

“X2ipi” tool box for DC and IP 2D measurements with SYSCAL and ELREC

A. Bobachev (INRA), with support of
A. Cataldi (TRX Consulting, Venezuela),
J.-F. Girard (BRGM),
R. Guerin (University Paris 6),
H. Robain (IRD),

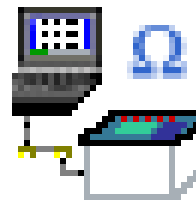
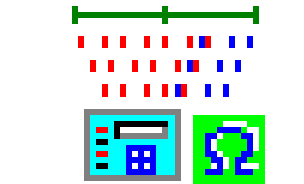
2D resistivity imaging

Create a sequence of reading with **Electre III, Electre II**

Take reading in the field with **Syscal or Elrec** equipments

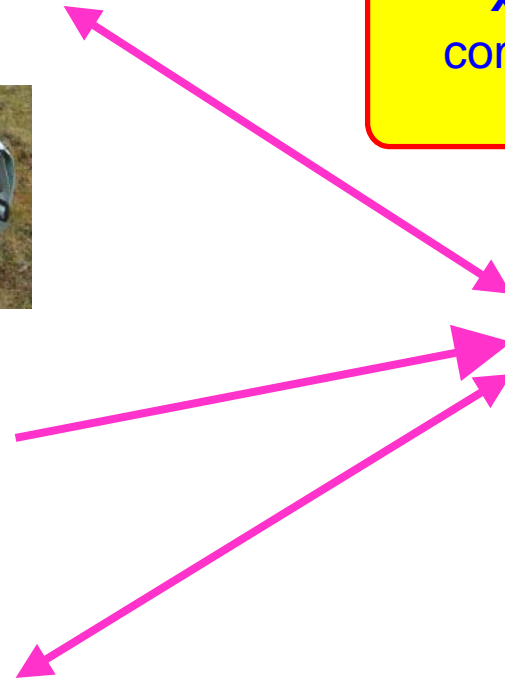
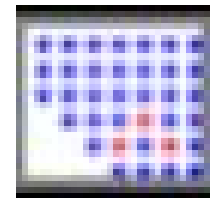
Transfer and process data with **Prosys**

Interprete the data with **Res2Dinv**



R2I

“x2ipi” tool box,
complementary
software



x2ipi: sequences

- Compatible with **Electre I** and **Electre** software
- Editing of sequences
 - Change “miltinode” number
 - Merger and separating sequences for different array type
 - Removing a faulty electrode
 - Removing measurement lines and particular quadripoles
 - Preparing a “Roll along” [* .seq] file
 - Preparing reciprocal array
- Create new sequences
- Create a sequence from data file (Res2dInv, Prosys)

Create new sequences

New SEQ file

N electrodes: Step: 1 2

Type of array:

Pole-dipole Wenner-Beta
 Half-Wenner Schlumberger
 Wenner-Alpha Dipole-Dipole

Dipole lengths:

MN=1 x a nLines=3
MN=3 x a nLines=5
MN=5 x a nLines=5
MN=7 x a nLines=0
MN=9 x a nLines=5
MN=15 x a nLines=5
MN=21 x a nLines=0

nQuadropoles=857

AM/MN R=00'2 (K_array/a) Yes/No N_reading

	9 x a	15 x a	21 x a		
	1 x a	3 x a	5 x a	7 x a	
<input checked="" type="checkbox"/>	3/3	3	(56.55)	Yes	55
<input checked="" type="checkbox"/>	5/3	4	(153.6)		53
<input checked="" type="checkbox"/>	7/3	5	(317.6)		51
<input checked="" type="checkbox"/>	9/3	6	(565.5)		49
<input checked="" type="checkbox"/>	11/3	7	(913.9)		47
<input type="checkbox"/>	13/3	8	(1380)		
<input type="checkbox"/>	15/3	9	(1979)		
<input type="checkbox"/>	17/3	10	(2730)		
<input type="checkbox"/>	19/3	11	(3648)		
<input type="checkbox"/>	21/3	12	(4750)		
<input type="checkbox"/>	23/3	13	(6054)		
<input type="checkbox"/>	25/3	14	(7575)		
<input type="checkbox"/>	27/3	15	(9331)		
<input type="checkbox"/>	29/3	16	(11338)		
<input type="checkbox"/>	31/3	17	(13613)		

Show Save Cancel Help

Configuration of array

X=17.5 Ps,Z=13

1 + + + + +
2 + + + + +
3 + + + + +
4 + + + + +
5 + + + + +
6 + + + + +
7 + + + + +
8 + + + + +
9 + + + + +
10 + + + + +
11 + + + + +
12 + + + + +
13 + + + + +
14 + + + + +
15 + + + + +
16 + + + + +
17 + + + + +
18 + + + + +
19 + + + + +

0 2.5 5 7.5 10 12.5 15 17.5 20 22.5 25 27.5 30 32.5 35 37.5 40 42.5 45 47.5 50 52.5 55 57.5 60 62.5

MN=a
MN=3 a
MN=5 a
MN=9 a
MN=15 a

Using “x2ipi” for data processing

- Compatible with **Prosys**, **Electre** and **Res2Dinv** software
- Presentation of data
- Trimming bad measurements (manual, q-factor, voltage, current, IP, bad electrode)
- Merger and separating data for different array type
- Comparing data files
- Time lapse data processing
- “Median” filtration of data for “geological noise” elimination
- Export to different formats: Res2Dinv (standard or general data format), SensInv2D, Ipi2win)

Data presentation

Read SysCal ProSys TXT format

File Converter Exchange Options Contours About

S:\Leshal\ELECTRE\aldo\example\ec6300\ec6300.txt

Shift (m) 0
Delete
last lines 0
first lines 0

SEQ - ABMN Electrodes - 59 Distance 50. m
R=OO'/2 Type of array - dipole-dipole (ABMN)
OO'/length (6) from 50 to 175 Overlapping 0
Data points - 398 Bad points 13 Quadripoles 398

ec6300.txt - K:\USERS\Leshal\ELECTRE\aldo\example\ec6300\

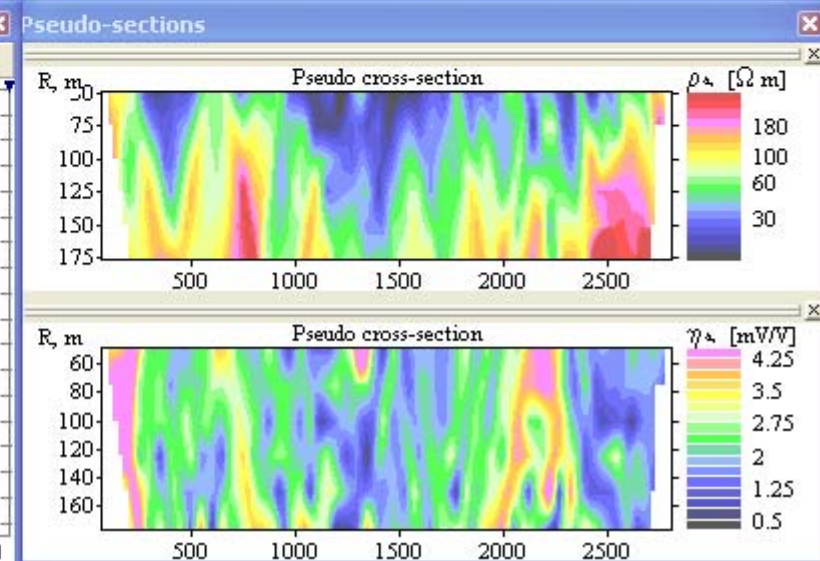
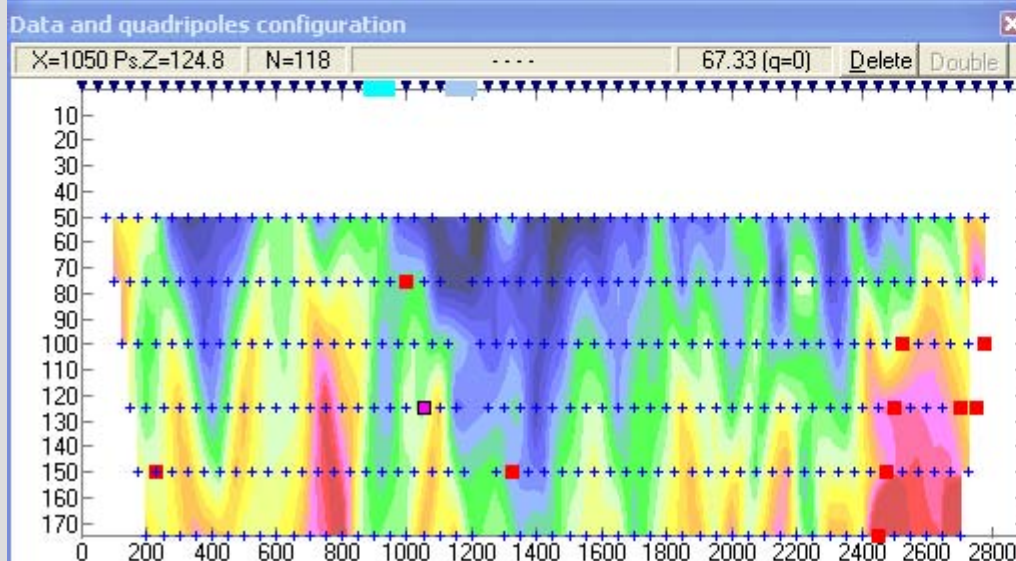
$A_0 B$ $M_0 N$
 $x=(B+M)/2$
 $Ps.Z=OO'/2$

Table

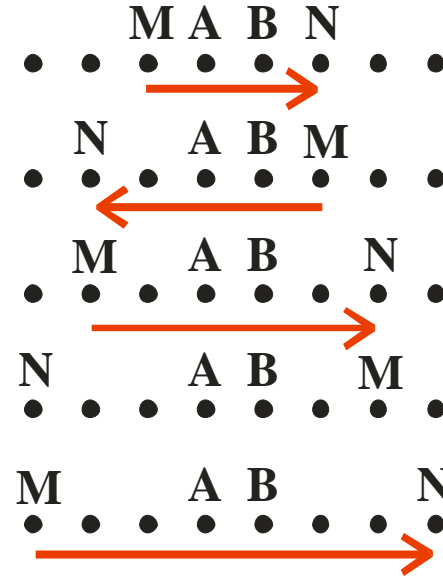
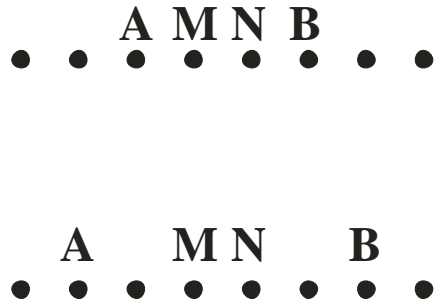
Data Electrodes

Max. q (%) 3 Min. dU 0 Min. I 0
Min. IP 0 Max. IP 30

N	Ps.Z	X	MN	App.Res. q	V	I	IP
113	150	1025	50	75.19	0.3	4.559	2000
114	175	1050	50	168.1	0	6.371	2000
115	50	975	50	30.4	1.2	64.51	2000
116	75	1000	50	39.79	3.9	21.11	2000
117	100	1025	50	75.09	0.1	15.94	2000
118	125	1050	50	67.33	0.4	7.144	2000
119	150	1075	50	168.3	0.4	10.2	2000
120	175	1100	50	91.03	0.8	3.45	2000
121	50	1025	50	25.55	0	89.47	3300
122	75	1050	50	54.43	0.1	47.64	3300

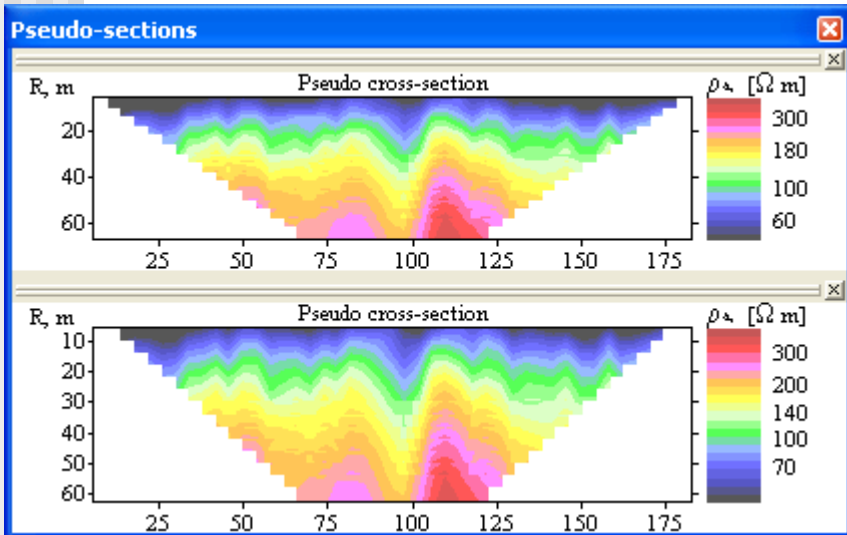


Reciprocal Schlumberger array optimized for Syscal Pro



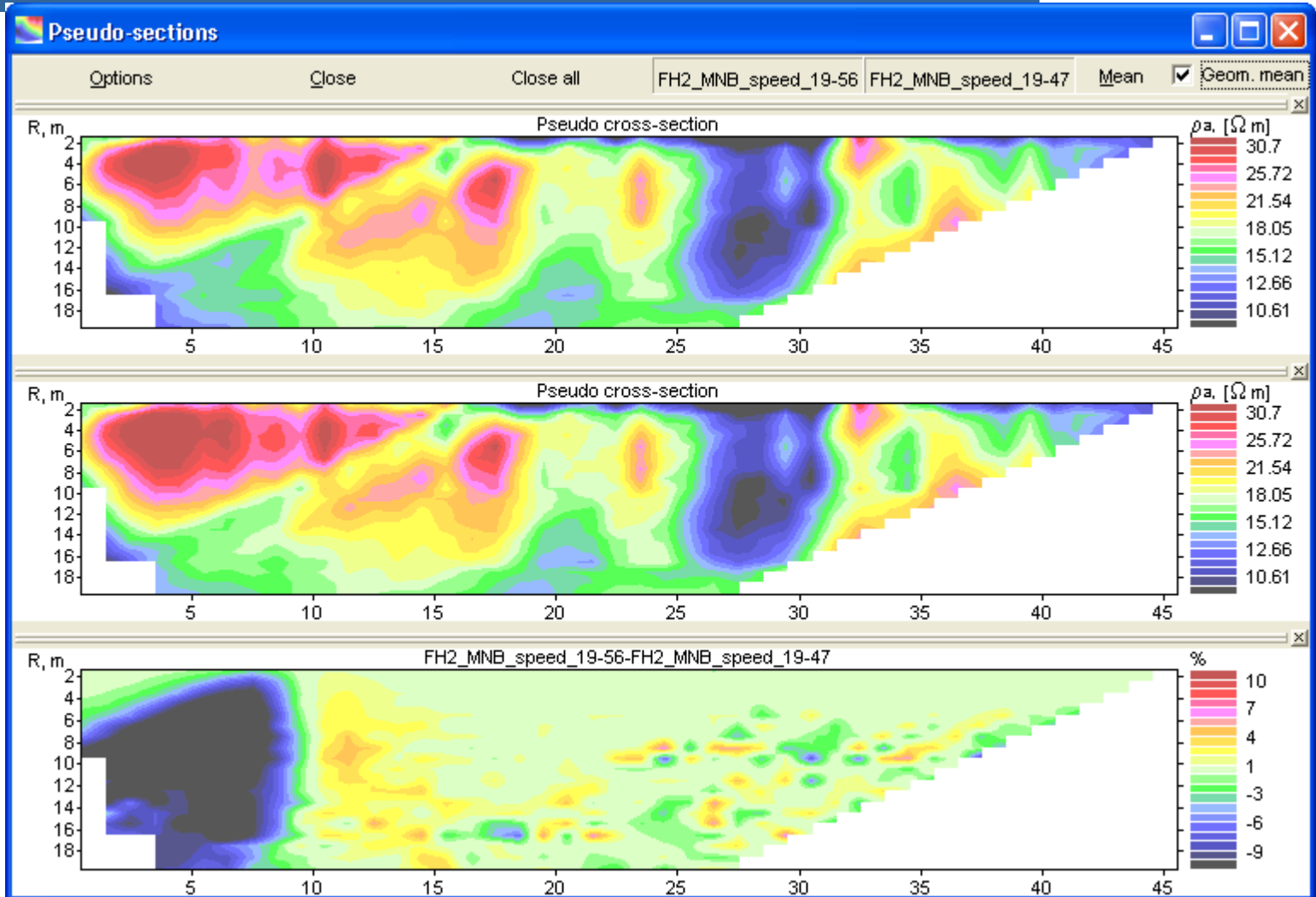
Schlumberger array

Asymmetrical array

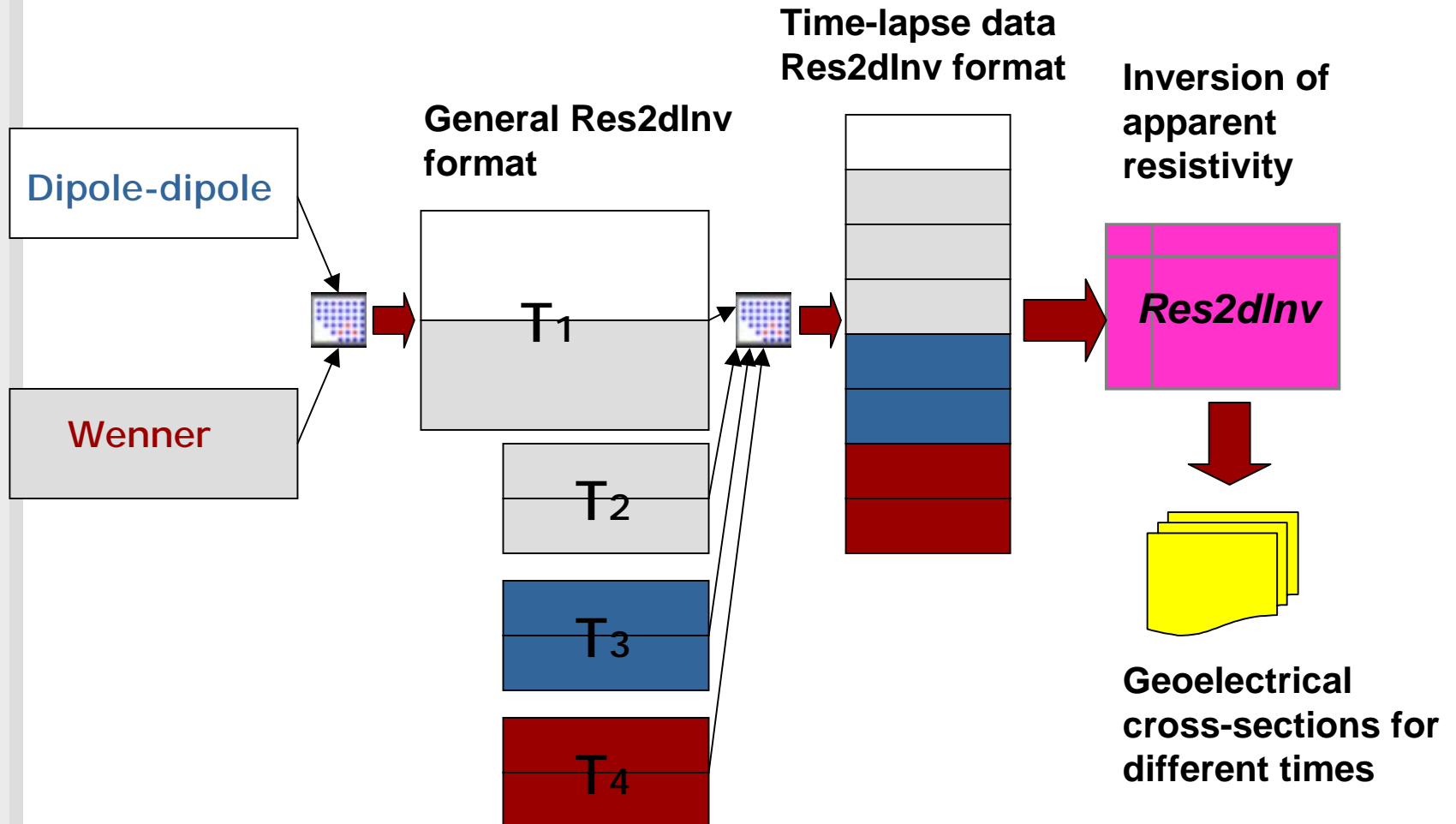


Data of Henri Robain, IRD

Data comparing (*data by R. Guerin*)



Preparation of data file for time lapse 2D inversion



"Median" processing

$$\rho_a(x, r) = \rho_a^{1D}(x, r) \cdot P(x_{MN}) \cdot C^A(x_A) \cdot C^B(x_B) \cdot \delta(x, r)$$



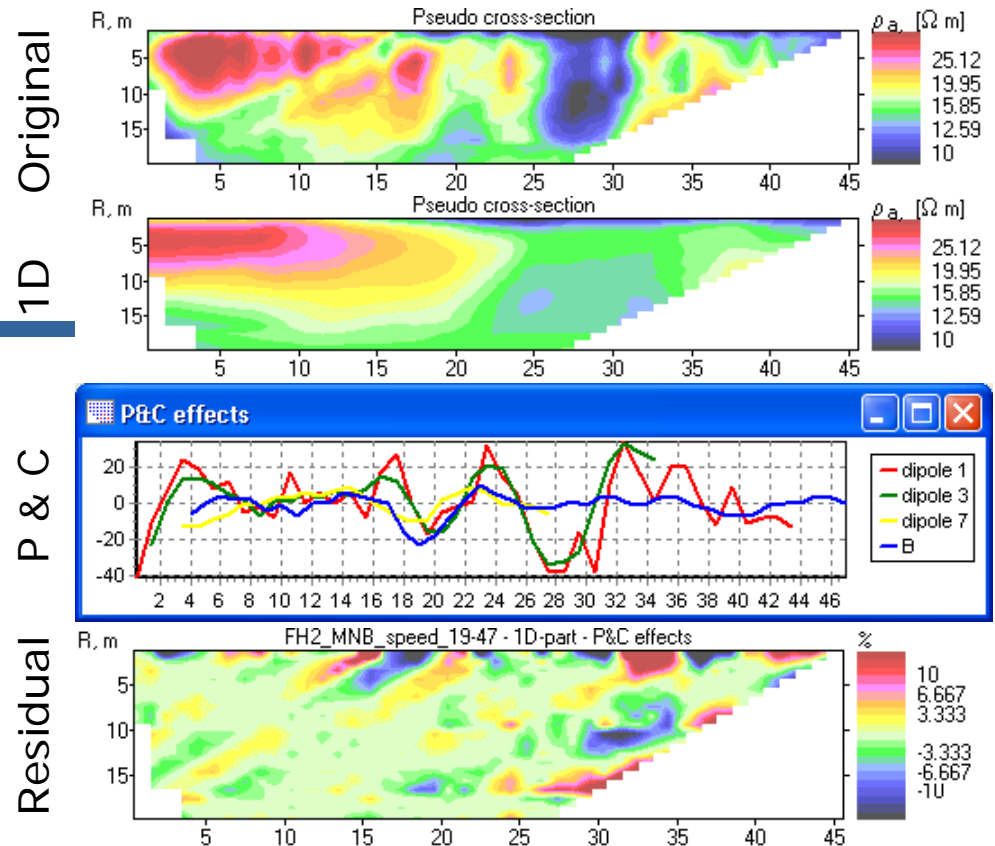
$$\tilde{\rho}_a(x, r) = \rho_a^{1D}(x, r) \cdot \tilde{P}(x_{MN}) \cdot \tilde{C}^A(x_A) \cdot \tilde{C}^B(x_B) \cdot \tilde{\delta}(x, r)$$



M. Ritz, H. Robain, E. Pervago, Y. Albouy, C. Camerlynck, M. Descloitres and A. Mariko. 1999. "Improvement to resistivity pseudosection modelling by removal of near-surface inhomogeneity effects: application to a soil system in south Cameroon". **Geophysical Prospecting**, 47, pp. 85 -101

Median processing

Step 1. Decomposition



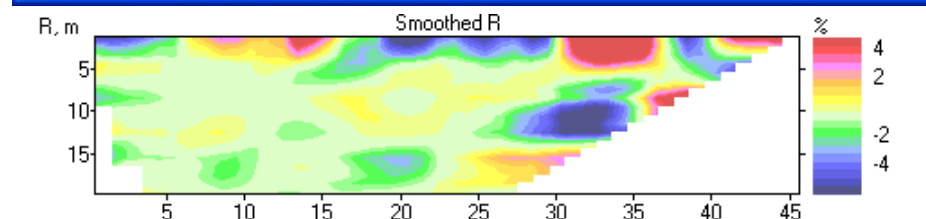
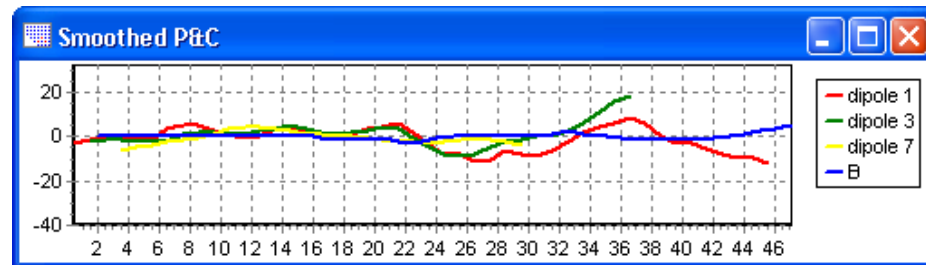
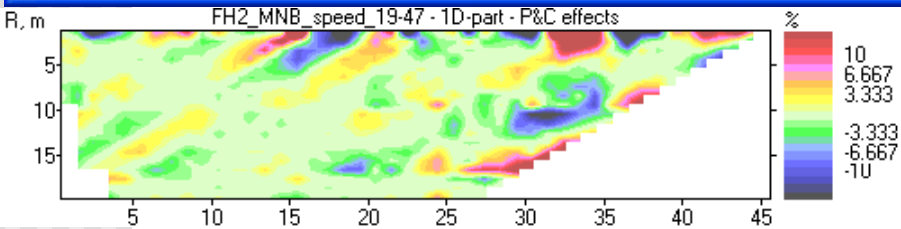
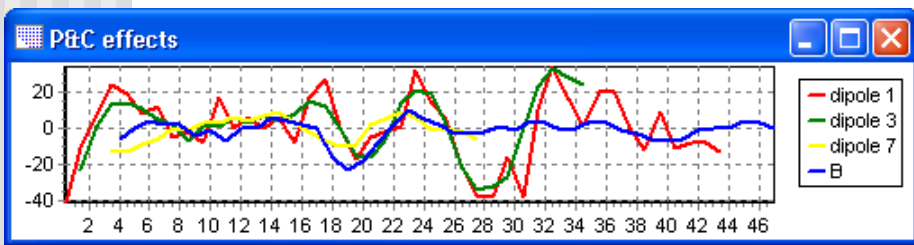
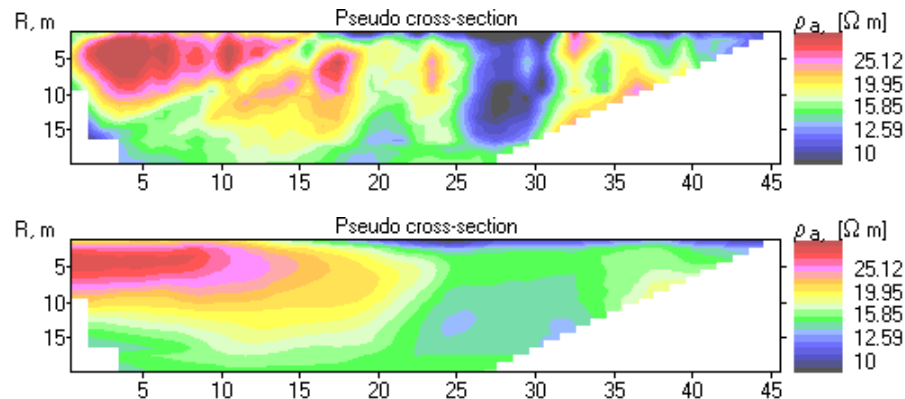
$$\rho_a(x, r) \Rightarrow \rho_a^{1D}(x, r)$$

$$\left[\rho_a(x, r) / \rho_a^{1D}(x, r) \right] \Rightarrow P(x_{MN})$$

$$\left[\rho_a(x, r) / \left(\rho_a^{1D}(x, r) \cdot P(x_{MN}) \right) \right] \Rightarrow C^A(x_A); C^B(x_B)$$

$$\left[\rho_a(x, r) / \left(\rho_a^{1D}(x, r) \cdot P(x_{MN}) \cdot C^A(x_A) \cdot C^B(x_B) \right) \right] \equiv \delta(x, r)$$

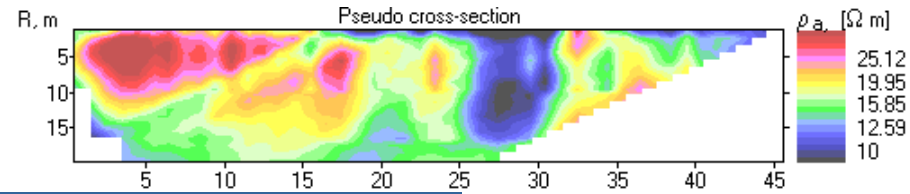
Median processing Step 2. Smoothing



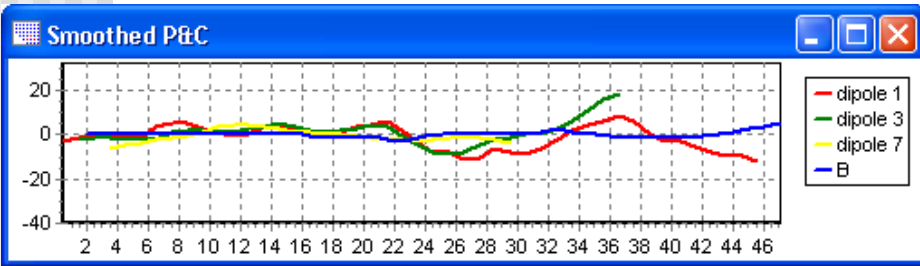
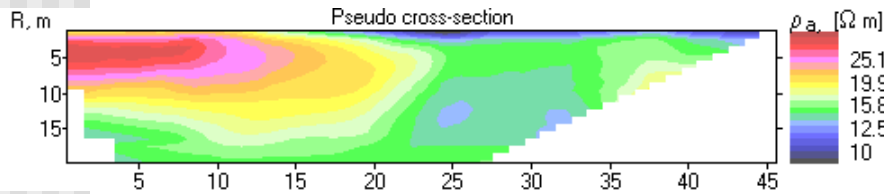
Parameters for smoothing

Median processing Step 3. Reconstruction

Original data

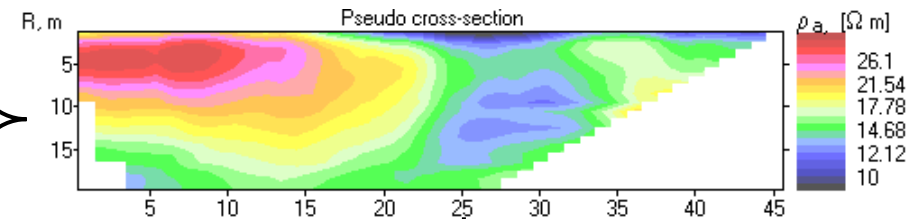


Smoothed components

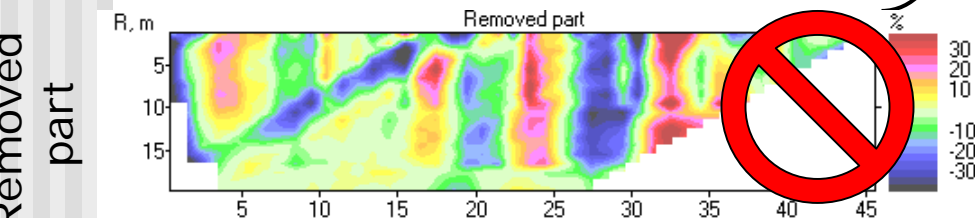
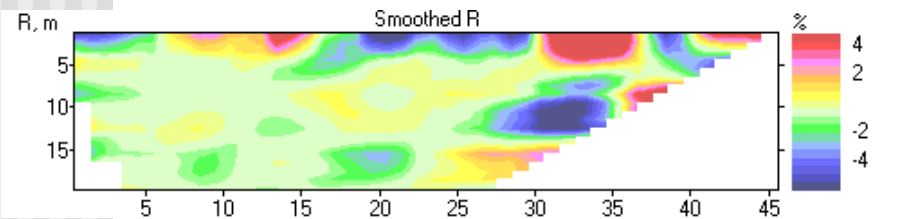


Recalculation 1D part

Smoothed data



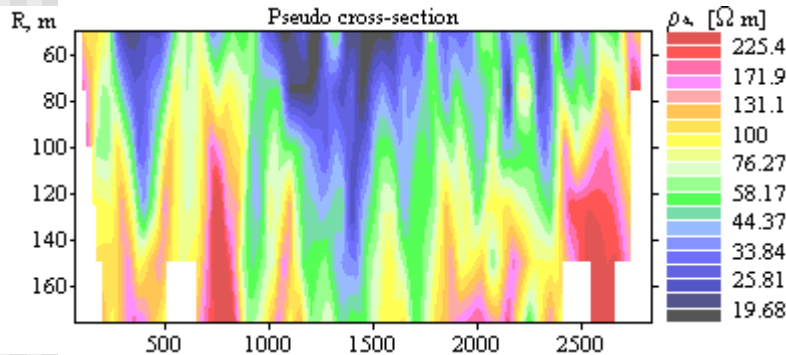
RE
I



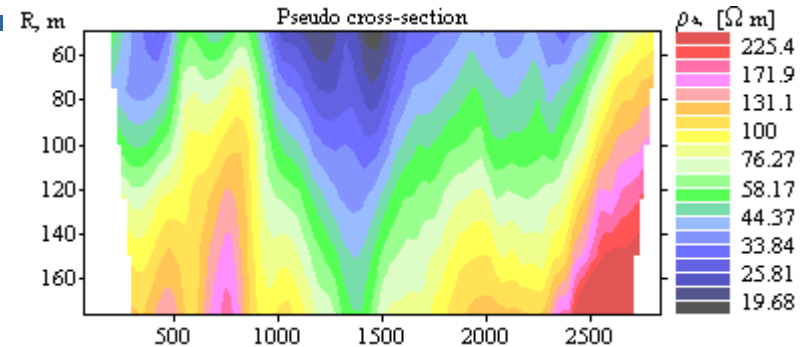
Median processing for apparent resistivity

Example by A. Cataldi (TRX Consulting, Venezuela), *Elrec*

Original

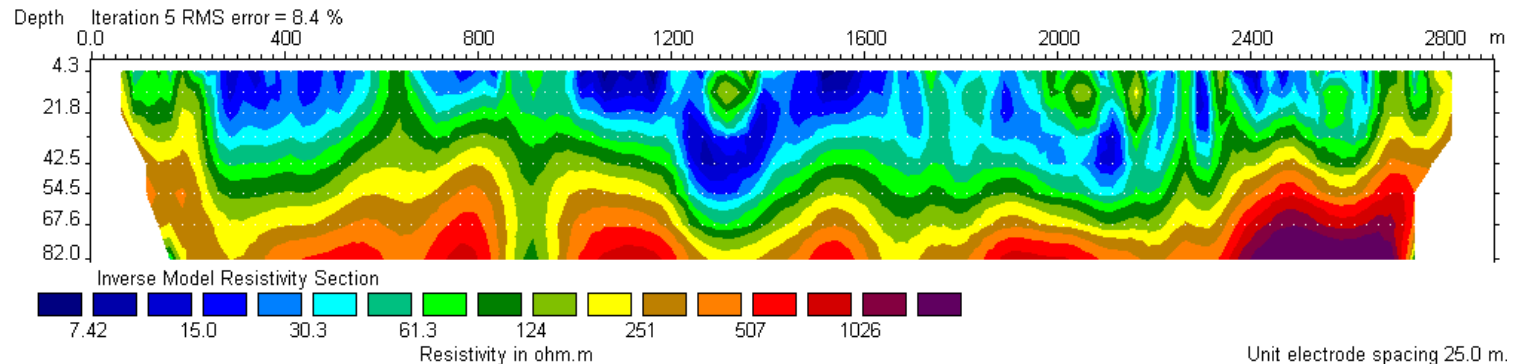


Smoothed

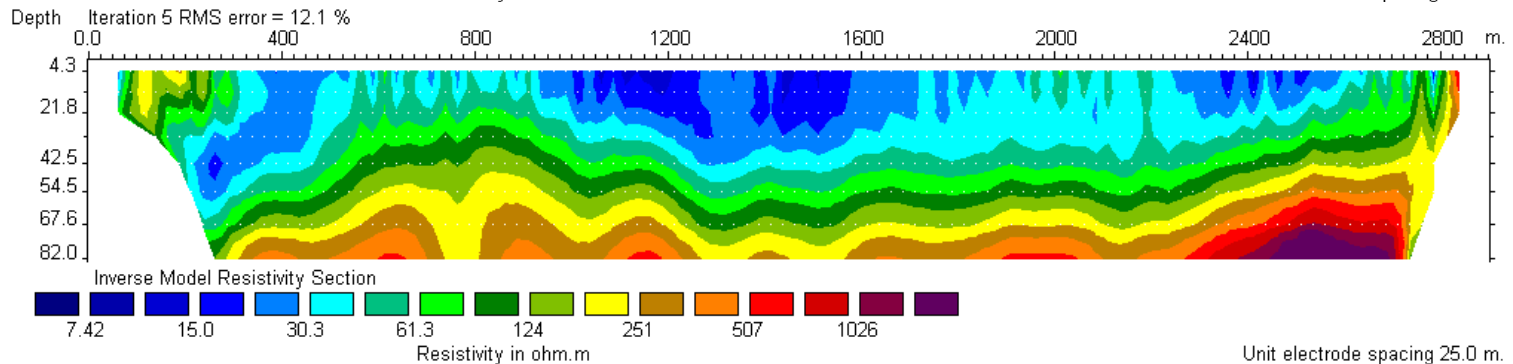


Result of inversion

original data



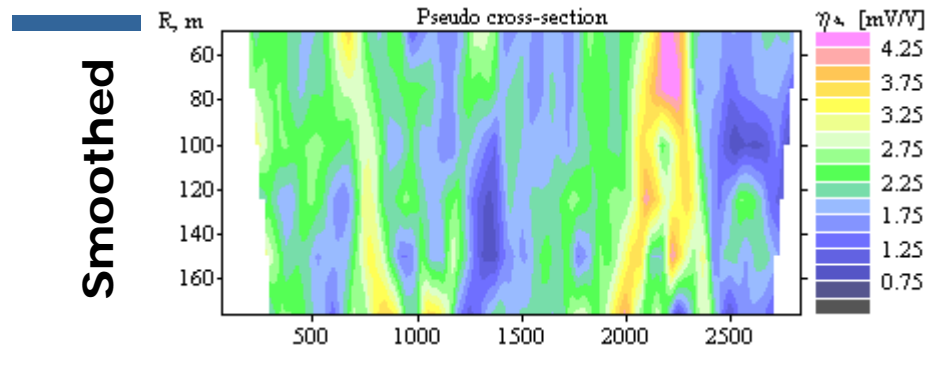
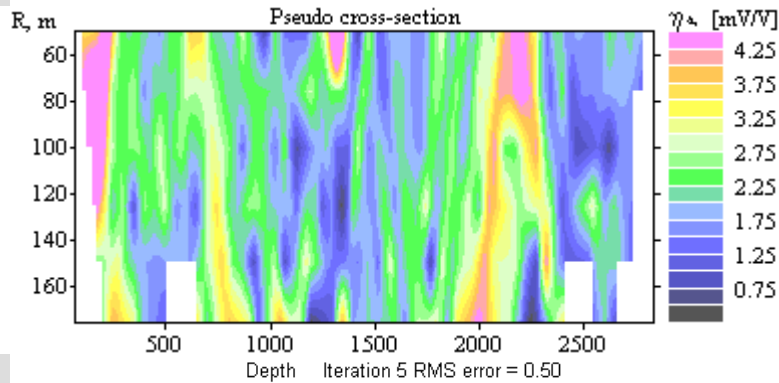
smoothed data



Median processing for IP

Example by A. Cataldi (TRX Consulting, Venezuela), *Elrec*

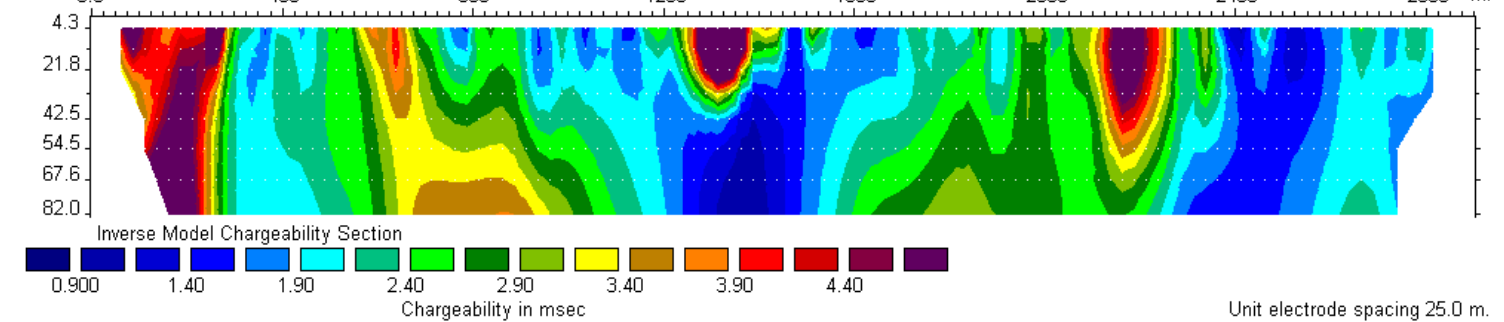
Original



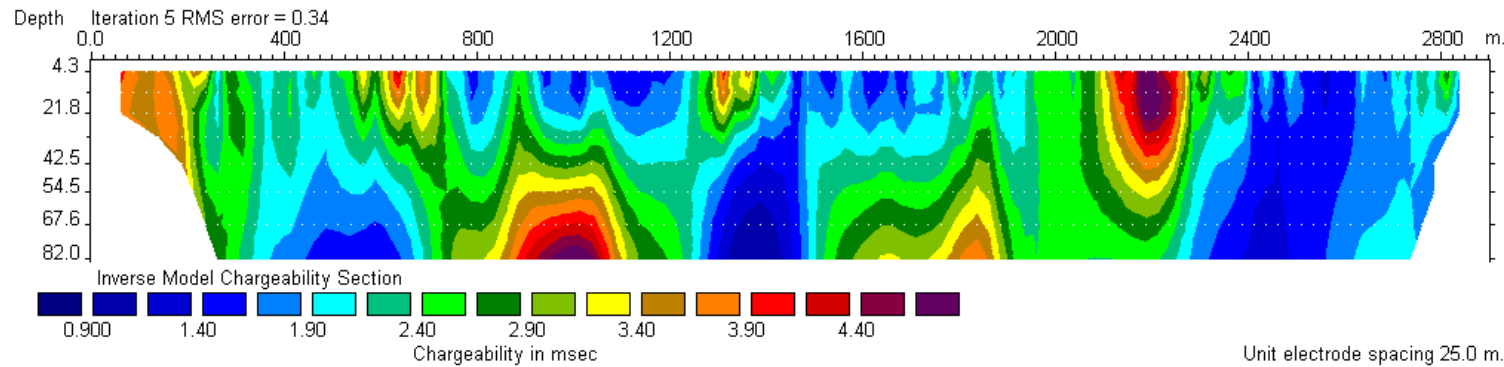
Smoothed

Result of inversion

original data



smoothed data



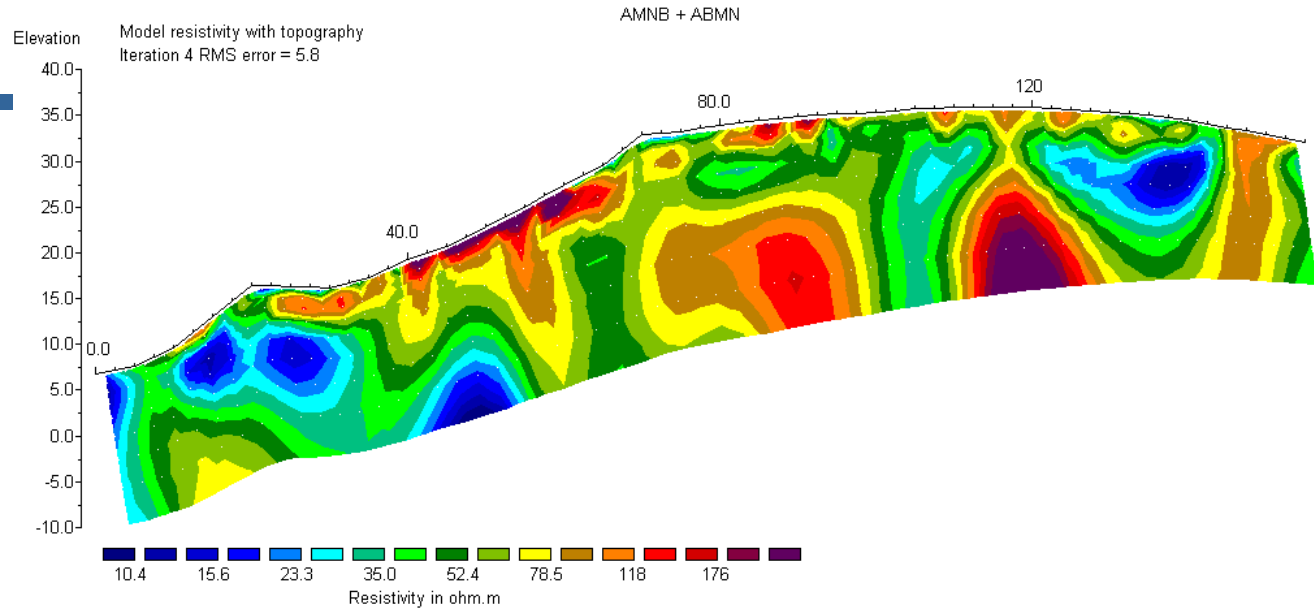
Unit electrode spacing 25.0 m.

Unit electrode spacing 25.0 m.

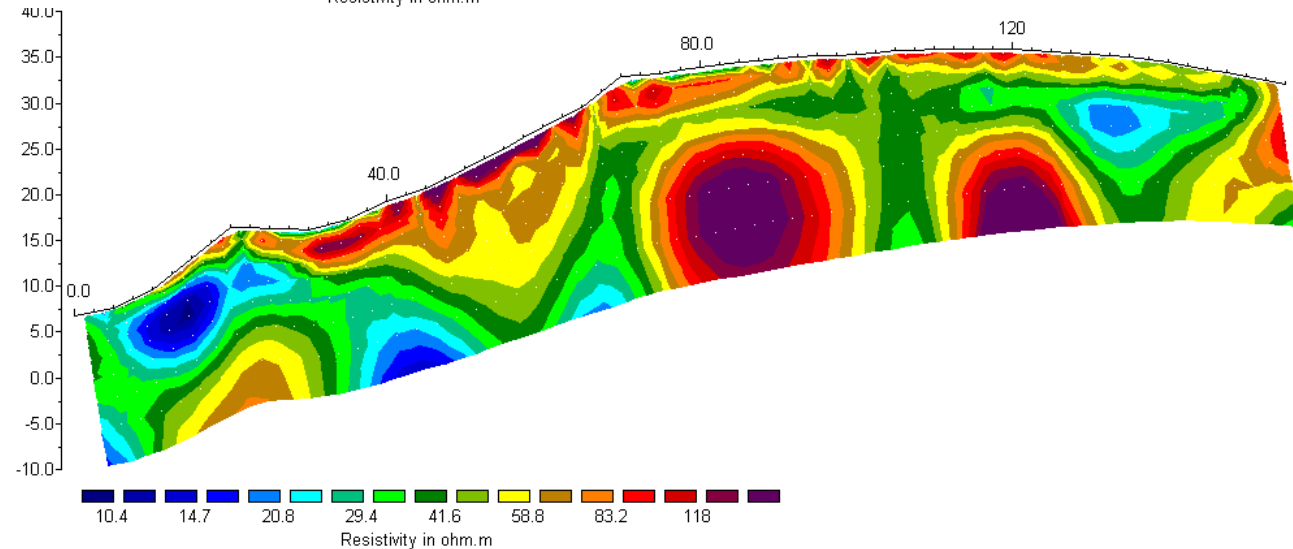
Example of data processing (data by J.-F. Girard (BRGM))

Result of inversion

original data



smoothed data



Conclusions

- **“x2ipi”** tool box is supplementary software for 2D DC and IP data processing with some unique features (smoothing data by Median-algorithm, work with data in General format of Res2dInv etc.)
- **“x2ipi”** is compatible with **Electrell I**, **Prosys** and **Res2dinv** software
- **“x2ipi”** can increase the efficiency of **Syscal** and **Elrec** units application