Spatial Analysis of Groundwater Resources Quality Parameters of Hamadan – Bahar plain

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1. Introduction

Inflation of population and rising living standards in many countries need to be enhanced the high quality water suitable for different uses such as agricultural, industrial and drinking sections. Groundwater is one of the most important water supply sources which are encountered with many problems such as drawdown, recharge reduction due to low rainfall and different natural and man-made pollutions. Therefore, monitoring of groundwater quality is very important. Chemical hazards are one of the major environmental hazards in the field of water quality issues and other areas that jeopardizes the health and security of human. Researchers report results from the application of geostatistics in hydro-solving processes, increase accuracy, and reduce the number of samples collected from the economic point of view. Study Zehtabian et al. (2010: 61) with the aim of modeling spatial variation of groundwater quality using geostatistical methods, showed that Co-Kriging method is more accurate than radial basis function and the inverse distance weighting methods. Maghami et al. (2011: 171) for groundwater quality zoning in Abadeh city used kriging and inverse distance weighted. Comparing the results of this study showed that kriging method with semi variogram of circle is compared to other methods. Spatial prediction of fluoride concentration in groundwater resources in the North West of Iran indicated that Kriging method with r= 0.73 was less than Co-kriging (r= 0.86) (Asghari Moghaddam et al., 2008: 1). Survey data and the findings indicate human use of chemical fertilizers and reduce the quality of water resources. Such a situation is not only caused environmental sustainability, sustainable development, but also to the environment will be broken. Therefore, unsustainable human development, along with its non-application of chemical fertilizers is one of the most important environmental hazards at all levels of society.

The purpose of this study was the spatial variability modeling of water quality parameters in Hamedan - Bahar plain by geostatistical methods.

2. Study Area

Hamadan – Bahar plain, called Siminehrood, with an area of 2459 km2 along 48° 17' to 48° 33 E and 34°49' to 35°02' N is located in the northern highlands of Alvand. For zoning of

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aquifer parameters used data of 25 observation wells during the spring and summer in during 2009-2010 years (Fig. 1).

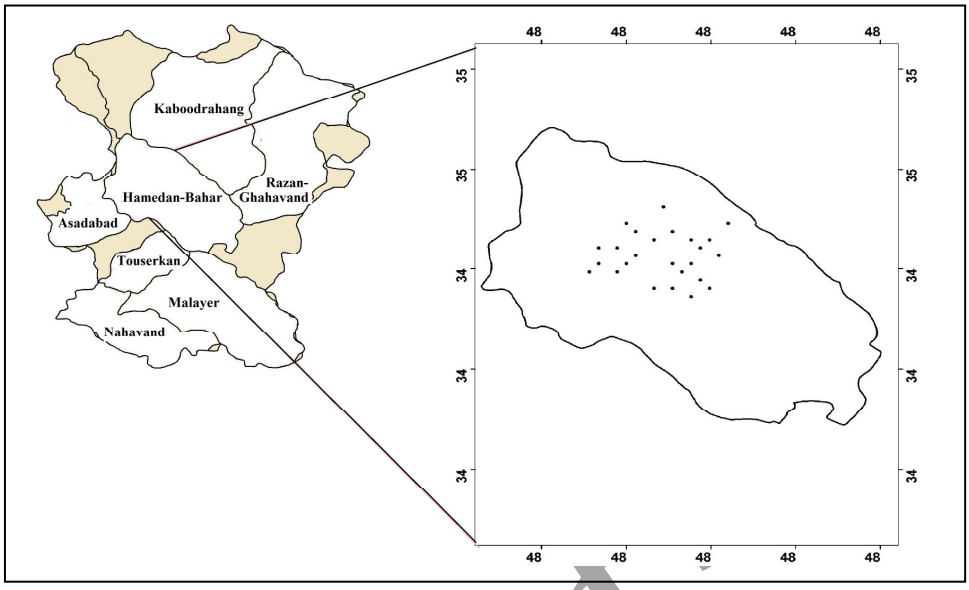

Fig. 1 Location of the study area

Lack of adequate surface water, rainfall and rainfall duration mismatch causes excessive pressure on groundwater resources for supplies more than 80 percent of agricultural water and 50 percent of drinking water aquifer is above (Balali et al., 2010: 194). On the other hand, indiscriminate and inappropriate use of fertilizers to increase agricultural production can alter the quality of groundwater resources.

For zoning of the aquifer quality, the data of 25 observation wells during the spring and summer of the years 2009 and 2010 were used. As the season of spring probe picked up in order to perform the irrigation of crops, and the importance of summer as the season of low water, picked up, and the spring is to provide drinking water for the cities of Hamedan.

3. Material and Methods

The parameters studied were EC, pH, SAR and TDS as the main characteristics of groundwater.

For interpolation of data in locations without measurements, were used three methods of geostatistical including ordinary kriging (OK), inverse distance weighting (IDW) and radial basis function networks (RBF). For choice modeling method, Normal Root Mean Square Error (NRMSE) and Mean Bias Error (MBE) in the form of cross-validation technique was used.

4. Results and Discussion

The results showed that kriging with spherical semi-variogram are useful for modeling qualitative factors (Fig. 2). NRMSE of the spherical semi-variogram for each of the four parameters was 0.95 to 0.96 that was lower to other semi-variogram (0.96-0.98). The

lowest error was modeled on the parameters pH, and the maximum error was awarded to EC parameters with NRMSE=0.42 and MBE= -0.01.

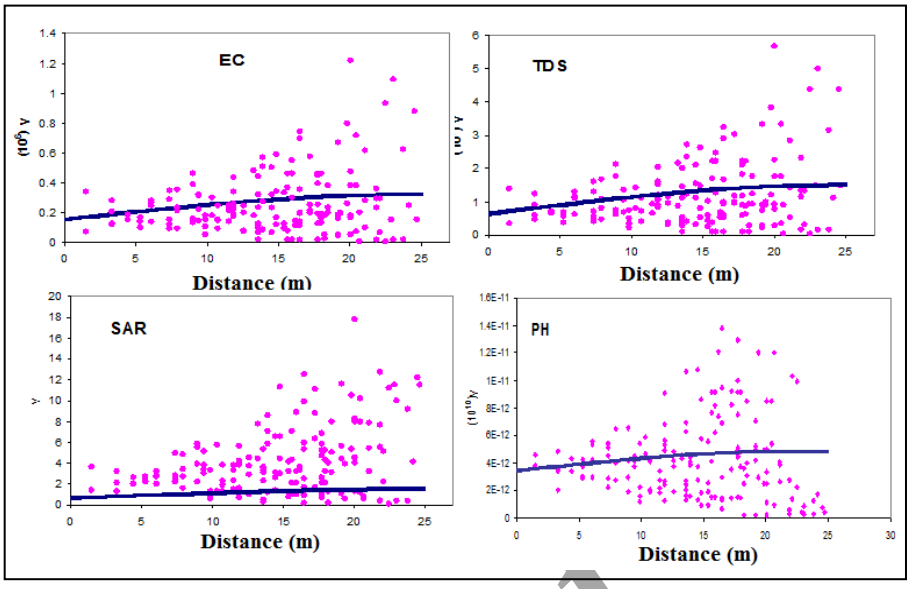

Fig. 2 The semi-variogram of each of the quality parameters

Accordingly, the zoning was done for the interpolation of aquifer quality parameters based on the information of plain aquifer. The map of zoning showed that trends of EC and TDS are similar. One of the main reasons of similarity changes is because of a linear relationship between these parameters. The results of zoning indicated EC, TDS and SAR values has increased form the South East along the North East. So that SAR from 1.9-28 to 1.2-0.8, EC from 2395.3-1266.4 to 823.5-483.3 µmoh/cm and TDS from 1591.3-826.3 to 526.2-295.7 mg/L decreased (Fig. 3). But change of pH was non-uniform than the other three parameters and its maximum was in the north-west plains (7.75-7.93). Also, The accuracy of geostatistical methods in the estimation of the area under study (non-peak) was higher. The reason is due to lack of measurement points in border studies, and regional climatic factors in causing maximum points, which is not in the geostatistical methods.

5. Conclusion

The results showed that kriging with spherical semi-variogram are useful for modeling qualitative factors. Also, the results show that the statistical accuracy is low in estimation of water quality parameters at maximum points. In general it can be stated, with water quality values at one point, can estimate amount to the same quantity at a point with known coordinates and high precision.

Key Words: Groundwater Quality, kriging, Semi-Variogram, Hamedan – Bahar plain.