

# Hydrochemical analysis and evaluation of groundwater quality in El Eulma area, Algeria

Lazhar Belkhiri · Lotfi Mouni

Received: 4 September 2011 / Accepted: 7 February 2012 / Published online: 28 February 2012  
© The Author(s) 2012. This article is published with open access at Springerlink.com

**Abstract** The groundwater sources in the El Eulma plain have been evaluated for their chemical composition and suitability for irrigation uses. Cluster analysis in Q-mode resulted in three major water types ( $\text{HCO}_3^-$ - $\text{Ca}^{2+}$ -dominated,  $\text{Cl}^-$ - $\text{HCO}_3^-$ - $\text{Ca}^{2+}$ -dominated and  $\text{Cl}^-$ - $\text{Ca}^{2+}$ - $\text{Na}^+$ -dominated) for the groundwater. The US salinity diagram illustrates that most of the groundwater samples fall in C3S1 quality with high salinity hazard and low sodium hazard. Based on RSC values, all the samples of the three groups had values less than 1.25 and were good for irrigation.

**Keywords** Hydrochemical · Q-mode cluster analysis · Irrigation · El Eulma area · Algeria

## Introduction

Quality of groundwater is equally important to its quantity owing to the suitability of water for various purposes. Water quality analysis is an important issue in groundwater studies. Variation of groundwater quality in an area is a function of physical and chemical parameters that are greatly influenced by geological formations and anthropogenic activities (Belkhiri et al. 2010).

The hydrochemical study reveals the quality of water that is suitable for drinking, agriculture and industrial

purposes and helps in understanding the change in quality due to rock–water interaction or any type of anthropogenic influence (Kelley 1940; Wilcox 1948). The chemical parameters of groundwater play a significant role in classifying and assessing water quality. It was observed that the criteria used in the classification of waters for a particular purpose considering the individual concentration may not find its suitability for other purposes and better results can be obtained only by considering the combined chemistry of all the ions rather than individual or paired ionic characters (Handa 1964, 1965; Hem 1985). Chemical classification also throws light on the concentration of various predominant cations, anions and their interrelationships.

The present work had the objective of understanding the spatial distribution of hydrochemical constituents of groundwater related to its suitability for agriculture and domestic use and application of cluster analysis.

## Study area

The study area is located in the East of Algeria (Fig. 1). Most of its inhabitants are concentrated in the town of El Eulma with more than 30,000 inhabitants working mainly in the production of cereals (barley, corn). The climate of the study area is considered to be semi-arid region, with an annual precipitation being approximately 421 mm. The rainy season extends from October to May, with a maximum rainfall during December and March of each year. The mean monthly temperature varies between  $-3$  and  $38^\circ\text{C}$ , the mean annual temperature of  $15^\circ\text{C}$ . The vegetation of the study area is characterized by grasses and herbs. Soils are generally sandy to clayey in texture and mostly classified as arid-sol and are calcareous. Mineralogically, most of the soils are dominated by kaolinite, illite,

L. Belkhiri (&  
University of Batna, 05000 Batna, Algeria  
e-mail: BELKHIRI\_Laz@yahoo.fr

L. Mouni  
Département des Sciences Techniques, Institut des Sciences,  
Université Akli Mohand Oulhadj, Bouira, Algeria

