

ROYAL OBSERVATORY, HONG KONG

METEOROLOGICAL RESULTS
1968

PART III — TROPICAL CYCLONE SUMMARIES



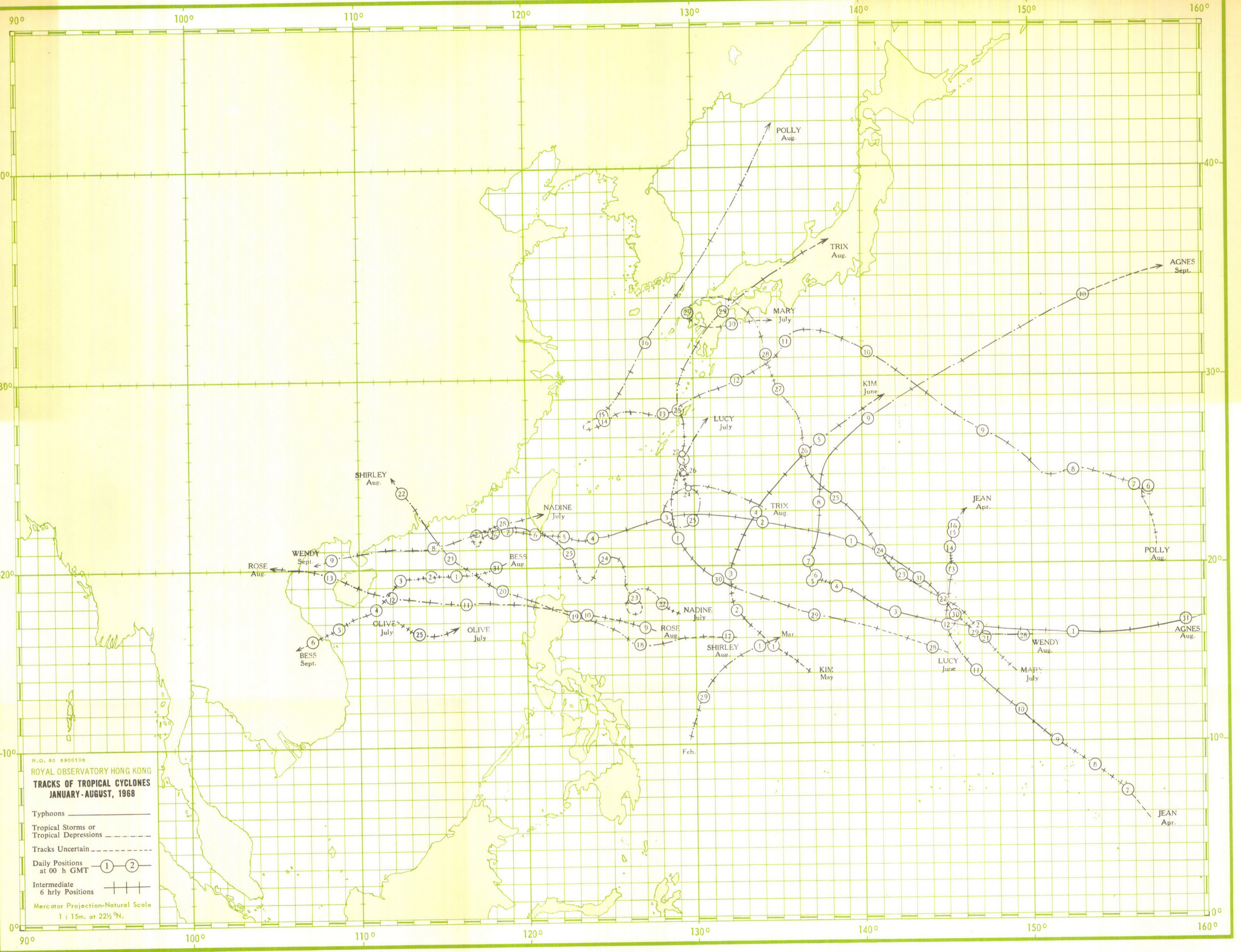
PRINTED AND PUBLISHED BY J. R. LEE, GOVERNMENT PRINTER
AT THE GOVERNMENT PRESS
JAVA ROAD, HONG KONG

1971

ERRATA TO HONG KONG METEOROLOGICAL RESULTS 1968
PART III – TROPICAL CYCLONE SUMMARIES

Page 10, para 2, line 8.

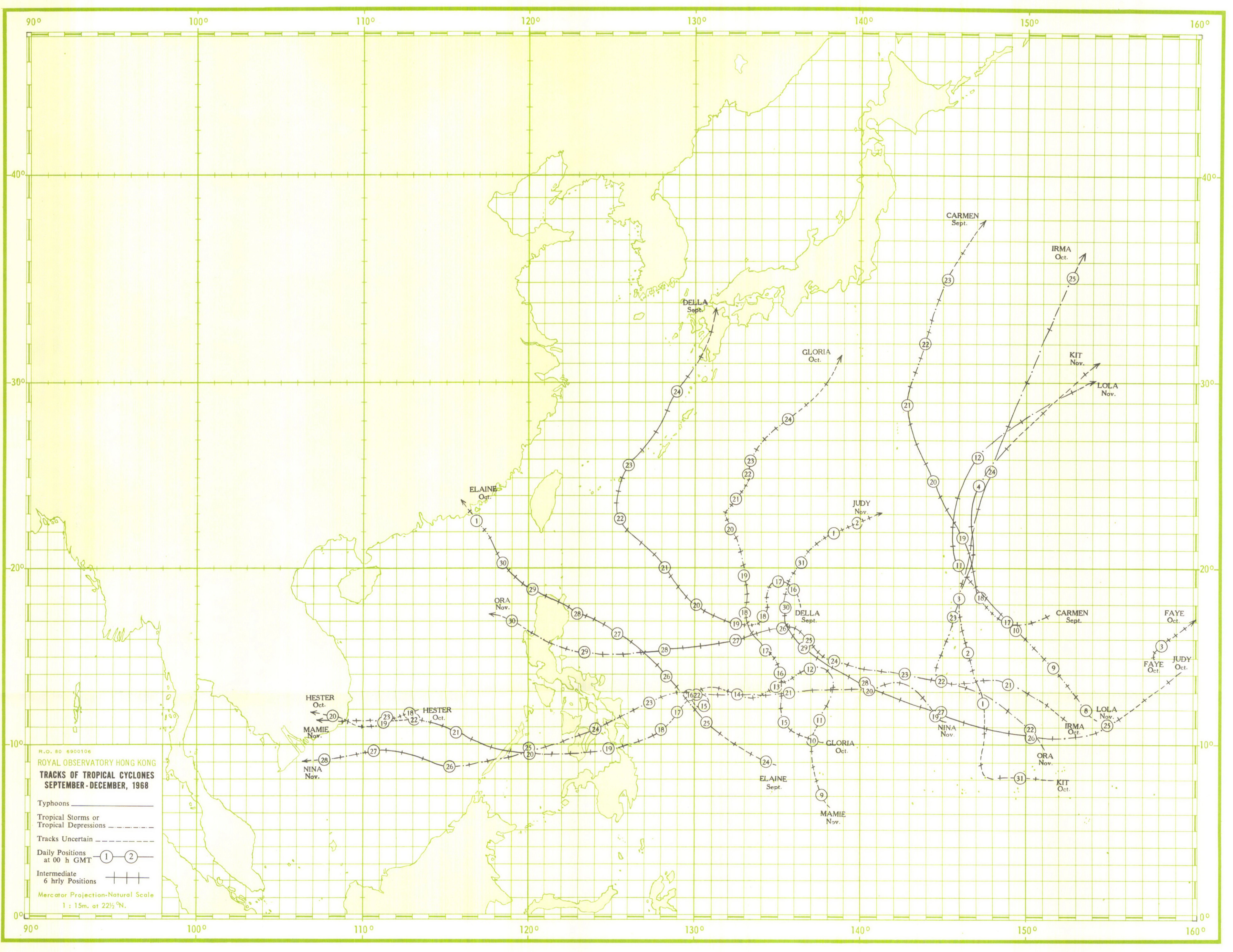
For "2.49 p.m." read "2.40 p.m.".



R.O. 80 6900106
ROYAL OBSERVATORY HONG KONG
TRACKS OF TROPICAL CYCLONES
JANUARY-AUGUST, 1968

- 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, 1968

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.

HESTER
Oct. 20
HESTER
Oct. 18
MAMIE
Nov. 28
NINA
Nov. 27

ELAINE
Oct. 1

DELLA
Sept. 24

GLORIA
Oct. 24

JUDY
Nov. 1

CARMEN
Sept. 23

IRMA
Oct. 25

KIT
Nov. 24

LOLA
Nov. 24

DELLA
Sept. 26

CARMEN
Sept. 9

FAYE
Oct. 3

JUDY
Oct. 3

LOLA
Nov. 6

IRMA
Oct. 22

GLORIA
Oct. 10

ELAINE
Sept. 9

MAMIE
Nov. 9

ORA
Nov. 22

KIT
Oct. 31

NINA
Nov. 19

METEOROLOGICAL RESULTS

1968

PART III—TROPICAL CYCLONE SUMMARIES

CROWN COPYRIGHT RESERVED

CONTENTS

	<i>Page</i>
FRONTISPIECE: Tracks of Tropical Cyclones in the western Pacific and the South China Sea, 1968	
FOREWORD	
1. INTRODUCTION	1
2. DESCRIPTION OF TABLES	3
3. LIST OF FIGURES	4
4. TROPICAL CYCLONE SUMMARY FOR 1968	5
5. REPORTS ON INDIVIDUAL TROPICAL CYCLONES AFFECTING HONG KONG IN 1968	
(a) Typhoon 'Nadine': July 21 - 28	6
(b) Severe Tropical Storm 'Rose': August 9 - 13	8
(c) Typhoon 'Shirley': August 17 - 22	9
(d) Typhoon 'Wendy': August 28 - September 9	14
(e) Severe Tropical Storm 'Bess': August 31 - September 6	17
(f) Typhoon 'Elaine': September 24 - October 1	19
6. TABLES	
Table 1. List of Tropical Cyclones in the western Pacific and the South China Sea in 1968 ...	26
Table 2. Non-local Tropical Cyclone Warnings Issued in 1968	27
Table 3. Local Storm Warning Signals Hoisted and Number of Local Warning Bulletins Issued in 1968	27
Table 4. Number of Occasions Local Storm Signals Hoisted: 1946 - 1968	28
Table 5. Number of Tropical Cyclones in Hong Kong's Area of Responsibility. Number of Tropical Cyclones Necessitating Local Signals and Total Number of Hours Local Signals Hoisted: 1956 - 1968	28
Table 6. Duration of Display of Local Storm Signals: 1946 - 1968	29
Table 7. Casualties and Damage Caused by Tropical Cyclones in Hong Kong: 1937 - 1968	29
Table 8. Ships Sunk, Damaged, Grounded, etc., by Tropical Cyclones in Hong Kong: 1960 - 1968	30
Table 9. Tropical Cyclones Causing Persistent Gales at the Royal Observatory: 1884 - 1968	31

FOREWORD

Information on tropical cyclones in the western Pacific and the South China Sea has hitherto been included in three separate publications of the Royal Observatory. In recent years there has been an increased demand for this information and it has therefore been decided to consolidate the information into one volume for the convenience of users. Also, since 1966, additional information on tropical cyclones has become available, locally, from meteorological satellites and radars; the opportunity has therefore been taken to include some of these data in this new publication.

We would be pleased to hear from any user of this report who considers that some other kind of presentation or the inclusion of additional material would enhance its value.

I wish to take this opportunity of expressing my appreciation to Mr. P. C. Chin and Mr. S. Y. W. Tse for the efforts they have devoted to the preparation of this first issue.

G. J. BELL,
Director.
Royal Observatory.

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 contains summaries of upper-air observations and the series 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.

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 is for the ground near the thermometer shelter, except at Tate's Cairn which was built for the operation of the Plessey Type 43S 10 cm radar. In all cases the height of the head of the anemometer refers to Mean Sea Level.

Station	Position		Elevation of barometer above M.S.L.	Elevation of ground above M.S.L.	Head of anemometer above M.S.L.
	Latitude N	Longitude E			
Royal Observatory	22° 18'	114° 10'	33 m	32 m	61 m
Hong Kong Airport	22° 20'	114° 11'	24 m	4 m	10 m
Waglan Island	22° 11'	114° 18'	56 m	55 m	74 m
Tate's Cairn	22° 22'	114° 13'	*	576 m†	589 m
Cheung Chau	22° 12'	114° 02'	39 m	39 m	92 m
Cape Collinson	22° 16'	114° 15'	48 m	46 m	59 m

N.B.

* 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 (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 orbiting 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 1968 Hong Kong Summer Time was in force during the period between 3.30 (Hong Kong Standard Time) in the morning of April 21 and 3.30 (Hong Kong Summer Time) in the morning of October 20.

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 Centre 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 1968 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 Centre, 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 1968, 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 1968 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. Times are given in hours and minutes in Hong Kong Standard Time which is 8 hours ahead of G.M.T.

Table 4 shows the number of occasions on which Local Storm Signals were hoisted during the period 1946 - 1968. Local Storm 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 - 1968. The annual number of tropical cyclones which caused Local Storm Signals to be raised and the total duration of the Local Signal display for each year are also given.

Table 6 shows the maximum, mean and minimum duration (hours and minutes) of display of each Local Storm Signal during the period 1946 - 1968.

Table 7 presents the casualty and damage figures associated with tropical cyclones in Hong Kong for the period 1937 - 1968. 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 - 1968. 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.) 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 and typhoons in the western Pacific and the South China Sea in 1968.
- Figure 2. ESSA 2 APT picture of Typhoon 'Nadine' taken at 7.38 a.m. on July 26, 1968.
- Figure 3. Photomosaic of ESSA 6 APT pictures of Typhoon 'Nadine' taken on the morning of July 26, 1968.
- Figure 4. Track of Typhoon 'Nadine'.
- Figure 5. Track of Severe Tropical Storm 'Rose'.
- Figure 6. Trees bent at Victoria Park in Causeway Bay during Typhoon 'Shirley'.
- Figure 7. ESSA 6 APT picture of 'Shirley' taken at 10.35 a.m. on August 18, 1968.
- Figure 8. ESSA 6 APT picture of Typhoon 'Shirley' taken at 11.21 a.m. on August 21, 1968.
- Figure 9. The eye of 'Shirley' as shown by the Observatory's Type 43S Radar at Tate's Cairn on the morning of August 21, 1968.
- Figure 10. Barogram of Typhoon 'Shirley' during the period August 19 - 22, 1968.
- Figure 11. Anemogram of Typhoon 'Shirley' for the period August 21 - 22, 1968.
- Figure 12. Results of a special radiosonde ascent made on August 21, 1968 in the eye of Typhoon 'Shirley'.
- Figure 13. Track of Typhoon 'Shirley'.
- Figure 14. ESSA 6 APT picture of Typhoon 'Wendy' taken at 10.37 a.m. on August 31, 1968.
- Figure 15. ESSA 6 APT picture of Typhoon 'Wendy' taken at 12.02 p.m. on September 8, 1968.
- Figure 16. Radar picture of Typhoon 'Wendy' taken at 9.25 a.m. on September 8, 1968.
- Figure 17. Track of Typhoon 'Wendy'.
- Figure 18. ESSA 6 APT picture of 'Bess' taken at 10.43 a.m. on August 31, 1968.
- Figure 19. ESSA 6 APT picture of 'Bess' taken at 12.17 p.m. on September 4, 1968.
- Figure 20. Track of Severe Tropical Storm 'Bess'.
- Figure 21. ESSA 6 APT picture of Typhoon 'Elaine' taken at 10.44 a.m. on September 28, 1968.
- Figure 22. ESSA 6 APT picture of Typhoon 'Elaine' taken at 11.38 a.m. on September 29, 1968.
- Figure 23. ESSA 2 APT picture of Typhoon 'Elaine' taken at 8.15 a.m. on September 30, 1968.
- Figure 24. Photograph of Typhoon 'Elaine' taken by the Observatory's Plessey Type 43S Radar at Tate's Cairn at 9.40 a.m. on October 1, 1968.
- Figure 25. Track of Typhoon 'Elaine'.
- Figure 26. Examples of ships sunk, capsized or damaged by tropical cyclones in Hong Kong.

TROPICAL CYCLONE SUMMARY FOR 1968

In 1968, there were 27 tropical cyclones in the western Pacific and the South China Sea bounded by latitudes 0° - 45° N and longitudes 100° E - 160° E, of which 19 attained typhoon intensity. Their monthly distributions are shown in Figure 1. Recurvature took place in 16 cases including 13 typhoons and 3 less intense tropical cyclones. 8 typhoons penetrated into temperate latitudes north of 30° N, but all except one (Typhoon 'Della') weakened considerably on or before reaching this latitude. There were only 2 less intense tropical cyclones passing beyond 30° N. All the 11 non-recurving tropical cyclones were confined to the south of 25° N. 6 of these were typhoons.

During the year, 3 tropical cyclones formed in the South China Sea but none reached typhoon intensity. 9 intruded into the region bounded by latitudes 10° - 30° N and longitudes 105° E - 125° E, which is referred to as Hong Kong's Area of Responsibility for tropical cyclone warnings. Of these nine, seven were typhoons while in the region. During the year, 238 non-local warnings were issued on 12 tropical cyclones by the Royal Observatory, Hong Kong (Table 2).

With the exception of 'Polly', all tropical cyclones in Hong Kong's Area of Responsibility during the period January - August were located within the latitude band 15° N - 25° N. However, tracks for the later months did not follow this pattern.

During the period July - October, 9 tropical cyclones formed or came within 400 nautical miles of Hong Kong, of which 6 affected Hong Kong and necessitated the display of Local Storm Warning Signals (Table 3).

Typhoon 'Ora' dissipated soon after crossing the 400 n mile circle. Typhoon 'Nadine' and Severe Tropical Storm 'Bess' followed unusual tracks.

Typhoon 'Wendy' moved along a track typical of typhoons causing persistent gales at the Royal Observatory but it missed Hong Kong by a narrow margin because of the small gale area in its circulation. Typhoon 'Shirley' was the only one which gave rise to hurricane force winds at the Royal Observatory. This typhoon was also one of the very few tropical cyclones whose centres have passed directly over Hong Kong. However, early warnings of 'Shirley' were provided and the damage caused by this typhoon was relatively slight despite its hurricane force winds and heavy rainfall.

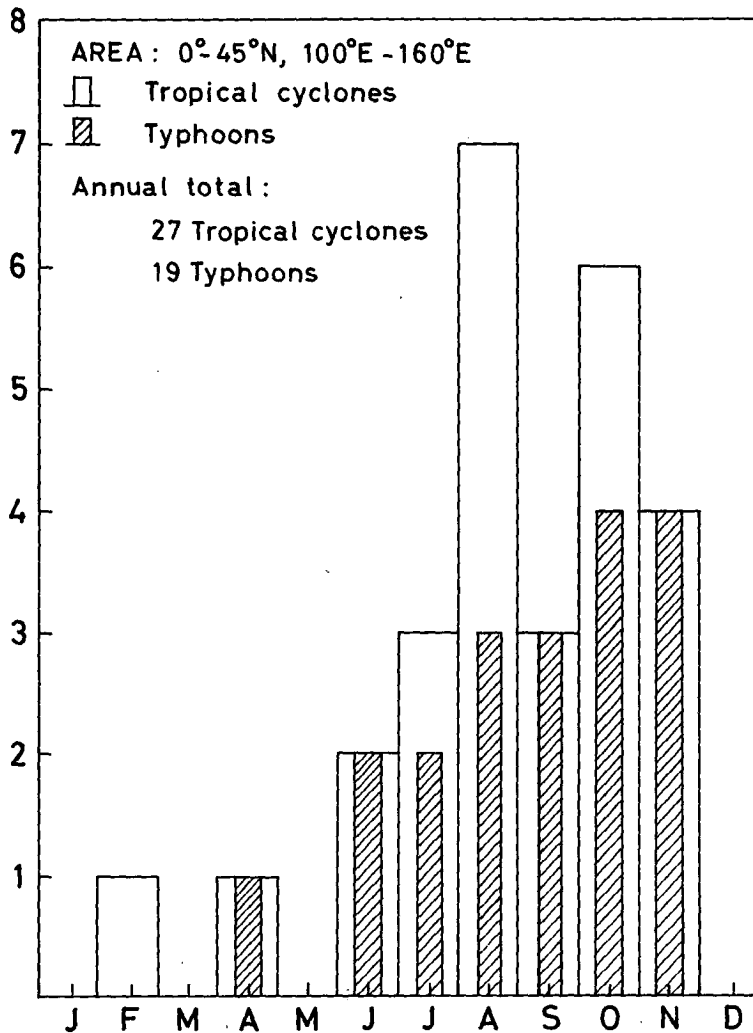


Figure 1. Monthly distribution of the frequency of occurrence of tropical cyclones and typhoons in the western Pacific and the South China Sea in 1968.

REPORT ON INDIVIDUAL TROPICAL CYCLONES AFFECTING HONG KONG

TYPHOON 'NADINE'

July 21 - 28, 1968

On July 21, a tropical depression formed over the western Pacific about 500 miles east-northeast of Manila and at first it was almost stationary. It intensified into a tropical storm named 'Nadine' on July 22. During the following 3 days, the storm followed a somewhat erratic course but with a general tendency towards the northwest. At 9.00 a.m. on July 25, a ship about 40 miles south of the centre reported winds of 70 knots and 'Nadine' was upgraded to a typhoon. The minimum sea-level pressure estimated by a reconnaissance aircraft at 11.40 a.m. on the same day was 966 mb.

On July 25, Typhoon 'Nadine' moved west-northwestwards across the southern tip of Taiwan and then turned westwards towards the South China coast. In Hong Kong Local Storm Signal No. 1 was hoisted at 9.40 a.m. on July 26 when the typhoon was centred about 220 miles east of the Colony. Cloud pictures received from weather satellites during the morning (Figures 2 and 3) revealed that the circulation of 'Nadine' was about 350 miles in diameter. 'Nadine' weakened to a severe tropical storm during the afternoon of July 26 but as it continued to move closer to Hong Kong, No. 1 Signal was replaced by No. 3 at 4.15 p.m. on the same day when the storm was about 180 miles away to the east-southeast. However, 'Nadine' slowed down rapidly during the evening and became almost stationary until 9.00 a.m. on July 27 when it further weakened to a tropical storm and started to drift slowly eastwards. No. 3 Signal was replaced by No. 1 Signal at 11.00 a.m. on the same day and all signals were lowered at 5.30 p.m. on July 28. 'Nadine' crossed south Taiwan, for the second time, during the evening of July 28 and dissipated there.

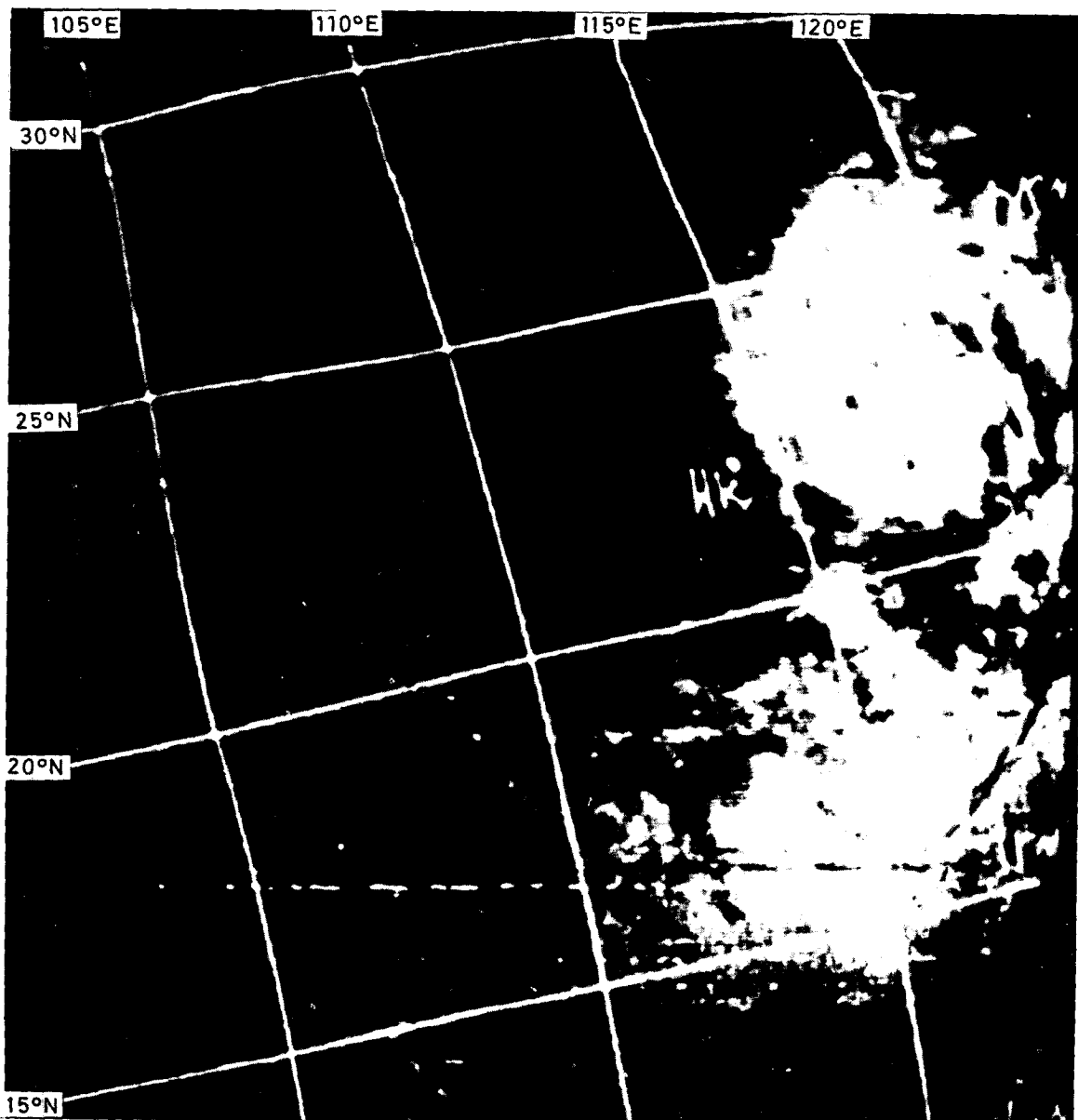


Figure 2. ESSA 2 APT picture of Typhoon 'Nadine' taken at about 7.38 a.m. on July 26, 1968.
(N.B. APT stands for Automatic Picture Transmission).

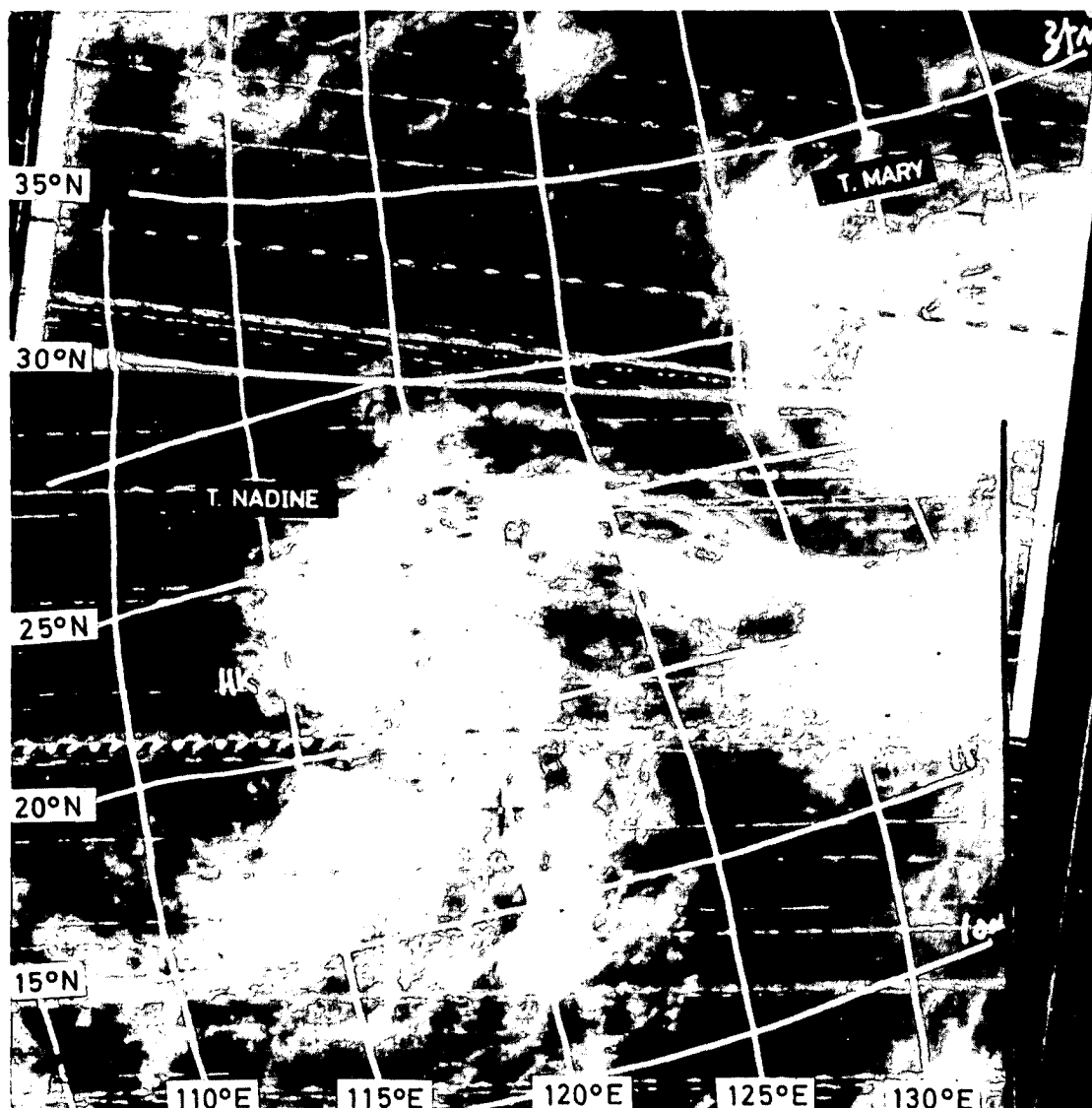


Figure 3. Photomosaic of ESSA 6 APT pictures of Typhoon 'Nadine' taken on the morning of July 26, 1968. The presence of Typhoon 'Mary' subsequently brought about a dramatic change in the track of 'Nadine' under the influence of the Fujiwara Effect.

On July 25, northerly winds associated with Typhoon 'Nadine' brought dry and very hot air from South China to Hong Kong and the maximum temperature recorded at the Royal Observatory during the afternoon was 35.7°C which was the second highest on record. Winds freshened gradually over the Colony and became strong in exposed places for several hours on July 26. The maximum gusts recorded were 34 knots at the Royal Observatory and 43 knots at Tate's Cairn. A total of 10.4 mm (0.41 in.) of rain was recorded at the Royal Observatory during the period when local storm signals were hoisted.

Figure 4 shows the track of Typhoon 'Nadine' together with those of tropical cyclones which gave rise to persistent gales at the Royal Observatory Hong Kong during the pentad July 25 - 29 for the period 1884 - 1967.

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

Location	Highest Tide Above Chart Datum			Maximum Storm Surge Above Predicted Level		
	Height	Date	Time	Height	Date	Time
North Point	2.77m (9'1")	July 26, 1968	10.55 a.m.	0.69m (2'3")	July 26, 1968	7.25 p.m.
Tai Po Kau	2.77m (9'1")	July 26, 1968	11.00 a.m.	0.79m (2'7")	July 26, 1968	8.40 p.m.
Chi Ma Wan (Lantau)	2.90m (9'6")	July 26, 1968	10.30 a.m.	0.76m (2'6")	July 26, 1968	8.00 p.m.

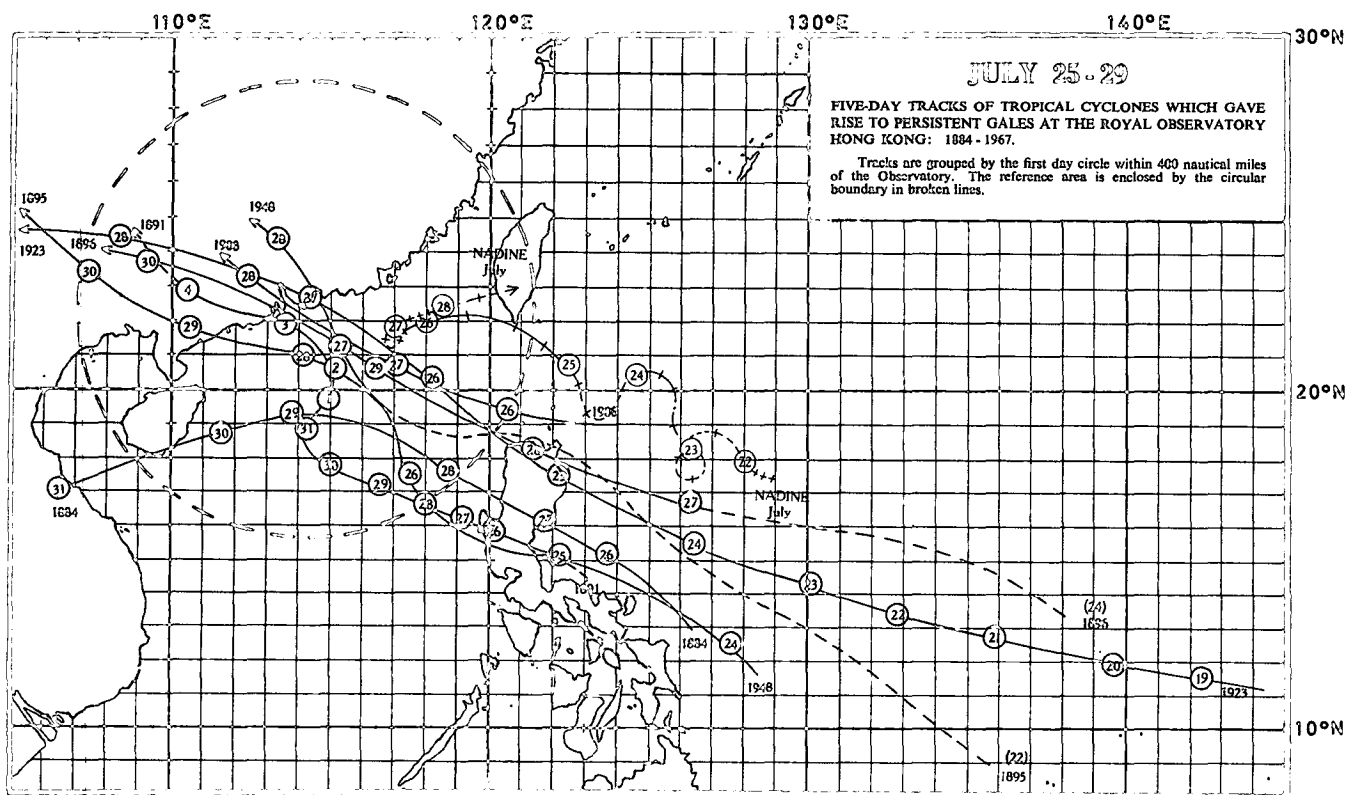


Figure 4. Track of Typhoon 'Nadine': July 21 - 28, 1968.

SEVERE TROPICAL STORM 'ROSE'

August 9 - 13, 1968

An area of low pressure was observed over the Pacific to the east of the Philippines on August 5 but it was not until August 9 that a depression developed and moved west-northwest. The depression was named 'Rose' and after crossing the northern part of Luzon during the evening of August 10, it turned to a more westerly course over the South China Sea.

'Rose' intensified into a tropical storm early on August 11. A ship about 60 miles south-southwest of the centre at 3.00 a.m. on the same day reported winds of 45 knots. As the storm continued to move closer to the Colony, Local Storm Signal No. 1 was hoisted at 7.45 a.m. when the centre was about 300 miles to the southeast. 'Rose' further intensified to a severe tropical storm later during the morning and a report from a reconnaissance aircraft at 9.49 a.m. indicated that the storm might even have reached typhoon intensity for a short period. The maximum winds given in this report were 80 knots and the minimum sea-level pressure was 962 mb. Due to the rapid intensification of the storm, No. 1 signal was replaced by No. 3 at 4.45 p.m. when 'Rose' was centred about 250 miles south of the Colony.

Severe Tropical Storm 'Rose' passed about 240 miles south of Hong Kong at 11.00 p.m. on August 11 and began to move west-northwest. As the storm moved further away from the Colony, No. 3 signal was lowered at 8.50 a.m. on August 12. 'Rose' crossed Hainan Island during the evening and dissipated over North Vietnam about 24 hours later.

In Hong Kong, winds were generally moderate or fresh on August 11. However strong winds were experienced at Tate's Cairn in the evening, where the maximum gust recorded was 54 knots. A total of 32.7 mm (1.29 in.) of rain was recorded at the Royal Observatory during the period when local signals were hoisted. There was no significant rise in tide heights in Hong Kong associated with this storm.

Figure 5 reveals that the track of Severe Tropical Storm 'Rose' lies too far south to bring about persistent gales to Hong Kong.

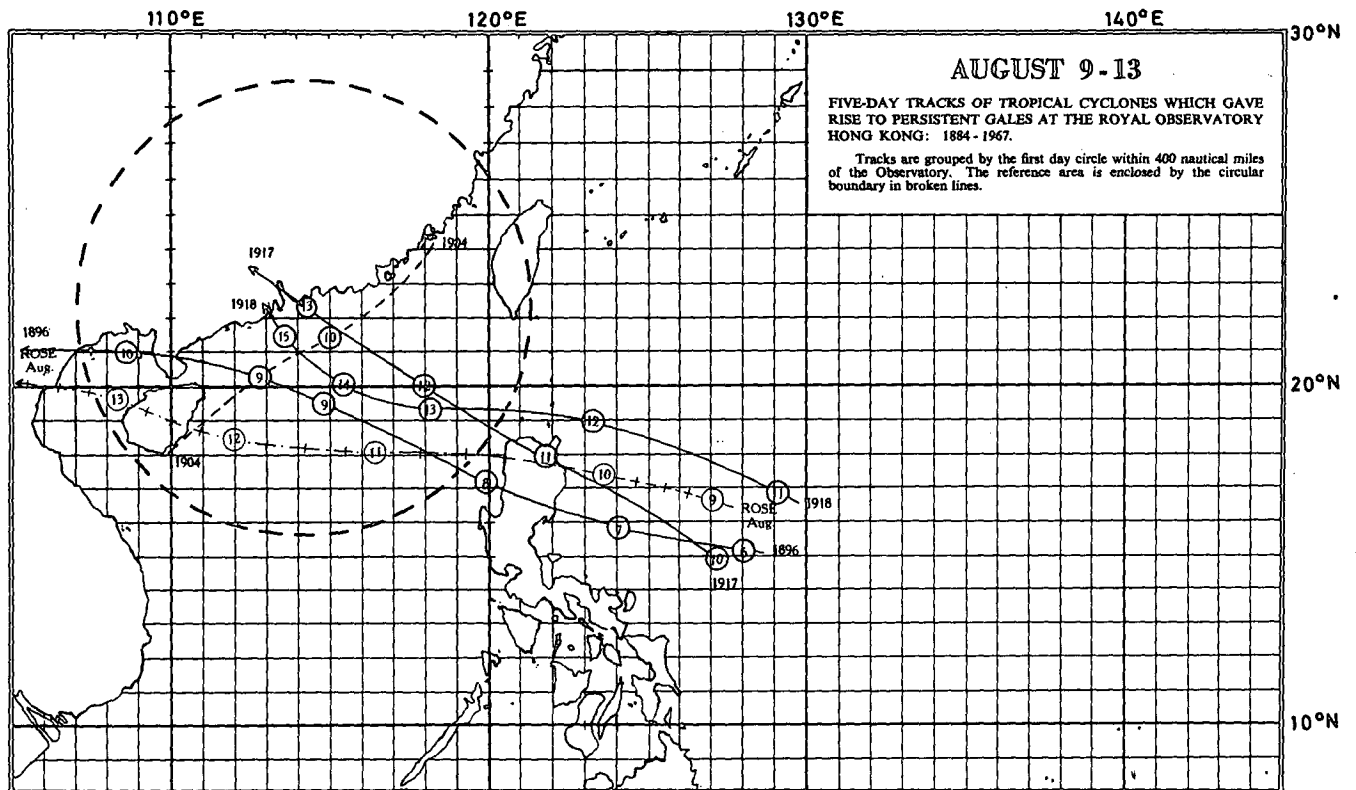


Figure 5. Track of Severe Tropical Storm 'Rose': August 9 - 13, 1968.

TYPHOON 'SHIRLEY'

August 17 - 22, 1968

The eye of Typhoon 'Shirley' was one of the very few which have passed directly over Hong Kong. There were only two previous occasions, November 23, 1939 and May 19, 1961, when the eye of a tropical cyclone has crossed the Royal Observatory. In Hong Kong early warnings of Typhoon 'Shirley' were provided and the damage caused by this typhoon was relatively slight despite its hurricane force winds and heavy rainfall. However, the force of Shirley's winds damaged a large number of trees at Victoria Park in Causeway Bay (Figure 6) and uprooted many of them.

版權照片刊登於印刷本內，該刊物可在香港天文台資源中心查閱。

天文台資源中心網址：

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

The copyrighted photo is available in the published version. The publication can be accessed at the Hong Kong Observatory Resource Centre.

Website of the Observatory Resource Centre:

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

Figure 6. Trees bent at Victoria Park in Causeway Bay during Typhoon 'Shirley'.
(By Courtesy of South China Morning Post).

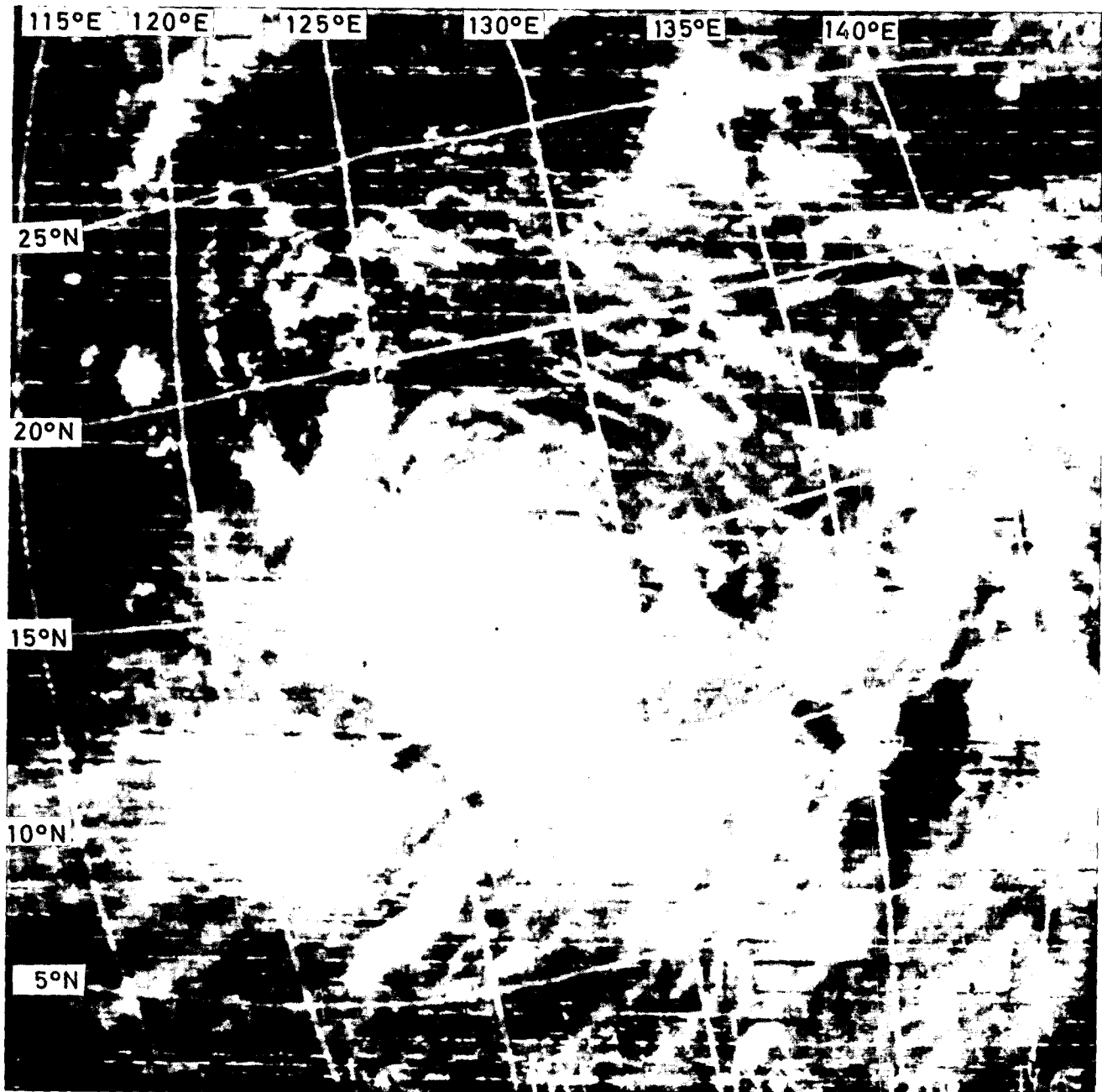


Figure 7. ESSA 6 APT picture of 'Shirley' taken at about 10.35 a.m. on August 18, 1968.

Early on August 17, a tropical depression formed over the western Pacific about 650 miles to the east of Manila and was moving on a generally westerly track. At 6.03 a.m. the next day, a reconnaissance aircraft reported a minimum sea-level pressure of 991 mb and the depression was upgraded to a tropical storm named 'Shirley'. A cloud picture received from a weather satellite during the morning (Figure 7) revealed that the circulation was well-organized and covered a diameter of about 360 miles. At this time, the storm began to turn to a west-northwest course and moved towards the northern tip of Luzon. 'Shirley' intensified to a severe tropical storm early on August 19 when a minimum sea-level pressure of 962 mb was reported near its centre by a reconnaissance aircraft. At 3.00 p.m. on the same day, a land station over Luzon about 65 miles west of the centre experienced winds of 40 knots. The storm moved in a more northerly direction after it entered the South China Sea, and Local Storm Signal No. 1 was hoisted at 6.10 a.m. on August 20 when it was centred about 350 miles southeast of the Colony. This was replaced by No. 3 signal at 6.15 p.m. as 'Shirley' continued to move closer. At 9.00 p.m. on the same day, the storm passed about 70 miles south-southeast of Pratas Island where winds of 60 knots were experienced.

During the early morning of August 21, 'Shirley' changed to a northwesterly course towards Hong Kong and Local Storm Signal No. 7 was hoisted at 6.00 a.m. when the storm was about 150 miles to the southeast. An ESSA 6 APT picture of 'Shirley' taken at about 11.21 a.m. is shown as Figure 8. The eye of the storm as revealed by the Observatory radar at Tate's Cairn was approximately circular in shape with a diameter of about 50 miles (Figure 9). Strong spiral bands were observed outside the eye and the height of the rain-clouds was estimated to extend to about 10 km. 'Shirley' became a typhoon during the afternoon and the maximum winds reported by reconnaissance aircraft at 12.20 p.m. and 5.45 p.m. were 75 and 80 knots respectively. Due to the intensification of the circulation, No. 7 signal was replaced by No. 9 at 2.49 p.m. to warn the increase of gales and then No. 10 at 4.10 p.m. when it was certain that the eye would pass over Hong Kong. At this time, the centre was located about 45 miles south-southeast of Tate's Cairn. The eye of 'Shirley' passed over the Royal Observatory between 7.00 p.m. and 9.30 p.m. During this period, the winds dropped but the weather remained overcast with almost continuous rain and the typhoon appeared to

have weakened slightly and the minimum sea-level pressure recorded at the Observatory at 7.00 p.m. was 968.7 mb. This was the lowest figure ever recorded in August. The barogram of Typhoon 'Shirley' recorded during the period August 19 - 22, 1968 is reproduced in Figure 10, and the anemogram for the period August 21 - 22, 1968 is shown in Figure 11.

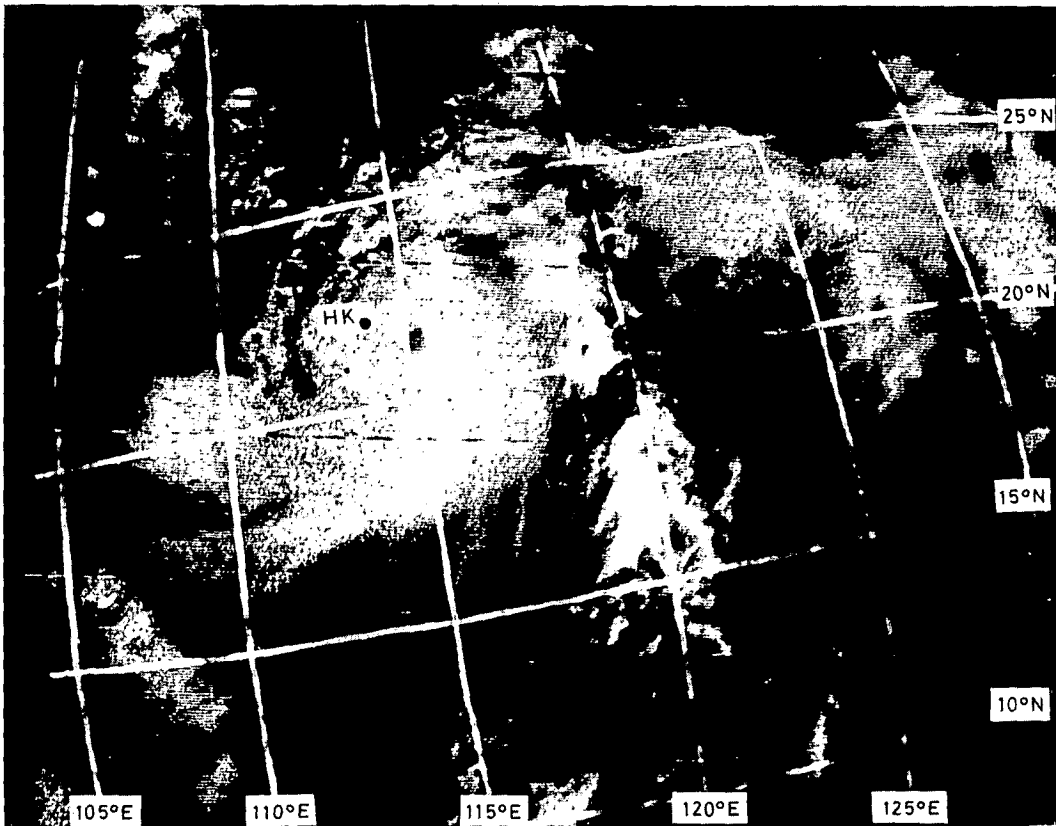


Figure 8. ESSA 6 APT picture of Typhoon 'Shirley' taken at about 11.21 a.m. on August 21, 1968.



Figure 9. The eye of 'Shirley' as shown by the Observatory's Type 43S Radar at Tate's Cairn on the morning of August 21, 1968.
(Radar centre off-set with range markers at 40 n mile intervals).

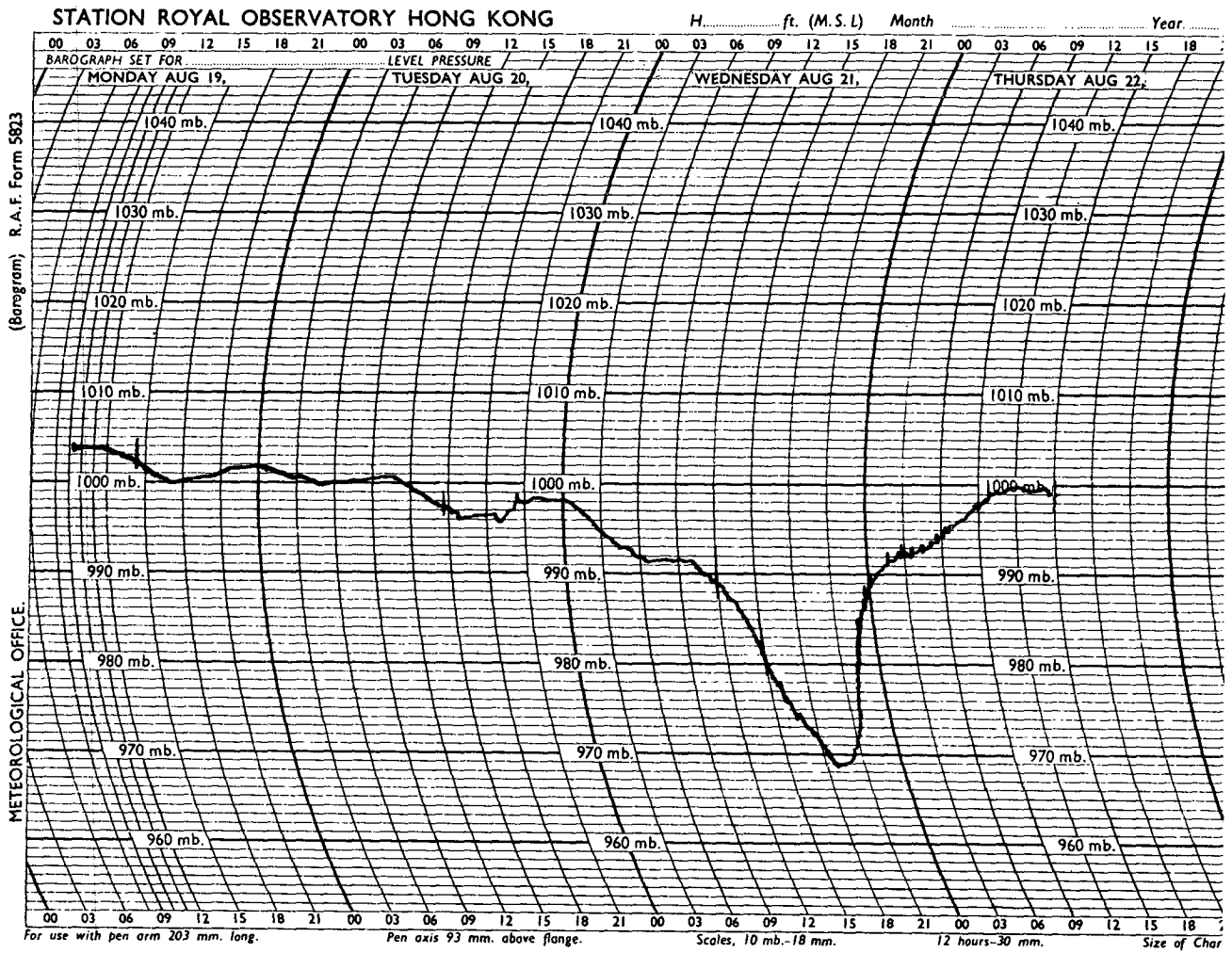


Figure 10. Barogram of Typhoon 'Shirley' during the period August 19 - 22, 1968.

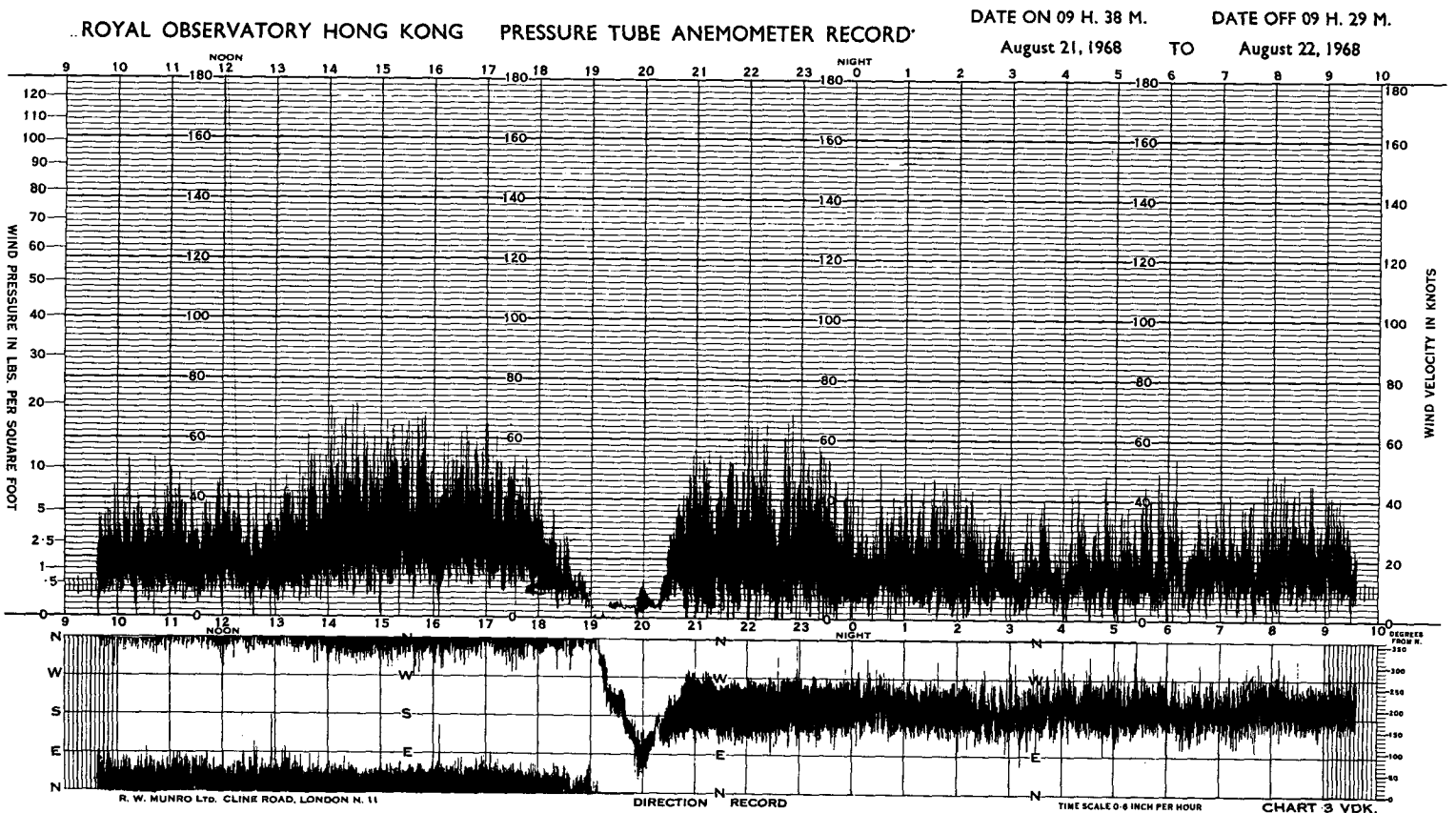


Figure 11. Anemogram of Typhoon 'Shirley' for the period August 21 - 22, 1968.

Typhoon 'Shirley' continued to move northwest during the evening and weakened into a severe tropical storm by midnight. No. 10 signal was replaced by No. 6 at 11.45 p.m. when the storm was about 45 miles north-northwest of Tate's Cairn. As winds moderated slowly, No. 6 signal was further replaced by No. 3 at 5.25 a.m. the next morning when the storm was about 110 miles to the northwest. 'Shirley' slowed down considerably over Kwangtung Province and finally degenerated into an area of low pressure later in the morning. All signals were lowered at 12.10 p.m. on August 22.

In Hong Kong, winds freshened from the north during the evening of August 20 and were strong in the morning of August 21. Gales set in at Tate's Cairn and Waglan Island at 6.00 a.m. and 8.00 a.m. on August 21 respectively and became general over the Colony by 3.00 p.m. Winds continued to increase during the afternoon and reached hurricane force in places by 4.00 p.m. The maximum gusts recorded were 110 knots at Tate's Cairn and 113 knots at Waglan Island.

With the arrival of the eye of the typhoon, winds decreased abruptly and became generally light and variable. The lull lasted for about 2 hours. A special radiosonde ascent was made in the eye of Typhoon 'Shirley' in order to record the thermal structure of its core and the results are shown in Figure 12. At 10 p.m. on August 21, southerly gales began to blow in many places and persisted until the early hours of August 22. Winds then began to moderate slowly but remained generally strong over the Colony until the early afternoon.

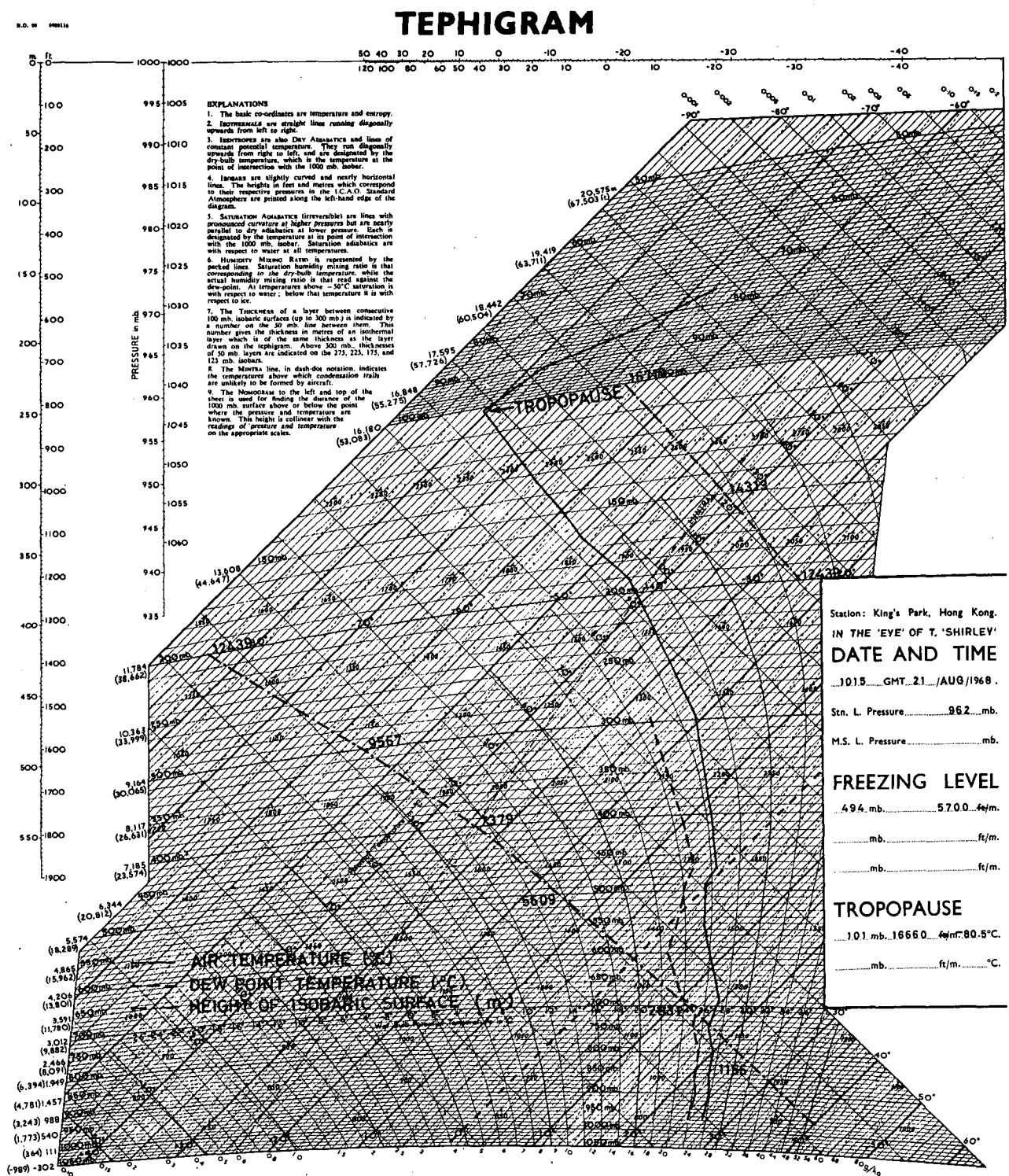


Figure 12. Results of a special radiosonde ascent made on August 21, 1968 in the eye of Typhoon 'Shirley'.

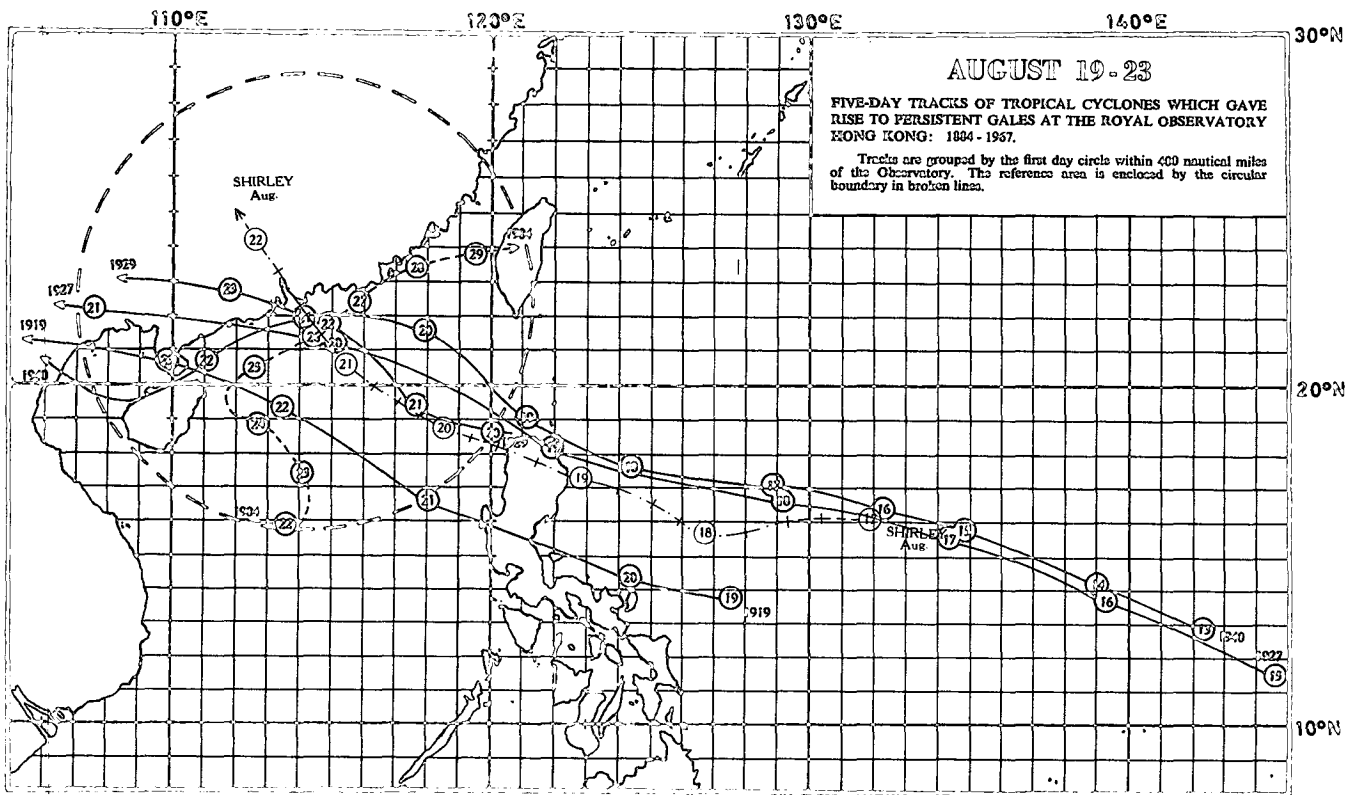


Figure 13. Track of Typhoon 'Shirley': August 17 - 22, 1968.

The track of Typhoon 'Shirley' is given in Figure 13, which also shows tracks of tropical cyclones previously giving rise to persistent gales at the Royal Observatory.

The following daily amounts of rainfall were recorded at the Observatory.

August 20	15.0 mm (0.59 in.)
August 21	165.1 mm (6.50 in.)
August 22	77.8 mm (3.06 in.)

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

Location	Highest Tide Above Chart Datum			Maximum Storm Surge Above Predicted Level		
	Height	Date	Time	Height	Date	Time
North Point	2.79m (9'2")	Aug. 21, 1968	9.05 a.m.	1.09m (3' 7")	Aug. 21, 1968	3.55 p.m.
Tai Po Kau	2.85m (9'4")	Aug. 21, 1968	8.37 a.m.	1.78m (5'10")	Aug. 21, 1968	5.00 p.m.
Tai Mei Tuk	2.90m (9'6")	Aug. 21, 1968	8.25 a.m.	1.65m (5' 5")	Aug. 21, 1968	4.37 p.m.

TYPHOON 'WENDY'

August 28 - September 9, 1968

Tropical Storm 'Wendy' formed over the Pacific near the Mariana Islands early on August 28. It moved westwards at first and rapidly intensified into a severe tropical storm in the afternoon. During the morning of August 30, 'Wendy' became a typhoon and at 6.00 a.m., a reconnaissance aircraft reported maximum surface winds of 80 knots and a minimum sea-level pressure of 926 mb near the centre. A satellite picture received on August 31 (Figure 14) revealed that the circulation of the storm was about 360 miles in diameter. 'Wendy' turned to a more northwesterly course on August 29 but it resumed a westward movement again 5 days later and crossed the southern tip of Taiwan on September 6. 'Wendy' appeared to have weakened slightly after it moved into the South China Sea. At 11.55 a.m. on September 7, the maximum surface winds and minimum sea-level pressure reported by a reconnaissance aircraft were 75 knots and 958 mb respectively.

In Hong Kong, Local Storm Signal No. 1 was hoisted at 3.00 p.m. on September 7 when 'Wendy' was centred about 210 miles east of the Colony. This was replaced by No. 3 signal at 10.50 p.m. when the storm was about 140 miles away. However, 'Wendy' rapidly weakened into a tropical storm during the evening and began to move west-southwest. Pratas Island, which was about 60 miles southeast of the centre, reported winds of only 12 knots at midnight. A satellite picture received on September 8 (Figure 15) revealed that the circulation of 'Wendy' was about 180 miles in diameter and the Royal Observatory radar also indicated that the heavy rain bands associated with the storm did not extend to more than 45 miles from the centre (Figure 16). 'Wendy' passed about 70 miles south of Hong Kong around 11.00 a.m. on the same day and continued to weaken. The maximum winds reported by a reconnaissance aircraft at 11.40 a.m. were only 25 knots. 'Wendy' moved westwards across the Luichow peninsula during the night of September 8 and dissipated over the Gulf of Tonkin during the next morning. No. 3 signal was lowered at 3.25 p.m. on September 8.

Winds in Hong Kong freshened from the north to northeast during the evening of September 7 and became generally strong by the next morning. The maximum gusts recorded were 55 knots at Tate's Cairn and 45 knots at Waglan Island. Winds then moderated slowly during the afternoon and veered to the east.

As the circulation of 'Wendy' was small and the storm passed rapidly to the south of the Colony, the rainfall recorded at the Royal Observatory amounted to only 44.7 mm (1.76 in.) on September 7 and 8. There was no significant rise in the tide height in Hong Kong during the passage of 'Wendy'.

Figure 17 shows that after September 6, Typhoon 'Wendy' followed a track typical of typhoons which gave persistent gales at the Observatory and it missed Hong Kong by a narrow margin because of the small gale area in its circulation.

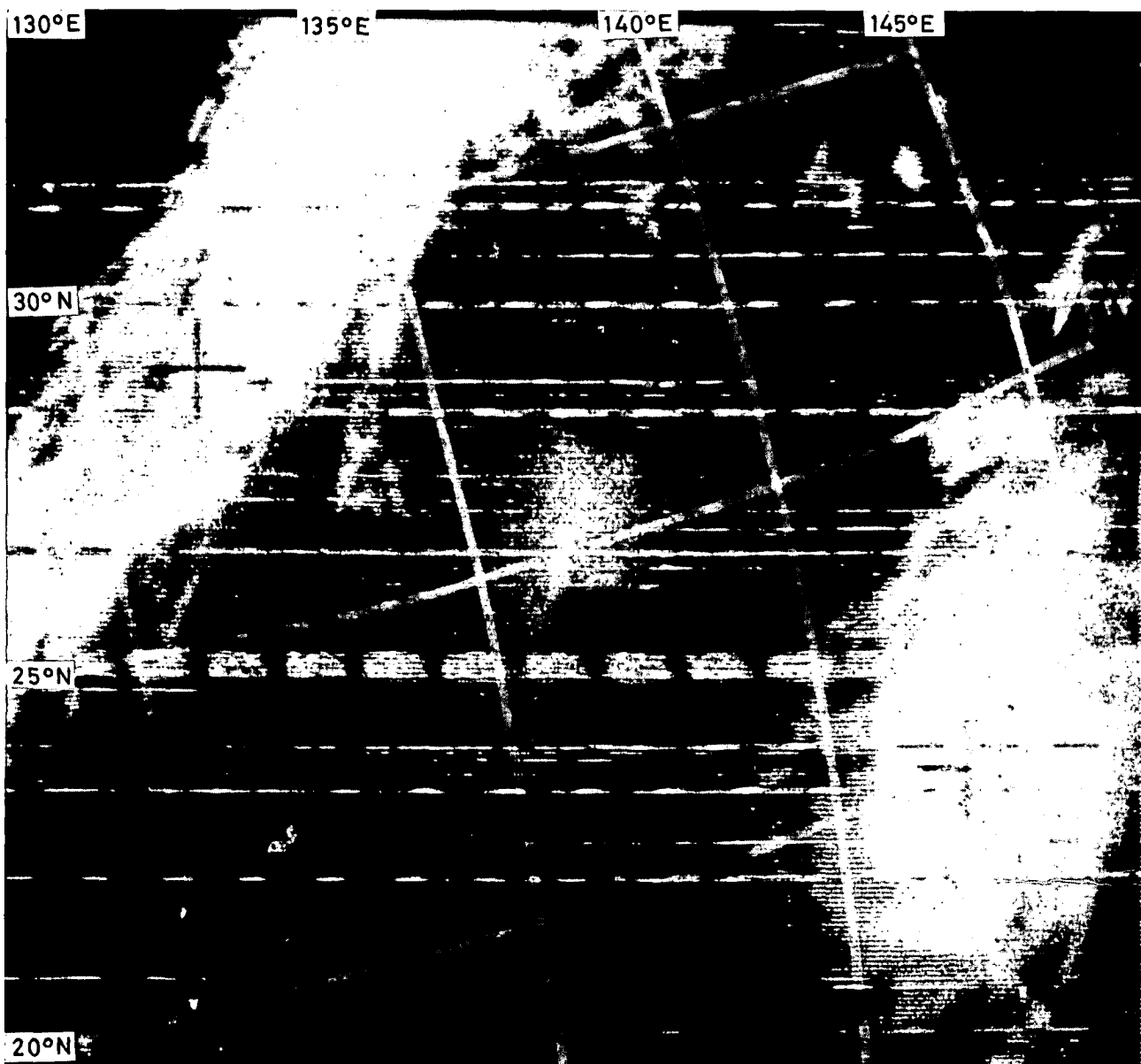


Figure 14. ESSA 6 APT picture of Typhoon 'Wendy' taken at about 10.37 a.m. on August 31, 1968.

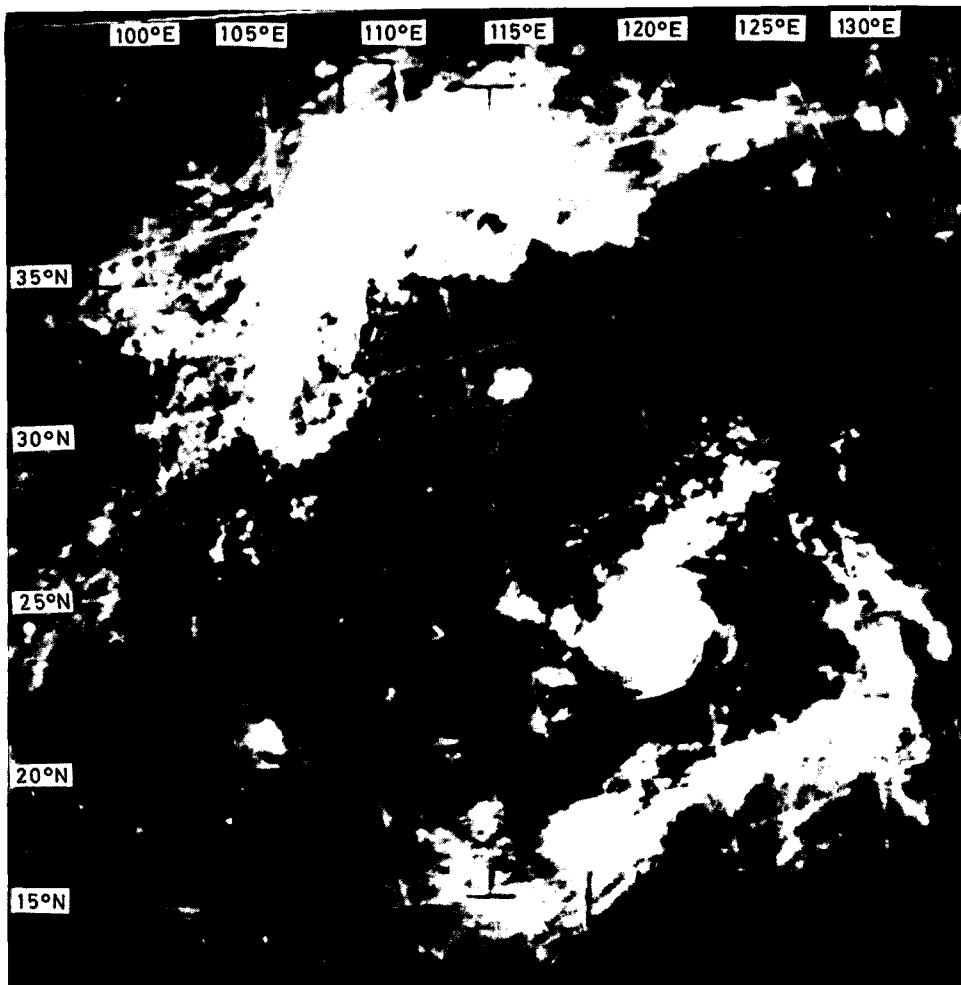


Figure 15. ESSA 6 APT picture of Typhoon 'Wendy' taken at about 12.02 p.m. on September 8, 1968.

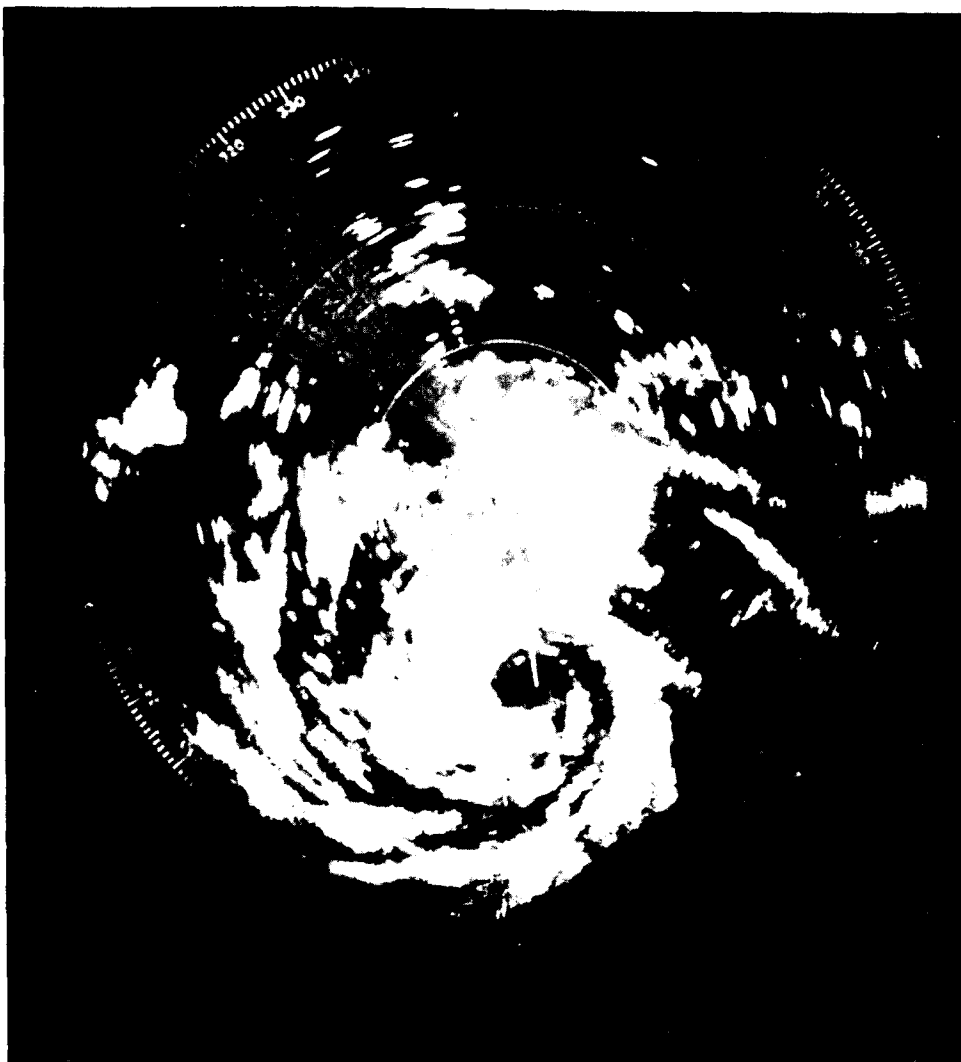


Figure 16. Radar picture of Typhoon 'Wendy' taken at 9.25 a.m. on September 8, 1968. (Range markers at 40 n mile intervals).

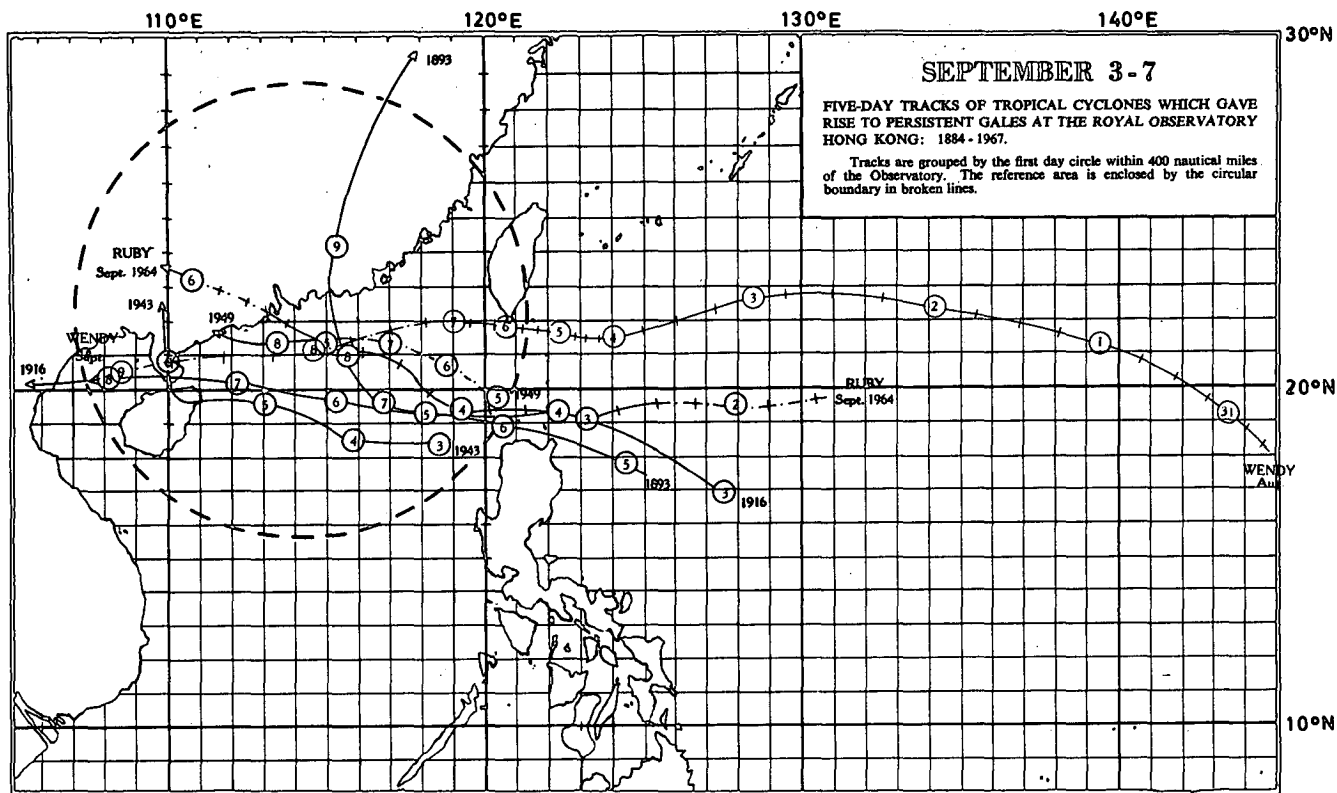


Figure 17. Track of Typhoon 'Wendy': August 28 - September 9, 1968.
(See Frontispiece for track east of 145°E).

SEVERE TROPICAL STORM 'BESS'

August 31 - September 6, 1968

On August 29, a trough of low pressure developed along the South China coast and drifted slowly southwards during the next two days. Early on August 31, a tropical depression formed in this trough near Pratas Island and rapidly intensified into a tropical storm named 'Bess'. At 9.00 a.m. it was centred about 250 miles east-southeast of Hong Kong moving west at 5 knots and winds of 30 knots were reported within 80 miles of the centre. A cloud picture received from a weather satellite during the morning (Figure 18) revealed that the circulation was not well-organized and its centre was ill-defined. As the storm came closer to Hong Kong, Local Storm Signal No. 1 was hoisted at 6.00 p.m. on August 31 when it was centred about 230 miles to the southeast. This was replaced by No. 3 signal at 10.30 p.m.

'Bess' continued to move on a westerly track and passed about 180 miles south of Hong Kong around 9.00 a.m. on September 2. During the morning of September 3, 'Bess' began to move south-westwards away from the Colony and No. 3 signal was lowered at 10.15 p.m. Subsequently, in the afternoon of September 4, 'Bess' intensified into a severe tropical storm. At this time, the circulation as shown by a satellite picture (Figure 19) was about 400 miles in diameter. At 5.25 p.m. a reconnaissance aircraft reported maximum surface winds of 75 knots and minimum sea-level pressure of 966 mb. The storm turned to a west-southwesterly course on September 4 and entered the coast of Vietnam near Danang during the morning of September 6.

In Hong Kong, winds freshened from the north or northeast early on September 1 and became generally strong later in the evening. Due to the slow movement of 'Bess', the strong winds persisted for almost two days and the No. 3 signal was hoisted for a period of 71 hours and 45 minutes, which is a record figure for this signal. During this period, the storm was within 230 miles of Hong Kong and the maximum gusts recorded were 54 knots at Tate's Cairn, 50 knots at Waglan Island and 50 knots at the Royal Observatory.

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

August 31	4.7 mm (0.19 in.)
September 1	Trace*
September 2	15.1 mm (0.59 in.)
September 3	4.4 mm (0.17 in.)

There was no significant rise in the tide height in Hong Kong during the passage of 'Bess'.

The track of Severe Tropical Storm 'Bess' is shown in Figure 20.

* Trace indicates amount <0.05 mm.

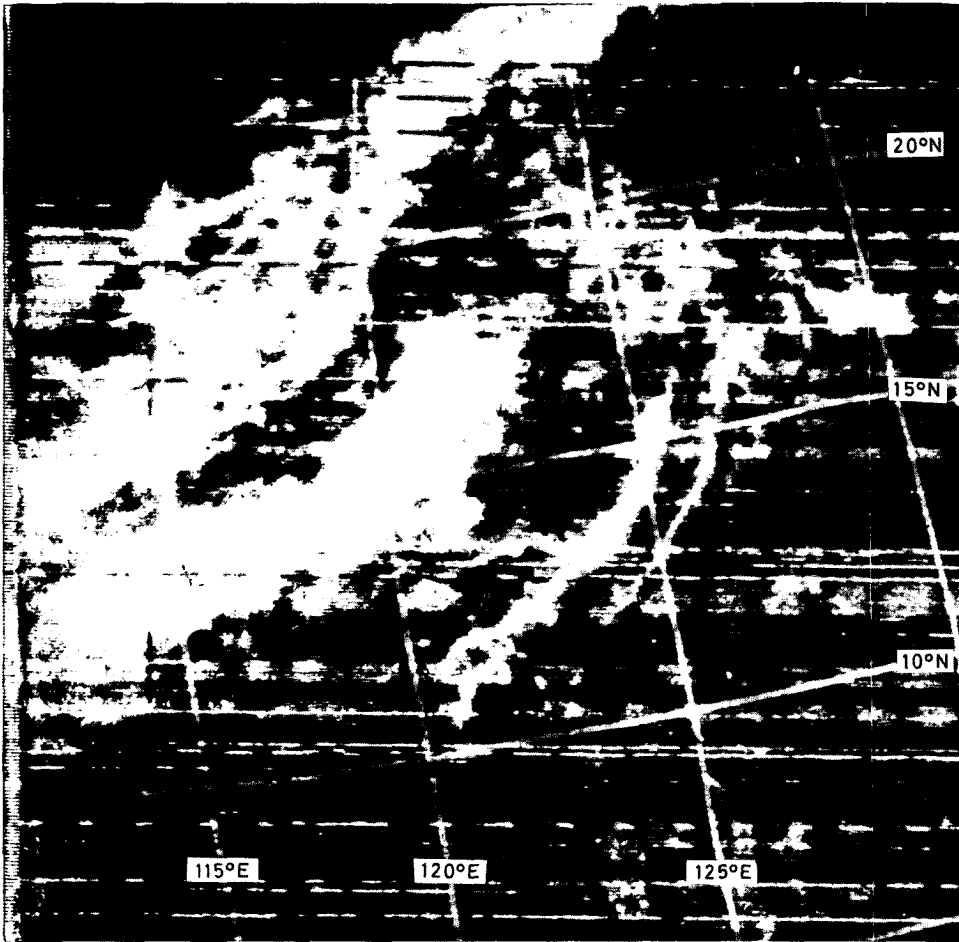


Figure 18. ESSA 6 APT picture of 'Bess' taken at about 10.43 a.m. on August 31, 1968.

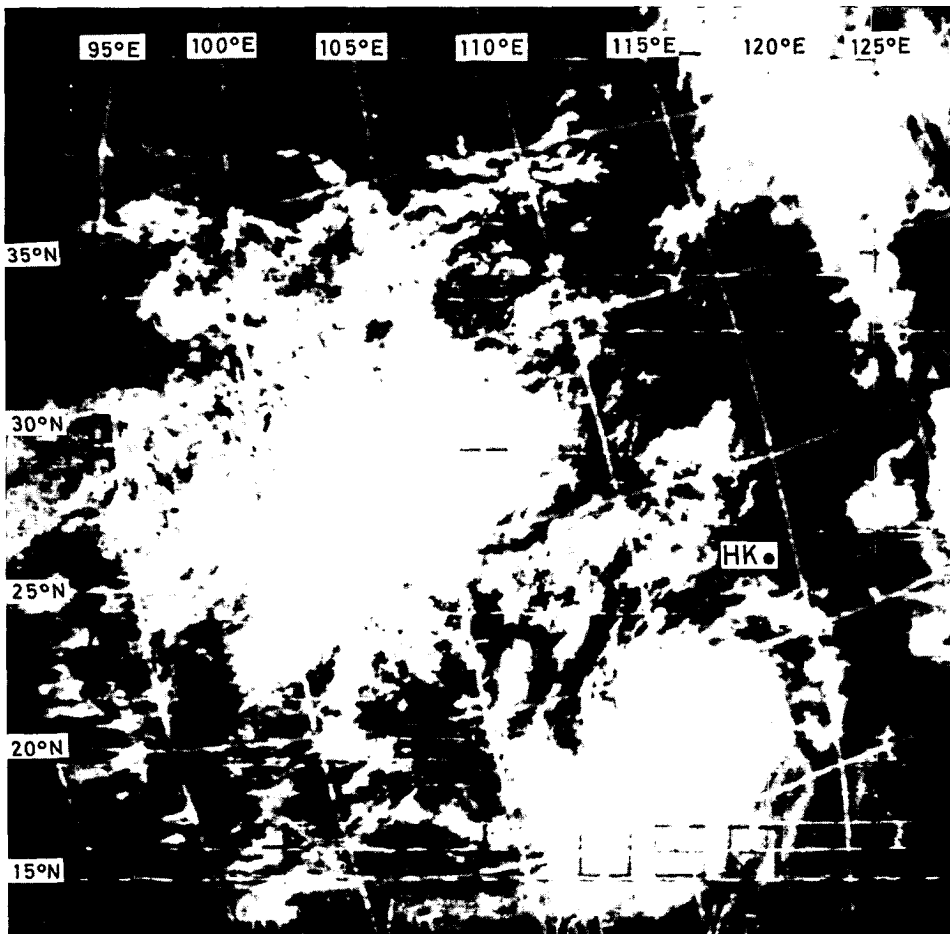


Figure 19. ESSA 6 APT picture of 'Bess' taken at about 12.23 p.m. on September 4, 1968.

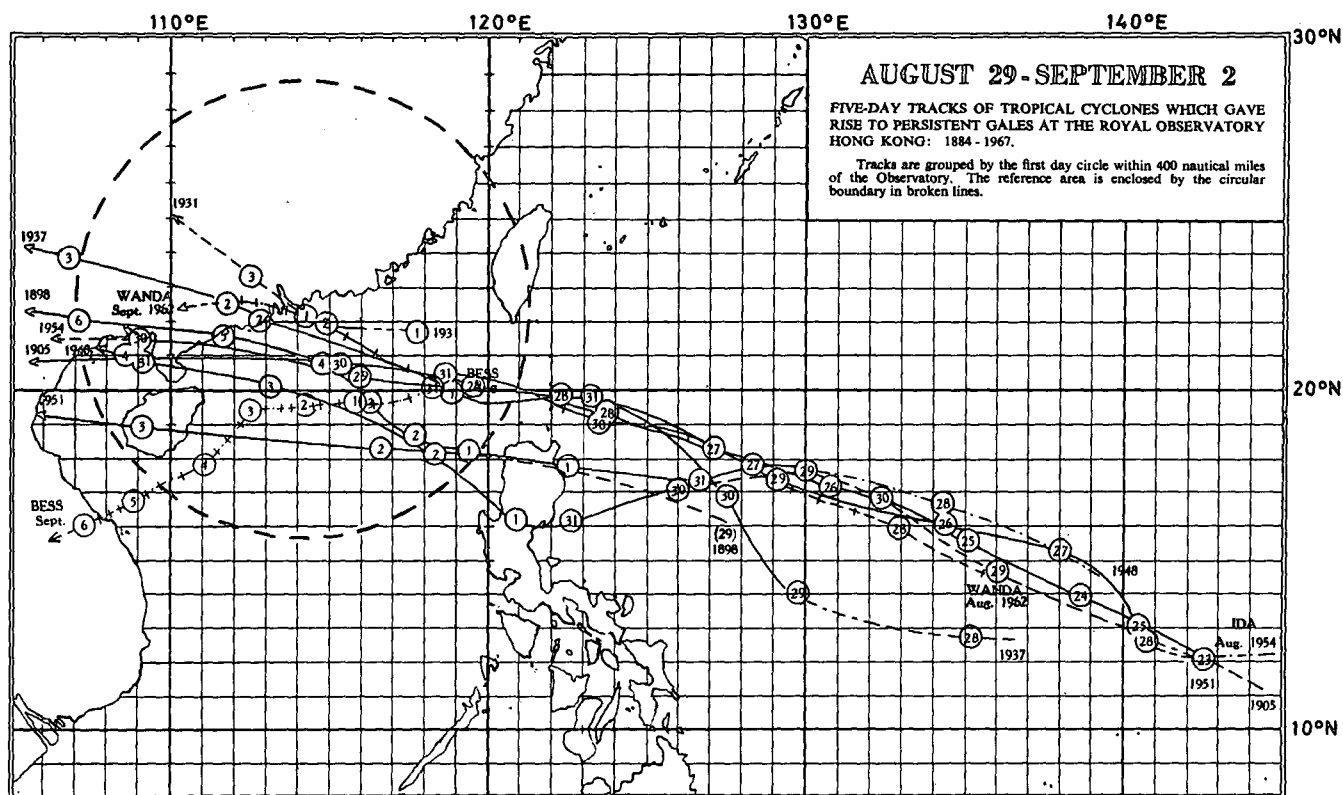


Figure 20. Track of Severe Tropical Storm 'Bess': August 31 - September 6, 1968.

TYPHOON 'ELAINE'

September 24 - October 1, 1968

An area of low pressure was observed over the western Pacific near the Caroline Islands on September 23. This developed into a tropical depression named 'Elaine' the next day and moved north-westwards towards Luzon. It intensified to a tropical storm on September 25 and became a typhoon the following day. At 5.15 p.m. on September 26, a reconnaissance aircraft reported maximum surface winds of 80 knots and minimum sea-level pressure of 955 mb near the centre. At this time, the typhoon was located about 360 miles east of Manila. On September 27, a reconnaissance report indicated that the minimum central sea-level pressure in Typhoon 'Elaine' fell to 908 mb at noon with maximum surface winds of 100 knots. 'Elaine' changed to a west-northwesterly course during the afternoon and crossed the northern tip of Luzon the following day. A cloud picture received from a weather satellite on the morning of September 28 (Figure 21) revealed that the circulation of the typhoon was very large, covering an area of about 540 miles in diameter. At 9.00 a.m. a land station about 60 miles west of the centre of the typhoon reported winds of 52 knots. Three hours later, a reconnaissance aircraft reported maximum surface winds of 100 knots and minimum sea-level pressure of 930 mb near the centre. In the mean time, a cold front which was moving southwards across China, had reached the South China coast, causing a tightening of pressure gradient and an increase in winds over the coastal waters.

In Hong Kong, Local Storm Signal No. 1 was hoisted at 7.25 a.m. on September 29 when 'Elaine' was centred about 420 miles to the east-southeast. This was later replaced by No. 3 signal at 7.45 p.m. when the typhoon was 330 miles away to the southeast. Satellite pictures received on the same day (Figures 22 and 23) revealed that the area of cloud associated with the typhoon had increased to about 750 miles in diameter. At this time winds of over 65 knots were reported within 70 miles of the centre.

Typhoon 'Elaine' continued to move west-northwest towards Hong Kong until the morning of September 30 when it began to turn north-northwest and slowly weakened into a tropical storm as a cold air stream about 5,000 feet deep entered the circulation from the north. The eye of the circulation first appeared on the Observatory radar on the morning of October 1 and was about 15 miles in diameter. The radar photograph of Typhoon 'Elaine' taken by the Observatory's Type 43S Radar at Tate's Cairn at about 9.40 a.m. on October 1, 1968 is shown as Figure 24.

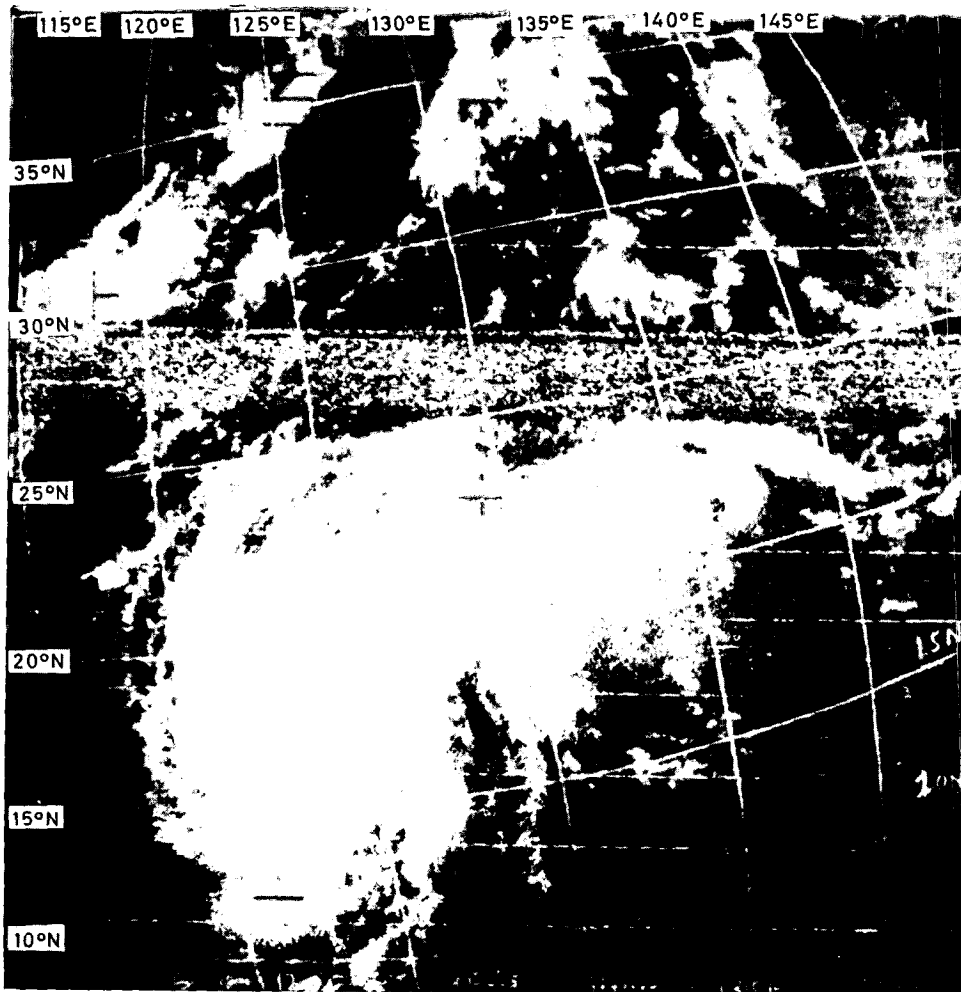


Figure 21. ESSA 6 APT picture of Typhoon 'Elaine' taken at about 10.44 a.m. on September 28, 1968.

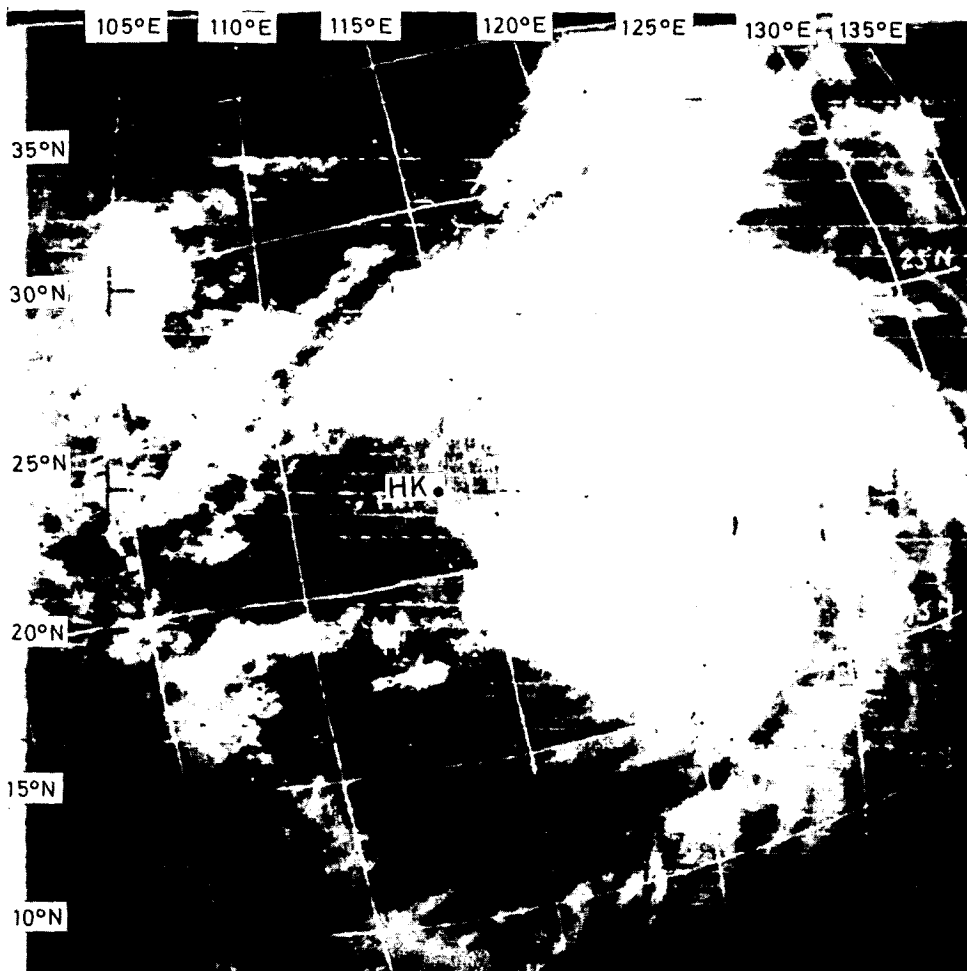


Figure 22. ESSA 6 APT picture of Typhoon 'Elaine' taken at about 11.38 a.m. on September 29, 1968.

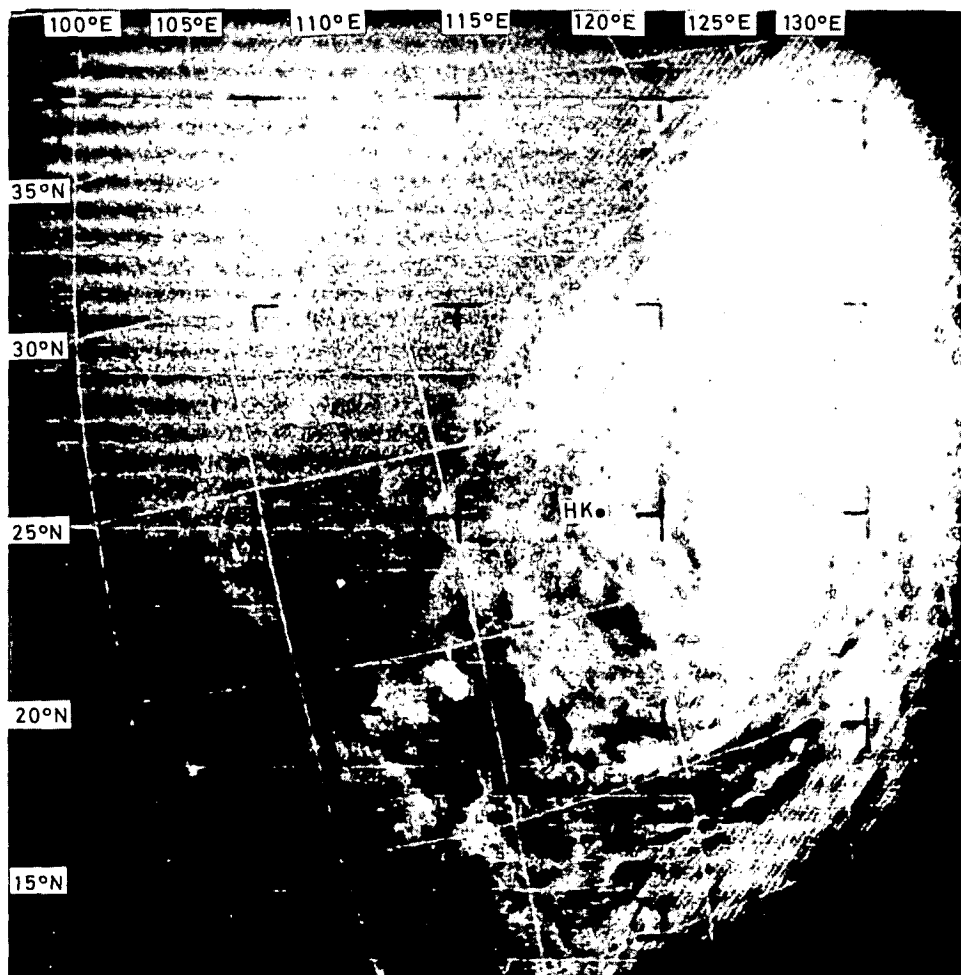


Figure 23. ESSA 6 APT picture of Typhoon 'Elaine' taken at about 8.15 a.m. on September 30, 1968.

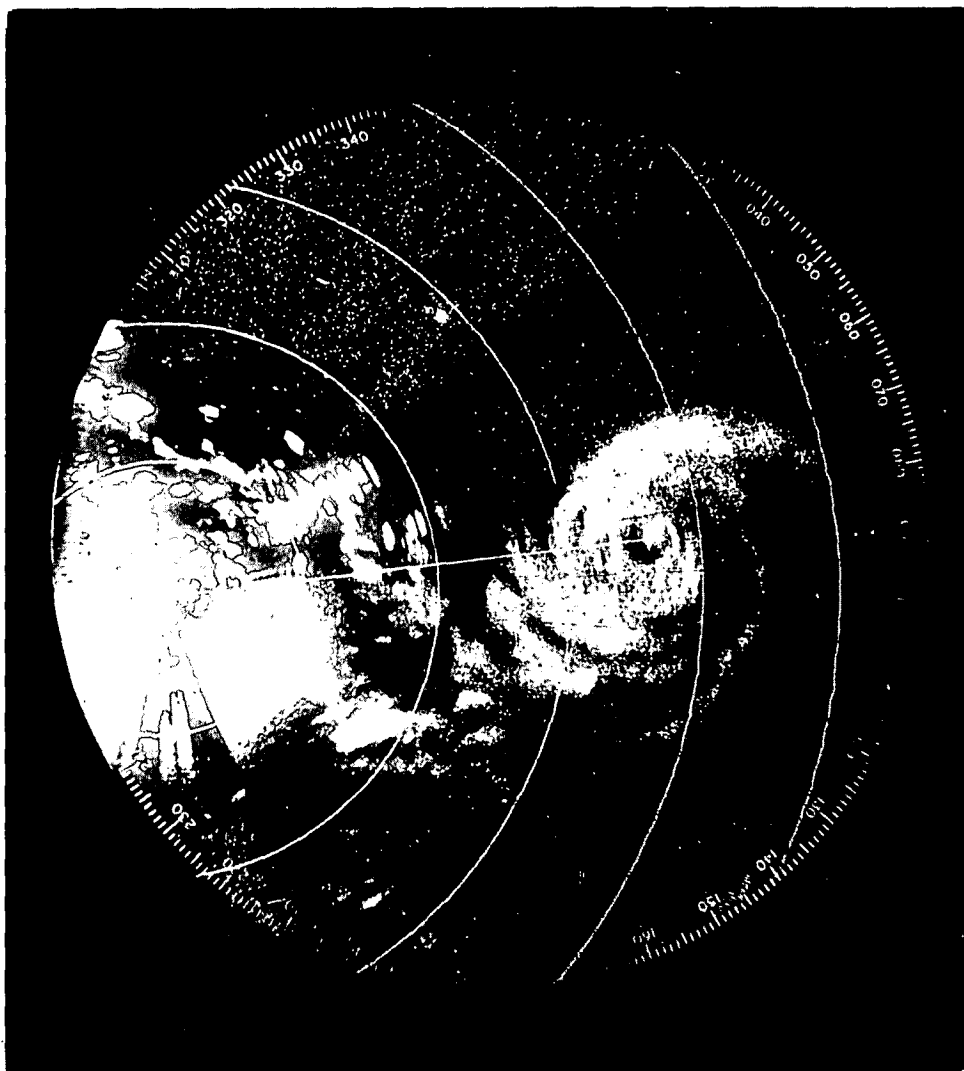


Figure 24. Photograph of Typhoon 'Elaine' taken by the Observatory's Plessey Type 43S Radar at Tate's Cairn at about 9.40 a.m. on October 1, 1968.

'Elaine' entered the South China coast about 140 miles east of Hong Kong during the afternoon and rapidly degenerated into an area of low pressure. No. 3 signal was lowered at 2.00 p.m. on the same day.

In Hong Kong, winds were fresh and gusty from the north during the night of September 28. The wind speed increased gradually the next morning and became generally strong over the Colony later in the day. During the night of September 29, the winds backed to northwest and began to moderate slowly. However, strong winds persisted at Tate's Cairn until the morning of October 1. The maximum gusts recorded were 58 knots at Tate's Cairn and 46 knots at Waglan Island. Because of the effect of entrainment of cold air, the rainfall recorded at the Observatory on September 30 and October 1 was only 1.9 mm (0.07 in.) which is considerably less than the normal value for a tropical cyclone passing to the east of Hong Kong.

There was no significant rise in the tide height in Hong Kong during the passage of 'Elaine'.

Figure 25 shows that Typhoon 'Elaine' was unlikely to produce persistent gales in Hong Kong.

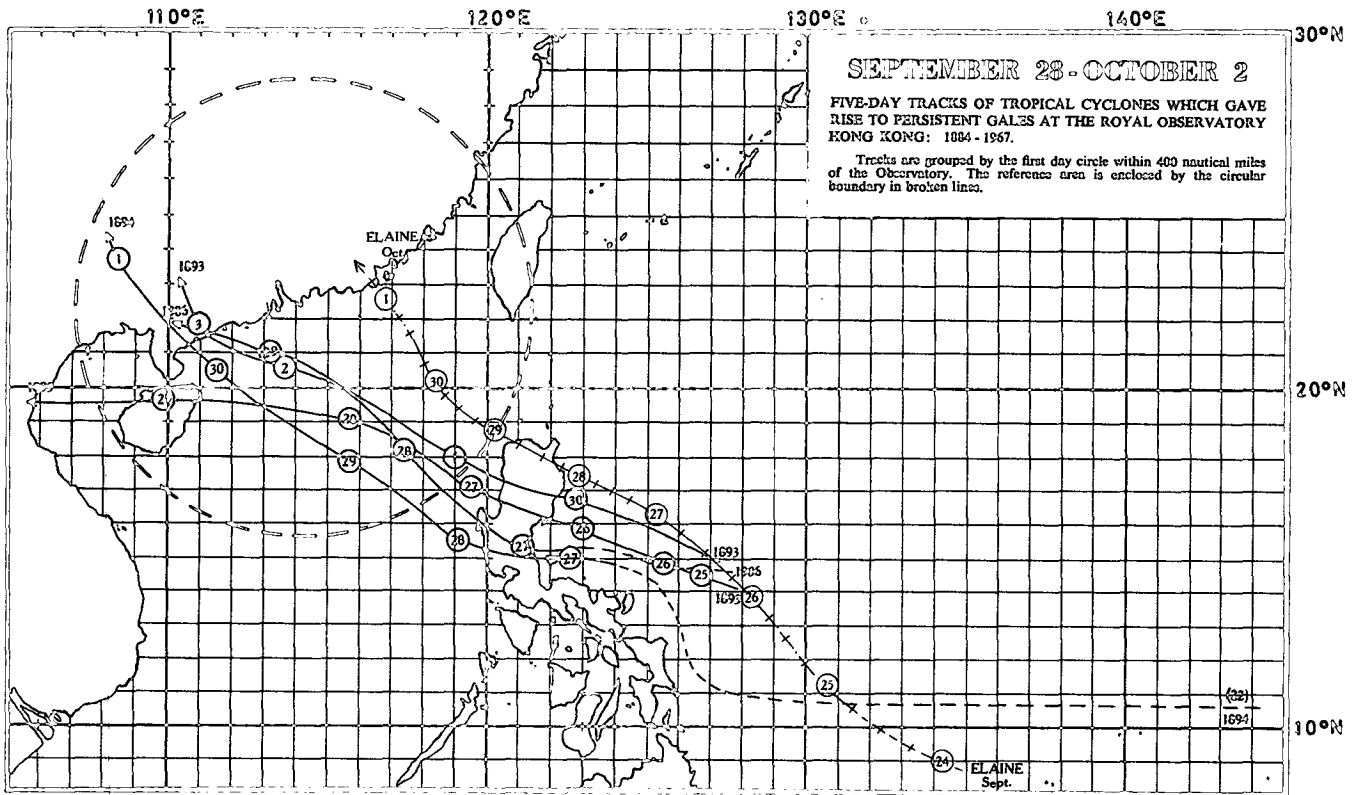


Figure 25. Track of Typhoon 'Elaine': September 24 - October 1, 1968.

Figure 26. Examples of ships sunk, capsized or damaged by tropical cyclones in Hong Kong.

版權照片刊登於印刷本內，該刊物可在香港天文台資源中心查閱。

天文台資源中心網址：

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

The copyrighted photo is available in the published version. The publication can be accessed at the Hong Kong Observatory Resource Centre.

Website of the Observatory Resource Centre:

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

(a) Side view of the 'ALASKA' stranded by the Typhoon of September 23, 1874, as she was lying ashore at Aberdeen. It conveys a good notion of the size and character of some of the vessels of the Pacific Mail Steamship Company in the 19th Century.

版權照片刊登於印刷本內，該刊物可在香港天文台資源中心查閱。

天文台資源中心網址：

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

The copyrighted photo is available in the published version. The publication can be accessed at the Hong Kong Observatory Resource Centre.

Website of the Observatory Resource Centre:

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

(b) A ship sunk by the Typhoon of September 18, 1906.

版權照片刊登於印刷本內，該刊物可在香港天文台資源中心查閱。

天文台資源中心網址：

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

The copyrighted photo is available in the published version. The publication can be accessed at the Hong Kong Observatory Resource Centre.

Website of the Observatory Resource Centre:

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

(c) S.S. CRONULLA of 2,330 tons capsized near North Point by Typhoon 'WANDA' of September 1, 1962.

版權照片刊登於印刷本內，該刊物可在香港天文台資源中心查閱。

天文台資源中心網址：

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

The copyrighted photo is available in the published version. The publication can be accessed at the Hong Kong Observatory Resource Centre.

Website of the Observatory Resource Centre:

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

(d) The 'TUNG FENG' of 6,458 tons sunk off the north of Green Island by Typhoon 'WANDA' of September 1, 1962.

版權照片刊登於印刷本內，該刊物可在香港天文台資源中心查閱。

天文台資源中心網址：

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

The copyrighted photo is available in the published version. The publication can be accessed at the Hong Kong Observatory Resource Centre.

Website of the Observatory Resource Centre:

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

(e) S.S. VINKON, a 7,160 ton merchant ship, ran aground close to the railway track near Tai Po Kau during the Typhoon 'WANDA' of September 1, 1962.

版權照片刊登於印刷本內，該刊物可在香港天文台資源中心查閱。

天文台資源中心網址：

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

The copyrighted photo is available in the published version. The publication can be accessed at the Hong Kong Observatory Resource Centre.

Website of the Observatory Resource Centre:

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

(f) S.S. LA GRANDE ABETO stranded on the western end of Stonecutter's Island during Typhoon 'SHIRLEY' of August 21, 1968.
(By Courtesy of South China Morning Post).

TABLE 1

LIST OF TROPICAL CYCLONES IN THE WESTERN PACIFIC AND THE SOUTH CHINA SEA IN 1968

Name of Tropical Cyclone	Period	Beginning of Track				Ending of Track			
		First day circle	Position		Day/Time	Last day circle	Position		Day/Time
			°N	°E			°N	°E	
1 T.D. —	Feb. 28 – Mar. 1	29	10.4	129.6	280600	1	16.0	134.6	010300
2 Typhoon Jean	Apr. 6 – 16	7	5.6	156.6	060300	16	23.0	146.0	160300
3 Typhoon Kim	May 31 – June 5	1	13.9	136.7	310600	5	29.3	141.2	051500
4 Typhoon Lucy	June 28 – July 2	28	15.2	144.8	272100	2	27.9	130.6	020300
5 Typhoon Mary	July 21 – 30	21	16.4	149.0	202100	30	32.8	134.5	300900
6 Typhoon Nadine	July 21 – 28	22	17.5	129.0	210600	28	23.0	120.8	280900
7 T.S. Olive	July 24 – 26	25	17.1	112.3	240300	25	16.6	115.7	251500
8 T.S. Polly	Aug. 5 – 16	6	20.9	157.2	050300	16	41.8	134.6	170000
9 S.T.S. Rose	Aug. 9 – 13	9	16.6	127.5	082100	13	20.3	104.9	132100
10 Typhoon Shirley	Aug. 17 – 22	17	16.1	132.4	162100	22	24.9	112.2	220300
11 S.T.S. Trix	Aug. 23 – 29	24	23.2	134.0	230300	29	36.6	138.0	291500
12 Typhoon Wendy	Aug. 28 – Sept. 9	28	16.0	150.0	272100	9	20.4	107.4	090300
13 Typhoon Agnes	Aug. 31 – Sept. 10	31	17.0	160.0	302100	10	35.3	157.6	100300
14 S.T.S. Bess	Aug. 31 – Sept. 6	31	20.4	118.6	302100	6	15.6	106.5	060300
15 Typhoon Carmen	Sept. 17 – 23	17	17.4	151.4	160600	23	37.8	147.4	230900
16 Typhoon Della	Sept. 16 – 24	16	17.9	136.3	152100	24	32.4	130.7	241500
17 Typhoon Elaine	Sept. 24 – Oct. 1	24	8.8	134.9	232100	1	23.6	116.0	010900
18 T.S. Faye*	Oct. 2 – 3	3	14.8	157.6	020900	3	17.0	160.0	032100
19 Typhoon Gloria	Oct. 14 – 24	15	10.2	137.6	140300	24	31.3	138.6	241500
20 T.D. Hester	Oct. 18 – 20	18	11.8	113.3	172100	20	11.6	107.1	200300
21 Typhoon Irma	Oct. 20 – 25	21	11.4	152.3	200600	25	36.3	153.3	250300
22 Typhoon Judy	Oct. 24 – Nov. 2	25	14.2	159.3	240900	2	23.0	141.0	021500
23 Typhoon Kit	Oct. 31 – Nov. 4	31	8.0	150.7	300600	4	31.0	154.2	042100
24 Typhoon Lola	Nov. 8 – 12	8	11.6	153.9	080000	12	30.0	154.0	121500
25 Typhoon Mamie	Nov. 9 – 24	9	6.4	138.1	082100	23	11.4	107.4	232100
26 Typhoon Nina	Nov. 18 – 28	19	10.0	145.4	180600	28	9.1	106.6	280300
27 Typhoon Ora	Nov. 21 – 30	22	9.7	151.7	211800	30	17.4	117.8	300300

N.B. (1) Times are given in hours G.M.T.

(2) * 'Faye' became a typhoon after passing out of chart area.

TABLE 2

NON-LOCAL TROPICAL CYCLONE WARNINGS ISSUED IN 1968

Tropical Cyclone	No. of Warnings Issued	Period of Validity				Duration of Warnings (h)
		First Warning		Last Warning		
		Date	Time	Date	Time	
Typhoon Nadine*	31	July 24	0000	July 29	0000	120
Tropical Storm Olive	10	July 24	0600	July 26	0600	48
Severe Tropical Storm Rose*	22	Aug. 10	0000	Aug. 13	1200	84
Tropical Storm Polly	8	Aug. 14	0300	Aug. 15	1200	33
Typhoon Shirley*	23	Aug. 18	1800	Aug. 22	0000	78
Severe Tropical Storm Bess*	37	Aug. 31	0600	Sept. 6	0000	138
Typhoon Wendy*	32	Sept. 3	1800	Sept. 8	1200	114
Typhoon Elaine*	31	Sept. 27	0300	Oct. 1	1500	108
Tropical Storm Hester	14	Oct. 18	0000	Oct. 20	0000	48
Typhoon Mamie	14	Nov. 20	1800	Nov. 24	0000	78
Typhoon Nina	7	Nov. 23	1800	Nov. 25	0600	36
Typhoon Ora	9	Nov. 28	1800	Nov. 30	1200	42
Total	238					927

N.B. (1) Times are given in hours G.M.T.

(2) * Tropical cyclones for which local storm warning signals were hoisted.

TABLE 3

LOCAL STORM WARNING SIGNALS HOISTED AND NUMBER OF LOCAL WARNING BULLETINS ISSUED IN 1968

SUMMARY

Signal	No. of Occasions	Total Duration†
1	7	82: 50
3	7	183: 55
5	Nil	— —
6	1	5: 40
7	1	8: 40
8	Nil	— —
9	1	1: 30
10	1	7: 35

DETAILS

Tropical Cyclone	No. of Local Warning Bulletins Issued	Signal	Hoisted		Lowered	
			Date	Time	Date	Time
Typhoon Nadine	23	1	July 26	0840	July 26	1515
		3	July 26	1515	July 27	1000
		1	July 27	1000	July 28	1630
Severe Tropical Storm Rose	11	1	Aug. 11	0645	Aug. 11	1545
		3	Aug. 11	1545	Aug. 12	0750
Typhoon Shirley	42	1	Aug. 20	0510	Aug. 20	1715
		3	Aug. 20	1715	Aug. 21	0500
		7	Aug. 21	0500	Aug. 21	1340
		9	Aug. 21	1340	Aug. 21	1510
		10	Aug. 21	1510	Aug. 21	2245
		6	Aug. 21	2245	Aug. 22	0425
Severe Tropical Storm Bess	32	3	Aug. 22	0425	Aug. 22	1110
		1	Aug. 31	1700	Aug. 31	2130
		3	Aug. 31	2130	Sept. 3	2115
Typhoon Wendy	12	1	Sept. 7	1400	Sept. 7	2150
		3	Sept. 7	2150	Sept. 8	1425
Typhoon Elaine	28	1	Sept. 29	0625	Sept. 29	1845
		3	Sept. 29	1845	Oct. 1	1300

† Hours: Minutes.

TABLE 4

NUMBER OF OCCASIONS LOCAL STORM SIGNALS HOISTED: 1946 - 1968

SIGNAL No. YEAR	1	3 ^o	5	6	7	8	9	10	Total
1946	7	—	1	0	1	2	1	1	13
1947	6	—	1	0	1	0	0	0	8
1948	5	—	1	1	3	2	0	0	12
1949	4	—	0	0	1	1	1	0	7
1950	2	—	0	0	1	1	1	0	5
1951	4	—	0	0	2	3	1	0	10
1952	2	—	0	0	1	1	0	0	4
1953	2	—	1	1	2	1	1	0	8
1954	5	—	0	0	3	2	2	0	12
1955	0	—	0	0	0	0	0	0	0
1956	5	4	0	0	0	0	0	0	9
1957	4	9	1	1	2	2	0	1	20
1958	4	5	0	0	1	0	0	0	10
1959	1	1	0	0	0	0	0	0	2
1960	11	7	0	2	2	2	1	1	26
1961	6	7	1	2	1	0	1	1	19
1962	4	3	0	1	1	0	1	1	11
1963	4	5	0	0	1	0	0	0	10
1964	11	14	1	3	5	3	3	2	42
1965	7	6	0	0	1	1	0	0	15
1966	6	5	0	0	2	2	0	0	15
1967	8	6	0	0	2	1	0	0	17
1968	7	7	0	1	1	0	1	1	18
Total	115	79	7	12	34	24	14	8	193
Mean	5.0	6.1	0.3	0.5	1.5	1.0	0.6	0.3	12.7

* Local Storm Signal No. 3 was introduced in 1956.

TABLE 5

Year	Number of Tropical Cyclones in Hong Kong's Area of Responsibility**	Number of Tropical Cyclones Necessitating the Display of Local Signals	Total Duration of Local Signal Display (h)
1956	23	5	191
1957	12	6	296
1958	14	5	214
1959	19	2	37
1960	20	9	433
1961	22	6	193
1962	16	4	158
1963	13	4	176
1964	25	10	570
1965	16	6	240
1966	16	6	285
1967	16	8	339
1968	12	6	290
Mean	17	6	263

** 10°N - 30°N, 105°E - 125°E.

TABLE 6

DURATION OF DISPLAY OF LOCAL STORM SIGNALS: 1946 - 1968

Signal	Duration			
	Mean	Maximum	Minimum	Mean per year
1	16:54†	102:10	1:20	84:31
3*	21:06	71:45	1:00	128:11
5	8:22	13:00	3:00	2:33
6	6:02	11:10	3:00	3:09
7	12:10	35:35	2:15	18:00
8	7:24	17:20	0:20	7:43
5 - 8	9:23	35:35	0:20	31:24
9	3:38	6:15	1:10	2:13
10	6:31	9:10	2:30	2:16

* 1956 - 1968.

† Hours:Minutes.

TABLE 7

CASUALTIES AND DAMAGE CAUSED BY TROPICAL CYCLONES IN HONG KONG: 1937 - 1968

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.

TABLE 8

SHIPS SUNK, DAMAGED, GROUNDED, ETC., BY VARIOUS TROPICAL CYCLONES
IN HONG KONG: 1960 - 1968

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.
	Typhoon Mary	U.S. Aircraft Carrier	Gin Drinker's Bay		
1961	Typhoon Alice	S.S. Adri XI	At Stonecutters Island	Aground	
1962	Typhoon Wanda	S.S. Cronulla	In Victoria Harbour near North Point	Capsized	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. Lian Hin	North of Stonecutters Island	Hard aground	
		S.S. Tung Feng	North of Green Island	Sunk	
		S.S. Yeni Meserret	In Victoria Harbour	Stranded	
		S.S. Vinkon	At Tai Po near the railway	Aground	
		S.S. Crescent	In Tolo Harbour	Stranded	
		S.S. Ocean Ventura	In Tolo Harbour	Aground	
		S.S. Bogola	In Tolo Harbour	Stranded	
S.S. Haijye	On Harbour Island, Tolo Harbour	Aground			
1964	Typhoon Viola	S.S. Saint George	At Stonecutters Island	Aground	
		S.S. Irene X	At Ping Chau	Aground	
		S.S. Gloria	Kellett Bank	Anchored off	
	Typhoon Ida	S.S. Dorothy	Near Kowloon Dock	Aground	
		S.S. Ruthy Ann	At Kowloon Bay	Dragged	
		S.S. Irene X	At Victoria Harbour	Broke adrift from buoy	
		S.S. Grosvenor Explorer	In Victoria Harbour	Broke adrift from buoy	
	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	Rammed by S.S. La Grande Abeto.
		S.S. San Eduardo	Near Stonecutters Island	Collision	

N.B. Information compiled from local newspapers since 1960.

TABLE 9

TROPICAL CYCLONES CAUSING PERSISTENT GALES AT THE ROYAL OBSERVATORY

1884 - 1968

Name of Tropical Cyclone	Date and Time of Occurrence of Minimum Pressure		Maximum Mean Hourly Wind		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		
1896	July	29 2200	E/S	69		10	NNE to S/E v	976.6		
	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		

Centre recurved around
Hong Kong.
Highest hourly wind velocity.

TABLE 9—Contd.

Name of Tropical Cyclone	Date and Time of Occurrence of Minimum Pressure		Maximum Mean Hourly Wind		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		Centre passed over Cheung Chau.
	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		
1911	July	4 0300	ESE	36	63	3	ENE to SE v	996.9		Dines anemograph installed in 1911.
	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	ENF to SE/E ... v	999.1		
1917	August	13 1100	SSW	40	81	2	backed from NW b	986.6		Centre passed a few miles to N'ward.
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		
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		Centre passed a few miles to S'ward.
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		

TABLE 9—Contd.

Name of Tropical Cyclone	Date and Time of Occurrence of Minimum Pressure		Maximum Mean Hourly Wind		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		
	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		Max. gust 145 kn at North Point. Centre passed over Observatory.
	1941 June	30 1600	ENE	44	83	9	NE to E	v	977.8		
	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	
	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	
Typhoon Susan	1953 September ...	18 1800	NE	42	75	8	N to ESE	v	995.0	994.7	
Typhoon Ida	1954 August	29 1400	ENE	47	87	12	NNE to ESE	v	992.9	992.4	
Typhoon Pamela	November ...	6 1100	E	47	84	5	NNE to SE	v	997.6	997.1	
Typhoon Gloria	1957 September ...	22 1700	ENE	59	101	14	N to SE	v	986.2	984.3	
Typhoon Mary	1960 June	9 0500	SSE	50	103	19	ENE to SW	v	974.3	973.8	Centre passed over Cheung Chau.

TABLE 9—Contd.

Name of Tropical Cyclone	Date and Time of Occurrence of Minimum Pressure		Maximum Mean Hourly Wind		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.
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	Centre passed about 10 miles to S'ward. Max. gust at Tate's Cairn 154 kn.
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 SSW ...	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.