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2D Multi-transient electromagnetic modelling of pseudo synthetic earth model from part of Anambra Basin, Nigeria.

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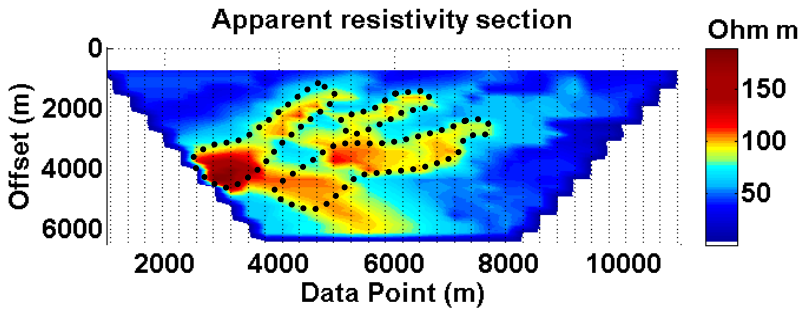
Anambra basin is one of the three basins within The Federal Republic of Nigeria that has potential for both production and storage of hydrocarbon deposit. However, in comparison to the Niger Delta basin, little has been done to fully characterise this deposit. Most of the past and present works done in this area have been focused on source rock maturity and seismic exploration, with about 18 and less than 50 wells drilled in the entire basin [1]. Though, the increase in global energy demand and the advent of improved exploration tools has led to a recent increase in pursuit of information necessary to optimize development in exploration and exploitation of petroleum in the Anambra Basin. However, little or no direct electromagnetic survey has been carried out to complement seismic survey and minimize exploration risks and cost. Hence, in this study we focused on showing the efficiency and effectiveness of Multi-transient electromagnetic (MTEM) method as an onshore geophysical tool for oil exploration/prospecting over part of the Enugu arm of the Anambra basin.

MTEM method is an high resolution EM method with applications in both land and marine study (including deep offshore study) [2]. Based on information obtained from 4 oil wells and geothermal maturity section used in the prediction of probable oil producing region, 2D resistivity model of the geological setup within the area of study was generated. The model was built on a 75x35 grid space, using a grid spacing of 150 m along the x-direction and 100 m along the z-direction. Using 2500 time steps and additional 15 cells for the PML region, the MTEM earth impulse response was modelled for offsets varying with respect to the receiver position from 900 m to 6300 m at an interval of 300 .



For quick data interpretation, the peak time of the modelled earth impulse response was used to calculate the subsurface apparent resistivity. Figure 1 shows a 2D image of the apparent resistivity plot on a common midpoint -

Figure 1: 2D apparent resistivity section.

offset section. The apparent resistivity distribution on the section indicates the presence of 2 distinct geoelectric mediums; the yellowish red to dark red coloration, which reflects a resistive to highly resistive reservoir formation and the deep blue colour represents the conductive background medium.

In conclusion, we were able to reconstruct the subsurface resistivity distribution over part of the Enugu arm of the Anambra basin using the MTEM method. Also, the obtained apparent resistivity can be used as a starting model for full waveform inversion, which is recommended for better representation of the reservoir geometry and accurate quantitative interpretation.

References:

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