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Electrical Resistivity Survey for Delineation of the Seawater Intrusion in the Çanakkale Plain, NW Turkey

Alper Demirci, Yunus Levent Ekinci, and Mehmet Ali Kaya
Canakkale Onsekiz Mart University, Department of Geophysical Enginnering, Canakkale-Turkey (alperdemirci@comu.edu.tr)

The city of Çanakkale (Dardanelles) is located on the west side of the Biga Peninsula. The Peninsula is delimited by the Strait of Çanakkale, which is the unique water linkage between the Aegean Sea and the Marmara Sea. The study area is covered by quaternary aged sediments. Sarıçay, which originates from the eastern hilly area, accumulates sediment deposits and forms this alluvial basin. Alluvial terrace including sand, gravel and block sized materials is observed towards northeastern part of this basin. There has been six-fold increase in the population and tremendous growth in industrial and environmental activities in Çanakkale city in the last two decades. Thus, there has been necessity of new settlement areas for planned urbanization and the parameters of liquefaction potential and the extent of seawater intrusion should be taken into consideration. To this end, we have carried out Direct Current (DC) electrical resistivity survey on 52 stations to shed light on the thickness of alluvial layers and traces of the seawater intrusion in the Çanakkale plain. We have used maximum half current electrode spacing (AB/2) of 80 m for each station. The acquired apparent resistivity data were processed by using a damped least square inversion algorithm with singular value decomposition (SVD) technique. After obtaining the model parameters (thickness and resistivity) of each resistivity curve, a MATLAB-based visualization algorithm was used for joint representation of the whole resistivity variation of the studied area. The produced psuedo-three dimensional volumetric resistivity distribution images indicated that the western part of investigation area has relatively resistive structures (> 80 ohm.m), which extend to the depth of 3 m. The sudden decrease in resistivity values to downward clearly indicated seawater saturated sediments (0.5-5 ohm.m). On contrary to these low resistivity values observed at the western part of the city, the central and eastern parts are characterized by relatively higher resistivity values ranging between 30-70 ohm.m. These results clearly outlined the extension of saturated zones. Due to the active tectonism of the region, and highly saturated zones, preventive measures should be considered against liquefaction risks in construction of engineering structures by local authorities.

Keywords: Resistivity, Seawater, Saturation, Çanakkale, Turkey