

Letters to the Editor

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A STUDY OF MONSOON SQUALLS OVER GOA

1. Goa gets a large number of squalls during monsoon season. A statistical study of such squalls occurring over Goa, during monsoon season has been made. Data for squalls and the associated changes in surface temperature and pressure have obtained from the autographic records of observatory at Port Meteorological Office, Marmugao for the years 1969 to 1973. The observatory is situated just on the sea shore at Lat. 15°25'N, Long. 73°47'E at an elevation of 60 m above mean sea level. The standard definition of squall *i.e.*, a sudden increase of wind speed by at least, three stages on Beaufort's scale, reaching at least 22 knots and lasting at least for one minute, has been used in this study.

2. Monthly frequencies of squalls for various years are presented in Table 1. Percentage frequencies for monsoon months have been shown in the last column. It can be clearly seen from the table that more than 90 per cent of squalls over Goa occur during monsoon season only. The mean percentage frequency works out to be 94 per cent. In fact, during the course of present study, no squalls were found to occur during December to March. It is for this reason, that the present work is confined to the study of squalls during monsoon

season only. On an average, 105 squalls are found to occur every year during monsoon period over Goa, the extreme values being 139 squalls in 1971 and 74 squalls in 1969. It is also observed, that at times, more than 10 squalls occur in a single day as shown in Fig. 1. Here it may be pointed out that George (1950) has shown the average value of squalls during monsoon over Juhu (Bombay), which is near shore, to be 86. This value is five times more than the average value of squalls during monsoon over Santacruz (Bombay), which is nearly 2½ km away from the sea shore, as shown by Dekate and Bajaj (1966). Similarly, this high average value of squalls during monsoon over Goa may be due to the fact that Marmugao Observatory is situated exactly on the sea shore. The table suggests that squall activity is maximum in July followed by June, August and September. The percentage frequencies are 42, 31, 17 and 4 for July, June, August and September respectively.

3. Fig. 2 gives frequencies of squalls from various directions for monsoon season. The figure clearly suggests that there is hardly any squall from the sector comprising NNW to SSE directions. Maximum number of squalls during monsoon period occur from SSW'ly to WNW'ly direction. It may be inferred that squalls over Goa, during monsoon season follow the prevailing direction of monsoon current at Goa.

TABLE 1
Frequency of squalls during various months at Goa.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total	Total for monsoon months	Percentage frequency for monsoon months
1969	0	0	0	3	3	16	32	15	11	1	0	0	81	74	91.4
1970	0	0	0	1	8	32	64	34	5	0	0	0	144	135	93.7
1971	0	0	0	0	7	76	47	14	2	0	1	0	147	139	94.6
1972	0	0	0	2	4	19	45	14	2	0	0	0	86	80	93.0
1973	0	0	0	0	4	32	47	17	3	1	0	0	104	99	95.2
Total	0	0	0	6	26	175	235	94	23	2	1	0	562	527	
Percentage Frequency	0	0	0	1.1	4.6	31.1	41.8	16.7	4.1	0.4	0.2	0	100	93.7	

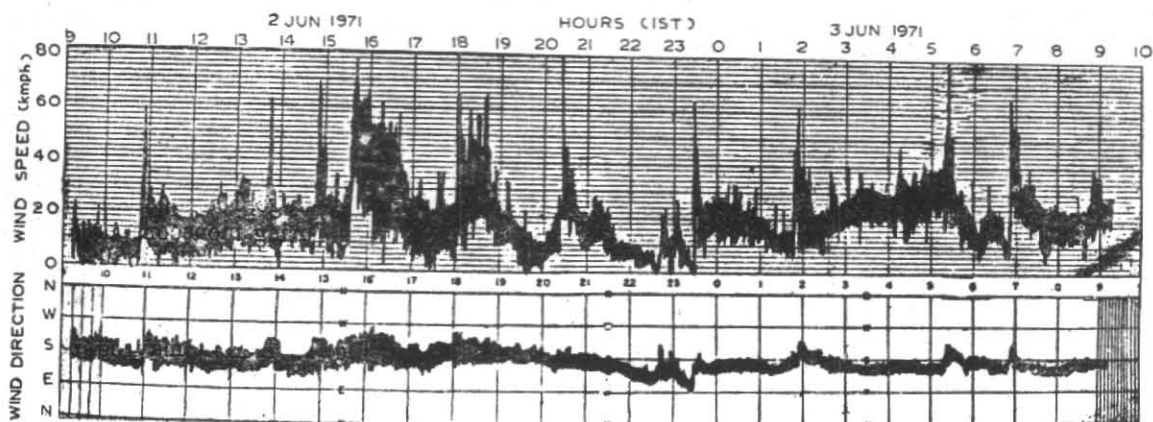


Fig. 1. Anemograph of Goa on 2 & 3 June 1971

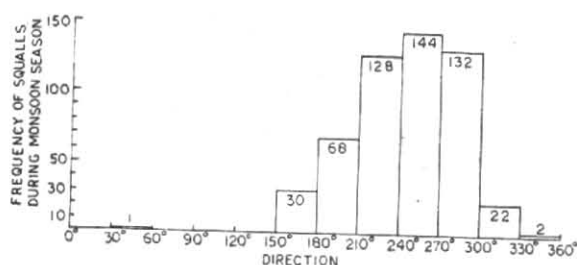


Fig. 2. Frequency of squalls from various directions for monsoon season at Goa

4. Table 2 gives the frequency of squalls of various speeds for the monsoon months. It may be seen that 92 per cent of the squalls reach wind speed of 70 kmph only. It is 2 per cent of the squalls which reach speed more than 80 kmph. The maximum speed recorded in the five-year period is 94 kmph in July. Thus monsoon squalls over Goa are mostly mild when compared to the pre-monsoon squalls of north India and Deccan Plateau which are associated with thunderstorms. This agrees with the findings of Dekate and Bajaj (1966) for Bombay and Ramakrishnan (1957) for Cochin. They have also pointed out that squalls during monsoon are mild over Bombay and Cochin.

5. An examination of autographic charts suggest that squalls during monsoon are of short duration. They are generally of duration not more than ten minutes, only rarely the spell exceeds fifteen minutes. Changes in surface temperature and pressure associated with the monsoon squalls are also examined. No well marked changes in these parameters are seen to occur in association with mon-

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TABLE 2
Frequency of squalls according to max. gust speed at Goa during monsoon months (1969-1973)

Max. gust speed (kmph)	Jun	Jul	Aug	Sep	Total	Percentage frequency
> 45	14	11	4	2	31	5.9
46-50	29	47	32	8	116	22.0
51-60	70	105	45	9	229	43.4
61-70	44	48	13	4	109	20.7
71-80	13	19	0	0	32	6.0
> 80	5	5	0	0	10	1.9
Total	175	235	94	23	527	
Max. gust recorded	92	94	70	68		

soon squalls over Goa. In most of the cases the fall in surface temperature is not more than 1.5°C and rise in surface pressure not more than 0.5 mb. This is in sharp contrast to the well marked changes occurring in surface temperature and pressure in association with pre-monsoon thundersqualls of north India and Deccan Plateau. It is also seen that most of these squalls are not associated with thunderstorms and, therefore, can be termed as rainsqualls like the monsoon squalls of Bombay which have been characterised by Narayanan (1967) as rainsqualls.

6. It is felt that the statistical information provided in this study, regarding the occurrence of squalls over Goa during monsoon season can be of great help to forecaster in issuing warnings for parked and moored aircraft at the aerodrome and for ships anchored in the harbour.

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