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An Impact of Rain fall in Ground Water Level Fluctuation and Prediction of Rainfall at Kanchipuram District, Tamil Nadu, India

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Abstract: ***Rain is a major component of the water cycle and is responsible for depositing most of the fresh water on the Earth. It provides suitable conditions for many types of ecosystems, as well as Ground Water. The main source of water exploits for drinking, agricultural, industrial and crop irrigation. A well-known fact that the ground water resource is limited, its utilizable component depends on the extent to which it is replenished.***
An Indian northeast monsoon (NEM) season of October to December and southwest monsoon (SWM) season of June to September is chief rainy season its annual rainfall realised during this season. Further, the NEM season is also the primary cyclone season for the North Indian Ocean (NIO) basin comprising of the Bay of Bengal (BOB) and the Arabian Sea (AS). The recent NEM season of 2015 saw an extreme seasonal rainfall scenario, it was +52% excess over the Tamil Nadu. So that, unprecedented floods over the east coastal region was the worst deficient scenario in the last 140 years.
The objectives of this study to find out the intensity of rainfall and water fluctuation in the Kanchipuram district, Tamil Nadu, India. Statistical methods of Rainfall Variability and Rainfall Ratio was used monthly, yearly rainfall data for last 17 years and ground water level for last 14 years in the selected 47 villages, 7 taluks and also to know the rainfall projection ARIMA model has used. It is found that the rainfall of different intensities in yearly, monthly, for Kanchipuram district is not statistically significant.
Keywords: Rainfall, Ground Water Level, Rainfall Variability, Rainfall Ratio, ARIMA.

I. INTRODUCTION

Rain is liquid water in the form of droplets that have condensed from atmospheric water vapor and then become heavy enough to fall under gravity.

Rain is a major component of the water cycle. Water plays an important role for the survival of human lives, which is invisible is considered as pure in nature and is used for drinking, domestic, agriculture and livestock. Further, water is one of the essential elements for the economic development. Besides rural areas the main employment is agricultural, they mainly depend on rainfall. An Indian northeast monsoon (NEM) season of October to December and southwest monsoon (SWM) season of June to September is chief rainy season its annual rainfall realised during this season. However, for the extreme south-eastern state of Tamil Nadu normal rainfall realised is only about 35% as this comes under the rain-shadow region during the SWM.

The state of Tamil Nadu gets rainfall during southwest monsoon June to September and northeast monsoon October to December. It receives an average rainfall 1247.33 mm of which 60% is contributed by the NE monsoon from October to December, which brings heavier rainfall un this season; the rest is during the SW monsoon, that is from June to September. The pre-monsoon rainfall is almost uniform throughout the coastal regions receive more rainfall than the interior ones. The water level increase in December to January the maximum ground water level found in 0.8 meter and minimum water level is 6.86 meter the normal water level is 1.6 meter. Therefore, rainfall pattern, extreme rainfall events etc. are very important among these are continuous monitoring of groundwater level variation in rainfall.

Several research works have been carried out around the world to understand the relation between rainfall and ground water level (Ramesam 1982, Jacks 1973, Hudson et. al., 1997). Hijioka et al., 2014, it is pointed out that “Over India, the increase in the number of monsoon break days and the decline in the number of monsoon depressions are consistent with the overall decrease in seasonal mean rainfall”. So far, no systematic rainfall forecasting study has been carried out in the Kanchipuram district, Tamil Nadu. Hence, in the present study, an impact of rainfall in water level fluctuation thorough understanding of groundwater regime in lower palar river basin Kanchipuram district.

II. STUDY AREA

The temple city of Kanchipuram district is situated (Figure No. 1) on the northeast coast of Tamil Nadu. It lies between 11° 00' to 12° 00' latitudes and 77° 28' to 78° 50' longitude. The district has a total geographical area of 4,43,210 hectares and a coastline of 57km. The total forest area in the district is 23,586 hectares. It covers an area of 234 sq.km extending approximately 18 km along north and south and about 13 km along east and west. The maximum elevation is 94 m above mean sea level in the eastern side of the study area and the minimum elevation is about 50 m above mean sea level. Generally, the area slopes towards east.

Palar river basin is one of the major river basins in Tamil Nadu. It originates from Nandhi Durg District in eastern part of Karnataka State, passes through the hilly portion of South Western part of Andhhra Pradesh, enters Tamil Nadu. Palar is not a perennial river, and most of the period it is in a dry state except very few rainy days per year. During rainy season, flow will be there only for about 40-45 days. Since the river bed is very porous, most of the water seeps through and reaches the ground water table. The main mode of water supply from palar river is through infiltration wells and infiltration galleries. At present ground water is utilized for irrigation, industry and domestic requirements.

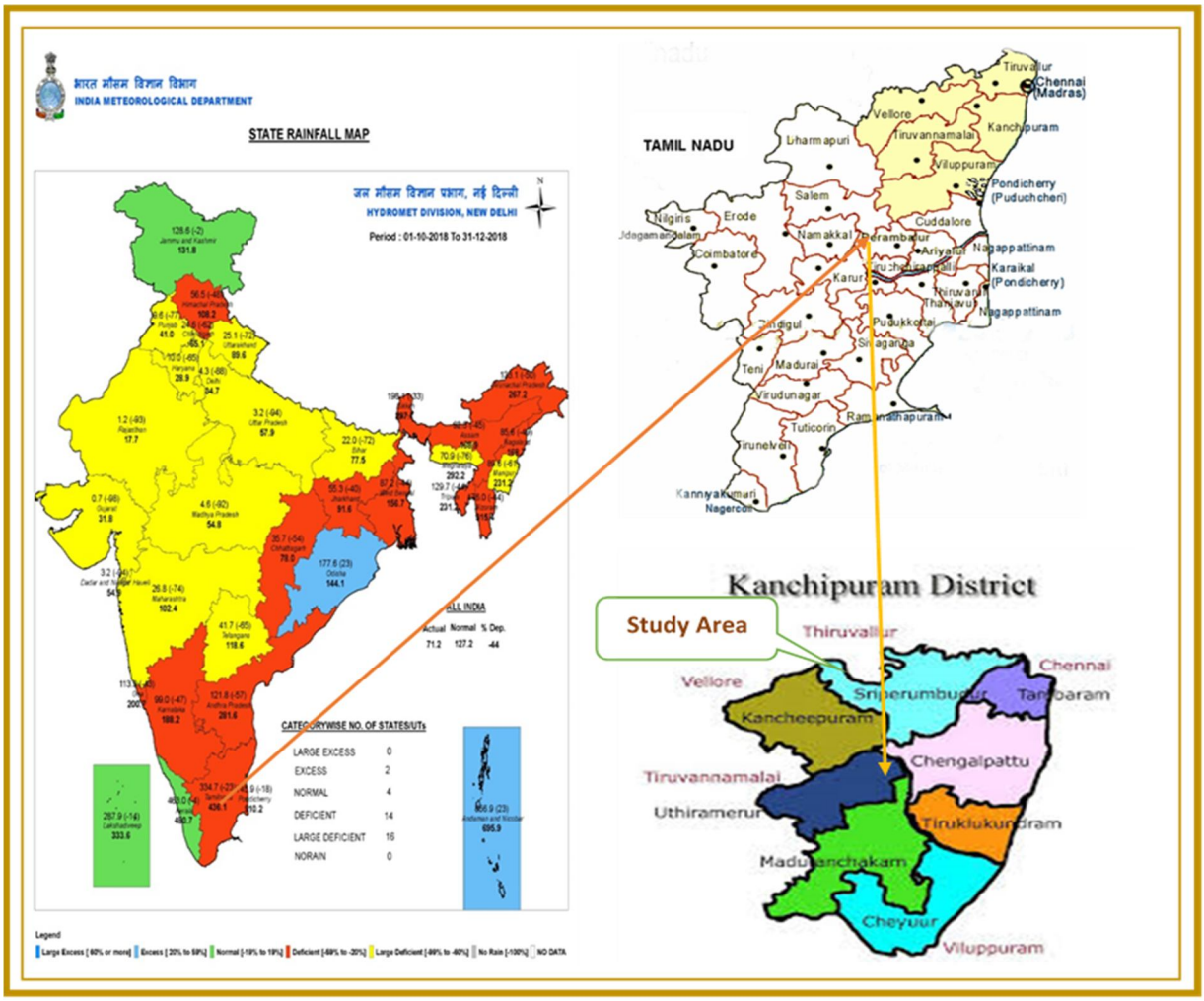


Figure No-1, Location map of study area

A. *Climate and Rainfall*

The study area has dry climatic condition with the maximum temperature of circa 37^0C during the months of April and May, minimum temperature of circa 21^0C during the month of November and December. The mean relative humidity of the basin varies from 37% in the month of March to 85% in the month of December and January average wind speed is generally moderate ranging from 4.9km/hr during October to 9.9 km/hr during July as observed at Kanchipuram IMD observatory.

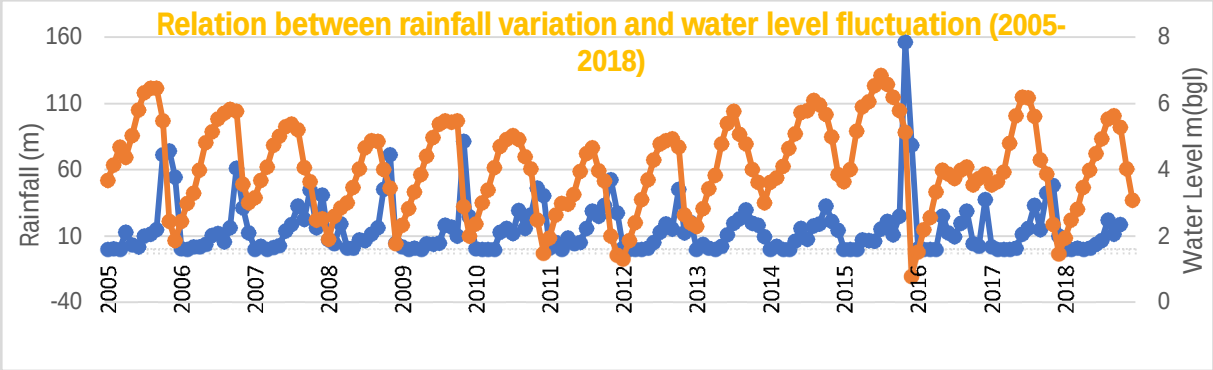


Figure No-2, Rain fall between water level fluctuation and rain fall variation (2005-2018)

The normal annual rainfall over the district varies from 883.15 mm to 1564.32 mm. Higher rainfall was received during 2015 as per last 17 (2002-2018) years rainfall records and that was heavy flood in the coastal region of Bay of Bengal. The rainfall fluctuation graph is prepared on the basis of monthly rainfall data (Figure No.2) In the present analysis the rainfall data has been collected from 14 rain-guage stations located in and around the Kanchipuram District (Table.1). The highest rainfall of Tambaram 494.2 mm on the eastern side and lowest rainfall of 210 mm on the western side Uthiramerur. Moreover, the average rainfall in some of the adjoining stations are e.g. Karunkuzhi (212 mm), Kelambakkam (265.5 mm), Madurantakam (277 mm), Mamallapuram (339.9 mm), Kanchipuram (342 mm), Meenambakam (354.1 mm), Cheyyur (375.5 mm), Chengalpattu (392 mm), Padappai (445.2 mm), Chembarmpakm (475 mm) and Pankatucheri (487.6 mm).

Rainfall Statistical Properties of Kanchipuram District (2002-2018)

S.No	Station Name	Yearly Mean	Monthly Mean	Standard Deviation	Coefficient of Variaion in %	Lowest Value	Year of Occurrence	Highest Value	Year of Occurrence
1	CHEMBARMPAKM	1374.93	115.56	31.42	27.19	1.00	11.10.2004	475.00	02.12.2015
2	CHENGALPATTU	1164.52	98.00	30.65	31.28	0.30	07.06.2017	392.00	02.12.2015
3	CHEYYUR	883.15	74.32	27.37	36.83	0.20	19.10.2013	375.50	02.12.2015
4	CHENNAI _MEENAMBAKAM	1449.25	127.97	27.83	21.75	0.10	27.09.2017	354.10	02.12.2015
5	KANCHEEPURAM	1255.05	105.62	29.33	27.77	0.10	16.05.2015	3420.00	13.11.2015
6	KARUNKUZHI	1239.79	104.34	25.52	24.46	0.30	28.10.2003	212.00	29.10.2007
7	KELAMBAKKAM	1216.04	102.34	27.21	26.59	0.10	25.07.2005	265.50	16.11.2015
8	MADURANTAKAM	1116.42	93.96	27.12	28.86	0.40	8.10.2007	277.00	02.12.2015
9	MAMALLAPURAM	1346.23	113.30	31.64	27.93	0.60	17.07.2002	339.90	02.12.2015
10	PADAPPAI	1232.55	103.72	33.67	32.46	0.40	22.07.2010	445.20	02.12.2015
11	PANKATUCHERI	1564.32	131.65	37.56	28.53	0.10	10.08.2011	487.60	02.12.2015
12	SRIPERUMDUR	1207.30	101.60	27.28	26.85	0.30	28.06.2013	379.60	02.12.2015
13	TAMBARAM	1206.25	101.51	29.68	29.24	0.10	11.09.2010	494.20	02.12.2015
14	UTHIRAMERUR	1206.86	101.56	25.95	25.55	0.50	26.11.2017	210.00	16.11.2015

Table No. 1Source: State ground and surface water resource data centre, Taramani, Chennai

B. Ground Water Level

Ground water levels change for many reasons. Some changes are due to natural phenomena and caused by men's activities. Study area monsoon period covers October to December. The water levels have collected from various wells in and around the study area there are 7 taluks 45 villages in the Kanchipuram district among these villages, present study area from 2002-2018 for the 14 years an average ground water levels taken as maximum and minimum value. The maximum ground water level has located in the village of Tambaram 9.86 m and minimum ground water level has located Palayersevaram (Sankarapur) 1.23m Kanchipuram district.

MONTH / YEAR	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	Mean
2005	3.70	4.15	4.69	4.38	5.04	5.81	6.33	6.47	6.48	5.48	2.46	1.88	*4.74*
2006	2.45	3.00	3.30	4.00	4.83	5.16	5.54	5.73	5.84	5.77	3.57	3.02	*4.35*
2007	3.17	3.70	4.10	4.76	5.02	5.31	5.40	5.21	4.08	3.66	2.50	2.54	*4.12*
2008	1.91	2.61	2.86	3.02	3.48	4.05	4.67	4.90	4.88	4.03	3.47	1.79	*3.47*
2009	2.34	2.84	3.35	3.87	4.42	4.98	5.39	5.48	5.45	5.48	2.91	2.02	*4.04*
2010	2.38	3.01	3.41	4.08	4.71	4.93	5.04	4.92	4.41	4.05	2.49	1.50	*3.74*
2011	1.95	2.65	2.99	2.98	3.27	3.96	4.50	4.67	3.98	3.68	2.01	1.44	*3.17*
2012	1.32	1.88	2.42	3.11	3.72	4.32	4.80	4.89	4.94	4.70	2.66	2.39	*3.43*
2013	2.30	2.85	3.44	3.84	4.79	5.42	5.78	5.09	4.79	4.03	3.64	3.01	*4.08*
2014	3.64	3.78	4.11	4.66	5.10	5.74	5.80	6.10	5.98	5.68	5.01	3.86	*4.96*
2015	3.66	4.03	5.19	5.91	6.06	6.55	6.86	6.59	6.21	5.80	5.14	0.80	*5.23*
2016	1.53	2.20	2.58	3.34	4.00	3.89	3.76	4.00	4.09	3.56	3.76	3.88	*3.38*
2017	3.55	3.65	3.95	4.82	5.64	6.20	6.18	5.63	4.31	3.89	2.37	1.47	*4.31*
2018	1.95	2.50	2.83	3.48	4.01	4.50	4.95	5.54	5.65	5.29	-	-	*3.99*

Table No.2

III. MATERIALS METHODS AND MODELLING

A. Material

In order to meet the objectives of the study the following data's and software has been used.

1) Rainfall data for the year 2002 to 2018 and Ground Water Level data for the year 2005 to 2018 collected from State ground and surface resource data centre, water resources department, Public Works Department. Tharamani, Chennai, Tamil Nadu.

2) Forecasting of rainfall Eviews-6 software was used for all analytical work.

3)

B. Methods

1) *Rainfall Variability:* The coefficient of variability expressed by Bhargava et al (1977) by the formula of coefficient of rainfall variability.

$$C.V = \frac{Standard\ deviation}{Mean\ Annual\ rainfall} X100$$

Where,

C.V is Coefficient of Variability,

Coefficient of variability has been worked out for all the 14 stations on a yearly basis (Table-1). It is known that the areas of high rainfall have low rainfall variability and the low rainfall areas have high variability. From the analysis, the annual rainfall variability of the Kanchipuram district area ranges from 21.75 to 36.83%. in the Cheyyer is low rainfall high variability Pankatucheri is high rainfall low variability.

2) *Rainfall Ratio:* Rainfall ratio denotes the abnormality in the occurrence of rainfall at any location. The rainfall ratio can be analysed by the formula (Bhargava et al (1977).

$$Rainfall\ Ratio = \frac{px - pn}{pm} X100$$

Where,

px and pn represent maximum and minimum yearly rainfall amongst over a series of years, pm is the average annual rainfall. Higher ratio indicates high abnormalities and lower values denote greater stability of rainfall (Table.1).

From the analysis of rainfall ratio of all the stations of the Kanchipuram district the ratio varies from 17.08 to 42.50%. the region shows high rainfall ratio denoting that there could be much variation in annual rainfall from the average annual rainfall of a normal year.

IV. RESULT AND DISCUSSION

A. Ground Water Level Fluctuation

Groundwater levels change for many reasons. Some changes are due to natural phenomena and other are caused by man's activities. From the year 2005 to 2008 the ground water levels shown some significant change and the water level has fluctuated in many areas.

1) Ground Water Level Fluctuation

Table No.3

S. No	Taluk	Well /Village Name	NORTHING	EASTING	2005	2018	Fluctu-ation
1	CHENGALPATTU	Thiruporur	12°43'10"	80°11'00"	2.42	1.69	0.73
2		Muttukkadu	12°48'45"	80°14'36"	3.97	4.59	-0.62
3		Kannivakkam	12°48'06"	80°05'14"	5.73	5.82	-0.09
4		Chengalpet-police Qtrs.	12°41'48"	79°58'34"	3.69	4.40	-0.71
5		(Palur Village) Devanur	12°45'26"	79°55'33"	4.29	3.71	0.58
6	CHEYYUR	Ammanur	12°22'05"	80°00'10"	4.65	4.63	0.02
7		Kadapakkam	12°16'53"	79°59'29"	4.10	2.97	1.13
8		Kadugupattu	12°25'38"	80°01'10"	4.45	3.89	0.56
9		Kolathur	12°24'40"	79°55'10"	2.30	3.01	-0.71
10		Mugaiyur	12°24'00"	80°05'50"	4.88	3.67	1.21
11		Vilambur	12°18'20"	80°00'40"	6.28	6.79	-0.51
12	KANCHEEPURAM	Babashahib Pettai	12°48'16"	79°46'56"	6.78	4.72	2.06
13		Kancheepuram	12°50'33"	79°41'22"	2.48	2.91	-0.43
14		Kancheepuramwarehouse	12°49'29"	79°42'42"	3.08	3.91	-0.83
15		Kannadiar Kudisai	12°46'52"	79°49'06"	4.08	3.59	0.49
16		Kilkadirpur	12°50'31"	79°41'22"	9.84	7.20	2.64
17		Magaral	12°43'05"	79°45'14"	3.56	2.39	1.17
18		Navettukulam	12°51'45"	79°52'32"	2.72	2.26	0.46
19		Orikkai Water Works damal	12°48'00"	79°42'14"	6.85	7.20	-0.35
20		Palayersevaram (Sankarapur)	12°46'57"	79°51'18"	1.85	1.23	0.62
21		Thenampakkam	12°48'31"	79°44'41"	2.42	2.45	-0.03
22	MADURANTAKAM	Acharapakkam Mosque	12°24'13"	79°48'59"	3.71	3.04	0.67
23		Acharapakkam Sangukulam	12°24'12"	79°48'54"	3.71	3.54	0.17
24		Chitravadi-1	12°28'02"	79°54'38"	6.27	3.40	2.87
25		Chitravadi-2	12°27'52"	79°54'24"	5.03	9.25	-4.22
26		L.Endathur	12°31'04"	79°46'12"	6.66	3.45	3.21
27		Madhuranthagam Taluk Offi	12°30'33"	79°53'12"	4.01	3.49	0.52
28		Malaivaiyavur	12°35'38"	79°53'37"	3.97	3.44	0.53

29		Vinayaganallur	12°33'51"	79°50'46"	4.83	3.11	1.72
30	SRIPERUMDUR	Chettipedu	13°00'59"	80°00'26"	3.24	3.48	-0.24
31		Maduramangalam	12°57'07"	79°49'03"	4.97	2.20	2.77
32		Pwd Lake	12°58'21"	79°56'27"	2.25	2.20	0.05
33		Thirumangai	12°58'18"	79°57'05"	1.99	1.97	0.02
34	TAMBARAM	Akkarai	12°53'55"	80°15'05"	3.53	2.50	1.03
35		Injambakkam	12°54'37"	80°14'59"	3.65	3.38	0.27
36		Maduraipakkam	12°52'07"	80°10'11"	4.15	3.41	0.74
37		Pallavaram	12°58'04"	80°09'01"	7.69	7.32	0.37
38		Pallikaranai	12°56'04"	80°12'13"	3.66	3.63	0.03
39		Tambaram	12°55'52"	80°07'00"	7.60	9.86	-2.26
40		Thiruneermalai	12°57'46"	80°06'47"	7.91	6.40	1.51
41		Vengivasal	12°55'02"	80°10'14"	4.11	7.59	-3.48
42	UTHIRAMERUR	Kavanipakkam	12°43'19"	79°53'36"	3.78	3.80	-0.02
43		Menallur	12°35'01"	79°44'29"	5.65	5.24	0.41
44		Uthirameru Sathakam St	12°37'02"	79°45'13"	2.68	1.62	1.06
45		Uthiramerur Nasarath pet	12°36'58"	79°45'15"	2.89	2.01	0.88

Source: State ground and surface water resource data centre, Taramani, Chennai

Ground water fluctuation L.Endathur village has shown in maximum fluctuation with 3.21m increase in depth. Then the other villages are Chitravadi-1 and Vinayaganallur with in increased depth of 2.87m and 1.72m respectively in Madurantakam Taluk. Out of the 45 well totally of 31 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 0.98m. There are 14 wells have seen decrease in the depth below the ground (or increase in water level). The average increase in water level is (-) 0.73m. The ground water levels have shown some significant change and water levels are fluctuated in many areas viz Chengalpattu and Tambaram in the Kanchipuram district (Table.4).

2) Impact of Rainfall for Groundwater Level

Table No.4

S.No	Rainfall Locations & Ground Water Location	NORTHING	EASTING	Rainfall in mm			Ground Water level in Meter		
				2005	2018	Fluctuation	2005	2018	Fluct-uation
1	CHENGALPATTU	12°42'03"	79°58'41"	2033.60	152.00	-1881.60	4.02	4.13	0.11
2	CHEYYUR	12°21'11"	79°59'53"	1726.39	551.50	-1174.89	4.78	4.19	-0.59
3	KANCHEEPURAM	12°50'00"	79°42'07"	1594.50	1086.30	-508.20	4.75	4.06	-0.69
4	MADURANTAKAM	12°30'33"	79°53'08"	1347.80	849.40	-498.40	4.89	4.11	-0.78
5	SRIPERUMDUR	12°58'01"	79°56'37"	1805.00	989.70	-815.30	3.11	2.46	-0.65
6	TAMBARAM	12°56'06"	80°07'37"	1702.20	1138.80	-563.40	4.95	5.08	0.13
7	UTHIRAMERUR	12°36'55"	79°45'22"	1385.00	758.00	-627.00	3.74	3.17	-0.57

B. Modelling by ARIMA

The Box-Jenkins methodology (Box and Jenkins (1976) assumes that the time series is stationary and serially correlated. ARIMA linear models have dominated many areas of time series forecasting. Autoregressive (AR) models can be effectively coupled with moving average (MA) models to form a general and useful class of time series models called Auto Regressive Moving Average (ARMA) models. In ARMA model the current value of the time series is expressed as a linear aggregate of p previous values and weighted sum of q previous deviations (original value minus fitted value of previous data) plus a random parameter. However, an ARMA model can be used when the data are stationary and also can be extended to non-stationary series by allowing differencing of data series.

A time series is said to be stationary, it has constant mean and variance. The general seasonal ARIMA model is AR to order p and MA to order q and operates on dth difference of the time series; thus, a model of the ARIMA family is classified by three parameters (p, d, q) that can have zero or positive integral values. The general seasonal ARIMA model may be written as

$$\phi(B)\nabla^d x_t = \theta(B)\varepsilon_t$$

Where,

ϕ(B) and θ(B) = Polynomials of order p and q, respectively.

$$\phi(B) = (1 - x_1 B - \phi_2 B^2 - \phi_p B^p)$$

And

$$\theta(B) = (1 - x_1 B - \phi_2 B^2 - \phi_p B^p)$$

Often time series possess a seasonal component that repeats every s observations. For monthly observations s = 12 (12 in 1 year), for quarterly observations s = 4 (4 in 1 year). Box et al. have generalized the ARIMA model to deal with seasonality, and define a general multiplicative seasonal ARIMA model, which are commonly known as SARIMA models. In short notation the SARIMA model described as ARIMA (p, d, q) x (P, D, Q) s, which is mentioned below:

$$\phi_p(B)\Phi_p(B^s)\nabla^d\nabla_s^D(Z_t) = \theta_q(B)\,\theta(B)\Theta_q\,(B^s)\varepsilon_t$$

In this work the statistical and econometric software Eviews-6 was used for all analytical work. It is based on the linear optimization criterion, its graphs forecasting rainfall is Fighre.3.

Changing in the Annual Rainfall for the period 2020 and end of 2050

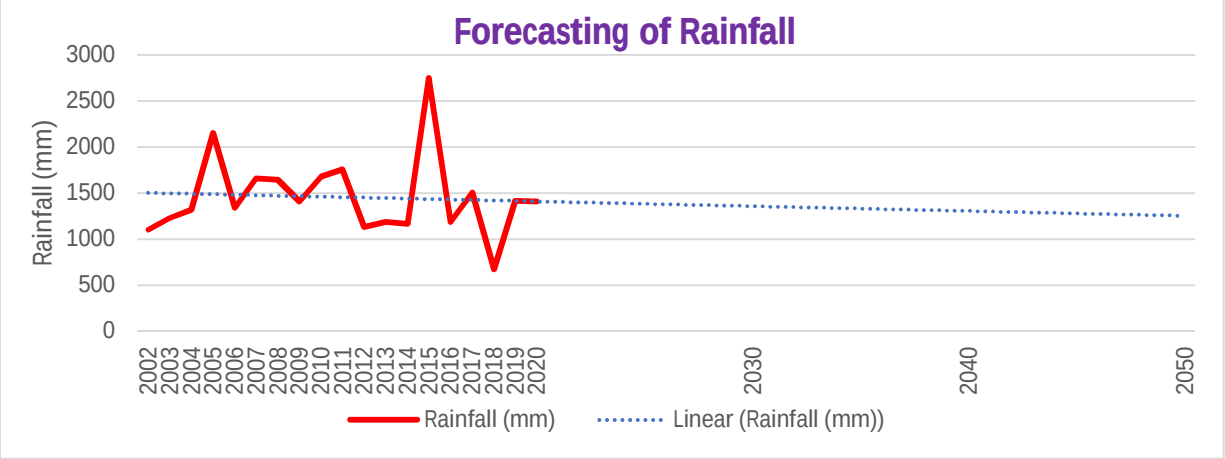


Figure No-3, Forecasting of Rainfall

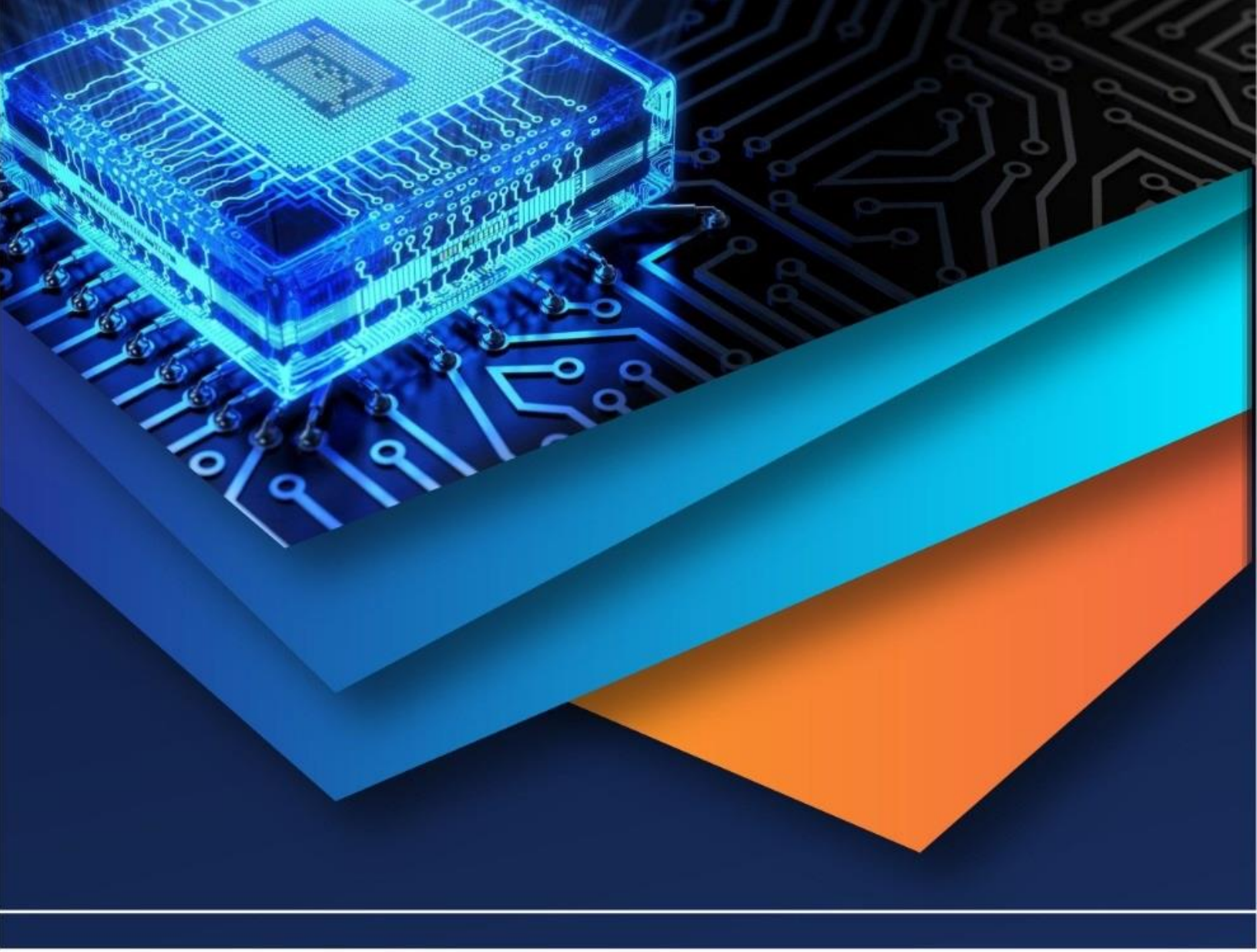
The projection periods 2020s, 2030s,2040s and end of the year 2050s, the rainfall forecasting general decrease of 5.26 mm, it's indicates that the series are stationary.

V. CONCLUSION

Study area of Kanchipuram district identified that ground water level fluctuation in many villages(wells). It is also noted from the graphs that major decrease of rainfall is found in the Kanchipuram district. The annual rainfall may reduce 5.29 mm at the end of 2050s as per the emission scenario of forecasting. As perscholar's survey Kanchipuram district consequently required yearly normal rainfall. Otherwise people should face the problems of water scarcity in upcoming days.

REFERENCES

[1] Rediat, T., 2012, "Statistical analysis of rainfall pattern in Dire Dawa, Eastern Ethiopia using descriptive analysis, cross spectral analysis and univariate Box-Jenkins method", M. Sc. thesis submitted to the Department of statistics, University of Addis Ababa, Ethiopia.
[2] Based on Actual rainfall in comparation to average annual for the region, Tamil Nadu.
[3] Based on the data provided from Indian Metrological Department, Chennai.
[4] 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.
[5] Amha, G. and Sharma, M. K., 2011, "Modeling and forecasting of rainfall data of Mekele for Tigray region (Ethiopia)", Statistics and Applications, 9, 1&2, (New Series), 31-53.
[6] IMD, 2013.Temperature of Kanchipuram District. Regional Meterological Centre, Chennai. http://www.kanchi.nic.in/district_profile_pro.html
[7] 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.
[8] 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.
[9] Sontakke, N. A., 1993, "Fluctuations in NE monsoon rainfall over India since 1871, In Advances in tropical meteorology", R. N. Keshavmurty and P. C. Joshi, (Eds) , Tata Mc Graw Hill, New Delhi, 149-158.
[10] Singh, N. and Sontakke, N.A., 1999, "On the variability and Prediction of rainfall in the post monsoon season over India", Int. J.Clmatol., 309-339.
[11] Suhartono, 2011, Time series forecasting by using seasonal Autoregressive Integrated Moving Average: Subset, multiplicative or additive model, J. of Mathematics and Statistics, 7(1), pp: 20-27.



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