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'Below Minima' conditions of weather over New Delhi (Palam) and their simultaneity of occurrence at New Delhi (Safdarjung), Agra, Allahabad, Lucknow and Jodhpur

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ABSTRACT. An analysis of the frequency and duration of spells of poor visibility and of low cloud ceiling over Palam, New Delhi, below certain specified limits has been presented using the data for the period 1949-53. 'Below minima' conditions prevailing simultaneously over the neighbouring airfield at Safdarjung are also presented. Simultaneity of weather conditions below specified limits over Agra, Allahabad, Lucknow and Jodhpur have also been studied with a view to assess their comparative suitability as alternates for Palam.

It has been found that on occasions of poor visibility over Palam, Safdarjung too may be affected simultaneously on nearly 60 per cent of the occasions. Agra is affected on 30 per cent and Allahabad, Lucknow and Jodhpur on only less than 12 per cent of the total number of occasions over Palam. Among these, Allahabad and Lucknow are more suitable as alternates for Palam during May and June while Jodhpur is better during the winter months. In regard to low clouds, Safdarjung is generally affected simultaneously with Palam on nearly 70 per cent of the occasions. On occasions of 'below minima' conditions of visibility or of low clouds or both over Palam the suitability of aerodromes mentioned above as diversionaries stands in the following order of preference—(1) Jodhpur, (2) Lucknow, (3) Allahabad and (4) Agra.

1. Introduction

With a view to ensure safety of operations, all airlines have stipulated certain minima conditions of low cloud ceiling and visibility, with varying limits for different aerodromes and for different types of aircraft, below which landings and take-off are generally forbidden. Balasubramaniam (1954) made a study of the comparative suitability of Ahmedabad and Poona as alternates for Bombay (Santacruz) airfield. Frequencies and duration of different weather phenomena adverse to aviation affecting Safdarjung aerodrome at New Delhi have been discussed by Chakravortty (1947). Whereas Safdarjung aerodrome is the terminus of many internal air routes, the international aerodrome at Delhi is at Palam which is at a distance of six and a half miles to its west and maintained by the I.A.F. This is an important airport on the Trans-India Air Route to the Far East through which the bigger and heavier types of aircrafts of national and many international airlines pass. It is, therefore, proposed to present here an analysis of the occurrence and duration of low clouds and of visibility at Palam during the period 1949-53 below some common limits and and also certain interesting features of associated weather. Conditions prevailing simultaneously over Safdarjung aerodrome is also studied with a view to examine how far these vary over the short distance separating these two aerodromes. Simultaneity of their occurrence at Agra, Allahabad, Lucknow and Jodhpur aerodromes is also shown in order to assess their comparative suitability as alternates for New Delhi (Palam). A spell is considered to have occurred at any of these aerodromes simultaneously with Palam when it continued or began to prevail over these stations within two hours of its duration at Palam.

2. Analysis

(*i*) *Visibility less than 1100 yards*—In Table 1(a) is shown the duration of spells of visibility below 1100 yards at Palam and also

TABLE 1(a)

Occasions of visibility less than 1100 yards over Palam and simultaneous occurrence of the same or of low clouds with base at or below 600 ft a.g.l. over other aerodromes (1949—53)

Duration (hrs)	No. of occasions at					
	Palam	Safdar-jung	Agra	Allaha-bad	Luck-now	Jodh-pur
< 1	63	26(1)	9(1)	1(1)	3(1)	3(1)
1— 2	24	15(2)	4(2)	3(2)	1(1)	1(1)
2— 3	12	9(2)	6(2)	2(1)	0	0
3— 4	6	4(3)	1(3)	0	0	1(1)
4— 5	5	4(2)	1(2)	0	0	0
5— 6	4	2(4)	1(6)	1(4)	1(2)	0
6— 7	2	2(4)	1(6)	0	0	1(7)
7— 8	6	6(5)	4(6)	2(4)	1(4)	0
8— 9	1	1(6)	1(5)	0	0	0
10—11	1	1(11)	1(11)	1(2)	1(3)	0
15—16	1	1(4)	1(4)	0	0	0
Total	125	71	30	10	7	6

Figures within brackets indicate average duration in hours

TABLE 1(b)

Number of occasions of visibility less than 1100 yards in association with (a) duststorms and (b) dust raising winds or dust fog (1949-53)

Duration (hrs)	No. of occasions at											
	Palam		Safdar-jung		Agra		Allaha-bad		Luck-now		Jodh-pur	
	a	b	a	b	a	b	a	b	a	b	a	b
<1	43	8	25	0	7	1	1	0	2	0	2	1
1–2	16	4	12	2	3	0	1	0	0	0	1	0
>2	10	14	9	8	6	4	1	0	0	0	1	1
Total	69	26	46	10	16	5	3	0	2	0	4	2

TABLE 1(c)

Number of occasions of visibility less than 1100 yards in association with fog (1949—53)

Duration (hrs)	No. of occasions at					
	Palam	Safdar-jung	Agra	Allaha-bad	Luck-now	Jodh-pur
<1	7	0	1	0	0	0
1—2	3	1	1	1	1	0
>2	14	13	6	5	2	0
Total	24	14	8	6	3	0

TABLE 1(d)

Monthly distribution of occasions of visibility less than 1100 yards over Palam and simultaneous occurrence of the same or of low clouds with base at or below 600 ft a.g.l. over other aerodromes during 1949—53

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Palam	12	6	10	7	41	31	10	2	3	0	1	2
Safdarjung	8	4	5	4	24	18	4	0	1	0	1	2
Agra	5	2	2	1	12	6	0	0	0	0	0	1
Allahabad	5	1	0	1	1	1	0	0	0	0	0	1
Lucknow	2	1	0	0	2	0	1	0	0	0	0	1
Jodhpur	0	0	0	0	3	2	1	0	0	0	0	0

TABLE 1(e)

Monthly distribution of occasions of visibility less than 1100 yards over Palam in association with duststorms, dust raising winds and dust fog and of their simultaneous occurrence at other aerodromes during 1949—53

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Palam	0	1	8	7	41	31	6	0	1	0	0	0
Safdarjung	0	1	5	4	24	18	3	0	1	0	0	0
Agra	0	0	2	1	12	6	0	0	0	0	0	0
Allahabad	0	0	0	1	1	1	0	0	0	0	0	0
Lucknow	0	0	0	0	2	0	0	0	0	0	0	0
Jodhpur	0	0	0	0	3	2	1	0	0	0	0	0

TABLE 1(f)

Monthly distribution of fog (1949—53)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Palam	12	5	1	0	0	0	1	1	1	0	1	2
Safdarjung	8	3	0	0	0	0	0	0	0	0	1	2
Agra	5	2	0	0	0	0	0	0	0	0	0	1
Allahabad	4	1	0	0	0	0	0	0	0	0	0	1
Lucknow	1	1	0	0	0	0	0	0	0	0	0	1
Jodhpur	0	0	0	0	0	0	0	0	0	0	0	0

similar occasions, or of low clouds with base at 600 ft or less a.g.l. occurring simultaneously at Safdarjung, Agra, Allahabad, Lucknow and Jodhpur during the five-year period 1949—53. Table 1(d) shows the total number of such spells in each month. Table 1(b) gives the number of occasions of visibility below 1100 yards in association with (*a*) duststorms and (*b*) dust raising winds or dust fog. Table 1(e) shows the total number of such occasions in each month. In Tables 1(c) and 1(f) are given respectively the number of accasions due to fog and their distribution in each month.

It is seen from Table 1(a) that Safdarjung experienced bad visibility simultaneously with Palam only on 58 per cent of the occasions. At both of these places about 3/4th of the spells were of less than 2 hours of duration and about only 1/8th of the total number of spells continued for more than 4 hours. Tables 1(b) and 1(c) point out that 70 to 80 per cent of the spells were due to lithometeors of which duststorms alone accounted for nearly 3/4th of the occasions. Most of the duststorms were of short duration and hardly 15 per cent lasted for more than 6 hours. On the other hand, spells due to dust raising winds and dust fog though smaller in number lasted for longer hours more frequently and consequently were more hazardous. However, as the synoptic situations responsible for such prolonged and widespread spells are well understood (Roy 1954, Sinha and Sharma 1953), it may be generally possible to issue warnings to aviators sufficiently in time against undertaking flights during such spells.

Table 1(e) shows that spells of bad visibility due to lithometeors occur in Delhi mostly during the summer months (from about the middle of March till the establishment of monsoon), their incidence being more frequent in May and June with a maximum frequency (about 43 per cent of these spells) in May. It is also seen that during this period Allahabad and Lucknow aerodromes were affected simultaneously with Palam only on 3-4 per cent of occasions. Therefore, during summer months Lucknow and Allahabad are the best diversionary airfields for Palam , Jodhpur coming next.

At both Palam and Safdarjung about 20 per cent of the total number of spells was due to fog. Fog lasting for less than an hour appears to be very much localized in nature; for instance out of seven such occasions at Palam there was not a single instance of their simultaneous occurrence at Safdarjung. However, a greater percentage of fog occurring over Palam are of longer duration, over 50 per cent lasting for more than 2 hours. Practically on all these occasions there were simultaneous spells at Safdarjung also and at Agra too on 45 per cent of the occasions. On one occasion (17 January 1951) all the three places were under fog simultaneously for nearly 11 hours. This was associated with the rapid movement of an active western disturbance on the night of 16 January 1951 and cold air at its rear swiftly sweeping over these places where rainfall occurred during the day. Most of the spells of fog of long duration occurred more or less under similar circumstances. In the remaining cases it has been found that fog of long duration occurred in association with the rapid movement during night of a feeble western disturbance or induced trough which although did not cause any precipitation served to bring in moist air over these areas.

It will be seen from Table 1(f) that the incidence of fog in New Delhi (Palam) is greatest in January, the coldest and the wettest month in winter. Even in this month, it is on an average only about 2 in a year. In February it is about 1, in December 1 in 2 years and is negligible in the rest of the winter period. Simultaneously with Palam, Agra was under fog on 33 per cent, Allahabad on 25 per cent and Lucknow on 13 per cent of the occasions while Jodhpur remained unaffected. Therefore, during winter, Jodhpur can serve as the best alternate for Palam, Lucknow stands next.

TABLE 2(a)

Occasions of low clouds with base at 600 ft a.g.l. or below over Palam and their simultaneous occurrence over other aerodromes (1949—53)

Duration (hrs)	No. of occasions at					
	Palam	Safdar-jung	Agra	Allaha-bad	Luck-now	Jodh-pur
<1	21	7(1)	4(1)	3(1)	4(1)	3(1)
1—2	21	11(2)	5(2)	5(2)	1(2)	1(2)
2—3	11	8(2)	6(2)	1(3)	2(3)	0
3—4	9	5(3)	3(3)	1(4)	0	0
4—5	6	3(3)	4(3)	1(2)	3(4)	1(5)
5—6	4	4(5)	3(3)	1(2)	2(5)	1(4)
6—7	3	2(7)	0	0	1(1)	0
7—8	2	1(5)	1(1)	0	1(2)	0
9—10	2	2(7)	1(2)	0	0	1(2)
10—11	1	1(3)	0	0	0	0
11—12	2	2(5)	1(10)	1(1)	1(3)	0
13—14	1	1(7)	1(1)	0	0	0
30—31	1	1(25)	1(22)	0	0	1(10)
Total	84	48	30	13	15	8
Associated with precipitation	61	35	26	12	5	6

Figures within brackets indicate average duration in hours

TABLE 2(b)

Monthly distribution of low clouds with base at 600 ft a.g.l. or below over Palam and of their simultaneous occurrence over other aerodromes (1949—53)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Palam	1	2	1	0	0	1	32	32	13	0	1	1
Safdarjung	0	0	0	0	0	0	21	19	8	0	0	0
Agra	1	2	0	0	0	0	8	14	5	0	0	0
Allahabad	1	0	1	0	0	0	4	6	1	0	0	0
Lucknow	1	1	0	0	0	0	4	5	3	0	0	0
Jodhpur	0	0	0	0	0	0	1	7	0	0	0	0

(*ii*) *Low clouds with base at 600 ft or less a.g.l.*—In Table 2(a) is given the duration of occasions of low clouds, 3 octas or more, with base at 600 ft or less a.g.l. Table 2(b) gives the number of such occasions in different months.

It will be seen that out of 84 such occasions at Palam, Safdarjung experienced 48 (57 per cent of the total) only simultaneously showing the largely localized nature of these cases. About 50 per cent of these were of less than 2 hours of duration and hardly 25 per cent lasted for more than 4 hours. On 5 occasions low clouds persisted over Palam for more than 10 hours. Safdarjung too was simultaneously affected on all these occasions, though not for the same duration. One of these spells was associated with a monsoon depression over southwest Uttar Pradesh moving in a northerly direction and finally breaking up over the Kumaon hills. The associated front passed very near Delhi. In the rest of the cases active monsoon conditions prevailed over west Uttar Pradesh, the Punjab (I) and northeast Rajasthan in association with either a low or a weakened monsoon depression merging into the seasonal trough and intensifying its upper end. It was found that in these cases low clouds and rain persisted for consecutive days till the intensified part of the monsoon trough weakened in due course.

Table 2 (b) indicates that the incidence of low clouds is most frequent at Palam during the monsoon months with the maximum frequency in July and August (about 40 per cent of the total in each of these months). Number of occasions in September is slightly less than half of this maximum frequency. Hazards due to low clouds is practically negligible during winter months, as low clouds are associated generally with very active western disturbances affecting New Delhi which are, however, very few. New Delhi is almost completely free from very low clouds during the summer months and in October. It is also seen that simultaneous spells of clouds of very low ceiling affecting Agra, Allahabad, Lucknow and Jodhpur are practically confined to the period July to September with a maximum in August. In view of their low incidence at Allahabad, Lucknow and Jodhpur as compared to Agra the first three are better suited as diversionaries for Palam. Jodhpur is, however, preferable to the other two as it is the least affected.

(*iii*) *Visibility less than 1 nautical mile*—Table 3(a) presents duration of spells when visibility was less than 1 nautical mile at Palam and duration of simultaneous occurrence of poor visibility or of low clouds below 1000 ft a.g.l. at Safdarjung, Agra, Allahabad, Jodhpur and Lucknow. In Table 3 (d) is given the total number of these spells in each month. Tables 3 (b) and 3(c) give respectively the number of occasions of visibility less than 1 nautical mile in association

TABLE 3(a)

Occasions of visibility less than one nautical mile over Palam and simultaneous occurrence of the same or of low clouds with base less than 1000 ft a.g.l. over other aerdromes (1949—53)

Duration (hrs)	No. of occasions at					
	Palam	Safdar-jung	Agra	Allaha-bad	Luck-now	Jodh-pur
<1	64	28(1)	14(1)	4(1)	3(1)	8(1)
1—2	37	24(2)	7(2)	4(2)	3(2)	2(2)
2—3	24	19(2)	7(3)	3(3)	2(2)	2(3)
3—4	9	7(2)	5(3)	1(1)	1(1)	1(1)
4—5	8	5(4)	5(3)	1(5)	1(4)	1(5)
5—6	5	3(5)	2(3)	0	1(3)	1(6)
6—7	7	7(6)	3(6)	1(6)	2(4)	1(4)
7—8	9	8(5)	5(8)	2(8)	3(4)	2(6)
8—9	5	4(7)	1(9)	1(4)	2(3)	1(3)
9—10	2	1(9)	1(3)	1(1)	1(1)	0
10—11	3	3(8)	1(3)	1(4)	0	2(9)
11—12	5	5(9)	3(7)	1(5)	2(8)	1(2)
12—13	1	0	0	0	0	0
15—16	1	1(12)	0	0	0	1(4)
16—17	1	1(12)	0	0	0	0
18—19	1	1(9)	1(9)	1(15)	1(1)	0
32—33	1	1(27)	1(17)	0	1(12)	0
Total	183	118	56	21	23	23

Figures within brackets indicate average duration in hours

TABLE 3(b)

Number of occasions of visibility less than one nautical mile in association with (a) duststorm and (b) dust-raising winds or dust haze (1949-53)

Dura-tion (hrs)	No. of occasions at											
	Palam		Safdar-jung		Agra		Allaha-bad		Luck-now		Jodh-pur	
	a	b	a	b	a	b	a	b	a	b	a	b
<1	33	10	20	4	8	3	0	0	1	0	4	2
1-2	21	6	14	6	3	2	1	0	0	1	1	0
2 4	11	12	10	6	3	6	2	0	1	1	1	2
>4	5	34	4	27	6	10	0	2	0	5	1	9
Total	70	62	48	43	20	21	3	2	2	7	7	13

TABLE 3(c)

Number of occasions of visibility less than one nautical mile in association with fog or mist (1949—53)

Duration (hrs)	No. of occasions at					
	Palam	Safdar-jung	Agra	Alla-habad	Luck-now	Jodh-pur
<1	5	1	1	1	0	0
1—2	9	3	1	1	1	1
2—4	10	10	3	1	0	0
>4	10	9	7	5	5	0
Total	34	23	12	8	6	1

TABLE 3(d)

Monthly distribution of occasions of visibility less than one nautical mile over Palam and simultaneous occurrence of the same or of low clouds with base less than 1000 ft a.g.l. over other aerodromes during 1949—53

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Palam	17	10	12	11	48	54	16	5	5	0	1	4
Safdarjung	11	6	6	8	37	34	8	0	3	0	1	4
Agra	6	4	3	2	22	14	2	0	0	0	0	3
Allahabad	8	2	0	1	3	2	3	1	0	0	0	1
Lucknow	5	2	1	1	4	6	2	0	0	0	1	1
Jodhpur	1	0	2	0	6	12	2	0	0	0	0	0

TABLE 3(e)

Monthly distribution of occasions of visibility less than one nautical mile in association with duststorms, dust-raising winds or dust haze (1949—53)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Palam	0	1	10	10	48	54	8	0	1	0	0	0
Safdarjung	0	1	5	8	36	34	6	0	1	0	0	0
Agra	0	1	3	2	22	13	0	0	0	0	0	0
Allahabad	0	0	0	1	3	1	0	0	0	0	0	0
Lucknow	0	1	1	1	4	2	0	0	0	0	0	0
Jodhpur	0	0	2	0	6	11	1	0	0	0	0	0

TABLE 3(f)

Monthly distribution of fog or mist (1949—53)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Palam	16	9	1	0	0	0	1	1	1	0	1	4
Safdarjung	11	5	1	0	0	0	0	0	1	0	1	4
Agra	6	3	0	0	0	0	0	0	0	0	0	3
Allahabad	5	2	0	0	0	0	0	0	0	0	0	1
Lucknow	3	1	0	0	0	0	0	0	0	0	1	1
Jodhpur	1	0	0	0	0	0	0	0	0	0	0	0

with duststorms, dust raising winds or dust haze and fog or mist. Tables 3 (e) and 3(f) show the total number of such occasions in each month.

It is seen from Table 3(a) that the ratio between the total number of spells at Palam to the spells which occurred simultaneously at Safdarjung is 64 per cent and just as in the case of visibility below 1100 yards, about 75 per cent of these were due to lithometeors. About 50 per cent of these spells ceased within two hours and only about 25 per cent lasted for more than 4 hours. On 13 occasions when poor visibility persisted over Palam for more than 10 hours, Safdarjung too experienced 12 spells simultaneously of which 6 lasted for more than 10 hours. These spells of long duration were associated with dust raising winds or dust haze. Cases of dust raising winds over Delhi were due to steep pressure gradient over Rajasthan and the south Punjab (I) while those of dust haze were generally associated with steep pressure gradient mainly over Rajasthan.

At both Palam and Safdarjung about 20 per cent of the spells of poor visibility were due to fog or mist and about 5 per cent were associated with heavy precipitation. It has been found that mist rarely lasted for more than 3 hours.

It is seen from Tables 3 (d) to 3(f) that the seasonal variation and the period of maximum frequency of occasions of visibility less than

TABLE 4(a)

Occasions of low clouds with base less than 1000 ft a.g.l. over Palam and their simultaneous occurrence over other aerodromes (1949—53)

Duration (hrs)	No. of occasions at					
	Palam	Safdarjung	Agra	Allahabad	Lucknow	Jodhpur
<1	14	7(1)	2(1)	2(1)	3(1)	2(1)
1—2	22	14(2)	5(2)	8(2)	7(2)	2(2)
2—3	20	13(3)	8(3)	9(3)	5(3)	1(3)
3—4	19	13(4)	6(4)	7(4)	7(4)	4(4)
4—5	13	12(4)	6(4)	5(5)	6(3)	4(4)
5—6	11	7(6)	8(5)	6(6)	6(3)	0
6—7	6	5(6)	5(3)	2(5)	2(7)	2(3)
7—8	7	7(6)	5(3)	6(8)	3(6)	2(6)
8—9	8	6(9)	6(7)	6(4)	3(2)	2(3)
9—10	3	3(9)	3(5)	1(7)	1(3)	0
10—11	2	2(5)	2(5)	2(11)	2(7)	0
11—12	5	5(11)	5(10)	3(5)	4(6)	0
12—13	4	4(10)	3(9)	1(6)	1(2)	3(8)
13—14	1	1(14)	0	1(8)	1(7)	0
19—20	1	1(17)	1(20)	0	1(6)	0
32—33	1	1(31)	1(33)	0	1(33)	1(26)
33—34	1	1(34)	1(26)	1(5)	0	0
34—35	1	1(10)	1(27)	0	0	0
36—37	1	1(26)	1(6)	1(7)	1(4)	0
Total	140	104	69	61	54	23
Associated with precipitation	98	71	60	42	27	16
Due to lifted fog	3	1	0	0	0	0

Figures within brackets indicate average duration in hours

TABLE 4(b)

Monthly distribution of occasions of low clouds with base less than 1000 ft a.g.l. over Palam and of their simultaneous occurrence over other aerodromes (1949—53)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Palam	5	5	3	0	0	1	52	48	22	0	3	1
Safdarjung	2	4	1	0	0	0	43	38	15	0	1	0
Agra	2	2	0	0	0	0	25	25	14	0	0	1
Allahabad	2	1	2	0	0	0	22	27	7	0	0	0
Lucknow	2	1	0	0	0	0	23	19	8	0	0	1
Jodhpur	0	0	0	0	0	0	7	12	3	0	1	0

1 nautical mile at Palam and of their simultaneous occurrence at the aerodromes under study are practically similar to those mentioned under visibility below 1100 yards.

(*iv*) *Low clouds with base below 1000 ft a.g.l.*—In Table 4(a) is given the duration of spells of low clouds 3 octas or more below 1000 ft a.g.l. over Palam and of simultaneous spells affecting Safdarjung, Agra, Allahabad, Lucknow and Jodhpur. Table 4(b) shows monthly distribution of such occasions. It is seen that the ratio of these spells over other aerodromes to that over Palam is much greater than in the case of spells of low clouds at 600 ft or less a.g.l. At both Palam and Safdarjung about 25 per cent of these spells ceased within 2 hours while about 50 per cent lasted for more than 4 hours. At the other aerodromes, too, on many occasions they lasted for more than 4 hours. This shows that these spells when once they occur, generally persist for some hours at least. There were 5 spells which continued over Palam for 20 hours or more of which the longest one lasted for 37 hours. Not only Safdarjung but Agra too were simultaneously affected on all these occasions. It has been found that the synoptic situation associated with these spells were similar to those already described under (*ii*).

3. Conclusions

The above analysis leads to the following conclusions —

3·1. (*a*) When visibility over Palam is below either 1100 yards or 1 nautical mile Safdarjung too may be affected on nearly 60 per cent of the occasions.

(*b*) About 75 per cent of these spells can be associated with lithometeors and occur mostly during the summer months with a maximum incidence in May and June.

(*c*) The remaining 25 per cent of the spells may be mainly due to fog or mist. Their frequency is highest in January, about half that number in February and nearly half of that in December.

(*d*) Simultaneously with Palam, Agra may be under poor visibility for 25 to 30 per cent and Allahabad, Lucknow and Jodhpur for less than 12 per cent of the occasions. Hence, the last three may serve as better diversionary airfields for Palam than Agra. Among them Allahabad and Lucknow are preferable during May and June while Jodhpur is better during winter months.

3·2. (*a*) When base of cloud 3 octas or more in amount lowers to 600 ft or less a.g.l. over Palam, Safdarjung too may be similarly affected for nearly 60 per cent of the occasions, Agra for 35 per cent, Allahabad and Lucknow for 15 to 20 per cent and Jodhpur for 10 per cent of the occasions.

(*b*) With regard to cases of spells of low cloud 3 octas or more with base below 1000 ft a.g.l. over Palam, Safdarjung, Agra, Lucknow and Jodhpur may be simultaneously affected on nearly 75, 50, 40, 40 and 15 per cent respectively of the occasions.

(*c*) Incidence of clouds with low ceiling at Palam and of their simultaneous occurrence at the other aerodromes in question is most frequent during the period July to September—frequencies for September are, however, less than half of those for any of the other two months.

(*d*) When Palam is under minima conditions due to low clouds, Allahabad, Lucknow or Jodhpur may be selected for diversion of aircrafts in preference to Agra. Jodhpur may, however, serve as a better alternate than either Lucknow or Allahabad, being less liable to low clouds than the latter.

3·3. From considerations of liability to poor visibility and low clouds simultaneously with Palam, both Lucknow and Allahabad stand more or less on equal footing for choice as a diversionary airfield for the former. However, Lucknow appears preferable on account of its nearness to Palam.

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