



Full Length Research Article

A STUDY ON THE TEMPERATURE AND RAINFALL CONDITIONS OF PUDUKKOTTAI DISTRICT, TAMIL NADU, INDIA

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ABSTRACT

Climate plays a vital role in the development of any region. Rainfall and temperature are the two important climatic parameters which determine the climatic situation of any place. Pudukkottai is a semi arid District situated in the central part of Tamil Nadu. The study deals with the seasonal and annual variation in rainfall using GIS. Temperature conditions are studied using a simple line graph and the relation between rainfall and temperature are analysed by using ombrothermic diagram. The study reveals that the highest rainfall is received during the north east monsoon in the southern and eastern parts of the district. The months during the summer areas the hottest the relation between temperature and rainfall shows the August to December are wet months with less temperature in Pudukkottai District.

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INTRODUCTION

Climate plays an important role in determining the agricultural, industrial and economic growth of any region. Climate includes the parameters like Temperature, Rainfall, Pressure, Wind, Humidity, Precipitation etc. Temperature and Rainfall are the most important aspects which directly affect the climate condition of any region. There is a slow and steady increase in the temperature which has a direct impact on rainfall. Due to industrialization, urbanization, deforestation, depletion of ozone there is a constant increase in temperature which has led to Global warming. This has a direct impact on the melting of snow, increase in mean sea-level, excess of rainfall/ deficit of rainfall, increase on temperature etc. Rain is the primary source of freshwater, providing suitable conditions for diverse ecosystems, as well as water for hydroelectric power plants and crop irrigation. Rainfall is measured through the use of rain gauges. Rainfall amounts are estimated actively by weather radar and passively by weather satellites. The urban heat island effect leads to increased rainfall, both in amounts and intensity, downwind of cities. Global warming is also causing changes in the precipitation pattern globally,

including wetter conditions across eastern North America and drier conditions in the tropics. Precipitation is a major component of the water cycle, and is responsible for depositing most of the fresh water on the planet. The globally averaged annual precipitation is 990 millimetres (39 in). Climate classification systems such as the Köppen climate classification system use average annual rainfall to help differentiate between differing climate regimes. Antarctica is the Earth's driest continent. Rain is also known or suspected on other worlds, composed of methane, iron, neon, and sulfuric acid rather than water. Rain and Temperature are the basic climate parameters essential for the development of agriculture and human settlement. Depending on the rainfall, temperature the growth of trees and yield of crops is dependent. The present study deals about prevailing condition of Temperature and Rainfall in Pudukkottai District.

Study Area

Pudukkottai District is the seventh largest District in Tamil Nadu. It is located in the central part of Tamil Nadu State. It lies between 9° 50' to 10° 40' North latitudes and 78° 25' to 79° 15' East longitudes. The District is wide spread with an aerial extent of about 4,663 sq.km and population of 1, 45,269 persons according to 2001 census. This District is bounded by the Districts of Thanjavur in Northeast, Tiruchirappalli in

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Northwest, Sivagangai in the West, Ramnathapuram in the Southwest and Palk Strait towards the east (Fig 1). This District is divided into two municipalities, eleven Taluks and thirteen blocks for administrative purposes. The municipalities of the District are Pudukkottai Municipality and Arantangi Municipality. The eleven taluks of Pudukkottai District are Pudukkottai, Gandarvakottai, Alangudi, Thirumayam, Kulathur, Illupur, Arantangi, Ponamaravathy, Karambakudi, Avudayarkoil and Manalmekudi. These taluks are further sub divided into thirteen blocks namely Pudukkottai, Gandarvakottai, Kunandavarkoil, Viralimalai, Ponamaravathy, Thirumayam, Annavasal, Karambakudi, Thiruvankulam, Arimalam, Arantangi, Avudayarkoil and Manalmekudi. These blocks are further sub divided into eight town Panchayats, 757 Revenue villages and 498 village panchayats. The study area forms a part of the Survey of India (SOI) topographic sheets 58 J/9, 10, 11, 14, 15, 16, 58 N/2, 3, 4 and 58 O/1&2 of 1:50,000 scale.

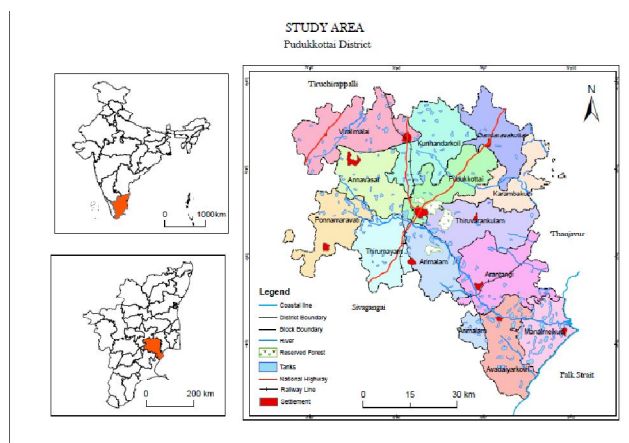


Fig. 1. Study area

MATERIALS AND METHODS

The rainfall and climate data used for the present study are secondary data. The secondary data regarding the temperature and rainfall were collected from the Groundwater Division Water Resource Organisation, Public works Department, Pudukkottai. For the study purpose rainfall from 1976 to 2010 (normal years) were collected and the average was found to study the temperature and rainfall condition. The rainfall data for 13 stations in and around the study area were collected and analysed. Rainfall conditions were studied season wise and Annual Rainfall was computed. ArcGIS9.3 version software was used to draw the maps. Ombrothermic graph is used to show the relation between temperature and rainfall of Pudukkottai District.

Rainfall

a) Average Annual Rainfall

In the present study rainfall data from 1976 to 2010 (thirty five years) was collected for 13 rainfall stations located in the study area. From the table 2.2 it is evident that the average annual rainfall in the study area is 821mm. However, considerable deviation from this average rainfall received is observed in various parts of the study area. The average annual

rainfall ranges from 683mm (Malaiyur) to 939mm (Kattumavadi). Out of the 13 rainfall stations, rainfall is observed to be the highest (>900 mm) at Kattumavadi and Arantangi. The regions of Thirumayam, Arimalam and Perugalur received rainfall between 850mm to 900mm which is considered to be high in the study area. The rainfall is observed to be moderate in (800mm to 850mm) Kudumiyanmalai. In the parts of Illuppur, Ayingudi and Pudukkottai the rainfall received was low, which ranged between 750mm to 800mm. The regions of Alangudi and Malaiyur received rainfall below 750mm which is the least rainfall received in the study area. The average annual rainfall variation in the study area is shown in the figure 2. From the figure it is evident that the average annual rainfall is highest in the south eastern part of the study area, which includes the coastal blocks of Manalmekudi and Avudayarkoil. It gradually decreases towards the northeast where the average annual rainfall is found to be the lowest in Malaiyur (Fig.2).

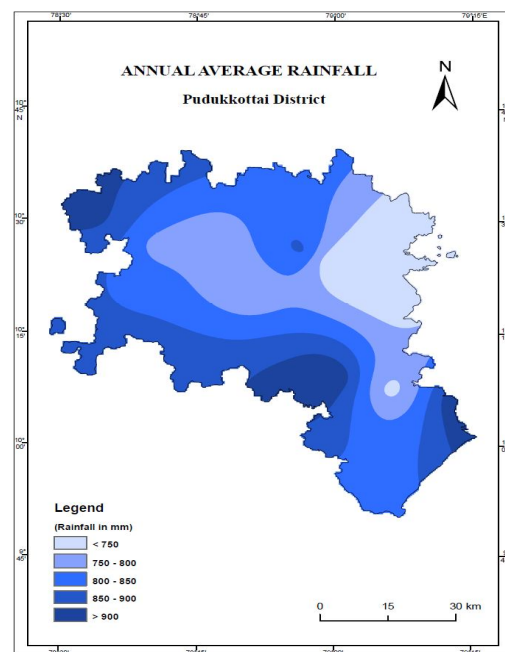


Fig. 2. Annual average rain fall

b) Seasonal Rainfall

The total rainfall computed for the four seasons viz, Winter (January and February) Summer (March, April and May) Southwest monsoon (June, July, August and September) Northeast monsoon (October, November and December) or Retreating monsoon are given in the table 1. Out of the four seasons, the Northeast monsoon season received the highest rainfall, which was about 397mm of rainfall contributing for 48 per cent of the average annual rainfall. During the Southwest monsoon, the total rainfall received was about 303mm which accounts for about 37 per cent of the average annual rainfall. Rainfall received during winter and summer rainfall seasons are comparatively lesser than the other two seasons. These seasons received a total rainfall of 40mm and 81mm respectively in the study area contributing only about 5 per cent and 10 per cent of the average annual rainfall. The seasonal rainfall variation for the study area is shown in

figures 3(a), 3(b), 3(c), 3(d) and their characteristics are described below.

c) Winter Rainfall

The average rainfall computed for winter rainfall is 40mm which is only about 5 per cent of the average annual rainfall of the District. Of the thirteen rainfall stations of the study area, the average rainfall during this season is found to be the maximum at Kattumavadi which receives 70mm of rainfall and minimum at Malaiyur with 18mm of rainfall. The spatial distribution of rainfall during this season is shown in the figure 3(a). The figure reveals that the eastern part of the study area receives higher rainfall and it gradually decreases towards the northeast.

d) Summer Rainfall

The average rainfall for this season is estimated to be 81mm, which is only 10 per cent of the average annual rainfall. Rainfall during this season is found to be highest in Kattumavadi (125mm) and lowest in Malaiyur (50mm). The spatial distribution of rainfall during this season is shown in figure 3(b). The figure shows that the northeastern parts of the study area receive lesser rainfall which gradually increases towards the eastern part of the study area.

Table 1. Seasonal and Annual Rainfall of Pudukkottai District (in mm)

Sl. No	Station	Winter Rainfall Jan to Feb	Summer Rainfall March to May	Southwest Monsoon June to Sep	Northeast Monsoon Oct to Dec	Average Annual Rainfall
1	Pudukkottai	31	77	331	322	761
2	Perungalur	42	84	338	389	853
3	Keeranur	32	97	312	466	907
4	Iluppur	22	90	336	344	792
5	Kudumiyamalai	43	96	356	329	824
6	Alangudi	35	62	250	361	708
7	Malaiyur	18	50	243	372	683
8	Thirumayam	44	102	392	347	885
9	Arimalam	30	82	373	389	874
10	Arantangi	47	84	372	432	935
11	Nagudi	56	57	204	424	741
12	Ayingudi	51	53	232	437	773
13	Kattumavadi	70	125	200	543	939
	Average	40	81	303	397	821

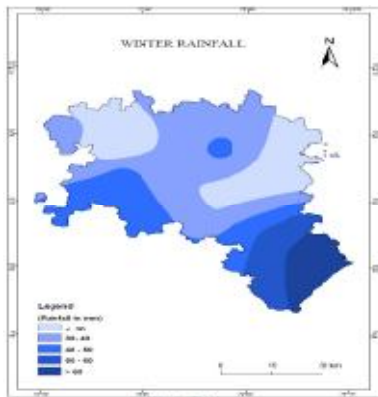


Fig. 3a. The spatial distribution of rainfall for Winter Rainfall

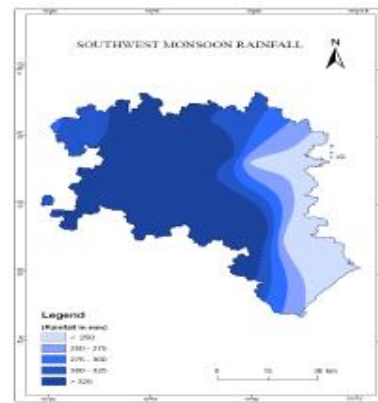


Fig. 3c. The spatial distribution of rainfall for Southwest Monsoon

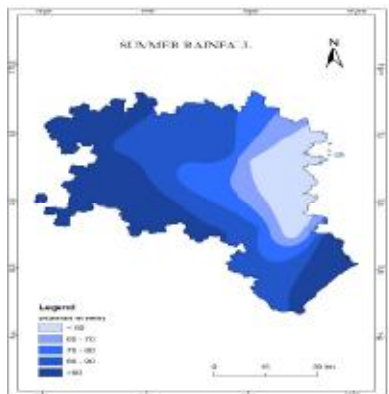


Fig. 3b. The spatial distribution of rainfall for Summer Rainfall

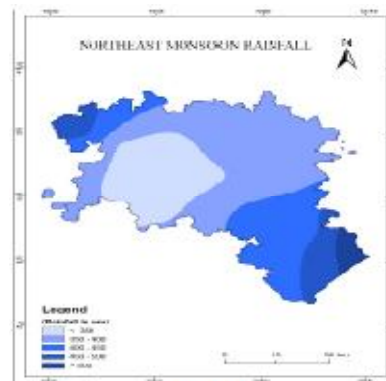


Fig. 3d. The spatial distribution of rainfall for North East (Retreating) Monsoon

Table 3. Average Temperature of Pudukkottai District in Degree Celsius

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	19.8	21.9	23.5	25.6	26.5	25.1	25.2	25.5	24.8	23.7	22.8	20.4
Maximum	32.1	33.3	35.7	37.4	38	35.3	35	35.7	35.5	32.3	29.8	28.8

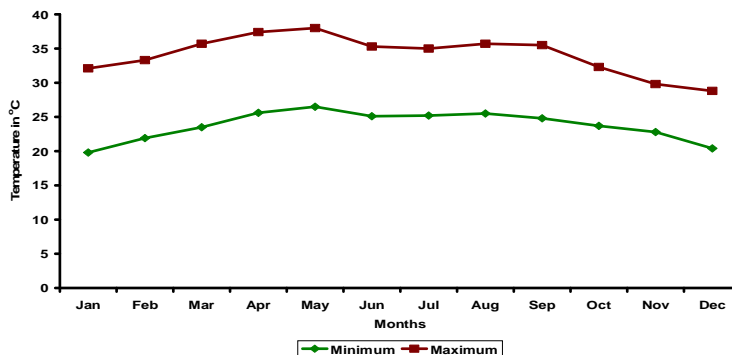


Fig. 4. Average temperature

e) Southwest Monsoon

The average rainfall computed during southwest monsoon season is 303mm, which is about 37 per cent of the average annual rainfall. Out of the thirteen rainfall stations of the study area, the average rainfall during the season is found to be highest at Thirumayam which receives 392mm of rainfall and minimum at Kattumavadi with 200mm of rainfall. The spatial distribution of rainfall during this season is shown in figure 3(c). The figure reveals that the western part of the study area receives higher rainfall and it gradually decreases towards the east.

Table: 5 Temperature and Rainfall Data of Pudukkottai District

Sl. No	Month	Temperature (Celsius)			Rainfall (mm)
		Min	Max	Mean	
1	January	19.8	32.1	26	37.5
2	February	21.9	33.3	27.6	17.6
3	March	23.5	35.7	29.6	15.9
4	April	25.6	37.4	31.5	46.3
5	May	26.5	38	32.2	54.4
6	June	25.1	35.3	30.2	45.6
7	July	25.2	35	30	67
8	August	25.5	35.7	30.6	116
9	September	24.8	35.5	30.1	112
10	October	23.7	32.3	28	163
11	November	22.8	29.8	26.3	153
12	December	20.4	28.8	24.6	94

f) North East (Retreating) Monsoon

Highest amount of rainfall is received during the northeast monsoon season which is about 397mm, contributing for 48 per cent of the average annual rainfall. Among the thirteen stations of the study area, the average rainfall during this season is found to be highest at Kattumavadi (543mm) and lowest at Pudukkottai (322mm).

In general rainfall during the season is relatively high (<400mm) in Keeranur, Arantangi, Nagudi, Ayingudi and Kattumavadi. The rainfall gradually decreases towards the western part of the study area from the south eastern part Fig. 3 (d).

Temperature

Temperature is an important parameter in determining the climatic condition of any region. The climatic condition determines the agricultural pattern, life style of people and the socio economic conditions of any region. Pudukkottai District falls under the tropical region so the temperature here is normally high. For the study area, the monthly mean temperature is calculated from the daily temperature data available for the period from 1976 to 2010. From the table 3, it is observed that the temperature varies according to the seasonal changes. It is inferred from the table, that the temperature is very high during summer season, low during the winter season and moderate during other months. During the summer season, the highest temperature, in the day time was recorded in the months of May (38°C) and April (37.4 °C). The highest temperature received during winter was 33.3 °C in the month of February and minimum temperature was found to be 19.8 °C in the month of January (Fig. 4).

4. Rainfall-Temperature Relationship

Ombrothermic diagram drawn helps to identify the dry and wet months in a region with the help of monthly average temperature and average rainfall. (Table 4) In the diagram, the

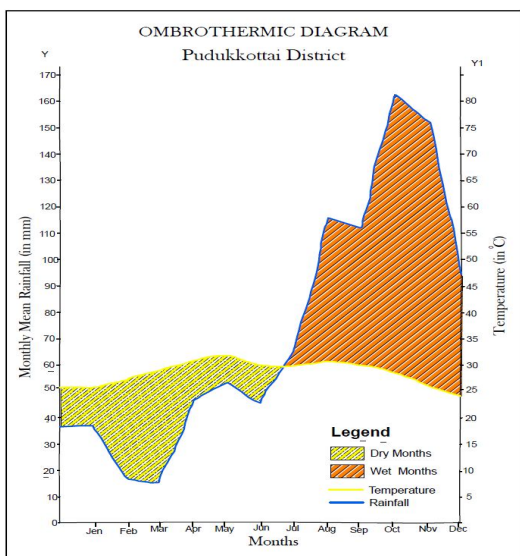


Fig. 5. Ombrothermic diagram

amount of rainfall has been plotted in the Y axis at the left side and the temperature is plotted on the right side of the Y axis and the months are plotted in the X axis. It is observed from the diagram that the months showing rainfall below the average temperature are identified as dry months and the months above the average temperature are considered to be as wet months. From the diagram it is evident that the months from July to December are considered as wet months, as they fall above the mean temperature, while the other months are dry months as they are fall below the mean temperature (Fig 5).

Conclusion

The study shows the distribution of rainfall and temperature conditions of Pudukkottai District. Using Arc GIS the spatial distribution of the rainfall condition for winter season, summer season, South west monsoon North east monsoon and Annual rainfall from 1976 to 2010 are analysed. The average rainfall in Pudukkottai is 821 mm. Northwest monsoons receives the highest rainfall with 397 mm followed by, South west monsoon receives 303mm of rainfall. The summer and winter rainfall receive 81 mm and 40mm respectively. Average rainfall shows that the rainfall is highest in the south eastern part of the study area, which includes the coastal blocks of Manalmelkudi and Avudayarkoil. It gradually decreases towards the northeast where the average annual rainfall is found to be the lowest in Malaiyur. The temperature is very high during summer season, low during the winter season and moderate during other months.

The months from July to December are considered as wet months, as they fall above the mean temperature, while the other months are dry months as they are fall below the mean temperature.

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