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CASE STUDY OF AREAS AROUND VISAKHAPATNAM FOR 2D AND 3D MODELING OF SALINE INTRUSION

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ABSTRACT

Visakhapatnam in the coastal belt area is suffering from saline intrusion water contamination is the main issue for the municipal authorities. Rock / soil resistivity is varying with texture of rock, conductivity of electrolyte and structure of mineralization. The purpose of the present work is to concentrate in areas adjacent to in Visakhapatnam. Combination of Wenner and Schlumberger methods gives correct modeling in 2D – 3D planes. By studying these areas the placement of layer is possible .Thus once the structure is known for data can be processed in 2D -3D modeling which are suitable for studies in disaster management.

Key words: Apparent Resistivity, contour, Wenner schlumberger array, 2D, 3D.

INTRODUCTION

In many fields of science and engineering, mathematical models are used to represent complex processes and results are used for system management and risk analysis. The methods commonly used to develop and apply such models often do not take full advantage of either the data available for model construction and calibration or the developed model. The residual state of Andhra Pradesh has a long coastline of over 800 Km .Due to high population density along the river banks and demand for water, coastal aquifers are under stress. This causes the sea water inrush and upcoming salinity, and then problems today are due to sea water intrusion, urban waste and agricultural demands. Visakhapatnam areas are adjacent to the Godavari belt which is drained at three major points .Quaternary alluvium with series of modification form the real structure of Godavari areas .This area has been studied from the angle of salinity [1]. The purpose of the proposal work is to concentrate in the areas around Visakhapatnam for 2D - 3D modeling using different types of electrode connections.

PRINCIPLE

It is known that rock/soil resistivity varies with texture of the rock, conductivity of electrolytes and nature structure of minerals states. This change from formation formats as well as arising a particular formation. Normally, it increase with grain size and is maximum when for coarse grains. In some cases fine grained compact structure also has high resistivity. There is a sharp fall due to inherit content of clay .For saturated rocks low resistivity is due to increased clay or salinity with depth of investigations up to 50 m. Wenner method combined with schlumberger array can be used to collect data .This principal area are in un consolidated alluvial formats under salt saline intrusion and sedimentary environment [2].

TYPES OF ELECTRODES

Wenner combinations of 20 electrodes system along with schlumberger techniques are formed to be most efficient in such systems of measurement. Placement of electrodes is varied to get optimum results. Illusions controller's selection can be done for the various steps.

PLACE OF MEASUREMENTS

Few points near by the coast of Visakhapatnam have been selected for study depending on the extent saline damage .the study of these areas has relevance for disaster management studied.

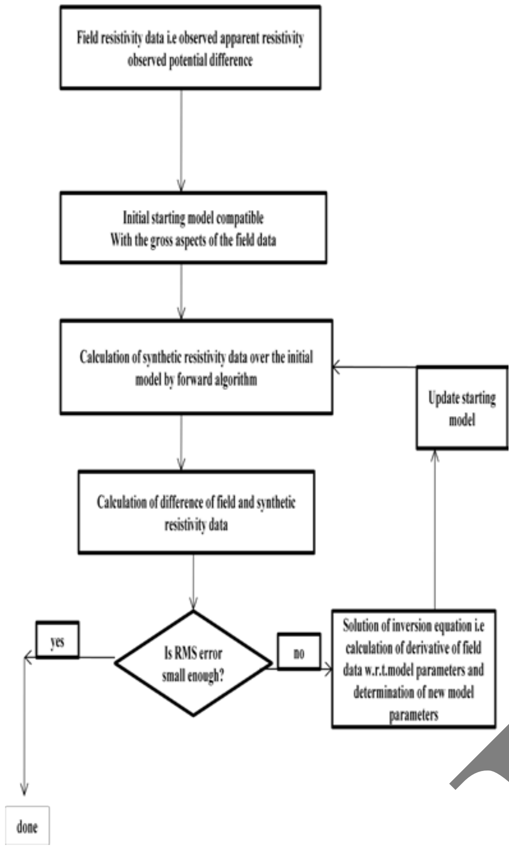

Figure 1 .Flow chart for a typical resistivity inversion algorithm

READINGS

C1	C2	P1	P2	row	R
5	10	0	15	136.4	4.3
10	15	5	20	155	4.9
10	20	0	30	250	4
15	20	10	25	158	5
15	25	5	35	229	3.6
15	30	0	45	240	2.6
20	35	15	30	151	4.8
20	25	15	30	151	4.8
20	35	5	50	234.4	2.5
25	30	20	35	157	5
25	40	10	55	255.3	2.7

Table 1 .Reading for resistivity inversion for different methods

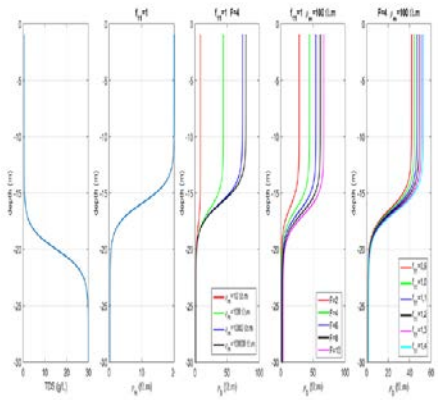

Figure 2 . Representation of modeling

DATA ANALYSIS

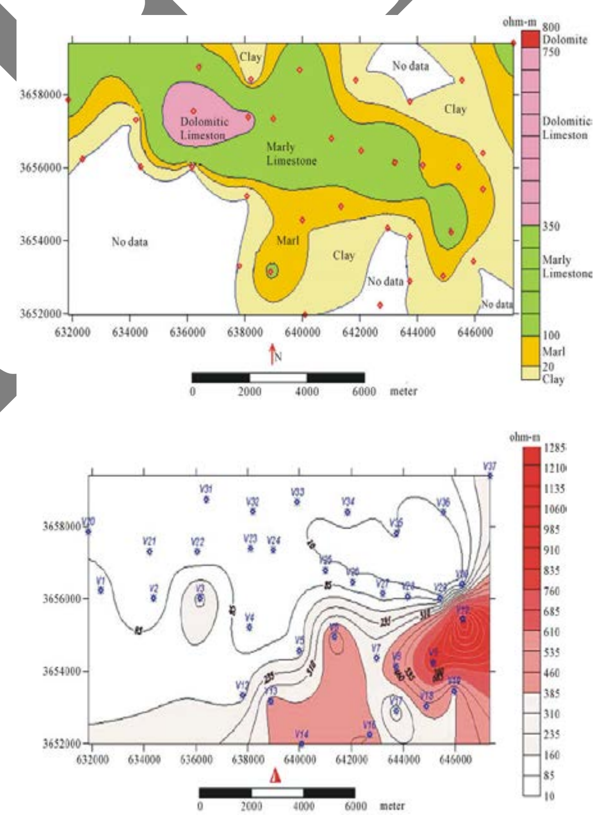

Figure 3. Data analysis for areas in Visakhapatnam

RESULT & DISCUSSION

Resistivity varies with texture of the rock, nature of mineralization and conductivity of electrolyte contained within the rock (Parkomenko et al. 1967). Resistivity not only changes from formation to formation but even within a particular formation (Sharma 1997). Resistivity increases with

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grain size and tends to maximum when the grains are coarse (Sharma and Rao 1962), also when the rock is fine grained and compact. The resistivity drastically reduces with increase in clay content and which are commonly dispersed throughout as coatings on grains or disseminated masses or as thin layers or lenses. In saturated rocks low resistivity can be due to increased clay content or salinity [3]. Hence the resistivity surveys are the best suited for delineation of clay or saline zone. Wenner schlumberger array with 5 m - 10 m electrode spacing was used to collect resistivity data as the array can adequately represents signal/noise ratio and also provides adequate resolution, which is an important parameter in low resistivity. The depth of investigation of about 50 m and various subsurface geological formations like marine clays and saline water mixing areas were inferred from the resistivity contrast up to a depth of 55 m only. In the coastal areas, the principal aquifers were formed in the unconsolidated alluvial formations, deposited under various sedimentary environments.

MODELING

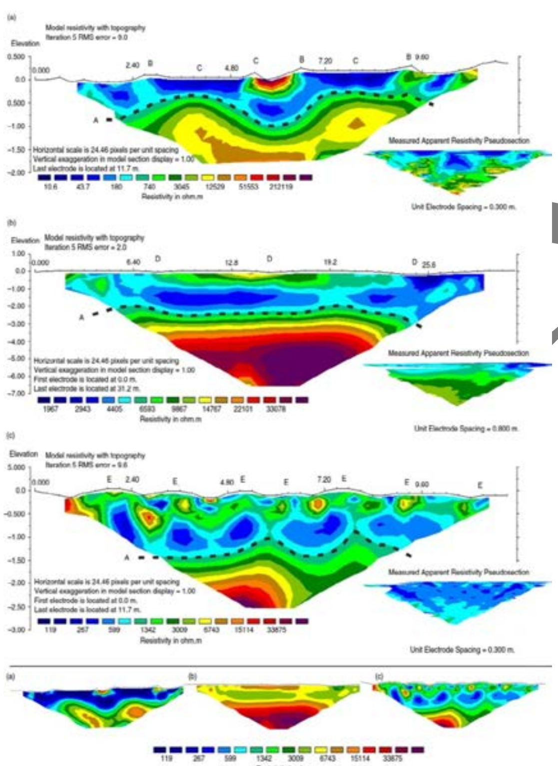

Figure 4 .Representation of Wenner schlumberger array

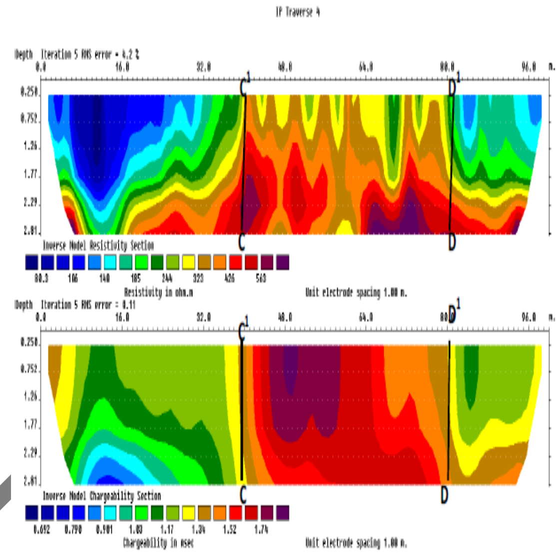

Figure 5 2D Wenner Schlumberger array

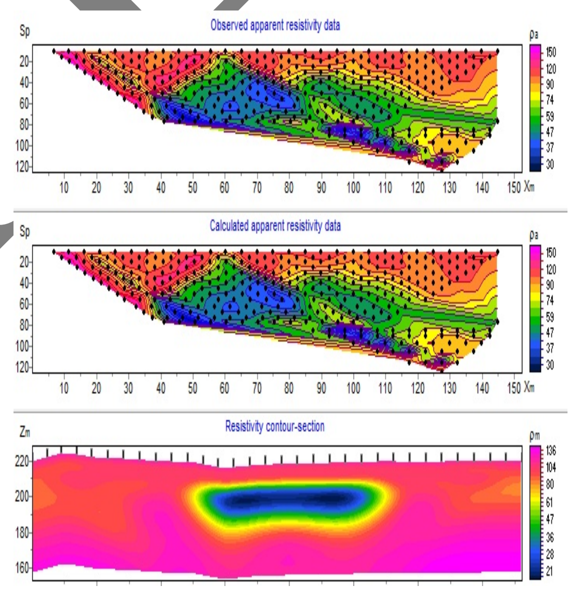

Figure 6 .Resistivity models in contour Wenner schlumberger array

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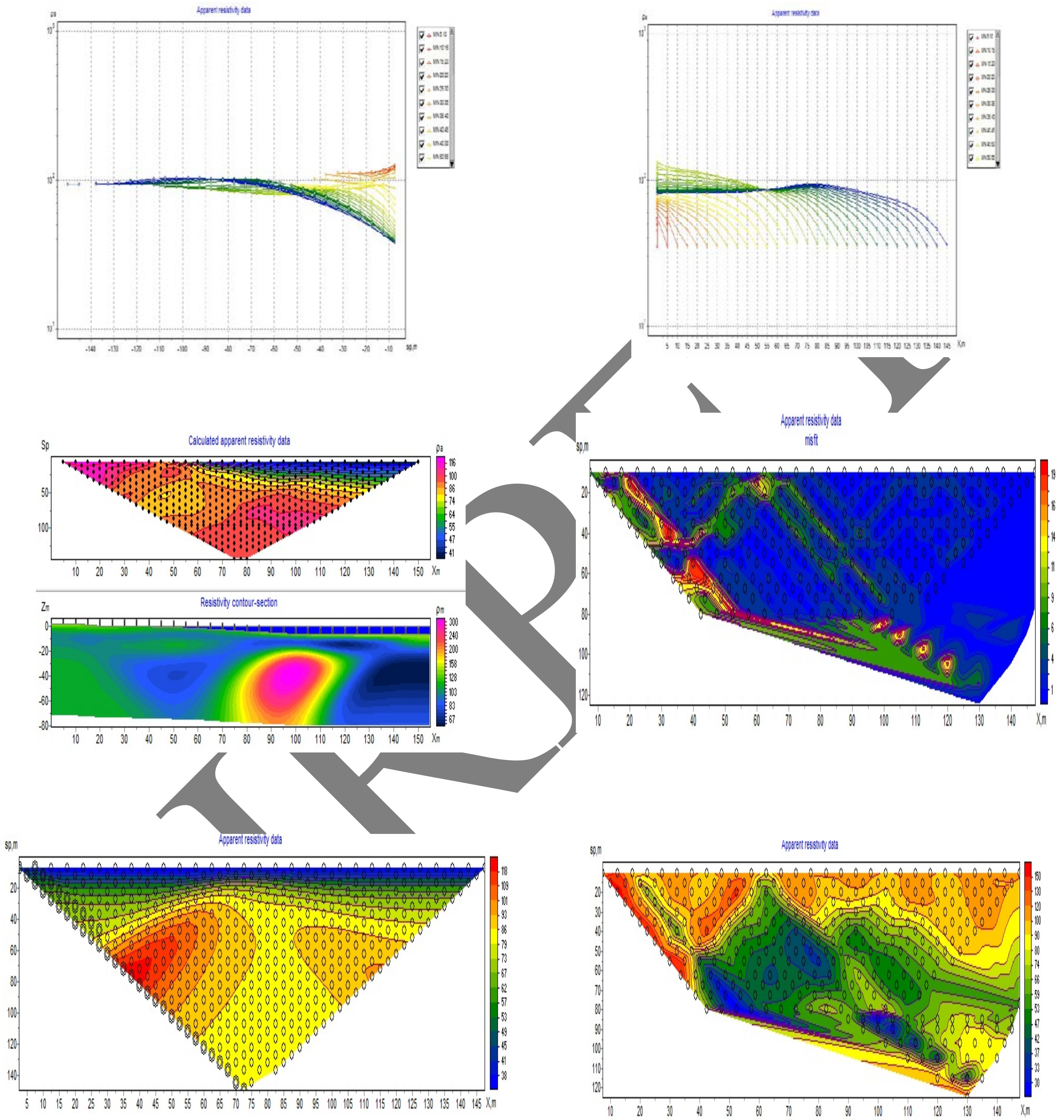

Figure 7 .Apparent Resistivity models in contour Wenner schlumberger array

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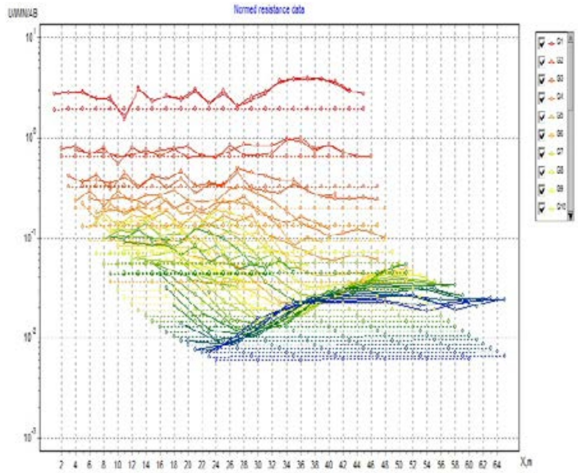


Figure 8 .Normal Resistivity data in misfit, contour Wenner schlumberger array

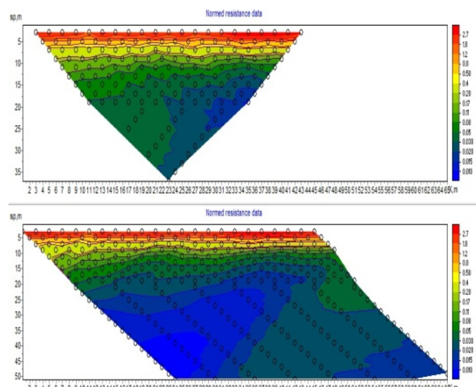
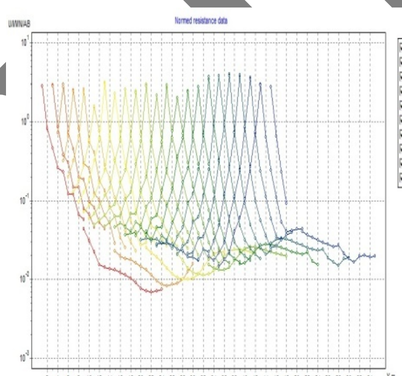


Figure 9.Apparent Resistivity models in contour block whole condition Wenner schlumberger array



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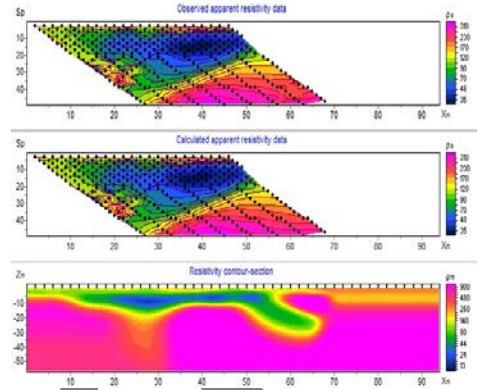

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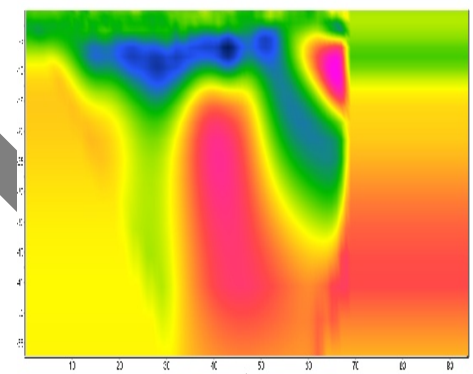

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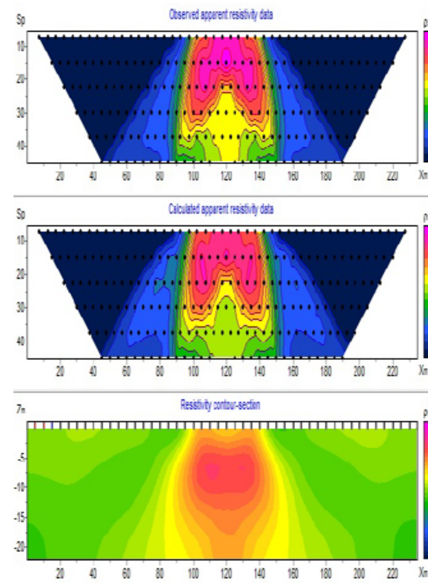

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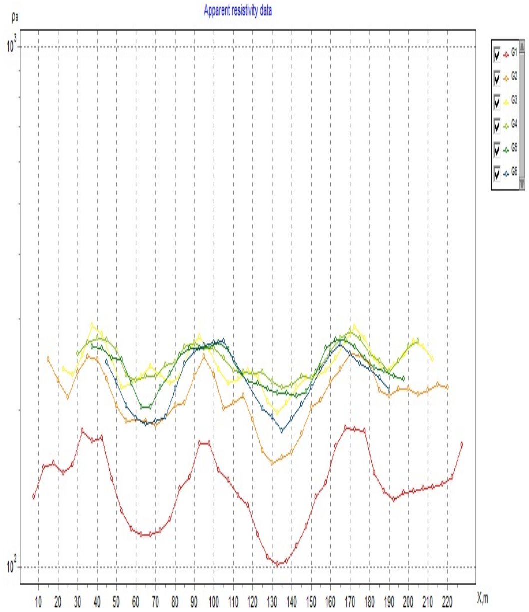

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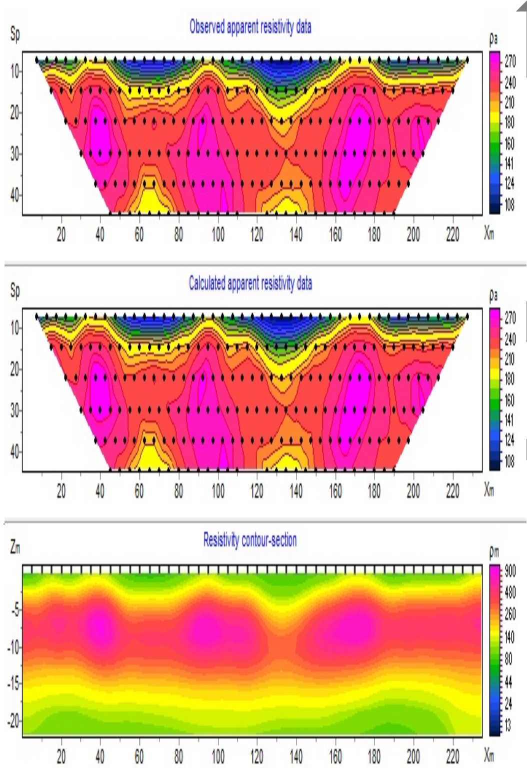

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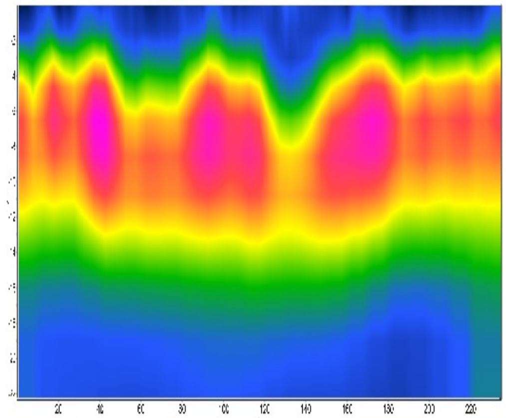

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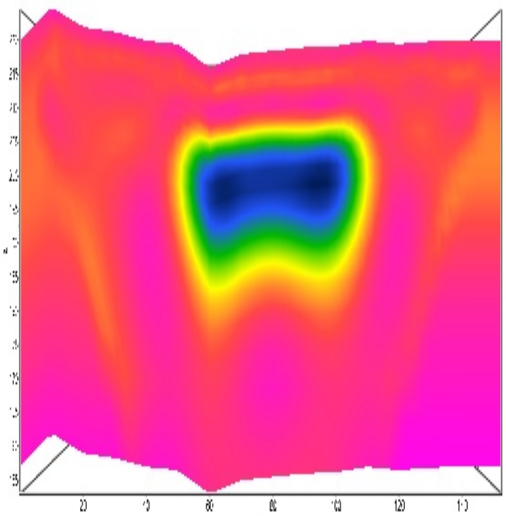

h

Figure 10. (a-h) Apparent Resistivity models in all 2D – 3D structures contour, misfit, Wenner schlumberger array

CONCLUSION

Geophysical and hydro chemical analysis was carried out to identify the saline water intrusion and salinity origin in the Visakhapatnam, Bay of Bengal Coast in Andhra Pradesh, India. The consistent groundwater flow direction is towards Bay of Bengal coast from Visakhapatnam area. Geophysical investigations indicated that thick marine clays are present on the surface and extended up to a thickness of about 10–15 m in the subsurface. The reliability of estimation of layer parameters is enhanced if resistivity techniques are supplemented by seismic, induced polarization and/or electromagnetic methods. The coastal study area incorporates a near surface, brackish/saline groundwater zone. In coastal areas, resistivity methods face limitations like the development of very low potentials, transition in resistivity with depth, suppression of thin layers with intermediate resistivity values, in coastal areas. The resistivity results and subsurface information obtained from this work have been found to be satisfaction. A typical area of data acquisition was around Visakhapatnam, where the information available prior to exploration also revealed the occurrence of a deeper, highly conductive horizon. On the other hand, a typical case for the interpretation of resistivity data existed in the area around coastal areas of Visakhapatnam. Excessive abstraction of groundwater from the coastal aquifer may trigger the lateral ingress of sea water and/or the up-coning of salt water from the deeper zones. This would lead to the deterioration of groundwater quality and hence degradation of the environment. For disaster management, these modeling will be of immense values.

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