Getting started with SPIA DC

AGS Aarhus GeoSoftware

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1. INTRODUCTION

This document gives a short introduction to the geophysical processing and inversion software SPIA DC. The software can process and invert 4 electrode resistivity configurations.

The software is developed by The HydroGeophysics Group at The University of Aarhus, Denmark. From October 2015 maintenance and updates for the software are done by Aarhus GeoSoftware. For updates and further information, please visit Aarhus GeoSoftware website www.aarhusgeosoftware.dk .

This guide contains a short overview of the installation and setup of SPIA DC. The functions of SPIA DC are explained and a step-by-step example of the complete processing and inversion process is provided, based on a real data example.

This manual refers to SPIA version 3.x.

SPIA has an online wiki page with tutorials and guides. Click here.

1.1 Overview

SPIA DC is used for processing and inversion of 4 electrode resistivity data.

The graphical user interface simplifies the processing and inversion process and has rich possibilities to edit data and models directly in the plots.. The data uncertainty expressed as data error can be changed for each individual data point, a priori information can be added to the model, and inversion models can be interpreted before making new inversions. The processed data and inversion models are all saved in the same SPIA database and can be imported into Aarhus Workbench for easy visualization of the results.

The typical workflow for the processing and inversion in SPIA is illustrated in figure 1.1.

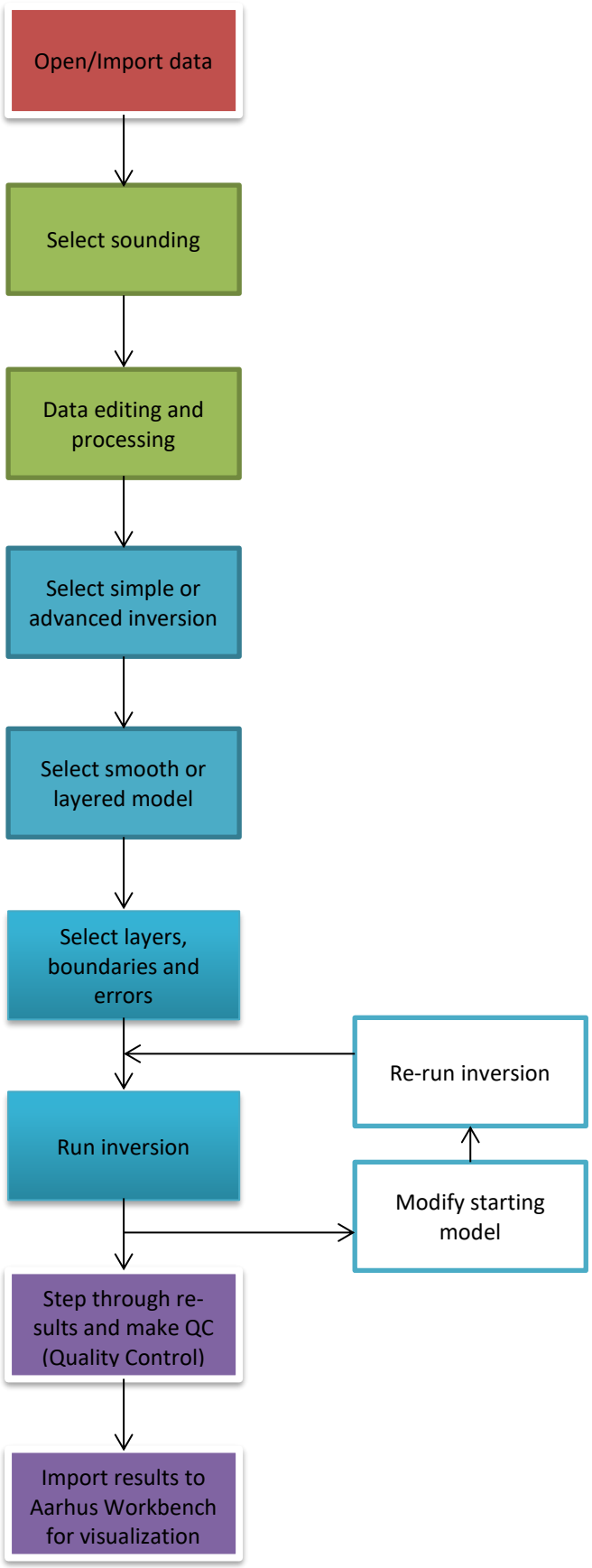

Figure 1.1. Workflow diagram for processing and inversion in SPIA.

2. INSTALLATION AND SETUP

This chapter provides the steps for the installation of SPIA and the demo database.

SPIA is running on **Windows XP, Windows Vista, Windows 7/8** and **Windows 10**.

2.1 SPIA

The SPIA software can be downloaded from Aarhus GeoSoftware's website: www.aarhusgeosoftware.dk.

The installation of SPIA is done from a self-extractable exe file. To install, run the executable file and follow the onscreen instructions.

2.2 Demo database

The included demo database is installed with SPIA in:

<SPIA install dir>\DemoWorkspace\

2.3 The license key

Starting the SPIA software the first time after installation, a window will pop up, asking for the license key. This key is obtained from Aarhus GeoSoftware.

3. WORKING WITH SPIA

SPIA has a very easy-to-use and intuitive graphical user interface for processing and inversion of data. The features of the program will be described in the following.

Data and models are stored in a database. The extension of the database file is .gdb. This database is documented on www.gerda.geus.dk and is in Firebird format. Do not make changes to the database unless you are familiar with SQL and relation databases.

3.1 Open data in SPIA

Open data
To create a new project in SPIA, start the SPIA program, press "New Project", select a folder destination and file name for the project. Then, the import window will open, select importer and follow our import guides:

http://wiki.hgg.au.dk/do/view/SPIA/ImportGuides

To open an existing SPIA project, press "Open project" and open the .gdb file containing the DC data.

3.2 The sounding tree, plot- and information windows

Sounding tree
After opening a SPIA database, SPIA starts up in the Data View tab. To the left, the sounding tree is located (fig 3.1). It contains a sounding node for each location measured with the geophysical system.

By expanding a sounding node, a sub-tree is revealed. Data are grouped into channel nodes, one for each channel measured. Clicking on any of these nodes, the data points from the selected channel will be plotted. Inversion results will also be listed in the sounding tree within the selected sounding node.

Several channels can be selected together to compare data curves between channels. Hold Ctrl key when clicking on a channel.

Plot window
When clicking on a channel node in the data tree, the measured data points are plotted in the plot window (fig 3.1). The data points are plotted as a resistivity curve. Formatting of axis, labels and grids can be changed by clicking the left or bottom axis.

Information and model plot window
The window to the right is the information and model plot window (fig 3.1). It shows information on the selected sounding tree or channel node.

For each channel node, the information given is

- Recording time
- Data points in use
- Data points in total

For a sounding tree, the following information is available:

- Recording time
- Data points in use
- Data points in total
- Google maps icon to see the sounding location
- Coordinates in latitude/longitude
- Elevation
- Coordinates in UTM
- EPSG

For an inversion node, the information and model plot window plots the starting model and the inversion model results. This plot is editable when creating a new starting model for inversion. The resistivity and layer thickness can be adjusted selecting the layer interface or resistivity with the mouse and move it.

For the inversion model, the depth of investigation (DOI) is plotted as a dotted line. A table with the model results and standard deviation (STD) for resistivity, thickness and depth can also be displayed by going to the Model tab and click “Table”.

Formatting of axis, labels and grids can be changed by clicking the left or bottom axis.

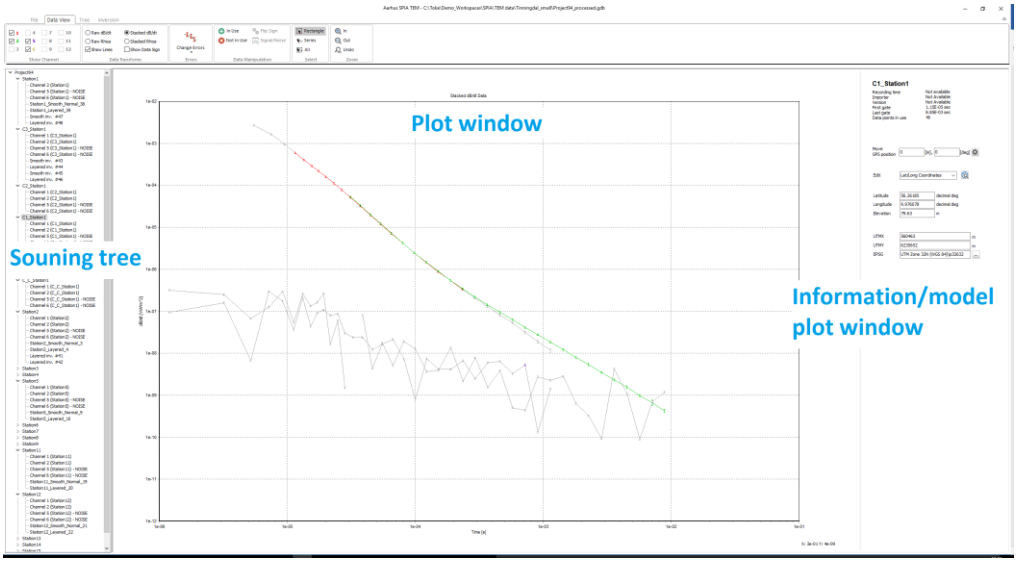

Figure 3.1. The project panel, plot panel and information and inversion result panel in SPIA.

3.3 External start model

It is possible to let SPIA automatically load an external start model from a text file. To be able to use this feature, the parameter:

UseExternalStartModel

in SPIAConfig.ini (located in the SPIA installation directory) needs to set to 1.

The text file containing the start model needs to be located in the same directory as the SPIA .gdb file. The format of the text file is:

Layer	Resistivity	ResSTD	Depth	DepSTD
1	100	1.01	10	99
2	50	1.30	110	99
3	60	99	125	99
4	10	2.00		

A file example can be found on the SPIA wiki page.
To use the external starting model in SPIA, the user needs to click "Edit" in the advanced inversion window. The external starting model will

load and the user can run the inversion.
Remember to set UseExternalStartModel = 0 when the starting model should not be used.

3.4 The File tab

New Project
Create a new project. Saves an empty gdb file and goes to import page for importing data.

Open Project
Opens dialog to browse for a SPIA database.

Open Recent
Shows a list of the ten most recently opened SPIA databases. Click the database name to open one of the databases.

Import

- Write station name and choose configuration. Options are Sclumberger, Wenner, Dipole dipole and general.
- Tick of and enter coordinates if available. The "show on map" displayes the location on Google Maps.
- Either enter manually the data or open a data file. Supported file formats are s4k and text files from the ABEM SAS instrument and the .ves format. See data examples on the SPIA wiki main page.
- Press "import" to import data and go to data view.

Export

- **Export to column file (xyz)** – exports the selected model(s) with the chosen edition label into .xyz files. Three .xyz files will be created:

  The **_inv.xyz** file contains all information of the inversion model, that is the model positioning, layer resistivity's, thicknesses and depths.

  The **_syn.xyz** file contains the forward model.

  The **_dat.xyz** file contains the data used in the inversion.

- **Create Model reports** – exports the selected model(s) with the chosen edition label as a PDF model report, one page for each model.

The exported files are saved in the subfolder \Model_reports in the same folder as the SPIA database.

Show on map
Show the location of the soundings in Google Maps. A separate window is opened in your default web browser.

Preferences
Model Plot - choose whether the axes on the model plot should be fixed or automatic based on DOI and model resistivity.

Model Report - choose whether the axes on the data and model plot in the PDF reports should be fixed or automatic based on DOI and model resistivity.
Also, the logo image can be changed for the model reports.

Rebuild
Rebuild gdb database. This is used if the database contains many soundings and us getting slow after many inversions. Only for advanced users.

Show License
Shows the license under which the program is currently registered. If the license should be moved to a different machine, use the "Unregister this machine" button.

Show Project Log
Showing change done to the data in the project during inversion.

Release history
See the release history for SPIA. Please consult this list to see important updates and new features whenever the program is updated.

Help
Open the main wiki help page for SPIA. It contains data examples, guides etc. Internet connection is needed.

Exit program
Exit SPIA

3.5 Data view tab

Show Channel
In the **Show Channel** window, the different channels can be toggled on or off. When a channel is toggled on, the data from the respective channel can be viewed by selecting the channel in the sounding tree. The channel number is colored corresponding to the color of the data plot.

Errors

Change Error
Change the error for the selected data points in the plot window. The error can be selected from the dropdown menu.

Keyboard shortcut is ***Alt+#***, where # is a number from 1-9. E.g. ***Alt+1*** adds 5% to the selected data points, ***Alt+2*** adds 10% etc.

Data manipulation

Not in use
Disable the selected data points in the plot window. Keyboard shortcut is ***Alt+q***.

In use
Enable the selected data points in the plot window. Keyboard shortcut is ***Alt+a***.

Select

Select
Select data points by dragging an area or by clicking a data point in the plot window.

Select all
Drag a square to select entire series within the selection.

Select Series
Select an entire data series by clicking a single point in the series.

Zoom

Zoom in
Zoom into the wanted level by clicking or dragging an area in the plot window.

Zoom out
Zoom out to the wanted level by clicking or dragging an area in the plot window.

Reset zoom
Reset the zoom level to default.

3.6 Tree tab

The **Tree** tab is used to manage the nodes in the **Sounding Tree**. The nodes can be renamed or deleted, and a model report, pictures or csv file can be created.

Node Management

Rename
Rename the selected project, sounding tree or channel node.

Delete
Delete the selected sounding tree or channel node. Keyboard shortcut is ***Delete***.

Export to

Model Report (PDF)
Create a model report in PDF format for the selected inversion model node. The exported pdf model report is saved in the subfolder \Model_reports in the same folder as the SPIA database.

Images/csv
Export the selected inversion node's data plot, model plot and model table into PNG and csv files.

3.7 Inversion tab

Standard
In the **Standard Inversion** window, the data can be inverted in auto mode. The processed data is inverted with a smooth model (20 layers)

with fixed thicknesses and a layered model (few layers). To run an inversion, a sounding tree needs to be highlighted.

Smoothness
Smoothness refers to the vertical constraints on the resistivities in the starting model. There are three options: low, normal and high vertical constraints. Setting the constraints to low, normal or high corresponds to factor values of 4, 2 and 1.5 respectively. A factor of e.g. 2 means that the resistivity values between two adjacent layers cannot change more than a factor 2.

Run inversion
Runs the **Standard** inversion. First the depth of investigation is estimated, then a smooth model with 20 layers and the given smoothness and a logarithmic layer distribution down to the depth of investigation is inverted, lastly a layered model based on this smooth inversion result is inverted.

Advanced
In the advanced window, a starting model can be constructed for a smooth, blocky or layered inversion. To edit an advanced inversion, a sounding tree or an inversion model needs to be selected. Press the edit button and a black data curve appears for each channel. This is the forward response based on the starting model. It will update automatically when the starting model is changed. Note: the DOI is not updated when the starting model is changed.

The smooth and blocky models have a large number of layers with fixed thicknesses, whereas the layered model has a few layers with no constraints on thicknesses. Advanced mode also gives the opportunity to customize a model by mouse-dragging the layer segments on the Model chart and by setting the STD values of the layers.

To edit the resistivity, standard deviation and layer thickness for a starting model, see **Layer editor** section below.

Edit
To do an advanced inversion, press the edit button when a sounding tree or an inversion model is highlighted to enter advanced mode.

Reset
Reset to the model's initial setup. This function can only be used if the user edits an inversion model and changes the parameters.

Inv Type
Choose inversion type; Smooth, Layered or Blocky in the dropdown.

Smooth
Use a smooth model for inversion. The smooth model has many layers (9-30 layers) with fixed thicknesses. The layer thicknesses are automatically log scaled after the first and last layer boundary in the starting model.

Layered
Use a layered model for inversion. Layered models have few layers with no constraints on thicknesses.

Blocky
Selecting this option will let the user customize a blocky model. A blocky inversion will better highlight where the big changes in resistivity is.

Layers
Set the number of layers in the starting model.

Smoothness
Smoothness refers to the vertical constraints on the resistivities in the starting model. There are three options: low, normal and high vertical constraints. Setting the constraints to low, normal or high corresponds to factor values of 4, 2 and 1.5 respectively. A factor of e.g. 2 means that the resistivity values between two adjacent layers cannot change more than a factor 2.

For a layered inversion, there are no vertical constraints for the starting model.

First boundary
Define the depth to the first layer's lower boundary in the starting model.

Last boundary
Define the depth to the last layer's lower boundary in the starting model.

Run inversion
Run the advanced inversion for the selected sounding tree.

Layer editor
In the layer editor window, the starting model can be edited. This can only be used in advanced mode.

Current layer
Select the layer in the starting model to edit.

Resistivity/Depth
Change the starting resistivity for the selected layer. The new resistivity for the layer will be plotted in the information window.

The user can switch between resistivity and depth by clicking on a layer boundary in the model window.

A priori STD
Change the standard deviation of the resistivity for the selected layer in the starting model.

Remove layer
Remove the selected layer in the information window.

Split layer
Split the selected layer in the information window. The selected layer will split into two layers.

Include channels
Select if any channels should be excluded for all soundings when doing inversions. This is used e.g. when two receiver coils are used at the same time and you only invert on the low moment data from one of them along with the high moment from the other.

3.8 Model tab

Depth of investigation (DOI)
Shows the **D**epth **O**f **I**nvestigation. As a means of evaluating inversion results, the **DOI** is calculated. The **DOI** calculation is based on the actual model output from the inversion and includes the full system response. Equally important, the data noise and the number data points are integrated in the calculation. The methodology is based on a recalculated sensitivity (Jacobian) matrix of the final model. The **DOI** is computed us-

ing a global and absolute threshold value contrary to defining a relative, say 5%, sensitivity limit.

Layers

The number of layers used in the inversion.

Data residual

Data residual for the inversion model results. A data residual of 1 corresponds to a fit to the data standard deviation for the sounding. So, a residual below 1 means that the model fits the data within the standard deviation.

Label

A label is used to label the inversion model results for later export or display in the Aarhus Workbench.

Each smooth and layered inversion model can be labeled with different labels and the text differs depending on the inversion model. The two label options are either a label describing the kind of model and if a priori information has been used, or a label including the word "final" in front of the previous description.

Only one inversion model result can be labeled "final" for each smooth and layered inversion in a sounding. The model name while be marked with a *. If a model is labeled "final", any existing model with this label will be relabeled automatically with the other label option.

View

The view window only applies to inversion model results.

Table

Show a table in the information window with the inversion results and STD for resistivity, thickness and depth for each layer in the model. An STD below one means that the model parameter is fitted within the noise. An STD of 0.3 does not mean that the parameter is a better fit compared to an STD of 0.7. Both are fitted within the noise so both are equal likely.

Graph

Show a graph in the information window with the inversion results for resistivity, thickness and depth for each layer in the model.

4. KEYBOARD SHORTCUT LIST

Alt+q

Disable selected data points in the plot window.

Alt+a

Enable selected data points in the plot window.

Alt+#

Change the standard deviation for the selected data points in the plot window.

is a number from 1-9. E.g. ***Alt+1*** adds 5% to the selected data points, ***Alt+2*** adds 10% etc.

Delete

Delete the selected tree and node in the sounding tree.

Ctrl+left/right/up/down/enter

Use left/right arrows to toggle between the tabs. Use up/down arrows to select a function within a tab. Use enter to run the function.

Ctrl+h

Open the help file.

Ctrl+o

Open a new project

Ctrl+ right mouse

Select several channels to plot together.

5. SPIA DC DATA EXAMPLES

Example files can be downloaded at our SPIA wiki page

Schlumberger

ab/2 rhoa a stdev
2 81.42 1 1.05
3 71.77 1 1.05
4 57.13 1 1.05
5 49.13 1 1.05
6 40.44 1 1.05
7 36.18 1 1.05
8 33.92 1 1.05
9 33.00 1 1.05
10 33.17 1 1.05
11 33.63 1 1.05

1. column: ab/2 is the half distance between the current electrodes A and B
2. column: Resistivity in rhoa (ohmm)
3. column: The distance a between the two potential electrodes M and N
4. column: Standard deviation where e.g. 1.05 equals 5%

Wenner

a rhoa stdev
1 81.42 1.05
2 71.77 1.05
3 57.13 1.05
4 49.13 1.05
5 40.44 1.05
6 36.18 1.05
7 33.92 1.05
8 33.00 1.05
9 33.17 1.05
10 33.63 1.05

1. column: The distance a between |AM|,|MN| and |NB|
2. column: Resistivity in rhoa (ohmm)
3. column: Standard deviation where e.g. 1.05 equals 5%

Dipole dipole / general

AX BX MX NX rhoa stdev
-1.5 -0.5 0.5 1.5 81.42 1.05
-2.0 -1.0 1.0 2.0 71.77 1.05
-2.5 -1.5 1.5 2.5 57.13 1.05
-3.0 -2.0 2.0 3.0 49.13 1.05
-3.5 -2.5 2.5 3.5 40.44 1.05
-4.0 -3.0 3.0 4.0 36.18 1.05
-4.5 -3.5 3.5 4.5 33.92 1.05
-5.0 -4.0 4.0 5.0 33.00 1.05
-5.5 -4.5 4.5 5.5 33.17 1.05
-6.0 -5.0 5.0 6.0 33.63 1.05

1-4. column: Electrode position A, B, M, N
5. column: Resistivity in rhoa (ohmm)
6. column: Standard deviation where e.g. 1.05 equals 5%

If electrodes have Y coordinates the following can be used:

AX, BX, MX, NX, AY, BY, MY, NY, Rhoa, STD

6. DEMO WORKSPACE AND TUTORIAL

Having installed SPIA and the included demo database, the following example can be used to get familiar with SPIA.

The included demo database is installed in:

<SPIA install dir>\DemoWorkspace\

1. **Open data**
   Open SPIA and open the database. It is noticed that there are six DC soundings. In this example, only data from "exercise12c" will be processed and inverted.

2. **Rename**
   The "exercise12c" sounding is a Schlumberger sounding and has been corrected for "Wenner-effects". Rename "exercise12c" to "Measurement12c" by using the rename function in the tree tab (fig 6.1).

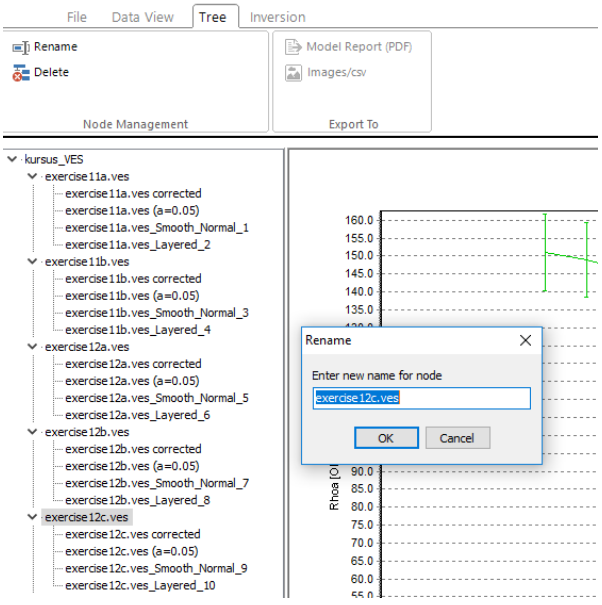

Figure 6.1. Renaming "exercise12c" to "Measurement 12c".

3. Processing

Since the data looks smooth without noise, no processing is needed, but try to select the two last data points and give them an error of 15%

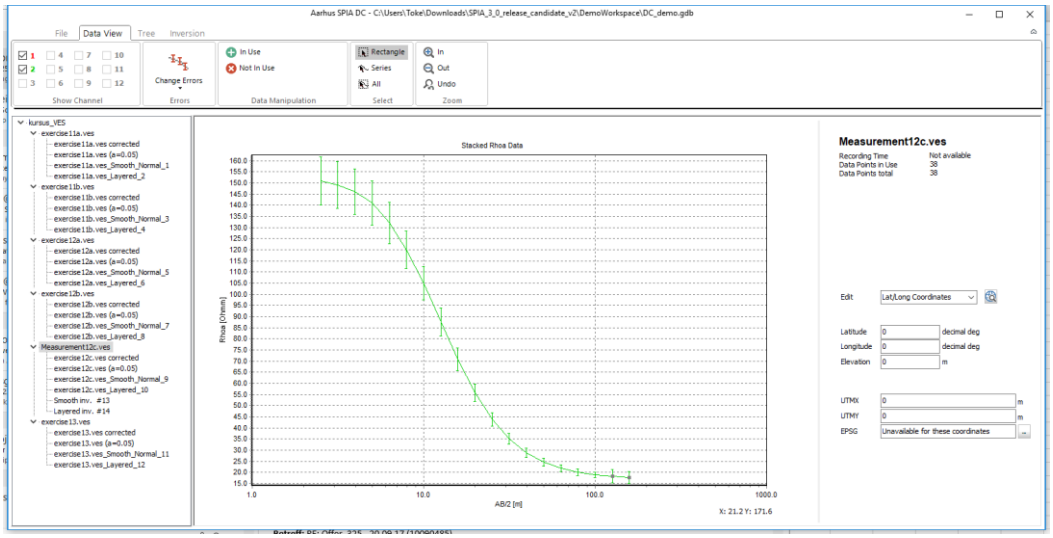

Figure 6.2. Processing result after disabling data and adding uncertainty.

4. Inversion

The data is now ready for inversion. The first thing to do is to make a simple inversion from the inversion tab. Highlight the" Measurement12c.ves" sounding and run a simple inversion with a normal smoothness. This gives both a smooth inverted model of 20 layers and a layered inverted model of five layers (fig 6.3). For both inversion models the DOI (Depth Of Investigation) is calculated and the residuals are low. Looking at the layered model in table view it is noticed that layer 2 and 3 have unfitted resistivity, thickness and depth parameters since the STD is well above 1. An STD below one means that the model parameter is fitted within the noise. An STD of 0.3 does not

mean that the parameter is a better fit compared to an STD of 0.7. Both are fitted within the noise so both are equal likely.

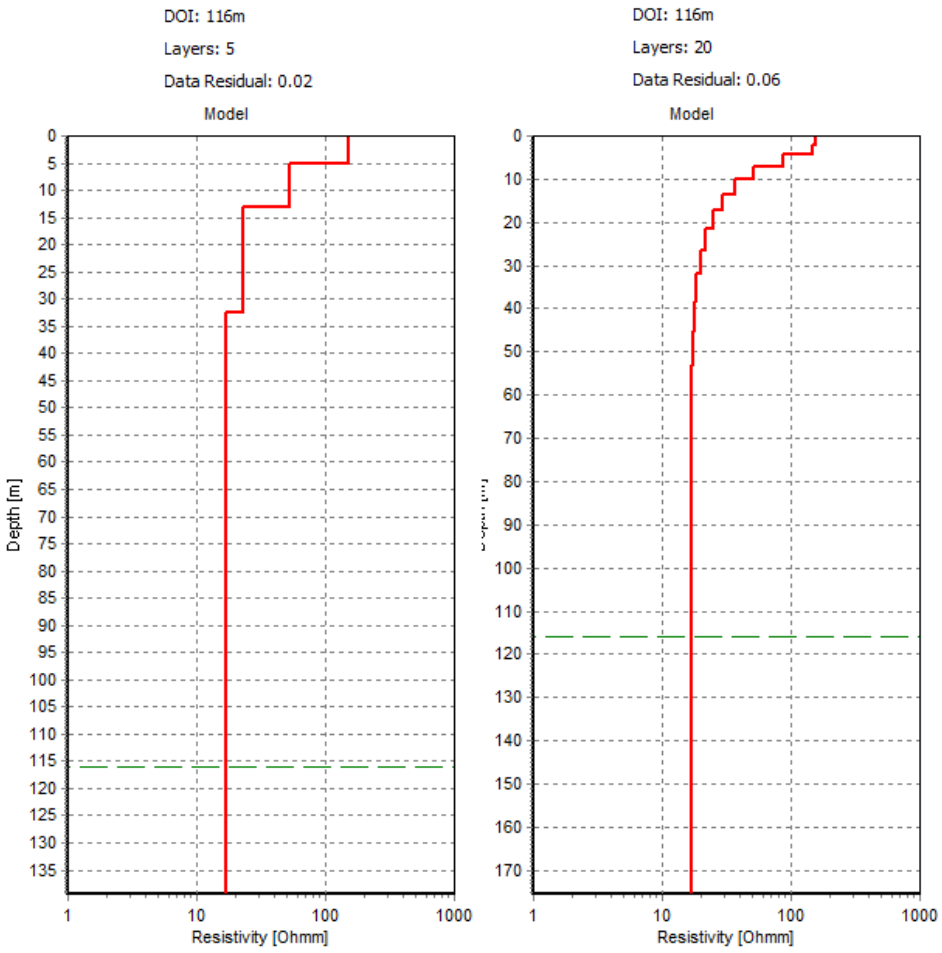

Figure 6.3. Inversion model results for a simple inversion with normal smoothness.

5. Advanced inversion

Try making a new advanced inversion. Highlight the Measurement12c.ves sounding and press edit. From the earlier inversion model result it is seen that a starting resistivity of 20 Ωm is a better guess than 50 Ωm. Change this in the layer editor for all layers. Also change the number of layers to 3. Run the inversion and compare the inversion model results. It is noticed that the data residual is more or less the same and the parameters in the table view are now closer to 1. Since we can fit a 3 layer model as good or better 4 layer model, the 3 layer model is preferred.

Try making a 2 layer model and it is noticed that the model cant fint the data.

6. Model report / export of data

Go to File→ export and select models labelled "Final – Layered no prior" and press export to Model Reports. A pdf will be created with all models selected.

Select Export to column file and 3 xyz files will be made for each inversion model:

- .dat file which contains the processed data used in the inversion.
- .inv which contains the inversion model
- .sys which contains the forward response for the inversion model.

It is also possible to export data and model plots into bitmaps and export the table information into a csv file. This is done in the tree tab.

For more training, process and invert the remaining soundings.

7. REFERENCES

SPIA is based on a number of scientific publications. If you want to read more we refer to the following publications:

Basic principles of TEM

Christiansen, A. V., E. Auken, and K. I. Sørensen, 2006, The transient electromagnetic method in Groundwater Geophysics. A tool for hydrogeology: Kirsch, R., Ed., Springer.

Schamper, C., J. B. Pedersen, E. Auken, A. V. Christiansen, B. Vittecoq, J. Deparis, Jaouen T., Lacquement F., P. Nehlig, J. Perrin, and P. A. Reninger, 2013, Airborne Transient EM Methods and Their Applications for Coastal Groundwater Investigations in Groundwater in the Coastal Zones of Asia-Pacific: Wetzelhuetter C., Ed., Springer\SCHAMPER2013C.pdf.

Data processing

Auken, E., A. V. Christiansen, J. A. Westergaard, C. Kirkegaard, N. Foged, and A. Viezzoli, 2009, An integrated processing scheme for high-resolution airborne electromagnetic surveys, the SkyTEM system: Exploration Geophysics, ***40,*** *184-192.*

Foged, N., E. Auken, A. V. Christiansen, and K. I. Sørensen, 2013, Test site calibration and validation of airborne and ground based TEM systems: Geophysics, ***78,*** *E95-E10*Inversion

Auken, E., A. V. Christiansen, B. H. Jacobsen, N. Foged, and K. I. Sørensen, 2005, Piecewise 1D Laterally Constrained Inversion of resistivity data: Geophysical Prospecting, ***53,*** *497-506.*

Kirkegaard, C. and E. Auken, 2014, A parallel, scalable and memory efficient inversion code for very large scale airborne EM surveys: Geophysical Prospecting.

Depth of investigation

Christiansen, A. V. and E. Auken, 2012, A global measure for depth of investigation: Geophysics, ***77,*** *WB171-WB177.*

APPENDIX I: SPIACONFIG.INI

SPIACONFIG.INI includes settings for SPIA.

```
[em1dinv]
em1dinv32=em1dinv\32bit\em1dinv32.exe
em1dinv32_WalkTem=em1dinv\32bit\em1dinv32_WalkTem.exe
em1dinv64=em1dinv\64bit\em1dinv64.exe
Inversion=em1dinv\TEM_inversion.con
DOIInversion=em1dinv\TEM_DOI_Estimation.con
Inversion_MixedOffset=em1dinv\TEM_inversion_MixedOffset.con
DOIInversion_MixedOffset=em1dinv\TEM_DOI_Estimation_MixedOffset.con
DOI=Lower
LayerThreshold=1.1

SaveEm1dinvOutput=Yes

MinPointsPrChannel=6
IncludeChannels=1,2,3,4,5,6,7,8,9,10,11,12
MaxDistanceBetweenRxCoils4ApproxResponses=1
UseExternalStartModel=0

[DataType]
DataType=

[Processing]

MaxAveSlope=0.6


SkipInitialDatapoints=3

AveSlopeBackStep= 1

NonSpikeFraction=0.1

MinimumdBdt=1E-20
MaxDataSTD=1.3
```

Path to 32-bit EM1DINV.exe
Path to 32-bit EM1DINV.exe for WalkTEM
Path to 64-bit EM1DINV.exe
Path to config file for AarhusINV
Path to DOI config file for AarhusINV
Path to config file for offset configuration for AarhusInv
Path to config file for DOI offset configuration for AarhusInv
Upper/Lower – Set which DOI SPIA displays for inverted models.
Constant used to estimate the number of layers used for the layered model from the smooth model in simple inversion mode.
Yes/No – Save output files from AarhusInv. If set to yes, the output files are saved in a subfolder named AarhusInvFiles in the folder location of the .gdb file.
Disregard channel with less than the selected number of data points.
Disregard channels not listed in the inversion.
Check for when offset config file is used.
Set to **1** to use external start model. Text file must be located with gdb file.

Set to **TEM** if SPIA automatically should start with the TEM module. Set to **DC_schlumberger** if SPIA should automatically start with the DC module.
The processing section is settings for the automatic processing the first time a .GDB file is opened in SPIA.
Upper limit for the second derivative of the averaged data point. If a second derivative exceeds this limit, the remaining data points are noise and are set "not in use".
Number of data points which are skipped in the beginning of a measurement before calculating the second derivative.
Number of data points which are set not in use before the iMaxAveSlope limit is met.
The percentage of data points which are set not in use in the top and bottom of the nonspike -filter. Here it is 10% in both ends giving a total of 20 %.
dB/dt values lower that this setting is set to 0.
If the standard deviation of an averaged data point is higher than this setting, the data point is set to not in use.

```
[DataColors]
Channel1=255,0,0
Channel2=0,204,0
Channel3=255,204,0
Channel4=255,0,255
Channel5=0,0,255
Channel6=194,194,71
Channel7=0,255,255
Channel8=163,0,82
Channel9=0,0,0
Channel10=0,0,0
Channel11=0,0,0
Channel12=0,0,0
```

RGB values for the 12 data channels.

```
[ModelColors]
ModelEdit=0,255,0
ModelEditHighlight=255,0,0
ModelBackground=0,0,255
```

RGB values for the model plot in the information window.

```
[STD]
STD1=Locked/1.001
STD2=0.5 %/1.005
STD3=1 %/1.01
STD4=3 %/1.03
STD5=5 %/1.05
STD6=10 %/1.1
STD7=30 %/1.3
STD8=50 %/1.5
STD9=100 %/2
STD10=Free/99
```

Values for the Errors dropdown menu.

```
[ModelDepthScale]
ModelMaxDepthScaleFactor=1.2
```

For calculation of the depth (y-axis) on the model plot. It is calculated as DOI times this factor.

```
[MinLayers]
SmoothMode=9
LayeredMode=2
```

Minimum number of layers allowed for a smooth and layered inversion.

```
[MaxLayers]
SmoothMode=30
LayeredMode=7
```

Maximum number of layers allowed for a smooth and layered inversion.

```
[ModelReport]
Logopath=
ModelResScaleMin=1
ModelResScaleMax=1000
ModelDepthScaleMin=0
ModelDepthScaleMax=300
DataResScaleMin=1
DataResScaleMax=1e03
DatadbdtScaleMin=1e-12
DatadbdtScaleMax=1e-03
DataTimeScaleMin=1e-06
DataTimeScaleMax=1e-02
AutoScaleModelPlot=No
AutoScaleDataPlot=No
```

Settings for the model report pdf maker. These settings should not be changed.

```
[Misc]
Contact=Support@ArhusGeoSoftware.dk
maxSoundingsinmem=100
```