

ROYAL OBSERVATORY, HONG KONG

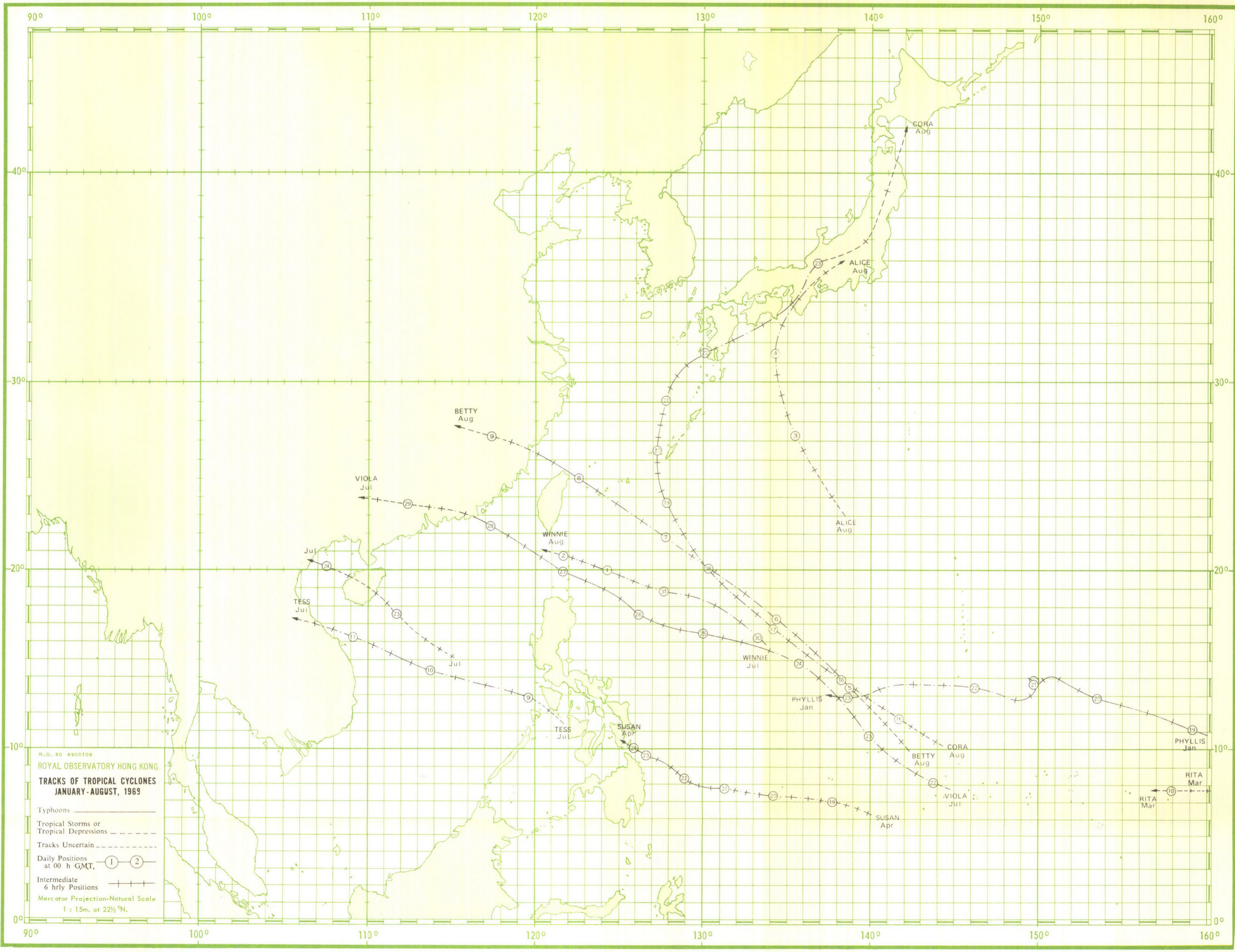
METEOROLOGICAL RESULTS
1969

PART III—TROPICAL CYCLONE SUMMARIES



PRINTED AND PUBLISHED BY J. R. LEE, GOVERNMENT PRINTER
AT THE GOVERNMENT PRESS
JAVA ROAD, HONG KONG

1972



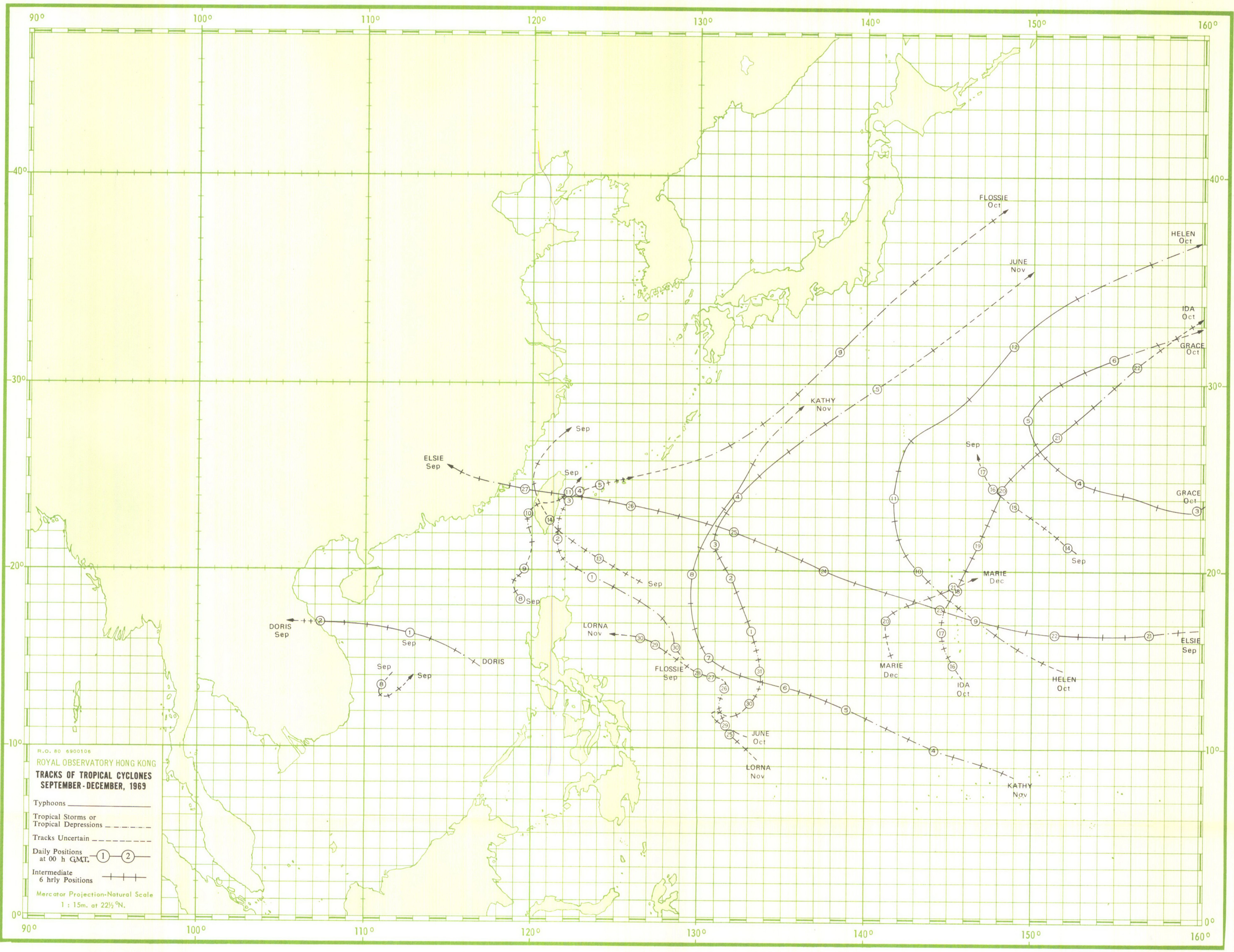
R.O. 80 6900106
 ROYAL OBSERVATORY HONG KONG
TRACKS OF TROPICAL CYCLONES
JANUARY - AUGUST, 1969

Typhoons ————
 Tropical Storms or
 Tropical Depressions - - - -
 Tracks Uncertain ······

Daily Positions
 at 00 h GMT. (1) (2)

Intermediate
 6 hrly Positions + + + +

Mercator Projection-Natural Scale
 1 : 15m. at 22½°N.



R.O. 80 6900106
ROYAL OBSERVATORY HONG KONG
TRACKS OF TROPICAL CYCLONES
SEPTEMBER-DECEMBER, 1969

Typhoons ———
 Tropical Storms or
 Tropical Depressions - - - -
 Tracks Uncertain
 Daily Positions
 at 00 h GMT. ① ②
 Intermediate
 6 hrly Positions + + + +
 Mercator Projection-Natural Scale
 1 : 15m. at 22½°N.

METEOROLOGICAL RESULTS

1969

PART III—TROPICAL CYCLONE SUMMARIES

CROWN COPYRIGHT RESERVED

CONTENTS

	<i>Page</i>
FRONTISPICE: Tracks of Tropical Cyclones in the western Pacific and the South China Sea, 1969	
1. INTRODUCTION	1
2. DESCRIPTION OF TABLES	3
3. LIST OF FIGURES	4
4. TROPICAL CYCLONE SUMMARY FOR 1969	5
5. REPORTS ON INDIVIDUAL TROPICAL CYCLONES AFFECTING HONG KONG IN 1969	
(a) Typhoon 'Viola': July 22-29	6
(b) Tropical Depression: September 8-11	9
(c) Typhoon 'Elsie': September 19-28	11
(d) Severe Tropical Storm 'Flossie': September 30-October 9	14
6. TABLES	
Table 1. List of Tropical Cyclones in the western Pacific and the South China Sea in 1969	16
Table 2. Non-local Tropical Cyclone Warnings Issued in 1969	17
Table 3. Local Storm Warning Signals Hoisted and Number of Local Warning Bulletins Issued in 1969	17
Table 4. Frequency and Annual Total Duration of Local Storm Signals: 1946-1969	18
Table 5. Number of Tropical Cyclones in Hong Kong's Area of Responsibility and That Necessitated the Display of Local Signals: 1956-1969	18
Table 6. Duration of Display of Local Storm Signals: 1946-1969	19
Table 7. Casualties and Damage Caused by Tropical Cyclones in Hong Kong: 1937-1969	19
Table 8. Ships Sunk, Damaged, Grounded, etc., by Tropical Cyclones in Hong Kong: 1960-1969	20
Table 9. Tropical Cyclones Causing Persistent Gales at the Royal Observatory: 1884-1969	21

INTRODUCTION

Apart from a short break 1940–1946, surface observations of meteorological elements since 1884 have been summarized and published in 'Meteorological Results, Part I—Surface Observations'. Part II which contains summaries of upper-air observations began in 1947. This series, 'Meteorological Results, Part III—Tropical Cyclone Summaries', is concerned with tropical cyclones which formed over the western Pacific and the South China Sea and commenced from 1968.

During the period 1884–1939, reports on destructive typhoons were occasionally prepared and were included in the Appendices of Meteorological Results, Part I. However, since 1947, this practice was extended and information on all tropical cyclones which caused gales in Hong Kong was contained in the Annual Departmental Reports of the Director of the Royal Observatory.

Tracks of tropical cyclones in the western Pacific and the South China Sea were published in Meteorological Results, Part I up to 1967. For the period 1884–1960, the tracks were plotted with day circle positions only. The day circle time varied to some extent but has remained fixed at 0000 h G.M.T. since 1944. The day circle time used in each tropical cyclone is given in the Appendix of Royal Observatory Technical Memoir No. 7. From 1961 onwards, 6-hourly intermediate positions were also shown on the tracks of all tropical cyclones.

Provisional reports on individual tropical cyclones affecting Hong Kong have been prepared since 1960; this was done in order to meet the immediate needs of the press, shipping companies and others. These reports were in cyclostyled form and were supplied on request. Initially, reports were only written on those tropical cyclones causing gale signals to be hoisted in Hong Kong, but by 1968 it had become necessary to produce individual reports for every tropical cyclone for which any Local Storm 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.

Local wind observations are regularly made at 6 stations located at suitable points in the Colony. Each station is equipped with a Dines pressure-tube anemograph incorporating a twin-pen direction recorder, manufactured by R. W. Munro Limited. Quick-run mechanisms are also fitted to the anemometers at Hong Kong Airport, Waglan Island and Tate's Cairn for recording the fine structure of the wind flow in typhoons for research purposes. Details of these stations are given below. The position shown is for the barometer where applicable and the elevation of the ground refers to ground level near the thermometer shelter, except at Tate's Cairn which was built for the operation of the Plessey Type 43S 10-cm radar.

Station	Position		Elevation of barometer above M.S.L. (m)	Elevation of ground above M.S.L. (m)	Head of anemometer above M.S.L. (m)
	Latitude N	Longitude E			
Royal Observatory	22° 18'	114° 10'	33	32	61
Hong Kong Airport	22° 20'	114° 11'	24	4	10
Waglan Island	22° 11'	114° 18'	56	55	74
Tate's Cairn	22° 22'	114° 13'	*	576†	589
Cheung Chau	22° 12'	114° 02'	39	39	48
Cape Collinson	22° 16'	114° 15'	48	46	59

* No barometer.

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

‡ Information on the operation of the Local Storm Warning Signal system is contained in other publications of the Royal Observatory, Hong Kong.

The present series gives a general description of the life history of each tropical cyclone affecting Hong Kong from formation to dissipation. In more detail it states:

- (a) how the tropical cyclone affected Hong Kong;
- (b) the sequence of display of Local Storm Signals;
- (c) the maximum gusts (maximum gust peak speeds) recorded at various stations throughout the Colony;
- (d) the lowest barometric pressure recorded in the Colony; and
- (e) the daily amount of rainfall recorded at the Royal Observatory.

Wherever practical, radar photographs and cloud pictures of the tropical cyclone received from weather satellites are included along with information and data obtained from aircraft reconnaissance reports*.

All information on tropical cyclones collected and collated at the Royal Observatory, Hong Kong which would be of interest to users will as far as possible be included in this publication.

It has proved necessary to use different times in different contexts in this publication. The reference times of non-local warnings for shipping are given in G.M.T., records of meteorological observations are kept in Hong Kong Standard Time (G.M.T. +8 hours), while Local Time is used in reports on tropical cyclones and other press releases. The Local Time used is either Hong Kong Standard Time or Hong Kong Summer Time (G.M.T. +9 hours). In 1969 Hong Kong Summer Time was in force during the period between 3.30 (Hong Kong Standard Time) in the morning of April 20 and 3.30 (Hong Kong Summer Time) in the morning of October 19.

The following conventions are used in this publication:

- (a) Unlabelled times given in hours and minutes (e.g., 1454) on a 24-hour clock are in Hong Kong Standard Time;
- (b) Times expressed as a.m. or p.m. are in Hong Kong Local Time;
- (c) Times labelled 'G.M.T.' are in Greenwich Mean Time.

Distances are generally given in international nautical miles (n mile), 1 international nautical mile being 1852 metres exactly, but in order to shorten the text the words 'international' and 'nautical' are usually omitted. The unit of speed is one international knot (kn), which is equal to 1.852 km/h or about 0.514 m/s.

* The wind reports by reconnaissance aircraft included in this publication were taken directly from the Annual Typhoon Report published by the Fleet Weather Central/Joint Typhoon Warning Center at Guam and no attempt was made to convert these observations into equivalent '10-minute mean winds' as normally reported by all surface stations.

DESCRIPTION OF TABLES

Table 1 is a list of tropical cyclones in 1969 in the western 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-stated 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 non-local tropical cyclone warnings, issued by the Royal Observatory, Hong Kong in 1969, 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 number of occasions each of the local Storm Warning Signals was hoisted, and also the total time throughout the year 1969 that each signal was displayed. The sequence in which signals were displayed in each tropical cyclone affecting Hong Kong and the number of Local Warning Bulletins issued in each case are also given.

Table 4 shows the number of occasions on which Local Storm Signals were hoisted and their annual total duration during the period 1946-1969. The Strong Wind Signal, No. 3, was not introduced until 1956.

Table 5 gives the annual number of tropical cyclones in Hong Kong's Area of Responsibility between 1956-1969. The annual number of tropical cyclones which caused Local Storm Signals to be raised is also included.

Table 6 shows the maximum, mean and minimum duration (hours and minutes) of display of each Local Storm Signal during the period 1946-1969.

Table 7 presents the casualty and damage figures associated with tropical cyclones in Hong Kong for the period 1937-1969. The information is compiled from local newspapers and the figures should only be considered as approximations.

Table 8 contains the particulars of ships sunk, damaged, grounded, etc., by various tropical cyclones which gave rise to persistent gales at the Royal Observatory, Hong Kong for the period 1960-1969. The information is compiled from local newspapers and the figures should only be considered as approximations.

Table 9 presents some features of tropical cyclones which gave winds of gale force or greater at the Observatory since 1884. In each case, data are tabulated in chronological order according to the date and time of barometric minimum recorded at the Royal Observatory. The information presented includes lowest hourly reading of barometer (reduced to M.S.L.), the maximum gust peak speed (maximum gust), duration of gale, direction of strongest winds and the sequence of wind direction in terms of veering and backing. Statements on storm surges and additional information, where applicable, are included as remarks. Information on gusts was not available before the installation of the Dines anemograph in 1911.

LIST OF FIGURES

- Figure 1. Monthly distribution of the frequency of occurrence of tropical cyclones in the western Pacific and the South China Sea in 1969.
- Figure 2. Track of Typhoon 'Viola': July 22-29, 1969.
- Figure 3. NIMBUS 3 APT picture of Typhoon 'Viola' taken at about 11.42 a.m. on July 25, 1969.
- Figure 4. ESSA 8 APT picture of Typhoon 'Viola' taken at about 10.01 a.m. on July 26, 1969.
- Figure 5. NIMBUS 3 APT picture of Typhoon 'Viola' taken at about 12.02 p.m. on July 27, 1969.
- Figure 6. Radar picture of Typhoon 'Viola' taken at the Royal Observatory at about 10.57 a.m. on July 28, 1969.
- Figure 7. Track of tropical depression of September 8-11, 1969.
- Figure 8. ESSA 8 APT picture of the tropical depression taken at about 10.09 a.m. on September 9, 1969.
- Figure 9. Track of Typhoon 'Elsie': September 19-28, 1969.
- Figure 10. ESSA 8 APT picture of Typhoon 'Elsie' taken at about 9.33 a.m. on September 24, 1969.
- Figure 11. NIMBUS 3 APT picture of Typhoon 'Elsie' taken at about 11.20 a.m. on September 25, 1969.
- Figure 12. ESSA 8 APT picture of Typhoon 'Elsie' taken at about 9.20 a.m. on September 26, 1969.
- Figure 13. NIMBUS 3 APT picture of Typhoon 'Elsie' taken at about 11.40 a.m. on September 27, 1969.
- Figure 14. Track of Severe Tropical Storm 'Flossie': September 30 - October 9, 1969.
- Figure 15. ESSA 8 APT picture of Severe Tropical Storm 'Flossie' taken at about 10.39 a.m. on October 2, 1969.
- Figure 16. ESSA 8 APT picture of Severe Tropical Storm 'Flossie' taken at about 9.55 a.m. on October 8, 1969.

TROPICAL CYCLONE SUMMARY FOR 1969

In 1969, 24 tropical cyclones were observed in the western Pacific and the South China Sea, of which 13 attained typhoon intensity. The monthly distribution of these tropical cyclones is given in Figure 1 and a general summary of their tracks is contained in Table 1.

11 tropical cyclones came into Hong Kong's Area of Responsibility for the issuing of non-local warnings but only 4 necessitated the hoisting of local warning signals. Of these 4, two were typhoons. However, none caused gales at the Royal Observatory.

The first two tropical cyclones of the year formed in the western Pacific east of the Caroline Islands and dissipated east of 135°E. In April, Typhoon 'Susan' formed near Yap and was the first typhoon to hit the Philippines.

No tropical cyclones were reported in May and June.

In July, 4 tropical cyclones were located, of which two attained typhoon intensity. They all came into Hong Kong's warning area but only one, Typhoon 'Viola', came close enough to cause strong winds in Hong Kong.

Three tropical cyclones occurred in August. Tropical Storm 'Alice' and Typhoon 'Cora' recurved north-eastwards to affect Japan whilst Typhoon 'Betty' persisted along a northwesterly track and crossed the south China coast near Foochow.

There were seven tropical cyclones in September and two were typhoons. Typhoon 'Doris' was relatively *short-lived* with a life span of about 48 hours. Typhoon 'Elsie' on the other hand was the largest and deepest of the year with maximum winds of 150 knots and a minimum pressure of 890 mb near its centre. The typhoon also persisted for an exceptionally long period of more than seven days and its surface circulation covered an area of more than 1000 miles in diameter at times. Although 'Elsie' dissipated after landfall near Swatow, its remnant recurved over China on September 28 and moved northeastwards across the Sea of Japan as a deep extra-tropical depression to Kamchatka on October 3.

All the 4 tropical cyclones observed in October were typhoons. They recurved northeastwards before reaching 130°E and passed to the southeast of Japan.

Only 3 tropical cyclones were reported during the last two months of the year, of which one reached typhoon intensity. The tracks of the other two were relatively short (less than 600 miles) and they both filled over the sea south of 20°N.

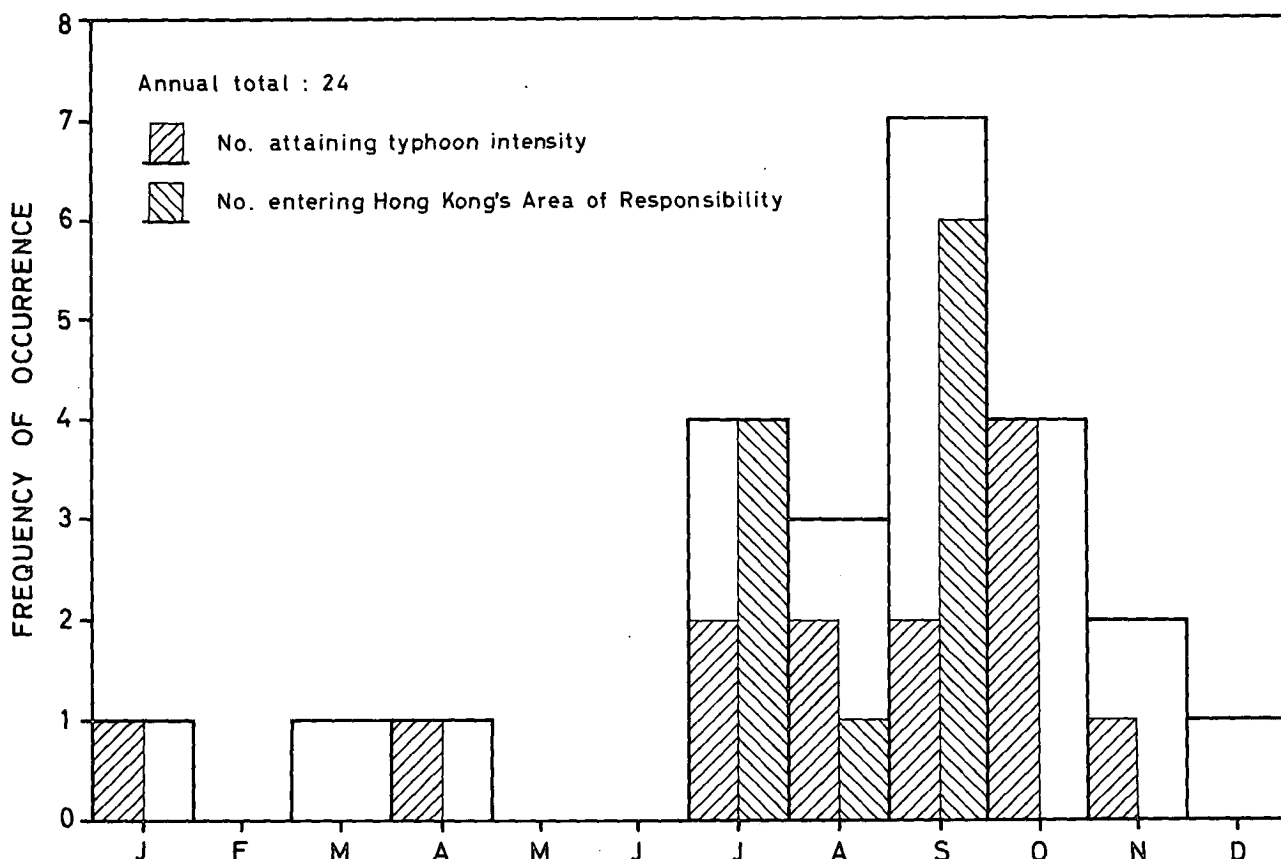


Figure 1. Monthly distribution of the frequency of occurrence of tropical cyclones in the western Pacific and the South China Sea in 1969 (classified in accordance with the month of the first day circle of each track).

REPORTS ON INDIVIDUAL TROPICAL CYCLONES AFFECTING HONG KONG IN 1969

TYPHOON 'VIOLA'

July 22 - 29, 1969

The track of this typhoon is shown in Figure 2

Early on July 22, a tropical depression formed over the western Pacific about 340 miles south of Guam. It intensified into a tropical storm named 'Viola' during the afternoon and became a typhoon two days later. Satellite cloud pictures (Figures 3-5) received at the Royal Observatory revealed that the circulation of the typhoon became well organized on July 25 and remained so for the next two days. At 6 a.m. on July 26, a reconnaissance aircraft reported maximum surface winds of 125 knots and a minimum sea-level central pressure of 900 mb.

'Viola' moved northwestwards at first and then changed to a west-northwesterly course on July 24, entering the Bashi Channel on July 27. However, information was scanty after 'Viola' moved into the northern part of the China Sea.

In Hong Kong, the Stand-by Signal, No. 1, was hoisted at 1.45 p.m. on July 27, when the centre of the typhoon was about 380 miles to the east-southeast, and was replaced by the Strong Wind Signal, No. 3, at 9.50 p.m. 'Viola' continued to move west-northwest during the night and came within the range of detection of the Observatory's radar early on July 28. At about 10.57 a.m., the typhoon was located by radar at about 160 miles east of Hong Kong (Figure 6) but its centre became ill-defined a few hours later when it was about to cross the coast. As the typhoon was expected to maintain its course and weaken rapidly after crossing the coast of southeast China, the Strong Wind Signal, No. 3, was lowered at noon on July 28.

'Viola' moved inland about 120 miles east of Hong Kong at about 1.15 p.m. on the same day and weakened slowly as it turned onto a more westerly track. However, gale force winds in its circulation persisted long after the centre had crossed the coast. When it became clear that strong westerly winds would affect the Colony, the Strong Wind Signal, No. 3, was hoisted again at 6.25 p.m. on July 28. Winds freshened in the harbour and became generally strong by 9.00 p.m. Mean hourly wind speeds reached 27 knots at the Royal Observatory at midnight and 28 knots on the Airport runway at 1 a.m. the following day; the corresponding maximum gusts were 67 and 73 knots. Gusts of 74 knots and 71 knots were recorded at Waglan and Tate's Cairn respectively.

As 'Viola' moved inland during the evening of July 28, information from the mainland was scanty and it was not possible to determine precisely when the typhoon weakened to tropical storm intensity but it was probably around 6 p.m. Radar observations made during the evening of July 28 indicated that the rain echoes associated with the storm were disorganized. The storm was closest to Hong Kong at 11 p.m. when it was about 60 miles away to the north of the Royal Observatory. At 3 a.m. 'Viola' was about 30 miles northeast of Canton and a similar distance south of another station both of which reported winds of less than 16 knots; the wind at the Royal Observatory, Hong Kong was then 24 knots with gusts to 65 knots. Winds began to moderate during the morning of July 29 and all signals were lowered by 3.10 p.m. as 'Viola' moved further away to the west. It degenerated into an area of low pressure and dissipated over southwest China later in the evening.

It was probable that the westward movement of 'Viola' enhanced the southwest monsoon over the South China Sea so that winds were much stronger in Hong Kong and over the coastal region than at inland stations near the centre of the storm. The strong southwesterlies gave rise to considerable disruption to the cross-harbour ferry service during the evening of July 28. Few tropical cyclones have caused strong winds in the Colony for such a long period after crossing the south China coast.

The following daily amounts of rainfall were recorded at the Royal Observatory:

July 27	5.7 mm
July 28	78.6 mm
July 29	41.0 mm

The times and heights of the highest tides and maximum storm surges recorded at the various locations in the Colony during 'Viola' were as follows:

Location	Highest Tide above Chart Datum			Maximum Storm Surge above Predicted level		
	Height (m)	Date	Time	Height (m)	Date	Time
North Point	3.11	July 28	9.45 a.m.	0.70	July 28	9.47 a.m.
Tai Po Kau	3.26	July 28	10.08 a.m.	0.98	July 28	10.12 a.m.
Chi Ma Wan (Lantau)	3.14	July 28	9.02 a.m.	0.82	July 28	11.10 a.m.

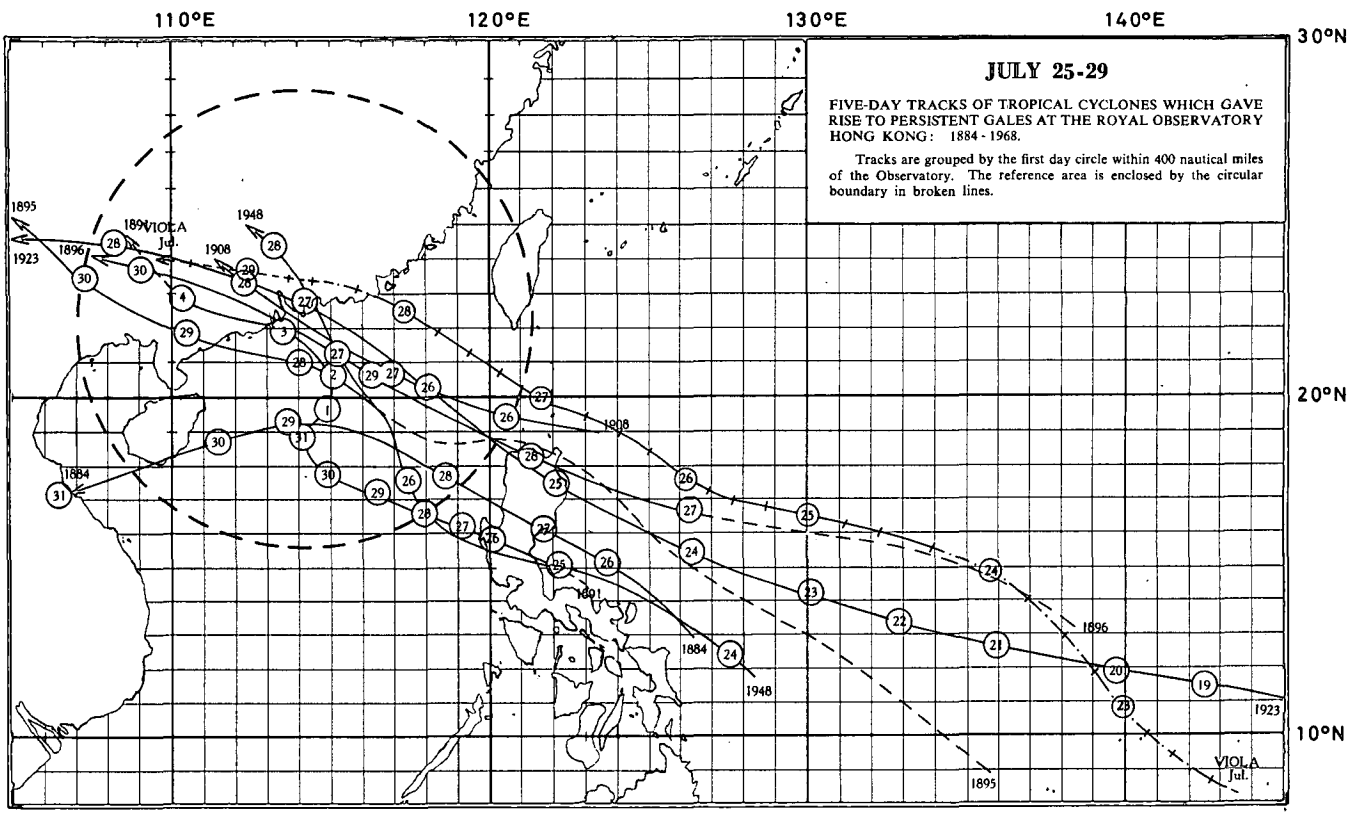


Figure 2. Track of Typhoon 'Viola': July 22-29, 1969.

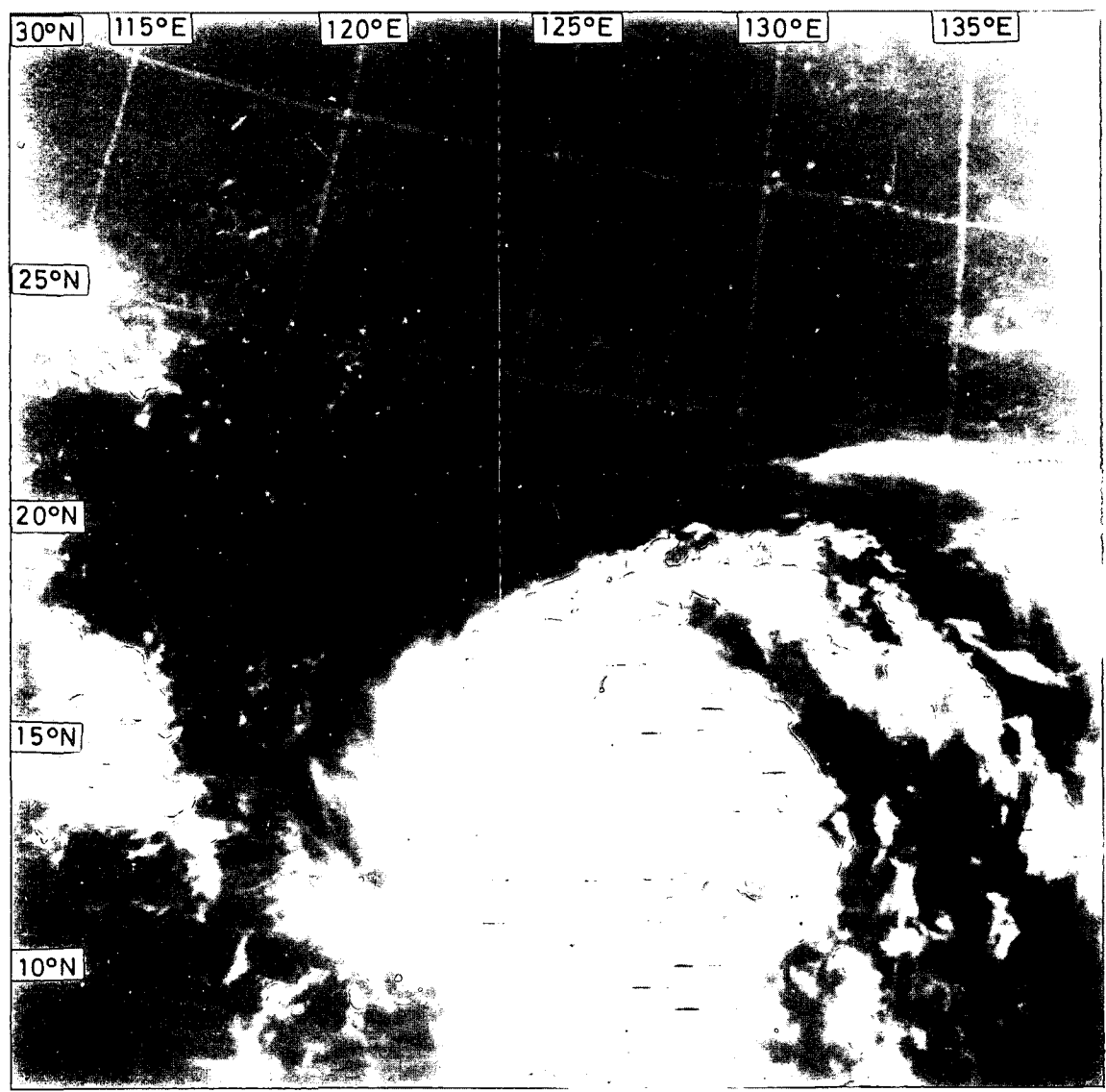


Figure 3. NIMBUS 3 APT picture of Typhoon 'Viola' taken at about 11.42 a.m. on July 25, 1969.

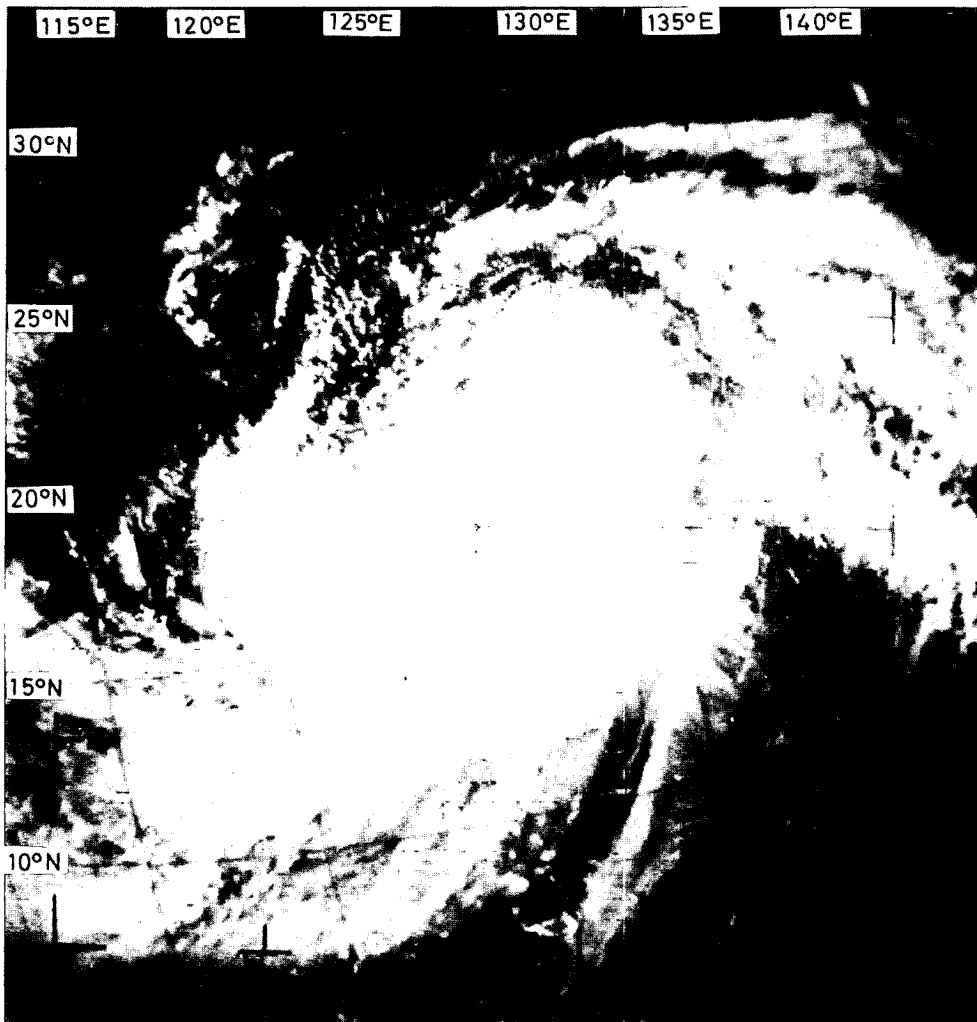


Figure 4. ESSA 8 APT picture of Typhoon 'Viola' taken at about 10.01 a.m. on July 26, 1969.

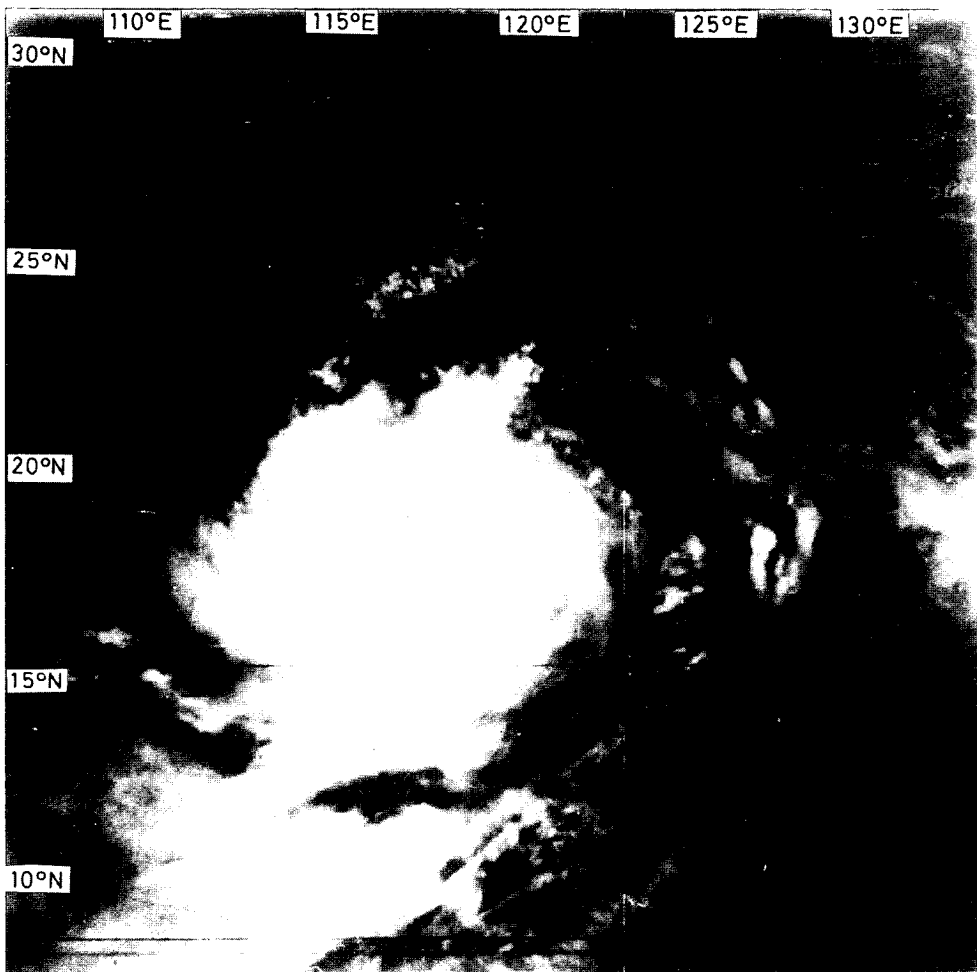


Figure 5. NIMBUS 3 APT picture of Typhoon 'Viola' taken at about 12.02 p.m. on July 27, 1969.

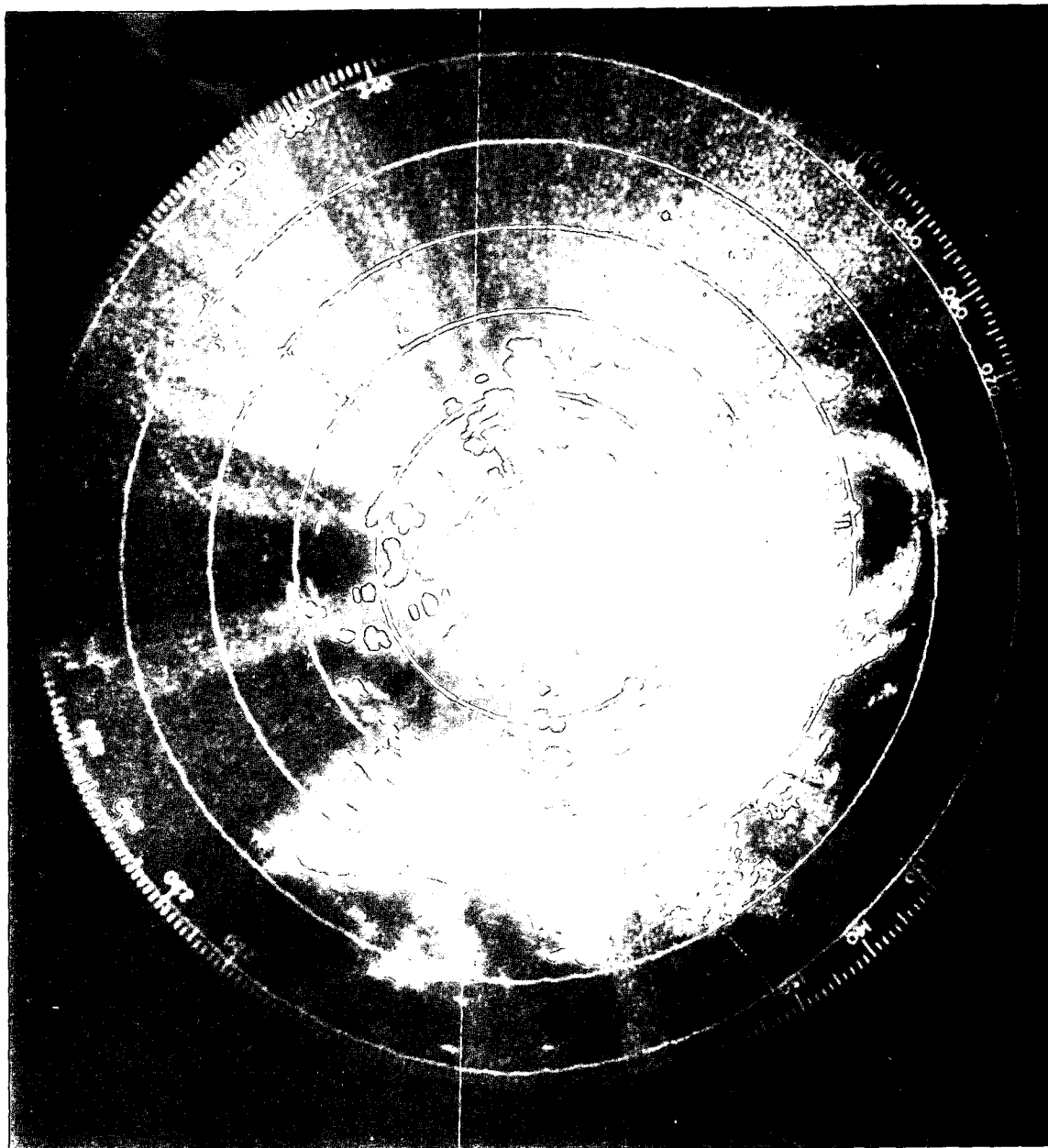


Figure 6. Radar picture of Typhoon 'Viola' taken at the Royal Observatory at about 10.57 a.m. on July 28, 1969. The eye was discernible. (Range markers at 40 n mile intervals.)

TROPICAL DEPRESSION

September 8 - 11, 1969

The track of this tropical depression is shown in Figure 7

At the beginning of September, an active trough of low pressure was lying from west to east across the South China Sea with two low pressure centres, one to the west of Luzon and the other near the Paracel Islands. By 9 a.m. the next morning, the eastern centre had developed into a tropical depression with maximum winds of 30 knots and a minimum pressure of 990 mb was reported by a reconnaissance aircraft. The depression drifted erratically towards the northwest at first and the Stand-by Signal, No. 1, was hoisted in Hong Kong at 4.25 p.m. on September 8 when it was about 340 miles southeast of the Colony. However, the depression turned onto a northerly course later in the evening and moved towards the Taiwan Strait. A satellite picture received during the morning of September 9 (Figure 8) revealed that the circulation of the depression covered an area of about 360 miles in diameter but the eye was not clearly defined. The depression weakened slowly as it moved northwards and all signals were lowered by 10.30 p.m. on the same day.

At 9 a.m. on September 10, the tropical depression was centred about 20 miles west of Tainan and began to move east-northeastwards across the island. The depression split into several weak circulations to the east of Taiwan on September 11 and all of them dissipated by the early morning on September 12.

During the period September 7 to 9, the weather in Hong Kong was fine and cool under the influence of a dry northerly airstream and no rainfall was recorded. There were also no abnormal changes in tide height during the period when the No. 1 signal was flying.

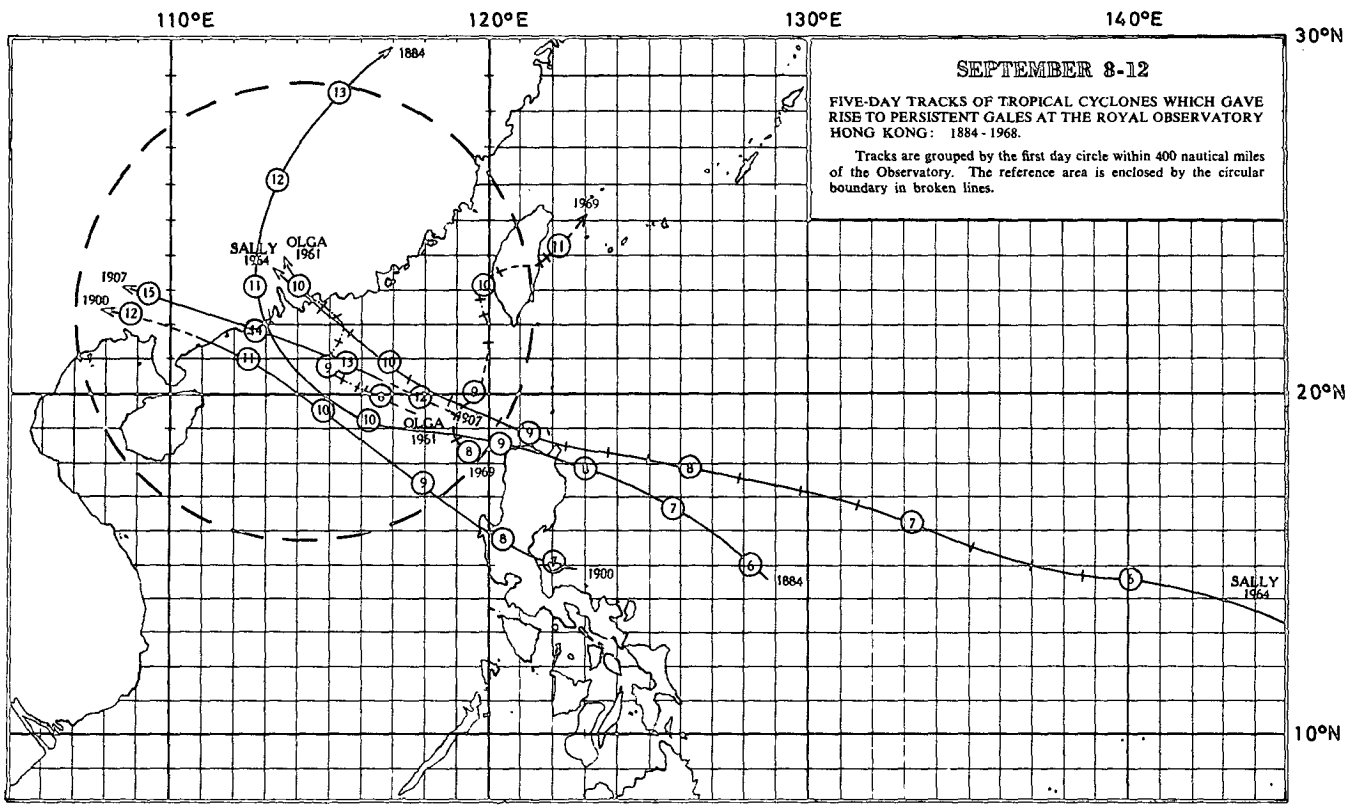


Figure 7. Track of tropical depression of September 8-11, 1969.

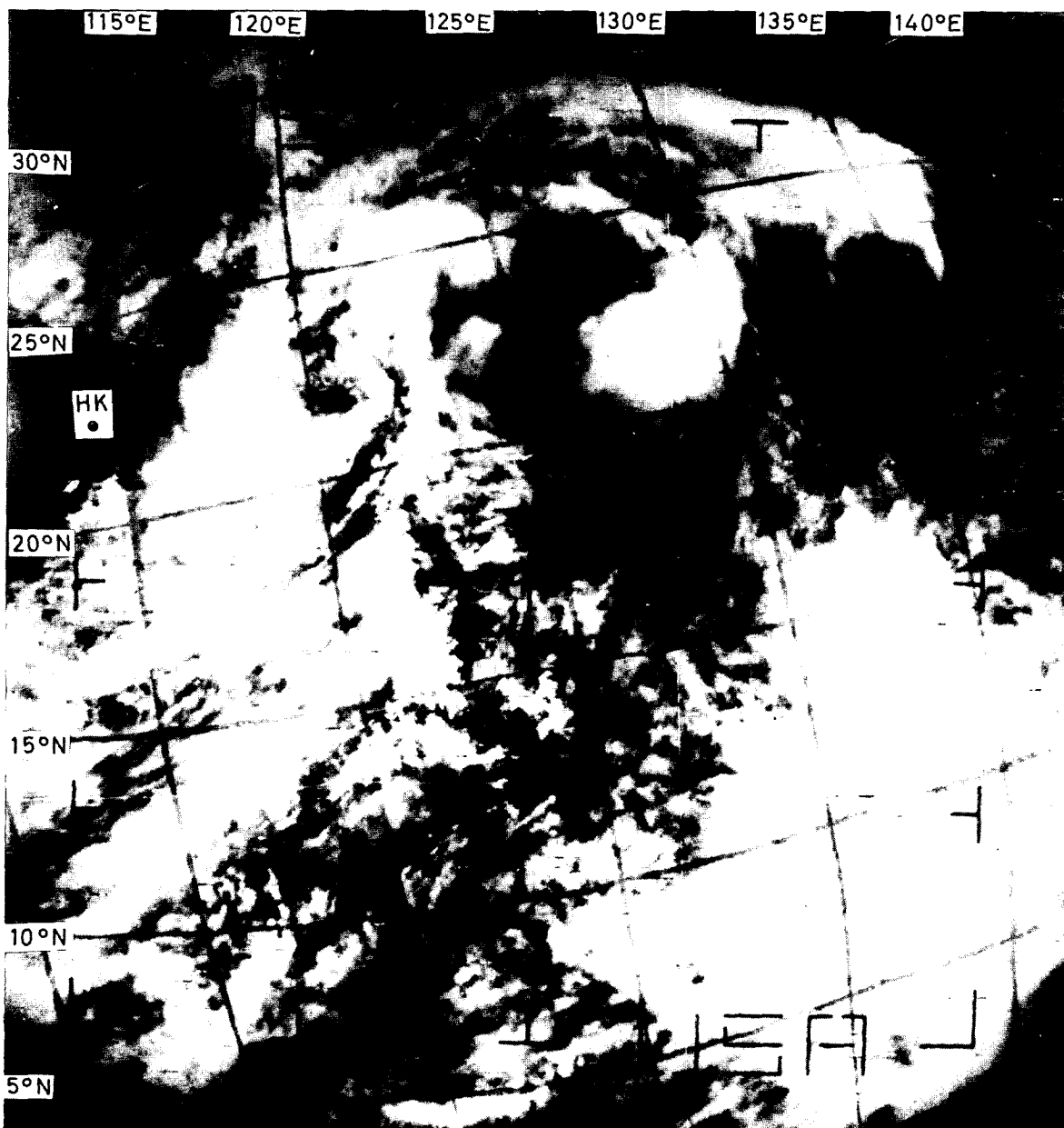


Figure 8. ESSA 8 APT picture of the tropical depression taken at about 10.09 a.m. on September 9, 1969.

TYPHOON 'ELSIE'

September 19 - 28, 1969

The track of this typhoon is shown in Figure 9

On September 19, a tropical depression formed about 150 miles southwest of Wake Island. It deepened to a tropical storm named 'Elsie' on September 20 and further intensified to a typhoon next day. Typhoon 'Elsie' drifted erratically along a westerly track at first and then moved west-northwestwards on September 22.

During the period September 22-25, the minimum sea-level pressure near the centre of Typhoon 'Elsie' as reported by reconnaissance aircraft was lower than 920 mb. The typhoon was deepest at about noon on September 24 when a minimum sea-level central pressure of 890 mb was reported with maximum surface winds of about 130 knots.

'Elsie' continued to move west-northwest until September 26, when it began to turn to a more westerly course and crossed central Taiwan early the following morning. 87 persons were killed, 284 others injured, nearly 6,000 houses destroyed and more than 12,000 buildings heavily damaged during its passage over the island. Satellite cloud pictures received at the Royal Observatory (Figures 10-13) showed that the cloud mass of 'Elsie' was well organized during the period September 24-27 and was about 500 miles in diameter. However, the circulation of the typhoon as revealed by synoptic weather charts covered an area of more than 1000 miles at times. The eye was also clearly discernible each day in this period.

In Hong Kong, the Stand-by Signal, No. 1, was hoisted at noon on September 27, when 'Elsie' was centred in the Taiwan Strait about 300 miles to the east-northeast of the Colony. The typhoon crossed the south China coast near Amoy about 280 miles east-northeast of Hong Kong around 3 p.m. and weakened to tropical storm intensity a few hours later. All signals were lowered at 6.25 a.m. on September 28 when 'Elsie' was slowly weakening over the Kwangtung Province about 200 miles north-northeast of Hong Kong. The remnant of 'Elsie' recurved over China and developed into a deep extra-tropical depression over the Sea of Japan which moved northeastward across Sakhalin and passed Kamchatka on October 3.

During the period September 27-28, winds over the Colony were moderate to fresh from the northeast but occasionally strong and gusty in exposed places. The weather was generally cloudy with scattered showers. The total rainfall recorded on these two days was 0.8 mm. There was no abnormal change in tide height during the period when the Stand-by Signal, No. 1, was flying.

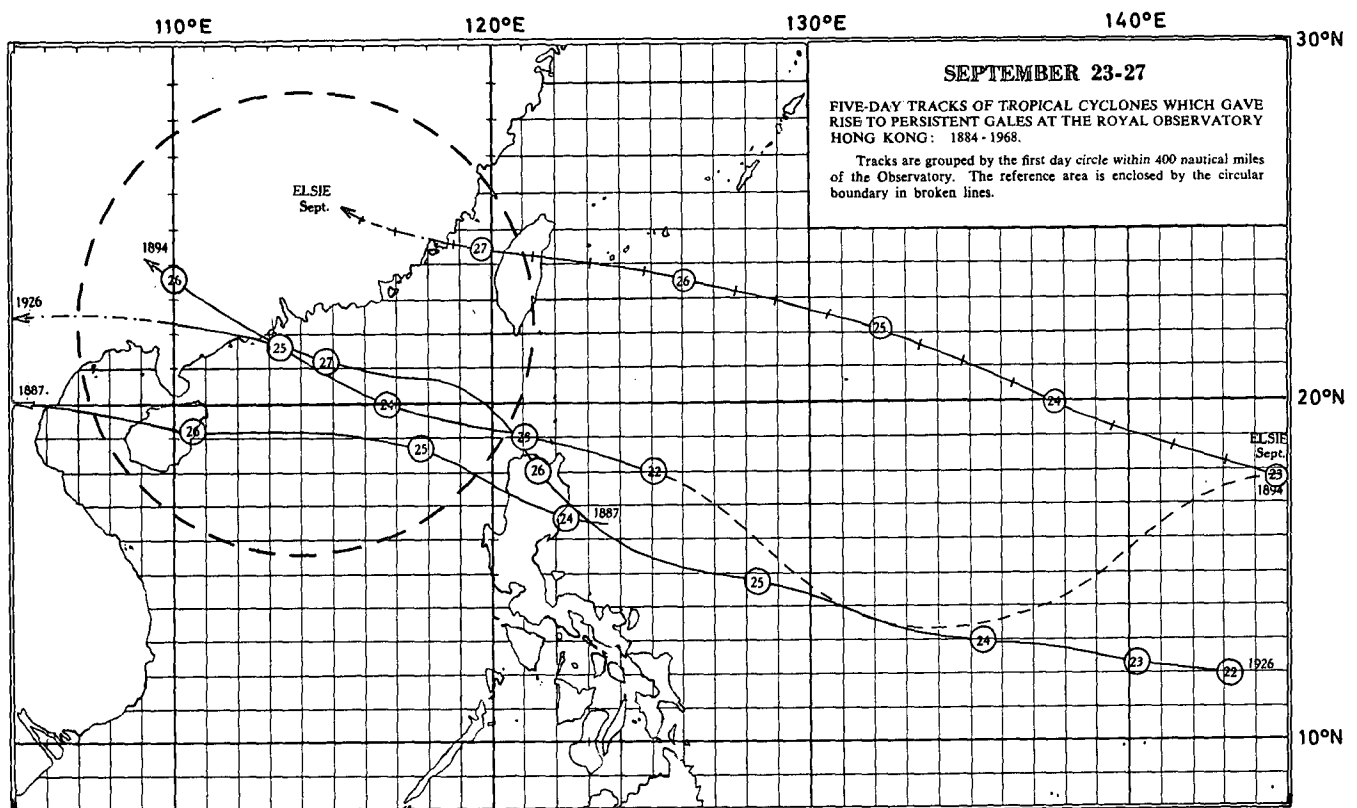


Figure 9. Track of Typhoon 'Elsie': September 19-28, 1969.

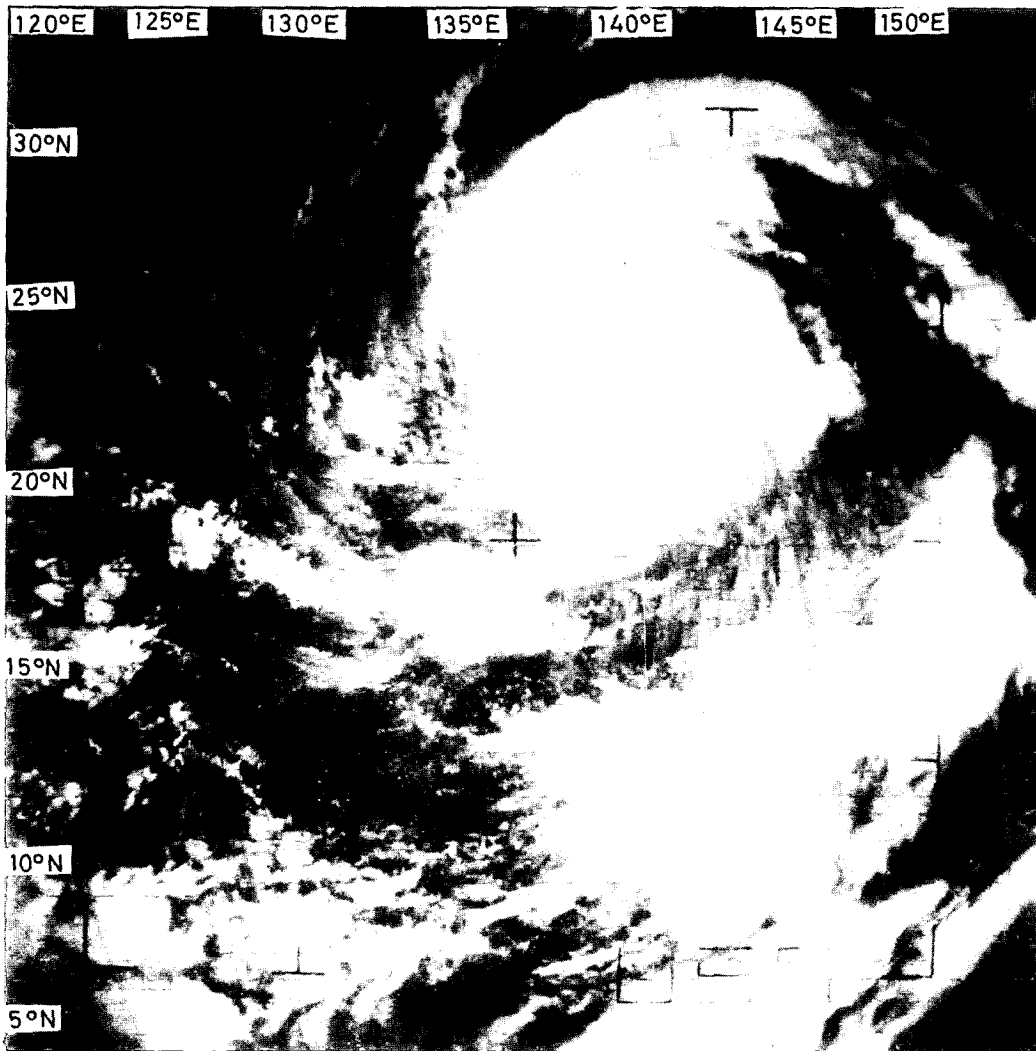


Figure 10. ESSA 8 APT picture of Typhoon 'Elsie' taken at about 9.33 a.m. on September 24, 1969.

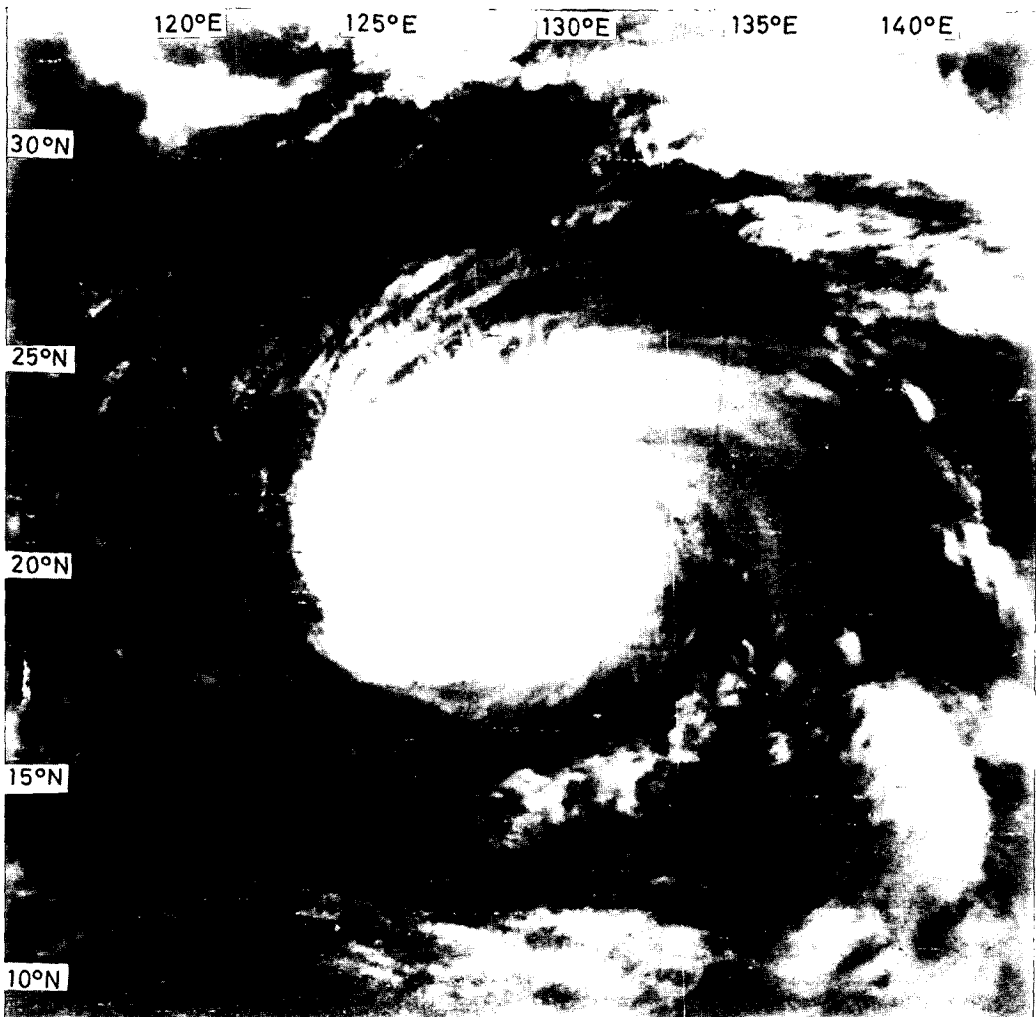


Figure 11. NIMBUS 3 APT picture of Typhoon 'Elsie' taken at about 11.20 a.m. on September 25, 1969.

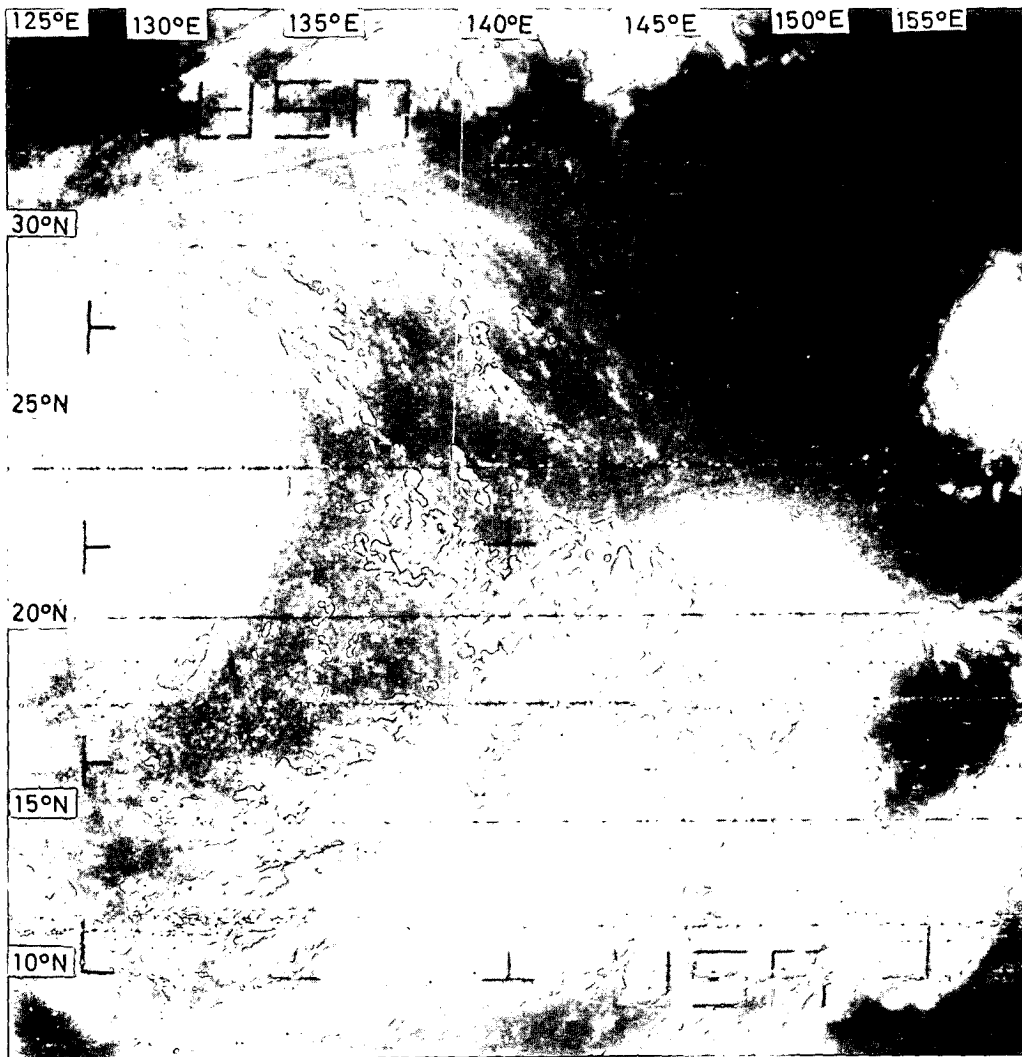


Figure 12. ESSA 8 APT picture of Typhoon 'Elsie' taken at about 9.20 a.m. on September 26, 1969.

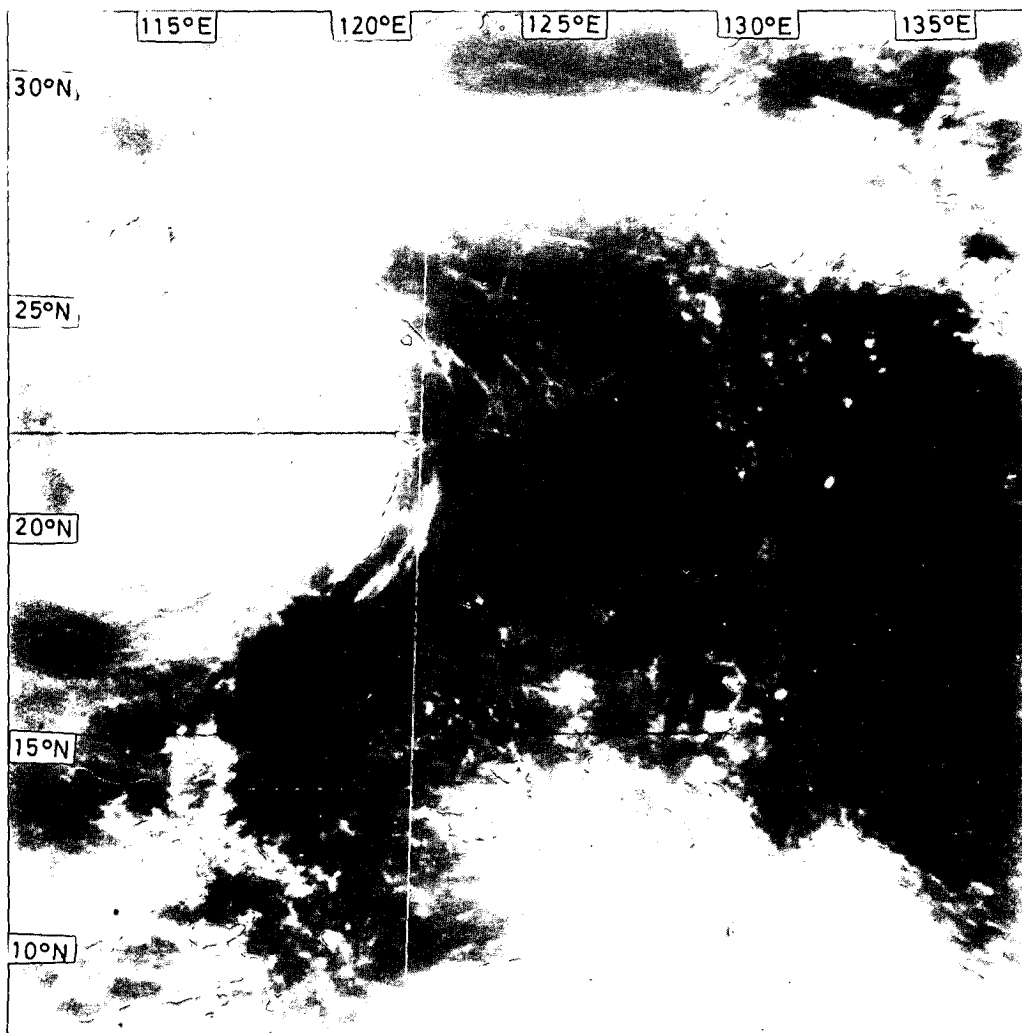


Figure 13. NIMBUS 3 APT picture of Typhoon 'Elsie' taken at about 11.40 a.m. on September 27, 1969.

SEVERE TROPICAL STORM 'FLOSSIE'

September 30 - October 9, 1969

The track of this severe tropical storm is shown in Figure 14

Early on September 30, 'Flossie' developed as a tropical storm about 460 miles east of Manila. It soon deepened to a severe tropical storm and moved northwestwards at about 15 knots.

In Hong Kong, the Stand-by Signal, No. 1, was hoisted at 4.15 p.m.[#] on October 1, when 'Flossie' was centred about 480 miles to the east-southeast. However, the storm turned to a northerly course later in the evening and passed close to the east of southern Taiwan next day.

At 6 a.m. on October 2, a reconnaissance aircraft reported that the minimum sea-level pressure was 956 mb but there were no reports on the maximum surface winds. Satellite pictures received at the Royal Observatory later in the morning (Figure 15) showed that the circulation of 'Flossie' was not well organized and covered an area of about 360 miles in diameter.

All signals were lowered at 11 a.m.[#] on October 2 when 'Flossie' was centred about 410 miles east of Hong Kong and followed a northerly track at about 5 knots. It weakened to a tropical depression late on October 3 and moved slowly northeastwards and then east-northeastwards in the next two days. 'Flossie' degenerated into an area of low pressure about 250 miles to the east of Taipei and drifted erratically east-northeastwards during the period October 6-7. However, a satellite picture received at the Royal Observatory (Figure 16) revealed that the circulation regenerated as a tropical depression in the morning of October 8. It moved very rapidly northeastwards and finally dissipated some 450 miles to the east-northeast of Tokyo. There were no abnormal changes in tide height during the period when the Stand-by Signal, No. 1, was displayed.

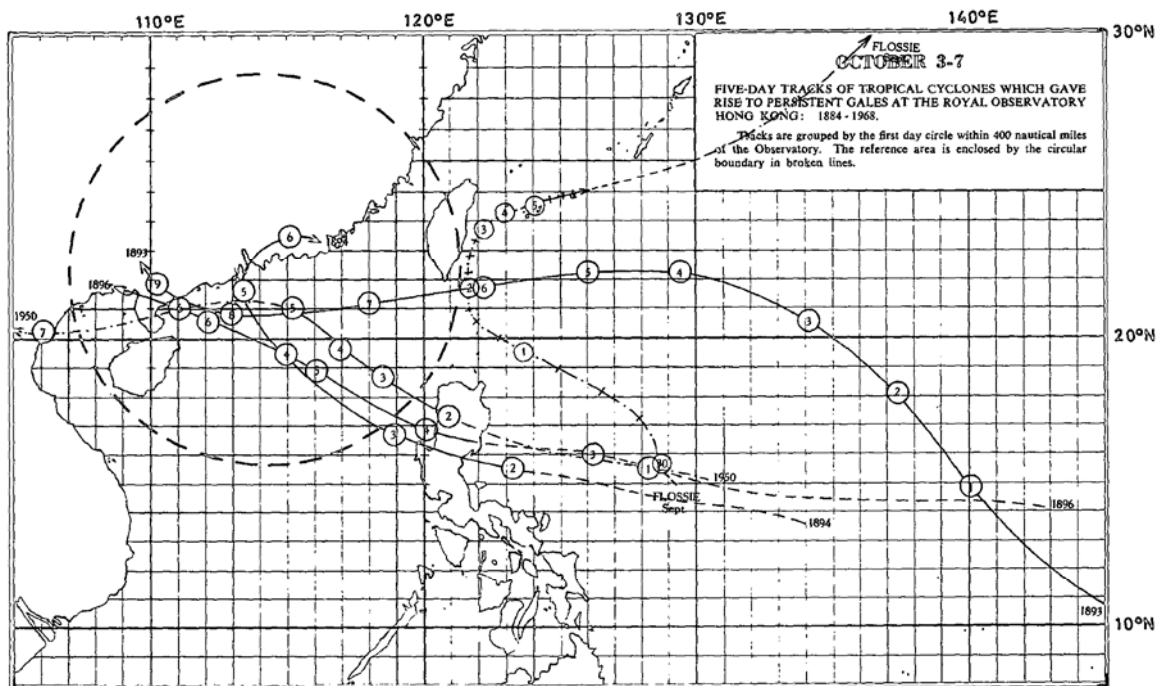


Figure 14. Track of Severe Tropical Storm 'Flossie': September 30-October 9, 1969.

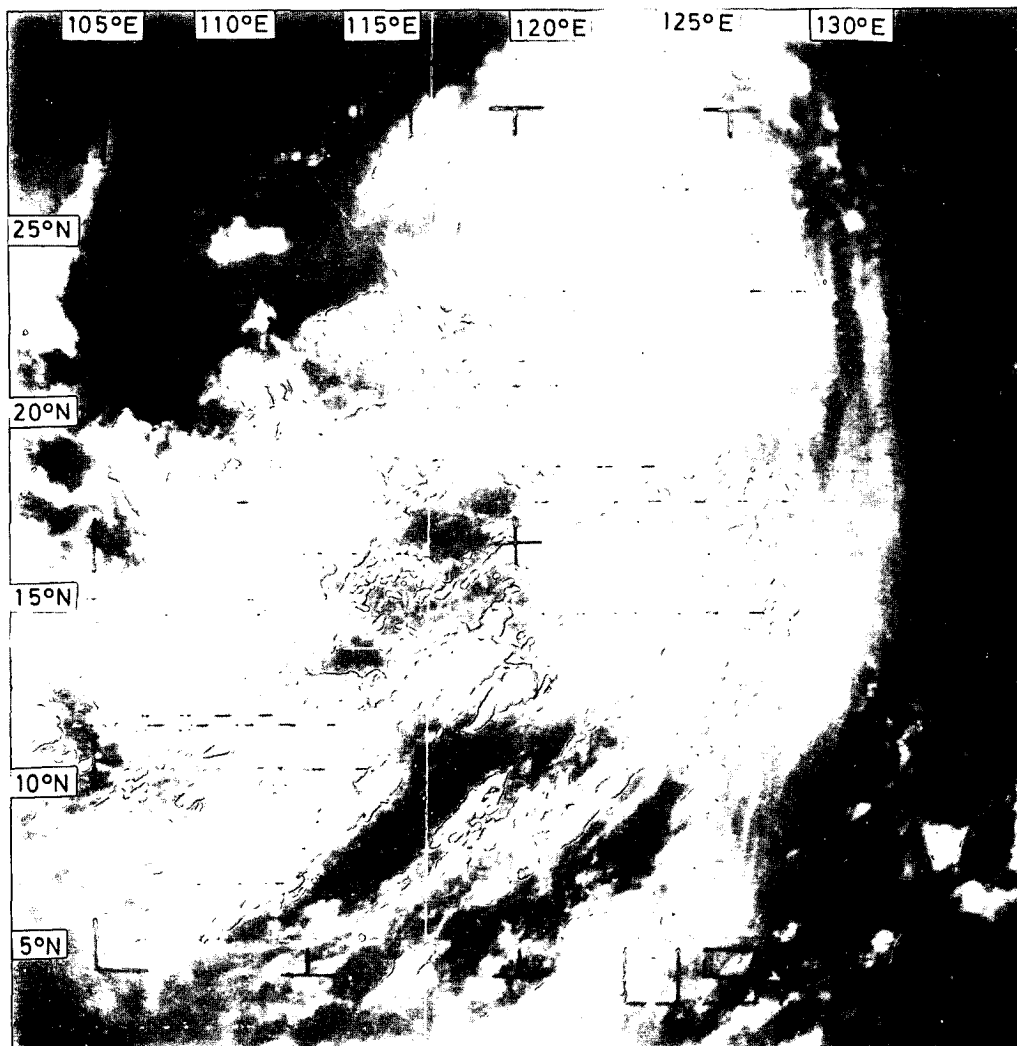


Figure 15. ESSA 8 APT picture of Severe Tropical Storm 'Flossie' taken at about 10.39 a.m. on October 2, 1969.

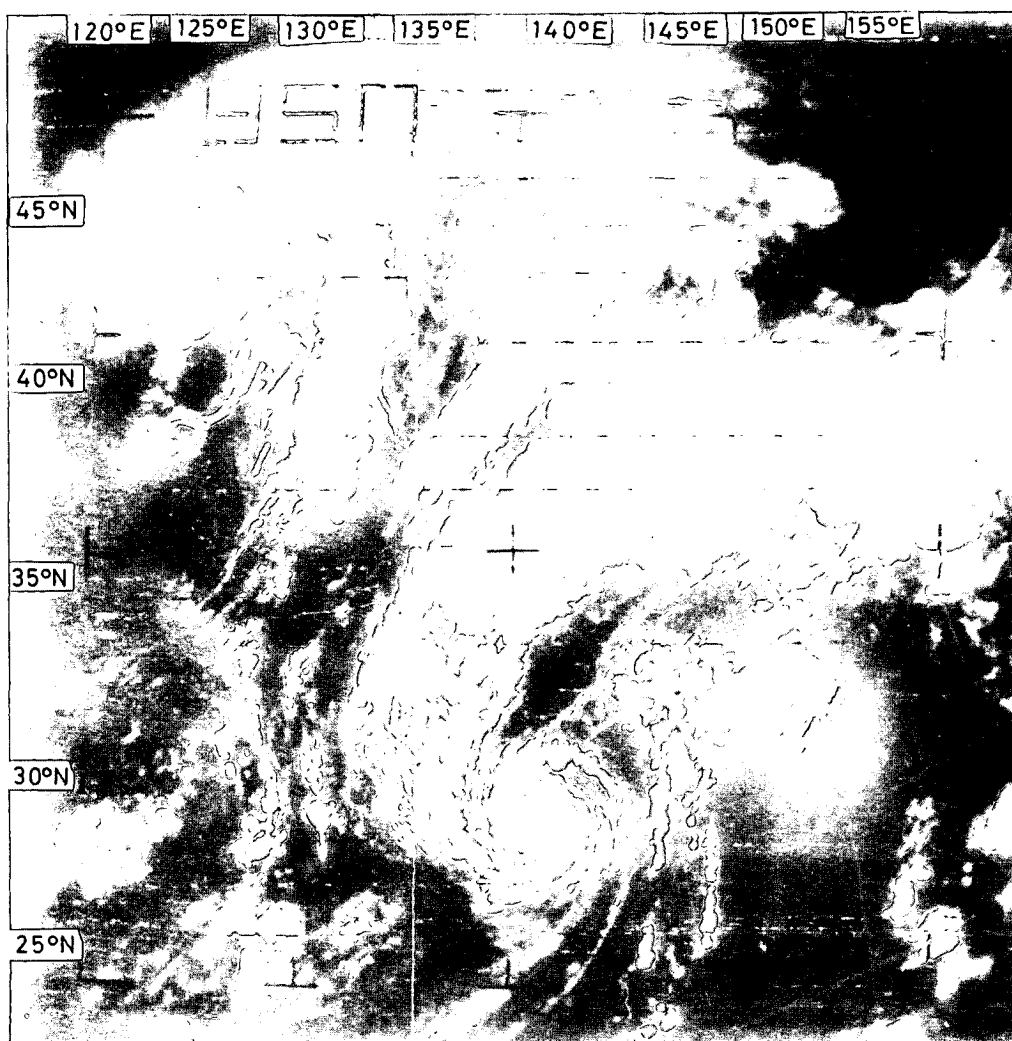


Figure 16. ESSA 8 APT picture of Severe Tropical Storm 'Flossie' taken at about 9.55 a.m. on October 8, 1969.

TABLE 1

LIST OF TROPICAL CYCLONES IN THE WESTERN PACIFIC AND THE SOUTH CHINA SEA IN 1969

Name of Tropical Cyclone	Period	Beginning of Track			First day circle	Last day circle	Ending of Track		
		Position		Day/Time G.M.T.			Position		Day/Time G.M.T.
		°N	°E				°N	°E	
1 Typhoon Phyllis*	Jan. 18 - 23	10.9	160.0	182100	19	23	13.1	137.5	230300
2 T.S. Rita*	Mar. 9 - 10	7.8	160.0	091200	10	10	7.8	156.7	100300
3 Typhoon Susan	Apr. 18 - 24	6.4	140.1	180300	19	24	10.4	125.2	240300
4 Typhoon Tess	July 8 - 11	11.4	121.6	061500	9	11	17.3	105.6	111500
5 Typhoon Viola	July 21 - 29	7.7	144.7	212100	22	29	23.9	109.4	290900
6 T.D. —	July 22 - 24	15.2	115.3	220300	23	24	20.5	106.4	240300
7 S.T.S. Winnie	July 29 - Aug. 2	15.9	133.7	292100	30	2	21.2	120.5	020300
8 T.S. Alice	Aug. 2 - 4	23.0	138.4	020300	3	4	35.9	138.3	042100
9 Typhoon Betty	Aug. 4 - 9	9.9	142.3	040300	5	9	27.6	115.4	090300
10 Typhoon Cora	Aug. 14 - 23	10.2	144.3	140300	15	23	42.1	142.1	231500
11 Typhoon Doris	Aug. 31 - Sept. 2	14.5	117.0	310300	1	2	17.0	105.6	020900
12 T.D. —	Sept. 7 - 8	14.1	111.7	072100	8	8	13.9	112.9	082100
13 T.D. —	Sept. 8 - 11	18.3	119.6	080000	8	11	24.9	122.9	110300
14 T.D. —	Sept. 12 - 14	19.3	126.7	120300	13	14	27.6	122.4	141500
15 T.D. —	Sept. 14 - 17	21.0	152.6	132100	14	17	26.4	146.7	170300
16 Typhoon Elsie*	Sept. 20 - 27	16.7	160.0	201500	21	27	25.6	115.3	272100
17 S.T.S. Flossie	Sept. 29 - Oct. 9	14.9	129.3	292100	30	9	38.5	148.5	091500
18 Typhoon Grace*	Oct. 3 - 6	23.4	160.0	030000	3	6	32.8	160.0	060900
19 Typhoon Helen*	Oct. 8 - 12	14.4	152.0	080300	9	12	36.9	160.0	121500
20 Typhoon Ida	Oct. 15 - 22	13.9	145.8	152100	16	22	33.3	160.0	222100
21 Typhoon June	Oct. 28 - Nov. 5	10.6	132.9	282100	29	5	35.5	150.1	050900
22 Typhoon Kathy	Nov. 3 - 8	8.4	149.1	030300	4	8	28.7	136.3	082100
23 T.S. Lorna	Nov. 24 - 30	9.4	133.6	240900	25	30	16.3	124.8	300300
24 T.S. Marie	Dec. 19 - 21	15.1	141.6	190900	20	21	19.6	146.7	210300

* Tracks extend outside chart area.

TABLE 2

NON-LOCAL TROPICAL CYCLONE WARNINGS ISSUED IN 1969

Tropical Cyclone	No. of Warnings Issued	Date and Time of Issue of				Duration of Warnings (h)
		First Warning		Last Warning		
Typhoon Tess	14	July 8	1800	July 11	1200	66
Tropical Depression	12	July 22	0600	July 24	0300	45
Typhoon Viola*	20	July 26	1200	July 29	1200	72
Tropical Storm Winnie	6	July 31	1800	Aug. 2	0000	30
Typhoon Betty	9	Aug. 7	1200	Aug. 9	0000	36
Typhoon Doris	18	Aug. 31	0300	Sept. 2	0900	54
Tropical Depression*†	23	Sept. 8	0000	Sept. 12	0000	96
Tropical Depression	9	Sept. 13	0600	Sept. 14	1800	36
Typhoon Elsie*	10	Sept. 26	0600	Sept. 27	1800	36
Severe Tropical Storm Flossie*	28	Sept. 30	2100	Oct. 5	0900	108
Total	149					579

* Tropical cyclones for which local storm signals were hoisted.

† Two tropical depressions were located in the South China Sea on September 8. No non-local warnings were issued on the other tropical depression, which was weak and short-lived.

N.B. Times are given in hours G.M.T.

TABLE 3

LOCAL STORM WARNING SIGNALS HOISTED AND NUMBER OF LOCAL WARNING BULLETINS ISSUED IN 1969

SUMMARY

Signal	No. of Occasions	Total Duration (Hours: Minutes)
1	4	75: 20
3	2	34: 55
5	Nil	—
6	Nil	—
7	Nil	—
8	Nil	—
9	Nil	—
10	Nil	—

DETAILS

Tropical Cyclone	No. of Local Warning Bulletins Issued	Signal	Hoisted		Lowered	
			Date	Time	Date	Time
Typhoon Viola	30	1	July 27	1245	July 27	2050
			July 27	2050	July 28	1100
			July 28	1725	July 29	1410
Tropical Depression	13	1	Sept. 8	1525	Sept. 9	2130
Typhoon Elsie	6	1	Sept. 27	1100	Sept. 28	0525
Severe Tropical Storm Flossie	9	1	Oct. 1	1515	Oct. 2	1000

TABLE 4

FREQUENCY AND ANNUAL TOTAL DURATION OF LOCAL STORM SIGNALS: 1946-1969

Signal No.		1	3*	5	6	7	8	9	10	Total	Total duration (h)
Year											
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
1946 to 1955	Total	37	—	4	2	15	13	7	1	79	1015
	Mean	3.7	—	0.4	0.2	1.5	1.3	0.7	0.1	7.9	101.5
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
1956 to 1969	Total	82	81	3	10	19	11	7	7	220	3532
	Mean	5.9	5.8	0.2	0.7	1.4	0.8	0.5	0.5	15.7	252.3

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

TABLE 5

NUMBER OF TROPICAL CYCLONES IN HONG KONG'S AREA OF RESPONSIBILITY† AND THAT NECESSITATED THE DISPLAY OF LOCAL SIGNALS: 1956-1969

Year	Number in Hong Kong's Area of Responsibility	Number Necessitating the Display of Local Signals
1956	23	5
1957	12	6
1958	14	5
1959	19	2
1960	20	9
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
Mean	17	6

† 10°N-30°N, 105°E-125°E.

TABLE 6

DURATION OF DISPLAY OF LOCAL STORM SIGNALS: 1946-1969

Signal	Duration (Hours: Minutes)			
	Mean	Maximum	Minimum	Mean per year
1	16:58	102:10	1:20	84:08
3†	21:00	71:45	1:00	121:31
5	8:22	13:00	3:00	2:26
6	6:02	11:10	3:00	3:01
7	12:10	35:35	2:15	17:15
8	7:24	17:20	0:20	7:24
5-8	9:23	35:35	0:20	30:06
9	3:38	6:15	1:10	2:07
10	6:31	9:10	2:30	2:10

† 1956-1969.

TABLE 7

CASUALTIES AND DAMAGE CAUSED BY TROPICAL CYCLONES IN HONG KONG: 1937-1969

Tropical Cyclones	No. of Ocean-going Vessels in Trouble	No. of Junks Sunk or Wrecked	No. of Junks Damaged	No. of Persons Dead	No. of Persons Missing	No. of Persons Injured	Remarks
1937 Typhoon	28	545	1,255	11,000	*	*	
1957 T. Gloria	5	2	Several	8	*	111	Up to Sept. 24, 1957
1960 T. Mary	6	352	462	11	11	127	Up to June 11, 1960
1961 T. Alice	*	*	*	4	0	20	
1962 T. Wanda	36	1,297	756	130	53	*	
1964 T. Viola	5	18	18	0	0	41	
T. Ida	3	7	60	5	4	56	
T. Ruby	20	32	282	38	6	300	
T. Sally	0	0	0	9	0	24	
T. Dot	2	31	59	26	10	85	
1966 S.T.S. Lola	0	*	6	1	0	6	
1968 T. Shirley	1	*	3	0	0	4	

N.B. Information compiled from local newspapers since 1937.
* Data unavailable.

TABLE 8

SHIPS SUNK, DAMAGED, GROUNDED, ETC., BY TROPICAL CYCLONES
IN HONG KONG: 1960 - 1969

Year	Name of Tropical Cyclones	Name of Ship	Location of Grounding, etc.	Nature of Incident	Remarks
1960	Typhoon Mary	S.S. Malaya Fair	On the side of the new Kai Tak Runway	Stranded	5 ocean-going vessels broke away from their mooring buoys in the harbour.
		U.S. Aircraft Carrier	Gin Drinker's Bay	Aground	
1961	Typhoon Alice	S.S. Adri XI	At Stonecutters Island	Aground	
1962	Typhoon Wanda	S.S. Bogola	In Tolo Harbour	Stranded	27 ocean-going ships were in trouble: many other vessels broke from their mooring at the height of the gales and drifted ashore or collided with other ships.
		S.S. Crescent	In Tolo Harbour	Stranded	
		S.S. Cronulla	In Victoria Harbour near North Point	Capsized	
		S.S. Haijye	On Harbour Island, Tolo Harbour	Aground	
		S.S. Lian Hin	North of Stonecutters Island	Hard aground	
		S.S. Ocean Ventura	In Tolo Harbour	Aground	
		S.S. Tung Feng	North of Green Island	Sunk	
		S.S. Vinkon	At Tai Po near the railway	Aground	
S.S. Yeni Meserret	Near Kennedy Town	Aground			
1964	Typhoon Viola	S.S. Gloria	At Lantau Island	Aground	
		S.S. Irene X	At Ping Chau	Aground	
		S.S. Rugeley	At Lantau Island	Aground	
		S.S. Saint George	At Stonecutters Island	Aground	
	Typhoon Ida	S.S. Dorothy	Near Kowloon Dock	Aground	S.S. Irene X drifted from berthing place to Kellet Island.
		S.S. Grosvenor Explorer	Near Hunghum Reclamation	Aground	
		S.S. Ruthy Ann	At Kowloon Bay	Aground	
	Typhoon Ruby	S.S. Grosvenor Explorer	In Victoria Harbour	Aground	15 ships went aground during this Typhoon.
	Typhoon Dot	S.S. Blissful	In Victoria Harbour	Collision	
		S.S. Negro Star	In Victoria Harbour	Collision	
		S.S. Sevilla	In Victoria Harbour	Aground	
	1968	Typhoon Shirley	S.S. La Grande Abeto	Stonecutters Island	Stranded
S.S. San Eduardo			Near Stonecutters Island	Collision	

TABLE 9

TROPICAL CYCLONES CAUSING PERSISTENT GALES AT THE ROYAL OBSERVATORY

1884 - 1969

Name of Tropical Cyclone	Date and Time of Occurrence of Minimum Pressure		Maximum Mean Hourly Wind		Maximum Gust Peak Speed (kn)	Duration of Gales (h)	Sequence of Wind Direction	Minimum Pressure (mb)		Remarks
			Direction	Speed (kn)				Hourly Reading	Instantaneous Minimum	
	Date	Time								
1884	July	29 0300	E/S	34		5	ENE to ESE v	997.5		
	September	11 0200	ENE	57		15	N/E to SSE v	979.8		
1885	August	17 1400	ESE	34		1	E to S/E v	997.8		
1887	September	17 1700	E/S	44		14	NE to SE v	999.3		
	September	21 0400	E	36		5	ENE to SE/E v	1000.6		
	September	25 1400	E	35		3	ENE to ESE v	1000.4		
1889	October	16 0400	W/N	39		4	NW/N to W b	997.0		
1890	October	13 0400	NE/E	34		1	NE to ENE v	1006.4		
1891	July	19 0500	SSW	41		5	NW/W to SSW ... b	980.9		
	August	3 0400	ESE	39		10	NNE to SE v	990.7		
1893	September	9 0300	NW	38		3	NNW to NW/W... b	983.2		
	September	28 1600	E/N	39		14	NE/E to E/N v	999.3		
	October	2 1400	E	52		23	NNE to SE v	991.8		
	October	8 0400	E/N	37		4	N/E to ESE v	1000.7		
1894	September	19 0300	E/S	43		15	NE/E to SE v	995.4		
	September	25 0900	E/N	55		10	NE to SE v	994.5		
	September	30 0600	E	41		17	NE/N to SE/E ... v	999.6		
	October	5 1700	SE/S	54		27	NE/E to SW/S ... v	987.0		
1895	July	28 1600	NE/E	34		2	NE/N to E/S v	995.1		Centre recurved around Hong Kong.
1896	July	29 2200	E/S	69		10	NNE to S/E v	976.6		Highest hourly wind velocity.
	August	9 1600	ENE	42		10	NE/E to SE/E ... v	997.8		
	October	6 0400	E/N	42		17	NE/E to SE v	996.4		
1897	September	17 1500	NE/E	36		2	NE/E to ENE ... v	1004.6		
1898	August	5 0300	E	39		7	ENE to SE v	987.1		
	August	17 1700	E	39		8	ENE to SE v	995.8		
1900	September	11 0500	E	43		12	NE/E to SE v	996.6		
	November	10 0600	NNE	57		11	NE/E to SW/W... b	975.0		

TABLE 9—Contd.

Name of Tropical Cyclone	Date and Time of Occurrence of Minimum Pressure		Maximum Mean Hourly Wind		Maximum Gust Peak Speed (kn)	Duration of Gales (h)	Sequence of Wind Direction	Minimum Pressure (mb)		Remarks
			Direction	Speed (kn)				Hourly Reading	Instantaneous Minimum	
	Date	Time								
	1902 July	18 1600	SW/S	39		2	N to SW/S	b	984.4	
	August	2 2000	SW/S	52		3	NW/W to SW/S ...	b	986.9	
	1904 August	10 0200	E/S	34		1	E to ESE	v	998.1	
	August	25 1700	E/N	36		6	E/N to NNE	b	986.8	
	1905 August	30 1500	ENE	41		10	N/E to E/N	v	988.2	
	1906 September ...	18 1000	SSW	49		2	NW to S	b	986.2	
	September ...	20 0400	E/S	36		3	ENE to ESE	v	1000.5	
	September ...	29 0900	E/N	50		15	NNE to SE	v	993.9	
	1907 September ...	14 0100	E/S	48		12	NE/N to SE	v	993.3	
	1908 July	28 0100	SSE	52		5	N to S/E	v	978.0	
	October	11 0100	E/S	34		1	NE/E to E/N	v	1003.6	
	1909 October	19 1700	ESE	48		13	NNE to SE	v	987.4	
	October	25 1700	E	35		1	NE to SE	v	1003.6	Centre passed over Cheung Chau.
	1911 July	4 0300	ESE	36	63	3	ENE to SE	v	996.9	
	July	27 1000	ESE	38	64	4	N to SSE	v	988.2	
	August	5 0900	S/E	39	69	12	ENE to SSE	v	991.1	
	1913 August	17 1100	ENE	55	91	11	NE/N to SE/E ...	v	991.1	
	September ...	18 2300	SW/W	36	61	1	WNW to SSW ...	b	992.2	
	1915 November ...	5 1600	E	36	60	2	NE/E to SE	v	1002.3	
	1916 September ...	7 0200	E	35	56	1	ENE to SE/E	v	999.1	
	1917 August	13 1100	SSW	40	81	2	backed from NW	b	986.6	
	1918 August	15 0800	E/N	40	82	4	NE/E to S/E	v	987.7	
	1919 August	22 1600	E/S	38	73	5	E/N to SE/E	v	999.2	Centre passed a few miles to N'ward.
	1922 September ...	20 1700	ENE	35	65	3	NE/E to E/S	v	999.8	
	1923 July	2 0500	E/S	39	—	8	ENE to S/E	v	990.8	
	July	22 1700	ESE	41	76	11	E/N to S/E	v	988.7	
	July	27 1000	S/W	38	—	1	SW/S to S/W	b	983.1	
	August	18 1000	NNE	67	113*	3	N/W to ESE	v	971.7	
	1926 July	22 0900	N/E	38	74	5	NE/N to ESE ...	v	991.7	
	September ...	27 0600	E/N	46	88	6	N to ESE	v	991.8	
	1927 August	20 1400	NE/E	53	101	10	NNE to SE	v	982.4	
	1928 July	15 0100	E	38	66	4	NE/E to SE/E ...	v	992.7	
	1929 August	22 1400	SE	57	102	3	NNE to S/E	v	983.2	
	1930 July	24 1800	E	42	72	6	NE/N to ESE ...	v	990.9	Centre passed a few miles to S'ward.

TABLE 9—Contd.

Name of Tropical Cyclone	Date and Time of Occurrence of Minimum Pressure		Maximum Mean Hourly Wind		Maximum Gust Peak Speed (kn)	Duration of Gales (h)	Sequence of Wind Direction	Minimum Pressure (mb)		Remarks	
			Direction	Speed (kn)				Hourly Reading	Instantaneous Minimum		
	Date	Time									
	1931 August	1 1200	E/N	60	118*	5	NE/N to SE v	989.2		Max. gust 145 kn at North Point. Centre passed over Observatory.	
	September	2 1500	S/E	41	82	3	NE/N to S/E v	988.7			
	1932 September	17 0500	NE/E	35	69	2	NE/E to ESE v	996.1			
	1936 August	17 0300	E/N	62	115*	6	NE/N to SE/S ... v	979.3			
	1937 September	2 0400	NE/E	59	130*	5	NNW to SE/S ... v	958.3			
	1939 November	23 1600	E/N	35	64	1	E to NW v	989.5			
	1940 August	21 0900	E	45	72	12	NNW to E/S v	990.2			
	1941 June	30 1600	ENE	44	83	9	NE to E v	977.8		Severest typhoon during the period on July 22, 1944.	
	September	16 1200	E/N	55	94	9	N to S/E v	983.7			
	1942 - 1945 No records due to World War II. (No very severe typhoons).										
	1946 July	18 1600	N/E	—	95	7	N to S v	985.7			
	1948 June	10 1200	E	39	48	1	NE to ESE v	993.1	992.9		
	July	27 1700	SSW	45	64	8	NNE to SW b	981.1	980.1		
	September	3 0400	E	46	75	14	NE to ESE v	996.3	995.5		
	1949 September	8 0300	E	56	81	6	N to SE v	991.3	990.8		
	1950 October	5 0400	E	34	59	1	N to ENE v	997.3	997.2		
	Typhoon Susan Typhoon Ida Typhoon Pamela Typhoon Gloria Typhoon Mary	1951 June	18 1800	E	36	63	2	ENE to ESE v	1001.7		1001.6
August		1 1800	ENE	44	76	19	ENE to ESE v	990.8	990.1		
September		2 1400	ENE	36	59	4	ENE to E v	1002.9	1002.4		
1953 September		18 1800	NE	42	75	8	N to ESE v	995.0	994.7		
1954 August		29 1400	ENE	47	87	12	NNE to ESE v	992.9	992.4		
November		6 1100	E	47	84	5	NNE to SE v	997.6	997.1		
1957 September		22 1700	ENE	59	101	14	N to SE v	986.2	984.3		
1960 June	9 0500	SSE	50	103	19	ENE to SW v	974.3	973.8			

TABLE 9—Contd.

Name of Tropical Cyclone	Date and Time of Occurrence of Minimum Pressure		Maximum Mean Hourly Wind		Maximum Gust Peak Speed (kn)	Duration of Gales (h)	Sequence of Wind Direction	Minimum Pressure (mb)		Remarks
			Direction	Speed (kn)				Hourly Reading	Instantaneous Minimum	
	Date	Time								
Typhoon Alice	1961 May	19 1200	ESE	43	89	6	ENE to SW v	981.6	981.1	Centre passed over Observatory. Centre passed about 10 miles to S'ward. Max. gust at Tate's Cairn 154 kn.
Severe Tropical Storm Olga	September ...	10 0200	W	35	64	1	NNE to SW b	986.5	986.1	
Typhoon Wanda	1962 September ...	1 1000	N	68	140	8	NNW to S v	955.1	953.2	
Typhoon Viola	1964 May	28 0700	ESE	35	82	3	ENE to SSE v	993.0	991.9	
Typhoon Ida	August	8 2300	NE	42	112	2	NNE to SSE v	972.3	972.0	
Typhoon Ruby	September ...	5 1300	ESE	58	122	6	N to SE v	971.0	968.2	
Typhoon Sally	September ...	10 2100	WSW	35	56	1	NNW to SW b	989.9	989.1	
Typhoon Dot	October	13 0500	N	46	94	8	N to SW b	978.9	977.3	
Severe Tropical Storm Lola	1966 July	13 2000	E	35	82	1	ENE to SSE v	990.1	989.5	
Typhoon Shirley	1968 August	21 1800	N	37	72	4	NNE to SS.W b	968.7	968.6	

Note: No corrections for air-density have been made to the wind speeds in this table.

* Estimated.

v = veering.

b = backing.