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Spatial mapping of groundwater quality using GIS for Jakham River basin of Southern Rajasthan

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ABSTRACT

The physico-chemical analysis of groundwater quality plays a significant role to manage the water resources for drinking as well as irrigation in the sub-humid and semi-arid agro-climatic areas. In this study, the hydrogeochemical analyses and spatial mapping of groundwater quality in the Jakham River Basin located in the southern part of Rajasthan were investigated.The groundwater quality samples were collected from 76 wells marked on the grid map of 5×5 km^2 area.A spatial distribution in sampling location in the basin was prepared using GIS (Geographical information system) tool based on 6 physico-chemical parameters i.e., pH, EC, TDS, Cl, $NO_3$and F.The groundwater quality data from the pre and post-monsoon seasons of 2019-20 were used to carry out a detailed analysis of water quality parameters.The water quality maps for the entire basin have been generated using anIDW interpolation technique for these parameters as per the identified location.The higher value of TDS and EC were found in the south-eastern part and along the roadside of study area, which were dominated by agriculture activities and industrial influence. The concentration was observed higher in the post-monsoon period. For EC and TDS, major part of the (>50%) of the study area comes under the safe limit of potable water. Major part of the basin witnessed fluoride concentration (0.40-80 mg/l) for both the season, which is lower than the permissible limit. Higher NO_3 concentration was observed after the rainy season. The influence of geogenic activities could be clearly seen in the groundwater quality of the basin. Theresultant map shows that the entire basin has optimally goodgroundwater quality for human consumption. Hence, this study provides suggestion to prepare strategies for the proper management and augmentation of the groundwater condition in the Jakham River Basin.

Introduction

Groundwater is a very important component of the human life support system and it is required for drinking, household, industrial and agricultural uses (Bhutiani *et al.,* 2021a; Bhutiani *et al.,* 2021b; Ruhela *et al.,* 2021).The groundwater quality is serious matter in arid and semi-arid areas, which is dominated by irrigation practices. Quality of ground water is adversely affected by the diffuse contamination devising from intensive agricultural practices (Bhutiani *et al.,* 2019; Ruhela *et al.,* 2022; Saidi *et al.,* 2009).Groundwater has been a major and consistent source of drinking and irrigation for a wide range of users (Afzali *et al.,* 2014). There is a need to develop models for efficient prediction of

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pollutants in these soils and water (Sener and Devraz, 2013).The groundwater quality can be analysed by physicochemical parameters compared to permissible limits pre-scribed at Indian water quality standards (BIS) and WHO.Groundwater quality depletion caused by various geogenic and human activities is a serious problem for human being (Buchanan and Triantafilis 2009; CGWB 2010). The demographic changes, also a concerning factor for groundwater quality deterioration. Furthermore, many studies have found untreated sewage to be the most critical issue with respect to water contamination, because 40% of the global population do not have adequate sanitary facilities, changes to land use, land cover or river basins in watershed areas (Shi et. al, 2010; Liyanage *et al.,* 2017), such as high scale agricultural activities, unplanned infrastructure developments, and sand mining, change the water quality and water balance due to human activities (Groppo *et al.,* 2008; Qin *et al.,* 2014). This may be caused by improperly planned urbanization or uncontrolled development (Liu and Chen, 2006). The groundwater quality is generally influenced by the parameters *viz.*, pH, electrical conductivity (EC), total dissolved solids (TDS), Ca, Mg, and NO_3(Gong *et al.,* 2014; Khadri *et al.,* 2013).The physico-chemical analysis is necessary to examine the groundwater quality in the location, where groundwater is used for both agriculture and drinking (Srinivas et al. 2013). The Geographical Information System (GIS) was observed as useful tool for mapping, monitoring and detecting the environmental variations. As such, the purpose of this research is to investigate the hydro-geochemistry of groundwater in various locations in the basaltic hard rock region (El-Hames *et al.,* 2011; Chen and Feng, 2013). Hence, the spatial mapping for selected water quality parameters were used to analyse the groundwater quality in the Jakham River Basin for drinkingpurpose.The different water quality maps were developed using IDW interpolation techniques by identifying the suitable wells based on groundwater quality standards as suggested by the BIS. Dahiphale *et al.* (2019) evaluated the ground water (GW) quality in Jaisamand Lake catchment area for checking its suitability for irrigation and drinking purpose. The spatio-temporal variations of WQ parameters were analysed for 109 wells of study area, by using GIS technique. As clearly explained in the introduction, the objective of this study is (1) To have an overview of status of groundwater quality (2) To explore the hydro-geochemistry of the groundwater in different well locations/villages in the basaltic hard rock areas. (3) To generate spatial distribution of drinking groundwater quality parameters i.e. pH, EC, TDS, Cl, SO_4, F and NO_3 concentrations in the Jakham basin area by using geospatial techniques. Also this study is intended to evaluate and spatially analyze the water quality parameters and accordingly assist to take fruitful decisions to make safeguard quality of the open well waters in Jakham River Basin.

Material and Methods

Study area

The River Jakham originates in the hills south-west of Chotti Sadari of Pratapgarh District, Rajasthan. The basin area lies between the latitudes of 24° 27' 19.81" and 23° 58' 57.81"N, and the longitudes of 74° 30'22.63" and 74° 48' 24.12". The Jakham river basin has a catchment area of 953 km^2 (Figure1).The study area has high geographical and physical diversity varies from mostly dense forest to hilly terrain. The geological set-up of the basin is characterized by different igneous and meta-sedimentary rocks (Gautam *et al*., 2022). The Pratapgarh districtis located on meta-sedimentary rocks of ‘Aravalli’ ‘Bhilwara’and‘Vindhayan’ Supergroup. Aravalli and Bhilwara super group represented by phyllite, greywacke, quartzite, dolomite and Shale, Slates, Phyllites, Meta-grey wackes, Limestone, Dolomitic marble respectively. Vindhayan super group divided in Khorip, Lasrawan, Sand and Satola Groups with Shale, Conglomerate, Limestone formations. This Super Group is exposed mainly in northern part of the district and some exposure in southeastern parts in Chhotisadri block and also partly in Dhariawad, Pratapgarh and Arnod blocks.Southern part of study area has majority of basalt rock formations. Basalts as aquifer occur in southern part of the district. However, these type of rock formations are not considered as a good aquifer. Moderate groundwater potentiality occurs within contact zone of basalt and other lithological units. Exploratory drilling in the district reveals that basalt, granite/gneiss, phyllite etc. form the hard rock

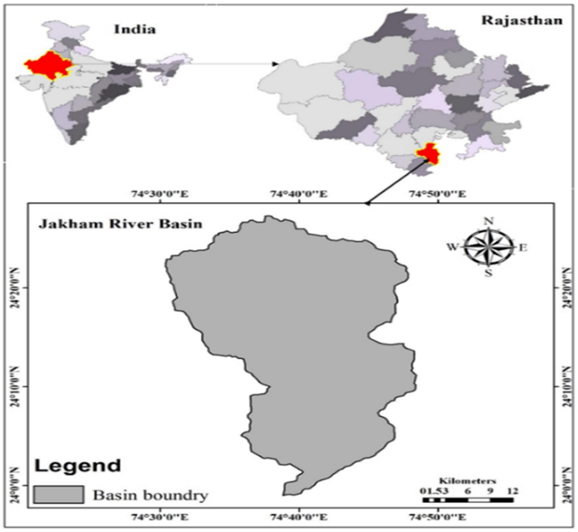


Figure1: Location map of study area

aquifer (CGWB, 2013). The groundwater is very dynamic in nature; owing to recharge by rains and in some areas the flow of Jakham River water has its influence (Gautam *et al.,* 2021). There was fluctuation observed in the depth of water in the open wells due to these factors. Therefore, this study area was selected to provide an overview of groundwater quality condition of the Jakham River Basin. Hence, spatial distribution maps for some selected water quality parameters were generated to detect the quality of ground water in the Jakham River Basin for potable and industry utilization purposes. The maps were digitized using toposheet for identifying the well in the study area. The primary tool used to generate the maps that facilitated analysis was spatial analyst tools in the ArcGIS software. It was observed in the area that, open wells and water bodies influencing the for groundwater quality via recharge in the basaltic hard rock region in lower part of the basin (Gautam *et al*., 2022).

Analysis of groundwater quality

Total seventy six (76) groundwater samples were collected in sterilized plastic bottles from 39 square grids to analyse the physico-chemical properties of the groundwater samples for pre and post-monsoon season,2019-20.The collected groundwater samples were put in an ice box at 4^{o}C from until they arrived at the laboratory.The physico-chemical analysis ofthe collected samples were done for the parameters *viz*. pH, total dissolved solids (TDS), Electrical conductivity (EC), nitrate (NO_3), chloride (Cl) and fluoride (F). Water quality parameters were analysed in the laboratory as per the Standard methods suggested by the BIS (2000& 2012) (Manjeet *et al.,* 2021).The drinking water quality norms suggested by the Indian agencies are listed in the Table 1.

Table 1: Drinking and Irrigation Water Quality (BIS) Standards.

SN	Water Quality Parameter	Prescribed limit	
		Desirable	Permissible
1	pH	6.5	8.5
2	EC	<1500 – Sensitive	
3	TDS	500	2000
4	Cl	250	1000
5	Fluoride	1	1.50
6	Nitrate	45	No relaxation

Spatial mapping of groundwater quality parameters

The inverse distance weighted (IDW) interpolation method of ARC GIS 10.1 software was used to generate spatial distribution maps of groundwater quality parameters i.e. pH, EC, TDS, SO_4, F, and Cl.The inverse distance technique is a spatial interpolation algorithm that estimates values between observations.The IDW estimates the weighted mean values of adjacent sampling locations. The weights are determined by taking the inverse of the distance between an observations and estimated value. The interpolation approachprovides the accurate results, when the samplinglocations are close enough to detect the spatial variation. Selvam *et al.* 2014 found that, if the sampling locations are unequally distributed in the area, the estimates may not accurately depict the anticipated changes. The Figure 2 represents the sampling location of the well in the study area.

Results and Discussion

Physico-chemical parameters of groundwater

The spatial distribution maps of groundwater quality parameters i.e. pH, EC, TDS, NO_3, F and Cl were generated using IDW technique using ArcGIS 10.4 software. These GW quality maps have been shown in the Figure 3-8, highlighting which wells are good for use as drinking purpose in the hard rock region. These spatial maps may help to identify the current status of water quality for drinking as well as irrigation purpose.

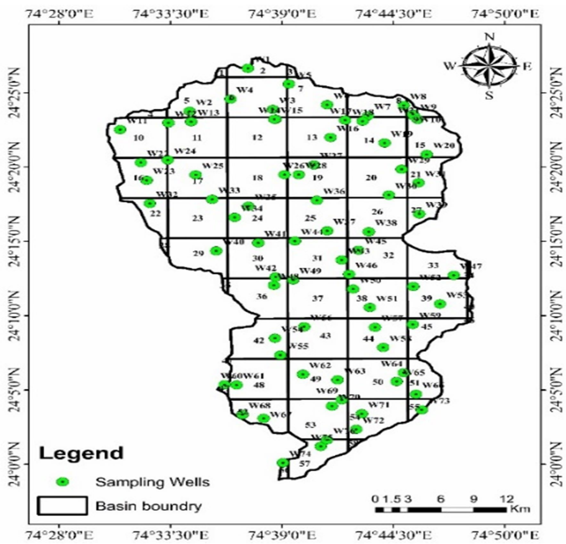


Figure 2: Grid map of groundwater sampling wells

The groundwater quality monitoring for drinking purpose (pre and post monsoon season) was analyzed in terms of physico-chemical parameters based on Bureau of Indian Standards (BIS, 2000, 2012) (Table 2).

pH

pH measures the hydrogen concentration in water, which decides the alkalinity and acidic nature of water sample. The pH ranges from 7.00 to 8.90 in the study area during pre- monsoon, which shows the slightly alkalinity of groundwater. Major part of the study area has pH ranges from 7.80 to 8.20. The highest pH value (8.20- 8.90) was observed in lower-middle part of the basin. The Spatial map of pH value is presented in the Figure 3.

In post-monsoon, pH value ranges from 6.50 to 8.00, which is under safe limit. Most of the samples was found alkaline in nature, in post monsoon. The low value (6.5-7.00) of pH indicates the influence ammonium sulphate and phosphate fertilizer in agriculture (Appelo and Postma, 2005). The highest pH value (7.50-8.00) was observed in middle part of the basin.

Electrical Conductivity (EC)

The EC value varies from < 650 to >1550 µS/cm in the study area, in pre- monsoon. Major parts of the basin has lower EC value (<650), which is suitable for drinking. Spatial distribution map of EC value is presented in the Figure 4. The higher value (950-1550 µS/cm) of EC was found in Top and bottom of the study area. Increase in the EC value decides the groundwater flow path, due to topographic circumstances and ion exchange capacity (Prashanth *et al.,* 2012).Higher value of EC was observed in the location, which is situated along the roadside. During post-monsoon, EC ranges from <650 to >1550 µS/cm. Major parts of the basin has EC value (650-950 µS/cm).Generally, variation in EC was observed due geochemical process in the study area.

Total Dissolved Solids (TDS)

TDS indicates the availability of different minerals (CO_3, SO_4, Si, Ca and Mg) dissolved in the groundwater. The TDS ranges from <300 to >1200 mg/l during pre and post monsoon in the study area. This range comes under highly desirable category (BIS, 2012). The concentration of TDS depends on the characteristics and types of ion. It is also affected by the landfills and animal wastage (Kumar *et al.,* 2018). The variation of TDS during pre and post-monsoon seasons are presented in the Figure 5. Major part of the (>50%) of the area comes under the safe limit of drinking water.

Chloride (Cl)

The concentration of Chloride (Cl) in water samples varies from 0.60 to 9.20 meq/l for pre-monsoon and 2.40 to 12.20 meq/l for post-monsoon season. The higher concentration of Chloride (Cl) seems like to be anthropogenic local contamination associated with sulphate and nitrate concentration. Sedimentary rock leaching, weathering and excess fertilizer application in paddy cultivation also influences the chloride concentration in the groundwater. The utmost area indicates the Cl concentration less than the permissible limit in pre monsoon, 0.60-3.20 meq/l and 3.20-6.20 meq/l in post-monsoon. About 2.50 % of area was observed, higher than the desirable limit for pre-monsoon and 13.74 % for post-monsoon season. Spatial distribution maps of chloride (Cl) concentration for pre and post monsoon seasons are presented in the Figure 6.

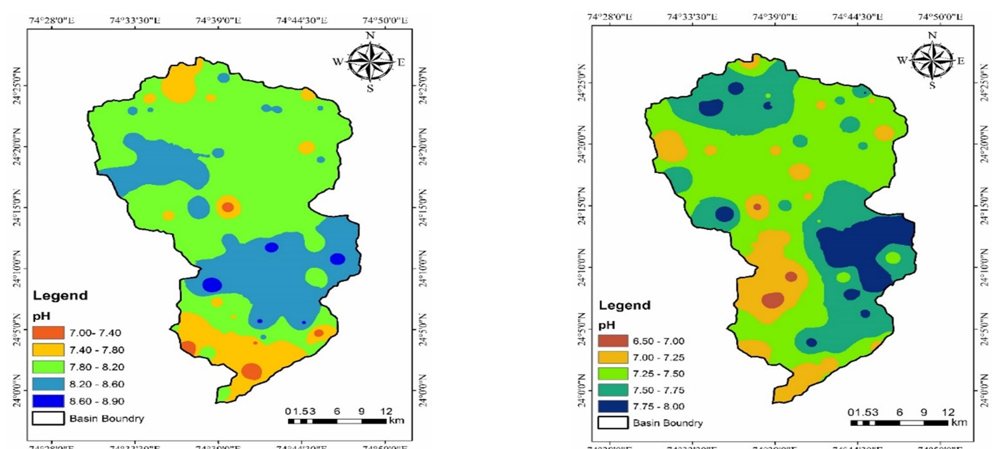
Nitrate (NO_3)

The concentration of Nitrates ranges from 0.05 to 1.90 meq/l in pre-monsoon while, 0.20 to 3.00 meq/l in post-monsoon season. The nitrates in groundwater was probably derived by application of nitrogen fertilizer in the agriculture practices. The Nitrate (NO_3) shows comparatively high concentration, during post-monsoon season.

Table 2: Physico-chemical parameters data of pre and post-monsoon

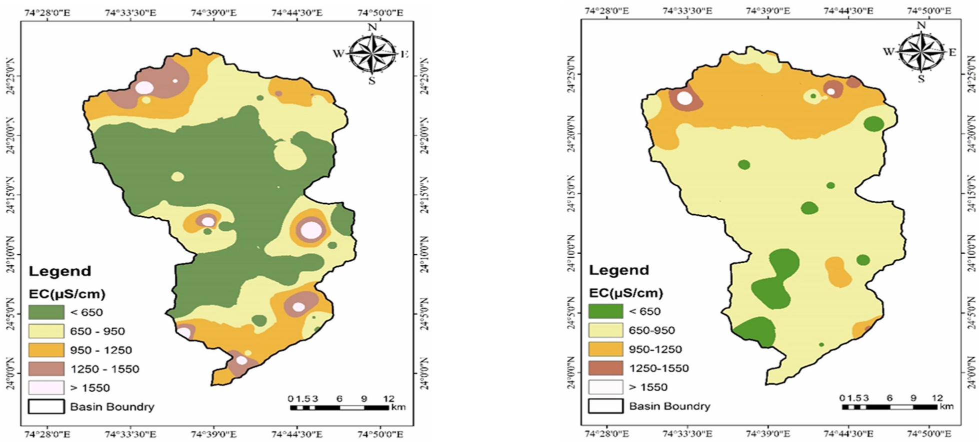
Well No.	Pre monsoon						Post monsoon					
	pH	EC	TDS	Cl	NO_3	F	pH	EC	TDS	Cl	NO_3	F
W1	8.06	835.00	529.17	5.84	0.75	0.52	7.08	755.00	440.00	5.60	0.19	0.39
W2	8.02	1420.00	843.50	9.33	1.74	0.41	7.66	1008.50	575.00	7.36	0.57	0.55
W3	8.05	672.50	384.54	3.24	0.53	0.45	7.46	1115.00	720.00	4.00	0.62	0.57
W4	7.93	1128.00	676.07	2.00	0.73	0.45	7.81	1120.00	737.50	3.70	0.66	0.43
W5	8.42	610.00	361.13	3.02	0.39	0.31	7.62	825.00	530.00	4.60	1.87	0.91
W6	8.15	530.00	326.78	4.96	0.44	0.25	7.39	1215.00	895.00	6.10	1.89	0.61
W7	8.30	960.00	499.71	2.13	0.04	0.39	7.57	1795.00	1167.50	5.60	1.83	0.69
W8	7.98	697.50	404.37	3.67	0.69	0.39	7.77	1355.00	905.00	7.80	1.87	0.61
W9	8.35	970.00	567.88	8.83	0.56	0.40	7.19	970.00	585.00	11.00	1.90	0.82
W10	8.03	727.50	394.97	4.08	0.40	0.24	7.22	1095.00	720.00	4.40	1.69	0.23
W11	8.23	860.00	525.17	4.50	1.64	0.38	7.39	730.00	425.00	7.10	1.70	0.22
W12	8.40	1052.50	627.05	9.26	1.26	0.40	7.65	1825.00	1280.00	7.15	1.60	1.18
W13	8.40	545.00	328.25	2.61	0.12	0.24	8.01	1207.50	890.00	7.50	1.43	0.62
W14	8.35	530.00	302.90	6.91	0.04	0.27	7.66	840.00	505.00	6.05	1.26	0.64
W15	8.19	682.50	413.00	5.66	1.23	0.34	7.92	1320.00	917.50	4.15	2.14	0.52
W16	8.25	495.00	290.99	2.52	0.44	0.70	7.41	1140.00	725.00	5.30	2.49	0.51
W17	8.40	507.50	306.41	1.56	0.27	0.44	7.14	522.50	322.50	5.60	1.77	0.44
W18	8.42	562.50	346.42	2.34	0.68	0.38	7.41	815.00	490.00	3.00	0.94	0.60
W19	8.22	553.00	329.63	3.50	0.81	0.63	7.62	1140.00	730.00	4.10	1.21	0.45
W20	8.23	637.50	367.50	2.62	0.73	0.38	7.11	675.00	415.00	6.70	0.89	0.48
W21	8.45	515.00	296.12	1.92	0.20	0.29	7.39	909.50	520.00	3.60	1.19	0.52
W22	8.37	461.00	276.97	1.92	0.85	0.63	7.06	910.00	550.00	4.30	0.83	0.54
W23	8.30	500.00	282.61	1.10	0.44	1.10	7.07	940.00	550.00	3.60	0.65	0.72
W24	8.40	431.00	275.61	2.18	0.70	0.81	7.29	875.00	515.00	5.10	0.60	0.69
W25	8.39	392.50	236.28	1.47	0.46	0.54	7.21	795.00	465.00	6.85	1.05	0.60
W26	8.40	440.00	255.62	1.60	0.49	0.46	7.19	905.00	540.00	5.40	1.18	0.79
W27	8.18	470.00	328.81	2.71	0.54	0.33	7.59	985.00	567.50	6.10	1.83	0.53
W28	8.33	460.00	278.71	1.40	0.56	0.29	7.32	802.50	487.50	7.40	1.75	0.53
W29	8.00	490.00	265.42	2.01	1.10	0.20	7.53	705.00	425.00	8.00	1.76	0.48
W30	8.25	635.00	350.15	1.68	0.12	0.21	7.42	900.00	550.00	6.10	1.65	0.71
W31	8.40	445.00	283.79	2.22	0.83	0.44	7.38	875.00	500.00	5.60	2.03	0.57
W32	8.44	340.00	206.00	1.32	0.42	0.42	7.74	780.00	470.00	4.70	1.78	0.51
W33	8.43	415.00	254.72	1.33	0.60	0.42	7.50	680.00	395.00	6.00	1.93	0.74
W34	8.30	565.00	344.91	1.37	0.78	0.29	7.26	760.00	455.00	8.10	2.28	0.88
W35	8.50	395.00	298.02	2.28	1.06	0.53	7.50	550.00	315.00	3.90	1.47	0.36
W36	8.33	485.00	291.28	1.25	0.40	0.49	7.14	785.00	465.00	5.50	1.93	0.35
W37	8.35	390.00	206.52	2.30	0.53	0.27	7.21	810.00	515.00	2.40	1.30	0.41
W38	8.30	530.00	323.55	1.89	0.77	0.58	7.75	585.00	335.00	3.30	1.18	0.60
W39	8.20	440.00	271.11	3.01	0.55	0.34	7.43	690.00	415.00	3.10	0.64	0.39
W40	8.08	530.00	311.72	2.00	0.95	0.28	7.93	605.00	355.00	4.60	1.12	0.42
W41	8.58	320.00	178.41	1.16	0.17	0.30	6.95	750.00	460.00	3.70	1.86	0.47
W42	8.15	1610.00	1658.26	6.05	0.12	1.23	7.24	890.00	567.50	3.20	1.82	0.39
W43	8.20	350.00	206.78	1.14	0.50	0.23	7.49	450.00	285.00	8.20	0.65	0.56
W44	7.73	390.00	223.48	1.50	0.88	0.84	7.58	655.00	395.00	8.70	0.59	0.38
W45	8.13	370.00	217.53	1.04	0.48	0.27	7.68	785.00	485.00	4.20	1.24	0.41

W46	8.33	360.00	211.89	1.84	0.19	1.22	7.92	740.00	435.00	4.75	0.95	0.73
W47	8.50	295.00	170.17	1.87	0.44	0.30	7.88	655.00	400.00	7.05	0.65	0.62
W48	8.35	370.00	216.13	1.95	0.48	0.31	7.21	685.00	420.00	4.00	0.67	0.45
W49	8.45	410.00	239.21	1.18	0.56	0.51	7.17	825.00	485.00	4.80	0.20	0.35
W50	8.75	425.00	259.18	2.52	0.45	0.69	7.79	740.00	415.00	4.10	0.69	0.37
W51	8.48	657.50	388.09	1.17	0.67	0.32	7.97	675.00	435.00	3.45	0.82	0.48
W52	8.30	1620.00	646.11	8.62	1.20	0.16	8.00	820.00	557.50	4.70	0.92	0.42
W53	8.70	505.00	349.51	0.86	0.43	0.37	7.38	735.00	485.00	6.10	1.27	0.35
W54	8.88	370.00	218.27	1.11	0.30	0.66	7.16	760.00	465.00	5.45	1.90	0.52
W55	8.03	395.00	234.16	0.60	0.58	0.38	6.76	490.00	290.00	6.45	0.70	0.51
W56	8.45	470.00	263.26	1.60	0.53	0.51	6.94	370.00	215.00	12.20	0.73	0.36
W57	8.40	360.00	235.10	0.80	1.05	0.34	7.37	1045.00	635.00	12.00	0.63	0.48
W58	8.43	435.00	261.74	1.20	0.64	0.33	7.80	1020.00	645.00	10.38	0.82	0.44
W59	8.28	400.00	240.10	1.40	0.70	0.43	8.00	527.50	292.50	7.50	0.61	0.48
W60	8.25	355.00	213.28	1.65	0.66	0.46	7.27	790.00	465.00	6.50	0.48	0.52
W61	7.91	430.00	266.30	2.16	0.57	0.32	7.37	715.00	420.00	7.20	0.77	0.56
W62	8.11	510.00	293.74	3.46	0.72	0.42	7.31	540.00	325.00	4.05	0.95	0.40
W63	8.65	655.00	400.76	2.60	1.04	0.37	7.37	900.00	632.50	4.75	0.96	0.50
W64	8.40	1050.00	565.22	2.40	0.68	0.46	7.78	790.00	480.00	3.70	1.23	0.55
W65	8.65	1290.00	762.25	5.91	0.49	0.96	7.72	735.00	435.00	3.90	1.29	0.47
W66	7.75	519.00	1257.53	4.14	0.56	0.42	7.58	815.00	495.00	6.50	1.39	0.49
W67	8.23	680.00	391.48	2.17	0.27	0.58	7.21	300.00	165.00	8.40	1.27	0.26
W68	7.61	1370.00	776.03	7.86	0.77	0.26	7.21	602.50	310.00	8.60	1.16	0.30
W69	8.43	310.00	840.69	1.87	0.73	0.32	7.69	825.00	505.00	7.10	1.25	0.56
W70	7.83	730.00	432.34	3.12	1.89	0.31	7.86	675.00	390.00	4.80	0.99	1.06
W71	7.98	740.00	435.09	6.57	0.89	0.35	7.59	695.00	395.00	4.20	1.29	1.00
W72	7.87	825.00	488.92	1.40	0.90	0.29	7.10	595.00	335.00	6.30	1.63	0.69
W73	8.20	510.00	301.25	1.42	1.04	0.27	7.08	1270.00	790.00	4.10	2.17	1.03
W74	8.18	715.00	432.43	4.72	0.55	0.36	7.06	745.00	435.00	2.70	2.34	0.57
W75	7.75	1325.00	540.72	6.15	0.82	0.33	7.13	830.00	490.00	4.40	2.95	1.04
W76	8.10	575.00	344.07	2.11	0.95	0.40	7.23	927.00	514.00	4.50	2.20	0.83



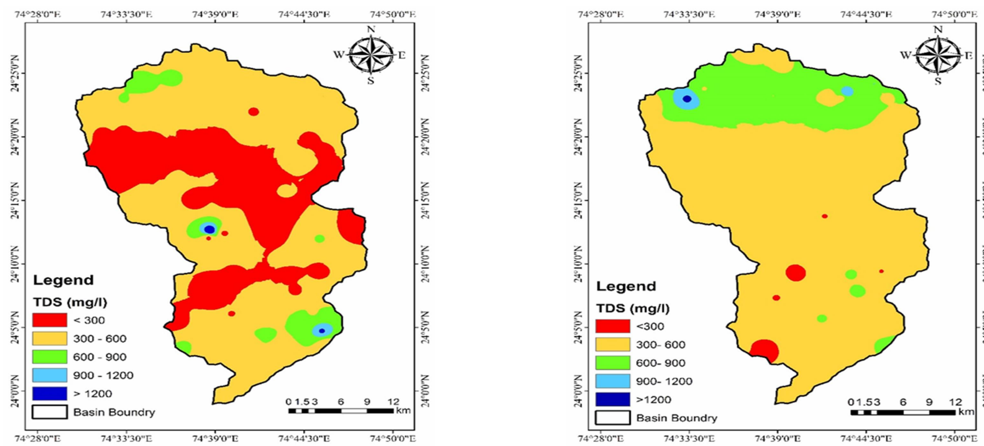
(a) (b)

Figure 3: Spatial Distribution Map pH for (a) Pre-monsoon (b) Post-monsoon



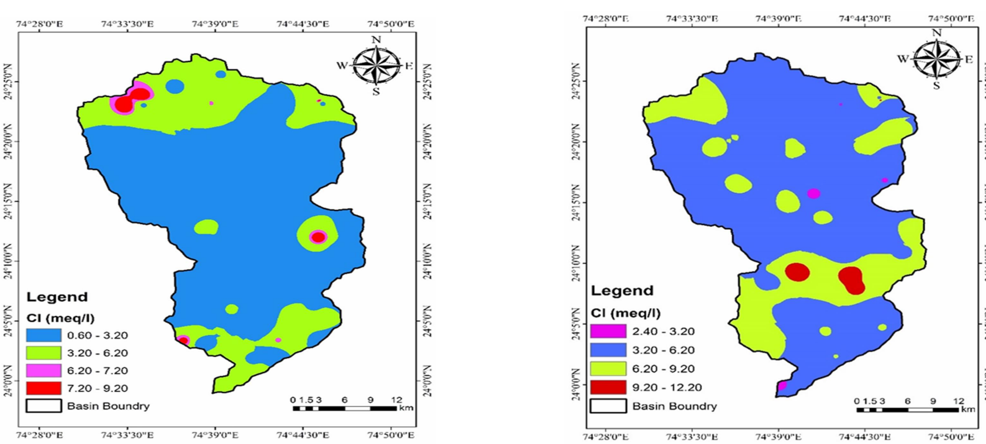
(a) (b)

Figure 4: Spatial Distribution Map EC for (a) Pre-monsoon (b) Post-monsoon



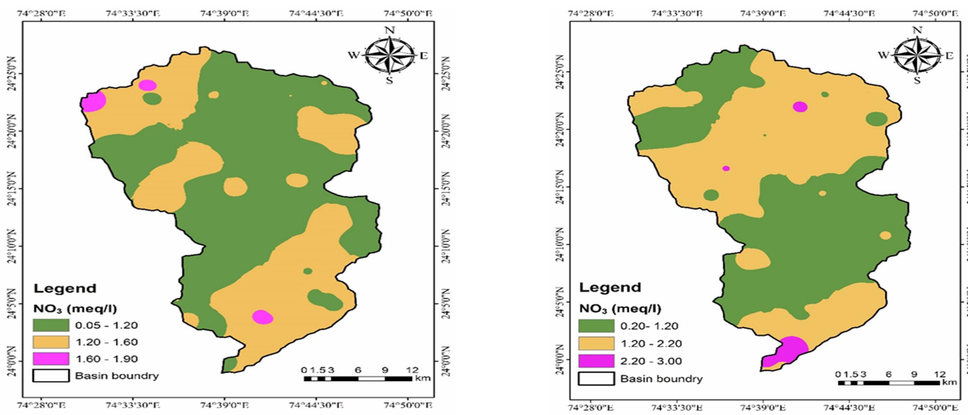
(a) (b)

Figure 5: Spatial Distribution Map TDS for (a) Pre-monsoon (b) Post-monsoon



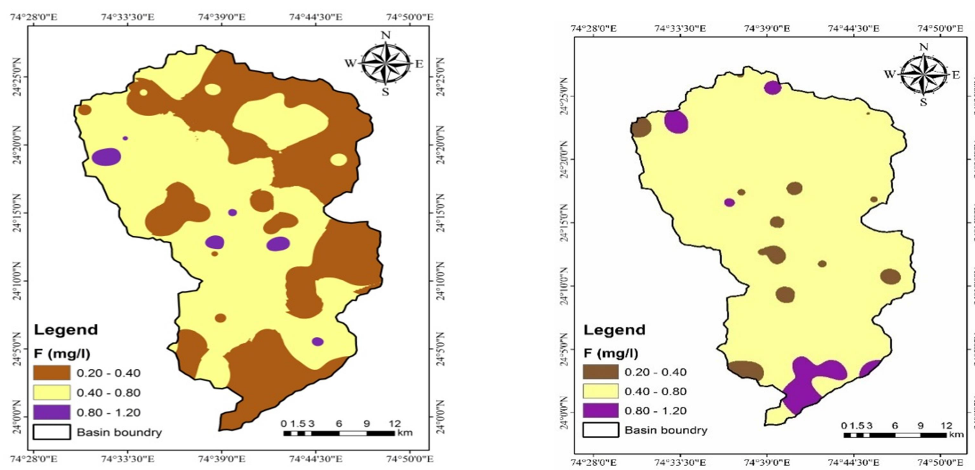
(a) (b)

Figure 6: Spatial Distribution Map Cl for (a) Pre-monsoon (b) Post-monsoon



(a) (b)

Figure 7: Spatial Distribution Map NO_3 for (a) Pre-monsoon (b) Post-monsoon



(a) (b)

Figure 8: Spatial Distribution Map F for (a) Pre-monsoon (b) Post-monsoon

The high concentrations were observed during pre and post-monsoon were 1.90 meq/l and 3.00 meq/l, respectively.Major part of the basin witnessed nitrate concentration (0.05-1.60 meq/l) in pre monsoon and (0.20-2.20 meq/l) in post monsoon, which is slightly higher than the standards suggested by BIS (2012). More NO_3 concentration was observed after the rainy season, due to its loose bounding characteristics to the soil.Spatial distribution maps of Nitrate (NO_3) concentration for pre and post monsoon seasons are presented in the Figure 7.

Fluoride (F)

The concentration of fluoride (F) ranges from 0.20 to 1.20 mg/l for both the seasons. Utmost area was observed with fairly good and safe for the drinking purpose (up to 1 mg/l). Higher value of F content attributed in the study area, due to presence of flour apatite and leaching of phosphate fertilizers in the saturated zone, after irrigation (Handa, 1975). In the upper region, low level of fluoride content indicates, the absence of fluoride bearing minerals in the rock strata, by which groundwater is flowing. Major part of the basin witnessed fluoride concentration (0.40-80 mg/l) for both the season, which is lower than the permissible limit suggested by BIS (2012). Spatial distribution maps of F concentration are presented in the Figure 8.

Conclusion

This study demonstrates the analysis and mapping of the water quality of collected groundwater samples for the Jakham River Basin of southern Rajasthan. The groundwater samples were collected from the different locations i.e. basaltic hard rock region were chemically analysed and database were prepared for detecting the spatial changes within the study area. At different locations, samples were observed fulfilling the standards for drinking purpose, but some were found not good for consumption. The higher value of TDS and EC were found in the south-eastern part and along the roadside of study area, which were dominated by agriculture activities and industrial influence. The concentration was observed higher in the post-monsoon period. For EC and TDS, major part of the (>50%) of the study area comes under the safe limit of potable water. Major part of the basin witnessed fluoride concentration (0.40-80 mg/l) for both the season, which is lower than the permissible limit. Higher NO_3 concentration was observed after the rainy season, due to its loose bounding characteristics to the soil. In the study area, groundwater quality is mainly influenced by the underground rock weathering, geogenic activities and evaporation, which affects the concentration of different parameters i.e. EC, TDS, Ca, Mg, Na, and Cl etc. Therefore, the results quietly indicate the moderate to good potable water quality for Jakham River Basin. This study highlights the significance of GIS (spatial interpolation) application with the integration of physico-chemical analysis of groundwater quality. In this basin, basaltic rock and geochemical weathering process plays key role in hydro-geochemical analysis, which impact the concentration of main ions in groundwater quality. Definitely, this study benefits us to understand the quality of the groundwater resources to improve proper management in the basin.

Conflict of interest

The authors declare that they have no conflict of interest.

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