Assessment of groundwater mineralization processes in the Djebeniana Coastal aquifer with emphasis on seawater intrusion: an integrated geophysical, hydrogeochemical and modeling study

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ABSTRACT

Several coastal regions are densely populated, and it is estimated that nearly half of the world's population lives within 60 km of sea and ocean coasts. Such a situation puts pressure on coastal water resources and the groundwater overexploitation is a growing concern in many areas where seawater intrusion in coastal aquifers impact groundwater quality. This is the case of the semi-arid Djebeniana Region (Tunisia, North Africa) where the shallow coastal aquifer groundwater is severely overpumped and probably impacted by seawater intrusion. Fitting in this context, this study aims at quantifying the hydrogeochemical processes responsible for the shallow aquifer salinization. Ten electrical resistivity tomography (ERT) profiles were performed along lines of 240 meters using 48 electrodes to evaluate the position of the fresh-water–salt-water interface. Groundwater samples were collected from 25 wells in November 2020. The samples were analyzed for major ions, trace elements, stable isotopes of water ($\delta^{2}H$-$\delta^{18}O$), $\delta^{37}Cl$ and $\delta^{81}Br$ to decipher the origin of the dissolved species and identify the processes responsible for groundwater mineralization. A 2D numerical model coupling water and dissolved mass transport was subsequently developed in SEEP/W and CTRAN/W in order to simulate actual conditions and analyze scenarios for groundwater quality remediation. Ultimately, this research will provide novel insights on groundwater management in coastal areas.