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Geophysical surveys for monitoring coastal salt water intrusion

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Geophysical surveys have been exploited in a coastal forest reserve, at the mouth of the river Bradano in South Italy (Basilicata, southern Italy, N 40°22', E 16°51'), to investigate the subsurface saltwater contamination.
Forest Reserve of Metapontum is a wood of artificial formation planted to protect fruit and vegetable cultivations from salt sea–wind; in particular it is constituted by a back dune pine forest mainly composed of Aleppo Pine trees (Pinus halepensis) and domestic pine trees (Pinus pinea).
Two separate geophysical field campaigns, one executed in 2006 and a second executed in 2008, were performed in the forest reserve; in particular, electrical resistivity tomographies, resistivity and ground penetrating radar maps were elaborated and analyzed.
In addition, chemical and physical analyses on soil and waters samples were performed in order to confirm and integrate geophysical data.
The analyses carried out allowed an accurate characterization of salt intrusion phenomenon: the spatial extension and depth of the saline wedge were estimated.
Primary and secondary salinity of the Metapontum forest reserve soil occurred because of high water-table and the evapo-transpiration rate which was much higher than the rainfall rate; these, of course, are linked to natural factors such as climate, natural drainage patterns, topographic features, geological structure and distance to the sea. Naturally, since poor land management, like the construction of river dams, indiscriminate extraction of inert from riverbeds that subtract supplies sedimentary, the alteration of the natural water balance, plays an important role in this process.
The obtained results highlighted that integrated geophysical surveys gave a precious contribute for better evaluating marine intrusion wedge in coastal aquifers and providing a rapid, non-invasive and low cost tool for coastal monitoring.