P-ISSN: 2618-0723
E-ISSN: 2618-0731

NAAS Rating: 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 8; SP-Issue 2; February 2025; Page No. 42-45

Received: 03-12-2024
Accepted: 10-01-2025

Indexed Journal
Peer Reviewed Journal

Change in rainfall pattern Gujarat region in the last 116 years (1901-2017): A case study

SS Chinchorkar, GJ Kamani and FG Sayyad

Anand Agricultural University, Anand, Gujarat, India

DOI: https://doi.org/10.33545/26180723.2025.v8.i2Sa.1617

Corresponding Author: SS Chinchorkar

Abstract

The analysis of rainfall records for long period provides information about rainfall pattern and variability. The long term monthly rainfall data for the period 1901-2017 (116 years) was studied. And also rainfall studies are utmost utility for understanding nature and behavior of climate change. The main objective of this paper is to analyses the rainfall data to study variation in rainfall pattern. The analysis of rainfall records for long period provides information about rainfall pattern and variability. And also rainfall studies are utmost utility for understanding nature and behavior of climate change. In this study, trends in rainfall, maximum rainfall intensity for 1901-2017 were examined. Long term data analysed for 116 years (1901-2017) annual data suggest that there is a significantly change in rainfall over last decade. It observed total mean rainfall June to October, total mean rainfall observed an increasing trend having an increase 0.24 mm per year. This implies that in Gujarat region annual rainfall has increased by 24 mm. From the average monthly rainfall analysis, it is observed that rainfall variation for first 20 years (1901-1920 & 1921-1940) and second 20 years (1941-1960, 1961-1980) are similar rainfall pattern whereas it differs for last decade (2000-2017) because of the change in magnitude however the overall trend is similar. Average monthly rainfall analysis indicates there is maximum rainfall in month of July and minimum rainfall in month of October.

Keywords: Climate change, linear regression, rainfall pattern, trend, rainfall variation

1. Introduction

India's economy is dependent on the agricultural production, which in turn is dependent one of the monsoon rainfall and its distribution. The year to year fluctuation in rainfall as well as the fluctuation within the monsoon season governs the crop growth, development and yield. Earlier studies on rainfall probability in India have been carried by many workers (Singh *et al*., 2009; IMD, 2010 and Halikatti *et al*., 2010) [5, 2, 1]. Rainfall, the main driver of the hydrological cycle, has been varying in part of the world in various ways. Rainfall is the main source of water. But rainfall is scares and erratic in Gujarat especially in Saurashtra region. So, its preservation and conservation has become the most important aspect in relation to the water resources development planning. Its magnitude, variation and distribution plays important role in hydrological response of the area. The analysis of rainfall records for long period provides information about rainfall pattern and variability. And also rainfall studies are utmost utility for understanding nature and behavior of climate change. (Solanki *et al*. 2014) [6].

Climate change is one of the main challenges in the world that is being studied by scientists and researchers. Rainfall is a key input in management of agriculture and irrigation projects and any change in this variable can influence on sustainable management of western resources, agriculture and ecosystems. Mainly, studies of climate change science are focused on the probable changes in the annual series of a variable such as rainfall and variability of this is important for crop planning. Globally the averaged precipitation is projected to increase; both increases and decreases are expected at the regional scale.

The impact change on water resources has received much attention globally. The analysis of rainfall records for long period provides information about rainfall pattern and variability (Lazaro *et al*. 2001) [3]. The main objective of this paper is to analyses the rainfall data to study variation in rainfall pattern.

2. Material and Methods

Study area

Gujarat is divided into eight agro-climatic zones based on rainfall. Based ion the annual rainfall of different agro-climatic zone, the mean annual rainfall varies between 442.3 mm in North-West Gujarat zone and 1651.4 mm in south Gujarat heavy rainfall zone. The number if rainy day varies between 18 in North-west zone and 63 in South Gujarat heavy zone. (M.C. Varshney *et al*. 2009) [4] Gujarat is a serene and pristine land where the azure seas meet sparkling sands. Gujarat is positioned between 20° 6′ N to 24° 42′ N latitude and 68° 10′ E to 74° 28′ E longitude.

Fig 1: Location of map

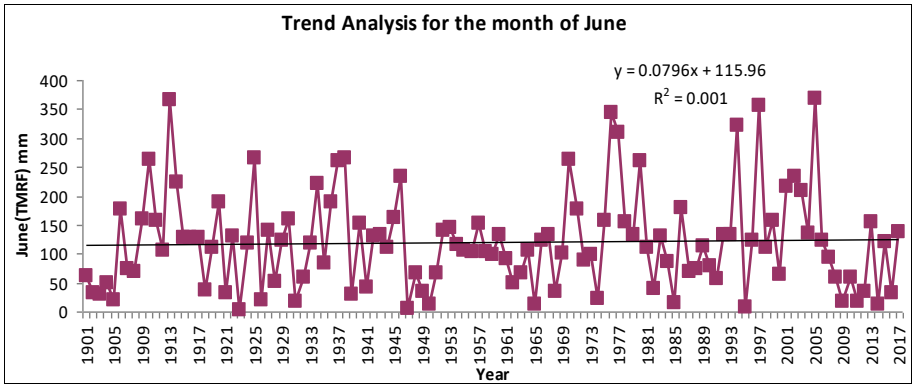
3. Data and Methodology

In this paper average of total mean rainfall (mm), maximum rainfall intensity of the month (mm/day) and rainy days data was used during 1901 – 2017 (116 years). The trend is determined by the relationship between the two variables as rainfall and time. The statistical method such as linear regression analysis and coefficient of determination R^2 are used. The equation of a linear regression line given as:

$$y = ax + b$$

Where, y is the observation on the dependent variable, x is the observation on the independent variable, a is the slope of the line and b is an intercept of the vertical axis. The drawing of the scattered diagrams and fitting of the regression lines were done in Microsoft Excel.

4. Results and Discussion



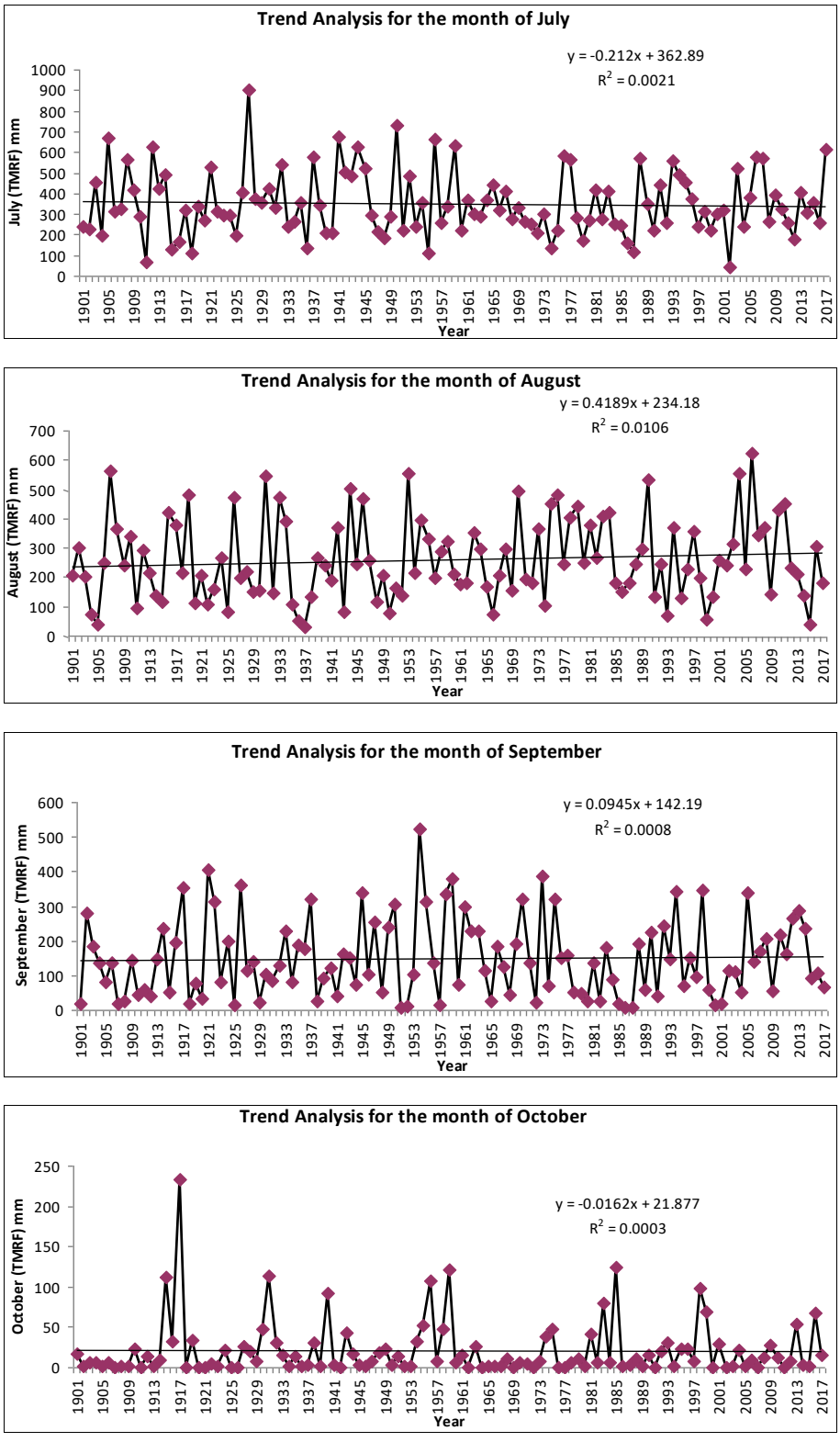


Fig 2: Linear regression trends of monthly mean of total mean rainfall.

Trend Analysis of Monthly Mean of Total Mean Rainfall (TMRF)

The linear regression trends with their linear regression equations and coefficient of determinations for the months from June to October (Monsoon season) are represented in figure 2.

It is evident from figure 2 that monthly mean of TMRF have increased significantly for the months June to October but in August has increased by 41 mm during last 116 years.

Trend Analysis of Annual Mean of total Mean Rainfall (TMRF) from the figure 3, the annual mean of total mean rainfall observed an increasing trend having an increase 0.24 mm per year. This implies that in Gujarat region annual rainfall has increased by 24 mm during last 116 years.

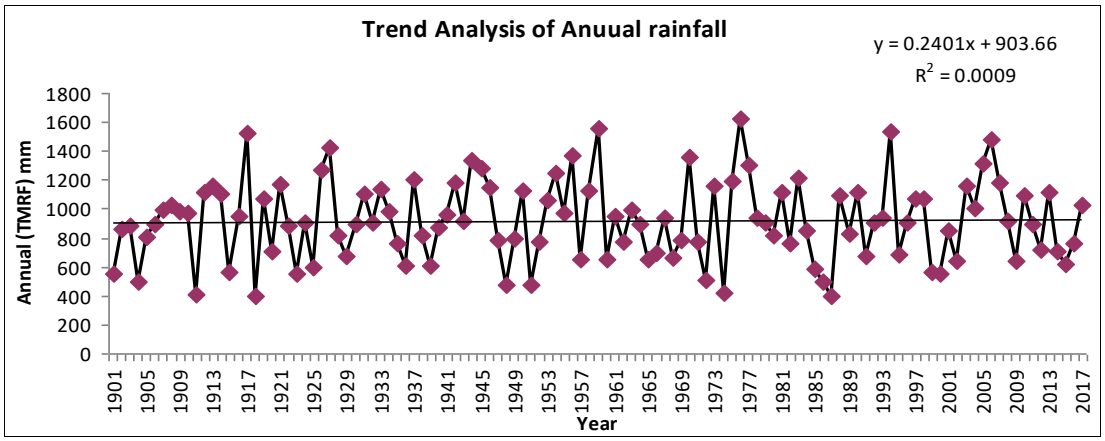


Fig 3: Linear regression trends of annual mean of total mean rainfall

Monthly Rainfall Pattern

From table 1 and figure 5 indicate that rainfall variation for first 20 years (1901-20), (1921-40), (1941-60), (1961-80) & 20 years (1981-2000) and (2001-2017) are similar rainfall pattern whereas it differs for last decade (2000-2017) because of the change in magnitude however the overall trend is similar.

Table 1: Monthly rainfall variation for 1901-1920, 1921-1940,1941-60, 1961-80,1981-2000 and 2001-2017

Month	Monthly Average Rainfall(mm)					
	1901-1920	1921-1940	1941-1960	1961-1980	1981-2000	2001-2017
June	125.0	127.7	104.1	135.8	117.9	119.0
July	331.29	365.3	401.71	318.0	333.8	352.9
August	251.5	220.2	265.8	275.2	248.6	297.6
September	113.6	159.7	180.8	156.1	122.5	154.8
October	24.9	21.5	25.4	8.99	28.2	15.5

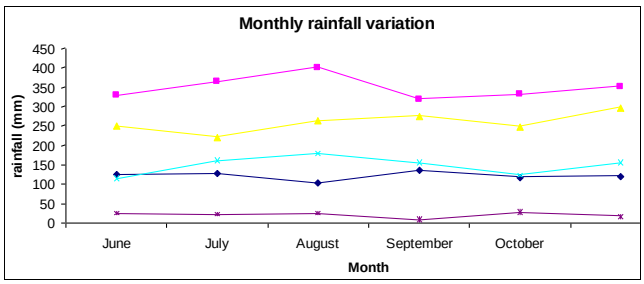


Fig 4: Monthly rainfall variation for 1901-1920, 1921-1940,1941-60, 1961-80,1981-2000 and 2001-2017

Climate change is a continuous process but it is analyzed in this study that there is a significantly change in rainfall over last decade.

5. Conclusion

Long term data analysed for 116 years (1901-2017) annual data suggest that there is a significantly change in rainfall over last decade. However an annual rainfall is the erratic with wide range from 1620.1 mm maximum and 392.6 mm minimum in Gujarat region. It observed total mean rainfall June to October, total mean rainfall observed an increasing trend having an increase 0.24 mm per year. This implies that in Gujarat region annual rainfall has increased by 24 mm. From the average monthly rainfall analysis, it is observed that rainfall variation for first 20 years (1901-1920 & 1921-1940) and second 20 years (1941-1960, 1961-1980) are similar rainfall pattern whereas it differs for last decade (2000-2017) because of the change in magnitude however the overall trend is similar. Average monthly rainfall analysis indicates there is maximum rainfall in month of July and minimum rainfall in month of October.

6. Acknowledgement

Authors are thankful to Head, Department of Agricultural Meteorology, BACA, AAU, Anand for their inspiring guidance, and valuable suggestion her constant support.

7. References

1. Halikatti SI, Potdar MP, Hiremathi SM, Dineshkumar SP. Annual and seasonal rainfall variability at Dharwad, Karnataka. J Agrometeorol. 2010;12(1):136-137.
2. IMD. Long range forecast of south-west monsoon for 2010 issued on IMD's website. Available from: www.imd.gov.in. 2010.
3. Lazaro R, Rodrigo FS, Gutierrez L, Domingo F, Puigdefafregas J. Analysis of a 30-year rainfall record (1967-1997) in semi-arid SE Spain for implications on vegetation. J Arid Environ. 2001;48:373-395.
4. Varshneya MC, Vaidya VB, Pandey V, Chimote LD, Damle KS, Shaikh AM, Karande BI. Forecasting of rainfall for Gujarat based on Astrometeorology. Asian Agri Hist. 2009;13(1):25-37.
5. Singh M, Kumar J, Bharadwaj SS. Rainfall probability during dormant and growing seasons of apple in Himachal Pradesh. J Agrometeorol. 2009;11(1):47-50.
6. Solanki PN, Shrimali NJ, Gohil KB. A study of change in rainfall pattern in Dhatarwadi Reservoir Catchment, Amreli, Gujarat. IJSRD. Int J Sci Res Dev. 2014;1(11).