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Nakshatra based rainfall climatology

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सार – भारतीय ग्रीष्मकालीन मानसून वर्षा, देश के कृषि उत्पादन और देश की अर्थ व्यवस्था में विशेष भूमिका निभाती है। मानसून वर्षा की परिवर्तनशीलता से संबंधित प्रारंभ में किए गए अध्ययन मासिक, मौसमी अथवा वार्षिक मान के आधार पर हैं जिससे यह निष्कर्ष निकलता है कि वर्षा की ये परिवर्तिताएँ आँकड़ों की सीमाओं में हैं। इस शोध–पत्र में नक्षत्रों पर आधारित मान की अल्प अवधि, जिसमें औसत अवधि 13–14 दिनों की है, की परिवर्तिता का अध्ययन करने का प्रयास किया गया है। प्रायोगिक अध्ययन के लिए महाराष्ट्र और गोआ के उपखंड़ों को चुना गया है। विभिन्न नक्षत्रों में वर्षा की राशि के आधारभूत साँख्यिकीय प्राचलों का विवेचन किया गया है। मानसून वर्षा ऋतु की चरम अवस्था के दौरान परिवर्तनशीलता के गुणांक अधिक हैं और वे 40 प्रतिशत – 80 प्रतिशत के क्रम मे हैं। इसका अभिप्राय यह है कि कृषि संबंधी कार्यों के लिए सामान्यतः भारत के किसानों द्वारा अपनाई जाने वाली नक्षत्र पर आधारित वर्षा की सक्रियता पर पूर्णतया निर्भर रहना व्यावहारिक नहीं है।

ABSTRACT. Indian summer monsoon rainfall plays a major role in the country's agricultural production and economy of the country. Earlier studies related to monsoon rainfall variations are based on monthly, seasonal or annual scale and concluded that the variations are within the statistical limits. In this paper, an attempt has been made to study the variability on a smaller period of the scale based on Nakshatras, which have an average period of 13-14 days. As a pilot study sub-divisions of Maharashtra and Goa have been selected. The basic statistical parameters of rainfall amount for different Nakshatras are discussed. The coefficients of variation during peak monsoon season are high and of the order of 40% - 80%. This means that total reliance of agricultural activities on Nakshatra based rainfall activity normally followed by Indian farmers is not a very good practice.

Key words – Monsoon rainfall, Nakshatra climatology, Rainfall variability, Trends.

1. Introduction

Meteorology is the science of atmosphere, which includes phenomenon such as wind and rain. From ancient times, man could not have escaped noticing them, particularly as he was more in contact with nature. In the ancient literature the year was divided into six seasons *viz*., Vasanta (Spring), Grishrna (Summer), Varsha (Rainy), Sarat (Moonlight), Hemanta (Foggy) and Sishira (Winter). Studies by several authors in India *e.g.* Sarker and Thapliyal (1988), Kulshrestha and Thapliyal (1991) and Mooley and Parthasarathy (1984) have shown that there is no significant trend in the all India rainfall. The variation shows decadal fluctuations. Though the monsoon rainfall is trend less over a long period of time, particularly on the all India scale (Mooley and Parthasarathy, 1984), there are pockets of significant long-term rainfall changes. These were reported by Koteswaram and Alvi (1969), Jagannathan & Parthasarathy (1973) and Chowdhury and Abhyankar (1979) etc. Studies by Rupa Kumar *et al*. (1992) have shown that areas of NE peninsula, NE India and NW peninsula show widespread decreasing trend in the Indian summer monsoon rainfall. Farmers are more interested in the forecast of 3-4 days, and so an attempt is made in the present study to see the variation of rainfall amount based on Nakshatra. The agricultural operations in the earlier years are mainly dependent on the seasons and Nakshatra period. The twenty-seven Nakshatras are having a mean period of 13 or 14 days. Nakshatra period differs in each year. The normal period of Rohini to Chitra Nakshatra is presented in Table 1.

As a pilot study, four meteorological sub-divisions of Maharashtra and Goa are selected. An attempt has been made to prepare the Nakshatra based climatology, *i.e*. the trends of rainfall activity during the different Nakshatra. These periods are of nearly two weeks duration and relevant for agricultural operations, covering south-west monsoon and post monsoon months.

TABLE 1

Normal dates of Nakshatra

	Nakshatra	Period	No. of days
1	Rohini	25 May to 7 Jun	14
2	Mrigashira	8 Jun to 21 Jun	14
3	Ardra	22 Jun to 5 Jul	14
4	Punarvasu	6 Jul to 19 Jul	14
5	Pushya	20 Jul to 2 Aug	14
6	Ashlesha	3 Aug to 16 Aug	14
7	Magha	17 Aug to 30 Aug	14
8	Purva	31 Aug to 12 Sep	13
9	Uttara	13 Sep to 26 Sep	14
10	Hasta	27 Sep to 9 Oct	13
11	Chitra	10 Oct to 23 Oct	14

TABLE 2

Sub-division : Madhya Maharashtra (Rainfall in mm)

Nakshatra	Rohini	Mrigashira	Ardra	Punarvasu	Pushya	Ashlesha	Magha	Purva	Uttara	Hasta	Chitra
						1931-90					
Mean	33.2	65.0	118.8	138.2	131.8	109.7	83.8	69.2	78.9	61.3	30.0
Standard deviation	32.76	32.81	53.73	61.52	65.70	49.69	45.67	44.02	49.00	41.18	28.41
Coeff. of variation (%)	98.67	50.47	45.23	44.52	49.85	45.30	54.49	63.61	62.11	67.18	94.69
Trend	+	+	-	-	-	+ *	-	-	+	-	- *
Range	201.8	134.0	264.2	284.0	329.5	230.4	190.3	216.5	193.6	167.8	115.7
						1931-60					
Mean	27.3	65.3	128.6	147.2	133.8	99.3	85.1	77.3	76.9	68.2	37.2
Standard deviation	22.79	34.89	59.93	68.47	62.10	40.81	48.66	43.72	44.83	47.01	29.28
Coeff. of variation (%)	83.47	53.42	46.60	46.51	46.41	41.10	57.18	56.56	58.30	68.93	78.70
Trend	+	-	+	+	+	+	-	+	-	+	-
Range	80.0	132.9	264.2	284.0	232.0	155.6	190.3	162.0	188.8	164.6	114.2
						1961-90					
Mean	39.1	64.7	109.0	129.1	129.8	120.2	82.5	61.0	81.0	54.4	22.8
Standard deviation	39.90	31.19	45.64	53.34	70.12	55.95	43.26	43.51	53.55	33.80	26.03
Coeff. of variation (%)	102.04	48.21	41.87	41.31	54.03	46.55	52.44	71.33	66.11	62.13	114.18
Trend	+	+ *	-	- *	-	+	+	-	+	+	-
Range	201.8	115.5	184.6	203.1	319.7	225.0	154.1	216.5	177.0	126.0	97.7
Student's *t*-value	-1.41	0.07	1.43	1.14	0.23	-1.65	0.22	1.45	-0.32	1.31	2.01*
						Decadal Means					
1931-40	23.3	71.0	122.1	134.8	121.0	87.0	93.2	76.3	83.0	72.8	36.6
1941-50	26.7	68.4	112.9	169.7	133.9	94.2	84.0	75.9	86.2	52.3	37.7
1951-60	31.9	56.5	151.0	137.1	146.5	116.6	78.1	79.7	61.6	79.6	37.3
1961-70	28.2	55.0	112.4	143.9	165.5	116.3	77.5	74.9	64.7	48.4	24.9
1971-80	57.1	63.8	123.3	125.8	105.4	119.7	88.1	58.8	82.9	50.9	27.7
1981-90	32.0	75.4	91.3	117.6	118.6	124.6	82.0	49.4	95.2	64.0	15.8

* Significant at 95% level; ** Significant at 99% level

TABLE 3

Sub-division : Marathwada (Rainfall in mm)

Nakshatra	Rohini	Mrigashira	Ardra	Punarvasu	Pushya	Ashlesha	Magha	Purva	Uttara	Hasta	Chitra
						1931-90					
Mean	28.2	68.9	80.6	75.5	93.0	71.4	81.5	81.7	81.1	52.0	23.5
Standard deviation	27.11	40.66	35.19	37.44	54.02	53.18	65.09	58.52	52.00	46.38	29.66
Coeff. of variation (%)	96.15	59.01	43.65	49.58	58.09	74.48	79.86	71.63	64.12	89.19	126.22
Trend	+	-	- *	-	+	+	+	-	+	+	-
Range	111.0	162.3	157.2	164.5	227.3	253.7	238.2	269.3	257.9	215.8	125.9
						1931-60					
Mean	26.5	74.4	89.7	80.7	93.7	63.2	79.9	89.5	81.5	54.8	23.5
Standard deviation	27.54	41.90	32.71	37.88	56.41	44.55	66.70	60.63	45.63	52.27	25.84
Coeff. of variation (%)	103.92	56.32	36.46	46.94	60.20	70.49	83.48	67.75	55.99	95.38	109.97
Trend	+	-	+	-	+	+	+	-	+	+	+
Range	111.0	162.3	149.6	127.8	227.3	162.0	235.0	269.3	193.9	214.6	125.9
						1961-90					
Mean	29.9	63.3	71.5	70.3	92.2	79.6	83.0	73.9	80.8	49.3	23.4
Standard deviation	27.04	39.29	35.74	36.88	52.48	60.25	64.54	56.26	58.48	40.35	33.50
Coeff. of variation (%)	90.45	62.07	49.98	52.46	56.92	75.69	77.76	76.12	72.37	81.85	143.16
Trend	+	+	-	+	-	+	-	-	+	+ *	-
Range	100.0	155.0	145.7	164.5	193.8	235.7	216.9	214.5	249.3	135.6	119.6
Student's *t*-value	-0.48	1.06	2.06*	1.08	0.11	-1.20	-0.18	1.03	0.05	0.46	0.01
						Decadal Means					
1931-40	23.2	87.7	92.7	93.2	92.3	62.2	85.0	87.7	81.6	55.5	18.1
1941-50	23.9	69.3	84.5	63.1	69.0	51.2	75.2	100.8	90.1	43.8	24.8
1951-60	32.4	66.3	92.0	85.9	120.0	76.1	79.5	80.1	72.8	65.1	27.7
1961-70	28.8	59.9	77.1	77.5	108.7	73.2	87.6	86.4	75.0	33.9	23.6
1971-80	28.7	62.4	73.3	51.0	76.8	67.0	97.1	63.6	63.5	42.8	25.6
1981-90	32.2	67.7	64.1	82.3	91.1	98.6	64.4	71.7	103.9	71.1	21.1

* Significant at 95% level; ** Significant at 99% level

2. Data

Rainfall data archived at National Data Centre (NDC), Pune of the India Meteorological Department has been used for the study. The data archived at NDC has undergone electronic data processing and quality control checks. For the present study, rainfall data for the two states Maharashtra and Goa for the period 1931-90 have been used.

3. Analysis

The daily rainfall data for 1931-90 have been arranged for each Nakshatra period and for each station. Normal rainfall values for each station are computed based on these rearranged data followed by the district normal. Normal rainfall values are also computed based on 60 years period for the four sub-divisions Madhya Maharashtra, Marathwada, Vidarbha and Konkan & Goa.

TABLE 4

Sub-Division : Vidarbha (Rainfall in mm)

Nakshatra	Rohini	Mrigashira	Ardra	Punarvasu	Pushya	Ashlesha	Magha	Purva	Uttara	Hasta	Chitra
						1931-90					
Mean	18.6	68.3	138.6	149.6	144.9	140.6	119.5	94.9	76.3	41.3	20.5
Standard deviation	22.16	47.91	58.88	63.88	62.69	68.40	69.65	51.65	50.02	42.71	24.53
Coeff. of variation (%)	119.14	70.15	42.48	42.70	43.27	48.65	58.29	54.42	65.56	103.42	119.68
Trend	-	-	-	- **	-	+ *	-	- *	- *	-	-
Range	102.8	241.4	293.8	284.3	279.6	310.1	288.7	222.2	223.4	238.7	83.6
						1931-60					
Mean	18.8	70.9	151.8	167.0	157.3	127.7	116.5	106.5	85.6	44.5	24.0
Standard deviation	23.69	50.67	63.17	62.84	62.72	62.67	67.16	46.74	51.47	49.55	24.97
Coeff. of variation (%)	126.01	71.46	41.61	37.63	39.87	49.07	57.65	43.89	60.13	111.35	104.05
Trend	+	-	+	-	-	+	-	+	-	-	-
Range	102.8	231.8	263.0	246.7	265.1	309.3	283.0	222.2	206.6	236.8	78.6
						1961-90					
Mean	18.4	65.8	125.3	132.3	132.4	153.4	122.6	83.4	67.0	38.2	17.0
Standard deviation	20.92	45.71	51.95	61.06	61.16	72.44	73.08	54.47	47.56	35.16	23.98
Coeff. of variation (%)	113.72	69.47	41.46	46.15	46.20	47.22	59.61	65.31	70.98	92.03	141.07
Trend	-	+	+	-	-	+	+	-	- *	+ *	-
Range	76.9	193.0	216.8	282.6	265.3	303.7	256.2	191.0	170.4	130.3	83.6
Student's *t*-value	0.07	0.41	1.77*	2.17*	1.56	-1.47	-0.34	1.76*	1.45	0.57	1.11
						Decadal Means					
1931-40	21.6	94.6	154.7	188.0	157.5	114.6	140.4	100.2	85.4	57.2	28.3
1941-50	16.4	64.2	139.6	172.0	156.3	110.3	117.3	97.4	89.5	26.0	21.7
1951-60	18.3	53.8	161.2	141.0	158.1	158.1	91.7	121.8	81.9	50.4	22.0
1961-70	22.6	63.2	102.9	120.7	164.1	141.3	115.7	98.4	100.4	18.5	14.5
1971-80	18.4	60.8	144.9	145.7	94.4	151.2	139.4	81.4	43.4	38.1	16.4
1981-90	14.4	73.3	128.1	130.3	138.7	167.8	112.6	70.5	57.2	58.0	20.0

* Significant at 95% level; ** Significant at 99% level

The data for Nakshatra based climatology during southwest monsoon season are analysed, beginning from Rohini Nakshatra (25 May - 7 Jun) to Basta Nakshatra (27 Sep - 9 Oct).

Rainfall series of 1931-90 has been split into two equal periods 1931-60 and 1961-90 to study the variations of rainfall between these periods. Basic statistical analysis like mean, standard deviation, coefficient of variation,

TABLE 5

Sub-Division : Konkan & Goa (Rainfall in mm)

Nakshatra	Rohini	Mrigashira	Ardra	Punarvasu	Pushya	Ashlesha	Magha	Purva	Uttara	Hasta	Chitra
						1931-90					
Mean	90.8	314.1	511.7	497.4	474.1	359.8	263.5	194.1	136.8	100.8	42.9
Standard deviation	92.83	137.42	196.20	176.28	191.44	198.19	162.98	127.04	101.75	82.90	43.45
Coeff. of variation (%)	102.23	43.75	38.34	35.44	40.38	55.08	61.85	65.45	74.38	82.25	101.28
Trend	+	+	-	- *	-	+ *	+	-	-	-	- **
Range	405.9	663.4	986.2	777.2	758.2	952.1	695.9	528.1	462.0	429.0	198.0
						1931-60					
Mean	87.4	307.0	534.4	533.6	495.4	316.2	267.5	212.9	137.4	103.6	55.9
Standard deviation	80.23	138.58	221.57	191.19	194.46	150.99	188.09	126.55	95.30	93.64	48.88
Coeff. of variation (%)	91.80	45.14	41.46	35.83	39.25	47.75	70.31	59.44	69.36	90.38	87.45
Trend	-	-	+	-	+	+	+	+	+	-	-
Range	238.1	497.3	986.2	662.9	758.2	541.7	695.9	522.5	462.0	424.6	196.5
						1961-90					
Mean	94.1	321.2	489.1	461.2	452.8	403.3	259.5	175.3	136.2	98.1	29.9
Standard deviation	105.22	138.25	167.81	154.79	189.24	230.63	136.49	126.85	109.45	72.11	33.19
Coeff. of variation (%)	111.82	43.04	34.31	33.56	41.79	57.19	52.60	72.36	80.36	73.50	110.99
Trend	-	+	-	-	-	+	+	-	+	+	-
Range	405.9	653.2	694.8	777.2	703.5	917.6	479.1	517.0	358.4	226.2	124.9
Student's *t*-value	-0.28	-0.40	0.89	1.61	0.86	-1.73*	0.19	1.15	0.05	0.25	2.41**
						Decadal Means					
1931-40	86.5	307.2	498.9	521.8	461.1	306.8	256.6	198.3	139.6	125.8	69.7
1941-50	95.5	320.8	447.4	561.9	430.0	267.5	240.3	224.9	167.2	56.5	39.2
1951-60	80.3	293.0	656.8	517.0	595.0	374.3	305.6	215.4	105.5	128.5	58.9
1961-70	73.9	318.7	507.0	515.6	515.2	394.5	267.0	206.8	137.1	92.2	31.7
1971-80	136.6	287.6	501.1	442.3	379.3	358.3	236.7	198.4	107.0	82.3	31.6
1981-90	72.0	357.2	459.2	425.7	464.0	457.1	274.6	120.8	164.6	119.7	26.5

* Significant at 95% level; ** Significant at 99% level

range, trend and significance of trend are carried out. The significance of difference in the mean rainfall values of 1931-60 and 1961-90 was tested by Student's *t*-test and the magnitude of gradient ascertained. The significance of trend was tested at 95% and 99% level of confidence. Decadal mean values are also calculated for the period 1931-90. These statistical values for the four sub-divisions are presented in Table 2-5.

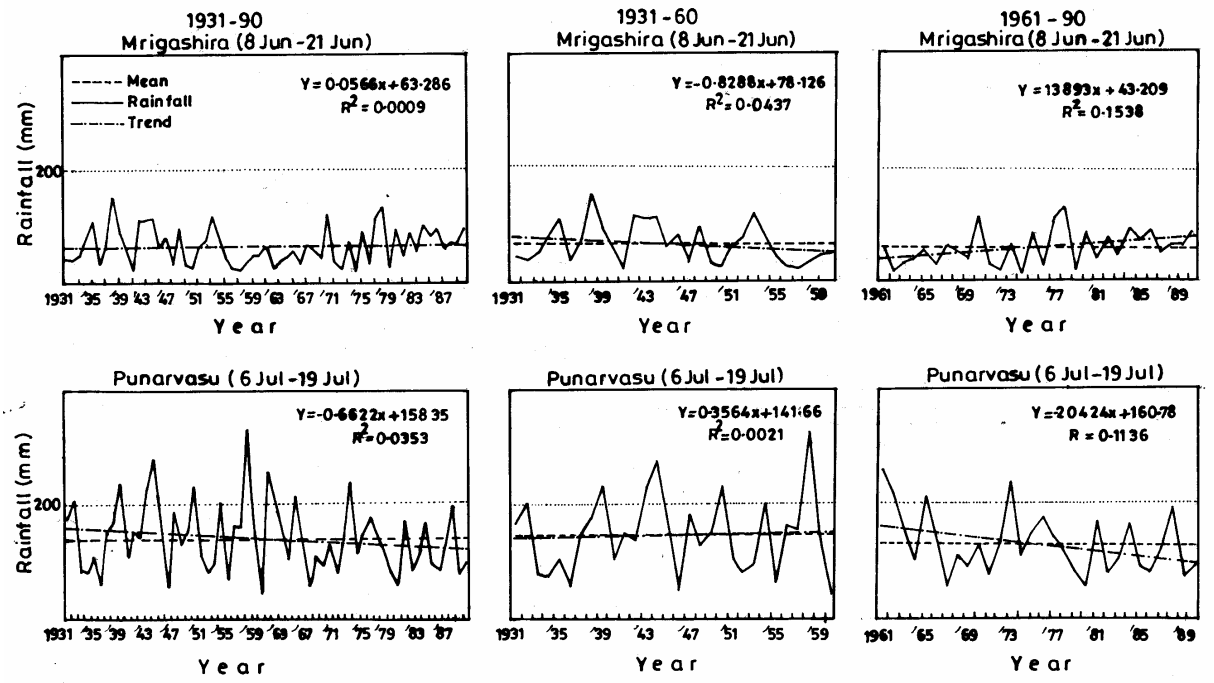

Fig. 1. Rainfall trends

4. Discussion

(a) *Madhya Maharashtra*

Positive rainfall trend for Ashlesha (3 Aug - 16 Aug) and negative trend for Chitra (10 Oct - 23 Oct) are significant at 95% level for the period 1931-90. No significant trends are observed during 1931-60 and 1961-90. Positive significant trend for Mrigashira (8 Jun - 21 Jun) and negative significant trend for Punarvasu (6 Jul - 19 Jul) are noticed for the period 1961-90. No significant trend is observed for 1931-90 and 1931-60. Student *t*-value for Chitra Nakshatra is significant at 95%. Trends are insignificant for other Nakshatra periods.

As an example, rainfall values along with mean, trend, regression equation for the sub-division Madhya Maharashtra are shown in Figs. 1 and 2 for the periods 1931-60, 1961-90 and 1931-90.

High coefficients of variation are observed during Rohini (25 May - 7 Jun) and Chitra (10 Oct - 23 Oct). Coefficients of variation are in the range of 40% - 70% for rest of the Nakshatras. If we consider variability between 1931-60 & 1961-90, it is noticed that variability is more during the period 1961-90 except for Mrigashira (08 Jun - 21 Jun) to Punarvasu (06 Jul - 19 Jul). This means that variability was more in the beginning of monsoon period during 1931-60, whereas the variability was more in the rest of the monsoon season during 1961-90.

(b) *Marathwada*

Rainfall during Ardra (22 Jun - 5 Jul) has a negative trend and is significant at 95% level during 1931-90, whereas no significant trend noticed during 1931-60 and 1961-90. For Hasta (27 Sep - 9 Oct) a significant positive trend at 95% level for the period 1961-90 is observed, but no significant trend during 1931-90 and 1931-60. Student's *t*-value is significant for Ardra. Trends are insignificant for rest of the Nakshatras.

High coefficients of variation (90% 126%) are observed for Rohini (25 May - 7 Jun), Hasta (27 Sep - 9 Oct) and Chitra (10 Oct - 23 Oct). The variation is 44% - 90% for rest of the Nakshatras. Comparison of variation for the period 1931-60 and 1961-90 shows that rainfall variability is more during 1961-90 except for Rohini (25 May - 7 Jun), Magha (17 Aug - 30 Aug) and Hasta (27 Sep - 9 Oct).

(c) *Vidarbha*

A negative trend for Punarvasu (6 Jul - 19 Jul) is observed and is significant at 99% level for 1931-90.

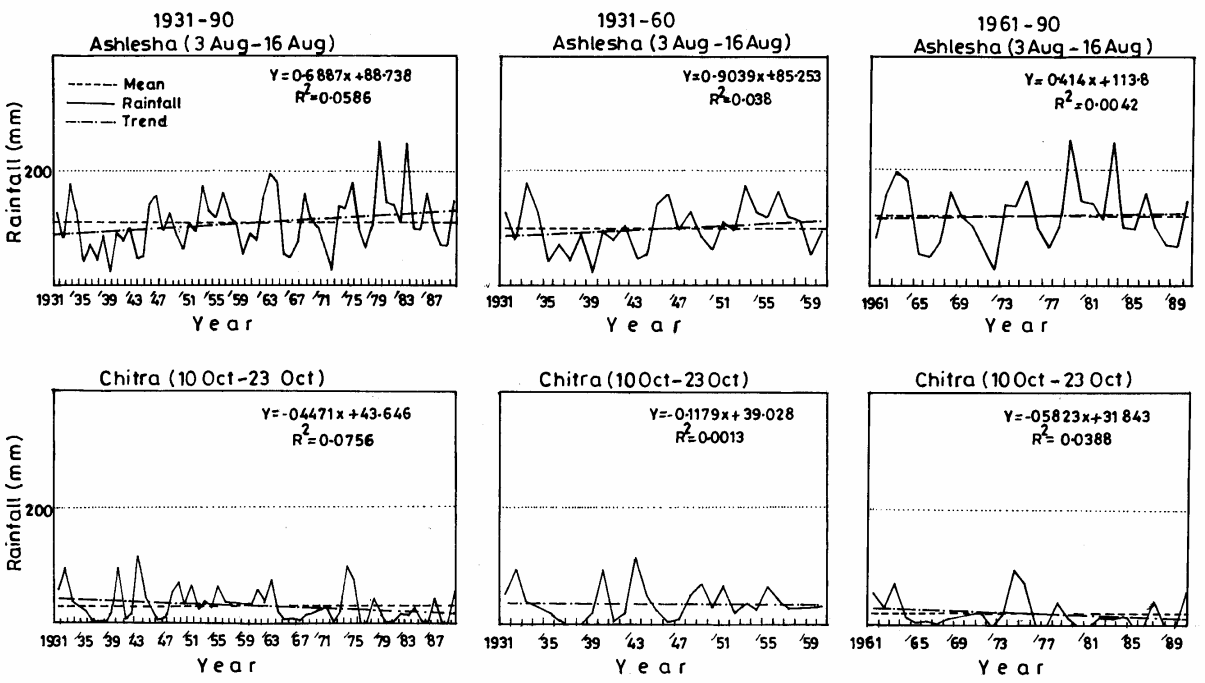

Fig. 2. Rainfall trends

However, the trends are not significant for 1931-60 and 1961-90. Significant (95%) negative trends are also observed for Uttara Nakshatra (13 Sep - 26 Sep) for 1931-90 and for 1961-90. Negative trend is significant during 1931-90 for Purva (31Aug - 12 Sep). Significant positive trends at 95% level are seen for Ashlesha (3 Aug - 16 Aug) during 1931-90 and Hasta (27 Sep - 9 Oct) during 1961-90. No other Nakshatra periods show any significant trend.

Similar to earlier two sub-divisions the coefficients of variation are high (103-120%) for Rohini (25 May - 7 Jun), Hasta & Chitra (27 Sep - 23 Oct). The variation is in the range of 40% - 70% for rest of the Nakshatras. Comparison of the variation for the period 1931-60 & 1961-90 shows that except for Rohini to Ardra (25 May - 5 Jul) and Hasta (27 Sep - 9 Oct) coefficients of variation are high during 1961-90.

(d) *Konkan and Goa*

Significant negative trends are seen for Punarvasu (6 Jul - 19 Jul) and Chitra (10 Oct - 23 Oct) at 95% and 99% respectively during 1931-90. Significant positive trend is observed for Ashlesha (3 Aug - 16 Aug) at 95% level during 1931-90. However, no significant trends are observed during 1931-60 and 1961-90. Student *t*-value for Ashlesha is significant at 95% and that for Chitra at 99% level. Trends are insignificant for the other Nakshatra periods.

Coefficients of variation are high for Rohini (25 May - 7 Jun), Hasta & Chitra (27 Sep - 23 Oct) Nakshatras, whereas variation is 35% - 75% for rest of the Nakshatras. Comparison of variation between 1931-60 & 1961-90 shows that Mrigashira to Punarvasu (8 Jun - 19 Jul), Magha (17 Aug - 30 Aug) & Hasta (27 Sep - 9 Oct) have higher rainfall variability during 1931-60 whereas for other Nakshatras rainfall variability is more during 1961-90.

The coefficients of variation of rainfall are of the order of 60% in western desert to 20% or less in the most rainy areas (Rao, 1976) during the monsoon season (Jun - Sep) .The mean monthly rainfall amounts are not uniform during the monsoon season. It is always high if the period of averaging is small. Coefficient of variation of seasonal rainfall for meteorological sub-divisions is smaller than the coefficient of variation of the same sub-division for the months June and July etc. It means that on an average rain does not occur in same quantum during shorter period year after year during a fixed week or a fixed Nakshatra or a given month. However, it is generally made up of when the rainfall for the whole season is added. As the period of

averaging in the present study is small (13 - 14 days), the coefficient of variation is high.

Indian farmers normally rely on Nakshatras for their agricultural activities during monsoon season. As the above study shows high amount of rainfall variability during the Nakshatra period, it is not a good practice to totally rely on Nakshatra based agricultural activities.

To summarise there is significant increasing trend at 95% level during Ashlesha Nakshatra (3 Aug - 16 Aug) for Vidarbha, Madhya Maharashtra and Konkan & Goa sub-divisions. This period is also the one where breaks in monsoon rainfall activity are most commonly observed (Ramamurthy, 1969). There is significant negative trend for Chitra Nakshatra (10 Oct - 23 Oct) for Konkan & Goa and Madhya Maharashtra sub-divisions. This is the period of withdrawal of SW monsoon for this area and the rainfall in this period is important for agricultural purposes and helps for the Rabi crops.

Coefficients of variation (percentage) for Mrigashira (8 Jun -21 Jun) to Hasta (27 Sep - 9 Oct) are low as compared to Rohini (25 May -7 Jun) and Chitra (10 Oct - 23 Oct). This is due to the high rainfall amounts during Mrigashira to Hasta.

5. Conclusions

(*i*) For Ashlesha Nakshatra (3 Aug - 16 Aug) the rainfall trend is increasing and significant at 95% level. This is observed for the Vidarbha, Madhya Maharashtra and Konkan & Goa sub-divisions. This period is also the one where breaks in monsoon rainfall activity are most commonly observed. Study on breaks by De and Mukhopadhyay, 2001 shows a similar decrease in number of break days during this period.

(*ii*) The rainfall trend is decreasing and significant for Chitra Nakshatra (10 Oct - 23 Oct) for Konkan & Goa and Madhya Maharashtra sub-divisions. This is the period of withdrawal of SW monsoon for this area and the rainfall in this period is important for agricultural purposes and helps for the *Rabi* crops. This could be a cause for concern to farmers in this area.

(*iii*) Vidarbha sub-division has a significant negative trend at 99% level for Punarvasu (6 Jul - 19 Jul).

(*iv*) Coefficients of variation are comparatively low from Mrigashira (8 Jun - 21 Jun) to Hasta (27 Sep - 9 Oct) Nakshatra.

(*v*) The coefficients of variation during peak monsoon season are high and of the order 40% - 80%. The total reliance on Nakshatra based agricultural activities, which is normally followed by Indian farmers, is not a very good practice.

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