

ROYAL OBSERVATORY, HONG KONG

METEOROLOGICAL RESULTS
1979

PART III—TROPICAL CYCLONE SUMMARIES



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CONTENTS

SECTION	<i>Page</i>
FRONTISPIECE: Tracks of tropical cyclones in the western North Pacific and the South China Sea, 1979.	
1. INTRODUCTION	5
2. DESCRIPTION OF TABLES	7
3. LIST OF FIGURES	8
4. TROPICAL CYCLONE SUMMARIES FOR 1979	9
5. REPORTS ON TROPICAL CYCLONES AFFECTING HONG KONG IN 1979	
(a) Typhoon Ellis: 1-6 July	12
(b) Severe Tropical Storm Gordon: 26-30 July	17
(c) Typhoon Hope: 28 July-3 August	20
(d) The Tropical Depressions: 6-9 August	34
(e) Severe Tropical Storm Mac and Tropical Storm Nancy: 16-24 September	38
6. TABLES	
Table 1. List of tropical cyclones in the western North Pacific and the South China Sea in 1979	44
Table 2. Tropical cyclone warnings for shipping issued in 1979	45
Table 3. Tropical cyclone warning signals hoisted in Hong Kong and number of warning bulletins issued in 1979	45
Table 4. Frequency and total duration of display of tropical cyclone warning signals: 1946-1979	46
Table 5. Number of tropical cyclones in Hong Kong's area of responsibility and the number that necessitated the display of tropical cyclone warning signals in Hong Kong: 1946-1979	46
Table 6. Duration of display of tropical cyclone warning signals in Hong Kong: 1946-1979	47
Table 7. Casualties and damage caused by tropical cyclones in Hong Kong: 1937-1979	47
Table 8. Ships sunk, damaged, grounded, etc., by tropical cyclones in Hong Kong in 1979	48
Table 9. A summary of meteorological observations recorded in Hong Kong during the passages of tropical cyclones in 1979	49
Table 10. Typhoons which required the hoisting of the Hurricane Signal No. 10 during the period 1946-1979	50
7. APPENDIX	
Six-hourly positions of tropical cyclones in the western North Pacific and the South China Sea, 1979	51

INTRODUCTION

Apart from a short break 1940–1946, surface observations of meteorological elements since 1884 have been summarized and published in the Royal Observatory's Meteorological Results. Upper-air observations were begun in 1947 and from then onwards the annual volumes were divided into two parts, namely Part I – Surface Observations and Part II – Upper-air Observations.

During the period 1884–1939, reports on destructive typhoons were occasionally prepared and were included as Appendices to the Meteorological Results. However, after 1947, this practice was extended and an account of all tropical cyclones which caused gales in Hong Kong was included in the Annual Departmental Reports. The first issue of a new series – 'Meteorological Results, Part III – Tropical Cyclone Summaries' was introduced in 1971. It contained information about all tropical cyclones over the western North Pacific and the South China Sea (i.e. the area bounded by the Equator, 45°N, 100°E and 160°E) that occurred in the year 1968.

Tracks of tropical cyclones in the western North Pacific and the South China Sea were published in Meteorological Results, Part I up to 1967. During the period 1884–1960, the tracks were plotted with day circle positions only. The time of the day circle varied to some extent but remained fixed at 0000 G.M.T. after 1944. The day circle times used for earlier tropical cyclones are given in the Royal Observatory Technical Memoir No. 11, Volume 1. From 1961 onwards, 6-hourly positions were shown on the tracks of all tropical cyclones.

Provisional reports on individual tropical cyclones affecting Hong Kong have been prepared since 1960; this is done in order to meet the immediate needs of the press, shipping companies and others. These reports are cyclostyled and supplied on request. Initially, reports were only written on those tropical cyclones for which gales or storm signals had been hoisted in Hong Kong, but by 1968 it had become necessary to produce a report on every tropical cyclone during which any tropical cyclone warning signal was raised.

In this publication, tropical cyclones are classified into the following four categories according to the maximum sustained winds within their circulations:

A TROPICAL DEPRESSION (T.D.) has maximum sustained winds of less than 34 knots and at this stage the centre is often not very clearly defined and cannot always be fixed precisely.

A TROPICAL STORM (T.S.) has maximum sustained winds in the range 34–47 knots.

A SEVERE TROPICAL STORM (S.T.S.) has maximum sustained winds in the range 48–63 knots.

A TYPHOON (T.) has maximum sustained winds of 64 knots or more.

The Royal Observatory has a network of anemographs to record surface winds in Hong Kong. The instruments used are all Dines pressure-tube anemographs or M.O. Mark IV cup generator type anemographs manufactured by R.W. Munro Ltd. Quick-run mechanisms are also fitted to the anemographs at the Hong Kong Airport (Southeast), Waglan Island, Tate's Cairn and Cheung Chau for recording the fine structure of the wind flow in typhoons for research purposes. Details of these stations are given below.

Station	Position		Elevation of barometer above M.S.L.	Elevation of ground above M.S.L.	Head of anemometer above M.S.L.	Type of anemometer
	Latitude N	Longitude E				
Royal Observatory	22° 18'	114° 10'	33	32	61	Dines, Cup
Hong Kong Airport (Southeast)	22° 20'	114° 11'	24	4	16	Dines, Cup
Hong Kong Airport (Northwest)	22° 20'	114° 11'	24	4	14	Dines, Cup
Waglan Island	22° 11'	114° 18'	62	55	75	Dines, Cup
Tate's Cairn	22° 22'	114° 13'	*	575†	588	Dines
Cheung Chau	22° 12'	114° 01'	79	72	92	Dines
King's Park	22° 19'	114° 10'	66	65	78	Cup
Star Ferry‡	22° 18'	114° 10'	*	3	17	Cup
Green Island	22° 17'	114° 07'	*	76	90	Cup
Tsim Bei Tsui	22° 29'	114° 00'	*	26	44	Dines
Tai O	22° 15'	113° 51'	*	76	90	Cup
Castle Peak	22° 23'	113° 58'	*	11	24	Dines
Chek Lap Kok§	22° 19'	113° 56'	53	51	65	Cup
Lei Yue Mun	22° 17'	114° 14'	*	54	73	Cup
Yau Yat Chuen	22° 20'	114° 10'	*	27	64	Cup
Kowloon Tsai Hill	22° 20'	114° 11'	*	91	105	Cup

* No barometer.

† Level of the ground floor of the building of the Radar Station.

‡ Anemometer mast damaged in an accident on 8.10.79. No record from 8.10.79 to 31.12.79.

§ Station commenced on 13.6.79.

|| Station commenced on 7.5.79.

Wind measurements are also made by China Light & Power Co. Ltd. at Hok Un and Tsing Yi Island, by Cable & Wireless Ltd. at Stanley, by the R.A.F. at Tai Mo Shan, by the University of Hong Kong at Cape D'Aguiar and by the Chinese University at Ma Liu Shui. Wind speed measurements have not been corrected for the reduced density of the air but in most cases this would increase the figures in the tables by less than 5 per cent.

The reports in Section 5 present a general description of the life history of each tropical cyclone affecting Hong Kong from formation to dissipation including:

- (a) how the tropical cyclone affected Hong Kong;
- (b) the sequence of display of tropical cyclone warning signals;
- (c) the maximum gust peak speeds and maximum winds recorded at various stations in Hong Kong;
- (d) the lowest barometric pressure recorded in Hong Kong;
- (e) the daily amount of rainfall recorded at the Royal Observatory; and
- (f) the times and heights of the highest tides and maximum storm surges recorded in Hong Kong.

Whenever practical, radar photographs and pictures received from weather satellites are included together with information and data* obtained from reconnaissance aircraft. With a view to providing further information on the characteristics of tropical cyclones, 6-hourly positions together with the corresponding estimated minimum central pressures and maximum surface winds for individual tropical cyclones are tabulated and presented in the appendix.

In this publication different times have been in use in different contexts. The reference times of tropical cyclone warnings for shipping are given in G.M.T. Unlabelled times given in hours and minutes (e.g. 1454) on a 24-hour clock or times expressed as a.m. or p.m. are in Hong Kong Time. Hong Kong Time is 8 hours ahead of G.M.T. but in the summer of 1979, it was 9 hours ahead of G.M.T. between 3.30 a.m. on 13 May and 3.30 a.m. on 21 October. Times labelled 'G.M.T.' are in Greenwich Mean Time.

* The data from reconnaissance aircraft were taken directly from eye-fix messages received operationally at the Royal Observatory, Hong Kong. No attempt has been made to convert the wind speeds into equivalent '10-minute mean winds' to make them comparable with reports from surface stations.

DESCRIPTION OF TABLES

Table 1 is a list of tropical cyclones in 1979 in the western North Pacific and the South China Sea (i.e. in the area bounded by the Equator, 45°N, 100°E and 160°E). The names of these tropical cyclones are those used by the U.S. Fleet Weather Central/Joint Typhoon Warning Center, Guam. The dates cited cover the period during which the track of each tropical cyclone lay within the above-mentioned region and may not necessarily represent its full life-span. This limitation applies to all other elements in the table.

Table 2 gives the number of tropical cyclone warnings for shipping issued by the Royal Observatory, Hong Kong in 1979, the duration of these warnings and the time of validity of the first and last warnings for all tropical cyclones in Hong Kong's area of responsibility (i.e. the area bounded by 10°N, 30°N, 105°E and 125°E). Times are given in hours G.M.T.

Table 3 presents a summary of the occasions on which the tropical cyclone warning signals were hoisted during 1979. The sequence of the signals displayed and the number of tropical cyclone warning bulletins issued for each tropical cyclone are also given. Times are given in hours and minutes in Hong Kong Time.

Table 4 presents a summary of the occasions on which the tropical cyclone warning signals were hoisted between 1946 and 1979. The Strong Wind Signal, No. 3, was not introduced until 1956 and the Gale or Storm Signals 5, 6, 7 and 8 were renumbered as 8 NW, 8 SW, 8 NE and 8 SE respectively with effect from 1 January 1973.

Table 5 gives the annual number of tropical cyclones in Hong Kong's area of responsibility between 1946 and 1979. The annual number of tropical cyclones which caused tropical cyclone warning signals to be raised in Hong Kong is also included.

Table 6 shows the maximum, mean and minimum duration of display of each tropical cyclone warning signal during the period 1946-1979.

Table 7 presents the casualties and damage figures associated with tropical cyclones in Hong Kong for the period 1937-1979. The information is compiled from local newspapers and from the Marine Department's records.

Table 8 contains the particulars of ships sunk, damaged, grounded, etc., by various tropical cyclones in 1979. The information is compiled from local newspapers and from the Marine Department's records.

Table 9 presents the maximum storm surge (the excess, in metres, of the actual water level over that predicted in the Tide Tables) for each tropical cyclone affecting Hong Kong in 1979. Information on the nearest approach, the maximum winds at the Royal Observatory and Waglan Island, the minimum sea-level pressure and the total rainfall recorded at the Royal Observatory is also included together with an estimate of the minimum central pressure of each tropical cyclone during its closest approach.

Table 10 presents some meteorological information for those typhoons which required the hoisting of the Hurricane Signal, No. 10, in Hong Kong since 1946. The information presented includes the distances and bearings of nearest approach, the minimum sea-level pressures recorded at the Royal Observatory and the maximum 60-minute mean winds and maximum gusts recorded at some selected stations in Hong Kong.

LIST OF FIGURES

- Figure 1. Monthly distribution of the frequency of occurrence of tropical cyclones and typhoons in the western North Pacific and the South China Sea in 1979.
- Figure 2. Monthly distribution of the mean frequency of occurrence of tropical cyclones and typhoons in the western North Pacific and the South China Sea, 1946-1978.
- Figure 3. Track of Typhoon Ellis: 1-6 July 1979.
- Figure 4. GMS-1 visible picture of Typhoon Ellis taken around 9.00 a.m. on 2 July 1979.
- Figure 5. GMS-1 visible picture of Typhoon Ellis taken around 9.00 a.m. on 3 July 1979.
- Figure 6. GMS-1 visible picture of Typhoon Ellis taken around noon on 4 July 1979.
- Figure 7. GMS-1 visible picture of Typhoon Ellis taken around 9.00 a.m. on 5 July 1979.
- Figure 8. Radar picture of Typhoon Ellis taken at noon on 5 July 1979.
- Figure 9. Track of Severe Tropical Storm Gordon: 26-30 July 1979.
- Figure 10. GMS-1 visible picture of Severe Tropical Storm Gordon taken around noon on 28 July 1979.
- Figure 11. Radar picture of Severe Tropical Storm Gordon taken at 9.00 a.m. on 29 July 1979.
- Figure 12(a). Track of Typhoon Hope: 28 July-3 August 1979.
(b). Trajectory of the centre of the eye of Typhoon Hope near Hong Kong on 2 August 1979.
- Figure 13. GMS-1 visible picture of Typhoon Hope taken around 9.00 a.m. on 30 July 1979.
- Figure 14. GMS-1 visible picture of Typhoon Hope taken around 9.00 a.m. on 31 July 1979.
- Figure 15. GMS-1 visible picture of Typhoon Hope taken around 9.00 a.m. on 1 August 1979.
- Figure 16. GMS-1 visible picture of Typhoon Hope taken around 9.00 a.m. on 2 August 1979.
- Figure 17. Radar pictures of Typhoon Hope taken early on the morning of 2 August 1979.
- Figure 18. Radar picture of Typhoon Hope taken at 1.00 p.m. on 2 August 1979.
- Figure 19. Photograph taken from Island House showing line of clouds in an arc during passage of the eye of Typhoon Hope.
- Figure 20. Photograph of the M.V. 'Argonaut' aground alongside Kowloon Public Pier after having damaged the Star Ferry Pier.
- Figure 21(a). Photograph taken from Island House showing flooding in Tai Po.
(b). Photograph showing flooding in Pak Kiu Tsai Village, Tai Po.
- Figure 22. Photograph showing damage to the dangerous goods storehouse at the Government Dockyard in Yau Ma Tei.
- Figure 23. Tracks of the Tropical Depressions: 6-9 August 1979.
- Figure 24. GMS-1 infra-red picture of the Tropical Depressions taken around 9.00 p.m. on 6 August 1979.
- Figure 25. GMS-1 visible picture of the Tropical Depressions taken around 3.00 p.m. on 8 August 1979.
- Figure 26. GMS-1 visible picture of the Tropical Depressions taken around 9.00 a.m. on 9 August 1979.
- Figure 27. Tracks of Severe Tropical Storm Mac and Tropical Storm Nancy: 16-24 September 1979.
- Figure 28. GMS-1 visible picture of Tropical Storm Nancy and Severe Tropical Storm Mac taken around 3.00 p.m. on 19 September 1979.
- Figure 29. Radar picture of Severe Tropical Storm Mac taken at 7.25 a.m. on 23 September 1979.
- Figure 30. Radar picture of Severe Tropical Storm Mac taken at 8.05 a.m. on 23 September 1979.
- Figure 31. GMS-1 visible picture of Severe Tropical Storm Mac taken around 3.00 p.m. on 23 September 1979.

TROPICAL CYCLONE SUMMARIES FOR 1979

In 1979 twenty-nine tropical cyclones formed over the western North Pacific and the South China Sea and thirteen of them attained typhoon intensity. Four tropical cyclones landed over Guangdong (Kwangtung). Three tropical cyclones crossed the coast of Indo-China while another six passed over the Philippines. Japan was directly hit by three tropical cyclones and another two dissipated just off its coast. There was only one tropical cyclone passing over Korea and none passed directly over Taiwan. The monthly distribution of tropical cyclones is shown in Figure 1 and a brief summary of their tracks is contained in Table 1. Six-hourly positions of these tropical cyclones together with the estimated minimum central pressures and maximum surface winds are tabulated in the appendix. The monthly mean frequency of occurrence of tropical cyclones during the years 1946-1978 is given in Figure 2.

During the year there were eighteen tropical cyclones in Hong Kong's area of responsibility for tropical cyclone warnings for shipping (i.e. the area bounded by 10°N, 30°N, 105°E and 125°E) compared with an average figure of seventeen in the past 33 years. Twelve tropical cyclones moved into the area while six developed within it. Altogether 418 warnings for shipping were issued by the Royal Observatory in connection with these tropical cyclones and tropical cyclone warning signals were displayed in Hong Kong for six of them.

In 1979 rainfall in Hong Kong associated with tropical cyclones amounted to 1073.9 mm which represents nearly half of the summer rain in the year. Most of the rainfall was due to two tropical cyclones; Typhoon Hope in August with 287.4 mm and Severe Tropical Storm Mac in September with 361.3 mm.

The first tropical cyclone of the year was Typhoon Alice which developed near the Marshall Islands on 1 January. It moved westwards and passed about 100 nautical miles south of Guam on 9 January. Alice finally dissipated over the ocean about 800 nautical miles east of Manila early on 15 January.

There were no tropical cyclones over the western North Pacific or the South China Sea in February.

Typhoon Bess formed near the Caroline Islands on 19 March. It recurved to the northeast on 23 March and dissipated north of the Marianas two days later.

Typhoon Cecil formed near the Caroline Islands on 11 April. It moved west-northwestwards and after crossing the Philippines, it dissipated to the southeast of the Ryukyu Islands ten days later.

Two tropical cyclones developed over the western North Pacific and the South China Sea in May. Tropical Storm Dot formed near Mindanao on 10 May. It moved close to Manila after crossing the southern Philippines and dissipated about 480 nautical miles to the northeast of Manila six days later. A tropical depression formed in the South China Sea near Dongsha Dao (Pratas Island) on 22 May. After skirting the southern tip of Taiwan, it continued moving east-northeastwards and became an extratropical depression over the Pacific to the south of Japan on 24 May.

Only one tropical cyclone was reported over the area in June. A area of low pressure near Palawan started to move across the South China Sea on 17 June. It deepened into a tropical depression on 21 June and remained quasi-stationary off the Vietnam coast for about a day before drifting southwards and degenerating into an area of low pressure about 100 nautical miles southeast of Danang on 23 June.

A total of four tropical cyclones developed in July and tropical cyclone warning signals were hoisted in Hong Kong for two of them. Typhoon Ellis passed about 100 nautical miles to the south-southwest of Hong Kong around midnight on 5 July. Severe Tropical Storm Faye, originated near the Caroline Islands on 2 July, took a northwesterly course and dissipated about 250 nautical miles south-southeast of Taipei (Taipei) seven days later. Severe Tropical Storm Gordon crossed the coast of South China near Shantau (Swatow) about 130 nautical miles east-northeast of Hong Kong on 29 July and passed about 40 nautical miles to the north of Hong Kong early next morning. At the end of the month Typhoon Hope was centred about 400 nautical miles northeast of Manila and was moving rapidly west-northwest towards the Bashi Channel.

There were six tropical cyclones over the western North Pacific and the South China Sea in August and for two of them tropical cyclone warning signals were hoisted in Hong Kong. Typhoon Hope swept across Hong Kong on 2 August. It continued moving westwards and dissipated about 110 nautical miles west of Hanoi the following evening. A pair of tropical depressions developed near Xisha (Paracels) in succession on 6 and 8 August respectively. They both dissipated on 9 August; the former was near Danang while the latter was off the southeast coast of Hainan Dao (Hainan Island). Typhoon Irving passed over the Ryukyu Islands on 14 August. It crossed south Korea on 17 August and on the following day it skirted the coast of eastern Russia where heavy damage was reported. Typhoon Judy passed through the Ryukyu Islands on 23 August and the next day it was centred about 90 nautical miles east of Shanghai. Judy then took a northeasterly course and passed through the Korea Strait on 26 August. It became extratropical about 160 nautical miles north-northeast of Nagasaki on 27 August. At the end of the month Tropical Storm Ken developed about 500 nautical miles east of Okinawa and moved west towards the Ryukyu Islands.

There were six tropical cyclones over the western North Pacific and the South China Sea in September but only Severe Tropical Storm Mac and Tropical Storm Nancy affected Hong Kong. Tropical Storm Nancy developed off Hainan Dao (Hainan Island) about 250 nautical miles south-southwest of Hong Kong on 19

September. It moved westwards and crossed the Vietnam coast about 140 nautical miles northwest of Danang on 22 September. Severe Tropical Storm Mac originated about 500 nautical miles east of Manila early on 16 September. It entered the South China Sea on 19 September and passed over western Lantau Island (Hong Kong) around midnight on 23 September. It then turned westwards and headed towards Macau. Mac finally degenerated into an area of low pressure north of Shangchuan Dao (St. John's Island) during the afternoon of 24 September.

Four tropical cyclones developed over the western North Pacific and the South China Sea in October but none of them came near Hong Kong. A tropical depression formed near the west coast of the Philippines on 1 October but soon dissipated when it crossed Luzon. Tropical Storm Roger formed west of Guam on 30 October. It moved northwards and dissipated off the coast of Japan four days later. Typhoon Sarah developed to the west of the Philippines on 5 October. It moved across the southern part of the South China Sea and dissipated near the coast of south Vietnam on 15 October. Typhoon Tip originated near the Truk Islands on 5 October and passed to the east of the Ryukyu Islands on 18 October. Tip crossed Honshu the following morning and caused heavy damage there.

Only two tropical cyclones formed over the western North Pacific in November. Typhoon Vera originated near the Caroline Islands on 2 November. It weakened rapidly over Luzon and dissipated over the South China Sea off the western coast of Luzon. Tropical Storm Wayne developed about 650 nautical miles east of Manila on 8 November. It moved towards the Philippines but dissipated over the ocean about 400 nautical miles northeast of Manila on 12 November.

There were three tropical cyclones over the area in December but none of them affected Hong Kong. A tropical depression developed to the east of the Marianas on 1 December. It moved rapidly northwards but dissipated the following afternoon. Typhoon Abby originated to the east of the Caroline Islands on 2 December. At first it moved west-northwest towards the Philippines. When it was centred about 550 nautical miles east of Manila on 12 December, it turned northeastwards and dissipated over the ocean three days later. Severe Tropical Storm Ben formed about 500 nautical miles east-southeast of Manila on 20 December. After passing about 90 nautical miles to the southwest of Manila on 22 December, it turned northeastwards and dissipated off the coast of north Luzon the following evening.

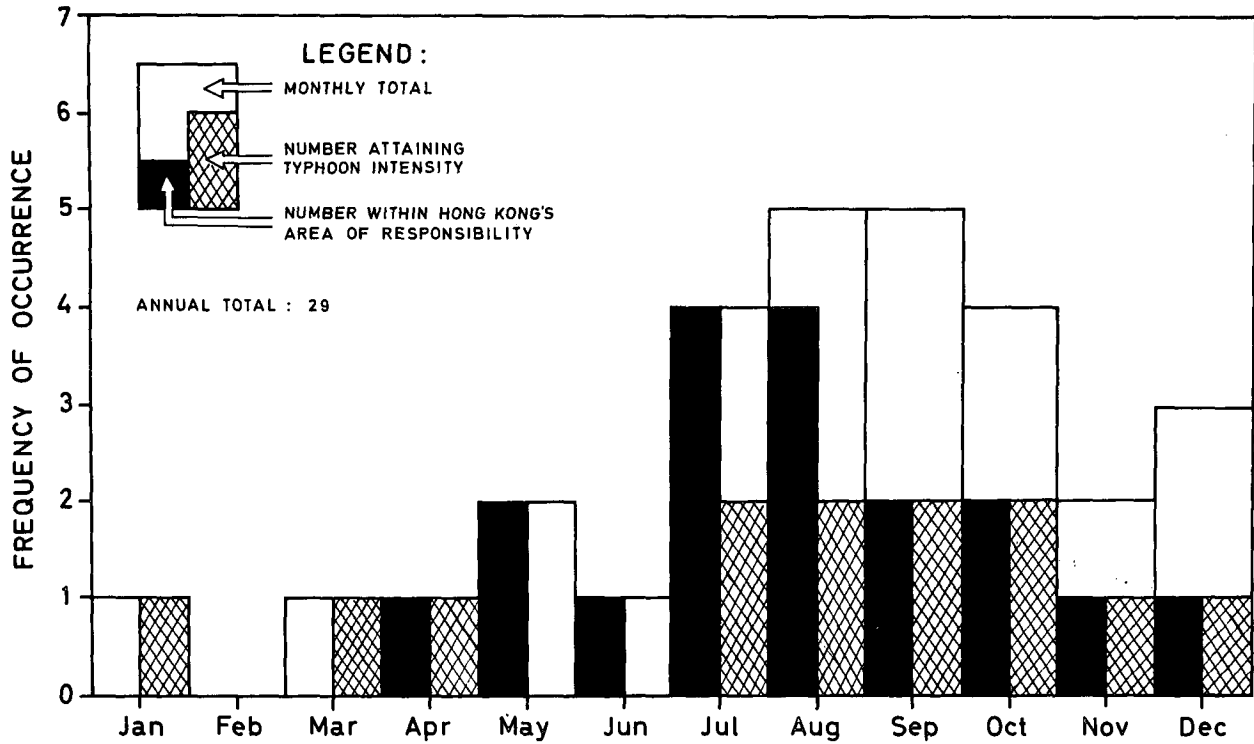


Figure 1. Monthly distribution of the frequency of occurrence of tropical cyclones and typhoons in the western North Pacific and the South China Sea in 1979 (classified in accordance with the month of the first 6-hourly position of each track).

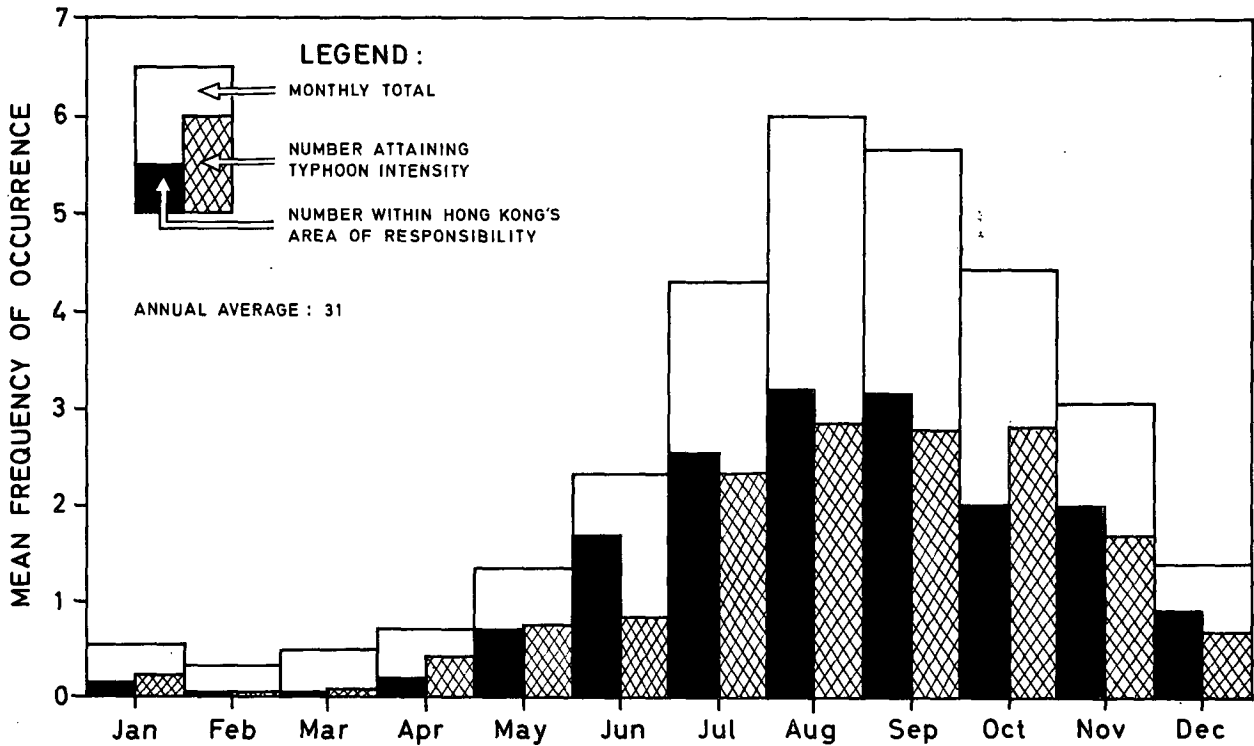


Figure 2. Monthly distribution of the mean frequency of occurrence of tropical cyclones and typhoons in the western North Pacific and the South China Sea, 1946-1978 (classified in accordance with the first 6-hourly position of each track).

REPORTS ON TROPICAL CYCLONES AFFECTING HONG KONG IN 1979

TYPHOON ELLIS

1-6 July 1979

The track of this typhoon is shown in Figure 3

Ellis developed as a tropical depression about 670 nautical miles east of Manila early on 1 July. It deepened rapidly into a tropical storm and moved west-northwest at about 6 knots. Satellite pictures on 2 July showed that Ellis was well organized with a dense cloud mass covering an area about 240 nautical miles in diameter (Figure 4). Ellis further intensified into a typhoon early on 3 July (Figure 5) and moved northwest at 12 knots heading towards north Luzon. At 6.57 a.m. on the same day, a reconnaissance aircraft reported that the minimum central pressure was about 955 millibars and the maximum surface winds were around 100 knots. Ellis passed close to the northern tip of Luzon on the morning of 4 July and, according to press reports, caused destruction to tobacco-rich regions of the Philippines. At 12.00 noon on 4 July, a ship 42 nautical miles west of the centre of the typhoon reported winds of 51 knots. Ellis weakened into a severe tropical storm on entering the South China Sea while still moving west-northwest at 12 knots. Satellite pictures revealed that most of the dense cloud mass of Ellis was confined to the quadrant southwest of the centre. There were relatively weak spiral cloud bands in the other quadrants (Figure 6).

In Hong Kong, the Stand By Signal, No. 1, was hoisted at 4.30 p.m. on 4 July when the severe tropical storm was centred about 390 nautical miles to the east-southeast. Ellis maintained a steady west-northwest movement at 12 knots and passed about 25 nautical miles south of Dongsha Dao (Pratas Island) around 8 a.m. on 5 July, when maximum sustained winds of 40 knots were reported from the island. Winds began to freshen over Hong Kong and the Strong Wind Signal, No. 3, was hoisted at 10.00 a.m. when Ellis was centred about 160 nautical miles to the southeast of Hong Kong. Maximum surface winds near the centre at this time were estimated to be about 60 knots. Satellite pictures showed only narrow spiral cloud bands (Figure 7). The Royal Observatory's radar also showed that there were only a few feeble rain bands but the eye of Ellis was not visible (Figure 8). However, thunderstorms were reported during the day at stations along the south China coast to the west of Hong Kong. Ellis continued to move on a west-northwest course at about 11 knots and was nearest to Hong Kong around midnight on 5 July when it was about 100 nautical miles away. In Hong Kong, all signals were lowered at 11.15 a.m. on 6 July when Ellis was crossing the south China coast about 150 nautical miles to the west-southwest. It weakened rapidly into a tropical depression after crossing the coast and degenerated into an area of low pressure near Leizhou Bandao (Luichow Peninsula) in the afternoon.

Winds in Hong Kong were light westerly on 4 July. During the next morning, northeasterlies set in, soon freshened and became strong easterly by the afternoon. During the night, winds gradually became southeasterly and moderated. The maximum winds and maximum gust peak speeds recorded at some selected locations were as follows:

<i>Location</i>	<i>Maximum mean hourly wind in points and knots</i>		<i>Maximum gust in points and knots</i>	
Royal Observatory	ENE	20	ENE	52
Hong Kong Airport (SE)	E	28	ENE	47
Hong Kong Airport (NW)	E	26	ENE	49
Waglan Island	ENE	40	ENE	49
Tate's Cairn	E	35	ENE	57
Cheung Chau	E	29	ENE	50
King's Park	E	21	ENE	42
Star Ferry	ESE	22	ESE	42
Green Island	ENE	32	ENE	42
Tsim Bei Tsui	ESE	26	ESE	40
Tai O	ESE	24	ESE	49
Castle Peak	NNE	15	NNE	37
Chek Lap Kok	E	30	ENE	47
Lei Yue Mun	E	35	E	52
Yau Yat Chuen	E	22	ENE	47
Kowloon Tsai Hill	ENE	23	ENE	47

The weather was fine, sunny and hot on 4 July. Apart from some isolated thunderstorms and showers, the next day was also sunny and hot with temperatures reaching a maximum of 33.8°C in the afternoon. More frequent showers occurred during the night and early on 6 July but conditions soon improved in the afternoon. The minimum sea-level pressure at the Royal Observatory was 995.0 millibars recorded at around 6.00 p.m. on 5 July when Ellis was about 120 nautical miles to the south-southeast of Hong Kong. The daily rainfall amounts recorded during the period 4–7 July were as follows:

	<i>Royal Observatory</i>	<i>Cheung Chau</i>	<i>Tate's Cairn</i>
4 July	Nil	Nil	Nil
5 July	0.7 mm	0.6 mm	2.0 mm
6 July	12.5 mm	10.8 mm	22.0 mm
7 July	Trace	0.4 mm	3.0 mm
Total:	13.2 mm	11.8 mm	27.0 mm

During the approach of Ellis, two boats sank in Yau Ma Tei Typhoon Anchorage. Damage to property in Hong Kong was minimal.

The times and heights of the highest tides and maximum storm surges recorded at various locations in Hong Kong during the display of tropical cyclone warning signals were as follows:

Location	Highest tide above chart datum			Maximum storm surge above astronomical tide		
	Height (m)	Date	Time	Height (m)	Date	Time
North Point	2.3	6 Jul	6.30 a.m.	0.6	6 Jul	3.00 a.m.
Tai Po Kau	2.2	6 Jul	6.00 a.m.	0.9	5 Jul	9.30 p.m.
Chi Ma Wan (Lantau Island)	2.4	6 Jul	7.45 a.m.	0.8	5 Jul	9.45 p.m.

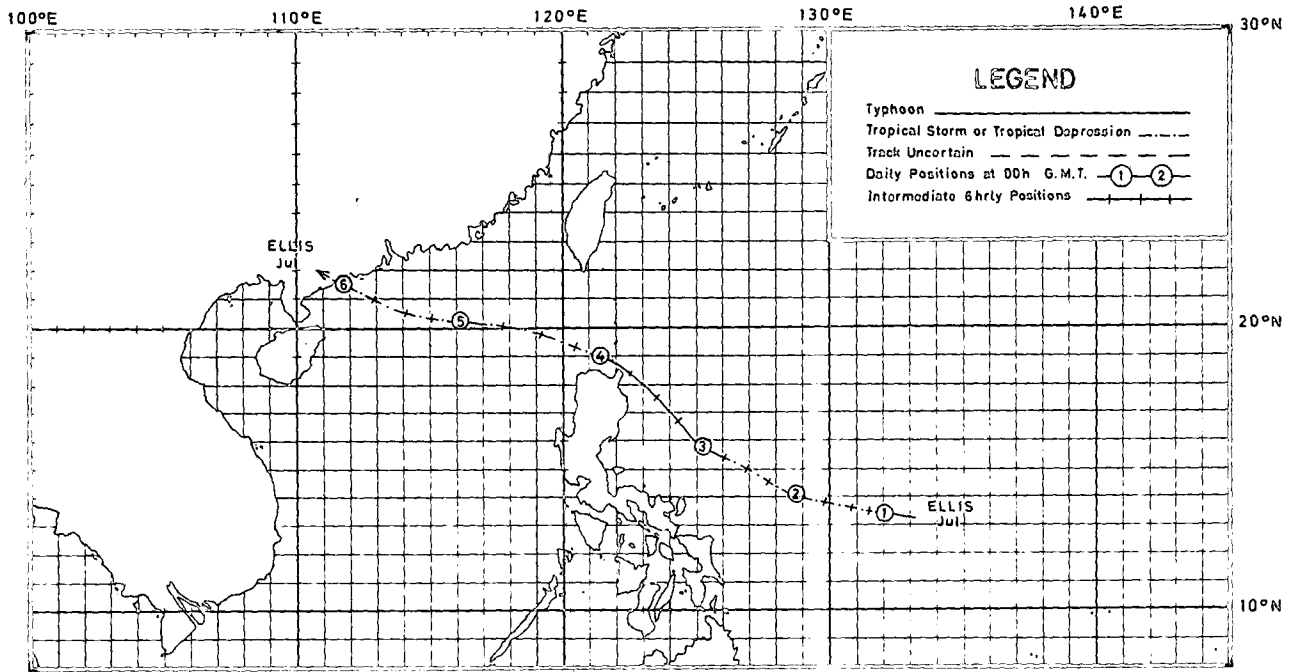


Figure 3. Track of Typhoon Ellis: 1-6 July 1979.

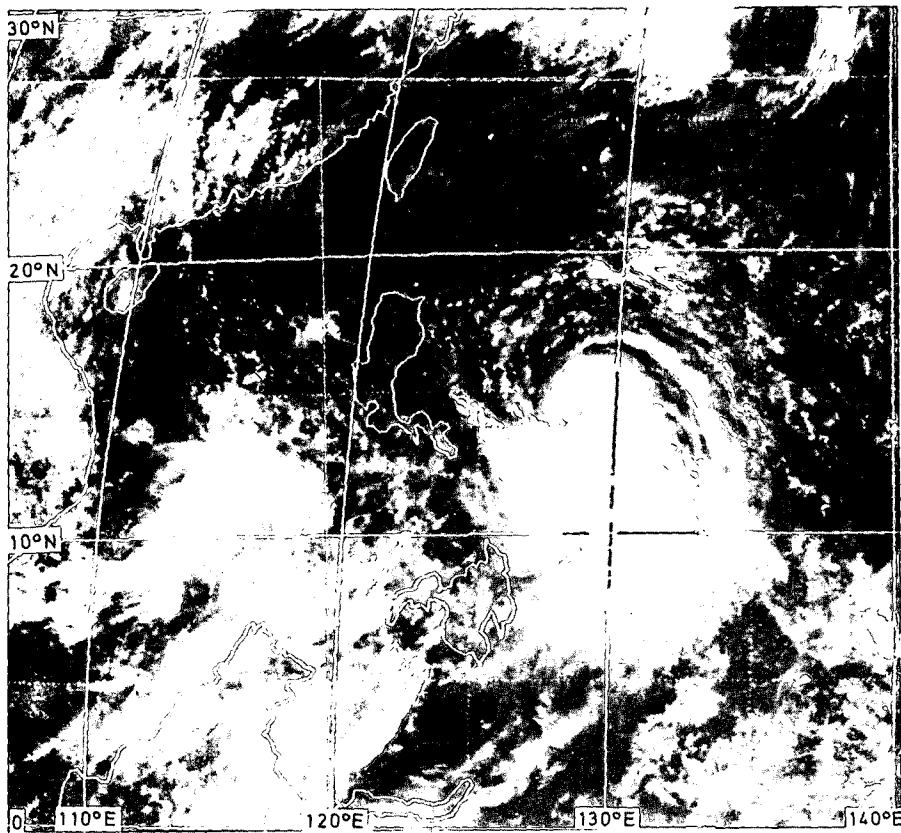


Figure 4. GMS-1 visible picture of Typhoon Ellis taken around 9.00 a.m. on 2 July 1979.

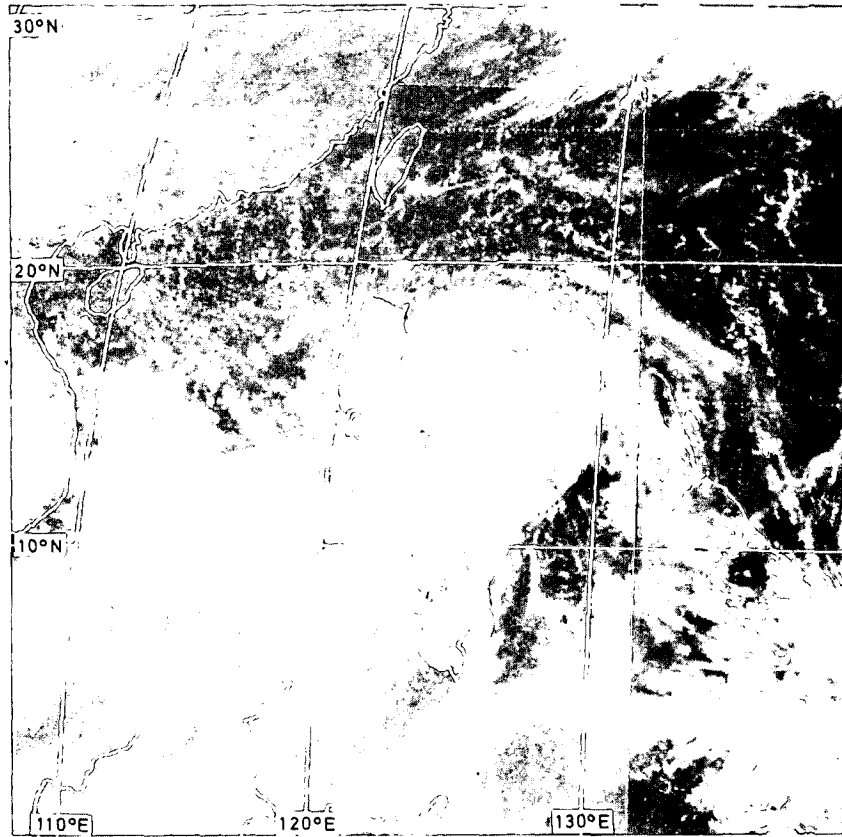


Figure 5. GMS-1 visible picture of Typhoon Ellis taken around 9.00 a.m. on 3 July 1979.

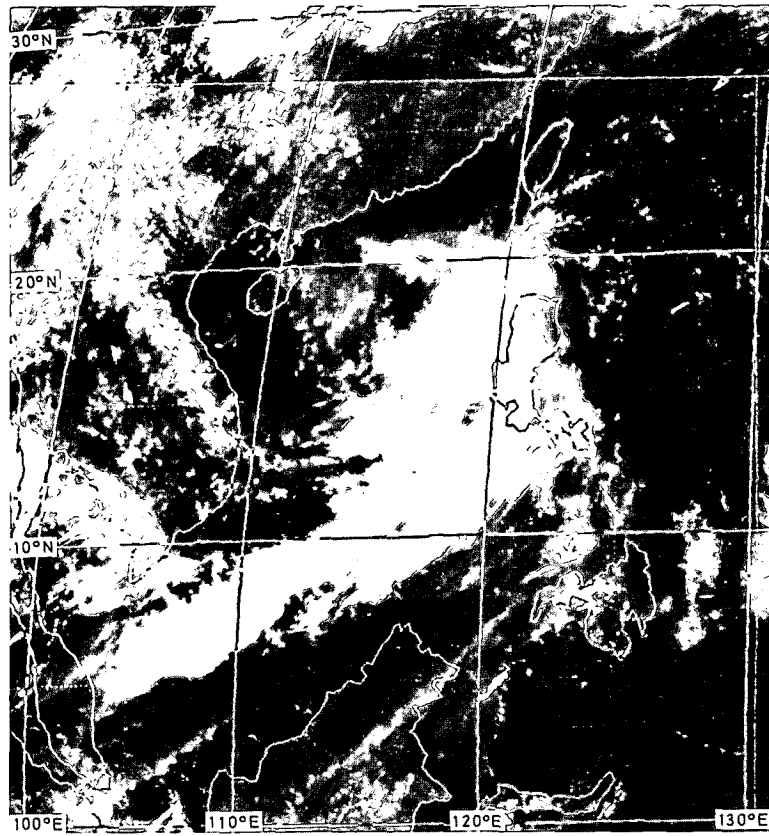


Figure 6. GMS-1 visible picture of Typhoon Ellis taken around noon on 4 July 1979.

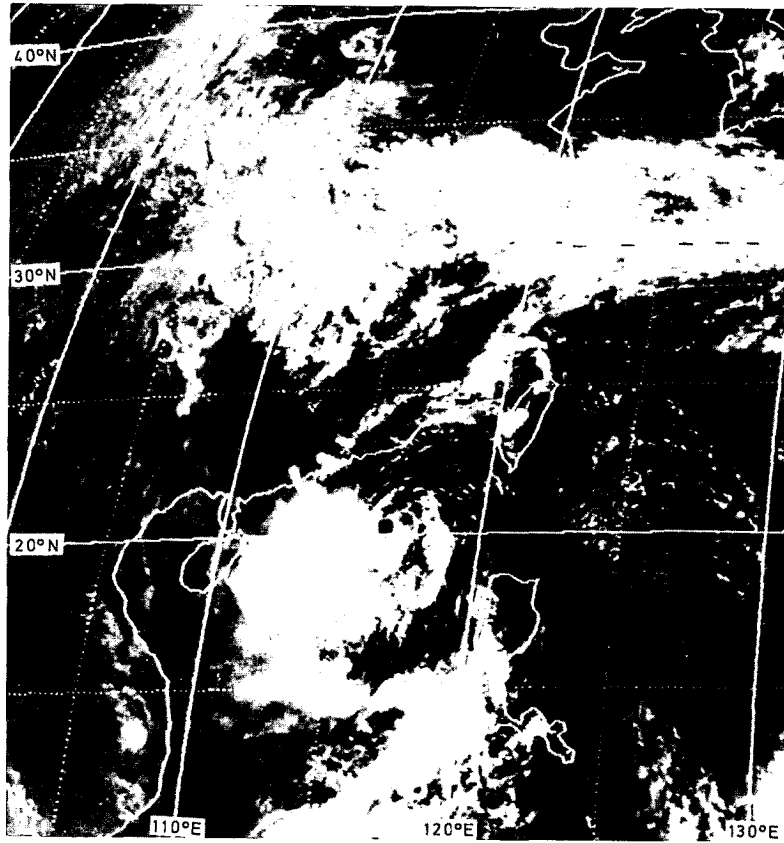


Figure 7. GMS-1 visible picture of Typhoon Ellis taken around 9.00 a.m. on 5 July 1979.

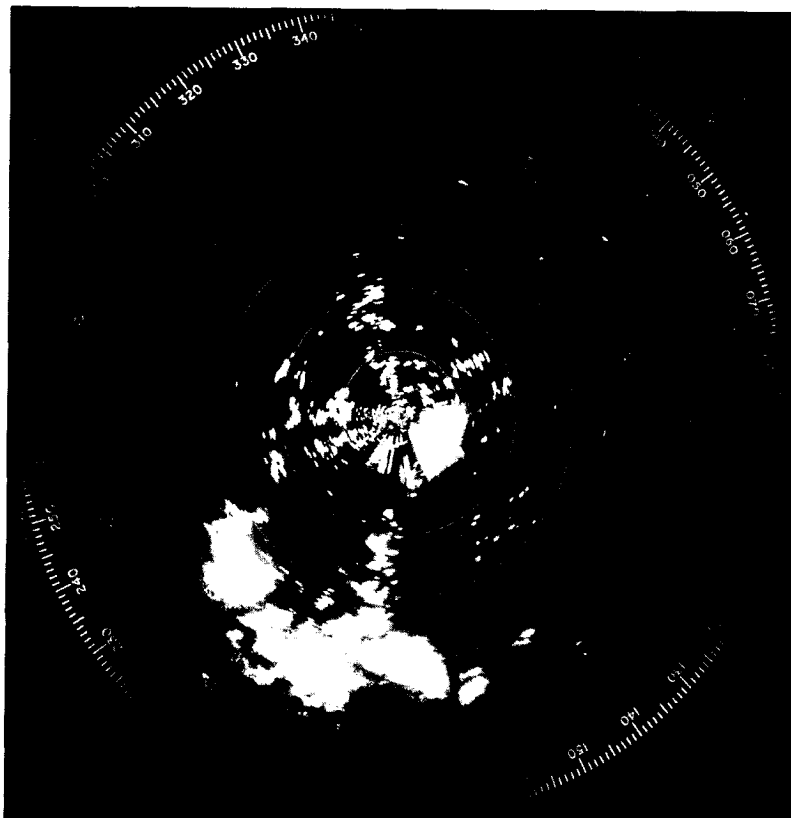


Figure 8. Radar picture of Typhoon Ellis taken at noon on 5 July 1979. (Range markers at 40-mile intervals)

SEVERE TROPICAL STORM GORDON

26-30 July 1979

The track of this severe tropical storm is shown in Figure 9

Gordon developed as a tropical depression about 640 nautical miles northeast of Manila on 26 July. It moved west-northwest at about 12 knots for a day while intensifying into a tropical storm. It then moved west towards the Bashi Channel at 11 knots, and at around 8.00 a.m. on 28 July, it passed within 15 nautical miles of Batan where a minimum sea-level pressure of 978.2 millibars and maximum sustained winds of 40 knots were reported. Satellite pictures taken at noon indicated that Gordon had become well organized with a dense overcast about 120 nautical miles in diameter and was surrounded by wide spiral cloud bands (Figure 10).

In Hong Kong, the Stand By Signal, No. 1, was hoisted at 1.10 p.m. on 28 July when the tropical storm was about 390 nautical miles east of Hong Kong. Gordon further intensified into a severe tropical storm while crossing the Bashi Channel and turned onto a northwest track, moving at 10 knots. At 7.50 p.m. on the same day, a reconnaissance aircraft reported that the minimum central pressure was about 975 millibars. Gordon then took a west-northwest course at a speed of 14 knots on entering the South China Sea. On the morning of 29 July the Royal Observatory's radar indicated that Gordon had a circular eye and rain bands were mainly confined to areas south and west of the centre (Figure 11). Gordon reached the coast of south China near Shantou (Swatow) about 130 nautical miles east-northeast of Hong Kong around 3 p.m. on 29 July. It weakened into a tropical storm after crossing the coast and, while moving west at 10 knots across southern Guangdong (Kwangtung), further weakened to a tropical depression early in the morning on 30 July. Gordon was nearest to Hong Kong around 2 a.m. when it was about 40 nautical miles to the north. It degenerated into an area of low pressure near Guangzhou (Canton) later in the morning. In Hong Kong, the Stand By Signal, No. 1, was lowered at 6.55 a.m. when Gordon was about 55 nautical miles northwest of Hong Kong.

Winds in Hong Kong were light westerly on 28 July. They became moderate northwesterly during the next day. Winds then turned west-southwesterly early on the morning of 30 July while increasing in strength to become strong for a few hours off-shore. Winds moderated later during the day.

The maximum winds and maximum gust peak speaks recorded at some selected locations were as follows:

<i>Location</i>	<i>Maximum mean hourly wind in points and knots</i>		<i>Maximum gust in points and knots</i>	
Royal Observatory	WSW	20	WSW	39
Hong Kong Airport (SE)	WSW	21	WSW	31
Hong Kong Airport (NW)	SW	13	WSW	38
Waglan Island	WSW	30	WSW	44
Tate's Cairn	SW	25	SW	47
Cheung Chau	WSW	22	WSW	37
King's Park	SSE	18	SSE	35
Star Ferry	W	25	W	39
Green Island	WSW	22	W	31
Tsim Bei Tsui	N	18	N	32
Castle Peak	SW	17	SW	46
Chek Lap Kok	W	29	W	40
Lei Yue Mun	W	23	W	42
Yau Yat Chuen	SW	20	SW	33
Kowloon Tsai Hill	SW	20	WSW	31

The weather was fine, sunny and very hot on 28 July. A maximum temperature of 33.1°C was recorded at the Royal Observatory in the afternoon. It remained hot on the following day but became cloudy with some showers. Showers became more frequent and violent in the early morning of 30 July and there were periods of rain during the day. Rain ceased for a while during the evening and night, but heavy showers set in again in the following morning and persisted throughout the day. The minimum sea-level pressure at the Royal Observatory was 994.9 millibars recorded at around 1 a.m. on 30 July when Gordon was about 45 nautical miles to the north of Hong Kong. The daily rainfall amounts recorded during the period 28 July-1 August were as follows:

	<i>Royal Observatory</i>	<i>Cheung Chau</i>	<i>Tate's Cairn</i>
28 July	Nil	Trace	Nil
29 July	18.0 mm	2.4 mm	36.0 mm
30 July	142.7 mm	31.3 mm	147.0 mm
31 July	99.5 mm	33.6 mm	165.8 mm
1 August	Nil	Nil	Nil
Total:	260.2 mm	67.3 mm	348.8 mm

The heavy rain brought by Gordon caused flooding in many places in Hong Kong, the worst occurring in Sha Tin, Sheung Shui and Kam Tin, where farmland was inundated. Some minor landslips also occurred on Black's Link and Peak Road on Hong Kong Island.

The times and heights of the highest tides and maximum storm surges recorded at various locations in Hong Kong during the display of the Stand By Signal were as follows:

Location	Highest tide above chart datum			Maximum storm surge above astronomical tide		
	Height (m)	Date	Time	Height (m)	Date	Time
North Point	2.1	29 Jul	1.00 p.m.	0.3	29 Jul	3.15 p.m.
Tai Po Kau	2.1	29 Jul	2.30 p.m.	0.5	30 Jul	4.00 a.m.
Chi Ma Wan (Lantau Island)	2.3	29 Jul	1.00 p.m.	0.5	28 Jul	9.30 p.m.

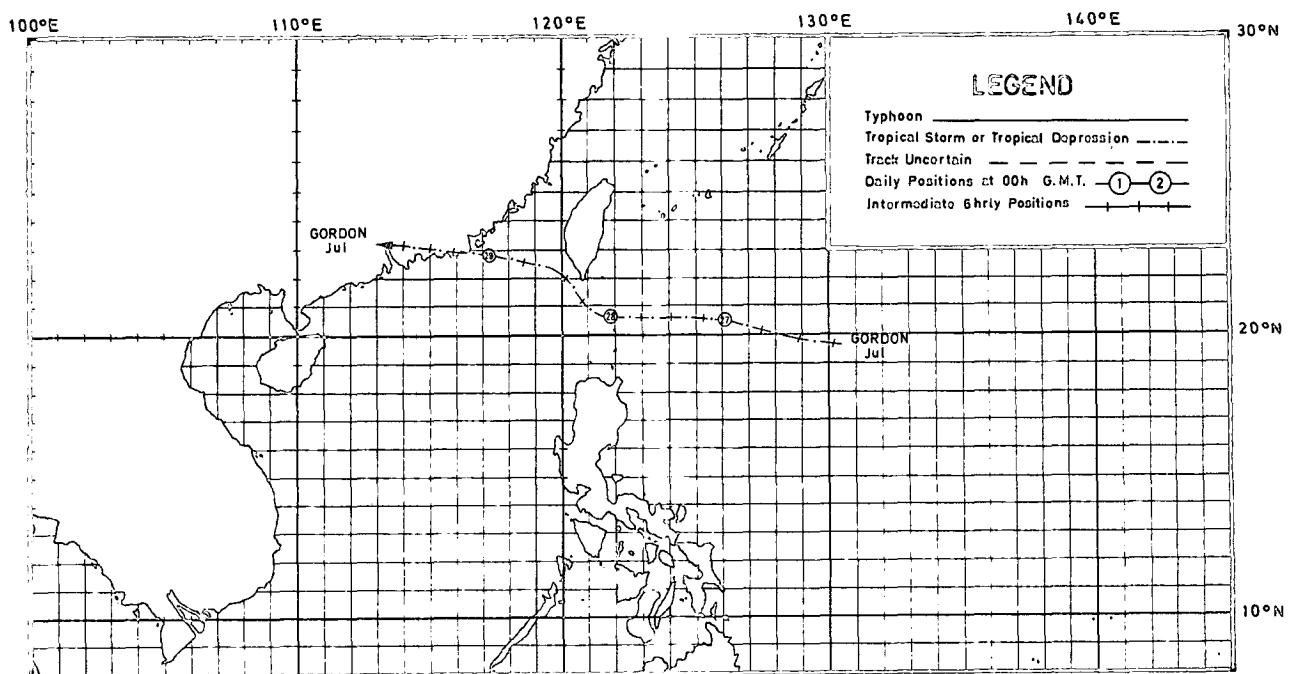


Figure 9. Track of Severe Tropical Storm Gordon: 26-30 July 1979.

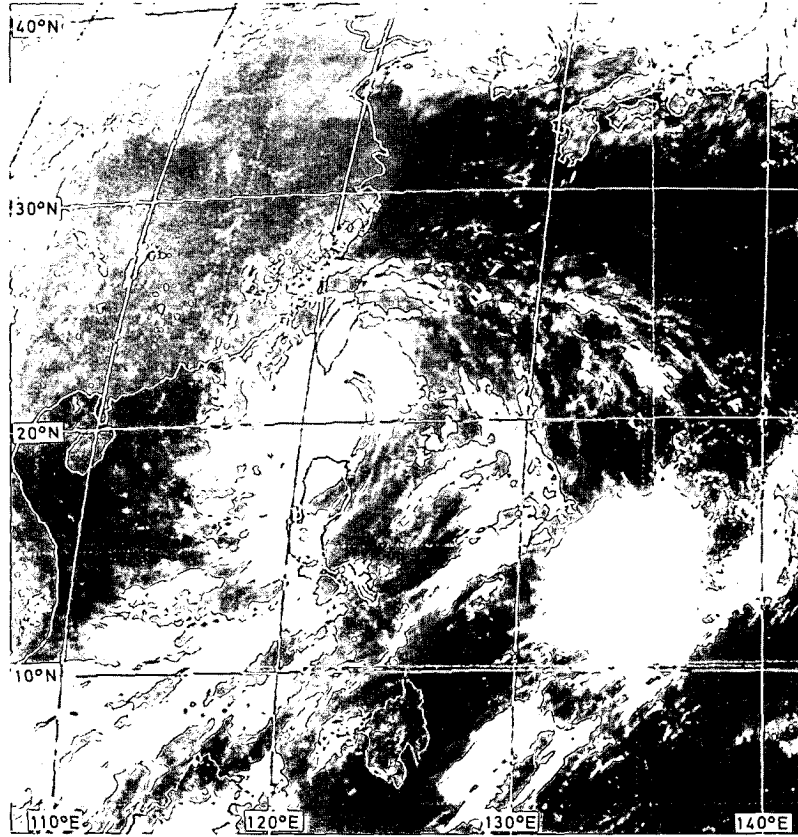


Figure 10. GMS-1 visible picture of Severe Tropical Storm Gordon taken around noon on 28 July 1979.

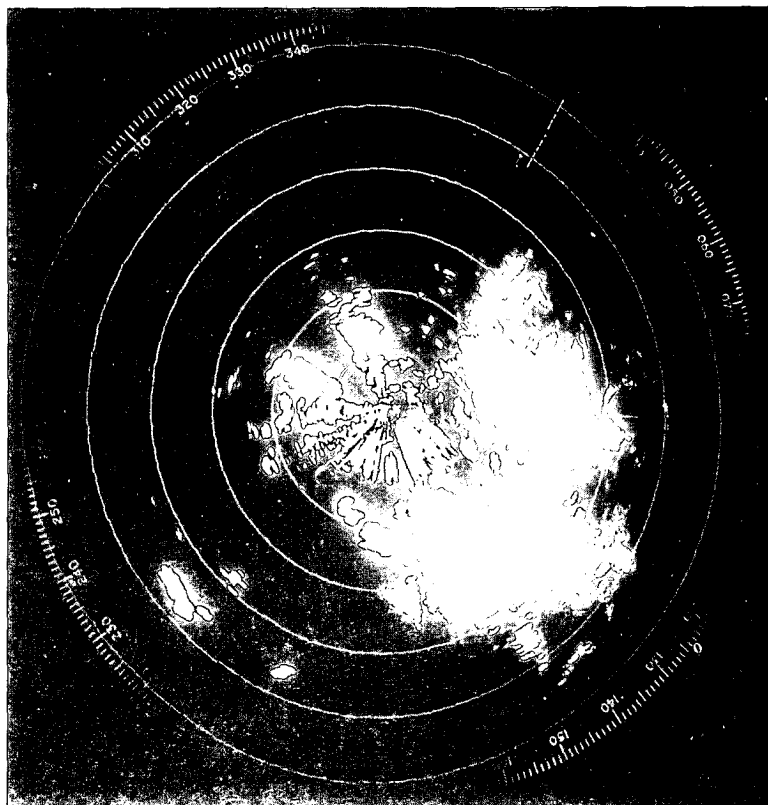


Figure 11. Radar picture of Severe Tropical Storm Gordon taken at 9.00 a.m. on 29 July 1979. (Range markers at 40-mile intervals)

TYPHOON HOPE

28 July–3 August 1979

The track of this typhoon is shown in Figure 12

Typhoon Hope was the most severe typhoon to affect Hong Kong since Typhoon Rose in 1971. It passed rapidly over the New Territories on 2 August and caused twelve deaths and injured 260 people. Maximum gusts were generally around 100 knots increasing to about 130 knots at elevated sites. Maximum gusts of 130 knots, 123 knots and 111 knots were recorded at Cape D'Aguiar, Tate's Cairn and Chek Lap Kok respectively. A maximum gust of 108 knots was recorded at Star Ferry Pier, Kowloon. This is the highest gust recorded inside the harbour since Typhoon Rose in 1971. The instantaneous minimum mean sea-level pressure of 961.6 millibars at the Royal Observatory was second lowest on record, the lowest being 953.2 millibars in Typhoon Wanda, 1962. It also broke the record of minimum mean sea-level pressure in August, the previous record being 968.6 millibars set by Typhoon Shirley in 1968. Fortunately, Hope was a fast-moving typhoon. If Hope had moved slower during its passage over Hong Kong, casualties and damage to property could have been more severe, considering the violence of the typhoon.

Hope began as a weak tropical disturbance on 25 July about 180 nautical miles south of Guam. It started moving westwards for a day and then moved northwest without much development during the next two days. The maximum sustained winds were only about 20 knots during this period. On the morning of 28 July, it intensified into a tropical depression about 420 nautical miles west-northwest of Guam. While moving west at about 5 knots, it intensified into a tropical storm and was named 'Hope' in the early hours of 29 July. During the day, it moved west-northwest at about 7 knots. At 6.20 p.m. on 29 July, a reconnaissance aircraft reported that the minimum mean sea-level pressure was about 972 millibars and the maximum sustained winds were about 70 knots. Hope turned onto a northwest track and intensified into a typhoon on 30 July. Satellite pictures received at 9.00 a.m. showed that Hope had a circular dense overcast about 120 nautical miles in diameter. The spiral cloud bands were particularly active to the southeast of the centre (Figure 13).

Hope gradually accelerated and by early next morning was moving at about 14 knots. At 7.25 a.m. on 31 July, a reconnaissance aircraft reported that the minimum sea-level pressure had dropped to about 926 millibars and maximum sustained winds were about 85 knots. At 9.00 a.m. on 31 July, the typhoon was centred about 530 nautical miles northeast of Manila. The dense overcast had expanded and was about 180 nautical miles in diameter (Figure 14). Spiral cloud bands became more evenly distributed around the centre and the circulation of the typhoon then covered an area about 600 nautical miles in diameter. The eye of Hope was well defined at this stage. Hope continued moving northwest at an average speed of 16 knots and underwent explosive intensification during the day. By 9.00 p.m. on 31 July, the maximum sustained winds had risen to about 130 knots.

At 6.48 a.m. on 1 August, a reconnaissance aircraft reported that maximum sustained winds near the centre of Hope were 140 knots. The minimum sea-level pressure was estimated to be 902 millibars. At 9.00 a.m. satellite pictures received at the Royal Observatory indicated that the dense overcast was about 150 nautical miles in diameter. Spiral cloud bands were increasingly active to the southwest of the centre. The circulation of the typhoon covered an area about 400 nautical miles in diameter. The maximum gusts were estimated to be in the region of 160 knots. At 1.00 p.m., Hope passed within 15 nautical miles of Batan, where maximum sustained winds of 100 knots were recorded and, one hour later, the mean sea-level pressure there dropped to a minimum of 950.9 millibars.

Hope was closest to Taiwan in the afternoon. Gales and heavy rain associated with Hope caused much damage there. In eastern Taiwan, 38 houses collapsed and 132 houses were seriously damaged. Farmland and fish-ponds were devastated. A number of bridges were broken. In Hengchun, southern Taiwan, 500 houses were flooded and one person died. Widespread flooding was reported in other places over southern Taiwan. Tremendous damage was caused to crops and vegetation.

While passing through the Bashi Channel, Hope took a west-northwest course and accelerated to enter the South China Sea at 18 knots. At 6.06 p.m. on 1 August, a reconnaissance aircraft reported that the minimum sea-level pressure was about 920 millibars. At 9.00 a.m. on 2 August, satellite pictures revealed that the dense overcast had shrunk to about 100 nautical miles in diameter but there was little change in the extent of the area covered by the spiral cloud bands (Figure 16). Maximum sustained winds near the centre of the typhoon were estimated to be around 110 knots at this time. Hope further accelerated to 28 knots and moved westward, reaching the eastern parts of Hong Kong at around 2.00 p.m. While Hope was moving across Hong Kong, it slowed down to an average speed of 17 knots. Hope then continued moving westward across the Zhu Jiang (Pearl River) estuary and swept through southern Guangdong (Kwangtung) at 22 knots. Macau survived Typhoon Hope with only minor damage and disruption to public services. No casualties were reported there. Hope weakened into a tropical storm around midnight while turning to move west-southwest. On 3 August, it passed over the northern coast of the Gulf of Tonkin at about 20 knots and dissipated about 110 nautical miles west of Hanoi.

According to a Chinese newspaper in Guangzhou (Canton), the passage of Typhoon Hope across the southern part of Guangdong (Kwangtung) province was catastrophic. 37 counties were affected. About 100 people were killed or reported missing. More than 50,000 houses were severely damaged. A number of embankments were broken. Extensive destruction was caused to agricultural land. In Shenchun (Shum Chun), two people were killed, and more than 20 were injured. The city suffered a blackout for about 2 days because many overhead transmission lines were blown down. Thousands of trees in vast areas were uprooted.

In Hong Kong, the Stand By Signal, No. 1, was hoisted at 3.30 p.m. on 1 August when Hope was about 420 nautical miles east-southeast of Hong Kong. Winds were moderate westerly or northwesterly. As winds began to freshen over Hong Kong, the Strong Wind Signal, No. 3, was hoisted at 10.00 p.m. on the same day. Winds turned northerly around 5.00 a.m. in the next morning and the Gale or Storm Signal, No. 8 NORTHEAST, was hoisted at 7.00 a.m. to warn the imminence of gales. The terrain of the territory sheltered most areas from northerly winds so that wind speeds were not particularly strong at this time. The first major spiral rain band of Hope appeared on the Royal Observatory's radar screen around 1.00 a.m. on 2 August and was some 160 nautical miles away to the east-southeast. The small eye of Hope which was about 10 nautical miles in diameter was first visible around 6.00 a.m. The double-walled eye of Hope was vividly displayed on the radar at 9.00 a.m. (Figure 17).

As winds began to turn northwesterly, the Gale or Storm Signal, No. 8 NORTHWEST, replaced the No. 8 NORTHEAST Signal at 11.00 a.m. Winds strengthened rapidly to near-gale force in the next hour and gusts of 73 knots were recorded at Tate's Cairn and 59 knots at Cheung Chau. The Increasing Gale or Storm Signal, No. 9, was hoisted at 12.35 p.m. as winds turned west-northwest and the full force of the typhoon was felt in most places. The Hurricane Signal, No. 10, was hoisted at 1.00 p.m. when Hope was about 25 nautical miles east of the New Territories. Winds increased in strength very rapidly and reached hurricane force in the following hour. Gusts of 90 knots were recorded at Star Ferry Pier, 94 knots at the Royal Observatory, 106 knots at Waglan Island and 105 knots at Tate's Cairn. Intense rain echoes were observed on the radar within 60 nautical miles of the centre (Figure 18).

The centre of Hope passed over Mirs Bay at around 2.00 p.m. Calm winds and bright sky were reported at Double Haven, Tai Po Kau and the Chinese University for about 20 minutes (Figure 19). The eye of Hope was near Tai Mo Shan around 3.00 p.m. Between 2.00 p.m. and 3.00 p.m., gusts of 108 knots were recorded at Star Ferry Pier, 107 knots at Waglan Island, 123 knots at Tate's Cairn and 110 knots at Chek Lap Kok. Sweeping through the New Territories at 17 knots, Hope was centred near Tuen Mun around 3.30 p.m. Residents in Sek Kong, Yuen Long, Hung Shui Kiu, Tuen Mun, Sham Tseng and Tsuen Wan also reported calm winds and bright sky for about 15 minutes during the passage of the eye. There were also reports of seeing blue sky in the eye. The minimum mean sea-level pressure at the centre of Hope was estimated to be about 950 millibars while Hope was crossing over the western part of the territory. In areas to the south of the centre, winds turned through southwest to become southerly around 3.00 p.m. to 4.00 p.m. Gusts of 111 knots were recorded at Chek Lap Kok, 102 knots at Waglan Island and 100 knots at Cheung Chau. Mean sea-level pressure rose sharply at all stations after the passage of the eye. Winds soon dropped below hurricane force and the No. 10 Signal was replaced by the No. 8 SOUTHEAST Gale or Storm Signal at 4.45 p.m. Gales from the south to southeast lasted for a few more hours. The No. 8 SOUTHEAST Gale or Storm Signal was replaced by the Strong Wind Signal, No. 3, at 8.05 p.m. while Hope was moving away from Hong Kong. Winds remained generally strong during the night but moderated on the morning of 3 August. The No. 3 Signal was lowered at 5.30 a.m. when Hope was centred about 270 nautical miles to the west of Hong Kong.

The minimum values of mean sea-level pressure recorded at various stations were as follows:

<i>Station</i>	<i>Minimum mean sea-level pressure in millibars</i>
Chek Lap Kok	957.9
King's Park	958.1
Hong Kong Airport	960.1
Royal Observatory	961.6
Waglan Island	964.1
Cheung Chau	967.9

The maximum winds and maximum gust peak speeds recorded at some selected locations were as follows:

<i>Location</i>	<i>Maximum mean hourly wind in points and knots</i>		<i>Maximum gust in points and knots</i>	
*Royal Observatory	W	38	W	94
*Hong Kong Airport (SE)	W	62	W	98
*Hong Kong Airport (NW)	SSW	41	W	88
*Waglan Island	SW	78	SW	107
*Tate's Cairn	S	60	WNW	123
*Cheung Chau	SSW	62	WSW	100
King's Park	W	44	WNW	90
Star Ferry	NW	70	NW	108
Green Island	W	56	W	90
*Tsim Bei Tsui	N	72	N	101
Tai O	W	34	W	47
*Castle Peak	—	52	—	93
Chek Lap Kok	—	80	—	111
*Hok Un	WNW	40	WSW	84
*Tsing Yi	—	45	—	86
Stanley	NW	80	NW	116
Cape D'Aguilar	—	100	—	130
Lei Yue Mun	W	60	W	92
Yau Yat Chuen	W	44	W	87
Kowloon Tsai Hill	W	44	W	90

(Stations marked with an asterisk were equipped with Dines pressure-tube anemographs and wind speeds should be adjusted to compensate for variations in air density for investigations requiring high precision).

The weather in Hong Kong was fine, sunny and hot on 1 August. A maximum temperature of 32.1°C was recorded at the Royal Observatory. It became cloudy in the following morning and some slight showers set in. Heavier rain occurred around noon and violent squally showers were reported when Hope was passing through the New Territories. The heaviest downpour at the Royal Observatory occurred between 2.00 p.m. and 3.00 p.m. when 82.1 mm of rain were recorded. Heavy squally showers continued until around 7.00 p.m. Showers then became lighter and less frequent during the night. It remained cloudy with occasional heavy showers on the following day. The daily rainfall amounts recorded during the period 1-4 August were as follows:

	<i>Royal Observatory</i>	<i>Cheung Chau</i>	<i>Tate's Cairn</i>
1 August	Nil	Nil	Nil
2 August	208.8 mm	81.4 mm	77.8 mm
3 August	26.2 mm	17.1 mm	27.0 mm
4 August	52.4 mm	41.5 mm	37.5 mm
Total:	287.4 mm	140.0 mm	142.3 mm

Typhoon Hope caused the highest toll of fatalities since Typhoon Rose in 1971. Twelve people were killed. 260 people were injured of whom 94 were hospitalised. About 2,000 people had to stay in temporary shelters provided by the Government. A total of 53 huts were destroyed and 796 people made homeless.

At the height of the typhoon, eleven collisions involving eighteen vessels occurred in the harbour. Nine vessels had their cables parted from buoys and another two went aground. The Greek-registered 10,300-tonne vessel, M.V. 'Argonaut', rammed the piers of Star Ferry and went aground alongside the Kowloon Public Pier (Figure 20).

A Panamanian vessel, M.V. 'New Ming Ren', ran aground at Tai Lam Chung in the New Territories. The refugee ship, M.V. 'Huey Fong', grounded at Tai Tsing Chau northeast of Lantau Island. The Royal Navy patrol craft 'Beachampton' was hit by a drifting 3,500-tonne vessel at its typhoon mooring and suffered damage.

Heavy damage was inflicted to many small craft. Hope sank 27 pleasure vessels and damaged another 69. Eighty-five dwelling boats were sunk while another 30 were damaged. The figures for other small craft and fishing vessels sunk or damaged were 56 and 108 respectively.

Many people were evacuated from their damaged homes. One major evacuation occurred in Tai Po where more than 40 huts were damaged. In Tai Hang, about 150 people had to be evacuated because the roofs of their squatter huts had been blown away. Two two-storey buildings in Sheung Wan and 25 squatter huts in Ngau Tau Kok had to be evacuated because they were in danger of collapsing. Three wooden huts on rooftops in Temple Street were blown down. About 100 people lost their homes in two separate squatter fires which broke out in Wan Chai and Shek O Village while Hope was affecting Hong Kong.

Numerous landslips occurred on both sides of the harbour, but none were serious. Two wooden huts in Shau Kei Wan collapsed in a landslip but no one was hurt. At Oi Man Estate, a minor landslip occurred with little damage. 200 squatters living in Tsuen Wan and 60 people in Chung Hom Kok Road were evacuated after landslips. Many roads were obstructed with fallen trees and debris.

A tide gauge at Tai Po Kau indicated that the sea-level rose abruptly from 0.9 metres at 2.30 p.m. to a maximum of 4.3 metres at 4.30 p.m. Serious flooding in Tin Sam Village near Lam Tsuen River in Tai Po caused the death of three persons. Flooding was widespread all over the New Territories, especially in Tai Po Market and Sha Tin (Figure 21). Flooding was also reported in several urban areas.

The times and heights of the highest tides and maximum storm surges recorded at various locations in Hong Kong during the passage of Hope were as follows:

Location	Highest tide above chart datum			Maximum storm surge above astronomical tide		
	Height (m)	Date	Time	Height (m)	Date	Time
North Point	2.7	2 Aug	4.15 p.m.	1.5	2 Aug	4.15 p.m.
Tai Po Kok	4.3	2 Aug	4.30 p.m.	3.2	2 Aug	4.30 p.m.
Chi Ma Wan (Lantau Island)	2.7	2 Aug	3.45 p.m.	1.5	2 Aug	3.45 p.m.

Public transport and all kinds of traffic came to a complete halt at the height of the typhoon. Five submerged telephone cables under the harbour were damaged by ships dragging their anchors. Telephone communications were impeded. About 19,000 telephone lines were out of order. There was widespread disruption to power supplies in the New Territories. Power failure was also reported in various districts over Hong Kong.

About 75 per cent of vegetables, flowers and fruit trees in the New Territories were destroyed or severely damaged. There was extensive damage to trees, shrubs and plants throughout Hong Kong. A survey indicated that Typhoon Hope destroyed more than 19,000 fruit trees, 1,200 hectares of vegetables, 140 hectares of cultivated flowers and more than 3,500 pots flowers. Nearly 113,000 head of livestock were also destroyed. The worst hit areas were around Yuen Long, Tuen Mun, Ping Shan, Ha Tsuen, San Tin, Kam Tin, Pat Heung and Sap Pat Heung, although there was also damage around Tai Po, Sai Kung and Tsuen Wan. More than 7,700 farmers registered claims for compensation for damage.

270 metal canisters containing lethal cyanide salt were flung into the harbour when a dangerous goods storehouse in Yau Ma Tei was damaged by sea waves (Figure 22).

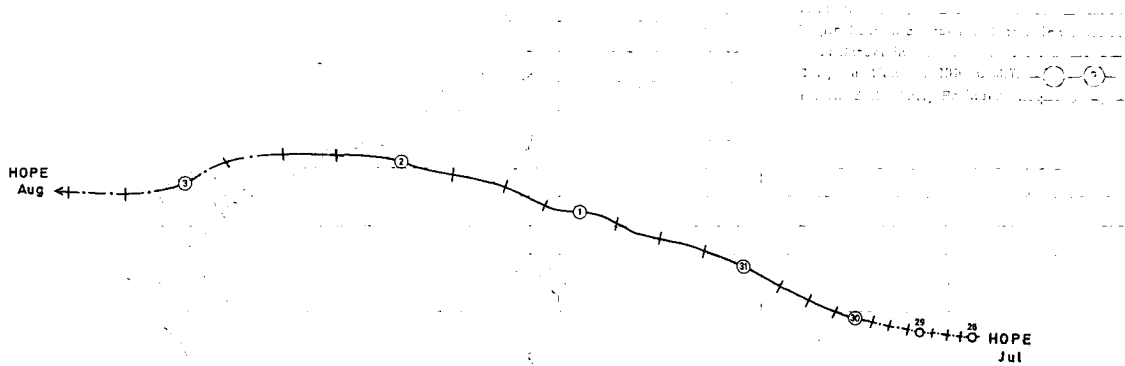


Figure 12(a). Track of Typhoon Hope: 28 July-3 August 1979.

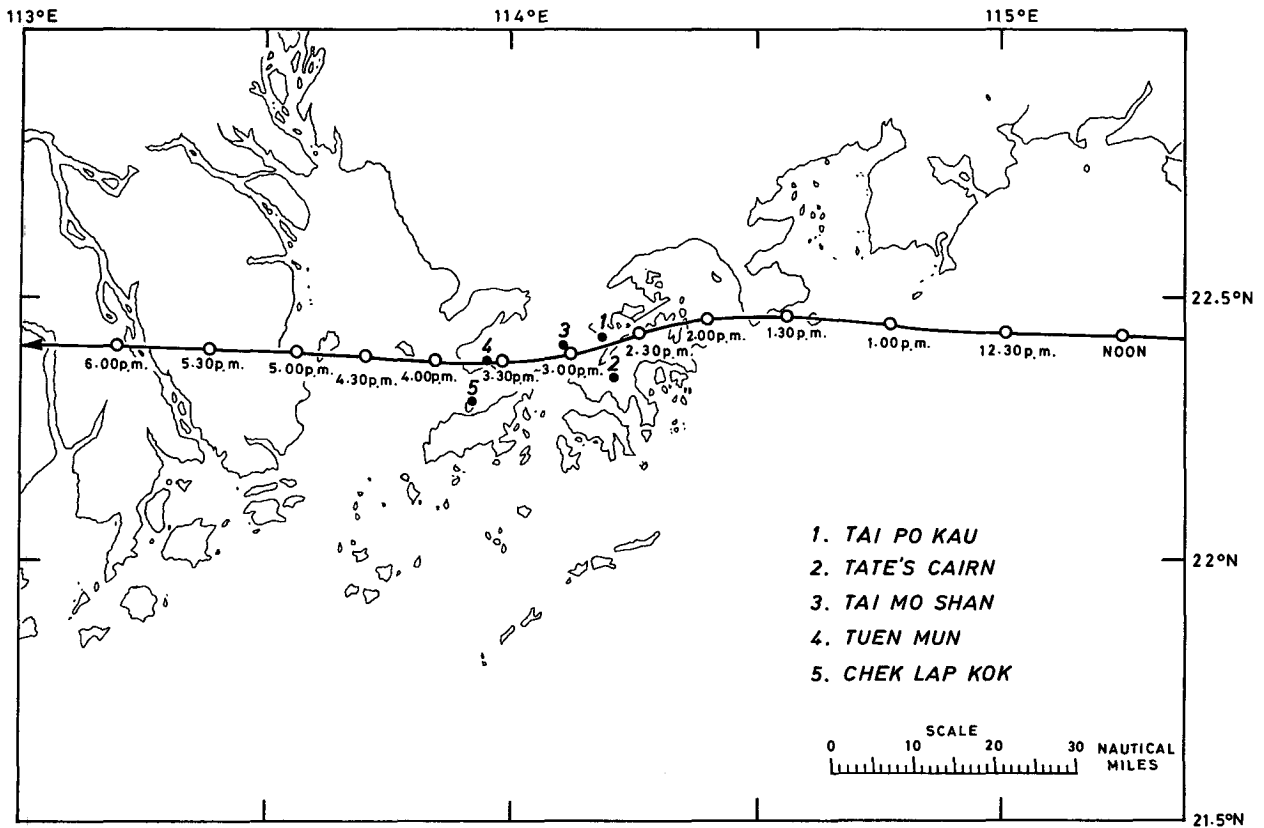


Figure 12(b). Trajectory of the centre of the eye of Typhoon Hope near Hong Kong on 2 August 1979.

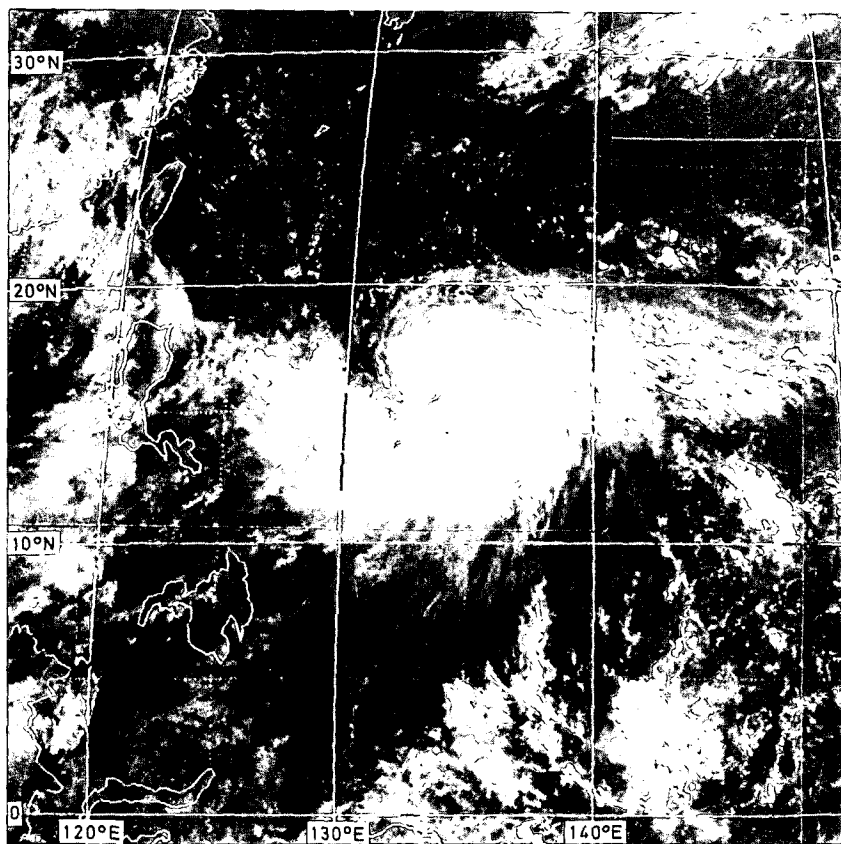


Figure 13. GMS-1 visible picture of Typhoon Hope taken around 9.00 a.m. on 30 July 1979.

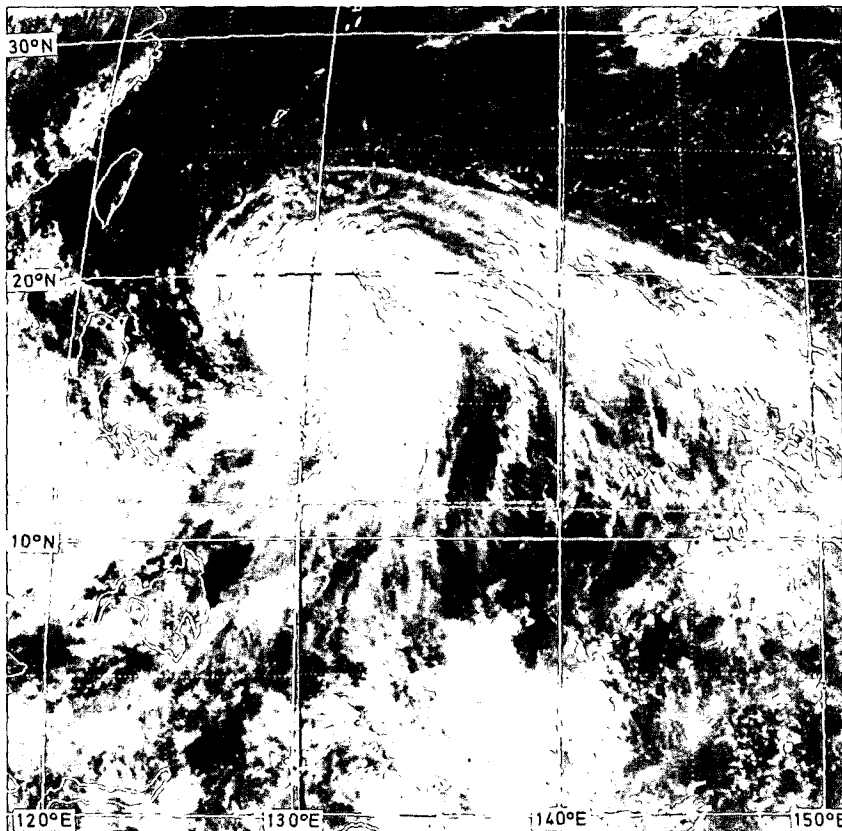


Figure 14. GMS-1 visible picture of Typhoon Hope taken around 9.00 a.m. on 31 July 1979.

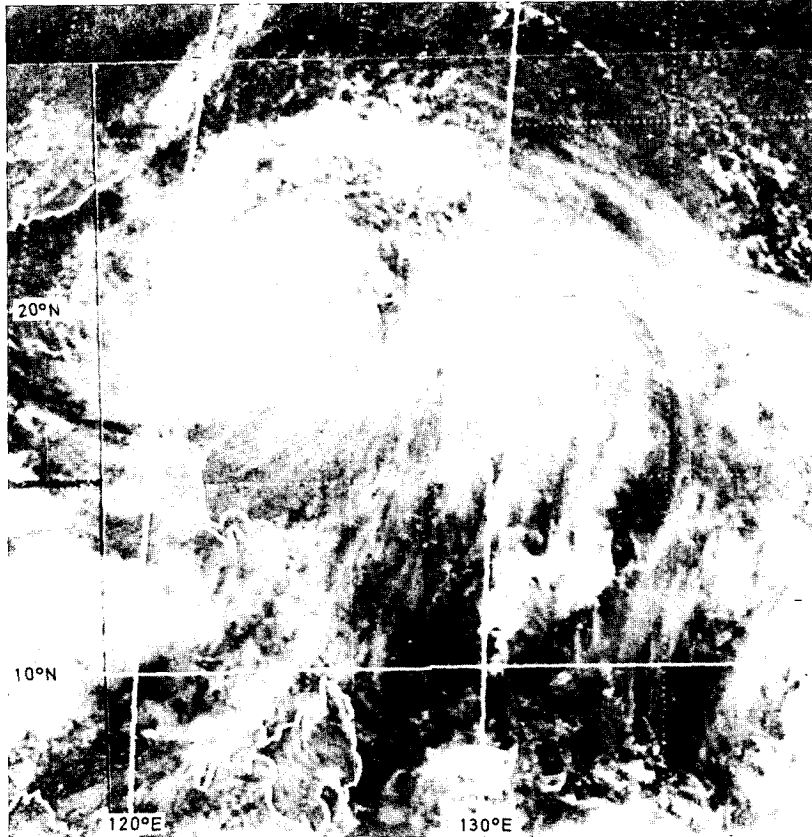


Figure 15. GMS-1 visible picture of Typhoon Hope taken around 9.00 a.m. on 1 August 1979.

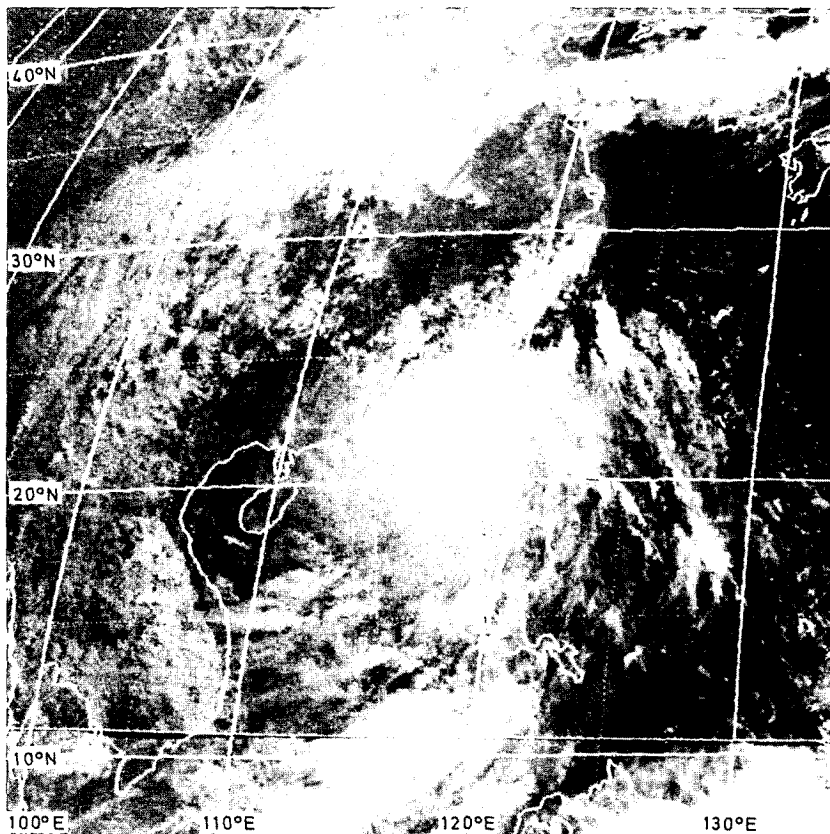


Figure 16. GMS-1 visible picture of Typhoon Hope taken around 9.00 a.m. on 2 August 1979.

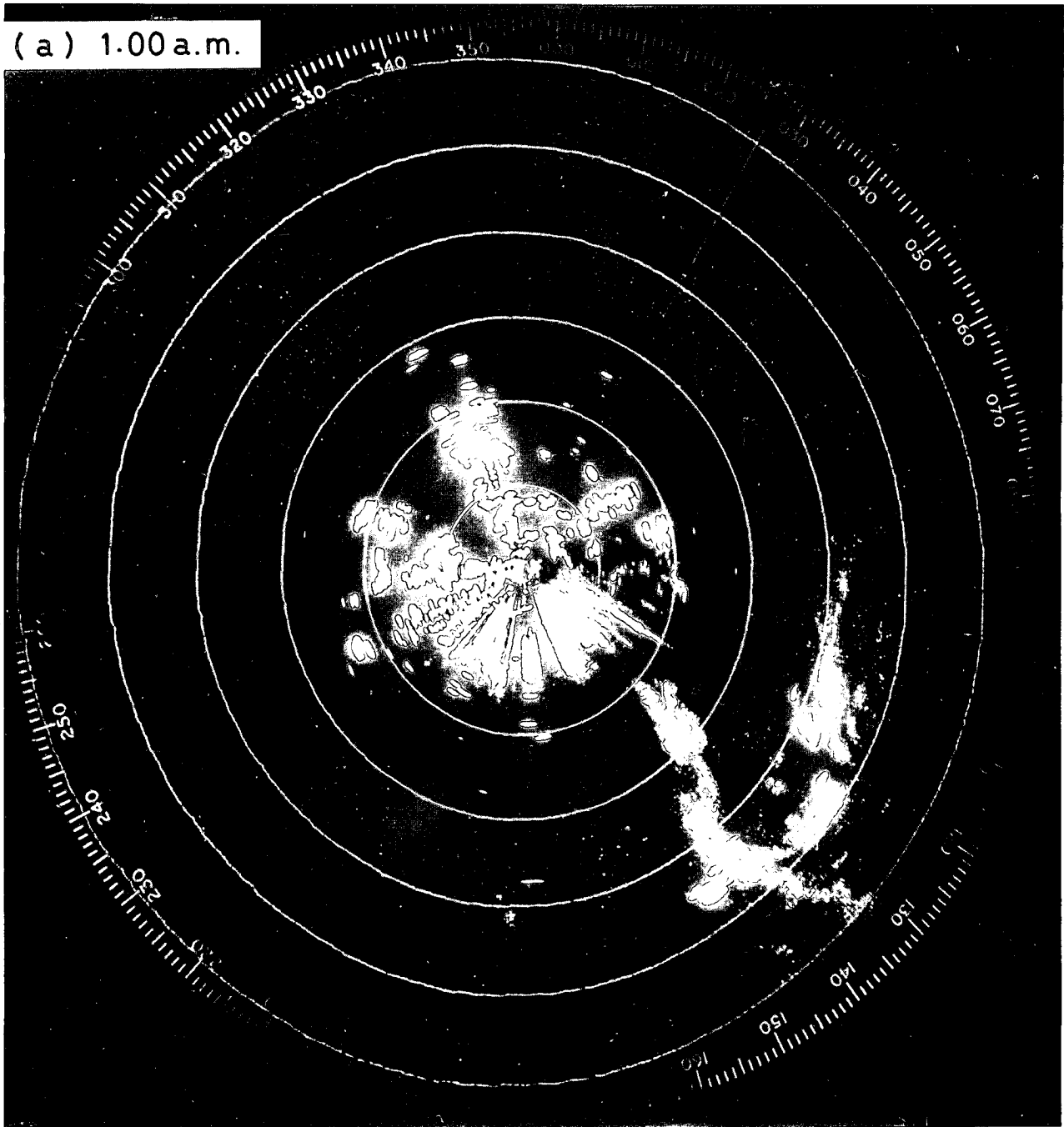


Figure 17. Radar pictures of Typhoon Hope taken early on the morning of 2 August 1979. (Range markers at 40-mile intervals)

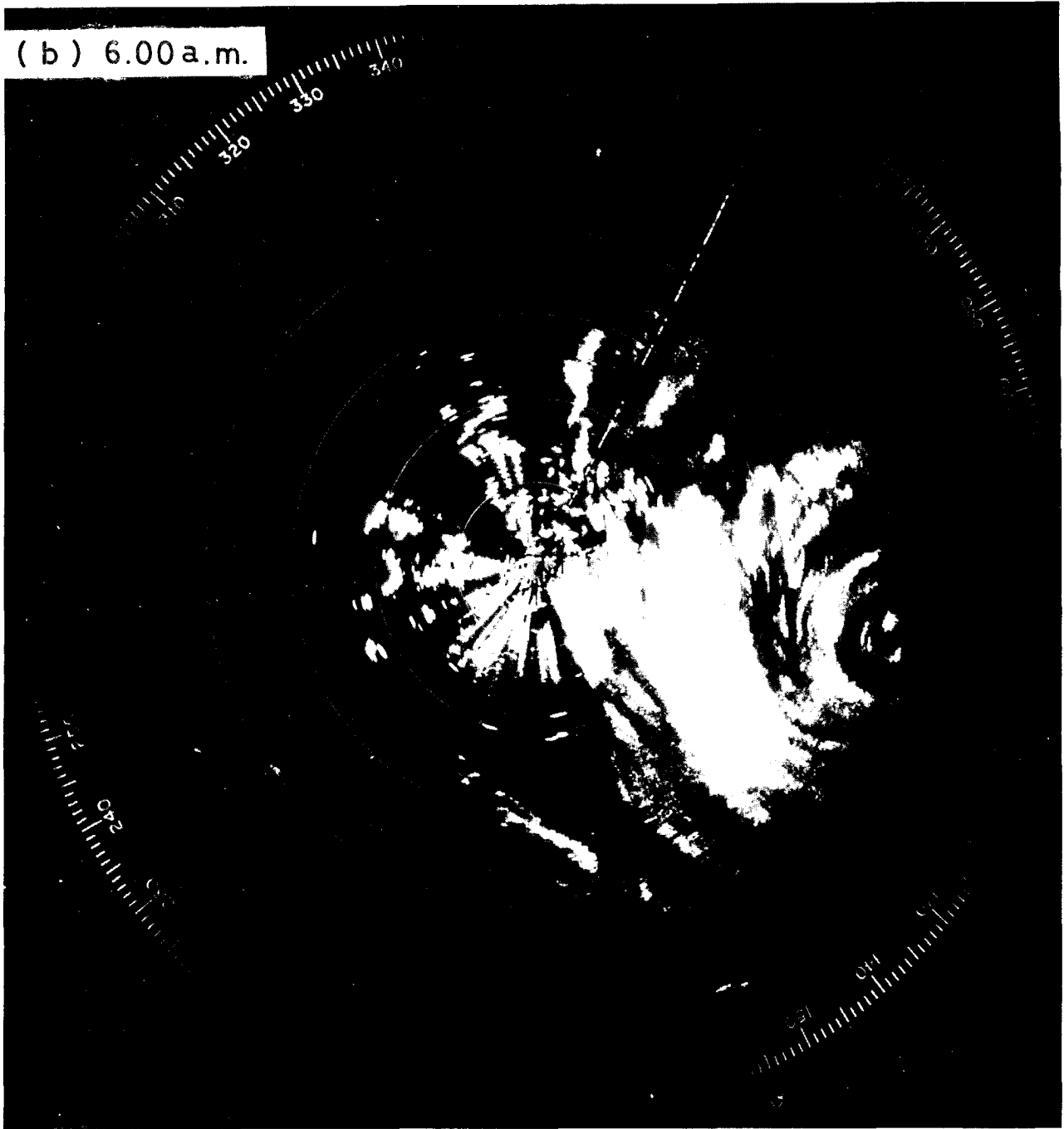


Figure 17. Continued.

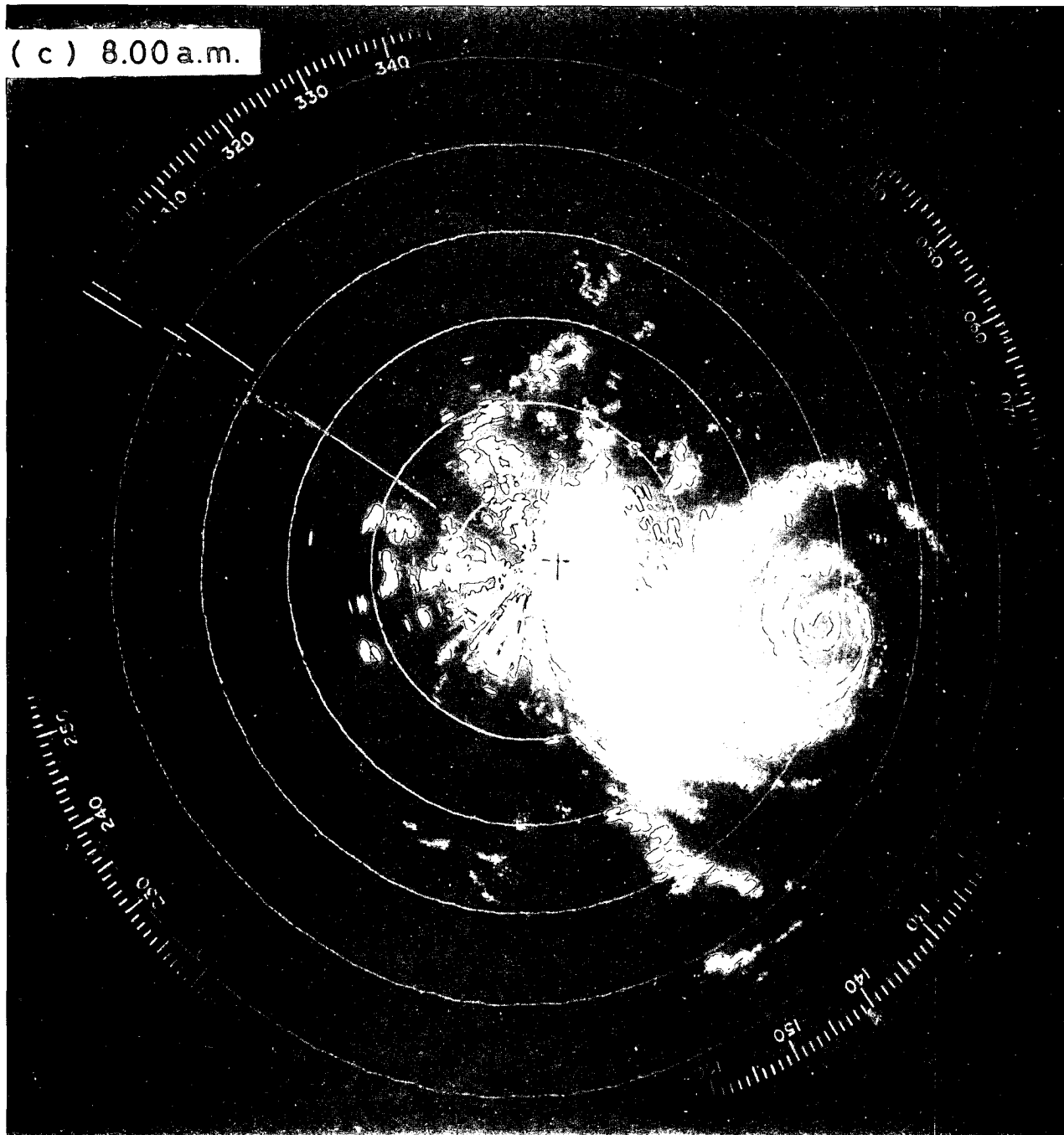


Figure 17. Continued.

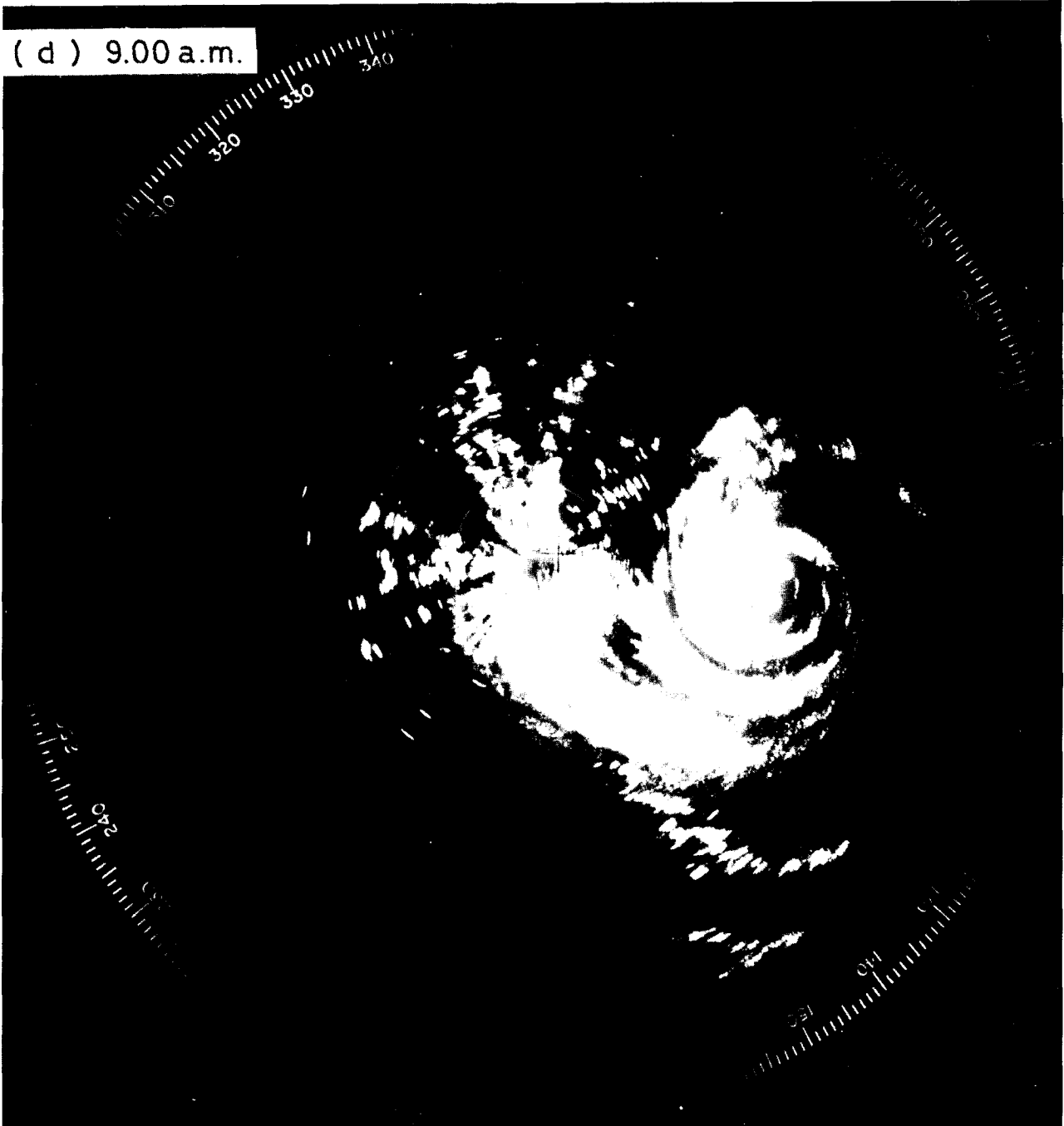


Figure 17. Continued.

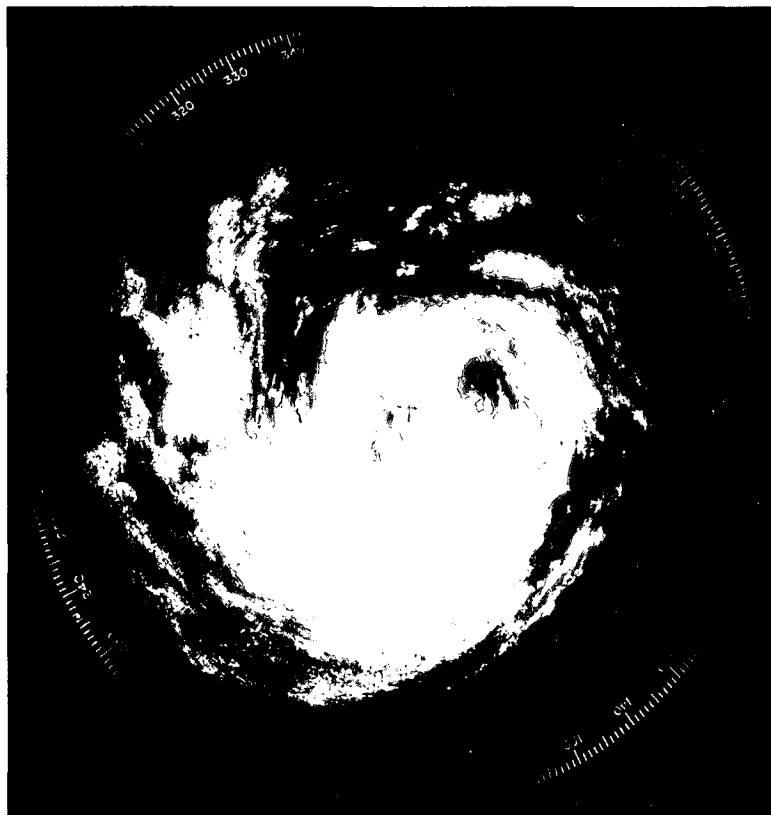


Figure 18. Radar picture of Typhoon Hope taken at 1.00 p.m. on 2 August 1979. (Range markers at 40-mile intervals)

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Figure 19. Photograph taken from Island House showing line of clouds in an arc during passage of the eye of Typhoon Hope. (By courtesy of D. Akers-Jones)

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Figure 20. Photograph of the M.V. 'Argonaut' aground alongside Kowloon Public Pier after having damaged the Star Ferry Pier. (By courtesy of Ta Kung Poa)

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Figure 21(a). Photograph taken from Island House showing flooding in Tai Po. (By courtesy of D. Akers-Jones)

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Website of the Observatory Resource Centre:

http://www.weather.gov.hk/education/edu04other/edu04_rcentre_e.htm
(Tel.: 2926 8250)

Figure 21(b). Photograph showing flooding in Pak Kiu Tsai Village, Tai Po. (By courtesy of Hong Kong Times)

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天文台資源中心網址：

http://www.weather.gov.hk/education/edu04other/edu04_rcentre_c.htm
(電話: 2926 8250)

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Website of the Observatory Resource Centre:

http://www.weather.gov.hk/education/edu04other/edu04_rcentre_e.htm
(Tel.: 2926 8250)

Figure 22. Photograph showing damage to the dangerous goods storehouse at the Government Dockyard in Yau Ma Tei. (By courtesy of Wen Wei Po)

THE TROPICAL DEPRESSIONS

6-9 August 1979

The tracks of these tropical depressions are shown in Figure 23

A tropical depression formed on 6 August about 55 nautical miles north-northeast of Xisha Dao (Paracel Island) in a broad area of low pressure over the northern part of the South China Sea. Satellite pictures received at 9.00 p.m. on 6 August showed that the tropical depression was not well organised with only scattered areas of convective activity (Figure 24). It remained almost stationary at first and then drifted northwest at about 4 knots. The minimum mean sea-level pressure near the centre of the tropical depression was estimated to be around 998 millibars at this time. In the following morning, it moved westwards at about 5 knots. In the afternoon, it changed its course again and moved west-southwest at 8 knots towards the southern tip of Hainan Dao (Hainan Island). It continued moving west-southwest at about 6 knots on 8 August. Satellite pictures showed that the circulation of the tropical depression was still ill-defined (Figure 25). Early on the morning of 9 August, the tropical depression reached the coast of Vietnam about 90 nautical miles northwest of Danang. It then moved along a small arc in an anticlockwise direction near the coast and then degenerated into an area of low pressure about 50 nautical miles northwest of Danang around noon.

Meanwhile, a second tropical depression formed around the area where the former tropical depression had developed. It was located about 70 nautical miles northeast of Xisha Dao (Paracel Island) in the afternoon of 8 August, when the minimum mean sea-level pressure near the centre was about 998 millibars. At 3.00 p.m., satellite pictures revealed that there were large areas of active convection to the south and southeast of the centre (see Figure 25). It started moving south and curved towards Xisha Dao (Paracel Island) at about 8 knots. It passed close to Xisha Dao (Paracel Island) at around midnight. It then moved westward at about 9 knots without much development. Prolonged period of thunderstorms and heavy showers were reported at Xisha Qundao (Paracel Islands) during its passage. On the morning of 9 August, it turned west-northwest and slowed down to 6 knots. Satellite pictures received at 9.00 a.m. showed that the convective cloudiness round the centre had become diffuse (Figure 26). The tropical depression degenerated into an area of low pressure in the afternoon about 170 nautical miles south-southeast of Haikou (Hoihow).

In Hong Kong, the Stand By Signal, No. 1, was hoisted at 4.15 p.m. on 7 August when the first tropical depression was centred about 300 nautical miles southwest of Hong Kong. Winds were fresh easterly in the afternoon and were strong off-shore for a short while. Winds became moderate in the evening and remained so throughout the night and the following morning. When the second tropical depression formed about 270 nautical miles south-southwest of Hong Kong on the afternoon of 8 August, easterly winds freshened again. The tropical depression was closest to Hong Kong at that time. Winds gradually moderated on the following morning as the tropical depression weakened over the South China Sea. It degenerated into an area of low pressure about 350 nautical miles southwest of Hong Kong and the Stand By Signal was lowered at 3.45 p.m. on 9 August.

The maximum winds and maximum gust peak speeds recorded at some selected locations were as follows:

<i>Location</i>	<i>Maximum mean hourly wind in points and knots</i>		<i>Maximum gusts in points and knots</i>	
Royal Observatory	E	17	E	43
Hong Kong Airport (SE)	E	23	E	44
Hong Kong Airport (NW)	E	22	E	45
Waglan Island	E	30	E	41
Tate's Cairn	E	29	E	55
Cheung Chau	E	25	E	41
King's Park	ESE	17	ESE	35
Star Ferry	ESE	19	ESE	40
Green Island	E	20	E	34
Tsim Bei Tsui	ESE	25	ESE	39
Tai O	ESE	18	E	39
Castle Peak	ENE	8	E	32
Chek Lap Kok	E	27	E	40
Lei Yue Mun	E	24	E	33
Yau Yat Chuen	ENE	20	E	41
Kowloon Tsai Hill	E	20	E	41

There were scattered showers which were heavy at times on 7–8 August. Thunderstorms were reported from 11.00 a.m. to 3.00 p.m. on 9 August at a number of stations. Heavy showers persisted throughout the day and the following morning. During the period when the Stand By Signal was displayed, the heaviest downpour occurred between 3.00 p.m. and 4.00 p.m. on 9 August when 11.6 mm of rain were recorded at the Royal Observatory. During the same period, the minimum mean sea-level pressure at the Royal Observatory was 1000.8 millibars recorded in a thunderstorm at 3.00 p.m. on 9 August. Owing to the proximity of a trough extending from an area of low pressure over the Gulf of Tonkin, occasional heavy showers occurred on 11–12 August, the heaviest of which was recorded in the hour ending at 1.00 a.m. on 11 August when 31.6 mm of rain fell. The following amounts of rainfall were recorded:

	<i>Royal Observatory</i>	<i>Cheung Chau</i>	<i>Tate's Cairn</i>
6 August	Trace	1.0 mm	Nil
7 August	6.3 mm	0.4 mm	6.0 mm
8 August	30.1 mm	3.4 mm	17.0 mm
9 August	54.8 mm	29.7 mm	97.0 mm
10 August	47.1 mm	51.8 mm	53.4 mm
11 August	57.0 mm	36.0 mm	80.8 mm
12 August	35.6 mm	12.5 mm	19.5 mm
Total:	230.9 mm	134.8 mm	273.7 mm

Other than three dwelling boats sunk in Yaumatei Typhoon Shelter, there were no other reports of damage to property in Hong Kong. The times and heights of the highest tides and maximum storm surges recorded at various locations in Hong Kong during the display of the Stand By Signal were as follows:

Location	Highest tide above chart datum			Maximum storm surge above astronomical tide		
	Height (m)	Date	Time	Height (m)	Date	Time
North Point	2.7	9 Aug	10.15 a.m.	0.4	9 Aug	8.15 a.m.
Tai Po Kau	2.6	9 Aug	8.30 a.m.	0.6	7 Aug	1.00 p.m.
Chi Ma Wan (Lantau Island)	2.9	9 Aug	10.00 a.m.	0.5	9 Aug	8.30 a.m.

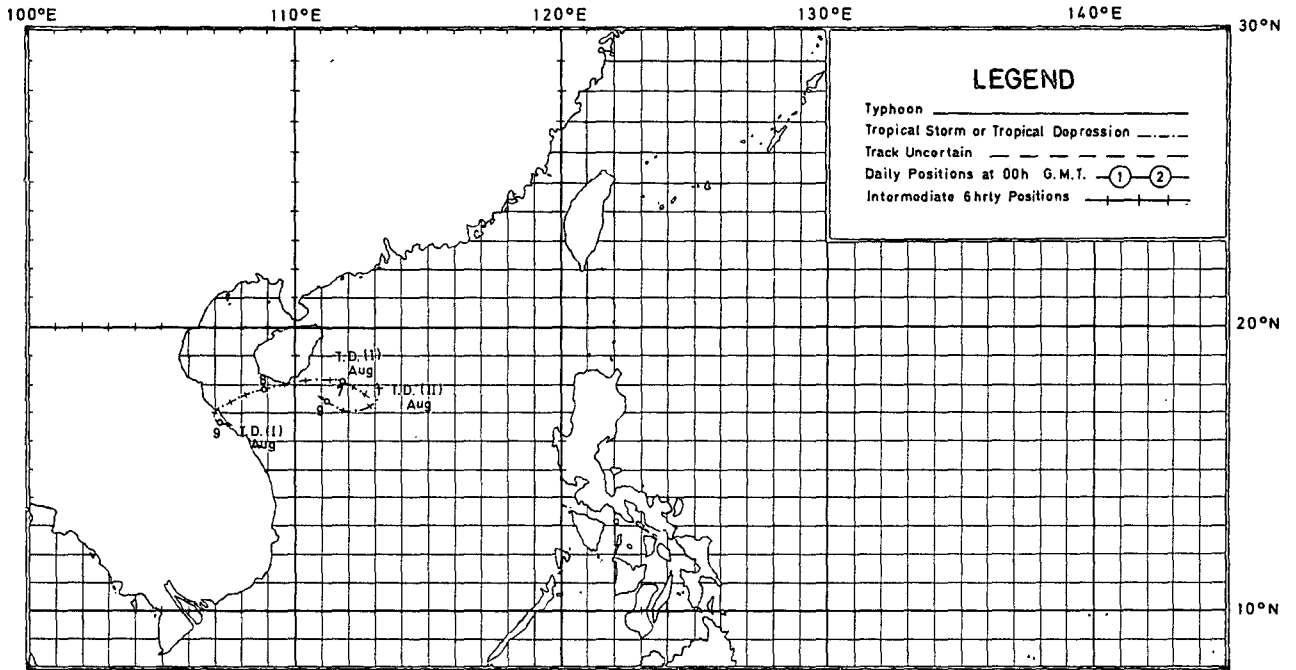


Figure 23. Tracks of the Tropical Depressions: 6-9 August 1979.

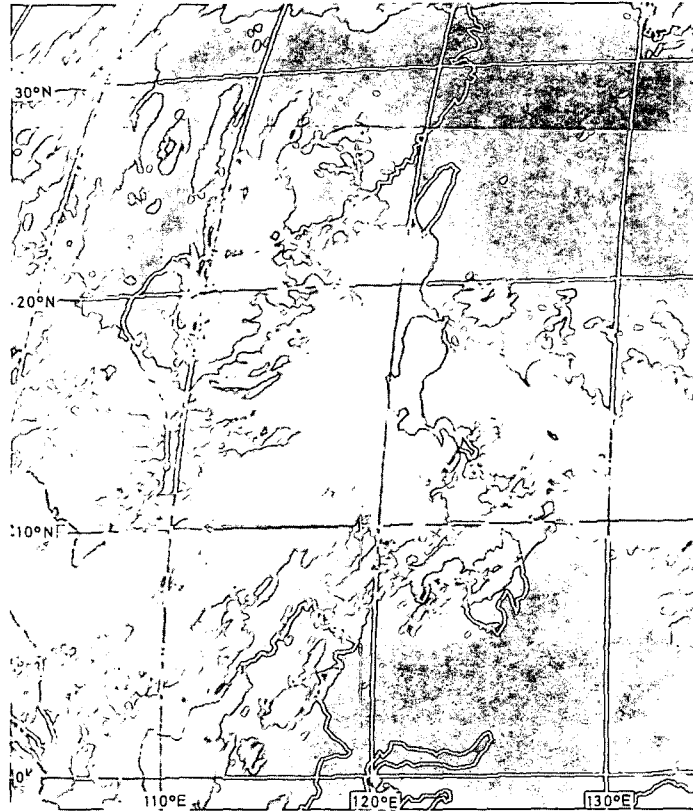


Figure 24. GMS-1 infra-red picture of the Tropical Depressions taken around 9.00 p.m. on 6 August 1979.

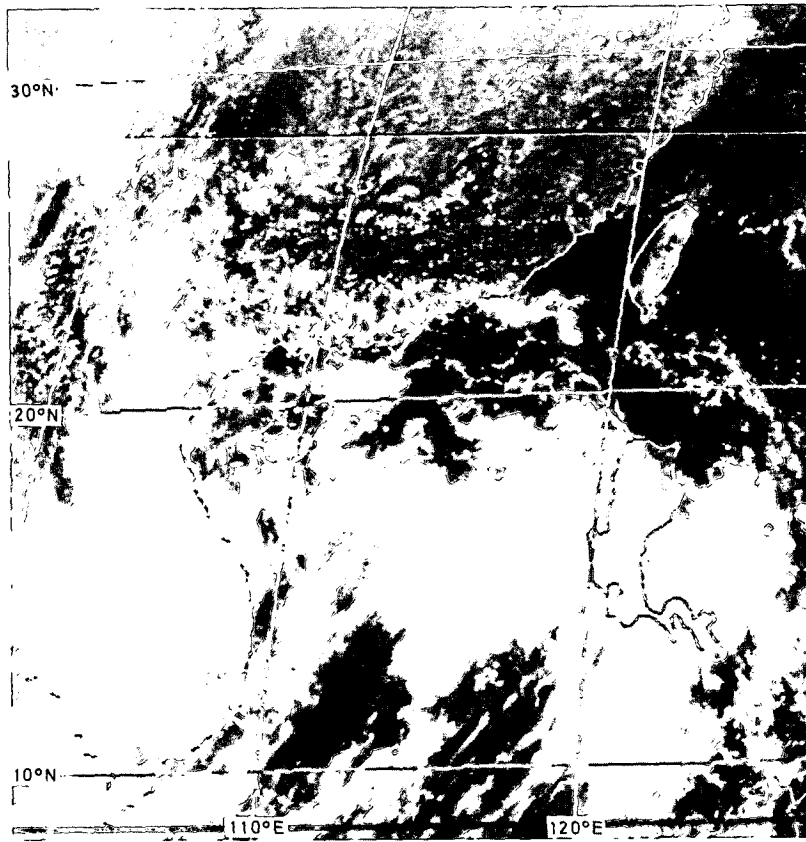


Figure 25. GMS-1 visible picture of the Tropical Depressions taken around 3.00 p.m. on 8 August 1979.

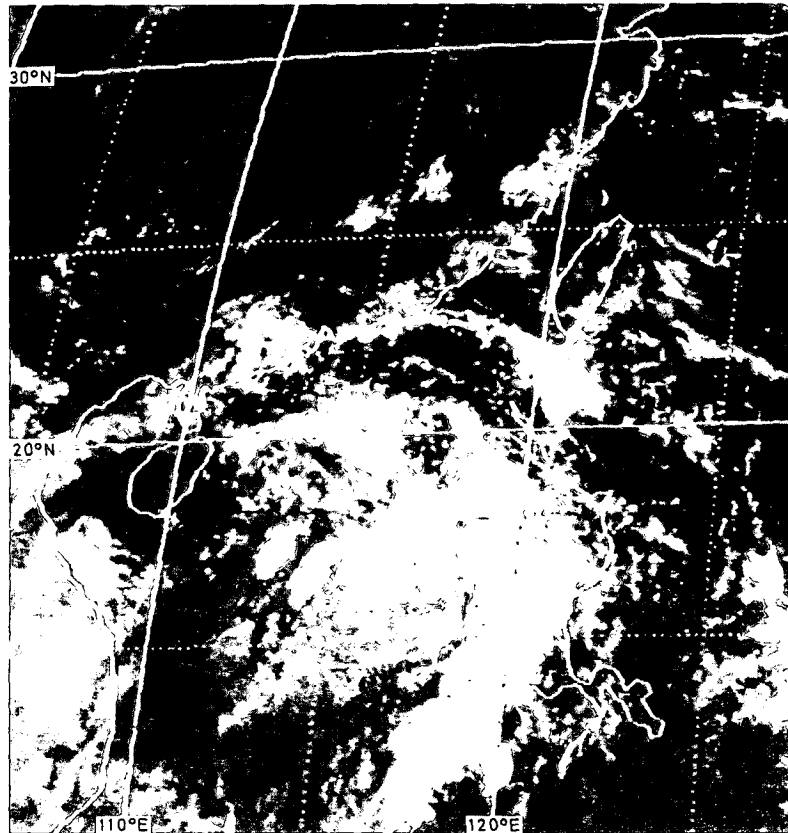


Figure 26. GMS-1 visible picture of the Tropical Depressions taken around 9.00 a.m. on 9 August 1979.

SEVERE TROPICAL STORM MAC AND TROPICAL STORM NANCY

16-24 September 1979

The tracks of these tropical cyclones are shown in Figure 27

There have been very few occasions when two tropical cyclones have been centred within 400 nautical miles of Hong Kong at the same time. On this occasion the Stand By Signal, No. 1, was hoisted for Tropical Storm Nancy but as Nancy moved away westwards across Hainan Dao (Hainan Island) Severe Tropical Storm Mac approached from the southeast and the Stand By Signal therefore remained hoisted.

Nancy first formed as a tropical depression off Hainan Dao (Hainan Island). At 9.00 a.m. on 19 September it was located about 250 nautical miles south-southwest of Hong Kong. Satellite pictures received during the afternoon indicated that Nancy was intensifying (Figure 27). The Stand By Signal was hoisted at 4.00 p.m. on 19 September when Nancy was 270 nautical miles southwest of Hong Kong.

Nancy moved westwards across Hainan Dao (Hainan Island) late on 19 September. The following evening it left the Island near Yulin where a minimum sea-level pressure of 993.0 millibars was reported. A station near the east coast of the Island reported maximum winds of 26 knots with gusts up to 48 knots. Nancy continued on a westerly course towards north Vietnam but on 21 September, it intensified into a tropical storm over the Gulf of Tonkin. The minimum sea-level pressure near the centre of Nancy was estimated to be 992 millibars. Nancy crossed the Vietnam coast about 140 nautical miles northwest of Danang during the afternoon of 22 September and degenerated into an area of low pressure over Lao.

Severe Tropical Storm Mac originated about 500 nautical miles east of Manila early on 16 September. It moved westwards and intensified into a tropical storm. At 2.03 p.m. a reconnaissance aircraft reported a minimum sea-level pressure of 995 millibars and maximum surface winds of 60 knots near the centre of Mac. The tropical storm continued to track westwards and crossed Luzon on 18 September. The following afternoon it passed about 40 nautical miles to the southwest of Manila where maximum winds of only 28 knots were reported. According to press reports, Mac killed two people in the Philippines and made hundreds of people homeless. It also caused damage worth millions of dollars.

Mac had weakened into a tropical depression when it entered the South China Sea on 19 September. Satellite pictures indicated that the cloud bands associated with the circulation of Mac were very disorganized and the centre was difficult to locate (see Figure 27). At first the tropical depression moved north-northwestwards at about 10 knots but gradually changed to a northwesterly course heading directly towards Hong Kong. It came within 400 nautical miles of Hong Kong on 20 September.

At this time the Stand By Signal was already hoisted in Hong Kong. Mac continued to track northwestwards towards Hong Kong. Both satellite pictures and reconnaissance aircraft reports received on 20 and 21 September indicated that Mac was still relatively weak. The minimum sea-level pressure reported was 997 millibars. Mac passed about 35 nautical miles southwest of Dongsha Dao (Pratas Island) during the morning of 22 September. At 7.00 a.m. there was an unconfirmed report from the Island of 46-knot east-southeast winds and mean sea-level pressure of 997 millibars.

In Hong Kong, winds gradually freshened from the northeast early on 22 September. The Strong Wind Signal, No. 3, was hoisted at 12.45 p.m. when Mac was centred about 150 nautical miles away. Mac moved northwest at about 7 knots towards the estuary of Zhu Jiang (Pearl River) overnight on 22 September and intensified rapidly. At 6.00 a.m. on 23 September, M.V. 'Kwangsi' reported winds of 37 knots when it was 90 nautical miles southeast of the centre and three hours later, M.V. 'Larisareysner' reported winds of 34 knots when it was 65 nautical miles south-southwest of Mac.

Mac reached severe tropical storm intensity early on the morning of 23 September. Radar echoes near the centre of Mac reached a height of 16 750 m (Figure 25). Although there was no well-defined eye, the radar indicated that there were heavy rain bands to the east of Hong Kong (Figure 29). The Gale or Storm Signal, No. 8 NORTHEAST was hoisted at 10.10 a.m. when Mac was 55 nautical miles away to the south-southeast. This was followed by the Gale or Storm Signal, No. 8 SOUTHEAST at 3.15 p.m. when the centre was 45 nautical miles south-southwest of Tate's Cairn. Mac probably reached its maximum intensity around this time. The minimum central pressure was estimated to be around 990 millibars and the maximum winds around 60 knots. Satellite pictures received in the afternoon also revealed that there were intense cloud bands associated with the circulation (Figure 30). Mac slowed down considerably later in the afternoon and began to drift slowly northwards, still coming closer to Hong Kong. After passing over western Lantau Island around midnight, Mac turned westwards and headed towards Macau. Winds over Hong Kong quickly abated and the Southeasterly Gale or Storm Signal was replaced by the Strong Wind Signal at 45 minutes past midnight when Mac was centred about 25 nautical miles west of Tate's Cairn. Mac was closest to Hong Kong around 1.00 a.m. but by this time pressure at the Royal Observatory had risen to 1003.4 millibars and the estimated central pressure of Mac to 995 millibars. The lowest pressures occurred earlier, 1001.0 millibars at 9.00 p.m. at the Royal Observatory and 997.3 millibars at 11.00 p.m. at Chek Lap Kok.

Overnight Mac passed just to the north of Macau where a minimum sea-level pressure of 995.3 millibars was reported. The maximum wind reported there was 30 knots with gusts up to 47 knots. Mac weakened rapidly overland and in Hong Kong all signals were lowered at 7.15 a.m. on 24 September when Mac was about 70 nautical miles due west of Hong Kong. Mac degenerated into an area of low pressure north of Shangchuan Dao (St. John's Island) during the afternoon of 24 September.

In Hong Kong winds were moderate to fresh easterly on 19–21 September. However, as Mac approached, winds freshened from the northeast early on 22 September and became strong later in the day. Apart from the urban areas, gales were experienced in many locations during 23 September. Winds turned southeasterly late in the afternoon and gradually moderated during the evening. The maximum winds and maximum gust peak speeds recorded at some selected locations were as follows:

<i>Location</i>	<i>Maximum mean hourly wind in points and knots</i>		<i>Maximum gust in points and knots</i>	
Royal Observatory	E	28	ENE	71
Hong Kong Airport (SE)	E	36	E	66
Hong Kong Airport (NW)	E	36	E	60
Waglan Island	E	66	E	80
Tate's Cairn	E	42	E	80
Cheung Chau	E	48	ESE	68
King's Park	ESE	26	SE	55
Stary Ferry	E	32	E	55
Green Island	ENE	36	ENE	53
Tsim Bei Tsui	ESE	24	ESE	39
Tai O	ESE	46	SW	73
Castle Peak	N	17	N	37
Chek Lap Kok	E	49	ESE	66
Stanley	NE	64	NE	79
Lei Yue Mun	ENE	43	ENE	69
Yau Yat Chuen	ENE	34	ENE	61
Kowloon Tsai Hill	ENE	34	ENE	63

It was cloudy with some showers on 19–20 September but the following two days were mainly fine. Showers began to set in overnight on 22 September and widespread heavy rain was experienced the following day. Rain was very heavy between 1.00 p.m. and 8.00 p.m. when the Royal Observatory recorded a total rainfall of 202.1 mm. Widespread thunderstorms also occurred on the evening of 23 September. Heavy rain was again experienced during the evening of 25 September, probably resulting from the passage of a trough of low pressure associated with the remnants of Mac which drifted back through Hong Kong. The daily amounts of rainfall recorded were as follows:

	<i>Royal Observatory</i>	<i>Cheung Chau</i>	<i>Tate's Cairn</i>
19 September	7.9 mm	19.1 mm	3.0 mm
20 September	5.3 mm	1.9 mm	Nil
21 September	7.2 mm	Nil	Nil
22 September	Trace	Nil	Nil
23 September	243.7 mm	150.7 mm	135.5 mm
24 September	9.0 mm	4.1 mm	6.8 mm
25 September	13.8 mm	Nil	17.0 mm
26 September	94.8 mm	34.2 mm	97.7 mm
27 September	Nil	0.2 mm	Nil
Total:	381.7 mm	210.2 mm	260.0 mm

Mac caused the death of one person and 67 people were injured, mostly by flying debris and falling objects. More than 300 people sought refuge in temporary shelters provided by Government. All public transport except the Kowloon-Canton Railway was suspended shortly after midday on 23 September. Air traffic was disrupted. Many flights were either cancelled or delayed and 25 aircraft were diverted from Hong Kong. Due to the heavy rain, many roads were flooded and several minor landslips occurred. A cargo ship broke her cables at Kellet Bank and subsequently ran aground at Fan Lau Point (southwest of Lantau). Another ship had her cables parted from buoy but was safely anchored later. Six dwelling boats and six pleasure vessels were sunk.

The times and heights of the highest tides and maximum storm surges recorded at various locations in Hong Kong during the approaches of Tropical Storm Nancy and Severe Tropical Storm Mac were as follows:

Tropical Storm Nancy

Location	Highest tide above chart datum			Maximum storm surge above astronomical tide		
	Height (m)	Date	Time	Height (m)	Date	Time
North Point	2.3	20 Sep	9.30 a.m.	0.3	20 Sep	2.15 p.m.
Tai Po Kau	2.3	20 Sep	11.00 a.m.	0.4	21 Sep	2.00 p.m.
Chi Ma Wan (Lantau Island)	2.4	20 Sep	9.30 a.m.	0.5	20 Sep	10.45 p.m.

Severe Tropical Storm Mac

Location	Highest tide above chart datum			Maximum storm surge above astronomical tide		
	Height (m)	Date	Time	Height (m)	Date	Time
North Point	2.3	23 Sep	11.45 a.m.	0.5	23 Sep	8.30 p.m.
Tai Po Kau	2.4	23 Sep	1.00 p.m.	0.8	23 Sep	8.30 p.m.
Chi Ma Wan (Lantau Island)	2.6	23 Sep	1.00 p.m.	0.7	23 Sep	3.15 p.m.

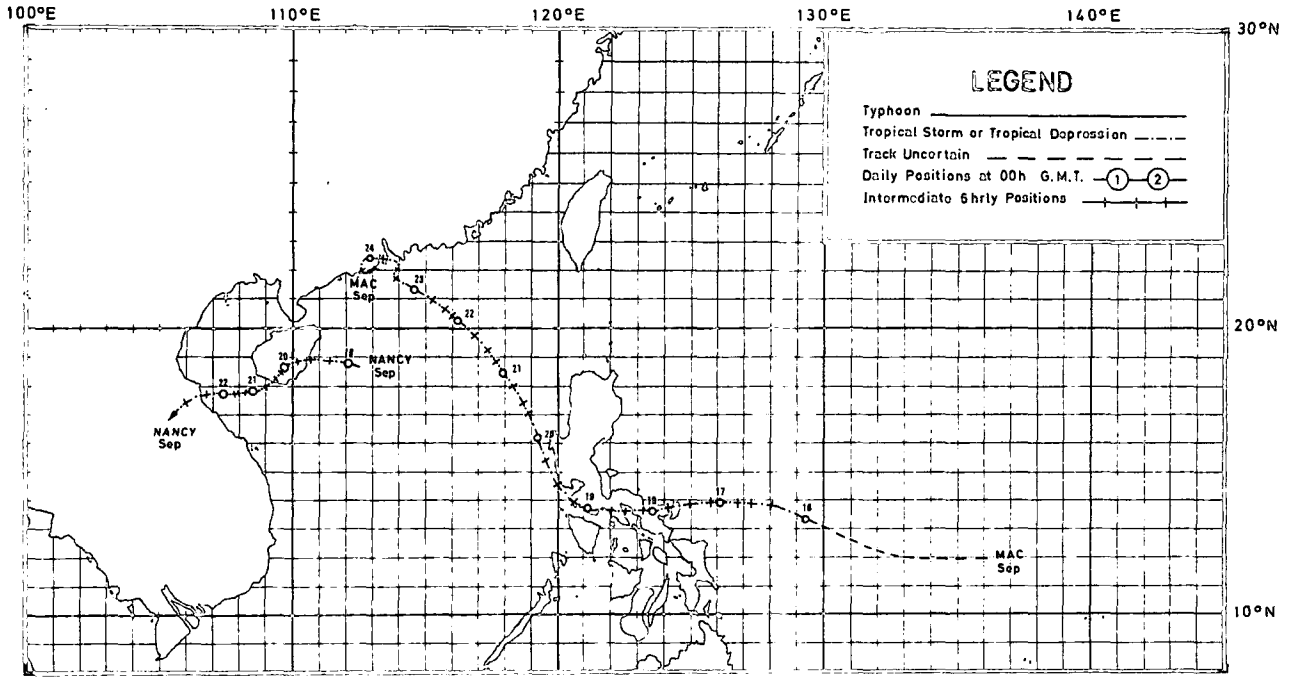


Figure 27. Tracks of Severe Tropical Storm Mac and Tropical Storm Nancy: 16-24 September 1979.

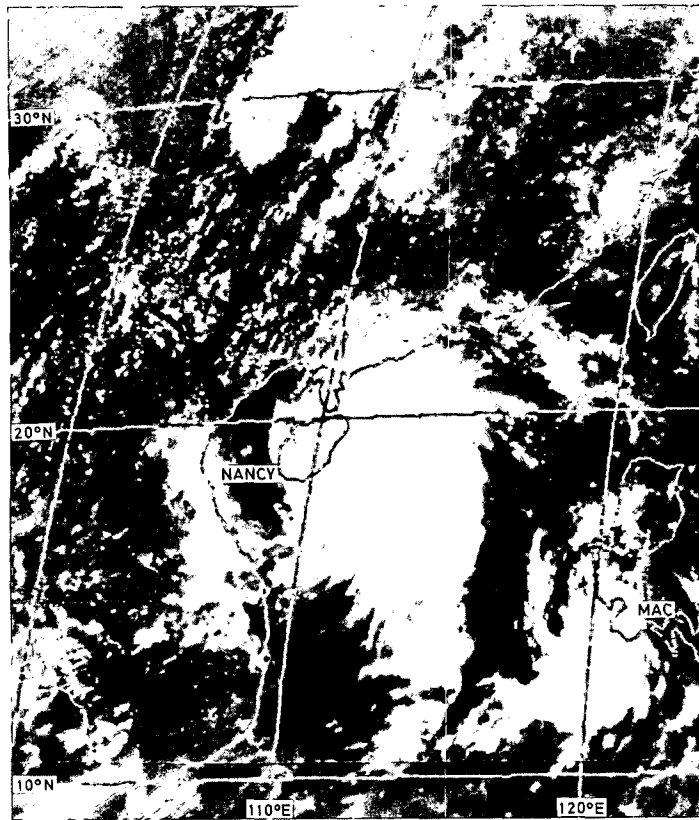


Figure 28. GMS-1 visible picture of Tropical Storm Nancy and Severe Tropical Storm Mac taken around 3.00 p.m. on 19 September 1979.

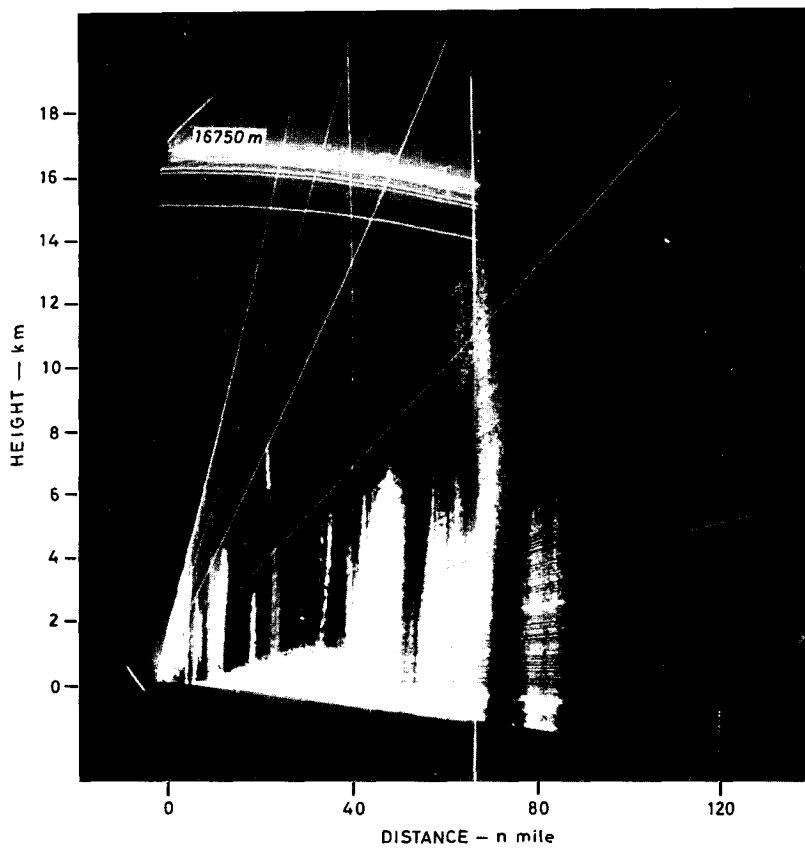


Figure 29. Radar picture of Severe Tropical Storm Mac taken at 7.25 a.m. on 23 September 1979.

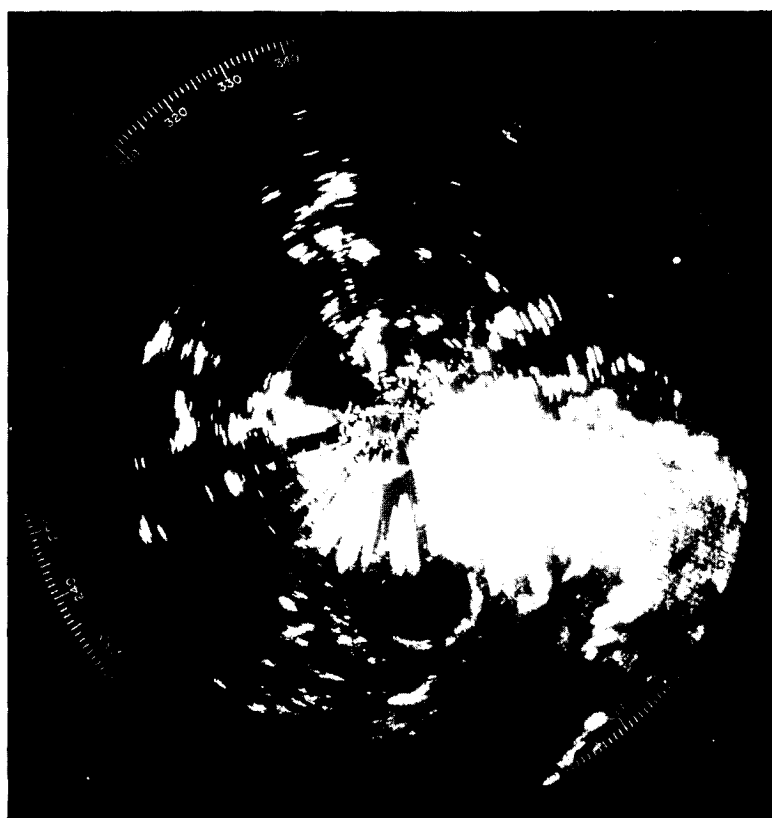


Figure 30. Radar picture of Severe Tropical Storm Mac taken at 8.05 a.m. on 23 September 1979. (Range markers at 40-mile intervals)

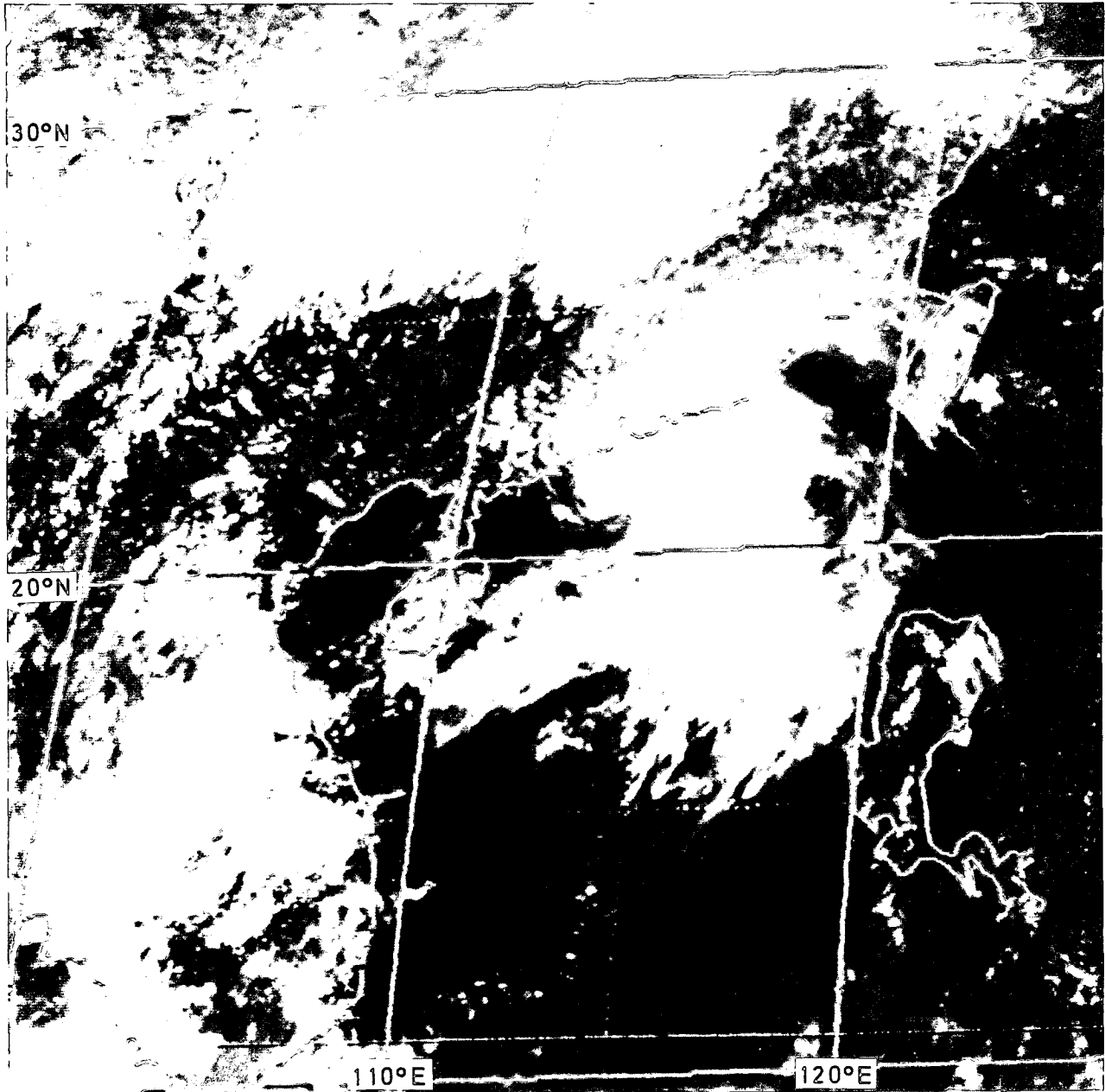


Figure 31. GMS-1 visible picture of Severe Tropical Storm Mac taken around 3.00 p.m. on 23 September 1979.

TABLE 1. LIST OF TROPICAL CYCLONES IN THE WESTERN NORTH PACIFIC AND THE SOUTH CHINA SEA IN 1979

Name of tropical cyclone	Beginning of track				First day circle Date	Last day circle Date	End of track			
	Date	Time G.M.T.	Position				Date	Time G.M.T.	Position	
			^o N	^o E	^o N	^o E				
1 Typhoon Alice	6 Jan	1200	12.0	160.0	7	14	14 Jan	1800	16.0	134.9
2 Typhoon Bess	19 Mar	0000	9.3	145.4	19	25	25 Mar	0600	24.1	145.2
3 Typhoon Cecil	11 Apr	0000	6.4	139.9	11	20	20 Apr	1800	24.1	134.1
4 Tropical Storm Dot	10 May	0000	7.2	131.9	10	16	16 May	1200	19.0	128.0
5 Tropical Depression	21 May	1800	20.6	116.5	22	24	24 May	0600	26.7	134.4
6 Tropical Depression	21 Jun	0600	15.9	110.0	22	23	23 Jun	0600	15.0	109.6
7 Typhoon Ellis	1 Jul	0000	13.4	132.5	1	6	6 Jul	0000	21.5	111.9
8 Severe Tropical Storm Faye	2 Jul	1200	7.9	144.9	3	9	9 Jul	0000	21.0	123.0
9 Severe Tropical Storm Gordon	26 Jul	0600	19.7	130.2	27	29	29 Jul	1800	23.1	114.0
10 Typhoon Hope	28 Jul	0000	16.2	137.8	28	3	3 Aug	1200	21.0	104.3
11 Tropical Depression	5 Aug	0000	17.5	127.4	5	7	7 Aug	0000	22.0	120.0
12 Tropical Depression (I)	6 Aug	1200	17.7	112.6	7	9	9 Aug	0000	16.6	107.2
(II)	8 Aug	0600	17.8	113.1	9	9	9 Aug	0000	17.4	111.2
13 Typhoon Irving	9 Aug	0000	17.8	136.0	9	18	18 Aug	1200	46.0	139.3
14 Typhoon Judy	17 Aug	0000	13.8	143.5	17	26	26 Aug	1800	35.3	131.1
15 Tropical Storm Ken	31 Aug	0000	25.0	137.0	31	4	4 Sep	1800	38.9	139.4
16 Typhoon Lola	3 Sep	0000	21.8	151.3	3	9	9 Sep	0600	38.1	158.5
17 Severe Tropical Storm Mac	16 Sep	0000	13.4	129.3	16	24	24 Sep	0600	22.0	112.5
18 Tropical Storm Nancy	19 Sep	0000	18.7	112.0	19	22	22 Sep	1200	17.4	106.0
19 Typhoon Owen	22 Sep	0600	12.4	138.2	23	1	1 Oct	0000	40.5	142.6
20 Tropical Storm Pamela	25 Sep	0000	19.0	144.0	25	26	26 Sep	1200	23.3	135.8
21 Tropical Depression	1 Oct	0600	15.0	119.0	2	2	2 Oct	0600	15.6	122.0
22 Tropical Storm Roger	3 Oct	0600	15.5	140.0	4	7	7 Oct	0000	31.5	137.0
23 Typhoon Sarah	4 Oct	1200	14.0	119.7	5	15	15 Oct	0600	12.7	109.0
24 Typhoon Tip	5 Oct	0000	5.5	154.5	5	19	19 Oct	1200	41.5	143.1
25 Typhoon Vera	2 Nov	0000	7.0	146.0	2	7	7 Nov	0600	17.5	120.0
26 Tropical Storm Wayne	8 Nov	1200	15.1	132.4	9	12	12 Nov	0000	18.4	127.1
27 Tropical Depression	1 Dec	0000	18.6	152.2	1	2	2 Dec	0600	26.5	150.5
28 Typhoon Abby	2 Dec	0600	5.8	159.8	3	14	14 Dec	1800	23.0	150.9
29 Severe Tropical Storm Ben	21 Dec	0000	11.5	127.0	21	23	23 Dec	1200	19.3	123.3

TABLE 2. TROPICAL CYCLONE WARNINGS FOR SHIPPING ISSUED IN 1979

Tropical cyclone	No. of warnings issued	Date and time ⁺ of issue of		Duration of warnings (hours)
		First warning	Last warning	
Typhoon Cecil	23	15 Apr 2100	18 Apr 1800	69
Tropical Storm Dot	29	11 May 1200	15 May 0000	84
Tropical Depression	10	22 May 0000	23 May 0300	27
Tropical Depression	15	21 Jun 0600	23 Jun 0600	48
Typhoon Ellis*	14	3 Jul 0300	6 Jul 0300	72
Severe Tropical Storm Faye	2	8 Jul 2100	9 Jul 0000	3
Severe Tropical Storm Gordon*	18	27 Jul 1200	29 Jul 1800	54
Typhoon Hope*	22	31 Jul 1800	3 Aug 0900	63
Tropical Depression	10	5 Aug 1800	7 Aug 0000	30
Tropical Depressions	23	6 Aug 0900	9 Aug 0600	69
Typhoon Irving	17	14 Aug 0300	16 Aug 0300	48
Typhoon Judy	10	23 Aug 0600	24 Aug 0900	27
Severe Tropical Storm Mac*	55	17 Sep 1200	24 Sep 0600	162
Tropical Storm Nancy*	29	19 Sep 0000	22 Sep 1200	84
Tropical Storm Roger	10	1 Oct 0300	2 Oct 0900	30
Typhoon Sarah	88	4 Oct 1200	15 Oct 0900	261
Typhoon Vera	23	5 Nov 0600	8 Nov 0000	66
Severe Tropical Storm Ben	20	21 Dec 0900	23 Dec 1800	57
Total	418			1254

* Tropical cyclones for which tropical cyclone warning signals were hoisted in Hong Kong

+ Times are given in hours G.M.T.

TABLE 3. TROPICAL CYCLONE WARNING SIGNALS HOISTED IN HONG KONG AND NUMBER OF WARNING BULLETINS ISSUED IN 1979

SUMMARY			
Signal	No. of occasions	Total duration	
1	5	182 h	0 min
3	5	71	35
8 NORTHWEST	1	1	35
8 SOUTHWEST	-	-	-
8 NORTHEAST	2	9	5
8 SOUTHEAST	2	12	50
9	1	0	25
10	1	3	45
Total	17	281	15

DETAILS

Tropical cyclone	No. of warning bulletins issued	Signal	Hoisted		Lowered	
			Date	Time*	Date	Time*
Typhoon Ellis	23	1	4 Jul	1630	5 Jul	1000
		3	5 Jul	1000	6 Jul	1115
Severe Tropical Storm Gordon	16	1	28 Jul	1310	30 Jul	0655
Typhoon Hope	28	1	1 Aug	1530	1 Aug	2200
		3	1 Aug	2200	2 Aug	0700
		8 NE	2 Aug	0700	2 Aug	1100
		8 NW	2 Aug	1100	2 Aug	1235
		9	2 Aug	1235	2 Aug	1300
		10	2 Aug	1300	2 Aug	1645
		8 SE	2 Aug	1645	2 Aug	2005
		3	2 Aug	2005	3 Aug	0530
Tropical Depressions	20	1	7 Aug	1615	9 Aug	1545
Severe Tropical Storm Mac and Tropical Storm Nancy	29	1	19 Sep	1600	22 Sep	1245
Severe Tropical Storm Mac	26	3	22 Sep	1245	23 Sep	1010
		8 NE	23 Sep	1010	23 Sep	1515
		8 SE	23 Sep	1515	24 Sep	0045
		3	24 Sep	0045	24 Sep	0715

* Hong Kong Time (G.M.T. + 9)

TABLE 4. FREQUENCY AND TOTAL DURATION OF DISPLAY OF TROPICAL CYCLONE WARNING SIGNALS : 1946 - 1979

Year	1	3*	8 NW ⁺	8 SW ⁺	8 NE ⁺	8 SE ⁺	9	10	Total	Total duration (hours)
1946	7	-	1	0	1	2	1	1	13	154
1947	6	-	1	0	1	0	0	0	8	124
1948	5	-	1	1	3	2	0	0	12	112
1949	4	-	0	0	1	1	1	0	7	67
1950	2	-	0	0	1	1	1	0	5	102
1951	4	-	0	0	2	3	1	0	10	133
1952	2	-	0	0	1	1	0	0	4	74
1953	2	-	1	1	2	1	1	0	8	116
1954	5	-	0	0	3	2	2	0	12	133
1955	0	-	0	0	0	0	0	0	0	0
1956	5	4	0	0	0	0	0	0	9	191
1957	4	9	1	1	2	2	0	1	20	296
1958	4	5	0	0	1	0	0	0	10	214
1959	1	1	0	0	0	0	0	0	2	37
1960	11	7	0	2	2	2	1	1	26	433
1961	6	7	1	2	1	0	1	1	19	193
1962	4	3	0	1	1	0	1	1	11	158
1963	4	5	0	0	1	0	0	0	10	176
1964	11	14	1	3	5	3	3	2	42	570
1965	7	6	0	0	1	1	0	0	15	240
1966	6	5	0	0	2	2	0	0	15	285
1967	8	6	0	0	2	1	0	0	17	339
1968	7	7	0	1	1	0	1	1	18	290
1969	4	2	0	0	0	0	0	0	6	110
1970	6	8	2	1	2	0	0	0	19	287
1971	9	10	1	3	2	2	1	1	29	323
1972	8	6	0	0	1	1	0	0	16	288
1973	8	6	1	1	1	0	1	0	18	417
1974	12	10	0	0	2	1	1	0	26	525
1975	8	6	1	0	0	1	1	1	18	292
1976	6	6	0	0	1	2	0	0	15	352
1977	8	6	0	0	1	0	0	0	15	395
1978	8	9	1	1	3	2	0	0	24	462
1979	5	5	1	0	2	2	1	1	17	281
Total	197	153	14	18	49	35	19	11	496	8169
Mean	5.8	6.4	0.4	0.5	1.4	1.0	0.6	0.3	14.6	240.3

* The Strong Wind Signal, No. 3, was introduced in 1956.

+ Gale or Storm Signals, 5, 6, 7 and 8 were renumbered as 8 NW, 8 SW, 8 NE, 8 SE respectively with effect from 1 January 1973

TABLE 5. NUMBER OF TROPICAL CYCLONES IN HONG KONG'S AREA OF RESPONSIBILITY AND THE NUMBER THAT NECESSITATED THE DISPLAY OF TROPICAL CYCLONE WARNING SIGNALS IN HONG KONG : 1946-1979

Year	Number in Hong Kong's area of responsibility	Number necessitating the display of signals in Hong Kong
1946	9	6
1947	21	6
1948	15	4
1949	16	4
1950	13	5
1951	12	7
1952	22	9
1953	19	6
1954	17	7
1955	14	3
1956	23	5
1957	12	6
1958	14	5
1959	19	2
1960	20	2
1961	22	6
1962	16	4
1963	13	4
1964	25	10
1965	16	6
1966	16	6
1967	16	8
1968	12	6
1969	11	4
1970	21	6
1971	17	9
1972	14	5
1973	17	9
1974	21	11
1975	12	7
1976	10	5
1977	10	8
1978	20	8
1979	18	6
Total	553	212
Mean	16.3	6.2

TABLE 6. DURATION OF DISPLAY OF TROPICAL CYCLONE WARNING SIGNALS IN HONG KONG : 1946 - 1979

Signal	Duration for each occasion			Duration per year		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum
1	19 h 33 min	124 h 40 min	1 h 20 min	113 h 19 min	273 h 15 min	0 h 0 min
3*	20 49	71 45	1 00	132 40	267 45	23 55
8 NW ⁺	6 39	13 00	1 30	2 44	13 00	0
8 SW ⁺	5 20	11 10	2 30	2 50	16 10	0
8 NE ⁺	10 58	35 35	2 15	15 48	61 45	0
8 SE ⁺	7 46	21 45	0 20	8 00	31 15	0
8	8 36	35 35	0 20	29 21	82 25	0
9	3 39	6 30	0 25	2 2	11 00	0
10	5 52	9 10	2 30	1 54	12 10	0

* 1956 - 1979

+ Gale or Storm Signals, 5, 6, 7, and 8 were renumbered as 8NW, 8SW, 8NE, and 8SE respectively with effect from 1 January 1973

TABLE 7. CASUALTIES AND DAMAGE CAUSED BY TROPICAL CYCLONES IN HONG KONG : 1937 - 1979

Year	Date	Name of tropical cyclone	Ocean-going vessels in trouble	Small craft sunk or wrecked	Small craft damaged	Persons dead	Persons missing	Persons injured
1937	1 - 2 Sep	Typhoon	28	545	1 255	11 000	*	*
1957	20 - 23 Sep	T. Gloria	5	2	Several	8	*	111
1960	4 - 12 Jun	T. Mary	6	352	462	11	11	127
1961	17 - 21 May	T. Alice	*	*	*	4	0	20
1962	28 Aug - 2 Sep	T. Wanda	36	1 297	756	130	53	*
1964	26 - 28 May	T. Viola	5	18	18	0	0	41
	2 - 9 Aug	T. Ida	3	7	60	5	4	56
	2 - 6 Sep	T. Ruby	20	32	282	38	6	300
	4 - 10 Sep	T. Sally	0	0	0	9	0	24
	7 - 13 Oct	T. Dot	2	31	59	26	10	85
1966	12 - 14 Jul	S.T.S. Lola	0	*	6	1	0	6
1968	17 - 22 Aug	T. Shirley	1	*	3	0	0	4
1970	1 - 3 Aug	T.D.	0	0	0	2 ⁺	0	0
	8 - 14 Sep	T. Georgia	2	0	*	0	0	0
1971	15 - 18 Jun	T. Freda	8	0	0	2	0	30
	16 - 22 Jul	T. Lucy	10	0	0	0	0	38
	10 - 17 Aug	T. Rose	34	303	*	110	15	286
1972	4 - 9 Nov	T. Pamela	3	0	0	1	0	8
1973	14 - 20 Jul	T. Dot	14	*	*	1	0	38
1974	7 - 14 Jun	T. Dinah	1	*	*	0	0	0
	18 - 22 Jul	T. Ivy	2	*	*	0	0	0
	15 - 19 Oct	T. Carmen	5	*	*	1	0	0
	21 - 27 Oct	T. Della	2	*	*	0	0	0
1975	10 - 14 Aug	T.D.	3	1	*	2	1	0
	9 - 14 Oct	T. Elsie	7	3	*	0	0	46
	16 - 23 Oct	S.T.S. Flossie	1	*	*	0	0	0
1976	22 Jun - 4 Jul	T. Ruby	0	0	0	3	2	2
	21 - 26 Jul	S.T.S. Violet	0	0	0	2	1	1
	5 - 6 Aug	S.T.S. Clara	0	0	0	0	0	4
	21 - 24 Aug	T.S. Ellen	0	4	7	27	3	65
	15 - 21 Sep	T. Iris	6	0	1	0	0	27
1977	4 - 6 Jul	T.D.	0	0	0	0	0	2
	3 - 5 Sep	T.S. Carla	1	0	0	0	0	1
	22 - 25 Sep	S.T.S. Freda	2	0	0	1	0	37
1978	24 - 30 Jul	S.T.S. Agnes	0	25	33	3	0	134
	9 - 12 Aug	T.S. Bonnie	2	0	0	0	0	0
	23 - 28 Aug	S.T.S. Elaine	6	3	0	1	0	51
	22 - 26 Sep	S.T.S. Kit	0	1	0	0	7	0
	7 - 16 Oct	S.T.S. Nina	0	0	0	0	0	2
	17 - 29 Oct	T. Rita	1	5	0	0	0	3
1979	1 - 6 Jul	T. Ellis	0	2	0	0	0	0
	28 Jul - 3 Aug	T. Hope	29	56	108	12	0	260
	16 - 24 Sep	S.T.S. Mac	2	0	0	1	0	67

N.B. Information compiled from Hong Kong newspapers and from the Marine Department's records

* Data unavailable

+ Struck by lightning

TABLE 8. SHIPS SUNK, DAMAGED, GROUNDED, ETC., BY TROPICAL CYCLONES IN HONG KONG, 1979

Year	Date	Name of tropical cyclone	Name of ship	Location of grounding, etc.	Nature of incident	Remarks
1979	28 Jul - 3 Aug	T. Hope	M.V. Pacific Courier	Western Anchorage	Collided with M.V. Xin Ming	
			M.V. Xin Ming	Western Anchorage	Collided with M.V. Pacific Courier	
			M.V. Da Qing 252	Western Anchorage	Collided with M.V. Great Sea	
			M.V. Great Sea	Western Anchorage	Collided with M.V. Da Qing 252 and M.V. Kai Lok	
			M.V. Kai Lok	Western Anchorage	Collided with M.V. Great Sea and M.V. Evershine	
			M.V. Evershine	Western Anchorage	Collided with M.V. Kai Lok	
			M.V. No. 4 Bineka	Buoy B-15	Collided with H.M.S. Beachampton	
			H.M.S. Beachampton	Buoy A-50	Collided with M.V. Bineka	
			M.V. Ming Li	Yaumati Anchorage	Collided with M.V. Yun Tai	
			M.V. Yun Tai	Yaumati Anchorage	Collided with M.V. Ming Li	
			M.V. Sea Horse	Western Anchorage	Collided with M.V. Riheng	
			M.V. Riheng	Western Anchorage	Collided with M.V. Sea Horse	
			M.V. Cheung Kong	Tsuen Wan Dangerous Goods Anchorage	Collided with M.V. Long An	
			M.V. Long An	Tsuen Wan Dangerous Goods Anchorage	Collided with M.V. Cheung Kong	
			M.V. Han Jiang	North Lantau Laid-Up Berth	Collided with M.V. Ming Ren Development	
			M.V. Ming Ren Development	North Lantau Laid-Up Berth	Collided with M.V. Han Jiang	
			M.V. Life Line	Yaumati Anchorage	Collided with M.V. Rung Ra Do	
			M.V. Rung Ra Do	Yaumati Anchorage	Collided with M.V. Life Line	
			M.V. Dong Shin	Buoy B-14	Adrift	
			M.V. Shalamar	Buoy A-19	Adrift	
	M.V. Lamma Island	Buoy A-33	Adrift			
	M.V. Friendship No. 2	Buoy B-5	Adrift			
	M.V. Argonaut	Kowloon Public Pier	Aground	Causing serious damage to Star Ferry Pier		
	16 - 24 Sep	S.T.S. Mac	M.V. Aliakmon Progress	Buoy A-36	Adrift	
			M.V. No. 5 Habsari	Buoy A-25	Adrift	
			M.V. Chittin Tanthuwani	Buoy B-17	Adrift	
			M.V. Aquarius	Buoy A-27	Adrift	
M.V. New Ming Ren			Tai Lam Chung	Aground		
M.V. Huey Fong			Tsing Chau Wan	Aground		
M.V. Chung Ming			Kellett Bank Anchorage	Adrift		
M.V. Guava			Buoy A-41	Adrift		

N.B. Information compiled from Hong Kong newspapers and from the Marine Department's records

TABLE 9. A SUMMARY OF METEOROLOGICAL OBSERVATIONS RECORDED IN HONG KONG DURING THE PASSAGES OF TROPICAL CYCLONES IN 1979

Name of tropical cyclone	Month	Nearest approach to Hong Kong							Minimum hourly M.S.L. pressure at the Royal Observatory			Maximum storm surge		
		Day	Time*	Direction	Distance	Movement		Estimated minimum central pressure	Day	Time*	Pressure	North Point	Tai Po Kau	Chi Ma Wan
				points	n miles	points	knots	mbar			mbar	m	m	m
T. Ellis	Jul	6	0000	SSW	100	WNW	11	985	5	1800	995.4	0.6	0.9	0.8
S.T.S. Gordon	Jul	30	0200	N	40	W	10	992	30	0200	994.9	0.3	0.5	0.5
T. Hope	Aug	2	1500	NNW	6	W	17	950	2	1500	961.8	1.5	3.2	1.5
T.D.	Aug	8	1500	SSW	270	SW	8	998	9	0600	1000.8	0.4	0.6	0.6
S.T.S. Mac	Sep	24	0100	W	25	W	5	995	23	2100	1001.0	0.5	0.8	0.7
T.S. Nancy	Sep	19	0900	SW	250	WNW	7	1000	21	1700	1007.1	0.3	0.4	0.5

* Hong Kong Time (G.M.T. + 9)

TABLE 9. (Cont'd)

Name of tropical cyclone	Month	Maximum 60-min mean wind in points and knots				Maximum 10-min mean wind in points and knots				Maximum gust peak speed in points and knots				Rainfall at the Royal Observatory (mm)				
		Royal Observatory		Waglan Island		Royal Observatory		Waglan Island		Royal Observatory		Waglan Island		(i) 300 n mile	(ii) 24 hours	(iii) 48 hours	(iv) 72 hours	(i)+(iv)
T. Ellis	Jul	ENE	20	ENE	40	ENE	23	ENE	40	ENE	52	ENE	49	10.9	2.3	2.3	2.3	13.2
S.T.S. Gordon	Jul	WSW	20	WSW	30	WSW	22	SW	32	WSW	39	WSW	44	86.2	74.5	174.0	174.0	260.2
T. Hope	Aug	W	40	SW	78	W	42	SW	82	W	94	SW	107	211.4	31.8	76.0	76.0	287.4
T.D.	Aug	E	17	E	32	E	22	E	35	E	43	E	41	-	29.3	70.8	135.1	135.1
S.T.S. Mac	Sep	E	28	E	66	E	30	E	66	ENE	71	E	80	250.9	1.8	96.8	110.4	361.3
T.S. Nancy	Sep	E	15	E	30	E	16	E	31	E	37	E	41	4.2	12.5	12.5	12.5	16.7

N.B. (i) during the period when the tropical cyclone was centred within 300 n miles of Hong Kong
(ii) during the 24-hour period after the tropical cyclone moved outside (or dissipated within) the 300-n mile radius
(iii) during the 48-hour period after the tropical cyclone moved outside (or dissipated within) the 300-n mile radius
(iv) during the 72-hour period after the tropical cyclone moved outside (or dissipated within) the 300-n mile radius

All data, other than the rainfall, refer to the period when tropical cyclone warning signals were hoisted. Times are given in Hong Kong Time. (G.M.T. + 9)

TABLE 10. TYPHOONS WHICH REQUIRED THE HOISTING OF THE HURRICANE SIGNAL NO. 10 DURING THE PERIOD 1946-1979

Name of typhoon	Date	Nearest approach to Royal Observatory n miles		Minimum M.S.L. pressure (mbar)		Maximum 60-min mean winds in points and knots								Maximum gust in points and knots								
				Hourly	Inst.	Royal Observatory	Hong Kong Airport	Waglan Island	Cheung Chau	Tate's Cairn	Cape Collinson	Green Island	Castle Peak	Royal Observatory	Hong Kong Airport	Waglan Island	Cheung Chau	Tate's Cairn	Cape Collinson	Green Island	Castle Peak	
-	18 Jul 1946	S	37	985.7	-	NE -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gloria	22 Sep 1957	SW	30	986.2	984.3	ESE 62	ESE 39	E 61	-	-	-	-	-	E 101	ENE 86	ENE 100	-	-	-	-	-	-
Mary	9 Jun 1960	WNW	5	974.3	973.8	SSE 52	SSE 50	SSW 60	-	-	-	-	-	SSE 103	SE 88	SSW 105	-	-	-	-	-	-
Alice	19 May 1961		0	981.6	981.1	ENE 45	E 38	ESE 49	ENE 41	-	-	-	-	E 89	ENE 75	SW 69	ENE 73	-	-	-	-	-
Wanda	1 Sep 1962	SSW	10	955.1	953.2	N 72	N 58	NW 80	NW 64	SE 102	-	-	-	N 140	N 123	NNW 117	NW 125	ESE 154	-	-	-	-
Ruby	5 Sep 1964	SW	17	971.0	968.2	E 59	N 64	ENE 80	NE 61	ESE 90	SSE 83	-	-	NNE 122	NW 110	E 124	NNE 117	E 145	S 120	-	-	-
Dot	13 Oct 1964	E	18	978.9	977.3	NNW 48	N 36	N 63	NNW 52	NNE 85	N 54	-	-	N 94	N 107	N 99	WNW 111	NE 119	NNE 101	-	-	-
Shirley	21 Aug 1968		0	968.7	968.6	N 37	N 40	NNE 67	SSW 49	NNE 68	SSW 46	-	-	N 72	N 82	NE 113	SSW 90	NNE 110	N 93	-	-	-
Rose	17 Aug 1971	WSW	11	984.5	982.8	SE 55	SE 66	ESE 76	SE 71	S 80	SSW 74	-	-	ESE 121	ESE 114	ESE 102	SE 105	S 120	S 103	-	-	-
Elsie	14 Oct 1975	S	27	996.4	996.2	ENE 31	NNW 36	NNE 64	N 57	NE 70	-	NNW 64	N 35	NE 76	N 76	ENE 95	NE 86	NNE 97	-	NE 90	N 65	-
Hope	2 Aug 1979	NNW	6	961.8	961.6	W 40	W 62	SW 78	SSW 63	NW 62	-	W 58	- 52	W 94	WNW 98	SW 107	WSW 100	WNW 123	-	W 90	- 93	-

APPENDIX 1 SIX-HOURLY POSITIONS OF TYPHOON ALICE

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
January	6	1200	T.	960	70	12.0	160.0
		1800	T.	960	70	12.2	158.8
	7	0000	T.	950	75	12.3	157.6
		0600	T.	945	80	12.4	156.4
		1200	T.	940	85	12.5	155.2
		1800	T.	930	90	12.4	154.0
	8	0000	T.	930	100	12.3	152.9
		0600	T.	940	110	12.0	151.6
		1200	T.	950	110	11.9	150.3
		1800	T.	960	95	11.7	149.0
	9	0000	T.	965	90	11.8	147.8
		0600	T.	970	85	12.1	146.6
		1200	T.	970	70	12.3	145.4
		1800	T.	970	70	11.8	144.2
	10	0000	T.	965	70	11.8	142.9
		0600	T.	960	70	12.3	141.5
		1200	T.	955	70	12.3	140.2
		1800	T.	950	75	12.2	139.2
	11	0000	T.	945	75	12.4	138.7
		0600	T.	940	80	12.7	138.2
		1200	T.	935	85	13.0	137.7
		1800	T.	940	85	13.5	137.2
	12	0000	T.	945	80	13.8	137.0
		0600	T.	950	80	14.2	136.8
		1200	T.	960	75	14.6	136.6
		1800	T.	960	70	15.0	136.5
	13	0000	T.	970	65	15.5	136.6
		0600	S.T.S.	980	60	15.9	136.8
		1200	S.T.S.	985	60	16.1	137.0
		1800	S.T.S.	990	50	16.3	136.9
	14	0000	T.D.	990	40	16.1	136.5
		0600	T.D.	995	35	16.0	136.0
		1200	T.D.	1000	30	16.0	135.5
		1800	T.D.	1004	25	16.0	134.9

APPENDIX 2 SIX-HOURLY POSITIONS OF TYPHOON BESS

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
March	19	0000	T.D.	1009	25	9.3	145.4
		0600	T.D.	1007	25	9.4	144.4
		1200	T.D.	1007	25	9.6	143.5
		1800	T.D.	1007	25	9.7	142.7
	20	0000	T.D.	1007	25	9.9	141.8
		0600	T.D.	1003	25	10.2	140.8
		1200	T.D.	1001	25	10.7	139.9
		1800	T.D.	1000	25	11.1	139.2
	21	0000	T.D.	998	30	11.6	138.5
		0600	T.S.	995	35	12.1	137.7
		1200	T.S.	990	35	12.8	137.0
		1800	T.S.	985	40	13.4	136.3
	22	0000	S.T.S.	975	55	14.0	135.6
		0600	S.T.S.	970	60	14.2	135.3
		1200	T.	965	65	14.7	134.9
		1800	T.	960	65	15.3	134.7
	23	0000	T.	955	70	16.0	134.6
		0600	T.	955	70	16.9	135.1
		1200	T.	960	70	17.9	135.8
		1800	T.	965	70	18.7	136.7
	24	0000	T.	970	70	19.4	137.6
		0600	T.	985	70	20.4	139.2
		1200	T.	990	65	21.4	140.8
		1800	S.T.S.	995	55	22.2	142.2
25	0000	T.S.	1000	35	23.2	143.8	
	0600	T.D.	1008	25	24.1	145.2	

APPENDIX 3 SIX-HOURLY POSITIONS OF TYPHOON CECIL

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
April	11	0000	T.D.	1000	25	6.4	139.9
		0600	T.D.	998	30	6.5	139.3
		1200	T.D.	997	30	6.6	138.6
		1800	T.D.	996	30	6.7	138.0
	12	0000	T.S.	995	35	6.8	137.4
		0600	T.S.	995	35	6.9	136.9
		1200	T.S.	994	35	7.1	136.1
		1800	T.S.	992	40	7.3	135.5
	13	0000	T.S.	990	40	7.6	135.0
		0600	T.S.	990	40	7.9	134.1
		1200	T.S.	988	40	8.0	133.3
		1800	T.S.	985	45	8.1	132.5
	14	0000	S.T.S.	980	50	8.2	131.4
		0600	S.T.S.	975	50	8.4	130.4
		1200	S.T.S.	970	60	8.5	129.4
		1800	S.T.S.	970	60	8.8	128.5
	15	0000	T.	965	65	9.1	127.5
		0600	T.	965	65	9.9	126.5
		1200	T.	965	70	10.7	125.4
		1800	T.	965	65	11.4	124.4
	16	0000	T.	970	65	12.0	123.5
		0600	T.	970	65	12.2	123.1
		1200	S.T.S.	975	60	12.5	122.9
		1800	S.T.S.	975	60	12.7	122.4
17	0000	S.T.S.	980	55	13.0	122.1	
	0600	S.T.S.	980	55	13.2	122.0	
	1200	S.T.S.	985	50	13.5	122.0	
	1800	T.S.	985	45	14.0	122.3	
18	0000	T.S.	985	45	14.7	122.9	
	0600	T.S.	990	45	15.1	123.4	
	1200	T.S.	990	45	15.7	124.0	
	1800	T.S.	990	45	16.2	124.5	
19	0000	S.T.S.	985	50	16.9	125.2	
	0600	S.T.S.	985	50	17.7	125.9	
	1200	S.T.S.	985	50	18.4	126.6	
	1800	S.T.S.	985	50	19.8	127.9	
20	0000	S.T.S.	990	50	21.0	129.2	
	0600	T.S.	990	45	22.3	130.6	
	1200	T.S.	992	40	23.3	132.4	
	1800	T.D.	994	30	24.1	134.1	

APPENDIX 4 SIX-HOURLY POSITIONS OF TROPICAL STORM DOT

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
May	10	0000	T.D.	1006	25	7.2	131.9
		0600	T.D.	1005	25	7.7	130.4
		1200	T.D.	1005	25	8.5	128.5
		1800	T.D.	1004	25	9.1	126.6
	11	0000	T.D.	1004	25	9.4	125.2
		0600	T.D.	1003	25	9.5	124.2
		1200	T.D.	1003	25	9.7	123.2
		1800	T.D.	1002	25	9.8	121.8
	12	0000	T.D.	1002	25	10.1	120.6
		0600	T.D.	1000	30	10.4	120.3
		1200	T.D.	997	30	10.7	120.0
		1800	T.D.	995	30	11.4	119.7
	13	0000	T.S.	992	35	12.0	119.6
		0600	T.S.	990	35	12.5	119.6
		1200	T.S.	988	35	12.9	119.8
		1800	T.S.	987	40	13.3	119.9
	14	0000	T.S.	985	40	13.7	120.1
		0600	T.S.	994	35	14.0	120.6
		1200	T.D.	995	30	14.3	121.1
		1800	T.D.	996	25	14.7	121.7
	15	0000	T.D.	997	25	15.1	122.4
		0600	T.D.	998	25	15.6	123.4
		1200	T.D.	999	25	16.1	124.2
		1800	T.D.	1000	25	16.8	125.0
16	0000	T.D.	1005	25	17.6	125.9	
	0600	T.D.	1006	25	18.3	126.7	
	1200	T.D.	1006	25	19.0	128.0	

APPENDIX 5 SIX-HOURLY POSITIONS OF THE TROPICAL DEPRESSION
(21 - 24 May)

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
May	21	1800	T.D.	1000	30	20.6	116.5
		0000	T.D.	1000	30	21.2	117.4
	22	0600	T.D.	1000	30	21.9	119.0
		1200	T.D.	998	30	21.6	120.8
		1800	T.D.	998	30	21.7	122.6
		0000	T.D.	997	30	22.0	124.5
	23	0600	T.D.	995	30	22.1	126.5
		1200	T.D.	995	30	22.5	128.4
		1800	T.D.	997	30	23.7	131.0
		0000	T.D.	1000	30	25.3	132.9
	24	0600	T.D.	1000	25	26.7	134.4

APPENDIX 6 SIX-HOURLY POSITIONS OF THE TROPICAL DEPRESSION
(21 - 23 June)

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
June	21	0600	T.D.	1003	30	15.9	110.0
		1200	T.D.	1003	30	15.8	110.1
		1800	T.D.	1003	30	15.7	110.2
	22	0000	T.D.	1003	30	15.7	110.1
		0600	T.D.	1003	30	15.8	109.8
		1200	T.D.	1003	30	15.4	109.6
		1800	T.D.	1003	30	15.2	109.6
	23	0000	T.D.	1003	25	15.1	109.6
		0600	T.D.	1003	25	15.0	109.6

APPENDIX 7 SIX-HOURLY POSITIONS OF TYPHOON ELLIS

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
July	1	0000	T.D.	1000	30	13.4	132.0
		0600	T.S.	997	35	13.5	131.5
		1200	T.S.	994	40	13.7	130.9
		1800	T.S.	990	50	13.9	129.9
	2	0000	S.T.S.	980	55	14.2	128.7
		0600	S.T.S.	975	55	14.5	127.7
		1200	S.T.S.	970	55	15.0	127.0
		1800	T.	960	65	15.4	126.1
	3	0000	T.	955	90	15.8	125.3
		0600	T.	960	85	16.7	124.3
		1200	T.	965	85	17.6	123.6
		1800	T.	970	85	18.5	122.6
	4	0000	T.	970	85	19.0	121.4
		0600	S.T.S.	980	60	19.4	120.5
		1200	S.T.S.	980	60	19.8	119.2
		1800	S.T.S.	982	60	20.1	117.9
	5	0000	S.T.S.	984	60	20.2	116.2
		0600	S.T.S.	984	55	20.4	115.1
		1200	S.T.S.	984	50	20.5	114.2
		1800	T.S.	986	45	21.0	113.0
	6	0000	T.S.	988	40	21.5	111.9

APPENDIX 8 SIX-HOURLY POSITIONS OF SEVERE TROPICAL STORM FAYE

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
July	2	1200	T.D.	1000	25	7.9	144.9
		1800	T.D.	1000	30	8.5	144.0
	3	0000	T.S.	998	35	9.2	143.0
		0600	T.S.	998	35	9.6	142.1
		1200	T.S.	997	40	9.8	141.5
		1800	T.S.	996	40	10.1	140.9
	4	0000	T.S.	996	40	10.4	140.0
		0600	T.S.	996	45	10.6	138.8
		1200	T.S.	995	45	10.6	137.3
		1800	T.S.	993	45	10.4	136.1
	5	0000	S.T.S.	990	55	10.1	136.2
		0600	S.T.S.	985	55	11.1	135.9
		1200	T.S.	994	40	12.0	135.2
		1800	T.S.	997	40	12.7	134.6
	6	0000	T.S.	998	35	13.3	133.7
		0600	T.D.	1000	25	14.0	132.6
		1200	T.D.	1000	25	15.0	131.5
		1800	T.D.	1000	25	16.3	130.8
	7	0000	T.D.	1004	25	17.6	129.9
		0600	T.D.	1004	25	18.0	129.0
		1200	T.D.	1004	25	18.1	128.1
		1800	T.D.	1004	25	18.4	127.2
	8	0000	T.D.	1004	25	18.9	126.4
		0600	T.D.	1006	25	19.4	125.4
		1200	T.D.	1006	25	20.0	124.8
		1800	T.D.	1004	25	20.5	124.0
	9	0000	T.D.	1004	25	21.0	123.0

APPENDIX 9 SIX-HOURLY POSITIONS OF SEVERE TROPICAL STORM GORDON

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
July	26	0600	T.D.	1000	25	19.7	130.2
		1200	T.D.	999	30	19.9	128.9
		1800	T.D.	998	30	20.2	127.5
	27	0000	T.D.	993	30	20.5	126.2
		0600	T.S.	991	35	20.6	125.3
		1200	T.S.	989	35	20.6	124.2
	28	1800	T.S.	984	40	20.6	123.0
		0000	T.S.	981	45	20.6	121.8
		0600	S.T.S.	978	50	21.3	120.8
	29	1200	S.T.S.	975	60	22.0	120.2
		1800	S.T.S.	979	55	22.5	118.6
		0000	S.T.S.	983	55	22.8	117.3
		0600	S.T.S.	988	50	22.9	116.3
		1200	T.S.	991	35	23.0	115.0
		1800	T.D.	992	25	23.1	114.0

APPENDIX 10 SIX-HOURLY POSITIONS OF TYPHOON HOPE

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
July	28	0000	T.D.	999	25	16.2	137.8
		0600	T.D.	998	25	16.2	137.4
		1200	T.D.	996	25	16.3	136.9
		1800	T.D.	996	30	16.4	136.4
	29	0000	T.S.	996	40	16.4	135.9
		0600	S.T.S.	976	50	16.5	135.5
		1200	S.T.S.	970	60	16.6	134.7
	30	1800	T.	964	65	16.7	134.1
		0000	T.	953	70	16.9	133.5
		0600	T.	939	75	17.1	132.7
		1200	T.	932	80	17.5	131.8
	31	1800	T.	928	85	18.0	130.6
		0000	T.	922	90	18.7	129.3
		0600	T.	913	105	19.1	127.8
		1200	T.	900	130	19.6	126.2
August	1	1800	T.	901	130	20.1	124.6
		0000	T.	906	130	20.5	123.2
		0600	T.	914	120	20.7	121.8
		1200	T.	925	110	21.4	120.4
	2	1800	T.	935	110	21.7	118.4
		0000	T.	940	110	22.2	116.5
		0600	T.	950	100	22.4	114.1
		1200	S.T.S.	970	60	22.4	112.1
	3	1800	T.S.	981	45	22.1	110.0
		0000	T.S.	990	40	21.4	108.5
		0600	T.S.	994	35	21.0	106.4
		1200	T.D.	995	25	21.0	104.3

APPENDIX 11 SIX-HOURLY POSITIONS OF THE TROPICAL DEPRESSION
(5 - 7 August)

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
August	5	0000	T.D.	1000	25	17.5	127.4
		0600	T.D.	999	25	18.5	126.5
		1200	T.D.	998	25	19.2	125.5
		1800	T.D.	998	25	19.7	124.5
	6	0000	T.D.	998	25	20.1	123.4
		0600	T.D.	1000	25	20.5	122.3
		1200	T.D.	1002	25	20.9	121.4
		1800	T.D.	1002	25	21.4	120.7
	7	0000	T.D.	1002	25	22.0	120.0

APPENDIX 12 SIX-HOURLY POSITIONS OF THE TROPICAL DEPRESSIONS
(6 - 9 August)

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
(I)							
August	6	1200	T.D.	997	25	17.7	112.6
		1800	T.D.	998	25	17.9	112.2
	7	0000	T.D.	998	25	18.1	111.8
		0600	T.D.	998	25	18.2	111.3
		1200	T.D.	998	25	18.1	110.4
		1800	T.D.	998	25	18.0	109.6
	8	0000	T.D.	997	25	17.8	108.8
		0600	T.D.	997	25	17.6	108.2
		1200	T.D.	996	25	17.3	107.6
		1800	T.D.	996	25	17.0	107.0
	9	0000	T.D.	995	25	16.6	107.2
	(II)						
August	8	0600	T.D.	998	25	17.8	113.1
		1200	T.D.	998	25	17.2	112.7
		1800	T.D.	997	25	17.1	111.7
	9	0000	T.D.	996	25	17.4	111.2

APPENDIX 13 SIX-HOURLY POSITIONS OF TYPHOON IRVING

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
August	9	0000	T.D.	998	25	17.8	136.0
		0600	T.D.	998	25	18.0	135.6
		1200	T.D.	998	25	18.1	135.0
		1800	T.D.	998	30	18.3	134.2
	10	0000	T.D.	998	30	18.4	133.2
		0600	T.D.	996	30	18.3	132.4
		1200	T.S.	995	35	17.9	131.3
		1800	T.S.	993	35	17.3	130.5
	11	0000	T.S.	993	35	17.2	129.9
		0600	T.S.	990	40	17.1	129.5
		1200	T.S.	990	40	17.1	128.9
		1800	T.S.	985	45	17.2	128.5
	12	0000	S.T.S.	985	50	17.4	128.0
		0600	S.T.S.	980	55	18.0	127.4
		1200	S.T.S.	980	55	18.7	127.1
		1800	S.T.S.	975	60	19.4	127.0
	13	0000	S.T.S.	970	60	20.0	127.0
		0600	T.	965	65	21.0	126.9
		1200	T.	965	65	22.0	126.0
		1800	T.	965	65	22.9	125.2
	14	0000	T.	960	65	23.4	125.0
		0600	T.	960	65	24.0	124.9
		1200	T.	955	70	24.5	124.8
		1800	T.	955	75	25.2	124.4
	15	0000	T.	955	75	25.9	124.5
		0600	T.	955	75	26.9	124.0
		1200	T.	955	75	27.5	123.7
		1800	T.	955	80	28.6	123.8
	16	0000	T.	955	80	29.6	123.8
		0600	T.	955	75	30.8	123.7
		1200	T.	955	75	31.8	123.7
		1800	T.	960	70	32.9	124.3
	17	0000	T.	965	65	34.0	125.3
		0600	S.T.S.	970	55	35.4	127.1
		1200	T.S.	975	45	37.1	129.1
		1800	T.S.	975	45	39.6	131.2
18	0000	T.S.	975	45	41.8	133.5	
	0600	T.S.	975	45	44.4	136.3	
	1200	T.S.	975	40	46.0	139.3	

APPENDIX 14 SIX-HOURLY POSITIONS OF TYPHOON JUDY

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
August	17	0000	T.D.	998	30	13.8	143.5
		0600	T.S.	994	35	14.2	142.2
		1200	T.S.	992	40	14.5	141.0
		1800	T.S.	990	45	15.1	139.8
	18	0000	S.T.S.	980	50	15.7	139.0
		0600	S.T.S.	960	60	16.2	138.3
		1200	T.	950	65	16.7	137.5
		1800	T.	945	70	17.3	136.5
	19	0000	T.	945	80	17.9	135.8
		0600	T.	945	85	18.9	135.0
		1200	T.	940	90	19.7	134.3
		1800	T.	935	95	20.4	133.9
	20	0000	T.	915	100	21.3	133.7
		0600	T.	910	120	22.2	133.2
		1200	T.	925	110	22.8	132.4
		1800	T.	935	100	23.1	131.6
	21	0000	T.	940	90	23.5	131.1
		0600	T.	945	90	24.0	130.3
		1200	T.	945	85	24.0	129.4
		1800	T.	950	80	24.3	128.9
	22	0000	T.	950	70	24.3	127.9
		0600	T.	950	70	24.2	127.3
		1200	T.	950	75	24.5	126.9
		1800	T.	950	80	24.9	126.3
	23	0000	T.	950	75	26.1	125.6
		0600	T.	950	70	26.8	124.4
		1200	T.	950	70	27.3	123.7
		1800	T.	955	70	28.1	123.2
	24	0000	T.	955	70	29.0	122.5
		0600	T.	960	70	29.5	122.2
		1200	T.	965	65	30.0	122.3
		1800	S.T.S.	970	60	30.5	122.4
	25	0000	S.T.S.	975	55	30.8	123.0
0600		S.T.S.	980	50	31.4	123.5	
1200		T.S.	980	45	31.8	124.1	
1800		T.S.	985	45	32.6	125.2	
26	0000	T.S.	990	40	33.4	126.7	
	0600	T.S.	992	40	33.8	127.7	
	1200	T.S.	993	35	34.4	128.9	
	1800	T.D.	994	25	35.3	131.1	

APPENDIX 15 SIX-HOURLY POSITIONS OF TROPICAL STORM KEN

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
August	31	0000	T.D.	1006	25	25.0	137.0
		0600	T.D.	1004	25	25.0	136.4
		1200	T.D.	1004	25	25.0	135.7
		1800	T.D.	1004	25	25.0	135.1
September	1	0000	T.D.	1004	25	24.9	134.5
		0600	T.D.	1004	25	24.9	133.8
		1200	T.D.	1002	25	25.0	133.1
		1800	T.D.	1000	25	25.3	132.5
	2	0000	T.D.	998	30	25.6	132.0
		0600	T.D.	998	30	26.1	131.5
		1200	T.S.	995	40	26.9	131.0
		1800	T.S.	995	40	27.7	130.6
	3	0000	T.S.	995	40	28.8	130.4
		0600	T.S.	990	45	30.0	130.6
		1200	T.S.	990	45	31.4	131.1
		1800	T.S.	990	40	32.7	132.1
	4	0000	T.D.	990	30	34.0	133.5
		0600	T.D.	990	30	35.4	134.8
		1200	T.D.	990	30	36.7	136.8
		1800	T.D.	990	30	38.9	139.4

APPENDIX 16 SIX-HOURLY POSITIONS OF TYPHOON LOLA

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
September	3	0000	T.D.	1004	25	21.8	151.3
		0600	T.D.	1002	25	22.3	150.9
		1200	T.D.	1000	30	22.9	150.4
		1800	T.D.	1000	30	23.5	149.9
	4	0000	T.S.	990	40	23.7	149.0
		0600	S.T.S.	985	50	24.0	148.5
		1200	T.	975	65	24.3	147.7
		1800	T.	970	70	24.8	147.1
	5	0000	T.	965	70	25.3	146.7
		0600	T.	960	75	25.7	146.5
		1200	T.	960	75	26.2	146.4
		1800	T.	955	80	26.7	146.4
	6	0000	T.	950	80	27.3	146.5
		0600	T.	955	80	27.9	146.5
		1200	T.	960	80	28.6	146.4
		1800	T.	965	75	29.4	146.3
	7	0000	T.	985	65	30.0	146.4
		0600	S.T.S.	985	55	30.9	146.6
		1200	S.T.S.	985	50	31.9	147.1
		1800	T.S.	990	45	33.0	147.8
	8	0000	T.S.	990	40	34.0	148.5
		0600	T.S.	990	40	35.2	150.0
		1200	T.S.	990	40	36.3	152.0
		1800	T.S.	992	40	37.2	154.1
9	0000	T.D.	995	30	37.8	156.3	
	0600	T.D.	998	30	38.1	158.5	

APPENDIX 17 SIX-HOURLY POSITIONS OF SEVERE TROPICAL STORM MAC

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
September	16	0000	T.D.	1004	25	13.4	129.3
		0600	T.S.	995	45	13.8	127.9
		1200	T.S.	992	45	13.9	127.1
	17	1800	T.S.	990	45	13.9	126.6
		0000	T.S.	990	45	13.9	126.0
		0600	T.S.	990	45	13.9	125.6
	18	1200	T.S.	990	45	13.8	124.9
		1800	T.S.	990	45	13.7	124.0
		0000	T.S.	990	45	13.6	123.5
	19	0600	T.S.	990	45	13.6	123.1
		1200	T.S.	990	45	13.6	122.6
		1800	T.S.	992	40	13.6	121.9
	20	0000	T.S.	996	35	13.6	121.0
		0600	T.S.	998	35	13.9	120.5
		1200	T.D.	1005	25	14.5	119.9
	21	1800	T.D.	1005	25	15.3	119.4
		0000	T.D.	1005	25	16.2	119.1
		0600	T.D.	1002	25	17.1	118.8
	22	1200	T.D.	1000	30	17.6	118.5
		1800	T.D.	998	30	18.0	118.2
		0000	T.D.	998	30	18.5	117.9
	23	0600	T.D.	998	30	18.9	117.5
		1200	T.D.	998	30	19.3	117.2
		1800	T.D.	998	30	19.8	116.7
24	0000	T.D.	998	30	20.3	116.1	
	0600	T.D.	998	30	20.5	115.9	
	1200	T.D.	998	30	20.7	115.7	
25	1800	T.D.	996	30	21.0	115.1	
	0000	S.T.S.	990	60	21.4	114.4	
	0600	S.T.S.	992	50	21.7	113.8	
26	1200	S.T.S.	994	50	21.9	113.9	
	1800	T.S.	998	35	22.3	113.3	
	0000	T.D.	1000	25	22.3	112.7	
27	0600	T.D.	1002	25	22.0	112.5	

APPENDIX 18 SIX-HOURLY POSITIONS OF TROPICAL STORM NANCY

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
September	19	0000	T.D.	1000	25	18.7	112.0
		0600	T.D.	998	30	18.8	111.3
		1200	T.D.	998	30	18.8	110.6
		1800	T.D.	996	30	18.8	110.1
	20	0000	T.D.	996	30	18.6	109.7
		0600	T.D.	994	30	18.4	109.5
		1200	T.D.	992	30	18.2	109.4
		1800	T.D.	992	30	17.9	109.0
	21	0000	T.D.	992	30	17.8	108.5
		0600	T.S.	992	35	17.8	108.3
		1200	T.S.	992	35	17.8	108.0
		1800	T.D.	994	30	17.7	107.7
	22	0000	T.D.	994	30	17.7	107.4
		0600	T.D.	994	30	17.7	106.7
		1200	T.D.	998	25	17.4	106.0

APPENDIX 19 SIX-HOURLY POSITIONS OF TYPHOON OWEN

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E	
September	22	0600	T.D.	1002	25	12.4	138.2	
		1200	T.D.	1002	25	12.2	137.8	
		1800	T.D.	1000	30	12.1	137.3	
	23	0000	T.D.	998	30	12.2	136.9	
		0600	T.S.	994	40	12.6	136.7	
		1200	T.S.	994	40	13.0	136.5	
	24	1800	T.S.	992	40	14.6	135.9	
		0000	T.S.	990	45	16.4	135.1	
		0600	S.T.S.	985	50	17.8	134.5	
	25	1200	S.T.S.	980	50	19.2	133.2	
		1800	S.T.S.	970	55	20.2	132.0	
		0000	S.T.S.	960	60	21.0	130.8	
	26	0600	T.	950	65	21.5	130.1	
		1200	T.	935	70	22.0	129.6	
		1800	T.	920	80	22.7	129.2	
	27	0000	T.	920	90	23.2	129.1	
		0600	T.	920	90	23.6	129.1	
		1200	T.	920	90	24.0	129.2	
	28	1800	T.	930	90	24.4	129.4	
		0000	T.	940	90	24.7	129.5	
		0600	T.	945	80	25.3	129.6	
	29	1200	T.	945	80	25.9	129.7	
		1800	T.	945	70	26.4	129.8	
		0000	T.	950	70	26.9	129.9	
	30	0600	T.	950	70	27.2	129.9	
		1200	T.	950	70	27.5	129.9	
		1800	T.	950	70	27.7	129.9	
	October	1	0000	T.	950	70	28.0	129.9
			0600	T.	950	70	28.5	129.9
			1200	T.	955	70	29.0	130.0
1	1800	T.	955	70	29.8	130.5		
	0000	T.	955	65	30.9	131.4		
	0600	T.	955	65	32.4	132.9		
1	1200	T.	955	65	34.0	135.0		
	1800	S.T.S.	980	50	36.6	138.0		
	0000	T.S.	980	40	40.5	142.6		

APPENDIX 20 SIX-HOURLY POSITIONS OF TROPICAL STORM PAMELA

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
September	25	0000	T.D.	1000	25	19.0	144.0
		0600	T.D.	1000	30	19.1	142.9
		1200	T.S.	996	35	19.5	141.7
	26	1800	T.S.	994	35	20.0	140.7
		0000	T.S.	994	35	20.5	139.8
		0600	T.D.	996	25	21.9	137.7
		1200	T.D.	998	25	23.3	135.8

APPENDIX 21 SIX-HOURLY POSITIONS OF THE TROPICAL DEPRESSION
(1-2 October)

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
October	1	0600	T.D.	1000	25	15.0	119.0
		1200	T.D.	1000	25	14.4	119.5
		1800	T.D.	1000	25	14.2	120.1
	2	0000	T.D.	1002	25	15.0	121.6
		0600	T.D.	1000	25	15.6	122.0

APPENDIX 22 SIX-HOURLY POSITIONS OF TROPICAL STORM ROGER

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
October	3	0600	T.D.	998	25	15.5	140.0
		1200	T.D.	998	25	16.6	139.6
		1800	T.D.	998	25	19.0	138.4
	4	0000	T.D.	995	30	20.9	136.1
		0600	T.S.	985	35	21.1	135.4
		1200	T.S.	985	35	21.5	134.5
	5	1800	T.S.	990	40	21.1	133.5
		0000	T.S.	990	40	20.2	134.0
		0600	T.S.	990	40	20.5	135.1
	6	1200	T.S.	990	40	21.5	135.6
		1800	T.S.	990	40	22.7	135.3
		0000	T.S.	992	40	23.9	134.7
	7	0600	T.S.	992	40	25.0	134.9
		1200	T.S.	992	40	26.5	135.5
		1800	T.S.	992	40	28.5	136.0
		0000	T.S.	992	40	31.5	137.0

APPENDIX 23 SIX-HOURLY POSITIONS OF TYPHOON SARAH

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
October	4	1200	T.D.	998	25	14.0	119.7
		1800	T.D.	996	30	13.8	119.2
	5	0000	T.D.	996	30	13.5	118.8
		0600	T.D.	996	30	12.7	118.5
		1200	T.S.	992	35	12.5	119.4
	6	1800	T.S.	992	35	12.5	119.5
		0000	T.S.	994	35	12.5	119.7
		0600	T.S.	992	40	12.4	119.7
	7	1200	T.S.	992	40	12.3	119.6
		1800	T.S.	990	45	12.3	119.5
		0000	T.S.	990	45	12.2	119.4
	8	0600	S.T.S.	985	60	12.1	119.2
		1200	S.T.S.	985	60	11.9	119.2
		1800	S.T.S.	985	60	11.7	119.2
	9	0000	S.T.S.	985	60	11.4	119.2
		0600	S.T.S.	980	60	11.1	119.2
		1200	S.T.S.	975	60	11.0	118.9
	10	1800	S.T.S.	970	60	11.1	118.5
		0000	T.	965	70	11.1	118.1
		0600	T.	960	80	11.2	117.7
	11	1200	T.	950	80	11.3	117.3
		1800	T.	940	80	11.4	116.9
		0000	T.	935	90	11.5	116.5
	12	0600	T.	930	90	11.6	116.1
		1200	T.	935	90	11.7	115.9
		1800	T.	940	90	11.8	115.7
	13	0000	T.	950	90	11.9	115.5
		0600	T.	960	80	12.0	115.1
		1200	T.	965	80	12.2	114.7
	14	1800	T.	965	80	12.4	114.4
		0000	T.	970	75	12.6	114.1
		0600	T.	970	75	12.9	113.7
	15	1200	T.	970	70	13.1	113.2
		1800	T.	970	70	13.3	112.9
		0000	T.	970	70	13.3	112.5
	16	0600	T.	970	65	13.4	112.1
		1200	T.	970	65	13.4	111.7
		1800	T.	970	65	13.4	111.3
	17	0000	S.T.S.	980	50	13.3	111.0
		0600	S.T.S.	980	50	13.3	110.6
		1200	T.S.	985	45	13.3	110.2
	18	1800	T.S.	990	40	13.3	109.8
		0000	T.D.	1000	30	13.2	109.3
		0600	T.D.	1000	25	12.7	109.0

APPENDIX 24 SIX-HOURLY POSITIONS OF TYPHOON TIP

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface winds (knots)	Lat. °N	Long. °E
October	5	0000	T.D.	1004	25	5.5	154.5
		0600	T.D.	1002	25	5.7	155.3
		1200	T.D.	1002	30	6.2	154.6
		1800	T.D.	1002	30	6.8	153.8
	6	0000	T.D.	1002	30	7.3	153.3
		0600	T.D.	1000	30	7.5	153.1
		1200	T.D.	1000	30	7.7	152.9
		1800	T.D.	1000	30	7.8	152.7
	7	0000	T.D.	1000	30	7.7	152.4
		0600	T.D.	1000	30	6.9	152.4
		1200	T.D.	1000	30	6.3	151.8
		1800	T.D.	1000	30	6.6	152.2
	8	0000	T.S.	995	35	7.5	152.1
		0600	T.S.	995	35	8.8	151.5
		1200	T.S.	995	40	10.0	150.4
		1800	T.S.	990	45	10.9	149.5
	9	0000	T.S.	990	45	12.0	147.9
		0600	S.T.S.	985	50	12.6	145.9
		1200	S.T.S.	975	55	12.8	144.3
		1800	S.T.S.	965	60	12.9	143.5
	10	0000	T.	955	70	13.0	142.7
		0600	T.	950	70	13.2	142.0
		1200	T.	940	85	13.5	141.0
		1800	T.	920	90	13.7	140.1
	11	0000	T.	900	110	14.2	139.4
		0600	T.	895	120	14.6	139.4
		1200	T.	905	130	15.1	139.4
		1800	T.	895	140	15.9	139.0
	12	0000	T.	880	155	16.5	138.3
		0600	T.	870	165	16.8	137.7
		1200	T.	885	140	16.9	137.2
		1800	T.	895	125	16.9	136.8
	13	0000	T.	905	110	16.8	136.2
		0600	T.	905	110	16.7	135.8
		1200	T.	910	110	16.7	135.4
		1800	T.	915	110	16.7	134.8
	14	0000	T.	920	100	17.0	134.0
		0600	T.	920	100	17.0	133.3
		1200	T.	920	100	17.3	132.6
		1800	T.	920	100	17.8	131.8
	15	0000	T.	920	100	18.0	131.0
		0600	T.	920	100	18.3	130.4
		1200	T.	920	100	18.6	130.0
		1800	T.	925	100	19.0	129.5

APPENDIX 24 (cont'd)

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface winds (knots)	Lat. °N	Long. °E
October	16	0000	T.	925	100	19.4	129.3
		0600	T.	930	100	20.0	129.0
		1200	T.	935	100	20.4	128.6
		1800	T.	935	100	20.9	128.4
	17	0000	T.	935	90	21.5	128.2
		0600	T.	940	90	22.2	127.9
		1200	T.	940	90	23.0	127.7
		1800	T.	940	90	24.0	127.6
	18	0000	T.	945	80	25.0	127.9
		0600	T.	950	80	26.5	128.5
		1200	T.	955	70	28.3	130.0
		1800	T.	960	70	30.4	132.0
	19	0000	T.	965	65	33.6	134.9
		0600	S.T.S.	965	60	37.3	139.2
		1200	S.T.S.	965	60	41.5	143.1

APPENDIX 25 SIX-HOURLY POSITIONS OF TYPHOON VERA

Month	Day	Time G.M.G.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
November	2	0000	T.D.	1004	30	7.0	146.0
		0600	T.S.	995	45	7.3	144.8
		1200	S.T.S.	990	50	7.5	143.4
		1800	S.T.S.	990	50	7.7	142.1
	3	0000	S.T.S.	985	55	8.0	140.9
		0600	S.T.S.	985	60	8.6	139.1
		1200	S.T.S.	975	60	9.1	137.2
		1800	T.	960	75	9.8	135.1
	4	0000	T.	935	110	10.5	133.1
		0600	T.	920	110	11.1	131.2
		1200	T.	915	110	11.7	129.2
		1800	T.	915	110	12.1	127.6
	5	0000	T.	920	110	12.7	126.0
		0600	T.	920	100	13.5	124.8
		1200	T.	930	100	14.1	124.0
		1800	T.	935	100	14.9	123.4
	6	0000	T.	945	85	15.5	123.0
		0600	T.	960	80	16.3	122.4
		1200	T.	970	80	17.1	122.2
		1800	T.	980	75	17.8	121.9
	7	0000	S.T.S.	990	55	17.9	121.0
0600		T.D.	1000	30	17.5	120.0	

APPENDIX 26 SIX-HOURLY POSITIONS OF TROPICAL STORM WAYNE

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
November	8	1200	T.D.	1000	25	15.1	132.4
		1800	T.D.	995	25	15.3	131.1
	9	0000	T.D.	995	30	15.8	130.0
		0600	T.D.	990	30	16.1	129.7
		1200	T.S.	990	40	16.6	129.5
		1800	T.S.	990	45	17.0	129.3
	10	0000	T.S.	990	45	17.6	129.2
		0600	T.S.	990	45	18.0	129.1
		1200	T.S.	995	45	18.2	129.0
		1800	T.S.	995	45	18.3	128.8
	11	0000	T.S.	998	35	18.5	128.6
		0600	T.D.	998	30	18.6	128.2
		1200	T.D.	1000	25	18.6	127.8
		1800	T.D.	1002	25	18.5	127.5
	12	0000	T.D.	1002	25	18.4	127.1

APPENDIX 27 SIX-HOURLY POSITIONS OF THE TROPICAL DEPRESSION
(1 - 2 December)

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
December	1	0000	T.D.	1004	25	18.6	152.2
		0600	T.D.	1002	25	19.5	151.6
		1200	T.D.	1002	30	20.9	151.4
		1800	T.D.	1002	30	22.6	150.0
	2	0000	T.D.	1002	30	24.5	150.0
		0600	T.D.	1002	30	26.5	150.5

APPENDIX 28 SIX-HOURLY POSITIONS OF TYPHOON ABBY

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
December	2	0600	T.D.	998	30	5.8	159.8
		1200	T.D.	998	30	6.0	159.5
		1800	T.D.	998	30	6.1	159.3
	3	0000	T.S.	998	40	6.4	159.2
		0600	T.S.	998	40	6.7	159.0
		1200	T.S.	995	40	7.0	158.9
	4	1800	T.S.	992	45	7.5	158.7
		0000	S.T.S.	990	50	8.1	158.3
		0600	S.T.S.	990	50	8.2	157.2
	5	1200	S.T.S.	985	50	8.2	156.5
		1800	S.T.S.	985	50	8.3	155.8
		0000	S.T.S.	985	55	8.3	155.2
	6	0600	S.T.S.	995	55	7.9	154.1
		1200	T.S.	1000	45	7.6	153.1
		1800	T.S.	1000	45	8.0	152.3
	7	0000	T.S.	1000	45	8.7	151.8
		0600	T.S.	1000	45	9.2	151.2
		1200	T.S.	1000	45	9.4	149.8
	8	1800	T.S.	1000	45	9.5	147.8
		0000	T.S.	995	45	9.8	146.4
		0600	T.S.	995	45	10.1	145.9
	9	1200	T.S.	995	40	10.4	145.4
		1800	T.S.	995	40	10.8	144.9
		0000	T.S.	995	35	11.3	144.4
	10	0600	T.D.	995	30	12.1	143.5
		1200	T.D.	995	30	12.0	141.7
		1800	T.D.	995	30	11.6	140.5
	11	0000	T.D.	995	30	11.5	139.3
		0600	T.S.	990	35	11.2	137.8
		1200	T.S.	985	40	11.0	136.3
	12	1800	T.S.	985	40	10.9	134.8
		0000	T.S.	980	45	11.3	133.9
		0600	S.T.S.	975	50	11.8	133.1
	13	1200	S.T.S.	970	55	12.3	132.3
		1800	S.T.S.	965	60	13.0	131.5
		0000	T.	965	70	13.6	130.7
	14	0600	T.	965	70	14.3	130.2
		1200	T.	960	70	15.0	130.0
		1800	T.	955	70	15.6	130.1
	15	0000	T.	955	80	16.3	130.3
		0600	T.	955	90	17.1	131.0
		1200	T.	950	85	18.0	131.9
	16	1800	T.	950	75	18.9	133.3
		0000	T.	950	75	19.8	134.6
		0600	T.	960	70	20.5	136.2
	17	1200	T.	970	80	21.3	138.2
		1800	T.	980	75	22.0	140.3
		0000	S.T.S.	990	60	22.3	142.7
	18	0600	S.T.S.	1000	50	22.6	145.2
		1200	T.S.	1002	40	22.9	147.7
		1800	T.D.	1002	30	23.0	150.9

APPENDIX 29 SIX-HOURLY POSITIONS OF SEVERE TROPICAL STORM BEN

Month	Day	Time G.M.T.	Intensity	Estimated minimum central pressure (mbar)	Estimated maximum surface wind (knots)	Lat. °N	Long. °E
December	21	0000	T.S.	1000	40	11.5	127.0
		0600	T.S.	995	45	11.5	125.9
		1200	S.T.S.	995	50	11.7	124.4
	22	1800	S.T.S.	995	50	12.2	123.0
		0000	S.T.S.	995	50	12.6	121.7
		0600	S.T.S.	995	50	13.2	120.4
		1200	S.T.S.	995	50	13.8	119.0
		1800	S.T.S.	995	50	14.6	118.3
		0000	S.T.S.	995	50	15.7	119.1
	23	0600	T.S.	1000	40	16.5	120.0
		1200	T.D.	1004	25	19.3	123.3