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Geoelectrical evaluation of soil properties

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Major efforts are directed lately worldwide in order to establish proper strategies for the preservation of soil quality, its protection and sustainable use. Therefore there is a great interest in finding new techniques able to offer information in real time on the soil properties (porosity, bulk density), compaction, salinity or moisture content.
Aiming at getting information on soil properties and relate their spatial modifications to variations of electric resistivity, laboratory analyses have been performed on soil samples taken on several lines. The data obtained on the selected line are presented in the following, as variation ranges: density 2.4 – 2.6 g/cm3; porosity 51 – 79%; moisture content 8 – 20%; electric resistivity 45 – 110 ohm*m. The variations of such physical properties along the soil line showed correlation between resistivity highs and lows of moisture content and porosity. High values of resistivity correlate well with high densities on this particular type of soil, meaning in both cases sectors of low porosity and lack of water.
In order to get information on the geoelectric measurements resolution on shallow layers of soil, a soil model have been built for the studied line, the depth between the surface and the depth of 0.63 m being divided in vertical sectors with resistivity contrasts. The electric resistivity values obtained on soil samples have been placed in the corresponding sectors, in order to reproduce the physical conditions on the surveyed line.
Resistivity measurements on this line were simulated for different geoelectric techniques: Wenner, Schlumberger, Wenner-Schlumberger and Gradient-Dipole. The results obtained using these techniques consisted in variations of resistivity for the considered soil model. The interpretation of such geoelectric data led to soil models for each employed technique. By comparing these results to the starting soil resistivity model, the capability of these techniques for shallow soil layer investigations has been evaluated.