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An Impact of Rainfall in Ground Water Level and Fluctuation in Tiruvannamalai District, Tamil Nadu, India – using GIS Technology

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***Abstract:** India is the largest groundwater user in the world. Groundwater has played a significant role in the maintenance of India's economy, environment and standard of living. Through the construction of millions of private bore wells, there has been an enormous growth in the exploitation of groundwater during the last five decades. Ground-water levels are controlled by the balance among recharge to, storage in, and discharge from an aquifer. Physical properties such as the porosity, permeability and thickness of the rocks or sediments that compose the aquifer affect this balance. Study of rainfall pattern is very important for understanding spatial and temporal variations in water levels. Ground water recharge and discharge, well ground water level and water quality ground water discharge and recharge are critical aspects of climate change. Present study, we have analyzed spatial distribution of ground water level and fluctuation of Tiruvannamalai District of Tamil Nadu, India. The ground water level samples are taken from 56 locations in study area. Physical, chemical and biological features in reservoirs are influenced by the seasonal surface level fluctuations, which are significantly associated with anthropogenic utilization. The interpolation technique is used for the spatial distribution of ground water level. Geographical information system is an efficient tool for analyzing water level of spatial and temporal changes.*

***Key Words:** Ground water Level, Rainfall, Fluctuation, Aquifer, Interpolation, GIS*

I. INTRODUCTION

Groundwater is the water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water. Ground water regime monitoring is one of the key activities of CGWB to generate information on ground water level/ quality through representative sampling. The primary objective of establishing the ground water monitoring network stations is to record the response of ground water regime to the natural and anthropogenic stresses of recharge and discharge parameters with reference to geology, climate, physiography, land use pattern and hydrologic characteristics. Groundwater is the 2nd largest available reservoir of fresh water. Surface waters such as rivers and lakes only accounts for less that 1% of the worlds fresh water reserves whereas groundwater accounts for 12% of the worlds freshwater resources. Water level / Piezometric heads are resultant of all input/ output from the aquifer. Apart from draft of ground water for various purposes, quantum of rainfall and its component being recharged to the ground water is major controlling factor of the depth to water levels and it's annual, seasonal or decadal fluctuations.

A. Study Area

The total geographical area of the Tiruvannamalai district is 6,191 sq.km. Cheyyar and Tiruvannamalai were the two revenue divisions in the District. The district is divided into seven taluks viz., Arni, Chengam, Cheyyar, Polur, Thandrampet, Tiruvannamalai and Vandavasi. There were 18 Panchayat Unions/ Blocks covering 860 Village Panchayats and ten Town Panchayats comprising of 1,067 revenue villages. The district had four Municipalities, i.e., Arani, Cheyyar, Tiruvannamalai and Vandavasi. Tiruvannamalai district was formed on 30th September 1989 after bifurcation of North Arcot district. The district lies between 11°55' and 13°15' North Latitudes and 78°20' and 79°50' East Longitudes.

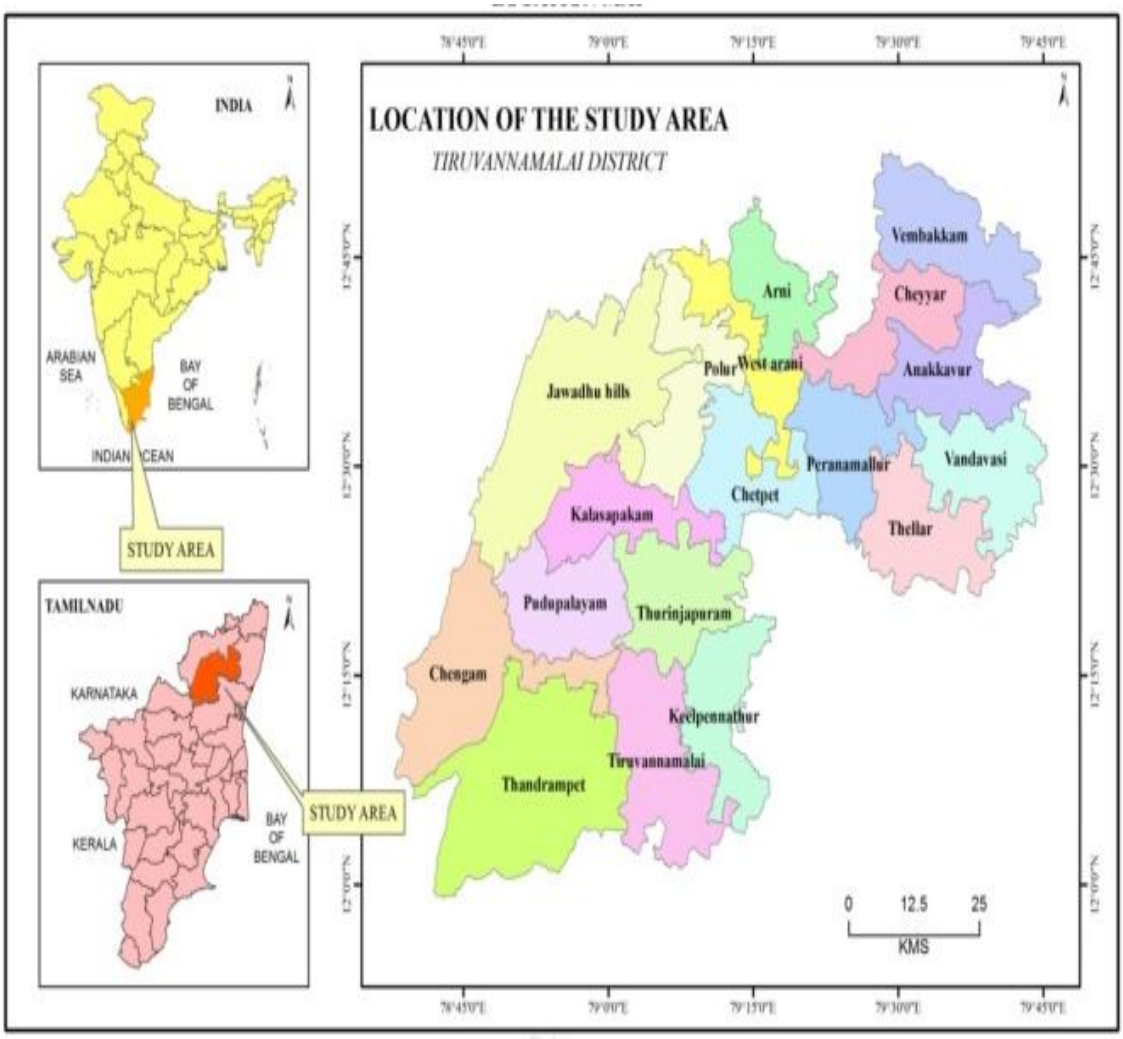


Figure No. 1 Location of the study Area

II. RESULT AND DISCUSSION

It has taken all twelve months and the seasons of the year. Groundwater is not in underground lakes, nor is it water flowing in underground rivers. It is simply water that fills pores or cracks in subsurface rocks. When rain falls or snow melts on the surface of the ground, some water may run off into lower land areas or lakes and streams. What is left may be absorbed by the soil, seep into deeper layers of soil and rock, or evaporate into the atmosphere.

A. Monthly Distribution of Ground Water Level

In month of January, the Tiruvannamalai district ground water level has taken present study from 2001 – 2015 for fourteen years. The ground water level at January month have high value at Polur block of Siruvallur village value as (10.69 m) and the lowest at Polur of Chetpet village value of (1.62m).In February month the highest value of ground water located at Polur block of Siruivallur village value of (11.56m) and the lowest value is (2.28m) in Polur at Chetpet. The highest average of ground water is recorded at Siruvallur village in polur block value is (13.02m) and the lowest was in Thandarai village of Cheyyar value of (2.61m) at the month of March. In the study area, at the month of April the high value of ground water is received in Polur, siruvallur village value of (14.06m). The lowest total average was received in Polur, chetpet village value of (2.61m). In the present study area, of May month have highest value in Polur, siruvallur village the ground water level is (14.83m) and the lowest ground water level is (3.34m) in chetpet village of Polur. For all these fourteen years of June month, siruvallur village has high ground water level value as (14.63m) and the low ground water level at chetpet village as (3.64m).

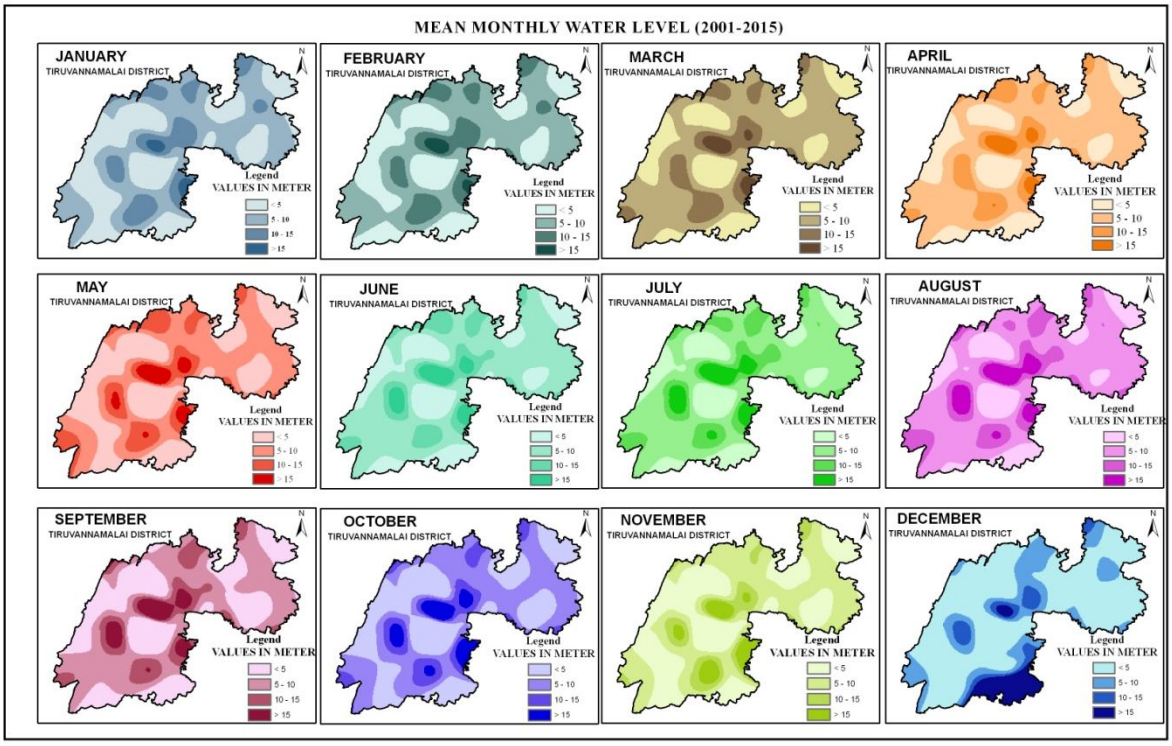


Figure No. 2 Mean Monthly Ground water Level in Tiruvannamalai District

The Siruvallur village of Polur have received (16.09m) of total average as highest and the lowest at Thandarai village of Cheyyar value of (3.63m) in the study area for July.In August month the highest value of the Thiruvannamalai district have located at Siruvallur village of Polur taluk, value as (16.12m) and the lowest average is located at Thandari of cheyyar value of (3.52m). As for the September month the ground water level has been marked high at Siruvallur value of (15.4m) and the lowest average at Thandarai in Cheyyar total as (3.05m). The groundwater level of Tiruvannamalai for October month has pointed high in Siruvallur(14.35) and low as (2.66) of total average in Thandarai village. The ground water level of thiruvannamalai has pointed high in Siruvallur village value as (14.35m) and low as (2.66m) of total average in thandarai village for November.The last month such as December month of the year for fourteen years it have recorded the highest average at Thatchampattu village value of (35.1m) and the lowest at Thanipadi value of (1.11m).

Table No. 1 Seasonal Analysis on Ground Water Level (2001 - 2015)

Sl. No	Well Name	Well No	Winter	Summer	N.E.M	S.W.M
1	Chengam	23002	4.36	5.85	7.39	4.36
2	Olagalapadi	23003	5.50	7.83	9.53	6.07
3	Thurinjapuram,	23008	3.16	4.89	5.72	3.00
4	Muniappanthangal	23008A	8.57	10.67	12.58	10.32
5	Thurinjapuram	23009	2.65	4.81	6.35	3.99
6	Vandavasi	23012	3.44	4.81	4.20	3.57
7	Vandavasi	23013	4.45	6.72	7.94	5.09
8	Vandavasi	23014	5.38	7.32	8.28	5.74
9	Peranamallur	23015	5.22	7.55	9.54	5.78
10	Vandavasi	23016	2.66	3.79	4.46	2.64
11	Cheyyar	23019	2.05	3.13	3.49	2.05
12	Cheyyar	23020	6.34	8.36	9.36	6.98

13	Arni	23021	6.94	8.63	9.48	7.24
14	Arni	23022	2.74	4.76	5.36	2.84
15	Perungalathur	23037	2.60	3.87	5.42	15.53
16	Thatchampattu	23038	2.48	4.53	5.17	2.40
17	Thanipadi	23039	7.63	10.56	11.40	8.46
18	Pachal	23040	6.46	7.75	9.03	7.10
19	Thurinjapuram	23041	3.18	4.86	6.55	4.03
20	Anakkavur	23054	2.98	4.808	5.75	3.57
21	Anakkavur	23055	4.29	5.58	6.76	4.37
22	Cheyyar	23057	4.05	5.46	6.19	4.11
23	Vembakkam	23059	6.94	8.11	9.16	8.00
24	Vembakkam	23060	4.63	6.02	7.24	6.18
25	Vandavasi	23061	2.77	4.74	6.46	4.39
26	Vandavasi	23062	5.67	8.18	9.95	8.15
27	Vandavasi	23063	4.42	5.94	7.68	5.86
28	Vandavasi	23064	2.37	3.85	4.40	2.21
29	Vandavasi	23065	8.50	7.41	6.86	7.66
30	Arni	23066	5.47	6.67	6.15	5.48
31	Arani west	23067	8.67	10.27	11.63	9.11
32	Arani west	23068	6.95	9.29	10.85	8.58
33	Arni	23069	5.17	6.561	7.49	5.94
34	Arni	23070	4.91	6.86	8.53	6.72
35	polur	23095	4.81	6.74	8.12	6.37
36	polur	23096	4.07	6.11	6.72	3.75
37	polur	23098	4.18	6.08	7.53	4.74
38	polur	23099	1.96	2.92	3.91	2.23
39	Polur	23100	8.25	10.10	12.49	10.43
40	Polur	23102	2.63	3.94	4.40	3.30
41	Chengam Farm 2	23105	4.95	7.13	8.90	5.38
42	Kilpennathur	23111	5.80	7.46	8.85	6.98
43	Kilpennathur	23112	4.41	7.96	9.33	5.67
44	Malaiyanur Chakkadi	23120	3.22	4.7	6.43	4.05
45	Kootaru	23122	4.63	5.68	6.64	4.90
46	Pudur Chakkadi	23124	5.01	7.86	9.08	5.89
47	Polur	23126	11.26	13.97	15.56	12.45
48	Polur	23130	4.36	6.60	7.65	6.50
49	Malappambadi	23138	2.78	5.16	6.30	3.61
50	Thurinjapuram	23141	5.67	8.41	9.12	6.37
51	Thurinjapuram	23143	2.32	3.60	4.04	2.47
52	Vandavasi	A 23010	6.36	7.90	8.57	7.19
53	Tiruvannamalai	A23014	7.11	9.78	11.40	9.04
54	Thiruvannamalai	A23015	7.04	8.15	8.51	7.10

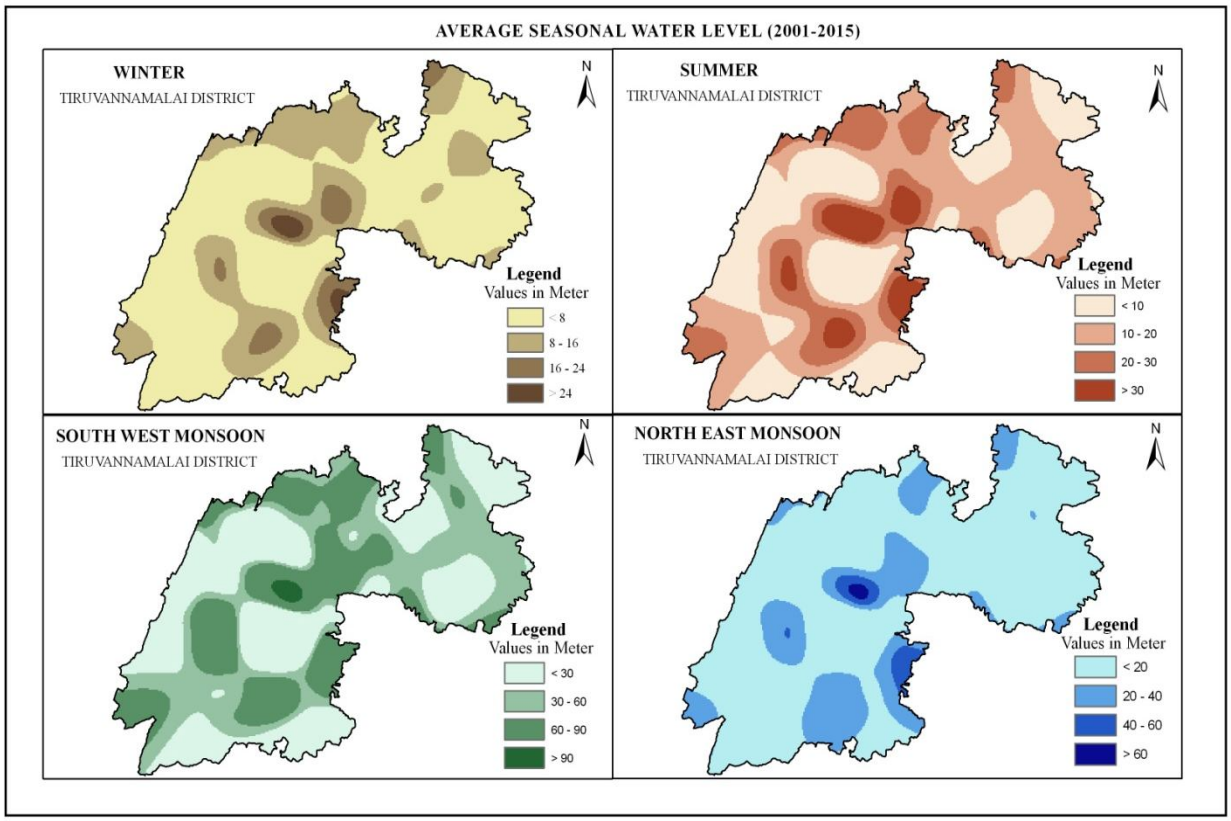
55	Chengam	A23016	6.53	8.21	10.13	8.35
56	Polur	A23018	4.10	5.56	6.50	4.55
57	Cheyyar	A23036	0.00	0.00	0.00	0.00

Source: State ground and surface water resources data centre,Tharamani, Chennai

B. Seasonal Analysis on Ground Water Level Winter

In thiruvannamalai , the ground water level have been calculated from seasonal wise analysis from 2001 to 2015. In winter season , the total average ground water level has occurred as maximum in village of Siruvallur ,(11.26m), Kamakurpalayam of Arni west (8.67m), Thurinjapuram , Sirugalambadi (8.57m), Arni of Nesal have (8.50m) and Pachal have (8.25m). along with this, the minimum values at Polur of Chetpet village (1.96m), Cheyyar of Thandari value as (2.05m).

Figure No.3 Seasonal Ground water Level in Tiruvannamalai District



The maximum value of ground water level have been located at Polur block , village of Siruvallur value of (13.97m), Thurinjipuram of Sirugalambadi (10.67m) and in Pachal value as (10.56m). The minimum value of ground water level have been recorded at polur of Chetpet village value as (2.92m) and Cheyyar block of Thandarai village have value of (3.13m) as total average of ground water level.

C. South West Monsoon

In the study area, this south west monsoon occur first (which covers June, July, August and September) with all these four months for fourteen years , an average ground water level have been taken as maximum and minimum value. The maximum ground water level have located at village of Siruvallur, Sirugalambadi, Vadamathimangalam, Kamakurpalayam and Thandarampattu values are (15.56m, 12.58m, 12.49m, 11.63m and 11.40m). The minimum ground water level has marked at village of Thandarai (3.49m), Chetpet (3.91m) and Vandavasi (4.04m).

D. North East Monsoon

The present study area of thiruvannamalai it have collected the ground water level average in this monsoon which covers October, November and December. Through the collected groundwater level for the fourteen years, the maximum average have been located at Thatchampattu(15.53m), Siruvallur (12.54m) and Vadamathimanagalm have (10.43m). The minimum values of total average for the study area are Thandarai (2.05m), Peranamallur (2.021m) and Chetpet (2.023m) of ground water level. Ground Water level (dbg) is maximum in Srivallur, Sirugalambadi, Vadamathimangal and Kamakurpalayam region with depth more than 10m from the ground Ground water level (dbg) is minimum in Chetpet and Tandarai region with a depth of 2.91m and 2.79m respectively. Here the water level is high.

E. Ground Water Level Fluctuation

Groundwater levels change for many reasons. Some changes are due to natural phenomena and others are caused by man's activities. From the year 2001 to 2015 the ground water level has shown some significant change and the water level has fluctuated in many areas. Common 58well taken for the study the average fluctuation is found to be 0.54m.

Table No.2 Water Level Fluctuations

Sl. No	Well Name	Village Name	2001	2015	Fluctuation
1	Chengam	Varagur	6.32	5.34	0.98
2	Olagalapadi	Olagalapadi	6.64	6.54	0.1
3	Thurinjapuram,	Nayadimangalam	9.93	7.77	2.16
4	Muniappanthangal	Muniappanthangal	7.27	4.93	2.34
5	Thurinjapuram	Sirugalambadi	9.39	7	2.39
6	Vandavasi	Kodiyalam	4.02	5.95	-1.93
7	Vandavasi	Desur	5.05	5.29	-0.24
8	Vandavasi	Tennangur	4.26	8.78	-4.52
9	Peranamallur	Vishamangalam	7.25	8.75	-1.5
10	Vandavasi	Gangapuram	9.14	10	-0.86
11	Cheyyar	Koolamandal	4.04	3.7	0.34
12	Cheyyar	Thandarai	4.03	3.35	0.68
13	Arni	Hariharan Colony	9.44	8.63	0.81
14	Arni	Vannakulam	7.45	9.12	-1.67
15	Perungalathur	Perungalathur	3.45	3.52	-0.07
16	Thatchampattu	Thatchampattu	1.48	6.84	-5.36
17	Thanipadi	Thanipadi	4.11	4.17	-0.06
18	Pachal	Pachal	9.03	0	9.03
19	Thurinjapuram	Mangalam	8.35	4.67	3.68
20	Anakkavur	Echur	4.03	6.56	-2.53
21	Anakkavur	Sengadu	4.83	5.621	-0.791
22	Cheyyar	Palli	7.22	8.03	-0.81
23	Vembakkam	Sumangali	5.62	4.96	0.66
24	Vembakkam	Moranam	9.78	4.59	5.19
25	Vandavasi	Marudhadu	4.8	9.34	-4.54
26	Vandavasi	Salavedu	3.4	6.14	-2.74
27	Vandavasi	Amudur	4.31	9.81	-5.5
28	Vandavasi	Nedungunam	6.61	7.5	-0.89
29	Vandavasi	Peranamallur	3.29	5.06	-1.77
30	Arni	Nesal	3	0.299	2.701
31	Arani west	Thatchur	7.02	0.19	6.83
32	Arani west	Kamakurpalayam	13.27	11.64	1.63
33	Arni	Velleri	8.09	0.29	7.8

34	Arni	Mullandram	7.06	8.45	-1.39
35	polur	Santhavasal	6.08	3	3.08
36	polur	Padavedu	7.17	5.8199	1.3501
37	polur	Kadaladi	5.31	5.76	-0.45
38	polur	Padagam	5.4	6.195	-0.795
39	Polur	Chetpet	2.61	5.09	-2.48
40	Polur	Vadamathimangalam	8.19	9.6	-1.41
41	Chengam Farm 2	Chengam Farm 2	1.78	6.92	-5.14
42	Kilpennathur	Keekalur	7.91	7.23	0.68
43	Kilpennathur	Polagunam	8.91	8.35	0.56
44	Malaiyanur Chakkadi	Malaiyanur Chakkadi	6.87	9.98	-3.11
45	Kootaru	Kootaru	3.57	5.7	-2.13
46	Pudur Chakkadi	Pudur Chakkadi	4.99	6.04	-1.05
47	Polur	Mampattu	8.44	10.97	-2.53
48	Polur	Siruvallur	9.1	17.82	-8.72
49	Malappambadi	Malappambadi	5.82	7.52	-1.7
50	Thurinjapuram	Pichanandal	5.05	5.11	-0.06
51	Thurinjapuram	Mallavadi	9.06	8.66	0.4
52	Vandavasi	Vandavasi	2.57	4.51	-1.94
53	Tiruvannamalai	Thiruvannamalai	6.09	7.4	-1.31
54	Thiruvannamalai	Thandarampattu	9.46	10.33	-0.87
55	Chengam	Chengam	7.11	9.57	-2.46
56	Cheyyar	Cheyyar G.B.H.School	5.74	7.47	-1.73

Source: State ground and surface water resources data centre, Tharamani, Chennai

Table No. 3 Impact of Rainfall for Groundwater Level

RF.STATIONS And S. Location	GROUNDWATERLEVEL(in Meter)				RAINFALL (in mm)			
	WINTER	SUMMER	SWM	NEM	WINTER	SUMMER	SWM	NEM
Chengam	6.53	8.21	10.13	8.35	7.72	40.37	111.04	126.24
Polur	4.10	5.56	6.50	4.55	16.34	35.85	117.31	144.01
Thiruvannamalai	7.11	9.78	11.40	9.04	8.68	39.37	108.43	146.94
Vandavasi	6.36	7.90	8.57	7.19	17.64	34.64	118.14	189.65
Thanipadi	7.63	10.56	11.40	8.54	13.96	42.98	82.13	141.90
Cheyyar	6.34	8.36	9.36	6.98	12.88	46.69	173.43	176.64

Source: Compiled by Author

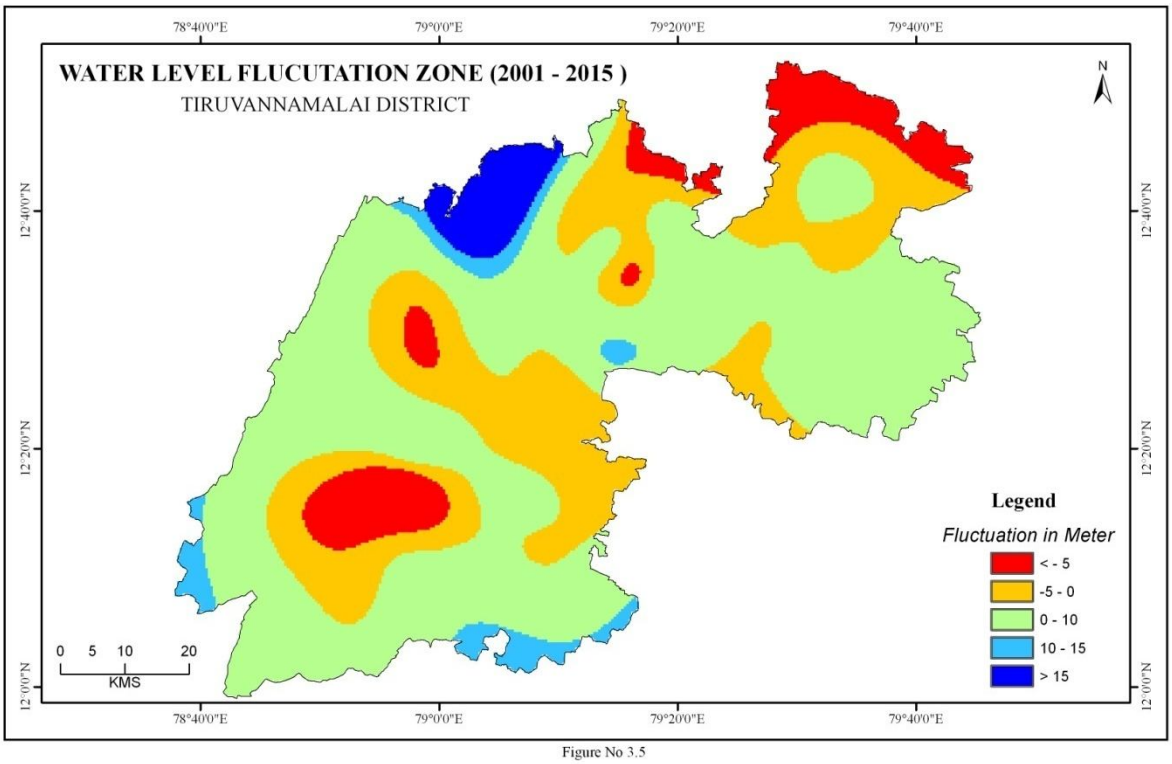


Figure No.4 Water Level Fluctuation in Tiruvannamalai District

Well number 23130 Polur has shown in maximum fluctuation with 8.72m increase in depth which in Polur region. Then the other well number is 23063, 23038 and 23105 with in increased depth of 5.5m, 5.63m and 5.14m respectively in Vandavasi, Tachampattu and Chengam region. Out of the 58 well totally of 36 well have seen increase in depth of water below ground (or fall in the water level). The average increase of depth below ground is found to be 2.09m. There are 20 wells have seen decrease in the depth below the ground (or increase in water level). The average increase in water level is (-) 2.21m. The maximum increase in water level is found to be 7.8m for well number 23069 in Arni region. Well number 23067, 23060 and 23041 are some of the well which have seen an increase in water level with an increase of 6.83m, 5.19m and 3.68m respectively Arni, Vembakkam and Thurinjapuram regions.

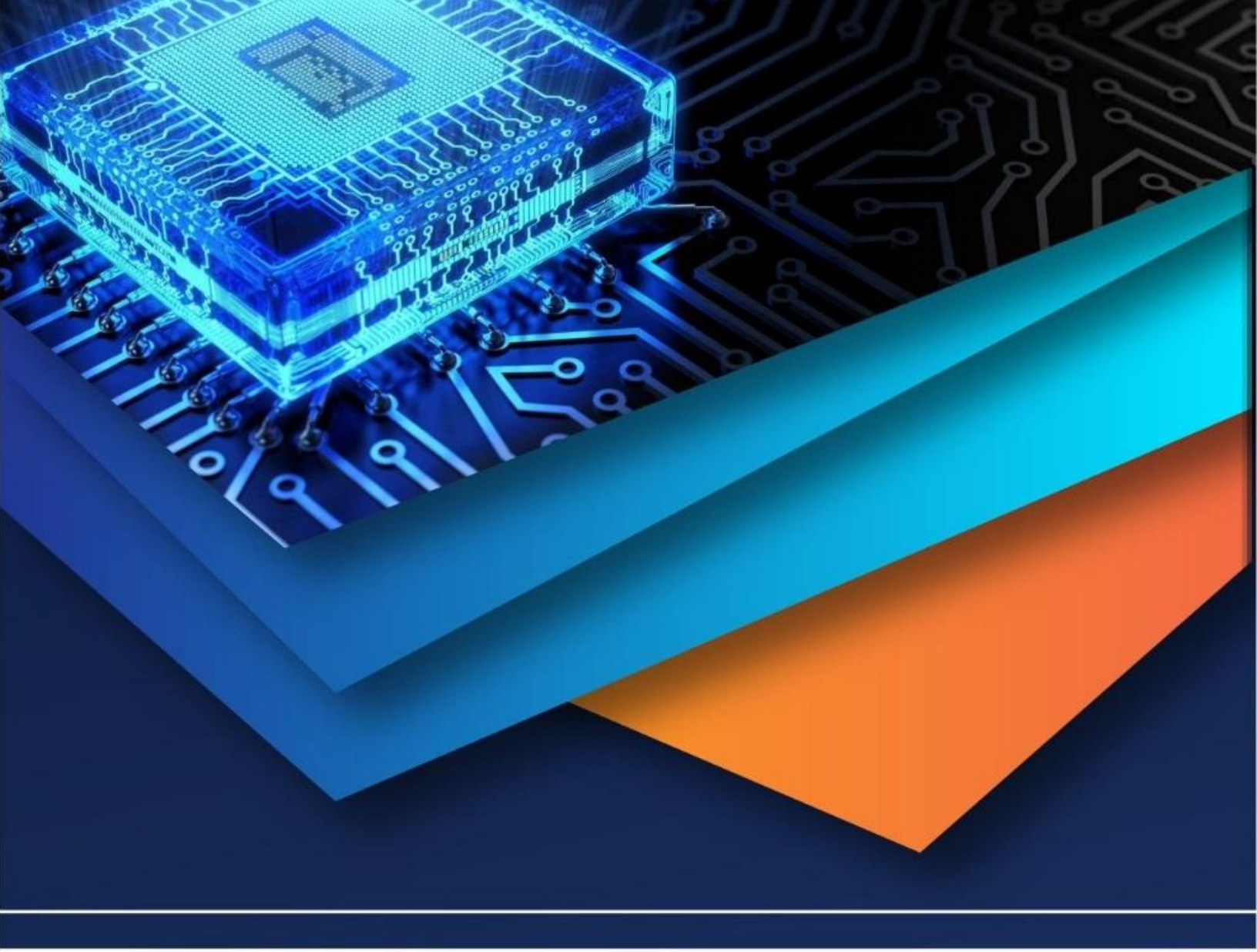
III. CONCLUSION

In the study of Tiruvannamalai district it gave a various dimension of groundwater level in the different blocks of the different villages of the present area about fourteen years. The analyzed ground water levels on the basis of months and seasons the out puts are: In winter season, the total average ground water level has occurred as maximum in village of Siruvallur, (11.26) and the minimum values at Polur of Chetpet village (1.96). The maximum value of ground water level have been located at Polur block , village of Siruvallur value of (13.97) and the minimum value of ground water level have been recorded at polur of Chetpet village value as (2.92). The maximum ground water level has located at village of Siruvallur (15.56) and the minimum ground water level has marked at village of Thandarai (3.49). Through the collected groundwater level for the fourteen years, the maximum average has been located at Thatchampattu (15.53) the minimum values of total average for the study area are Thandarai (2.05). The rainfall and water level data has been obtained and we identified where the ground water level has reduced and increased in these 14 years. From that we identified the water level fluctuation in Tiruvannamalai. Many wells have less ground water level and some wells have been closed without water. The final result of impact of rainfall and the groundwater level changes have been evaluated.

REFERENCES

[1] Ameresh Krsingh and Raviprakash, S. “Groundwater potential modeling in Chandraprabha Subwater Basin” Uttarpradesh using Remote sensing, Geoelectrical and GIS. GIS development, GIS Publication. 2006.
[2] Anbhazhgan and Archana Nair, “Geographic information system and groundwater quality Mapping in Panvel Basin”, Maharastra, Environmental Geology, pp. 753-761, 2004.

[3] Anderson, "Land use / land cover changes a framework for monitoring" Journal of research by geological survey, Vol.5, pp. 143-153. 1977.
[4] Andreas Mende, Allan Astorga, and Detlev Neumann "Strategy for groundwater management in developing countries" A case study in Northern Costa Rica, Journal of Hydrology, Vol. 334, pp.109-124. 2007.
[5] Anuragh Mohan and Kirtipandey, "Assessment of underground water quality in industrial area of Bareilly" Indian Journal of Environment Pollution, Vol. 26, No. 2, pp.153-158. 2006.
[6] APHA "Standard methods for Examination of Water and Wastewater" American public health Association, American Water works Association and Water Pollution control federation, 19th Edition, Washington, DC, 1995.
[7] Asadi, S.S., Padmaja Vuppala, and Anji Reddy, "Remote sensing and GIS Techniques for evaluation of groundwater quality in Municipal corporation of Hyderabad" International journal of Environmental research and Public Health, Vol. 4, No.1, pp.45-52, 2007.
[8] Bassappa Reddy M. and Gaikwad R.L. "Use of Remote sensing techniques for targeting ground water in fractures crystalline rock" Proceedings of the Sixth Asian Conference on Remote Sensing, Hyderabad, 1985.
[9] Chyan Deng Jan, Tsung Hsien Chen and Wei Cheng "Effect of intensity and distribution of groundwater level fluctuation", Statistical approach to rainfall Intensity on groundwater level fluctuation. Journal of Hydrology, pp.348-360. 2007.
[10] David L.L. and Geoffry N.D. "A regression model to estimate region ground water recharge" ground water, Vol. 32, pp 1-13, 2006.
[11] De Vries, J.J. "Ground water level fluctuations" Evaluation and Protection of ground water resources, UNESCO, pp. 27-43, 2000. 24.
[12] Dutt, D.K. "Trends in ground water development and management" Theme paper on groundwater, First National water Convention, New Delhi. 1997 27.
[13] Goutam Banergee "Analysis of Groundwater potential through pumping river subsurface bed", A case study on Kasai in West Bengal, Journal of Indian water Works Association pp. 131-135. 2009.
[14] Health, R.C. and Trainer, F.W. "Long term and Short term fluctuations of ground water levels" Introduction to Ground water Hydrology, John Wiley & Sons, pp. 49-74. 1968.
[15] Hsin-Fu Yeh, Cheng-Haw Lee, Kuo-Chin Hsu and Po-HsunChang, "GIS for assessment of groundwater recharge potential zone" Environmental Geology, Vol.58, No. 1, pp.185-195, 2008.
[16] Huang Mingmin "Analysis of perennial fluctuation of groundwater table in part of Alluvio-proluvial fan of Yongding River", China, Proceedings of Exeter symposium IAHS Pub No 136, pp.205-212. 1982.
[17] Prasad, R.K., Mondal, Pallavi, Bannerji, Nandha Kumar, M.V. and Singh, V.S. "Delineating Potential groundwater Zone in Hard rock through application of GIS" Environmental Geology, Vol. 55, No. 3, pp. 467-475, 2007.
[18] Singh, K.P. "Non linear estimation of aquifer parameters" Hydrology and earth system sciences, No. 2, pp. 917-938, 2005 96.
[19] Singh, V.S. "Well Storage effect during pumping test in an aquifer of low permeability" Hydrological Sciences Journal Vol.45, No. 4, pp. 223-232, 2000. 97.
[20] Singhal, B.B.S "Artificial recharge of groundwater in hard rocks with special reference to India" Proceedings of Rabat symposium, IAHS Pub No 241. 1997.
[21] Todd, D.K. "Occurance of ground water in aquifers" Ground water Hydrology John Wiley & Sons. 1994.
[22] Knighton, R.E., James, D. W., 1985. Soil Test Phosphorus as a Regionalised Variable in Leveled Land, Soil Sci. Soc. Am. J., 49, 675-679.
[23] Krige, D.G., 1966. Two-dimensional weighted moving average trend surfaces for ore-valuation, in Proc. Symposium on Mathematical Statistics and Computer Applications in Ore Valuation: Journ. South African Inst. Mining and Metallurgy, Johannesburg, Mar. 7-8, pp. 13-38.
[24] Comparison of Several Spatial Prediction Methods for Soil pH, Soil Sci. Soc. American J., 38, 325-341. Matheron, G.F., 1963. Principles of Geostatistics: Economic Geology. 58, 1246-1266. Nayak, T.R., 2002. Analysis of Declining Water Table in Sagar District.
[25] National Institute of Hydrology, Roorkee, pp. 47. Nayak, T.R., Bhar, A.K. 2003. Monitoring Groundwater Fluctuation in a Part of Bundelkhand. Hydrology Journal, 26(1-2), 45-53.



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