

Rainfall Trend Analysis of Mysore District in Karnataka

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Abstract: The daily rainfall data of Mysore district of Karnataka for last 39 years (1971-2009) were analyzed to study its variability. Being a part of the semi-arid region it receives mean annual rainfall of 834.2 mm with 25.8 per cent variability. The contributing from winter, pre-monsoon, monsoon and post monsoon period to the total rainfall was 1.2, 11.0, 43.7 and 28.1 per cent. Each standard meteorological week (SMW) from 16th to 46th receive a rainfall of above 20 mm with less variability (within 150%) indicating the crop growing period from 2nd fortnight of April to 2nd fortnight of November. The monthly mean rainfall was observed to be 75.7, 133.0, 75.5, 79.6, 88.2, 120.9, 159.4 and 60.6 for April, May, June, July, August, September October and November months, respectively. The trend analysis of rainfall indicated that, the mean annual rainfall was changing since 1971 with increasing trend in variability in alternative 10 years cycle. Being a semi-arid climate, Mysore district was frequently affected by periodical drought and the study indicated out of past 39 years, one year was slight drought (-19 to -25% D from N) and 6 years were falls under moderate drought (-26 to -50% D from N).

Keywords: Drought, Karnataka, Mysore, Rainfall, Trend, Variability.

I. INTRODUCTION

Rainfall variability is a major factor influencing the agricultural productivity and sustainability in tropics [6]. Rainfall pattern and the quantity decides the cropping system in the rainfed agriculture. Amount, distribution and intensity of rainfall mainly determine the choice of any particular crop and agronomic practices. Scientific study on the quantum and distribution of rainfall if made would enable the farming community to adjust or modify the cropping programme as well as the cultural operations to utilize the actual moisture available in the field for profitable crop production. Hence, a study was undertaken at Mysore district to understand the rainfall variability for crop planning purpose. Such analysis is helpful in prediction of annual and seasonal rainfall probability for the next one or two years, in turn crop planning. Similarly, rainfall variability analysis at Akola was done by [5]; [4] reported for Bihar and [2] for Kerala and [1] reported the rainfall variability in coastal district of Karnataka.

II. MATERIALS AND METHODS

Daily rainfall data of 39 years (1971-2009) collected from IMD, Bangalore Met centre were used for analysis of probability and variability. The data were aggregated to weekly, seasonal and annual totals. The mean rainfall, standard deviation and coefficient of variation for annual, seasonal and weekly period were also worked out. The annual rainfall received was classified based on IMD specification as normal (particular year that received +19 per cent of mean annual rainfall), excess (year that received more than 19 per cent of mean annual rainfall) and deficit (year that received less than 19 per cent of the mean annual rainfall).

III. RESULTS AND DISCUSSION

Annual Rainfall:

The data on mean annual rainfall, deviation from normal, coefficient of variation, standard deviation and its classification are given in Table 1 and 2. The mean annual rainfall of this region was 834.2 mm spread with coefficient of variation of

25.8 %. The maximum rainfall was 1577.0 mm during 1994 followed by 1156.8 mm in 1996 and 1077.7 mm in 1995; and the minimum was 493.8 mm in 1982 and 548.5 in 1974. The normal range *i.e.* between ± 19 of mean annual rainfall was 544.0 to 910.1 mm. Out of 39 years, ten years *viz.*, 1972, 1977, 1987, 1994, 1995, 1996, 1997, 2000, 2008 and 2009 received excess of rainfall ($>19\%$). Whereas seven years *viz.*, 1974, 1982, 1985, 1990, 2001, 2002 and 2007 received less than -26 to -49% rainfall than the normal range and these seven years are declared as moderate drought years. In general, the annual precipitation receipt in this region was not normal and varied significantly. and the normal rainfall from 19971 to 2009 ranges from 468.9 mm to 1577 mm.

The rainfall of 39 years (Table 2) ranged from 468.9 mm to 1577.0 mm with a mean of 834.2 mm. The standard deviation (SD) was moderately high (215.3) with a coefficient of variation (CV) of 25.8 per cent, indicating moderately high variability and dependability on rainfall. The 10 years decadal analysis (Table 2) indicated that, the mean annual rainfall was varied consistently with alternative decades with slightly high coefficient of variation ($<25\%$). During better rainfall years, 1991-2000 (10 years) mean rainfall was 1020.7 mm with higher SD (247.7) and CV (24.3%). While, during the period 1981-1990, this region experienced moderate drought (mean rainfall of 695.2 mm) with lower SD (135.8) and CV (19.5 %).

Seasonal Rainfall:

The data on mean seasonal rainfall, standard deviation, coefficient of variation and percentage contribution of seasonal rainfall are presented in Table 3. Highest amount of 364.2 mm of rainfall was received in south-west monsoon contributing to 43.7% per cent to total amount of rainfall with coefficient of variation of 35.0% indicating its dependability. For post-monsoon season, the rainfall received was 234.7 mm and thus contributing 28.1% to the total with coefficient of variation of 58.7%. Pre-monsoon rainfall also contributed substantially (92.2 mm), 11.0% of the total with 68.4% coefficient of variation, in winter, the rainfall was 10.2 mm are thus contributing 1.2% to the total with coefficient of variation of 232.3%. The monthly rainfall analysis indicated that the crop growing period in Mysore district was started from May month and remain up to end of November as indicated by the less coefficient of variation ($<100\%$) and more dependability of rainfall during these months.

Weekly rainfall:

The weekly rainfall analysis was done for mean, standard deviation and coefficient of variation and the relevant data were presented Table 4. Each standard week from 16th to 46th received rainfall more than 20 mm. It indicated that from April III week onwards the crop season starts and extended up to November III week. However, in between many of the weeks rainfall was not equally distributed and many times there was a break in monsoon and received less than 20 mm of rainfall especially in the months of June and July. These results clearly indicated that, farmers in Mysore started sowing the crops like Cotton, tobacco, pulses and oilseeds in the month of April itself due to sufficient rainfall available for land preparation, sowing and germination of crops seeds. However, due to low and inconsistent rainfall in the months of June and July, the seedlings are more prone to shortage of moisture and reduction in the plant population or even complete failure of crops is most common in this region. Hence, more importance in this region should be given on saving the crop seedlings through protective irrigation or some mid season corrections like dust mulching, residue mulching, in situ water conservation practices, spraying of anti-transparent *etc.* In case of complete failure of main crop in such situation we need to suggest contingency crops like short duration pulses to utilize the forthcoming seasons. Since some parts of Mysore district contain deep black soil, the end season rainfall peak at October II and November I fortnight, made more successful post-monsoon crops in deep black soil under stored soil moisture condition.

IV. CONCLUSION

On the basis above, it was concluded that Mysore district received mean annual rainfall of 834.2 mm with less coefficient of variation (25.8%) and there was much deviation among the different years. This region received more amount of pre-monsoon rainfall (18.87% of total rainfall) and it was start from April III week (>20 mm rainfall in each week) and helped in land preparation and subsequent sowing of crops like cotton, finger millet, pulses and oil seeds and in Hunsur taluk tobacco. But there was a break in monsoon in June and July months and hence, monsoon crops suffer from want of moisture and in that situation either supplemental irrigation or mid season corrections measures ensure good crop stand and yield. On the other hand due to end season rainfall peak at October last week and November I week (30-50 mm of

rainfall in both the weeks) helps in better storage of moisture for rabi season crops like chickpea and sorghum and also short duration pulses like green gram, black gram *etc.*

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APPENDIX - A

Table: 1. Year wise mean rainfall and % rainfall departure from normal at Mysore district of Karnataka

Year	Mean	% RF departure from normal	Situation	Year	Mean	% RF departure from normal	Situation
1971	904.5	8.4	N	1991	1094.8	31.2	E
1972	1075.3	28.9	E	1992	675.9	-19.0	N
1973	820.8	-1.6	N	1993	924.5	10.8	N
1974	548.5	-34.2	MD	1994	1577	89.0	E
1975	805.4	-3.5	N	1995	1077.7	29.2	E
1976	809.1	-3.0	N	1996	1156.8	38.7	E
1977	1052.1	26.1	E	1997	1066.1	27.8	E
1978	739.4	-11.4	N	1998	774.1	-7.2	N
1979	964	15.6	N	1999	866.2	3.8	N
1980	639.6	-23.3	SD	2000	994.3	19.2	E
1981	741.8	-11.1	N	2001	560	-32.9	MD
1982	493.8	-40.8	MD	2002	538.5	-35.4	MD
1983	867	3.9	N	2003	759.5	-9.0	N
1984	823.8	-1.2	N	2004	700.4	-16.0	N
1985	468.9	-43.8	MD	2005	910.5	9.1	N
1986	689.3	-17.4	N	2006	836.3	0.3	N
1987	734	19.23	E	2007	1052.1	-47.27	MD
1988	714.2	2.90	N	2008	778.1	23.27	E
1989	818.8	-7.93	N	2009	879.9	25.70	E
1990	600.8	-40.17	MD				

Mean = 834.2 mm IMD Classification: E= Excess RF (>19%), N = Normal RF (\pm 19%), SLD = Slight Drought (> -19 to -25%),

MD = Moderate Drought (-26 to -49%) and SD = Severe Drought (-50% & above)

Table: 2. Annual Rainfall (mm) variability between 1971to 2009 (39 years) at Mysore

Decades	1971-1981	1981-1990	1991-2000	2001-2009
Mean	835.9	695.2	1020.7	801.0
SD	169.1	135.8	247.7	169.7
CV%	20.2	19.5	24.3	21.2

Table: 3. Mean seasonal and annual rainfall of Mysore district of Karnataka

Month	Mean	SD	CV (%)	% of Total
January	5.5	20.1	368.5	0.7
February	4.7	13.1	277.6	0.6
March	16.4	36.2	220.9	2.0
April	75.7	57.4	75.8	9.1
May	133.0	76.7	57.6	15.9
June	75.5	45.9	60.9	9.0
July	79.6	45.9	57.7	9.5
August	88.2	52.4	59.4	10.6
September	120.9	75.1	62.1	14.5
October	159.4	100.7	63.2	19.1
November	60.6	63.0	104.1	7.3
December	14.7	26.3	179.5	1.8
Winter	10.2	23.6	232.3	1.2
Pre-monsoon	92.2	63.0	68.4	11.0
Monsoon	364.2	127.6	35.0	43.7
Post monsoon	234.7	137.8	58.7	28.1
Total	834.2	215.3	25.8	100.0

Table 4. Weekly rainfall analysis (1971to 2009) at Mysore district of Karnataka

SMW	Month and date	Mean RF (mm)	SD	CV%
1	1 - 7 Jan	0.1	0.5	455.9
2	8 - 14 Jan	0.2	1.0	421.1
3	15 - 21 Jan	1.9	9.3	488.2
4	22 - 28 Jan	2.9	18.3	623.9
5	29 Jan - 4 Feb	0.2	0.9	481.8
6	5 - 11 Feb	0.2	0.6	412.4
7	12 - 18 Feb	0.8	2.0	256.3
8	19 - 25 Feb	2.4	9.7	410.7
9	26 Feb - 4 Mar	1.5	7.3	484.5
10	5 - 11 Mar	4.3	16.4	380.6
11	12 - 18 Mar	2.8	10.5	372.8
12	19 - 25 Mar	3.5	14.0	398.9
13	26 Mar - 1 Apr	2.7	7.7	283.0
14	2 - 8 Apr	12.4	24.6	198.7
15	9 - 15 Apr	8.1	11.8	145.8
16	16 - 22 Apr	22.0	33.2	150.8
17	23 - 29 Apr	20.5	26.8	130.9
18	30 Apr - 6 May	25.9	28.7	110.8

19	7 - 13 May	30.9	32.7	105.8
20	14 - 20 May	29.3	32.8	111.9
21	21 - 27 May	30.5	34.9	114.5
22	28 May - 3 Jun	30.2	30.4	100.4
23	4 - 10 Jun	21.0	26.4	125.5
24	11 - 17 Jun	23.7	24.4	103.0
25	18 - 24 Jun	15.3	15.1	98.6
26	25 Jun - 1 Jul	14.7	16.0	108.7
27	2 - 8 Jul	9.4	8.9	94.5
28	9 - 15 Jul	17.3	18.9	109.0
29	16 - 22 Jul	18.6	24.4	130.9
30	23 - 29 Jul	19.1	21.8	113.8
31	30 Jul - 5 Aug	21.6	18.4	85.1
32	6 - 12 Aug	16.5	19.7	118.8
33	13 - 19 Aug	16.9	14.9	87.9
34	20 - 26 Aug	24.1	35.9	149.0
35	27 Aug - 2 Sep	23.0	29.6	128.8
36	3 - 9 Sep	18.9	24.9	131.9
37	10 - 16 Sep	17.3	26.5	152.9
38	17 - 23 Sep	34.6	35.2	101.8
39	24 - 30 Sep	40.1	40.7	101.5
40	1 - 7 Oct	34.1	34.7	101.8
41	8 - 14 Oct	30.3	28.9	95.4
42	15 - 21 Oct	36.2	30.2	83.4
43	22 - 28 Oct	33.9	35.9	105.9
44	29 Oct - 4 Nov	41.8	55.0	131.6
45	5 - 11 Nov	23.7	36.4	153.5
46	12 - 18 Nov	16.1	19.9	123.7
47	19 - 25 Nov	10.2	20.1	197.7
48	26 Nov - 2 Dec	6.8	18.7	274.3
49	3 Dec - 9 Dec	3.1	10.1	327.5
50	10 - 16 Dec	6.2	19.3	311.1
51	17 - 23 Dec	2.2	6.5	291.6
52	24 - 31 Dec	3.9	12.9	332.9