Long Term Trends and Variations in Rainfall under Present Climatic Scenarios at Pantnagar

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ABSTRACT

The present analysis was carried out on the long term rainfall data from 1981 to 2015 recorded at NEBCRC, GBPUA&T, Pantnagar, situated in Udham Singh Nagar district. The data pertaining to annual rainfall shows an increasing trend of rainfall over the period only during rainy season however the number of rainydays shows a declining trend for this season. The month of August receives average annual rainfall highest and November the minimum. Average number of rainy days is highest in July and minimum in November The mean annual rainfall over Pantnagar is 1569.7_± 576.0 mm with coefficient of variation of 36.7 % . July and August receive the highest and November and December receives the least rainfall.

Keywords*: Rainfall, Trend analysis, Seasons and Variability.*

1. Introduction

Rainfall is one of the key components of all weather variables which influence the agricultural productivity. Agriculture in India is largely depends on rain as around 60% of the net sown area is rain fed (Venkateswarlu and Ramarao, 2010). Climate variability particularly the rainfall variability is the major

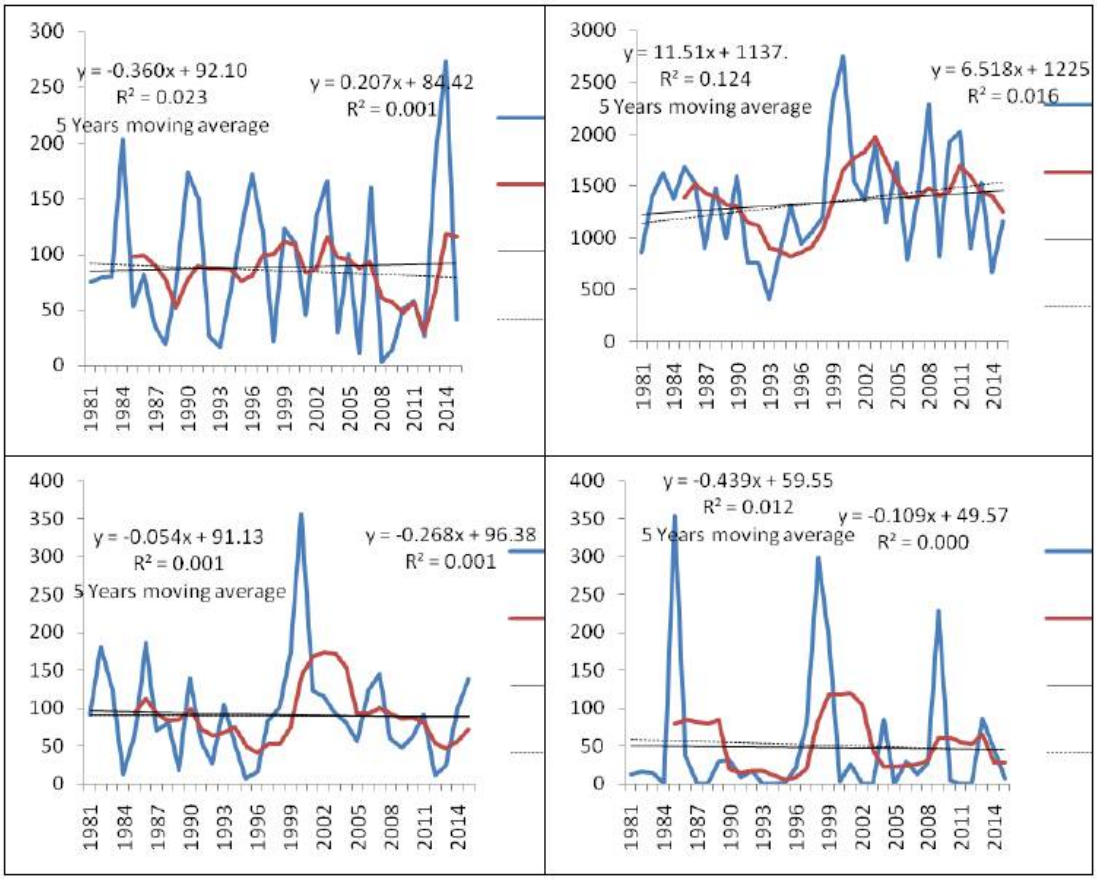

Figure 1: Seasonal trend of rainfall from 1981 to 2015 at Pantnagar

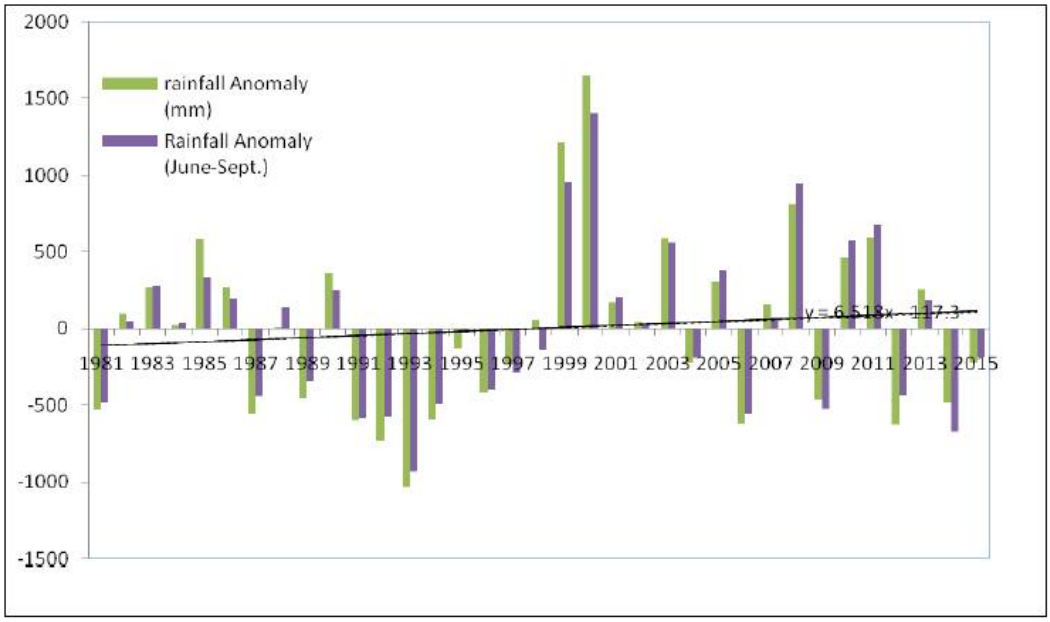

Figure 2: Annual Rainfall anomaly from 1981 to 2015 at Pantnagar

Table 1. Rainfall variations over 1981-2015 period at Pantnagar

Month	Average rainfall (mm)	Standard Deviation	Coefficient of Variation (%)
Jan.	30.4	30.7	100.9
Feb.	41.7	48.8	117.0
March	21.7	26.8	123.1
April	18.1	22.2	122.5
May	51.6	60.8	117.7
June	195.8	150.0	76.6
July	437.6	175.5	40.1
Aug.	450.7	216.7	48.0
Sept.	258.1	199.0	77.1
Oct.	43.6	85.6	196.3
Nov.	3.9	7.5	190.9
Dec.	15.9	23.9	149.8
Monsoon (June-Sept.)	1342.4	523.6	39.0
Post Monsoon (Oct Nov)	47.6	86.6	181.9
Winter (Dec-Feb)	88.1	65.8	74.7
Summer (Mar-May)	91.5	67.2	73.4
Annual	1569.7	577.0	36.7

factor for wide variation in production. In Indian conditions the South – West monsoon provides around 70% of the total rainfall. Therefore it has direct bearing upon the overall performance of rain fed crops. It depicts considerable large inter annual variability which results into widespread drought situations in the country. In India, rainfall distribution is very erratic temporally and spatially. Adequate rainfall is received during

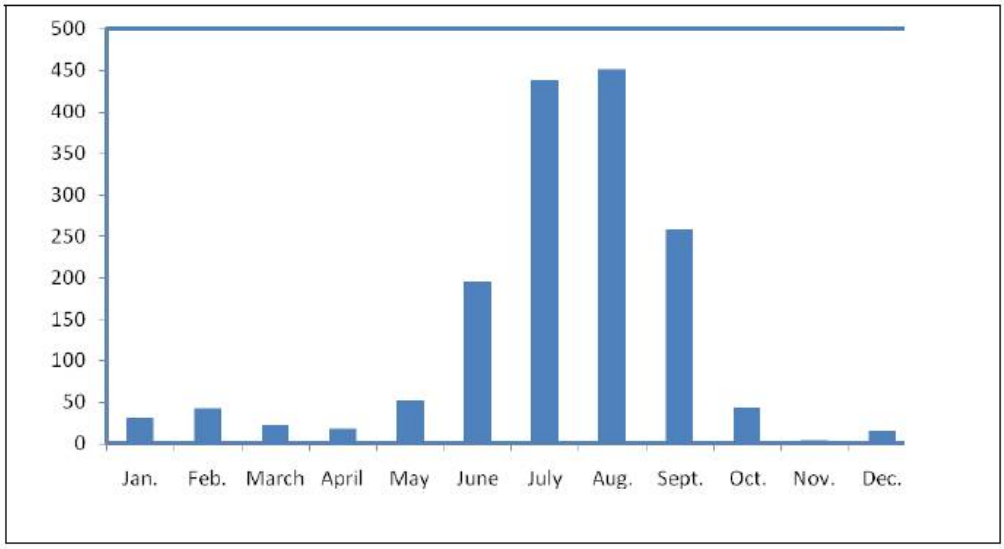

Figure 3: Average monthly rainfall (mm) at Pantnagar for the period 1981-2015

south-west monsoon (about 74%), north-east monsoon (about 3%), pre-monsoon (about 13%) and post-monsoon (about 10%) with an average annual rainfall as 119 cm. High coefficient of variability over any region is found to be associated with drought. The past decades have shown increased extremes in rainfall over North West India. To optimize use of available rainfall effectively, crop planning and management practices must follow the strategy based on amount and distribution of rainfall at a place. The variation in rainfall pattern and its distribution at Udham Singh Nagar district of Uttarakhand was analyzed on the basis of long-term rainfall dataset of 53 years (1961-2013) recorded at the Govind Ballabh Pant University of Agriculture & Technology, Pantnagar. The analysis revealed high magnitude of rainfall dissimilarity as it varied in between 3.89-430.33 mm and 775.70-3218.60 mm on monthly and annual basis respectively (Tomar, et.al.,2015).

2. Data and Method

The present analysis was made using the rainfall data from 1981 to 2015 recorded at NEBCRC, GBPUA&T, Pantnagar which is situated in Udham Singh Nagar district (290 N Latitude 79.3 Longitude and 243.8 m MSL). This area lies in Tarai belt located in the foothills of Himalaya with annual rainfall of about 1400 mm. the daily meteorological data was collected from the Agrometeorological Observatory situated at Normen E. Borlague Crop Research Centre at Pantnagar and verified for errors. Further the data were processed at decadal and annual scales and various statistical analyses were made to draw any final conclusion. The magnitude of the trends of increase in and decreasing rainfall and number of number of rainydays were derived and tested by the Mann-Kendall (Mann, 1945) test and slope of regression line using the least square method.

3. Discussion

The seasonal trend of rainfall during different seasons is presented in Fig 1. Winter season (Dec-Feb) shows a slight increasing trend however the 5 –years moving average show a decreasing trend. For summer season there is a sharp increase in rainfall amount over the years. During post monsoon season slight decline has been observed. During winter season again a slight decline has been observed. The Rainfall anomaly from 1981 to 2015 is presented in Fig 2. For the years 1981-2015 an increasing trend of rainfall anomalies is observed. Total annual rainfall at Pantnagar also shows an increasing trend over the period 1981-2015 (Fig.4). Average annual rainfall is

found to be highest in August and minimum in November (Fig. 3).

The seasonal trend of number of rainy days during different seasons is presented in Fig 5.

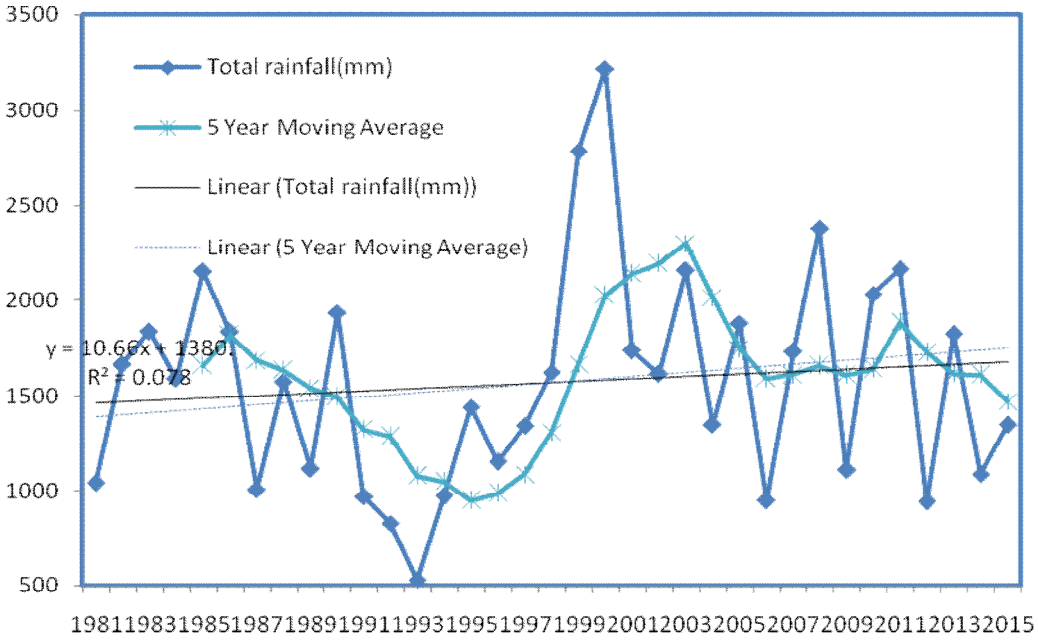

Figure 4: Total rainfall (mm) at Pantnagar for the period 1981-2015

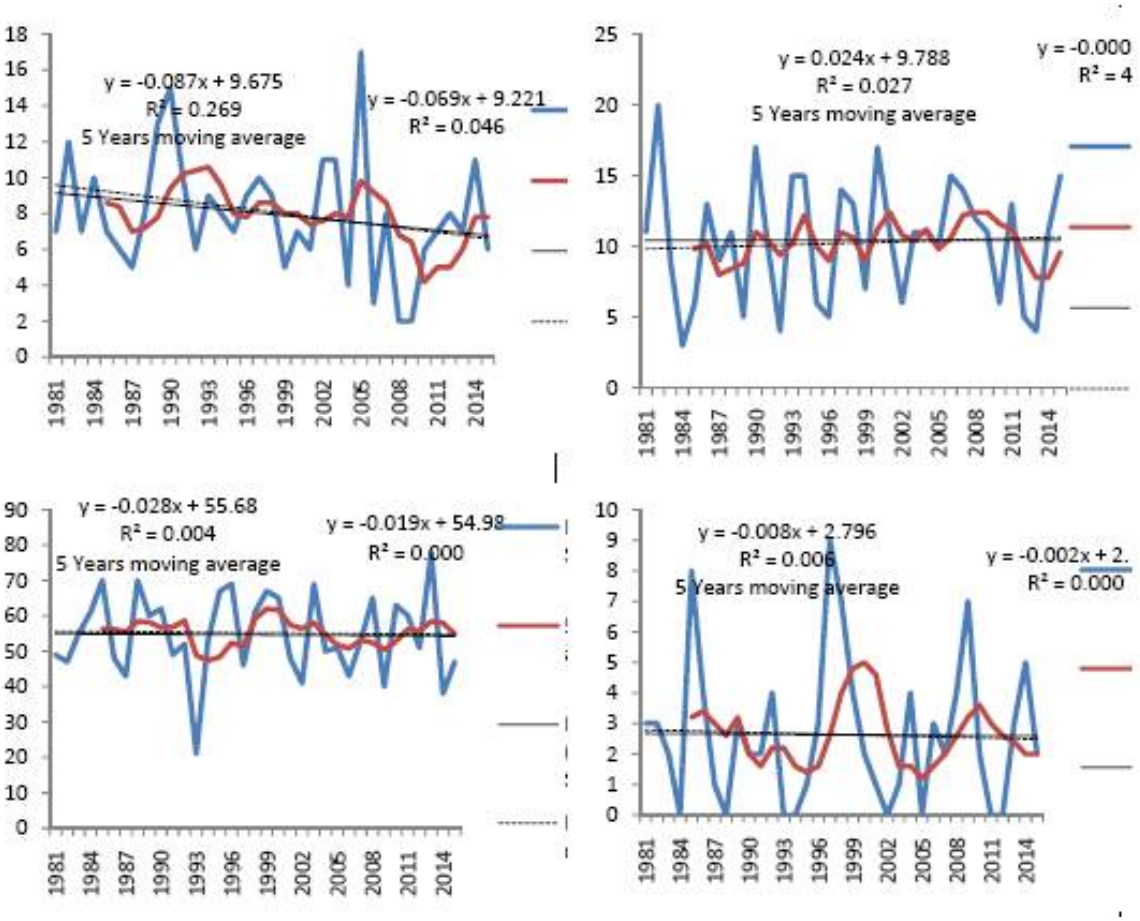

Figure 5: Seasonal trend of number of rainy days from 1981 to 2015 at Pantnagar

Winter season (Dec-Feb) shows a sharp decreasing trend. Summer season shows a decreasing trend of number of rainy days. During monsoon season a slight decline in number of rainy days has been observed. During post monsoon season a decline in number of rainy days has been observed. The rainy day anomaly from 1981 to 2015 is presented in Fig 6. For the years 1981-2015 a decreasing trend of number of rainy days anomalies is observed. Average number of rainy days is found to be highest in July and minimum in November (Fig 7). Total annual number of rainy days at Pantnagar also shows an increasing trend over the period 1981-2015 (Fig.8).

The long term mean annual rainfall over Pantnagar is 1569.7_± 576.0 mm with coefficient of variation of 36.7 % . However coefficient of variation of monthly rainfall

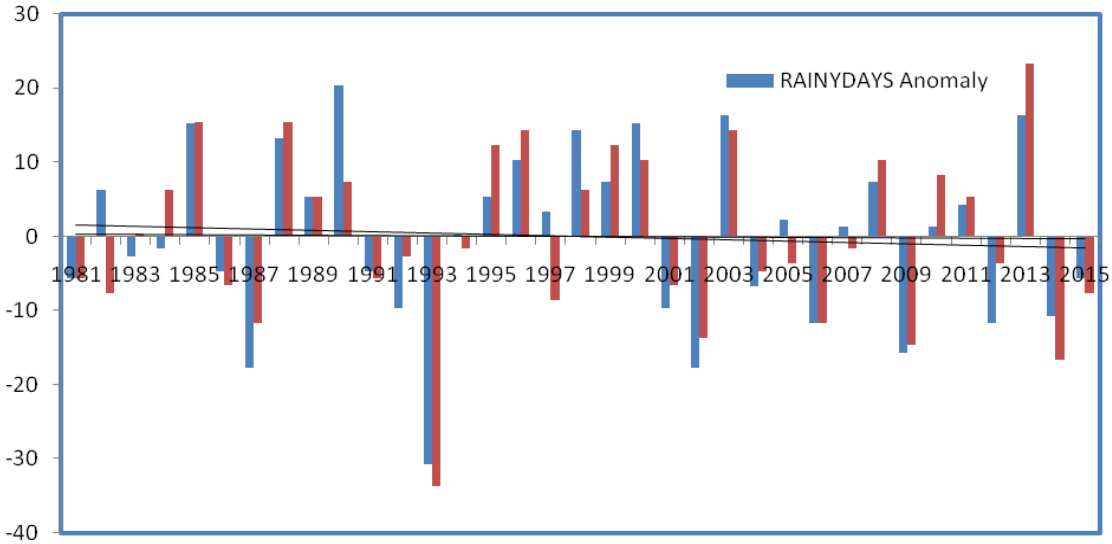

Figure 6: Number of rainy day anomaly from 1981 to 2015 at Pantnagar

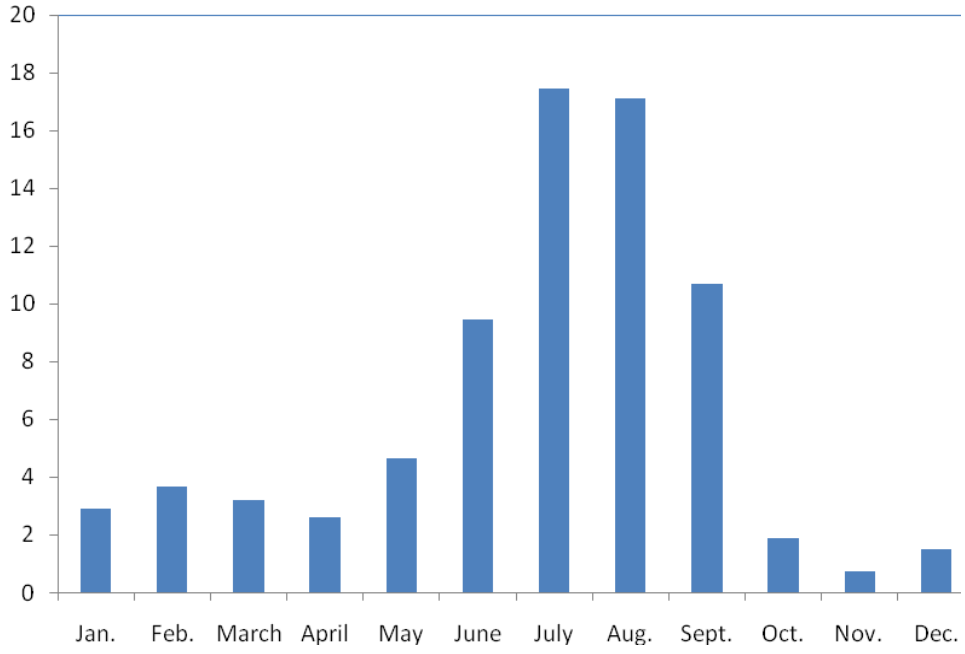

Figure 7: Average number of rainy days at Pantnagar for the period 1981-2015

varied over 100%

from January to May and October to December with below 40% in July and August. July and August were rainiest month and November and December received the least rainfall (Table 1). However the season wise rainfall distribution depicts that the 85.5 % rainfall was received during monsoon followed by summer, winter and Post monsoon season respectively. Coefficient of variation was least in monsoon season followed by winter, summer and post monsoon seasons. Pre-monsoon and monsoon season rainfall has been reported to show a increasing trend while post monsoon and winter season rainfall has a decreasing trend. The total minimum value 775.70 mm was recorded in year 1978.

On an all-India basis, the annual rainfall showed a small decreasing trend. As for annual rainfall, nearly half of the sub-divisions experienced an increasing trend in June and July monthly rainfall, and the remaining months showed an opposite trend. In August, about 75% of sub-divisions witnessed an increasing trend, whereas in September about 75% sub-divisions experienced a decreasing trend. In terms of percentage of mean per 100 years, Punjab and Haryana witnessed a large increasing trend in annual rainfall. On an all-India basis, the annual rainfall has decreased by 0.3% of the mean/100 years (Vijay Kumar

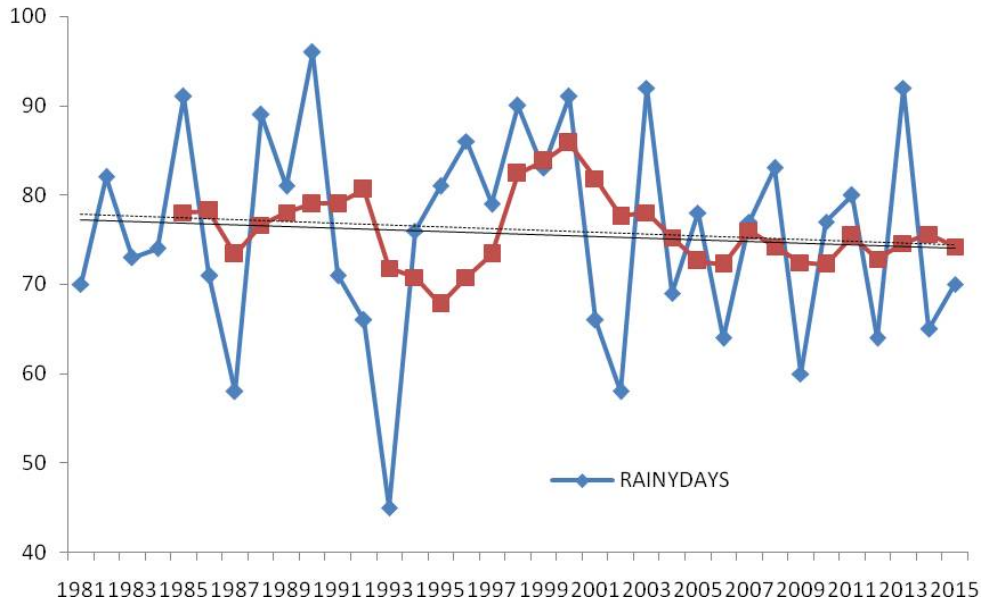

Figure 8: Total annual number of rainy days at Pantnagar for the period 1981-2015

annual rainfall showed an increasing trend (Yadav et.al, 2014). Ramarao *et al.* 2013 also have reported an increase in future rain over 173 districts of India.

The maximum rainfall during monsoon, post monsoon, winter and summer seasons was recorded as 2750.9 mm, 354.20 , 272.9 and 356.20 mm in years 2000, 1985, 2014 and 2000 respectively. However, their respective minimum values were recorded as 410.20 mm, 2.80 mm and 6.60in the year 1993, 2008 and 1995 during monsoon, winter and summer seasons, respectively. The maximum annual rainfall during study period was observed as 3218.60 mm in year 2000, whereas, its

et.al.,2010).

4. Conclusions

The increasing trend of rainfall and number of rainy days in monsoon suggest an increase in future monsoon rainfall over the region. However the annual rainfall having an increasing trend with decreasing number of rainy days shows more water losses through runoff than to go to soil. Increasing trend osf rainfall anomalies indicate that in future vide variations in the rainfall amount is expected . This may be due to changing climatic scenario affecting the hydrological cycle all over the world.

Acknowledgement

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