

Original Research Article

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Rainfall Variability Estimation for District Karauli, Rajasthan, India

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ABSTRACT

Keywords

Agriculture, winter, summer, rainfall, temperature, hydrology

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The present research investigation was undertaken to work out the rainfall variability analysis of different blocks of district Karauli, Rajasthan. The coefficient of variation and standard deviation for weekly, monthly and annual rainfall were computed for all the six blocks. The normal onset of monsoon in district Karauli is between June to September. It was found that the annual rainfall is higher at Karauli block during last two decade followed by Sapotra and Mandrayal block. The mean annual rainfall is lowest in Hindaun block. When the CV for the annual rainfall was examined, it was found be the least in Mandrayal block followed by Hindaun, Nadauti, Sapotra and Karauli block, it was the highest.

Introduction

The distribution pattern of rainfall for India is very uneven and varies considerably from year to year and region to region. In eastern Rajasthan district there is high dependency on rainfall. It is one of the important sources of ground water recharge.

The contribution of winter, summer and Post-Monsoon season's rainfall amounts to about 2%, 3% and 4% respectively of the annual total rainfall (Upadhyaya, 2014). The long term climatic changes related to rainfall and temperature is most likely to affect the agriculture and hydrology of whole India and

definitely the Rajasthan region. Different studies have been conducted to know the inter-annual and inter-seasonal variability in rainfall. Krishnamurty and Shukla (2005) studied the inter-seasonal and seasonally persisting patterns of Indian monsoon rainfall. Thus this research focuses on the variability of rainfall in district Karauli, Rajasthan.

Materials and Methods

The rainfall data for six blocks of district Karauli, Rajasthan was taken from water resources department (water.rajasthan.gov.in) for period 1991-2020. The 30 years data was future used for the rainfall variability analysis.

Time series analysis such as standard deviation, coefficient of variation and mean rainfall.

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 is known as annual rainfall. The mean of the annual rainfall over of 35 years (in India) is known as mean annual rainfall (average annual rainfall or normal annual rainfall). The mean of the annual rainfall was calculated by given formula:

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

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

The results of this study have been presented in different sub headings as following:

Decadal Rainfall analysis

For this the 30 years (starting from 1991 to 2020) rainfall data has been divided into 3 decades viz 1991-2000, 2001-2010 and 2011-2020 respectively district wise. In table 1 the mean and coefficient of variation of these different decades has been presented.

The lowest CV was found for Mandrayl, Nadauti and Hindaun block for last decade, while for the 2nd decade (2001-2010) the CV was least in case of Hindaun block.

For the first and second decades the least rainfall was observed in Hindaun block, while there is variation in maximum amount of rainfall in three decades.

The result of the study shows that the coefficient of variation during the south west monsoon was highest in Sapotra (63.16 %) and Mandrayal (55.08 %) district, while the lowest CV was found in the Karauli block (49.76 %). Overall the range of CV for the six blocks of district Karauli Rajasthan varied from 49.76 % to 63.16 % (Table 2).

Table.1 Mean rainfall variability for the period of 1991-2020 (3 decades) district Karauli of Rajasthan

Block	1991-2000 Decade -I	2001-2010 Decade -II	2011-2020 Decade -III	1991-2000 Decade -I	2001-2010 Decade -II	2011-2020 Decade -III
	Mean Rainfall	Mean Rainfall	Mean Rainfall	Coefficient of Variance	Coefficient of Variance	Coefficient of Variance
Hindaun	531.80	529.1	658.1	54.05	28.46	26.86
Karauli	765.98	683.16	647.42	48.90	41.08	33.17
Mandrayal	683.30	621	677.85	84.74	40.18	25.02
Nadauti	541.55	611.3	607.3	57.49	45.31	26.53
Sapotra	743.20	619.8	715.9	54.81	29.46	30.20
Todabhim	579.86	534.8	573.5	51.00	43.00	44.28

Table.2 Variability of South West (SW) monsoon of district Karauli, Rajasthan

Month	Block					
	Hindaun	Karauli	Mandrayal	Nadauti	Sapotra	Todabhim
June	70.97	81.52	81.20	67.97	61.07	66.87
July	164.00	206.79	217.90	188.23	246.40	167.56
August	206.23	240.56	221.07	196.15	242.30	187.83
September	74.97	100.26	74.37	76.10	82.97	74.53
Total	516.17	629.13	594.53	528.45	632.73	496.80
Mean	129.04	157.28	148.63	132.11	158.18	124.20
SD	67.03	78.27	81.87	69.53	99.91	62.40
CV	51.94	49.76	55.08	52.63	63.16	50.24

Table.3 Variability of North East (NE) monsoon of district Karauli, Rajasthan

Month	Block					
	Hindaun	Karauli	Mandrayal	Nadauti	Sapotra	Todabhim
October	9.60	14.76	15.23	10.47	9.97	14.27
November	3.27	14.09	8.73	3.63	9.83	4.67
December	3.70	5.02	3.37	4.60	3.07	4.21
Total	16.57	33.87	27.33	18.70	22.87	23.15
Mean	5.52	11.29	9.11	6.23	7.62	7.72
SD	3.54	5.44	5.94	3.70	3.95	5.68
CV	64.07	48.16	65.22	59.32	51.77	73.59

From the Table 2 it may be concluded that there is high variation in the amount of rainfall in different blocks of district Karauli, Rajasthan.

During SW monsoon the Sapotra and Karauli block received the highest amount of rainfall (632.73 mm & 629.13 mm), respectively and Todabhim block received only 496.80 mm of rainfall. Similar kind of study had been

conducted by Upadhyaya, H., (2014), Which conducted that the state receives 91% of its annual rainfall due to the South-West monsoon, which is its principal rainy season. The contribution of winter, summer and Post-Monsoon season's rainfall amounts to about 2%, 3% and 4% respectively of the annual total rainfall. Study suggested an increase of 30% or more in precipitation over north-western India by 2050 and an increase in probability of extreme rainfall events. The state of Rajasthan is also likely to get affected by this scenario of climate change as well, making it essential to study the variations in rainfall in the state.

The result of the study shows that the coefficient of variation during the north east monsoon was highest in Todabhim (73.59%) and Mandrayal (65.22%) block, while the lowest CV was found in the Karauli block (48.16%). Overall the range of CV for the six blocks of district Karauli, Rajasthan varied from 48.16 % to 73.59 % (Table 3). From the Table 3 it may be concluded that there is high variation in the amount of rainfall in different blocks of districts of Karauli. During NE monsoon the Karauli block received the highest amount of rainfall (33.87 mm) and Hindaun bloc received only 16.57 mm of rainfall. Similar kind of study had been conducted by Gill *et al.*, (2010), Which conducted that the rainfall over three agro-climate region of Punjab and found that in last 40 years the Ludhiana received below normal rainfall for 24 years being highest during 1988 (1334mm) and the lowest during 1974 (379.6mm). The rainfall variability showed a

SD of 210.45, 227.07 and 312.30 mm and CV of 33.70, 30.14 and 30.46 % for Bathinda, Ludhiana and Ballawal Saunkhri, respectively.

From this study it may be concluded that there is high variation in rainfall pattern of district Karauli, Rajasthan. The study of rainfall variability is important for planning and operational strategies of any agriculture crop. From the annual analysis of rainfall it was conducted that lowest rainfall was at Todabhim block and highest at Sapotra block of the district.

References

- Gill, K. K, Bains, G. S., Mukherjee, J., Kingra, P. K., and Bal, S. K. (2010). Variability in climate in three Agroclimatic regions of Punjab. *Indian J. Ecol.* 37(1): 33-39.
- Krishnamurthy, V and Shukla, J. (2000). Intra-seasonal and inter-annual variability of rainfall over India. *J. of Climate*, 13: 4366-4377.
- Kumar, K. (2008). Rainfall trends in twentieth century over Kerala, India, *Atmospheric Environment*, Volume 43(11) pp: 1940-1944.
- Upadhyaya, H. (2014.) Variability of rainfall in Rajasthan (1960-2009) *Int. journal of Innovative Research & Review*. Vol 2(1): 17-19
- Yadav, Sunil Kumar., Gautam, Shweta and Rawat, Sharaddha (2018). Rainfall Variability Estimation for Western Rajasthan, India. *Int. J.Curr. Microbiol. App. Sci.* 7(07): 4344-4348.

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