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Rainy Days Characteristics for Gadag District in Karnataka State in India from 2009 to 2016

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Abstract:- The characterization of rainy days is utmost importance particularly in Gadag District to understand the patterns of the rainy event across the district in a semi-arid region in the State of Karnataka, India. The statistical parameters were analyzed by using IMD definition for a rainy day. One major finding is in this district for the period of study (2009-2016) differed number of rainy days across the various taluk and averaging across the district would provide potential problems since rainy day is high variable across district. Also, there is tendency within the district for some talk to experience drought like condition while other do not. Thus, consideration must be considered the taluk the number of rainy days is not necessarily the same average district wise value.

Keywords:- *Nunber of rainy events and rainfall characteristics.*

I. INTRODUCTION

Rainfall characteristics are important in various studies such as hydrology, water resource planning, agriculture, and ecology services. The IPCC sixth assessment of the climate indicated that in India climate would be modified by climate changes such that there would be greater frequency of higher intense rainfall and drought occurrences [1]. In Gadag largely agriculturally based community, rainfed agriculture plays an important part in crop success and farmers survival.

In the recent years, debate on whether the survival of crop and the environmental conditions propel the need for understanding both synoptic climate systems such as the southwest monsoon (JJAS) and the various rain gauge stations across a district scale. IMD covers the prediction and rainfall characteristics across India which occurs in large spatial range than that of a district characterization. India has vast systems interplaying to produce various characterized precipitation pattern which gives rise to different ecological zones. Various studies across the years for classification of rainfall regime were developed using different spatial scales ranging from all India study to regional analysis of homogenous rainfall areas, where the northern Indian has a distinctively difference rainfall pattern than the southern India [2]. Thus, understanding of the rainfall pattern for a particular region in India is utmost importance.

Day to day variability is expressed by shorter time scales which can be affected by large scale events across the Indian ocean. Also, day to day variation gives more a fine scale temporal resolution with an additional factor of locality such as the orographic convectional rainfall or proximity to land and sea breeze. Monsoonal system in Indian is influenced by the pressure cells primarily the Tahiti and Darwin [2] and the sea surface temperatures across the Pacific known as the Indian Ocean Dipole (IOD) [3]. Indian monsoon although this phenomenon is thoroughly revisited by numerous authors, latter findings indicate that each regionalized area varied with different number of rainy days for each year as well as area of coverage. Correlation analysis and teleconnections between the factors of daily or monthly rainfall to synoptic phenomena. In general, the finer scale studies are necessary to observe the fluctuation and variability of rainy days with recent rainfall pattern and if the rainfall pattern is fairly uniform among the taluks. This type of analysis would aid in monitoring and contingency planning activities for farmers welfare.

The major objective of this study is to understand the pattern of rainy days across a district in Karnataka. This study is a base study for the rainfall characterization of rainy days which serves as a documentation of the rainy days for Gadag.

II. MATERIAL AND METHODS

A. Study Area

Gadag district is located within latitude of 15.4 North and 75.6 East longitude with area spanning 4656 km^2 and a population of 1.2 million and elevation ranging from 596 to 633 msl [4]. This area is considered as a semi- arid region with climatological average of 720 mm of rainfall. Mostly in this district fiber, oilseeds and sugarcane are major commercial crops.

B. Data and Definitions

The data were sourced from tip bucket rain gauge with data logger for each station located at each taluk. The data was then preprocessed in aggregated daily rainfall and then underwent the statistical calculation discussed below:

- **Definition:** The rainy day is defined as a day in which 2.5mm or more rainfall is accumulated. This day is considered a rainy day given by IMD standards [5]. In agriculture a daily 2.5mm of rainfall is adequate for majority of crop daily irrigation needs that the plant will not undergo water stress conditions.
- **Statistical calculations:** The following equations were used to determine the statistical parameters for this study.

Arithmetic mean $\hat{Y}=\sum y/n$ (1)

Where y- no of rainy days n – the total number of counts of rainy days for a station

Standard Deviation $\sigma= \sqrt{\sum} (y-\hat{y}) \text{ ^2 } /n$ (2)

Coefficient of Variation $CV=\sigma/\hat{y}\times100$ (3)

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III. RESULTS AND DISCUSSION

The number of rainy days general characteristics is described in the following Table I for each station where the maximum, minimum, standard deviation, and coefficient of variation for the rainy days. It is clearly noted that the rainfall maximum number of rainy days station is given in the table below.

Table 1: Overall number of rainy days characteristics for Gadag District

Station	Maximum	Minimum	Average	σ	CV
Lakshmesh	66	13	48.7	17.3	35.7
Nargal	60	15	48.3	14.8	30.0
Holealur	59	26	44.8	10.6	23.6
Ron	60	38	47.7	8.5	17.8
Konnur	58	27	41.6	9.9	23.7
Naragund	52	25	42.2	9.6	19.2
Gadag	68	30	48.0	12.7	25.1
Dambal	62	8	41.3	17.7	42.8
Betageri	67	32	52.5	12.9	24.7
Mundargi	58	27	41.6	9.89	23.7

It is evident that although the average number of rainy days lies within the range of 42 to 52 shows that average number of rainy days are closely related amongst stations. However, there is a discrepancy in the number of rainy days per year among the stations. For example, Dambal has the least number of rainy days across all stations and correspondingly the highest coefficient of variation with a value of 42.8%. Thus, in these stations although average analysis is carried out to delineate homogenous characteristics of pattern of the number of rainy days can lead to faulty presumptions. The structure of the number of rainy days are less in some district by even a factor of 3.5 from Dambal to Gadag station. Farmers in Dambal would experience irrigation stress during rainfed farming as compared to Gadag within the same district. Policymakers should made aware of the inconsistencies in taluk wise rainy- day events so that the farmers can access the necessary aid for government initiative projects for a viable agricultural system in Gadag. Utmost importance in rainfed agriculture, is the availability of rainfall during the crucial growing stages of the plant development process such as the early growth stage i.e., the formation of seedling development. Framers would risk the crop failure and low productivity due to the rainy events. Most of the farmers are small scale and are mainly dependent of rainfed agriculture and crop failure would likely result in increasing number of suicides [6] due to missing rainy events leading to drought like conditions.

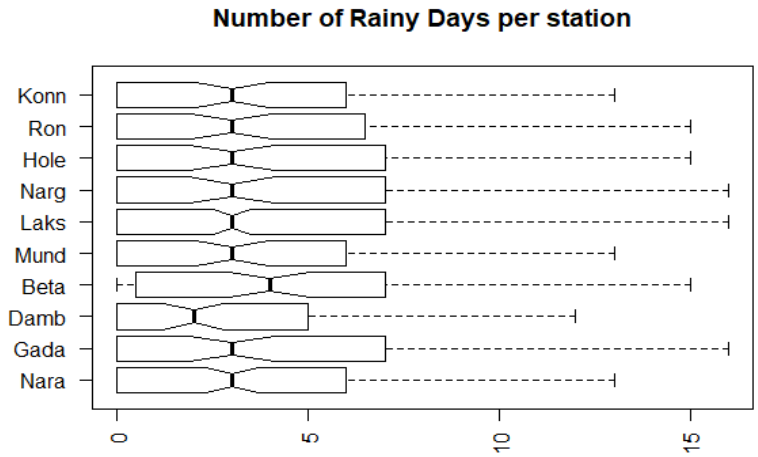

Fig. 1: Boxplot of number of rainy days for each year during the period 2009 to 2016

Legend: Konn : Konnur station, Ron : Ron station, Hole:Holealur station, Narg: Nargagund station, Laks: Lakshmesh station, Mind: Mundargi station, Beta: Betageri station, Damb: Dambal station, Gada: Gadag station and Narg: Nargal station.

From Figure 1, the annual average of the number of rainy days is lower than 5 days per month for each year. This shows that within this district 5 days with a daily rainfall of 2.5mm and above is expected during the monthly annual distribution of rainy days. It is noted that there are some months whereby the number of rainy are as high as 10to about 15 days of rainy days. From this graphical analysis Dambal is least station of rainy days while Betageri has a minimum of more than one rainy day per month in the annual rainfall distribution for the period of 2009 to 2016. Thus, Betageri region had less comparative risk of drought like conditions and higher possibility of cropping success than the other taluks under this study.

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Table 2: The maximum number of rainy days monthly for the duration of 2009 to 2016

Station	Year	Month	Maximum no. of rainy days
Mundargi	2010	August	11
Betageri	2014	August	13
Dambal	2013	September	12
Gadag	2013	September	16
Nargund	2013	September	13
Konnur	2013	September	13
Ron	2009	September	11
Holealur	2014	August	14
Nargal	2009	September	14
Lakshmeshwar	2009	July	16

From Table II, it is clearly evident that the maximum number of rainy days are station dependent and varies in the monthly and yearly for each station that is independent of year and month. For example, station Gadag and Lakshmeshwar both have maximum number of rainy days to be 16 but the year is different as well as the month. Majority of the station experiences September as the month with the maximum number of rainy days but 2013 is the year in which most stations have a maximum number of rainy days. So, it can be concluded that in 2013, there is a possibility of more rainfall events such as a synoptic system that increased the daily rainfall events in Gadag district. This further exemplifies that rainy day characteristics varies across the District of Gadag.

IV. CONCLUSION

The rainy-days characteristics across Gadag for the period of this study emphasized that the number of rainy days is station dependent. For each station, there exist a variability that need to be taken to consideration and the averaging of the number of rainy days does not justify the station variability as well as the temporal annual variation of maximum number of rainy days in a month.

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REFERENCES

[1.] IPCC, “Cliamte Change 2022: Impacts, Adaptation, and Vulnerability Contribution to Working group II to the sixth aseessment report . Cambridge University Press. In Press 2022.

[2.] Parthasarthy, K. Rupa-Kumar, and A.A. Munot,“Homogenous Indian monsoon rainfall:variablility and prediction”,Proc.Indian.Acad.Sci, March 1993, pp. 121-155.

[3.] K. Ashok, Z. Guan, and T. Yamagata, “Impact of the Indian Ocean dipoleon the relationship between the Indian monsoon rainfall and ENSO”, Geophys. Res. Lett., December 2001, vol 28(23),pp. 4499-4502.

[4.] Government of India, Ministry of Water Resources,“Groundwater information booklet Gadag District, Karnataka,” Report , South Western Region Bangalore, January 2009.

[5.] IMD “Met Glossary,” Weather Report IMD Pune, January 2013.

[6.] R.K. Singh, S.K. Garg, and S.G. Deshmukh.”Strategy development by small scale industries in India,” Ind Magt and Data Sys, August 2010.