551·555 (54)

The stronger squalls of Poona

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The potentiality of squalls for damage and destruction is too well known to require elaboration. Warnings for squalls are, therefore, an item of high importance among duties of weather services. Although the general weather situation is the more important factor in determining whether a squall is or is not likely, local experience also goes a long way. Studies of squalls of a place become the more useful, the more light they throw on the conditions under which the squalls can be predicted. Yet, studies from a statistical angle can also greatly help, by at least narrowing down the seasons, times of day and so on when precautions against squalls are necessary. For instance, in a 30 or 40 year period, if squalls never occur at a place in six months of the year, one can, with a high degree of confidence, concentrate on taking precautionary measures in the remaining 6 months. Again, knowledge of the maximum intensities recorded can be used to judge the extent to which precautionary measures are to be taken. Several studies of squalls in different parts of the country have been made before (Krishna Rao 1938, Ramaswamy and Majumdar 1950, Mull and Rao 1950 and Desai 1931). Yet the points elaborated above will sufficiently justify similar studies of squalls of stations not covered already.

2. A Dines' Pressure Tube Anemograph has been working at the Poona Meteorological Office (Lat. 18° 32′N, Long. 73° 51′E, height of ground 1820 ft above sea level, height of anemograph head above ground 130 ft) since 1929. Records for the 20 year period 1930—1949 inclusive were examined for the present analysis. Attention has in the first instance been confined to stronger squalls, *viz.*, those that had a maximum gust speed of 40 mph or above. This has been done with the hope that the major features will still be shown, while the material to be handled is reduced to some extent.

3. Beginning from the year 1948, some particulars of squalls of stations equipped with anemographs are being given in Part A of the India Weather Reviews. Data prior to that year have not been published so far.

4. The numbers of days with squalls at Poona (with maximum gust speed=40 mph or more) in each month and year for the 20 years 1930—1949 are given in Table 1. Of the 101 squally days which occurred in this period, 66 were in the hot months of April, May and June. 10 instances occurred in October. December and January never got a strong squall.

5. The distribution of the squalls according to hour of commencement, for each of 4 seasons and the year as a whole, is given in Table 2. In the year as a whole, while 92 squalls occurred between the hours 1400 and 1900, only 19* occurred outside these hours. Anemograms of two representative squalls, one on 14 April 1930 and the other on 28-29 May 1946, are reproduced in Figs. 1 and 2.

6. Table 3 gives the distribution according to duration. A squall was deemed to have terminated when the speed fell to such value as prevailed before the squall began. It may be mentioned that in some cases, the times of commencement and cessation are somewhat difficult to fix, and there can be an element of non-objectivity. Yet in the majority of cases, the times are sharp and unmistakable. Taking the year as a whole once again, the most favoured duration is half to one hour. About an eighth of the squalls continue for more than 2 hours.

*The total number of squalls here becomes 111, while the number of squally days (vide Table 1) were only 101. On 10 of the days, there were two squalls, separated by several hours

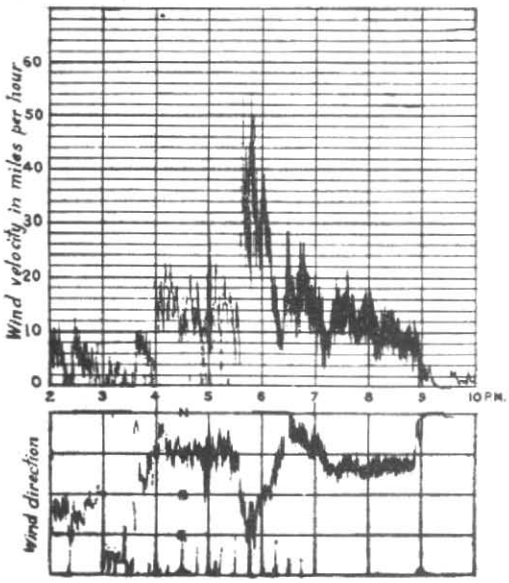


Fig. 1. Poona anemogram of representative squall on 14 April 1930

7. The distribution of the squalls according to maximum gust velocity is given in Table 4. As one would expect, the number falls off as one proceeds to higher speed groups. The highest gust speed ever recorded instrumentally at Poona was 70 mph and this occurred at 1648 IST on 13 May 1932. The relevant portion of the anemogram of this date is reproduced in Fig. 3.

8. It may be of interest here to recall a report about one squall at Poona with a much greater speed, which appeared in the India Weather Review for 1923. In this case, however, the speed must have been estimated visually and not recorded by any instrument. At this distance of time, it is not possible to verify the statement, but it is reproduced below—

Extract from India Weather Review for 1923

"Of the local storms reported in newspapers, the following are noteworthy—

May 27—A severe storm burst over Poona city late in the afternoon; in some parts of the district it was preceded by heavy sandstorm, while over a large area a severe thunderstorm was experienced. The wind was very strong and is reported to have been blowing at 90 miles an hour. The large meat stores shed at the Wanowrie Military Hospital was overturned

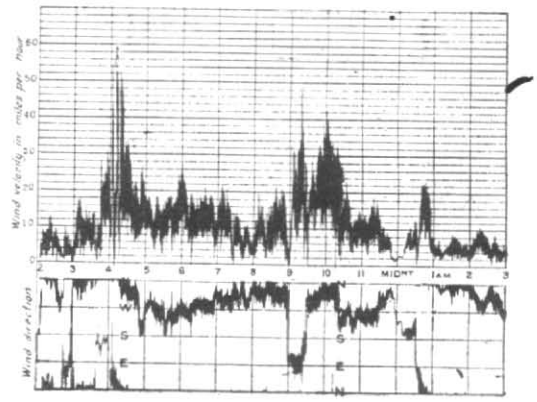


Fig. 2. Anemogram of representative squall (Poona 28-29 May 1946)

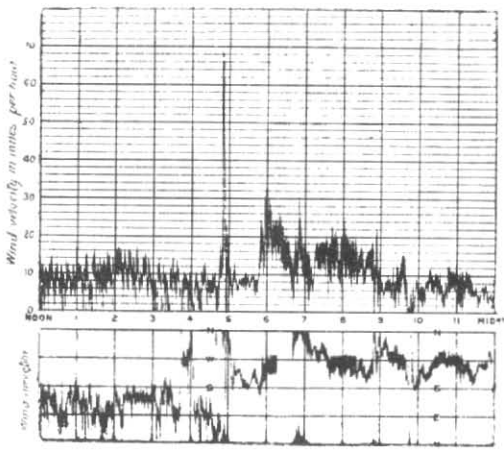


Fig. 3. Poona Observatory Pressure Tube Anemometer record on 13 May 1932. Squalls with highest speed at Poona in the 20 years

and the frame work of three new stands under construction at the race course were completely destroyed. Huge teak beams twelve inches by six inches in thickness were split as though they were sheets of paper. In the city, several houses were demolished and large numbers of trees blown down. The heavy fall of rain and hail flooded many houses and did much damage to roads and gardens".

9. Another information of interest is the highest gust speed that occurred in each month in these 20 years, whether associated with squalls or not, and this is given in Table 5.

10. *The direction from which the squall comes*—The direction of the wind when the squall is established may be taken to be the direction from which the squall comes. In

TABLE 1

Number of days with squalls

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1930	..	..	..	1	3	1	..	..	1	3	..	..	9
1931	..	..	..	1	1	..	1	..	..	..	1	..	4
1932	..	..	..	5	7	2	1	1	..	1	..	..	17
1933	..	..	..	2	7	1	..	..	1	..	..	..	11
1934	..	1	..	..	2	1	1	..	..	..	..	..	5
1935	..	..	..	..	..	..	..	..	..	1	..	..	1
1936	..	..	1	..	..	2	..	..	3	..	..	..	6
1937	..	..	..	1	..	..	..	..	1	..	..	..	2
1938	..	..	..	2	1	..	..	..	..	..	..	..	3
1939	..	..	..	2	..	..	..	..	..	1	..	..	3
1940	..	..	..	2	1	..	1	..	..	1	..	..	5
1941	..	..	..	..	..	1	1	..	..	1	..	..	3
1942	..	..	..	..	1	..	2	..	..	..	..	..	3
1943	..	..	..	..	2	..	..	..	..	2	..	..	4
1944	..	..	..	..	..	3	..	..	..	..	..	..	3
1945	..	..	..	1	..	..	..	2	..	..	..	..	3
1946	..	..	..	4	4	2	..	..	1	..	1	..	12
1947	..	..	1	..	1	1	2	..	..	..	..	..	5
1948	..	..	..	..	..	1	..	..	..	..	1	..	2
1949	..	..	..	..	..	..	..	..	..	..	..	..	0
Total	..	1	2	21	30	15	9	3	7	10	3	..	101

TABLE 2

Distribution of the stronger squalls at Poona according to the time of occurrence (commencement)

Time (IST)	1201-1300	1301-1400	1401-1500	1501-1600	1601-1700	1701-1800	1801-1900	1901-2000	2001-2100	2101-2200	2201-2300	2301-2400	0001-0100	0101-0200
April-June	1	3	13	19	13	11	9	3	1	1	..	1	1	..
July-August	..	1	1	1	2	2	2	1	1	..	..	..	..	1
September-October	1	2	2	5	2	3	2	..	..	..	..	..	..	..
November-March	1	..	1	1	..	3	..	..	..	..	..	..	..	..
Year	3	6	17	26	17	19	13	4	2	1	0	1	1	1

TABLE 3

Distribution of the stronger squalls at Poona (V_x =40 mph or more) according to duration

	Duration (minutes)				
	30 or less	31 to 60	61 to 90	91 to 120	More than 120
April-June	10	24	18	11	13
July-August	6	5	1	..	1
September-October	7	7	2	1	..
November-March	2	..	2	1	1
Year	25	36	22	13	15

TABLE 4

Distribution according to maximum gust speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
(mph)													
40 to 49	—	1	1	14	23	14	7	3	5	7	3	—	78
50 to 59	—	—	1	9	8	1	1	—	2	2	—	—	24
60 to 69	—	—	—	—	4	—	1	—	—	1	—	—	6
70 or more	—	—	—	—	1	—	—	—	—	—	—	—	1

TABLE 5

Highest gust speed in each month at Poona in 1930-1949

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(mph)	<40	41	41	58	70	57	60	47	50	66	48	<40

TABLE 6

Direction of Squalls—Poona

	N	NE	E	SE	S	SW	W	NW
April-June	4	5	3	5	3	9	15	9
July-August	—	—	—	—	—	4	5	1
September October	2	5	3	1	1	3	1	1
November-March	—	1	1	1	—	1	1	1

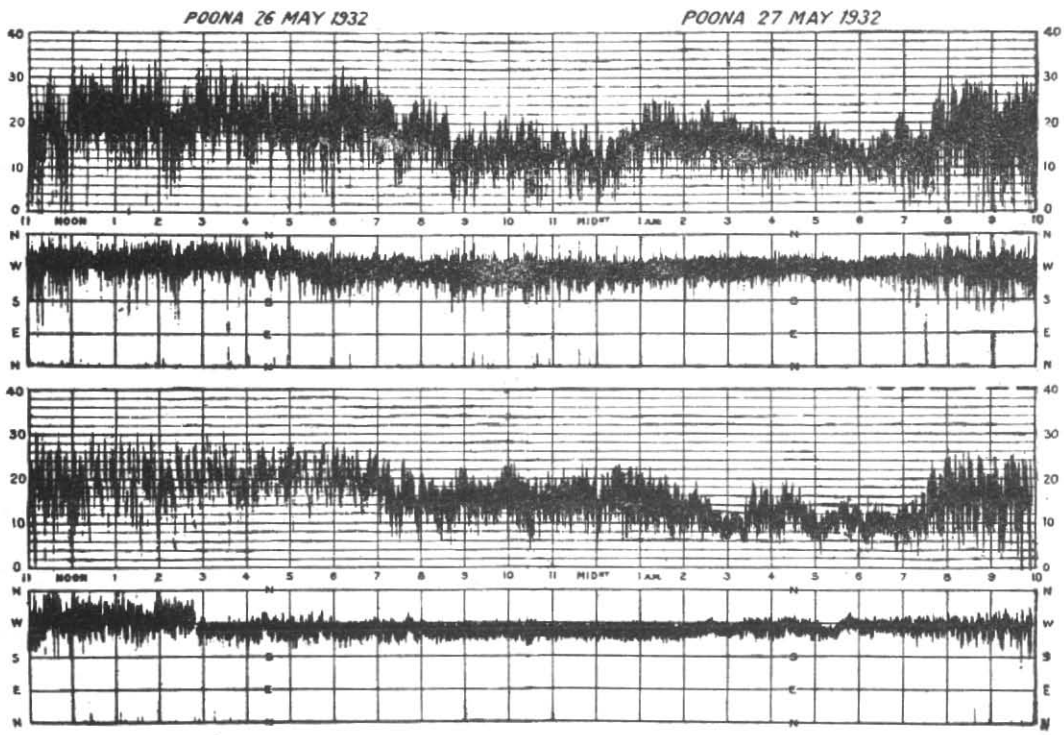


Fig. 4. Typical of windy spells at the beginning of the southwest monsoon

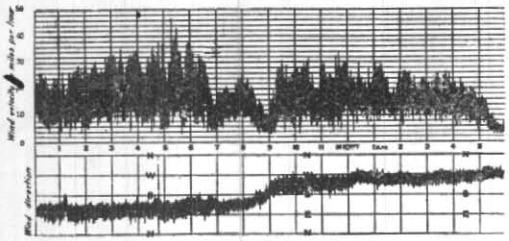


Fig. 5. Poona anemogram of 18-19 November 1946 when a cyclonic storm was close to the station

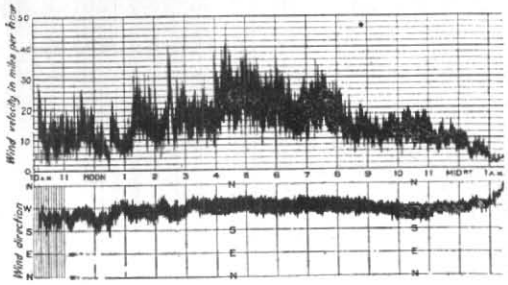
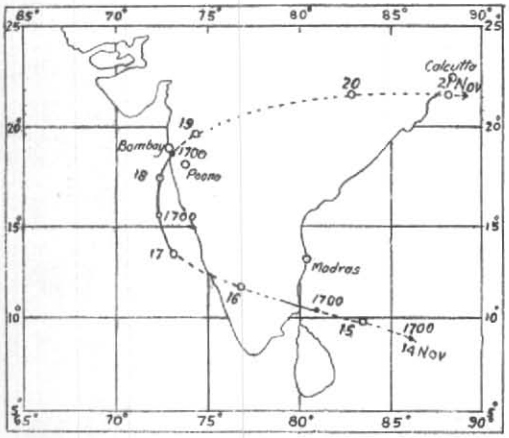
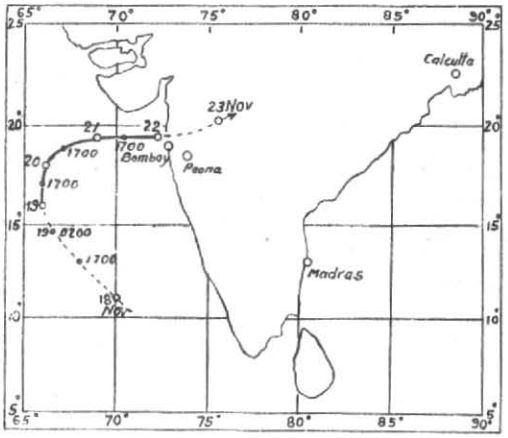


Fig. 6. Poona anemogram of 22-23 November 1948 when a cyclonic storm was close to the station



Track of the cyclonic storm 14-21 November 1946



Track of the severe cyclonic storm 15-23 November 1948

Fig. 7

25 of the 111 cases, the direction was rather indeterminate, either because it varied during the progress of the squall or because the whole squall was made up of distinctly different components from different directions. It appears as though the orographical features near Poona* are favourable to make the direction variable. This point, however, will not be pursued here.

In the remaining 86 squalls, the directions were tabulated in 16 points of the compass and frequencies in 8 points are given in Table 6. (If a squall came from NNE, it was counted as half in N and half in NE). The predominant directions are (*i*) W in April to August and (*ii*) NE in September—October. The quadrant SW-NW accounts for about two-thirds of the squalls in the former group of months and that from N-NE will cover half the squalls in the latter group of months.

11. Prolonged spells of strong winds can cause as much damage as, if not more than, squalls. Such spells occur in Poona usually under two sets of circumstances. (*i*) With each fresh pulse of the southwest monsoon, the winds at Poona often remain strong for a major part of the 24 hours of the day, gust speeds frequently exceeding 30 mph. The anemograms of 25 to 26 and 26 to 27 May 1932, reproduced in Fig. 4 are typical of this type of spell. These spells generally last from 5 to 10 days. (*ii*) The second circumstance when such longish spells of continuous strong winds occur in Poona is when

*An account of the physical features of Poona has been given in Ind. Met. Dep. Sci. Notes, Vol. 3, No. 27 (1931)

the centre of a cyclonic storm has been within 150 miles of Poona. In the 20 years under study in this paper, there were two instances when storms passed close enough to Poona to cause prolonged spells of strong winds there. These were 17 to 19 November 1946 and 22 to 23 November 1948. Portions of the anemograms of 18 to 19 November 1946 and 22 to 23 November 1948 are reproduced in Figs. 5 and 6. The relevant storm tracks are shown in Fig. 7 to enable the reader to know the position of Poona relative to the storm track.

12. The changes occurring in other meteorological elements like pressure, temperature and humidity, the synoptic situations, upper winds and temperature distributions that are favourable for the occurrences of squall, are all being studied and the results will be published later.

13. Acknowledgement

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