HONG KONG OBSERVATORY

Technical Note No. 91

CLIMATOLOGY OF WAGLAN ISLAND 1968-1988

by

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551.506.1:551.582(512.317)

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1. INTRODUCTION

The data used in this note are 3-hourly observations made at Waglan Island between January 1968 and December 1988. A total of 61 368 observations was loaded into the Oracle database of the Hong Kong Observatory and analyzed using SQL (Structured Query Language) to show significant climatological characteristics at Waglan Island. Observations taken during the years 1953-1967 are not included in the present analysis as only those data since 1968 are available on computer tape.

2. HISTORY OF THE STATION

Waglan Island is situated at the southeast extremity of Hong Kong waters about 5 km southeast of Cape D'Aguilar, the southeast tip of Hong Kong Island. It consists of two small islands separated by a narrow channel. The total area is about 0.1 km^2 with the highest point 58 m above mean sea level. The station is located at the lighthouse on the southern island (22°10'58''N, 114°18'04''E) with station level 55.2 m above mean sea-level. The northern one is uninhabited. Another small island, Sung Kong, with a peak of 147 m is 2 km to the west and Po Toi Island with a peak 241 m is 5 km to west-southwest. Other directions are almost unobstructed. It has a good exposure to winds and the environment remains much the same. Figure 1 shows a map of these islands and Figure 2 a bird's eye view of the station.

The station started operation in December 1952 and its WMO station number was 45009. Depending on staff arrangement, observation times varied from time to time. During 1968-1988, 3-hourly observations at synoptic hours (i.e. 2, 5, 8, 11 a.m. and p.m.) were made regularly.

Observations had been made by Hong Kong Observatory staff until 1 January 1964 when the duty was handed over to lighthouse keepers of Marine Department. Due to de-manning of the lighthouse by Marine Department, it became automated in August 1989. The last observation made was at 0300 UTC on 22 August 1989.

3. INSTRUMENTS AND METHODS OF OBSERVATION

The following paragraphs describe the instruments and methods of observation used in Waglan Island during the years 1968-1988.

(a) Atmospheric pressure

The barometer used was a Kew pattern. Correction for index error, adjustment of the readings to the standard temperature of 0 °C and the standard gravity of 9.80665 m/s^2, and reduction to mean sea-level were carried out using the methods described in the WMO publication No. 8, 'Guide to Meteorological Instruments and Observing Practices'.

Height of cistern above floor = 0.7 m
Height of cistern above mean sea-level = 62.2 m

A Casella barogragh kept a continuous record of the mean sea-level pressure. This was used to check the accuracy of the readings.

(b) Air temperature, dew point and relative humidity

The thermometers were placed in a Stevenson screen with their bulbs 1.09 m above ground. Values of dew point temperature and relative humidity were calculated from the dry and wet bulb temperatures.

The maximum and minimum thermometers were similarly exposed, both read daily at 8 a.m.

A mercury-in-steel distant recording thermograph was used to keep a continuous record of the dry and wet bulb temperatures until 24 September 1982.

Platinum resistance digital thermometers were also installed on 21 October 1981.

(c) Wind

Winds had been measured by a Dines pressure-tube anemograph with the head 74.8 m above mean sea-level. On 19 March 1975, a Mark IV Cup Generator and Vane anemometer was installed on the same mast with the cup centre at the same height of the Dines head. Records from the Mark IV anemometer were regarded as official from 1 January 1986.

Gust had been reported only when it was greater than the mean wind speed by 5 m/s or more until January 1975 when hourly readings were available.

(d) Rainfall

24-hour total rainfall was measured daily at 3 p.m. using an ordinary 127 mm standard rain-gauge.

A Dines Tropical Type rain-gauge had been installed to keep a continuous record of rainfall until 18 November 1975 when it was replaced by an automatic tilting bucket rain-gauge.

(e) Cloud

Visual observations of cloud type and amount, and estimates of the height of the cloud base were made with reference to well-marked topographical features.

(f) Visibility

Eye estimates of horizontal visibility were made with reference to well-marked topographical features.

(g) Weather

Occurrences of thunderstorm, fog, mist and haze were reported in routine weather observations.

(h) Sea surface temperature

Weather permitting, sea surface temperatures were taken twice daily at 11 a.m. and 5 p.m. from the landing stage at Waglan Island. The sea bottom slopes steeply to over 18 metres on all sides of the island, and the temperature may be taken as representative of the adjacent open coastal waters.

4. ANALYSIS

(a) Monthly and annual wind roses

Since Waglan Island is well exposed geographically and is not directly affected by urbanization, the wind recorded is more representative of the general flow over Hong Kong.

The total number of occurrences of concurrent wind speed and direction is computed for each month. Wind directions are grouped into ranges of 30° and wind speeds in m/s into categories as follows : 0.3-3.3, 3.4-7.9, 8.0-13.8 and >13.8. The percentage frequencies are plotted in the form of wind roses in Figures 3-5.

Winds at Waglan Island are most frequent from the east, the northeast and the north from September to May whereas the southwesterlies are significant from June to August. However, if we have to choose a single direction as the monthly prevailing wind direction, as presented in Table 1, it is easterly in all months except July when the southwest monsoon dominates.

Because of its good exposure and long fetch of winds over water in most directions, the anemometer at Waglan Island usually recorded the highest winds of all the weather stations in Hong Kong except Tai Mo Shan and Tate's Cairn on high grounds (Lui 1991).

(b) Diurnal variation of wind

3-hourly vector mean winds for each month are plotted in Figures 6 and 7. There is a general, though not marked, pattern that winds veer during the day and back during the night. Roughly speaking, there is a maximum in wind speed (more noticeable from October to February) around or just before dawn.

(c) Climatological summary

Monthly values of meteorological elements are summarized in Table 1. It should be noted that the data period of maximum and minimum temperatures and sea surface temperature for analysis is 1975-1988 as records in digital form are available only since 1975.

A day with thunderstorm, fog, mist or haze is defined as one having one or more reports of the weather concerned during the day. It can be seen that the occurrence of thunderstorm was relatively few.

Strong and gale force winds are defined as 14.5 and 20.0 m/s of hourly mean wind respectively following the results obtained by Chin and Leong (1978).

It is worthwhile to point out that Waglan Island usually recorded the lowest rainfall among all rainfall stations in Hong Kong (Ng and Wong 1996).

(d) Diurnal variation of meteorological elements

3-hourly means in each month for the following elements are shown in Tables 2-7 and Figures 8-13.

(i) mean sea-level pressure
(ii) air temperature
(iii) wet-bulb temperature
(iv) dew point
(v) relative humidity
(vi) cloud amount

(e) Percentage frequencies of the height of the base of the lowest cloud layer

Percentage frequencies of the height of the base of the lowest cloud layer covering 5 oktas or more of the sky below specified values are computed for each month. A similar analysis is also made for occasions when the lowest cloud layer covered 1 okta or more. These are given in Tables 8 and 9.

(f) Percentage frequencies of visibilities below specified values

The data period of visibility under analysis is 1975-1988 as their records in digital form are available only since 1975. These frequencies are shown in Table 10. Visibility is worst in March and best in November.

(g) Frequency distributions of parameters relating to the occurrence of fog

Parameters chosen are occurrence time, duration, visibility, times of onset and cessation, temperatures at onset and cessation of fog. These are plotted in Figures 14-20. Fog period is regarded as the duration between the first hour and the last hour of consecutive fog reports. This is based on the assumption that fog usually occurs in stable conditions and continues between two consecutive reports. The frequency distribution of wind direction and speed when fog was observed is shown in Table 11.

During the 21-year period under study, about half of the fog occurrences lay between 2 and 8 a.m. and two thirds of fog periods had durations of not more than 7 hours (Figures 14 and 15). Visibilities reported had a skew distribution with more than 60% below 250 m (Figures 16). About 20% of fog periods had onset times at 2 a.m. About half had temperatures between 17.5 and 21 °C at onset. The preferred cessation time of fog was around 11 a.m. when about 20% of the fog ceased. Temperatures at fog cessation most frequently (around 55%) lay between 18 and 22 °C (Figures 17-20).

During fog, 77% of the wind directions were between 360 and 090 degrees, 80% of the wind speeds were below 5.5 m/s and the mean wind speed was 3.5 m/s (Table 11).

(h) Frequency distributions of parameters relating to the occurrence of mist

These are plotted in Figures 21-27. Assumption, definition, and parameters chosen are similar with fog situation. The frequency distribution of wind direction and speed when mist was observed is shown in Table 12.

There was no preference time for the occurrence, onset and cessation of mist. Around 85% of mist periods had durations of not more than 4 hours. The distribution of visibility was uniform between 1000 and 4500 m.. About 60% of temperatures at onset time was 17 to 23 °C and it is similar for temperatures at cessation. During mist, 65% of the wind direction were between 360 and 090 degrees, 64% of the wind speeds were below 5.5 m/s and the mean wind speed was 4.5 m/s.

The analysis for haze is not carried out since there were only 29 reports of haze at Waglan Island during this 21-year period.

(i) Diurnal variation of the occurrence of thunderstorm

The occurrence of thunderstorms was relatively few at Waglan Island with only 149 reports during the 21-year period. From Figure 28, we see that thunderstorms could occur at any time of the day although it was less likely at 5 p.m.

(j) Gust factor

Gust factor is defined as the ratio of hourly instantaneous maximum gust to hourly mean wind. Using the regression equation of gust(G) on hourly mean wind(M), gust factor(GF) can be obtained. If the regression equation is written as

$$G = a\,M + b$$

then $$GF = a + b/M$$

Regression equations for winds at Waglan Island in different quadrants with gust greater than the mean wind by 5 m/s or more and their corresponding gust factors are shown below :

$G = 1.16\,M + 1.35$,	$r=0.97$	(direction between 050° and 130° , east)
$G = 1.22\,M + 1.06$,	$r=0.94$	(direction between 140° and 220° , south)
$G = 1.26\,M + 1.30$,	$r=0.93$	(direction between 230° and 310° , west)
$G = 1.24\,M + 1.00$,	$r=0.97$	(direction between 320° and 040° , north)

where r is the correlation coefficient.

Hourly mean wind (m/s)	Gust factor			
	East	South	West	North
10	1.29	1.33	1.40	1.34
20	1.23	1.28	1.33	1.29
30	1.20	1.26	1.31	1.27
40	1.19	1.25	1.30	1.27

Waglan Island has the lowest gust factor among all the anemometer stations in Hong Kong because of its geographical location and good exposure except Tai Mo Shan and Tate's Cairn on high grounds (Lui 1991).

(k) Extreme values of temperature, rainfall and gust

The top 20 extreme values of maximum and minimum temperatures, maximum gust and maximum hourly, daily and monthly rainfall for Waglan Island are listed in Table 13. The extreme values recorded at the Hong Kong Observatory during the same period are also given on the last line for comparison.

The occurrences of extreme maximum temperatures were due to the southwest monsoon, the Pacific ridge, low pressure areas in the South China Sea or the subsidence ahead of a tropical cyclone near Bashi.

The heaviest rainfall at Waglan Island, as characteristic of Hong Kong, was brought by tropical cyclones, monsoon troughs or the southwest monsoon.

The top 20 maximum gusts were all recorded during the passage of typhoons. The typhoons were Ellen, Hope, Elsie, Rose and Shirley in 1983, 1979, 1975, 1971 and 1968 respectively.

REFERENCES

1. Chen, T.Y. 1975 Comparison of Surface Winds in Hong Kong, Hong Kong Observatory Technical Note No. 41

2. Chin P.C. and Leong H.C. 1975 Estimation of Wind Speeds near Sea-level during Tropical Cyclone Conditions in Hong Kong, Hong Kong Observatory Technical Note No. 45

3. Lui, W.H. 1991 Preliminary Analysis of Wind Data Recorded at Automatic Weather Stations in Hong Kong, Hong Kong Observatory Technical Note (Local) No. 59

4. Ng, M.C. and K.P. Wong 1996 30-Year Mean Rainfall in Hong Kong 1961-1990, Hong Kong Observatory Technical Note No. 88

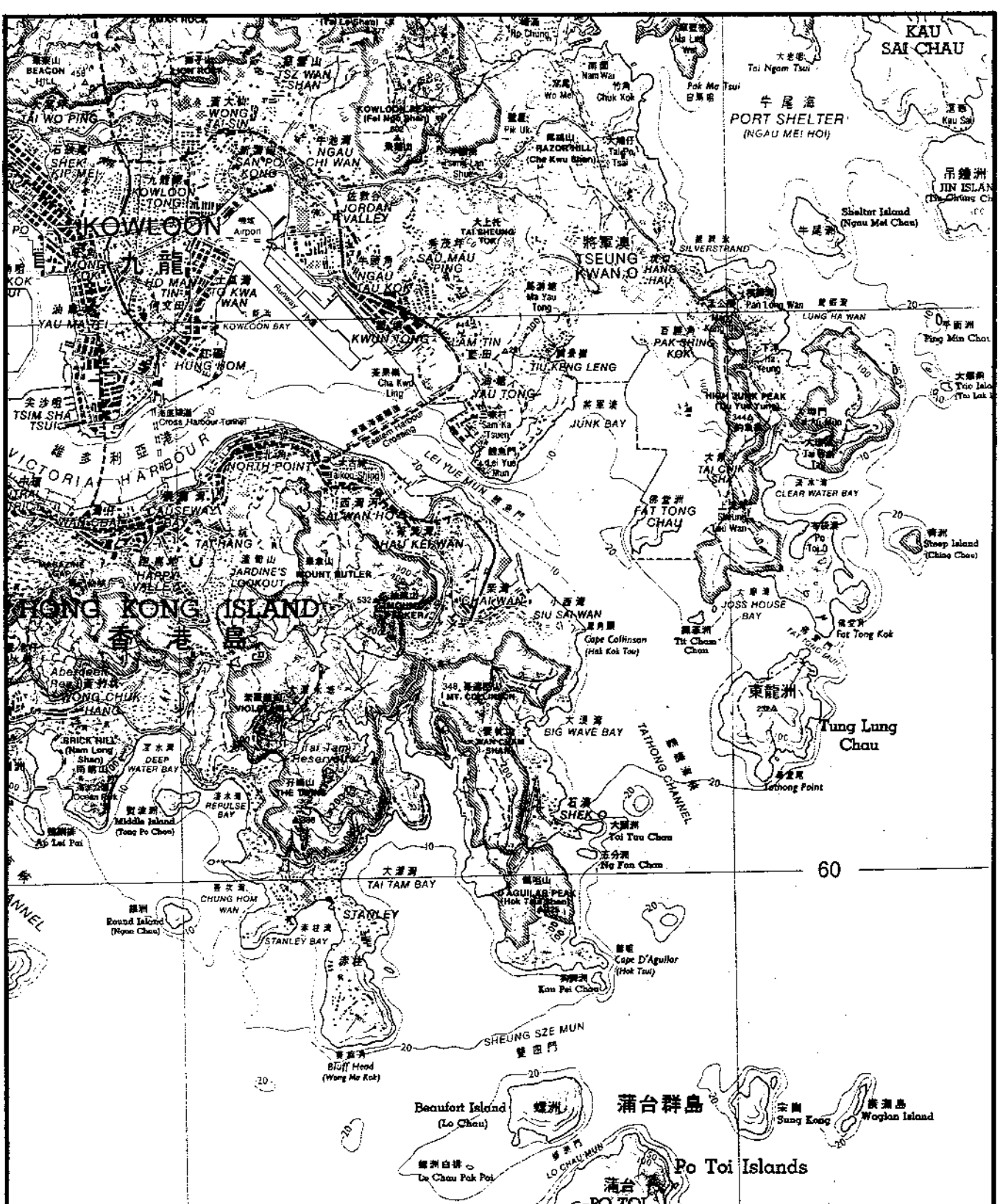


Fig. 1. Location of Waglan Island.

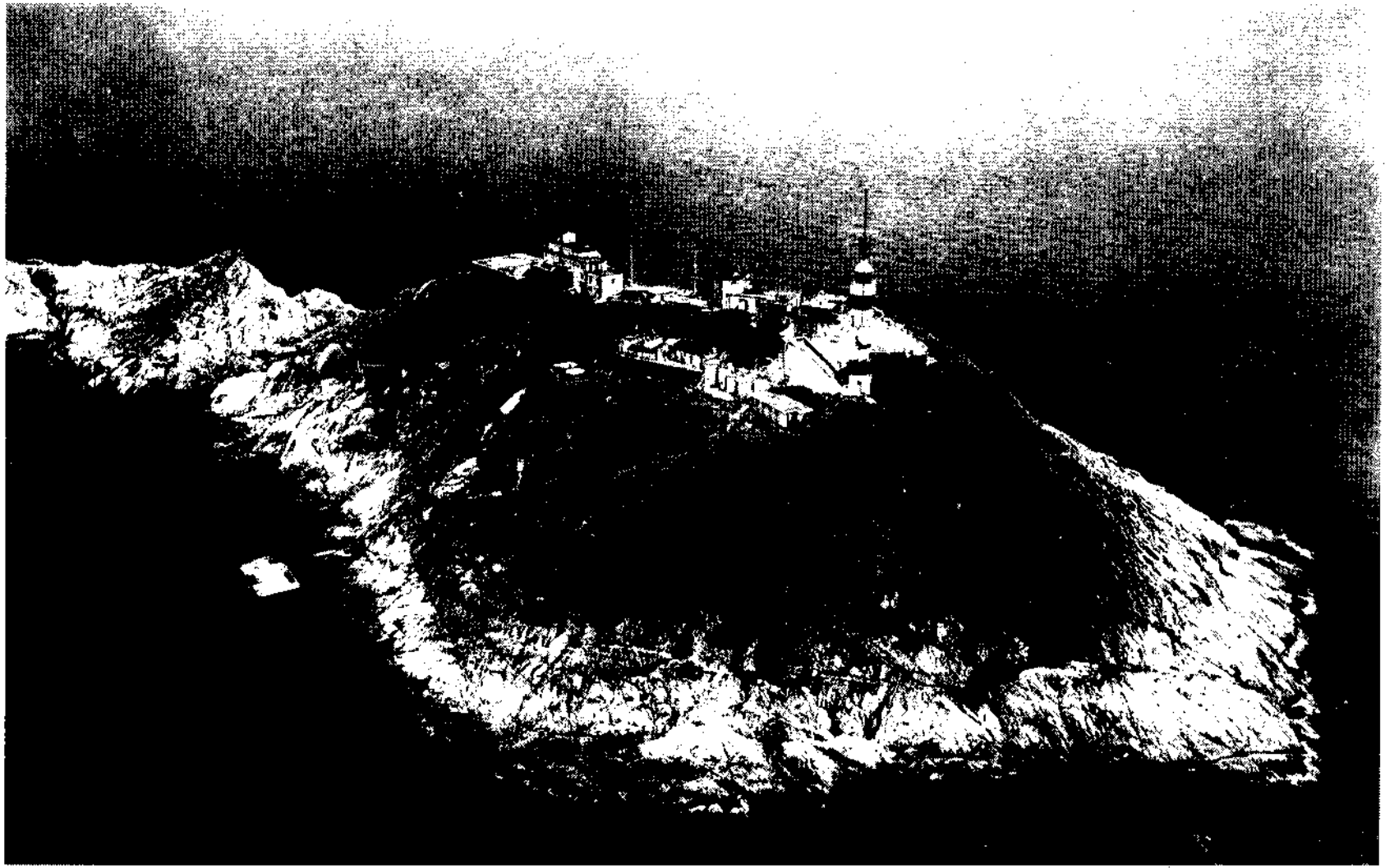


Fig. 2. A bird's eye view of Waglan Island looking towards the northeast.

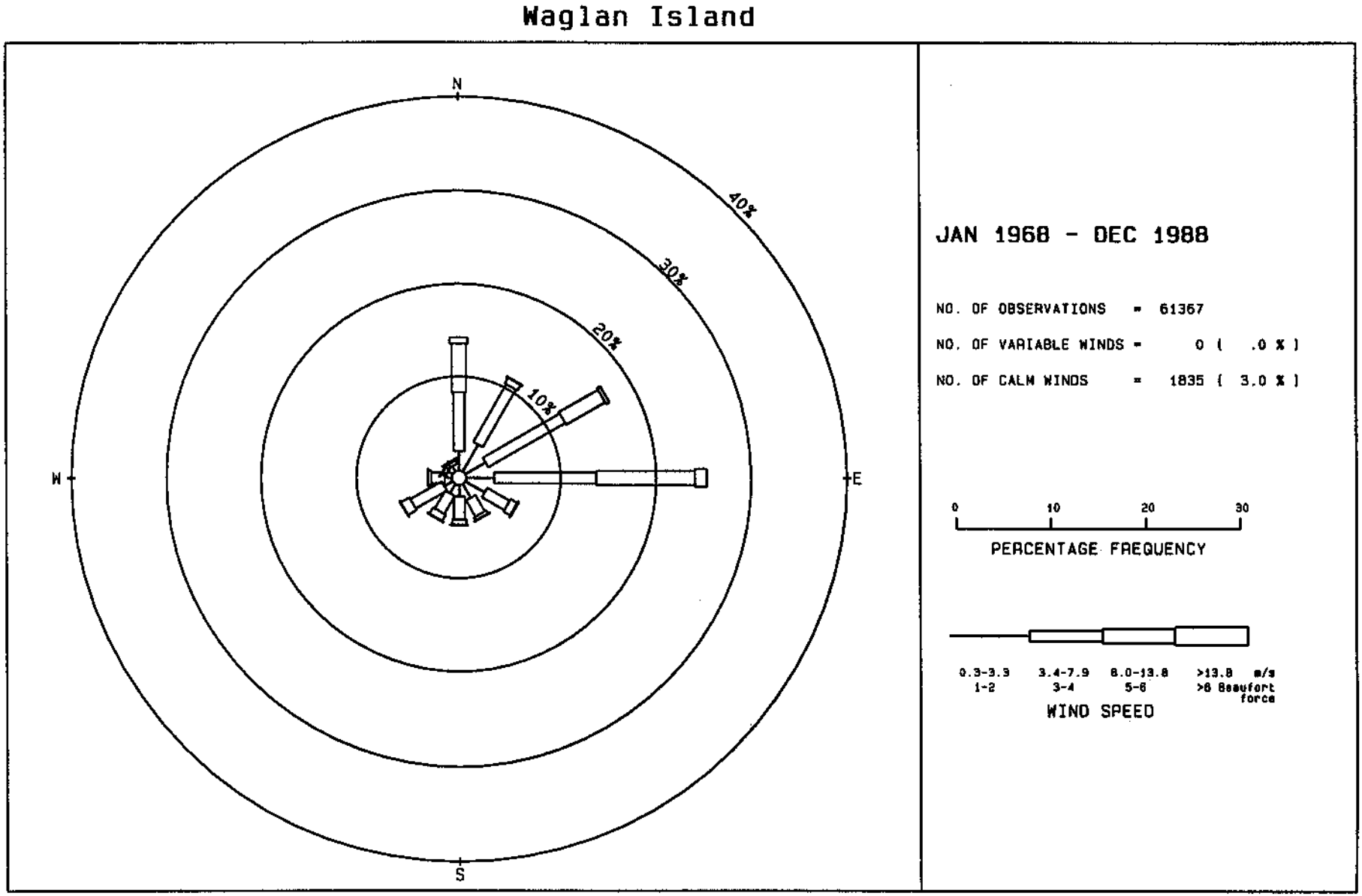


Fig. 3. Annual wind rose for Waglan Island, 1968-1988.

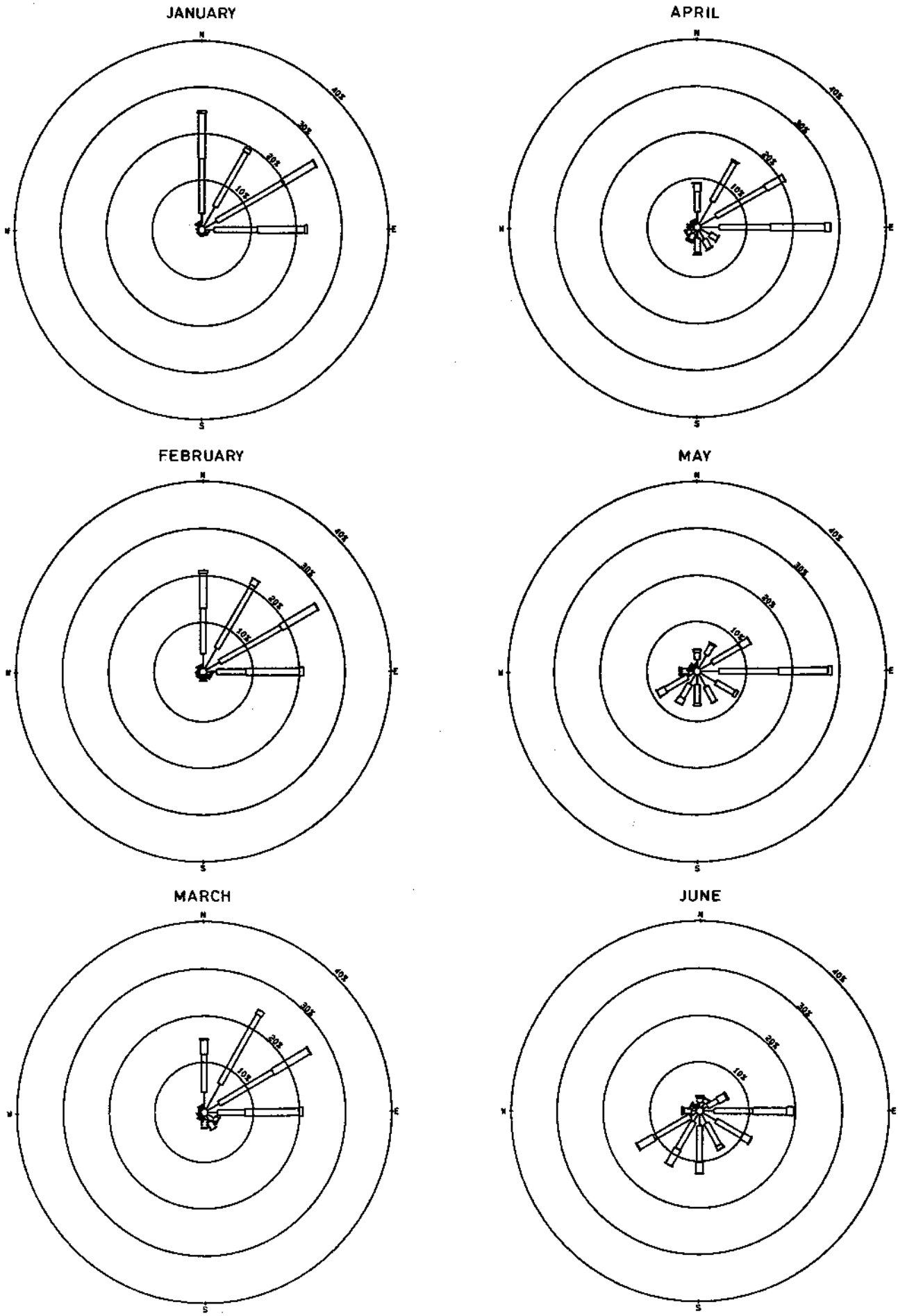


Fig. 4. Monthly wind roses from January to June for Waglan Island, 1968-1988.

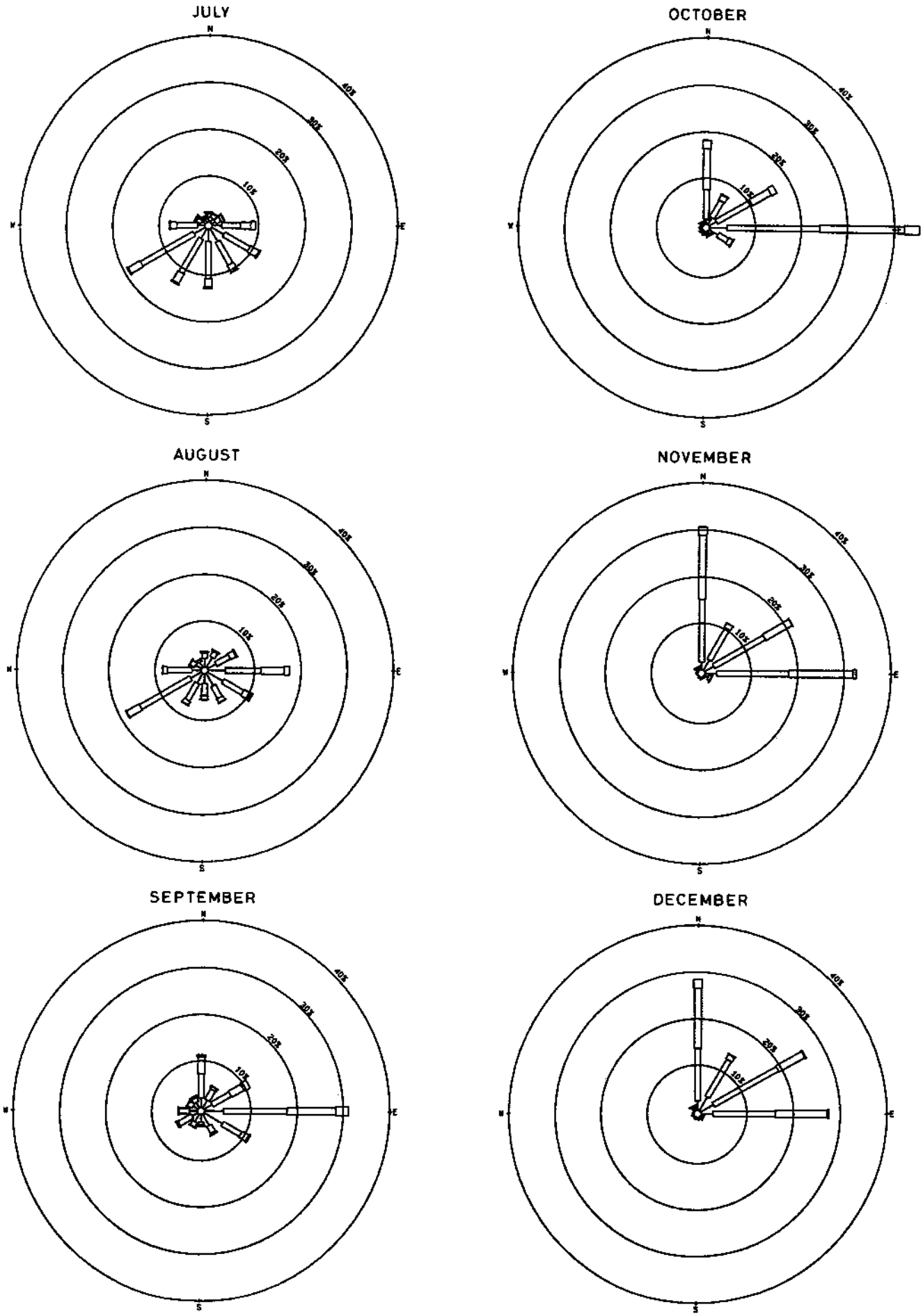
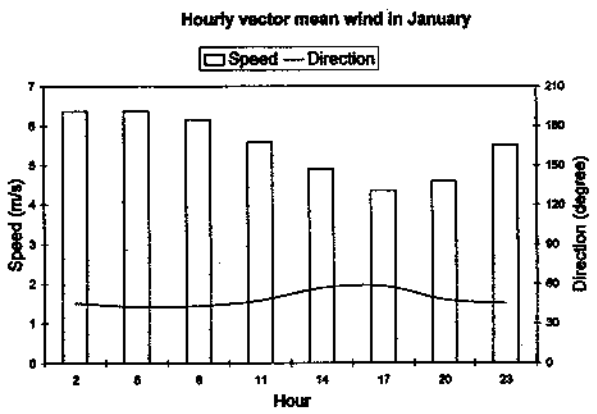
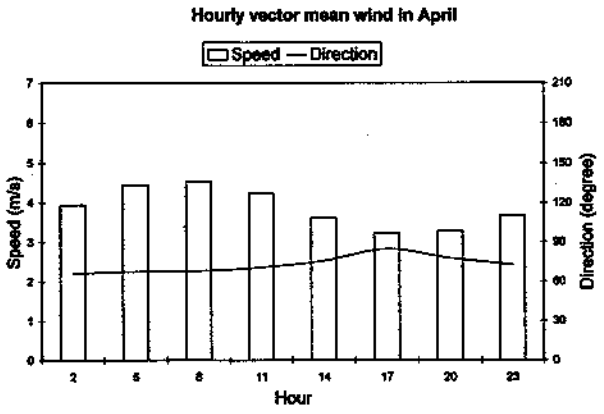
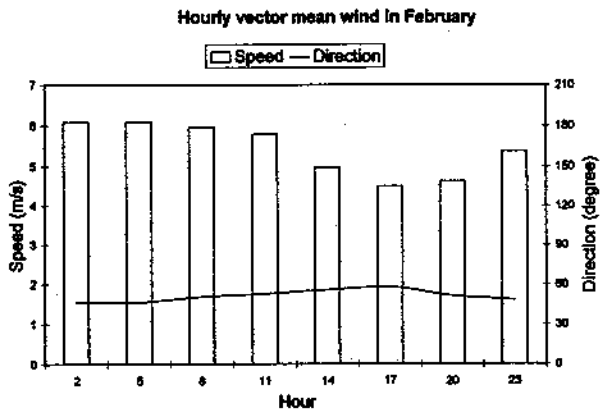
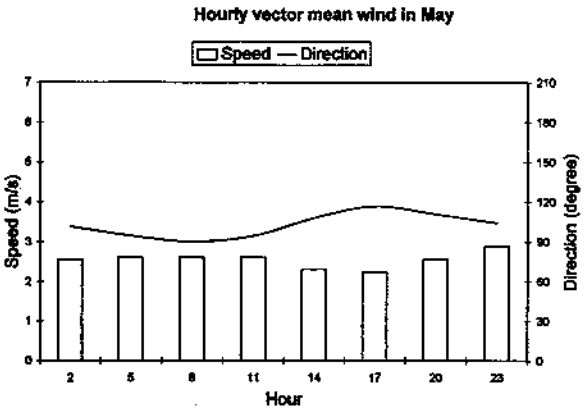


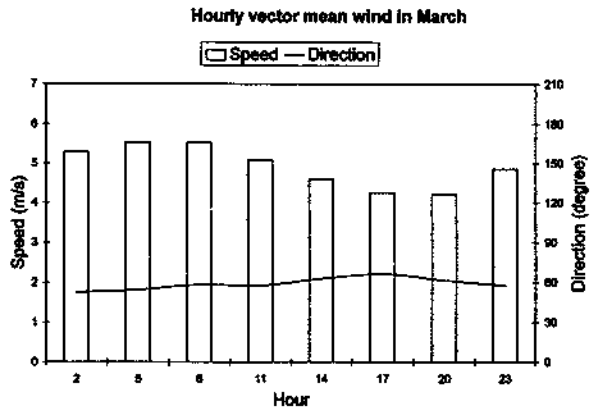
Fig. 5. Monthly wind roses from July to December for Waglan Island, 1968-1988.











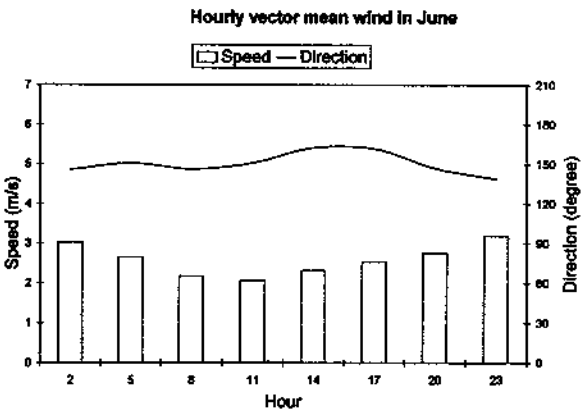
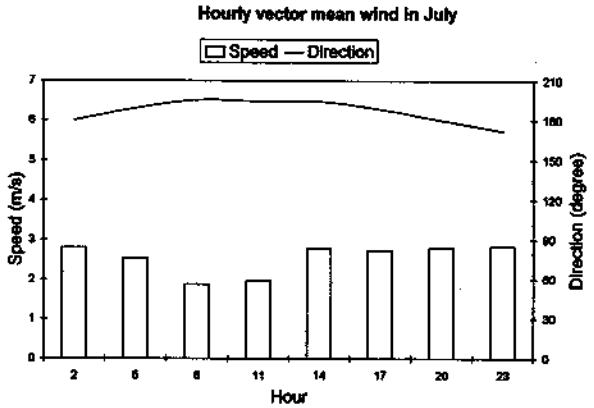
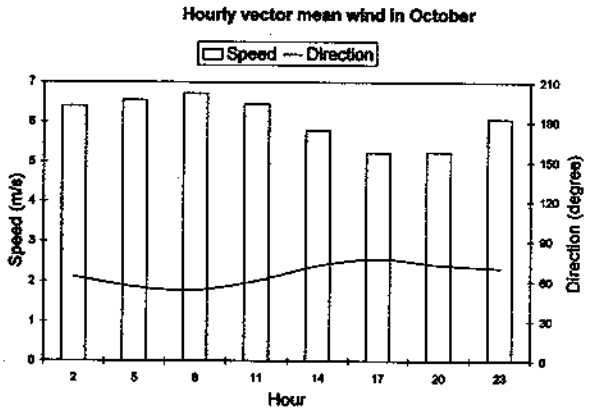
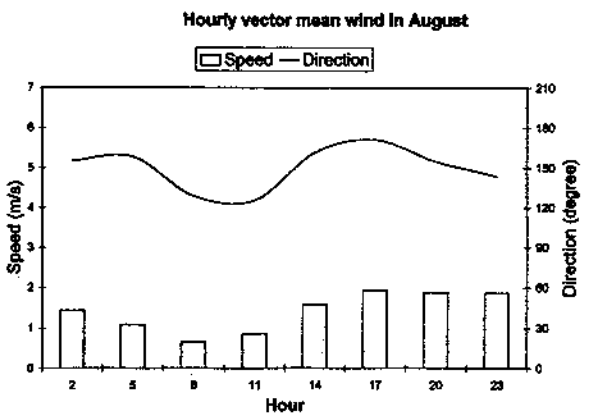
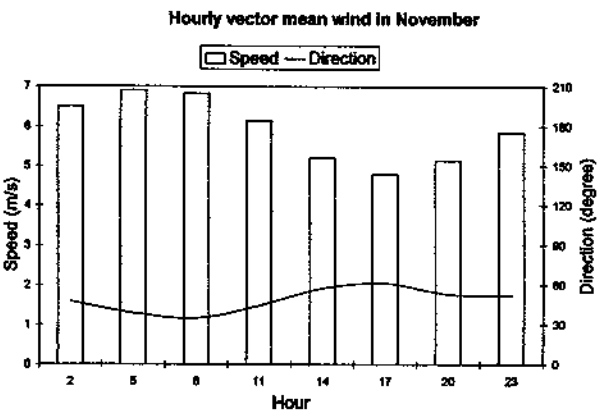


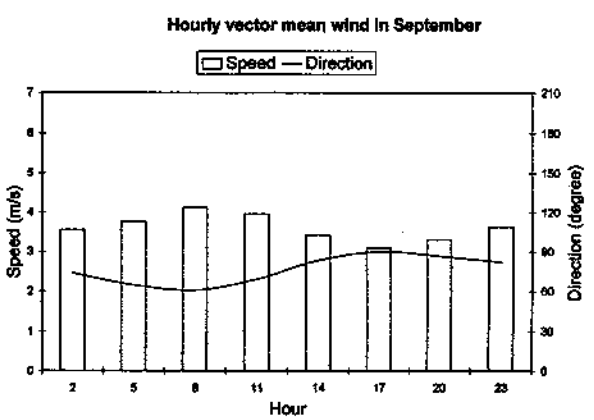
Fig. 6. Hourly vector mean wind from January to June at Waglan Island, 1968-1988.











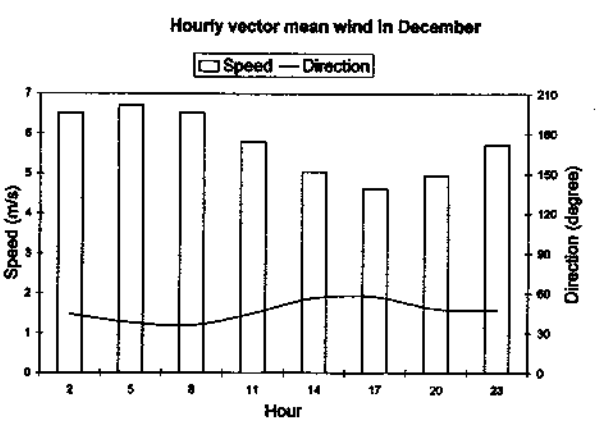


Fig. 7. Hourly vector mean wind from July to December at Waglan Island, 1968-1988.

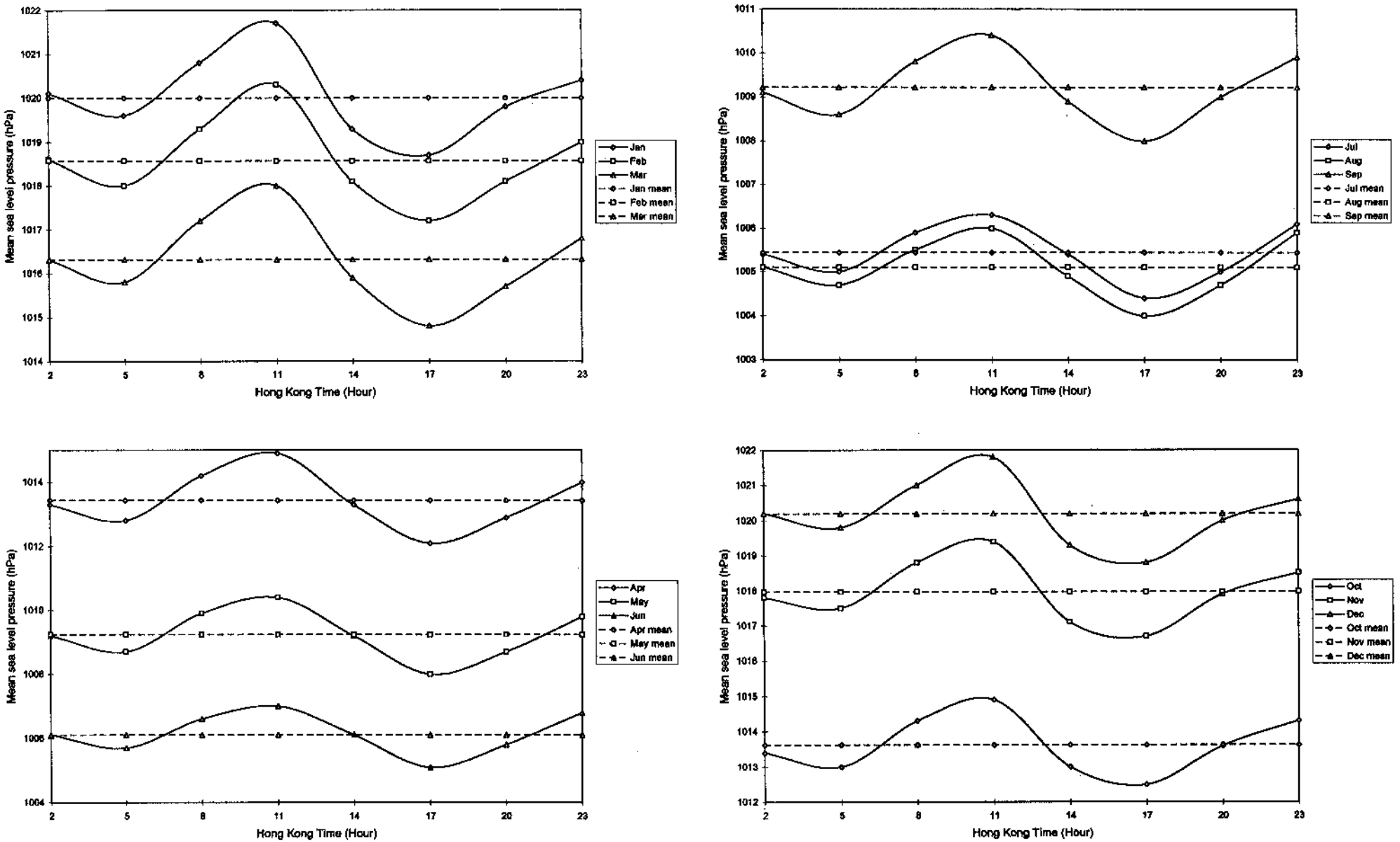


Fig. 8. Diurnal variation of mean sea level pressure at Waglan Island, 1968-1988.

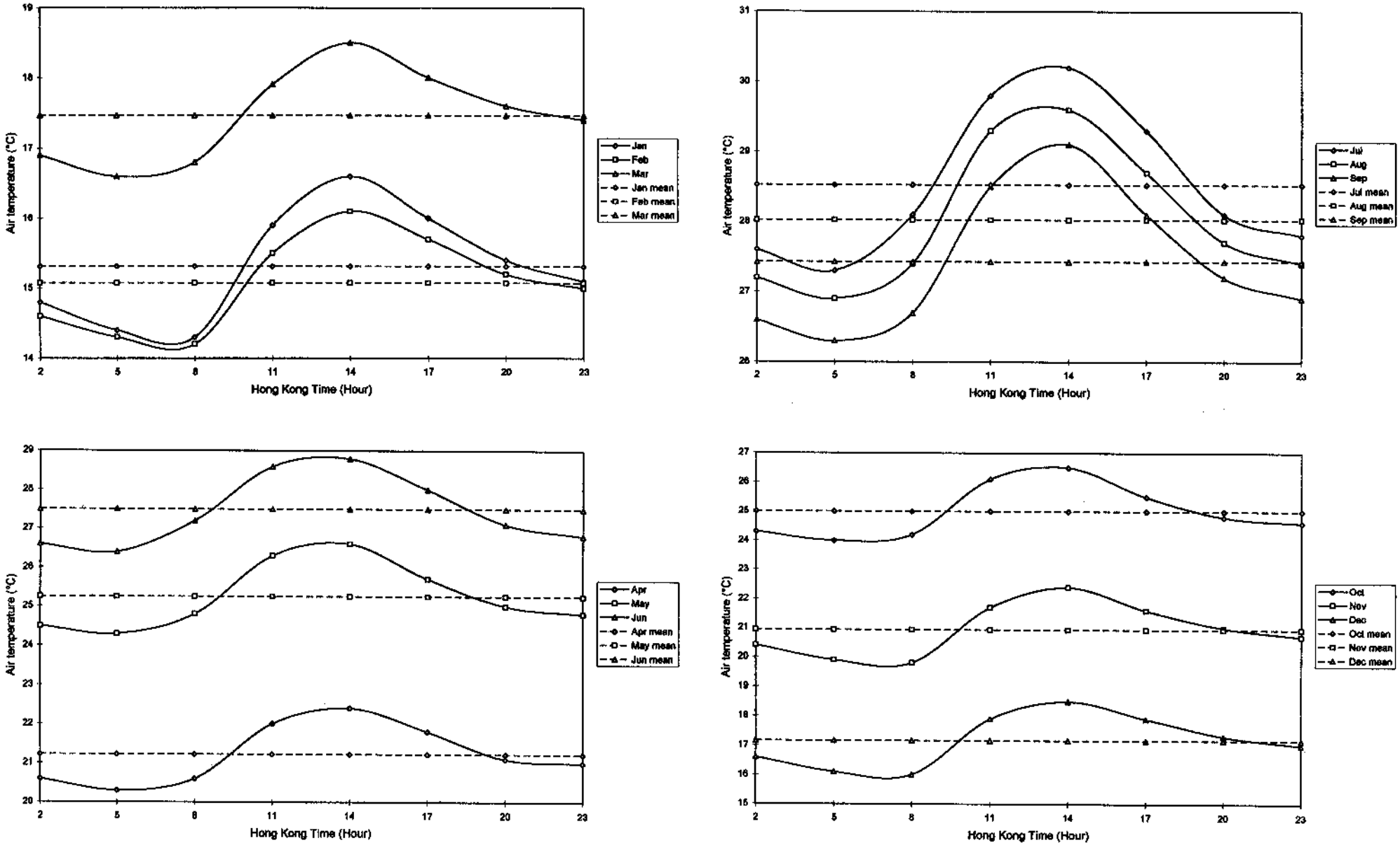


Fig. 9. Diurnal variation of air temperature at Waglan Island, 1968-1988.

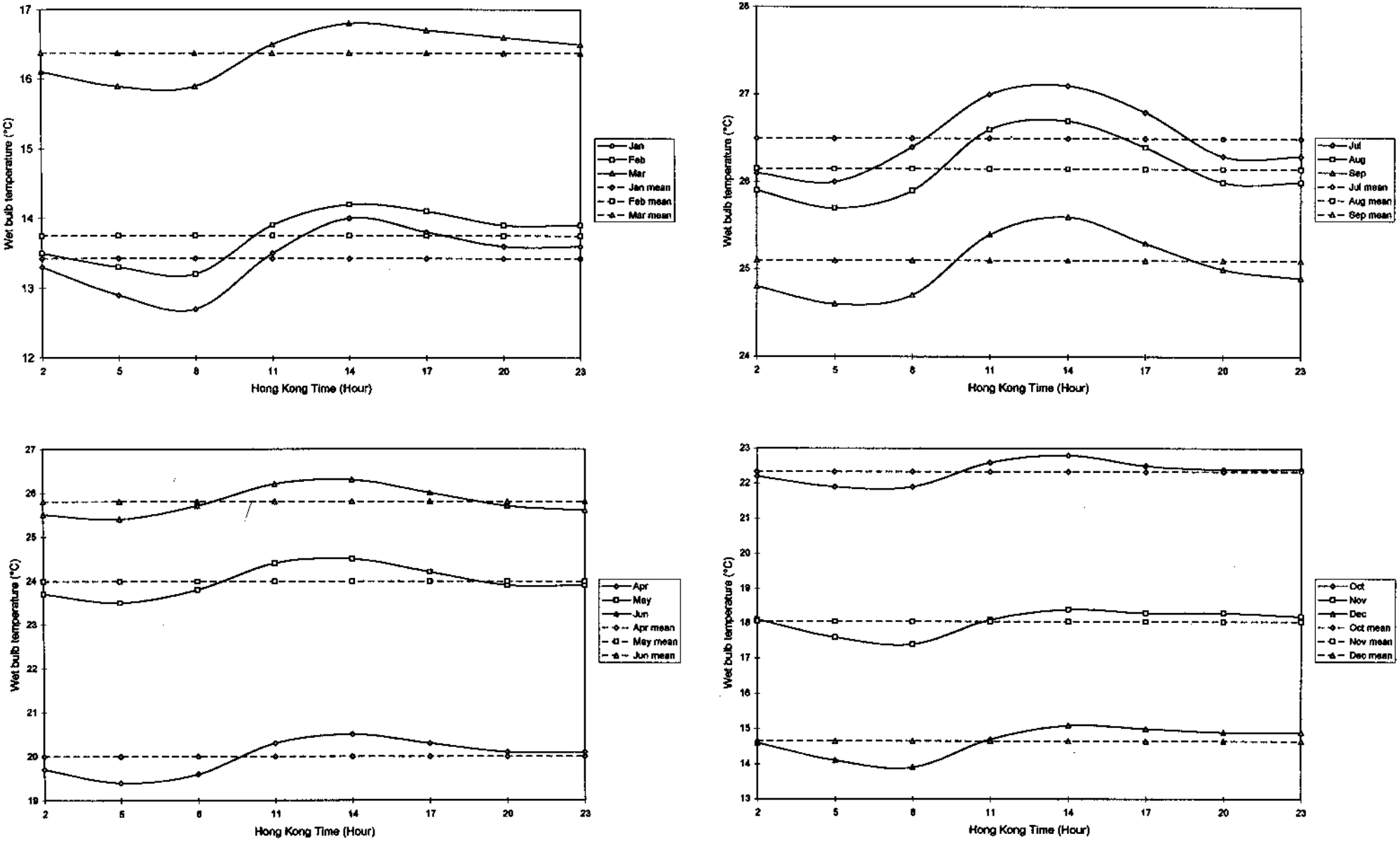


Fig. 10. Diurnal variation of wet bulb temperature at Waglan Island, 1968-1988.

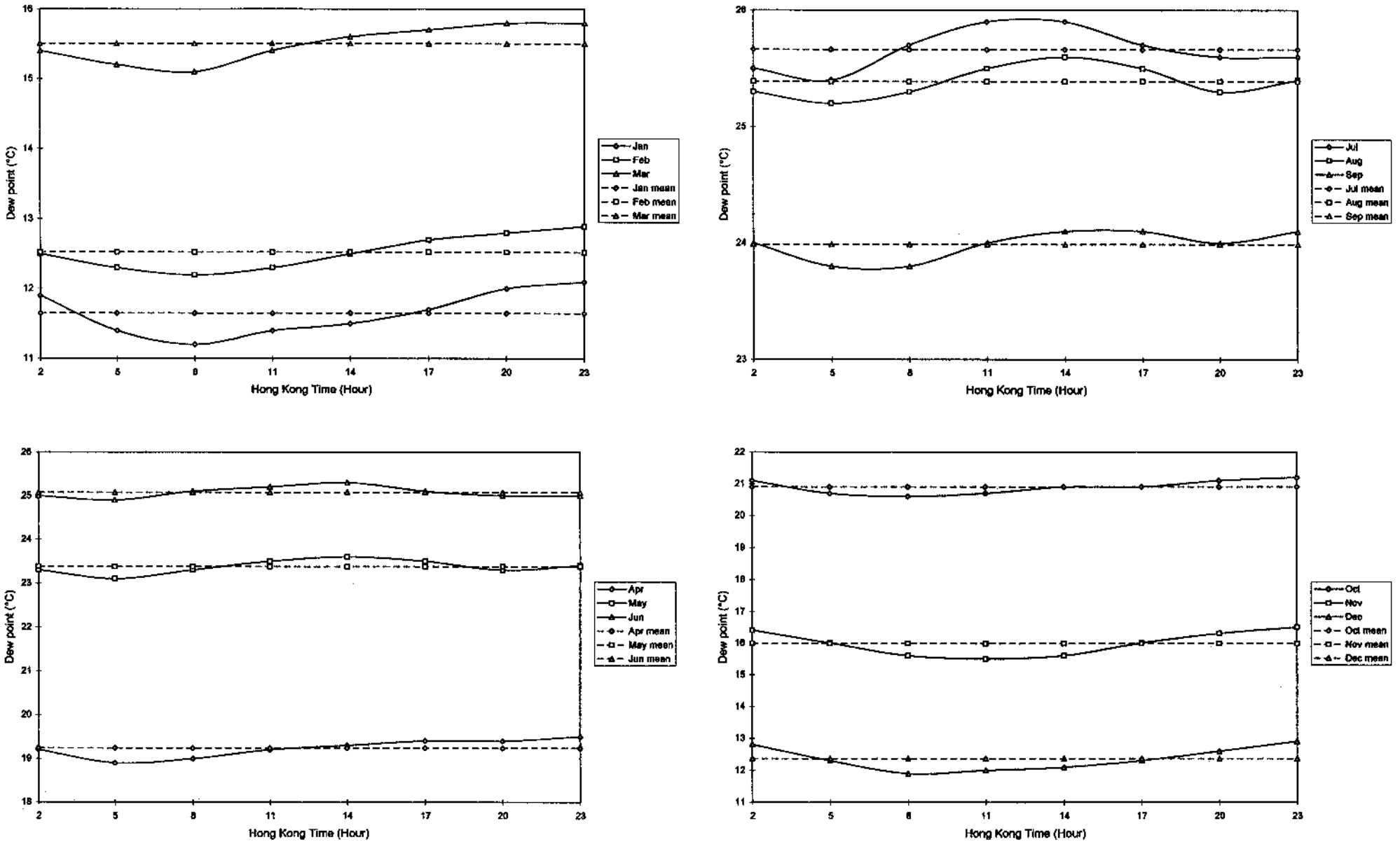


Fig. 11. Diurnal variation of dew point at Waglan Island, 1968-1988.

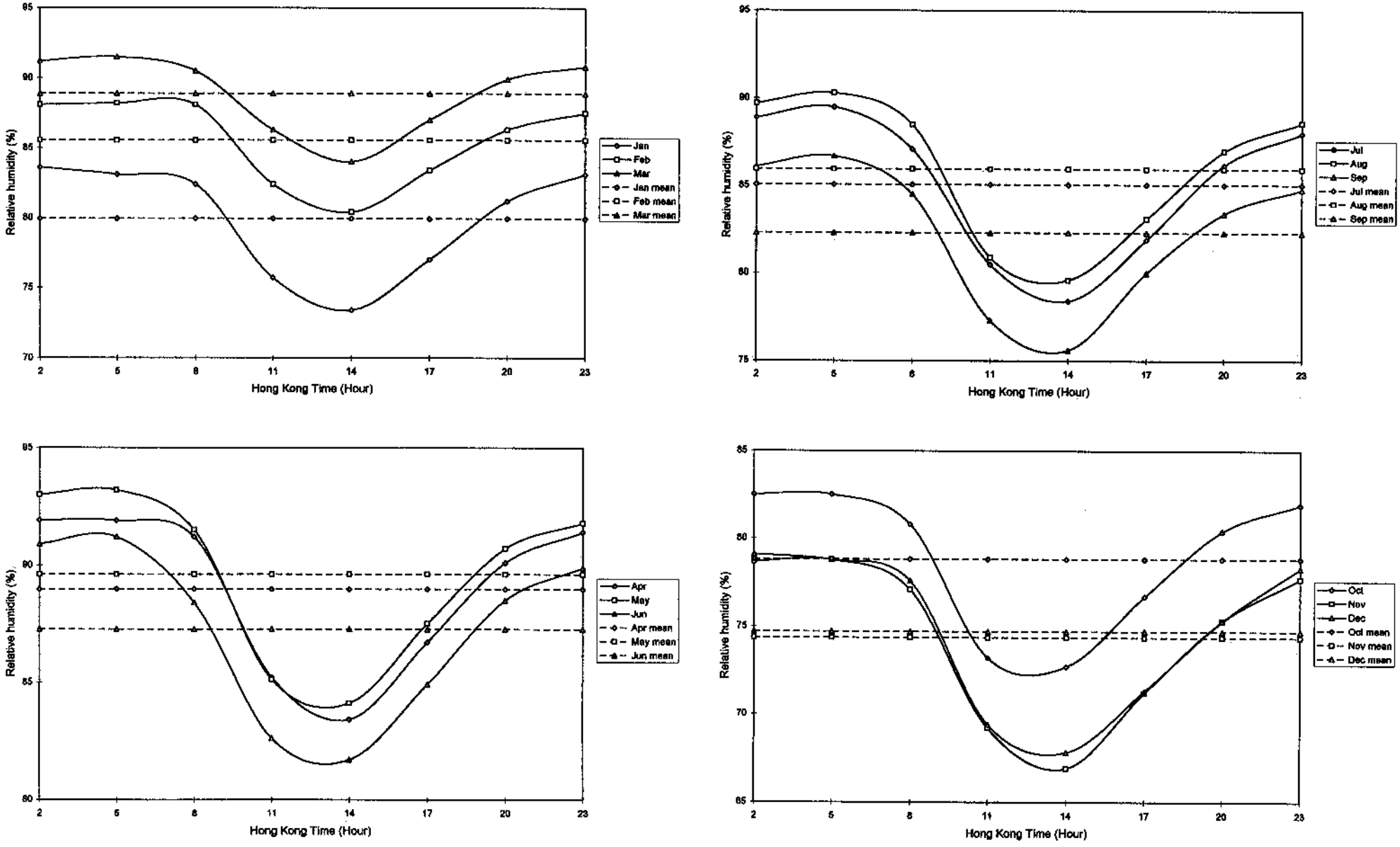


Fig. 12. Diurnal variation of relative humidity at Waglan Island, 1968-1988.

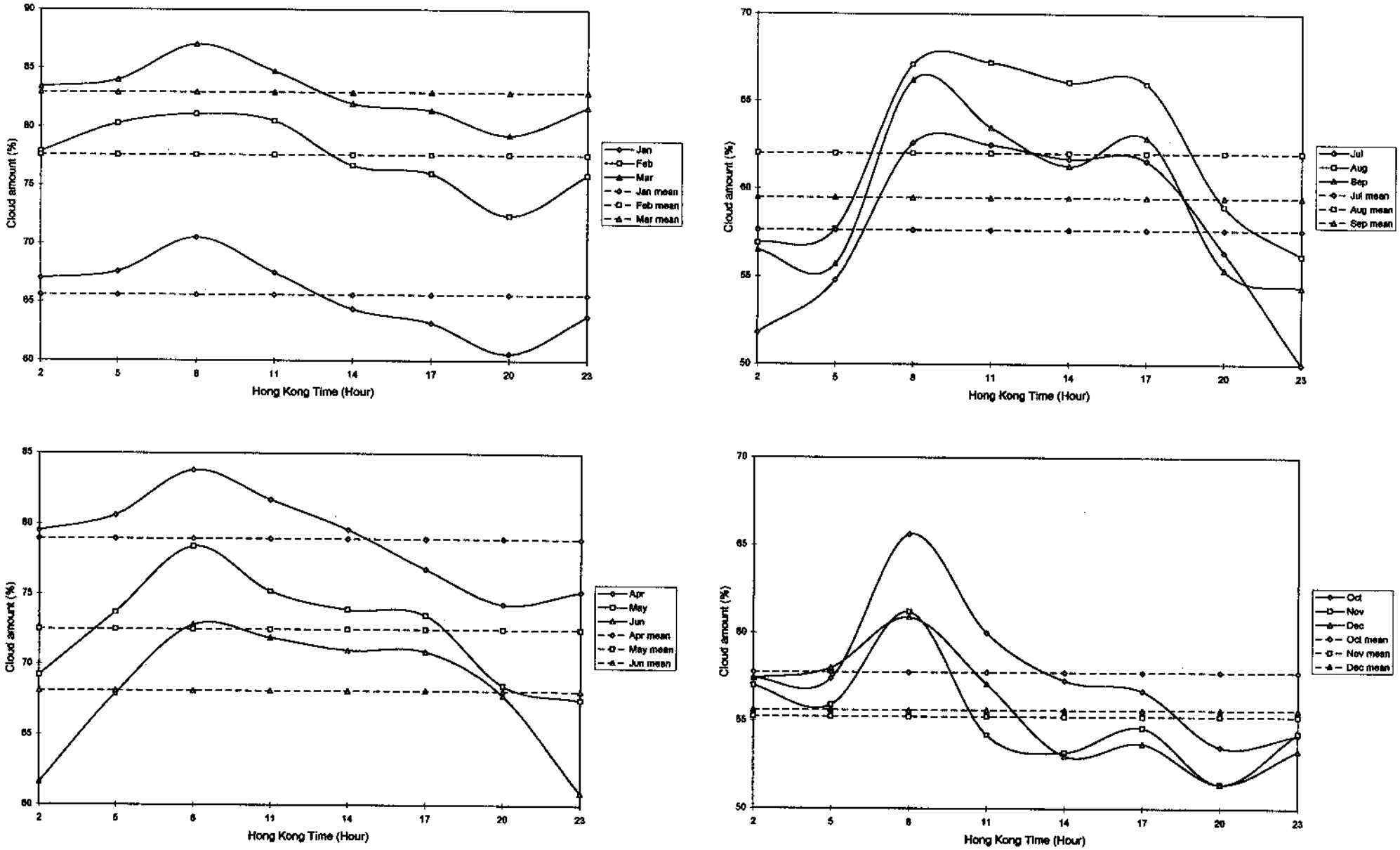


Fig. 13. Diurnal variation of cloud amount at Waglan Island, 1968-1988.

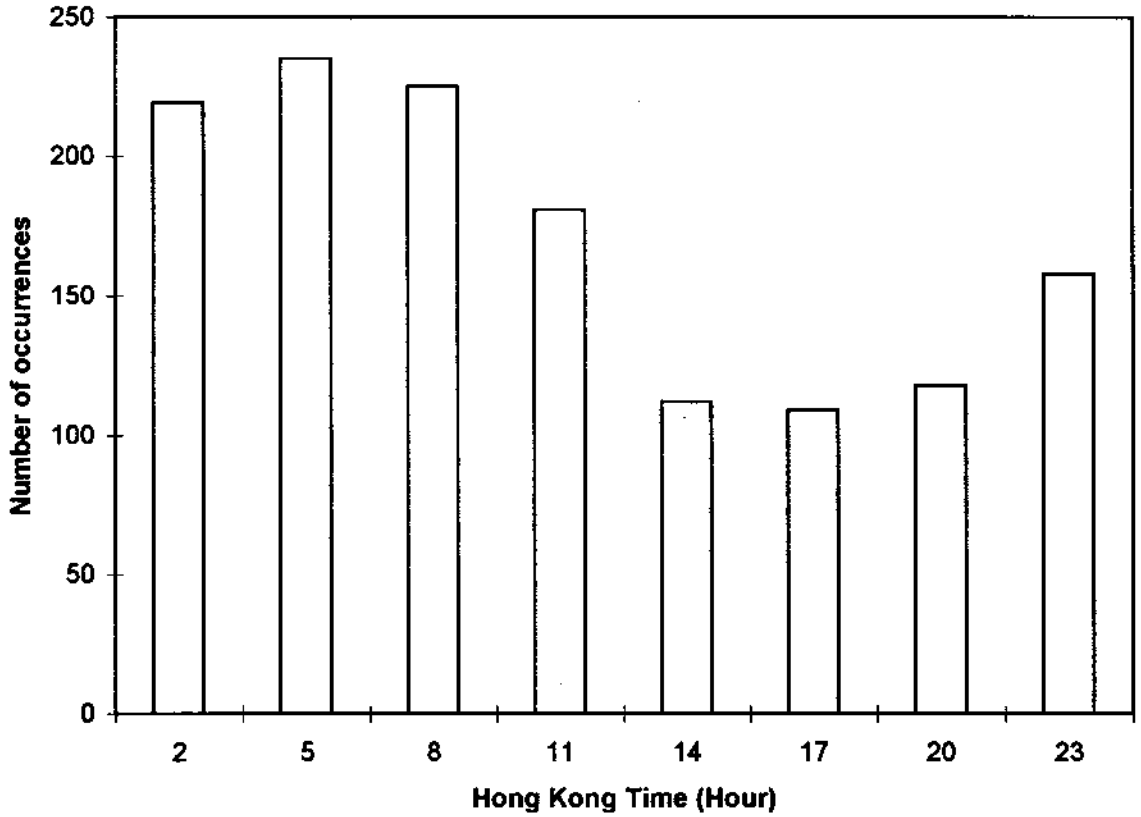


Fig. 14. Diurnal variation of the occurrence of fog at Waglan Island, 1968-1988.

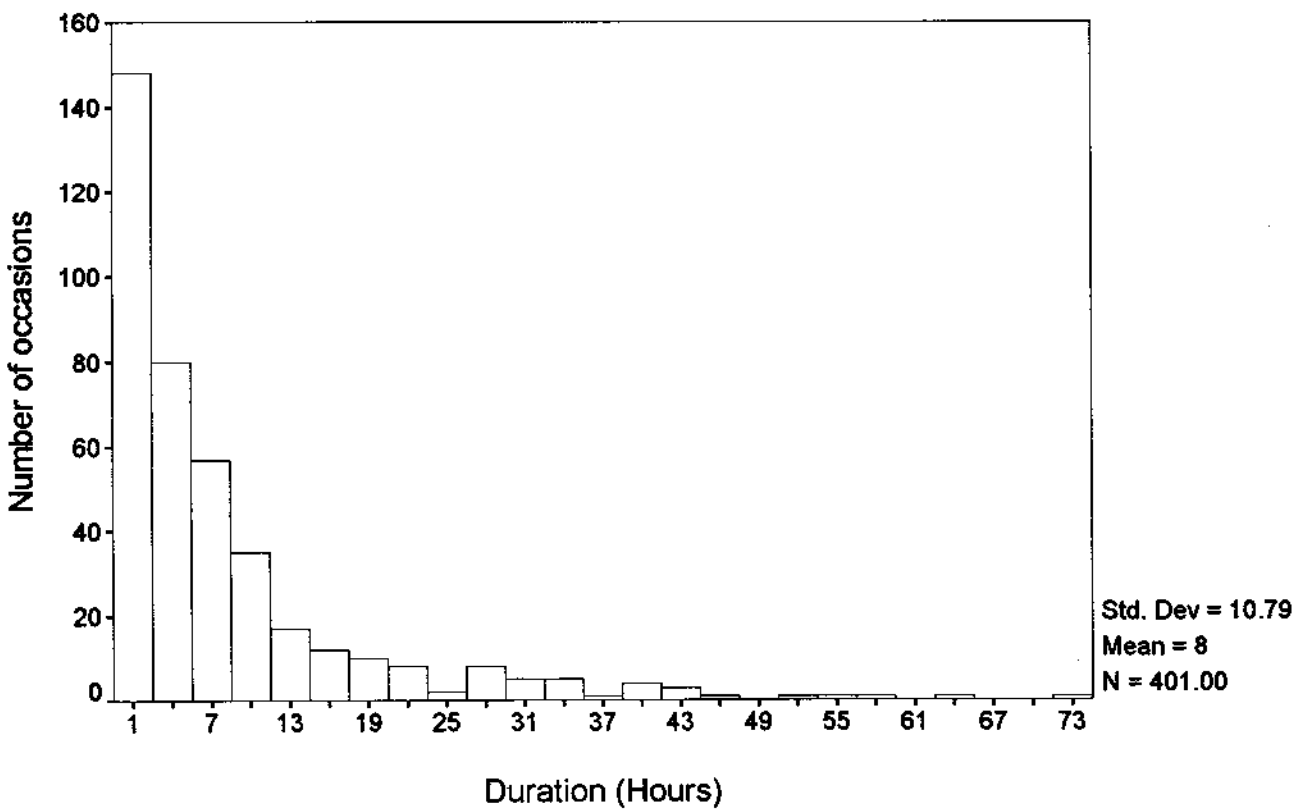


Fig. 15. Frequency distribution of duration of fog at Waglan Island, 1968-1988.

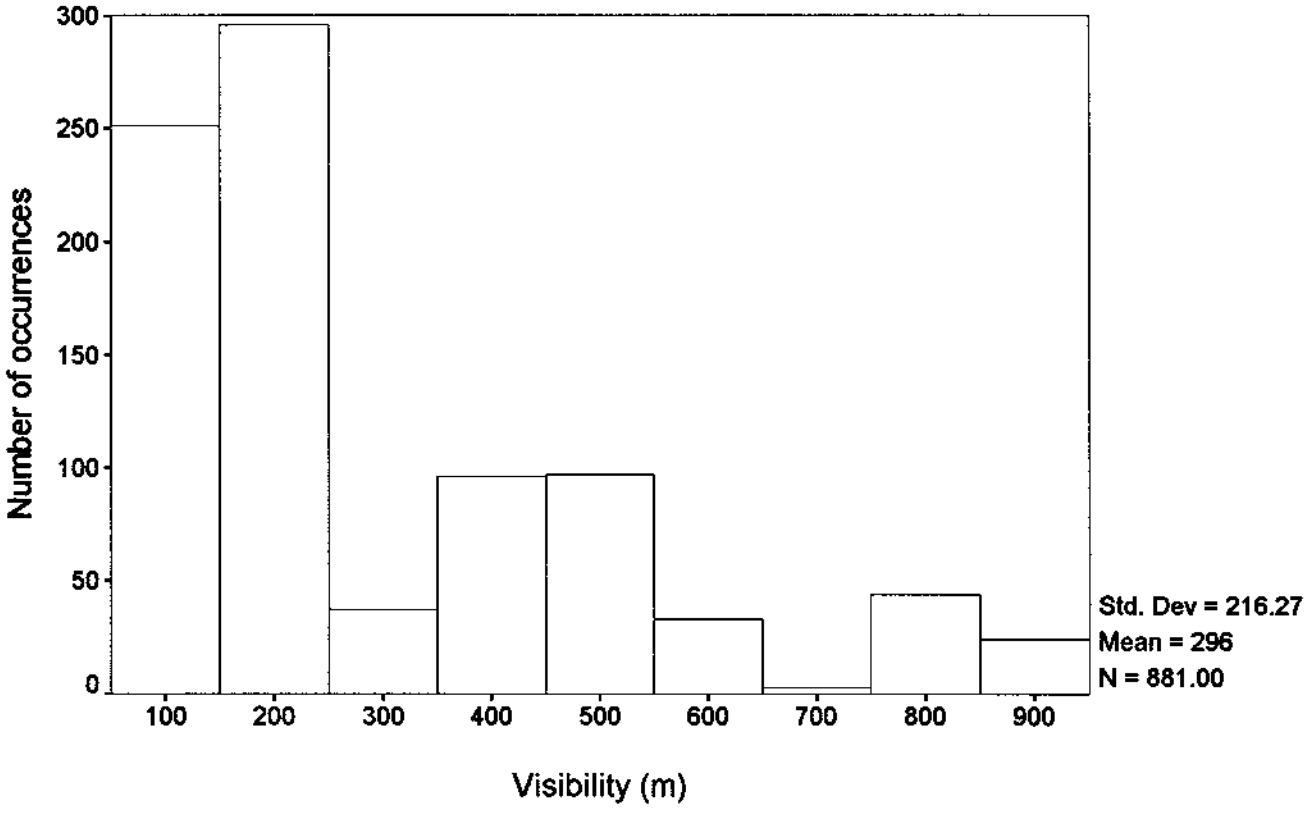


Fig. 16. Frequency distribution of visibility during the occurrence of fog at Waglan Island, 1975-1988.

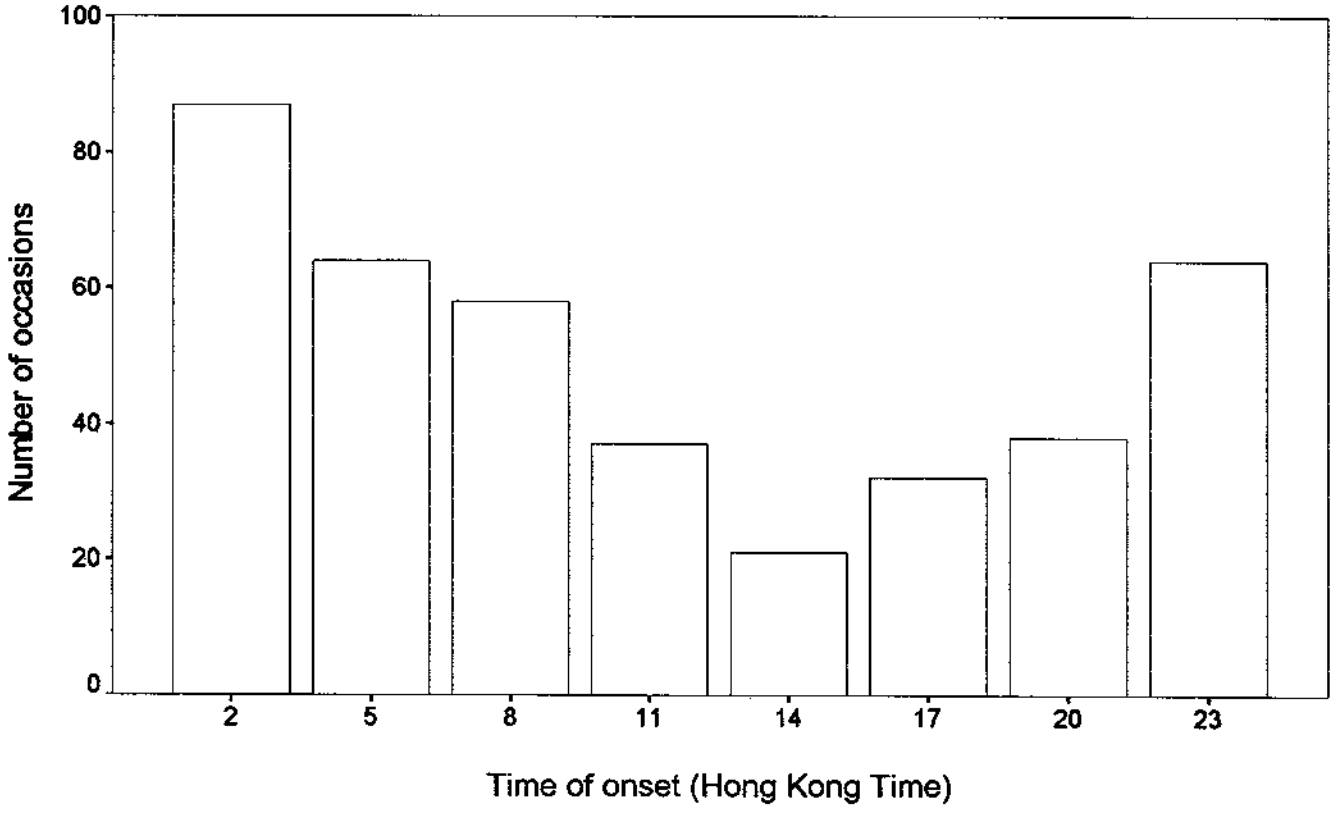


Fig. 17. Frequency distribution of the time of onset of fog at Waglan Island, 1968-1988.

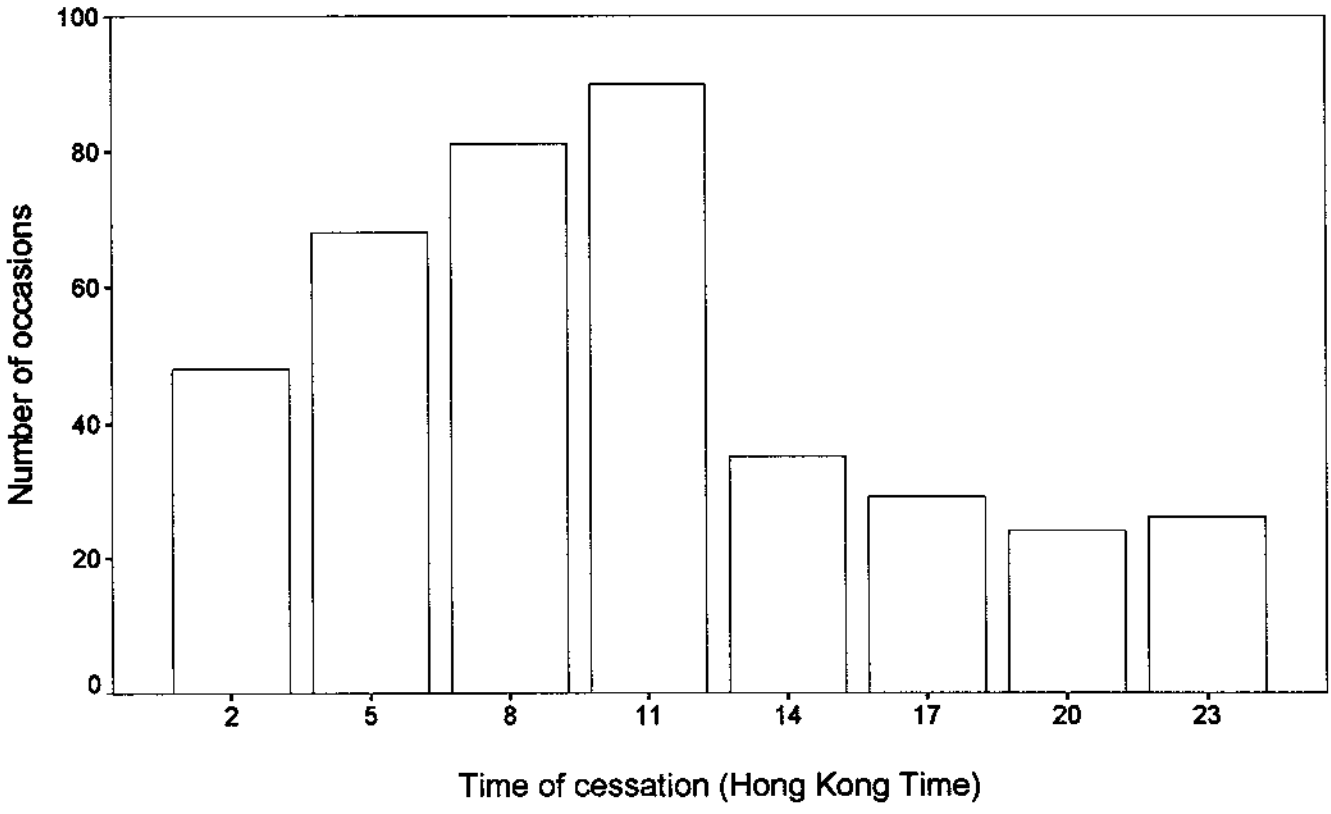


Fig. 18. Frequency distribution of the time of cessation of fog at Waglan Island, 1968-1988.

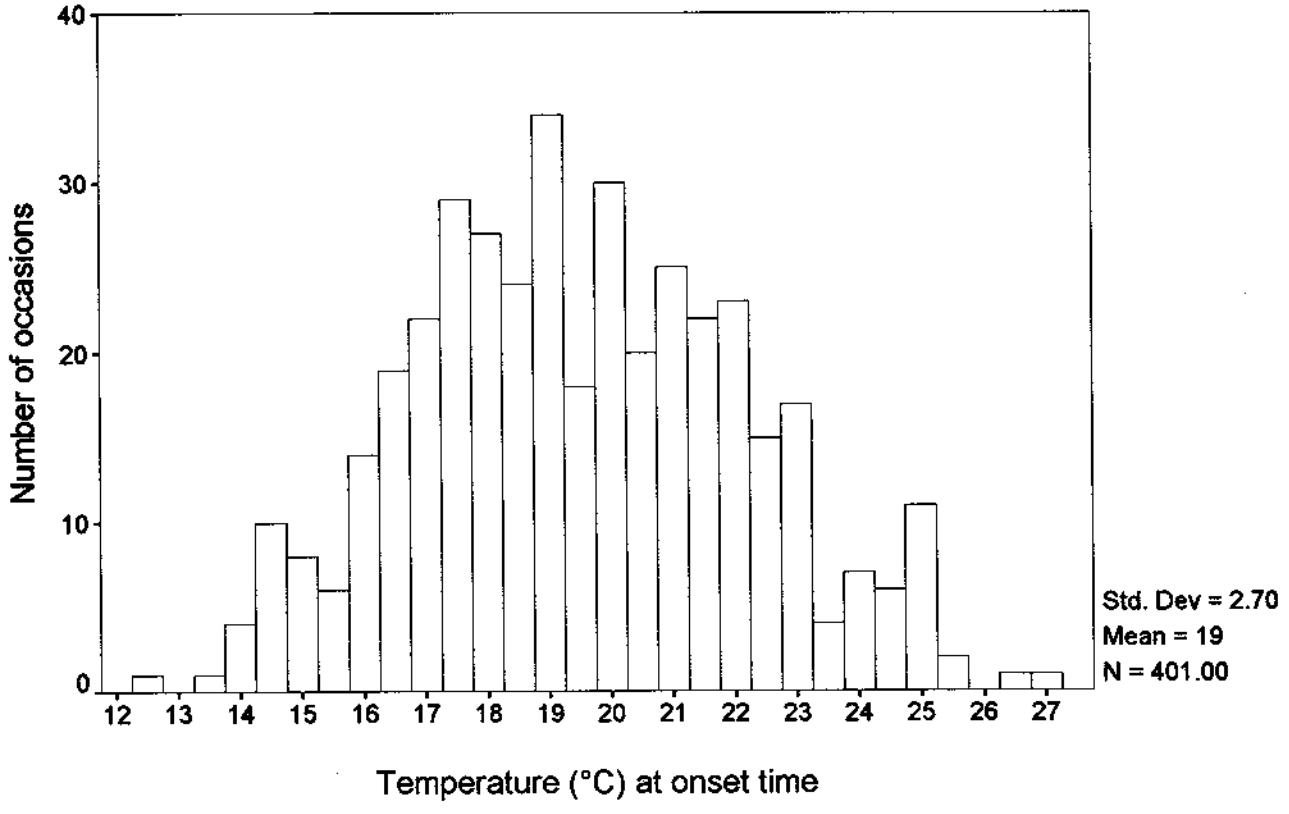


Fig. 19. Frequency distribution of temperature at onset time of fog at Waglan Island, 1968-1988.

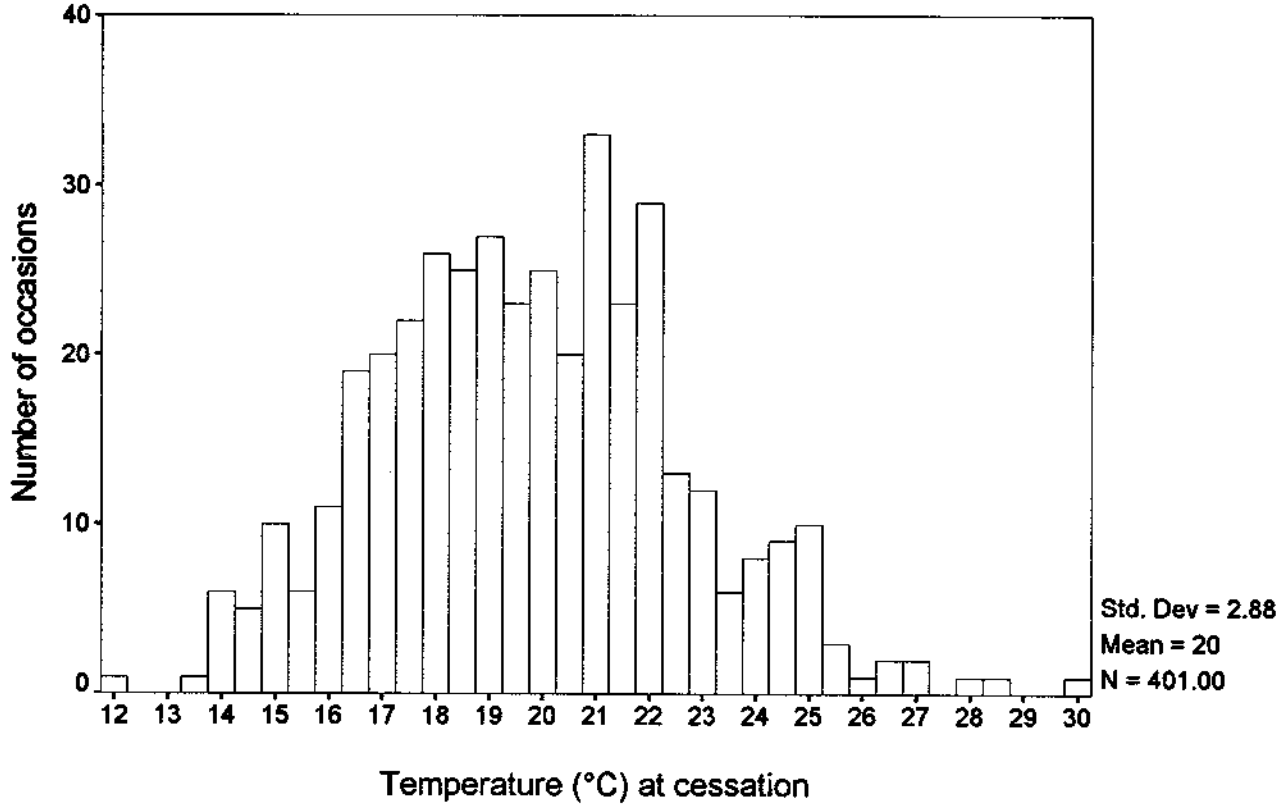


Fig. 20. Frequency distribution of temperature at cessation time of fog at Waglan Island, 1968-1988.

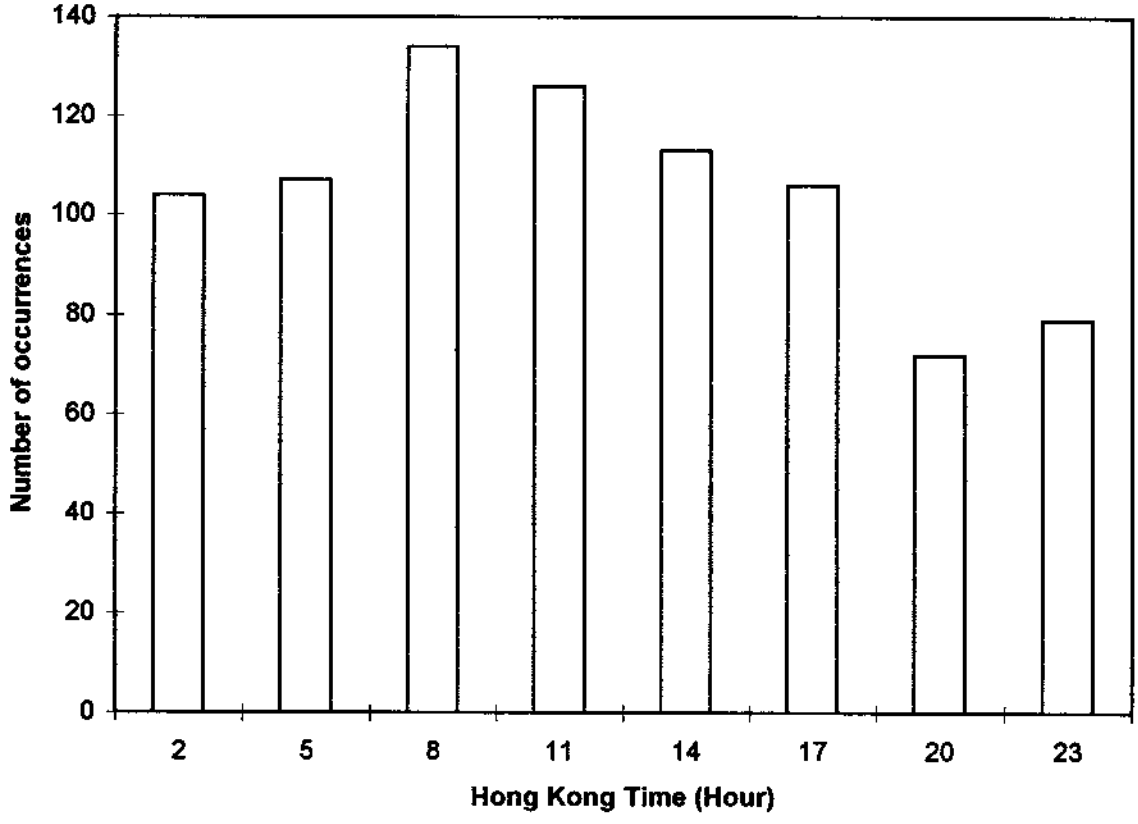


Fig. 21. Diurnal variation of the occurrence of mist at Waglan Island, 1968-1988.

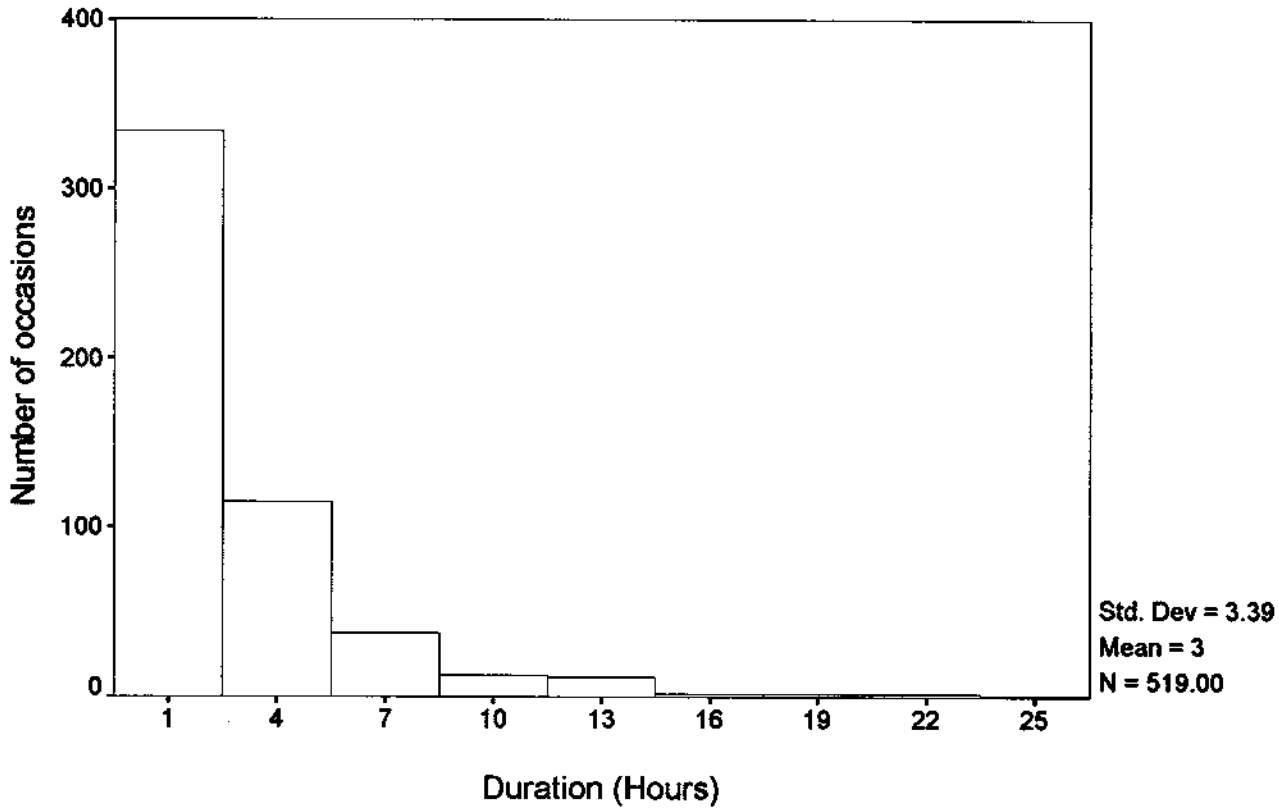


Fig. 22. Frequency distribution of duration of mist at Waglan Island, 1968-1988.

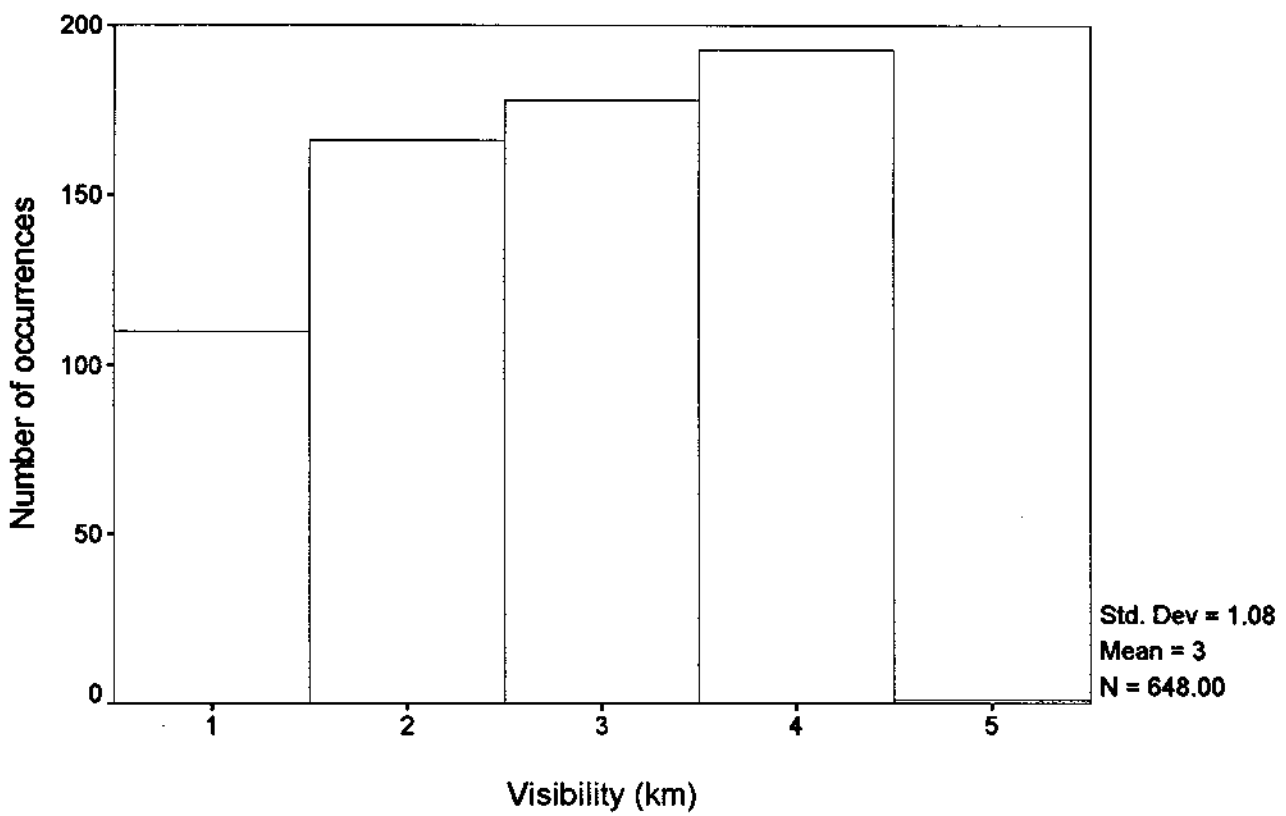


Fig. 23. Frequency distribution of visibility during the occurrence of mist at Waglan Island, 1975-1988.

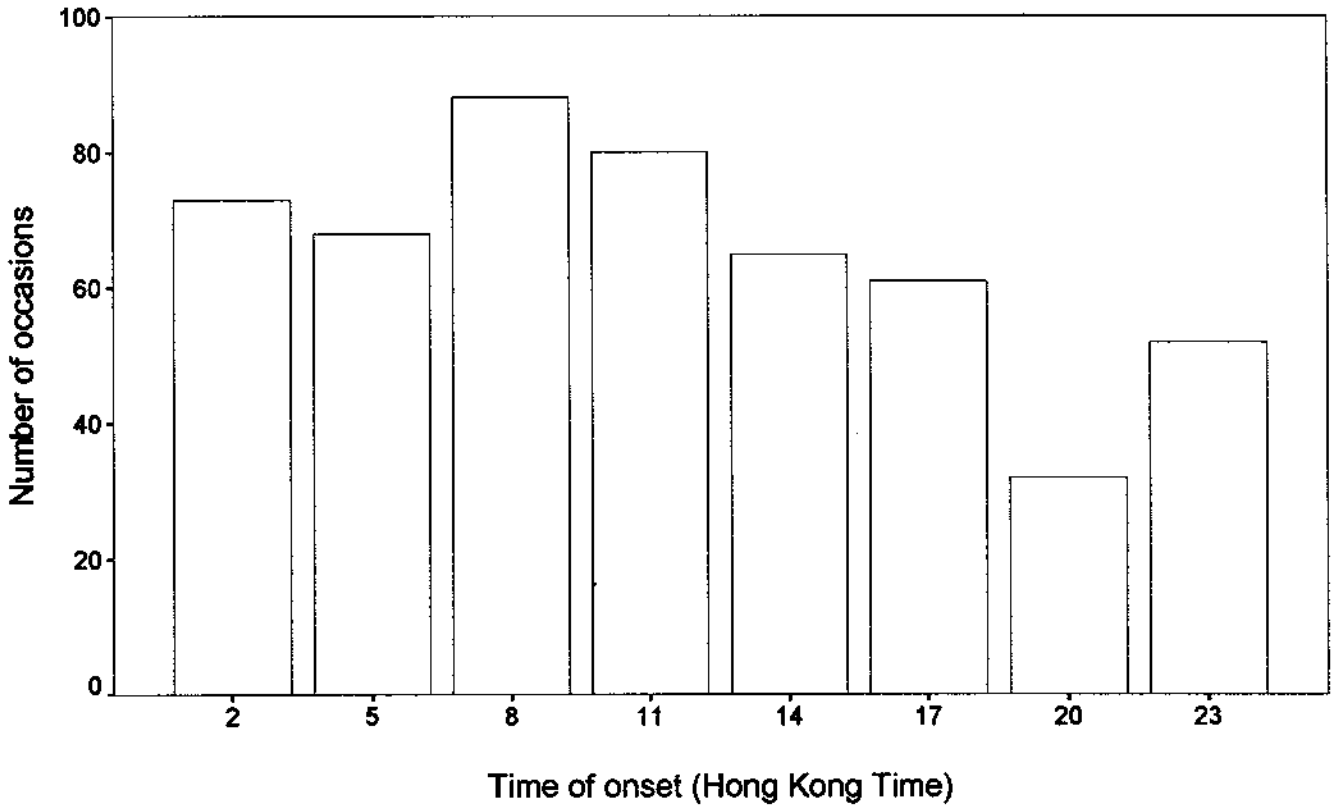


Fig. 24. Frequency distribution of the time of onset of mist at Waglan Island, 1968-1988.

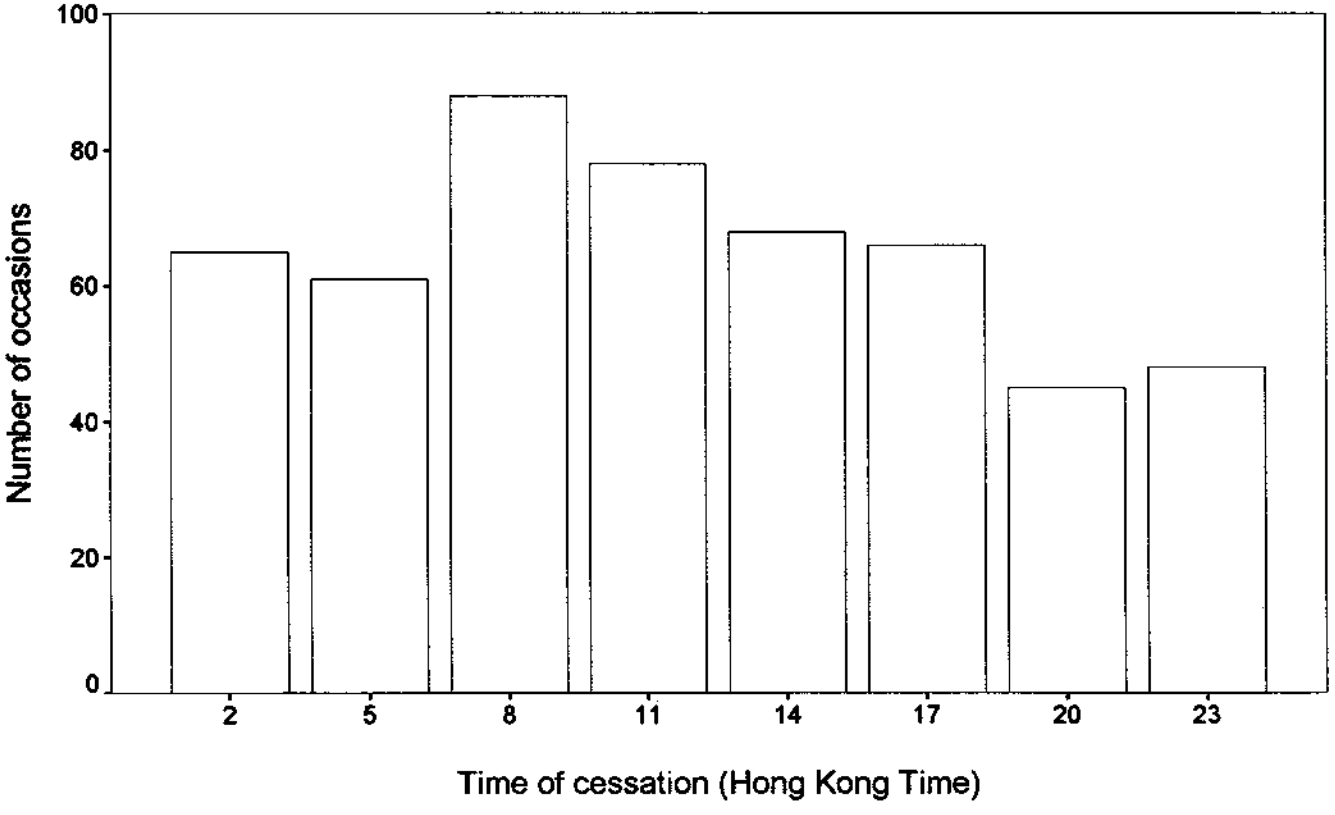


Fig. 25. Frequency distribution of the time of cessation of mist at Waglan Island, 1968-1988.

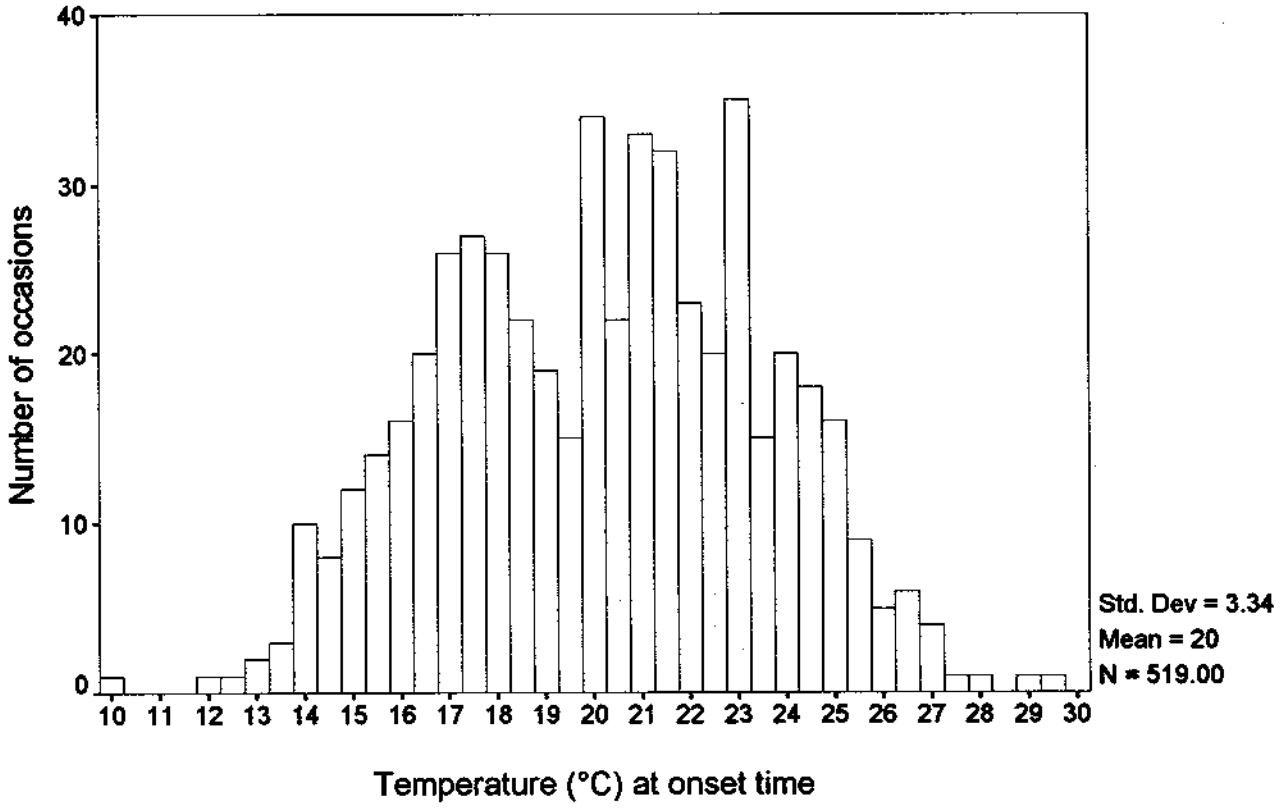


Fig. 26. Frequency distribution of temperature at onset time of mist at Waglan Island, 1968-1988.

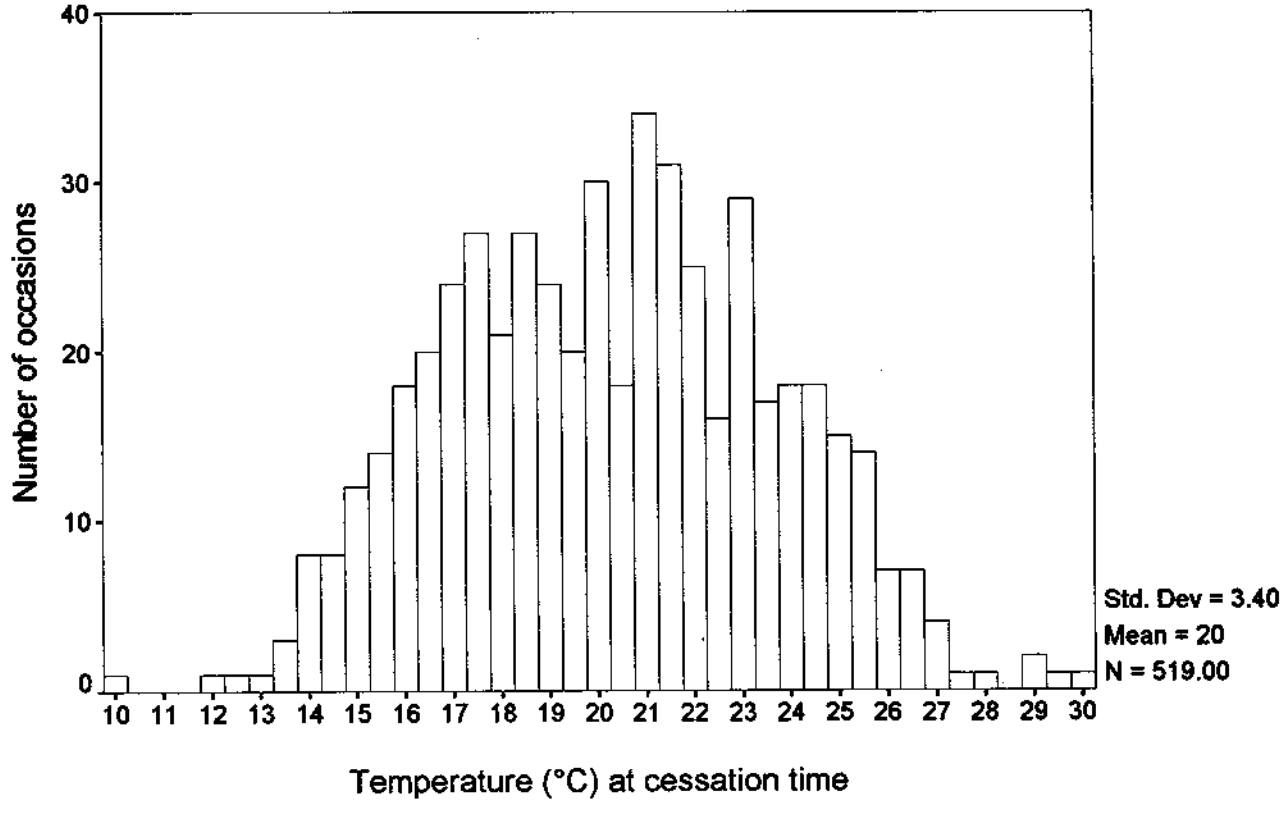


Fig. 27. Frequency distribution of temperature at cessation time of mist at Waglan Island, 1968-1988.

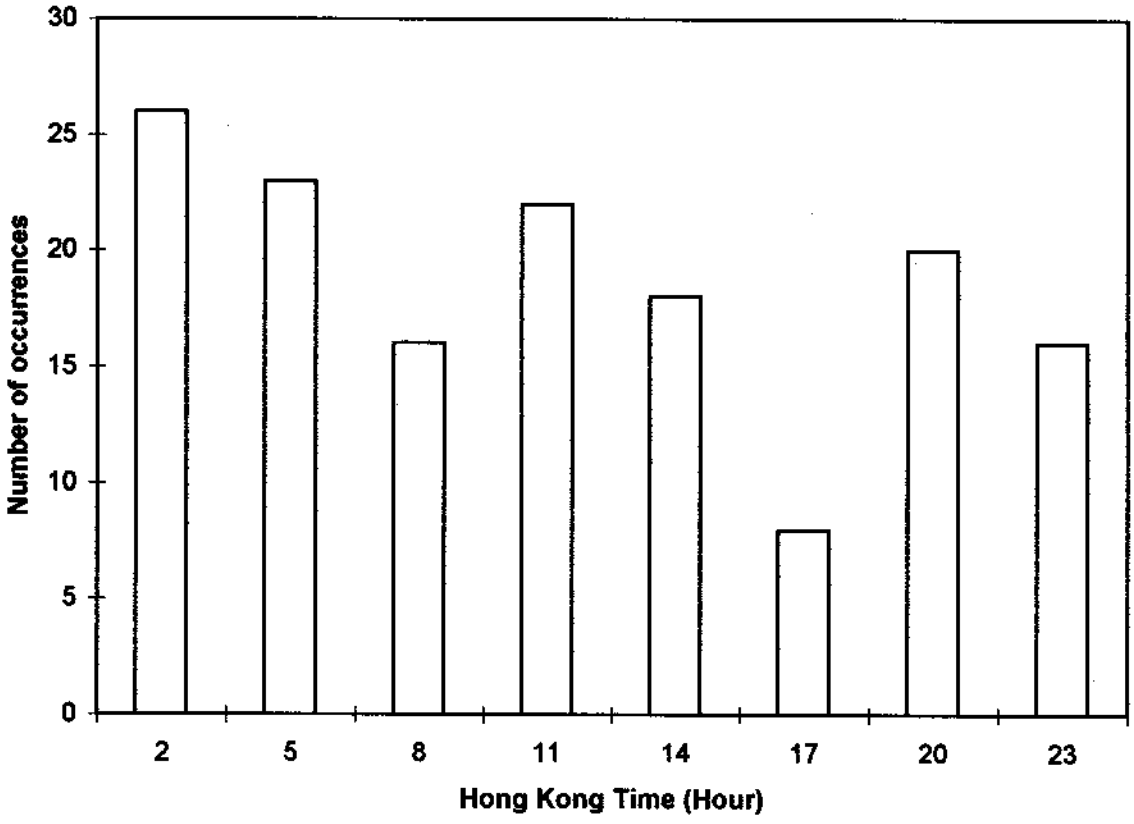


Fig. 28. Diurnal variation of the occurrence of thunderstorm at Waglan Island, 1968-1988.

TABLE 1.

CLIMATOLOGICAL SUMMARY FOR WAGLAN ISLAND, 1968-1988

Month	Mean Sea Level Pressure hPa	Air Temperature #							Wet Bulb Temperature °C	Dew Point °C	Relative Humidity %	Rainfall ##	
		Mean °C	Mean		Absolute Extremes							Total mm	Maximum Daily mm
			Maximum °C	Minimum °C	Maximum °C	Date	Minimum °C	Date					
January	1020.0	15.3	17.9	12.9	26.2	1/1/75	5.0	30/1/80	13.4	11.7	80	12.2	23.5
February	1018.6	15.1	17.4	13.0	26.3	22/2/79	5.3	28/2/86	13.8	12.5	86	28.2	49.2
March	1016.3	17.5	19.7	15.6	28.2	15/3/88	7.3	1/3/76	16.4	15.5	89	65.7	86.6
April	1013.4	21.2	23.7	19.3	32.1	26/4/87	12.2	1/4/80	20.0	19.2	89	124.3	121.0
May	1009.2	25.3	27.4	23.0	35.3	18/5/77	15.0	3/5/81	24.0	23.4	90	247.0	257.5
June	1006.1	27.5	30.0	25.1	36.5	15/6/88	15.6	24/6/84	25.8	25.1	87	244.4	292.5
July	1005.4	28.5	31.3	26.0	36.0	1/7/87	19.6	10/7/86	26.5	25.7	85	191.4	167.1
August	1005.1	28.0	30.9	25.8	36.1	28/8/86	17.0	31/8/76	26.2	25.4	86	249.6	250.5
September	1009.2	27.4	30.2	25.0	35.3	20/9/82	17.1	8/9/83	25.1	24.0	82	142.0	175.3
October	1013.6	25.0	27.6	22.9	34.9	11/10/87	9.7	28/10/78	22.3	20.9	79	50.1	84.7
November	1018.0	20.9	23.4	18.4	30.6	1/11/82	5.9	29/11/87	18.1	16.0	74	22.1	40.0
December	1020.2	17.2	19.6	14.3	31.2	3/12/82	3.8	13/12/75	14.7	12.4	75	16.5	73.5
Year	1012.9	22.4	25.0	20.1	36.5	15/6/88	3.8	13/12/75	20.5	19.3	83	1393.6	292.5

Data period for maximum and minimum temperature 1975-1988
Daily maximum and minimum temperatures refer to the values recorded during the 24-hour period ending at 8 a.m. the next day.

Daily rainfall refers to the 24-hour total ending at 3 p.m. on that day.

TABLE 1. (cont'd)

Month	Cloud Amount %	Prevailing Wind Direction # degrees	Wind Speed # m/s	Maximum Gust m/s	Number of Days with				Number of Days with Rainfall ##					
					Thunderstorm	Fog	Mist	Haze	>=0.1 mm	>=1.0 mm	>=10.0 mm	>=25.0 mm	>=50.0 mm	>=100.0 mm
January	66	080	6.7	22.5	0.10	1.24	1.43	0.14	3.33	2.19	0.43	-	-	-
February	78	080	6.7	27.7	0.19	4.19	3.29	0.29	5.86	3.81	0.71	0.24	-	-
March	83	080	6.3	23.5	0.43	8.00	6.29	0.10	9.52	6.38	1.76	0.62	0.29	-
April	79	080	5.5	24.5	0.95	6.10	6.95	0.19	8.43	6.57	3.19	1.57	0.76	0.10
May	72	090	5.4	29.0	1.38	1.57	2.38	0.24	13.10	10.62	5.76	3.29	1.48	0.29
June	68	090	6.2	35.5	0.71	-	0.19	0.10	14.29	12.19	5.38	2.19	1.10	0.43
July	58	230	5.7	39.0	0.81	-	0.10	-	13.14	10.71	5.14	2.33	0.90	0.19
August	62	090	5.3	55.0	0.81	0.05	-	-	13.67	12.43	5.33	2.71	1.24	0.43
September	59	090	6.1	63.0	0.38	-	-	0.05	11.05	9.05	3.76	1.81	0.48	0.19
October	58	080	7.8	49.0	0.10	-	-	-	5.86	4.57	1.57	0.52	0.05	-
November	55	080	7.4	30.3	-	-	0.05	-	3.38	2.38	0.62	0.19	-	-
December	56	080	7.1	28.6	-	0.33	0.67	-	2.67	1.76	0.33	0.14	0.10	-
Year	66	080	6.3	63.0	5.86	21.48	21.33	1.10	104.29	82.67	34.00	15.62	6.38	1.62

Prevailing wind directions and mean wind speed are computed using 10-minute mean wind data.
Daily rainfall refers to the 24-hour total ending at 3 p.m. on that day.

TABLE 1. (cont'd)

Month	Sea surface temperature (°C)		Number of days with maximum temperature				Number of days with wind force	
	11 a.m.	5 p.m.	>=30°C	>=33°C	>=34°C	>=35°C	Strong or above	Gale or above
January	17.2	17.4	-	-	-	-	2.00	-
February	16.4	16.5	-	-	-	-	2.29	0.05
March	17.4	17.5	-	-	-	-	2.29	-
April	20.3	20.5	0.71	-	-	-	2.24	-
May	24.5	24.6	4.43	0.24	0.05	0.05	1.81	0.10
June	26.7	26.8	10.76	2.10	0.71	0.29	2.24	0.24
July	27.5	27.7	15.95	4.19	1.57	0.10	2.19	0.76
August	27.3	27.4	14.76	3.90	1.52	0.29	2.29	0.48
September	27.6	27.7	11.00	2.05	0.90	0.19	3.95	0.62
October	26.5	26.6	3.24	0.33	0.10	-	5.52	0.81
November	23.4	23.5	0.10	-	-	-	3.48	0.14
December	19.5	19.6	0.05	-	-	-	3.00	0.10
Year	22.9	23.0	61.00	12.81	4.85	0.92	33.30	3.30

Note. Data period for sea surface temperature and maximum temperature 1975-1988

TABLE 2.

HOURLY MEAN OF MEAN SEA LEVEL PRESSURE (hPa) AT WAGLAN ISLAND, 1968-1988

Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0200	1020.1	1018.6	1016.3	1013.3	1009.2	1006.1	1005.4	1005.1	1009.1	1013.4	1017.8	1020.2
0500	1019.6	1018.0	1015.8	1012.8	1008.7	1005.7	1005.0	1004.7	1008.6	1013.0	1017.5	1019.8
0800	1020.8	1019.3	1017.2	1014.2	1009.9	1006.6	1005.9	1005.5	1009.8	1014.3	1018.8	1021.0
1100	1021.7	1020.3	1018.0	1014.9	1010.4	1007.0	1006.3	1006.0	1010.4	1014.9	1019.4	1021.8
1400	1019.3	1018.1	1015.9	1013.3	1009.2	1006.1	1005.4	1004.9	1008.9	1013.0	1017.1	1019.3
1700	1018.7	1017.2	1014.8	1012.1	1008.0	1005.1	1004.4	1004.0	1008.0	1012.5	1016.7	1018.8
2000	1019.8	1018.1	1015.7	1012.9	1008.7	1005.8	1005.0	1004.7	1009.0	1013.6	1017.9	1020.0
2300	1020.4	1019.0	1016.8	1014.0	1009.8	1006.8	1006.1	1005.9	1009.9	1014.3	1018.5	1020.6
Mean	1020.0	1018.6	1016.3	1013.4	1009.2	1006.1	1005.4	1005.1	1009.2	1013.6	1018.0	1020.2

TABLE 3.

HOURLY MEAN OF AIR TEMPERATURE (°C) AT WAGLAN ISLAND, 1968-1988

Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0200	14.8	14.6	16.9	20.6	24.5	26.6	27.6	27.2	26.6	24.3	20.4	16.6
0500	14.4	14.3	16.6	20.3	24.3	26.4	27.3	26.9	26.3	24.0	19.9	16.1
0800	14.3	14.2	16.8	20.6	24.8	27.2	28.1	27.4	26.7	24.2	19.8	16.0
1100	15.9	15.5	17.9	22.0	26.3	28.6	29.8	29.3	28.5	26.1	21.7	17.9
1400	16.6	16.1	18.5	22.4	26.6	28.8	30.2	29.6	29.1	26.5	22.4	18.5
1700	16.0	15.7	18.0	21.8	25.7	28.0	29.3	28.7	28.1	25.5	21.6	17.9
2000	15.4	15.2	17.6	21.1	25.0	27.1	28.1	27.7	27.2	24.8	21.0	17.3
2300	15.1	15.0	17.4	21.0	24.8	26.8	27.8	27.4	26.9	24.6	20.7	17.0
Mean	15.3	15.1	17.5	21.2	25.3	27.5	28.5	28.0	27.4	25.0	20.9	17.2

TABLE 4.

HOURLY MEAN OF WET BULB TEMPERATURE (°C) AT WAGLAN ISLAND, 1968-1988

Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0200	13.3	13.5	16.1	19.7	23.7	25.5	26.1	25.9	24.8	22.2	18.1	14.6
0500	12.9	13.3	15.9	19.4	23.5	25.4	26.0	25.7	24.6	21.9	17.6	14.1
0800	12.7	13.2	15.9	19.6	23.8	25.7	26.4	25.9	24.7	21.9	17.4	13.9
1100	13.5	13.9	16.5	20.3	24.4	26.2	27.0	26.6	25.4	22.6	18.1	14.7
1400	14.0	14.2	16.8	20.5	24.5	26.3	27.1	26.7	25.6	22.8	18.4	15.1
1700	13.8	14.1	16.7	20.3	24.2	26.0	26.8	26.4	25.3	22.5	18.3	15.0
2000	13.6	13.9	16.6	20.1	23.9	25.7	26.3	26.0	25.0	22.4	18.3	14.9
2300	13.6	13.9	16.5	20.1	23.9	25.6	26.3	26.0	24.9	22.4	18.2	14.9
Mean	13.4	13.8	16.4	20.0	24.0	25.8	26.5	26.2	25.1	22.3	18.1	14.7

TABLE 5.

HOURLY MEAN OF DEW POINT (°C) AT WAGLAN ISLAND, 1968-1988

Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0200	11.9	12.5	15.4	19.2	23.3	25.0	25.5	25.3	24.0	21.1	16.4	12.8
0500	11.4	12.3	15.2	18.9	23.1	24.9	25.4	25.2	23.8	20.7	16.0	12.3
0800	11.2	12.2	15.1	19.0	23.3	25.1	25.7	25.3	23.8	20.6	15.6	11.9
1100	11.4	12.3	15.4	19.2	23.5	25.2	25.9	25.5	24.0	20.7	15.5	12.0
1400	11.5	12.5	15.6	19.3	23.6	25.3	25.9	25.6	24.1	20.9	15.6	12.1
1700	11.7	12.7	15.7	19.4	23.5	25.1	25.7	25.5	24.1	20.9	16.0	12.3
2000	12.0	12.8	15.8	19.4	23.3	25.0	25.6	25.3	24.0	21.1	16.3	12.6
2300	12.1	12.9	15.8	19.5	23.4	25.0	25.6	25.4	24.1	21.2	16.5	12.9
Mean	11.7	12.5	15.5	19.2	23.4	25.1	25.7	25.4	24.0	20.9	16.0	12.4

TABLE 6.

HOURLY MEAN OF RELATIVE HUMIDITY (%) AT WAGLAN ISLAND, 1968-1988

Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0200	84	88	91	92	93	91	89	90	86	83	79	79
0500	83	88	92	92	93	91	90	90	87	83	79	79
0800	82	88	91	91	92	88	87	89	85	81	77	78
1100	76	82	86	85	85	83	81	81	77	73	69	69
1400	73	80	84	83	84	82	78	80	76	73	67	68
1700	77	83	87	87	88	85	82	83	80	77	71	71
2000	81	86	90	90	91	89	86	87	83	80	75	75
2300	83	88	91	91	92	90	88	89	85	82	78	78
Mean	80	86	89	89	90	87	85	86	82	79	74	75

TABLE 7.

HOURLY MEAN OF CLOUD AMOUNT (%) AT WAGLAN ISLAND, 1968-1988

Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0200	67	78	83	80	69	62	52	57	57	57	57	57
0500	68	80	84	81	74	68	55	58	56	57	56	58
0800	71	81	87	84	78	73	63	67	66	66	61	61
1100	68	81	85	82	75	72	63	67	64	60	54	57
1400	64	77	82	80	74	71	62	66	61	57	53	53
1700	63	76	81	77	74	71	62	66	63	57	55	54
2000	61	72	79	74	69	68	56	59	55	54	51	51
2300	64	76	82	75	68	61	50	56	54	54	54	53
Mean	66	78	83	79	72	68	58	62	59	58	55	56

TABLE 8.

PERCENTAGE FREQUENCIES OF THE OCCURRENCE OF THE BASE OF THE LOWEST CLOUD LAYER COVERING 5 OKTAS OR MORE OF THE SKY BELOW SPECIFIED VALUES AT WAGLAN ISLAND, 1968-1988

Month	Cloud base (m)									
	<30	<60	<90	<120	<150	<300	<600	<1000	<1500	<2400
Jan					0.0	0.2	4.1	28.1	40.3	41.3
Feb				0.0	0.1	0.6	10.4	41.5	56.3	57.2
Mar			0.0	0.0	0.1	0.3	13.9	49.9	61.8	62.4
Apr			0.0	0.1	0.1	0.4	11.5	45.9	55.1	55.6
May						0.1	10.3	34.7	39.6	39.7
Jun						0.1	5.2	20.6	22.7	22.8
Jul							1.3	10.0	11.3	11.3
Aug							2.2	10.4	11.8	11.8
Sep							1.7	10.5	13.1	13.3
Oct							1.2	12.9	20.0	20.8
Nov							0.9	11.6	21.1	21.8
Dec						0.0	3.1	17.1	25.6	26.7

0.0 indicates less than 0.05

TABLE 9.

PERCENTAGE FREQUENCIES OF THE OCCURRENCE OF THE BASE OF THE LOWEST CLOUD LAYER COVERING 1 OKTA OR MORE OF THE SKY BELOW SPECIFIED VALUES AT WAGLAN ISLAND, 1968-1988

Month	Cloud base (m)									
	<30	<60	<90	<120	<150	<300	<600	<1000	<1500	<2400
Jan			0.1	0.4	1.4	7.0	34.2	83.2	89.5	90.1
Feb			0.2	1.6	5.0	18.9	53.1	88.0	92.1	92.2
Mar			0.2	2.2	7.0	26.3	62.9	85.7	87.3	87.3
Apr		0.1	0.4	2.9	8.8	28.5	66.9	91.2	92.5	92.6
May	0.0	0.0	0.1	1.8	5.1	24.2	76.7	97.1	97.8	97.9
Jun			0.0	0.1	1.0	10.2	69.3	99.3	99.8	99.8
Jul				0.0	0.3	3.0	49.3	98.9	99.6	99.6
Aug		0.0	0.0	0.1	0.6	6.4	52.5	98.4	99.5	99.5
Sep				0.0	0.2	2.8	41.6	96.4	98.4	98.4
Oct						1.8	29.4	92.7	96.9	97.1
Nov						1.7	19.2	86.7	93.3	93.5
Dec				0.3	0.7	4.4	24.1	82.6	90.5	91.0

0.0 indicates less than 0.05

TABLE 10.

MONTHLY PERCENTAGE FREQUENCIES OF VISIBILITY BELOW SPECIFIED VALUES AT WAGLAN ISLAND, 1975-1988

Month	Visibility (m)							
	<100	<200	<400	<800	<1000	<1500	<3000	<8000
Jan		0.0	0.4	0.9	0.9	1.0	1.7	5.9
Feb		1.1	3.0	5.1	5.5	6.3	7.6	18.4
Mar	0.3	4.5	9.4	11.6	12.5	14.4	17.6	34.1
Apr	0.0	1.4	3.7	5.5	6.1	7.3	9.9	28.2
May		0.5	1.3	1.8	2.0	2.4	3.3	13.2
Jun						0.0	0.1	2.7
Jul							0.1	2.1
Aug						0.0	0.0	1.9
Sep							0.1	1.3
Oct								1.1
Nov								0.7
Dec				0.1	0.2	0.4	0.6	3.1

0.0 indicates less than 0.05

TABLE 11.

FREQUENCY DISTRIBUTION OF WIND DIRECTION AND SPEED DURING FOG
AT WAGLAN ISLAND, 1968-1988

Speed (m/s)	Direction in degrees																		
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190
0.3 - 1.5	23	16	30	19	18	12	12	6	13	6	11	6	8	8	7	7	3	7	1
1.6 - 3.3	35	55	38	49	31	19	12	19	13	7	4	5	4	4	5	6	3	4	3
3.4 - 5.4	56	56	50	50	29	26	23	20	16	2	6	0	6	6	5	9	7	1	0
5.5 - 7.9	17	19	26	38	23	18	17	14	9	2	1	2	0	2	2	1	9	2	0
8.0 - 10.7	0	1	2	8	6	5	12	11	2	0	1	0	0	1	1	0	0	0	1
10.8 - 13.8	0	0	0	2	0	0	1	4	1	1	0	0	0	0	0	0	0	0	0
13.9 - 17.1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
17.2 - 20.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.8 - 24.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.5 - 28.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28.5 - 32.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32.7 - 99.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	131	147	146	166	107	80	77	74	54	18	23	13	18	22	20	23	22	14	5

Speed (m/s)	Direction in degrees																		
	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360	Var.	Total
0.3 - 1.5	3	0	2	2	0	2	2	0	1	2	1	1	2	2	2	3	8	0	246
1.6 - 3.3	2	0	1	1	0	0	2	2	0	0	1	0	3	0	2	4	29	0	363
3.4 - 5.4	1	1	0	0	1	0	0	0	2	0	0	0	0	1	0	1	23	0	398
5.5 - 7.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	205
8.0 - 10.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	52
10.8 - 13.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
13.9 - 17.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
17.2 - 20.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.8 - 24.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.5 - 28.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28.5 - 32.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32.7 - 99.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	6	1	3	3	1	2	4	2	3	2	2	1	5	3	4	8	64	0	1274

Number of calm wind occasions = 83
Total number of observations = 1357

TABLE 12.

FREQUENCY DISTRIBUTION OF WIND DIRECTION AND SPEED DURING MIST
AT WAGLAN ISLAND, 1968-1988

Speed (m/s)	Direction in degrees																		
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190
0.3 - 1.5	7	7	4	13	3	7	5	8	13	3	7	4	4	1	3	5	2	3	0
1.6 - 3.3	18	10	20	13	11	7	7	3	6	3	5	3	1	2	8	3	3	2	0
3.4 - 5.4	13	19	25	27	15	7	12	11	11	3	3	3	2	3	6	12	5	5	0
5.5 - 7.9	5	7	15	23	13	19	13	9	8	4	2	2	2	2	7	4	7	8	3
8.0 - 10.7	1	0	1	5	3	12	15	21	19	5	2	0	1	1	0	2	1	2	0
10.8 - 13.8	0	0	0	1	0	2	6	5	10	1	1	0	0	0	0	0	0	0	0
13.9 - 17.1	1	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0
17.2 - 20.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.8 - 24.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.5 - 28.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28.5 - 32.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32.7 - 99.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	45	43	65	82	45	54	58	58	69	19	20	12	10	9	24	26	18	20	3

Speed (m/s)	Direction in degrees																		
	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360	Var.	Total
0.3 - 1.5	2	1	2	2	1	0	2	2	2	1	1	1	0	1	1	3	9	0	130
1.6 - 3.3	1	5	6	2	1	3	0	2	0	0	0	0	1	1	2	2	10	0	161
3.4 - 5.4	0	0	3	2	0	1	0	0	2	0	1	0	0	0	0	5	4	0	200
5.5 - 7.9	1	2	0	1	3	0	1	0	1	1	0	0	0	2	2	3	5	0	175
8.0 - 10.7	0	0	0	0	0	1	1	0	0	0	1	0	0	0	1	3	3	0	101
10.8 - 13.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
13.9 - 17.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
17.2 - 20.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.8 - 24.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.5 - 28.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28.5 - 32.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32.7 - 99.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	4	8	11	7	5	5	4	4	5	2	3	1	1	4	6	16	31	0	797

Number of calm wind occasions = 44
Total number of observations = 841

TABLE 13.

EXTREME VALUES OF TEMPERATURE, RAINFALL AND GUST AT WAGLAN ISLAND, 1968-1988

Rank	Temperature #				Maximum Rainfall ##				Maximum Gust		
	Maximum °C	Date	Minimum °C	Date	Daily mm	Date	Monthly mm	Month	Hourly m/s	Time	
1	36.5	15/6/88	3.8	13/12/75	292.5	17/6/83	688.8	May-82	63.0	03	9/9/83
2	36.1	28/8/86	4.0	14/12/75	257.5	29/5/82	679.2	Jun-72	59.5	05	9/9/83
3	36.0	1/7/87	4.6	15/12/75	254.7	4/6/73	583.3	Jul-87	57.5	02	9/9/83
4	35.7	29/8/86	4.7	28/12/76	250.5	25/8/76	506.1	Aug-88	56.5	04	9/9/83
5	35.6	10/8/83	5.0	30/1/80	210.8	7/6/71	495.4	Jun-83	55.0	14	2/8/79
6	35.6	10/6/88	5.2	23/12/75	191.8	17/6/72	474.7	May-75	54.5	13	2/8/79
7	35.6	14/6/88	5.3	28/2/86	180.7	16/6/72	474.1	Aug-79	54.5	01	9/9/83
8	35.5	13/6/88	5.4	2/2/77	175.3	16/9/84	440.8	Aug-82	50.5	06	9/9/83
9	35.3	18/5/77	5.5	4/1/77	170.0	11/5/81	415.4	Mar-83	49.0	12	14/10/75
10	35.3	16/8/77	5.5	1/2/77	167.1	30/7/87	403.6	Aug-76	48.5	02	17/8/71
11	35.3	20/9/82	5.5	8/2/80	162.6	3/8/70	384.1	Aug-85	48.5	24	8/9/83
12	35.3	31/7/86	5.6	4/2/80	161.8	18/6/83	383.5	May-83	47.0	23	16/8/71
13	35.2	5/9/87	5.6	9/2/80	157.9	31/5/82	367.7	Jun-75	46.5	07	9/9/83
14	35.2	12/9/88	5.7	27/12/76	156.3	16/8/82	363.0	Jun-73	46.0	13	14/10/75
15	35.1	12/8/83	5.9	29/11/87	154.0	18/6/72	348.8	May-81	46.0	12	2/8/79
16	35.1	2/9/86	6.0	29/12/76	142.9	17/8/82	341.1	Jun-71	44.5	09	9/9/83
17	35.1	30/6/87	6.0	17/1/78	139.2	26/8/85	336.7	Sep-84	44.0	14	21/8/68
18	35.0	28/6/83	6.0	30/12/83	137.9	23/8/74	327.0	Apr-82	44.0	08	9/9/83
19	35.0	3/8/86	6.1	29/12/83	134.9	18/8/79	320.7	Sep-82	43.0	10	9/9/83
20	34.9	27/8/80	6.2	7/2/84	131.0	13/7/75	307.6	May-77	42.0	11	14/10/75
*	35.2	26/5/76	4.3	14/12/75	346.7	17/6/83	872.0	Aug-82	62.0	01	17/8/71

Data period 1975-1988
Daily maximum and minimum temperatures at Waglan Island refer to the values recorded during the 24-hour period ending at 8 a.m. the next day.

Daily rainfall at Waglan Island refers to the 24-hour total ending at 3 p.m. on that day.

* Extreme values recorded at the Hong Kong Observatory within the same period