

Evaluation of spatial and temporal variation of water quality parameters of Karkheh River and the suitability of its quality for irrigation purposes

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Abstract

The declining quality of surface water resources has become a major concern in recent years. Therefore, the need to evaluate the Spatio-temporal variations of river water quality and also to assess different parameters affecting their water quality and identify the most important variables and factors significantly affecting water quality has been created. In the present study, to monitor the surface water quality of Karkheh River, a data set of Karkheh River water quality containing 16 parameters recorded during 17 Years (2003-2020) from seven different monitoring sites was prepared from the Water and Power Organization of Khuzestan Province. Then, to study and interpret this complex and large data matrix consisting of a large number of physicochemical parameters from long-term monitoring programs, trend analysis, multivariate statistical techniques, and also the use of some indicators to evaluate the suitability of river water quality for irrigation purposes were used. The results of trend analysis showed that the pattern of parameter changes in the annual and seasonal scales was similar, and except for the pH parameter, other water quality parameters such as EC, TDS, SO_4^{2-} , Ca^{2+} , and calcium hardness were significantly increased. PCA analysis identified three PCs as responsible for the data structure explaining 65% of the total variance in water quality. According to the results of PCA, TDS, EC, HCO_3^- and pH were the most important parameters contributing to spatial variations of surface water quality of Karkheh River. Results of cluster analysis revealed three significant groups of similarity among the 7 monitoring sites. Investigation and analysis of linear regression of cations, anions and other parameters as a dependent variable against river discharge as an independent variable showed a negative correlation. In this study, River Water quality for irrigation purposes was assessed through different indices including EC, sodium percent (SP), sodium adsorption ratio (SAR), Magnesium Hazard (MH), permeability index (PI), and Kelly's ratio (KR). The interpreted results showed that the surface water quality in different stations based on the calculated indicators (except EC) in general is suitable for irrigation. The results of this study provide useful information in the interpretation of complex datasets, identification of pollution sources/factors, and understanding of temporal and spatial variations of water quality that can be used to manage projects for improving surface water quality at the study area.

Keywords: Water Quality, Multivariate Statistical Techniques, Trend Analysis, Irrigation Quality Indicators, Karkheh River.