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ORIGINAL ARTICLE

Modelling and simulating the geoelectrical attributes of near-surface buried objects to optimizing its discovery

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Abstract
This study explores the current state of research in modeling and simulating geoelectrical properties of buried objects, focusing on 2D and 3D techniques. The study evaluated the ability of geoelectrical data to determine geometrical structures and analyze resistivity values of geological features using three models:1) a steel buried object model; 2) a brick model representing a small-scale normal fault, and 3) a foam object model. The study assessed geoelectrical data quality and dependability using Pearson correlation coefficients for both synthetic and laboratory models. Wenner arrays are used to accurately detect the depth of buried steel objects, whereas Dipole-Dipole arrays are effective in locating faults. Additionally, the study examined Wenner and Dipole-Dipole arrays' usefulness for buried object cases, highlighted how multiple arrays may be used to identify foam objects, and emphasized the importance of array selection for specific surveys. The study emphasizes the importance of considering 3D effects, choosing the right array, and being aware of the limitations of two-dimensional electrical resistivity tomography 2DERT in accurately representing geoelectrical structures in various subsurface environments.

Keywords Buried objects · 2D and 3D resistivity imaging · Near surface geophysics · Different arrays

Introduction

Detecting near-surface buried objects using Near-surface geophysics is critical-vital for several scientific branches like Archeology, forensic and civil investigation for a variety of reasons. Several research studies have explored various aspects of the applicability of multielectrodes geoelectrical measurements for different configurations and setups in terms of resolution to detect map geological boundaries and faults, search for buried utilities, locate unmarked burials, determining solid/liquid waste contamination as well as seawater intrusion and detection of subsurface cavity (Dupras et al. 2006; Schultz 2007; Ruffell et al. 2009; Alfouzan et al. 2016; Bharti et al. 2022; Ekwok et al. 2022; Etuk et al. 2023; Vu et al. 2024). This is mainly due to the cost-efficient, non-invasive and reliability merit of geophysical methods evidence (Davenport 2001a; Killam 2004; Dupras et al. 2006). Recently, researchers have shown an increased interest in using multi-electrode electrical exploration method in investigating hidden hazards in general, and the seepage areas in dams in particular (Do et al. 2021).

One of the most effective ways to gain expertise in performing geophysical surveys for buried evidence or features is to set up a controlled study site where specific objects may be investigated and identified over time. Controlled studies not only provide operators with experience in a known environment, which is crucial when conducting real-world searches, but they also educate operators on the limitations and applicability of employing various

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