551.577.31 : 551.576 : 551.515(547)

DIURNAL VARIATION OF RAIN AND LOW CLOUD OVER OZAR AIRFIELD DURING JULY AND AUGUST

1. Test flights of high speed jet aircraft are the major activity over Ozar aerodrome. These flights are conducted during the periods of no rain and no low cloud under SPECI conditions. Forecasting such periods during the day is one of the problems of the forecaster at the station. This study has been taken up to understand the diurnal variation of rain and low cloud and the influence of synoptic situations on them as a prelimninary step to tackle the above problem.

2. Spells of rain and occasions of low cloud under SPECI conditions as recorded in the current weather registers during the months July and August of the years 1968 to 1974 have been considered in this study. All spells of rain during the one hour period preceding an hourly observation have been taken as one spell or incidence at that hour of observation. Surface charts of 0830 IST from 1969 to 1974 have been considered for locating the synoptic situations influencing the incidence of rain and low clouds at the station. In view of limited data only broad groups of synoptic situation were considered. The groups are given below.

*At present on deputation with the Central Ground Water Board, Sholapur.

TABLE 1

Total hourly spells of rain

(July and August 1968 to 1974)

	Three hourly moving average at time (IST)																							
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
No. of spells	81	76	78	84	92	97	102	108	111	113	108	103	97	101	107	112	112	110	103	92	82	75	78	79

TABLE 2

Total hourly occasions of low cloud under SPECI conditions

(July and August 1968 to 1974)

	Time (IST)																							
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
No. of occasions	4	6	6	5	6	4	10	15	23	26	24	21	15	22	21	15	14	7	6	5	5	1	1	3

TABLE 3

	Synoptic situation							
	Ia	Ib	IIa	IIb	IIIa	IIIb	IVa	IVb
A	36	106	21	104	14	33	8	50
B	7·3	5·0	4·8	3·1	10·5	8·0	7·4	5·7
C	0·8	0·5	0·3	0·2	1·3	1·0	1·5	0·5

A — Number of days each synoptic situation appeared during July and August (1969-74)

B — Average number of hourly spells of rain per day

C — Average number of occasions of low cloud, under SPECI conditions per day, caused by each synoptic situation.

TABLE 4

Total hourly number of spells of rain caused by different synoptic situations

(July and August 1969 to 1974)

	Time (IST)																							
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Ia	7	7	8	9	10	10	11	11	11	11	10	11	9	11	11	14	15	16	13	13	11	12	10	9
Ib	23	19	20	21	22	23	22	23	20	19	20	21	22	22	23	26	25	23	24	22	20	18	20	22
IIa	3	3	3	4	5	4	5	5	5	6	5	4	4	4	5	5	4	5	6	5	3	2	3	3
IIb	11	11	10	11	11	12	14	17	19	18	18	16	16	15	16	14	15	15	14	12	10	9	9	10
IIIa	6	5	5	5	7	7	8	7	7	8	8	7	6	6	7	5	6	5	6	4	4	6	6	6
IIIb	9	9	9	8	9	9	10	12	13	13	12	12	13	13	14	14	14	13	13	11	9	8	8	9
IVa	2	2	3	1	3	2	3	3	4	4	4	5	3	3	2	2	2	2	1	1	2	2	2	1
IVb	9	8	8	10	13	14	14	13	13	14	15	14	13	13	13	16	17	15	13	9	8	8	8	8

I—Monsoon trough on surface charts (0830 IST) dipping into Head Bay and passing south of Gorakhpur, without a well marked low or depression in the Head Bay.

II—Monsoon trough displaced to the north (weak monsoon conditions).

III—A low pressure system south of 25°N between Orissa and Gujarat.

IV—Monsoon trough on surface charts (0830 IST) as in I above with a well marked low or depression in the Head Bay.

All the four groups mentioned were further divided into two subgroups each namely (a) the one with a trough off the west coast, extending upto north Maharashtra, and (b) the one without having such a trough.

3. Total hourly spells of rain (Table 1) show that the diurnal distribution of incidence of rain is bimodal with equally marked maxima at 0900 IST and 1500 IST the main minimum at about 2100 IST and secondary minimum at 1200 IST. Broadly speaking the activity is more during the day (56 per cent of spells) than during the night (44 per cent of spells).

Total hourly occasions of low cloud under SPECI conditions (Table 2) show that incidence of low cloud also have the same features of diurnal variation as that of incidence of rain but with marked variation. On an average there were 38 occasions of SPECI for low cloud per year with 80 per cent of the occasions occurring during day and 20 per cent during night.

From Table 3, it can be seen that the incidence of low cloud and rain increases with the appearance of a trough off west coast extending upto north Maharashtra coast. The depression between Orissa and Gujarat, with a trough off west coast (IIIa) is the most effective in increasing the incidence of low cloud and rain. The presence of a low or depression in the Head Bay (IVa and IVb), interestingly, has no striking effect on the weather over the station. Weak monsoon conditions without a trough off west-coast (IIb) also give weather though to a comparatively less extent.

Total hourly number of spells of rain caused by different groups of synoptic situations (Table 4) generally show double maxima and minima, and more activity during day than during night, under all synoptic situations.

It was also observed that low cloud under SPECI conditions caused by each group of synoptic situations show similar features of diurnal variation as incidence of rain but in a more marked manner.

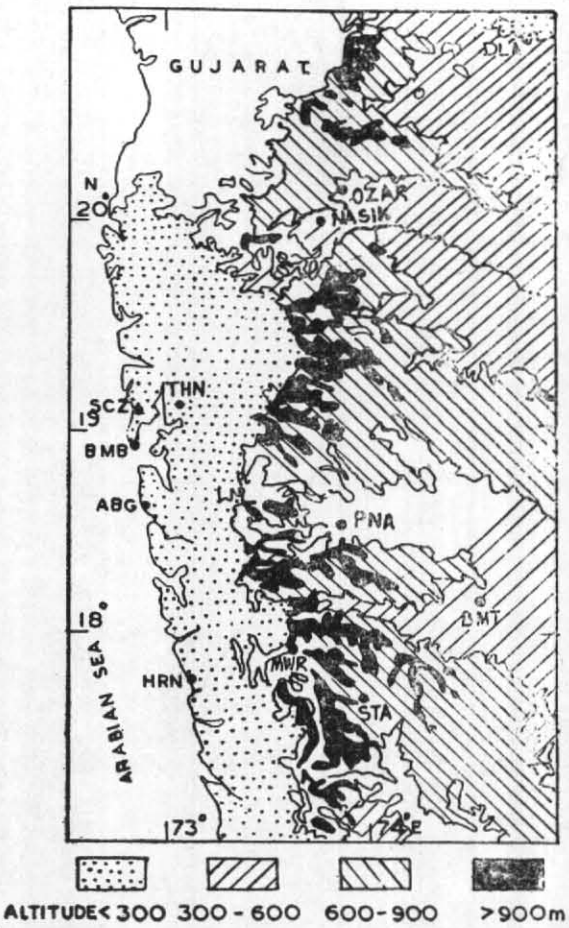

Fig. 1. Orography of Ozar

4. Ozar and Pune are similarly situated at almost the same altitude on the eastern slopes of Western Ghats in north Madhya Maharashtra and are under the influence of Arabian Sea which is about 100 km to the west of the stations. But a comparison of diurnal variation of rain at the two places show marked and interesting differences (Even the type of precipitation at the two places is different as explained later). Hourly rainfall of Pune (Jagannathan 1968 and Prasad 1970) shows maxima at 0600 IST and 1600 IST, main minimum at 1000 IST and secondary minimum at 2300 IST. Though incidence of rain for Ozar and amount of rainfall for Pune were considered in the respective studies, the differences appear to be real. While the similarity of situation does not, a close examination of the local topography (Fig. 1) alone will explain these differences.

Ozar is having high land on its west sloping towards it. Clouds from the Arabian Sea drift eastwards towards the station with westerly winds, blowing at a mean speed of 20 to 25kt. over this part of Peninsula (Philips *et al.* 1973). West coast stations (nearer to Ozar), as seen from the hourly rainfall of Bombay (Jagannathan 1968 and Prasad 1970), show an increase in the early morning at about 0600 IST due to the interaction of land breeze with westerlies from Arabian Sea (Prasad 1970). According to Ramage (1964) as quoted by Prasad (1970) land and sea breezes play an important role on rainfall of coastal stations. At Ozar morning maximum occurred at 0900 IST, about 3 hours after the early morning maximum occurred on the west coast roughly accounting for the distance of the station from the west coast. The decrease afterwards and the second maximum at 1500 IST is due to local convection. This maximum, however, does not predominate as the local convection is suppressed by the subsidence from the convective clouds grown on the high land on the west of the station. Continuation of subsidence till late evening and also decreased activity over sea till 1800 IST as seen from hourly rainfall of Bombay are responsible for the primary minimum at 2100 IST. Drifting clouds from the Arabian Sea and local convection keep incidence of rain more during day than during night. After crossing the high land, clouds dissolve due to the lee effect giving passing drizzle type of precipitation.

Pune is situated somewhat in a valley with more hilly terrain around. Probably, convergence due to the valley effect, which persists during night and is maximum about the time of sunrise, is the cause for the early morning maximum. The afternoon maximum occurs at the time of peak convection. This argument also explains the occurrence of main minimum during the day at 1000 IST. The small valley effect which minimises lee effect causes showery type of precipitation at the station.

5. Though, the incidence of low cloud and rain is uniformly spread throughout day time, advantage of decreasing tendency of these phenomena around noon and late afternoon may be taken for local flying at Ozar.

6. The authors are thankful to Dr. A. K. Mukherjee, Director, R.M.C., Bombay for the encouragement given throughout the work. They are also thankful to Shri. G. K. Bhalerao, S.O. for typing the manuscript.

A. U. RAO
B. PRASAD
M. D. KUNDRA

Meteorological Office, Ozar
22 September 1977

REFERENCES

Jagannathan, P.	1968	FMU. Rep. No. IV-13, India met. Dep.
Philip, N. M., Srinivasan, V., Ramamurthy, K.	1973	FMU . Rep. No. III-3·9, p. 13, India met. Dep.
Ramage, C. S.	1964	*J. Met.*, **9**, p. 83.
Prasad, B.	1970	*Indian J. Met. Geophys.*, **21**, p. 443.