Study of water salinity in the Chtouka plain (Morocco) using TEM geophysical method, chemical and isotopes tracers

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The Chtouka plain in Morocco suffers from groundwater overexploitation and a significant increase in water salinity. In this study, a multidisciplinary approach combining water chemistry, stable isotopes of water (Δ¹⁸O, Δ²H) and Transient Electromagnetic (TEM) method was used. The main objective was to identify the water salinity sources and the extension of the marine intrusion. Water samples were collected from wells and boreholes, springs, the Massa river and the main source of freshwater in the region, the Youssef Ibn Tachfine Dam. Geophysical (TEM) measurements (12 profiles comprising 83 measurement points) were carried out along the coastal zone and around the northern bank of the Massa river. The results show a spatial variability of water salinity, indicating rock-water interaction, seawater intrusion and anthropogenic influence. The interpretation of the TEM soundings allow to draw the front line of the marine intrusion in the aquifer. The results, compared to previous numerical simulations, show a significant progress of the marine intrusion into the coastal aquifer. The intrusion indeed reaches a distance of 2.5 km from the coast, far beyond models' predictions. The local water authorities can use these results to improve their monitoring network and better assess the progress of the seawater intrusion.

Keywords: Water salinity, TEM geophysical method, chemical and isotopes tracers, marine intrusion