evit				
T	i .			
1				



Use File/New Model and try different resistivity values for a homogeneous (one-layer) earth, until you have something which fits fairly closely. Remember this value, close the Sounding window and go back to the profile window. In this case, the resistivity estimate is 1 Ohm-m.

#### **Estimate Smooth Model**





Use the Calculate/Estimate Smooth Model command to start smooth model estimation. Pick a reasonable number of layers, say one for each data pair. For a coil spacing of 1.66 m, depth range from 0.1 to 2 m would be reasonable. Use the starting resistivity determined from the experiment on the single sounding, in this case 1 Ohm-m.

# **Adjust Display for Results**



When the smooth modeling is finished, the display needs to be adjusted to display the appropriate smooth model. On the Profile display, be sure the View/Layered option is unchecked and that the View/Smooth is checked. Use View/Model/Depth Section and select Color Fill Only. Finally use the zoom feature or View/Properties to scale the display to your liking.

### **View Final Smooth Section**



The smooth inversion is only one way to interpret the data. However, it is a good starting point layered modeling. We can start the layered modeling by looking at some of the smooth inversion results.

## **Starting Layered Model**



🛣 Resistivity Model 🛛 🛛 🔀						X		
	Surface Elevation: 0.0000			Fitt s Uni	ting Error:   ts:	0.000	00	
	#	Rho	Fix?	Thick	Depth	Elev	Fix?	
	1	2.0000	Γ	.5				
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	11							
	12		Γ					•
	Insert Cell Insert Row Column Math:							
	Dele	ete Cell	Dele	te Row	Add T	o		
		OK	Ca	ancel	Multiply	Ву		

One way to make a starting model for the Layered inversion is to use File/New Model in the Profile window. Then enter the starting model in the Resistivity model dialog. In this case we have selected a model with 2 Ohm-m over 1 Ohm-m, 0.5 m thick.

### **Perform Inversion & Adjust Display**

	🕅 Section Display Properties
Multiple Iteration Inversion	Display Type
Ž Profile: [GEM-2-1 ]	C Contour Fill Only
File Edit View Calculate Help	C Contour Fill w/Contours
Image: Solution of the second seco	
✓ Layered Smooth	Colored Surface
Data as Line	Reverse Color Fill Sequence
Data	Additonal Surface Plotting Parameters:
Grid  Caborvsky Plot Copth Section	Elevation: 22.500 Rotation: 0.0000
Properties Elevation Section	OK Cancel

Once the model is stored, use the Calculate/Inverse/Multiple Iterations or the equivalent toolbar button several times until the results stabilize. Be sure to check View/Layered, uncheck View/Smooth and be sure the Depth Section is selected for display as before.

# **View Final Layered Model**



This display shows the final results for two layers. Feel free to also try 3-layer models. More than 3 layers is not generally useful for this kind of data. Fixing one or more parameters may sometimes be useful.

# **Copy/Paste Layered Model**





A third way to devise a starting layered model is to open a sounding and experiment with a layered model. When a good fit is found for a "typical" sounding, use this to develop a model where the thicknesses or depths are well estimated and ball-park estimates of the resistivities are used. Then use the Edit/Copy Model in the Sounding window, close the sounding window, and use the Edit/Paste Model to All in the Profile window. Use the Calculate/Inverse/Multiple Iterations or the equivalent toolbar button several times until the results stabilize, as we did before.