



Trend Analysis of Rainfall in Kolhapur District (Year 1988-2019)

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INTRODUCTION

The rainfall trend is a common direction in which rainfall is changing. The trend of rainfall is important for socio-economic agriculture, activity, and disaster management. The rainfall trend analysis research study helps to judge the direction and pattern of rainfall (Intergovernmental Panels on climate change) that defines the rainfall change scenario of the world. A sympathetic rainfall trend for the Kolhapur district is to appreciate the impacts of Global warming and climate change. The key rainfall trend of different 14 stations in 31 years (1988-2019) during annual, monthly, and seasonal has been analyzed in this paper.

Study Area:

The district of Kolhapur lies in the south-west of Maharashtra between 15°43' to 17° 17' North latitude and 73°40' to 74° 42' East longitude and spreads across the Deccan Plateau in the rain shadow region of the Sahyadri mountain ranges on the southernmost tip of the state of Maharashtra. The Sangli district lies to the north, the Belgaum district of Karnataka State is to the east and south, Ratnangiri and Sindhudurg districts of Maharashtra are to the West. Kolhapur district has wet tropical type of climate. In the summer's temperature ranges in between 24°C to 34°C, and in winter temperature ranges from 21°C to 27°C.

Objective:

This Research paper has main objective is to the Trend analysis of Rainfall in Kolhapur District.

Database and Methodology:

Present study generally depends on the Indian Metrological Department data. There has used data in fourteen different IMD rainfall stations in the Kolhapur district. It has used 31 years rainfall data for trend analysis of Rainfall. The trend analysis of annual and seasonal rainfall was statistically analyzed. In this research linear rainfall trend is calculated using the Minitab Software.

The calculation of the rainfall trend is below the following formula.

The linear trend model is:

$$\text{Formula- } Y_t = \beta_0 + \beta_1 t + e_t$$

Whereas,

β_0 - the constant, β_1 - average change from one period to the next

t - value of the time unit, e_t - the error term

TABLE - I

KOLHAPUR DISTRICT SEASONAL, AND ANNUAL RAINFALL TREND (1988-2019)

Station Name	Annual	SUM	SW	NEM	WIN
Ajra	2.50	9.90	-6.36	-1.62	0.59
Bhudargad	10.14	-2.01	14.48	-2.31	-0.02
Chandgad	-15.90	-2.82	-12.60	-0.41	-0.07
Gadhinglaj	0.61	-1.93	3.71	-1.12	-0.05
Gaganbawada	-49.10	-2.03	-42.50	-4.52	-0.10
Gargoti	2.05	-1.52	5.12	-1.55	0.00
Hatkanangale	2.19	-2.00	3.93	0.31	-0.05
Kagal	13.51	-0.98	14.50	0.14	-0.14
Karveer	2.85	0.29	5.94	-3.29	-0.12
Kolhapur	2.02	-0.05	3.76	-1.47	-0.22
Panhala	8.90	0.49	7.80	0.76	-0.10
Radhanagri	-23.50	-0.79	-23.20	0.49	0.00
Shahuwadi	25.10	-0.30	25.10	0.50	-0.12
Shirol	-1.84	-1.75	0.47	-0.31	-0.25
overall	-1.46	-0.39	0.01	-1.03	-0.05

SEASONAL TREND

The southwest monsoon period (89.35 %) is the foremost rainfall distilled over the Kolhapur district; the other three seasons (10.65 %) have also contributed from 1988-2019. The rainfall during the winter period (0.090 %) and summer period (3.17 %) are generally largest by convection and western disturbances or cyclone activities whereas during the northeast monsoon period (7.39 %) is largest over the study area in October – December. Therefore, rainfall trends analysis was also approved out on 14 stations rainfall for southwest monsoon seasons (June to September), northeast monsoon season (October to December), winter season (January and February), summer season (March to May), and also for the annual



rainfall. Table - I show the increase and decrease trend in 31 years in each of the 14 stations for seasonal, and annual.

SOUTH WEST MONSOON TREND:

The overall Kolhapur district in the southwest monsoon season rainfall trend observed 0.01 MM/year. During this season 89.35 percent of rainfall in the annual study period. All 14 stations' rainfall in the SWM period increasing trend indicating 25.10 MM/year is observed at Shahuwadi station and decreasing -42.50 MM/year is observed at Gaganbawada station (Table - I). Figure 4.1 shows the rainfall trend of the Kolhapur district during this season. The 10 stations have indicated an increasing rainfall trend and 4 rain gauge stations have observed decreasing trend (Table - I). The highest increasing trend has shown 25.10 MM/year in Shahuwadi, followed by Kagal (14.50 MM/year), Bhudargad(14.48 MM/year), Panhala (7.80 MM/year), Karveer(5.94 MM/year), Gargoti (5.12 MM/year), Hatkanangale (3.93MM/year), Kolhapur (3.76 MM/year), Gadhinglaj (3.71 MM/year) and Shirol(0.47 MM/year) rain gauge stations of Kolhapur district. In this season highest decreasing rainfall trend is found at -42.50 MM/year at Gaganbawada followed by Radhanagri(-23.20 MM/year), Chandgad(-12.60 MM/year), Bhavarwadi (-3.44 MM/year) and Ajra (-6.36 MM/year) stations in the study period of the study area (Table - I). Figure 4.1 shows the rainfall trend increasing from west to east in the SWM season in the study period. The rainfall of this season has important for the agricultural activity and economy of the Kolhapur district.

POST / NORTH EAST MONSOON TREND:

In the Kolhapur district, the Northeast monsoon season rainfall is decreasing by -1.03 MM/year during 1988-2019 (Table -I). Out of the 14 rain gauge stations of the district, 9 stations observed a decreasing trend and 5 stations observed an increasing trend during this period. The maximum increasing trend is observed in Panhala (0.76 MM/year) followed by Shahuwadi (0.50 MM/year), Radhanagri (0.49 MM/year), Hatkanangale (0.31 MM/year), and last Kagal (0.0.14 MM/year) station, it is located in the central part, South, north and northeast region of the study area. The highest decreasing trend is indicated in the western and northeast-centre parts of the district. i.e. Gaganbawada (-4.52 MM/year), Karveer (-3.29 MM/year), Bhudargad (-2.31MM/year), Ajra (-1.62 MM/year), Gargoti (-1.55 MM/year), Kolhapur (-1.47 MM/year), Gadhinglaj (-1.12 MM/year), Chandgad (-0.41 MM/year) and Shirol (-0.31 MM/year) stations (Table - I). Figure 4.1 shows the above 0 rainfall trend in 5 rain gauge stations. 6 stations observed a decreasing trend between 0 to -2 MM/year and below -2 MM/year rainfall trend are records 3 rain gauge stations. The overall northeast monsoon season

does not observe a specific trend. But due to decreasing rainfall trend of this season, it is not suitable for rabbi crop season in the district.

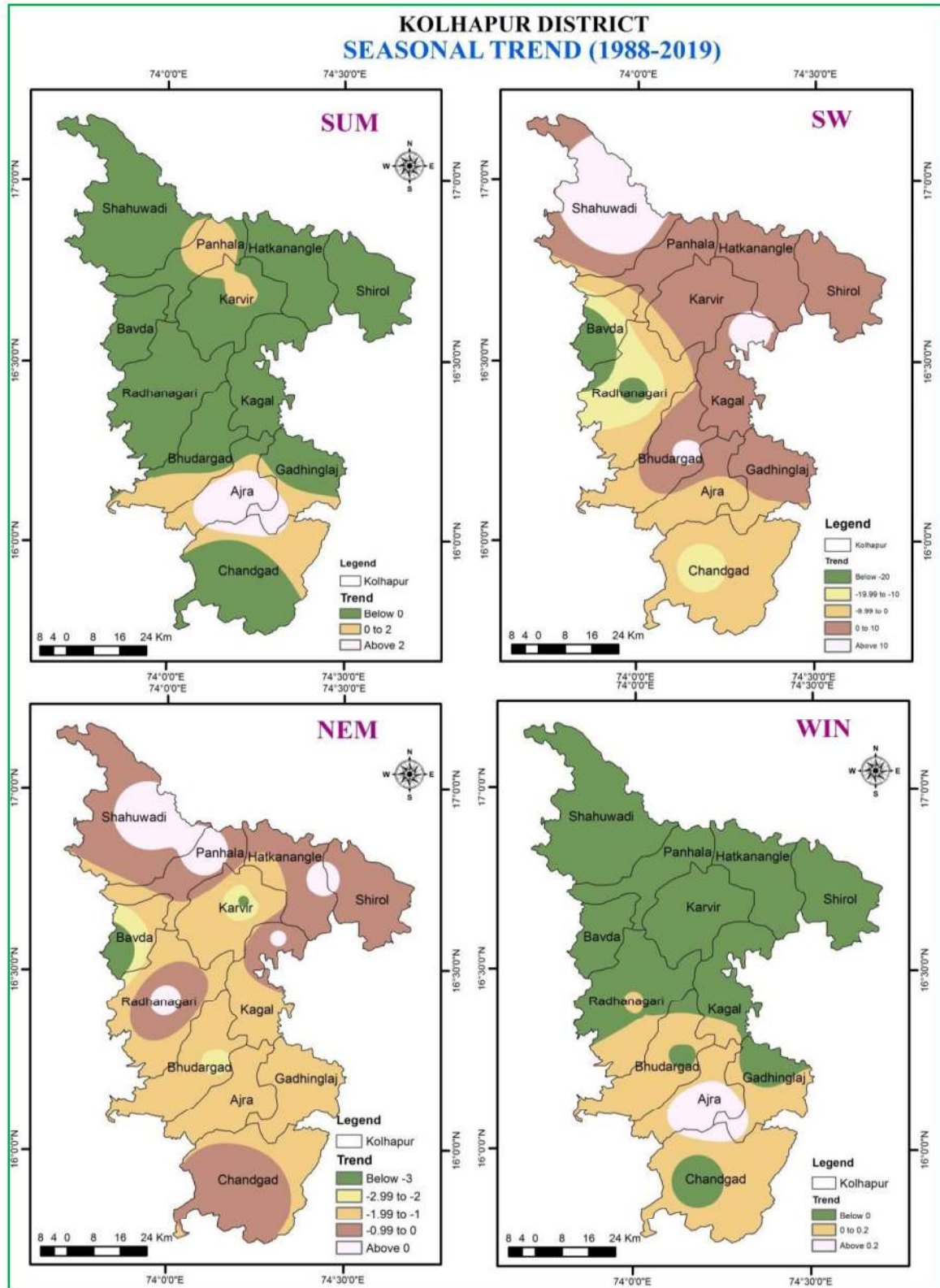


Figure 1



COLD / WINTER SEASON TREND

During the winter season, rainfall observed a decreasing trend in the entire area up to -0.05 MM/year during the 1988-2019 periods. Only the Ajra rain gauge station shows an increasing trend of winter rainfall and 11 stations observed decreasing trend of rainfall in the winter season. Two stations observed rain-free situations during the study period in this season. The maximum increasing trend in Ajra (0.59 MM/year) station (Table - I). In the Kolhapur district, the winter season rainfall trend is recorded as -0.05 MM/year, it is uneven find in the overall study period.

HOT / SUMMER SEASON TREND

The rainfall trend of the summer season in the district was observed to decrease by -0.39 MM/year during the study period. Out of the 14 rain gauge stations of the Kolhapur district, 11 stations observed a decreasing rainfall trend and only 3 stations indicated an increasing trend. The decreasing trend is recorded in Chandgad (-2.82 MM/year), Gaganbawada (-2.03 MM/year), Bhudargad (-2.01 MM/year), Hatkanangale (-2.00 MM/year), Gadhinglaj (-1.93 MM/year), Shirol (-1.75 MM/year), Gargoti(-1.52 MM/year), Kagal(-0.98 MM/year), Radhanagri (-0.79 MM/year), Shahuwadi(-0.30 MM/year), Kolhapur (-0.05 MM/year), rain gauge stations of Kolhapur district.

ANNUAL TREND

The trend investigations of rainfall in various stations lead to a better appreciation of the difficulties associated with floods, drought, and water availability for various uses. The previous performances of the rainfall may give suggestions for future scenarios. But to do so we should also realize the climatology in a better way. The yearly rainfall trend in the Kolhapur district is shown in Table – I. The 10 stations in the Kolhapur district detected an increasing trend and 4 stations indicated decreasing trend of annual rainfall trend. The highest annual increasing rainfall trend is detected at Shahuwadi (25.10 MM/year) and decreasing at Gaganbawada (-49.10 MM/year) station. The overall pattern of annual decrease is recorded at Shirol, Chandgad, Radhanagri, and Gaganbawada stations (-22.59 to -1.84 MM/year) respectively. Shahuwadi, Kagal, Bhudargad, and Panhalastations are indicating increasing trends in the eastern, northern, and central regions except Shirol station. The south, southeast, northwest, and central part of the district show the lower trend is increasing at Panhala (8.90 MM/year), Karveer (2.85 MM/year), Ajra (2.50 MM/year), Hatkanangale (2.19 MM/year), Gargoti (2.05 MM/year), Kolhapur (2.02 MM/year) andGadhinglaj (0.61 MM/year). (Figure 4.2). This study relating to changing patterns of rainfall trends over the Kolhapur district

observed that there is no perfect trend of increase or decrease in the study period over the study area.

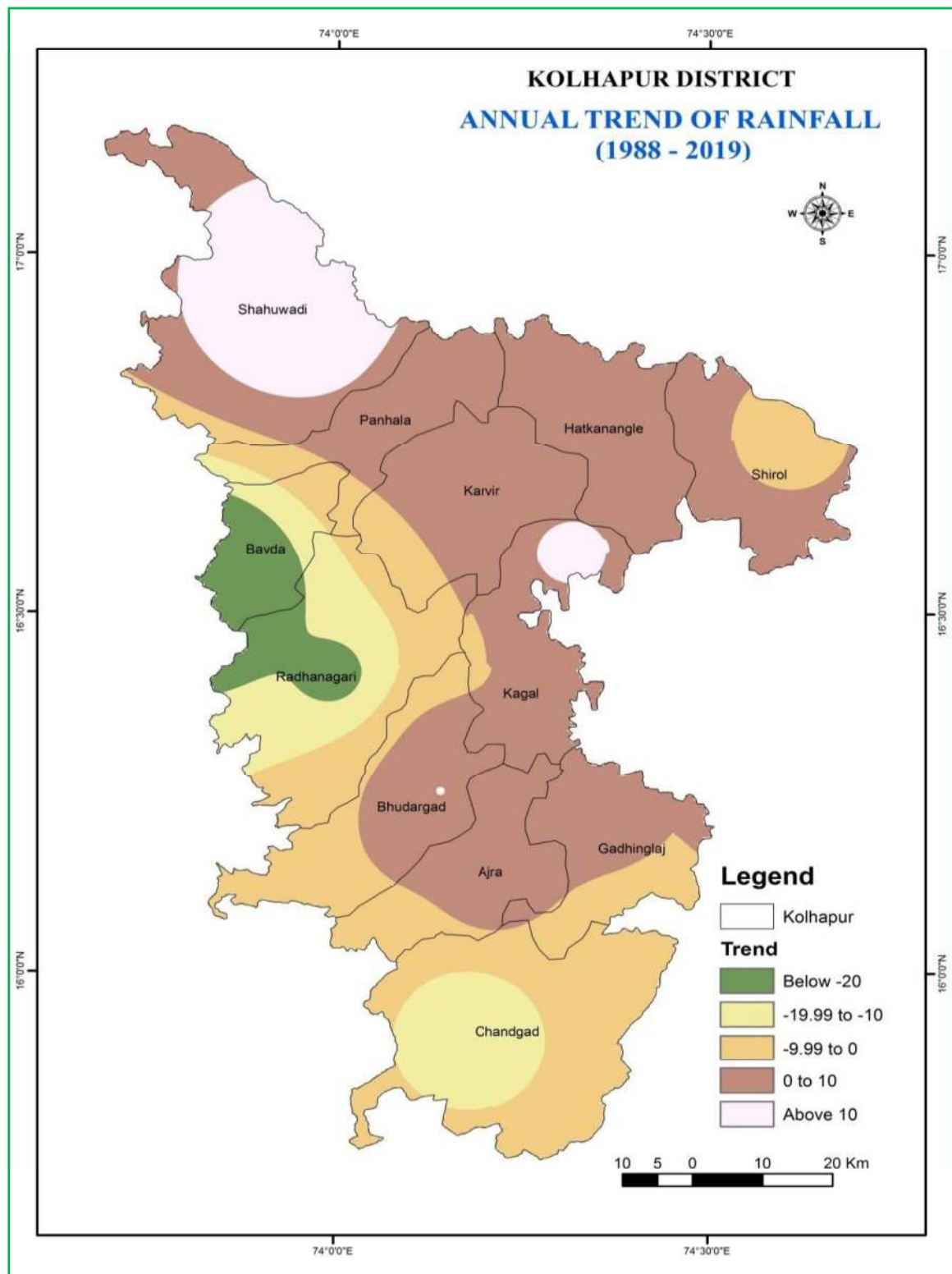


Figure 2



Conclusion:

- 1) All 14 stations' rainfall in the south west monsoon period increasing trend indicating 25.10 MM/year is observed at Shahuwadi station and decreasing -42.50 MM/year is observed at Gaganbawada station.
- 2) In the Kolhapur district, the Northeast monsoon season rainfall is decreasing by -1.03 MM/year during 1988-2019. The maximum increasing trend is observed in Panhala (0.76 MM/year). The highest decreasing trend is indicated in the western and northeast-centre parts of the district. i.e. Gaganbawada (-4.52 MM/year)
- 3) The winter season rainfall trend is recorded as -0.05 MM/year, it is uneven find in the overall study period.
- 4) The rainfall trend of the summer season in the district was observed to decrease by -0.39 MM/year during the study period.
- 5) The 10 stations in the Kolhapur district detected an increasing trend and 4 stations indicated decreasing trend of annual rainfall trend.
- 6) The highest annual increasing rainfall trend is detected at Shahuwadi (25.10 MM/year) and decreasing at Gaganbawada (-49.10 MM/year) station.

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