Geoelectric joint inversion: a novel approach for grape vineyards investigation

Nicola Lopane[1,2,3], **Matteo Alberi**, **Alessio Barbagli**, **Enrico Chiarelli**, **Tommaso Colonna**, **Michele Franceschi**, **Fabio Gallorini**, **Enrico Guastaldi**, **Andrea Maino**, **Fabio Mantovani**, **Dario Petrone**, **Silvio Pierini**, **Kassandra Giulia Cristina Raptis**, and **Virginia Strati**

[1]Department of Physics and Earth Sciences, University of Ferrara, 44122 Ferrara, Italy, [2]GeoExplorer Impresa Sociale s.r.l. 52100 Arezzo, Italy, [3]INFN Ferrara Section, 44122 Ferrara, Italy

Abstract

This study focuses on a joint inversion approach within an agronomic framework, involving the inversion of 3D electrical conductivity data from the galvanic contact resistivity (GCR) method and 2D data from the capacitively-coupled resistivity (CCR). By minimizing misfit in model parameters, the joint inversion process enhances data-fitting in terms of resolution and accuracy of subsurface models within the inversion theory framework. The method integrates data pertaining to the same petrophysical property, mitigating ambiguity arising from variable survey sensitivities to distinct properties. The joint inversion algorithm was executed on a shared model parameterized with an irregular 3D mesh, and the optimization objective function was defined as the weighted misfit of the two datasets. Datasets were acquired in a red Sangiovese grape vineyard ("Tenuta il Poggione" - Montalcino, Siena, Italy), covering a 200 m^2 area. Employing a 3D GCR configuration for maximum resolution perpendicular to the vineyard rows and 2D CCR sections along the rows, the study explores up to a 5-meter depth, encompassing the entire vineyard's root system. We compare the results from the joint inversion method against those obtained from individual GCR and CCR inversions, with the primary objective of characterizing the geopedological properties more accurately. This study demonstrates the enhanced effectiveness and precision of the joint inversion method when applied to geoelectrical data in agrogeophysical investigations.

Keywords GCR, CCR, joint inversion, field experiment, plant roots

Conference Talk

Published Dec 18, 2023

Correspondence to
Nicola Lopane
lopane@geoexplorersrl.it