Earth Stewardship Science Research Institute

Tshwane University of Technology
We empower people

Development of a D.C. Resistivity Modelling Laboratory for the Simulation of Wenner, Schlumberger and Dipole-dipole Configurations

MABUNDA .V & C.J.S. FOURIE
Faculty of science
Department of Environmental ,Water & Earth Sciences

ABSTRACT.

D.C. resistivity is one of the principal electrical methods that have been used for many decades in geohydrological, geotechnical and mining exploration. Due to time constraints for students to go to the field and gain practical experience, a scale modelling tank was designed and developed to simulate the field geology and D.C. Resistivity field operations in a laboratory. This improves the student's study and understanding of the D.C. Resistivity techniques by the means of simulating the field survey within a laboratory.

One modelling tank represents a normal fault and the second tank represents normal layering. The Wenner and Dipole-dipole configurations are simulated to detect the fault and the normal layering. The Schlumberger configuration is used to simulate D.C. Resistivity soundings. The results are processed and interpreted using sounding curves, inversion software and resistivity maps.

Keywords: D.C. resistivity, Wenner Configuration, Schlumberger Configuration, Dipole-dipole Configuration

INTRODUCTION

DC. Resistivity is an active geophysical method that employs measurements of electrical potential associated with subsurface current flow generated by DC source. The purpose of DC Resistivity survey is to determine the subsurface resistivity distribution by making measurements on the ground ,There are several configuration that can be used to determine the subsurface resistivity distribution: Wenner, Schlumberger, Dipole-dipole, Pole-pole etc. The results of DC. Resistivity are interpreted using sounding curves, maps, modeling and inversion.

OBJECTIVES

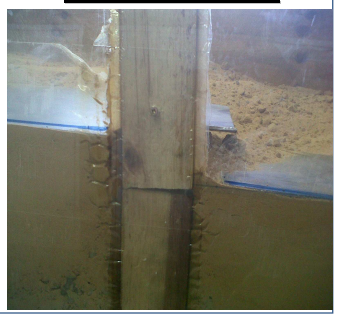
- To describe the design and development of a new scale modelling tank
- Construction and testing of the modelling tank
- Simulate the field geology in a laboratory scale, to enhance the study of the Dc resistivity method at practical's by means of simulating the field Dc Resistivity survey within a laboratory scale.

CONSTRUCTING THE TANK AND ELECTRONICS

CONSTRUCTING THE GEOLOGY

NORMAL LAYERS

FAULTED LAYERS



LABORATORY TESITNG

Scaling factor

The scaling may differ, on this model we selected 1:100 to secure source prospecting systems to signify a suitably sized model

SCHLUMBERGER

$$\rho_a = \frac{\Delta v}{I} * k$$

WENNER

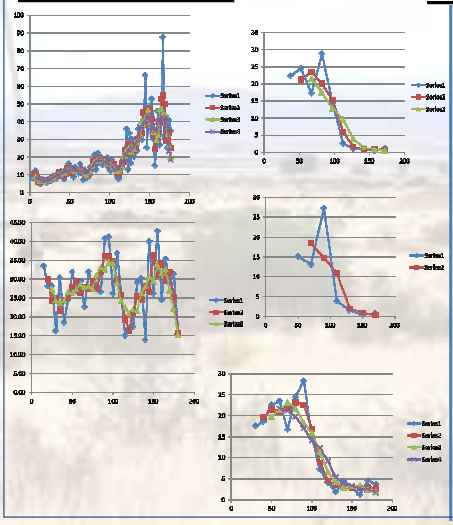
$$\rho_a = \frac{\Delta v}{I} * 2\Pi * a$$

Dipole-dipole

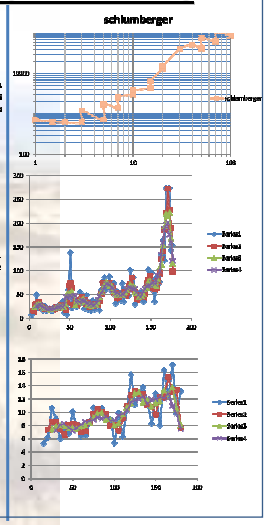
$$\rho_a = \frac{\Delta v}{I} * \Pi * b(n+1)(n+2)$$

RESULTS

FAULTED LAYERS



NORMAL LAYERS



Acknowledgements:

I would like to thank, Tshwane university of technology, AEON, Inkaba yeAfrica and my supervisor Dr C.J.S Fourie.

science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

National Research Foundation