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Research paper

Factor analysis and spatial distribution of water quality parameters of Aurangabad District, India.

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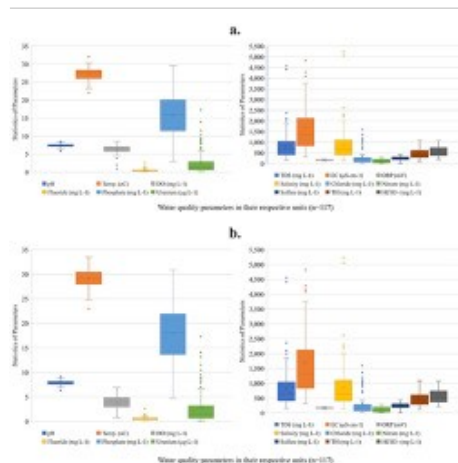
Highlights

- To analyze and extract number of sets of inter-corelated factors, principle component analysis is used for water quality parameters, out of which 6 factors were extracted in both seasons.
- Correlational study among the water quality parameters including uranium concentration were done.
- Spatial distribution map were prepared using ArcGIS 10.3 software."

Abstract:

In statistical analytical methods, the factor analysis is a key tool for extracting inter-relationship between water quality parameters and environmental system. For the study, 117 number of samples were collected within Aurangabad district for pre and post monsoon season. In-situ water quality parameters were analyzed on-site with the help of portable multi-parameter water analysis kit. Uranium concentration and rest of parameters were analyzed in the departmental laboratory. To analyze and extract number of sets of inter-corelated variables (i.e. factors), principle component analysis is used for 18 variables, out of which 6 factors were extracted in post and pre-monsoon. Extracted factor based on eigen value (>1) which contribute 72.87% and 72.46% variations in respective seasons. Out of which, the first factor is contribute 32.48% in post and 28.34% variance in pre-monsoon. The second factor was contributed 10.05% and 13.01% variance in post and pre-monsoon seasons respectively. The third, fourth, fifth and sixth factors are contributing 9.6%, 8.25%, 6.88% and 5.60% in post monsoon, where as 9.74%, 7.39%, 7.12% and 6.81% variance in pre-monsoon respectively. For spatial distribution of water quality parameters in study area, maps were created using the ArcGIS 10.3 software.

Graphical abstract



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Introduction

In study area, the main source for availability of water for regular activity and agricultural purpose is groundwater. Though 90% of groundwater is used for irrigation purpose, near about three quarters of total groundwater is consumed for agricultural purpose in the study area (Rashid et al., 2015). For understanding the factors and processes which control and affect the water quality, the hydrological study is the key concern (Arslan, 2009). The analysis and clarification of data sets, water quality assessment, source identification of pollution and understanding spatio-temporal

dissimilarities in water quality for effective water quality management, the multivariate statistical techniques is useful (Shrestha and Kazama, 2007). The hydro-chemical characteristics is useful for protection of aquifer, prediction of fluctuations, reducing the effects of salinization and pollution load in agricultural, hydro-chemical characteristics is operative (Hamzah et al., 2017). To evaluate hydro-chemistry and groundwater pollution, the multivariate statistical analysis method i.e. principal component analysis (PCA) is useful (Yang et al., 2015). The principal component analysis is useful tool which indicates that geogenic and anthropogenic sources are responsible for variation in physio-chemical parameters in the groundwater (Islam et al., 2017). In the earlier study, the processes that are observed which is responsible for this hydro-chemistry i.e. silicate minerals weathering, chloride salts dissolution, ion exchange between sodium, potassium and calcium, magnesium during the infiltration of reclaimed water, carbonate precipitation and anthropogenic activities (Nagaraju et al., 2016). Geographic Information System (GIS) is a key tool for management of groundwater resource with respect to prediction for spatial variation/distribution; groundwater quality and location of sources of pollution. Geographical Information System (GIS) is essential information tool for understand past, present and future impacts of environmental changes and management practices (Kura et al., 2014; Singh and Shashtri, 2011; Swarna Latha and Nageswara Rao, 2012). The outcome of GIS application is pictographic representation of groundwater quality for its suitability for various purposes (Anbazhagan and Nair, 2004; Huchhe and Bandela, 2016; Tikle et al., 2012).

Section snippets

Description of study area

Aurangabad is the regional capital of Marathwada, is situated central part of Maharashtra Fig. 1. The Aurangabad city was instituted by Malik Ambar in 1610, the city known as “Khidki” which is renamed as Fatehpur. In 1953, city again renamed as Aurangabad when Aurangzeb took over the Deccan kingdom and made it the capital to overpower the expanding his power against Maratha empire Chatrapati Shivaji Maharaj. It is bordered by the districts of Nashik to the west, Jalgaon to the north, Jalna to...

Water quality parameters

The complied data of water quality analysis were shown in table no1 for both seasons (n=117) along with univariate statistic results as box plot which is shown in Fig. 2a and b (post-monsoon and pre-monsoon) respectively....

Factor analysis

The data is obtained from the water quality analysis including the uranium concentration for both seasons is organized in a matrix with variables columns and for 117 samples in the form rows. The statistical software (SPSS version 23) was used for carrying out statistical...

Conclusion


The application of principal component analysis on chemical composition of groundwater reveals that major contaminants causes by anthropogenic activities for all parameters were done. The rotated component matrix shows that correlations between the observed variables and principal components. The first factor has shown positive correlation between salinity, chloride, hardness and bicarbonates which is showing that it may be happen due to increasing in the salt concentration, excess use of...

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References (23)

P. Bose *et al.*

[Role of iron in controlling speciation and mobilization of arsenic in subsurface environment](#)

Water Res. (2002)

P. Ndegwa *et al.*

[Potential strategies for process control and monitoring of stabilization of dairy wastewaters in batch aerobic treatment systems](#)

Process Biochem. (2007)

S. Shrestha *et al.*

Assessment of surface water quality using multivariate statistical techniques: a case study of the Fuji river basin, Japan

Environ. Model. Software (2007)

K. Aher *et al.*

Assessment of water quality of the Maniyad reservoir of Parala village, district Aurangabad: suitability for multipurpose usage

(2011)

S. Anbazhagan *et al.*

Geographic information System and groundwater quality mapping in Panvel basin, Maharashtra, India

Environ. Geol. (2004)

APHA

Standard Methods for the Examination of Water & Wastewater

(1998)

O. Arslan

A GIS-based spatial-multivariate statistical analysis of water quality data in the Porsuk river, Turkey

Water Qual. Res. J. Can. (2009)

K.B. Bjugstad *et al.*

Oxidation-Reduction Potential as a Biomarker for Severity and Acute Outcome in Traumatic Brain Injury

(2016)

Census of India

CGWB

(2013)



View more references

Cited by (28)

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Evaluation of groundwater suitability in the Cretaceous Abeokuta Formation, Nigeria: Implications for water supply and public health

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Citation Excerpt :

...The health risks index (which focuses on metals and carcinogens) has been used as a complement to extend the parameter coverage of WQI (physicochemical and nutrients) in establishing groundwater suitability in some studies (Das et al., 2020; Kadam et al., 2022; Zakir et al., 2020). In recent years, mapping of spatial distribution/variation of groundwater quality and suitability through spatial analysis have been explored by researchers (Ijumulana et al., 2021; Kale et al., 2020; Paramasivam and Venkatramanan, 2019; Sahoo et al., 2021; Shankar and Nafyad, 2019; Swain et al., 2022a; Wagh et al., 2018). Spatial analysis guides in locating areas with consequential groundwater quality and helps decision-makers implement policy (Quino Lima et al., 2020; Shankar and Nafyad, 2019)....

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Evaluation of uranium contamination of Raipur district of Chhattisgarh: GIS assisted hydrogeochemical study of underground water

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Citation Excerpt :

...Hence the water quality is not a cause of concern right now, however the occasional appearance of uranium in the water need to be monitored regularly to avoid the health complications. IDW (inverse distance weighted) method [40] has been used to interpolate the spatial distribution of uranium and water quality index in Arc GIS 10.3. Because of its accuracy for predicting unmeasured values for neighbouring geographic

points, the IDW method was chosen for interpolation....

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...Factor analysis is a form of statistical explanation, which has been applied to find out the hydrogeochemical processes that occur in analyzed groundwater data set [34 35]. Factor analysis is used to find out the contamination in groundwater [36 37]. From Table 6. there are mainly two factors are occurring in the study area....

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