

RES3DINV - 3D RESISTIVITY & IP INVERSION software for Windows XP/Vista/7
Uses the smoothness constrained Gauss-Newton least-squares optimization method
Supports on land and underwater surveys. Supports smooth and sharp contrasts inversion
Supports multi-core CPUs. Supports up to 6000 electrodes (26000 electrodes for RES3DINVx64)
Supports electrodes at arbitrary positions and IP inversion using the complex resistivity method.

In areas with complex structures, there is no substitute for a fully 3D survey. The arrays supported include the pole-pole, pole-dipole, inline dipole-dipole, equatorial dipole-dipole and Wenner-Schlumberger and non-conventional arrays.

The RES3DINV program uses the smoothness-constrained least-squares inversion technique to produce a 3D model of the subsurface from the apparent resistivity data. The RES3DINVx32 program supports parallel calculations for up to 12 CPU cores, while RES3DINVx64 supports up to 128 GB RAM and 64 cores on PCs with 64-bit Windows. The data inversion takes less than a minute for small surveys with 100 electrodes in a flat area, to several hours for extremely large surveys with 3000 electrodes in rugged terrain.

The program will automatically choose the optimum inversion parameters for a data set. However, the parameters that affect the inversion process can be modified by the user. The inversion settings can be optimized for areas where the subsurface resistivity varies in a smooth manner, or optimized for areas with sharp boundaries. Topographic effects can be incorporated into the model by using a distorted finite-element grid such that the surface of the grid matches the topography (Sasaki 1994).

An example of the results obtained from an electrical imaging survey in an area with complex geology is shown in Figure 1. This survey was carried out in Southern Sweden over a closed sludge deposit using the pole-pole array (Dahlin *et al.* 2002). A survey grid with 21 by 17 electrodes was used. The former sludge ponds containing highly contaminated ground water show up as low resistivity zones in the top two layers. This was confirmed by chemical analysis of samples. The low resistivity areas in the bottom layer are due to saline water from a nearby sea.

The results from a 3D resistivity and IP survey over a copper and gold porphyry prospect in Southeast Asia is in Figure 2 displayed by a 3D Virtual Reality Modeling program to show selected regions of the model. The survey area covers a 5000 by 5000 meters grid. The main targets are regions with high IP values over 20 and 30 mV/V.

RES3DINVx64 also supports data collected with electrodes at arbitrary positions that do not fit into a simple rectangular grid. This situation frequently occurs because of physical obstructions such that straight surveys lines cannot be used, or the data is collated from surveys over different periods with lines in different directions (Rucker *et al.* 2010). It also supports IP inversion using the complex resistivity method.

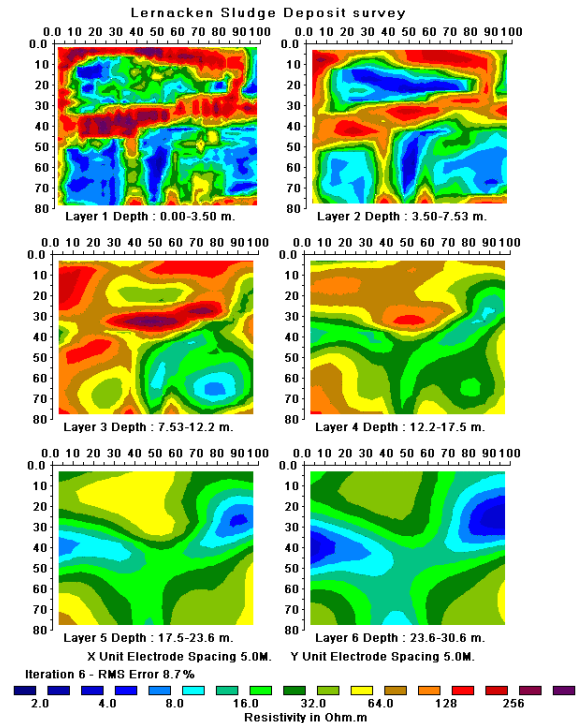


Figure 1. The 3D model obtained from the inversion of the Lernacken Sludge deposit survey data set. The model is shown in the form of horizontal slices through the earth.

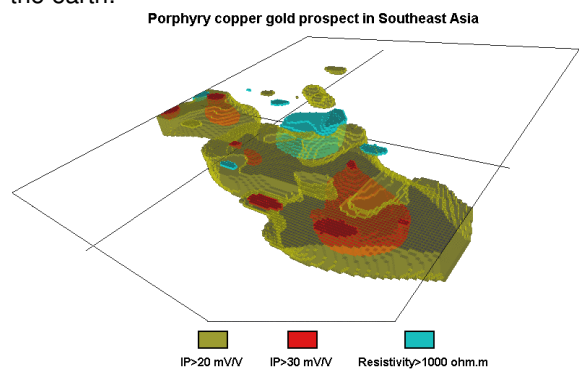


Figure 2. 3D view from the southeast of the resistivity and IP model from a survey over a copper and gold porphyry prospect in Southeast Asia.

References

Dahlin, T., Bernstone, C. and Loke, M.H., 2002. A 3-D resistivity investigation of a contaminated site at Lernacken, Sweden. *Geophysics*, 67, 1692-1700.
 Rucker, D.F., Loke, M.H., Levitt, M.T. and Noonan, G.E., 2010. Electrical resistivity characterization of an industrial site using long electrodes. *Geophysics*, 75, WA95-WA104.
 Sasaki, S., 1994. 3-D resistivity inversion using the finite-element method. *Geophysics*, 59, 1839-1848.