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RAINFALL FLUCTUATION AND FREQUENCY ANALYSIS OF ERODE TALUK, TAMILNADU, INDIA

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ABSTRACT

Precipitation is the most essential for horticultural reason yet the climatic components, the precipitation is the main list, ever considered by agriculturists. The precipitation information got from meteorological stations situated in Erode Taluk for a long time are gathered from Public Works Department (PWD) Therefore, the present study bargains the precipitation attributes of the Erode Taluk, which incorporates the precipitation vacillation as for spatial circulation utilizing GIS Technique. The precipitation varieties amid summer, winter, southwest storm and upper east rainstorm were dissected. Precipitation investigation was done in detail including the four seasons as arranged by the Meteorological Department. This investigation incorporates the investigations of occasional and spatial precipitation varieties. The study shows that an expanding pattern in precipitation focus is seen amongst January and May at all the stations and power of precipitation then reductions amid June and again increments till October. A pinnacle power of precipitation is seen amid October at all the precipitation stations. The region gets more precipitation amid the north-east rainstorm season and less precipitation amid the post-storm season.

Key words

Annual and seasonal rainfall, Monsoon Season, Spatial Distribution; Geographic Information System (GIS)

Academic Discipline and Sub-Disciplines

Environmental Engineering

SUBJECT CLASSIFICATION

Monthly and Seasonal variation of Rainfall

TYPE (METHOD/APPROACH)

Rainfall Fluctuation and Frequency Analysis

INTRODUCTION

Precipitation is a key climatologically calculate the regularly parched parts of the world and its study an essential for farming arranging in India, Alak Gadgil (1986). The populace increment and simultaneous requirement for existing water assets are for sure exceptionally settled truths (Vorosmarty et al. 2006). Precipitation is a key variable into the hydrological hover, paying little heed to the atmosphere of the area. In semi-dry locales precipitation measures were inside general of brief span and high power and regularly described by a vast level of spatial heterogeneity (Wheater et al. 2008). These qualities are significantly more purported in locales with topographic many-sided quality, for example, mountain ranges (Wilson and Guan 2004). The investigation of precipitation and groundwater level variety is exceptionally crucial. G.Vennila (2007) has dissected precipitation deviation investigation of Vattamalaikarai subbasin, Tamil Nadu, India. He has deciphered occasional, month to month variety, recurrence, and power of precipitation. The correlation between these has been widely utilized as a part of flow decades in light of its incredible importance in setting up the groundwater level. Regardless of the low thickness of rain gaged for the most part found in semi bone-dry districts, the spatial appraisals of precipitation are generally processed from point estimations utilizing entrenched spatial interjection methods, for example, Thiessen polygons. As the arrangement of extraordinary precipitation measures is an element of scale with the ability to highlight precipitation extremes expanding in venture by method for the Geographical Information Systems (GIS) innovation (Nageswara Rao, 2002). GIS has developed as a capable device for guideline, for research (Openshaw 1991; Longley 2000; Sui and Morrill 2004).

STUDY AREA

The study range falls in Erode Taluk which is situated in Erode District, an uncommon review Municipal Town which is arranged close to 100 km East of Coimbatore and is arranged on the bank of River Cauvery somewhere around 11°01'33.067" and 11°27'42.163" N scopes and 77°36'39.857" and 77°55'46.25" E longitudes. The Erode Taluk reaches out over a zone of 752.61 km2. The Erode Taluk comprises of three squares in particular Erode, Modakurichi and Kodumudi.The summer season starts right on time in March and the most elevated temperature is come to in April, May and achieving 400C. The Erode locale has hot climate with the exception of amid the storm season. The normal yearly precipitation of Erode area is 660.10 mm from four seasons' viz., winter, summer, North east storm, South west rainstorm. The ordinary yearly precipitation in Erode taluk is around 852mm.

MATERIALS AND METHODS

The month to month precipitation information was gathered from PWD for the time of ten years. The present study has been attempted to break down the precipitation information with a view to think about the frequency, power and periodicity of dry spells over the area. For this reason, yearly precipitation information for the accessible six stations, which spread over the locale, have been measurably broke down and comes about have been introduced as different maps and tables.

Rain Gauge Station

The rain gauges are introduced (PWD) to gauge the precipitation during the time at Erode, Bhavani, Chennimalai, Perundurai, Mettunasuvanpalayam and Ammapettai, as appeared in Figure 1. Month to month precipitation information for a 10-year time frame (2003 - 2012) were gathered from the Public Works Department, Tamil Nadu (PWD, 2006). Occasional conduct, spatial variety of precipitation force and recurrence circulation of precipitation has been concentrated on.

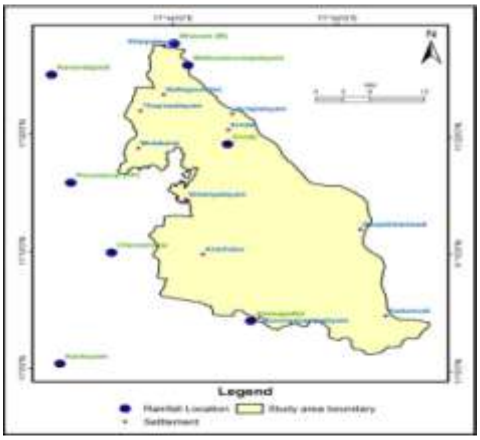


Figure 1 Rain gauge station location map

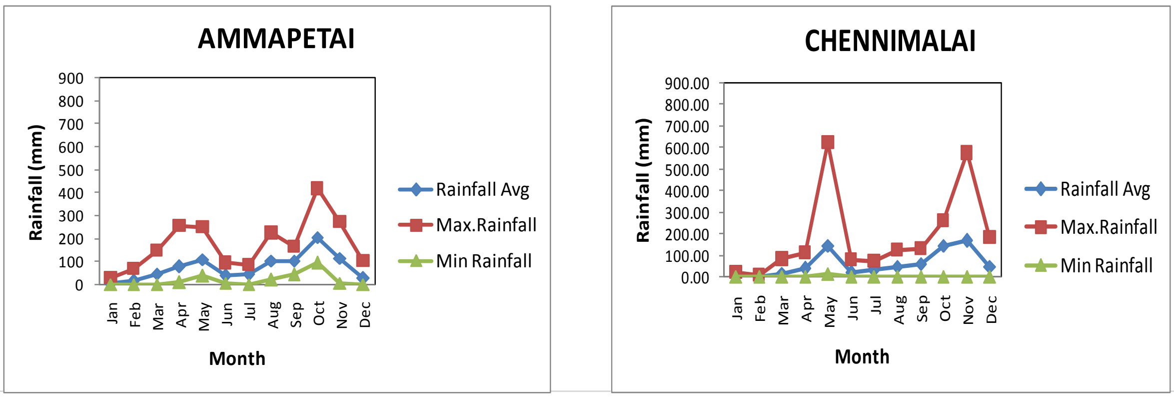
Rainfall Data Analysis

In six rain gauge stations, the ten year normal yearly precipitation information is computed and sorted into four noteworthy seasons, for example, Pre-storm, Post-rainstorm, SW storm and NE rainstorm. Along these lines it (832 mm) is not exactly the typical precipitation of Tamil Nadu (920 mm). At last, with the assistance of GIS, the information is translated as various graphs and charts.

RESULTS AND DISCUSSION

Monthly Variations of Rainfall Data

For all the precipitation stations which are appeared in Figure 2, the normal month to month variety of precipitation power is ascertained for the time of ten years (2003 - 2012) and has been plotted. In the rain gage stations a homogeneous example of precipitation variety has been surmised. For the most part at all the stations, an expanding pattern in precipitation power is found amongst January and May. It has been diminished amid June and expanded amid October. At all the precipitation stations, a crest in precipitation power is seen amid October.



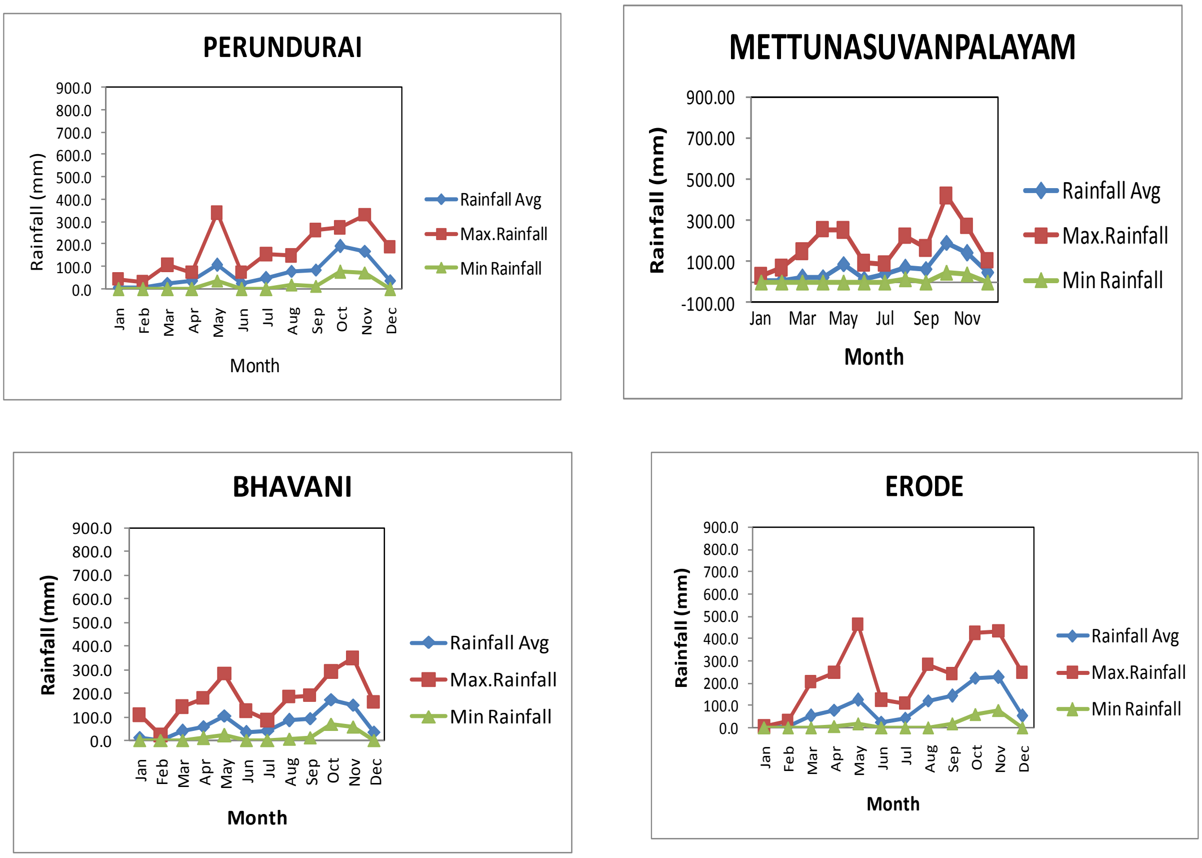


Figure 2 Monthly variations of rainfall pattern

Seasonal Variations of Rainfall Data

In the study range, the occasional varieties of precipitation appeared in amid 2003 – 2012 has been broke down for all the rain gauge stations. A noteworthy segment of the aggregate precipitation was contributed by the North – East (NE) storm, which is greatest at Chennimalai station (50-70%). It is likewise gathered that in the year 2008, the commitment of NE storm was more at all stations, with the greatest force of 983 mm at Erode station and shifted between 580 to 750 mm amid 2008 at alternate stations. In a few stations, the SW rainstorm contributes a decent measure of precipitation. At Erode station in 2012, most extreme 491 mm is recorded and at the other five stations, it is gone from 264 to 466 mm amid this season. In every one of the stations, event of impressive precipitation is watched likewise amid pre-storm period. In 2007, at Erode station, the normal commitment of pre-storm precipitation was around 22%, the greatest being 45%. At the point when contrasted and alternate seasons, precipitation commitment by post-storm is less. The rate of precipitation has additionally been resolved and introduced for different seasons in Table 1.

Table.1 Average, maximum and minimum rainfall during various seasons

Monsoon/ Season	Average contribution (2003-2012)		Maximum occurrence				Minimum occurrence			
	in mm	in %	Station	Year	in mm	in %	Station	Year	in mm	in %
Post-monsoon	10.2	1.25	Bhavani	2008	107.9	5.07	All	2005, 2007 & 2012	0.00	0
Pre-monsoon	186.9	22.94	Erode	2007	545.5	25.64	Mettunasu-vanpalayam	2009	2.76	3.7
SW monsoon	235	28.85	Erode	2012	491	23.08	Chennimalai	2006	21.55	41.3
NE monsoon	382.5	46.96	Erode	2008	983	46.21	Mettunasu-vanpalayam	2003	75.69	55

The Chennimalai station in South-western part of the range gets least precipitation and it is watched that Erode station situated in North-eastern segment of the region by and large gets most extreme precipitation. The precipitation force represented in Figure 3 shows normal occasional and yearly varieties of precipitation.

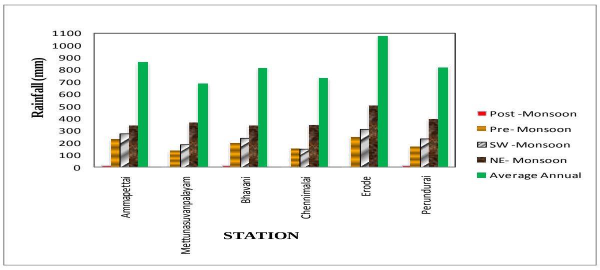
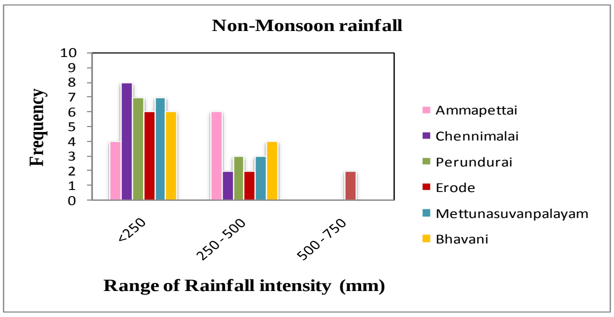


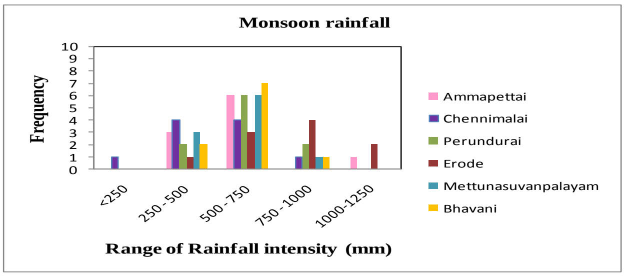
Figure 3 Average annual and seasonal variations of rainfall

Frequency Distribution of Rainfall Data

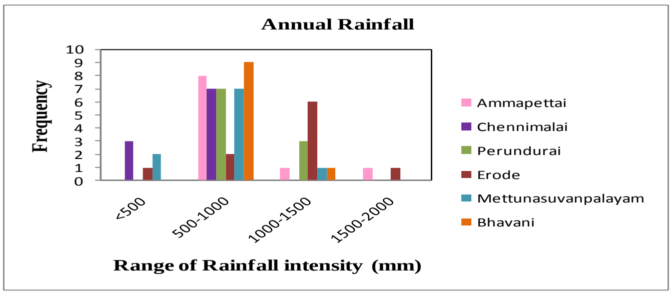
In Figure 4 (a) and 4 (b), recurrence dissemination outlines of pre-rainstorm, post-storm, SW rainstorm and NE rainstorm for the six rain gage stations are shown. As the ten year precipitation information (2003 – 2012) is measured in support of setting up the recurrence circulation outlines, the recurrence scale has been extended from 0 to 10. The yearly precipitation recurrence conveyance graph (Figure 4. c) demonstrates that Chennimalai station has the precipitation recurrence of 3.0 in the precipitation force scope of under 500 mm. Bhavani station has the most extreme recurrence of 9.0 in the precipitation power scope of 500 – 1000mm. Ammapettai station and Erode station has the most extreme recurrence of 8.0 and 6.0 in the precipitation power scope of 1000 – 1500mm separately. The recurrence dissemination table considers the normal precipitation of all stations as outfitted in Table 2(a) and 2 (b).



(A)



(B)



(C)

Figure 4 Frequency distribution of rainfall at various rain gauge stations

Table 2(a) Frequency distribution of monsoon and non-monsoon Rainfall

Sl.No.	Frequency ranges (Rainfall intensity in mm)	Frequency out of 10 (Average of all stations put together)	
		Monsoon (NE & SW monsoons together)	Non-monsoon (Pre & post-monsoons together)
1.	< 250	0.16	6.33
2.	250 – 500	2.50	3.33
3.	500 – 750	5.33	0.33
4.	750 – 1000	1.50	0
5.	1000 – 1250	0.50	0

Table 2 (b) Frequency distribution of annual rainfall

Sl.No.	Frequency ranges (Rainfall intensity in mm)	Frequency out of 10 (Average of all stations put together)
		Annual
1.	< 500	1.00
2.	500 – 1000	6.67
3.	1000 – 1500	2.00
4.	1500 – 2000	0.33

Variability of Rainfall

The examination of authentic precipitation records of the rain gage stations in and around the study zone show broad variety in the dispersion of regular and yearly precipitation. The 10 year ordinary yearly precipitation for every station has been processed and its flight is resolved under the classification of dry season. The dry season event recurrence at every station has additionally been evaluated as far as years per dry spell. The pattern of yearly precipitation at every rain gage station over the study time frame has been investigated.

Arithmetic *Mean (X')*: This is the normal of the considerable number of estimations of a variable. It is acquired by the accompanying recipe:

$$X' = \sum_{I=1}^{N} X/N \qquad (1)$$

Where

X' is the number juggling mean,

X is the variable, and

N is the aggregate number of perceptions

Standard Deviation (σ) : The square foundation of the mean of the squared deviations of the individual esteem is known as the standard Deviation. This is acquired by the accompanying equation:

$$\sigma = \sqrt{\{\sum (X - X')^2 / N\}} \qquad (2)$$

Where

X' is the number-crunching mean,

X is the variable, and

N is the aggregate number of perceptions

Coefficient of variation (Cv): The connection of the Standard Deviation to the mean communicated as a portion is known as the Coefficient of Variation. This parameter is free of the units in which the variable is measured and got by the accompanying recipe

$$Cv = (\sigma/X')\ 100 \qquad (3)$$

Where

X' is the number-crunching mean,

σ is the standard deviation

A year/period of dry spell is characterized, as a year/season in which the aggregate precipitation got is 84% of the ordinary precipitation.

Spatial distribution of rainfall

For the investigation of conveyance of precipitation in space, the verifiable precipitation information accessible from rain gage stations in and around the area has been utilized. The isohyetal guide of ordinary yearly precipitation (2003-2012) in the area. GIS is an explanatory strategy connected with the investigation of areas of geographic marvel together through their spatial estimation and their related ascribes like grouping, table examination, polygon characterization and weight arrangement. The post storm, pre Monsoon, Northeast rainstorm Southwest rainstorm, and Annual normal precipitation topical maps as depicted above have been changed into raster shape considering 30 m as cell size to accomplish extraordinary precision. These were then renamed with allocated appropriate weights and spatial conveyance comes about (Table 3). The post-rainstorm season GIS delineate that the northern of the study territory has been seen with high precipitation with a zone of 172.07 km^2.

3. Average seasonal rainfall data spatial distribution results

Sl.No.	Rainfall Seasons	Class Category	Area in km^2	Area in Percentage
1	Post monsoon	High Rainfall	172.07	22.86
		Medium Rainfall	580.3	77.11
		Low Rainfall	0.23	0.03
2	Pre monsoon	High Rainfall	161.55	21.47
		Medium Rainfall	490.9	65.22
		Low Rainfall	100.15	13.31
3	Southwest Monsoon	High Rainfall	92.24	12.26
		Medium Rainfall	607.85	80.76
		Low Rainfall	52.52	6.98
4	Northeast Monsoon	High Rainfall	652.92	86.76
		Medium Rainfall	99.68	13.24
		Low Rainfall	-	-
5	Annual Average	High Rainfall	683.72	90.85
		Medium Rainfall	68.89	9.15
		Low Rainfall	-	-

Pre rainstorm season GIS picture uncovers that spatially 490.90 km^2 range fell in the medium class classification and 161.55 km^2 region falls in the high precipitation class zone. Pre-storm spatial circulation outlines that north side of the study region fall under high precipitation zones. The southwest storm GIS uncovers that spatially 92.24 km^2 range falls in the high precipitation classification and 607.85 km^2 region falls in the direct class. High precipitation zones have been seen in western part of the study zone. Upper East rainstorm GIS picture uncovers that spatially 99.68 km^2 territory falls in the medium precipitation class and rest of the region 652.92 km^2 falls in high precipitation zones. All bits with the exception of northern side of the study zone fall under high precipitation class. Normal yearly precipitation spatial dispersion result demonstrates that spatially 683.72 km^2 territory falls in (high precipitation) great class classification and rest of the region 68.89 km^2 fall in direct class. Precipitation is medium in some piece of south and west district rest of the zone falls in high precipitation zones, where it is around 1071.78 mm and declines slowly towards northwest to around 500.35 mm.

CONCLUSION

The present study uncovers that the study territory gets precipitation amid monsoonal period. The NE monsoonal precipitation (373.55 mm) is high as opposed to the SW rainstorm precipitation (222.37mm). Ten year precipitation information from 2003 to 2012 have been examined which demonstrates that amid 2003 to 2006, high precipitation have been seen while a declining pattern have been recorded from 2008 to 2012. In Erode Taluk, the yearly precipitation is gotten amid the SW storm is 28.54 percent and NE rainstorm is 49.39 percent. About under 0.65 percent of the yearly precipitation is gotten amid post-rainstorm season while around 21.41 percent is gotten amid the pre-storm or hot climate period. The information demonstrates that the study range get the top level augmentation of precipitation from the NE while the base commitment is amid the post-storm period.

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