



Original Article

Spatio-Temporal Changes in Rainfall Distribution in Satara District

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Abstract

The rainfall is most dynamic elements of climate determining on human being turn into the agriculture, vegetation, water resources as well as settlement. The regional and economic development considerable depends on spatial variation in rainfall. The physiographic of particular region influences on rainfall variation in distribution. The present study devoted to the tahsilwise pattern and trends of rainfall distribution and its variation in Satara district. The analysis indicates a strong gradient in rainfall towards west to east. The tahsil Mahablashwar, Jarwali and Patan has having substantially higher rainfall, where as tahsil like Phaltan, Khandala, Khatav and Man receive comparatively lower rainfall. This spatial variability has important for sustainable water resource planning for agriculture, drought management and flood risk reduction.

Keywords: Rainfall, Spatial Variation, Rainfall trends, Tahsils.

Introduction

Today the rainfall is a significant component of the hydrological cycle and play major role in the determining the socio-economic and agricultural characteristics of study region. The Satara district is one of the major parts of southern Maharashtra. This district is located in western Maharashtra and includes both high and low rainfall areas. The western ghat inflected high rainfall in western part of Satara district and relatively dry rain- shadow areas in the eastern part of the district. Meanwhile the rainfall distribution indicates variability in distribution throughout the district. According to the Disaster Management record from last 15 years (2005-06 to 2020-21) the district has considerable spatial variation in annual rainfall throughout region. The western highland tahsil Mahableshwar and Patan receive heavy rainfall and decrease progressively towards eastern tahsils like as Phaltan, Khatav and Man.

Study Area:

The Satara district is one of the major parts of southern Maharashtra. This district is located in western Maharashtra and includes both high and low rainfall areas. This district consists 11 tahsils Phaltan, Man, Khatav, Koregaon, Satara Karad, Patan Jaoli, Mahablashwar, Wai and Khandala covers 10480 sq. km area. The western ghat influcd high rainfall in western.

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Location Map of the Study Region

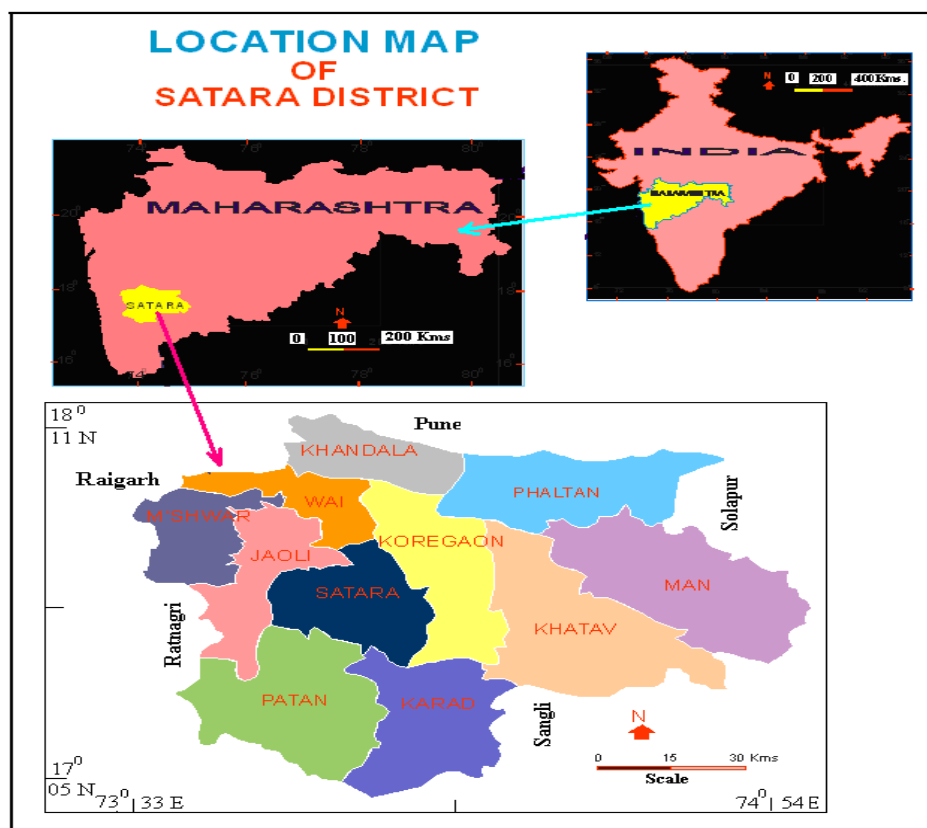


Fig No. 1

part and relatively dry rain- shadow areas in the eastern part of the district, because physiographic features differs from west to east parts. This principal reason marked rainfall gradient in the study reason.

1. Objective:-

The present investigation devoted to the rainfall distribution and analysis of rainfall variability in the study region. And identify the high rainfall as well as low rainfall tahsils for management of water resources.

2. Data Base and Methodology:-

The present study is based on primary and secondary data. The primary data obtained from observation method. The secondary data obtained from district socio-economic abstract and records of district disaster management department publications as well as Indian metrological department. The data has been used during the study period from last 15 years, (2005-06 to 2020-21). For the analysis and characterized entire study area the average rainfall data converted into the mean, standard deviation and coefficient variation.

$$1. \text{ Mean Rainfall} = X = \frac{\sum X}{N}$$

Whereas, X = Average Rainfall
 $\sum X$ = Total of Rainfall.
 N = Total Number of Years.

2. Standard Deviation of Average Rainfall

$$SD = \frac{\sum (X - X)^2}{N-1}$$

Whereas, X = Rainfall of Every Year.

X = Average Rainfall.

N = Total observation.

3. Coefficient Variation. $CV = SD \times 100 / \text{Mean}$

Whereas, SD = Standard Deviation.

Mean = Average Rainfall.

For the calculation of trends of rainfall analysis following formula has been used. For the result obtained the data tabulated into the table form.

3. Tahsilwise Spatial Distribution of Rainfall:-

The Table No. 2 shows that west to east statistics of decline in rainfall. The Table No. 1 shows that west to east decline in rainfall. The tahsil Mahabaleshwar records very high 5152 mm rainfall because of windward location in western ghat. Tahsils like Patan and Jaoli 1594 mm and 1578 mm

Table No. 1
Tahsilwise Statistical Analysis of Rainfall

Sr. No.	Tahsil	Category	Mean Rainfall (mm)	Standard Deviation (mm)	Coefficient Variation (%)	Rainfall Trends (mm)
1	Mahableshwar	Very High	5152	427	40.51	+11.12
2	Jaoli	High	1594	514	30.81	+9.45
3	Patan	High	1578	302	43.49	+8.45
4	Satara	Moderate	994	306	43.36	+8.40
5	Wai	Moderate	875	625	37.41	+7.95
6	Karad	Moderate	703	220	47.10	+6.96
7	Koregaon	Moderate	670	281	40.56	+5.74
8	Phaltan	Low	585	275	38.90	-3.23
9	Khatav	Low	584	274	34.23	-3.10
10	Khandala	Low	575	156	36.64	-2.98
11	Man	Low	513	151	29.30	-2.34

Source: - Compiled form by Author.

respectively. Meanwhile the tahsils like Satara, Karad, Koregaon and Wai occupy moderate level of rainfall. And the lowest rainfall records tahsils like Phaltan, Khatav, Khandala and Man. It is relatively insufficient rainfall.

4. Variability of Rainfall:-

The coefficient of variation is best tools to measure annual variability. It provides clear picture of rainfall variability. Lower the figure higher the variability and higher the figure lower the variability. The tahsil Man records highest rainfall variability approximately 29.30, Then Khatav 34.23, Khandala 36.64 and Phaltan records 38.90 figure with high variability. Tahsil like Satara, Karad, Patan and Jaoli receive high absolute rainfall whereas Mahableshwar has the lowest variability in rainfall. The eastern part of study region witnessed grater fluctuations in rainfall experiences water security risk and agriculture drought.

5. Spatio-Temporal Trends of Rainfall:-

In the study region annual observation shows that the fluctuations substantial year to year all over the study period. The variation marked that the rainfall is not only spatially uneven but also temporally variable. Year by year deficient rainfall turns the eastern part of study region in drought conditions, whereas the western part of study region indicates of excessive rainfall can increase the probability of landslides, soil erosion and flood conditions. There are need of monitoring the variability and support to reduce by management decisions.

6. Agriculture and Rainfall:-

The variation and distribution in rainfall directly affect on sowing dates of seeds, crop growth, requirement of irrigation, turns into the agricultural productivity. The western tahsils are relatively wet and suitable for crops due to the grater water availability of water. Whereas the eastern tahsils are dry region and more dependent for irrigation on groundwater and water conservation tools.

7. Flood and Drought Risk:-

The study region indicates contrasting rainfall pattern and creates two major risks. The western tahsils covers high rainfall belt and experience intense rainfall as well as flooding and landslides. Whereas, the eastern tahsils has receive more and usually vulnerable rainfall deficiency and drought conditions. Hence this study region identifies multi hazard prone and highlights droughts, floods and landslide risks.

Conclusion:-

The rainfall variability is significant geographical factor affecting on agriculture, water availability and disaster risk in the study region. The study region marked highly tahsilwise contrasting in rainfall pattern. The western mountainous tahsils like as Mahableshwar having highest rainfall and decrease towards the tahsils in the eastern part. Besides these tahsils like as Satara, Jaoli, Patan and Karad represents high rainfall zone, whereas Phaltan, Man Khatav and Khandala constitute comparatively low rainfall zone. And the annual rainfall observations further reveal considerable year to year variability. For the sustainable regional development of the study region effective watershed management, scientific irrigation methods, rainwater harvesting and rainfall monitoring are immense significant.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper

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