XXXVIII IAH Congress

Groundwater Quality Sustainability
Krakow, 12–17 September 2010

Extended Abstracts

Editors:
Andrzej Zuber
Jarosław Kania
Ewa Kmiecik

University of Silesia Press 2010

abstract id: **251**

topic: **5**
Data processing in hydrogeology

5.2
Groundwater flow and solute transport modelling

title: **Identification of groundwater salinization sources using experimental, multivariate statistical analysis and numerical modelling tools: Case of Korba coastal aquifer (Tunisia)**

author(s): **Fairouz Slama**
(1) ENIT, Tunisia,
(2) CHYN UNINE, Switzerland, fairouz.slama@unine.ch

Rachida Bouhlila
ENIT, Tunisia, rjbouhlila@yahoo.fr

Philippe Renard
CHYN UNINE, Switzerland, philippe.renard@unine.ch

keywords: salinization, multivariate statistics, numerical modelling, coastal aquifer, Tunisia

Groundwater quality degradation processes are threatening environmental and social sustainability in arid and semi-arid regions. Salinization is one of the most world spread forms of groundwater contamination (Custodio, Bruggeman, 1987). It mainly results from seawater intrusion due to over-pumping and loading of agricultural residual substances through irrigation return flow (Koh et al., 2007). This study aims to understand and predict groundwater and soil salinization processes in coastal irrigated areas using experimental and numerical tools. Field experiment was carried out in Korba coastal aquifer along two transects perpendicular to the sea (Fig. 1).

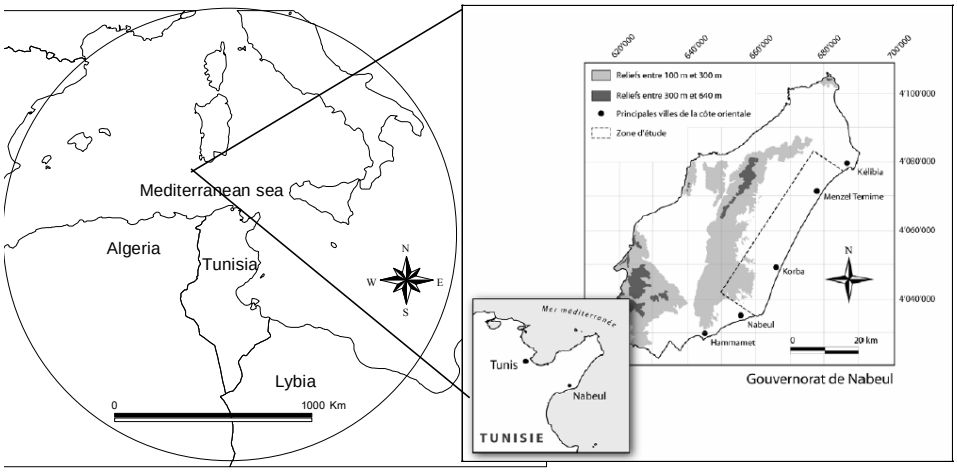

Figure 1. Location of Korba coastal aquifer.

The first transect is located in a piezometric depression and it is affected by seawater intrusion. In the second transect, the flow is still seaward. Experimentation involved soil and groundwater sampling as well as Electrical Resistivity Tomography Imaging (ERT). Irrigation water comes mainly from groundwater pumping. Groundwater was sampled at different periods from June 2006 to March 2008 in 50 observation wells along the two transects. Soil samples were used to determine vertical soil salinity, major ions and nitrate profiles on extractions from saturated soil paste. Major ions, nitrates and bromide were also determined for groundwater samples. Conventional geochemical methods and multivariate statistical analysis were performed to identify superimposed salinity sources. HYDRUS1D was used to simulate flow and solute transport in variably saturated profiles in order to predict soil and groundwater salinity. Simulations were first performed for a cycle corresponding to the irrigation season and second for some years. Results show that measured electrical conductivity in observation wells presents important values reaching 9 mS/cm. Principal Component Analysis as well as the geochemical study showed that salinity is originating from mixing with seawater and from irrigation return flow (Fig. 2).

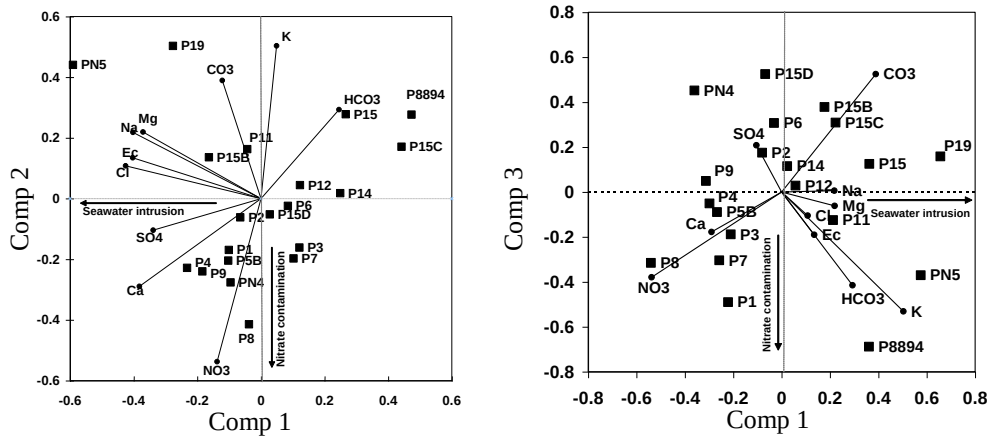

Figure 2. Principal Component Biplot of variables and observation points in the first transect for the dry sampling survey.

Electrical conductivity as well as major ions profiles, show salt accumulation in the soil surface reaching 17.5 mS/cm (Fig. 3).

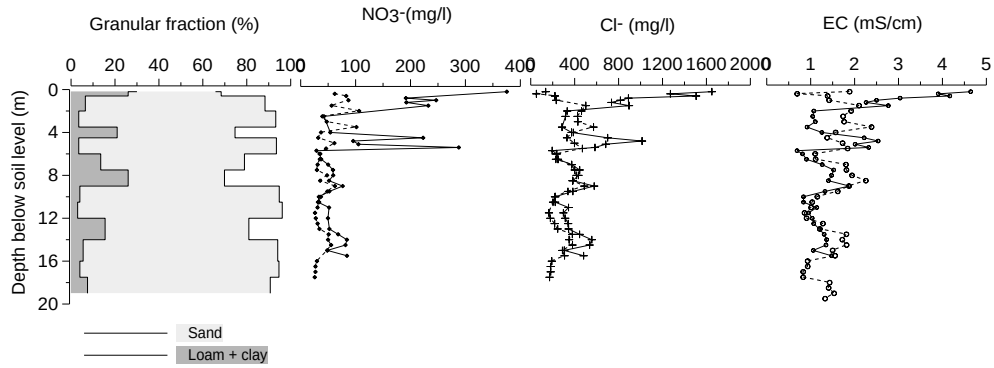

Figure 3. Distribution of granular fraction, chloride, nitrates, and electrical conductivity, along a 19 m soil profile. Variables (Cl, NO_3 and EC) were measured in August 2006 and April 2007 (dashed line).

This is essentially due to evapotranspiration processes and high irrigation water salinity. HYDRUS1D also simulated surface salinisation during the irrigation season. Impacts on groundwater quality are rather visible after some years of simulation.

ACKNOWLEDGEMENTS

This work was entirely funded by The Swiss National Science Foundation (SNSF).

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International Association of Hydrogeologists

AGH University of Science and Technology

2-vol. set + CD
ISSN 0208-6336
ISBN 978-83-226-1979-0