Characteristics of groundwater quality and its non-carcinogenic health risk assessment through monsoon inputs in Wanaparthy watershed, Telangana, India.

Presented
by
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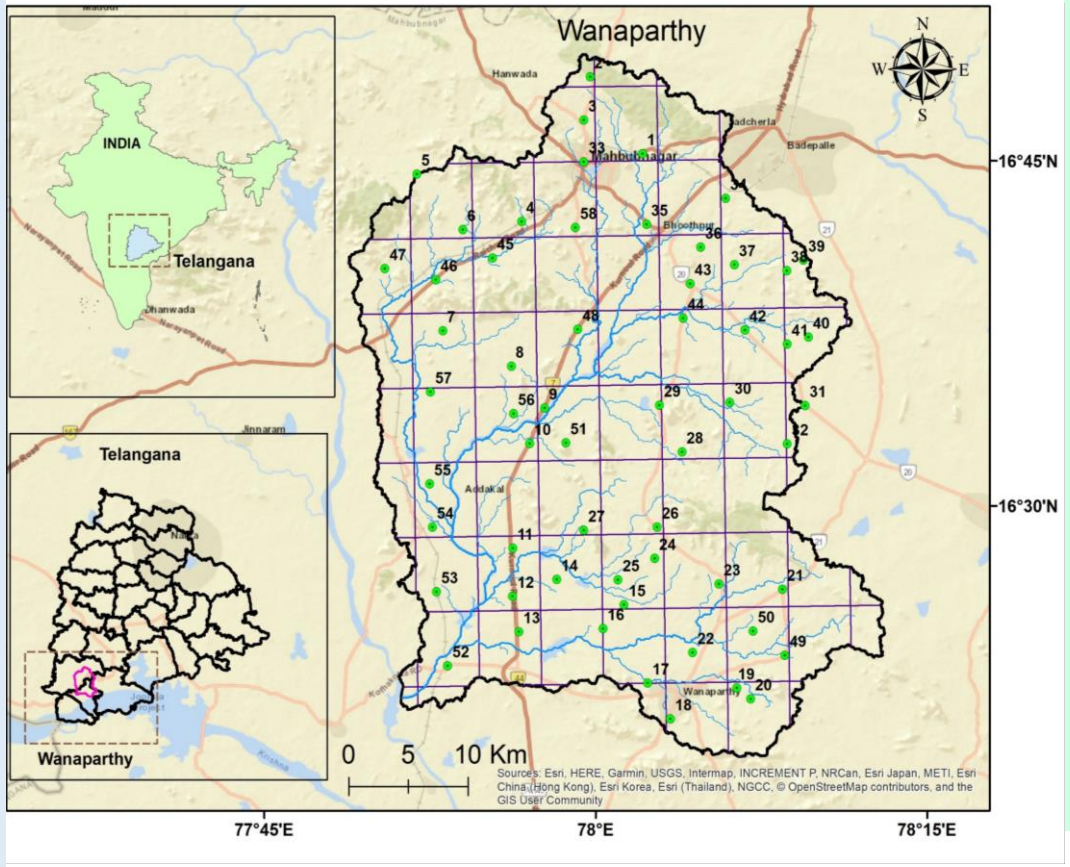
Importance of Groundwater studies

- Groundwater is naturally found and stored in aquifers connected through joints, cracks, fractures, or structurally deformed zones.
- Groundwater contamination is a global issue. Earth's naturally available groundwater can serve only for about 2/3 of the total human population worldwide (Jousma and Roelofsen, 2004).
- Annual extraction of groundwater in India exceeded the total consumption of the USA and China collectively, (NGWA 2016).
- India top the world list in groundwater consumption, with an approximate usage of 250 billion m3/yr. (Shah et al., 2007).
- Cholera, diarrhea, dysentery, lead poisoning, teeth fluorosis, typhoid, infantile paralysis, guinea worm disease, skin infection, etc. (WHO, 2011; Egbueri, 2020).
- Over 10.82 crores population in India drink daily water containing high nitrate above the permissible limit, i.e., 100 mg/l (Balamurugan et al.,2020)

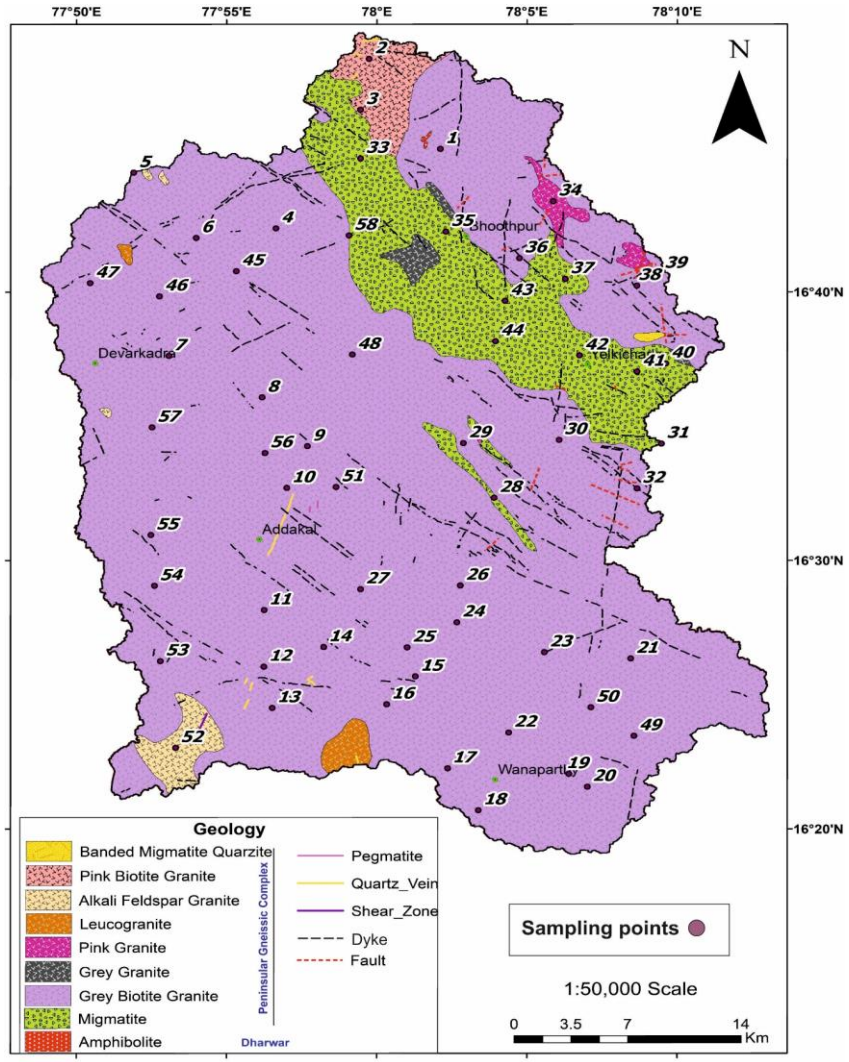
Motivations/reasons for selection Wanaparthy watershed

- No/less scientific reports is available.
- The main source of living is agriculture farming .
- Less perennial rivers.
- Dense boring within few meters were installed for drinking purpose as well agriculture activities.
- The maximum area cover comes under rural area where inhabitant is dominant.
- The region is devoid from industrial influence.



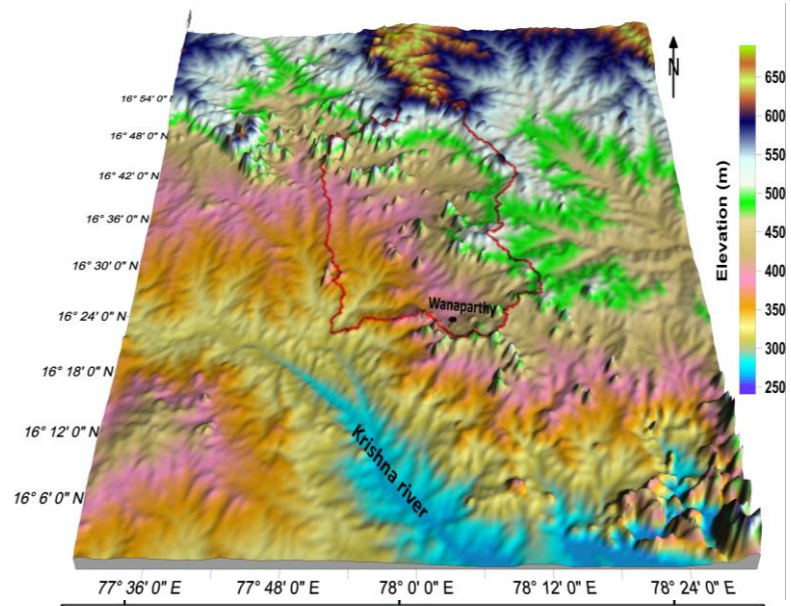
OBJECTIVES

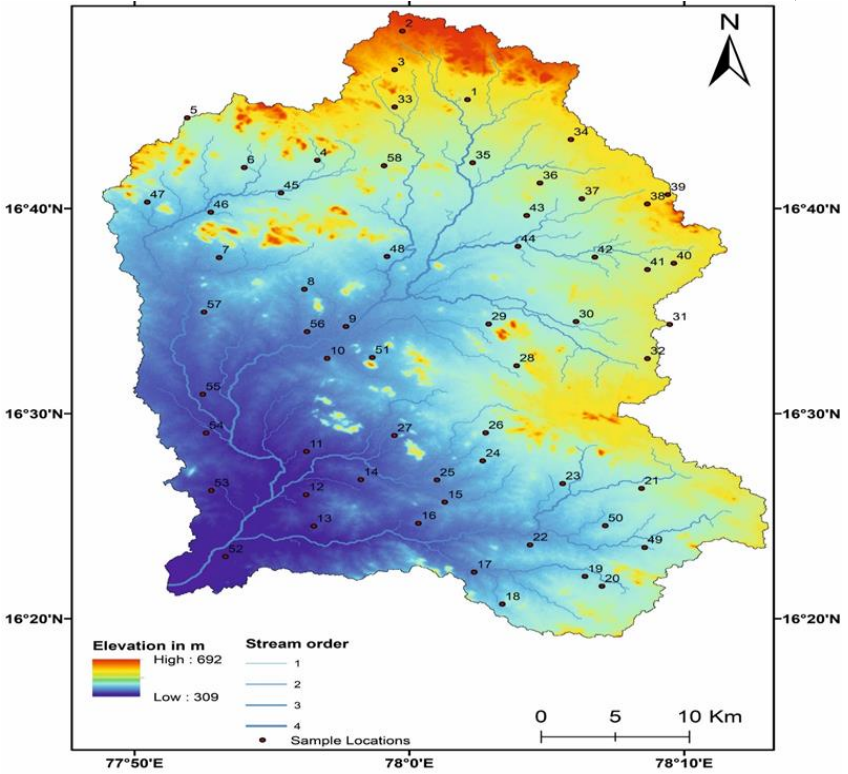
1. To understand the hydrogeochemistry of groundwater.
2. To understand the nitrate health risk assessment for different age groups.
3. To provide data to the concern authority and NGOs to provide awareness and preventive measurements



Short description of study area

1. It covers an area of about 1600 km^2
2. Temperature ranging from 16.9°C - 42°C in winter and summer.
3. The average annual rainfall is 596mm.
4. Granitoid rock is dominant in the study area of Peninsular gneissic complex and Dharwar.
5. The deepest fracture is recorded up to 124.5m bgl (CGWB, 2019).



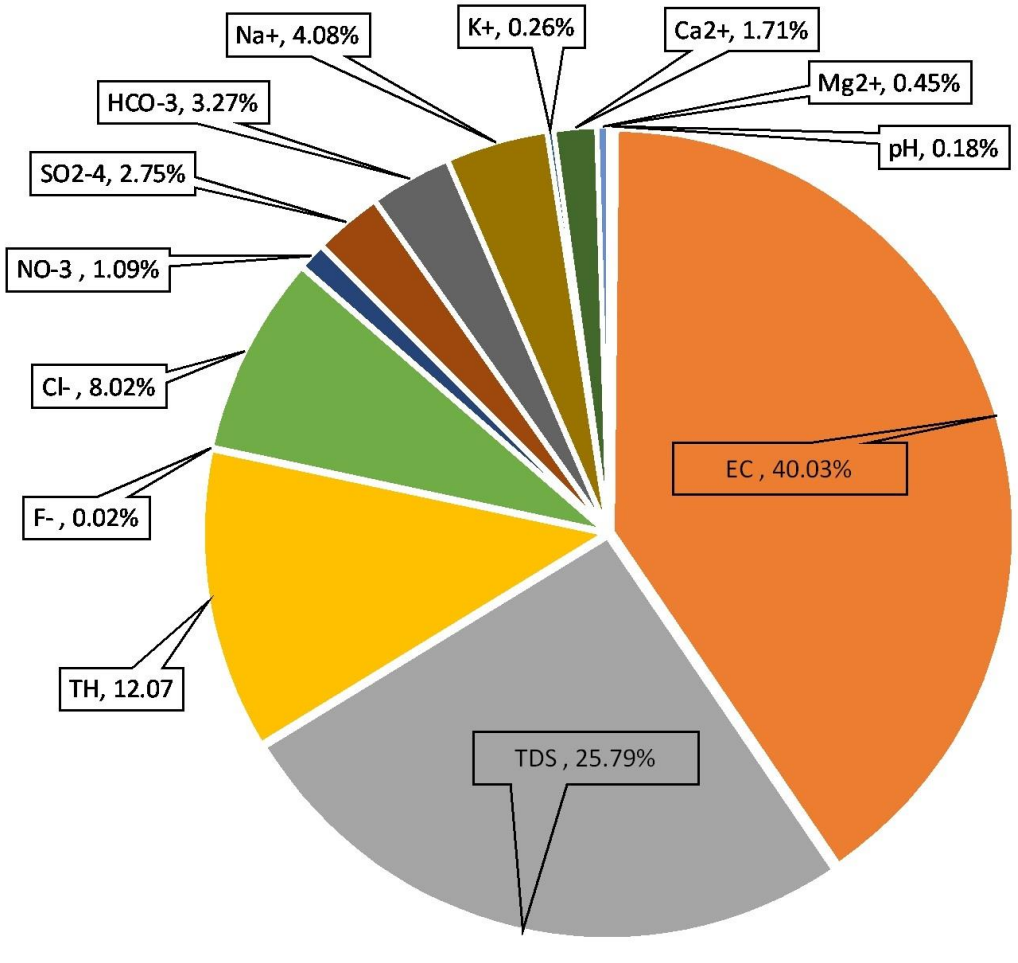


Results and discussion:

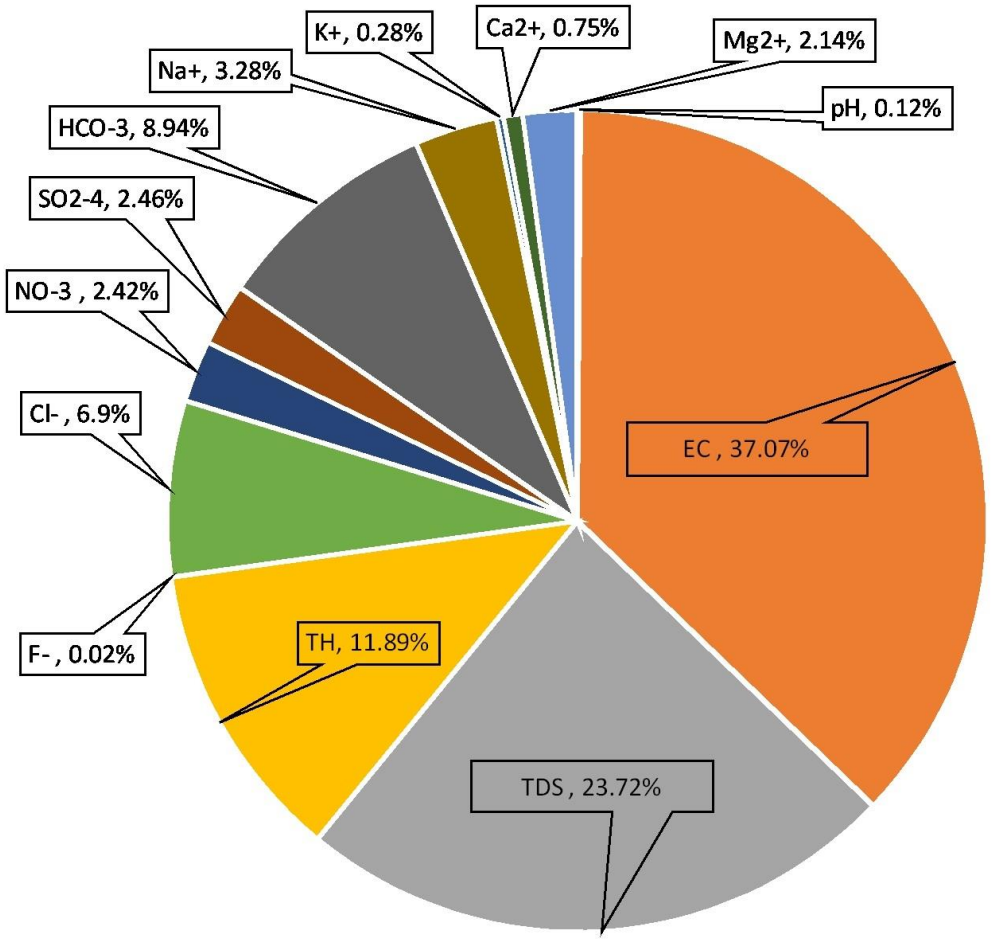
Permissible limits of all parameters with reference to WHO (2011) and BIS (2012) standard showing minimum, maximum, average, median and standard deviation values

Parameters	Minimum value		Maximum value		Average value		BIS 2012/ WHO 2011	Samples exceeding permissible limit BIS (2012) mg/l			
							desire	No. of Samples		% of Samples	
Physico-Chemical	**PRM**	**POM**	**PRM**	**POM**	**PRM**	**POM**	**limit mg/l**	**PRM**	**POM**	**PRM**	**POM**
pH	7.28	5.72	8.43	8.21	7.876	6.66	6.5-8.5	nil	nil	nil	nil
Temperature ^{0}C	29	28	30	31.5	29.64	29.89	---	----	---	---	---
EC (µS/cm)	640	600	5890	7160	1757.93	1997.76	1500	32	33	55.17	56.89
TDS (mg/l)	409.6	384.00	3769.6	4582.40	1125.07	1278.57	500-2000	3	8	5.17	13.79
TH (mg/l)	58.5	87.26	1480.5	1374.41	526.57	640.90	200-600	18	27	31.03	46.55
Alk (mg/l)	60	27.00	580	261.00	251.55	113.20	200-600	nil	nil	nil	nil
Anions											
F^- (mg/l)	0.13	0.34	2.83	3.97	0.906	1.14	1-1.5	11	13	18.97	22.41
Cl^- (mg/l)	10.7	8.01	1794.5	1198.85	349.87	385.27	250-1000	2	1	3.44	1.72
NO_3^- (mg/l)	0.11	0.70	261.97	499.13	48.49	130.67	45-100	5	17	8.62	29.31
SO_4^{2-} (mg/l)	0.11	0.91	632.01	903.22	119.86	132.82	200-400	3	2	5.17	3.45
HCO_3^- (mg/l)	30.5	122.00	329.4	610.00	142.71	481.69	500	nil	nil	nil	nil
Cations											
Na^+ (mg/l)	0.27	49.35	580.45	701.90	181.22	179.61	200	20	21	34.48	36.21
K^+ (mg/l)	0.11	0.53	152.18	218.14	11.12	15.06	200	nil	nil	nil	nil
Ca^{2+} (mg/l)	5.83	3.54	304	102.04	80.15	40.29	75-200	1	nil	1.72	nil
Mg^{2+} (mg/l)	0.52	17.66	64.28	276.32	19.74	115.44	30-150	nil	15	nil	25.86

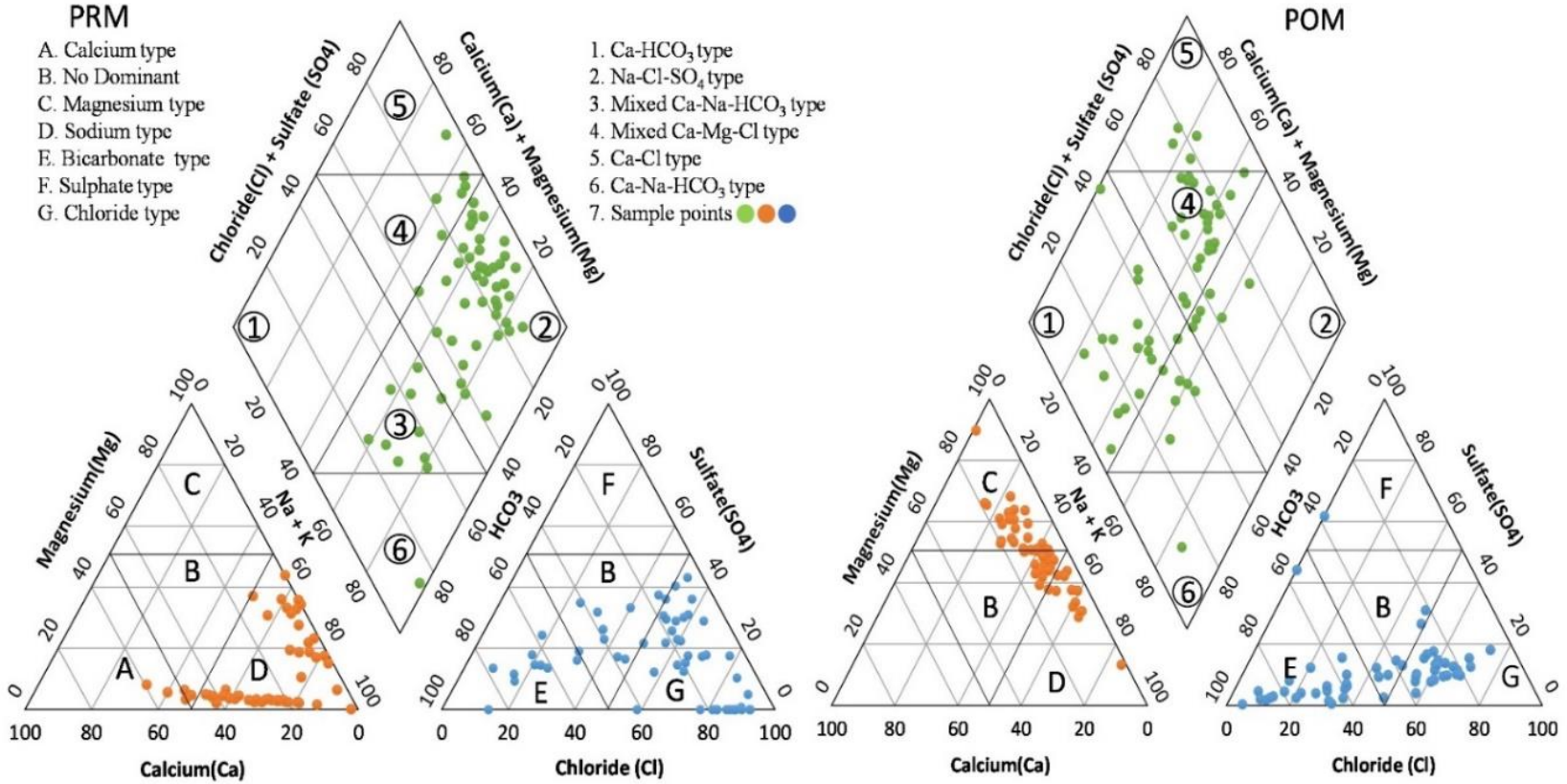
PRM percentage distribution of all parameters



POM percentage distribution of all parameters

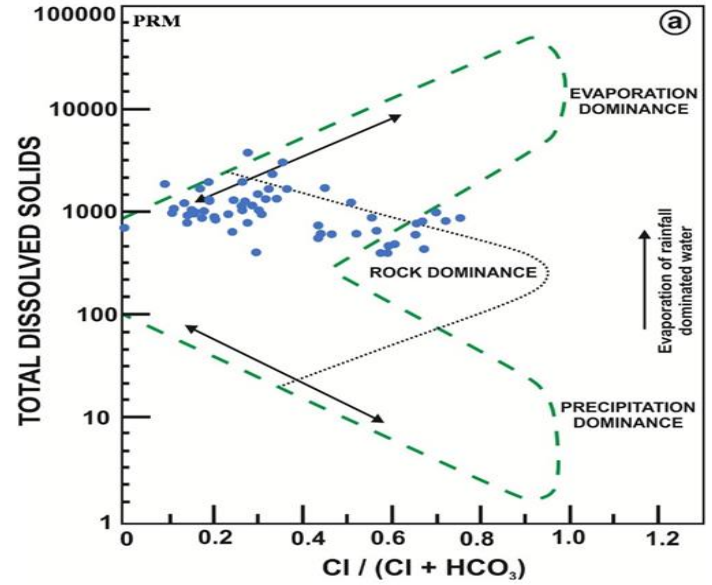


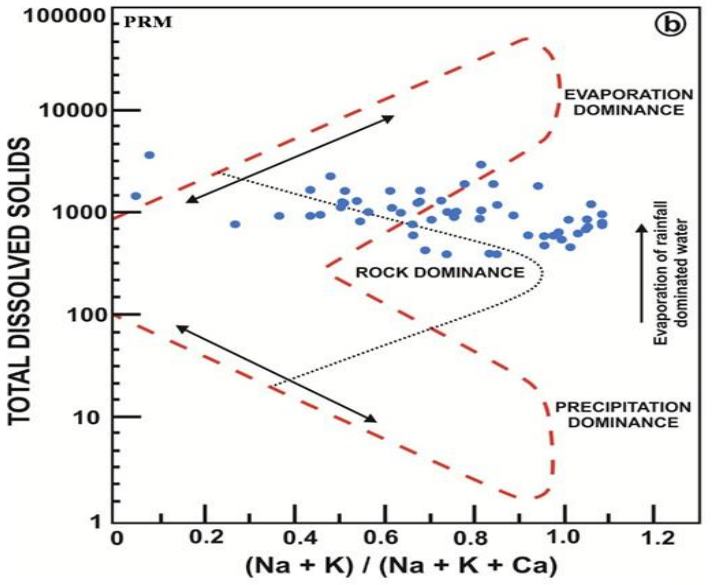
Pie chart showing analytes concentration variations during PRM and POM

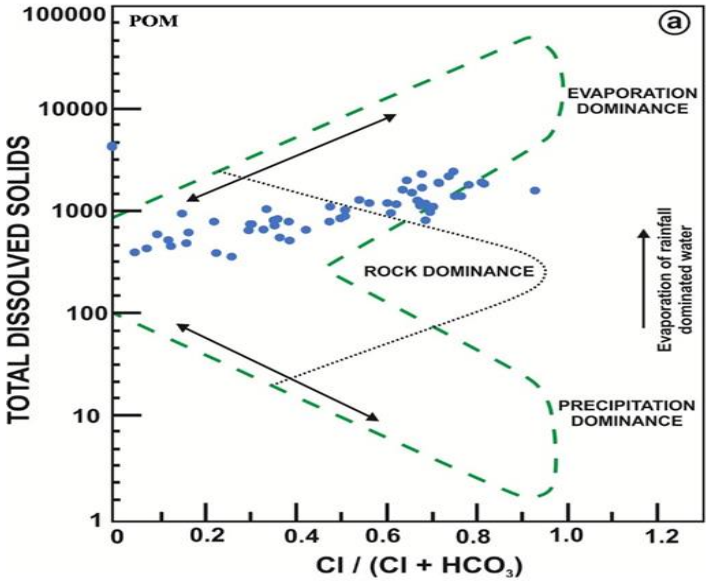


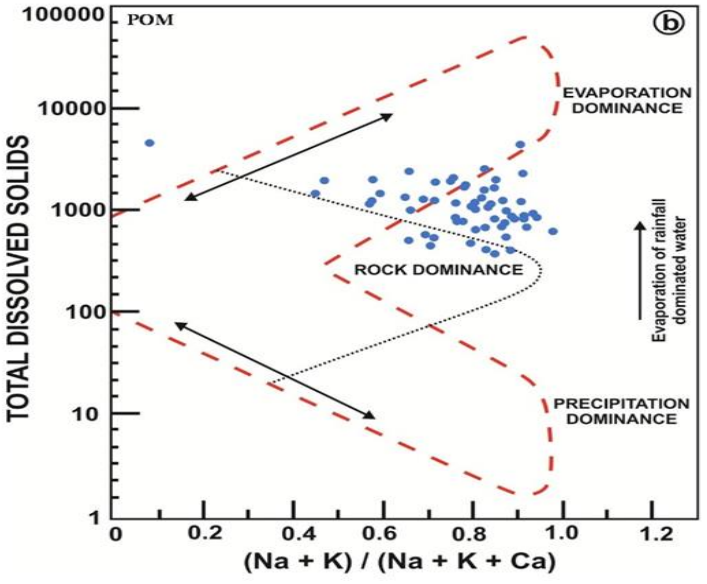
1. Piper diagram explains the major type of groundwater for PRM is Na-Cl type (70.68%) while POM with Ca-Mg-Cl type (39.66%).

2. Changes in ions concentration is observed during seasonal variation.









1. Gibbs diagram shows the anions in groundwater samples falls in rock dominance during pre-monsoon while rock dominance and evaporation dominance during post-monsoon.

2. In cation most of the samples is found dominant to have evaporate dominance environment.

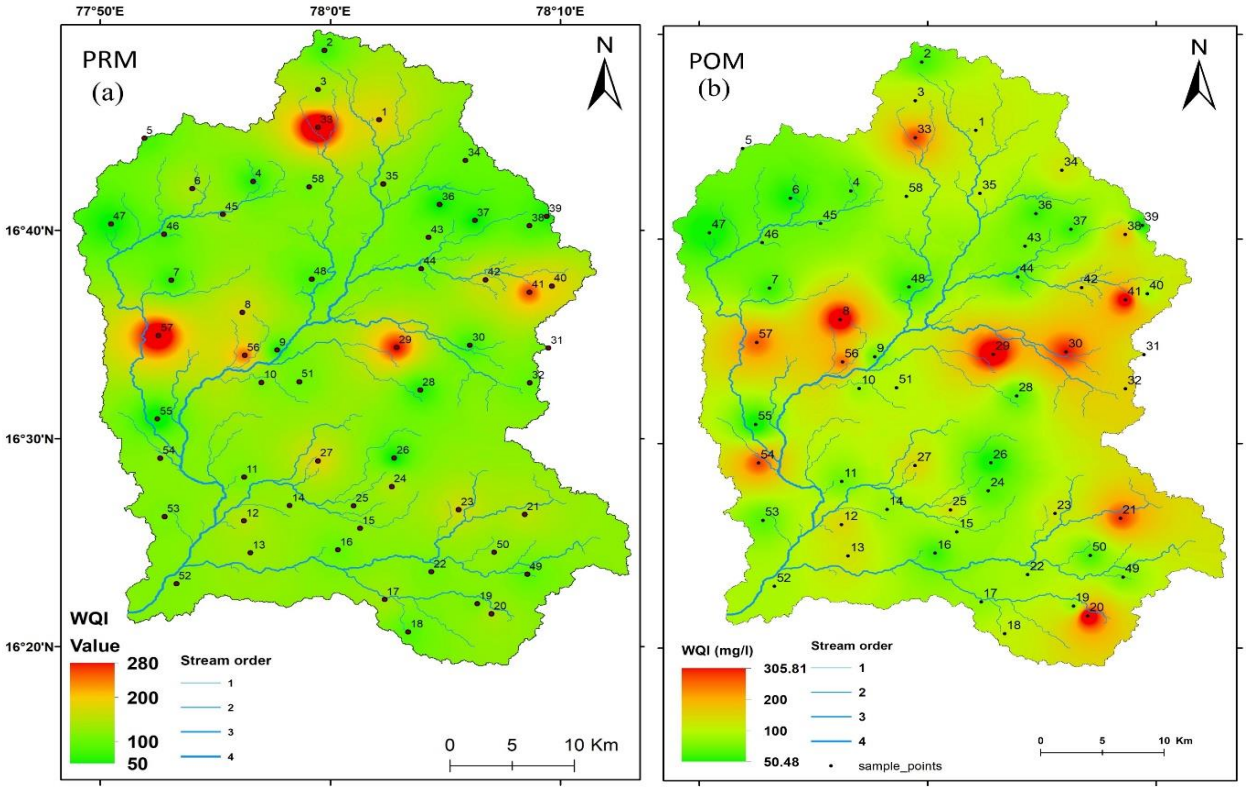
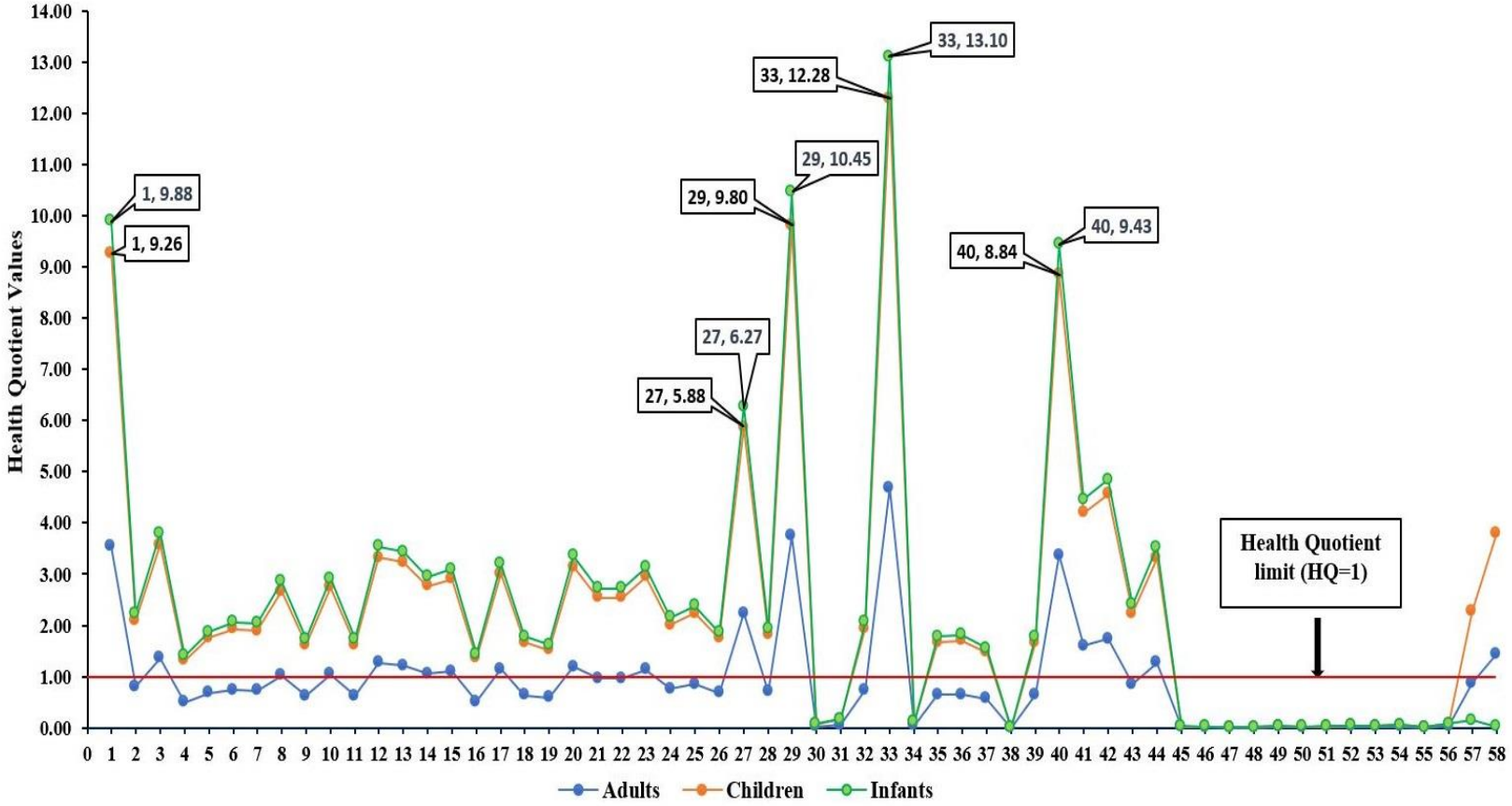


Figure a) and b) show seasonal variation in groundwater quality and spatial distribution with respect to Water Quality Index (WQI) in Wanaparthy watershed for PRM and POM-monsoon seasons

Table: Comparison for WQI during PRE and POM seasons in groundwater samples

WQI range	Type of water	No of samples exceeding allowable limits		% of samples exceeding allowable limits	
		PRM	POM	PRM	POM
<50	Excellent water	2	nil	3.45	nil
50 -100	Good water	35	23	64.34	39.66
100-200	Poor water	17	23	29.31	39.66
200-300	Very poor water	4	10	6.90	17.24
>300	Unfit for drinking	nil	2	nil	3.44
	Total	58	58	100.00	100.00



Scatter plot showing HQ>1 for nitrate concentration in all groundwater samples for different age groups

1. HQ>1 for infants is 68.97%
2. HQ>1 for Children with 72.41%
3. Agriculture fertilizer leaching could be one of the significant sources of nitrate contamination in groundwater because the area is dominant with farming.
4. This suggest that high risk of non-carcinogenic disease is more prone towards young age compare to adult from drinking high nitrate groundwater.
5. It is recommended to drink groundwater only after getting proper treatment in the study area.

Publications

1. **Vaiphei, S. P.,** Kurakalva, R. M., Sahadevan, D. K. (**2020**). Water quality index and GIS-based technique for assessment of groundwater quality in Wanaparthy watershed, Telangana, India. **Environmental Science and Pollution Research.**

2. **Vaiphei, S. P.,** & Kurakalva, R. M. (**2021**). Hydrochemical characteristics and nitrate health risk assessment of groundwater through seasonal variations from an intensive agricultural region of upper Krishna River basin, Telangana, India. **Ecotoxicology and Environ Safety.**

3. **Vaiphei, S. P.,** & Kurakalva, R. M. (**2021**). Comprehensive assessment of groundwater quality using heavy metal pollution indices and geospatial technique: A case study from Wanaparthy watershed of upper Krishna River basin, Telangana, India. **Environmental Earth Sciences**. Impact Factor- **2.7**

4. Kurakalva, R. M., Kuna, G., **Vaiphei, S. P.,** Guddeti, S. S. (**2021**). Evaluation of hydrogeochemical profile, potential health risk and groundwater quality in rapidly growing urban region of Hyderabad, South India. **Environmental Earth Sciences**.

5. **Vaiphei, S. P.,** Sahadevan, D. K., Kurakalva, R. M., Bichal, S. “Delineation of Groundwater Potential Zone Potable Water via integrated Groundwater Potential Zone Index and Water Quality Index: A case study in Wanaparthy watershed, Telangana, India”.
   (Under review)

Thanks to all for your valuable time