Rainfall Trend Analysis: A Parametric Method

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***Abstract*:- Rainfall is a key input to the hydrological cycle, shows temporal variability over the land surfaces. This study focuses on the temporal variability of historical rainfall data, over an eastern point of Dakshina Kannada district, called Belthangady. Rainfall data for about 30 years, ranging from 1975 to 2005 were considered for this study. Parametric method of identifying the variability was adopted. Rainfall data was analysed by considering seasonal averages and annual mean values of rainy days. Existence of trend is being evident from parametric method. Results revealed that except for pre-monsoon season trend is decreasing including the monsoon events.**

Keywords: Belthangady, Rainfall, Trend analysis.

1. INTRODUCTION

Amount of rain showering within a given area with respect to time is called as rainfall. The rainfall occurring in any region is believed to exhibit variabilities depending upon atmospheric temperature, pressure, wind speed, and direction. Rainfall variability is one of the major factors determining the overall impact of climate change. Further, the future rainfall can be predicted by collecting the historical data and subjecting those data to a suitable model. The set of processes involved in the analysis of rainfall data in order to predict the future trend is known as Trend analysis. Rainfall trend is an urgent call as availability of freshwater is depleting. It is also necessary as the food security of country like India dependent on the downpour of rainfall.

A number of techniques have been developed for analysis of rainfall trend which involves parametric and non-parametric tests for consistent datas. The nonparametric test includes Mann-Kendal test, Sen’s slope estimator, Detrended fluctuation analysis and seasonal Kendall method [1][2]. Most of the studies operated in sub-continental level, have performed non-parametric tests such as Mann- Kendal test, Sens’s slope [4], [5], [6], [7] and found significant trend results. The parametric linear regression analysis [3] can also be used for the analysis of trend. A parametric, simple approach is being adopted in [3] and spatial variation of the rainfall is also being calculated.

Present study portrays a parametric method of calculating rainfall trends for annual average, monthly average and seasonal average rainfall

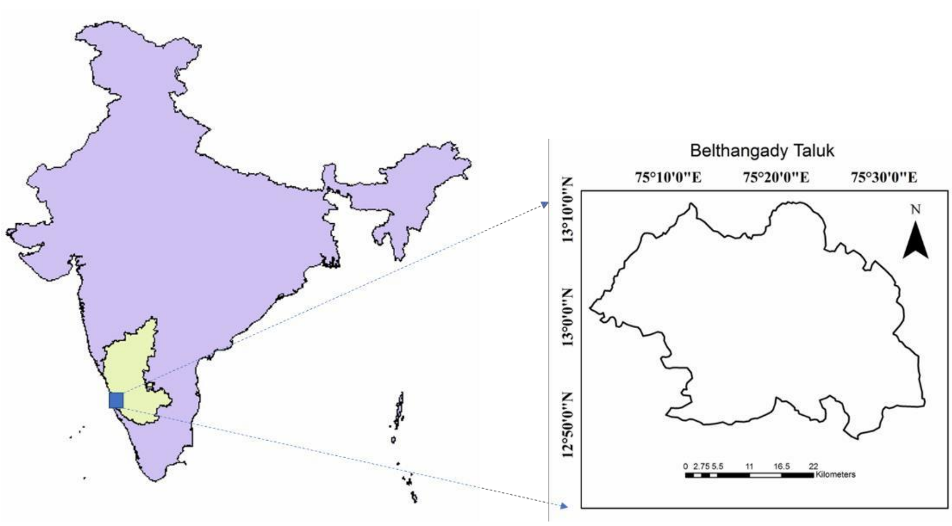

Figure 1: Study area

of Belthangady thaluk which is situated in Dakshina Kannada district of Karnataka state.

2. STUDY AREA AND DATA

Belthangady taluk is the largest taluk of Dakshina Kannada district which has a total area of 1375 square km. Spatial details of the study region is given in figure 1. The average elevation of this taluk is 685 m from mean sea level and the headquarters Belthangady lies at around 100 m from the mean sea level. Land use and land cover of the district are mostly covered by plantations and forest covers.

The average weather condition in this taluk is hot and humid, average humidity is 43%. The average temperature of this taluk is 29.6 ^{0}C. The average annual rainfall is 241.87mm. At present there is one rain gauge station available in headquarters of Belthangady taluk. The present study considers the rain data of 30 years from 1975 to 2005.

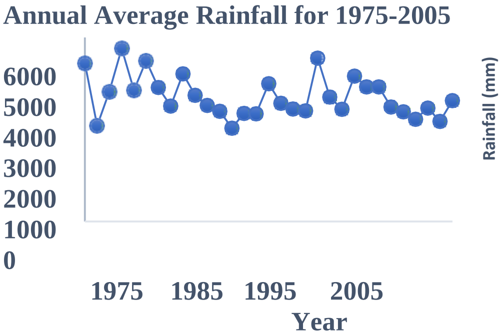

Figure 2: Annual Average Rainfall of study region

3. METHODOLOGY

The methodology adopted to calculate the trend in rainfall is four-fold. It involves the steps such as collection of rainfall data, annual averaging of them, data pre-processing to fill missing values or to inspect the anomalies, arrangement of data, and calculation of mean values. A detailed process chart is given in figure 3.

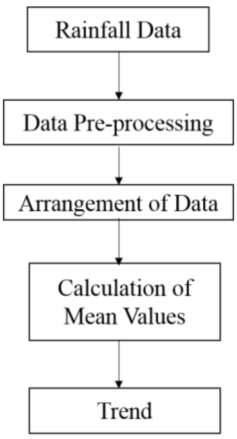

Figure 3: Methodology

Historical data of 30-year period 1975-2005 were collected, In the first phase data were averaged for annual rainfall, monthly rainfall and seasonal rainfall which includes monsoon season, pre- monsoon season, post monsoon and winter season. The second phase involved identification of the significance of increasing or decreasing trend by using statistical method. Linear trend has been plotted by considering years against the rainfall. A more detailed view on the results will be brought in next section.

4. RESULTS AND DISCUSSIONS

Trend analysis performed over a categorical data for normal years shows substantial variations (Figure 4,5,6,7,8 and table 1). It is evident from the results that the trend monsoon and post-monsoon and annual values are decreasing, whereas trends for pre-monsoon show a positive trend. Among the trends observed here, slopes are decreasing for all seasons except for the pre-monsoon. It is observed that the frequency of occurrence of pre-monsoon rainfall are less and hence, very uncertain. Pre-monsoon rainfalls of lowlands are termed as -'mango showers', characterized for being highly infrequent. These less frequent day rainfall has contributed towards positive trend pattern. Rainfall in post-monsoon season also shows quite decreasing trend. This depiction is also quite realistic as for as north- east winds for the region is concerned. What makes the nuance is the decreasing monsoon rainfall trend.

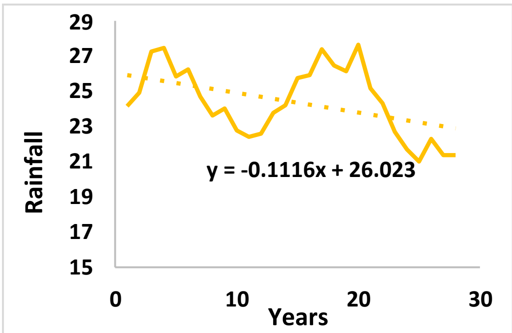

Figure 4: Trend of rainfall for annual average.

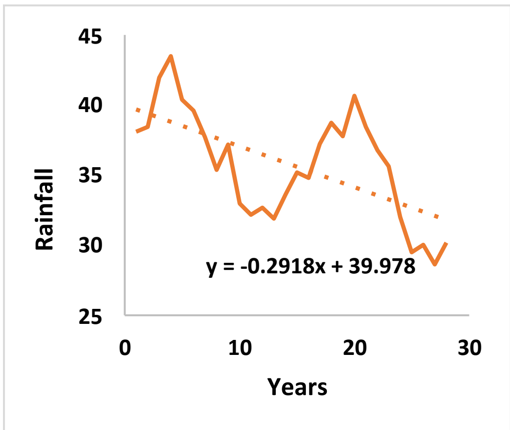

Figure 5: Trend of rainfall in monsoon

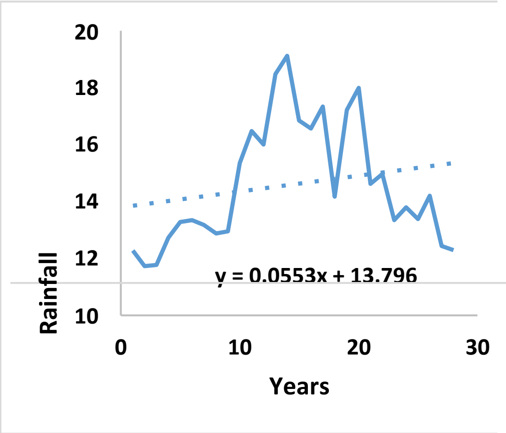

Figure 6: Trend of rainfall in pre-monsoon

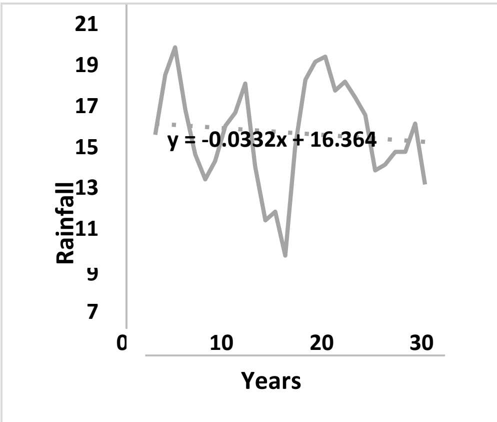

Figure 7: Trend of rainfall in post-monsoon

Table 1: Details of seasonal average and slope values

Seasonal averaging	**Trend equation**	**slope**
Pre-monsoon	0.0553x + 13.796	0.0553
Monsoon	-0.2918x+39.978	-0.2918
Post-monsoon	-0.0332x + 16.364	-0.0332
Annual average	-0.1116x + 26.023	-0.1116

The monsoonal trend is highly prominent when compared with post monsoon showers. Decreased trend may reflect the decreased number of days of rainfall, as average is calculated based on number of rainy days. Despite of all, the calculation also shows an increasing slope for annual averages. Increasing slope may also indicate the increased number of rainy days in pre- monsoon or summer days.

5. CONCLUSION

This study throws light on the rainfall trends for a sub-urban town - Belthangady situated on the foothills of the Western Ghats. The analysis involved rainfall for a normal year by be inferred in addition to their spatial variation.

parametric method. Some of the salient conclusions can be drawn are as follows:

- Except for pre-monsoons, the slopes of trend line are negative and shows clearly the decreased pattern of rainfall in corresponding seasons;
- Monsoonal rainfall is decreasing and is really a call for a tattle;
- Parametric method is quite justifiable for investigating whether the trend is present or not, and
- Further, if non-parametric methods are considered, quantum of variation can also

6. REFERENCES

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