

DEPARTMENT OF TRANSPORT AND POWER
METEOROLOGICAL SERVICE

TECHNICAL NOTE No. 30



A SURVEY OF WEATHER CONDITIONS AT CORK AIRPORT

BY

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A Survey of Selected Weather Conditions at Cork Airport in the period

from November 1st, 1961, to October 31st, 1963.

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Summary:

Of the 17,510 hourly observations examined 2,793, or approximately 16% of the total, had conditions at or below 500 foot ceiling and/or 1 mile visibility. The distribution of these conditions according to wind direction revealed a high frequency of occurrence in the sector from 130° to 220°. Approximately 41% of all observations with 180° winds had conditions at or below 500 feet and/or 1 mile. There was a marked fall-off in the frequency of occurrence of these conditions in the sector from west to westnorthwest. The distribution of conditions below 200 foot ceiling and/or ½ mile visibility followed a similar pattern, there being 1,188 observations (approximately 7% of the total) in this category.

Some aspects of visibilities and ceilings associated with snow and showers are discussed.

Diurnal variations of poor conditions are discussed briefly.

Introduction:

Routine weather observing was commenced at Cork Airport in mid-October, 1961.

This survey was undertaken in order to make available a summary of the more significant weather conditions appertaining to the first two years for which continuous observations are available.

Definitions:

Visibility - throughout this note "visibility" refers to the prevailing visibility, i.e., the greatest visibility common to at least half the horizon.

Ceiling - the ceiling is, for the purpose of this note, defined as the lowest level, above airfield level, at and below which the cloud amount as observed from the ground is at least 5 okta.

Situation:

Cork Airport is situated at 51.50N 08.29W. It lies 4 miles south of Cork City. Approximately 10½ miles to the south and southeast is the Atlantic seaboard. The official airfield level is 502 feet above Mean Sea Level.

Runway directions are 160-340 degrees true, and 062-242 degrees true.

Topographical Features:

The airfield lies just south of a ridge crest, north of which is the valley of the River Lee. In the sector from east to south-southwest there is, in general, a gradual slope to the sea, through to the southsoutheast at a distance of 4 to $5\frac{1}{2}$ miles there are some small hills. The highest of these reaches 606 feet. At approximately 20 miles to the north and northwest hills are in excess of 1,000 feet. Due west at the same distance is a peak of 947 feet. Further west are the mountains of west Cork and Kerry. (See Fig. 1).

Variation with Wind Direction:

From the hourly reports for the two years were extracted those with conditions of ceiling and/or visibility at or below 500 feet and/or 1 mile, as also were those below 200 foot ceiling and/or $\frac{1}{2}$ mile visibility.

The distribution of these selected observations with reported wind directions is shown in Fig. 2.

This shows a steady increase in the frequency of occurrence, of the selected conditions, from northeast to southeast then a tendency to level off from southeast to south, with a rapid increase to the maximal frequencies of the southsouthwest. There is a marked drop as the frequency of occurrence falls to very low values in the west and westnorthwest. Secondary maxima occur in the northnorthwest sector.

The inner graph (conditions below 200 feet and/or $\frac{1}{2}$ mile) closely reflects the pattern of the outer one, though there is apparently a significant change associated with 220° winds. There were slightly more observations at or below 500 feet and 1 mile, associated with 220 degrees than with 200 degrees. On the other hand there were 122 observations of below 200 feet and/or $\frac{1}{2}$ mile associated with 200 degrees as compared with only 77 such observations with 220 degrees.

It can be seen, too, that association with an easterly wind had greater relative effect on the frequency of occurrence of conditions at or below 500 feet and/or 1 mile than it had on those below 200 feet and/or $\frac{1}{2}$ mile.

Local topography probably contributes greatly to the effect of 200 and 220 degree wind directions. In Fig. 1 it can be seen that on a heading of 220° from Cork Airport lie three hills (with tops at 476 feet, 523 feet and 461 feet) and with the coast at 22 miles away; whilst on a heading of 200° the coast is only 14 miles distant and only one hill (424 feet high) lies on this heading.

Prevalence of Wind Directions:

To allow for some directions having greater prevalence than others, the hourly wind directions as reported were tabulated to show the frequency of occurrence of any given direction, winds of less than 3 knots being taken as calms. Figures 3(a) and 3(b) show the frequency distribution of wind directions at these hourly observations.

The general distributions of the selected conditions according to wind directions were then related to the prevalence of the individual wind directions. The resulting distributions are shown in Fig. 4.

The individual percentage frequency for any particular wind direction was obtained by dividing the number of observations of the selected conditions with that wind direction, by the total number of reports of that wind direction, and multiplying by 100.

It is seen that the sharp change in the west southwest is retained though the fall-off is not so steep due to the marked shift of the maximal values from southsouthwest to south. Some rounding of the upper values derives from the increased influence of the southsoutheasterly value. It is noticeable too that the secondary maximum at 330 degrees is shifted to due north.

Comments on the Directional Distributions:

The factors which seemed closely related to the incidence of the conditions under review were considered. Having regard to the airport's elevation and its exposure to winds from off the sea from east to southsouthwest, it is to be expected that these directions should give poor conditions. That the maxima should lean towards the south or southsouthwest rather than towards the southeast is possibly due to the fact that, in the particular circumstances, the associated air masses were modified by maritime rather than by continental influences.

It is not possible to assess herein the shelter given to the airfield by the small hills to the southsoutheast (see Topographical Features). However, comparison of Figs. 2 and 4, and the recurring "dip" for 160 degrees lend support to the suggestions of some shelter being obtained in a 160 degree flow. Due south of the airfield is a river valley extending from north to south. This direct opening to the sea must greatly assist the occurrence of poor conditions in a direct southerly flow while the rising ground (424 feet) near the sea may give slight shelter in a 190 degree flow.

The sharp transition associated with the westsouthwest winds and the minimal frequencies of occurrence in the west and northwest sectors are, it is suggested, due to the drying effects of the mountains of west Cork and Kerry. (The highest mountain of these is Carrauntoohil - 3,414 feet.). To illustrate this point the rainfall distributions for 1962 and 1963 are reproduced in Fig. 5.

Similarly there may be an association between the frequencies of occurrence of poor conditions with winds in the sector from northwest to north and the rainfall pattern. The effect of the gap between the Nagles (peak 1,406 feet) and the Boggeraghs (peak 1,371 feet) seems well marked.

The values in the sector from 320 through North to 110 degrees are to some extent influenced by snow. Of the 80 observations of snow with conditions at or below 500 feet and/or 1 mile all but two had winds in this sector. The ceilings and visibilities associated with snow are discussed in greater detail later in this Note.

Particular Frequencies of Occurrence of Poor Conditions:

- (i) 40.74% of the total number of observations with 180 degree winds had conditions at or below 500 foot ceilings and/or 1 mile visibility, and 21.58% had conditions below 200 feet and/or $\frac{1}{2}$ mile.
- (ii) Each direction from 130 to 220 degrees, inclusive, had 25% or more of its observations with conditions at or below 500 feet and/or 1 mile, and approximately 10% or over below 200 feet and/or $\frac{1}{2}$ mile.
- (iii) No direction from 260 to 320 degrees, inclusive, had over 1.12% of its observations below 200 feet and/or $\frac{1}{2}$ mile.
- (iv) The relative percentages associated with calms are 20% and 11.4%.
- (v) The two-year survey revealed that 15.89% of the total number of observations had conditions at or below 500 foot ceilings and/or 1 mile visibility and 6.78% of the total were below 200 feet and/or $\frac{1}{2}$ mile.

By comparison, a twelve-year survey of conditions at Shannon revealed that at Shannon 1.24% of the total number of observations examined had conditions below 200 feet and/or $\frac{1}{2}$ mile.

Diurnal Variations:

The total period of this survey is probably too short to allow a full investigation of the diurnal variations in the selected conditions of ceiling and visibility

However, in Fig. 6 is shown, in histogram form a summary of the information available. Here are illustrated the diurnal variations over (i) the total period, (ii) the "equinoctial" months of March, April, September and October, (iii) the winter months of November to February, inclusive, and (iv) the summer months of May to August, inclusive.

The distributions, in histogram form, express the occurrence of the conditions as a percentage of the possible occurrence. They appear to indicate some seasonal variations which may or may not be substantiated by more extensive records.

Fog:

In a survey of this nature based on the reported hourly observations, over a relatively short period, and considering the elevation and situation of the airport, it would be impossible to differentiate, with any great confidence, between radiator or advection fog and coastal or frontal stratus.

Snow:

There were in all 221 observations with snow (including snow showers) at the time of observation. Of these, 80 were of conditions at or below 500 foot ceilings and/or 1 mile visibility, and 10 were of conditions below 200 feet and/or $\frac{1}{2}$ mile.

TABLE 1. Number of Observations of snow with associated wind directions.

	<u>Wind Direction</u>															
	320	330	350	010	020	030	040	050	060	070	080	090	100	110	140	170
Number at or below 500 feet and/or 1 mile	2	8	7	2	5	3	7	9	8	11	4	5	3	4	1	1
Number below 200 feet and/or 1/2 mile					1			1	3	4		1				

N.B. Calms and all directions, other than those specified, gave zero values.

TABLE 2. Ceilings reported with snow (or snow showers).

Ceilings 100's feet	1	2	3	4	5	6	7	8	9	10	10	12	13	14	15	over 15
No. of observations.	7	26	18	20	5	23	10	10	1	9	4	8	5	11	12	52
Cumulative Totals.	7	33	51	71	76	99	109	119	120	129	133	141	146	157	169	

There were 42 observations of snow with visibilities less than or equal to 1 mile.

Of these 42 observations, 33 had ceilings at or below 300 feet, and 5 had ceilings above 500 feet.

Showers.

In the two years surveyed, 756 of the Cork hourly observations included reports of showers. Considering that the airfield level is 502 feet above Mean Sea Level it is interesting to note the high ceilings reported in showers.

Table 3 shows the distribution of these ceilings.

TABLE 3. Ceilings associated with showers (including snow showers) and also with snow showers in particular.

Ceilings (100's feet)	No. of showers (inc. snow showers)	Cumulative Totals	No. of snow showers.	Cumulative Totals
2	1	1	1	1
3		1		1
4	3	4	3	4
5	6	10	1	5
6	12	22	4	9
7	4	26		9
8	9	35 (4.6%)		9
9	11	46 (6.1%)	1	10 (3.5%)
10	14	60 (7.9%)	5	15
11	11	71 (9.4%)	2	17
12	49	120 (15.9%)	6	23
13	49	169 (22.3%)	5	28
14	63	232 (30.7%)	8	36
15	79	311 (41.1%)	7	43
16	91	402 (53.5%)	8	51 (68.9%)
17	35	437 (57.8%)	4	55
18	52	489 (64.6%)	2	57
19	9	498 (65.9%)		57
20	16	514 (68.0%)	2	59
Over 20	242		15	

The bracketed figures indicate the percentages of the total number of "shower observations" reported with ceilings at or below the ceiling height indicated. Less than 10% of the showers had ceilings below 1,200 feet. Even in snow showers only approximately 20% of the observations had ceilings below 1,100 feet.

Thunderstorms:

There were 7 hourly observations during thunderstorms. The associated ceilings were 1,500 feet (2), 1,300 feet (2), 1,100 feet (1), 1,000 feet (1) and 500 feet (1). The associated visibilities were $1\frac{1}{2}$ miles (2) and the other 5 greater than or equal to $4\frac{1}{2}$ miles.

Freezing Precipitation:

This was reported in 7 hourly-reports. Four of these were at consecutive hours in December, 1962, and were associated with a warm sector which moved southwards over Ireland and replaced a cold anticyclone. The warm front was preceded by snow. An air temperature of -0.5°C was reported at each of the four observations. Freezing precipitation was reported when the surface front was 120 nautical miles to the north and ceased when it was 80-100 nautical miles to the north. Associated ceilings were at 2,600 feet with visibilities at or above 10 miles.

Two observations of freezing precipitation in January, 1963, were associated with a cyclonic circulation centred over northern France with an occlusion over southern England. Associated ceilings were 600 feet and 400 feet with air temperatures of -0.5°C and -1.0°C , respectively, and visibilities of approximately 4 miles.

In February, 1963, a slow-moving depression south of Ireland, with a weakening quasi-stationary occlusion off the south coast, occasioned an observation of freezing rain with an air temperature of 1.5°C , and ceiling of 200 feet and visibility of 3 miles.

Smoke:

The nearest smoke sources to the airport are in Cork City, approximately 4 miles to the north, and approximately 400 feet below airfield level. (cf. Fig. 1).

In the two years under review, smoke was reported at only one observation when a visibility of $2\frac{1}{2}$ miles was recorded.

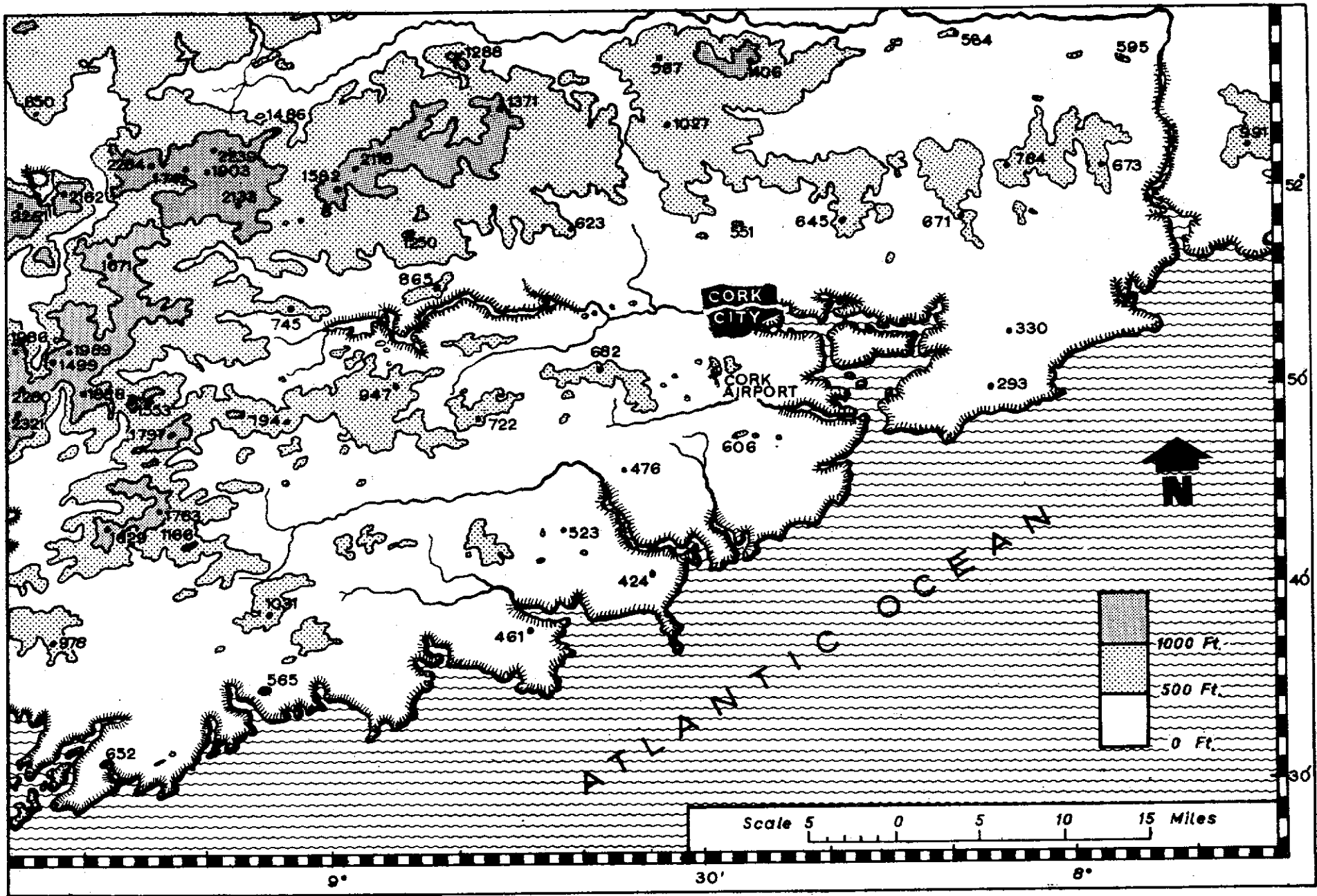


Fig. 1 Topography of Environments of Cork Airport.

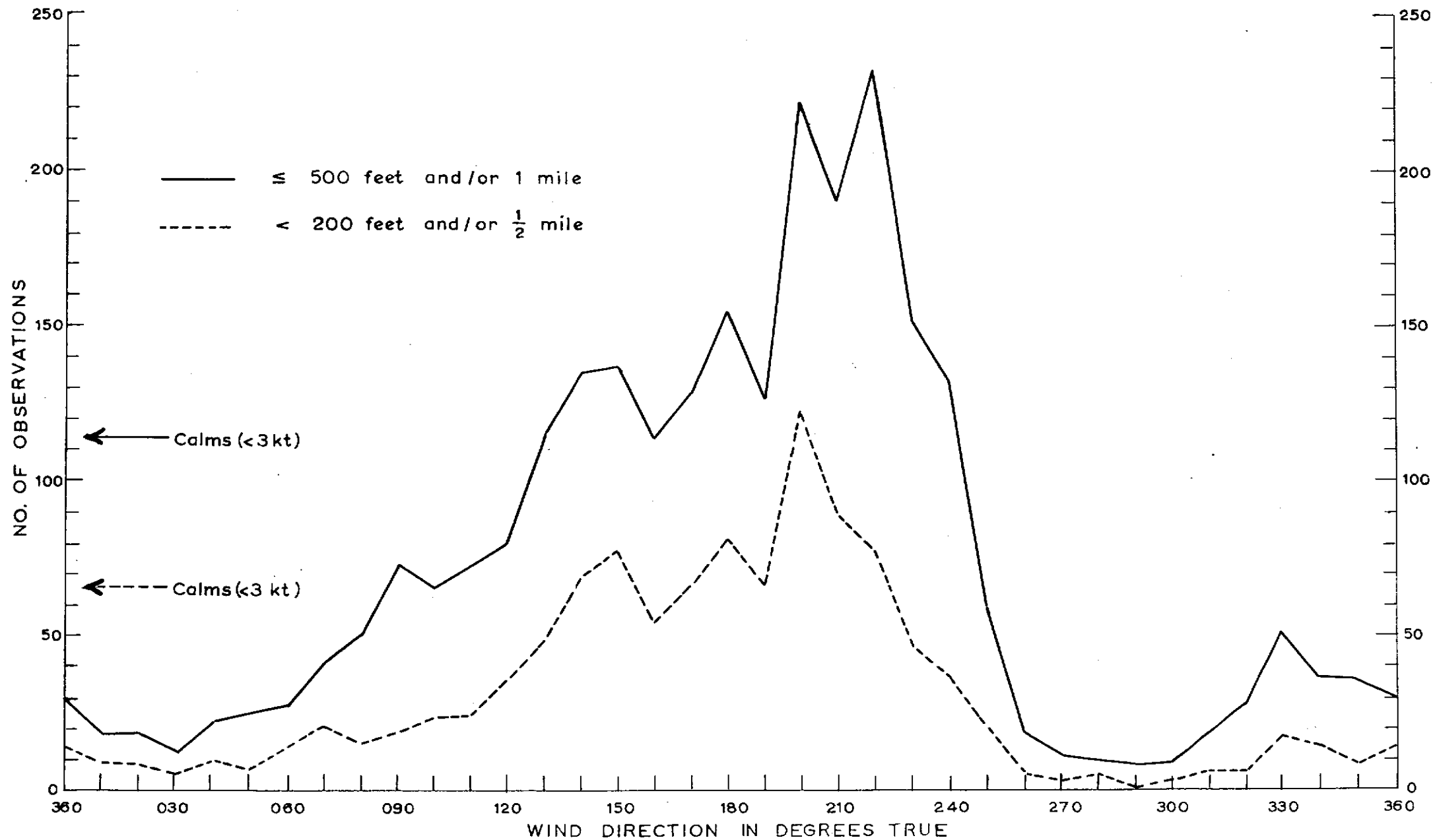


Fig. 2 Frequency of occurrence of selected conditions of cloud base and visibility with wind direction at hourly observations (November 1961–October 1963).

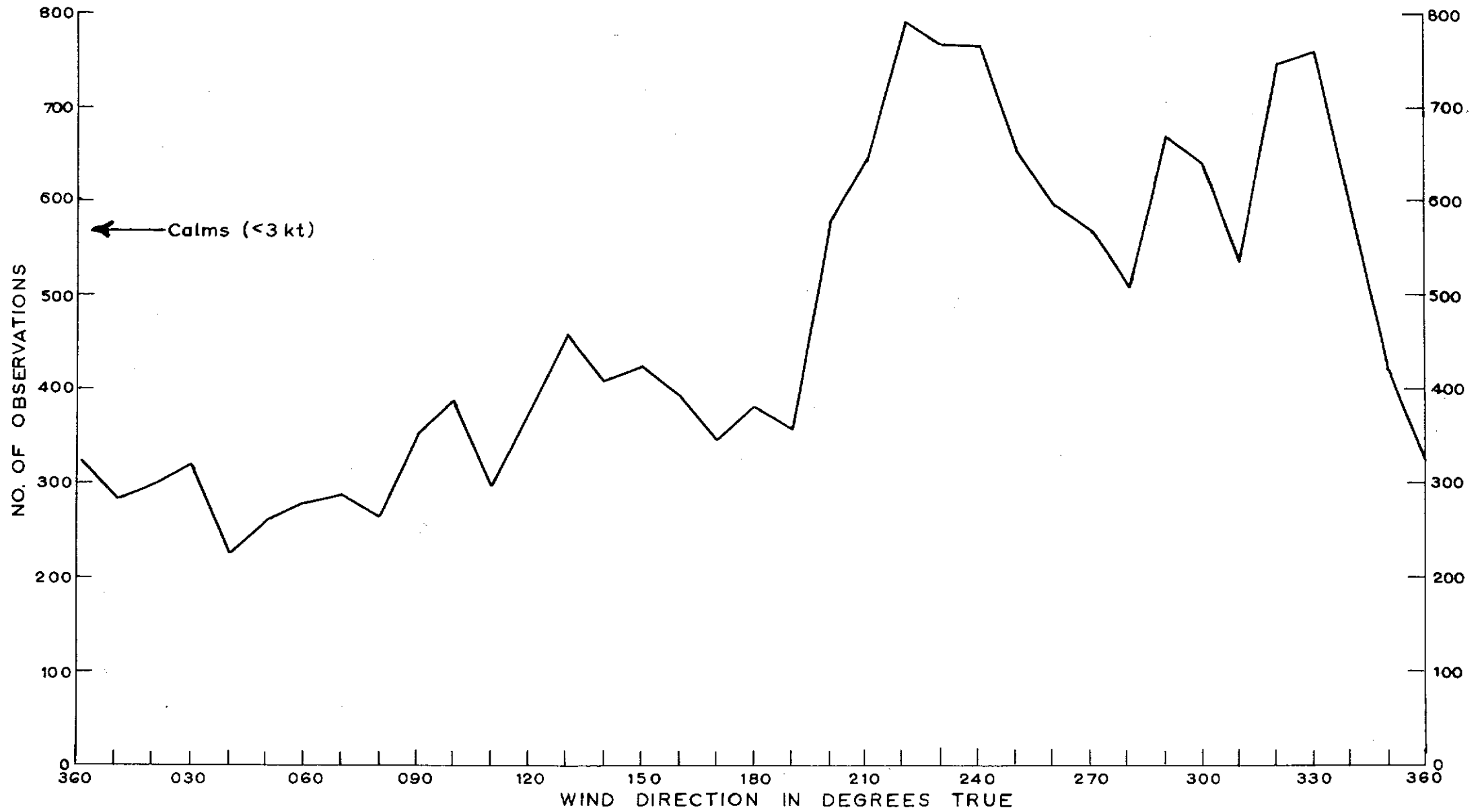


Fig. 3(a) Frequency of wind direction at hourly observations (November 1961 – October 1963).

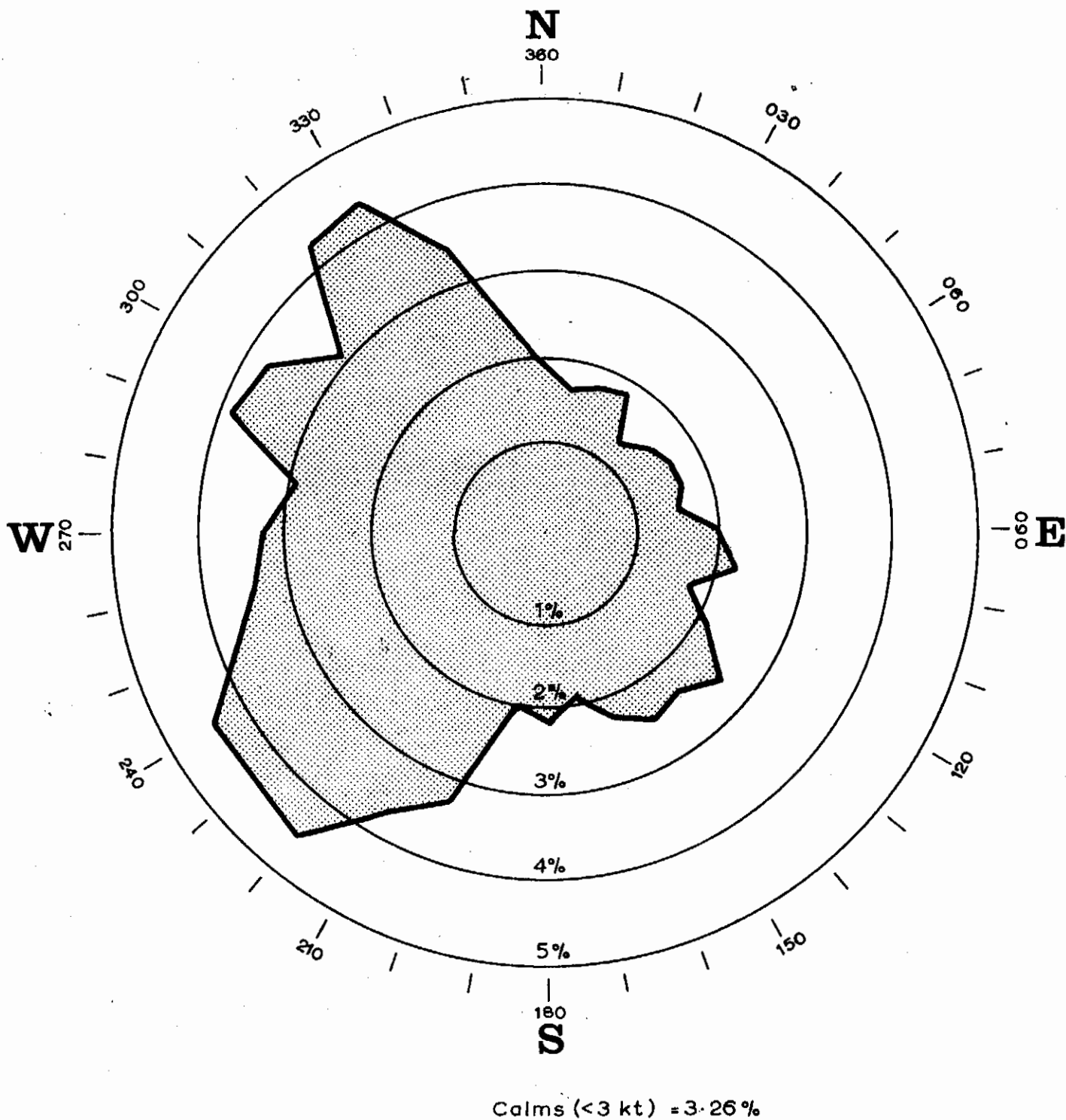


Fig. 3(b) Wind direction as percentage of total observations
(November 1961 - October 1963)

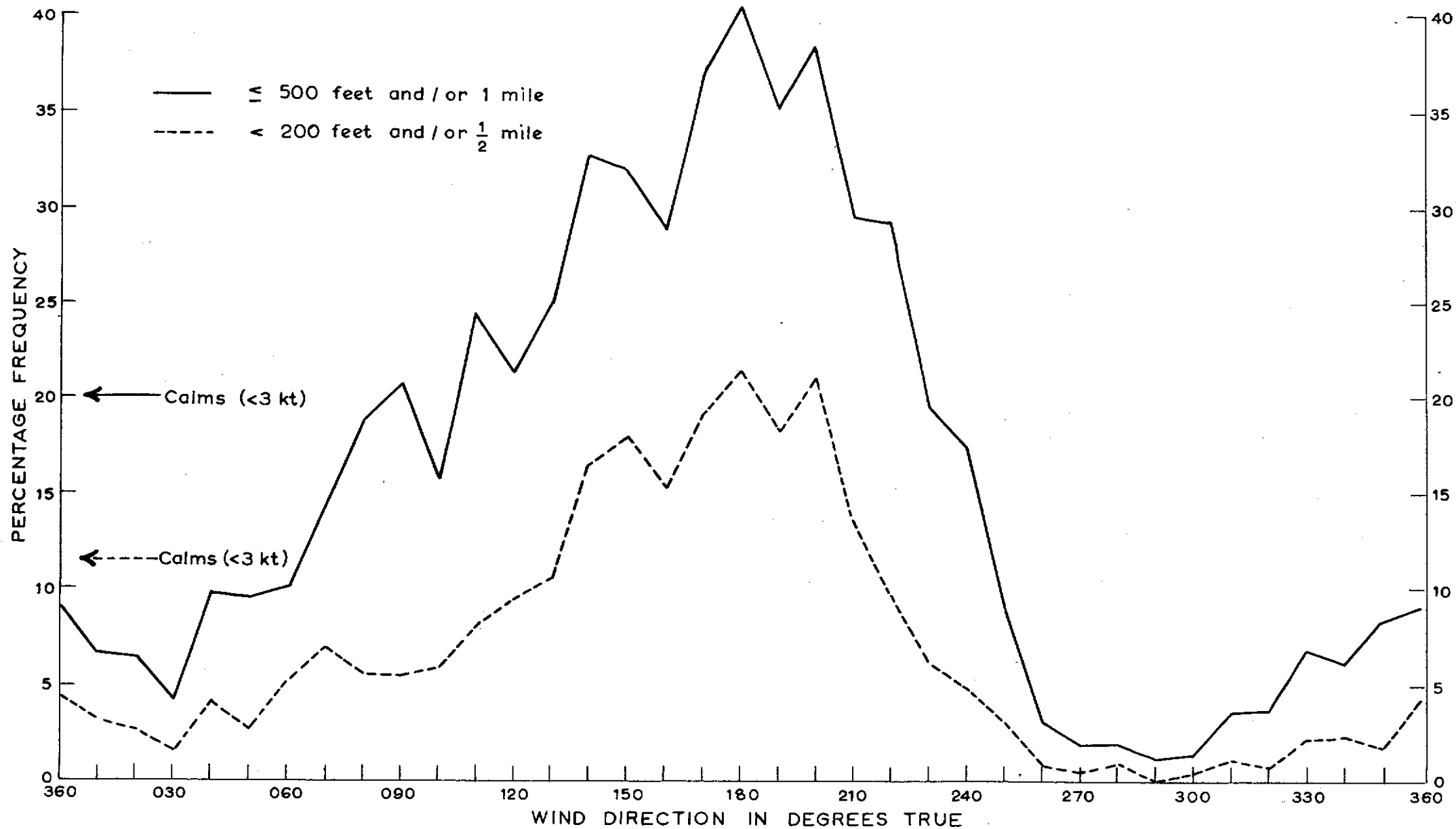


Fig. 4 Percentage of possible frequency of occurrence of selected conditions of cloud base and visibility with wind direction at hourly observations (November 1961—October 1963).

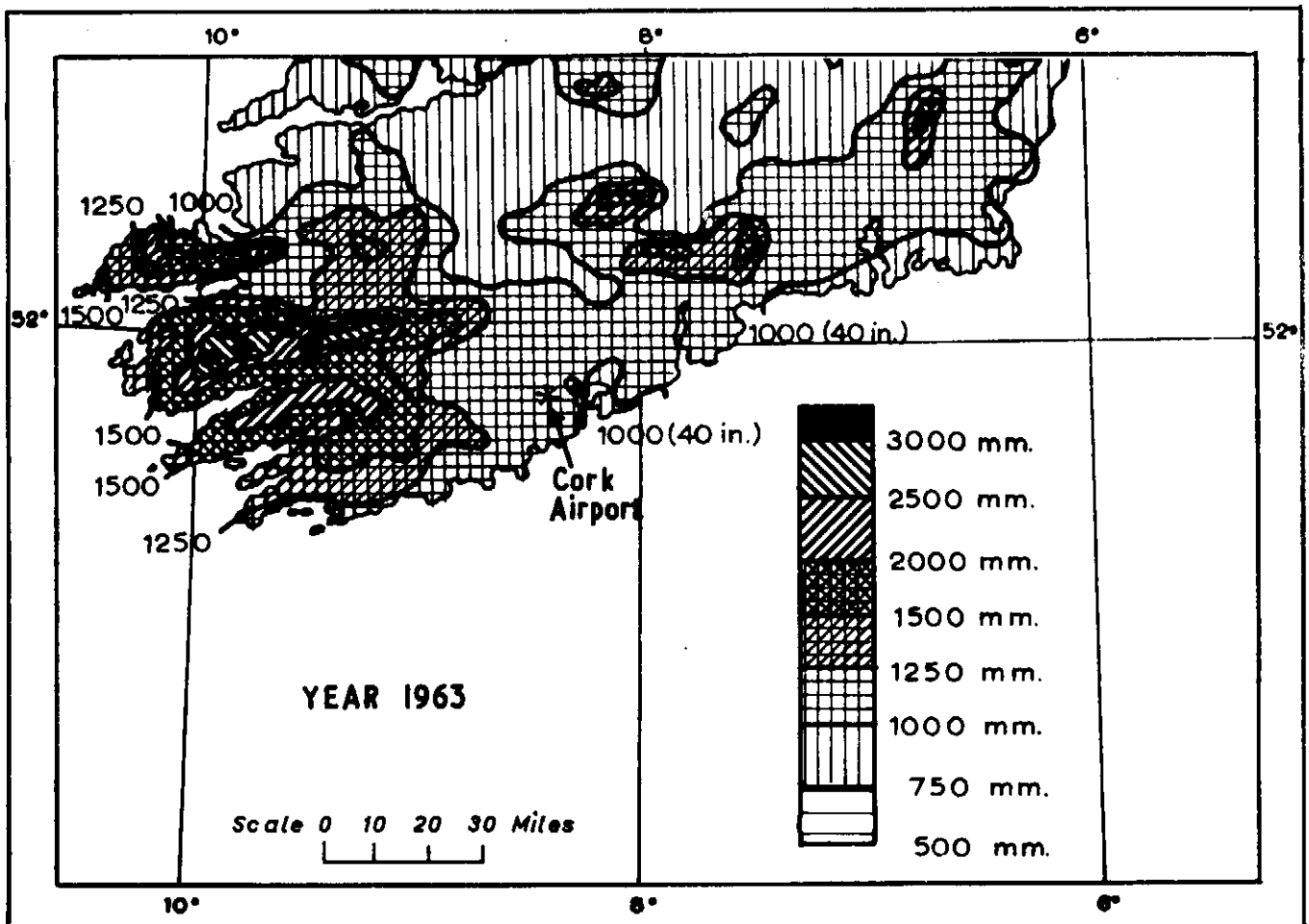
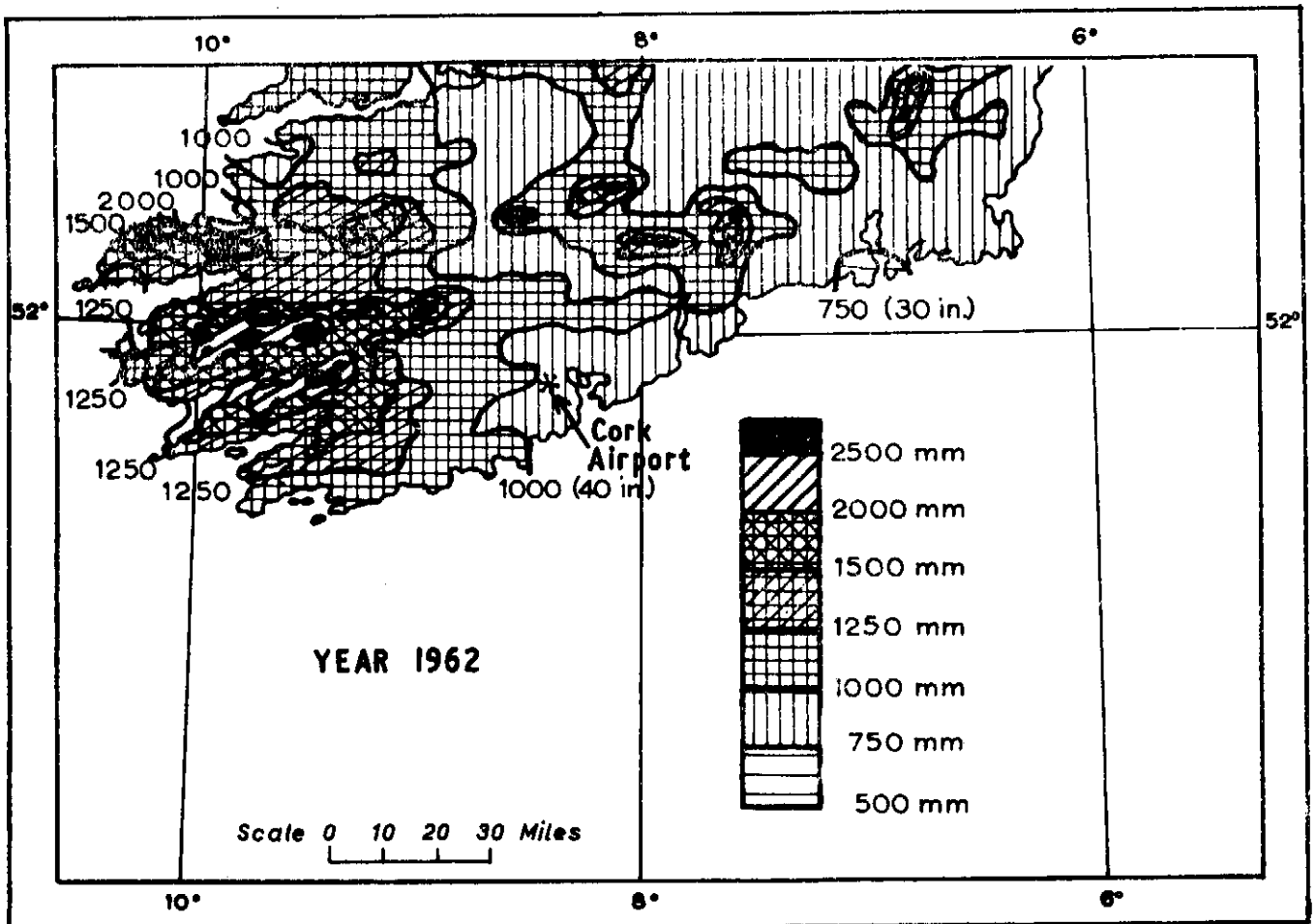
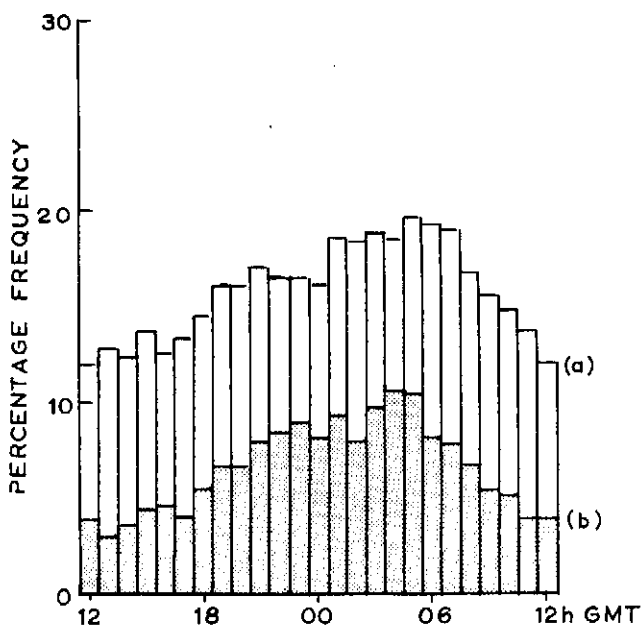
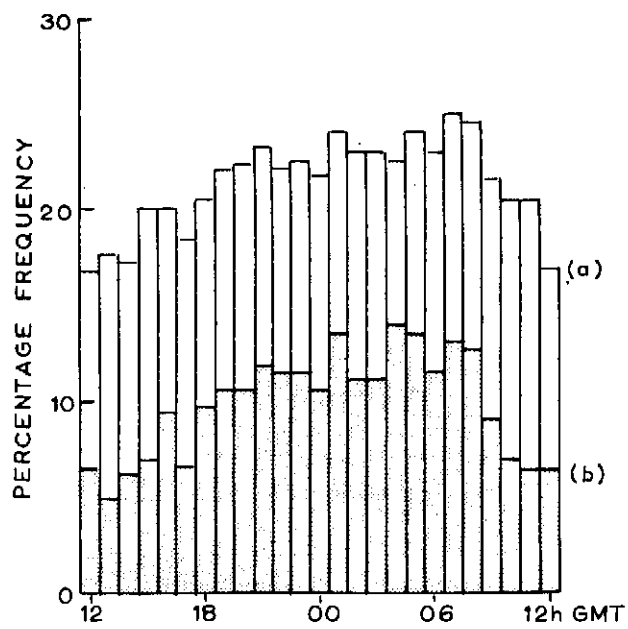


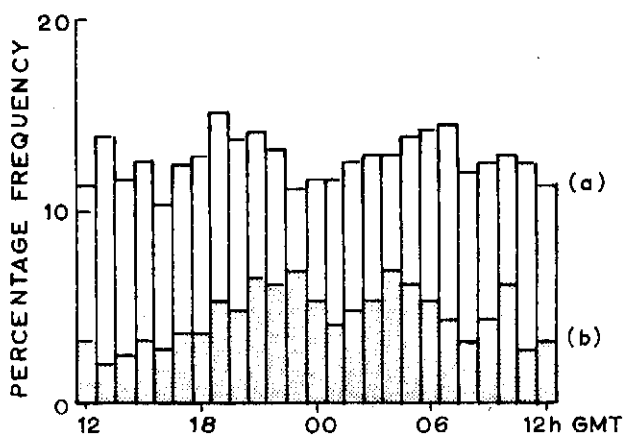
Fig. 5 Annual rainfall for southern counties of Ireland.



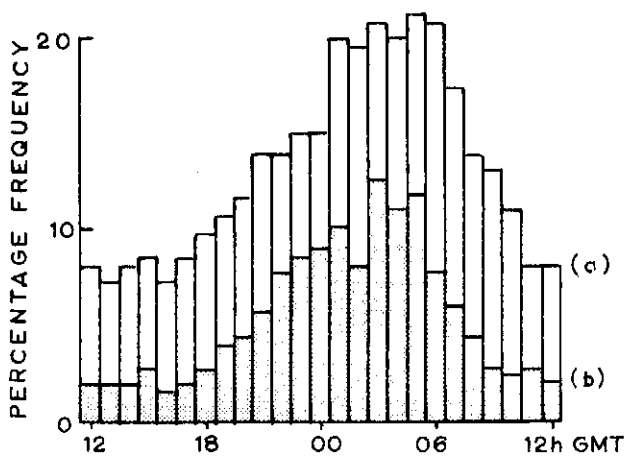
(i) Nov. 1961 - Oct. 1963



(ii) Mar., Apr., Sept., Oct. 1962 and 1963.



(iii) Nov., Dec. 1961 and 1962
Jan., Feb. 1962 and 1963.



(iv) May, June, July, Aug. 1962 and 1963.

Fig. 6 Diurnal variation in the occurrence (a) of conditions of visibility and or ceiling at or below 1 mile and/or 500 feet and (b) of visibility and/or ceiling below 1/2 mile and/or 200 feet expressed as a percentage of the possible frequency.