TN 063

ROYAL OBSERVATORY, HONG KONG

WIND, VISIBILITY, SEA AND SWELL OVER COASTAL WATERS OF WESTERN GUANGDONG (KWANGTUNG)

1961-1970

by

LAM Chiu Ying

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SUMMARY

Based on weather observations made by voluntary observers aboard ships during 1961-70, climatological information on wind, visibility, sea and swell conditions over the coastal waters of western Guangdong (Kwangtung) is presented. The sea area covered is bounded by longitudes 110°E and 114°E and north of 20°N.

The area is very much influenced by the monsoons. There is a major peak in the wind speed and in the heights of sea and swell in November associated with the winter monsoon. Minor peaks also appear in February and July, the latter one being associated with the summer monsoon. The results show that, in winter, swells tend to be higher in western Guangdong when compared with those in eastern Guangdong probably because of the longer fetch to the east and east-northeast.

The frequency of reduced visibility is highest in April associated with mist and fog. However, the occurrence of mist and fog is less frequent than in eastern Guangdong.

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1. INTRODUCTION

There has been a significant increase in the activity taking place in coastal waters in the past few years. This is the consequence of a greater awareness of the vast resources that are available in the continental shelves. In the South China Sea, oil has been discovered at several sites while prospecting is taking place in other coastal areas(Lauriat, 1979).

Field surveys during the exploratory stage and the operation of oil-drilling platforms during the production stage are both weather-dependent. For example, delays of up to three months in the completion of seismic surveys off the coast of southern China due to strong monsoon winds were reported during the winter of 1979-80 (Liu, 1980). It is anticipated that in the next few years, there will be an increased demand for the provision of meteorological services to support these activities.

This note is intended to provide climatological information on wind, visibility, sea and swell off the coast of western Guangdong based on 1961-70 data. It is a complement to Lam (1979) which covers the coastal waters of eastern Guangdong.

2. PROCEDURE

(a) Source of data

Weather observations made by voluntary observers aboard ships are recorded in logbooks. They are later punched onto cards by various national meteorological services and despatched to the "responsible members" of the Marine Climatological Summaries Scheme (WMO, 1977). Hong Kong is the responsible member for the South China Sea area bounded by longitudes 100°E and 120°E and by latitudes 0° and 25°N. All cards received are transferred onto magnetic tapes. These form the basic data set for the preparation of marine climatological summaries.

Information on wind, visibility, sea and swell was extracted from the basic data set for this study. Since there were less data prior to 1961, the ten-year period 1961-70 was chosen, and observations made within the area bounded by longitudes 110°E and 114°E and between 20°N and the coast of western Gunagdong were analysed. Figure 1 shows the area under study.

(b) Analysis of data

Monthly and annual tables of wind observations classified according to wind direction and wind force in the Beaufort scale were computed and are given in tables 1-13.

Observers aboard ships report sea and swell separately whenever it is possible to make a distinction between the two. "Sea" refers to waves raised by the wind blowing at the point of observation. Its direction is the same as that of the wind so that it is not given in the International Maritime Meteorological Punch Card (IMMPC) code. Only heights are observed and recorded. "Swell" refers to a wave system observed at a point remote from the winds which produced the waves or observed when the winds which generated the waves have died down. Both heights and periods of swell are observed and recorded.

There are several ways of presenting statistical information on the state of the sea. One way is to analyse the "sea" and "swell" separately. Another procedure is to select the group of "sea" or "swell" with the greater height (or greater period when the heights are equal). The latter procedure was, for example, adopted by Hogben and Lumb (1967). However, this involves discarding part of the available information so the first procedure was adopted for the present study.

An analysis of the "sea", that is, locally wind-driven waves, gives the frequency distribution of waves in different height intervals (table 14). For swells, frequency tables were prepared for different swell directions (table 15-28). The monthly frequency distribution of swells in different height intervals is given in each of these tables.

Visibility reports made by marine observers follow a WMO code which is given in table 29. A table giving monthly frequency distribution of different visibility ranges was prepared (table 30).

3. DISCUSSIONS

(a) Wind

The sea area examined in this report is situated on the southeastern edge of the Asia continent. It is therefore affected by the monsoons. Table 1 shows that there is a modal peak in the 050° - 070° direction sector, which is related to the winter monsoon. Another modal peak, which is less well-defined, occurs in the 170° - 190° secter. This is related to the summer monsoon.

In going through tables 2-13, it will be noticed that 050° - 070° is the preferred wind direction during most of the year apart from June, July and August when southerly or southwesterly winds (170° - 190° or 200° - 220°) are more frequent. The modal wind speeds show some interesting features. The maximum value occurs in November with a modal speed of force 5. As in the case of eastern Guangdong, there is also a seconday maximum of force 4-5 in February. Two minima occur in May and August with modal speeds of force 3. These coincide with the periods when trough situations (type T pattern) are most frequent in this area (Heywood, 1953). In between these minima, there is a minor peak in the wind speed in July associated with the summer monsoon.

(b) Sea and swell

Table 14 shows that like the winds, higher waves occur during the winter months. The following figures confirm this.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
% of reports ≥ 2 metres	24	25	17	14	10	4	15	7	12	28	37	28

The peak frequency of 37% in November and the secondary peak of 25% in February are related to the generally higher wind speeds in these months. A minor peak occurs in July related to the summer monsoon. In Lam (1979), it was shown that, when waves higher than or equal to 5 metres are considered, there was a peak in September. No such pattern appears in the present set of data, mainly because the number of such reports is very small (only 14).

Tables 15-28 show that the monsoons have significant influence on the directions of swells observed at different times of the year. In the months October to April, the most frequent swell direction is from 050° - 070°. In the months June to August, the preferred direction is 170° - 190°. May is a transition period with two modal directions: 080° - 100° and 200° - 220°. September is also a transition period with two modal directions : 050° - 070° and 170° - 190°. The percentage of reports of swell with heights exceeding or equal to 2 metres are :

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
% of reports ≥ 2 metres	52	48	46	31	30	13	31	24	35	55	71	63

A major peak occurs in November. There is no secondary peak in February. Instead one appears in July probably associated with the prevailing southerly winds which have a long fetch over the South China Sea. On comparing these results with those of the coastal waters of eastern Guangdong, the frequency of higher swells is relatively higher during the winter months. It is thought that this may be a result of the longer fetch to the east and east-northeast compared with that available to the coastal waters of eastern Guangdong.

(c) Visibility

Table 30 shows that April is the month with the highest frequency of reduced visibility. This is readily borne out by the following figures:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
% of reports < 2 km	0.6	0.3	0.9	1.5	0.3	0.0	0.6	0.5	0.0	0.3	0.0	0.0
% of reports < 10 km	5.2	5.9	9.2	12.7	6.3	2.6	4.3	3.1	5.8	6.3	3.7	3.1

The peak in April is related to the occurrence of fog and mist when warm moist air with a long sea track from the Pacific reaches the cool coastal waters off the south China coast. Compared with similar figures for the coastal waters of eastern Guangdong, it appears that the frequency of fog is relatively lower over the coastal waters of western Guangdong. This is probably due to the smaller gradient of the sea surface temperature west of the Zhu Jiang eastuary (Wong, 1979).

4. CONCLUSIONS

Data on the climatological conditions off the coast of western Guangdong have been presented and discussed. It is shown that this area is very much influenced by the monsoons.

Judging from the wind statistics, the northeast monsoon is dominant from September to May. Winds are strongest in November but there is a secondary peak in wind speed in February. From June to August, the area is under the influence of the summer monsoon. Winds tend to be lightest during the transition months, May and August, when surface troughs frequently occur in the area.

The seasonal variation of sea waves follows closely that of winds. The sea is roughest in November. The statistics also shows minor peaks of wave heights in February and July.

Swell conditions are closely related to the prevailing wind. In winter, because of the longer fetch to the east and east-northeast, swells tend to be higher than those observed over the coastal waters of eastern Guangdong. Some higher swells are also present in summer, mainly in July, when winds are southerly and there is a long fetch over the South China Sea.

Visibility conditions are worst in April due to mist and fog. However, the frequency of low visibility conditions is significantly less than that over the coastal waters of eastern Guangdong.

REFERENCES

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TABLE 1. FREQUENCY OF WIND OBSERVATIONS IN DIFFERENT SPEED AND DIRECTION CLASSES - ALL MONTHS

			DIRECTION IN TENS OF DEGREES											
FORCE	CALM	VARIABLE	35-01	02-04	05-07	08-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	NO.OF OBS
0	180														180
1		37	8	25	30	41	28	38	33	34	14	5	9	5	307
2		16	22	71	147	136	106	110	137	67	47	20	12	14	905
3		3	43	179	365	306	199	185	195	162	91	25	33	25	1811
4		0	71	330	651	351	125	89	155	158	74	27	29	29	2089
5		0	38	327	592	183	28	28	57	59	31	12	6	12	1373
6		0	24	208	305	44	7	9	10	10	11	3	9	6	646
7		0	16	65	53	7	1	1	1	1	3	1	0	5	154
8		0	4	28	20	1	0	0	0	0	3	2	0	2	60
9		0	1	1	0	0	0	0	0	1	0	0	0	0	3
10		0	0	0	1	0	0	0	0	0	0	0	0	0	1
11		0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO.OF OBS	180	56	227	1234	2164	1069	494	460	588	492	274	95	98	98	7529

TABLE 2. FREQUENCY OF WIND OBSERVATIONS IN DIFFERENT SPEED AND DIRECTION CLASSES - JANUARY

			DIRECTION IN TENS OF DEGREES											
FORCE	CALM	VARIABLE	35-01	02-04	05-07	08-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	NO.OF OBS
0	8														8
1		0	2	4	3	0	1	1	1	0	2	0	0	1	15
2		3	2	5	8	11	8	4	2	0	0	1	0	0	44
3		0	3	29	48	24	10	12	5	0	0	0	2	3	136
4		0	13	67	94	22	5	4	1	1	0	0	2	0	209
5		0	7	79	72	12	0	0	0	0	0	0	0	2	172
6		0	5	37	52	3	0	0	0	0	0	0	0	0	97
7		0	4	10	8	1	0	0	0	0	0	0	0	0	23
8		0	0	2	4	0	0	0	0	0	0	0	0	0	6
9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
10		0	0	0	0	0	0	0	0	0	0	0	0	0	0
11		0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO.OF OBS	8	3	36	233	289	73	24	21	9	1	2	1	4	6	716

TABLE 3. FREQUENCY OF WIND OBSERVATIONS IN DIFFERENT SPEED AND DIRECTION CLASSES - FEBRUARY

		DIRECTION IN TENS OF DEGREES												
FORCE	CALM	VARIABLE	35-01	02-04	05-07	08-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	NO.OF OBS
0	6														6
1		2	0	3	4	10	4	1	0	2	0	0	1	0	27
2		0	1	7	15	11	11	3	1	0	1	0	1	0	51
3		1	2	15	42	33	20	5	2	0	1	0	0	1	122
4		0	4	45	64	25	8	6	1	0	0	0	0	7	160
5		0	5	37	96	13	2	1	0	0	0	0	0	0	154
6		0	1	26	34	7	0	0	0	0	2	0	0	2	72
7		0	1	8	3	0	0	0	0	0	0	0	0	1	13
8		0	1	1	1	0	0	0	0	0	0	0	0	0	3
9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
10		0	0	0	0	0	0	0	0	0	0	0	0	0	0
11		0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO OF OBS	6	3	15	142	259	99	45	16	4	2	4	0	2	11	608

TABLE 4. FREQUENCY OF WIND OBSERVATIONS IN DIFFERENT SPEED AND DIRECTION CLASSES - MARCH

		DIRECTION IN TENS OF DEGREES												
FORCE	CALM	VARIABLE	35-01	02-04	05-07	08-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	NO.OF OBS
0	13														13
1		3	1	3	2	3	1	4	0	2	0	0	0	0	19
2		0	2	11	26	19	16	8	10	0	1	0	0	0	93
3		0	2	23	54	40	14	10	10	2	1	0	6	0	162
4		0	1	23	76	48	24	8	14	2	1	0	0	2	199
5		0	0	25	60	27	1	1	2	1	0	0	0	1	118
6		0	2	9	25	3	1	0	0	0	0	0	0	0	40
7		0	0	3	6	0	0	0	0	0	0	0	0	0	9
8		0	0	0	0	0	0	0	0	0	0	0	0	0	0
9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
10		0	0	0	0	0	0	0	0	0	0	0	0	0	0
11		0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO.OF OBS	13	3	8	97	249	140	57	31	36	7	3	0	6	3	653

TABLE 5. FREQUENCY OF WIND OBSERVATIONS IN DIFFERENT SPEED AND DIRECTION CLASSES - APRIL

		DIRECTION IN TENS OF DEGREES												
FORCE	CALM	VARIABLE	35-01	02-04	05-07	08-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	NO.OF OBS
0	50														50
1		6	0	0	6	9	6	10	3	4	1	0	0	0	45
2		0	1	8	23	28	16	18	18	8	4	1	1	0	126
3		0	9	18	30	55	30	25	12	1	5	3	3	0	191
4		0	4	24	52	59	17	12	6	1	1	7	6	1	190
5		0	2	17	43	38	3	2	2	0	1	0	0	1	109
6		0	0	5	8	1	0	0	0	0	0	0	0	0	14
7		0	0	0	1	1	1	0	0	0	0	0	0	0	3
8		0	0	0	0	0	0	0	0	0	0	0	0	0	0
9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
10		0	0	0	0	0	0	0	0	0	0	0	0	0	0
11		0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO.OF OBS	50	6	16	72	163	191	73	67	41	14	12	11	10	2	728

TABLE 6. FREQUENCY OF WIND OBSERVATIONS IN DIFFERENT SPEED AND DIRECTION CLASSES - MAY

		DIRECTION IN TENS OF DEGREES												
FORCE	CALM	VARIABLE	35-01	02-04	05-07	08-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	NO.OF OBS
0	17														17
1		1	1	0	4	2	2	3	7	3	2	0	0	0	25
2		1	2	4	17	14	15	20	27	15	4	2	1	0	122
3		0	1	11	15	22	33	42	33	30	14	2	0	0	203
4		0	6	8	33	24	10	19	21	39	3	1	0	0	164
5		0	0	14	29	10	0	0	1	3	1	0	0	0	58
6		0	2	4	14	0	0	0	0	0	0	0	0	0	20
7		0	1	3	2	0	0	0	0	0	0	0	0	1	7
8		0	0	1	0	0	0	0	0	0	0	0	0	0	1
9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
10		0	0	0	1	0	0	0	0	0	0	0	0	0	1
11		0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO.OF OBS	17	2	13	45	115	72	60	84	89	90	24	5	1	1	616

TABLE 7. FREQUENCY OF WIND OBSERVATIONS IN DIFFERENT SPEED AND DIRECTION CLASSES - JUNE

		DIRECTION IN TENS OF DEGREES													
FORCE	CALM	VARIABLE	35-01	02-04	05-07	08-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	NO.OF OBS
0	12														12
1		3	1	2	0	1	4	3	8	1	1	2	2	0	28
2		1	0	3	4	7	7	8	23	10	7	2	0	3	75
3		0	5	8	16	14	7	21	41	51	14	3	0	3	183
4		0	2	4	7	8	11	16	56	56	11	1	1	0	173
5		0	0	1	1	1	0	7	22	23	4	0	0	0	59
6		0	0	1	0	2	0	0	2	1	0	0	0	0	6
7		0	0	0	0	0	0	0	0	0	0	0	0	0	0
8		0	0	0	0	0	0	0	0	0	0	0	0	0	0
9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
10		0	0	0	0	0	0	0	0	0	0	0	0	0	0
11		0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO OF OBS	12	4	8	19	28	33	29	55	152	142	37	8	3	6	536

TABLE 8. FREQUENCY OF WIND OBSERVATIONS IN DIFFERENT SPEED AND DIRECTION CLASSES - JULY

		DIRECTION IN TENS OF DEGREES												
FORCE	CALM	VARIABLE	35-01	02-04	05-07	08-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	NO.OF OBS
0	16														16
1		3	0	4	2	3	2	6	2	5	1	0	3	1	32
2		3	3	5	8	11	8	17	28	11	4	4	2	3	107
3		1	1	8	5	9	28	29	43	32	10	4	0	3	173
4		0	3	4	7	13	17	12	32	32	28	5	5	1	159
5		0	2	7	4	9	4	8	19	19	12	5	2	2	93
6		0	0	3	2	4	3	8	4	1	6	1	4	0	36
7		0	0	1	0	0	0	1	0	1	2	0	0	0	5
8		0	0	2	1	0	0	0	0	0	3	1	0	1	8
9		0	0	0	0	0	0	0	0	1	0	0	0	0	1
10		0	0	0	0	0	0	0	0	0	0	0	0	0	0
11		0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO.OF OBS	16	7	9	34	29	49	62	81	128	102	66	20	16	11	630

TABLE 9. FREQUENCY OF WIND OBSERVATIONS IN DIFFERENT SPEED AND DIRECTION CLASSES - AUGUST

		DIRECTION IN TENS OF DEGREES												
FORCE	CALM	VARIABLE	35-01	02-04	05-07	08-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	NO.OF OBS
0	13														13
1		8	1	1	5	5	3	5	6	5	2	3	1	1	46
2		1	2	3	9	10	15	21	12	13	15	5	2	0	108
3		1	2	5	14	16	27	20	31	32	32	3	6	2	191
4		0	8	4	11	14	11	10	17	16	26	8	3	8	136
5		0	2	3	2	5	6	7	8	12	8	1	1	3	58
6		0	2	4	1	2	1	1	4	7	2	1	0	0	25
7		0	2	0	0	2	0	0	1	0	1	0	0	1	7
8		0	0	0	0	0	0	0	0	0	0	0	0	0	0
9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
10		0	0	0	0	0	0	0	0	0	0	0	0	0	0
11		0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO.OF OBS	13	10	19	20	42	54	63	64	79	85	86	21	13	15	584

TABLE 10. FREQUENCY OF WIND OBSERVATIONS IN DIFFERENT SPEED AND DIRECTION CLASSES - SEPTEMBER

		DIRECTION IN TENS OF DEGREES												
FORCE	CALM	VARIABLE	35-01	02-04	05-07	08-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	NO.OF OBS
0	18														18
1		5	1	1	1	2	4	3	5	0	0	0	2	0	28
2		3	2	8	12	8	6	7	6	8	5	2	3	4	74
3		0	6	16	28	31	12	10	16	11	14	10	11	8	173
4		0	8	25	54	30	9	1	7	9	3	5	12	3	166
5		0	3	16	25	22	8	1	2	1	5	6	1	2	92
6		0	3	6	16	4	2	0	0	1	1	1	1	1	36
7		0	4	3	4	2	0	0	0	0	0	1	0	0	14
8		0	0	0	0	1	0	0	0	0	0	0	0	0	1
9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
10		0	0	0	0	0	0	0	0	0	0	0	0	0	0
11		0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO OF OBS	18	8	27	75	140	100	41	22	36	34	28	25	30	18	602

TABLE 11. FREQUENCY OF WIND OBSERVATIONS IN DIFFERENT SPEED AND DIRECTION CLASSES - OCTOBER

		DIRECTION IN TENS OF DEGREES													
FORCE	CALM	VARIABLE	35-01	02-04	05-07	08-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	NO.OF OBS
0	9														9
1		1	0	4	1	4	1	0	0	8	4	0	0	1	24
2		0	1	8	12	13	2	3	8	2	4	2	1	0	56
3		0	8	10	59	35	12	11	2	3	0	0	2	3	145
4		0	1	32	79	62	9	0	0	2	0	0	0	2	187
5		0	1	27	72	19	2	0	1	0	0	0	2	1	125
6		0	4	22	50	8	0	0	0	0	0	0	3	2	89
7		0	2	10	4	0	0	0	0	0	0	0	0	2	18
8		0	3	6	1	0	0	0	0	0	0	1	0	1	12
9		0	1	1	0	0	0	0	0	0	0	0	0	0	2
10		0	0	0	0	0	0	0	0	0	0	0	0	0	0
11		0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO.OF OBS	9	1	21	120	278	141	26	14	11	15	8	3	8	12	667

TABLE 12. FREQUENCY OF WIND OBSERVATIONS IN DIFFERENT SPEED AND DIRECTION CLASSES - NOVEMBER

		DIRECTION IN TENS OF DEGREES													
FORCE	CALM	VARIABLE	35-01	02-04	05-07	08-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	NO.OF OBS
0	5														5
1		1	0	0	1	0	0	1	0	0	1	0	0	1	5
2		0	4	3	8	1	1	1	2	0	0	0	0	1	21
3		0	3	11	27	13	1	0	0	0	0	0	1	2	58
4		0	13	41	69	20	0	1	0	0	1	0	0	3	148
5		0	10	56	98	18	2	1	0	0	0	0	0	0	185
6		0	4	55	47	9	0	0	0	0	0	0	1	0	116
7		0	2	12	14	0	0	0	0	0	0	0	0	0	28
8		0	0	9	7	0	0	0	0	0	0	0	0	0	16
9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
10		0	0	0	0	0	0	0	0	0	0	0	0	0	0
11		0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO.OF OBS	5	1	36	187	271	61	4	4	2	0	2	0	2	7	582

TABLE 13. FREQUENCY OF WIND OBSERVATIONS IN DIFFERENT SPEED AND DIRECTION CLASSES - DECEMBER

		DIRECTION IN TENS OF DEGREES												
FORCE	CALM	VARIABLE	35-01	02-04	05-07	08-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	NO.OF OBS
0	13														13
1		4	1	3	1	2	0	1	1	0	0	0	0	0	13
2		4	2	6	5	3	1	0	0	0	2	1	1	3	28
3		0	1	25	27	14	5	0	0	0	0	0	2	0	74
4		0	8	53	105	26	4	0	0	0	0	0	0	2	198
5		0	6	45	90	9	0	0	0	0	0	0	0	0	150
6		0	1	36	56	1	0	0	0	0	0	0	0	1	95
7		0	0	15	11	1	0	0	0	0	0	0	0	0	27
8		0	0	7	6	0	0	0	0	0	0	0	0	0	13
9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
10		0	0	0	0	0	0	0	0	0	0	0	0	0	0
11		0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO OF OBS	13	8	19	190	301	56	10	1	1	0	2	1	3	6	611

TABLE 14. FREQUENCY OF WAVE REPORTS IN DIFFERENT HEIGHT INTERVALS

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	124	116	180	247	221	221	231	230	202	149	68	89	2078
1 - 1.5	297	211	237	176	208	175	188	185	193	225	215	261	2571
2 - 2.5	94	88	64	63	39	13	59	25	47	113	99	98	802
3 - 3.5	32	18	15	4	8	2	8	4	8	25	55	30	209
4 - 4.5	7	3	4	1	1	0	6	2	1	6	8	9	48
5 - 5.5	1	1	0	0	0	0	1	0	0	1	1	1	6
6 - 6.5	1	0	0	0	1	0	0	0	0	0	0	0	2
7 - 7.5	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	0	0	0	0	0	0	0	0	0	3	0	0	3
10 OR MORE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	556	437	500	491	478	411	493	446	451	522	446	488	5719

TABLE 15. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - ALL DIRECTIONS

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	18	13	27	33	47	42	36	30	36	21	5	5	313
1 - 1.5	111	115	117	122	112	125	136	109	103	87	65	86	1288
2 - 2.5	86	71	85	56	44	23	42	27	58	68	90	96	746
3 - 3.5	31	30	25	11	9	2	21	12	12	29	48	42	272
4 - 4.5	11	15	8	2	15	0	8	3	5	24	22	9	122
5 - 5.5	6	2	3	0	1	0	6	1	1	10	7	7	44
6 - 6.5	1	0	1	0	0	0	2	0	0	2	1	0	7
7 - 7.5	0	0	1	0	0	0	0	0	0	0	2	0	3
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	1	0	0	0	0	0	0	0	0	0	0	0	1
10 OR MORE	1	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	266	246	267	224	228	192	251	182	215	241	240	245	2797
SWELL CALM	8	8	9	15	26	16	27	25	30	14	5	2	185

TABLE 16. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - DIRECTION 350° - 010°

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	1	0	0	0	1	0	0	0	1	1	0	1	5
1 - 1.5	2	1	4	2	1	1	1	1	0	1	2	1	17
2 - 2.5	2	4	1	1	0	0	0	0	0	2	0	1	11
3 - 3.5	0	1	0	0	0	0	0	0	0	4	0	1	6
4 - 4.5	0	0	0	0	0	0	0	0	0	2	0	0	2
5 - 5.5	1	0	0	0	0	0	0	0	0	0	0	0	1
6 - 6.5	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - 7.5	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	0	0	0	0	0	0	0	0	0	0	0	0	0
10 OR MORE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	6	6	5	3	2	1	1	1	1	10	2	4	42

TABLE 17. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - DIRECTION 020° - 040°

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	2	1	1	5	1	1	2	1	2	1	0	0	17
1 - 1.5	23	16	10	8	10	2	1	0	3	7	9	8	97
2 - 2.5	29	13	16	8	3	0	0	0	5	12	20	23	129
3 - 3.5	9	8	5	3	2	0	0	1	0	3	15	12	58
4 - 4.5	8	1	2	0	1	0	0	0	1	7	9	2	31
5 - 5.5	2	0	0	0	0	0	0	0	1	4	1	2	10
6 - 6.5	0	0	1	0	0	0	0	0	0	1	0	0	2
7 - 7.5	0	0	0	0	0	0	0	0	0	0	2	0	2
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	0	0	0	0	0	0	0	0	0	0	0	0	0
10 OR MORE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	73	39	35	24	17	3	3	2	12	35	56	47	346

TABLE 18. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - DIRECTION 050° - 070°

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	7	7	3	9	6	5	1	1	2	4	4	3	52
1 - 1.5	57	49	48	45	15	11	3	7	34	37	23	42	371
2 - 2.5	46	35	48	23	14	2	5	2	22	34	46	56	333
3 - 3.5	17	13	15	7	5	2	0	3	6	19	32	27	146
4 - 4.5	3	12	5	1	3	0	0	1	4	13	8	7	57
5 - 5.5	2	1	3	0	1	0	0	0	0	6	6	4	23
6 - 6.5	1	0	0	0	0	0	0	0	0	1	1	0	3
7 - 7.5	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	1	0	0	0	0	0	0	0	0	0	0	0	1
10 OR MORE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	134	117	122	85	44	20	9	14	68	114	120	139	986

TABLE 19. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - DIRECTION 080° - 100°

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	0	3	10	7	9	4	4	5	5	5	1	1	54
1 - 1.5	20	31	44	43	18	6	8	12	16	24	22	28	272
2 - 2.5	8	17	16	18	22	4	4	1	9	11	20	16	146
3 - 3.5	4	8	5	1	1	0	4	1	2	2	1	1	30
4 - 4.5	0	2	1	0	7	0	0	0	0	0	5	0	15
5 - 5.5	1	1	0	0	0	0	0	0	0	0	0	0	2
6 - 6.5	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - 7.5	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	0	0	0	0	0	0	0	0	0	0	0	0	0
10 OR MORE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	33	62	76	69	57	14	20	19	32	42	49	46	519

TABLE 20. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - DIRECTION 110° - 130°

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	1	0	8	6	1	3	5	2	2	3	0	0	31
1 - 1.5	6	13	4	5	5	7	8	9	10	5	8	4	84
2 - 2.5	0	0	3	1	2	2	2	1	4	3	3	0	21
3 - 3.5	0	0	0	0	0	0	0	0	0	0	0	0	0
4 - 4.5	0	0	0	0	0	0	1	0	0	0	0	0	1
5 - 5.5	0	0	0	0	0	0	0	0	0	0	0	1	1
6 - 6.5	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - 7.5	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	0	0	0	0	0	0	0	0	0	0	0	0	0
10 OR MORE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	7	13	15	12	8	12	16	12	16	11	11	5	138

TABLE 21. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - DIRECTION 140° - 160°

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	5	1	2	1	4	1	2	3	4	2	0	0	25
1 - 1.5	0	3	0	5	6	9	15	19	10	4	0	3	74
2 - 2.5	0	1	0	2	0	5	3	4	3	0	1	0	19
3 - 3.5	0	0	0	0	0	0	2	1	0	0	0	0	3
4 - 4.5	0	0	0	0	1	0	2	1	0	0	0	0	4
5 - 5.5	0	0	0	0	0	0	5	1	0	0	0	0	6
6 - 6.5	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - 7.5	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	0	0	0	0	0	0	0	0	0	0	0	0	0
10 OR MORE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	5	5	2	8	11	15	29	29	17	6	1	3	131

TABLE 22. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - DIRECTION 170° - 190°

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	0	0	0	1	9	16	13	8	17	1	0	0	65
1 - 1.5	0	1	1	6	10	35	45	24	9	1	0	0	132
2 - 2.5	0	0	1	1	1	6	10	6	6	0	0	0	31
3 - 3.5	0	0	0	0	0	0	6	1	0	0	0	0	7
4 - 4.5	0	0	0	0	2	0	0	1	0	0	0	0	3
5 - 5.5	0	0	0	0	0	0	0	0	0	0	0	0	0
6 - 6.5	0	0	0	0	0	0	1	0	0	0	0	0	1
7 - 7.5	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	0	0	0	0	0	0	0	0	0	0	0	0	0
10 OR MORE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	1	2	8	22	57	75	40	32	2	0	0	239

TABLE 23. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - DIRECTION 200° - 220°

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	1	0	0	3	10	9	6	6	3	1	0	0	39
1 - 1.5	1	0	2	3	33	37	33	19	10	5	0	0	143
2 - 2.5	0	0	0	1	1	4	10	7	2	0	0	0	25
3 - 3.5	0	0	0	0	0	0	2	2	0	0	0	1	5
4 - 4.5	0	0	0	0	1	0	4	0	0	0	0	0	5
5 - 5.5	0	0	0	0	0	0	0	0	0	0	0	0	0
6 - 6.5	0	0	0	0	0	0	1	0	0	0	0	0	1
7 - 7.5	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	0	0	0	0	0	0	0	0	0	0	0	0	0
10 OR MORE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	0	2	7	45	50	56	34	15	6	0	1	218

TABLE 24. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - DIRECTION 230° - 250°

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	0	0	0	0	5	0	2	2	0	2	0	0	11
1 - 1.5	0	0	1	2	10	12	10	14	4	0	0	0	53
2 - 2.5	0	0	0	0	0	0	4	5	0	0	0	0	9
3 - 3.5	0	0	0	0	0	0	4	3	1	0	0	0	8
4 - 4.5	0	0	0	0	0	0	1	0	0	0	0	0	1
5 - 5.5	0	0	0	0	0	0	0	0	0	0	0	0	0
6 - 6.5	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - 7.5	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	0	0	0	0	0	0	0	0	0	0	0	0	0
10 OR MORE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	2	15	12	21	24	5	2	0	0	82

TABLE 25. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - DIRECTION 260° - 280°

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	0	0	1	0	0	1	0	0	0	0	0	0	2
1 - 1.5	0	0	0	0	0	0	7	2	2	0	0	0	11
2 - 2.5	0	0	0	0	0	0	1	1	2	1	0	0	5
3 - 3.5	0	0	0	0	0	0	1	0	0	0	0	0	1
4 - 4.5	0	0	0	0	0	0	0	0	0	1	0	0	1
5 - 5.5	0	0	0	0	0	0	0	0	0	0	0	0	0
6 - 6.5	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - 7.5	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	0	0	0	0	0	0	0	0	0	0	0	0	0
10 OR MORE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	0	0	1	9	3	4	2	0	0	20

TABLE 26. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - DIRECTION 290° - 310°

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	0	0	0	0	0	0	0	1	0	0	0	0	1
1 - 1.5	1	0	0	0	0	0	0	0	2	0	0	0	3
2 - 2.5	0	0	0	0	0	0	3	0	1	1	0	0	5
3 - 3.5	0	0	0	0	0	0	0	0	0	0	0	0	0
4 - 4.5	0	0	0	0	0	0	0	0	0	0	0	0	0
5 - 5.5	0	0	0	0	0	0	0	0	0	0	0	0	0
6 - 6.5	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - 7.5	0	0	1	0	0	0	0	0	0	0	0	0	1
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	0	0	0	0	0	0	0	0	0	0	0	0	0
10 OR MORE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	0	1	0	0	0	3	1	3	1	0	0	10

TABLE 27. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - DIRECTION 320° - 340°

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	0	1	0	1	0	0	1	1	0	0	0	0	4
1 - 1.5	1	1	0	2	0	1	2	0	0	1	0	0	8
2 - 2.5	0	1	0	0	1	0	0	0	2	2	0	0	6
3 - 3.5	1	0	0	0	0	0	0	0	1	0	0	0	2
4 - 4.5	0	0	0	0	0	0	0	0	0	0	0	0	0
5 - 5.5	0	0	0	0	0	0	0	0	0	0	0	0	0
6 - 6.5	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - 7.5	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	0	0	0	0	0	0	0	0	0	0	0	0	0
10 OR MORE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	3	0	3	1	1	3	1	3	3	0	0	20

TABLE 28. FREQUENCY OF SWELL REPORTS IN DIFFERENT HEIGHT INTERVALS - DIRECTION INDETERMINATE

METRES	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0 - 0.5	1	0	2	0	1	2	0	0	0	1	0	0	7
1 - 1.5	0	0	3	1	4	4	3	2	3	2	1	0	23
2 - 2.5	1	0	0	1	0	0	0	0	2	2	0	0	6
3 - 3.5	0	0	0	0	1	0	2	0	2	1	0	0	6
4 - 4.5	0	0	0	1	0	0	0	0	0	1	0	0	2
5 - 5.5	0	0	0	0	0	0	1	0	0	0	0	0	1
6 - 6.5	0	0	0	0	0	0	0	0	0	0	0	0	0
7 - 7.5	0	0	0	0	0	0	0	0	0	0	0	0	0
8 - 8.5	0	0	0	0	0	0	0	0	0	0	0	0	0
9 - 9.5	0	0	0	0	0	0	0	0	0	0	0	0	0
10 OR MORE	1	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	3	0	5	3	6	6	6	2	7	7	1	0	46

TABLE 29. W.M.O. VISIBILITY CODE

Code figure	km
90	< 0.05
91	0.05
92	0.2
93	0.5
94	1
95	2
96	4
97	10
98	20
99	≥ 50

Note : The following rule is followed in coding : If the observed visibility is between two of the reportable distances as given in the table, the code figure for the lower reportable distance is reported.

TABLE 30. FREQUENCY OF VISIBILITY OBSERVATIONS IN DIFFERENT RANGES

CODE	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
90	0	0	1	1	0	0	0	0	0	0	0	0	2
91	2	0	0	3	0	0	0	0	0	0	0	0	5
92	0	2	1	1	0	0	0	0	0	0	0	0	0
93	0	0	0	3	1	0	2	2	0	2	0	0	10
94	2	0	4	3	1	0	2	1	0	0	0	0	13
95	5	3	9	7	4	0	6	2	1	3	2	7	49
96	28	31	45	75	33	14	17	13	34	37	20	12	359
97	134	140	159	204	60	62	75	46	73	91	127	104	1275
98	424	354	365	344	378	317	342	352	372	389	336	382	4359
99	116	81	69	89	142	143	189	170	125	150	103	112	1489
TOTAL	711	611	653	730	619	536	633	586	605	672	588	617	7561

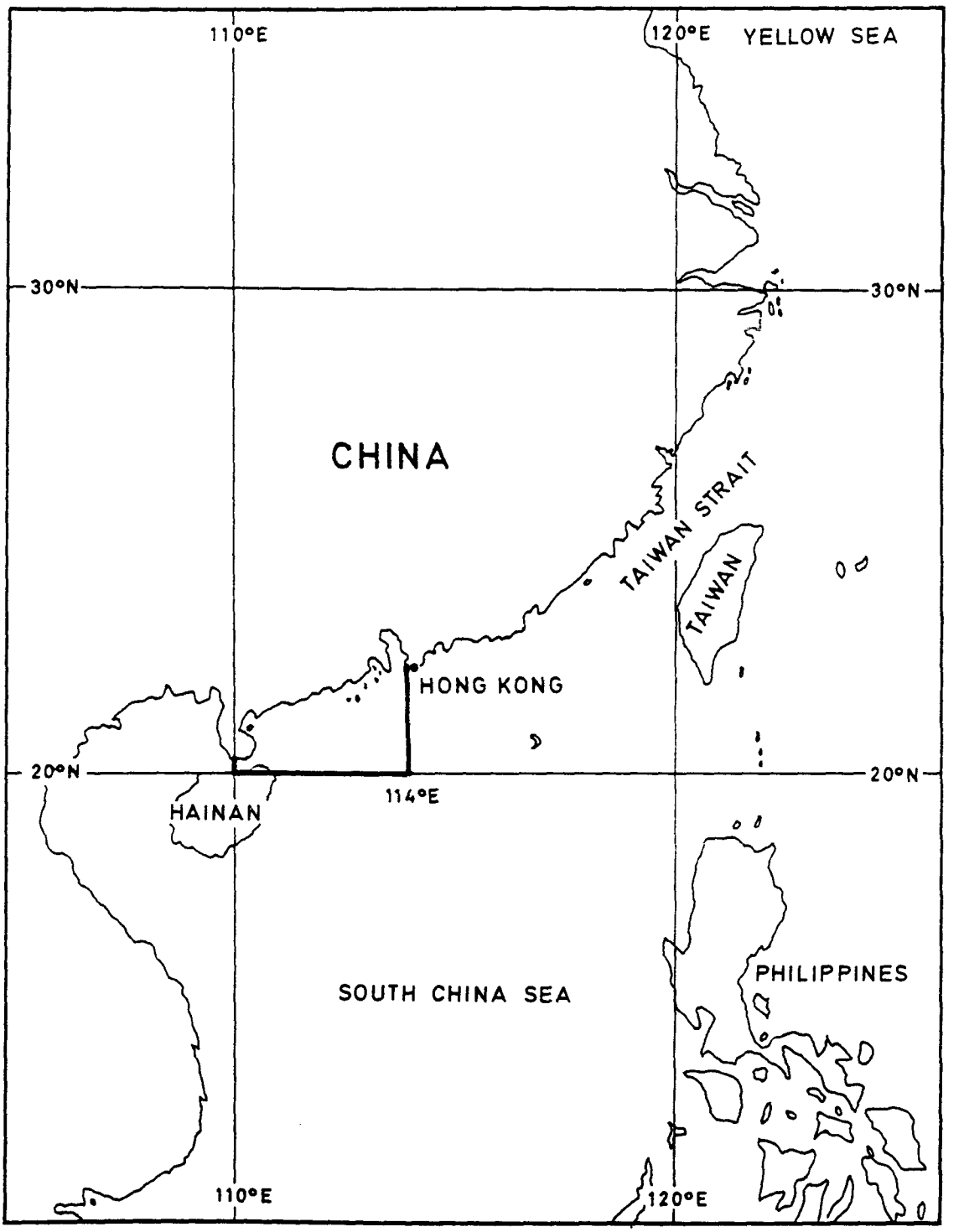

FIGURE 1 Map to show the sea area covered by this report.