

Some broad features of the occurrence of Squalls in different parts of India

K. P. RAMAKRISHNAN and B. GOPINATHA RAO

Meteorological Office, Poona

(Received 29 March 1954)

Squalls are important for the harm they can do. Provision exists for the reporting of squalls by every reporting surface observatory. But owing to pre-occupations of the observer, except where 24-hour "meteorological watch" is maintained, many will go unreported. Further the rustling of a sudden 15 mph wind coming out of the dead calm of night may impress a half-sleepy observer more than a sudden rise to 35 mph from an already steady wind of 20 mph to the same observer when he is busily engaged in work. A considerable amount of subjectivity thus enters into statistics of occurrence of squalls based on 'personal' reporting. Statistics based on anemograph records, on the other hand are very much more objective and so give a true representation. Even here, absence of records on particular days for various reasons can lower the perfection of the statistics; yet, the results are objective and true to a high degree.

2. Statistics of squalls of a few individual stations—Karachi, Jodhpur, Peshawar, Madras and Poona for instance—extracted out of anemograms have been presented and discussed by different workers (Krishna Rao 1938, Jaisinghani 1946, Ramaswamy and Mazumdar 1950, Ramakrishnan and Ganapathiraman 1953, and Ramakrishnan 1953). Beginning from 1948, particulars of squalls of all stations having Dines' Pressure Tube anemographs are being published in parts A of the India Weather Reviews. Out of these (including data for some recent years still in unpublished Ms. form) a summary for the five-year period 1948-52 giving the salient

features for all stations for which data are available for at least 3 years is being given in this note. For Poona, Madras and Fort Cochin,* additional data collected by the first author have been used, wherever possible.

3. Table 1 gives the numbers of squalls in each month for a dozen stations for which data for at least 3 years are available. For this purpose, only those in which the maximum speed in gust reached 30 mph have been used. This slightly higher limit than one fixed for squalls as judged from readings of anemometers is considered justified because anemograph values are instantaneous speeds and will naturally be higher than 3 minute readings of anemometers for any particular gust. Further, when several distinct squalls occurred on same day—0000 to 2400 IST—a maximum of two have been counted; with a view to avoid a large contribution to the average by exceptional days.

For the majority of the stations, data for the five-year period 1948-52 have been used; and the figures for each month (and year) are 5-year totals. For the few stations for which data for greater or less period were used, the numbers have been proportionately adjusted for a five-year total, and the fact indicated in the table.

4. It will be seen that Cochin gets, round the year, and in the southwest monsoon months, June-September, more than double the number of squalls when compared with any other station. As not more than two squalls have been chosen for any day, it follows that Cochin has more

* The anemograms for Fort Cochin are those from the anemograph maintained at the Port Office, Willingdon Island, which were kindly made available to the authors for study by the Chief Engineer, Shri C. V. Venkateswaran. Data of these do not go into the India Weather Review

TABLE 1

Numbers of squalls with maximum speed in gust equal to 30 mph or more in five years (generally 1948-52)

Station	Position	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
New Delhi	28°35'N 77°12'E	3	2	8	18	40	28	10	3	5	5	—	—	122
Jodhpur	26°18'N 73°01'E	—	—	6	7	18	18	13	9	6	—	—	—	77
Allahabad	25°27'N 81°44'E	1	2	6	1	12	5	11	1	5	1	—	2	47
Alipore	22°32'N 88°20'E	1	3	24	31	32	24	6	1	5	5	—	—	132
Nagpur (1950-52) × 5/3	21°09'N 79°07'E	—	7	5	10	22	25	15	7	5	2	—	—	98
Bombay (1948-51) × 5/4	18°54'N 72°49'E	—	—	4	—	6	16	24	20	3	—	—	—	73
Poona	18°32'N 73°51'E	—	—	—	3	9	4	2	—	—	10	1	—	29
Visakhapatnam	17°42'N 82°18'E	—	—	1	10	15	10	5	7	8	8	2	—	66
Madras (1938-50) × 5/13	13°04'N 80°15'E	—	—	—	2	7	18	23	15	12	7	6	4	94
Bangalore (1950-52) × 5/3	12°58'N 77°35'E	—	—	—	3	22	3	2	13	—	2	—	—	45
Kodaikanal	10°14'N 77°28'E	—	1	5	4	14	12	7	5	1	1	1	—	51
Cochin (1943-52) ÷ 2	09°58'N 76°14'E	1	1	5	11	28	100	72	50	23	9	4	2	306

When several squalls occurred on a single day, a maximum of two has been counted

days with squalls also than any other station. The difference between the numbers of days with (at least one) squall and numbers of squalls—Table 2—is conspicuously more in Cochin* than at any other station studied. Monsoon areas like Calicut and Mangalore also probably share this feature and we are not sufficiently aware of the fact, there being no anemographs at those stations.

Other stations having a large number of squalls are Calcutta, New Delhi, Nagpur and Madras. At the other end of the scale Poona and Bangalore are the quietest (least squally) stations. In his analysis of 2 years' data for 1943 and 1944 Jaisinghani (1946) got a total of 66 squalls at Jodhpur. At that rate, for 5 years, the total for this station would have come to 165 and the station

would have taken the second place. Apparently the two years he analysed had more than the average quota of squalls.

5. From the point of view of damage to standing agricultural crops, like sugarcane, even 30 mph is not too strong a wind and frequencies of squalls with a slightly higher speed limit may be useful. Numbers of squalls with gust speeds of 40 mph or more, again adjusted for a 5-year period, are given in Table 3. It is interesting that the order of stations with high and low frequencies gets considerably altered. Most striking is the way Cochin goes down third in the list, New Delhi and Calcutta now becoming more important. Madras too gets a considerably smaller number of these stronger squalls, and with Bangalore, remains at the bottom. In

* A more detailed study of the squalls of Cochin is in progress and will form the subject matter of another paper

the case of Poona, in Table 3, data for 20 years collected by one of the authors have been used, but as that study considered only squalls with gust speeds of 40 mph or more could not be used for Table 1. Hence data for the 5 years 1948-52 only have been used for Poona in Table 1. Thus inference about relative frequencies of 40 mph squalls and 30 mph squalls at Poona made from Tables 1 and 3 requires later corroboration. It may be mentioned that of the 29 squalls included in Table 1 in Poona, 15 had gust speeds of 40 mph or more.

6. Frequencies of squalls with different

speed ranges 30-39 mph, 40-49 mph etc, and the highest speed recorded at each station with date of occurrence, for two seasons—October-March and April-September—(also adjusted for 5 years) are given in Table 4. The same grouping for different stations is not a very satisfactory arrangement and monthly frequencies with different speed limits are desirable. These, it is however felt, along with analysis according to times of occurrence, durations, pressure and temperature changes etc may be studied with greater profit when a few more years' data become available.

TABLE 2

Numbers of days with at least one squall and numbers of squalls at Cochin in 10 years (1943-52)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Days with squall	1	2	8	21	45	139	100	78	39	17	7	3
Distinct squalls	1	2	9	22	56	243	173	120	53	19	7	3

Largest number of separate squalls on a single day at Cochin : 7 on 23 August 1946 and 14 August 1952

TABLE 3

Numbers of squalls with maximum speed in gust equal to 40 miles per hour or more in five years (generally 1948 to 1952)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
New Delhi	1	1	3	14	35	21	10	2	2	2	—	—	91
Jodhpur	—	—	4	5	7	16	12	1	5	—	—	—	50
Allahabad	—	1	5	1	8	3	7	—	4	—	—	1	30
Alipore	—	—	13	18	26	12	1	—	2	2	—	—	74
Nagpur	—	5	3	7	2	17	3	2	—	—	—	—	39
Bombay	—	—	1	—	2	2	8	4	—	—	—	—	17
Poona*	—	—	1	5	8	4	2	1	2	3	1	—	27
(1930-49) ÷ 4													
Vizag	—	—	—	5	7	2	1	4	2	4	2	—	27
Madras*	—	—	—	1	3	2	5	1	1	—	1	1	15
(1941-50) ÷ 2													
Bangalore	—	—	—	2	10	2	—	—	—	—	—	—	14
Kodaikanal	—	—	—	—	4	9	4	2	1	1	—	—	21
Cochin	—	—	1	3	6	17	14	6	3	1	1	—	52

* Periods indicated when they are different from Table 1

TABLE 4
Numbers of squalls with different ranges of maximum gust speed (mph) (generally 1948-52)

	30-39	40-49	50-59	60-69	70-79	80-89	90-99	Highest gust speed*	Date of occurrence
OCTOBER—MARCH									
New Delhi	11	6	—	—	—	—	—	49	2 days
Jodhpur	2	3	—	1	—	—	—	60†	22-3-49
Allahabad	5	5	1	—	—	—	1	99*	21-3-50
Alipore	17	12	2	1	—	—	—	65	14-3-48
Nagpur	3	3	2	2	—	—	—	64	8-2-52
Bombay	3	1	—	—	—	—	—	43	24-3-51
Poona	7	4	—	1	—	—	—	66	20-10-30
Vizag	3	5	1	—	—	—	—	54	6-10-52
Madras (Nungumbakam)	15	2	—	1	—	—	—	65	3-12-41
Bangalore	2	—	—	—	—	—	—	35	1-10-52
Kodaikanal	7	1	—	—	—	—	—	43	27-10-49
Cochin	18	2	1	—	—	—	—	50	26-3-46
APRIL—SEPTEMBER									
New Delhi	27	53	23	6	—	—	—	68	2 days
Jodhpur	24	25	12	6	2	—	1	90	27-6-51
Allahabad	12	17	5	1	—	—	—	66	15-6-51
Alipore	40	37	16	5	1	—	—	74	6-5-49
Nagpur	53	17	10	2	—	2	—	82	15-6-52
Bombay	52	16	—	—	—	—	—	48	29-5-49
Poona	7	10	1	—	1	—	—	70	13-5-32
Vizag	34	14	7	—	—	—	—	59	27-5-52
Madras (Nungumbakam)	62	12	2	—	—	—	—	58	26-5-50
Bangalore	30	60	2	2	—	—	—	66	3-5-50
Kodaikanal	23	13	7	—	—	—	—	55	1-6-51
Cochin	236	42	7	—	—	—	—	58	5-5-44

NOTE: When several squalls occurred on same day, 2 with highest gust speeds have been counted

† Outside this period, a maximum speed of 93 mph occurred on 2 July 1944 (*vide* Jaisinghani loc. cit.)

* Perhaps the squall did touch 101 mph. The anemogram in respect of this squall has been reproduced on page 306 of Vol. 1 of the Indian Journal of Meteorology and Geophysics

REFERENCES

- Krishna Rao, P.R. (1938). *Ind. met. Dep. Sci. Notes*, 7, 75. *Mem. Ind. met. Dep.*, 28, Pt. 1.
- Jaisinghani, M. T. (1946). *Sci. and Cult.*, pp. 441-442. Ramakrishnan, K.P. and Ganapathiraman, G. V. (1953). *Ind. J. Met. Geophys.*, 4, 1, p. 103.
- Ramaswamy, C. and Majumdar, K. C. (1950). Ramakrishnan, K.P. (1953). *Ind. J. Met. Geophys.*, 4, 3, p. 243.