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Evaluating the water quality in the agriculture part of the Hamoun Hirmand basin

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Abstract

Awareness from quality and quantity of the water resources is one of the important neediness in planning and developing the water resources and protecting and controlling of them. It is obvious that for awareness from the quality of the water resources and producing the needed information the monitoring should be done. The primary estimations of the quality of the agriculture were done in the standard Wilcox diagram with considering the values of the SAR and EC and it was specified that the water of this basin in the agriculture part is set in three categories of the very brine, slightly brine and brine that respectively they are inappropriate for agriculture, usable for agriculture and appropriate for agriculture, among this the share of the very brine waters is more than other waters. Among studied stations the stations of choto, shileh and Lar have water with the very brine quality and they are inappropriate for agriculture that respectively are placed in the qualitative classes of C4-S3, C4-S4 and C4-S3 that qualitatively they are in the lowest possible level. Results of evaluating the two stations of Gourband and Shirdel showed the better quality of these two regions than other parts in the form that the water of these two stations have recognized as the appropriate waters for agriculture and qualitative classes of these two stations respectively were C2-S1 and C3-S1. Also it was specified from zoning the agriculture water that the agriculture water in the studied basin has been placed in the 2 classes of medium and inappropriate.

Keywords: Water Quality, SAR, EC, Hamoun Hirmand basin

Introduction:

Today the water quality is used for description of biological, chemical and physical features of the water according to appropriateness of the water with beneficial uses of that. The water quality is usually subordinate to factors such as gender of the ground formations, recognition of catchment of the rivers or

the bedrock of the aquifer, the geomorphology of the basin, discharge regime of the water, sewages resulting from human activities and exchange range of the surficial and underground waters. Today water in considered as a one factors of the economic improvement and development of the communities, so optimal management of the water resources specially the fresh water is considered as a one of the most important plans of the countries (9). The quality of surficial waters in different regions has different changes because of variety of formations and geological structures and hydrogeological factors. Recognition and evaluation of the quality of the water resources have a high importance in management and optimal use of that (10). The Wilcox method is also a common method in the classification of waters in terms of agriculture. In this classification two factors of electrical conductivity (EC) and sodium adsorption ratio (SAR) are considered and each one of them is divided into the four parts that totally it is causes to creation of 16 groups of the water quality (1).

The first step in determination of the water quality by using this method is choosing a suitable model order to interpolation and zoning the data. The geographical information system (GIS) has many uses in monitoring and qualitative classification of waters of the basins and provides the ability of analyzing and evaluating the information in the high volume. In this system the more useful management plans can be presented by determination of population, industrial and agricultural centers and estimation of the pollution load and combination of it with other information. In addition to this, there is the possibility of achievement to more accurate relations for relation between qualitative parameters of the water resources and effective parameters in this basin with this tool (2).

Evaluating the seasonal changes of the quality of the surficial waters is an important aspect in evaluating the temporary changes of the pollutions of the rivers due to natural and human point and non-point resources (Ouyang et al) (6). Different researches have been formed in the world order to evaluating the quality of the water resources that including that evaluating the quality of the surficial water in the basin of the Foujin River in Japan Shrestha and Kazama can be mentioned (7). Lucas (5) evaluated monthly the data of runoff 15 stations and quality data of the water of six stations based on national, European and international standards for evaluating the quality and quantity of the surficial water in the Pinetus River of the Greece.

Results showed that the water quality of the river is medium in a range and the water of the river should be used cautiously for irrigation. Zehtabian et al (3) evaluated the water quality of the river in the Jajroud in Varamin. Results showed that as we come closer to the south side of the Varamin plain the water quality of the water is reduced that this issue is because of agricultural, industrial and urban sewages from one hand and impressing from evaporative formations from another hand. Dehghan et al (4) Investigation of Pollutants effects in Kashafroud river water quality. The results underline that water quality in Olang, Pol Khaton and Shor Ghale are not appropriate for agricultur in these regions.

Research methodology

The Studied area has a total area of 35331 square kilometers that it has been placed between the provinces of south Khorasan and Sistan & Balouchestan among the eastern longitudes of 59 to 62 and northern latitudes of 29 to 33. This rang has been linked from north to south Khorasan province and from south to Sistan & Balouchestan province. The maximum height of the region from the sea is 2683 meters. In the

figure number (1), the status of the studied region is visible in the mentioned provinces and also the Islamic Republic of Iran.

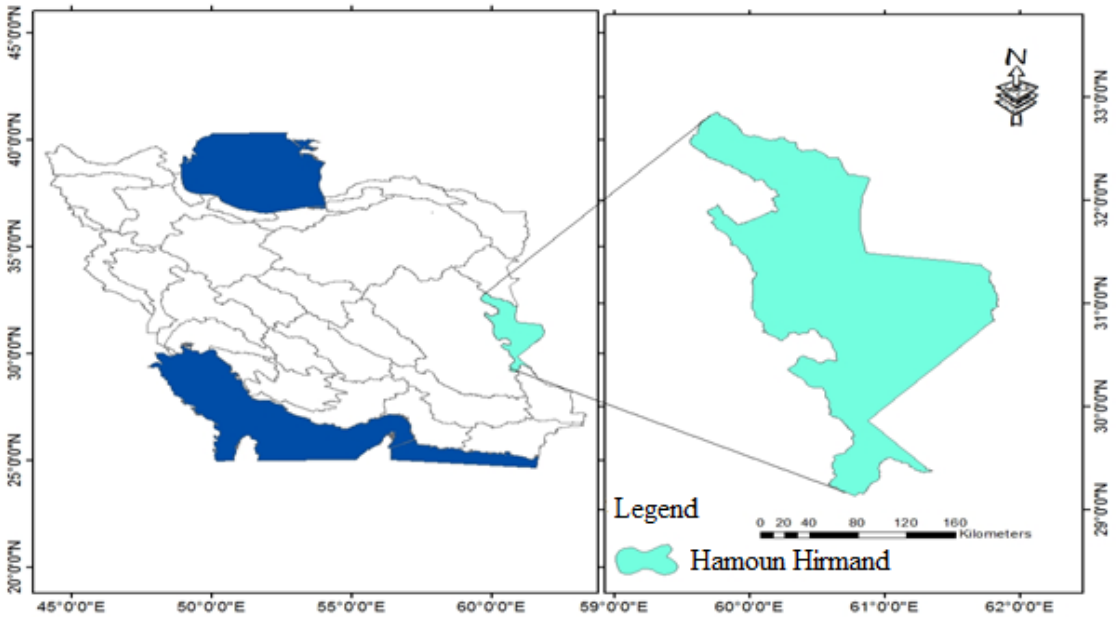


Figure 1- The status of the studied region

Research tools

The most important qualitative measures in the water classification in terms of agriculture are salinity (electrical conductivity) and the amount of sodium in it because these two not only are effective in the growth of the plant, but also they specify the appropriateness degree of the water in terms of irrigation and its effect on soil penetration. In the Wilcox diagram the horizontal axis belongs to salinity of the water and the vertical axis belongs to sodium adsorption ratio (SAR). The coordinate related to each sample of the water is placed in the region that is gotten (C) in terms of salinity and (S) in terms of sodium, which the sodium adsorption ratio (SAR) was obtained from following relation that the sodium and calcium and magnesium are expressed with Mill equivalents per liter in it. Results output from Wilcox in different mentioned groups are classified as following.

- The very good waters which the EC is less than 250 Micromhos per centimeter and they are in the C_1S_1 class.
- The good waters which are related to one of the classes of C_2S_1 ، C_2S_2 ، C_1S_2.
- The waters with the medium quality that are related to one of the classes of the C_3S_3 ، C_1S_3 ، C_2S_3 ، C_3S_1، and they are only appropriate for irrigation of coarse textured grounds and with good drainage.

- The inappropriate waters which are paced in C_1S_4، C_2S_4 ،C_3S_4 ، C_4S_4 ، C_4S_4 ، C_4S_1 ، C_4S_3 that as their index is increased they become more inappropriate. The table number 1 shows the classification of agriculture water based on the values of the EC and SAR.

$Z_1(S) = \mu_1+\varepsilon_1(S)$
$Z_2(S) = \mu_2+\varepsilon_2(S)$

Table 1: Classification of agriculture water

SAR	EC	
10>	250>	Excellent
10-18	250-750	Good
18-26	750-2250	Average
26<	2250<	Inappropriate

Interpolation

Cokriging method

Cokriging method uses the all information of the variables. The main variable is Z_1 and uses autocorrelation for Z_1 and also the bilateral correlation between Z_1 and other variables order to better predication. Using from the information of other variables is not for helping to attractive predication but it is with cost. The Cokriging needs to more estimation including correlation estimation for each variable and also bilateral correlation between other variables. The normal Cokriging model is as following:

$Z_1(S) = \mu_1+\varepsilon_1(S)$
$Z_2(S) = \mu_2+\varepsilon_2(S)$

The normal Cokriging tries to predict Z_1 (S_0) but it uses the information of $Z_2(S)$ order to better prediction.

Research Findings

In this part the estimations related to agriculture water have been mentioned. In this part the main parameters which are needed for general recognition from agriculture water of the region, the two effective parameters are SAR and EC. It was determined that the agriculture water of the region is divided into three appropriateness levels of low, high and very high according to results from Wilcox diagram and only the water appropriateness level of medium was not observed. Wilcox diagram is showen in figure number 2.

In this part the table 2 shows the results from Wilcox diagram in the part of agriculture water in five studied stations and table 3 shows the percentage of each one of these classes in the basin. The figure number 3 shows zoning the agriculture water of Hamoun Hirmand basin that the water of this basin has been classified into two classed of medium and good for agriculture based on the performed estimation.

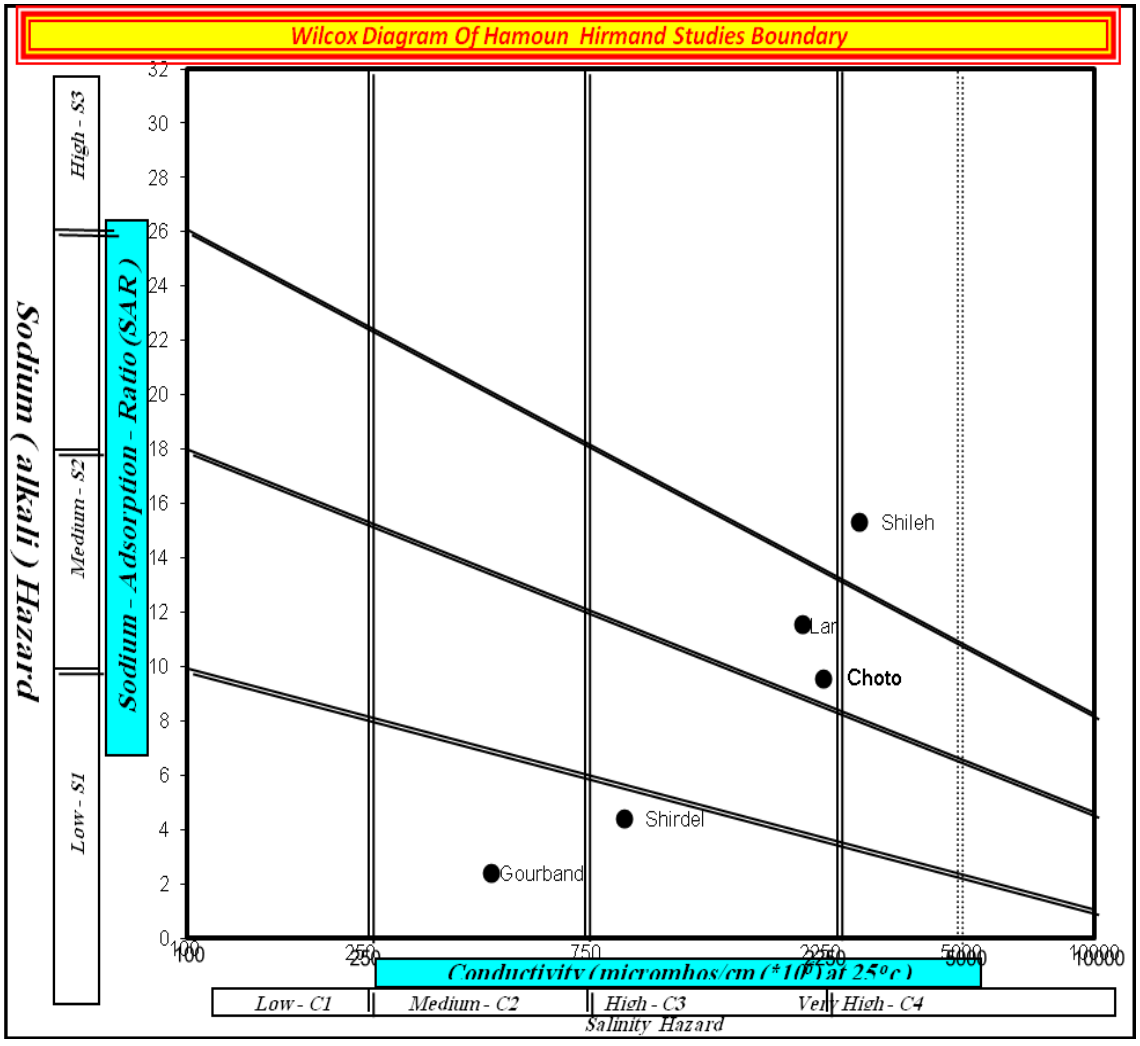


Figure 2- Wilcox diagram

Table 2: Results from Wilcox diagram in the part of agriculture water

Quality of agriculture water	Water Classification	EC	SAR	Station	Row
Too salty water	C4-S3	2528.47	9.56	Choto	1
Slightly salty water	C2-S1	469.885	2.42	Gourband	2
Too salty water	C4-S4	3041.61	15.34	Shileh	3

Too salty water	C4-S3	2280.14	11.53	Lar	4
salty water	C3-S1	920.625	4.4	Shirdel	5

Table 3: The percentage of each one of agriculture water classes

C1				C2				C3				C4			
S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4
0	0	0	0	20	0	0	0	20	0	0	0	0	0	40	20

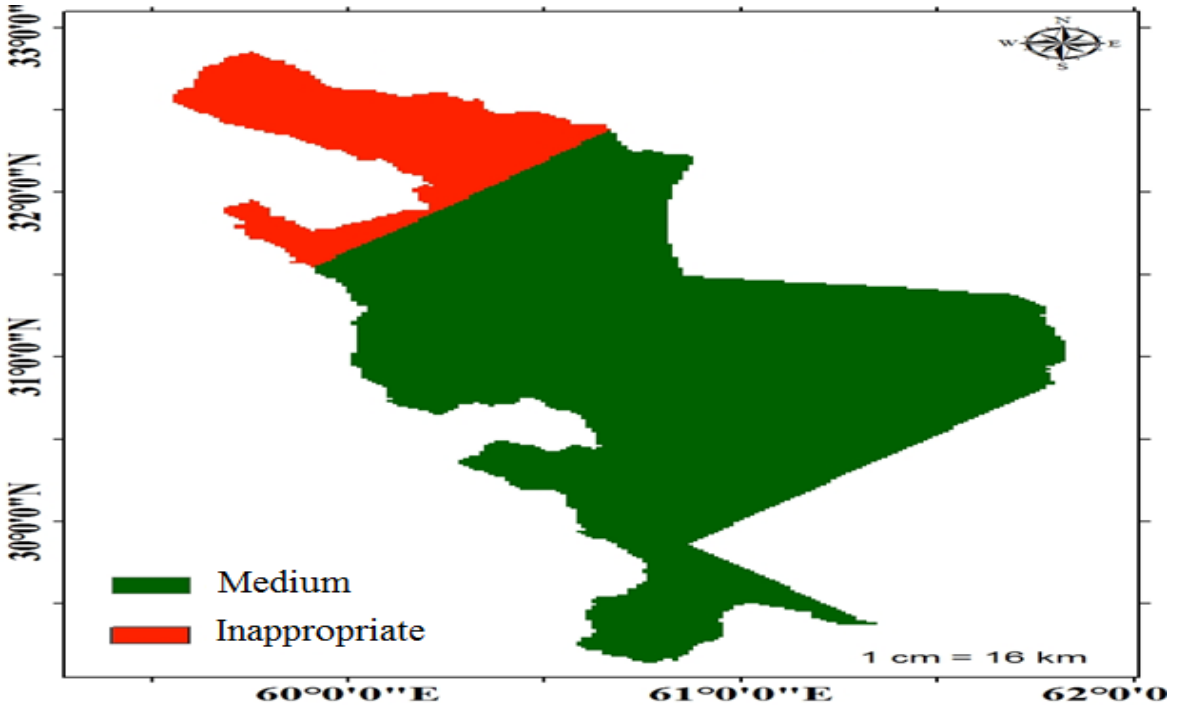


Figure 3: zoning the agriculture water of Hamoun Hirmand basin

Conclusion:

In the part of agriculture water Hamoun Hirmand basin which its primary estimations were done in the standard Wilcox diagram it was determined that the water of this basin in the part of the agriculture is placed in the three categories of the very brine, slightly brine and brine that respectively they are inappropriate for agriculture, usable for agriculture and appropriate for agriculture, among this the share of the very brine waters is more than other waters in a form that the quality of agriculture water have low quality in the stations of choto, shileh and Lar in terms of agriculture and thy have been recognized inappropriate and water in the station of Shirdel showed more quality for irrigation of agricultural produces in a form that the water of this region is usable for agriculture yet. But the quality of agriculture water in the Gourband station was better than the other studied stations in a form that the water of this

station have an appropriate capability and quality for agriculture irrigation. Among the studied stations the stations of Choto, Shile and Lar have water with the quality of very brine and they are inappropriate for agriculture that respectively they are in the qualitative classes of C4-S3, C4-S4 and C4-S3 that qualitatively they are in the lowest possible level. Among this the qualitative status of the water is worse than the other 2 stations in the Shileh station. The results of evaluating the two stations of Gourband and Shirdel had waters with the better quality than the other parts. In a form that the water of these two stations were respectively C2-S1 and C3-S1 that among this the water quality of the Gourband station was recognized much better than the Shirdel station. Also it was determined that agriculture water in the studied basin has been placed in the 2 classes of medium and inappropriate based on the obtained results. In the agriculture part the medium quality of the water has dedicated the most area of the basin to itself in the Hamoun Hirmand basin that is equal to 65/2680 square kilometer of the basin which is equal to 84 percent of the entire basin.

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