Asian Jr. of Microbiol. Biotech. Env. Sc. Vol. 23, No. (1) : 2022 : 86-89

ISSN-0972-3005

http://doi.org/10.53550/AJMBES.2022.v24i01.016

BLOCK WISE RAINFALL VARIABILITY ANALYSIS OF DISTRICT SAWAI MADHOPUR, RAJASTHAN, INDIA

***M. K. NAYAK, **S.L. KHASWAN, [1]MADHO SINGH, [2]PARDEEP KUMAR AND [3]ATUL GALAV**

*Krishi Vigyan Kendra, Karauli, Rajasthan, India
[1]Krishi Vigyan Kendra, Dholpur, Rajasthan, India
[2]Krishi Vigyan Kendra, Hanumangarh, Rajasthan, India
[3]Krishi Vigyan Kendra, Jaisalmer, Rajasthan, India

(Received 11 November, 2021; Accepted 18 December, 2021)

Key words: *Rainfall variability estimation, Rainfall variability analysis of district Sawai Madhopur*

Abstract –An attempt has been made to study the block wise rainfall variability analysis of districts Sawai Madhopur of Rajasthan. Study was performed on data sets of annual rainfall for the period of 1990-2020 (31 years) for district Sawai madhopur of Rajasthan. The coefficient of variation and standard deviation for weekly, monthly and annual rainfall were also computed for district Sawai Madhopur. The normal onset of monsoon in district Sawai Madhopur is between June to September. It was found that the annual rainfall is higher at Sawai madhopur block followed by Gangapur and Khandar block during last second and third decade. The mean annual rainfall is lowest in Bonli block. When the CV for the annual rainfall was examined, it was found be the least in Gangapur block followed by Sawai madhopur, bonli, bamanwas and khandar block, it was the highest.

INTRODUCTION

Sawai Madhopur district comes in flood prone eastern plain area and agro climatic zone III B. The soils of this zone are predominantly loamy sand to sandy loam in texture and clay type under alluvium prone to water logging and Lithosols and Regosols group. These are alluvium calcareous. The mean annual rainfall is 714.89 mm. The mean daily maximum temperature at district Sawai madhopur from 18.0 °C in January to 42.0 °C in June. Similarly the mean daily minimum temperature ranges from 10.0 °C in January to 29.0 °C in June. The principal crops of the zone are pear millet, cluster bean, groundnut, wheat, Mustard and Gram. Rainfall is one of the most important natural resource input to crop production in this region.

Rainfall characteristics

Rainfall variability of five blocks (Bamanwas, Bonli, Gangapur, Khandar and Sawai M adhopur block) of flood prone eastern plain area, Rajasthan during the period 1990-2020 (31 years) was computed from available daily rainfall data recorded at rain-gauge stations of the district. The data were downloaded from the web site (www.waterresources.rajasthan.gov.in) for further scrutinized and checked for their use in the present study.

Mean rainfall

The amount of rainfall collected by a given rain gauge in 24 hrs is known as daily rainfall (mm or cm) and the amount collected in one year in known as annual rainfall. The mean of the annual rainfall was calculated by given formula

$$\text{Mean Annual Rainfall} = \frac{\text{Total Rainfall}}{\text{Number of Yeras}}$$

Standard Deviation (SD)

It is defined as the square root of the mean of the squares of deviations of the rainfall value from the arithmetic mean of all such rainfall. It is a measure of variability or the scatter or the dispersion about the mean value. It is given by the following formula.

$$SD\ (\sigma) = \sqrt{\sum \frac{(X - \bar{X})2}{n - 1}}$$

X = Rainfall

$\bar{X}$ = Mean rainfall
n = Number of year

Coefficient of variation

Assessment of rainfall variability through Coefficient of variation (CV %) appears to be simple. CV is defined as the Standard deviation divided by the mean value of rainfall. It shows the variability of rainfall in percentage.

$$CV\ \% = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100$$

The greater the CV, the lesser the dependability of receiving rainfall. Considering the annual CV, the IMD is using the following criteria for assessing the rainfall in a particular area.

Normal = - 19 to 19 % of annual normal rainfall.
Deficit = - 20 to - 59 % of annual normal rainfall.
Scarce = - 60 % and above of annual normal rainfall

RESULTS AND DISCUSSION

Decadal Rainfall analysis

From the Table 1, indicated that decadal rainfall for 31 years (1990 to 2020). The analysis of rainfall were performed on decade basis, Decade I from 1990 to 1999, Decade –II from 2000 to 2009) and Decade III from 2010 to 2020. The calculated mean rainfall data for different blocks was reported in Table 1. The maximum mean rainfall was observed in Sawai Madhopur (841.20 mm), (805.70 mm) and (1017.00 mm) block for the decade I (1990-1999), II (2000-2009) and decade III (2010-2020), respectively followed by Gangapur (607.75 mm), (779.27 mm) and Khandar (605.90 mm), (746.6 mm) block for decade II (2000-2009) and decade III (2010-2020), respectively. The lowest CV was observed for block Gangapur, Bonli and Baman was block for the decade II (2000-2009) and decade III (2010-2020). The least rainfall observed in bamanwas block for the decade II (2000-2009) and III (2010-2020). Similar study trends were observed by other authors (Yadav and Nath, 2018; Yadav *et al.* 2018 and Rajbanshi, 2015).

Year

Monthly variation of rainfall, standard deviations and coefficient of variation for the period of 1990-2020 (31 years)

The observed mean rainfall, coefficient of variation and standard deviation for a period of 1990 to 2020 (31 years) for different blocks of district Sawai madhopur. The observed mean rainfall reported in the Table 2. It was found that the annual rainfall is higher at Sawai madhopur (892.13 mm) block followed by Gangapur (711.06 mm) and Khandar (702.24 mm) block. The mean annual rainfall is lowest at Bonli (543.61 mm) block. The observed monthly rainfall was highest at Sawai madhopur (301.48 mm) block followed by Khandar (232.03 mm) block in the month of July. The higher rainfall always was observed in the month of July and August due to the monsoon season. From observation of Table 3 data showed that the calculated coefficient of variation. The monthly values of CV during monsoon months were lower when compared to other months. However the lowest values of CV were in the month of July and August the variation of coefficient value due to the cyclonic activity perform in the district. When the CV for the annual rainfall was examined, it was found be the least at Gangapur (29.29 %) followed by Khandar (29.78 %), Bamanwas (31.16 %) block and highest in Bonli (39.37 %) block. The calculated standard deviation reported in the Table 4. It was found that the annual standard deviation is higher at Sawai Madhopur (304.16) block followed by Bonli (214.01) and Khandar (209.10) block. The annual

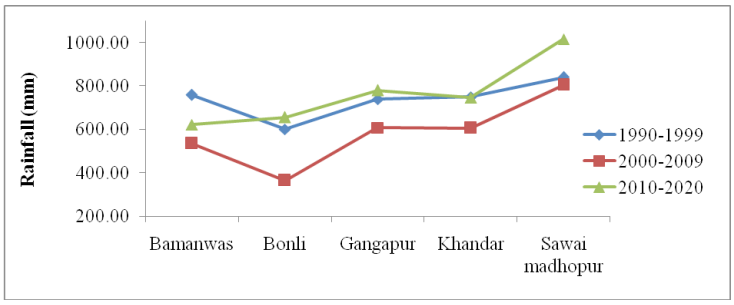

Fig. 1. Mean rainfall for the period of 1990-2020 (3 decades) district Sawai Madhopur of Rajasthan Coefficient of Variance (%)

standard deviation is lowest at Bamanwas (198.88) block. (Similar study on variability and trend analysis of rainfall data for Rajasthan by (Singh, 2016; Yadav and Nath, 2018). Other authors worked on rainfall analysis (Asim and Nath, 2015; Roy, 2015) .

CONCLUSION

The present study concluded that "Block wise rainfall variability analysis of district Sawai Madhopur, Rajasthan," for the period (1990 - 2020) to evaluate basis on different precipitation data. It

Table 1. Mean rainfall variability for the period of 1990-2020 (3 decades) district Sawai Madhopur of Rajasthan

Block	1990-1999	2000-2009	2010-2020	1990-1999	2000-2009	2010-2020
	Decade -I Mean	Decade -II Mean	Decade -III Mean	Decade -I Coefficient of	Decade -II Coefficient	Decade -III Coefficient
	Rainfall	Rainfall	Rainfall	Variance	of Variance	of Variance
Bamanwas	758.03	535.90	622.27	20.15	36.63	31.28
Bonli	600.30	363.90	655.45	33.56	35.71	29.11
Gangapur	739.33	607.75	779.27	35.02	32.69	17.06
Khandar	750.05	605.90	746.36	24.52	37.47	27.00
Sawai madhopur	841.20	805.70	1017.00	19.08	34.93	38.82

Table 2. Monthly variation of mean rainfall for the period of 1990-2020 (3 decades) district Sawai Madhopur of Rajasthan

	Mean rainfall (mm)				
Month	Bamanwas	Bonli	Gangapur	Khandar	Sawai Madhopur
January	9.30	6.23	7.55	8.32	7.95
Febuary	8.03	3.81	6.94	5.84	8.05
March	5.94	5.87	4.61	4.94	7.58
April	5.16	2.10	3.90	3.97	6.52
May	7.90	7.71	8.92	8.90	15.29
June	57.46	43.39	71.29	82.63	100.81
July	206.18	181.71	214.35	232.03	301.48
August	221.74	203.45	261.18	233.03	303.81
September	95.48	71.10	104.78	89.87	106.74
October	13.85	9.42	19.97	20.13	22.81
November	3.90	7.23	4.66	9.23	8.97
December	3.55	1.61	2.90	3.35	2.13
Total	**638.50**	**543.61**	**711.06**	**702.24**	**892.13**

Table 3. Monthly Coefficient of variation for the period of 1990-2020 (3 decades) district Sawai Madhopur of Rajasthan

	Coefficient of Variation (%)				
Month	Bamanwas	Bonli	Gangapur	Khandar	Sawai Madhopur
January	186.05	241.49	200.30	190.09	175.80
Febuary	159.42	218.27	167.03	199.74	195.85
March	210.11	254.46	213.41	251.16	262.39
April	217.32	209.83	132.03	197.86	148.68
May	128.97	227.25	149.37	160.14	164.36
June	75.24	97.47	81.16	84.27	86.03
July	56.10	57.50	61.70	70.55	54.93
August	57.63	77.53	58.90	53.00	55.54
September	71.76	88.99	68.40	65.21	98.34
October	178.09	207.13	170.80	185.66	159.23
November	322.13	310.15	308.38	324.34	376.85
December	295.65	324.81	241.50	345.52	252.28
Annual	**31.16**	**39.37**	**29.29**	**29.78**	**34.09**

Table 4. Monthly standard deviation for the period of 1990-2020 (3 decades) district Sawai Madhopur of Rajasthan Block

Month	Bamanwas	Bonli	Gangapur	Khandar	Sawai madhopur
January	17.30	15.03	15.12	15.82	13.98
Febuary	12.80	8.31	11.58	11.66	15.76
March	12.47	14.94	9.84	12.40	19.89
April	11.22	4.40	5.15	7.85	9.69
May	10.19	17.52	13.32	14.26	25.13
June	43.23	42.29	57.86	69.63	86.72
July	115.67	104.48	132.25	163.70	165.60
August	127.78	157.74	153.84	123.51	168.73
September	68.51	63.27	71.67	58.60	104.97
October	24.67	19.51	34.10	37.37	36.32
November	12.57	22.41	14.37	29.92	33.79
December	10.49	5.24	7.01	11.59	5.37
Annual	**198.88**	**214.01**	**208.28**	**209.10**	**304.16**

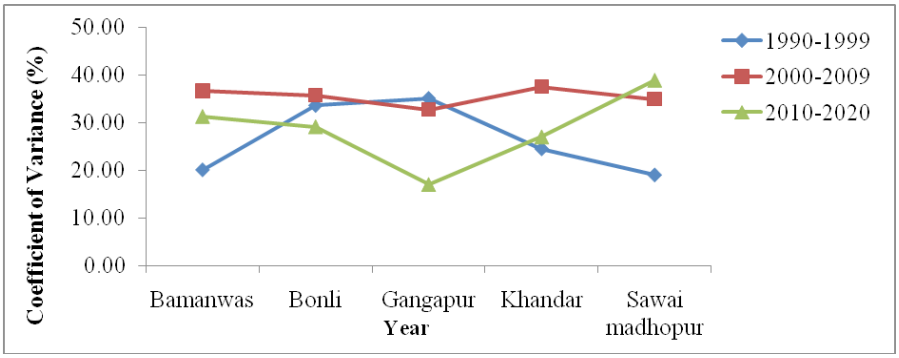

Fig. 2. Coefficient of variation for period of 1990-2020 (3 decades) district Sawai madhopur of Rajasthan

was found that the annual rainfall is higher at Sawai madhopur block followed by Gangapur and Khandar block. The mean annual rainfall is lowest in Bamanwas block. Coefficient of variation for the annual rainfall was examined, it was found be the least at Gangapur followed by Khandar, Bamanwas and highest in Bonli block and Coefficient of variation in monsoon months were lower than other months. However the lowest values of CV were observed in the month of July and August due to cyclonic activity the maximum rainfall observed in the month of August.

ACKNOWLEDGEMENTS

Author expresses their sincere thanks to Meteorological Department, water resources Department Government of Rajasthan for providing the meteorological data for this study

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