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Micro-Analysis of Rainfall Using Statistical Techniques

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Abstract: ***Rainfall over a region across the earth is the prima face reason of its uniqueness. Data is taken from official website of Indian Meteorological Department.***
Figure 2 shows that the district wise comparison of average rainfall in Maharashtra. Figure 3 shows that the district wise comparison of average rainy days in Maharashtra. There is significant difference between actual and normal (expected) rainfall of the all districts over the period 1998-2017. There is significant difference between average actual and normal (expected) rainfall of the districts in Maharashtra.
Keywords: Meteorological, actual rainfall, rainy days, district, normal rainfall.

I. INTRODUCTION

Water in liquid or reliable systems falling to the earth is called precipitation (not clear). Rain is the precipitation of water in the liquid state. Foster defined precipitation as "It is deposition of atmospheric moisture and is the most important phase of the hydrological cycle."
The distribution of rainfall is undoubtedly complex in the world. Latitude, temperature, moisture, mountain barriers, atmospheric disturbances, movement of air masses, frontal activity, differential heating of land and ocean are some of the factors involved in causing rainfall. Climate of region along with the factors is mainly affected by Rainfall. Rainfall distribution is affected by geomorphology of region, wind direction, presence of humidity etc.[1] Maharashtra is part which comes under influence of this monsoon climate and weather. The variation of rainfall has greater impact on mainly agriculture and economic, social life of human beings.
Different regions over the earth having different rainfall pattern in turn is directly related to the region's uniqueness, it is referred as ecosystem. India is one of the ancient regions having different rainfall pattern which has developed into places with its own unique ecosystem prevailing over its different states.[2] Our aim is to check, whether Maharashtra is a state of India having different rainfall pattern which has developed into five regions. Geographically, historically, politically, and according to cultural sentiments, Maharashtra has five main regions.[3] Regions are Western Maharashtra, Konkan, Marathwada, Vidarbha, Khandeshi and Northern Maharashtra.
Rainfall is the main way that the water in the skies comes down to Earth, where it fills our lakes and rivers, recharges the underground aquifers, and provides drinks to plants and animals.[4]
In this paper, Compare the actual rainfall and normal rainfall. Is there any significant difference between actual rainfall and expected rainfall (normal rainfall)?

II. METHODOLOGY

For the fulfil objective of the study, I want different parameters of rainfall, like district, actual rainfall, normal rainfall and rainy days for the year 1998 to 2017.
This data is taken from official website of Indian Meteorological Department. This data is modified according to region. Two variables are computed as total actual rainfall and rainy days for each region.
The plan for statistical analysis is discussed in this session, Chi-square test for goodness of fit is used for check the significance between actual rainfall and normal rainfall. For the analysis purpose, MS-excel is used.

III. ANALYSIS AND DISCUSSION

Graphical Representation of data

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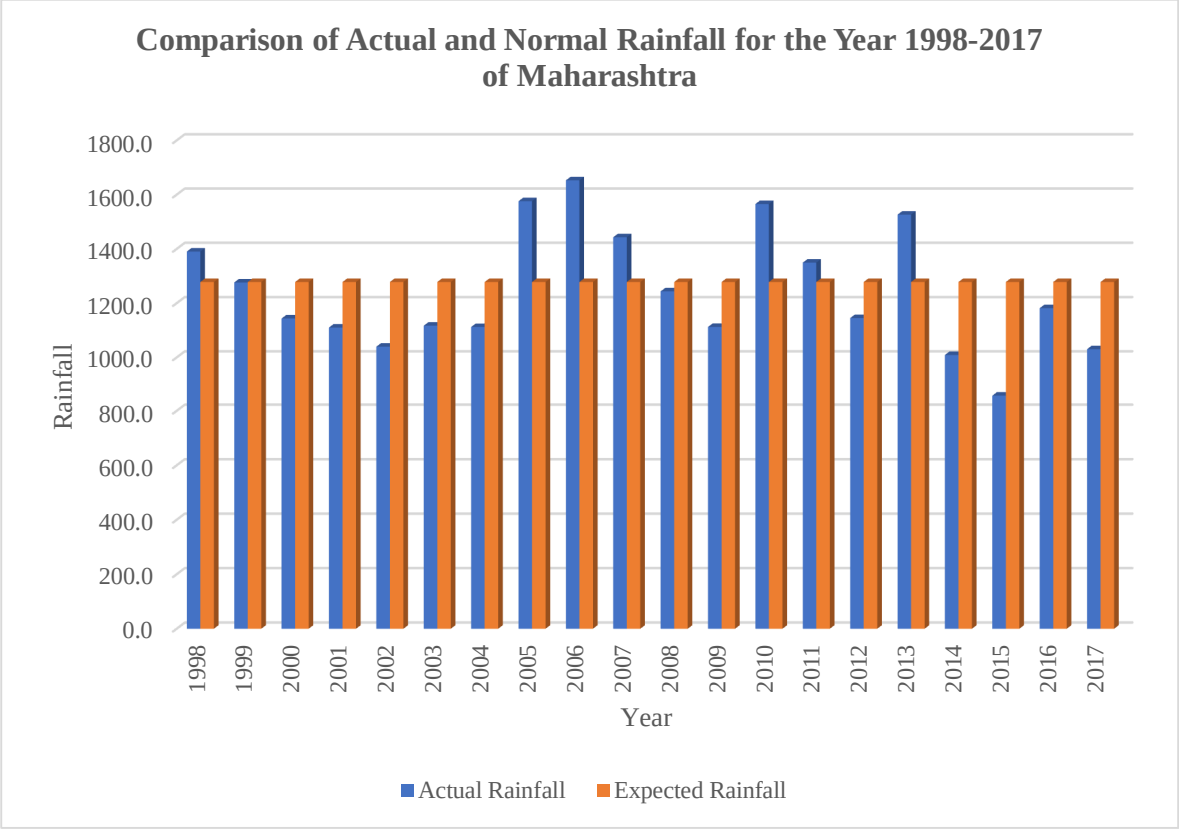


Figure 1: Comparison of Actual and Normal Rainfall for the Year 1998-2017 of Maharashtra

From the above graph, shows the comparison of actual and expected rainfall for the year 1998-2017 of Maharashtra.

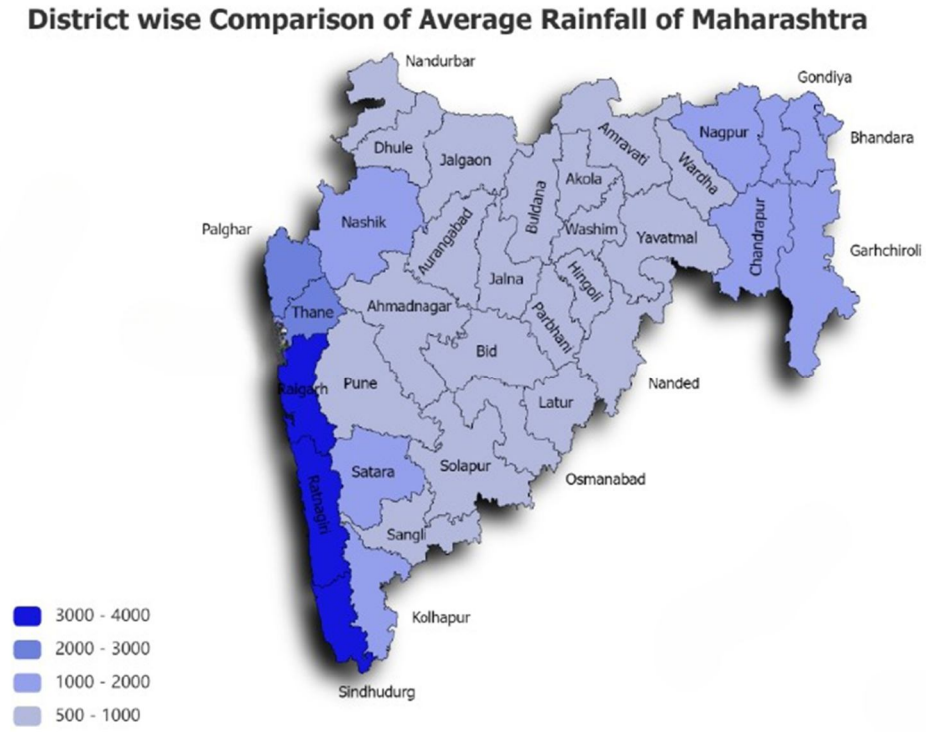


Figure 2: District wise comparison of Average Rainfall of Maharashtra

The above map shows, Comparision of districtwise avereage rainfall of Maharashtra. Faint colour shows minimum rainfall and dark colour shows maximum rainfall in the particular area.

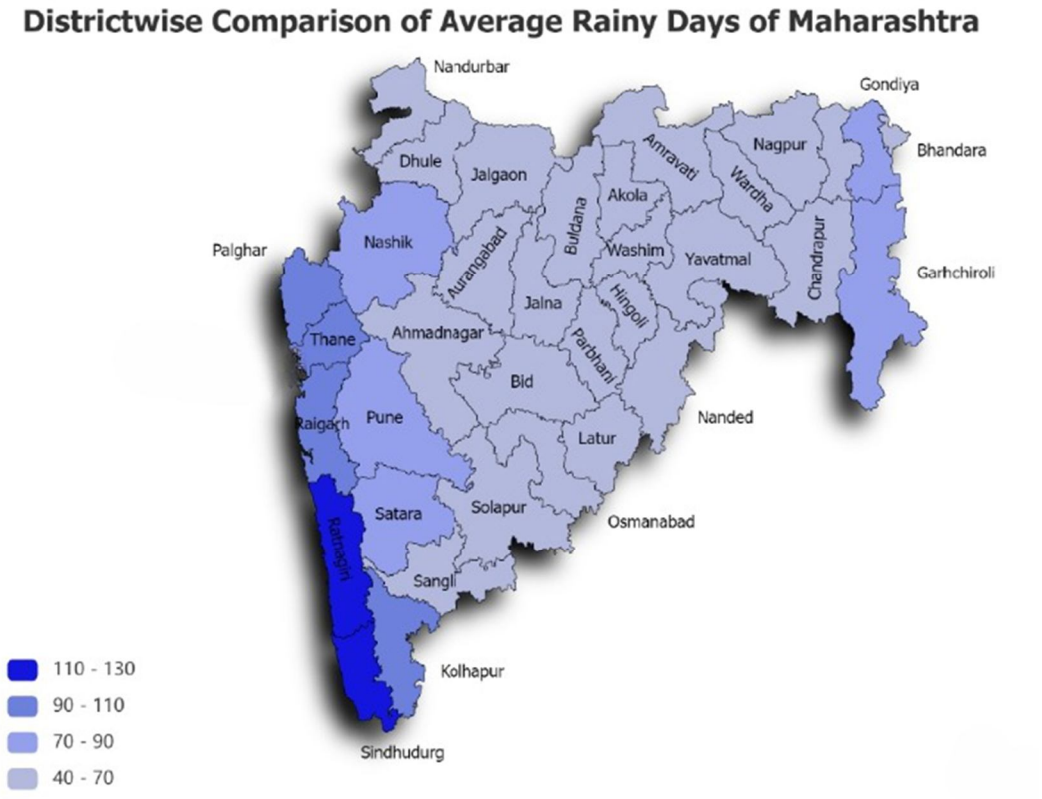


Figure 3: District wise comparison of Average Rainy Days of Maharashtra

The above map shows, Comparision of districtwise avereage rainy days of Maharashtra. Faint colour shows minimum rainy days and dark colour shows maximum rainy days in the particular area.

1) To check the significance of actual rainfall with normal (expected) rainfall of Maharashtra over the long period.

H_0: There is no significant difference between actual and normal (expected) rainfall of Maharashtra over the long period.

Table 1

Calculated Value	Degrees of Freedom	Table Value	p value	Decision
737.22	19	30.14	<0.001*	H_0 Rejected

For the testing of hypothesis level of significance 5% is considered. From the above table, p value is less than level of significance. There is significant difference between actual and normal (expected) rainfall of Maharashtra over the long period.

2) To check the significance of actual rainfall with normal (expected) rainfall of all district over the long period of 1998-2017.

H_0: There is no significant difference between actual and normal (expected) rainfall of the particular districts over the long period.

Table 2

District	Calculated Value	Degrees of Freedom	Table Value	p value	Decision
Thane	1810.44	19	30.14	<0.001*	H_0 Rejected
Raigad	1988.33	19	30.14	<0.001*	H_0 Rejected
Ratnagiri	2251.01	19	30.14	<0.001*	H_0 Rejected
Sindhudurg	2659.13	19	30.14	<0.001*	H_0 Rejected
Palghar	1390.82	19	30.14	<0.001*	H_0 Rejected
Nashik	1338.63	19	30.14	<0.001*	H_0 Rejected
Dhule	893.55	19	30.14	<0.001*	H_0 Rejected

Nandurbar	1722.87	19	30.14	<0.001*	H_0 Rejected
Jalgaon	1173.01	19	30.14	<0.001*	H_0 Rejected
Ahmednagar	1156.20	19	30.14	<0.001*	H_0 Rejected
Pune	1637.77	19	30.14	<0.001*	H_0 Rejected
Solapur	1108.42	19	30.14	<0.001*	H_0 Rejected
Satara	3299.57	19	30.14	<0.001*	H_0 Rejected
Sangli	626.91	19	30.14	<0.001*	H_0 Rejected
Kolhapur	2980.41	19	30.14	<0.001*	H_0 Rejected
Aurangabad	793.21	19	30.14	<0.001*	H_0 Rejected
Jalna	952.15	19	30.14	<0.001*	H_0 Rejected
Beed	748.88	19	30.14	<0.001*	H_0 Rejected
Latur	868.14	19	30.14	<0.001*	H_0 Rejected
Osmanabad	1097.23	19	30.14	<0.001*	H_0 Rejected
Nanded	1824.80	19	30.14	<0.001*	H_0 Rejected
Parbhani	1252.36	19	30.14	<0.001*	H_0 Rejected
Hingoli	1446.98	19	30.14	<0.001*	H_0 Rejected
Buldhana	697.31	19	30.14	<0.001*	H_0 Rejected
Akola	759.69	19	30.14	<0.001*	H_0 Rejected
Washim	1181.12	19	30.14	<0.001*	H_0 Rejected
Amravati	780.71	19	30.14	<0.001*	H_0 Rejected
Yavatmal	1844.77	19	30.14	<0.001*	H_0 Rejected
Wardha	1455.23	19	30.14	<0.001*	H_0 Rejected
Nagpur	1000.18	19	30.14	<0.001*	H_0 Rejected
Bhandara	1905.18	19	30.14	<0.001*	H_0 Rejected
Gondia	1567.96	19	30.14	<0.001*	H_0 Rejected
Chandrapur	1748.68	19	30.14	<0.001*	H_0 Rejected
Gadchiroli	1841.95	19	30.14	<0.001*	H_0 Rejected

For the testing of hypothesis level of significance 5% is considered. From the above table, column of p value is less than level of significance. There is significant difference between actual and normal (expected) rainfall of the all districts over the period 1998-2017.

3) To check the significance of actual rainfall with normal (expected) rainfall of the districts in Maharashtra.

H_0: There is no significant difference between actual and normal (expected) rainfall of the districts in Maharashtra.

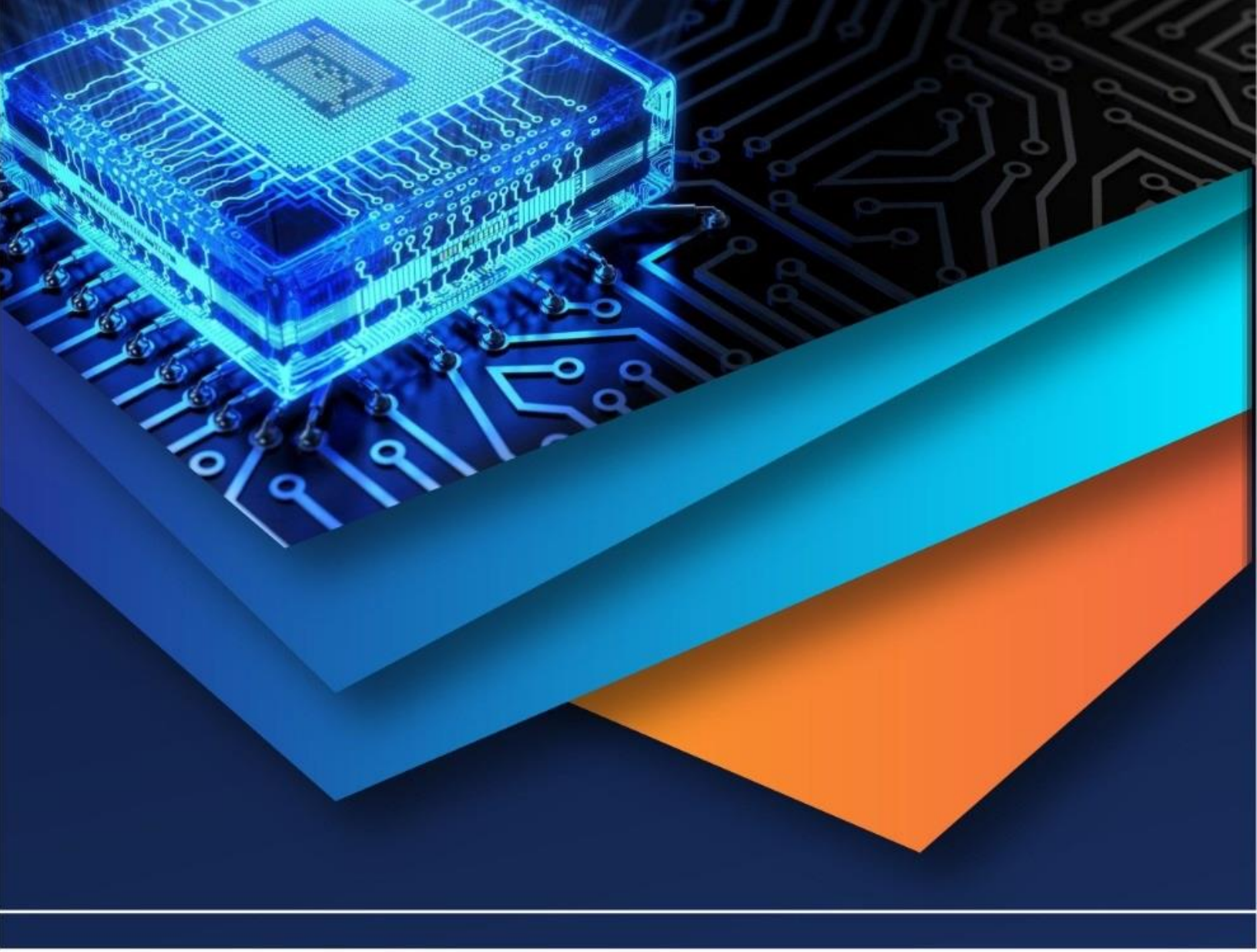
Table 3

Calculated Value	Degrees of Freedom	Table Value	p value	Decision
381.55	33	50.72	<0.001*	H_0 Rejected

For the testing of hypothesis level of significance 5% is considered. From the above table, p value is less than level of significance. There is significant difference between actual and normal (expected) rainfall of the districts in Maharashtra.

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