

Study of Rainfall Trends and Frequency of Rainy Day over Parbhani

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Abstract – Changing climate unfavorably disturb the countries whose economy depends upon rain-fed agriculture since agricultural production is directly depends upon to the amount of rainfall. Taking this fact in consideration here the attempt was made to study trends of rainfall and rainy day of Parbhani city. Long term annual rainfall over Parbhani displayed significantly mounting trends for the period of 42 years. Rainfall trends of winter, summer and post Monsoon over Parbhani showed slightly growing trends while monsoon rainfall trends over Parbhani show slightly falling trends. January, March, April, July, October, November, December show increasing monthly rainfall trends. Maximum increase was seen for July and it was 2.80mm/ year while February, May, June, August, September show decreasing trends.

Keywords – Rainfall Trends, Rainy Days, Parbhani, Climate Change, Increasing, Decreasing, Long Term Annual Rainfall Trends.

1. INTRODUCTION

Climate change adversely affect the developed, developing and under developed countries alike. Up to 1950-60 it was mostly human activity which accelerated adverse change in climate. But now climate change becomes natural activity. Climate change controls extent of development of the developed, developing and under developed countries. Due to all the anthropogenic happenings normal behavior of climate parameter get changed specially temperature and rainfall (Karnewar and kadam, 2016“b”). In recent past due to Climate change and global warming extreme events increased adversely affecting the economic activities like agriculture in developing countries. So most of the scientist, researcher, and climatologist focus their view on urban climate change. (Karnewar and kadam, 2015“a”).

One of the pointers of climate change is rainfall (Adger et al.,2003; Frinch et al., 2002; Novorthy and Stetan, 2007). Many scholars like Gregory (1956) , Panabokke and Walgame (1974), Benoit (1977), Stern et al. (1981), Roy et al. (1987) studies the trends of rainfall all over the world and confirm the change in rainfall trends. In India Dr. Kailas Vijay Karnewar (2018), Parthasarathy, and Dhar (1974), studies rainfall trends in India and found increasing rainfall trends. Therefore the basic aim of this paper is to study the monthly, seasonal, annual rainfall trends and frequency of rainy day over Parbhani.

2. STUDY AREA

Parbhani city is part of Marathwada region of Maharashtra in India. Parbhani is situated approximately at the Centre of Maharashtra. Parbhani is located at 19.27 N76.78 E. It has an average elevation of 347 meters. In Parbhani district there is extension of Ajanta ranges called Nirmal hills. According to 2011 census population of Parbhani city is 3, 07,191 and is officially accorded city status by establishing municipal corporation. Male and female are 157,628 and 149,563 respectively. The sex ratio of Parbhani city is 949 per 1000 males.



Figure: 1.1 Presenting Google map of Parbhani

3. DATA AND METHODOLOGY

The daily rainfall data from 1969 to 2010 of Parbhani was collected from IMD, Pune. A climate normal is

defined by convention as the mean of the climatological variable over a 30-year period (WMO, 1989). To examine the variations in rainfall, rainfall scrutiny was carried for years, for different season, for all monthly basis separately. A year is separated into four seasons: winter (January-February), summer (March-may), monsoon (June- September), post monsoon (October-December). For trend investigation, daily rainfall series were used to form monthly, seasonal and annual rainfall series of these variables.

4. RESULT AND DISCUSSION

4.1 Analysis of Annual rainfall trends of Parbhani.

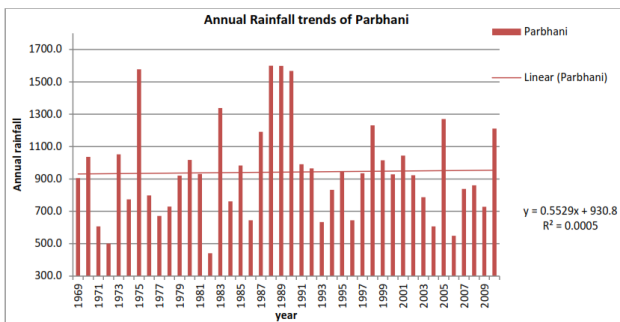


Figure 1 Annual rainfall trends of Parbhani

From above figure it can be stated that Long term annual rainfall over Parbhani showed significantly growing trends for the period of 42 years. Increase of about 0.5529 mm/year was detected and total rise for 42 years was 23.22 mm. The mean of annual rainfall for Parbhani for the period of 42 years was 940.60 mm. Near about 56 % years display annual rainfall less than that of mean annual rainfall and 44% years show annual rainfall more that of mean annual rainfall. The maximum rainfall of 1783.00mm was observed in 1988 and minimum annual rainfall of about 440.70mm was observed in the year 1982 for the study area.

The mean of annual rainfall for first half years (1969-1989) was 964.90 mm. Annual rainfall of first half years (1969-1989) shows increasing trends. For those 21 years annual rainfall increased by 20.74 mm/year and total increase observed was 871 mm. The average annual rainfall of second half was 929.20 mm. Annual rainfalls of second half (1990-2010) shows decreasing trends. Annual rainfall of later 20 years decreased by 8.60 mm/year and total decrease observed was 359.70 mm. The coefficient of variation of first half was 37.55 and for second half it was 26.59 that means rainfall was more varied in first half than that of second half.

4.2 Departure of Annual Rainfall from Normal of Parbhani

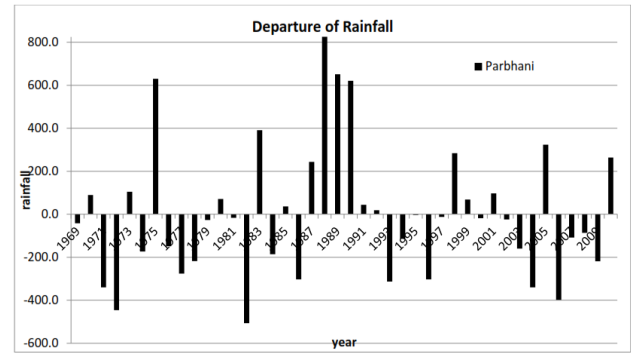


Figure 2: Departure of Annual rainfall from Normal of Parbhani

From above figure 5.5 it is evident that for Parbhani there were 25 years with below normal rainfall (deficit rainfall), only 17 years with above normal rainfall (excess rainfall). Maximum negative departure (maximum rainfall deficit) was observed in 1982 which was -506.3 mm and. Maximum positive departure (maximum excess) was observed in 1989 and it was 651.10 mm. from normal. Out of last ten years only 2 years shows excess rainfall and eight years shows negative departure i.e. deficit rainfall.

4.3 Seasonal rainfall trends over Parbhani

Analysis of seasonal rainfall trends of Parbhani reveals that Maximum seasonal rainfall was observed in monsoon. Monsoon contributes 83.30% and minimum seasonal rainfall of about 0.93% is contributed by winter. Maximum seasonal mean was observed in Monsoon and it is 774.40mm. Increasing trends were seen for monsoon rainfall. Minimum mean rainfall observed for winter which was 8.72 mm decreasing trends was observed for winter. Maximum coefficient of variation was seen in winter and minimum coefficient of variation was seen for monsoon. Which means rainfall is more variable in winter and less variable in monsoon.

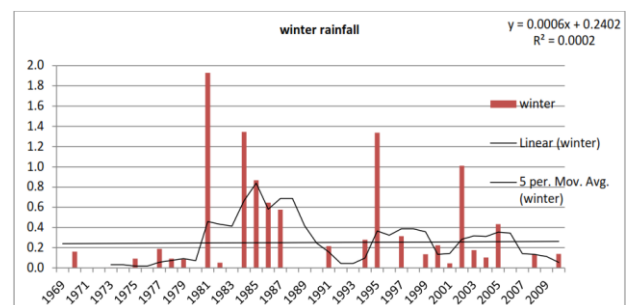


Figure 3 winter rainfall trends over Parbhani

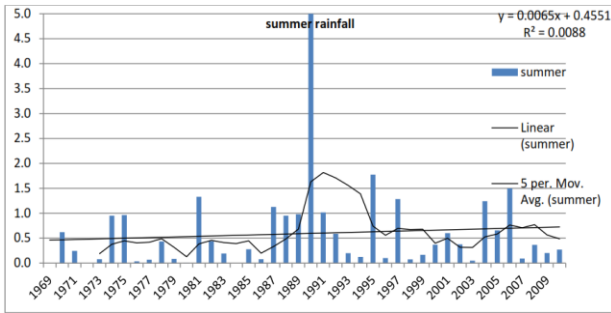


Figure 4 summer rainfall trends over Parbhani

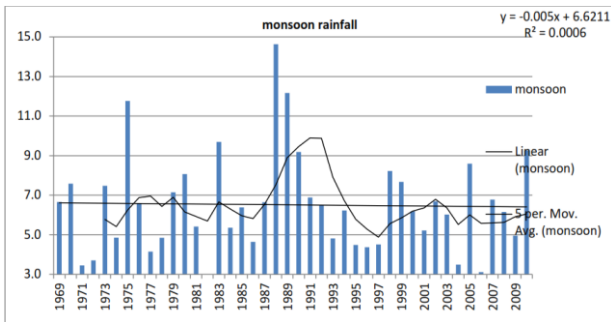


Figure 5 monsoon rainfall trends over Parbhani

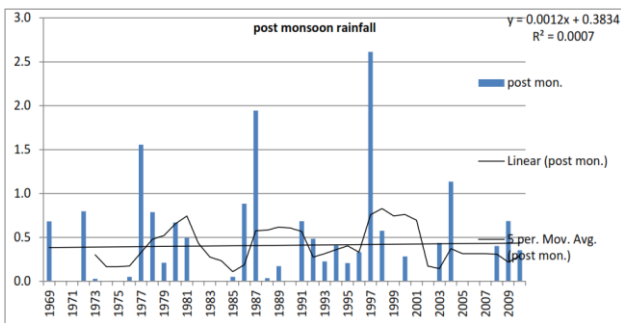


Figure 6 Post monsoon rainfall trends over Parbhani

4.5 Monthly Rainfall Trends of Parbhani

Table 1 Monthly and seasonal Rainfall statistics of Parbhani

Month	Mean	SD	COV	COD	Trends	Increase	contribution
January	9.6	18.9	197.4	0.011	Upward	6.6	0.4
February	5.4	14.3	262.0	0.009	Downward	-4.7	0.5
March	12.6	23.5	186.4	0.036	Upward	15.3	0.7
April	12.2	28.1	229.5	0.015	Upward	10.9	0.7
May	29.7	53.4	179.7	0.000	Downward	-2.5	2.7
June	165.8	93.1	56.1	0.004	Downward	-19.5	16.3
July	250.6	150.0	59.9	0.054	Upward	118.9	24.7
August	210.6	125.2	59.5	0.079	Downward	-120.4	23.8
September	155.2	101.2	65.2	0.003	Downward	-20.3	17.3
October	68.7	72.6	105.7	0.003	Upward	13.8	6.8
November	18.2	22.9	125.9	0.001	Upward	2.0	1.5
December	6.2	19.8	318.2	0.000	Upward	1.2	4.6
winter	15.0	26.0	172.9	0.001	Upward	1.9	0.93
Summer	54.6	77.3	141.6	0.017	Upward	24.1	9.20
Monsoon	782.2	292.4	37.4	0.000	Downward	-19.4	83.30
Po.Mon.	93.1	78.2	84.0	0.003	Upward	15.0	7.97

Behavior of monthly rainfall has been studied for individual months by subjecting them to the linear

trends. The results are presented in above tables and from above figures. It is evident from above figures and table that maximum monthly rainfall was observed for July, August, June and September and it was 250.60mm, 210.60mm, 165.80mm, and 155.20mm respectively. January, March, April, July, October, November, December show increasing monthly rainfall trends. Maximum increase was seen for July and it was 2.80mm/year and total increase for the period of 42 year was 118.90 mm.

For Parbhani February, May, June, August, September show decreasing trends. Maximum fall was seen for the month of August and it was 2.86mm/year and total fall for the period of 42 year was 120.40 mm. For monthly rainfall, maximum coefficient of variation was observed for December and February and it was 318.15 and 262.016 respectively and minimum coefficient of variation was observed for June, August and September and it was 56.12, 59.45, and 56.87 respectively. This means that monthly rainfall was more variable in December and February and it is more stable in June, August and September. In annual rainfall maximum contribution was done by July and it was 24.7 % and January contributes minimum rainfall of about 0.4%.

4.6 Analysis of Trends of Rainy Days of Parbhani

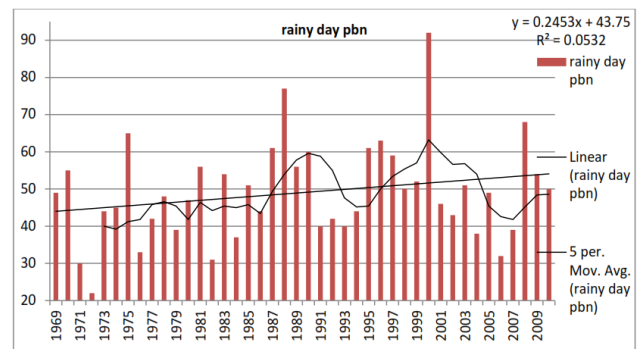


Figure 7 Rainy days Trends of Parbhani

A. Analysis of trends of rainy days of Parbhani

Rainfall amount realized in a day is 2.5 mm or additional is termed as rainy day. Investigation of rainy days carried out considering three periods 1. Total months 2. for monsoon season, 3. Season other than monsoon

It is evident from above figure that the mean of Annual rainy days for Parbhani was 49. Maximum 92 rainy days were observed in 2000. Minimum 27 rainy days were observed in 1972. The linear trends of total rainy days show increasing trends of 0.2311 days/year and total increase was 9.70. The mean of first half (1969-1989) of annual rainy days was 46.75. The linear trends of first half of total rainy days shows increasing trends of about 0.7974 days/ year and

total increase observed was 15.948. The mean of second half of total rainy days was 51.30. The linear trends of second half (1990-2010) of total rainy days show slightly decreasing trends of 0.0636 days/year, total decrease was 1.272.

The mean of monsoon rainy days for Parbhani was 40.10. Maximum rainy days were observed in 2000 and it was 70. Minimum rainy days were observed in 1982 and 2006 it was 23. The linear trends of monsoon rainy days show increasing trends of 0.1657 days/year and total increase was 6.96. The mean of first half (1990-2010) of monsoon rainy days was 38.85. The linear trends of first half (1990-2010) of monsoon rainy days shows increasing trends of 0.539 days/year and total increase was 10.78. The linear trends of second half of monsoon rainy days also shows increasing trends of about 0.3935 days/year and total increase observed was 7.87 which is less than that of first half

The mean of non-monsoonal rainy days was 9.10. Maximum rainy days were observed in 1997 and it was 25. Minimum rainy days were observed on 2007 it was 2. The linear trends of non-monsoon rainy days show increasing trends of 0.0654 days/year and total increase was 2.75. The mean of first half (1969-1989) of non-monsoon rainy days was 7.90. The linear trends of first half (1969-1989) of non-monsoon rainy days shows increasing trends of 0.3278 days/year and total increase was 6.556. The mean of second half of non-monsoon rainy days was 10.10. The linear trends of second half of non-monsoon rainy days shows decreasing trends of about 0.3461 days/year total decrease observed was 6.576.

During the study period of 42 years 2325 rainy days were witnessed over Parbhani. Out of 2325 rainy days 1921(82.62 %) rainy days were witnessed in monsoon season and only 404 (17.38 %) rainy days witnessed in summer and winter and post monsoon season.

5. CONCLUSION

Long term annual rainfall over Parbhani showed significantly growing trends for the period of 42 years. Increase of about 0.5529 mm/year was detected and total rise for 42 years was 23.22 mm.

Long-term seasonal rainfall trends of winter, summer and post Monsoon over Parbhani showed slightly increasing trends of 0.0454/year (total increase 1.90 mm), 0.5733 mm/year (total increase 24.08 mm), and 0.3564 mm/year (total increase 14.90mm) respectively while Long-term monsoon rainfall trends over Parbhani show slightly decreasing trends. The rainfall decreased by 0.462 mm/year and total decrease for this period was 19.404mm.

For Parbhani monthly rainfall trends of February, May, June, August, September showed decreasing trends. Maximum fall was seen for the month of August and it was 2.86mm/year and total fall for the

period of 42 year was 120.40 mm. The mean of Annual rainy days for Parbhani was 49. The linear trends of total rainy days show increasing trends of 0.2311 days/year and total increase was 9.70. During the study period of 42 years 2325 rainy days were witnessed over Parbhani.

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