Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AHW27-P01 Room:Poster Time:May 1 18:15-19:30

Characteristics on groundwater salinization in a downstream area of dam reservoir, a coastal region of NorthEast Tunisia

UCHIDA, Chisato[1*] ; KAWACHI, Atsushi[2] ; TSUJIMURA, Maki[2] ; SHIBAYAMA, Naoyuki[1] ; ZIADI, Amira[3] ; TARHOUNI, Jamira[3]

[1]Graduate School of Life and Environmental Sciences, University of Tsukuba, [2]Faculty of Life and Environmental Sciences, University of Tsukuba, [3]National Institute of Agronomy in Tunisia

This study tried to characterize salinization processes of coastal shallow groundwater in a downstream are of dam reservoir, based on field investigation and chemical water analyses in order to indicate positive effects of dam reservoir on prevention of the groundwater salinization or seawater intrusion. Thus, focusing on two neighboring watersheds: Lebna and Chiba watersheds located in Korba aquifer (North-East Tunisia), the field investigation was carried out at 72 locations in June 2013, then water samples were collected at the 63 locations.

At first groundwater table contour map was drawn using investigated groundwater level data, and the groundwater flow was estimated. From the chemical analyses, spatial distributions of dissolved inorganic ions' concentrations, and stable hydrogen and oxygen isotopic compositions were obtained. Then, the seawater ratio in the groundwater samples were calculated using mass balance equation of chloride concentration under assumption chloride was derived from seawater. Using the seawater ratio, a theoretical concentration of each parameter were estimated, and differences between the analytical and theoretical concentrations were obtained. Additionally saturation indices were calculated based on chemical equilibration theory. Moreover, multivariable analyses: Cluster Analysis (CA) and Principal Component Analysis (PCA), were conducted to classify the groundwater salinization process and to determine the important parameters associated with the process.

As a result, the groundwater level (GWL) in the downstream of Lebna dam reservoir was higher than the sea level, while the GWL in Chiba watershed was lower than the sea level. The lowest point is about -10 m above sea level. According to seawater ratios and stable isotopic compositions, the study area were categorized into the following three types: (i) high seawater ratio, (ii) low seawater ratio and low isotopic compositions, and (iii) low seawater ratio and high isotopic compositions. On the other hand, CA results showed the study area were categorized into 5 clusters, and the PCA showed the following three phenomena were main reasons for the 5 clusters: (a) seawater ratio in groundwater, (b) inverse cation exchange by reaction between seawater and clay minerals, and (c) directly or indirectly groundwater recharge from Lebna dam reservoir. Moreover, considering totally the three types (i), (ii), (iii), three phenomena (a), (b), (c), and groundwater level, the study area could finally be divided into 3 areas A, B, C which have different characteristics on groundwater salinization

Area A is located around Lebna dam reservoir, in which groundwater level is higher than sea level and the stable isotopic compositions are relatively higher. High groundwater level is probably sustained by the direct recharge from the reservoir, or by infiltration of the irrigation water from the reservoir in the farm land. Area B is located near shoreline, in which groundwater level ranges 0 to -4 m above sea level, and high seawater ratio and high concentration of each dissolved ion are observed. The groundwater in this area has high concentrations of sodium and chloride (derived from seawater) and calcium (derived from inverse cation exchange) due to seawater intrusion. Area C is located in inland area of Chiba watershed, in which groundwater level is lower than -4 m above sea level. There should be three groundwater flows: from Area A, and the upstream of Chiba watershed with fresh groundwater derived from precipitation, and from Area B with saline water, especially high concentration of calcium. Therefore, the groundwater in this area probably consists of the three different origin waters.

Keywords: seawater intrusion, dam reservoir, dissolved inorganic ions, stable hydrogen and oxygen isotopic compositions, mass balance, multivariable analyses