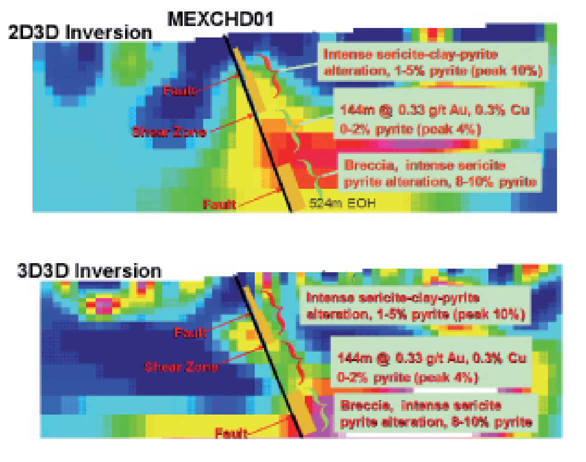

Figure 4: Long section through drillhole location 75m off and parallel to receiver line. 3D3D result (bottom) shows improved reconciliation with drilling results over 2D3D results (top).

Results

Some results from the 3D inversions of 2D and 3D array data are presented in Figures 3 & 4. It can be readily seen that data acquired in 3D enabled the inversion routine to better resolve the sub-surface, particularly at depth and for features parallel to the line layout.

Summary

Comparison of 3D inversion modelling of truly three dimensional IP data and 2D data extracted from the 3D dataset shows that the three dimensional data significantly improves model resolution. 3D models of 2D data do show an improvement over 2D inversions, however the 2D data lacks the ‘between the lines’ information of the truly three dimensional survey. This information is necessary to properly resolve subsurface geology and structure. For the MIMDAS system, the time required to acquire either 3D or 2D data over the same grid is similar. If you would like to know more about the MIMDAS system please feel free to contact us directly.

References

Webb, D., Rowston, P.A., and McNeill, G., 2003. ‘A Comparison of 2D and 3D IP from Copper Hill N.S.W’. ASEG Conference Proceedings Feb 2003.

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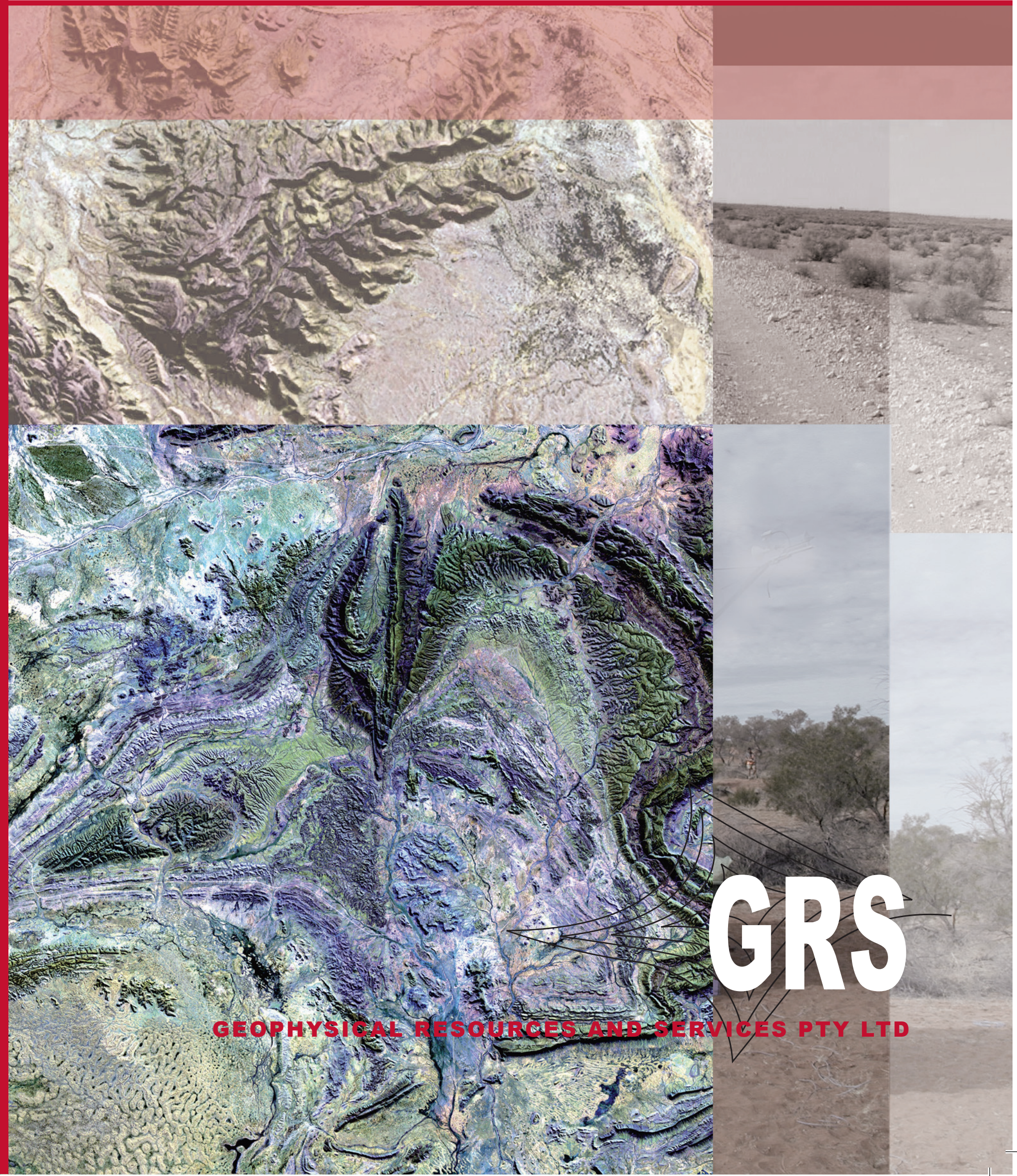
MIMDAS

3D Acquisition For A 3D World



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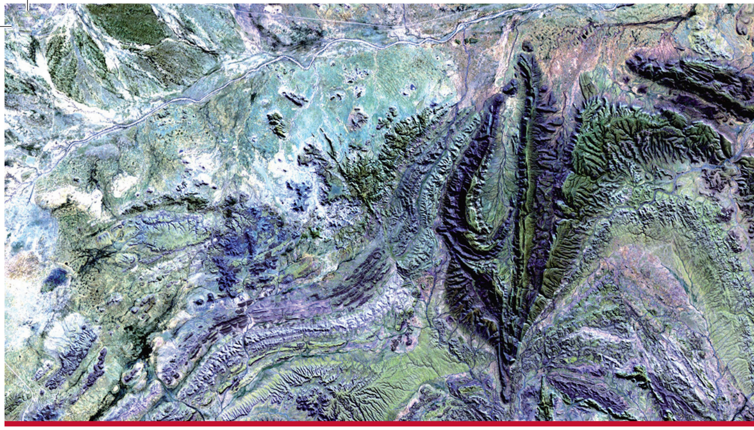

3D ACQUISITION

Introduction

The use of smooth model inversion to assist interpretation of electrical geophysical data is now prevalent. With the increased use of inversion methodologies comes the recognition of the spatial under-sampling inherent in traditional survey geometries. The MIMDAS system is an ideal tool to extend electrical geophysical acquisition into the third dimension. The use of 3D grid-based survey geometries indicates that 3D acquisition and interpretation can show significant improvement in resolution over traditional survey geometries. This is illustrated with an example from Copper Hill, NSW.

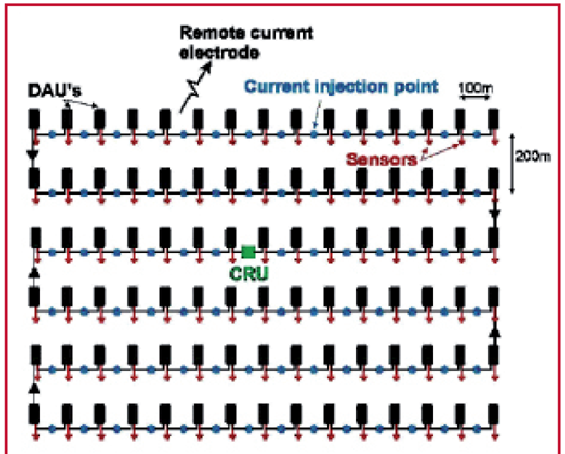

Figure 1: Layout schematic for acquiring 3D IP data at Copper Hill. Data were collected over the entire array for each current injection. Data path is indicated by black arrows.

The MIMDAS system is an ideal tool to extend electrical geophysical acquisition into the third dimension.

Field Procedure

A grid consisting of six 1.5 km lines, with 100 metre station spacing and 200 metre line separation, was laid out over the area of interest (see Figure 1). A pole-dipole survey geometry was used, with the centre four lines set up with the transmitter poles separated by 100 metres and offset by half an a-spacing from the receiver locations. This avoids the slight logistical problem associated with common transmitter and receiver positions.

The six lines of receiving dipoles were set up as a single network allowing them to be read simultaneously for each transmitter pole position. The setup allowed true 3D pole-dipole IP data to be collected on all six lines as well as standard 2D pole-dipole IP data to be collected along the four centre lines. It also allowed the collection of 200 metre dipole Ey component data, which through the principles of superposition, can be used to further constrain the 3D inversion. In all, six full days were required to set up and acquire the 3D IP and MT data It is thought that a similar time would be required to acquire 2D data over the six lines.

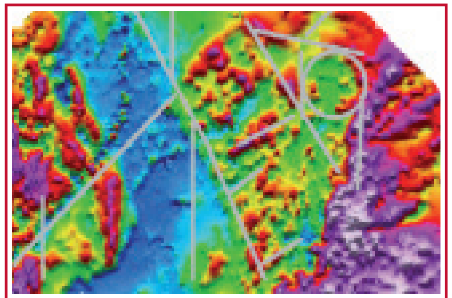

Figure 2: High-resolution ground magnetics from the survey area. Grey "doodling" references the same areas in Figure 3 (right).

Inversion modelling

Final data were modelled as a 3D inversion of 3D data (herein denoted 3D3D), 3D inversion of 2D data (2D3D) and 2D inversion of 2D data (2D2D) using the same mesh and relative errors for each inversion. 2D data were inverted using U.B.C.'s dcip2d software while 3D inversion models for 2D and 3D data were generated using U.B.C.'s dcip3d code ported to an N.E.C. SX-5 supercomputer. All errors were based linearly upon observational errors. 2D inversion of 2D data for lines 4450N, 4650N, 4850N, and 5050N used the same mesh and relative errors as the 3D modelling. Care was also taken to ensure that smoothing factors and the chi factors were, as far as possible, the same for all inversions.

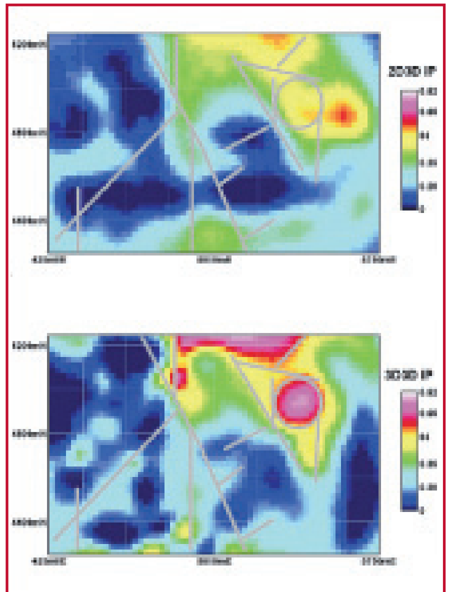

Figure 3: Intrinsic chargeability plan at approximately 150m depth for 2D3D (top) and for 3D3D (bottom).