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Data Article

Data on appraisal of groundwater quality in north-eastern Haryana

Sandeep Ravish [1,*], Baldev Setia, Surinder Deswal

Department of Civil Engineering, National Institute of Technology, Kurukshetra, India

A R T I C L E I N F O

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A B S T R A C T

This dataset paper aimed to analyse the quality of groundwater of Yamunanagar and Ambala districts in North-Eastern Haryana, India rooted on the various analytical elements and hydro-chemical parameters. Also, Piper and Gibbs diagram were applied to observe hydro-chemical characteristics and controlling constituents of the underground aqua region. The impendence of anions was noted to be tolerable in 93.33% of the spots while 86.67% groundwater samples were observed to be in the desirable limit for cations. The analytical constituents of TH, TA, TDS, and pH were reported to be tolerable in 76.66%, 80%, 60%, and 100% of the water-samples, respectively. Eight water-sampling spots manifested unacceptable ranges of one or more of the physico-chemical constituents. Seven spots were observed to be suffering from one constituent and therefore were classified to be falling in the 'Grey-Zone'. One location (i.e. 23) has been found to be severely influenced by excess of TH, TA, TDS, SO_4^{2-}, and Ca^{2+} and is reported to be falling in the 'Red-Zone'. The classification of groundwater based on Piper diagram depicted that pre-dominant type of sub-surface water hydro-chemical facies of area was 'Ca–Mg– HCO_3–Cl'. Gibb's figure revealed that underground water pre-eminence distribution is probably resulted by water-rock dominance in sub-surface water.

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* Corresponding author.
E-mail addresses: mmec11081224@gmail.com (S. Ravish), setia@nitkkr.ac.in (B. Setia), deswal.leo@gmail.com (S. Deswal).
[1] sandeepravish_6150036@nitkkr.ac.in

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Table of specifications

Subject field	Hydro-environment
More specific subject field	Groundwater quality
Type of dataset	Figures, Tables
How dataset was acquired	All groundwater samples were appraised pursuance to the APHA, AWWA and WPCF [1].
Dataset format	Raw data, Appraised
Experimental elements	All groundwater samples in poly-ethylene bottles were kept in a dark-place at room temperature until the metals were appraised.
Experimental characteristics	The elements as given in the abstract section, were appraised pursuance to the guidelines for quality of sub-surface water.
Dataset source position	Yamunanagar and Ambala districts in north-eastern Haryana, India.
Dataset accessibility	Dataset are included in this paper.
Related research article	Ravish et al. [8]. Hydro-chemical analysis of pre-monsoon groundwater of north-eastern Haryana. *Groundwater for Sustainable Development*. 2019, 8 (2019): 630–643.

Value of the data

- Rooted on confined surveys in north-eastern Haryana, India, the dataset can contribute to an understanding of the pre-eminence of sub-surface aqua in the area and can provide assistance in analysis on the pre-eminence of drinking aqua, agriculture and industrial purposes.
- The groundwater pre-eminence elements represent fruitful information on the drinking aqua quality. Hence, these dataset could be fruitful for cities or communities that have identical quality of drinking aqua.
- The dataset of the computed groundwater pre-eminence elements can be useful for irrigation purposes. Gibbs and Piper plot can be applied to evaluate physico-chemical characteristics and other controlling factor of the sub-surface aqua.

1. Data

The observations consist of information and characteristics of the groundwater of Yamunanagar and Ambala (between longitudes 76° 30′ to 77° 28′°E and latitudes 30°06′ to 31°35′°N) districts of north-eastern Haryana. The data has been obtained through a field-cum-laboratory investigation and has been classified according to the Bureau of Indian Standards (BIS) and World Health Organization (WHO) [3,10]. Level of investigated physico-chemical elements in the underground aqua of India, North-Eastern Haryana, and groundwater sampling details are summarized in Fig. 1 and Table 1. Based on the observations groundwater quality has been categorized into two classes as ‘Red-Zone’ and ‘Grey-Zone’ and is presented in Table 2. Recourse has been made to Piper plot and Gibb's diagram to visually manifest the quality and controlling factor of groundwater quality of the region (Figs. 2 and 3).

2. Experimental design, materials and methods

2.1. Investigation area

The area of investigation comprises two districts in the state of Haryana, India, namely Yamunanagar and Ambala. The area is extended between the longitudes 76° 30′ to 77° 28′°E and latitudes 30°06′ to 31°35′°N, encompassing an region of about 3,330 sq.km and the average elevation of the Yamunanagar and Ambala districts is 263 m and 255 m above sea level, respectively.

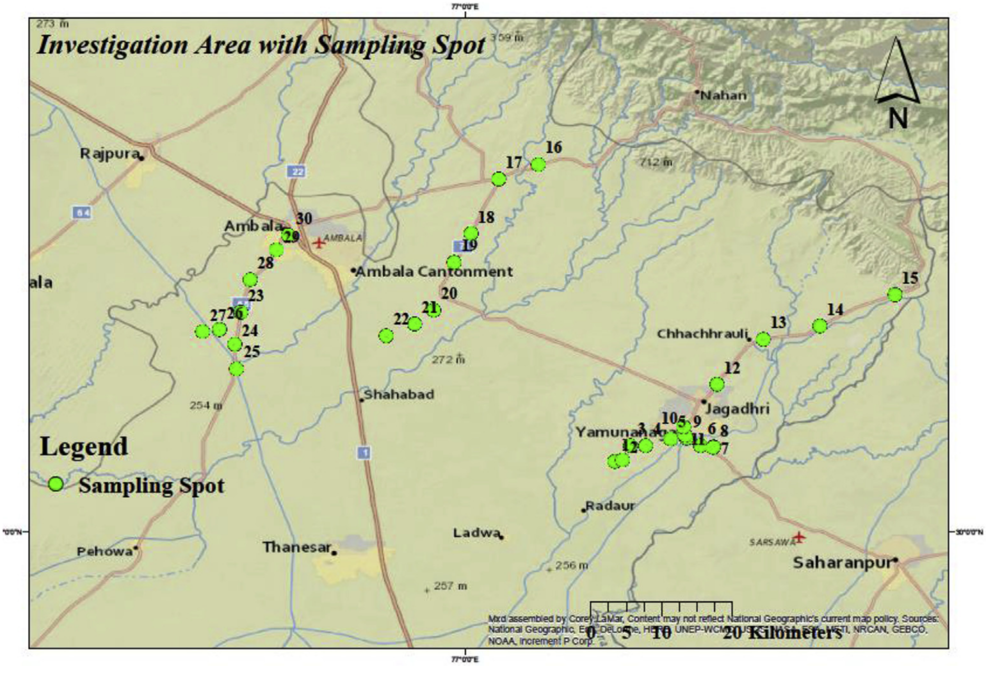


Fig. 1. Site map of the investigation area.

2.2. Water sample collection and chemical procedures

For the purpose of this dataset paper, a total of 30 underground water sources were procured in Yamunanagar and Ambala districts in Haryana state, for pre-monsoon period (2017). Groundwater samples were appraised pursuance to hydro-chemical elements, analytical elements and metal ions. The study region, as well as sampling sites, has been presented in Fig. 1 using ArcGIS 10.2. In this investigation, 16 physico-chemical elements including TDS (Total Dissolved Solids), TA (Total Alkalinity as $CaCO_3$), TH (Total Hardness as $CaCO_3$), pH, bicarbonate (HCO_3), carbonate (CO_3), fluoride (F), nitrate (NO_3), sulphate (SO_4), chloride (Cl), magnesium (Mg), potassium (K), calcium (Ca), sodium (Na), iron (Fe) and chromium (Cr) were used to determine the sub-surface water pre-eminence for agricultural and drinking purposes and were benchmarked as specified by BIS and WHO guidelines [3,10]. Groundwater samples were acquired in poly-ethylene bottles (2L) and then the acquired groundwater samples were stored in an ice box and then relocated to a refrigerator where they were kept at 4 °C until delivery to the lab. All groundwater samples were appraised pursuance to the specified techniques for analysis of drinking aqua given in APHA, AWWA and WPCF [1–5]. The value of total dissolved solids (TDS) and H^+ ion (pH) were also appraised with TDS meter (HACH, HQ40d, USA), and pH meter (EUTECH Instruments pH-700), respectively. The TH, TA, CO_3, Cl and HCO_3 were estimated with titration methods (APHA 2340C and 2320B; IS: 3025 (Part32); 1988, Reaffirmed-2003). The Ca and Mg were calculated using EDTA method (APHA 3500-CaB and APHA 3500-MgB). The NO_3, F, SO_4 and Fe were computed using spectrophotometer (HACH DR- 2800). On the other hand, Values of, Na, K and Cr were obtained using flame photometer (EI-380) technique. All dataset of this investigation were statistically appraised, and applying a SPSS (IBM SPSS Statistics

Table 1
Hydro-chemical and statistically appraised groundwater pre-eminence elements.

Well number	source	UTM		pH	TDS	TA	TH	Ca	Mg	K	Na	Cl	SO_4	NO_3	F	HCO_3	CO_3	Cr	Fe
		Y	X		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
1	T.W	30.02	77.14	7.29	686	530	430	96	45.6	9.4	69.1	127.8	41	1.6	0.16	646.6	ND	ND	0.03
2	T.W	30.05	77.17	7.1	441	420	330	80	31.2	7.4	32	92.3	32	0.8	0.21	512.4	ND	ND	0.03
3	T.W	30.07	77.20	7.67	434	380	210	68	09.6	6.3	49.9	85.2	45	0.7	0.48	463.6	ND	ND	0.04
4	T.W	30.10	77.23	7.8	289	270	200	60	12.0	5.3	19.9	85.2	31	0.5	0.14	329.4	ND	ND	0.02
5	T.W	30.12	77.26	7.54	769	570	430	128	26.4	7.7	97.3	134.9	89	0.9	0.45	695.4	ND	ND	0.03
6	T.W	30.11	77.30	7.34	237	220	180	44	16.8	5.7	18.6	71	22	0.6	0.36	268.4	ND	ND	0.02
7	H.P	30.11	77.32	8.12	220	200	190	36	24.0	4.9	14.3	71	18	0.4	0.44	244	ND	ND	0.01
8	H.P	30.11	77.31	7.49	657	540	400	100	36.0	7.1	58.6	78.1	102	1.2	0.22	658.8	ND	ND	1.41
9	T.W	30.12	77.28	7.48	590	420	370	104	26.4	5.6	56.8	92.3	62	0.9	0.38	512.4	ND	ND	0.03
10	H.P	30.12	77.28	7.45	947	550	550	136	50.0	10.9	97.9	184.6	95	0.6	0.51	671	ND	ND	0.2
11	T.W	30.13	77.28	7.58	568	460	370	96	31.2	9.0	73.4	99.4	54	0.7	0.64	561.2	ND	ND	0.03
12	T.W	30.19	77.32	7.61	363	290	290	64	31.2	7.0	32.0	63.9	31	0.5	0.39	353.8	ND	ND	0.02
13	H.P	30.25	77.38	7.51	449	390	380	96	33.6	2.9	22.0	78.1	43	0.8	0.62	475.8	ND	ND	0.04
14	H.P	30.26	77.45	7.28	374	350	310	80	26.4	4.5	08.9	78.1	33	0.5	0.34	427	ND	ND	0.03
15	H.P	30.30	77.55	7.54	314	300	270	68	24.0	5.2	8.50	92.3	31	0.4	0.68	366	ND	ND	0.02
16	H.P	30.47	77.09	7.25	675	570	440	120	33.6	20.9	52.5	106.5	41	2.7	0.49	695.4	ND	ND	0.21
17	T.W	30.45	77.04	7.45	556	490	380	92	36.0	2.1	55.2	99.4	45	0.8	0.71	597.8	ND	ND	0.02
18	H.P	30.38	77.01	7.28	666	550	350	96	26.4	11.9	92.5	78.1	64	0.6	0.4	671	ND	ND	0.04
19	T.W	30.34	76.99	7.76	611	550	270	60	28.8	4.1	135	92.3	48	0.7	1.65	671	ND	ND	0.04
20	H.P	30.28	76.96	7.27	584	550	370	76	43.2	0.91	96.7	63.9	29	0.9	0.37	671	ND	ND	0.05
21	H.P	30.26	76.94	7.44	723	580	350	88	31.2	0.91	136	99.4	64	1.1	0.88	707.6	ND	ND	0.04
22	H.P	30.25	76.90	7.26	1306	870	370	80	40.8	5.6	305	127.8	216	0.7	0.8	1061.4	ND	ND	0.17
23	H.P	30.28	76.72	7.52	2770	740	900	212	88.8	5.2	521	766.8	460	0.8	0.2	902.8	ND	ND	0.04
24	H.P	30.24	76.71	7.09	929	640	390	76	48.0	7.7	205	170.5	95	0.4	0.75	780.8	ND	ND	0.03
25	H.P	30.21	76.71	7.72	262	230	195	48	18.0	4.5	16	56.8	32	0.8	0.7	280.6	ND	ND	0.04
26	H.P	30.26	76.69	7.71	859	600	320	64	38.4	0.0	220	113.6	39	0.9	1.16	732	ND	ND	0.05
27	H.P	30.26	76.67	7.6	605	510	200	40	24.0	7.1	180	78.1	71	1	0.91	622.2	ND	ND	1.27
28	H.P	30.32	76.73	7.07	408	340	120	40	4.8	1.7	139	85.2	22	0.5	0.48	414.8	ND	ND	0.02
29	H.P	30.36	76.76	7.53	1462	750	310	76	28.8	1.57	370	248.5	92	0.7	0.66	915	ND	ND	0.06
30	H.P	30.38	76.78	7.57	1568	660	330	68	38.4	3.3	380	418.9	108	0.4	0.64	805.2	ND	ND	0.07
Mean				7.47	710.7	484	340.2	83.07	31.79	5.88	118.8	134.7	71.8	0.80	0.56	590.5	ND	ND	0.13
Max				8.12	2770	870	900	188	88.8	20.9	521	766.8	460	2.7	1.65	1061.40	ND	ND	1.41
Min				7.07	220	200	120	36	4.8	0.0	8.5	56.8	18	0.4	0.14	244	ND	ND	0.01
SD				0.23	514.3	166.2	142.1	35.06	15.22	4.07	127	138.6	83.3	0.44	0.31	202.7	ND	ND	0.33

*H.P= Hand Pump, *T.W = Tube Well, **ND = Not Detected.

Table 2
Description and classification of sub-surface sampling locations of study area.

Undesirable limits of elements	Site	Zone
Fe	8 and 27	Grey
F^-	19	Grey
TA	22, 23 and 24	Grey and Red
TDS	23	Red
TH	23	Red
SO_4^{2-}	23	Red
Ca^{2+}	23	Red

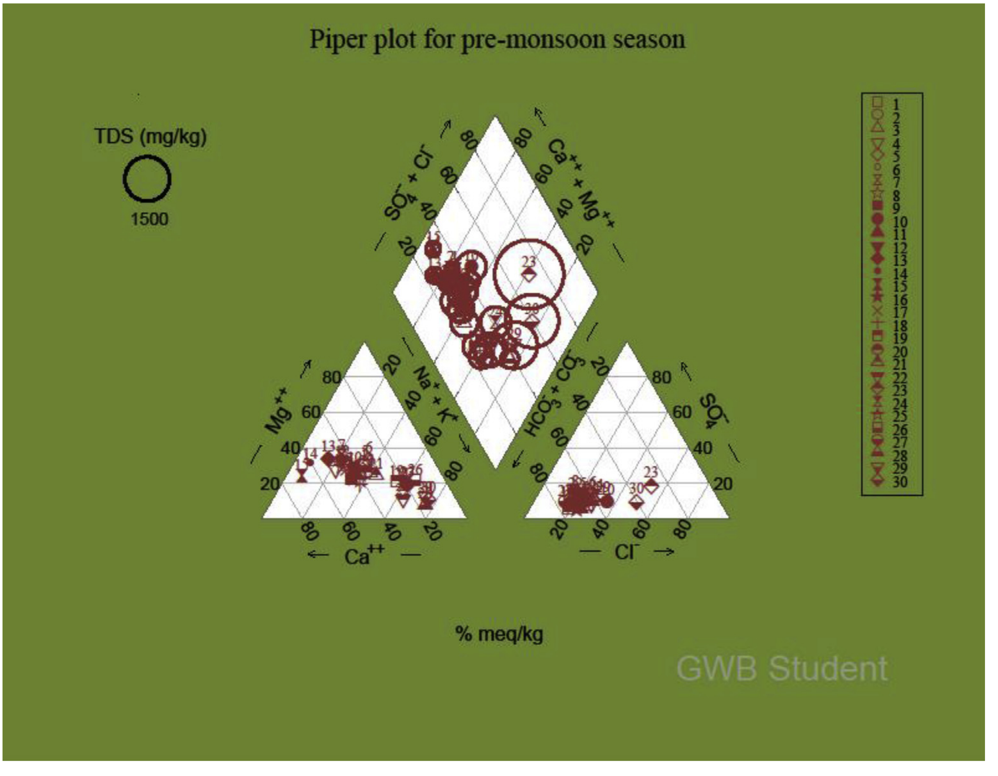
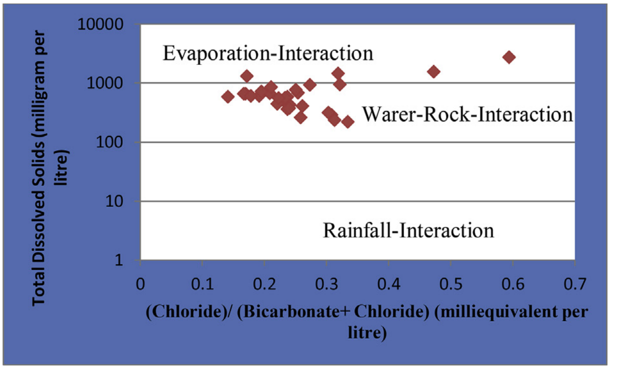
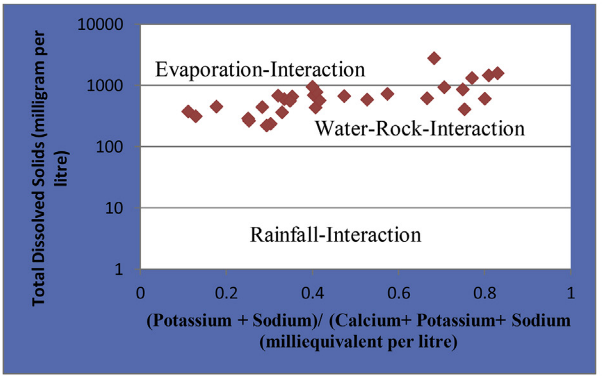


Fig. 2. Piper plot of sub-surface water samples of the current study.

for Windows, Version 20.0. Armonk, NY: IBM Corp, IBM Corp. Released 2016). In order to determine sub-surface aqua pre-eminence and also presumable path-ways of geo-chemical changes, prime ion hydro-chemical dataset, controlling factor, have been delineated on Piper plot (Piper 1944) and Gibbs plot (Gibbs 1970) in Figs. 2 and 3 [6–9].



(a)



(b)

Fig. 3. Classification and controlling element of sub-surface water quality based on Gibb's plot **(a)** For anions **(b)** For cations (Ravish et al., 2019).

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Conflict of interest statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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