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Geography

PATTERN OF RAINFALL DISTRIBUTION IN RAJASTHAN

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ABSTRACT The degree to which rainfall amounts vary across an area or through time is an important characteristic of climate of that area. This subject area in meteorology and climatology is called 'Rainfall Variability'. Rainfall Variability explains the availability of water at a particular time and area. There are 2 components of rainfall variability – Areal and Temporal Variability. Temporal variation analysis helps to explain the nature of rainfall variability across time-span. Simulation models predict an increased hydrological cycle and an increase in mean annual rainfall over most of Asia but there is a large degree of variation in these predictions. Some studies suggest an increase of 30% or more in precipitation over north-western India by 2050 and an increase in the probability of extreme rainfall events.

KEYWORDS : Rainfall, Distribution, Rajasthan

INTRODUCTION

The State of Rajasthan comprising of 33 districts has a geographical area of 3, 42,239 square kilometer (sq km) and is the largest State in the country. It is situated between north latitudes 230 03' and 300 12' and east longitudes 690 30' and 780 17'. The ground water monitoring is being carried out through a network of observation wells the National Hydrograph Network Stations (NHS).

Rainfall is the important element of Indian economy. Although the monsoons affect most part of India, the amount of rainfall varies from heavy to scanty on different parts. There is great regional and temporal variation in the distribution of rainfall. Over 80% of the annual rainfall is received in the four rainy months of June to September. The average annual rainfall is about 125 cm, but it has great spatial variations.

a. Areas of Heavy Rainfall (Over 200cm): The highest rainfall occurs in west costs, on the Western Ghats as well as the Sub-Himalayan areas in North East and Meghalaya Hills. Assam, West Bengal, West Coast and Southern slopes of eastern Himalayas.

b. Areas of Moderately Heavy Rainfall (100-200 cm): This rainfall occurs in Southern Parts of Gujarat, East Tamil Nadu, North-eastern Peninsular, Western Ghats, eastern Maharashtra, Madhya Pradesh, Orrisa, the middle Ganga valley.

c. Areas of Less Rainfall (50-100 cm): Upper Ganga valley, eastern Rajasthan, Punjab, Southern Plateau of Karnataka, Andhra Pradesh and Tamil Nadu.

d. Areas of Scanty Rainfall (Less than 50 cm): Northern part of Kashmir, Western Rajasthan, Punjab and Deccan Plateau. The two significant features of India's rainfall is that

i. in the north India, rainfall decreases westwards and
ii. in Peninsular India, except Tamil Nadu, it decreases eastward.

REVIEW OF LITERATURE

Rajasthan state's rainfall variability has been analyzed. This may be termed as the large scale variability analysis. This form of analysis can reflect the presence or absence of cyclic nature in the rainfall availability and can also reveal the nature of rainfall variability for the coming period.

Gupta (1990) has explained that the variability increases with decreasing of time which has been considered for the analysis of rainfall. Khan (1998) states that the time duration influences the value of rainfall variability and daily rainfall will always be higher than the annual one.

Rainfall in large parts of the State is not only inadequate but also varies sharply from year to year and place to place. The average rainfall of Rajasthan is 564.89 mm (1960 to 2009) compared to the all-India average of 1,100mm (Government of Rajasthan, 2011) and a significant variation is seen across different regions.

The annual spatially averaged rainfall is highly variable and it is most erratic in the western region with frequent dry spells, punctuated occasionally by heavy downpour in some years associated with the passing low pressure systems over the region (Rathore, 2006).

The maximum average rainfall of 726 mm was recorded in 1996 and minimum 291.6 mm was recorded in 1987, prior to 2002 (Goel and Singh, 2006).

According to Intergovernmental Panel on Climate Change Fourth Assessment Report the world indeed has become more drought prone with higher frequencies of extreme events (IPCC Report, 2007) some clear instances around the world can be noticed ,like changing trends of monsoonal rainfall over India due to climate change (Naidu et al., 2009) increase in drought events in UK (Arnell, 2007), in Korean peninsula (Kyoung et al., 2011), in Iran (Sayari et al., 2013), and over Indian subcontinent (Sivakumar and Stefanski, 2011) describing the impacts of climate change. In India, 80% of annual rainfall comes from southwest monsoon, and very important for the whole country, especially for the low rainfall belts like Rajasthan state. Any kind of deficiency in monsoon ,mostly because of climate change causes higher frequencies of droughts in these areas as high as once in every four years (Gupta et al., 2011). Out of 13 states repeatedly declared as drought-prone, Rajasthan is the most critical state in the country with highest probabilities of drought occurrence and rainfall deficiencies. Several records shows that about 48 drought years have been reported of varied intensity since 1901 in last 102 years and only 9 years out of them were totally free from drought (Rathore, 2005).

It is characterized in terms of spatial extension, intensity and duration (Drought Manual; Govt. of India, 2009).Generally rainfall deficiencies over a long time period leads to severe droughts events (Wilhite & Knutson, 2008). Mainly four types of droughts are mostly observed, meteorological (lack of precipitation), agricultural (lack of root zone soil moisture), hydrological (drying of surface water storage),socio- economic drought (lack of water supply for socio-economic purpose) and these drought types are generally interlinked with each other (Sigdel and Ikeda, 2010).There are several drought indices available nowadays and ,SPI is one of the most widely used and commonly accepted drought index. It is recommend for agricultural and hydrological drought analysis by WMO (World Meteorological Department), because it is very simple, spatially consistent, probabilistic in nature and peculiar with the ability to represent droughts on both spatial and temporal scales, so it provides better results. Multi-time scale results such as 3, 6, 12, 24 months from SPI represents impacts of drought on different water availabilities like for soil moisture, water reserves, steam water and ground water etc (Guttmann, 1998). Several examples of its significant use at different regions like, Nepal (Sigdel and Ikeda, 2010), Turkey (Sirdas and Sen, 2001; Sönmez et al., 2005) Zimbabwe (Manatsa et al., 2010), Greece (Livada and Assimakopoulos, 2006; Karavitis et al., 2011), Iran (Sayari et al., 2013) also in India, Gujarat (Patel et al., 2007) Guwahati situated in Assam (Jhajharia et al., 2007), and at Aravali terrain Rajasthan (Bhuiyan et al., 2006) can be observed. There is also need to focus on water management aspects to conserve and use water in dry spells and drought situation (Sharma et al., 2010).

SPATIO TEMPORAL VARIATION IN THE RAINFALL

1. Though the jet streams go a long way in explaining the origin of

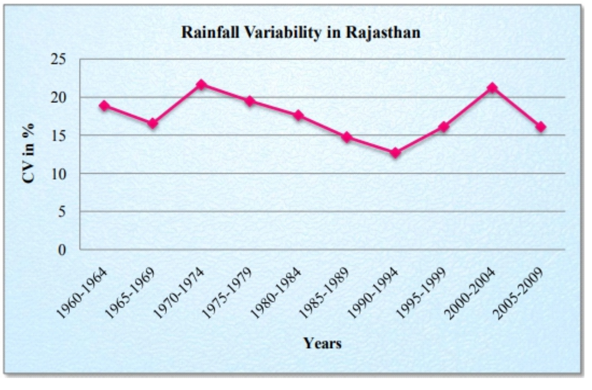
monsoon some questions remain unanswered. The great variation in the amount of rainfall both spatially and temporally, the high degree of uncertainty related to the date of arrival etc. are unexplained. Meteorologists have been trying to explain these phenomena from different angles relating to wide variety of generalization. They have been monitoring huge high pressure or anticyclone zones that form a few kilometers below the jet streams. This ridge hovers over south Goa. It has been noticed that if the ridge moves towards karwar in Karnataka it does not augur well for the monsoon. This high-pressure zone, it is reasoned, blocks the low flowing south westerly monsoon from intensifying over the west coast. When it is not positioned well, several meteorologists remain skeptical about the monsoon's performance.

2. The unusual cooling of surface temperatures over the Arabian Sea by as much as 3 to 4 degrees before the onset of monsoon is another curious phenomenon. This is due to the cool Somali current. It pushes the cool waters of the Indian Ocean towards the Arabian Sea and the drop in temperature seen to have an impact on the progress of the rains.

3. Just before the monsoon sets over south-east Asia the atmosphere pressure over the Indian Ocean drops. Simultaneously about 10,000 kilometers away in the South Pacific there is rise in pressure, when the rain is over, this reverses. This phenomenon called southern oscillations is key indicator of the south-west monsoon. When the pressure over Indian Ocean is lower than normal it augurs well for the good monsoon.

RAINFALL VARIABILITY IN RAJASTHAN

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 seen 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.



Source: Monsoon Report – 2010, Indian Meteorological Department

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.

Category of Intensity of Rainfall

Sr. No.	Category	
1	Abnormal	60% or more
2	Excess	20% to 59%
3	Normal	19% to (-)19%
4	Deficit	(-)20% to (-)59%
5	Scanty	(-)60% or less

Source: Monsoon Report – 2010, Indian Meteorological Department

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