Effect of surface water use on mitigation of GW salinization in a semi-arid coastal shallow aquifer setting: a case study of lower Lebna watershed, Tunisia

Atsushi Kawachi1,2, Chisato Uchida3, Mohamed Kefi4, Jamila Tarhouni5, and Kenichi Kashiwagi2,6
1Faculty of Life and Environmental Sciences, University of Tsukuba, Ibaraki, Japan
2Alliance for Research on North Africa (ARENA), University of Tsukuba, Ibaraki, Japan
3Graduate School of Life and Environmental Sciences, University of Tsukuba, Ibaraki, Japan
4Water Researches and Technologies Centre of Borj Cedria (CERTE), Ben Arous, Tunisia
5National Institute of Agronomy in Tunis (INAT), Tunis, Tunisia
6Faculty of Humanities and Social Sciences, University of Tsukuba, Ibaraki, Japan

ABSTRACT
The study evaluated surface water (SW) use for irrigation in a semi-arid coastal agricultural region northeast of Tunisia. In the shallow aquifer, groundwater salinization occurred due to the over-exploitation of groundwater (GW). However, after the construction of a dam reservoir located about 5 km to the sea, the GW quality improved in part of the aquifer. Though irrigation using SW could affect GW quality due to infiltration process, few studies on effect of the SW use on GW quality in salinized coastal aquifers exist. This communication therefore presents the relationship between chemical and physical properties of GW in the coastal area of less than 100 km², focusing on effects of both SW and GW uses for irrigation to their properties.

Spatial distribution of GW table and chemical compositions were investigated by GW sampling conducted at 60 wells in the area. Meanwhile, GW use was estimated using a regression model of cropping area vs. water use that was established using the data for each farmer provided by the water user association, and farmer interviews was also conducted to confirm the estimation of GW use.

It was found that GW table was associated with GW use. In irrigated area using SW, GW table remains higher than above the sea level, and low salt concentration in GW was observed. Additionally, stable isotopic values of GW were higher than that in irrigated area using GW or no irrigated area, while stable isotopic value of SW in the reservoir was higher due to evaporation effect. That is, the GW could be affected by SW infiltration through irrigation. This study suggests that reasonable SW use is one of the good ways to mitigate GW salinization, but provides no details on how and where to allocate the limited SW resource.

KEYWORDS: surface water use; irrigation; stable isotopic compositions of water; semi-arid region; Tunisia

Contact Information: Atsushi Kawachi, University of Tsukuba, Faculty of Life and Environmental Sciences, 1-1-1, Tennodai, Tsukuba, Ibaraki, 305-8572
Phone: +81-29-853-6997, Fax: +81-29-853-6997, Email: kawachi.atsushi.fp@u.tsukuba.ac.jp