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SPATIAL TEMPORAL VARIABILITYOF RAINFALL TRENDS ANALYSIS IN NAGAPATTINAM COASTAL ZONE, TAMIL NADU

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Abstract: *The present study involves intensive of rainfall data and Drought assessment of the Nagapattinam taluk during 1980-2017 using graphical statistical method. Rainfall data for the past 30 years were analysed to the distribution of rainfall and to assess the rainfall pattern changes. The maximum average annual rainfall recorded in the year (2004)-254.88 cm at Thirupoondi station, and minimum rainfall recorded in the year (1980) was 7.67 cm in Thiruvaraur station. The highest rainfall observed in Thalanayar, Thirupoondi, Muthupet and Nagapattinam compared with other station from 950 mm to 1500 mm.In 1980-81, 1982-83,1995-96,2001-02, 2002-03, 2012, 2016, 2017the rainfall has not followed a regular pattern of sinusoidal array, and it is greatly disturbed by the complicated climate system.*

Key words: Rainfall intensive, Climate change, Monsoons and Drought assessment.

Introduction

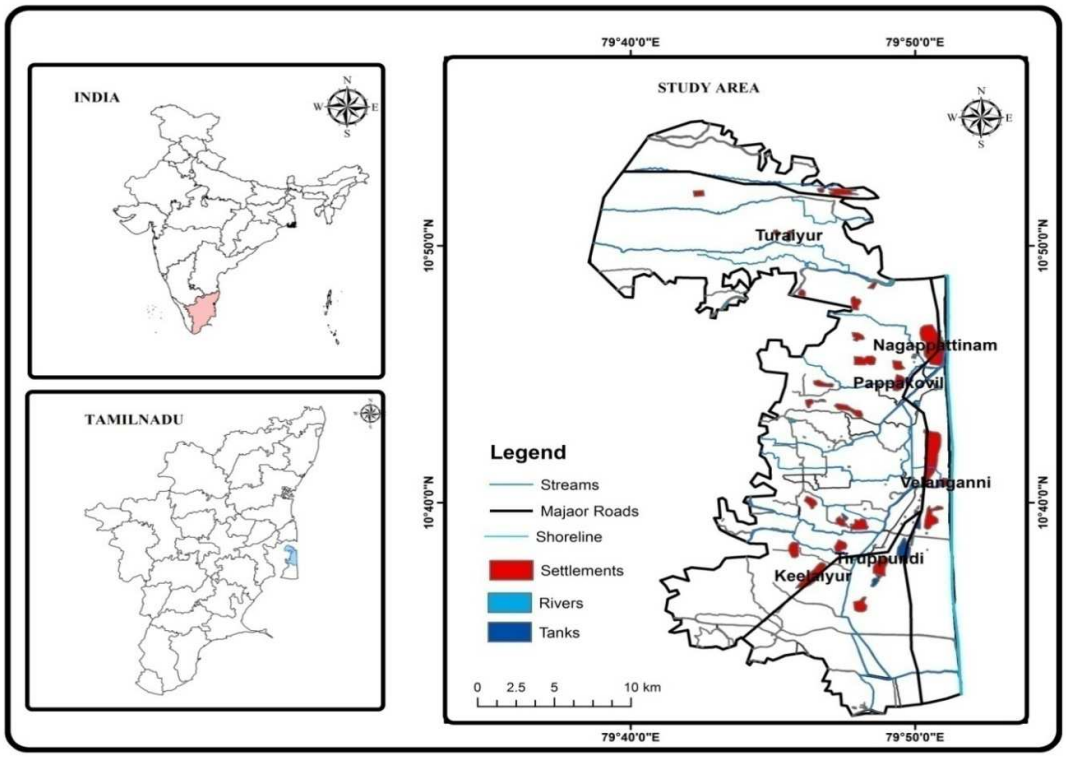
The rains may cause heavy inflow of water in the rivers and jungle streams, odais etc. These water courses then become too narrow to carry large volume of water which flows. Therefore the water overflows thereby breaching embankments, causes enormous damages to houses, huts, agricultural lands, roads, telephone lines, railway tracks, electricity lines and other public properties. Seetharam (2013) studied the rainfall regime and pattern in past and future trends in the rainfall pattern for the drought monitoring and management. Venkatraman et al., (2013) have studied the Rainfall of Dindigul district and reveal the variation in the trends. The rainfall distribution and trend for Salem district were analysed in Gurugnanam et al., (2010), and they have used the GIS tool to map the spatial distribution of rainfall. The result shows the variation with the amount of precipitation in the particular domain. As the rainfall trends of Tamil Nadu has been studied by many authors, the influence of climate change on precipitation pattern in last 50 years has studied, and the domain characterizations were done by Suhatharahima et al., (2013).The rainfall history had utilized to define climate change in Coloroda by McKee et al., (1993) and also Parthasarathy et al., 1993) studied homogeneous Indian Monsoon rainfall series over the period 1971 -1990. Iwashima et al., 1993: Karl et al., 1995: Mason et al., 1999 have revealed the importance of rainfall study and they had used daily rainfall and extreme rainfall records to investigate changes in the frequency of extreme rainfall.

Study area description

Nagapattinam taluk, Tamil Nadu State of Southern India, lies between Northern Latitude $10^0$46'16'' and $79^0$50'50'' Eastern Longitude. Nagapattinam is known for its rich religious heritage and communal harmony with the total population of 282784 as per 2011 census. Male population is around 139917 and female population is 142867, number of house hold in this taluk is 70683. The area receives rainfall under the influence of both southwest and northeast monsoon. A good part of the precipitation occurs as during very intensive storms resulting mainly from cyclones generated in the Bay of Bengal especially during the northeast monsoon. The rainfall pattern of the district shows interesting features, annual precipitation, which is around 1500 mm, the southern part of the district and it decreases about 1100 mm towards the northern part of the district. The area enjoys humid and tropical climate with hot summers, significant to mild winters and moderate to heavy rainfall. The temperature varies from 40.6 to

19.3° C with sharp fall in night temperatures during monsoon periods. The relative humidity ranges from 70 - 77% and it is high during October to November. (Fig. 1.)

Figure 01: Study Area Description



Methodology

The rainfall data have collected from Department of Economics and Statistics, Chennai. The mean annual rainfall has analysed graphically, and the rainfalls received in the past decades have correlated with each other. The trends of the rainfall data were taken into Excel for each decade has represented and analysed by a graphical and statistical method.

RESULTS AND DISCUSSION

Rainfall pattern

Rainfall Pattern for the 32 years from 1980 to 2012 shows much variation in every year. (Table-2).shows that amount of average annual rainfall recorded in the study area. However considerable variation from this rainfall observed in various parts of the study area. The maximum average annual rainfall recorded in the year (2004)-254.88 cm at Thirupoondi station, and minimum rainfall recorded in the year (1980) was 7.67 cm in Thiruvaraur station. The highest rainfall observed in Thalanayar, Thirupoondi, Muthupet and Nagapattinam compared with other station from 950 mm to 1500 mm. Most of the rainfall is received between October and December in the influence of Northeast monsoon. Rainfall is higher in the coastal areas and progressively decreases towards inland.

The spatial distribution of rainfall in the Nagapattinam areas shows highly heterogeneous. Rainfall intensity amount is higher in the coastal region compared with inland area. (Fig.2. and Fig.3.). An analysis of annual rainy days indicates that there is no change in the Cauvery basin in the last 100 year period, however, the river basins north and south of the Cauvery basins have experience decreasing trend by -3.6 per cent and -32.3 per cent. The quantified changes in annual rainfall and number of rainy days are indicated in (Table -1) at annual and seasonal levels. (Jain and Kumar 2012).

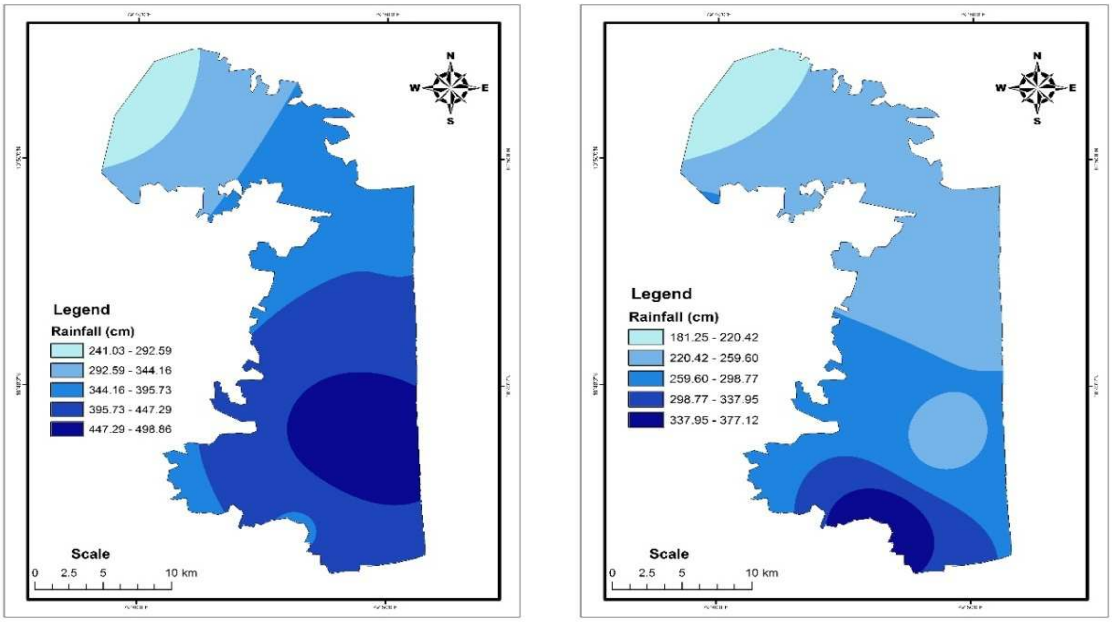
Table 01: Details of Cauvery delta E Rainfall Trends

Basin	Annual		Pre monsoon		Monsoon		Post monsoon		Winter	
	Rainfall (mm/yr)	Rainy days (Days/yr)	Rainfall (mm/yr)	Rainy days (Days/ yr)	Rainfall (mm/yr)	Rainy days (Days/ yr)	Rainfall (mm/yr)	Rainy days (Days/ yr)	Rainfall (mm/ yr)	Rainy days (Days/ yr)
EF1[1]	0.0445	-0.032	-0.345	-0.032	-0.214	-0.047	0.659	0.00	0.197	0.00
Cauvery	0.879	0.00	-0.563	0.00	0.075	0.028	1.748	0.05	0.024	0.00
EF2[2]	-0.95	-0.333	-0.8	-0.143	-0.5	-0.125	0.491	0.00	-0.246	-0.032

1. EF1- East flowing river basins that are north of the Cauvery river Basin
2. EF2 – East flowing river basins that are South of Cauvery river Basin

Figure 02: Rainfall distribution map in North-east monsoon (1985-2000)

a) 1985 b) 1990



c) 1995 d) 2000

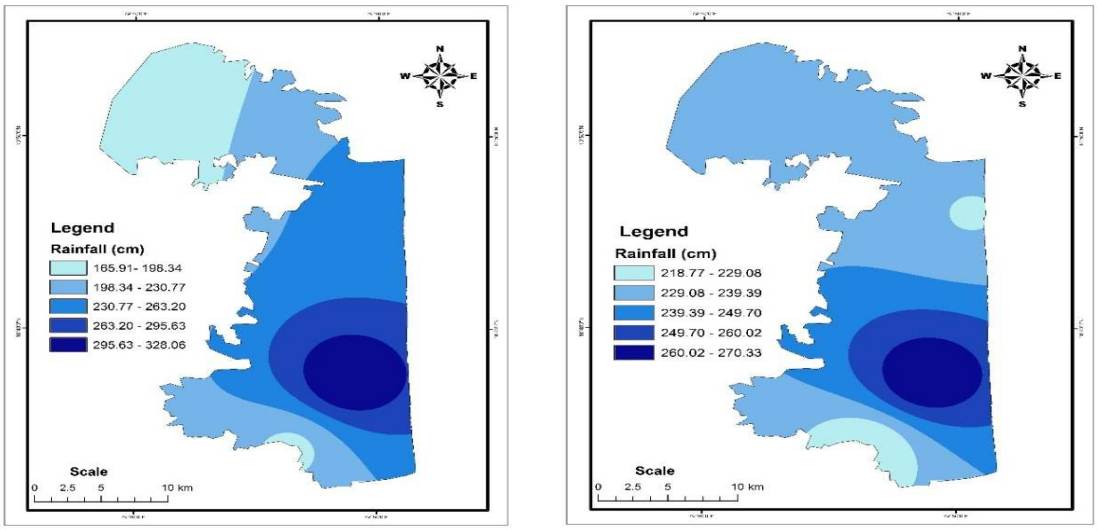


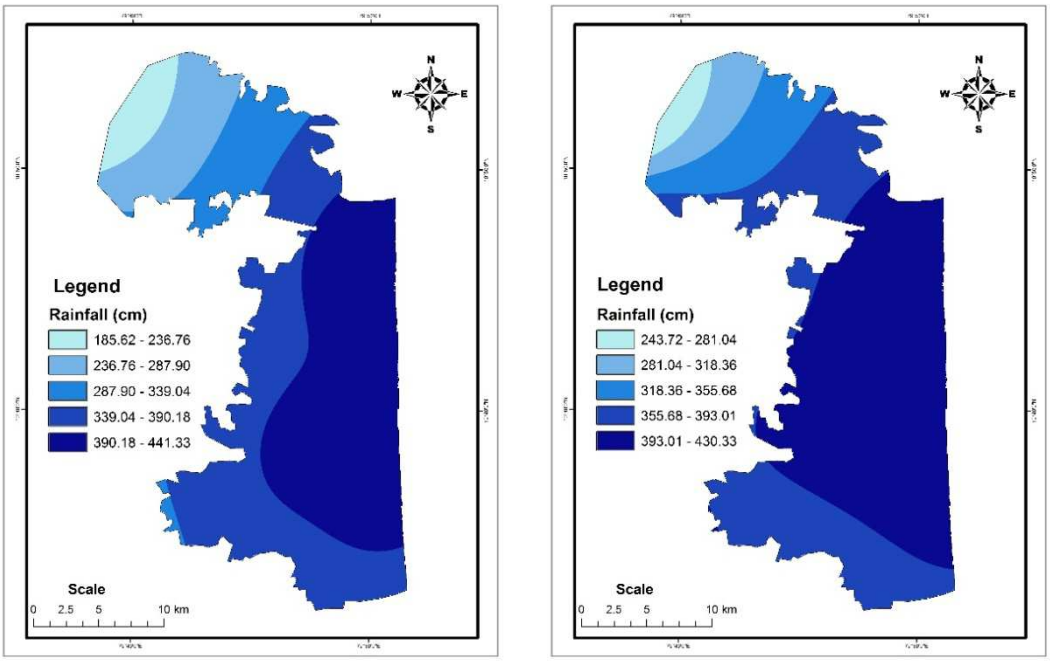
Table 02: Average annual Rainfall in (cm) 1980 to 2012

Rainfall station	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Nannilam	31.21	138.24	15.39	121.74	110.42	98.19	110.20	102.55	95.04	78.14	89.63	94.87	78.18	147.53	83.46	85.26	125.13	126.41	98.18
Nagappattinam	69.03	116.48	92.77	133.55	126.58	150.22	113.34	111.50	99.28	99.46	111.31	131.98	67.93	128.93	89.43	98.91	135.64	129.02	92.33
Tirupoondi	80.22	128.13	61.86	130.54	146.30	162.06	128.78	97.64	107.47	109.34	101.83	131.53	76.23	115.33	74.20	123.68	151.38	184.04	137.17
Tiruthuraipoondi	7.67	114.03	60.49	94.97	95.91	125.08	102.77	91.18	94.50	94.28	84.73	95.98	85.75	131.63	76.43	106.49	151.26	107.06	112.18
Muthupettai	61.73	118.43	91.95	114.65	108.48	128.33	96.30	91.18	80.48	82.78	101.33	95.17	79.02	144.63	88.65	82.45	142.43	94.98	101.61
Thiruvarur	59.33	142.25	76.74	129.40	105.10	129.67	122.17	83.14	95.44	94.09	129.08	92.53	94.20	164.09	85.34	86.63	128.90	124.22	99.08
Thalanayar	69.85	27.54	84.58	130.97	133.38	143.79	118.25	98.25	138.75	140.58	167.08	193.94	111.88	173.96	69.02	88.84	122.66	132.44	110.83
Vedaranyam	81.63	132.94	-	107.18	154.83	160.25	101.51	97.10	109.20	108.26	120.19	103.13	72.99	143.67	84.38	88.18	150.03	87.43	140.00

Rainfall station	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Nannilam	104.65	108.67	100.68	45.59	143.34	169.68	113.60	117.63	121.65	87.73	85.26	114.72	40.40	92.91
Nagappattinam	142.97	112.95	121.07	109.78	92.81	162.70	152.07	135.06	118.06	125.15	147.89	158.88	26.24	105.85
Tirupoondi	110.09	126.50	137.05	124.67	115.53	254.88	156.00	147.54	139.08	157.75	126.29	190.08	21.50	80.04
Tiruthuraipoondi	111.70	123.01	67.23	97.64	99.10	146.34	115.23	109.24	103.25	143.05	120.70	169.23	55.08	86.28
Muthupettai	87.20	107.18	82.16	98.17	90.04	117.23	91.38	103.66	115.94	180.81	120.54	163.73	73.22	80.88
Thiruvarur	81.41	105.60	49.50	100.75	64.70	181.99	118.38	119.66	119.93	127.96	128.14	166.12	60.17	111.36
Thalanayar	107.75	104.47	112.41	108.12	97.62	177.61	125.44	118.70	111.95	161.59	150.05	157.34	23.73	89.10
Vedaranyam	105.96	104.38	96.07	92.61	99.01	149.97	112.30	111.17	110.04	175.37	159.60	135.48	23.27	115.37

Source: Directorate of statistics and economics dept, Tamil Nadu.

Figure 03. Rainfall distribution map in Northeast Monsoon (2005-2010)



e) 2005 f) 2010

The Cauvery delta region is known for floods and drought in the same year in 1983-84, the South West monsoon was failure and in the month of the rainfall was low, there were severe drought conditions in the month of from July to October, in the month of December 1983 and January 1984 there was heavy rainfall fall the delta region leading to unprecedented floods, low lying areas especially in Nagapattinam district. Most of the villages were marooned for weeks. Then the year 1991 November heavy rainfall occurred in Nagapattinam district, completely damaged the crops, similarly in 1993 the severe cyclone occurred with high speed wind of 188 km/ph and damaged the entire delta region and 1100 people lost their lives. In the year 1995 not much rainfall recorded in this region. Major cyclonic event in the year 2000 November occurred with high speed wind of 189 km/ph, and 102 knots pressure caused severe damages to the delta district both lives and property mainly crop lands are damaged, 1000 kucha houses were partially damaged, 3000 plantation trees and 50,000 plantation, sapling got destroyed around 30,000 trees were uprooted in Nagapattinam district. Later in 2004 severe flood occurred in Nagapattinam district and damaged the agriculture land and property of the people around 12000 houses affected during 29, October, 2004.

Subsequently December 2004 Tsunami severely affected the Nagapattinam coastal region 8460 Ha cropland damaged 10,000 people lost their lives. Also in the year 2005 severe flood occurred in this region affected the Agriculture land during harvesting period. The cyclone named “Nisha” occurred with the intensity of T-3.0, wind pressure is 45 knots, 83 km/ph speed of occurred and loss of life 78 over state during 24th to 28th November, 2008 in Nagapattinam region due to heavy rainfall. Cyclonic storm Nilam was reported as tropical cyclone and directly affected the south India. Cyclone “Jal” in 2010 occurred around 33 people was killed. Cyclone “Thane” occurred in 2011 with the speed of 140 km/ph, hit the Tamil Nadu coastal areas near Cuddalore on Friday, 30, 2011, Nagapattinam and Cuddalore witnessed heavy wind and rainfall. Thane cyclone especially severe damaged to agriculture, tree covers, settlement in the place of the eastern coastal areas of Nagapattinam district.

Subsequently in October 2012 low pressure in formed in the Bay of Bengal near Nagapattinam caused heavy rainfall and severe flood occurred totally 5486 ha affected by flood water around 3150 people were affected lost their properties and evacuated. Another extreme event named “Madi” cyclone storm crossed the Nagapattinam coastal areas in December 2013 heavy rainfall and flooding occurred, caused damaged. Record keeping began in 1871, but a worsen northeast monsoon, which sweeps across Tamil Nadu, between October and December was recorded in 876, making 2016 the year of the second worst monsoon in 145 years.

Table 03: History of Natural Disasters in the Past Five Decades

Occurrence Date	Calamity	Damages
30.11.1952	storm surge in land up to 5 miles 400 lives	
08.12.1967	Cyclone	7 lives lost and 15,000 rendered homeless
12.11.1977	Cyclone	560 lives lost and 196 missing. Damages to port, irrigation systems, road, power supply and communication including large number of houses
01.12.1984	Floods due to heavy rain	Crops damaged in large scale and normal life affected due to heavy floods
15.11.1991	Heavy rainfall	Crops damaged
04.12.1993	Cyclone speed 188 km/ph	1100 people lost their lives, severe damage to crops
29.10.2004/Nov 2004	Floods due to heavy rain	Crops damaged, around 12,000 houses damaged
26.12.2004	Tsunami (Indian Ocean)	6065 dead and 1922 injured. 12,821 cattle lost, large number of houses, boats and infrastructure damaged
28.11.2008	Nisha Cyclone, due to heavy rain led to flood	Crops damaged, and several houses affected around Nagapattinam and Cuddalore
31.12.2011	Thane cyclone, speed140 km/ph	Cyclone killed as 33 person and standing crops on around 25,000 acres.
30.10.2012	Nilam cyclone, weak depression 550 km	Crops damaged
12.12.2013	Madi cyclone, Heavy rainfall	Low lying area only damaged
01.12.2016	Nada cyclone, Deep depression	Crops damaged in large scale and normal life affected due to heavy rainfall

Source: www.nagapattinam.nic.in

Recommendation

1. Move away from low-lying beaches or other location, which may be swept by high tides or storm waves. Leave sufficiently early before your way to high ground gets flooded. Do not delay and run the risk of being marooned.

2. Keep your T.V., Radio on and listen to latest weather warnings and advisories from the Doordharsan All India Radio station. Pass on the information to others as quickly as possible.
3. Be alert for high water in areas where streams of rivers may flood due to heavy rains.
4. If your house is out of danger from high tides and flooding from the river and it is well built it is then probably the best place to weather the storm. However please act promptly if asked to evacuate.
5. Remove cattle to safe place as far away as possible.
6. If the centre of eye of the storm passes directly over your place, there will be wind and rain lasting for half an hour or more. During this period stay in a safe place. Make emergency repairs during the pre-monsoon period, if necessary, but remember that strong winds will return suddenly from the opposite direction, frequently with even greater velocity.

Conclusion

The rainfall data were analysed graphically and found out the rainfall variations in last six decades. Rainfall data for 32 years analysed in season wise to assess the changes in the rainfall pattern and to identify the drought and extreme flood events in the study area. The result of the paper revealed that the rains may cause heavy inflow of water in the rivers and jungle streams, odais etc. These water courses then become too narrow to carry large volume of water which flows. Therefore the water overflows thereby breaching embankments, causes enormous damages to houses, huts, agricultural lands, roads, telephone lines, railway tracks, electricity lines and other public properties. It is not feasible to completely prevent nature's fury at one stroke.

References

1. Gurugnanam .B, Suresh. M, Vinoth. M. and Kumaravel. S (2010) High/Low Rainfall Domain Demarcation Mapping Using GIS at Salem District, Central Tamil Nadu. (ISSN 0974 - 6846).Indian Journal of Science and Technology. Vol. 3. No.5. pp.542-545.
2. Ishappa Muniyappa Rathod and Aruchamy. S., (2010), Spatial Analysis of Rainfall Variation in Coimbatore District Tamil Nadu using GIS, International Journal of Geomatics and Geosciences Volume 1, No 2,
3. Jain and Kumar (2012). Trend analysis of rainfall and temperature data for India SK Jain, V Kumar Current Science (Bangalore) 102 (1), pp 37-49
4. Kain, J.S., (2002), “The kain-Fritsch Convective Parameterization: An update”, Journal of Applied Meteorology, v.43, pp.170-181.
5. Mckee, T., Doeskin, N., and Kliest, J., (1993), the relationship of drought frequency and duration to timescale, Proceeding of 8th conference on Applied Climatology, pp.17-22, Boston, AMS.
6. Parthasarathy, B., Rupakumar, K., and Munot, A., (1993), Homogenious Indian Monsoon rainfall; Variability and prediction, Journal of Earth System Sciences, v.102, pp.121 -155.
7. Seetharam, K., (2013) Rainfall analysis over Rayala seema meteorological division, Mausam.
8. Suhatha Rahima. S, Gurugnanam. Band Isai. R, (2013), Climate change signals from seasonal and annual rainfall trend (1951 -2011) in Tamil Nadu India, Journal of Research, Development and Extension, (ISSN 2319-1899) v.1 no.11 pp.178-184.
9. Venkat Raman A.T.V.R, Gurugnanam B, and Arunkumar. M, (2013), One decade hydro meteorological data assessment through statistics, Dindigul district, Tamil Nadu, South India (ISSN 0976 – 4380), v.3 pp.659-667.