

Regional Rainfall Distribution and Variability in Maharashtra

¹Mr. Kailas Balaso Madane and ²Dr. S. M. Kamble

¹Research Scholar, Mahila Mahavidyalaya, Karad

² Research Guide/Assistant Professor and Head of Department of Geography

Arts, Commerce Science College Palus, Sangli²

madanekailas@484gmail.com, sajjankamble@gmail.com

Abstract: Rainfall is a key climatic factor that significantly influences agriculture, water resources, and environmental sustainability. Maharashtra, one of the largest states in India, experiences considerable spatial variation in rainfall due to its diverse topography and climatic conditions. The present study examines the regional distribution and variability of rainfall across the administrative divisions of Maharashtra using rainfall data collected over a two-year period. The analysis focuses on identifying differences in rainfall patterns among regions and understanding the spatial characteristics of precipitation distribution. July 2023, the Konkan division recorded the highest rainfall, measuring 1,688 mm. In October, rainfall levels declined across all divisions. In 2024, all divisions of Maharashtra received adequate rainfall. The Konkan division once again recorded the highest rainfall in 2024. However, the Chhatrapati Sambhajnagar and Amravati divisions received low rainfall. In 2024, the average rainfall in Maharashtra Konkan region was higher compared to 2023. In 2023, the Nashik division received an average of 92 mm of rainfall. During 2023, the Konkan division of Maharashtra experienced heavy rainfall, the Pune division received moderate rainfall, while the other divisions received very scant rainfall. The results indicate that western coastal regions receive higher rainfall compared to the interior plateau regions due to the influence of the Western Ghats and monsoon winds.

Keywords: Rainfall distribution, rainfall variability, monsoon rainfall, spatial analysis, climate study

I. INTRODUCTION

Rainfall plays an important role in determining agricultural productivity, water availability, and climatic conditions in any region. India experiences a monsoon-dominated climate, where the majority of annual rainfall occurs during the southwest monsoon season from June to September. Maharashtra, located in the western part of India, is one of the largest states in terms of geographical area and population. The state exhibits considerable diversity in terms of topography, climate, and land use patterns. The presence of the Western Ghats, coastal plains, and the Deccan Plateau creates significant spatial variation in rainfall distribution across the state. The Western Ghats play a crucial role in influencing rainfall patterns by acting as a barrier to moisture-laden monsoon winds coming from the Arabian Sea.

The coastal regions of Maharashtra, particularly the Konkan division, receive extremely high rainfall due to orographic precipitation caused by the uplift of moist air along the slopes of the Western Ghats. In contrast, the interior plateau regions such as Marathwada and Vidarbha lie in the rain-shadow zone of the Western Ghats and therefore receive comparatively lower rainfall. This uneven distribution of rainfall often creates water scarcity issues in several parts of the state, especially during years of weak monsoon activity.

Understanding rainfall distribution and variability is extremely important for agricultural planning and water resource management in Maharashtra. Agriculture in the state largely depends on monsoon rainfall, and variations in precipitation can directly influence crop productivity, irrigation availability, and rural livelihoods. Therefore, detailed analysis of rainfall patterns can help in identifying drought-prone areas, improving water management strategies, and supporting climate adaptation planning.



The present study focuses on examining the regional distribution and variability of rainfall across the administrative divisions of Maharashtra using rainfall data for a period of two years. By analysing rainfall patterns at the divisional level, the study aims to provide a better understanding of spatial rainfall characteristics and their implications for regional planning and environmental management.

II. STUDY AREA

Maharashtra is located in western India and extends between approximately 15°35' N to 22°02' N latitude and 72°36' E to 80°54' E longitude. The state covers an area of about 307,713 Sqkm. and is one of the most populous and economically important states in the country.

Administratively, Maharashtra is divided into six major divisions: Konkan Division, Pune Division, Nashik Division, Chhatrapati Sambhajnagar Division, Amravati Division and Nagpur Division.

The Konkan division lies along the Arabian Sea and receives extremely heavy rainfall due to the southwest monsoon and the presence of the Western Ghats. The Pune and Nashik divisions are located on the Deccan Plateau and receive moderate rainfall. The Aurangabad, Amravati, and Nagpur divisions are located in the interior region and generally receive lower rainfall compared to the coastal regions.

Major rivers such as the Godavari, Krishna, Tapi, and Wardha originate or flow through Maharashtra, and their water availability largely depends on monsoon rainfall.

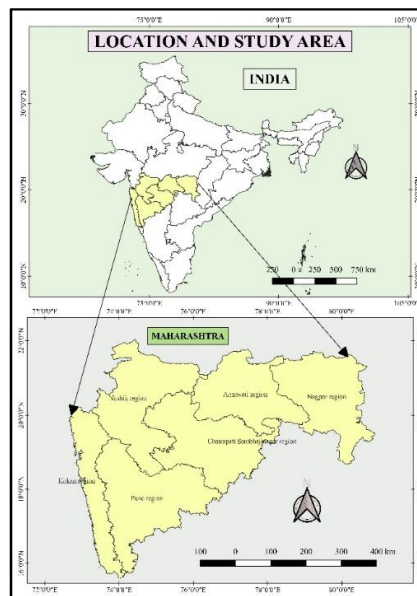


Fig No.1 Location and Study Area

III. OBJECTIVES OF THE STUDY

The main objectives of this research are:

1. To understand the regional rainfall distribution in the administrative divisions of Maharashtra.
2. To identify high and low rainfall region in Maharashtra.

IV. DATA SOURCES AND METHODOLOGY

The rainfall data used in this study were obtained from secondary sources including meteorological departments and government climate databases. The dataset consists of rainfall records for two consecutive years across the administrative divisions of Maharashtra. Basic statistical methods such as average rainfall, comparison of rainfall values, and variability analysis were used to examine rainfall patterns across divisions. The collected information is



organized, classified and tabulated and used for the analysis. On the basis of analysis, cartographic techniques and statistical methods are used for drawing the graphs, diagrams and maps.

V. COMPARATIVE ANALYSIS

Rainfall values from different administrative divisions were compared to understand spatial differences and rainfall gradients across the state.

Table No. 1 Region wise Rainfall in Maharashtra 2023

Month	Administrative Region Rainfall 2023 (mm)					
	Kokan	Nashik	Pune	Chhatrapati Sambhajnagar	Amravati	Nagpur
June	465	69	68	56	49	127
July	1688	200	304	273	371	468
August	315	50	70	54	75	204
September	478	227	144	199	186	288
October	78	5	37	8	3	8

Source: Economic Survey of Maharashtra 2024-25 P. 92

Table No. 1 shows the region-wise rainfall distribution in Maharashtra for the year 2023. The data is presented for six administrative regions Konkan, Nashik, Pune, Chhatrapati Sambhajnagar, Amravati, and Nagpur for the monsoon months from June to October. The table indicates that the Konkan region received the highest rainfall, especially in July (1688 mm), due to its coastal location and strong influence of the southwest monsoon. In contrast, the Nashik, Pune, and Chhatrapati Sambhajnagar regions received comparatively moderate rainfall during the same period. The Amravati and Nagpur regions in Vidarbha also recorded significant rainfall in July, with 371 mm and 468 mm respectively. Rainfall gradually decreased in September and October across all regions, indicating the withdrawal phase of the monsoon.

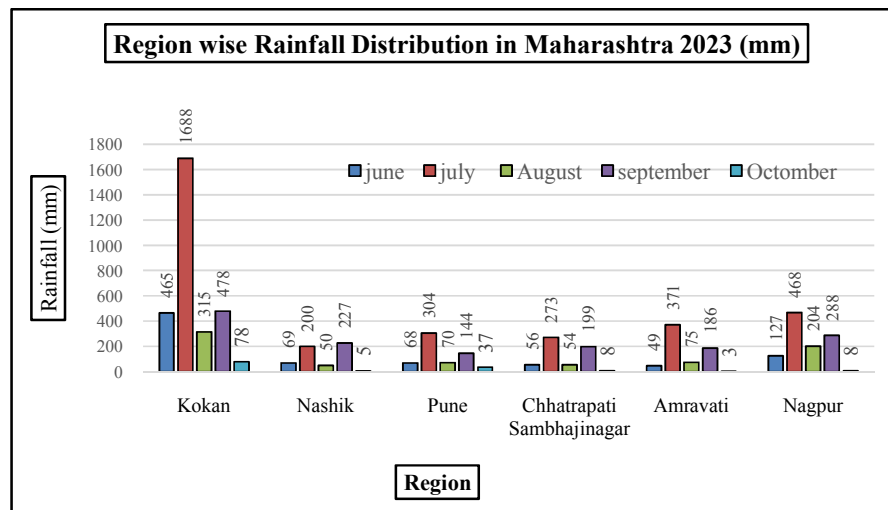


Fig No.2 Region wise rainfall (mm) in Maharashtra 2023

Table No. 2 Region wise Rainfall in Maharashtra 2024

Months	Administrative Region Rainfall 2024 (mm)					
	Kokan	Nashik	Pune	Chhatrapati Sambhajnagar	Amravati	Nagpur
June	629	160	211	183	164	131
July	1563	225	422	230	324	652



August	598	258	254	161	200	237
September	416	146	136	230	176	228
October	167	96	108	81	59	28

Source: Survey of Maharashtra 2024-25 P. 92

Table No. 2 shows the region-wise rainfall distribution in Maharashtra for the year 2024. The table indicates that the Konkan region received the highest rainfall throughout the monsoon season. In June the rainfall was 629 mm and it increased significantly in July to 1563 mm, which is the highest rainfall recorded among all regions. This is mainly due to the strong influence of the southwest monsoon and the coastal geographical location of the Konkan region. The Pune and Nashik regions received moderate rainfall. Pune recorded 422 mm rainfall in July and Nashik recorded 258 mm in August, indicating steady monsoon activity in the western Maharashtra region.

The Vidarbha region, including Amravati and Nagpur, also experienced considerable rainfall during the monsoon months. Nagpur recorded 652 mm rainfall in July, which is the highest rainfall in Vidarbha during 2024. Rainfall in all regions gradually decreased from September to October, indicating the withdrawal phase of the monsoon season.

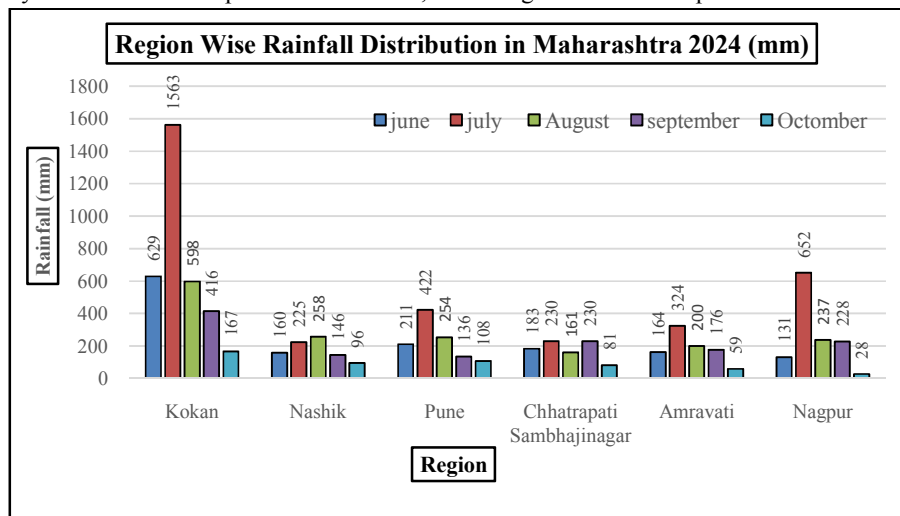


Fig No.3 Region wise rainfall (mm) in Maharashtra 2024

Table No.3 Average Rainfall of Administrative Region of Maharashtra in 2023-2024

Sr. No	Administrative Region	Average Rainfall (mm) Years	
		2023	2024
1	Konkan	504	675
2	Nashik	92	177
3	Pune	104	226
4	Chatrapati Sambhajanagar	98	177
5	Amravati	114	185
6	Nagpur	182	255

Source: Survey of Maharashtra 2024-25

Table No. 3 shows the average rainfall of different administrative regions of Maharashtra for the years 2023 and 2024. The table indicates that the Konkan region recorded the highest average rainfall in both years, with 504 mm in 2023



and 675 mm in 2024. This is mainly due to the coastal location of the region and the strong influence of the southwest monsoon.

The Nashik, Pune, and Chhatrapati Sambhajnagar regions recorded comparatively moderate rainfall. Nashik received an average of 92 mm in 2023, which increased to 177 mm in 2024. Similarly, Pune recorded 104 mm in 2023 and increased significantly to 226 mm in 2024. Chhatrapati Sambhajnagar also showed an increase from 98 mm in 2023 to 177 mm in 2024.

In the Vidarbha region, Amravati and Nagpur also experienced an increase in rainfall. Amravati recorded 114 mm in 2023 and 185 mm in 2024, while Nagpur increased from 182 mm in 2023 to 255 mm in 2024.

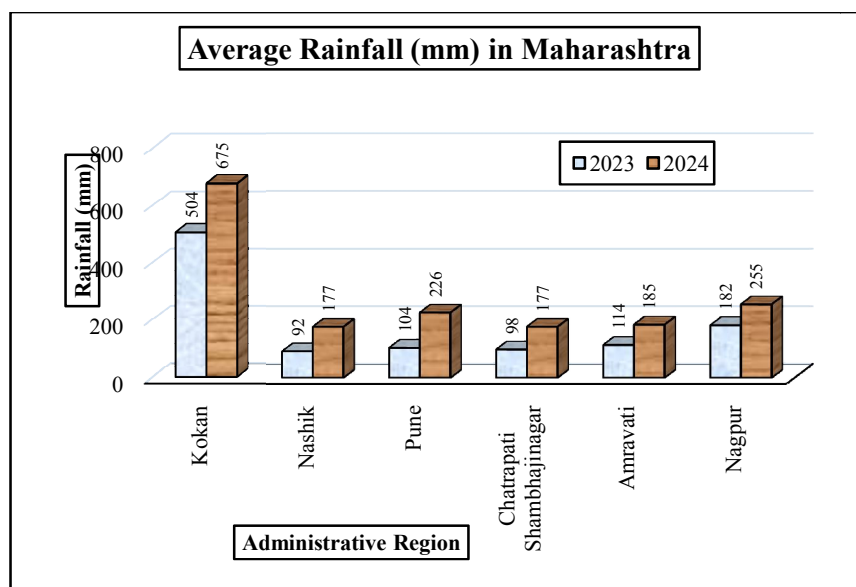


Fig No.4 Region wise Average rainfall (mm) in Maharashtra 2023-24

VI. RESULTS AND DISCUSSION:

The analysis of rainfall data for the two-year period reveals significant spatial variation across the administrative divisions of Maharashtra.

The Konkan division recorded the highest rainfall among all divisions. This is mainly due to its proximity to the Arabian Sea and the influence of the Western Ghats. Moist monsoon winds rise along the slopes of the Western Ghats, leading to heavy orographic rainfall in this region.

The Pune and Nashik divisions experienced moderate rainfall levels. However, rainfall distribution within these divisions varies depending on topographic conditions. Areas located closer to the Western Ghats receive higher rainfall compared to the interior plateau regions. The Chhatrapati Sambhajnagar, Amravati, and Nagpur divisions recorded comparatively lower rainfall. These regions lie in the rain-shadow area of the Western Ghats where the monsoon winds lose much of their moisture before reaching the interior parts of the state.

The spatial pattern observed in the analysis indicates a gradual decrease in rainfall from the western coastal region towards the eastern interior region of Maharashtra. This pattern reflects the strong influence of topography and monsoon circulation on rainfall distribution.

Variability in rainfall across regions has important implications for agriculture, particularly in drought-prone districts where crop production depends heavily on monsoon rainfall.



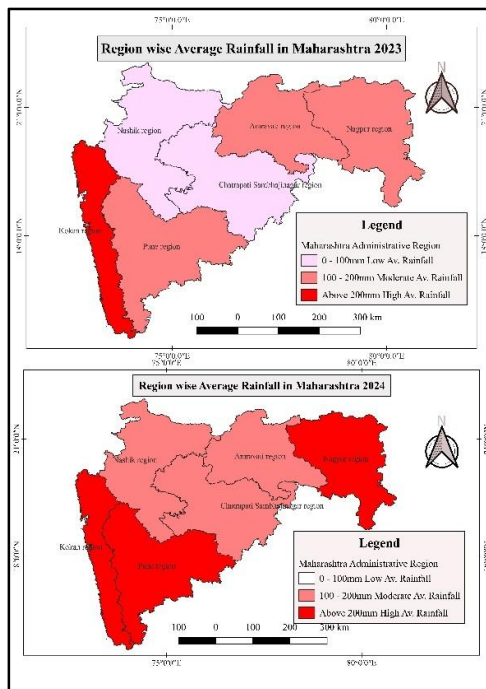


Fig No. 5 Region wise Average rainfall (mm) in Maharashtra 2023-24

VII. CONCLUSION

The present study examined the regional distribution and variability of rainfall across the administrative divisions of Maharashtra over a two-year period. The results reveal significant spatial differences in rainfall patterns across the state. The Konkan division receives the highest rainfall due to its coastal location and the influence of the Western Ghats. In contrast, the interior divisions such as Chhatrapati Sambhajnagar, Amravati, and Nagpur receive comparatively lower rainfall due to their location in the rain-shadow region. In July 2023, the Konkan division recorded the highest rainfall, amounting to 1,688 mm. In October, the intensity of rainfall decreased across all divisions. In 2024, all divisions of Maharashtra received satisfactory rainfall. The Konkan division recorded the highest rainfall in 2024. Rainfall was lower in the Chhatrapati Sambhajnagar and Amravati divisions. In the Konkan region of Maharashtra, the average rainfall in 2024 was higher compared to 2023. The Nashik division received an average of 92 mm of rainfall in 2023. In Maharashtra, the Konkan division received heavy rainfall, the Pune division received moderate rainfall, while the other divisions received low rainfall in 2023.

This study underscores the critical importance of rainfall analysis for understanding weather patterns and supporting agricultural and water resource planning. To gain a better understanding of the variability in rainfall across Maharashtra, future studies should incorporate long-term rainfall records and advanced spatial analysis techniques.

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