Analyzing Two-Dimensional Effects in Central Loop Transient Electromagnetic Data

Yogeshwar, P.1* & Tezkan, B.1

1Institute of Geophysics & Meteorology, University of Cologne, Germany.  
yogeshwar@geo uni-koeln.de

Abstract

Thick sedimentary sequences are deposited in the central area of the Azraq basin (Jordan) consisting mostly of hyper-saline clay and various evaporates. These sediment successions form the 10 km × 10 km Azraq mudflats and are promising hydrocarbon reservoirs. In a palaeogeographical reconstruction carried out by our research group, it is shown that the eastern part of this area is covered by a large alluvial fan. Therefore, a 1D interpretation may not be adequate. Here we present the calculation of a semi-synthetic TEM Tipper to quantify a probable 2D effect. Although the horizontal component of the magnetic field was not measured in the field, it is possible to use the TEM Tipper to investigate if the derived subsurface model generates a 2D effect, which is e.g. larger than the data error-floor.

Survey area and TEM setup

A total of 150 TEM soundings were recorded with an inter-station distance of generally 70 m up to a maximum distance of 200 m and a transmitter loop size of either 500 m2 or 1000 m2. The investigated profiles cross four geological formations (cf. Fig. 1 & 2(a)).

Quasi 2D resistivity-depth sections

The 1D models along both profiles are stitched together as quasi 2D sections (cf. Fig. 2(a),(b)). The derived resistivity depth section along profile A is in excellent agreement with the corresponding geological cross-section and the depth to uncertain geological boundaries (dashed lines in Fig. 2(a)) are well detected. Moreover the transition zone from fresh to saline groundwater and the 2D resistivity perturbations which profiles result in a resistivity decrease from moderate to extremely low values. Around sounding A42 the Al Bayda Fault is expected. The resistivity structure exhibits maximal lateral variation in that zone. Therefore, the 1D interpretation may be inadequate and lead to miss-interpretations.

Conclusions

• The 1D inversion results are consistent and in good agreement with the geology.
• Considering the derived 2D model, the semi-synthetic TEM Tipper approach indicates that 8 soundings exhibit a 2D effect. Moreover, the zone where the 2D effect is maximal correlates partly with larger data residuals.
• The presented approach can be used to analyze if a 2D interpretation is required.

Acknowledgements:

The project was funded by the German Research Foundation (DFG) and hosted in the frame of the CRC-806 ‘Our Way to Europe’. We thank all our colleagues from the National Resources Authority, Jordan for their great support and hospitality during field surveys.

References:

2. Schmucker-Weidelt-Kolloquium

Contact: yogeshwar@geo.uni-koeln.de, www.geo.uni-koeln.de