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Research Article

VARIABILITY OF RAINFALL IN RAJASTHAN (1960-2009)

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ABSTRACT
In the desert state of Rajasthan there is a very high dependency on rainfall. It is the primary source of surface and ground water recharge. In the climate change scenario of the present times it is suggested that there would be a decrease in rainfall over the state. This makes it important for the policy makers to study the pattern of rainfall so that the required mitigation and adaptation steps can be taken timely. The present paper looks at the rainfall variability in Rajasthan by calculating the co-efficient of variation (CV) of rainfall in the state for the past 50 years, ranging from 1960 to 2009.

Keywords: *Co-Efficient of Variation (CV), Rainfall Variability, Rajasthan*

INTRODUCTION
There is a wide variation of rainfall in the state due to the presence of Aravallis, which divides the state into Semi-Arid Eastern and Arid Western Rajasthan. 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. Studies suggest 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.
One of the important climatic characteristic of an area is the degree to which rainfall amounts vary across that area through time. This subject area in meteorology and climatology is called "Rainfall Variability". The paper analyses large scale variability in Rajasthan during 1960 to 2009, covering a span of 50 years. The annual average rainfall in state of Rajasthan during these 50 years has been depicted in Figure 1.1.

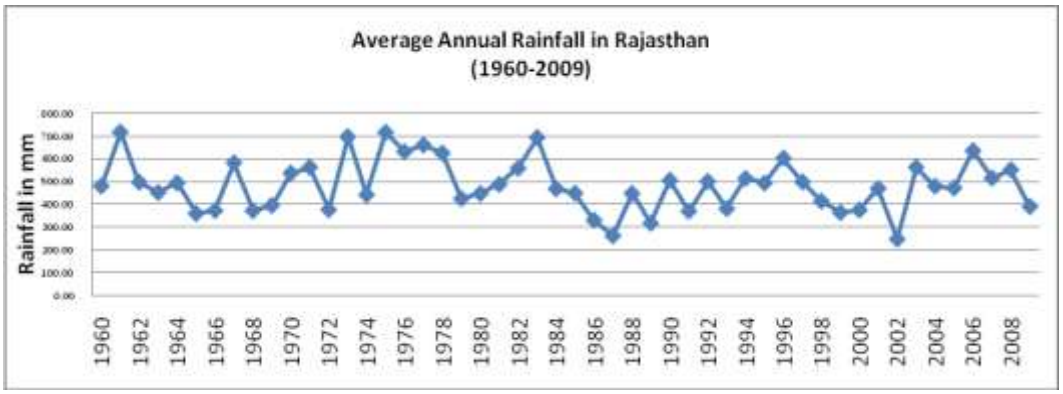

Figure 1.1: The Annual Average Rainfall in Rajasthan (1960-2009)

The analysis of rainfall variability of the state has been carried out on the basis of co-efficient of variation dividing the time span of 1960 to 2009 into units of 5 years each.

MATERIALS AND METHODS
The coefficient of variation (CV) which is expressed in percentage is defined as below:

$$\text{C.V.} = \frac{\text{Standard deviation } (\sigma)\, x}{\text{Normal Annual Rainfall}}$$

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Here, Normal Annual Rainfall (N) is 564.89 mm. and the standard deviation calculation has been shown in Table 1.2.

Table 1.2: Standard Deviation

YEAR	σ
1960-1964	106.71
1965-1969	93.55
1970-1974	122.3
1975-1979	110.05
1980-1984	99.62
1985-1989	83.36
1990-1994	71.83
1995-1999	91.14
2000-2004	120.01
2005-2009	91.001

The CV hence obtained range between 12.7% and 21.6% and have been depicted in the Figure 1.3.

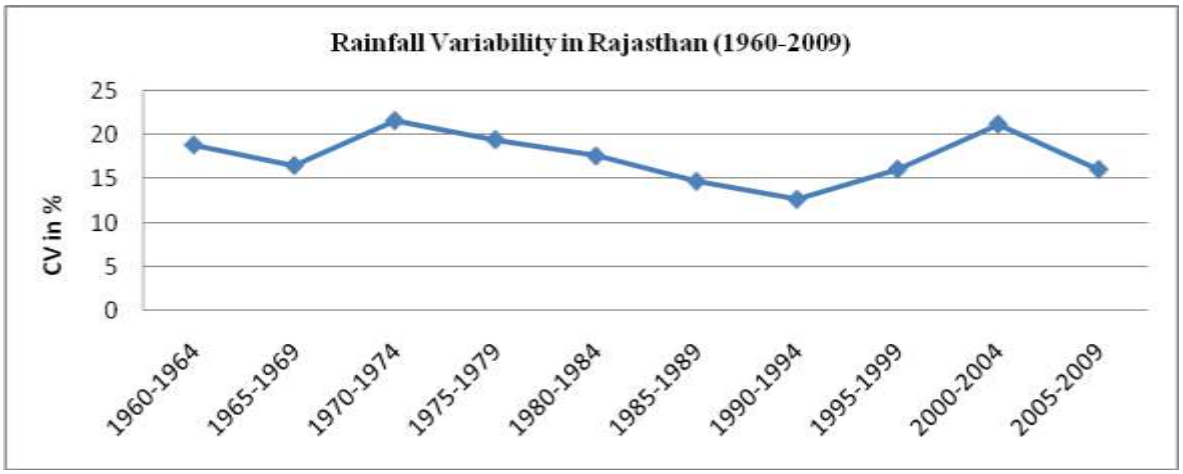

Figure 1.3: The Co-efficient of Variation (CV) during 1960- 2009 in Rajasthan

RESULTS AND DISCUSSION

During 1960 to 1964 the CV of the state was 18.89% which decreased to 16.56% during 1965 and 1969. During 1970 and 1974 the state recorded the highest CV in the 50 years (1960 to 2009) which was 21.65%. For the next 5 years the CV was 19.48%. Continuing this low CV trend was during 1980 and 1984 when it reached 17.63%. Further lowering of CV in Rajasthan state was seen during 1985 and 1989 and 1990 and 1994 when CV was 14.75% and 12.71% respectively. 12.71% CV is the lowest of the observed 50 years in the state.

During 1995 and 1999 time span the CV rose to 16.13 and further to 21.24% during 2000 and 2004. The CV reduced to 16.10% during 2005 and 2009.

Hence, it is seen that an alternatively temporal variation with increase and decrease of CV was observed from 1960 and 1964 to 1965 and 1969 to 1970 and 1974 and 1975 and 1979. But the five –five year time span from 1980 – 1994 saw continuous decrease of CV.

During 1995 to 1999 CV percentage again increased and the increasing trend continued further during 2000 and 2004. During 2005 and 2009 CV again decreased. It is generally observed that the time period with high rainfall variability have flood years and the ones with low rainfall variability have drought years, but it is not a rule.

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Rainfall variability at a time scale from years to days is as much a characteristic of climate as the total amounts recorded and low values do not necessarily lead to drought and high values do not necessarily lead to flooding. Variability of rainfall may be used to characterize a climate and to deduce evidences of climate change.

By the study of rainfall and variability the adaptation to future climate change can be developed through the experience of adapting to rainfall variability today on the various components like water resource availability, in increase or decrease of floods on drought or change in the nature of rainfall.

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