

Using RES2DMOD and RES2DINV to Explore Electrical Resistivity Results

This is an introduction to resistivity software followed by a few exercises with four objectives:

1. get a feel for working with electrical resistivity data
2. learn what pseudosections look like for known models
3. experiment with noise and removing noisy observations, and
4. compare Wenner and dipole-dipole arrays.

The two programs, **RES2DMOD** and **RES2DINV**, are from <http://www.geoelectrical.com/>. The modeling program is available on the web site as is a demo version of the inversion program. For both programs, the manuals are detailed and good as are the help documents available from the menu bar; this is a short, 'quick start', synopsis. The site also has an excellent tutorial on electrical methods.

RES2DMOD

For RES2DMOD, the general sequence is to open a file, calculate the results, and display the model and results. From there, you can change array types, edit the model, change resistivities, or save the model for RES2DINV. There are a number of canned models that install with the program.

From the menu bar in RES2DMOD (bullets indicate individual steps)

- FILE – read file with forward model. Now, the example files should show up. If they don't they are in the installation directory. Choose Blocks_up.mod
- EDIT/Edit Model to see what the model looks like (figure 1).

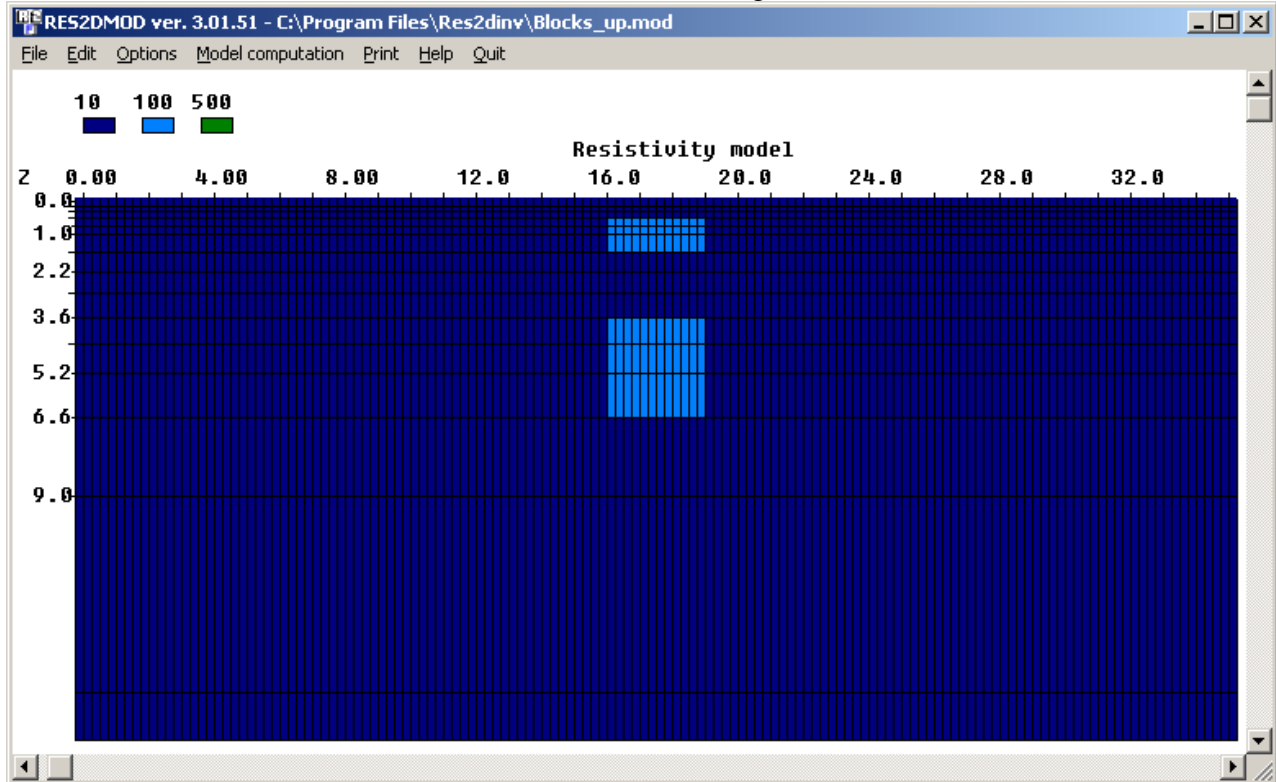


Figure 1. Model as displayed by RES2DMOD/Edit. The model shows two higher resistivity blocks (light blue) in a matrix of lower resistivity (dark blue). The grid lines show the cells for which RES2DMOD will calculate apparent resistivity.

- MODEL COMPUTATION – calculate the apparent resistivity values.
- Edit Model (generally choose logarithmic contour intervals) now yields figure 2. You get a display of the apparent resistivity values above the model.

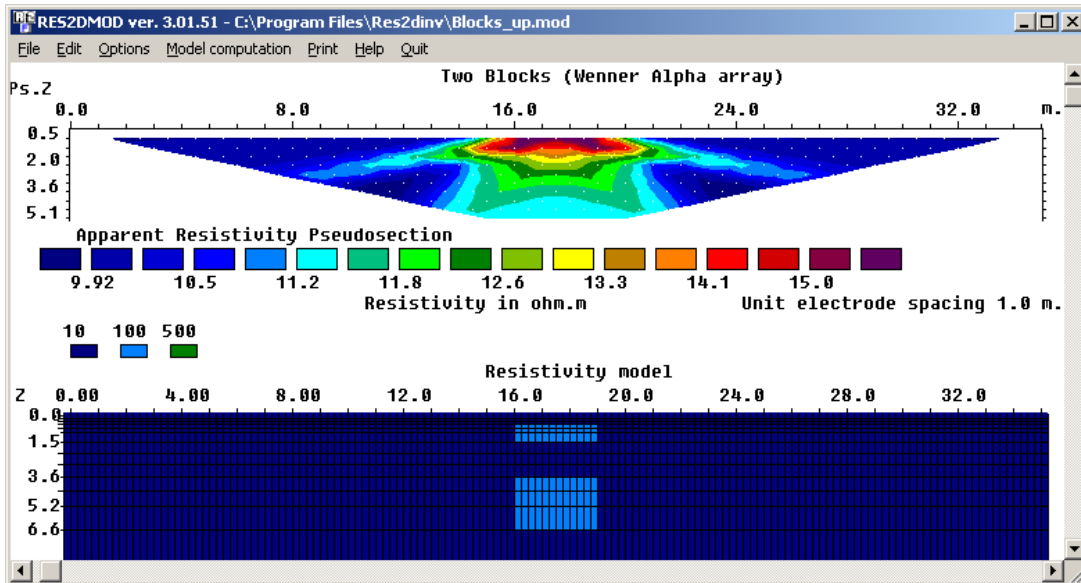


Figure 2. The upper panel shows the forward calculated apparent resistivity, in a typical pseudosection, for the model displayed in the lower panel.

- FILE – save results in RES2DINV format as 'blocks_up_wenner.dat'. You will be asked if you want to add random noise – add 2% but also experiment with this later in the exercises.
- EDIT – change array type to dipole-dipole. Now calculate and edit again gives figure 3.
- FILE - save these results in RES2DINV format with 2% noise in 'Blocks_up_dip-dip.dat'. Note that the apparent resistivity sections are different depending on the electrode array.

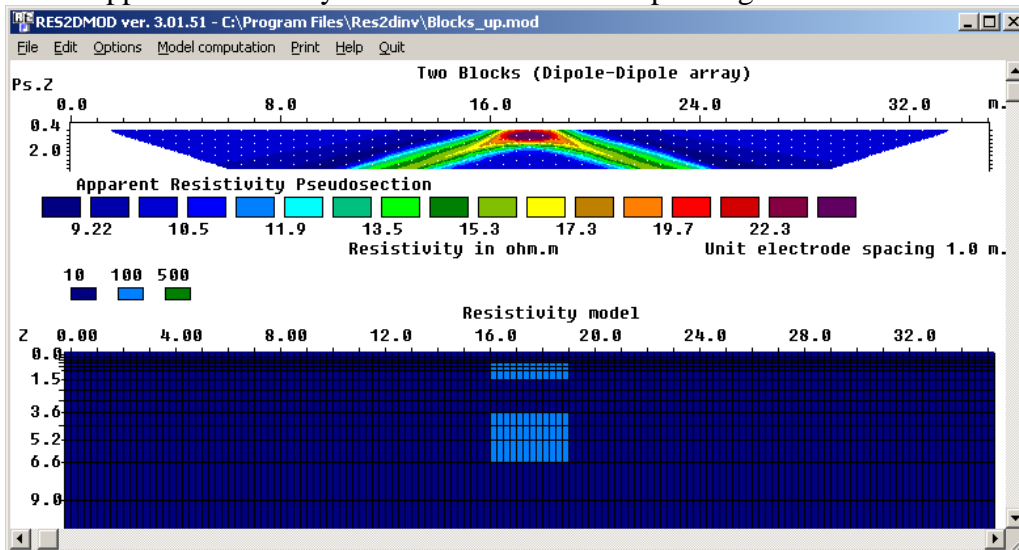


Figure 3. The dipole-dipole pseudosection for the same model as displayed for the Wenner array in figure 1.

- Edit Model – right click a number of random cells at or near the surface of the model; these are the cells whose values you are changing. Now left-click the green box showing resistivity of 500 and the selected blocks will change to higher resistivity. you can simulate noise, heterogeneous ground conditions and the like with this approach. Now calculate, edit and display for the changed model (figure 4).

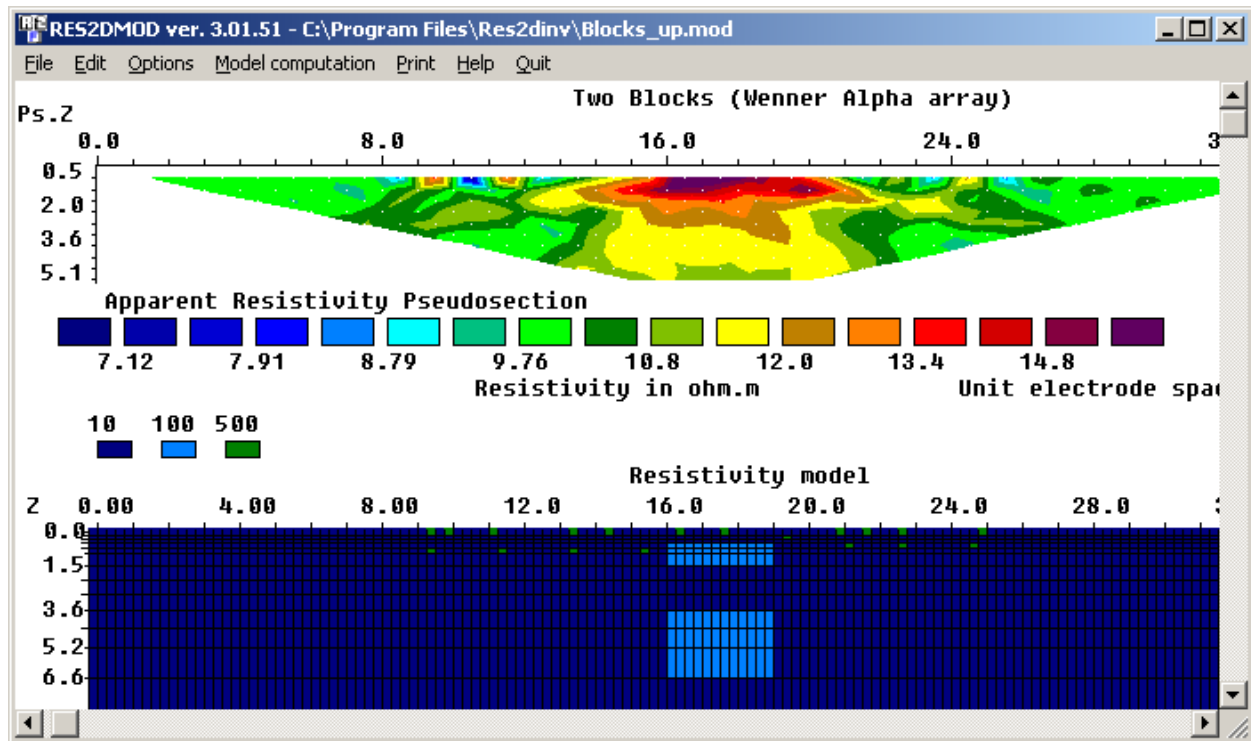
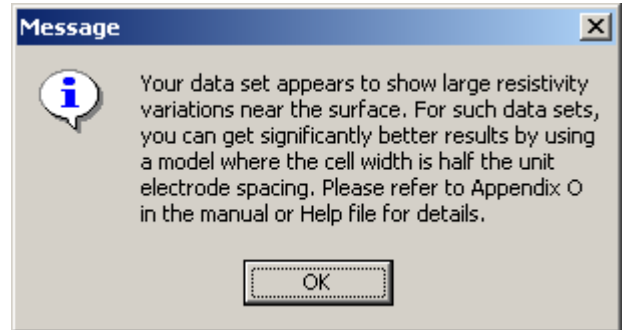


Figure 4. Model with an assortment of higher resistivity cells distributed at or near the surface.

RES2DINV is the program for inverting the forward results.

- FILE – Find Blocks_up_wenner.dat.
RES2DINV will probably come up with the comment in the figure to the right. You address that with 'OK', followed by:



- INVERSION - Model Discretization/Use Model Refinement and hitting the 'Use model cells with widths half that of unit spacing' radio button.
- INVERSION/Least Squares Inversion will set RES2DINV to solving the inverse problem for the model data. Do the same thing for the results stored for the dipole-dipole array and compare the results.

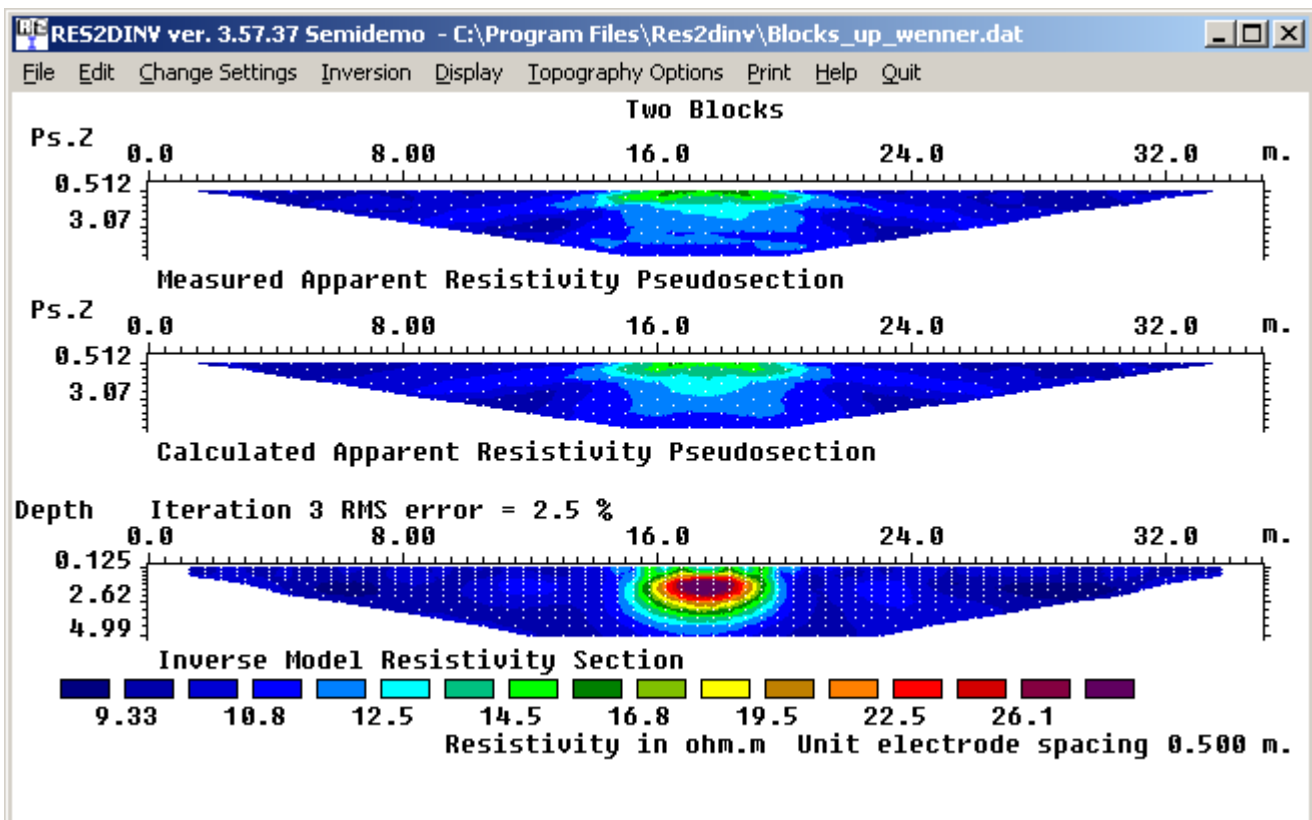


Figure 5. The top panel shows the observed or modeled apparent resistivity pseudosection for a Wenner array. The bottom panel is the final inverse result, a 'best estimate' of the subsurface conditions that cause the observed results. The middle panel is the forward calculated apparent resistivities from the inverse model.

Compare the inverse solution from the Wenner array to that for the dipole-dipole array (figures 5, 6).

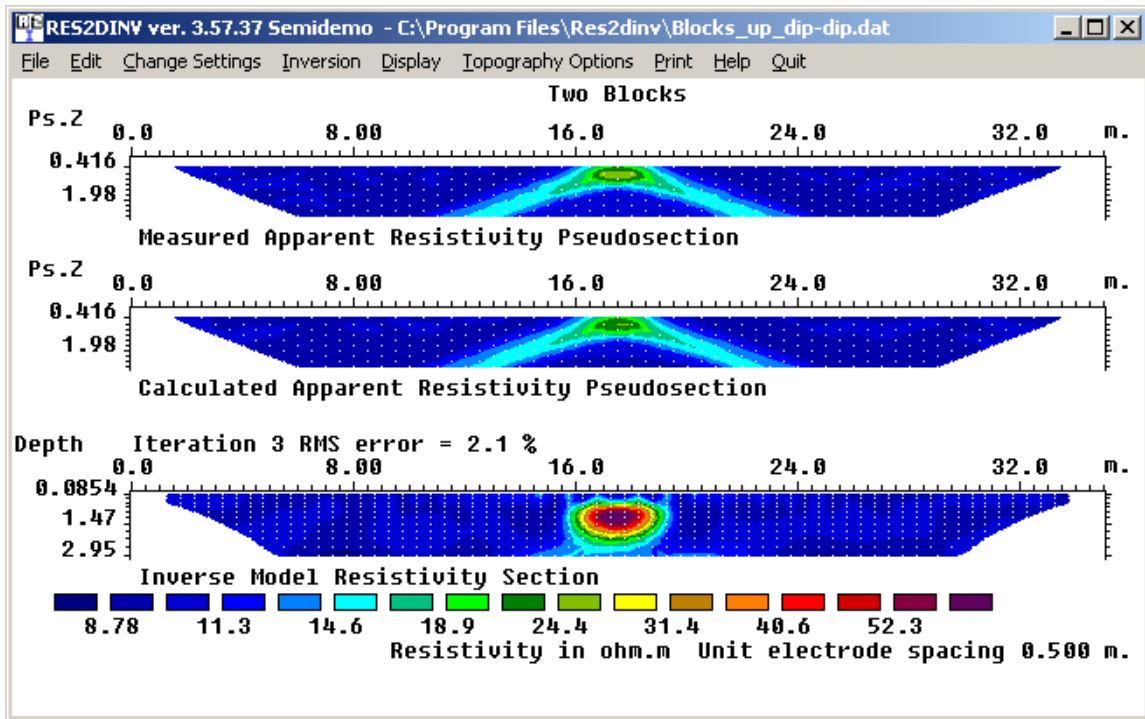


Figure 6. The top panel shows the observed or modeled apparent resistivity pseudosection for a dipole-dipole array. The bottom panel is the final inverse result, a 'best estimate' of the subsurface conditions that cause the observed results. The middle panel is the forward calculated apparent resistivities from the inverse model.

Experimenting with heterogeneous conditions. Inverting the data where some extra high resistivity blocks were added yield a somewhat different result (figure 7).

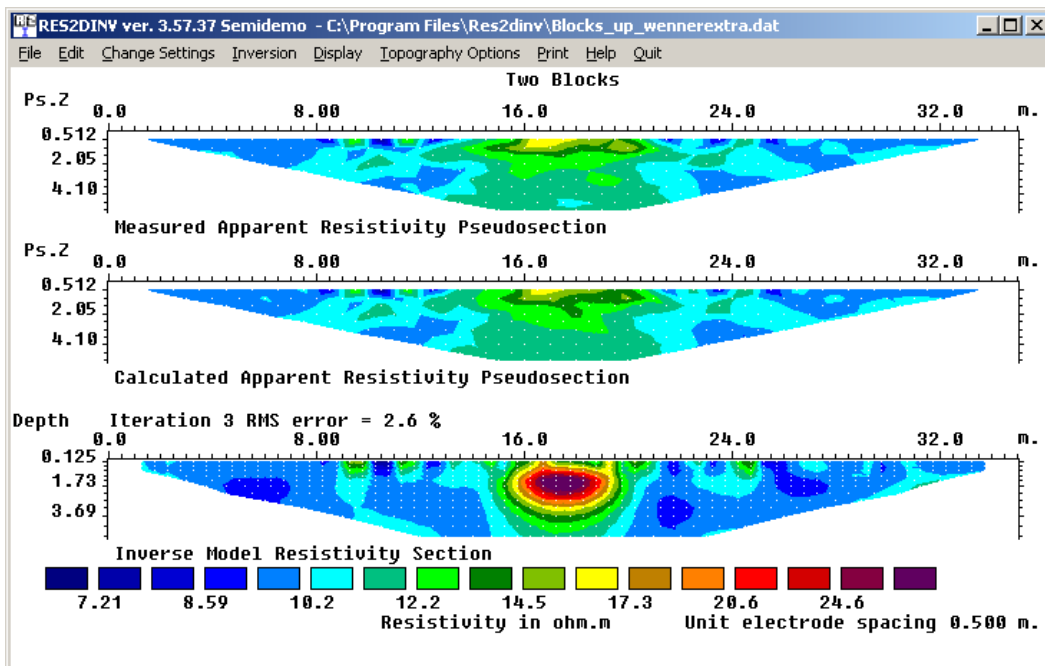


Figure 7. Inverse solution for the data for which included a distribution of high resistivity cells near the surface.

Editing Data using EDIT/exterminate bad datum points. RES2DINV allows you to remove results from the observed pseudosection via a display such as figure 8. The prime question you always need to ask before such a procedure is: how do you know the points are “bad”? You can use this feature as a way to guide your understanding of results and to suggest further experiments.

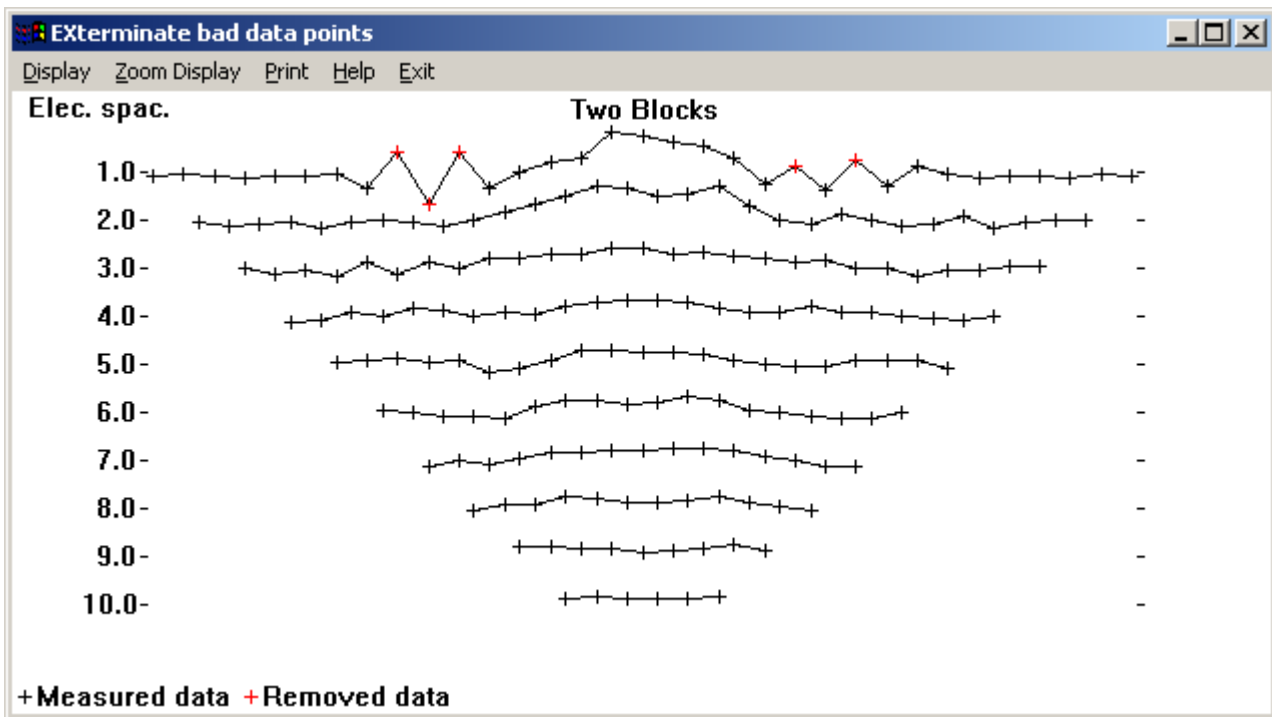
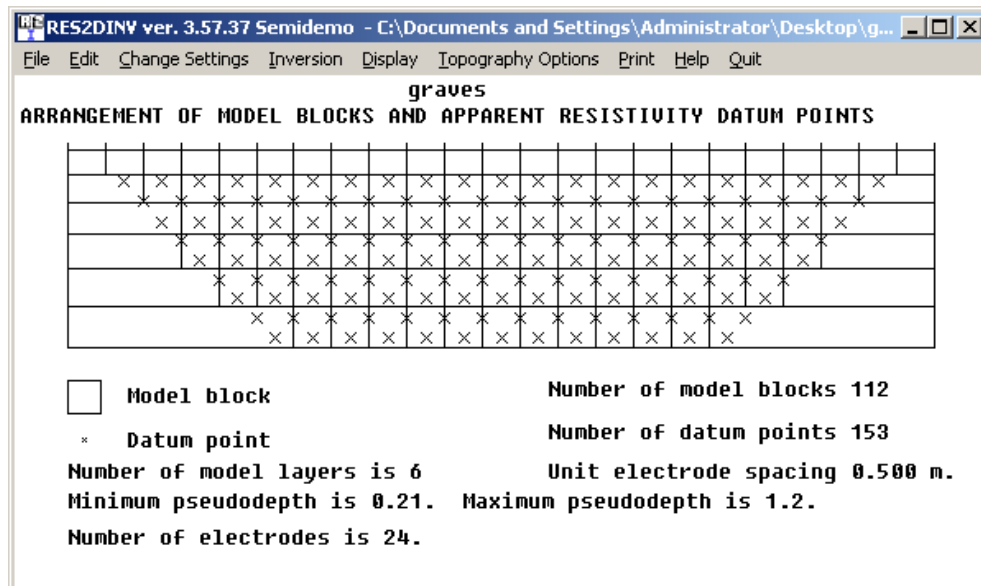


Figure 8. RES2DINV’s display for “exterminating bad datum points”.

In Figure 8, the points in red, which were selected with mouse clicking, are to be eliminated from the subsequent inversion. Once you exit the “edit Data Window”, save the altered data set with a new name (e.g., modified.dat). You can use this editing feature to test the impact on, or a few, apparent resistivities has on the solution. Other features will help your visualization and understanding:

Inversion/Model Discretization/Display Model Blocks:



Inversion/Model Sensitivity Options/Display Model Blocks Sensitivity

