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Study of normal rainfall over central Madhya Maharashtra

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ABSTRACT. Previous studies of analysis of rainfall characteristics over Nasik district in north Madhya Maharashtra showed that there is definite variation in the rainfall distribution in the different parts of the Nasik district. Hence, an attempt is made in this paper to examine the rainfall distribution in Pune and Ahmednagar districts of central Madhya Maharashtra.

The study of the monthly, seasonal and annual rainfall distribution for 16 stations in Pune and 11 stations in Ahmednagar districts has been made for the period 1901-1950. While the daily normal rainfall for 7 stations in Pune district and 7 stations in Ahmednagar district for same period have been utilised to study the rainfall characteristics and nature of correlation between the stations in the two districts.

In section 2 results about Pune district are given while section 3 deals with Ahmednagar district. Section 4 is the combined study of the 2 districts. It is seen that there is a difference in rainfall distribution in western parts and eastern parts of Pune district. The same is seen in case of Ahmednagar district also even though the western part is very small. Combined study of the two districts shows that the rainfall distribution in western part of Pune district is the same as the western part of Ahmednagar district while the rainfall distribution in eastern part of Pune district is same as that in the eastern part of Ahmednagar district so that taking the two districts together, a rough line of delineation running north south can be imagined which distinguishes the rainfall characteristics in the talukas to the west of the line to the rainfall characteristic in the talukas to the east. This tentative conclusion will be confirmed by the study of actual rainfall data over the region.

1. Introduction

The Farmers' Weather Bulletins issued by the India Meteorological Department at present contains weather forecasts for each of the districts in the various meteorological sub-divisions assuming that the rainfall pattern remains the same in the different parts of the districts. However, from a preliminary study of the rainfall characteristics in Nasik district by Rao and Prasad (1976) and by Mukherjee *et al.* (1978). it is seen that the rainfall patterns differs from the hill stations of the district to the plain stations of the district. Further, study of the rainfall characteristics of Satara district by Mukherjee *et al.* (1979) also indicates the existence of 2 regions in the district with different rainfall distribution. Though it is well known that rainfall decreases as we go from west to east, still to locate the areas of different rainfall intensities more precisely for issuing suitable agriculture bulletins for the different areas in the district, an attempt is made in this paper to study the variation of rainfall in Pune and Ahmednagar district of central Madhya Maharashtra. In the first section results about Pune district are given while the section 3 deals with Ahmednagar district. Section 4 is the combined study of the 2 districts. Fig. 1 gives the contour map of Ahmednagar and Pune districts.

2. Rainfall pattern in Pune district

2.1. *Physical feature*

Pune district lies between 17° 54′ & 19° 24′ N, and 73° 19′ & 75° 10′ E with an area of 5,349 sq. miles. The west of the district is undulating and intersected by numerous spurs of the Western Ghats, which breaks off in south-east direction becoming lower as they pass eastwards to that the Sahyadris along the western border with some peaks rising upto 1500 m, many scattered hills sloping eastwards to about 300 m and in the end sinking to the general level of plain. The extreme west border is rugged and cut by valleys and the Ghat forms a barrier inaccessible except few passes such as Bhor and Nana Pass.

TABLE 1

Location of stations in Pune district

Station	Lat. (°N)	Long. (°E)	Height (m)
1 Lonavala	18°45′	73°24′	625
2 Paud	18°32′	73°37′	—
3 Vadgaon	18°44′	73°39′	—
4 Ghod	19°03′	73°50′	—
5 Bhor	18°08′	73°51′	—
6 Pune	18°32′	73°51′	559
7 Alandi	18°40′	73°53′	—
8 Junnar	19°13′	73°53′	675
9 Khed	18°51′	73°54′	—
10 Saswad	18°21′	74°02′	—
11 Talegaon	18°39′	74°09′	—
12 Jejuri	18°17′	74°10′	—
13 Sirur	18°50′	74°23′	—
14 Baramati	18°09′	74°35′	551
15 Dhond	18°28′	74°36′	—
16 Indapur	18°07′	75°02′	541

TABLE 2

(Average monsoon rainfall (mm) and number of rainy days (Pune district)

	June			July			August			September			Annual rainfall
	RR	Rainy day	RR/ Rainy day	RR	Rainy day	RR/ Rainy day	RR	Rainy day	RR/ Rainy day	RR	Rainy day	RR/ Rainy day	
Lonavala	610.1	18.5	33.0	1764.6	29.3	60.2	1229.7	28.9	42.5	510.1	20.0	25.5	430.3
Paud	215.7	11.0	19.6	622.4	23.7	26.3	368.1	12.4	29.7	161.9	10.4	15.6	1519.3
Vadgaon	160.0	9.2	17.4	429.5	21.5	20.0	243.7	18.5	13.2	149.4	9.6	15.5	1124.7
Ghod	119.7	7.6	15.7	241.0	16.2	14.9	130.0	11.9	10.9	124.1	7.5	16.5	761.4
Bhor	132.1	9.1	14.5	354.6	20.2	17.5	191.2	15.8	12.1	122.2	8.4	14.5	955.2
Pune	107.3	7.0	15.3	169.0	12.9	13.1	96.5	8.2	11.8	130.0	7.5	17.3	660.9
Alandi	98.4	6.5	15.1	147.2	12.7	11.6	89.5	8.9	10.0	128.7	7.2	17.9	603.0
Junnar	113.5	7.5	15.1	231.5	16.2	14.3	133.4	12.1	11.0	118.8	7.7	15.4	742.9
Khed	114.9	6.9	16.7	174.3	13.3	13.1	100.7	8.9	11.3	135.6	7.3	18.6	673.3
Saswad	88.6	6.2	14.3	109.8	10.2	10.8	64.1	6.3	10.2	112.1	6.7	16.7	542.9
Talegaon	97.3	5.5	17.7	96.8	8.3	11.7	66.8	5.9	11.3	123.3	6.4	19.3	537.9
Jejuri	85.1	2.5	17.6	81.8	7.4	11.0	49.5	4.1	12.0	117.1	6.3	18.6	512.7
Sirur	106.9	6.1	17.5	74.4	6.2	12.0	48.3	4.2	11.5	144.5	7.4	19.5	510.4
Baramati	83.3	5.4	15.4	49.2	4.5	10.9	50.0	3.9	12.8	136.0	7.2	18.9	465.5
Dhond	81.6	5.5	14.8	60.1	5.7	10.5	46.7	3.6	13.0	138.6	6.8	20.4	462.9
Indapur	92.2	5.8	15.9	63.1	4.8	13.1	53.1	4.1	13.0	145.2	7.8	18.6	503.1

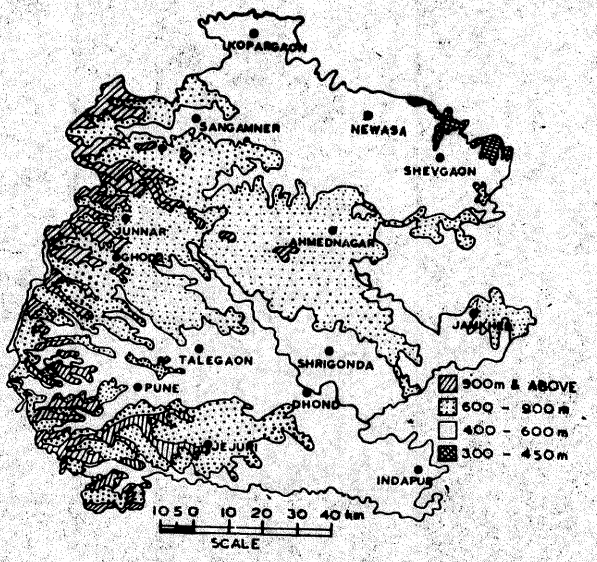

Fig. 1. Contour map of Pune and Ahmednagar districts

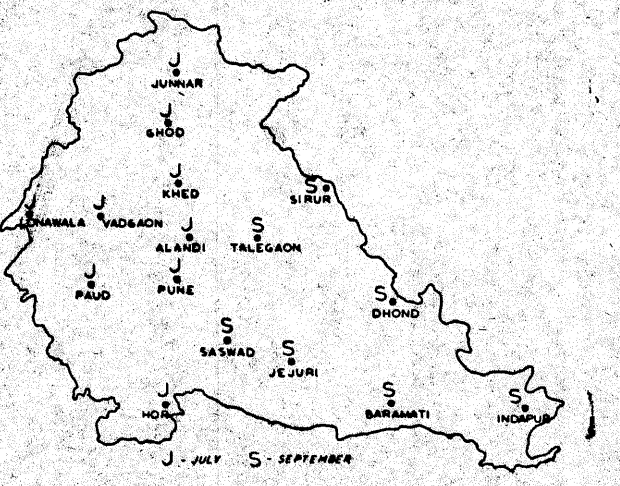

Fig. 2. Month of Maximum rainfall.

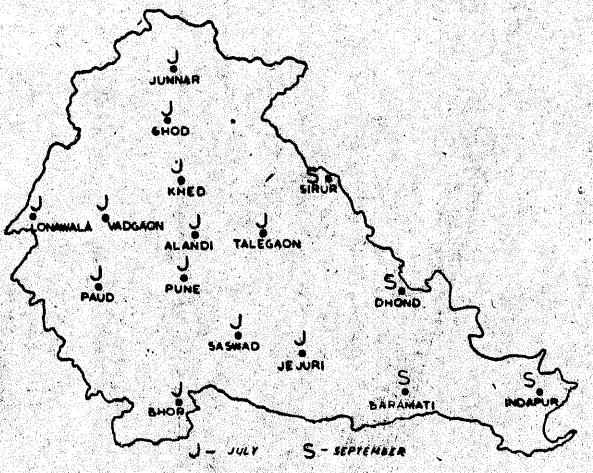

Fig. 3. Month of maximum number of rainy days.

2.2. *Data*

Pune District consists of 12 talukas. Monthly rainfall data for 16 stations published by India Meteorological Department have been utilised in the study of seasonal and annual rainfall. While daily rainfall normals for 8 stations, namely, Ghod, Pune, Junnar, Indapur, Talegaon, Jejuri, Dhond and Baramati have been used for the study of various aspects of pentad and daily rainfall distribution in the district. Table 1 gives the geographical co-ordinates of the stations in the district and their height above mean sea level.

2.3. *Analysis and results*

The study has been divided into 3 parts, namely study of monthly rainfall, pentad rainfall and daily rainfall.

2.31. *Monthly rainfall*

The monthly, seasonal and annual rainfall for the 16 stations are given in Table 2. It is seen that the annual rainfall amount varies within the district from 4304 mm at Lonavala to 463 mm at Dhond and the rainfall decreases from west to east. The season as a whole contributes about 85 per cent of annual rainfall in the stations Pune, Ghod, Lonavala, Vadgaon, Junnar, Paud, Bhor, Alandi and Khed while the contribution of seasonal rainfall is only 70 per cent in case of the stations Saswad, Talegaon, Jejuri, Sirur, Baramati, Dhond and Indapur. The distribution of the month of maximum rainfall is given in Fig. 2. It is seen that the stations Lonavala, Paud, Vadgaon, Ghod, Bhor, Pune, Alandi, Junnar and Khed get maximum rainfall in the month of July and the stations Saswad, Talegaon, Jejuri, Sirur, Baramati, Dhond and Indapur get maximum rainfall in the month of September. The distribution of month of highest number of rainy days as given in Fig. 3 shows that the number of rainy days are more in the month of July, for most of the stations except Sirur, Baramati, Indapur, Dhond where the number of rainy days are more in the month of September. Maximum rainfall intensities occur in the month of July for the stations Paud, Lonavala, Vadgaon, and Bhor whereas in the month of September for Indapur, Khed, Junnar, Jejuri, Saswad, Talegaon, Baramati, Sirur, Dhond, Alandi, Pune and Ghod.

The above study of monthly, seasonal, annual rainfall and number of rainy days indicates that the distribution of rainfall in different areas of the district is not the same and suggests that a further detailed study of rainfall characteristics in the district is necessary. The analysis of pentad rainfall was the next step in the study.

2.3.2. *Pentad rainfall*

The normal pentad rainfall pattern of the 8 stations Ghod, Pune, Junnar, Talegaon, Jejuri,

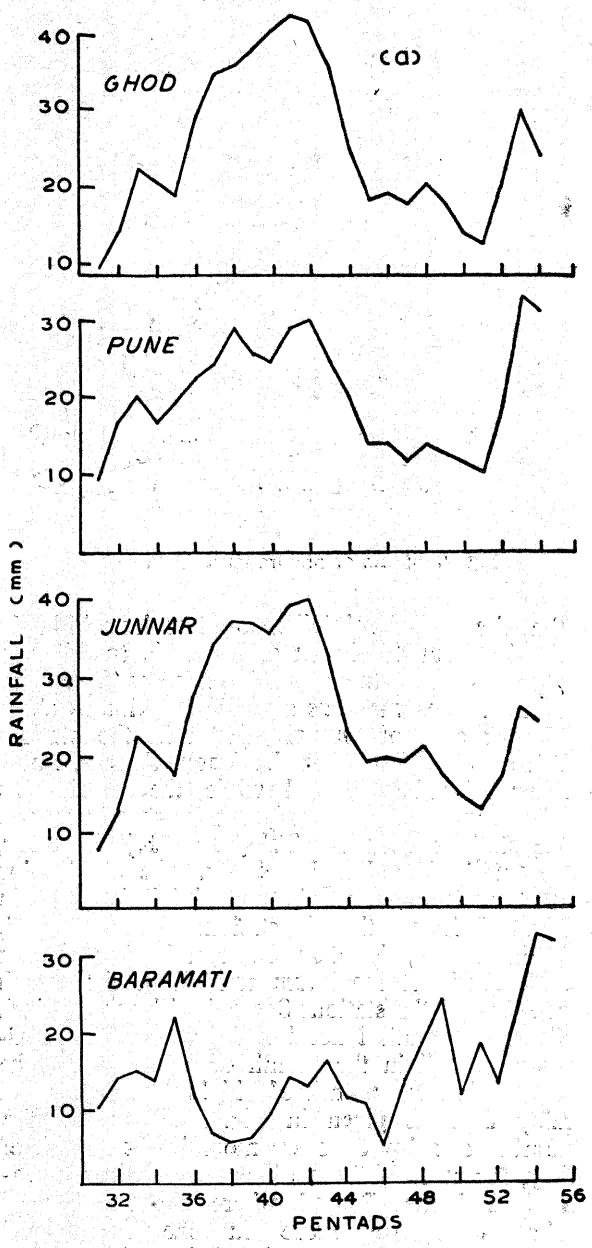

Fig. 4. (a) Pentad Rainfall

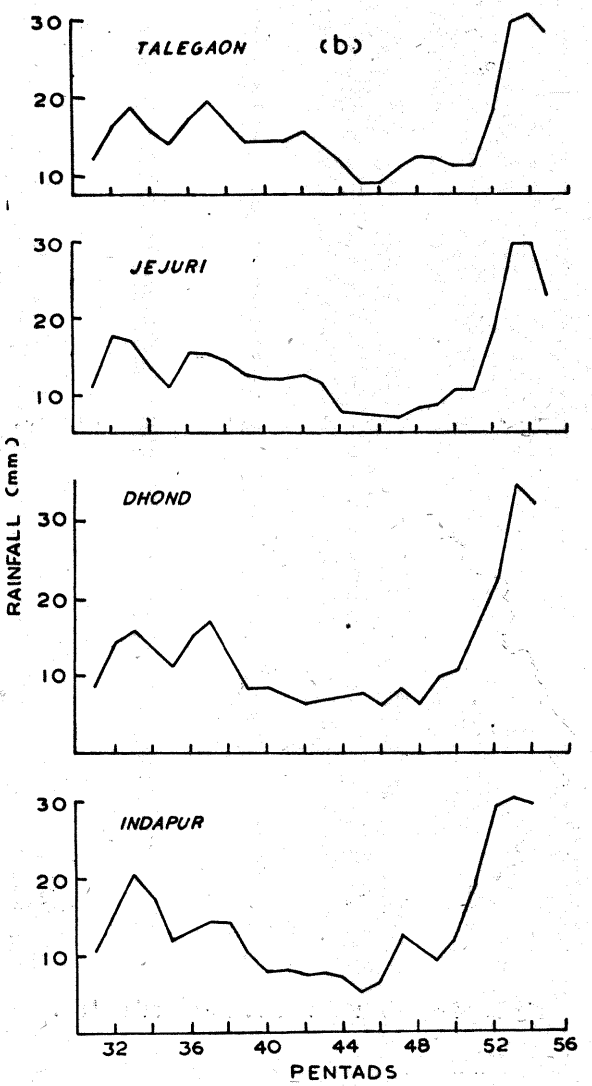

Fig. 4. (b) Pentad Rainfall

Indapur, Dhond and Baramati are given in Figs. 4(a) and 4(b). The observed characteristics of the pentad rainfall are summarized below:

(*i*) The pentad rainfall steadily increases from 31st pentad for all the stations and reaches a maximum during 32nd/33rd pentad.

(*ii*) It decreases during 34th and 35th pentad and starts increasing from 36th pentad for all the stations.

(iii) The increasing trend of the pentad rainfall persists upto 42nd pentad for Ghod, Junnar and Pune while in Jejuri, Indapur, Talegaon and Dhond the pentad rainfall gradually decreases from 37th pentad upto 48th pentad.

(*iv*) In case of Ghod, Pune and Junnar pentad rainfall reaches the maximum at 42nd pentad and decreases subsequently from 43rd to 51st pentad.

(*v*) The rainfall considerably increases from 49th pentad for Talegaon, Jejuri, Indapur and Dhond and from 52nd pentad for Ghod, Junnar and Pune. The rainfall reaches maximum in 53rd pentad for all the stations and starts decreasing from 54th pentad.

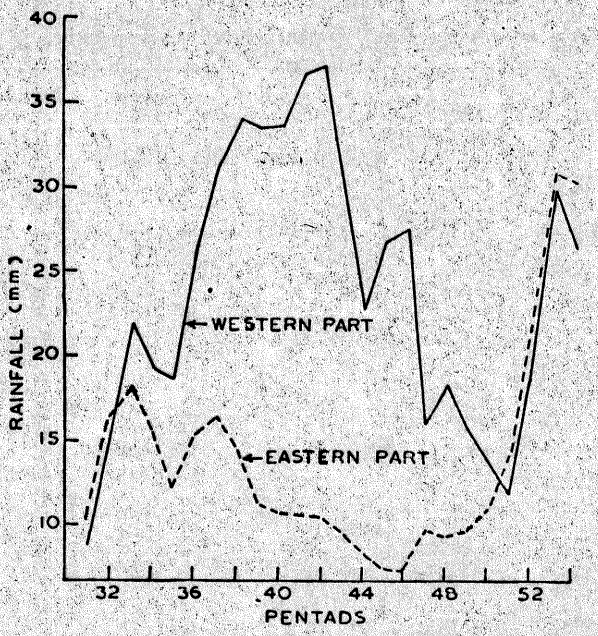

Fig. 5. Average pentad rainfall of western part and eastern part of Pune district

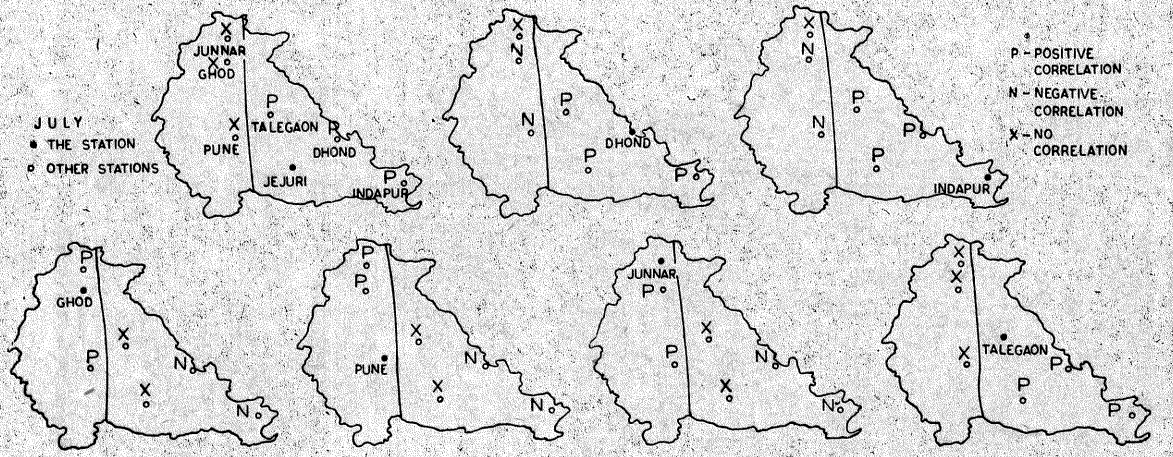

Fig. 6. Nature of correlation between the station (circle) with other stations

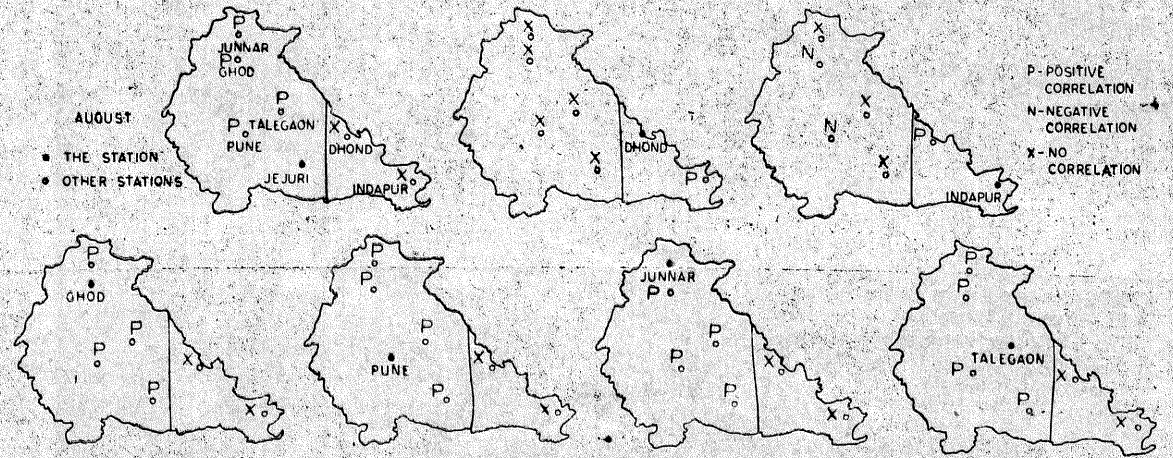

Fig. 7. Nature of correlation between the station (circle) with other stations

TABLE 3

Nature of relationship between daily normal rainfall at seven stations in Pune district

	Ghod	Pune	Junner	Talegaon	Jejuri	Dhond	Indapur
			June				
Ghod	PLP	PL +0·9	PL +0.9	X	X	X	X
Pune	PL +0.9	PLP	PL +0·8	X	X	X	X
Junner	PL +0.9	PL +0.8	PLP	X	X	X	X
Talegaon	X	X	X	PLP	PL +0.6	PL +0.9	PL +0.8
Jejuri	X	X	X	PL +0.6	PLP	PL +0.8	PL +0.8
Dhond	X	X	X	PL +0.9	PL +0.8	PLP	PL +0.8
Indapur	X	X	X	PL +0.8	PL +0.8	PL +0.8	PLP
			July				
Ghod	PLP	PNL	PNL	X	X	NNL	NNL
Pune	PNL	PLP	PL +0.9	X	X	NNL	NNL
Junner	PNL	PL +0.9	PLP	X	X	X	X
Talegaon	X	X	X	PLP	PL +0.9	PL +0.9	PL +0.8
Jejuri	X	X	X	PL +0.9	PLP	PL +0.9	PL +0.9
Dhond	NNL	NNL	X	PL +0.9	PL +0.9	PLP	PL +0.9
Indapur	NNL	NNL	X	PL +0.8	PL +0.9	PL +0.9	PLP
			August				
Ghod	PLP	PL +0.9	PL +0.9	PNL	PL +0.7	X	NNL
Pune	PL +0.9	PLP	PL +0.9	PNL	PL +0.6	X	NNL
Junner	PL +0.9	PL +0.9	PLP	PL +0.6	PL +0.8	X	X
Talegaon	PNL	PNL	PL +0.6	PLP	PL +0.7	X	X
Jejuri	PL +0.7	PL +0.6	PL +0.8	PL +0.7	PLP	X	X
Dhond	X	X	X	X	X	PLP	PNL
Indapur	NNL	NNL	X	X	X	PNL	PLP
			September				
Ghod	PLP	PL +0.9	PL +0.9	PL +0.9	PL +0.9	PNL	PNL
Pune	PL +0.9	PLP	PL +0.9	PL +0.9	PL +0.9	PL +0.9	PL +0.8
Junnar	PL +0.9	PL +0.9	PLP	PL +0.9	PL +0.9	PL +0.9	PL +0.8
Talegaon	PL +0.9	PL +0.9	PL +0.9	PLP	PL +0.9	PL +0.9	PNL
Jejuri	PL +0.9	PL +0.9	PL +0.9	PL +0.9	PLP	PL +0.9	PNL
Dhond	PNL	PL +0.9	PL +0.9	PL +0.9	PL +0.9	PLP	PNL
Indapur	PNL	PL +0.8	PL +0.8	PNL	PNL	PNL	PLP

PLP—Positive Linear Perfect.
PL—Positive Linear.
PNL—Positive Non-Linear.
X—No correlation.
NL—Negative Linear.
NNL—Negative Non-Linear.

Thus we notice that the 1st maximum in pentad rainfall occurs for all the stations during 32nd/33rd pentad.

The 2nd maximum is observed at Talegaon, Jejuri, Indapur and Dhond at 37th pentad but later in Ghod, Junnar and Pune during 42nd pentad. The 2nd maximum is high of the order of 30-40 mm in Ghod, Junnar and Pune whereas for Talegaon, Jejuri, Indapur and Dhond the value is about 15-20 mm.

The 3rd maximum is noticed at 53rd pentad for all the stations.

Since the pentad rainfall pattern for Baramati shows irregular fluctuations it has not been included in the further study.

The above study of pentad rainfall pattern in the district reveals that the stations Ghod, Junnar and Pune have similar rainfall characteristics while Jejuri, Talegaon, Dhond and Indapur show similar pentad rainfall behaviour. In the subsequent discussions the stations Ghod, Pune and Junnar are referred to as constituting western part of the district, Talegaon, Jejuri, Indapur and Dhond as eastern part of the district. The average pentad rainfall for the western and eastern parts of the district were calculated and the pentad rainfall pattern is given in Fig. 5. The disparity in the rainfall behaviour of the western and eastern stations is clearly brought-out in this figure. It is noticed that the two rainfall amounts approach each other and rainfall amounts are nearly same for both the eastern and western region from 50/51st pentad and increase simultaneously in the subsequent pentads more or less at the same rate. Thus the study of average pentad rainfall normals also confirms the idea that the rainfall patterns of the western and eastern parts of the district are dissimilar during July and August.

2.3.3. *Daily rainfall*

The five day moving averages of the daily normal rainfall for the stations Pune, Ghod, Junnar, Talegaon, Jejuri, Dhond and Indapur were calculated. The scatter diagrams were plotted by taking the moving averages for every pair of stations and their correlation coefficients were determined in case of linear correlation. From the forecasting point of view it may be mentioned that the nature of correlation is more important than the degree of correlation so that in case of a positive correlation a single forecast will hold good for both the stations, while in the case of negative or no correlation different forecasts may have to be issued for the 2 stations. The nature of correlation and the values of correlation coefficients for linear correlation are given in Table 3 and are plotted in the Figs. 6 and 7. The correlations are discussed below for different months separately.

June—Pune, Ghod, Junnar are positively correlated with each other while they are negatively correlated with Talegaon, Jejuri, Dhond and Indapur. The latter group of stations are positively correlated.

July—The nature of correlations are similar to the month of June.

August—Pune, Ghod, Junnar, Jejuri and Talegaon are found to be positively correlated while they are negatively correlated with Indapur and Dhond.

September—All the stations are positively correlated.

We find from this analysis that during the month of June and July we can imagine a line dividing the Pune district into two regions consisting of Ghod, Pune, Junnar in the western part and Telegaon, Jejuri, Indapur and Dhond in the eastern part which are having similar rainfall characteristics. But during August, this line appears to shift to the east thus including Talegaon and Jejuri in the western part with Indapur and Dhond in the eastern side. However, the entire district is seen to be homogeneous in the month of September.

3. Rainfall pattern in Ahmednagar district

3.1. *Physical Features*—Ahmednagar district lies between 18° 2′ & 19° 9′ N and 73° 9′ and 75° 5′ E with an area of about 17,035 sq. km. The district includes the Sahyadris and its 3 eastward offshoots, the Kalsubai—Adala range in the north, the Baleshwar range in the middle and the Harishchandragad range in the south, the vast Ahmednagar plateau in the middle and the river basins of the *Godavari* and *Bhima*, on either side of the plateau. The district as a whole is a table land with number of plateaus within it at various levels. The western taluka of Akola which abuts on Sahyadris is the highest part of the district at 800m asl in contrast to the plains that lie below 450 m in the *Godavari* valley in the extreme eastern part.

3.2. *Data*—Ahmednagar district consists of 13 talukas. The study of seasonal and annual rainfall was made from the data for 11 stations available in the India met. Dep. publication. The daily rainfall normals for Shevgaon, Newasa, Shrigonda, Sangamner, Jamkhed, Ahmednagar and Kopargaon stations have been utilised to study the various aspects of pentad rainfall and daily rainfall distribution in the district. Table 4 gives the geographical co-ordinates of the stations and their heights above mean sea level.

3.3. *Analysis and results*—The study is made in 3 parts with respect to monthly rainfall, pentad rainfall and daily rainfall.

TABLE 4

Location of 11 stations in Ahmednagar district

Stations	Lat. (°N)	Long. (°E)	Height (m)
1 Akola	19°33′	74°01′	—
2 Sangamner	19°34′	74°13′	—
3 Parner	19°00′	74°27′	—
4 Kopargaon	19°54′	74°29′	—
5 Rahuri	19°24′	74°39′	514
6 Shrigonda	18°37′	74°42′	—
7 Ahmednagar	19°05′	74°55′	657
8 Newasa	19°33′	74°55′	—
9 Karjat	18°33′	75°00′	—
10 Shevgaon	19°20′	75°13′	—
11 Jamkhed	18°44′	75°19′	—

TABLE 5

(Average rainfall and number of rainy days (Ahmednagar district)

	June			July			August			September			
	RR	Rainy day	RR/ Rainy day	RR	Rainy day	RR/ Rainy day	RR	Rainy day	RR/ Rainy day	RR	Rainy day	RR/ Rainy day	Annual rain-fall
Akola	98.3	6.3	15.6	156.3	11.9	16.2	84.1	8.3	10.1	124.2	6.8	18.3	596.5
Sangamner	89.1	5.7	15.6	89.6	6.7	13.4	56.1	4.2	13.4	136.7	6.8	20.1	496.1
Parner	110.0	6.6	16.7	94.7	8.2	11.5	74.4	6.0	12.4	158.2	8.2	19.3	574.2
Kopargaon	98.1	6.0	16.3	97.3	8.1	12.0	68.7	5.4	12.7	129.9	7.3	17.8	512.1
Rahuri	100.7	5.8	17.4	92.7	5.9	15.7	58.0	4.2	13.8	143.0	7.4	19.3	520.2
Shirgonda	100.4	5.9	17.0	63.3	5.7	11.1	51.8	3.9	13.3	152.8	7.5	20.4	515.5
Ahmednagar	128.3	7.2	17.8	97.5	6.8	14.3	73.7	4.6	16.0	175.6	8.4	20.9	621.8
Nevasa	111.1	6.4	17.4	105.6	6.9	15.3	77.9	6.1	12.8	162.6	7.9	20.6	587.8
Karjat	108.3	5.7	19.0	69.1	5.6	12.3	68.9	4.7	14.7	168.2	8.0	21.0	557.1
Shevgaon	123.8	7.3	16.9	114.8	6.8	16.9	86.9	5.6	15.5	185.3	8.4	22.1	632.0
Jamkhed	131.6	7.3	18.0	112.8	8.0	14.1	88.5	6.6	13.4	176.7	8.6	20.5	651.7

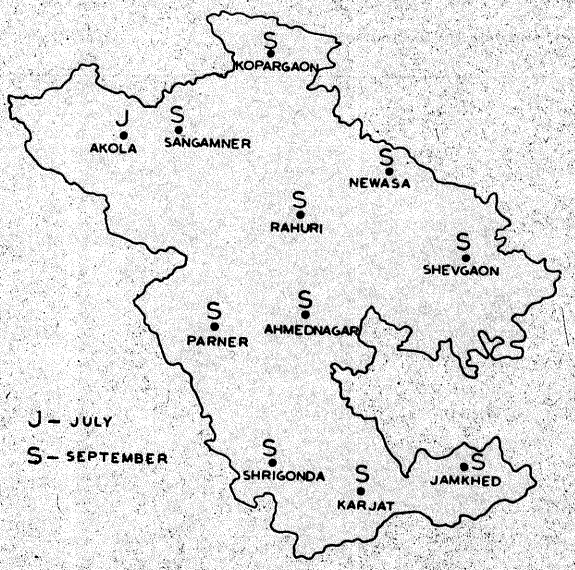

Fig. 8. Month of maximum rainfall

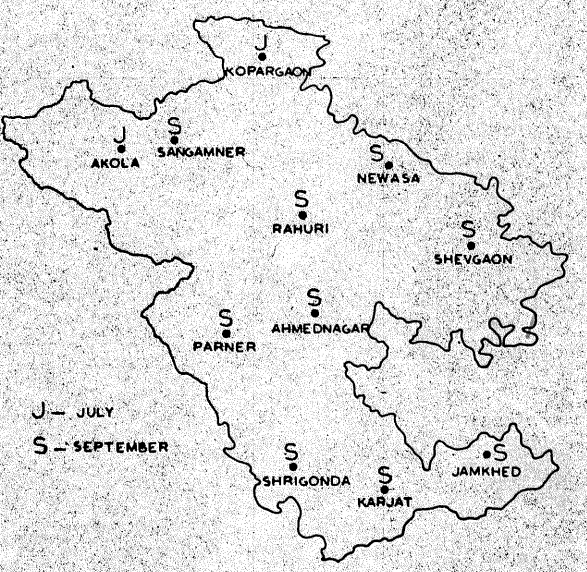

Fig. 9. Month of maximum number of rainy days

3.3.1. *Monthly rainfall*—The monthly, seasonal and annual rainfall for the 11 stations are given in Table 5. The study of annual rainfall indicates that the rainfall is uniform about 600 m at almost all the 11 stations. The season from June, July, August and September gets about 75 per cent of annual rainfall. The distribution of the month of maximum rainfall and the highest number of rainy days are given in Figs. 8 and 9. It is noticed that Akola station gets maximum rainfall in the month of July while the remaining stations get maximum rainfall in the month of September. The number of rainy days are more in July for Akola and Kopargaon while it is more in September for the other stations. It is interesting to note that the rainfall amount and the number of rainy days during July decrease sharply from Akola to Sangamner within a distance of only 20 km. This trend is seen to a lesser extent in August also. The intensities of rainfall were found to be more in September for all the stations. With this preliminary idea of monthly rainfall distribution the pentad rainfall normals were studied as the next step.

3.3.2. *Pentad rainfall*—The pentad rainfall pattern for the 7 stations Jamkhed, Kopargaon Shevgaon, Shrigonda, Sangamner, Nevasa, and Ahmednagar are given in Fig. 10 and are discussed below :

(*i*) The pentad rainfall increases for the 7 stations from 31st/34th pentad and gradually decreases from 35th pentad to 45th/46th pentad for all the 7 stations.

(*ii*) The pentad rainfall increases in the subsequent pentad upto 53rd pentad and reaches maximum at 53rd pentad for all the 7 stations. The rate of increase of rainfall is well marked during 50-52 pentad. Then the pentad rainfall starts decreasing from 54th pentad for all the 7 stations.

Thus the 7 stations exhibit double maximum in pentad rainfall at 33rd/34th pentad and at 53rd pentad, the maximum in September being higher. The minimum rainfall occurs during the 45th/46th pentad.

3.3.3. *Daily rainfall*—The five day moving averages were calculated from the daily rainfall normals for the 7 stations Jamkhed, Kopargaon, Ahmednagar, Nevasa, Sangamner, Shevgaon, Shrigonda. The scatter diagrams were plotted by taking the moving averages of every pair of stations and the correlation coefficients were determined in case of linear correlation and the values are given in Table 6. The nature of correlation and the values are given in Table 6.

It is seen that all the 7 stations are positively correlated with each other during June, July, August and September so that the entire district appears to be homogeneous with respect to rainfall. But the conclusion has an apparent limitation because the daily rainfall normals are available only for 7 stations in the district and the study of monthly rainfall has shown Akola in the northwestern part of the district having maximum rainfall and maximum number of rainy days in the month of July. It is, therefore, not certain whether Akola has rainfall pattern similar to the other 7 stations. Since it receives maximum rainfall and more number of rainy days in July while the other stations in September and there is a sharp decrease in rainfall amount and number of rainy days from

TABLE 6

Nature of correlation between stations in Ahmednagar district

	Sangamner	Kopargaon	Shrigonda	Ahmednagar	Nevasa	Shevgaon	Jamkhed
				June			
Sangamner	PLP	PL +0.8	PL +0.7	PL +0.9	PL +0.6	PNL	PNL
Kopargaon	PL +0.8	PLP	PL +0.7	PL +0.8	PL +0.8	PL +0.8	PL +0.7
Shrigonda	PL +0.7	PL +0.7	PLP	PL +0.7	PL +0.7	PNL	PL +0.8
Ahmednagar	PL +0.9	PL +0.8	PL +0.7	PLP	PL +0.6	PL +0.7	PL +0.7
Nevasa	PL +0.6	PL +0.8	PL +0.7	PL +0.6	PLP	PL +0.9	PL +0.9
Shevgaon	PNL	PL +0.8	PNL	PL +0.7	PL +0.9	PLP	PL +0.8
Jamkhed	PNL	PL +0.7	PL +0.8	PL +0.7	PL +0.9	PL +0.8	PLP
				July			
Sangamner	PLP	PL +0.8	PL +0.9	PL +0.9	PL +0.9	PL +0.8	PL +0.8
Kopargaon	PL +0.8	PLP	PL +0.9	PL +0.9	PL +0.8	PL +0.9	PL +0.9
Shrigonda	PL +0.9	PL +0.9	PLP	PL +0.9	PL +0.9	PL +0.9	PL +0.9
Ahmednagar	PL +0.9	PL +0.9	PL +0.9	PLP	PL +0.9	PL +0.9	PL +0.9
Nevasa	PL +0.9	PL +0.8	PL +0.9	PL +0.9	PLP	PL +0.8	PL +0.8
Shevgaon	PL +0.8	PL +0.9	PL +0.9	PL +0.9	PL +0.8	PLP	PL +0.9
Jamkhed	PL +0.8	PL +0.9	PL +0.9	PL +0.9	PL +0.8	PL +0.9	PLP
				August			
Sangamner	PLP	PL +0.8	PL +0.6	PNL	PNL	PNL	PL +0.9
Kopargaon	PL +0.8	PLP	PL +0.6	PNL	PNL	PL +0.6	PL +0.8
Shrigonda	PL +0.9	PL +0.6	PLP	PL +0.9	PNL	PL +0.9	PL +0.9
Ahmednagar	PL +0.6	PNL	PL +0.9	PLP	PNL	PL +0.9	PL +0.8
Nevasa	PNL	PNL	PNL	PNL	PLP	PNL	PNL
Shevgaon	PNL	PL +0.6	PL +0.9	PL +0.9	PNL	PLP	PL +0.9
Jamkhed	PL +0.9	PL +0.8	PL +0.9	PL +0.8	PNL	PL +0.9	PLP

Table 6—(contd)

	Sangamner	Kopargaon	Shrigonda	Ahmednagar	Nevasa	Shevgaon	Jamkhed
				September			
Sangamner	PLP	PL +0.7	PL +0.8	PL +0.6	PL +0.8	PNL	PNL
Kopargaon	PL +0.7	PLP	PL +0.8	PL +0.9	PL +0.8	PL +0.6	PL +0.7
Shrigonda	PL +0.8	PL +0.8	PLP	PL +0.9	PL +0.9	PNL	PL +0.9
Ahmednagar	PL +0.6	PL +0.9	PL +0.9	PLP	PL +0.9	PL +0.6	PL +0.9
Nevasa	PL +0.8	PL +0.8	PL +0.9	PL +0.9	PLP	PNL	PL +0.9
Shevgaon	PNL	PL +0.6	PL +0.6	PL +0.6	PNL	PLP	PNL
Jamkhed	PNL	PL +0.7	PL +0.9	PL +0.9	PL +0.9	PNL	PLP

PLP=Positive Linear perfect.

PL=Positive Linear .

PNL=Positive Non-Linear.

X=No correlation.

NL=Negative Linear.

NNL=Negative Non-Linear.

Akola to Sangamner, we expect the station to have different rainfall pattern. This point will be confirmed in the subsequent papers by the study of actual rainfall. Thus this study of rainfall distribution in the district indicates that most of the parts of the district is homogeneous with respect to rainfall except for a smaller area in the northwestern part of the district.

4. Combined study of rainfall pattern in Pune and Ahmednagar district

In this section an attempt is made to study the rainfall pattern in the 2 districts together in the light of the results arrived in section 2 and section 3 of the study. The conclusions are summarised below :

(*i*) During June and July there exists a line of delineation separating the eastern and western parts of Pune district. This line shifts slightly to the east during August.

(*ii*) During the same period a delineating line can be imagined in Ahmednagar district also, separating the north western part from the result of the district. The location of the line in Pune and Ahmednagar district during June, July and August is given in Fig. 11.

(*iii*) During September the two districts have similar rainfall distribution.

As a first step a comparison is made between the average pentad rainfall of the different stations in the Pune and Ahmednagar districts to the east of the line indicated in Fig. 11. The pentad rainfall pattern is given in Fig. 12. It is seen that the two regions have similar rainfall characteristics during the pentads 31st to 54th except for small fluctuations between 35th-38th pentad. The five day moving averages of daily

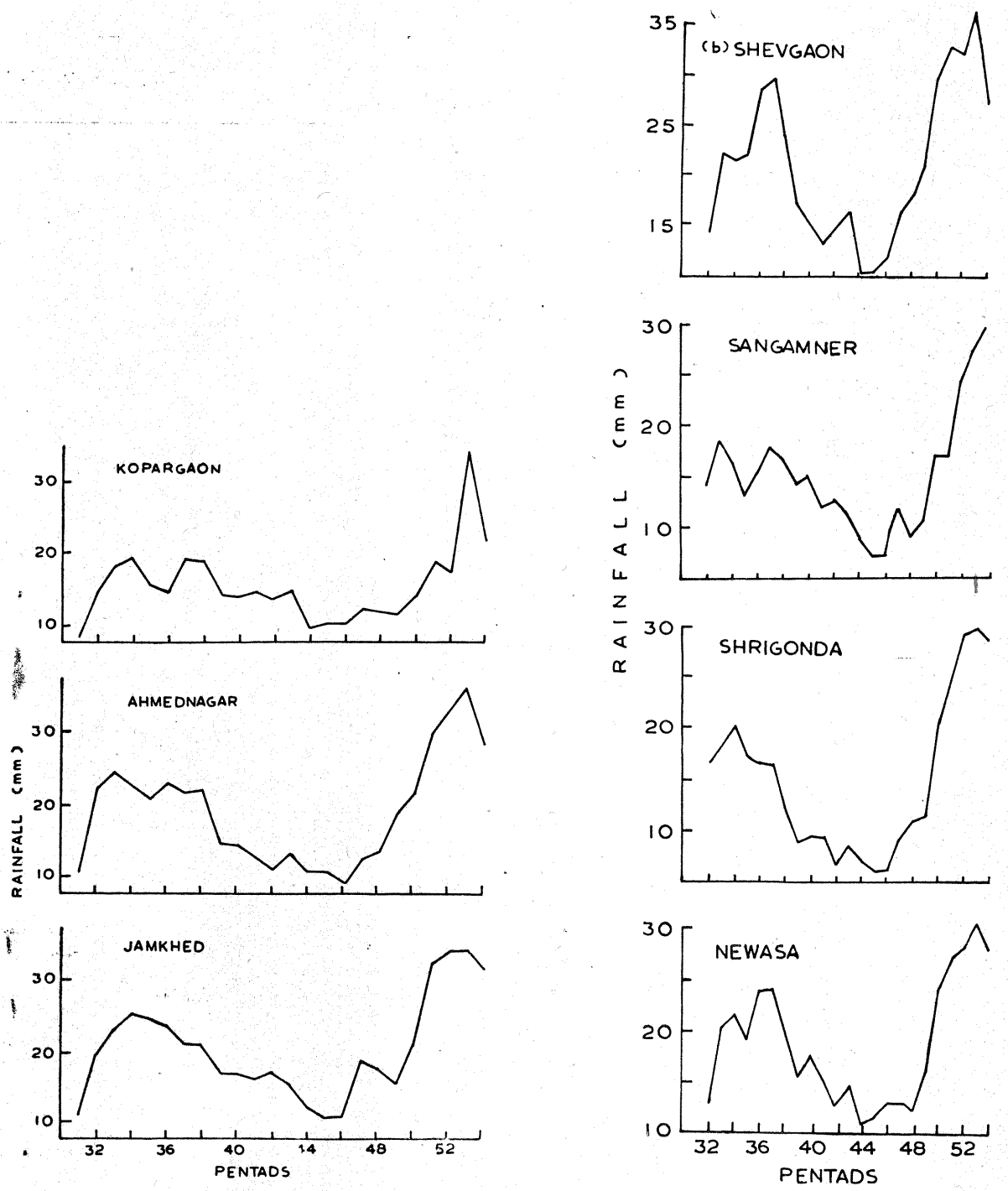

Fig. 10. Pentad rainfall

rainfall normals for the stations in the 2 regions were also found to be positively correlated ($r \approx 0.8$) during June, July, August and September.

Next average pentad rainfall of the 2 regions on either side of the delineating line (ref. in Fig. 11) were compared to study the rainfall distribution in the 2 regions and are given in Fig. 13. It is seen that the pentad rainfall behaviour is dissimilar for the 2 regions. The five day moving averages of daily rainfall for the stations in the two areas shows that the areas

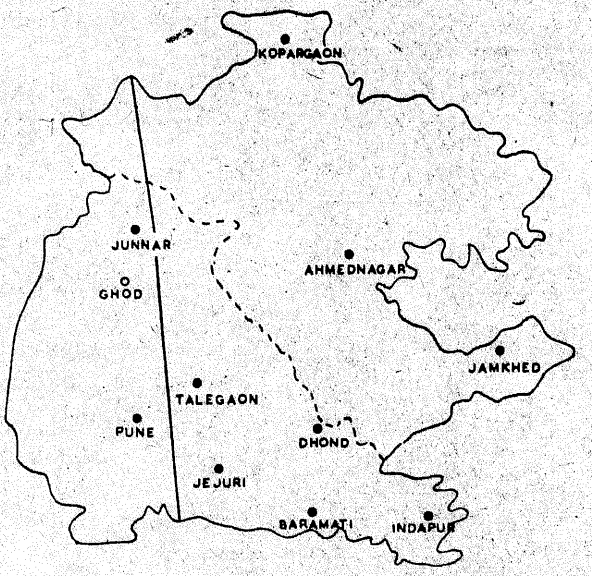

Fig. 11. Line of delineation

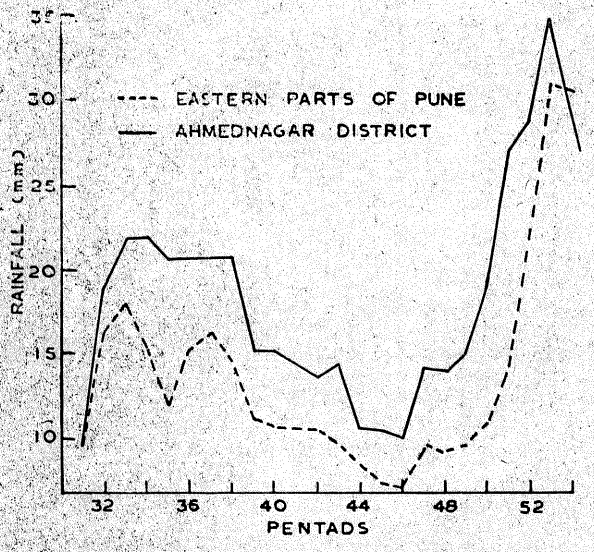

Fig. 12. Average pentad rainfall of eastern part of Pune & Ahmednagar district

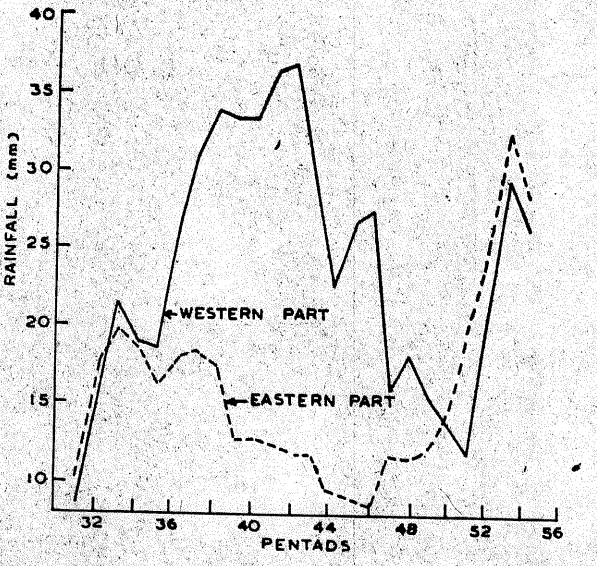

Fig. 13. Average pentad rainfall of western & eastern part of the delineating line

are not correlated during June, negatively correlated in July and August and are positively correlated in September.

5. Conclusions

It is apparent from the above study that the distribution of rainfall is different in the western and eastern parts of Pune and Ahmednagar districts during June to August so that it is possible to draw a dividing line in the districts. Where as during September the 2 parts of the districts are homogeneous with respect to rainfall. The rainfall character of eastern parts of Pune district and Ahmednagar district are also similar. This idea will be confirmed by considering the daily actual rainfall data.

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