

# Analysis of Change in Annual Rainfall for Raipur District, Chhattisgarh

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**Abstract** - Trend analysis is a method to obtain the variation with respect to time for a particular parameter. It is performed on a data set for a longer duration to quantify the variation. This paper presents an analysis of variation in annual rainfall for Raipur district, Chhattisgarh by checking the percentage change with respect to that of previous year and also by comparing with the mean annual rainfall for the whole period under investigation. The monthly precipitation data is collected from the website of Indian Meteorological Department (IMD) for the period of 1901-2002. Further, the rainfall in various decades is compared. The results reveal that the last decade of the 20<sup>th</sup> century witnesses maximum decrease in rainfall in the whole duration.

**Keywords**- Trend, parameter, rainfall, percentage change

## I. INTRODUCTION

Climate change indicates a different behaviour of the hydro-meteorological parameters comparing between two different periods. The climatic variability is not a very short span process. It takes years or decades to have a noticeable change in climate. Whenever the word 'Climate change' is coined, the changes in temperature and erratic rainfall come first into picture. The variation in rainfall and temperature has been arising as a challenging issue for the present generation and it will also remarkably affect the future. From the point of view of India, this may lead to severe detrimental conditions due to poor adaptation strategies and a very high population. According to Gosain et al. (2006), intense flooding and severe drought conditions may prevail in various parts of the country simultaneously. This will be further accelerated by the rampant human interventions. But the matter to look into is that, be it a drought or a flood, the amount of natural precipitation will certainly govern these aspects to a significant extent. Moreover, in India, it matters for rainfall due to South-West monsoon i.e. rainfall during June-September.

## II. STUDY AREA

Raipur district is a district of Chhattisgarh, India. It is situated between 22° 33' N to 21° 14' N Latitude and 82°06' to 81°38'E Longitude. The study area is presented in Fig. 1. Major portion of the district is occupied by Mahanadi river

basin and hilly areas. Thus, geographically it is divided into plains and mountainous regions. Bilaspur district, Bastar district along with a part of Odisha, Raigarh district along with a part of Odisha and Durg district surrounds the Study area in North, South, East and West directions respectively. Area of the district is 13083 square kilometres. Talking about the climatic aspects, generally moderate climate prevails over Raipur for the whole year except for the month of April and May, where the weather conditions become too hot and sunny. The maximum temperature rises to almost 50 °C for hottest days of May. The annual rainfall is about 50 inches. Like most other parts of India, more than 80% of the annual precipitation occurs in the monsoon period.

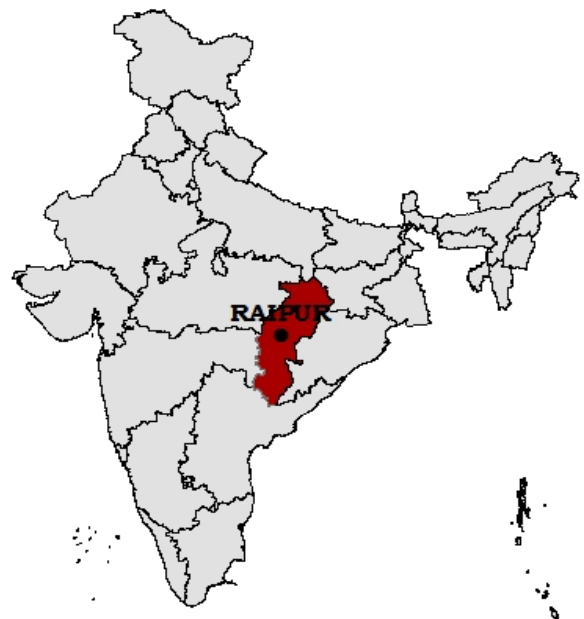


Figure 1: Raipur, Chhattisgarh in India Map

## III. METHODOLOGY AND DATA COLLECTION

The monthly rainfall data for Raipur district is obtained from the official website of Indian Meteorological Department (IMD) for Raipur station. The data is collected

for a period of 1901-2002. The month wise variation of rainfall is presented through EXCEL Graph for these 102 years. Then Annual rainfall for these years is determined and the percentage change in rainfall is determined for each year with respect to the previous year. Annual rainfall for each year is also compared with the mean annual rainfall for whole period. Further, the decadal rainfall amount for different decades were obtained and compared.

IV. RESULTS AND DISCUSSION

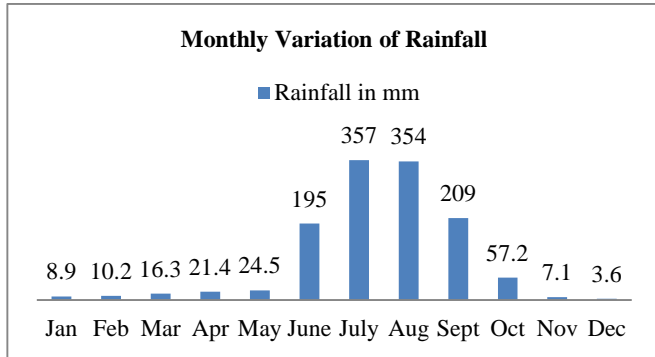


Figure 2: Average monthly rainfall in Raipur for 1901-2002

The monthly variation of rainfall over Raipur for the period of 1901-2002 is presented above in Fig. 2. It can be clearly observed that the rainfall occurs mainly in the months of June, July, August and September, mostly referred to as the period of southwest monsoon. The study area has an average annual rainfall of about 1265 mm, out of which 1115 mm (about 88%) rainfall occurs in the months of June, July, August and September, generally referred to as Southwest monsoon period with a maximum in July or August.

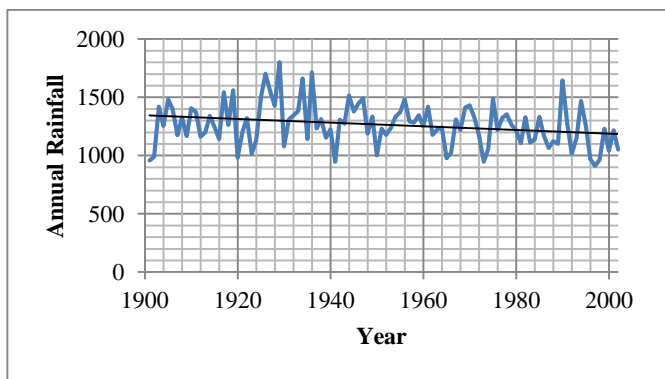


Figure 3: Variation in Annual Rainfall for Raipur

The variation in Annual rainfall for the period of 1901-2002 for Raipur is presented in Fig. 3 above. This represents that the trend line for annual rainfall is decreasing from 1901 towards 2002. The maximum annual rainfall is 1801.6 mm that occurred in 1929, whereas the minimum observed is 911.6 mm in the year 1997. By checking the percentage change in annual rainfall compared to that of previous year, it was observed that the year 1936 (1714 mm) witnessed a highest percentage increase in annual rainfall compared to previous year 1935 (1141 mm). The percentage increase was 50.14%. Similarly, a highest percentage decrease of 40.1% was observed for 1930 (1078.5 mm) compared to 1929(1801.6 mm).

TABLE I: DECADAL CHANGE IN ANNUAL RAINFALL

YEAR	AVERAGE ANNUAL RAINFALL	PERCENTAGE CHANGE
1901-1910	1257.2	
1911-1920	1281.3	1.92
1921-1930	1373.9	7.22
1931-1940	1347.7	-1.91
1941-1950	1288.8	-4.37
1951-1960	1300.9	0.93
1961-1970	1244.2	-4.36
1971-1980	1237.8	-0.52
1981-1990	1212.1	-2.07
1991-2000	1128.2	-6.92

The average annual rainfall for various decades from 1901-2000 and percentage change compared to previous decade is presented in Table I above. It can be noticed that the maximum average annual rainfall for the decade 1921-30 is 1373.9 mm whereas the minimum is observed for the last decade of the 20<sup>th</sup> century i.e. 1991-2000, which is 1128.2 mm. Comparing the annual average rainfall for each decade with their previous ones, it can be noticed that the percentage increase was maximum (7.2%) for the decade 1921-30 with respect to 1911-20. Similarly, the percentage decrease (-6.92%) is observed for the decade 1991-2000 compared to 1981-90. Another important thing to notice is that, after 1960, the average annual precipitation has been decreasing for all the decades. The mean annual rainfall value is 1128.2 mm for 1991-2000, which is about 11% lesser to the mean annual rainfall for the whole 102 years. Mishra et al. (2013) studied the annual and seasonal time series for 24 stations of Seonath river basin for the period of 1960-2008. Trend analysis was performed on these stations using the non-statistical Mann-Kendall and Sen Slope Estimator test. The results reveal that 4 stations showed a significant negative trend and 16 stations showed non-significant decreasing trend. Talking about the causes, it can be said that, increasing anthropogenic activities i.e. reckless deforestation, rapid urbanization, improper utilization of natural resources, reduction in forest areas etc. are some of the major factors responsible for this remarkable variability in precipitation. Such erratic precipitation may lead to aridity and drought conditions in future. Furthermore, India being a developing country with an agro-based economy, any deviation in the rainfall due to monsoon will affect to a great extent. Therefore, proper irrigation planning, water conservation and management practices, integrated information system, public awareness, extensive research, early drought warning system etc. are some of the measures that need to be focused for coping up with possible drastic conditions.

V. CONCLUSION

For any development and planning issues including food production, flood control and effective environmental management, water resources has become a primary concern.

The highest influencing parameter for water resources is precipitation. The monthly rainfall data was collected from Indian Meteorological Department (IMD) website for the period of 1901-2002 and analysed for variation in annual rainfall. It was observed that the study area receives about 88% of the annual rainfall during June-September. The maximum and minimum annual rainfall for the period under investigation are 1801.6 mm and 911.6 mm respectively. Moreover, the mean annual rainfall for each decade was found and percentage change with respect to previous decade was obtained. The comparisons show that there has been a significant decrease in average annual rainfall in the last decade and there has been a reduction in it since 1960 to 2002. Such erratic precipitation may be detrimental, particularly if the economy is mainly based on agriculture. Increased human activities are further deteriorating the conditions. Therefore various coping issues should be undertaken to adapt with such changing scenario.

#### ACKNOWLEDGMENT

I would like to thank all of those individuals who have supported me to complete this paper. First of all, I want to express my sincere gratitude to Prof. Mani Kant Verma for his invaluable suggestions, support and readiness for consultation without which the paper could not have been completed. His assistance and educative comments were very much helpful. I would also like to thank Dr. M. K. Verma for being a source of constant support and motivation. I extend my gratitude to Prof. Ishtiyaq Ahmad for his encouragement and always being with me at necessary times. I also take this opportunity to acknowledge my friends for their constant support and help whenever it was required. I also thank my parents and Almighty for their support and blessings.

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