

Local variations of rainfall at Delhi

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ABSTRACT. In this paper the results of analysis of the mean monthly rainfall recorded at four observatories, (1) Safdarjung Airport, (2) Lodi Road, (3) Palam Airport and (4) Delhi University, during the years 1956-59 have been given and discussed.

1. Introduction

It is well-known that incidence of rainfall in small areas is sometimes markedly localised. In a recent article entitled "Metric Monsoon", Bose (1960) has *inter alia* discussed the space variation of rainfall in India and given a few illustrations of the localised nature of rainfall within small areas in India. In view of the importance of Delhi as the Capital of India and as a busy airport, different aspects of the weather conditions at Delhi such as temperature and rainfall have been the subject of study in the past (Sinha 1957, Vittal Sarma 1952). In a recent paper (Agarwala 1960) the author has also discussed the local variations of air temperature at Delhi. In the present paper a similar study of the local variations of rainfall at Delhi has been made. For this purpose, the mean monthly values of rainfall recorded at four raingauge stations situated in the Delhi area have been analysed and discussed. The raingauge stations are: (1) Meteorological observatory at the Safdarjung airport, (2) Hydrometeorological observatory at Lodi Road, (3) Meteorological observatory at the Palam airport and (4) the Raingauge station at Delhi University. The locations of the four raingauge stations are indicated in Fig. 1. The observatory at Lodi Road is at a distance of about 1 km from the Safdarjung airport observatory, while the observatory at Palam airport is at a distance of about 8 km from Safdarjung. So far as the raingauge station at

Delhi University is concerned, it is situated at a straight distance of approximately 11 km from Safdarjung. At all the four sites the raingauges installed are of standard India Met. Dep. type, with 12·7 cm diameter funnel and they are erected with the rims of the funnel 30·5 cm above the ground level. The exposure is good at all the sites. As regards the topography of the four sites, it does not offer any unusual features but the Palam site is more open.

2. General features of weather at Delhi

Delhi (Lat. 28° 35' N, 77° 12' E) is situated at a height of 700 ft above sea level and occupies an inland position in a monsoon region. Air of continental origin generally prevails over the station except during the rainy season when there is maritime air of moderate thickness over the area. The monsoon months are June, July, August and September. During this period heavy showers are frequent on account of the strengthening of the monsoon over Delhi area. The monsoon generally sets in the last week of June and withdraws towards the last week of September. Table 1 gives the normal rainfall of Delhi month by month together with the monthly and seasonal means of the rainfall at the four localities. The normals are based on the rainfall data for 60 years (1881-1940) and have remained unchanged due to change of site and apply to the Safdarjung observatory. It will be seen that the bulk of the rainfall

TABLE 1

Monthly and seasonal means of rainfall (in mm) at the four observatories in Delhi area together with normal rainfall

	Safdarjung	Palam	Lodi Road	University	Normal
MONTHLY RAINFALL					
January	38.3	33.9	33.9	32.8	25.1
February	0.7	0.2	0.3	0.3	21.1
March	20.8	10.4	17.7	16.0	12.9
April	1.6	0.7	2.0	2.0	8.4
May	9.7	3.6	7.7	4.4	13.2
June	28.7	26.3	24.8	13.8	77.0
July	277.2	249.7	269.7	233.6	178.6
August	195.7	183.2	177.8	189.7	183.6
September	161.6	167.1	146.2	140.1	122.9
October	69.3	84.7	66.0	102.2	10.2
November	4.1	13.4	3.7	1.7	2.5
December	5.9	4.0	5.2	0	10.9
Annual	813.6	777.2	755.0	736.6	666.4
SEASONAL RAINFALL					
Pre-monsoon (March to May)	32.1	14.7	27.4	22.4	34.5
Monsoon (June to September)	663.2	626.3	618.5	577.2	562.1
Post-monsoon (October to December)	79.3	102.1	74.9	103.9	23.6
Winter (January and February)	39.0	34.1	34.2	33.1	46.2

at Delhi occurs during the monsoon months, June to September, *viz.*, 586 mm, while the rainfall during the remaining 8 months of the year is only 80 mm of which 46 mm fall

during the winter months, January and February. This rainfall during the winter months, although small, is of considerable importance for the winter crop. During the

months of April and May, there are occasional thunderstorms, some of which may be accompanied by heavy rain. Another feature of the rainfall at Delhi is that heavy rainfall amounting to 76 mm or more in 24 hours occurs only occasionally. An examination of the monthly rainfall from year to year shows that there are marked variations for different months from year to year. This is due to the effect of continentality of Delhi. There are light winds during the months October to February but the wind speed increases as the summer season advances. During April to June, steep pressure gradients give rise to strong gusty winds during afternoons which bring considerable amount of dust from the semi-arid regions lying to the west of Delhi.

3. Data and analysis

3.1. The monthly and seasonal means of the rainfall at the four sites are also given in Table 1. The space variations in the monthly rainfall are appreciable. These variations differ from month to month and from area to area and depend upon the nature of the precipitation, *i.e.*, showery type of precipitation or continuous heavy rain or intermittent rain. Generally speaking, the variations are more pronounced in the case of showery type of precipitation. In this type, the active rain centre is limited in its lateral dimensions and passes through a life cycle of roughly half-an-hour to three hours duration during which the rainfall intensity waxes to its maximum and wanes to its minimum. The figures also go to indicate how localised the rainfall can be even within short distances.

The space variations of rainfall are found to be still more striking for shorter periods such as a day or so.

3.2. The results of analysis of four years' (1956—59) data of rainfall recorded at the four sites are given in Table 2 in the form of differences of monthly mean values of rainfall between (i) Safdarjung and Lodi Road, (ii) Safdarjung and Palam and (iii) Safdarjung and University. Similarly, differences of monthly mean values of rainfall between

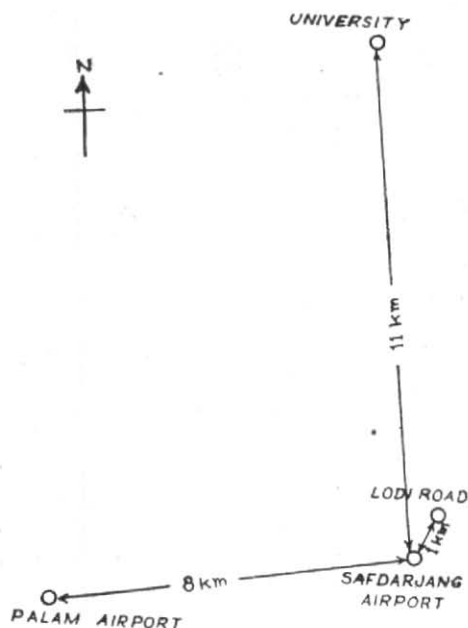


Fig. 1. Locations of four rain gauge stations over Delhi

(i) Lodi Road and Palam, (ii) Palam and University and (iii) Lodi Road and University, are also given in this table.

Table 2 shows that the monthly rainfall occurring at Safdarjung site is generally higher than that at Lodi Road as well as the University sites during the months June to September. On the other hand, during the post-monsoon months October and November, the rain gauge at Safdarjung reads less than those at Palam and University. It also indicates that the variations differ from month to month and site to site and emphasises the localised nature of rainfall.

3.3. The seasonal mean differences are also given in Table 2. The figures show that Safdarjung gets more rain than Lodi Road and University in the monsoon season. During the post-monsoon season, while Safdarjung gets more rainfall than Lodi Road, it gets less rain than Palam and University. Again during the winter season, Safdarjung gets more rain than the other

TABLE 2
Differences in monthly and seasonal mean values of rainfall in mm (1956-59)

	S-L	S-P	S-U	L-P	P-U	L-U
MONTHLY						
January	+ 4.1	+ 4.1	+ 5.2	0	+ 1.1	+ 1.1
February	+ 0.4	+ 0.5	+ 0.4	+ 0.1	- 0.1	0
March	+ 3.0	+10.4	+ 4.8	+ 7.4	- 5.6	+ 1.8
April	- 0.4	+ 0.9	- 0.4	+ 1.3	- 1.3	+ 2.0
May	+ 2.0	+ 6.1	+ 5.3	+ 4.1	- 0.8	+ 3.3
June	+ 3.3	+ 1.8	+14.3	- 1.5	+12.5	+11.0
July	+ 7.5	+27.5	+43.4	+20.0	+15.9	+35.9
August	+17.9	+12.5	+ 6.0	- 5.4	- 6.5	-11.9
September	+15.4	- 5.6	+21.5	-21.0	+27.1	+ 6.1
October	+ 3.4	-15.3	-32.8	-18.7	-17.5	-36.2
November	+ 0.4	- 9.3	+ 2.4	- 9.7	+11.7	+ 2.0
December	+ 0.7	+ 1.9	+ 5.9	+ 1.2	+ 4.0	+ 5.2
SEASONAL						
Pre-monsoon (March to May)	+ 1.5	+ 5.8	+ 3.2	+ 4.3	-2.6	+ 2.4
Monsoon (June to September)	+11.0	+ 9.1	+21.3	- 2.0	+12.3	+10.3
Post-monsoon (October to December)	+ 1.5	- 7.6	- 8.2	- 9.1	- 0.6	- 9.7
Winter (January and February)	+ 2.3	+ 2.3	+ 2.8	+ 0.1	+ 0.5	+ 0.5

NOTE: S—Safdarjung, L—Lodi Road, P—Palam, U—University

sites, although the differences are smaller. So far as the sites at Palam and University are concerned, Palam raingauge records more than the one at the University site during the monsoon season and less during the pre-monsoon months. During post-monsoon and winter months, the rainfall at these two sites is almost equal.

4. Conclusion

The analysis of the data indicates a variation of 3 to 20 per cent in the mean monthly and seasonal totals which shows that there is some local variation and that the rainfall at Delhi is localised even at short distances, the differences being greater in the rainy months than in the drier months.

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