Journal of Basic and Applied Engineering Research
p-ISSN: 2350-0077; e-ISSN: 2350-0255; Volume 3, Issue 10; July-September, 2016, pp. 898-902

http://www.krishisanskriti.org/Publication.html

Rainfall Trend of Buldana Station by using Metrological Data

S. P. Shinde[1], P. D. Naitam[2] and M. U. Kale[3]

[1,2,3]Dr. P.D.K.V, Akola
E-mail: [1]sachinshinde04121992@gmail.com, [2]pranalinaitam2@gmail.com, [3]kale921@gmail.com

Abstract—*The Rainfall trend was analysed from meteorological data for Buldana station in Vidarbha from Maharashtra state in India, over 17 years from 1998-2014. The rainfall has been assessed by linear trend analysis and Mann-Kendall trend test. From analysis it is seen that month of May and June shows decreasing trends, month July shows increasing trend and months August, September, October, November and December shows no trend.*
To determine onset of effective monsoon (OEM) and withdrawal of monsoon (WOM) for Buldana station by Ashok Raj criteria (1979). The mean dates of onset of effective monsoon (OEM) is varies from 1 June to 19 June and withdrawal of effective monsoon (WOM) is varies from 1 September to 25 September in Buldana station.

Keywords*: Rainfall Trend, Mann-Kendall Trend test, Effective Monsoon.*

1. INTRODUCTION

Climate change is long term process. It has raised as most alarming issue for whole world. Therefore quantification of climate changes has become necessary. Trend analysis is method to determine the spatial variation and temporal changes for different parameters associated to climates for nation like India, this is a crucial issue of our country having an agro based economy .Which largely depends upon rainfall due to monsoon. Thus any change in that phase of year may ruin the agricultural condition of country and there by the economy. More ever, it will also cause threat to food security of nation. The climate change is too high for India compare to global climatic variability. It will further lead to essence of determining in most important climatological parameter that is rainfall may be responsible to natural calamities like draught and flood conditions.

World meteorological organization (2000) has recommended a number of statistical techniques for climatological analysis. Using sum of these methods, rainfall in Buldana has been analyses to study presence of any trend in rainfall series.

Rainfall forms the input of all hydrological studies a part from quantum of rainfall. It's time distribution plays a critical role in planning and management of water resources. Peak rainfall data, are used in designing storm water management system and in determining flooding potential of variance storm events. Daily or hourly data are required in continuous hydrological simulation procedure. Monthly and seasonal data are used in determining supplementary irrigation water requirement and in engineering studies related to storage analysis, water supply and reservoir management.

Onset of effective monsoon is important for planning and management in dry land crop. Dry farming region face the greatest drought hazard and characterized by low and uncertain crop yields. This situation can be improved by focusing towards dry land agriculture in a planned manner from soil and water conservation point of view and by certain protective irrigation facilities through rain water harvesting.

2. DESCRIPTION OF STUDY AREA

Buldana is among the 36 districts of Maharashtra situated in central part of state. Madhya Pradesh is situated in the north side of Buldana. In the East side Akola, Washim and Amrawati districts are situated in the south side there is Jalna district and in west side Jalgaon Khandesh and Aurangabad districts are situated.

3. METHODOLOGY

Methodology applied in this theses is Trend analysis i.e. Mann-Kendall test on the daily or monthly rainfall data of Buldana for 17 years. Generally, non-parametric tests are preferred over parametric tests because problems aroused due to data skew can be evaded by non- parametric ones. Mann-Kendall test is most commonly used test for trend analysis of any hydro climatic series for checking spatial variation and temporal deviation. This formula was derived by both Mann and Kendall i.e. Mann(1945) formulated it as non- parametric test to detect trend where as Kendall (1975) gave test Statistic Distribution to test non-linear trend and turning point.

3.1 Trend Analysis by Mann-Kendall Test

The Mann-Kendall statistics "s" is given by The Mann-Kendall statistics "s" is given by

$S = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} sgn(X_j - X_i)$……. ……(1)

Application of trend test is done to a time series "X_i" i.e. ranked from, i=1,2,….n,n-1 and "X_j" which is ranked from, j=i+1,2…n. Each of data point "X_i" is taken as reference point which is compared with the rest of data points "X_j" so that,

$$Sgn(X_j - X_i) = \begin{cases} +1, > (Xj - Xi) \\ 0, = (Xj - Xi) \\ 1, < (Xj - Xi) \end{cases} \quad \ldots\ldots\ldots\ldots \quad \ldots\ldots(2)$$

For n>8, follows approx normal distribution with mean i.e.

E(S) = 0

Varaiance Statistics is given by,

$$Var(S) = \frac{n(n-1)(2n-5) - \sum_{i=1}^{n} ti(i)(i-i)(2i+5)}{18} \quad \ldots\ldots\ldots\ldots(3)$$

Where,

t_i- considered as number of ties up to sample i.

The test statistics "Z_{mk}" (Mann-Kendall coef^n) computed as,

$$Z_{mk} = \begin{cases} s+1 \Big/ \sqrt{var(s)}, s > 0 \\ 0, S = 0 \\ s+1 \Big/ \sqrt{var(s)}, s < o \end{cases} \quad \ldots\ldots\ldots\ldots \quad \ldots\ldots..(4)$$

"Z_{mk}" here follows a standard normal distribution. A positive and negative values of Z_{mk} indicates an Upward Trend and Downward Trend respectively. But for greater length of data," $Zmk \Big/ sqrt(n)$" is also used as Mann-Kendall statistics to determine trend, where "n" is the number of data years.

Given table shows the conditions for increasing, decreasing and no trend respectively.

Table 1: Conditions of "Z" values and its trend by Mann-Kendall trend

Condition	Trend
if Z is positive and probability is more than 95 %	Increasing
if Z is negative and probability is more than 95 %	Decreasing
if probability is less than 95 %	No trend

3.2 Onset of Effective Monsoon

The daily rainfall data in Buldana district reveals that the pre monsoon showers are very frequent in the region. However, the rains are followed by long dry spells. The dates of onset and end of effective monsoon were found out by using daily rainfall data. The concept developed by Ashok Raj (1979), for onset of effective monsoon (OEM) and dry spells were adopted in the present study. According to this concept the date of commencement of seven days spells satisfying following three criteria is taken as the date of onset of effective monsoon.

- The first day rain in the seven day spell should be more than the average daily evaporation (e) mm of the place.
- The total rain during the seven days spell should be at least (5e+10mm).
- At least four out of these seven days should be rainy day having rainfall more than or equal to 2.5 mm.

The dates of onset of effective monsoon for each year were determined by applying the above criterion, the mean date of onset of effective monsoon 'm' was computed by using the equation as below :-

$$M = \sum_{i=1}^{n} \frac{Xi}{n}$$

Where,

X_i(i=1,2,3…….n) = dates of onset of effective monsoon.

n = Total number of years.

The standard deviation of X_i (i = 1,2,3…….n) dates of onset effective monsoon (OEM) as calculated by using following equation.

$$\sigma = \left[\frac{\sum_{i=1}^{n} Xi^2 - \left(\frac{\sum_{i=1}^{n} Xi}{n} \right)^2}{n-1} \right]^{\frac{1}{2}}$$

4. RESULT AND DISCUSSION

4.1 Trend Analysis

The Mann-Kendall test for different months of different years from 1998-2014 done for Buldana shows that the months May, August and October has 1 tied group and 2 items. While month September possess 2 tied groups and 4 items and months June, July, November and December has a 0 tied groups and 0 tied items.

The values of "Z" (Mann-Kendall coef^n) and it's variations are shown in given table which shows the behaviour of rainfall or trend shown by graphs.

Given table shows the values of "Z" in the range of -3 to 1.20 computed by using the formula noted as equation (1) and the trends are shown in column "trend" by using graphs.

Table 2 Value of "Z" With Respective Month and It's Trend

Sr. No.	Month	Z	Trend
1)	May	-2.76	Decreasing
2)	June	-1.19	Decreasing
3)	July	1.19	Increasing
4)	Aug	-0.58	No Trend
5)	Sep	0.66	No Trend
6)	Oct	-0.58	No Trend
7)	Nov	0.91	No Trend
8)	Dec	0.74	No Trend

4.1 Graphs Showing Behaviour of Rainfall or Trend

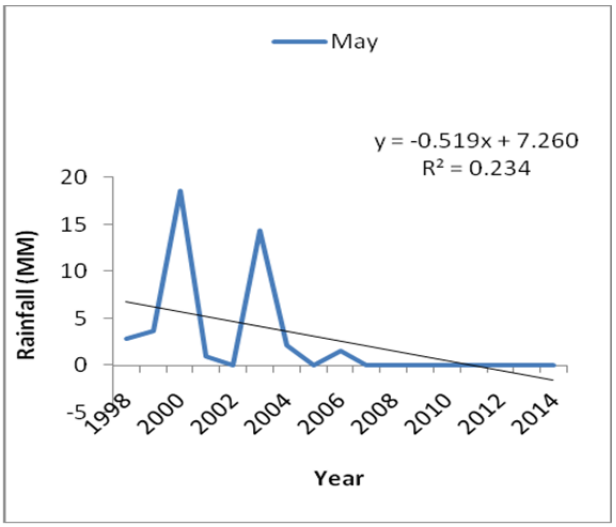

Fig. 1. Rainfall data of month-May Graph

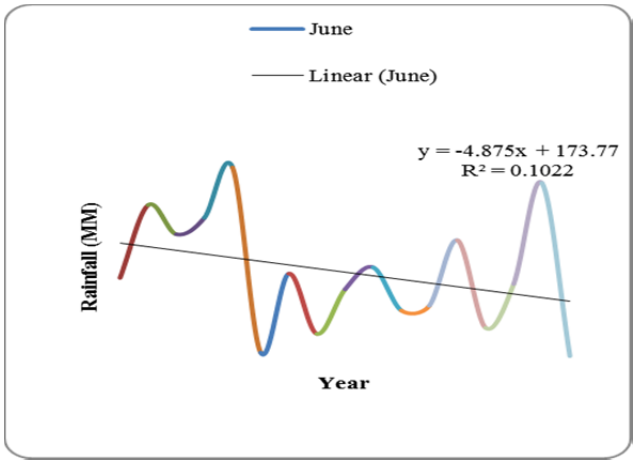

Fig. 2: Rainfall data of month-June

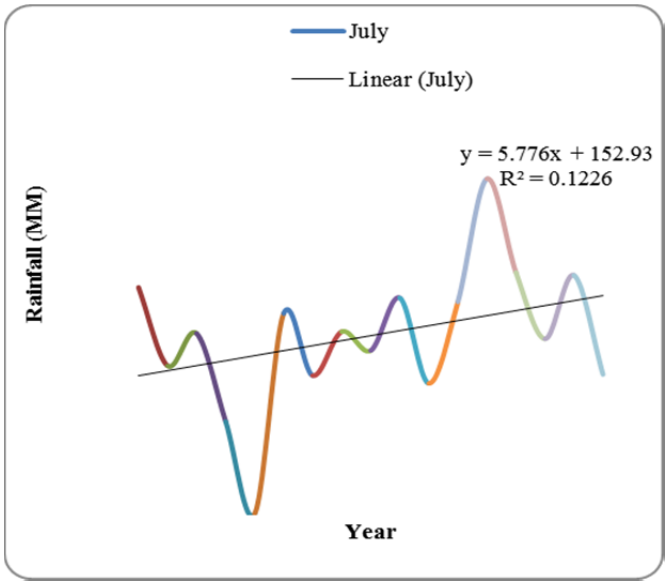

Fig. 3. Rainfall data of month-July

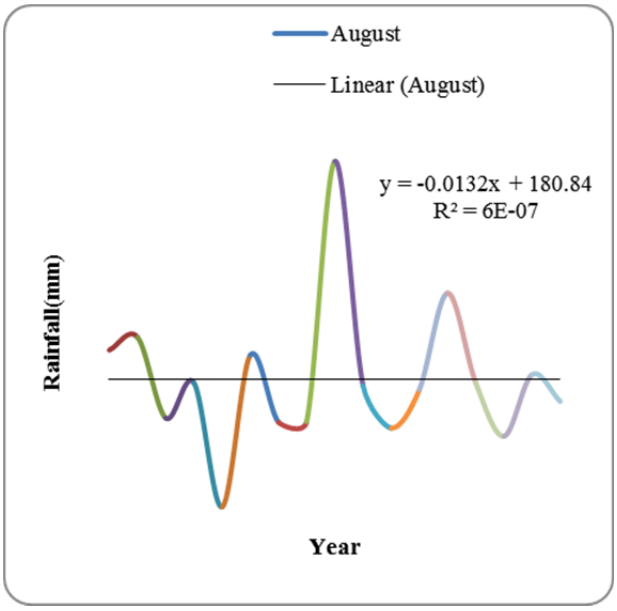

Fig. 4. Rainfall data of month-August

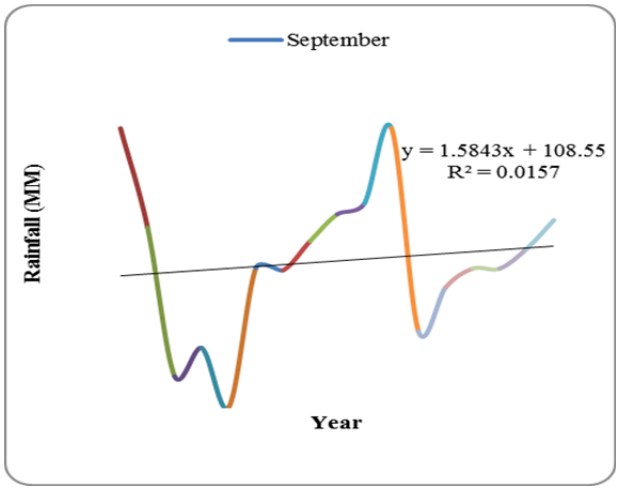

Fig. 5. Rainfall data of month-September

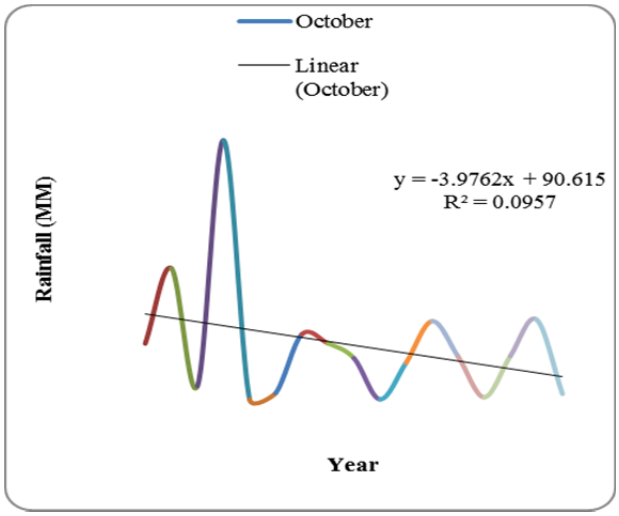

Fig. 6. Rainfall data of month-October

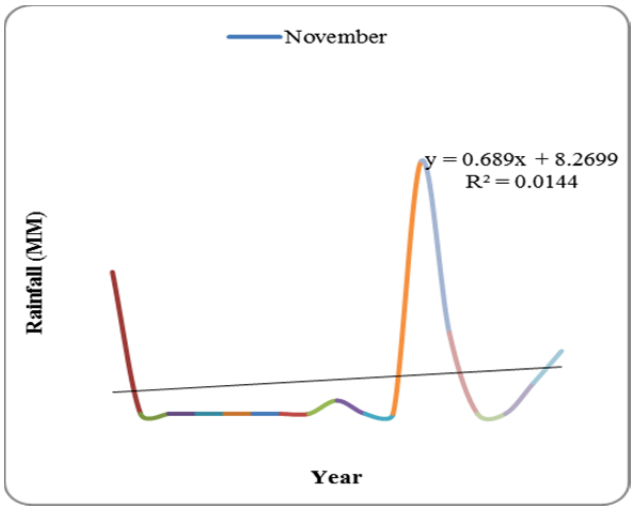

Fig. 7. Rainfall data of month-November

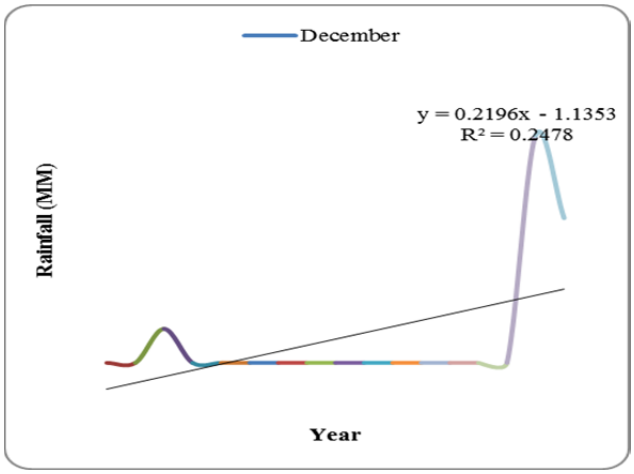

Fig. 8. Rainfall data of month-December

Months May and June shows decreasing trend because the value of "Z" is positive and probability is more than 95% which is -2.76 and -1.19 respectively and it is clearly shows the trend-line of Fig. 1 and Fig. 2 respectively.

Month July shows increasing trend because value of "Z" is negative and probability is more than 95% which is 1.19 respectively and it is clearly shows the trend-line of Graph 3.

Months August, September, October, November and December shows no trend as the probability is less than 95% which is -0.58, 0.66, -0.58, 0.91, 0.74 respectively and it is clearly shows the trend-line of Graphs 4,5,6,7,8 respectively.

5. CONCLUSION

Average seasonal rainfall during Kharif season in Buldana district ranges from 600 to 819.6 mm. We found that the trend-line in month May and June shows decreasing trend. Trend-line of month July shows increasing trend, while there is no trend in remaining months i.e. August, September, October, November and December.

REFERENCES

[1] Ashok Raj, P.C., (1979)."Onset of Critical Dry Spell. A Computer Base Forecasting Technique ."IARI Bulletin no. 11WTC New Delhi.

[2] Amrutha Rani H. R. and Sgreedhar R. (2014)."Study of Rainfall Trends and Variability for Belgum District".International Journal of Research in Engineering and Technology.eISSN:2319-1163.

[3] Devendrakumar, (1995)."Variation in Rainfall Pattern Terrain Region of Utter Pradesh Ind. J. Soil.Conser." 23(2) : pp. 103-106.

[4] Dhar, O. N. and Ghosh, (1974)."A Study of Mean Monthly an Annual Rainfall of India."Vayumandal.4(2). pp. 49-52.

[5] Jajoo,S. B. , S. D. Benke, and G. R. A. Tal. (1992). “Probability Analysis of Daily and Weekly Rainfall for Akola”,pkv.Res. J. 16(2) ;pp 233-237.

[6] Ray, C. B. , P. C. Senapati, and p.lal, (1987) “Rainfall Analysis for Crop Planning in Gopalpur” j. Agril. Engg. 17(3): pp. 1-8.

[7] Swain sabyasachi, VermaManikant and Verma M. K. (2015).“Statistical Trend Analysis of Monthly Rainfall for Raipur District, Chhatisgarh”.International Journal of Advance Engineerig Research and Studies.E-ISSN2249-8974.

[8]Deshmukh D. T. and Lunge H. S. (2013). “A Study of Rainfall Trends InBuldana District of Vidarbha, India”. International Journal of Scientific and Technology research volume 2, Issue 2, February 2013. ISSN 2277-8616.

[9] Tomar. A. S, Ranade. D.H, Jain L.K, and ‘Vishvakarma. S. K., (2002) “Crop Planning in VertisolsBased on Monsoon Period Rainfall Analysis Indian Journal”, ‘Agricultural Sciences.72(6):362-363.

[10]Wadatkar, S.B. , V. B. Dalvi, and B. S. Rajkumar, (1990). “Analysis of Rainfall Data for Irrigation Planning at Akola Station” PKV Res J14(2): pp. 218-221.