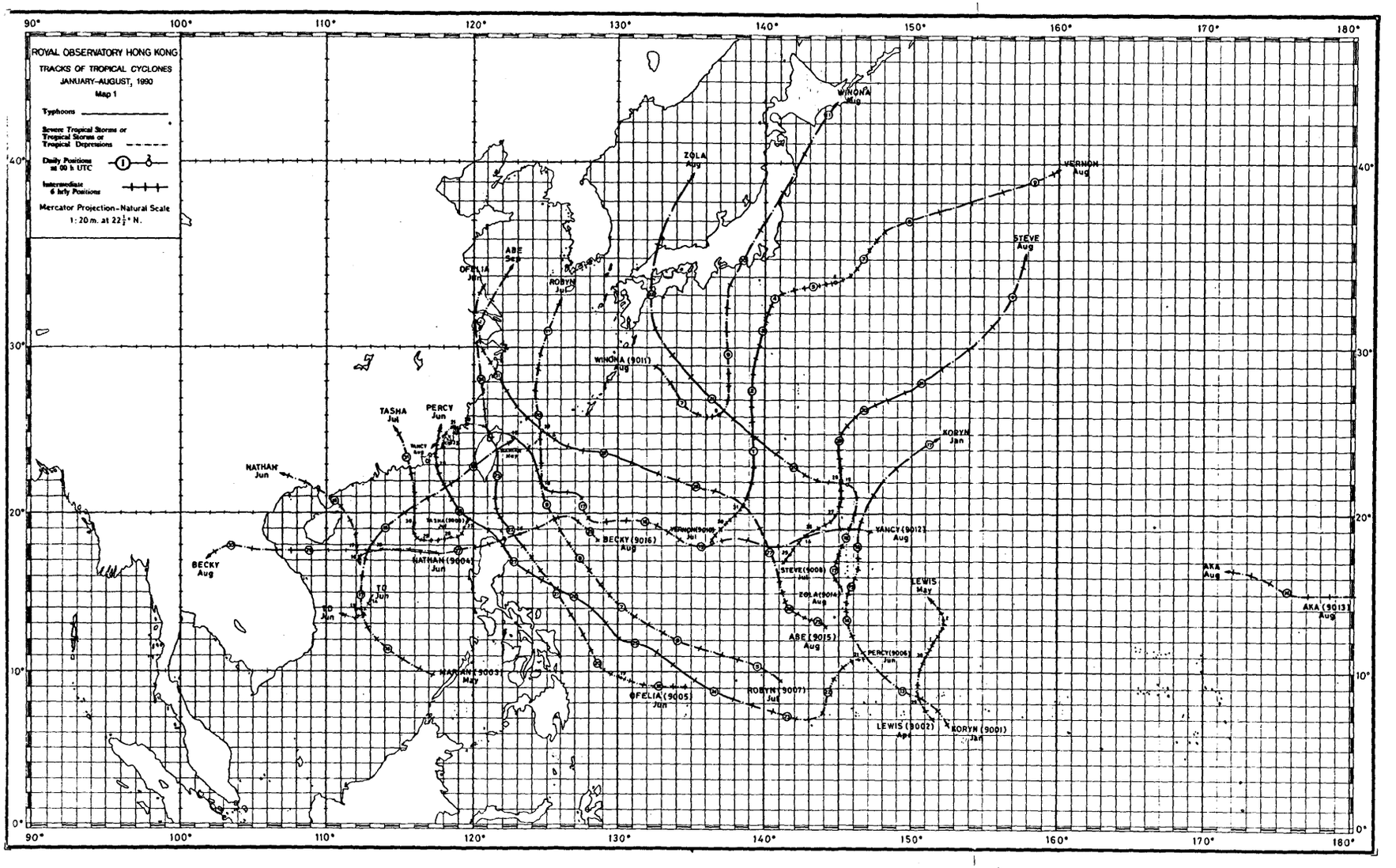
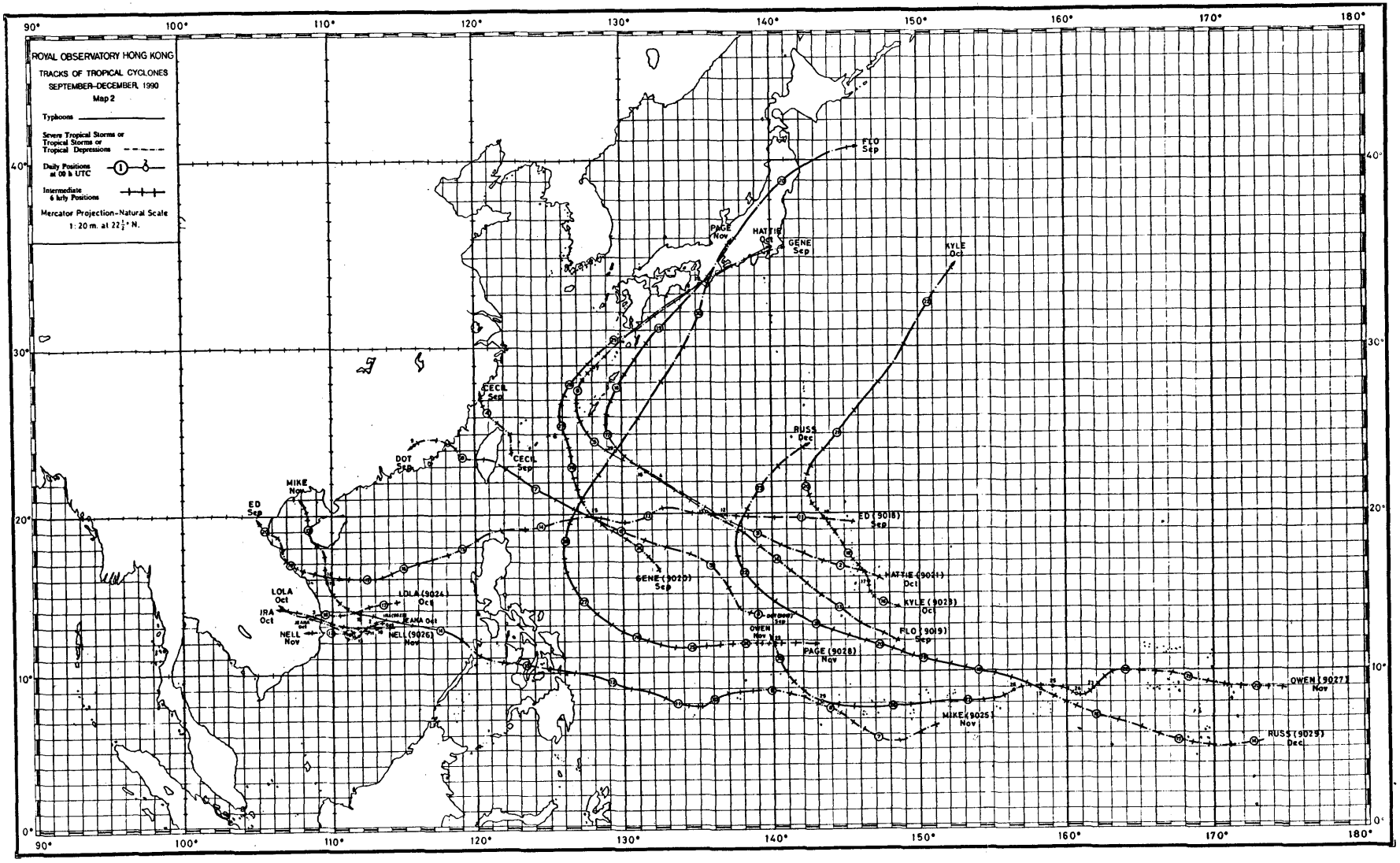

ROYAL OBSERVATORY HONG KONG
TRACKS OF TROPICAL CYCLONES
JANUARY–AUGUST, 1990
Map 1
Typhoons
Severe Tropical Storms or Tropical Storms or Tropical Depressions
Daily Positions at 00 h UTC
Intermediate 6 hrly Positions
Mercator Projection–Natural Scale
1:20 m. at 22½° N.
90°
100°
110°
120°
130°
140°
150°
160°
170°
180°
40°
30°
20°
10°
0°
WINONA Aug
ZOLA Aug
VERNON Aug
STEVE Aug
ABE Sep
OFELIA Jun
ROBYN Jul
WINONA (9011) Aug
TASHA Jul
PERCY Jun
KORYN Jan
NATHAN Jun
BECKY (9016) Aug
VERNON(9008) Jul
VANCY (9012) Aug
BECKY Aug
NATHAN (9004) Jun
STEVE(9008) Jul
ZOLA(9014) Aug
LEWIS May
AKA Aug
AKA (9013) Aug
TO Jun
ABE (9015) Aug
PERCY(9006) Jun
MARIAN(9003) May
OFELIA (9005) Jun
ROBYN (9007) Jul
LEWIS (9002) Apr
KORYN (9001) Jan


ROYAL OBSERVATORY HONG KONG
TRACKS OF TROPICAL CYCLONES
SEPTEMBER–DECEMBER, 1990
Map 2
Typhoons
Severe Tropical Storms or Tropical Storms or Tropical Depressions
Daily Positions at 00 h UTC
Intermediate 6 hrly Positions
Mercator Projection–Natural Scale
1:20 m. at 22½° N.
90°
100°
110°
120°
130°
140°
150°
160°
170°
180°
40°
30°
20°
10°
0°
FLO Sep
PAGE Nov
HATTIE Oct
GENE Sep
KYLE Oct
CECIL Sep
DOT Sep
CECIL Sep
RUSS Dec
MIKE Nov
ED Sep
ED (9018) Sep
HATTIE (9021) Oct
GENE (9022) Sep
KYLE (9023) Oct
LOLA Oct
LOLA (9024) Oct
IRA Oct
NELL Nov
NELL (9026) Nov
OWEN Nov
FLO (9019) Sep
PAGE (9028) Nov
OWEN (9027) Nov
MIKE (9025) Nov
RUSS (9029) Dec

ROYAL OBSERVATORY HONG KONG

TROPICAL CYCLONES IN 1990

Published February 1992

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FIGURES

TABLES

Hong Kong's Tropical Cyclone Warning Signals

Signal		Display		Meaning of the Signal
		Symbol	Lights	
Stand By	1		White White White	A tropical cyclone is centred within about 800 kilometres of Hong Kong and may later affect Hong Kong.
Strong Wind	3		Green White Green	Strong wind is expected or blowing in the Victoria harbour, with a sustained speed of 41–62 kilometres per hour (km/h), and gusts which may exceed 110 km/h.
NW'ly Gale or Storm	8NW		White Green Green	Gale or storm force wind is expected or blowing in the Victoria harbour, with a sustained wind speed of 63–117 km/h from the quarter indicated and gusts which may exceed 180 km/h.
SW'ly Gale or Storm	8SW		Green White White	
NE'ly Gale or Storm	8NE		Green Green White	
SE'ly Gale or Storm	8SE		White White Green	
Increasing Gale or Storm	9		Green Green Green	Gale or storm force wind is increasing or expected to increase significantly in strength.
Hurricane	10		Red Green Red	Hurricane force wind is expected or blowing, with sustained speed reaching upwards from 118 km/h and with gusts that may exceed 220 km/h.

1. INTRODUCTION

Apart from a short break during 1940-1946, surface observations of meteorological elements since 1884 have been summarized and published in the Royal Observatory's Meteorological Results. Upper-air observations began in 1947 and from then onwards the annual publication was divided into two parts, namely Part I - Surface Observations, and Part II - Upper-air Observations. The publication of Meteorological Results Part II was terminated in 1981. Upper-air data are now archived on magnetic tape. Starting from 1987, Part I was re-titled as 'Surface Observations in Hong Kong' but the format and contents remained unchanged.

During the period 1884-1939, reports on some destructive typhoons were printed as Appendices to the Meteorological Results. This practice was extended and accounts of all tropical cyclones which caused gales in Hong Kong were included in the Director's Annual Departmental Reports from 1947 until 1967 inclusive. The series 'Meteorological Results, Part III - Tropical Cyclone Summaries' was subsequently introduced. It contained information on tropical cyclones over the western North Pacific and the South China Sea. The first issue, which contained reports on tropical cyclones occurring in 1968, was published in 1971. Tropical cyclones within the area bounded by the Equator, 45°N, 100°E and 160°E were described. With reconnaissance aircraft reports (terminated from August 1987 onwards) and satellite pictures facilitating the tracking of tropical cyclones over the otherwise data-sparse ocean, the eastern boundary of the area of coverage was extended from 160°E to 180° from 1985 onwards. Starting from 1987, the series was re-titled as 'Tropical Cyclones in 19XX' but its contents remained largely the same.

Tracks of tropical cyclones in the western North Pacific and the South China Sea were published in Meteorological Results up to 1939 and in Meteorological Results, Part I from 1947 to 1967. Before 1961, only daily positions were plotted on the tracks. The time of the daily positions varied to some extent in the older publications but remained fixed at 0000 UTC after 1944. Details of the variation are given in the Royal Observatory Technical Memoir No. 11, Volume 1. From 1961 onwards, six-hourly positions are shown on the tracks of all tropical cyclones.

Provisional reports on individual tropical cyclones affecting Hong Kong have been prepared since 1960 to meet the immediate needs of the press, shipping companies and others. These reports are printed and supplied on request. Initially, reports were only written on those tropical cyclones for which gale or storm signals had been hoisted in Hong Kong. By 1968, it had become necessary to produce a report on every tropical cyclone that necessitated the hoisting of tropical cyclone warning signals.

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

A TROPICAL DEPRESSION (T.D.) has maximum sustained winds of less than 63 km/h.
A TROPICAL STORM (T.S.) has maximum sustained winds in the range 63-87 km/h.
A SEVERE TROPICAL STORM (S.T.S.) has maximum sustained winds in the range 88-117 km/h.
A TYPHOON (T.) has maximum sustained winds of 118 km/h or more.

Throughout this publication, maximum sustained surface winds when used without qualification refer to wind speeds averaged over a period of 10 minutes. Mean hourly winds were the winds averaged over a 60-minute interval ending on the hour. Daily rainfall amounts were rainfall recorded during a 24-hour period ending at midnight Hong Kong Time.

At the 13th session of the ESCAP/WMO Typhoon Committee held in December 1980, a common system for identification of tropical cyclones in the western North Pacific and the South China Sea was adopted. Since 1 January 1981, the Japan Meteorological Agency has undertaken the responsibility of assigning to each tropical cyclone of tropical storm intensity or above a common code which is composed of four digits. For example, the third tropical cyclone of tropical storm intensity or above which occurred within the region in 1990 was assigned the code '9003'. In this publication, the appropriate code immediately follows the name of the tropical cyclone in bracket, for example, Typhoon Marian (9003).

Surface wind data presented in this report were obtained from a network of anemometers operated by the Royal Observatory. Details of the stations are listed on next page:

Station	Position		Head of anemometer above M.S.L. (m)
	Latitude N	Longitude E	
Royal Observatory	22°18′	114°10′	72
Hong Kong Airport (NW)	22°19′	114°12′	14
Hong Kong Airport (SE)	22°19′	114°13′	16
Waglan Island	22°11′	114°18′	75
Tate's Cairn	22°22′	114°13′	588
Cheung Chau	22°12′	114°01′	92
King's Park	22°19′	114°10′	78
Star Ferry	22°18′	114°10′	17
Green Island	22°17′	114°07′	90
Tai O	22°15′	113°51′	90
Sha Tin*	22°24′	114°12′	16
Chek Lap Kok*	22°19′	113°56′	65
Lau Fau Shan*	22°28′	113°59′	50
Ta Kwu Ling*	22°32′	114°09′	28
Tuen Mun*	22°24′	113°58′	68
Wong Chuk Hang*	22°15′	114°10′	30
Cheung Sha Wan	22°20′	114°09′	30
Tai Po Kau*	22°27′	114°11′	28
Sai Kung*	22°23′	114°16′	41
Tai Mo Shan	22°25′	114°07′	969
Tsing Yi (Mobil Oil Co.)	22°21′	114°06′	18
Tamar	22°17′	114°10′	15

* Automatic weather station

Wind reports were also provided by Hong Kong International Terminal Ltd. at Kwai Chung. Maximum storm surges caused by tropical cyclones were measured by tide gauges installed at several locations around Hong Kong. The locations of these anemometers and tide gauges are shown in Figure 1.

Section 2 gives an overall summary of all the tropical cyclones in 1990.

The reports in Section 3 present a general description of the life history of individual tropical cyclones affecting Hong Kong in 1990. They include the following information:-

(a) the effect of the tropical cyclone on Hong Kong;
(b) the sequence of display of tropical cyclone warning signals;
(c) the maximum gust peak speeds and maximum hourly mean winds recorded in Hong Kong;
(d) the lowest barometric pressure recorded at the Royal Observatory;
(e) the daily amounts of rainfall recorded at the Royal Observatory and selected locations;
(f) the times and heights of the highest tides and maximum storm surges recorded in Hong Kong;
(g) satellite pictures and/or radar displays if applicable.

Statistics and information relating to tropical cyclones are presented in various tables in Section 4.

Six-hourly positions together with the corresponding estimated minimum central pressures and maximum sustained surface winds for individual tropical cyclones are tabulated and presented in Section 5.

In this publication, different times are used in different contexts. The official reference times are given in Co-ordinated Universal Time and labelled UTC. Times expressed as 'a.m.' or 'p.m.' or as 'morning', 'evening', etc. in the tropical cyclone narratives are in Hong Kong Time which is eight hours ahead of UTC.

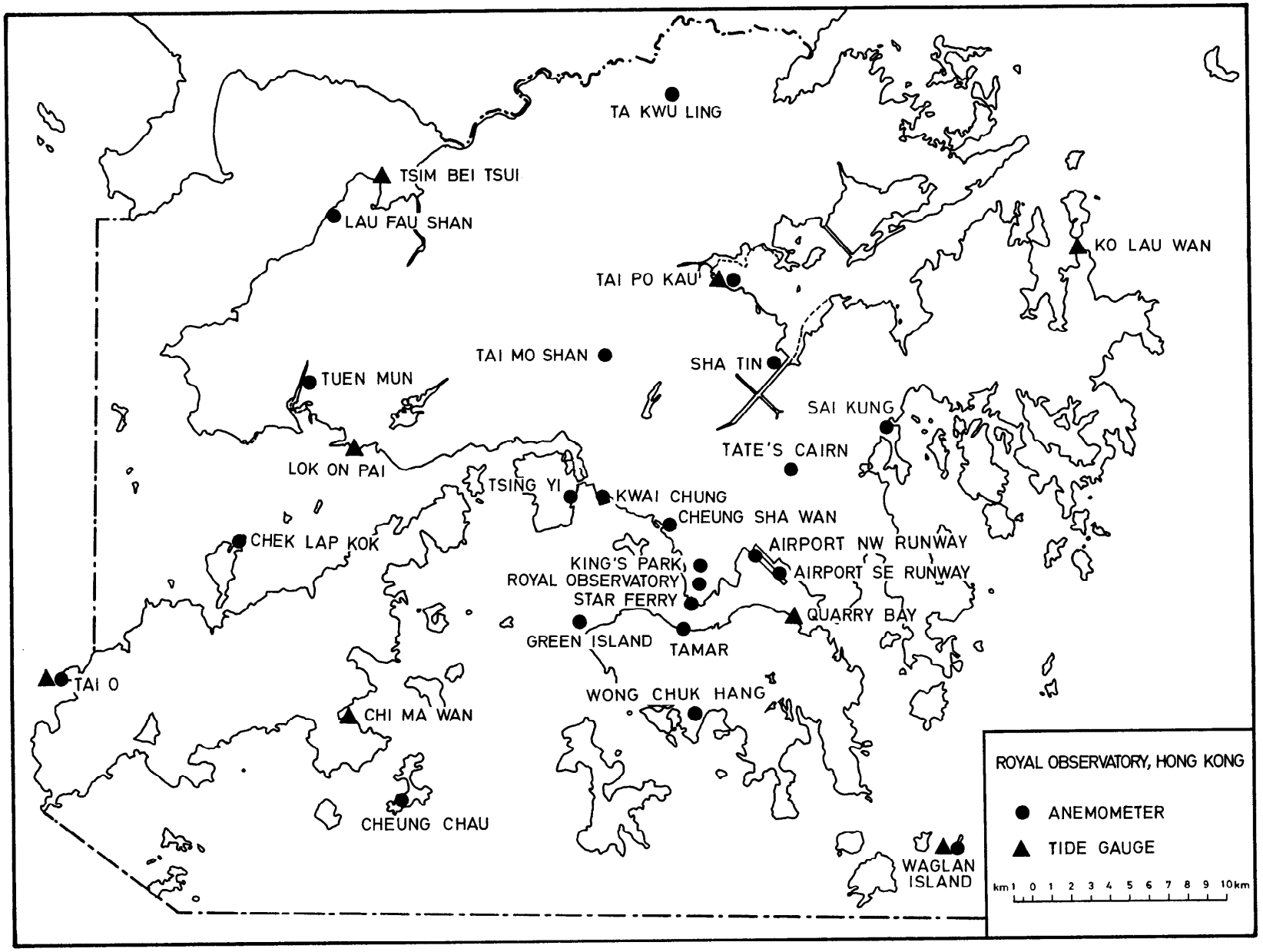

Figure 1. Locations of anemometer and tide gauge stations in Hong Kong.

2. TROPICAL CYCLONE SUMMARIES FOR 1990

In 1990, there were 32 tropical cyclones over the western North Pacific and the adjacent seas bounded by the Equator, 45°N, 100°E and 180°. As compared to the annual average (1961-1990) of 31 tropical cyclones, this means that 1990 is a year with near normal tropical cyclone activity. However, the number of tropical cyclones attaining typhoon intensity is above normal - a total of 19 typhoons in 1990 against an annual average of 16. The monthly distributions of the frequencies of first occurrence of tropical cyclones and that of typhoons for 1990 are shown in Figure 2. The monthly mean frequencies of these two parameters during the years 1961-1990 are shown in Figure 3.

Twelve tropical cyclones affected the South China Sea, of which eight developed within it. As for the rest which developed over the western North Pacific, three hit the islands of the Philippines and one went through the Balintang Channel off the coast of northern Luzon. A total of six tropical cyclones landed in Vietnam. The southern part of the country experienced a hectic time in October and November when four tropical cyclones made their passages. Only one tropical cyclone crossed Hainan Island. Similarly, western Guangdong, with only one tropical cyclone landing early in the season, had a relatively quiet year. The southeast coast of China between Hong Kong and Shanghai became the preferred landfall area where a total of seven tropical cyclones struck. Taiwan was in the paths of four tropical cyclones, of which three subsequently landed in southeastern China. Japan had a busy year as well with the visit of six tropical cyclones between August and November. Typhoon Page (9028) landed in Honshu on the last day of November, the first time Japan was hit by a tropical cyclone so late in the season.

The most intense tropical cyclones of the year were Typhoon Mike (9025) and Typhoon Page (9028). Typhoon Mike was without doubt the killer storm of 1990. It killed hundreds of people during its passage across the Philippines in November. Other major killer storms included Ofelia (9005), Tasha (9009) Yancy (9012), Abe (9015), Becky (9016), Cecil and Dot (9017). Typhoon Abe (9015), which hit eastern China in late August, was considered to be the most destructive on the basis of known material damage.

During the year, 18 tropical cyclones occurred within the area of responsibility of Hong Kong (i.e. the area bounded by 10°N, 30°N, 105°E and 125°E). This number was slightly higher than the 30-year (1961-90) annual average of 16.4. Half of the 18 tropical cyclones moved into Hong Kong's area of responsibility while the other half developed within it. Altogether, 450 warnings to ships and vessels for these storms were issued by the Royal Observatory in 1990 (see Table 2).

Tropical cyclone warning signals were displayed in Hong Kong for six tropical cyclones. Four of them necessitated the hoisting of the Strong Wind Signal No. 3, one each in the months from May to August.

The total tropical cyclone rainfall (defined as the total rainfall recorded at the Royal Observatory from the time when a tropical cyclone was centred within 600 km of Hong Kong to 72 hours after the tropical cyclone has dissipated or moved outside 600 km of Hong Kong) in 1990 amounted to 689.8 mm, which was 6 per cent below the mean annual value of 742.1 mm (1961-1990). It accounted for 34 per cent of the year's total rainfall of 2 046.9 mm. Apart from Ed (9018), all tropical cyclones that necessitated the hoisting of tropical cyclone signals came within 600 km of Hong Kong. Another two tropical cyclones, namely Yancy (9012) and Dot (9017), also came within 600 km of Hong Kong after landfall. Rainfall figures associated with these tropical cyclones are given in Table 11.

The following is an overall review of all the tropical cyclones which occurred in the western North Pacific and adjacent seas bounded by the Equator, 45°N, 100°E and 180° in 1990.

The first tropical cyclone in 1990 was named Koryn (9001). It formed as a tropical depression about 100 km southeast of Truk Island on 12 January. It moved to the northwest at first before turning west-northwestwards that evening at 23 km/h. Koryn accelerated to a speed of 38 km/h the next day and intensified to a tropical storm by the evening about 320 km southeast of Guam. It turned north and slowed down to 10 km/h on 14 January, passing about 70 km east of Guam later in the day. By then, Koryn had developed into a severe tropical storm. After reaching peak intensity, Koryn started to weaken. It became a tropical storm later on 15 January about 370 km north-northeast of Guam. On the following day, Koryn accelerated north-northeastwards before turning further to the northeast and evolving into an extratropical cyclone about 1 380 km north-northeast of Guam on 17 January.

After a break of over three months, the 1990 tropical cyclone season started in earnest with Lewis (9002) forming as a tropical depression on the evening of 28 April about 60 km southwest of Truk Island. It moved north-northwestwards at 15 km/h after formation but soon took on a north-northeastward track the next day. The movement of Lewis became hesitant on 30 April, and while still slow-moving, it reverted to a north-northwestward track on 2 May before finally dissipating about 730 km east of Guam early on 3 May.

Twelve days later, the South China Sea had its first tropical cyclone of the season. An area of disturbance originating from the Caroline Islands moved across the Philippines and developed into a tropical depression named Marian (9003) about 320 km east of Nansha on 15 May. Moving west-northwestwards at 20 km/h, it intensified to a tropical storm early on 16 May about 730 km south-southeast of Xisha and then to a severe tropical storm that evening about 450 km south of the island. Continuing to intensify, Marian attained typhoon strength about 24 hours later when it was 50 km northeast of Xisha. On the night of 17 May, Marian turned

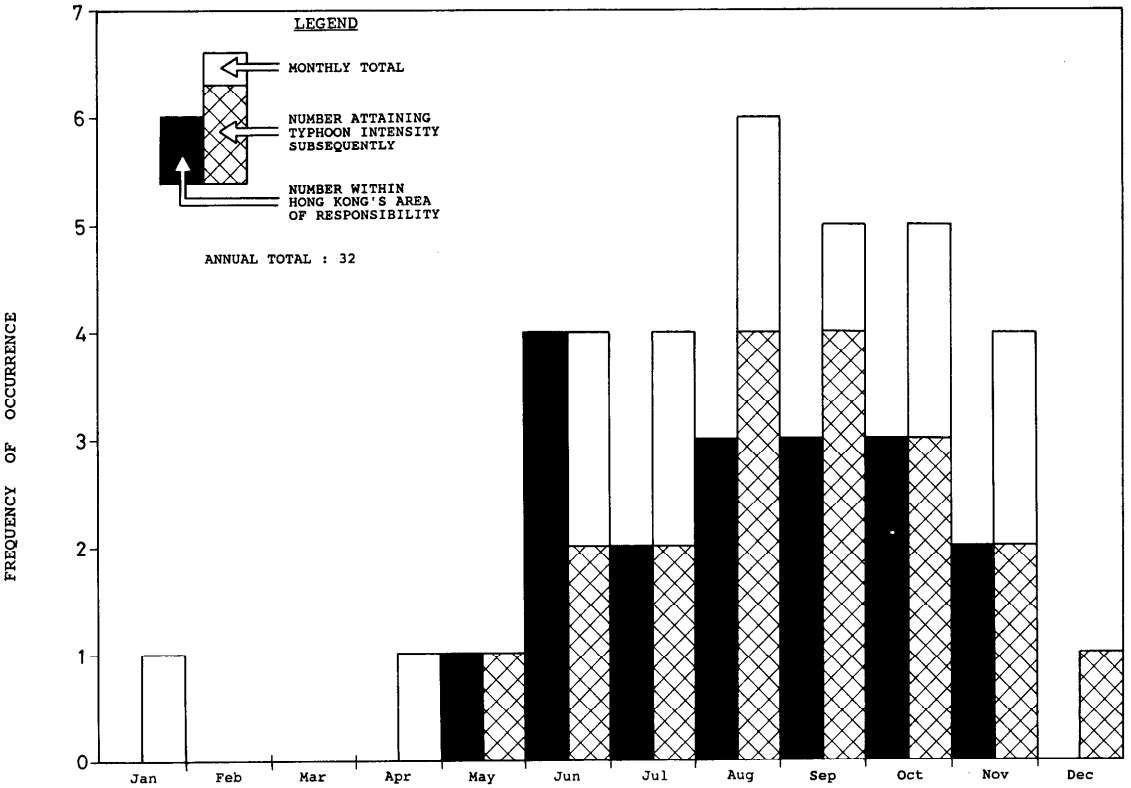

Figure 2. Monthly distributions of the frequency of first occurrence of tropical cyclones in the western North Pacific and the South China Sea in 1990.

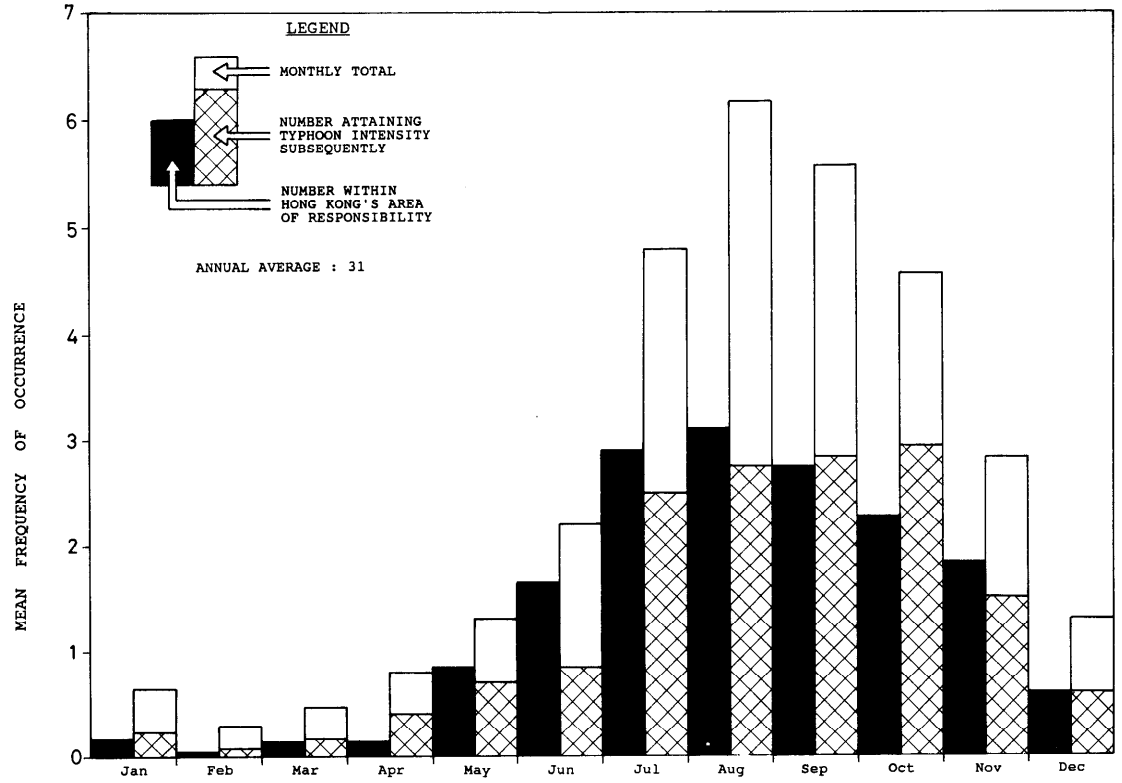

Figure 3. Monthly distributions of the mean frequency of first occurrence of tropical cyclones in the western North Pacific and the South China Sea, 1961-1990.

further to the northeast across the northern part of the South China Sea. With the intrusion of drier air from the north, it began to weaken and became a severe tropical storm about 170 km west-southwest of Dongsha on 18 May. Accelerating to a speed of 34 km/h, Marian headed towards Taiwan. It weakened to a tropical storm about 200 km west-southwest of Gaoxiong during the night and made landfall in the vicinity of Tainan the next morning. After killing two people on the island, Marian completed its crossing of Taiwan in the afternoon. By then the terrain effect had weakened the storm further. Despite moving over open waters again, Marian degenerated into a tropical depression about 120 km southeast of Taibei. It tracked northeastwards for a while before becoming an extratropical cyclone later in the day on 19 May.

A tropical depression developed over the South China Sea about 530 km east-southeast of Danang on 14 June and moved slowly southwestwards at 7 km/h. After doing a loop, it started to move westwards on 15 June. With another tropical cyclone, Nathan, strengthening in its vicinity, the tropical depression soon lost its identity and dissipated about 430 km southeast of Danang early next morning.

Nathan (9004) formed as a tropical depression over the South China Sea about 350 km south-southeast of Dongsha on 15 June and moved rapidly westwards. It intensified to a tropical storm about 50 km north of Xisha the next day but slowed down significantly. After completing an anti-clockwise loop, it tracked north-northwestwards and intensified to a severe tropical storm about 120 km north-northwest of Xisha on 17 June. Nathan turned increasingly to the northwest that night and weakened to a tropical storm about 110 km southeast of Zhanjiang early on 18 June. It hit Leizhou Peninsula during the day and ploughed into Guangxi. Nathan weakened to a tropical depression in the evening and dissipated during the night. During the passage of Nathan, there were 10 people killed in Guangdong, two reported missing in Macau, and six were found dead or missing in Hong Kong.

While Nathan was approaching the Leizhou Peninsula, Ofelia (9005) formed as a tropical depression over the Caroline Islands about 390 km west of Yap on the evening of 17 June. It moved westwards and intensified to a tropical storm about 700 km west of Yap the next day. Moving slowly on 19 June, Ofelia turned northwestwards that night and intensified to a severe tropical storm about 940 km east-southeast of Manila the next day. Traversing the waters east of Luzon, it attained typhoon intensity early on 22 June just before it skirted past the northeastern tip of Luzon later that morning. Turning north over the Luzon Strait, it landed over the east coast of Taiwan on 23 June. From this point onwards, Ofelia began to weaken. After crossing the northern part of the island, Ofelia hit the coast of southern Zhejiang early on 24 June as a severe tropical storm and moved into Jiangsu Province later that day as a tropical storm. It became an extratropical low as it moved towards the Yellow Sea early on 25 June.

The circulation of Ofelia was rather extensive. Although it did not hit the Philippines directly, heavy rain associated with Ofelia caused flooding and landslides in northern Luzon where 173 houses were ruined or damaged. At least 40 people were killed and more than 85 000 people had to flee their homes.

Torrential rain also ravaged Taiwan where 12 people were killed and 25 others were missing. In some places, water levels rose to over one metre high. Over 200 houses were destroyed or damaged and about 8 500 hectares of rice paddies and vegetables were inundated. Roads and highways were blocked by landslides and floods. The agricultural loss amounted to more than NT$2,550 million. In the harbour of Hualian, a 10 900-tonne freighter, 'Cahaya', broke into three sections while a 7000-tonne freighter, 'Juliana', ran aground.

In Wenzhou, about 21 000 hectares of farmland were inundated and over 800 hectares of shrimp ponds were flooded. Houses damaged totalled 215. The direct loss was estimated at about 205 million RMB. In Zhejiang, 15 people were killed and 21 people were injured. About 3 700 houses collapsed and 1 696 boats capsized. In the neighbouring province of Fujian, 15 people were killed and 9 044 houses were destroyed. About 91 000 hectares of farmland were inundated. The direct loss was estimated at 338 million RMB.

While Ofelia was intensifying to the east of the Philippines, another tropical disturbance developed into Tropical Depression Percy (9006) over the western North Pacific about 340 km southeast of Guam early on 21 June. It moved southwestwards and then south-southwestwards as it continued to intensify, becoming a severe tropical storm about 680 km south of Guam on 22 June. It then turned west-northwestwards and became a typhoon while passing 120 km south-southwest of Yap early on 24 June. Percy struck the east coast of northern Luzon three days later and moved into the northeastern part of the South China Sea on a northwestward track. It weakened to a severe tropical storm before making landfall about 120 km southwest of Xiamen on 29 June. It continued to weaken rapidly further inland and finally dissiapted over Fujian the next day. Severe damage was incurred in southeastern China. The total number of deaths in the Philippines, China and Hong Kong as a result of Percy was at least 18.

Robyn (9007) formed as a tropical depression early on 5 July about 320 km east of Yap. Despite having an extensive circulation, Robyn intensified rather slowly and took four days to attain tropical storm strength. During that time, it moved west-northwestwards at 27 km/h towards the Philippines before turning northwestwards on 7 July. After becoming a tropical storm about 770 km south-southwest of Okinawa, Robyn started to track north at 20 km/h towards the Ryukyu Islands on 9 July. Its outermost rainband affected Taiwan as it traversed the waters off the east coast of the island. Over the East China Sea, Robyn started to turn north-northeastwards. It weakened to a tropical depression about 340 km east of Shanghai on the morning of 11 July and evolved into an extratropical low later that day.

Almost two weeks later, Steve (9008) formed as a tropical depression about 550 km northwest of Guam late on 24 July. It moved northeastwards at 7 km/h across the western North Pacific and intensified to a tropical storm 690 km south-southeast of Iwo Jima early on 26 July. Rapid intensification continued as Steve became a typhoon about 600 km southeast of Iwo Jima by the afternoon of 27 July. It started to track northwards at 10 km/h that night but then reverted to a northeastward course on 29 July. Over the next couple of days, Steve accelerated towards the central North Pacific, weakening to a severe tropical storm about 1 460 km east-southeast of Tokyo on the evening of 31 July. It became an extratropical cyclone the next day about 1 620 km east of Tokyo.

Tasha (9009), a contemporary of Steve, formed as a tropical depression to the west of Luzon Strait about 320 km east-southeast of Dongsha on 27 July. Over the next couple of days, it drifted first southwards and then westwards over the northeastern part of the South China Sea. During that period, Tasha slowly gathered strength and eventually attained severe tropical storm intensity about 250 km south-southwest of Dongsha. On 30 July, Tasha accelerated northwards and landed early next morning over eastern Guangdong. Over land, it weakened progressivley into an area of low pressure. Over one hundred people were killed in Guangdong and Fujian and severe damage was incurred.

Sandwiched between Steve and Tasha, Vernon (9010) was the third tropical cyclone which flourished near the end of July. It formed as a tropical depression over the western North Pacific about 880 km southwest of Iwo Jima on 29 July. Moving slowly northeastwards at 12 km/h for the first two days, it intensified steadily and became a typhoon during the day on 31 July when it was 500 km south-southwest of Iwo Jima. Vernon then turned increasingly to the north and accelerated. Moving at a speed of about 16 km/h, it tracked more to the north-northeast on 2 August before slowing down again the next day. From the morning of 4 August to the evening of 6 August, Vernon moved slowly east-northeastwards, weakening all the time and becoming a tropical storm by the end of the period when it was 570 km east-southeast of Tokyo. It turned to the northeast on the night of 6 August but soon reverted to a course towards the east-northeast early on 8 August. Vernon then started to move swiftly away towards the central North Pacific. It became extratropical on 9 August about 1 870 km east-northeast of Tokyo.

With Steve gone and Vernon on the way out, the remnant of Tasha cut across southeastern China and moved into the East China Sea in early August. With renewed convection, it skirted past the southern tip of Kyushu on the morning of 6 August, turned southeastwards and developed into Tropical Depression Winona (9011) about 350 km south-southeast of Kagoshima that evening. On 7 and 8 August, Winona moved to the east and then the north. During that time, it intensified to a severe tropical storm about 900 km south-southwest of Tokyo. Taking on a north-northeastward track on the night of 9 August, Winona hit the south coast of Honshu the next morning and brought some damage to Japan. It accelerated across eastern Honshu, weakened to a tropical storm on the evening of 10 August about 330 km north-northeast of Tokyo, and evolved into an extratropical cyclone as it approached the northeastern part of Hokkaido on 11 August.

Twelve people were injured during the passage of Winona across Japan. In central Japan, heavy rain associated with Winona triggered off 43 cases of landslides and caused flooding in many places. Thirteen houses were damaged and about 700 others were flooded. Two bridges were washed away and 18 roads were rendered impassable. More than 10 domestic flights were cancelled and railway transportation was also interrupted.

Tropical Storm Aka (9013), originated from the central North Pacific, moved westwards across the International Date Line late during the day on 13 August and soon weakened to a tropical depression about 1 340 km east-southeast of Wake Island. It briefly re-gained tropical storm intensity that night when it was located 1 200 km east-southeast of Wake Island. Downgraded again to a tropical depression the next morning, Aka tracked to the west-northwest for a while before reverting back to a westward course later in the day. It finally dissipated early in the morning on 15 August about 640 km east-southeast of Wake Island.

A few hours after Aka crossed the International Date Line, Yancy (9012) formed near the Mariana Islands about 650 km north-northeast of Guam. Oscillating along a west to west-northwestward track, Yancy grew into a massive storm and acquired typhoon intensity about 750 km southeast of Taibei on 17 August. It tracked more to the northwest on 18 August before it made a westward turn towards northern Taiwan the next day. It made a loop over the island before crossing the Taiwan Strait that night and weakened to a severe tropical storm. Yancy landed over Fujian Province about 150 km northeast of Xiamen on the morning of 20 August. Over the next couple of days, it rolled along the coast of Fujian towards Guangdong as it gradually weakened to a tropical depression. It finally dissipated over eastern Guangdong early on 23 August.

In the Philippines, two ships capsized in rough seas whipped up by the extensive circulation of Yancy. Altogether, six people were killed, four were reported missing and eight were injured in the two accidents.

In Taiwan, 13 people were killed, seven were reported missing and 14 were injured. Floods washed away 3 000 hectares of rice, vegetable and fruit plantation. One house collapsed and seven were damaged. Many roads and railways were blocked due to floods and landslides. Hundreds of trees were uprooted. In Taibei, about 525 000 families were blacked out. In Chilung harbour, one fishing vessel capsized and a 31 600-tonne ship, 'Livi', went aground. The total loss in Taiwan due to Yancy was estimated at NT$2,700 million.

In Fujian where Yancy hovered for days before its dissipation, 161 people were killed and 468 were injured. More than 40 000 houses were destroyed or damaged. About 171 300 hectares of farmland were inundated and 157 boats were swept away. Other damage included 447 bridges, 20 000 sites of irrigation works and 237 km of communication lines. The total damage due to Yancy was estimated at 900 million RMB.

In the neighbouring province of Zhejiang, 96 people were killed, 63 were reported missing and more than 400 were injured. About 20 700 houses were damaged and 7 800 heads of livestock were killed. The financial damage was estimated at 450 million RMB. Wenzhou was the hardest hit place with extensive flooding over an area of about 99 000 hectares.

In eastern Guangdong, heavy rain associated with Yancy killed eight people and wounded 37 others. Over 4 800 houses collapsed and about 89 000 hectares of farmland were inundated.

While Yancy was gathering strength to the southeast of the Ryukyus, Zola (9014) developed as a tropical depression about 220 km north of Guam on 16 August and moved slowly north-northwestwards initially. It turned north-northeastwards the next day and crossed the northern part of the Mariana Islands on the morning of 18 August. By then, Zola had intensified to a severe tropical storm about 560 km north of Guam. It tracked westwards on 19 August but then accelerated northwestwards over the next couple of days, during which time it developed further into a typhoon about 140 km south-southwest of Iwo Jima. Weakening to a severe tropical storm and turning northwards early on 22 August, Zola passed between Kyushu and Shikoku and swept across western Honshu during the day. Over the Sea of Japan, Zola weakened to a tropical storm 490 km north of Osaka that evening and became an extratropical low during the night. During the passage of Zola, three people were killed in Japan and 22 others were injured. Houses flooded totalled 180. More than 250 flights were cancelled due to adverse weather.

Early on 25 August, Abe and Becky formed in quick succession over the western North Pacific - the former in the vicinity of Guam and the latter to the east of northern Luzon.

Abe (9015) formed about 110 km southwest of Guam and moved west-northwestwards initially. It turned north-northwestwards on 26 August and intensified to a tropical storm about 400 km west-northwest of Guam. Abe became a severe tropical storm early on 28 August as it took on a west-northwestward track. It intensified further to a typhoon about 660 km southeast of Okinawa that evening. By 30 August, it had crossed the Ryukyu Islands and entered the East China Sea. Moving more to the northwest, Abe landed over Zhejiang Province about 270 km south of Shanghai on the morning of 31 August. It weakened progressively to a tropical storm before recurving across Jiangsu Province and the Yellow Sea where extratropical transition took place on the night of 1 September.

In Taiwan, one person was killed during the passage of Abe across the East China Sea and three others were injured. Heavy rain associated with Abe caused floods and triggered off landslides on the island. Electricity supply to about 70 000 households was cut off. Heavy rain associated with Abe also led to unspecified losses in the Philippines.

In Zhejiang where Abe made landfall, 65 people were killed, 40 were reported missing and 839 others were injured. Over 373 000 hectares of farmland were flooded and about 660 000 people were stranded by floods. More than 21 800 houses collapsed and 41 000 people were made homeless. At the seaside, more than 1 000 boats sank. The total direct economic loss amounted to 1 800 million RMB. In the neighbouring province of Jiangsu where Abe made its way out to sea, at least 23 people were killed and hundreds were injured. About 80 000 houses were destroyed and 120 000 houses were damaged. Moreover, 1.34 million hectares of rice and cotton fields were devastated by flood. In Shanghai, three people were killed and another 46 people were injured. A tornado was also spawned in the suburban area.

Becky (9016) formed about 910 km east-northeast of Manila early on 25 August and moved northwestwards at about 13 km/h initially. It intensified to a tropical storm that afternoon about 860 km northeast of Manila and turned west-southwestwards. After crossing Luzon as a severe tropical storm, Becky adopted a steady westward track across the South China Sea and intensified to a typhoon about 350 km south-southeast of Dongsha on 27 August. It passed to the south of Hainan Island on the night of 28 August and landed the following evening over northern Vietnam as a severe tropical storm about 250 km northwest of Danang. Becky weakened further to a tropical depression as it went past Vientiane on 30 August. It finally dissipated over northern Thailand later that day. The number of deaths in the Philippines and Vietnam exceeded 100. Two ships vanished in the high seas near Hainan.

Another two tropical cyclones developed in quick succession on 3 and 4 September. One was a short-lived storm named Cecil which formed off the east coast of Taiwan on the afternoon of 3 September. It moved round the northern tip of the island at 20 km/h and briefly attained tropical storm intensity early on 4 September about 70 km north of Taibei. Cecil weakened to a tropical depression just before landfall about 380 km northeast of Xiamen that night and soon dissipated as it pushed northwards over land. Torrential rain affected southern Zhejiang. The deluge led to local landslide and debris flow. In Wenzhou, 43 people were killed, 42 were reported missing and 135 others were injured. About 2 700 homes were destroyed and 13 000 hectares of farmland were inundated.

The other tropical cyclone which formed round that time was Dot (9017). Genesis took place to the west of the Mariana Islands and on the morning of 4 September Dot developed into a tropical depression. Moving northwestwards and then west-northwestwards, Dot intensified to a tropical storm that evening about 770 km west of Guam and to a severe tropical storm about 1 400 km east-southeast of Taibei a day later. Dot attained typhoon intensity about 910 km southeast of Taibei on 6 September. While crossing Taiwan on the night of 7 September, Dot weakened to a severe tropical storm and traversed the Taiwan Strait the next day. Dot landed over southeastern China near Xiamen and weakened to a tropical storm over land. It finally dissipated on 9 September in eastern Guangdong.

In northern Philippines, four people were killed and heavy rain associated with the large circulation of Dot triggered off landslides which buried buildings including a church, a school and a hospital. Manila was also affected by heavy rain and floods.

In Taiwan, seven people were killed and four others were reported missing. Widespread electricity failure affected 850 000 households in northern and eastern Taiwan. About 6 000 hectares of farmland were damaged. Landslides also interrupted railway and highway traffic on the island. The loss in agriculture was estimated at NT$730 million.

In Fujian where Dot made landfall, 60 people were killed, two were reported missing and at least 17 others were injured. More than 25 000 houses collapsed and 142 000 hectares of farmland were inundated. The direct loss due to Dot in Fuzhou was estimated at 200 million RMB. In the neighbouring province of Zhejiang to the north, flood water of over three metres in depth occurred in Wenzhou. One person was killed and about 26 000 hectares of farmland were inundated. From June to September, the direct loss in Wenzhou due to tropical cyclones amounted to 1 200 million RMB and the death toll was 185. To the south in Guangdong Province, rainfall associated with Dot eased the drought condition in many places. However, torrential rain in Maizhou incurred heavy damage. Eight people were killed and at least 160 others were injured. About 5 800 houses collapsed, 4 200 others were damaged and 19 500 hectares of farmland were inundated. Other damage included 34 bridges, 100 kilometres of road and some irrigation works. According to a later report, the overall death toll in China due to Dot totalled 74 and property loss was estimated at 1 020 million RMB.

Torrential rain associated with the remnant of Dot also triggered off flooding and landslip over various parts of Hong Kong.

The day after Dot dissipated over southern China, Ed (9018) developed into a tropical depression over the northern Mariana Islands about 670 km north of Guam on the evening of 10 September. For the next three days, it tracked westwards and intensified steadily to a severe tropical storm about 830 km northeast of Manila early on 14 September. Ed gradually turned west-southwestwards after entering the Balintang Channel on 14 September. It intensified further to a typhoon over the South China Sea about 380 km south of Dongsha on the evening of 15 September. Slowing down, Ed turned more to the west on 17 September. While drifting north-northwestwards over the waters off the coast of Vietnam on 19 September, Ed weakened gradually to a tropical storm. A west-northwestward turn early on 20 September took it ashore and Ed soon dissipated over land. In Vietnam, at least 10 people were killed and thousands were made homeless.

While Ed was still crossing the western North Pacific, Flo (9019) formed over the waters about 430 km east-southeast of Guam on 12 September and tracked steadily northwestwards over the next four days. During that time, it intensified steadily and attained typhoon intensity about 780 km southeast of Okinawa on the evening of 15 September. Approaching the Ryukyu Islands, it recurved on 17 September towards Japan. Accelerating on 19 September, it hit the south coast of Honshu that evening and weakened rapidly over land to a tropical storm about 240 km northeast of Osaka. Flo became an extratropical cyclone on 20 September as it moved over the waters east of northern Honshu.

Torrential rain brought by Flo triggered off 557 cases of landslides and widespread flood in Japan. Thirty-eight people were killed, 12 were reported missing and 90 others were injured. About 16 800 houses were flooded and 234 houses were destroyed. Heavy rain also washed away 31 bridges and 68 boats. About 740 hectares of rice paddy were submerged. A tornado also hit a town about 100 km north of Tokyo.

Gene (9020) formed as a tropical depression about 1 170 km south-southeast of Okinawa on the evening of 23 September. It moved northwestwards and intensified to a tropical storm the next day about 980 km south-southeast of Okinawa. Gene intensified further to a severe tropical storm on the evening of 25 September and took on a more northward track. Typhoon intensity was attained on 26 September when Gene was 380 km south-southwest of Okinawa. After crossing the Ryukyu Islands early on 27 September, Gene recurved and skirted past to the south of Kyushu and Shikoku on 29 September as it struggled to maintain typhoon intensity. Sweeping across the south coast of Honshu towards Tokyo on 30 September, Gene weakened rapidly to a tropical depression and became extratropical as it approached Tokyo.

In Japan, four people were killed, one was reported missing and 13 others were injured during the passage of Gene. Landslides triggered off by heavy rain were reported at 340 places and roads were damaged at 182 locations. About 3 800 houses were flooded. More than 200 000 people were affected by cancellation of flights and train services.

Soon after Gene rampaged through Japan, another tropical cyclone named Hattie (9021) formed east of the Mariana Islands about 370 km northeast of Guam on the evening of 1 October. Moving west-northwestwards and then northwestwards, it intensified to a severe tropical storm about 690 km northwest of Guam early on 3 October. Hattie accelerated towards the Ryukyu Islands and intensified to a typhoon about 380 km southeast of Okinawa on the evening of 4 October. Slowing down, it started to turn northwards on 5 October west of Okinawa and recurved to the northeast the next day. From then onwards, it followed the footsteps of Gene, dealing a glancing blow to Kyushu and Shikoku as a severe tropical storm before hitting the south coast of central Honshu as a tropical storm on the morning of 8 October. Moving at a high speed, Hattie became extratropical as it approached Tokyo.

In Japan, heavy rain associated with Hattie led to 68 cases of landslide. Extensive flooding affected 1 100 houses. Three people were killed, one was reported missing and 19 others were injured. In Okinawa, flights and

ferry services were suspended. All schools and government offices were closed during the passage of Hattie. In Kyushu, 136 flights and many ferry services were cancelled.

Several hours after the formation of Hattie, Ira (9022) formed as a tropical depression over the South China Sea about 650 km east-southeast of Danang early on 2 October and moved westwards. It intensified to a tropical storm that evening about 360 km south-southeast of Danang before landing over Vietnam early next day. Ira soon weakened to an area of low pressure later on 3 October. The remnant of Ira swept through Cambodia and Thailand, bringing heavy rain and severe flooding to the region. In Thailand, six people were drowned and another four were reported missing. Damage was inflicted on 418 houses, 439 roads and 21 bridges.

Another tropical cyclone developed in the South China Sea on 12 October and was named Jeana. After formation about 750 km east-southeast of Danang, it moved westwards and then west-southwestwards. Jeana moved erratically on the night of 13 October before adopting a west-northwestward track at 22 km/h towards the coast of Vietnam the next day. It made landfall about 3 10 km south-southeast of Danang towards the evening and soon dissipated over land. No damage was reported in Vietnam.

Tropical Depression Kyle (9023) formed about 390 km east of Guam early on 16 October and moved west-northwestwards. It turned north-northwestwards later that day as it intensified to a tropical storm about 270 km northeast of Guam. On 17 October, Kyle tracked northwestwards at 9 km/h and crossed the Mariana Islands that night. It continued to intensify and became a severe tropical storm about 590 km north of Guam on the evening of 18 October. It attained typhoon intensity about 280 km south-southeast of Iwo Jima on 20 October as it recurved to the northeast. Weakening to a severe tropical storm about 970 km northeast of Iwo Jima early on 22 October, Kyle tracked more to the north-northeast at a speed of 49 km/h. It degenerated further to a tropical storm later that day about 1 140 km east of Tokyo and soon evolved into an extratropical cyclone.

The third tropical cyclone to form in the South China Sea in October was Lola (9024). It formed about 700 km east-southeast of Danang early on 17 October and moved steadily west towards Vietnam. Lola intensified to a tropical storm in the afternoon about 510 km east-southeast of Danang and made landfall about 270 km south-southeast of Danang the next day. It weakened to a tropical depression soon after landfall and dissipated inland that evening. In central Vietnam, 23 people were killed and over 100 000 houses were flooded. The total damage was estimated at US$2.1 million.

One of the most ferocious storms in 1990 occurred late in the season in November. Mike (9025) began as a tropical depression over the Caroline Islands on 6 November about 1 450 km east-southeast of Yap and intensified all the way to a typhoon about 80 km southeast of Yap three days later. Following a snake-like path, Mike reached the waters east of the Philippines late on 12 November. For the next 24 hours, it rampaged across the isles of central Philippines and inflicted severe damage on the country.

Over the central Philippines, it weakened to a severe tropical storm but re-gained typhoon intensity once over the South China Sea when it was 330 km southwest of Manila. Mike proceeded to cross the South China Sea on 14 November. It weakened to a severe tropical storm about 320 km south-southwest of Xisha on 15 November and turned to the north-northwest. Mike hit the western part of Hainan Island in the early morning of 17 November and weakened to a tropical storm about 210 km west-southwest of Haikou. It drifted northwards slowly over Beibu Wan and degenerated rapidly into an area of low pressure early on 18 November.

In the Philippines, the number of dead or missing people amounted to 560. Another 855 people were injured. About 73 000 houses were destroyed and 372 300 others were damaged. Thousands of hectares of agricultural crops, including 1.9 million tons of sugar crops, were destroyed. A total of 64 ships were sunk. Cebu was the hardest hit area. The city of Cebu, with a population of more than half a million, had drinking water, telephone and electricity supply cut off for at least two days. Total loss in crops, livestock and property was estimated at UZ$20.3 million.

As Mike moved towards the Philippines, Nell (9026) developed into a tropical depression over the South China Sea about 830 km east-northeast of Ho Chi Minh City early on 10 November and moved westwards initially. Moving hesitantly, Nell intensified to a tropical storm about 660 km east-northeast of Ho Chi Minh City that afternoon. After reverting to a westward movement on 11 November, Nell hit the coast of Vietnam the next day and dissipated over land. In Vietnam, heavy rain caused flooding in low-lying areas. More than 2 000 hectares of farmland were damaged.

Owen (9027) developed as a tropical depression about 1 430 km southeast of Wake Island on the evening of 19 November. It moved westwards at 20 km/h across the Marshall Islands over the next couple of days and intensified progressively to a severe tropical storm. Typhoon intensity was attained on 22 November when Owen was 1 060 km south-southwest of Wake Island. Turning southwestwards later that day, the movement of Owen became slow and hesitant over the next two days. Storm intensity also fluctuated and Owen was downgraded to a severe tropical storm on 24 November. Owen tracked westwards at 13 km/h on 25 November but turned towards the west-southwest the next day as it re-intensified to a typhoon about 1 310 km east-southeast of Guam. Over the next two days, Owen moved westwards at an average speed of 15 km/h across the Caroline Islands. After weakening to a severe tropical storm about 440 km east of Yap on 29 November, Owen turned increasingly to the north-northwest. It degenerated further into a tropical storm the next day about 340 km northeast of Yap and dissipated rapidly over water.

As Owen intensified to a typhoon near the Marshall Islands, another disturbance further west developed into a tropical depression named Page (9028) about 580 km east-northeast of Yap on 22 November. Taking on a

westward track, it slowed down on 23 November before picking up speed again to 16 km/h the next day. During that time, it continued to intensify and became a typhoon on the evening of 24 November about 320 km northwest of Yap. Page gradually turned to the northwest on 26 November and northwards the next day. Over the waters east of Luzon, it recurved to the northeast on 28 November, moving at a speed of 30 km/h. It weakened to a severe tropical storm on the morning of 29 November about 310 km southeast of Okinawa and accelerated to a speed of 45 km/h. Turning more to the north-northeast that night, Page weakened further to a tropical storm the next day as it landed over the south coast of central Honshu about 130 km south of Osaka. It was the fourth time in three months that the same area was hit by a landfalling tropical cyclone. But unlike its predecessors, no significant damage was incurred in the case of Page. Over land, Page soon became an extratropical cyclone that evening about 240 km west of Tokyo.

The last tropical cyclone of 1990 occurred in the latter part of December. Russ (9029) developed into a tropical depression near the Marshall Islands on 14 December. Moving westwards, it intensified to a tropical storm that evening about 1 950 km east of Truk Island. From 15 to 21 December, Russ tracked west-northwestwards with varying speeds between 13 and 30 km/h. Typhoon intensity was attained on 17 December when Russ was 720 km east-northeast of Truk. Russ passed about 120 km south-southwest of Guam on the night of 20 December, leaving 88 people injured and over 2 000 houses damaged. A Korean fishing vessel sank south of the island and none of the 10 crew members on board was found. On 22 December, Russ started to recurve. Moving at a speed of 30 km/h, it weakened rapidly to a tropical storm during the day on 23 December about 220 km south-southwest of Iwo Jima and soon dissipated that night over water.

Note: Casualties and damage figures were compiled from press reports.

3. REPORTS ON TROPICAL CYCLONES AFFECTING HONG KONG IN 1990

(a) Typhoon Marian (9003)

15-19 May 1990

The track of Marian is shown in Figure 4

Marian was the first tropical cyclone to threaten Hong Kong in 1990. It originated from an area of disturbance over the Caroline Islands. Moving westwards across the southern Philippines, the disturbance developed into Tropical Depression Marian over the South China Sea about 320 km east of Nansha on 15 May.

Marian moved northwestwards at about 20 km/h and intensified to a tropical storm early on 16 May about 110 km east-northeast of Nansha. It strengthened further to a severe tropical storm about 450 km south of Xisha that evening and turned northwards. 'M.V. Fossarina', about 80 km from the centre of Marian on 17 May, reported winds exceeding 100 km/h. An eye began to form and became visible on the satellite imageries as Marian continued to intensify.

Typhoon intensity was attained after Marian passed about 30 km east of Xisha in the early evening of 17 May. During the night, Marian turned further to the northeast across the northern part of the South China Sea. With the intrusion of drier air from the north, Marian began to weaken and became a severe tropical storm about 280 km south-southeast of Hong Kong on 18 May. Accelerating to a speed of 34 km/h, Marian passed just north of Dongsha that evening and headed for Taiwan.

Marian weakened to a tropical storm about 200 km west-southwest of Gaoxiong on the night of 18 May and made landfall in the vicinity of Tainan later next morning. It completed the crossing of Taiwan in the afternoon but by then the terrain effect had weakened the storm further. Despite entering open waters again, Marian degenerated into a tropical depression about 120 km southeast of Taibei. It persisted along a northeastward track for a while before becoming an extratropical cyclone that evening.

In Taiwan, two people were swept away by waves while fishing by the seaside. Winds also blew down electricity pylons. Electricity supply to over 30 000 families was cut. Fields and fruit plantations in Tainan were also affected. The agricultural loss was estimated at NT$270 million.

In Hong Kong, the Stand By Signal No. 1 was hoisted at 3.45 p.m. on 17 May when Marian was about 680 km to the south-southwest. Winds were moderate northerly at first but they gradually increased as Marian moved closer along a northeastward track. The Strong Wind Signal No. 3 was hoisted at 5.00 a.m. on 18 May. Winds became occasionally strong offshore during the day. Marian came closest to Hong Kong at about 3 p.m. when it was about 280 km to the south-southeast. The lowest sea-level pressure of 1 004.5 hPa was recorded at the Royal Observatory two hours later. All signals were lowered at 6.15 p.m. on 18 May as Marian weakened and moved away. At that time, Marian was about 310 km southeast of Hong Kong. The maximum hourly mean winds and maximum gust peak speeds together with associated wind directions at various locations are given as follows:

Location	*Maximum hourly mean wind speed (km/h) and direction*		*Maximum gust peak speed (km/h) and direction*	
Royal Observatory	NE	19	NE	43
H.K. Airport (SE)	NNW&NE	16	NE	34
H.K. Airport (NW)	N	30	NNW	58
Waglan Island	N	52	N	67
Tate's Cairn	N	51	N	81
Cheung Chau	NNE	38	NNE	62
King's Park	NNE	19	NNE	40
Star Ferry	WNW&W	9	NNE	36
Green Island	NE	31	NNE	43
Tai O	NNE	45	NNE	63
Sha Tin	E	22	E	36
Chek Lap Kok	NNE	25	NNE&N	45
Lau Fau Shan	NE	19	ENE	31
Ta Kwu Ling	NNE	25	NNE	62
Tuen Mun	NNE	31	NNE	70
Tamar	NNE	19	N	34
Cheung Sha Wan	N	23	NNE	65
Tsing Yi	NE	20	NE	40
Kwai Chung	NNE	19	NE	41

With a compact circulation, Marian did not bring much rain to Hong Kong. The rain on 17 May was mainly associated with a trough of low pressure that moved across southeastern China. The weather remained cloudy with some light rain patches the next day as Marian came closer to Hong Kong. Fine and sunny conditions set in on 19 May as Marian moved away in the direction of Taiwan. The daily amounts of rainfall recorded at some selected locations are given as follows:

Date	*Royal Observatory*	*North Point*	*Sha Tin*	*High Island*	*Yuen Long*
	mm	mm	mm	mm	mm
17 May	16.4	20.0	12.0	6.5	0.5
18 May	2.1	2.0	0.5	2.0	3.0
19 May	Nil	Nil	Nil	Nil	Nil
Total	18.5	22.0	12.5	8.5	3.5

The times and heights of the highest tides and maximum storm surges recorded at various locations in Hong Kong during the passage of Marian are tabulated below:

Location	Highest tide above chart datum			Maximum storm surge above astronomical tide		
	Height (m)	Date	Time	Height (m)	Date	Time
Ko Lau Wan	1.95	17 May	11.53 a.m.	0.34	19 May	0.12 a.m.
Lok On Pai	1.91	17 May	2.02 p.m.	0.39	17 May	3.05 a.m.
Quarry Bay	1.94	17 May	1.55 p.m.	0.30	18 May	8.02 p.m.
Tai O	1.95	17 May	1.39 p.m.	0.26	17 May	3.08 a.m.
Tai Po Kau	1.90	18 May	3.25 p.m.	0.41	19 May	4.27 a.m.
Tsim Bei Tsui	2.05	17 May	1.51 p.m.	0.57	17 May	3.09 a.m.
Waglan Island	1.99	17 May	1.10 p.m.	0.22	18 May	5.37 p.m.

No casualties were reported in Hong Kong. Only some ferry services were suspended on 18 May due to the approach of Marian.

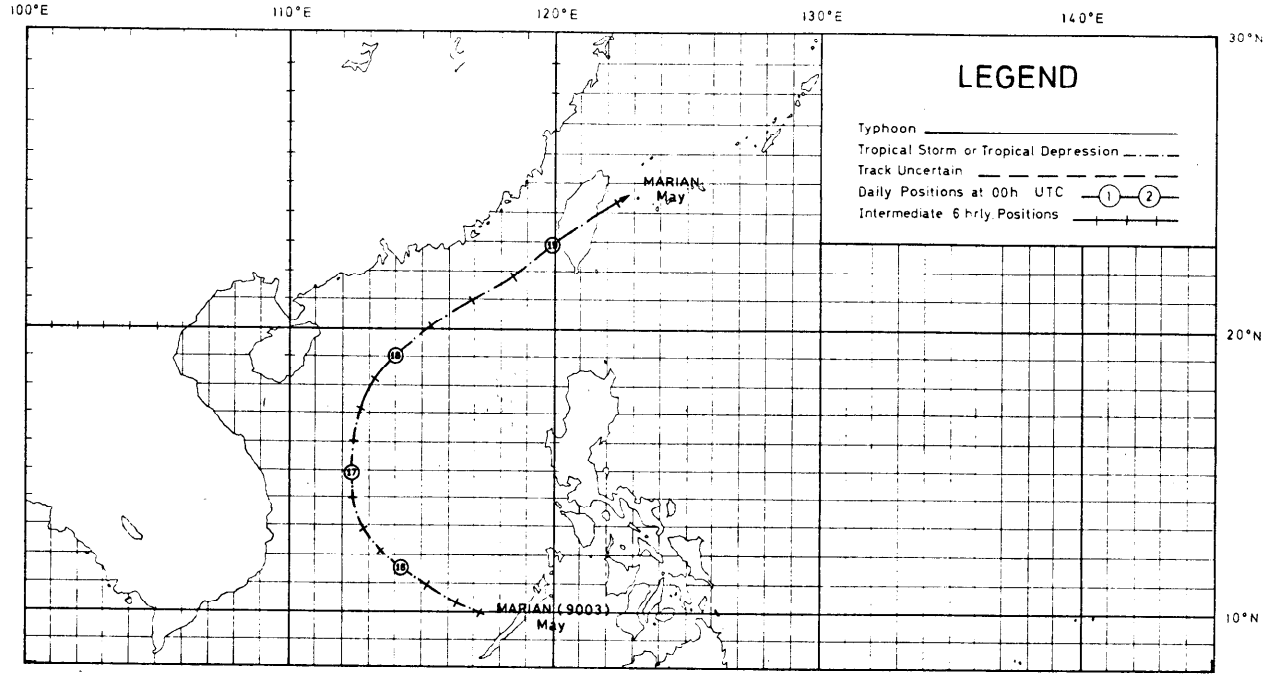

Figure 4. Track of Typhoon Marian (9003): 15-19 May 1990.

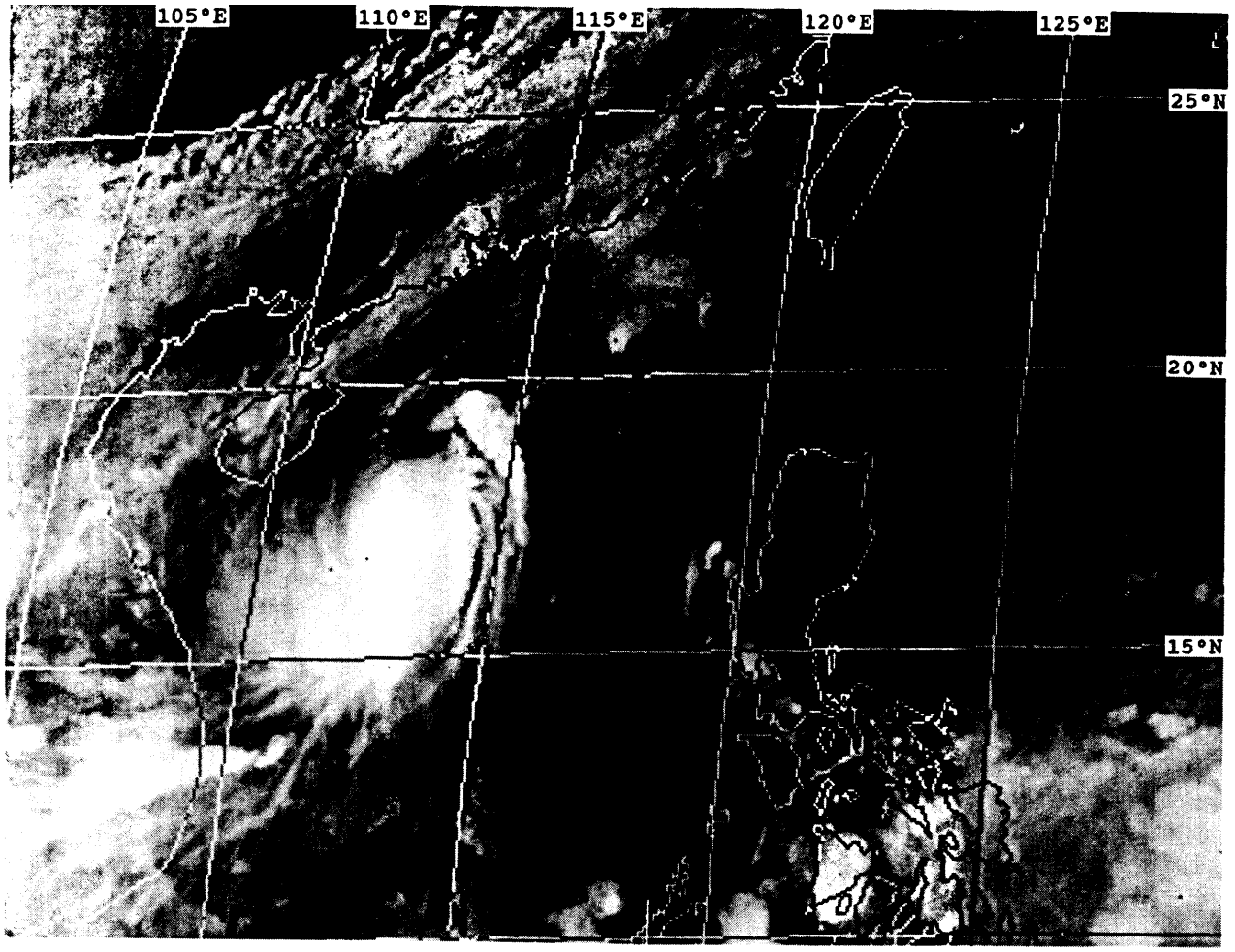

Figure 5. GMS-4 infra-red imagery of Marian (9003) around 10 p.m. on 17 May 1990, several hours after it attained typhoon intensity.

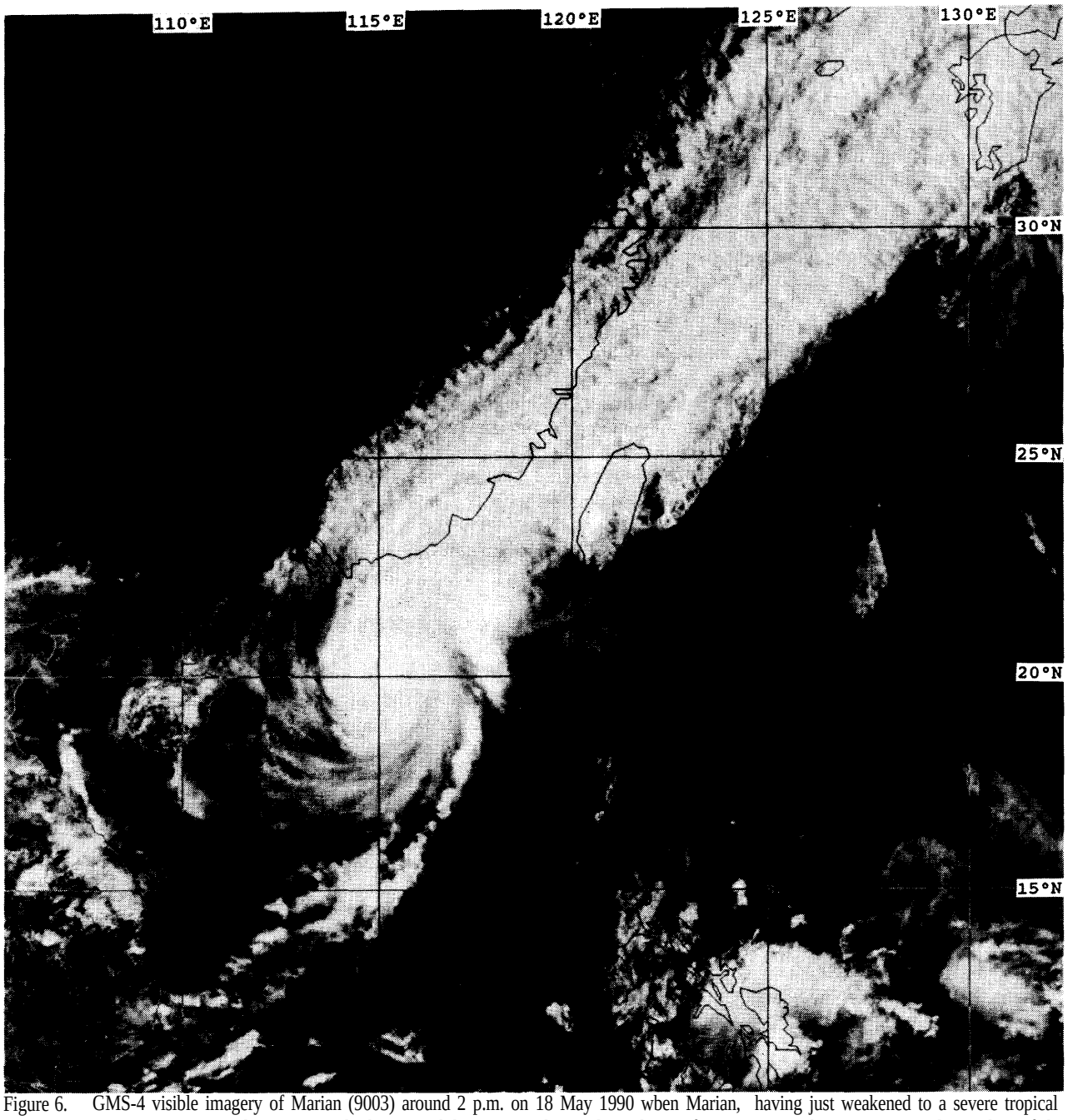

Figure 6. GMS-4 visible imagery of Marian (9003) around 2 p.m. on 18 May 1990 wben Marian, having just weakened to a severe tropical storm, was near its closest approach about 280 kilometres to the south-southeast of Hong Kong. The territory stayed just clear of the major rainbands of Marian while the weather was fine over most part of China.

(b) Severe Tropical Storm Nathan (9004)

15-19 June 1990

The track of Nathan is shown in Figure 7

An area of disturbance to the east of southern Philippines moved northwestwards and crossed Luzon early on 15 June. After entering the South China Sea, it developed into a tropical depression during the day about 350 km south-southeast of Dongsha and moved rapidly westwards at a speed of over 30 km/h.

On approaching Xisha the next day, it intensified to a tropical storm about 50 km north of the island and decelerated significantly. After making a slow loop near Xisha on 16 June, it started to move to the north-northwest that night. It intensified to a severe tropical storm named Nathan about 120 km north-northwest of Xisha and moved northwards during the day at about 14 km/h. 'M.V. Sealand Freedom' reported winds of 92 km/h that morning about 190 km southeast of the centre of Nathan. Later in the day, 'M.V. Kapitan Gotsky' reported a pressure of 985.1 hPa and winds of 94 km/h about 60 km from the storm centre.

Nathan started to turn gradually northwestwards later on 17 June and weakened to a tropical storm that night about 110 km southeast of Zhanjiang. It crossed Leizhou Peninsula on the morning of 18 June, passing about 30 km to the southwest of Zhangjiang. It moved into Guangxi that afternoon on a west-northwestward track. It weakened to a tropical depression about 110 km south-southeast of Nanning in the evening and dissipated during the night.

Disturbed weather on the periphery of Nathan exerted a rather extensive influence over the south China coastal areas. In eastern Guangdong, torrential rain associated with Nathan was responsible for 10 deaths, 14 injuries, and damage on several houses, bridges and roads. About 5 000 hectares of farmlands were inundated. In Shantou, the damage was estimated at 1.9 million RMB. Although Nathan landed over western Guandong and Guangxi, the impact there was not as severe since the storm had started to weaken. In Zhanjiang, about 100 000 hectares of paddy fields were affected.

In Macau, two men were reported missing after they were swept overboard from a dredger on the night of 17 June.

In Hong Kong, the Stand By Signal No. 1 was hoisted at 4.05 p.m. on 17 June when Severe Tropical Storm Nathan was about 440 km to the south-southwest. Winds were fresh from the east and continued to strengthen as Nathan came nearer to Hong Kong. The Strong Wind Signal No. 3 was hoisted at 10.00 p.m. Nathan came closest to Hong Kong around midnight of 17 June when it was about 390 km to the southwest. The lowest sea-level pressure of 1 000.7 hPa was recorded at the Royal Observatory earlier at 6 p.m. All signals were lowered at 10.10 a.m. on 18 June as Nathan landed over Leizhou Peninsula about 430 km west-southwest of Hong Kong. The maximum hourly mean winds and maximum gust peak speeds together with associated wind directions at various locations are given as follows:

Location	*Maximum hourly mean wind speed (km/h) and direction*		*Maximum gust peak speed (km/h) and direction*	
Royal Observatory	E	40	E	75
H.K. Airport (SE)	E	43	ESE	99
H.K. Airport (NW)	E	51	E	88
Waglan Island	E	63	ESE	85
Tate's Cairn	ESE	56	ESE	110
Cheung Chau	SSE	63	SE	96
King's Park	ESE	36	ESE	87
Star Ferry	E	45	E	83
Green Island	ESE	49	ESE	115
Tai O	SE	45	SE	81
Sha Tin	S	23	S	45
Chek Lap Kok	E	63	ESE	90
Lau Fau Shan	E,ESE&SE	31	SE	68
Ta Kwu Ling	ESE	31	ESE	77
Tuen Mun	SE	30	ESE	79
Tamar	ENE	25	ENE	65
Cheung Sha Wan	ENE	22	ESE	62
Tsing Yi	SE	38	SE	70
Kwai Chung	ESE	34	E	67

The weather in Hong Kong was cloudy with some squally showers on 16 June. The showers continued into the next day and became less frequent on 18 June. As Nathan dissipated over Guangxi, sunny and hot weather set in on 19 June. The daily amounts of rainfall recorded at some selected locations are given as follows:

Date	*Royal Observatory*	*Happy Valley*	*Tai Mo Shan*	*Tai Mei Tuk*	*High Island*
	mm	mm	mm	mm	mm
15 June	Trace	Nil	Nil	Nil	Nil
16 June	58.4	65.5	94.0	29.0	29.0
17 June	55.1	56.5	89.0	21.0	10.5
18 June	11.2	7.5	43.5	7.5	13.5
19 June	1.1	1.5	6.0	7.5	2.0
20 June	Trace	Nil	17.0	10.0	4.0
21 June	Nil	Nil	Nil	Nil	Nil
Total	125.8	131.0	249.5	75.0	59.0

The times and heights of the highest tides aind maximum storm surges recorded at various locations in Hong Kong during the passage of Nathan are tabulated below:

Location	Highest tide above chart datum			Maximum storm surge above astronomical tide		
	Height (m)	Date	Time	Height (m)	Date	Time
Ko Lau Wan	2.15	18 June	5.14 a.m.	0.67	17 June	11.57 a.m.
Lok On Pai	2.17	18 June	5.53 a.m.	0.48	18 June	0.56 a.m.
Quarry Bay	2.12	18 June	5.50 a.m.	0.46	17 June	5.01 p.m.
Tai O	2.19	18 June	5.38 a.m.	0.54	18 June	3.02 a.m.
Tai Po Kau	2.17	18 June	5.00 a.m.	0.67	18 June	0.39 a.m.
Tsim Bei Tsui	2.16	18 June	7.25 a.m.	0.46	18 June	10.25 a.m.
Waglan Island	2.11	18 June	4.59 a.m.	0.45	17 June	12.20 p.m.

In Hong Kong, three cars were damaged by rocks brought down by a mudslip at Lai Tak Tsuen. A minor mudslip was also reported at Pok Fu Lam village. Collapsed scaffoldings were reported in Wan Chai, Sham Shui Po and Tai Kok Tsui. There were also reports of collapsed signboards in Wan Chai and San Po Kong. The driver of a car was injured in Ta Kwu Ling by a falling tree. A 3 379-tonne cargo ship, 'Tien Fu', sank on the night of 16 June over the waters off the Ninepin Islands. The captain of the ship was missing while three of the crew members were drowned in rough seas. Two people were swept away by surging waves - one was swimming at Tai Long Wan, Sai Kung and the other was rowing near Tung Lung Island. Some ferry services were suspended.

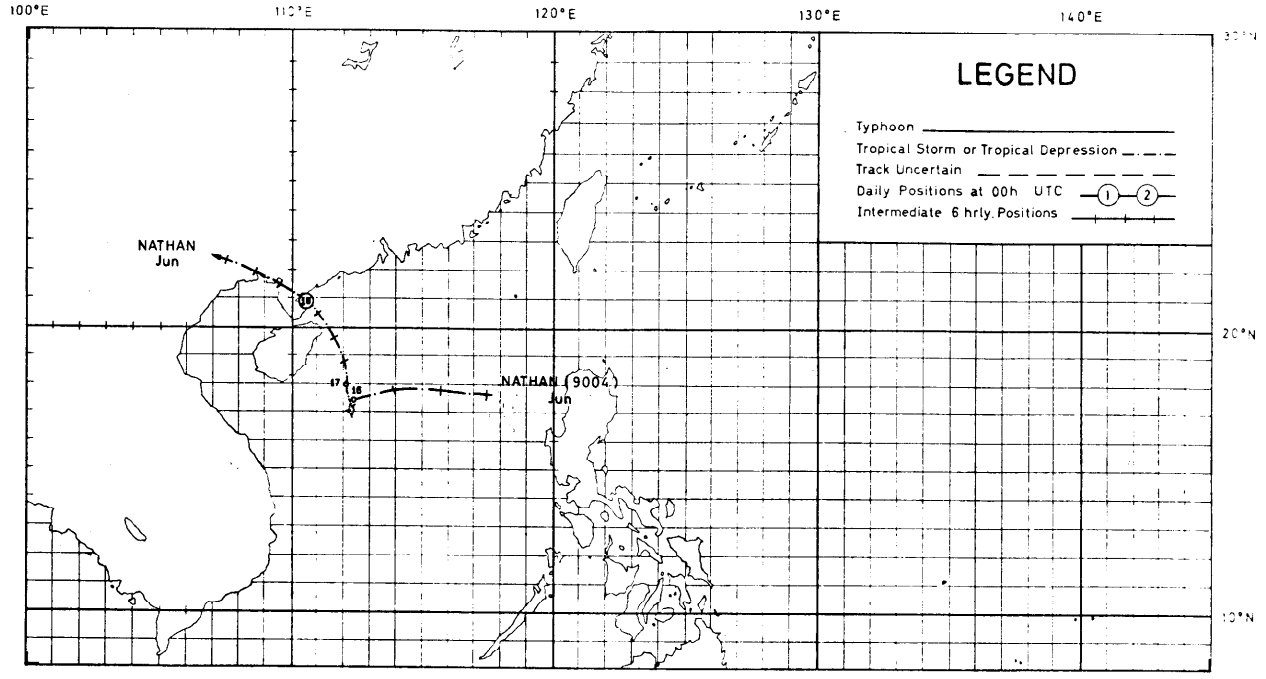

Figure 7. Track of Severe Tropical Storm Nathan (9004): 15-19 June 1990.

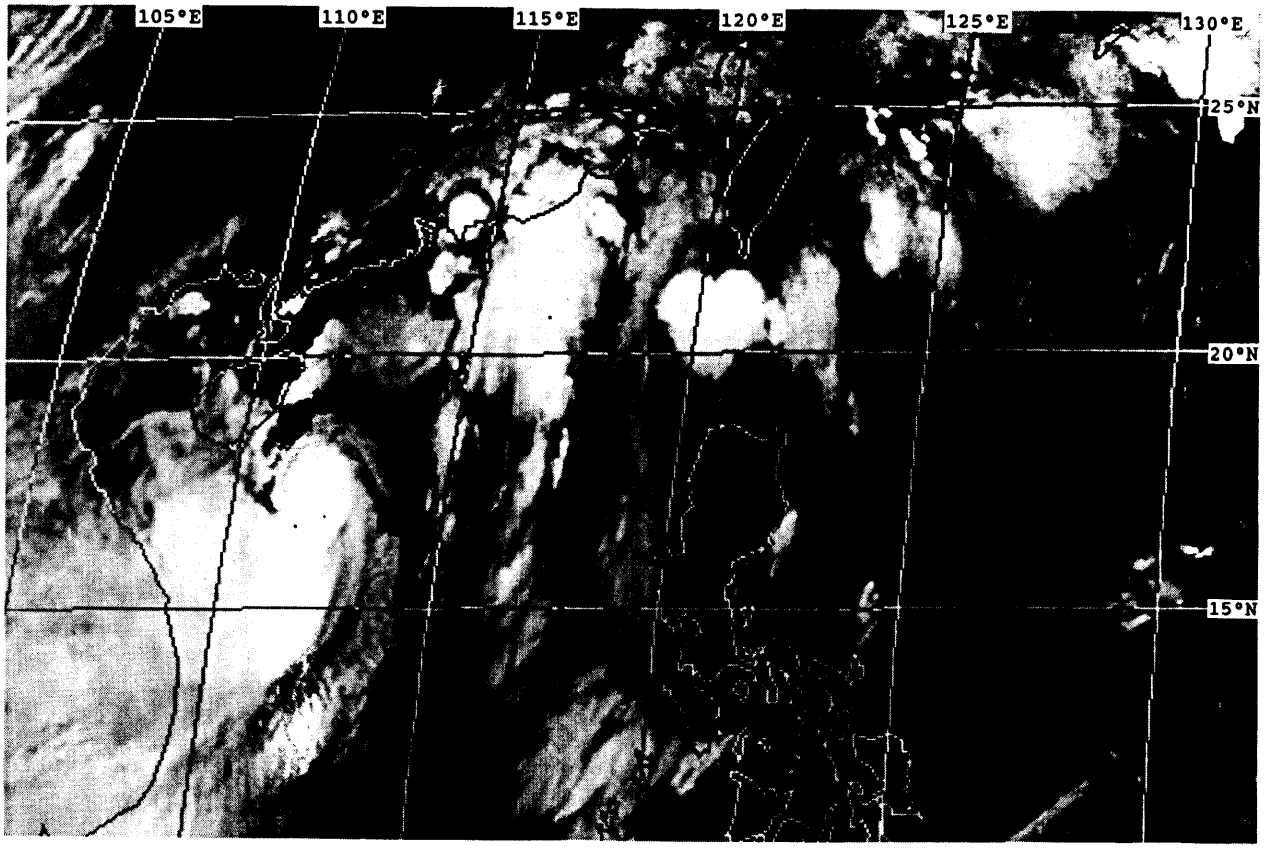

Figure 8. GMS-4 infra-red imagery of Nathan around 5 a.m. on 17 June 1990. Strong convection on the periphery of Nathan brought torrential rainfall to the coastal area east of eastern Guangdong.

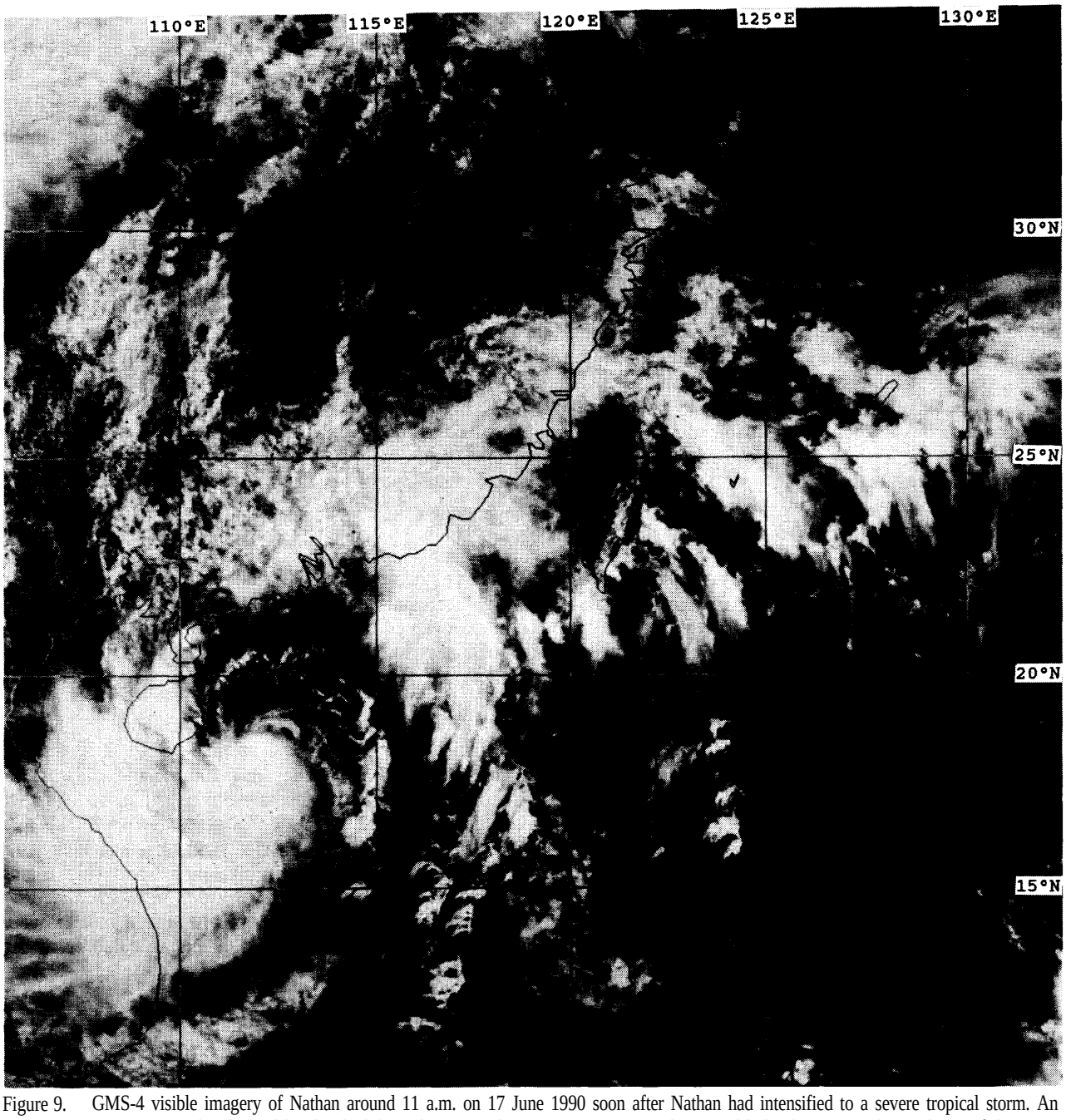

Figure 9. GMS-4 visible imagery of Nathan around 11 a.m. on 17 June 1990 soon after Nathan had intensified to a severe tropical storm. An extensive peripheral cloud band, which brought torrential rain to eastern Guangdong, could also be seen to the northeast of the storm circulation.

(c) Typhoon Percy (9006)

21-30 June 1990

The track of Percy is shown in Figure 10

Percy was the second tropical cyclone to affect Hong Kong in June. It was also the third tropical cyclone which necessitated the hoisting of tropical cyclone signals in Hong Kong in 1990. Percy caused widespread damage and flooding in the Philippines and southeastern China. Its remnant indirectly brought heavy rain and flooding to Hong Kong.

An area of disturbance over the western North Pacific southeast of Guam intensified to a tropical depression early on 21 June about 340 km southeast of the island. Tracking west-southwestwards at about 7 km/h, the tropical depression strengthened further into a tropical storm named Percy during the day. On 22 June, Percy took on a south-southwestward track while gathering strength. It intensified to a severe tropical storm about 680 km south of Guam during the day and turned west towards the southern Philippines in the evening.

Traversing the warm waters east of the Philippines, Percy continued to intensify and turned further to the west-northwest at about 14 km/h on 23 June. It attained typhoon intensity early on 24 June while passing 120 km south-southwest of the island of Yap. Satellite pictures showed a ragged eye and an extensive circulation associated with the typhoon. During the next two days, Percy continued to move towards Luzon at an average speed of about 25 km/h. The storm grew more intense with maximum winds of about 165 km/h near the centre. Around noon on 27 June, Percy landed over the northeastern tip of Luzon. A maximum wind of 118 km/h was reported by a weather station in northeastern Luzon at 1 p.m. while another station further north reported a minimum pressure of 983.3 hPa four hours later.

According to press reports, Percy brought widespread flooding, triggered off landslips, and disrupted air and sea traffic in the Philippines. At least eight people were killed. In the southern Philippines, a family of five was buried alive in a landslip. In the northern provinces, about 45 000 people were evacuated from their homes.

Percy weakened slightly while passing over Luzon, but still maintained typhoon strength as it entered the South China Sea on the evening of 27 June. It continued to move west-northwest towards the south China coast and regained its strength over open sea with an eye re-appearing. At 2 p.m. on 28 June, 'M.V. Jagrashmi' reported winds of 83 km/h when it was about 190 km south-southeast of the centre of Percy. Percy decelerated to 14 km/h earlier during the day and turned increasingly to a north-northwest track during the afternoon. It weakened to a severe tropical storm before making landfall over the eastern part of the south China coast about 120 km southwest of Xiamen on the afternoon of 29 June. A maximum gust of 140 km/h was recorded at Xiamen during the passage of Percy. Percy continued to weaken rapidly as it moved further inland and finally dissipated over Fujian on 30 June.

According to press reports, nine people were killed and more than 100 were injured in southeastern China. Over 6 650 homes were damaged, numerous fishing boats were sunk, and large areas of rice land were submerged in heavy rain. About 2.59 million and 3.06 million people were affected in Fujian and Guangdong respectively. Communication links and electricity supply were severed or disrupted in many areas. Farm production was reduced by 400 million catties in Fujian. In Nan'ao, gales persisted for about 10 hours and more than 410 mm of rainfall were recorded, the heaviest in 300 years. Flood water in the villages was up to 2 metres deep. Statistics of some of the damage sustained at other locations are given below:

	Shantou	*Dongshan*	*Zhangzhou*	*Quanzhou*
Dead		1	1	4
Missing		2		
Injured		4 (>100*)	>100	1
Agricultural land affected/hectares (type of crops if specified)	270 000 (Rice/174 000)	30 000 (asparagus)		100 000 (rice)
Vessels sunk		1		
Vessels damaged	190	7		
Buildings destroyed	95	2 500*		
Buildings damaged	201			
Other damage	20 km of highway	one-third of trees, coastal dykes*		>100 000 trees, >1 000 electric posts
Direct economic loss/RMB	49 million	27 million	Tens of million	

(* neighbouring coastal areas of Dongshan)

In Hong Kong, the Stand By Signal No. 1 was hoisted at 8.00 a.m. on 28 June when Percy was about 550 km to the east-southeast. Percy came closest to Hong Kong around 11 a.m. on 29 June when it was about 350 km to the east-northeast. Local winds were generally moderate and from the west. As Percy moved away and started to weaken, the Stand By Signal No. 1 was lowered at 1.30 p.m. that day. The lowest sea-level pressure at the Royal Observatory of 999.4 hPa was recorded at 3 p.m. when Percy was about 360 km to the east-northeast. The maximum hourly mean winds and maximum gust peak speeds together with associated wind directions at various locations are given as follows:

Location	*Maximum hourly mean wind speed (km/h) and direction*		*Maximum gust peak speed (km/h) and direction*	
Royal Observatory	W	23	W	30
H.K. Airport (SE)	W	25	W	38
H.K. Airport (NW)	SW & WSW	19	WSW	34
Waglan Island	WSW & W	31	WNW	45
Tate's Cairn	SW	25	SSW	43
Cheung Chau	W	22	W	36
King's Park	WSW	16	WSW	31
Star Ferry	W	25	WSW	36
Green Island	SSW	23	SSW	31
Tai O	SSW	22	SSW	31
Sha Tin	SSE	13	SSE	23
Chek Lap Kok	W	20	SW	31
Lau Fau Shan	WSW	22	SW	30
Ta Kwu Ling	W	13	WSW	31
Tuen Mun	NW	12	WNW, SW, S & NW	27
Tamar	WNW	16	WNW	36
Cheung Sha Wan	SW	19	SW	34
Tsing Yi	W	16	W	31
Kwai Chung	SSW	14	WNW & SSW	25

The times and heights of the highest tides and maximum storm surges recorded at various locations in Hong Kong during the passage of Percy are tabulated below:

Location	Highest tide above chart datum			Maximum storm surge above astronomical tide		
	Height (m)	Date	Time	Height (m)	Date	Time
Ko Lau Wan	2.03	28 June	10.17 a.m.	0.43	28 June	9.23 a.m.
Lok On Pai	2.06	28 June	1.39 p.m.	0.27	28 June	5.29 p.m.
Quarry Bay	1.98	28 June	11.14 a.m.	0.20	29 June	2.42 a.m.
Tai O	2.04	28 June	12.59 p.m.	0.20	29 June	1.03 a.m.
Tai Po Kau	1.97	28 June	10.46 a.m.	0.30	28 June	8.54 a.m.
Waglan Island	2.01	28 June	10.56 a.m.	0.18	28 June	9.44 a.m.

It was fine, sunny and hot on 28 June. The outermost rainband of Percy started to affect Hong Kong early on 29 June and brought thunderstorms and showers that morning. The rest of the day was cloudy with some light showers. As Percy landed over the south China coast and weakened, the southwest monsoon became active and this resulted in heavy rain and thunderstorms on 30 June. The rain was heaviest in Sai Kung, Sha Tin and Tsuen Wan. A total of 80.9 mm of rainfall was recorded at the Royal Observatory between 10 a.m. and 4 p.m. that day. The rain eased off during the evening and there were sunny intervals for the next two days. The daily amounts of rainfall recorded at some selected locations are given as follows:

Date	*Royal Observatory*	*Central*	*Tai Mei Tuk*	*High Island*	*Tuen Mun*
	mm	mm	mm	mm	mm
28 June	Nil	Nil	Nil	Nil	Nil
29 June	12.6	14.5	16.0	59.0	10.0
30 June	83.0	141.5	56.5	193.5	29.5
1 July	0.1	Nil	9.0	2.0	1.0
2 July	Trace	Nil	0.5	Nil	2.5
Total	95.7	156.0	82.0	254.5	43.0

Torrential rain associated with Percy resulted in over 30 incidents of flooding in Hong Kong, causing chaos and bringing traffic to a standstill in many parts of the territory. Most of the flooding occurred in the New Territories. Areas affected included Tai Po, Sha Tin, Kwai Chung and Castle Peak Road. Other flooding incidents occurred in Tsim Sha Tsui and Kwun.Tong while only one was reported on Hong Kong Island in Shau Kei Wan. Flood water of 0.6 metre deep was reported in Kwai Chung when the rain was heaviest. A l0-year-old boy was swept away when he fell into a flooded culvert near his home by the hillside squatter area of Shek Lei Hang village. His body was later found under the Kwai Chung bridge. A landslip warning was issued by the Royal Observatory and three cases of landslip were reported: one at Kwai Chung where five families had to be evacuated, another along a footpath in Sai Kung, and the third one at Ching Cheung Road, Cheung Sha Wan. Electricity supply to two villages - one in Yuen Long and the other in Sham Tseng - was temporarily cut off. At Shing Mun Road in Tsuen Wan, two trees exceeding six metres in height collapsed, blocking the traffic in the vicinity. In Kwai Chung, 11 people had to be evacuated as mud was swept into their homes by the running rain water. However, damage to crops in the New Territories was slight.

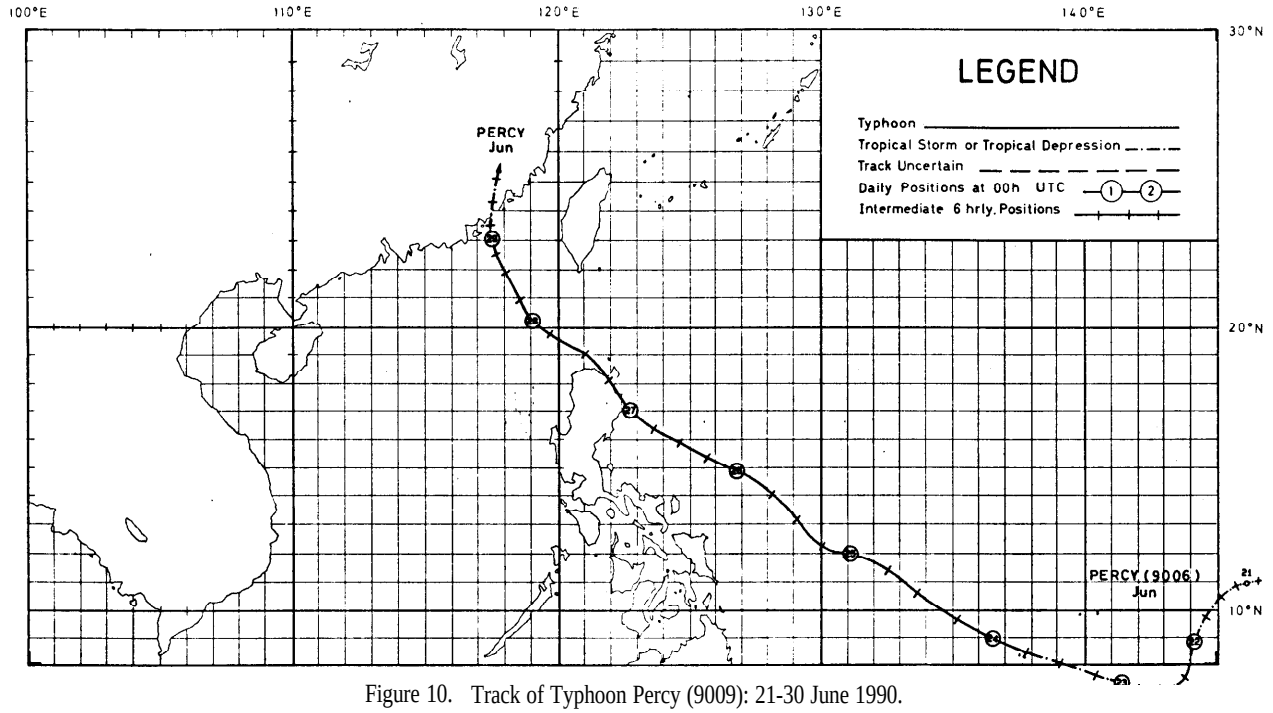

Figure 10. Track of Typhoon Percy (9009): 21-30 June 1990.

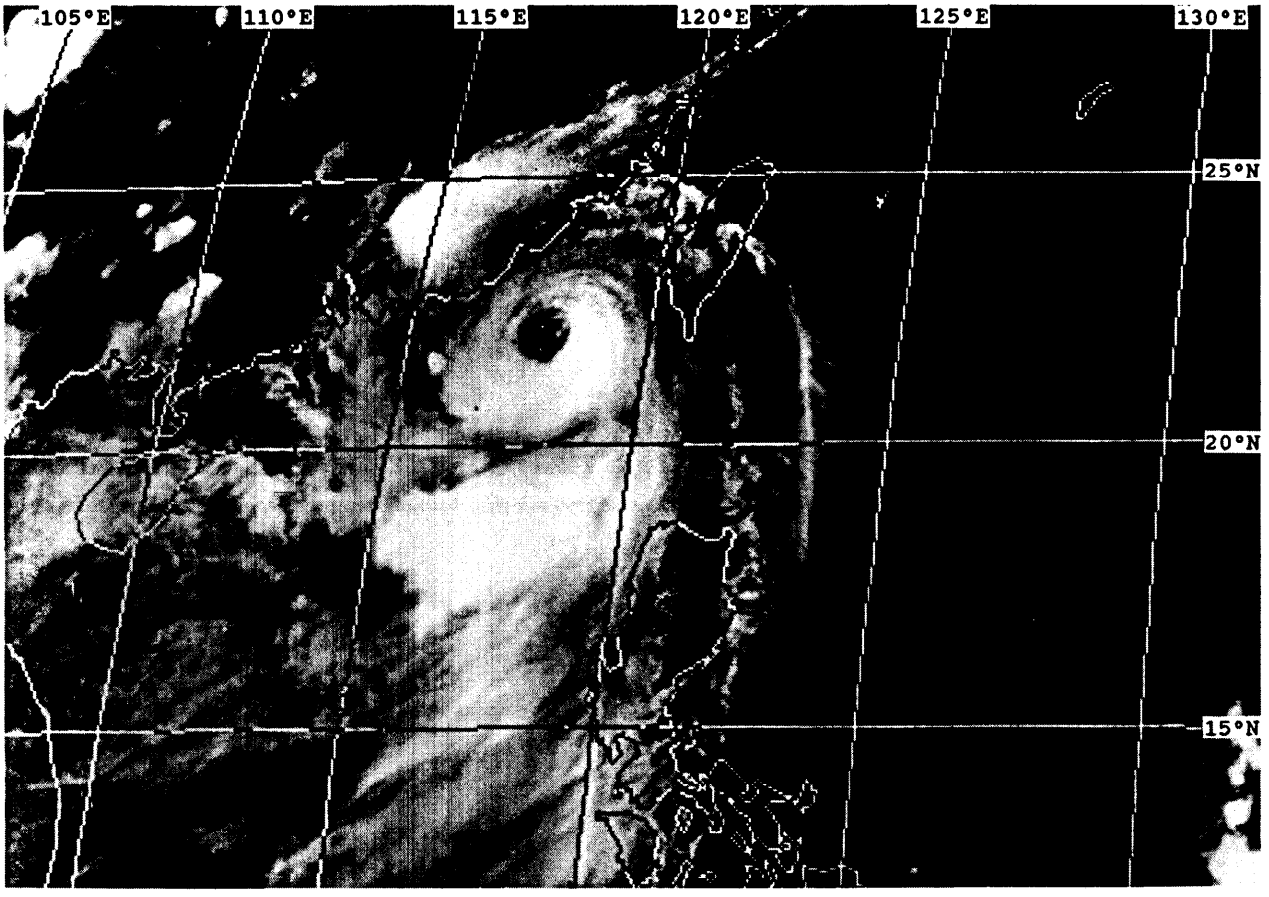

Figure 11. GMS-4 infra-red imagery of Percy around 11 p.m. on 28 June 1990 when the large eye of Percy could be seen to the east of Hong Kong.

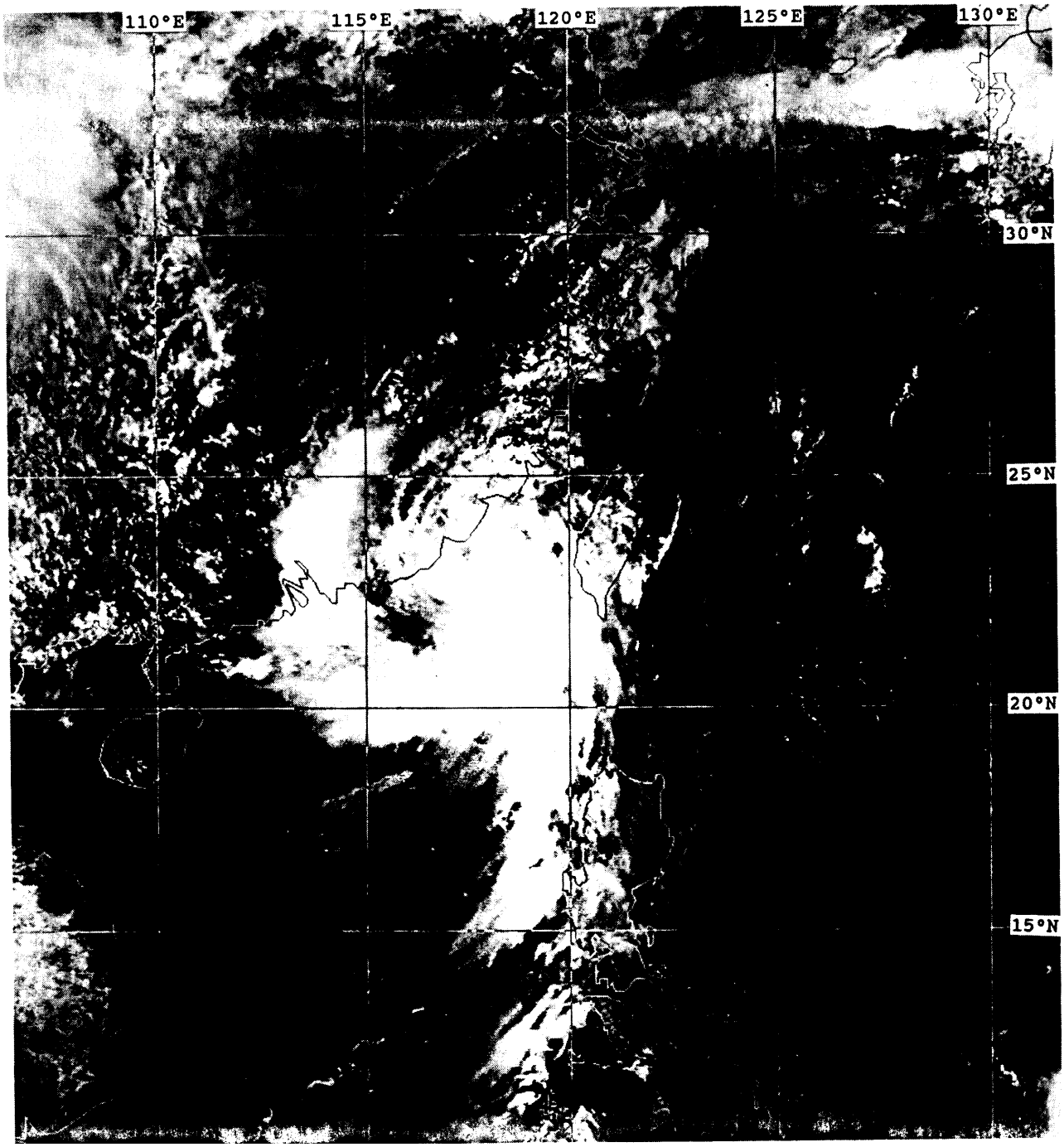

Figure 12. GMS-4 visible imagery of Percy around 11 a.m. on 29 June 1990 as a cloud band of intense convection covered Hong Kong.

Figure 13. A 7-metre tree was blown down at Shing Mun Road near Cheung Shan Estate, blocked the traffic (by courtesy of Sing Tao Ltd.).

Figure 14. A flood scene after heavy rain in Kwai Chung (by courtesy of Ming Pao Daily News).

(d) Severe Tropical Storm Tasha (9009)

27-31 July 1990

The track of Tasha is shown in Figure 15

Tasha originated from an area of disturbance over the Balintang Channel. Drifting into the South China Sea, it became a tropical depression about 320 km east-southeast of Dongsha on the morning of 27 July, moving south-southwest at about 7 km/h. It intensified further to a tropical storm about 310 km southeast of Dongsha early next day and began to move westwards. As the storm traversed across the northern part of the South China Sea, Tasha continued to gather strength. At 2 p.m. on 29 July, 'M.V. German Senator' reported winds of 76 km/h when it was about 260 km west-northwest of the centre of Tasha. By this time, strong to gale force winds had begun to affect the northern part of the South China Sea. Tasha slowed down as it reached severe tropical storm intensity about 250 km south-southwest of Dongsha that evening. It turned northwards overnight and accelerated to a speed of about 13 km/h early on 30 July. Later in the afternoon, its centre passed about 90 km west of Dongsha where a minimum sea-level pressure of 982.7 hPa was reported. At peak intensity, winds near the centre of Tasha were estimated to be about 110 km/h. By the evening, Tasha's speed had increased to about 19 km/h. During the night, Tasha turned more to the north-northwest and made landfall over the south China coast about 160 km east-northeast of Hong Kong around 4.30 a.m. on 31 July. Gusts of 108 km/h and a minimum sea-level pressure of 973.9 hPa were recorded at Shanwei close to where Tasha landed. Thereafter, Tasha continued to move north-northwestwards inland and weakened progressively into an area of low pressure over northern Guangdong during the day.

During the passage of Tasha, severe damage due to heavy rain and flooding was inflicted upon Guangdong and Fujian. In Fujian, 69 people were killed and more than three million people were affected. Over 9 900 houses were destroyed, water facilities were damaged, and 2.03 million hectares of farmland were flooded. Heavy rain continued even after the dissipation of Tasha. Over 300 mm of rainfall were reported in 18 counties. Economic losses were estimated to be 391 million RMB. In Guangdong, rain was particularly heavy in the southeastern, northeastern and southwestern parts. Rainfall in Shanwei exceeded 366 mm. Thirty-nine people were killed, 335 people were injured and about 1.78 million people in seven cities and 34 counties were affected. About 2.15 million hectares of farmland were flooded, and 25 200 homes were destroyed. On the other hand, the heavy rain brought much relief to the dry spell which prevailed before the storm.

In Hong Kong, the Stand By Signal No. 1 was hoisted at 9.20 a.m. on 28 July when Tasha was about 610 km to the southeast. Winds were moderate east to northeasterly initially. They gradually strengthened the next day, particularly over offshore waters. As Tasha moved closer and local winds continued to increase, the No. 3 Strong Wind Signal was hoisted at 1.45 p.m. on 30 July when Tasha was about 290 km to the southeast. Gales were reported on high ground as winds turned northerly later that afternoon. Winds also approached gale force offshore and sea conditions were rough during the small hours of 31 July as Tasha started to cross the coast. As local winds subsided later in the morning, all signals were lowered at 1.30 p.m. when Tasha was about 290 km to the north-northeast. The lowest sea-level pressure of 990.9 hPa was recorded at the Royal Observatory at 3 a.m. on 31 July when Tasha was at its closest approach to Hong Kong about 160 km to the east-northeast. The maximum hourly mean winds and maximum gust peak speeds together with associated wind directions at various locations are given as follows:

Location	*Maximum hourly mean wind speed (km/h) and direction*		*Maximum gust peak speed (km/h) and direction*	
Royal Observatory	W	36	NE	72
H.K. Airport (SE)	WNW	43	NNE, N & WNW	67
H.K. Airport (NW)	NNE & N	43	NNE & N	94
Waglan Island	ENE	67	ENE	96
Tate's Cairn	NNE	77	NNE	133
Cheung Chau	NW	49	NW	85
King's Park	W	30	NE	65
Star Ferry	W	51	WNW	76
Green Island	NNE	51	NNE	87
Tai O	N	51	N	81
Sha Tin	N	20	N	51
Chek Lap Kok	WNW	63	WNW	79
Lau Fau Shan	WNW	59	WNW	85
Ta Kwu Ling	NE	34	NE	83
Tuen Mun	NE	31	W	83
Wong Chuk Hang	W	31	W	77
Tamar	NE	31	NNE	70
Cheung Sha Wan	NE	20	N	67
Tsing Yi	NNE & W	23	NNE	67
Kwai Chung	WNW	31	WNW	62

It was mainly fine apart from a few showers and isolated thunderstorms on 27 July. The weather was cloudier on 28 July with showers and thunderstorms affecting the territory. On the following day, showers were less frequent and there were even some sunny periods. As Tasha moved closer on 30 July, the weather turned overcast with rain and squalls. After Tasha made landfall on 31 July, some heavy showers and thunderstorms associated with the enhanced southwesterlies continued to affect the territory. The daily amounts of rainfall recorded at some selected locations are given as follows:

Date	*Royal Observatory* mm	*Yuen Long* mm	*Tai Po* mm	*Sai Kung* mm	*Cape D'Aguilar* mm
27 July	1.7	1.5	Nil	Nil	Nil
28 July	10.0	0.5	1.0	4.0	24.0
29 July	17.4	Nil	Nil	0.5	0.5
30 July	13.2	4.5	15.0	30.5	23.5
31 July	57.6	36.5	103.5	77.5	70.0
1 August	3.6	Nil	3.0	2.5	Nil
2 August	73.3	10.5	9.0	56.5	5.5
Total	176.8	53.5	131.5	171.5	123.5

The times and heights of the highest tides and maximum storm surges recorded at various locations in Hong Kong during the passage of Tasha are tabulated below:

Location	Highest tide above chart datum			Maximum storm surge above astronomical tide		
	Height (m)	Date	Time	Height (m)	Date	Time
Chi Ma Wan	2.28	31 July	0.58 a.m.	0.70	31 July	0.14 a.m.
Ko Lau Wan	2.35	31 July	0.33 a.m.	1.00	30 July	11.09 a.m.
Lok On Pai	2.30	30 July	3.39 a.m.	0.59	30 July	11.51 p.m.
Quarry Bay	2.38	31 July	1.40 a.m.	0.73	31 July	0.34 a.m.
Tai Po Kau	2.28	31 July	1.54 a.m.	0.74	30 July	11.52 p.m.
Waglan Island	2.49	31 July	0.26 a.m.	0.89	31 July	0.11 a.m.

Damage in Hong Kong during the passage of Tasha was minor. Ferries to outlying islands, Macau and many parts of Guangdong were suspended or cancelled. No serious flooding or landslides occurred. In To Kwa Wan, wooden boards outside a building undergoing repair work were blown down. One person was slightly injured. In Hung Horn, the stormy weather resulted in the collapse of some scaffoldings, hitting the windscreen of a car nearby.

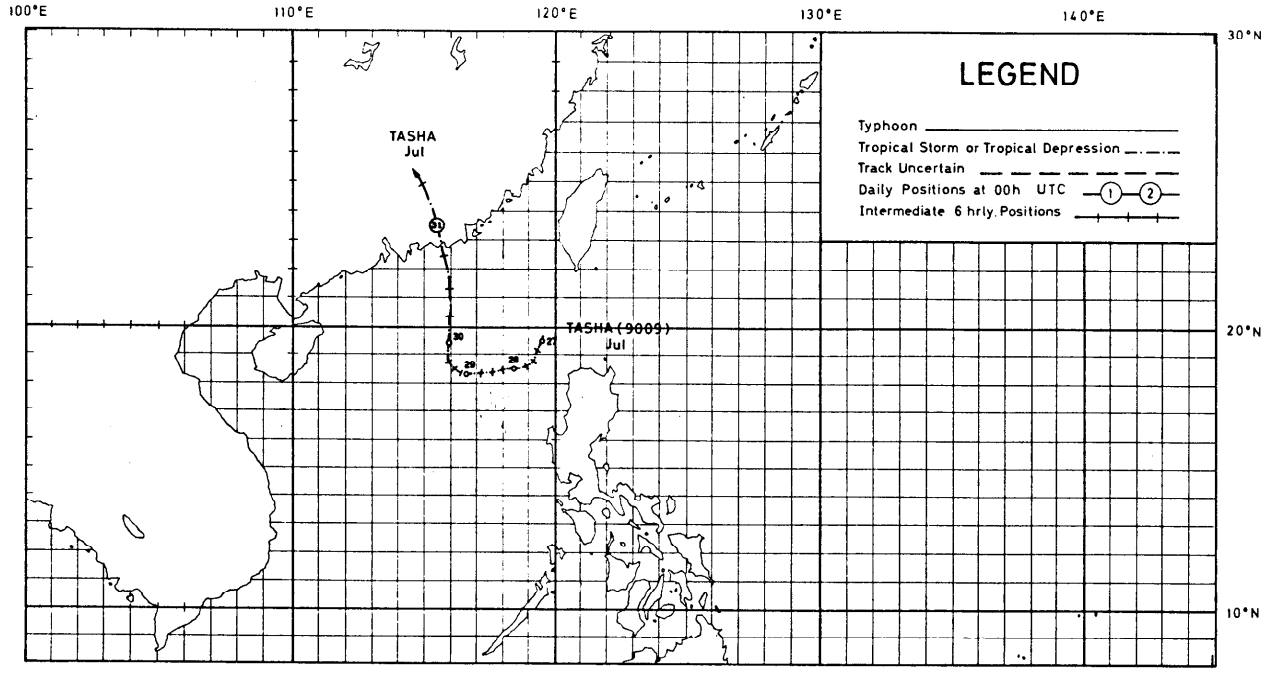

Figure 15. Track of Severe Tropical Storm Tasha (9009): 27-31 July 1990.

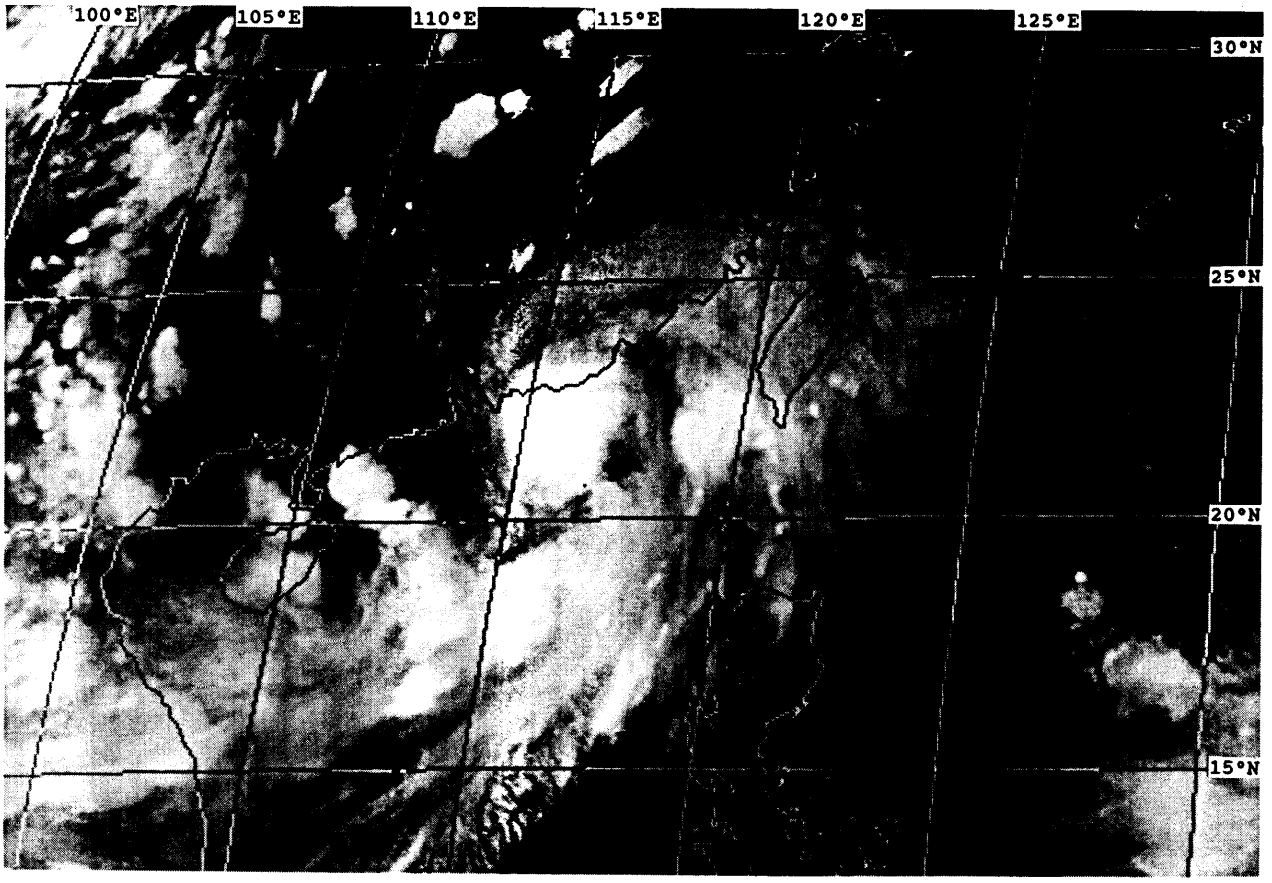

Figure 16. GMS-4 infra-red imagery of Tasha around 8 p.m. on 30 July 1990 as Tasha moved towards the coast of eastern Guangdong.

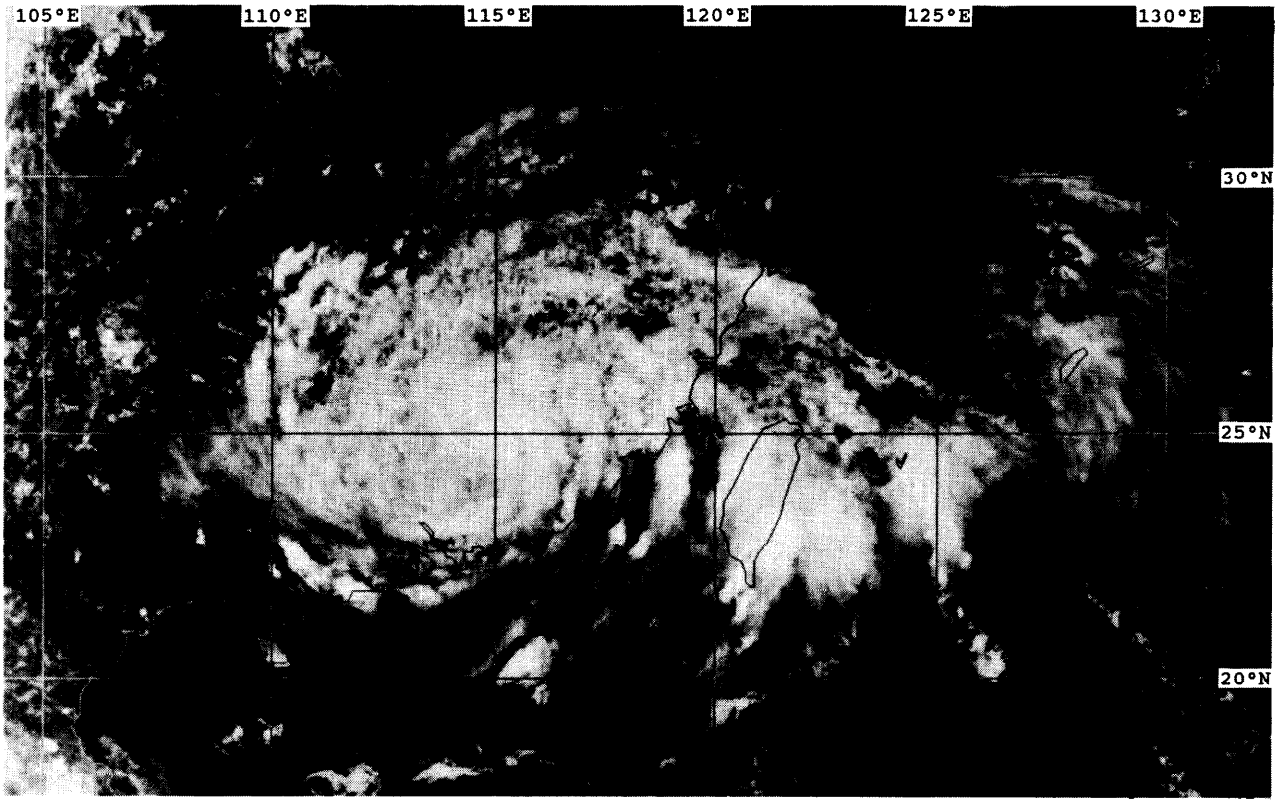

Figure 17. GMS-4 visible imagery of Tasha around 2 p.m. on 31 July 1990 as a weakening Tasha moved into Jiangxi Province while retaining a fairly good spiral structure. A band of squally showers and thunderstorms could also be seen extending from western Guangdong to the Pearl River estuary.

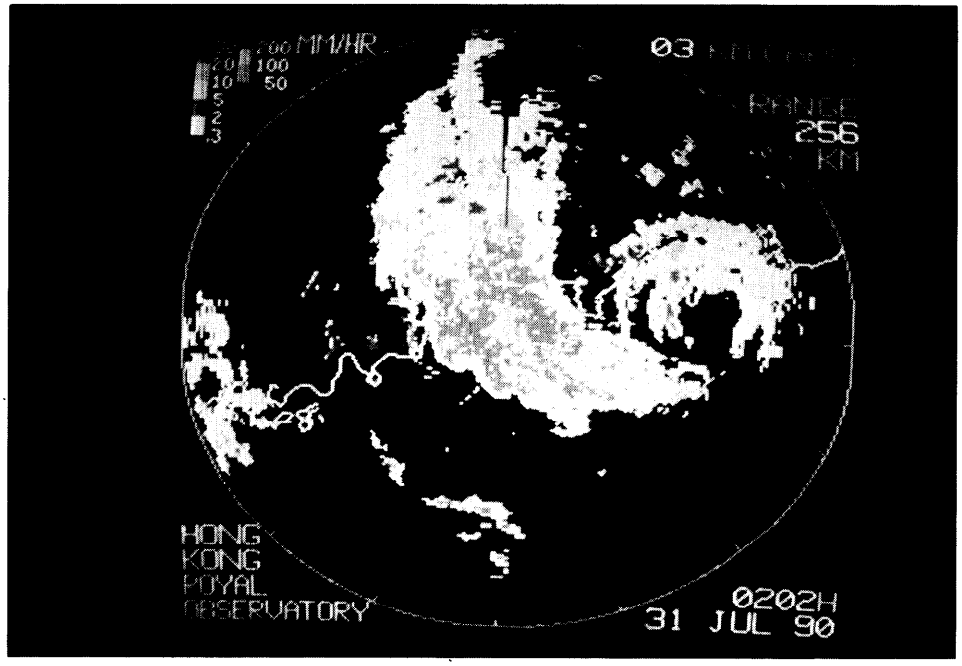

Figure 18. Radar display of the rain echoes of Severe Tropical Storm Tasha (9009) at 2.02 a.m. on 31 July 1990.

Figure 19. An advertising banner near Sung Wong Toi Garden was blown upside-down by the strong winds of Tasha (by courtesy of Sing Tao Ltd.)

(e) Typhoon Becky (9016)

25-30 August 1990

The track of Becky is shown in Figure 20

An area of disturbed weather hovered over the western North Pacific to the east of Luzon for several days before developing into a tropical depression about 910 km east-northeast of Manila early on 25 August. It moved northwestwards at about 13 km/h initially and intensified to a tropical storm named Becky in the afternoon. It then turned west-southwestwards towards Luzon. Having reached severe tropical storm intensity about 520 km north-northeast of Manila earlier that day, Becky made landfall over northern Luzon on the afternoon of 26 August.

There were 103 people in the Philippines killed during the passage of Becky. A missionary school dormitory and at least 250 houses were buried by landslides triggered by heavy rain as Becky swept across three villages in northern Luzon. Another landslide occurred near a gold mine.

Becky entered the South China Sea around midnight of 26 August. Its circulation grew in size and it attained typhoon intensity about 350 km south-southeast of Dongsha on 27 August. Thereafter, it moved steadily westwards in an almost straight line at a speed of about 22 km/h. A ragged eye appeared temporarily on satellite photographs that evening. Becky passed about 100 km north of Xisha during the day on 28 August and about 50 km south of Hainan Island the next morning.

In Hainan, about 4000 hectares of rice paddy were damaged and other crops such as sugar cane, rubber and lumber were also ruined. An engineering ship and a 7000-tonne cargo ship, 'Alphard', vanished in the high seas with 13 and 22 crewmen on board respectively.

Becky weakened to a severe tropical storm just before landing over central Vietnam about 250 km northwest of Danang early in the evening on 29 August. It crossed Laos and entered northeastern Thailand where it finally dissipated about 470 km north-northeast of Bangkok on 30 August. In the central provinces of Vietnam, about 6600 houses were destroyed and 8900 others were damaged. Three ships capsized and 237 fishing boats were destroyed or damaged. About 160 000 hectares of rice paddy were ruined. The death toll was 15 and thousands of people were made homeless.

In Hong Kong, the Stand By Signal, No. 1, was hoisted at 6.00 a.m. on 27 August when Becky was about 730 km to the southeast. Winds were light easterly at first but became fresh northeasterly during the day. Offshore, winds became strong during the night. As Becky moved closer and winds continued to strengthen, the Strong Wind Signal, No. 3, was hoisted at 5.00 a.m. on 28 August. Becky came closest to Hong Kong an hour later when it was about 510 km to the south. The lowest sea-level pressure of 1 002.2 hPa was recorded at the Royal Observatory at 5 a.m. and 7 a.m. that morning. Winds in the urban area were strong during the day. With Becky moving further away from Hong Kong and winds moderating inside the harbour, all signals were lowered at 8.10 p.m. on 28 August. At that time, Becky was about 590 km to the south-southwest. The maximum hourly mean winds and maximum gust peak speeds and their associated wind directions at various locations are given as follows:

Location	*Maximum hourly mean wind speed (km/h) and direction*		*Maximum gust peak speed (km/h) and direction*	
Royal Observatory	E	38	E	81
H.K. Airport (SE)	ENE	43	ENE	83
H.K. Airport (NW)	E	45	E	108
Waglan Island	E	70	ENE	94
Tate's Cairn	E	68	E	137
Cheung Chau	ENE	58	ENE	96
King's Park	ENE	30	ENE	83
Star Ferry	E	38	E	77
Green Island	ENE	63	ENE	92
Tai O	E	40	E	85
Sha Tin	ENE & E	20	NE	65
Chek Lap Kok	E	52	E	79
Lau Fau Shan	ENE	31	E	63
Ta Kwu Ling	E	30	E	75
Tuen Mun	NE & ENE	19	NE	62
Wong Chuk Hang	E	34	E	96
Tai Po Kau	E	43	E & ESE	68
Tamar	ENE	31	ENE	76
Cheung Sha Wan	NE	30	NE	83
Tsing Yi	E	30	ENE	68

The weather on 27 August was cloudy with sunny periods in the morning and some light showers in the afternoon. Squally showers buffeted the territory the next day. As Becky moved towards the Vietnam coast, showery activity died out on the afternoon of 29 August. The weather improved further on 30 August and became fine and sunny. The daily amounts of rainfall recorded at some selected locations are given as follows:

Date	*Royal Observatory*	*Aberdeen*	*Tai Po*	*Yuen Long*	*High Island*
	mm	mm	mm	mm	mm
27 August	Trace	Nil	Nil	Nil	Nil
28 August	22.7	32.0	32.0	12.0	30.0
29 August	2.9	4.0	1.5	0.5	1.0
30 August	Nil	Nil	Nil	Nil	Nil
Total	25.6	36.0	33.5	12.5	31.0

The times and heights of the highest tides and maximum storm surges recorded at various locations in Hong Kong during the passage of Becky are tabulated below:

Location	Highest tide above chart datum			Maximum storm surge above astronomical tide		
	Height (m)	Date	Time	Height (m)	Date	Time
Chi Ma Wan	2.46	28 August	0.59 a.m.	0.59	28 August	8.20 a.m.
Ko Lau Wan	2.40	28 August	1.58 a.m.	0.64	28 August	9.26 a.m.
Lok On Pai	2.51	28 August	1.20 a.m.	0.63	28 August	1.53 p.m.
Quarry Bay	2.47	28 August	1.01 a.m.	0.64	28 August	8.07 a.m.
Tai Po Kau	2.40	28 August	1.40 a.m.	0.77	28 August	7.23 a.m.

In Hong Kong, a teenager swimming in Sai Kung was reported missing on 28 August as the seas turned rough. During the passage of Becky, some ferry services to the outlying islands were suspended. No other damage was reported.

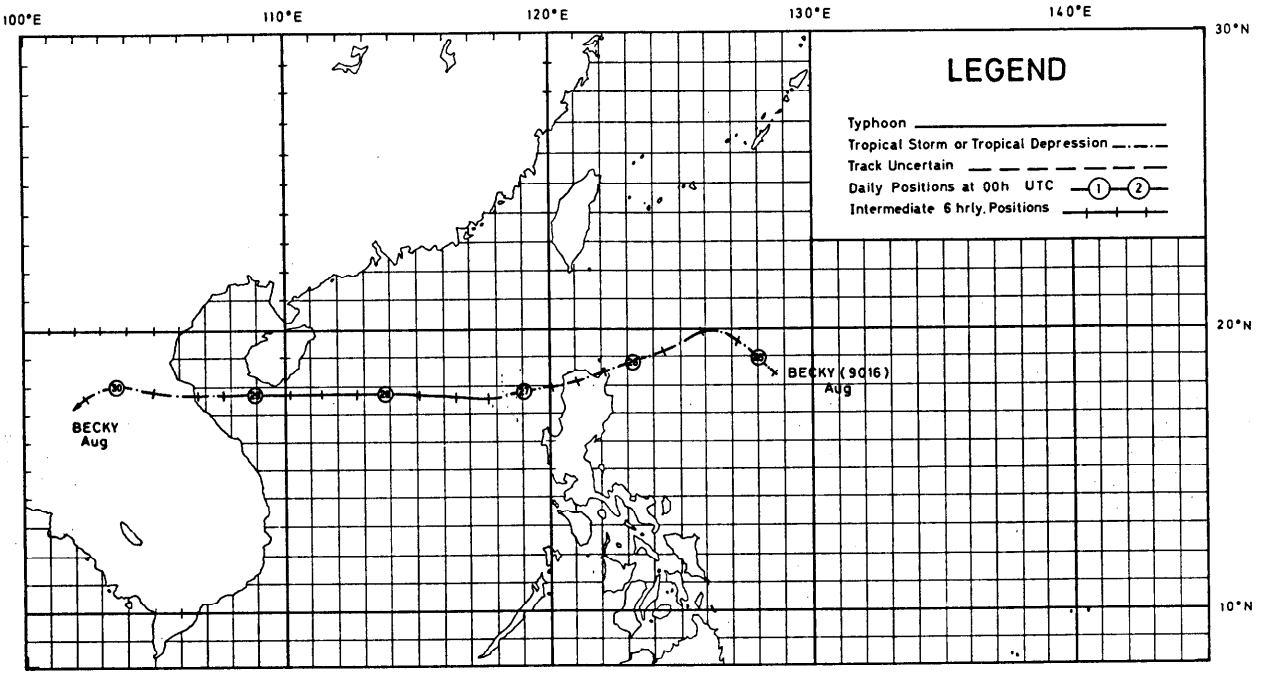

Figure 20. Track of Typhoon Becky (9016): 25-30 August 1990.

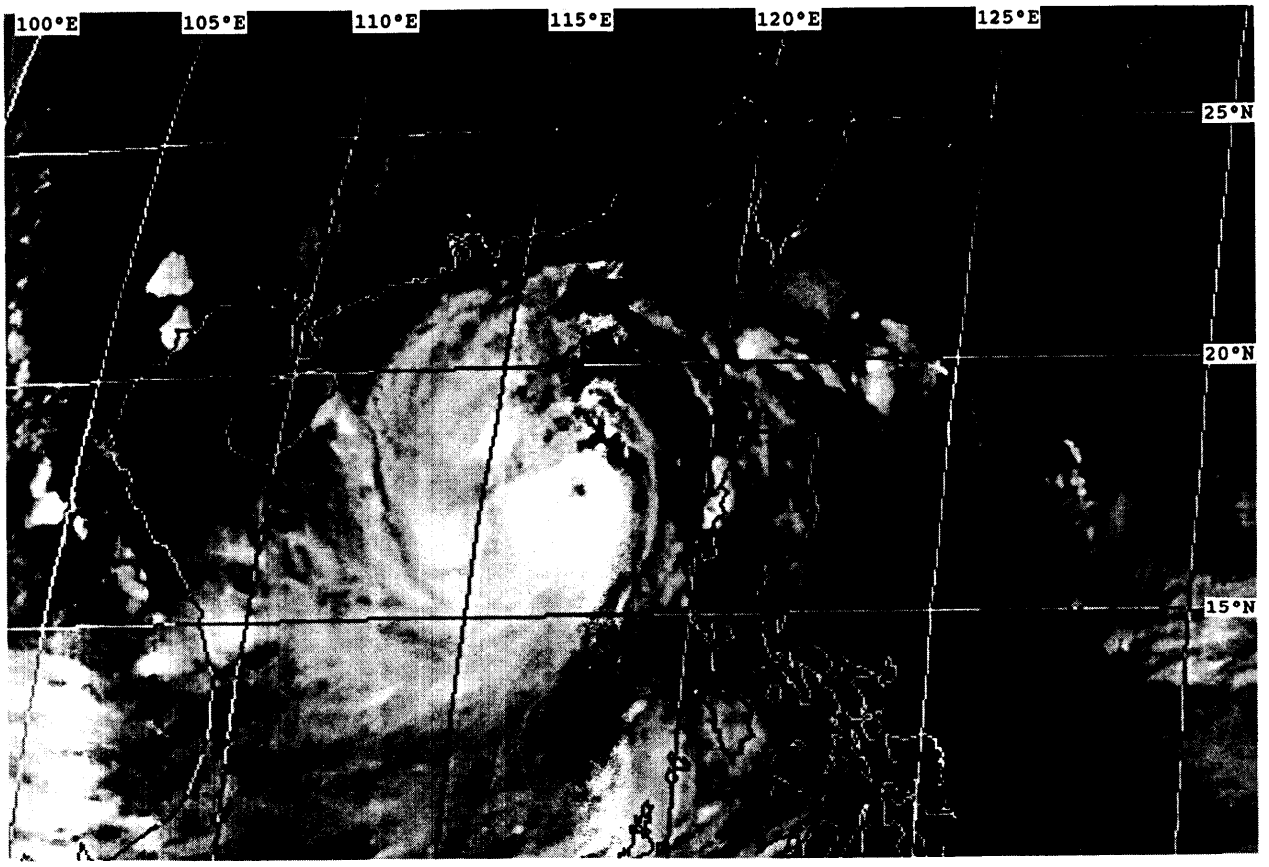

Figure 21. GMS-4 infra-red imagery of Becky around 5 p.m. on 27 August 1990 shortly after Becky had intensified to a typhoon over the South China Sea.

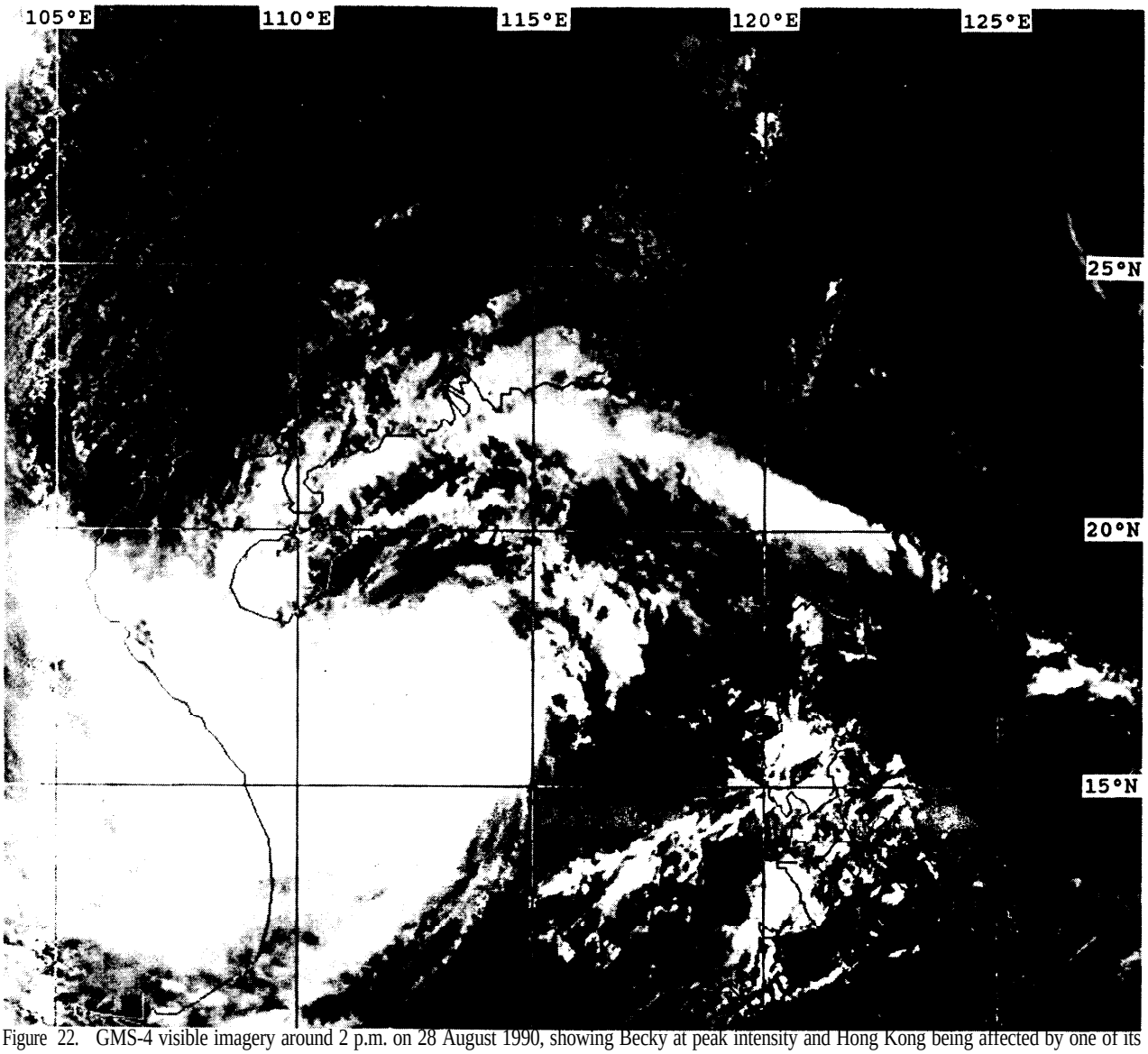

Figure 22. GMS-4 visible imagery around 2 p.m. on 28 August 1990, showing Becky at peak intensity and Hong Kong being affected by one of its outer rainbands.

(f) Typhoon Ed (9018)

10-20 September 1990

The track of Ed is shown in Figure 23

Ed developed as a tropical depression about 670 km north of Guam on the evening of 10 September. It moved westwards at a speed of about 30 km/h initially but slowed down to 15 km/h the following day. Ed intensified to a tropical storm about 1 120 km northwest of Guam on 12 September and picked up speed in the evening. After a detour to the southwest, Ed resumed its westward track and further strengthened to a severe tropical storm about 830 km northeast of Manila early on 14 September.

Ed crossed the Balintang Channel on a west-southwestward track on the night of 14 September. Over the South China Sea, it moved at about 20 km/h and attained typhoon intensity about 380 km south of Dongsha on the evening of 15 September. Slowing down, Ed passed about 80 km south of Xisha on 17 September. It then changed its track more to the west-northwest towards Vietnam and weakened to a severe tropical storm about 60 km north of Danang on the evening of 18 September. Ed skirted the coast of central and northern Vietnam and further weakened to a tropical storm about 260 km northwest of Danang late on 19 September. Ed made landfall about 210 km south of Hanoi the next morning and finally dissipated about 140 km southwest of the city that afternoon.

According to press reports, at least 10 people were killed and thousands were left homeless in Vietnam.

In Hong Kong, the Stand By Signal, No. 1, was hoisted at 11.00 p.m. on 14 September when Ed was about 800 km to the southeast. Winds were light at first but became moderate easterly on the afternoon of 15 September. In the evening, winds freshened as Ed intensified further. Ed came closest to Hong Kong around 2 a.m. on 16 September when it was about 620 km to the south-southeast. The lowest sea-level pressure of 1 006.2 hPa was recorded at the Royal Observatory at 4 p.m. that afternoon. With Ed moving away towards the Vietnam coast, winds moderated and all signals were lowered at 7.45 a.m. on 17 September. At that time, Ed was about 710 km to the south-southwest. The maximum hourly mean winds and maximum gust peak speeds together with associated wind directions at various locations are given as follows:

Location	*Maximum hourly mean wind speed (km/h) and direction*		*Maximum gust peak speed (km/h) and direction*	
Royal Observatory	E	23	E	45
H.K. Airport (SE)	E	27	E	47
H.K. Airport (NW)	E	30	E	83
Waglan Island	ENE	52	E	72
Tate's Cairn	E	41	E	67
Cheung Chau	N & NNE	27	E	51
King's Park	ESE	19	ESE	41
Star Ferry	E	23	E	47
Green Island	ENE	43	ENE	63
Tai O	NNE	27	ESE	58
Sha Tin	ENE	12	ENE	36
Chek Lap Kok	E	31	ENE	45
Lau Fau Shan	NE	16	NE	31
Ta Kwu Ling	NNE	19	N	41
Tuen Mun	NE	23	NNE	41
Wong Chuk Hang	E	23	ENE	52
Tai Po Kau	E	16	SE	34
Tamar	NE	23	NNE	51
Cheung Sha Wan	N	16	NE	43
Tsing Yi	E	20	E	45
Kwai Chung	E	14	ESE & E	31

The weather was fine on the night of 14 September. Some isolated showers occurred on the afternoon of 15 September. It was generally fine for the next three days while Ed was traversing the South China Sea. The weather deteriorated on 19 September as Ed turned to a more northward track towards northern Vietnam and one of its associated rainbands reached the south China coast. The rain persisted throughout the day with heavy showers and thunderstorms. The rain eased off the next day. The daily amounts of rainfall recorded at some selected locations are given as follows:

Date	*Royal Observatory*	*North Point*	*Tai Mei Tuk*	*High Island*
	mm	mm	mm	mm
15 September	6.8	3.5	1.0	Nil
16 September	Nil	Nil	Nil	Nil
17 September	Trace	Nil	Nil	Nil
18 September	Trace	Nil	Nil	Nil
19 September	97.5	115.5	66.5	34.0
20 September	1.0	0.5	15.5	7.0
Total	105.3	119.5	83.0	41.0

The times and heights of the highest tides and maximum storm surges recorded at various locations in Hong Kong during the passage of Ed are tabulated below:

Location	Highest tide above chart datum			Maximum storm surge above astronomical tide		
	Height (m)	Date	Time	Height (m)	Date	Time
Chi Ma Wan	2.48	16 Sep	7.17 a.m.	0.39	16 Sep	11.56 a.m.
Ko Lau Wan	2.49	16 Sep	7.17 a.m.	0.58	16 Sep	2.38 a.m.
Lok On Pai	2.54	16 Sep	7.56 a.m.	0.36	16 Sep	12.20 p.m.
Quarry Bay	2.53	16 Sep	7.51 a.m.	0.28	16 Sep	7.54 a.m.
Tai O	2.52	16 Sep	7.34 a.m.	0.30	16 Sep	6.13 a.m.
Tai Po Kau	2.43	16 Sep	7.05 a.m.	0.20	16 Sep	1.32 a.m.

In North Point, squalls associated with the showers on 15 September blew down some scaffoldings, damaging some windows of the nearby flats. At another location in North Point, a l0-metre reinforced concrete canopy collapsed. A man was injured when his boat was overturned by blustery winds and rough seas off Chai Wan on 16 September.

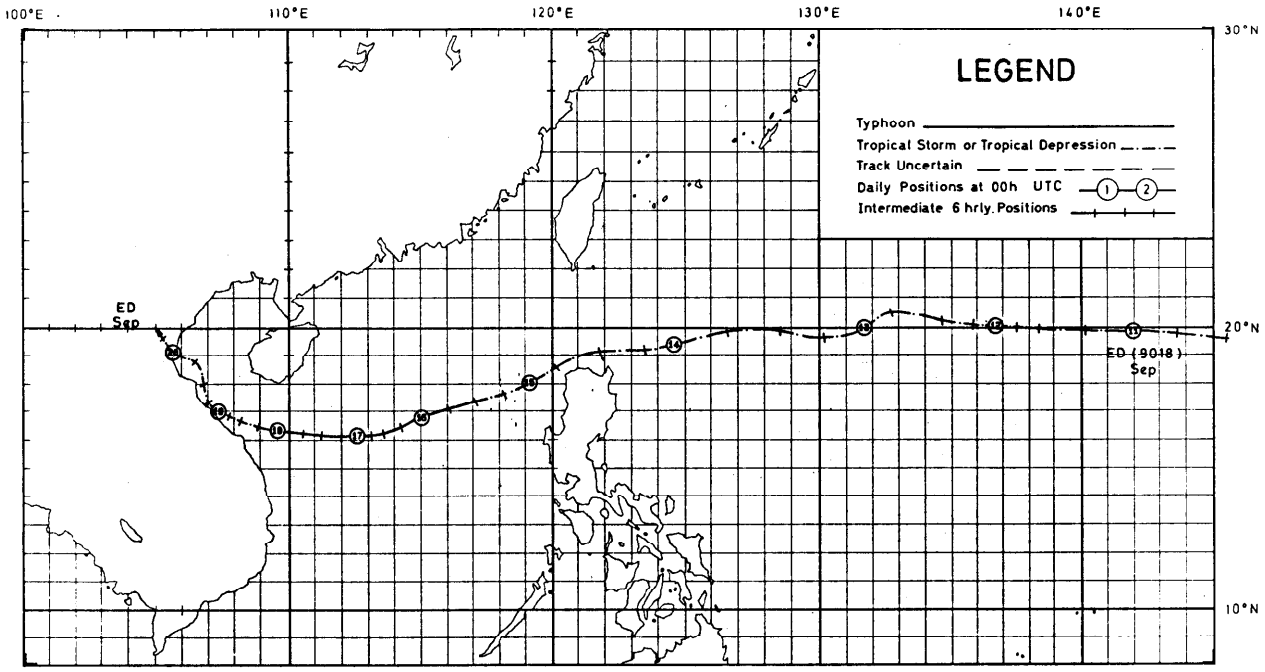

Figure 23. Track of Typhoon Ed (9018): 10-20 September 1990.

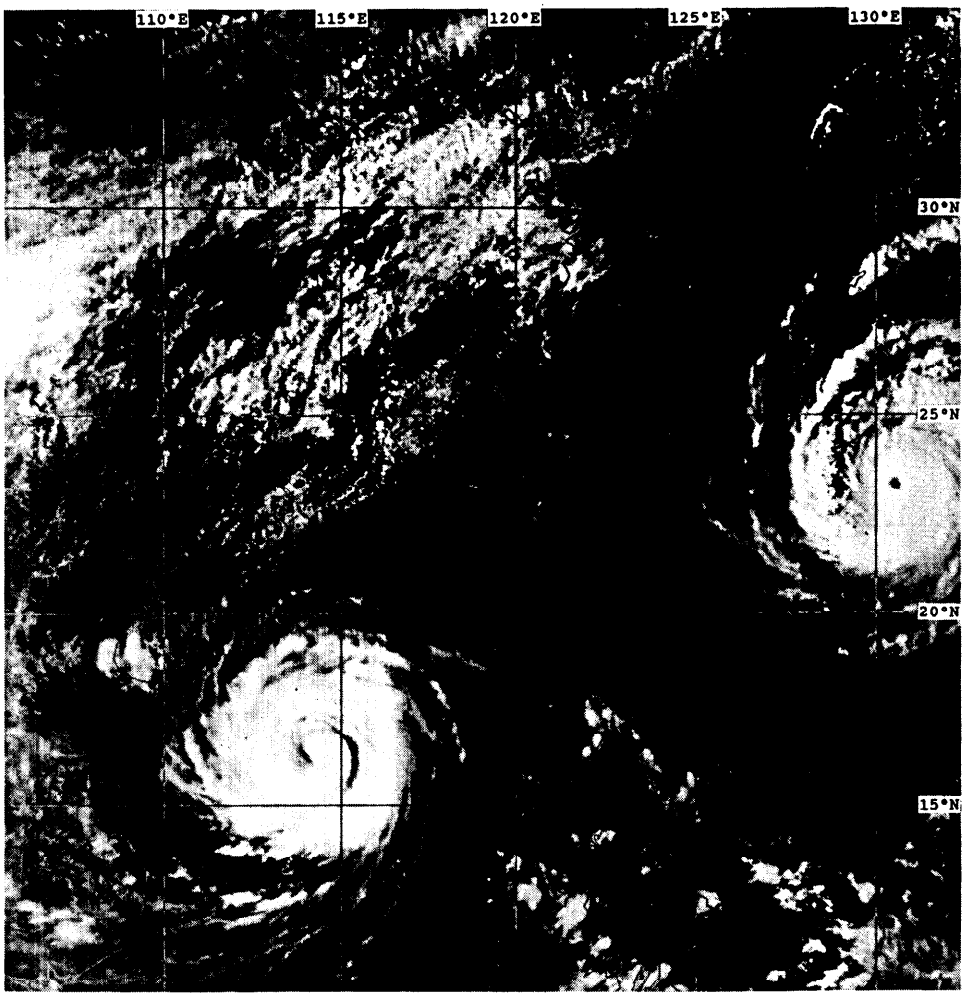

Figure 24. GMS-4 visible imagery around 2 p.m. on 16 September 1990 showing Ed at peak intensity. The other typhoon to the east of Taiwan was Flo.

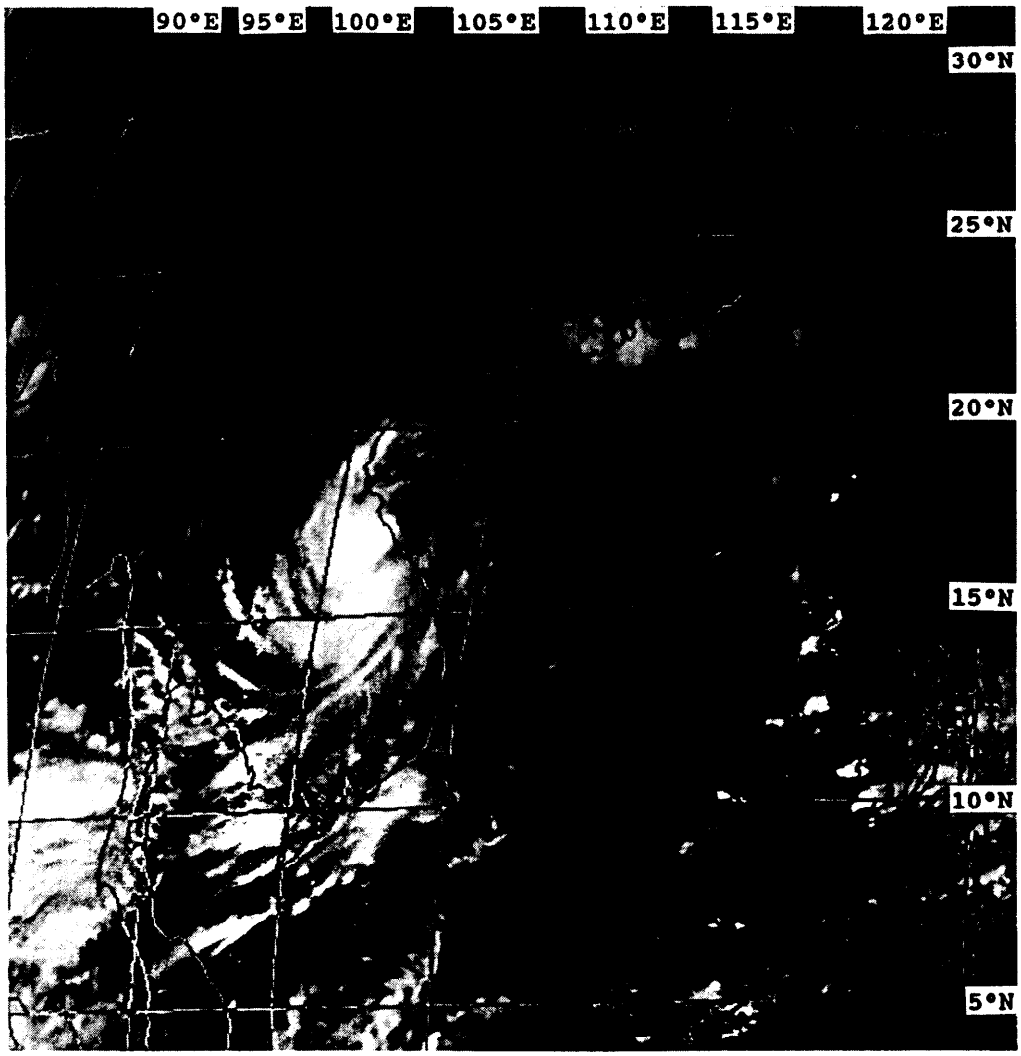

Figure 25. GMS-4 infra-red imagery around 2 p.m. on 19 September 1990 with Ed located near the Vietnamese coast. An outer rainband of Ed extended all the way to the coast of Guangdong and brought heavy rain to Hong Kong.

4. DESCRIPTION OF TABLES

TABLE 1 is a list of tropical cyclones in 1990 in the western North Pacific and the adjacent seas (i.e. the area bounded by the Equator, 45°N, 100°E and 180°). The names of these tropical cyclones are those used by the U.S. Naval Oceanography Command Center/Joint Typhoon Warning Center in Guam. The four-digit numbers in parentheses are numbers assigned to each tropical cyclone of tropical storm intensity or above by the Japan Meteorological Agency. The dates cited are the residence times of each tropical cyclone within the above-mentioned region and as such might not cover the full life-span. This limitation applies to all other elements in the table.

TABLE 2 gives the number of tropical cyclone warnings for shipping issued by the Royal Observatory, Hong Kong in 1990, the duration of these warnings and the time of issue of the first and last warnings for all tropical cyclones in Hong Kong's area of responsibility (i.e. the area bounded by l0°N, 30°N, 105°E and 125°E). Times are given in hours and minutes in UTC.

TABLE 3 presents a summary of the occasions/durations of the hoisting of tropical cyclone warning signals in 1990. The sequence of the signals displayed and the number of tropical cyclone warning bulletins issued for each tropical cyclone are also given. Times are given in hours and minutes in Hong Kong Time.

TABLE 4 presents a summary of the occasions/durations of the hoisting of tropical cyclone warning signals from 1956 to 1990 inclusive.

TABLE 5 gives the annual number of tropical cyclones in Hong Kong's area of responsibility between 1956 and 1990. The annual number of tropical cyclones causing tropical cyclone warning signals to be raised in Hong Kong is also included.

TABLE 6 shows the maximum, mean and minimum duration of display of each tropical cyclone warning signal during the period 1956-1990.

TABLE 7 provides some meteorological information for those typhoons requiring the hoisting of the Hurricane Signal, No. 10, in Hong Kong since 1946. The information presented includes the distances and bearings of nearest approach, the minimum mean sea-level pressures recorded at the Royal Observatory and the maximum 60-minute mean winds and maximum gust peak speeds recorded at some stations in Hong Kong.

TABLE 8 presents the casualties and damage figures associated with tropical cyclones in Hong Kong for 1957-1990. The information is compiled from local newspaper reports and from the Marine Department's records.

TABLE 9 contains damage caused by tropical cyclones in 1990. The information is compiled from reports by various government departments, public utility companies and local newspapers.

TABLE 10 is a summary of meteorological information for each tropical cyclone affecting Hong Kong in 1990. Information on the nearest approach together with an estimate of the minimum central pressure of each tropical cyclone during its closest approach, the maximum winds at the Royal Observatory and Waglan Island, the minimum mean sea-level pressure recorded at the Royal Observatory and the maximum storm surge (the excess, in metres, of the actual water level over that predicted in the Tide Tables) are included.

TABLE 11 tabulates the amount of rainfall associated with each tropical cyclone that came within 600 km of Hong Kong in 1990, and highlights the 10 wettest tropical cyclones in Hong Kong for the period 1884-1939 and 1947-1990.

TABLE 1. LIST OF TROPICAL CYCLONES IN THE WESTERN NORTH PACIFIC AND THE SOUTH CHINA SEA IN 1990

Name of tropical cyclone		Beginning of track			End of track			Remark
		Date	Time UTC	Position °N °E	Date	Time UTC	Position °N °E	
Severe Tropical Storm Koryn	(9001)	12 Jan	0600	6.8 152.5	17 Jan	0000	24.4 151.2	Became Extratropical
Tropical Depression Lewis	(9002)	28 Apr	1200	7.1 151.5	2 May	1800	14.5 151.5	Dissipated
Typhoon Marian	(9003)	15 May	0600	9.9 117.3	19 May	0600	24.3 122.3	Became Extratropical
Tropical Depression		14 Jun	0000	14.5 112.9	15 Jun	1800	13.6 111.3	Dissipated
Severe Tropical Storm Nathan	(9004)	15 Jun	0600	17.6 117.5	18 Jun	1800	22.3 107.4	Dissipated
Typhoon Ofelia	(9005)	17 Jun	1200	9.2 134.5	24 Jun	1800	33.1 120.3	Became Extratropical
Typhoon Percy	(9006)	20 Jun	1800	11.0 146.6	29 Jun	1800	25.1 117.7	Dissipated
Tropical Storm Robyn	(9007)	4 Jul	1800	9.6 141.0	11 Jul	0600	32.4 125.8	Became Extratropical
Typhoon Steve	(9008)	24 Jul	1200	17.0 141.2	1 Aug	0600	34.6 157.5	Became Extratropical
Severe Tropical Storm Tasha	(9009)	27 Jul	0000	19.5 119.5	31 Jul	0600	24.9 114.9	Dissipated
Typhoon Vernon	(9010)	29 Jul	0600	18.4 136.3	9 Aug	0600	39.5 160.5	Became Extratropical
Severe Tropical Storm Winona	(9011)	6 Aug	1200	28.9 132.5	11 Aug	0000	42.3 144.1	Became Extratropical
Tropical Storm Aka	(9013)	13 Aug	0600	15.0 180.0	14 Aug	1800	16.5 172.0	Dissipated
Typhoon Yancy	(9012)	13 Aug	1200	19.0 147.0	22 Aug	1800	24.5 117.5	Dissipated
Typhoon Zola	(9014)	16 Aug	1200	15.5 145.0	22 Aug	1200	39.0 134.7	Became Extratropical
Typhoon Abe	(9015)	24 Aug	1800	13.0 144.0	1 Sep	1200	34.0 122.2	Became Extratropical
Typhoon Becky	(9016)	24 Aug	1800	18.3 128.6	30 Aug	0600	17.6 102.3	Dissipated
Tropical Storm Cecil		3 Sep	0600	23.8 122.5	4 Sep	1800	27.2 120.4	Dissipated
Typhoon Dot	(9017)	4 Sep	0000	13.7 139.0	9 Sep	0000	24.4 115.8	Dissipated
Typhoon Ed	(9018)	10 Sep	1200	19.5 145.5	20 Sep	0600	19.6 105.2	Dissipated
Typhoon Flo	(9019)	12 Sep	0600	12.0 148.5	20 Sep	0600	40.6 145.3	Became Extratropical
Typhoon Gene	(9020)	23 Sep	1200	16.6 132.3	30 Sep	1200	35.3 139.8	Became Extratropical
Typhoon Hattie	(9021)	1 Oct	1200	16.0 147.2	8 Oct	0600	34.9 138.2	Became Extratropical
Tropical Storm Ira	(9022)	1 Oct	1800	13.4 113.6	3 Oct	0600	14.0 107.6	Dissipated
Tropical Depression Jeana		12 Oct	0600	13.4 114.6	14 Oct	1200	13.6 108.8	Dissipated
Typhoon Kyle	(9023)	15 Oct	1800	14.2 148.4	22 Oct	0600	34.3 152.2	Became Extratropical
Tropical Storm Lola	(9024)	16 Oct	1800	14.6 114.5	18 Oct	1200	14.2 107.0	Dissipated
Typhoon Mike	(9025)	6 Nov	0600	6.7 151.0	17 Nov	1800	20.6 108.2	Dissipated
Tropical Storm Nell	(9026)	9 Nov	1800	13.0 114.0	12 Nov	0600	12.7 108.7	Dissipated
Typhoon Owen	(9027)	19 Nov	1200	8.9 174.5	30 Nov	0600	11.8 140.1	Dissipated
Typhoon Page	(9028)	22 Nov	0600	11.9 142.8	30 Nov	1200	35.6 137.1	Became Extratropical
Typhoon Russ	(9029)	14 Dec	0000	5.4 172.5	23 Dec	1200	24.1 142.0	Dissipated

TABLE 2. TROPICAL CYCLONE WARNINGS FOR SHIPPING ISSUED IN 1990

Tropical cyclone	No. of warnings issued	Date and time+ of issue of		Duration of warnings (hours)
		First warning	Last warning	
*Typhoon Marian	34	15 May 1200	19 May 1500	99
Tropical Depression	17	14 Jun 0900	16 Jun 0900	48
*Severe Tropical Storm Nathan	29	15 Jun 0600	18 Jun 1800	84
Typhoon Ofelia	26	21 Jun 0600	24 Jun 0900	75
*Typhoon Percy	30	26 Jun 1200	30 Jun 0300	87
Tropical Storm Robyn	16	8 Jul 2100	10 Jul 1800	45
*Severe Tropical Storm Tasha	34	27 Jul 0300	31 Jul 0600	99
Typhoon Yancy	42	17 Aug 2100	23 Aug 0000	123
*Typhoon Becky	31	25 Aug 2100	29 Aug 1500	90
Typhoon Abe	13	30 Aug 0000	31 Aug 1200	36
Tropical Storm Cecil	12	4 Sep 0000	5 Sep 0900	33
Typhoon Dot	19	6 Sep 2100	9 Sep 0300	54
*Typhoon Ed	52	14 Sep 0000	20 Sep 0900	153
Tropical Storm Ira	13	2 Oct 0300	3 Oct 1500	36
Tropical Storm Lola	15	17 Oct 0600	19 Oct 0000	42
Tropical Storm Nell	22	10 Nov 0300	12 Nov 1800	63
Typhoon Mike	45	12 Nov 1800	18 Nov 0600	132
Total	450			1299

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

+ Times are given in hours and minutes UTC

TABLE 3. TROPICAL CYCLONE WARNING SIGNALS HOISTED IN HONG KONG AND NUMBER OF WARNING BULLETINS ISSUED IN 1990

SUMMARY

Signal	No. of occasions	Total duration
1	6	180 h 50 min
3	4	64 h 20 min
8 NORTHWEST	-	-
8 SOUTHWEST	-	-
8 NORTHEAST	-	-
8 SOUTHEAST	-	-
9	-	-
10	-	-
Total	10	245 h 10 min

DETAILS

Tropical cyclone	No. of warning bulletins issued	Signal	Hoisted		Lowered	
			Date	Time*	Date	Time*
Typhoon Marian	19	1	17 May	1545	18 May	0500
		3	18 May	0500	18 May	1815
Severe Tropical Storm Nathan	12	1	17 Jun	1605	17 Jun	2200
		3	17 Jun	2200	18 Jun	1010
Typhoon Percy	16	1	28 Jun	0800	29 Jun	1330
Severe Tropical Storm Tasha	37	1	28 Jul	0920	30 Jul	1345
		3	30 Jul	1345	31 Jul	1330
Typhoon Becky	20	1	27 Aug	0600	28 Aug	0500
		3	28 Aug	0500	28 Aug	2010
Typhoon Ed	27	1	14 Sep	2300	17 Sep	0745

* Hong Kong Time (UTC + 8) in hours and minutes

TABLE 4. FREQUENCY AND TOTAL DURATION OF DISPLAY OF TROPICAL CYCLONE WARNING SIGNALS : 1956-1990

Year \ Signals	1	3	8 NW	8 SW	8 NE	8 SE	9	10	Total duration h min
1956	5	4	0	0	0	0	0	0	191 25
1957	4	9	1	1	2	2	0	1	295 45
1958	4	5	0	0	1	0	0	0	214 5
1959	1	1	0	0	0	0	0	0	36 35
1960	11	7	0	2	2	2	1	1	432 35
1961	6	7	1	2	1	0	1	1	192 55
1962	4	3	0	1	1	0	1	1	158 10
1963	4	5	0	0	1	0	0	0	175 50
1964	11	14	1	3	5	3	3	2	570 15
1965	7	6	0	0	1	1	0	0	239 40
1966	6	5	0	0	2	2	0	0	284 40
1967	8	6	0	0	2	1	0	0	339 10
1968	7	7	0	1	1	0	1	1	290 10
1969	4	2	0	0	0	0	0	0	110 15
1970	6	8	2	1	2	0	0	0	286 45
1971	9	10	1	3	2	2	1	1	323 25
1972	8	6	0	0	1	1	0	0	288 20
1973	8	6	1	1	1	0	1	0	416 50
1974	12	10	0	0	2	1	1	0	525 20
1975	8	6	1	0	0	1	1	1	292 20
1976	6	6	0	0	1	2	0	0	351 30
1977	8	6	0	0	1	0	0	0	395 10
1978	8	9	1	1	3	2	0	0	462 10
1979	5	5	1	0	2	2	1	1	281 15
1980	10	8	0	0	1	1	0	0	414 5
1981	5	4	0	0	1	1	0	0	202 20
1982	7	4	0	0	0	0	0	0	247 35
1983	8	7	0	1	2	2	1	1	289 42
1984	6	6	0	0	1	0	0	0	280 2
1985	5	4	1	0	0	1	0	0	193 35
1986	6	7	0	1	1	0	0	0	305 0
1987	6	1	0	0	0	0	0	0	165 45
1988	6	4	0	0	0	0	0	0	204 10
1989	7	8	0	0	2	2	0	0	306 10
1990	6	4	0	0	0	0	0	0	245 10
Total	232	210	11	18	42	29	13	11	10008 9
Mean	6.6	6.0	0.3	0.5	1.2	0.8	0.4	0.3	285 57

TABLE 5. NUMBER OF TROPICAL CYCLONES IN HONG KONG'S AREA OF RESPONSIBILITY AND THE NUMBER THAT NECESSITATED THE DISPLAY OF TROPICAL CYCLONE WARNING SIGNALS IN HONG KONG : 1956-1990

Year	Number in Hong Kong's Area of responsibility	Number necessitating the display of signals in Hong Kong
1956	23	5
1957	12	6
1958	15	5
1959	18	2
1960	18	9
1961	24	6
1962	20	4
1963	13	4
1964	26	10
1965	16	6
1966	17	6
1967	17	8
1968	12	6
1969	11	4
1970	21	6
1971	20	9
1972	15	5
1973	17	9
1974	21	11
1975	12	7
1976	10	5
1977	10	8
1978	20	8
1979	18	6
1980	17	10
1981	15	5
1982	16	5
1983	15	7
1984	14	5
1985	15	5
1986	16	4
1987	12	5
1988	17	6
1989	17	7
1990	18	6
Total	578	220
Mean	16.5	6.3

TABLE 6. DURATION OF DISPLAY OF TROPICAL CYCLONE WARNING SIGNALS IN HONG KONG, 1956-1990

Signal hoisted	Number of occasions	Duration of each occasion						Total duration per year					
		mean		maximum		minimum		mean		maximum		minimum	
		h	min	h	min	h	min	h	min	h	min	h	min
1 or higher	228	43	54	161	0	9	35	285	57	570	15	36	35
3 or higher	162	31	42	124	15	6	55	146	43	306	35	23	55
8 or higher	50	17	13	66	50	2	40	24	35	100	55	0	0
8NW	11	6	51	15	45	1	30	2	9	15	45	0	0
8SW	18	5	17	10	45	2	30	2	43	16	10	0	0
8NE	42	8	48	35	35	2	35	10	33	40	20	0	0
8SE	29	7	32	21	45	0	20	6	15	31	15	0	0
9 or higher	14	7	18	11	33	3	35	2	55	19	25	0	0
10	11	6	10	9	10	2	30	1	56	12	10	0	0

TABLE 7. TYPHOONS REQUIRING THE HOISTING OF THE HURRICANE SIGNAL NO. 10 DURING THE PERIOD 1946-1990

Name of typhoon	Date	Nearest approach to Royal Observatory (km)	Minimum M.S.L. pressure(hPa)		Maximum 60-min mean winds in points and km/h								Maximum gust peak speed in km/h with direction in points							
			Hourly	Inst.	Royal Observatory	Hong Kong Airport	Waglan Island	Cheung Chau	Tate's Cairn	Cape Collinson	Green Island	Castle Peak	Royal Observatory	Hong Kong Airport	Waglan Island	Cheung Chau	Tate's Cairn	Cape Collinson	Green Island	Castle Peak
-	18 Jul 1946	S 70	985.7	-	NE -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gloria	22 Sep 1957	SW 55	986.2	984.3	ESE 115	ESE 72	E 113	-	-	-	-	-	E 187	ENE 158	ENE 185	-	-	-	-	-
Mary	9 Jun 1960	WNW 10	974.3	973.8	SSE 96	SSE 92	SSW 112	-	-	-	-	-	SSE 191	SE 164	SSW 194	-	-	-	-	-
Alice	19 May 1961	0	981.6	981.1	ENE 83	E 70	ESE 90	ENE 76	-	-	-	-	E 166	ENE 139	SW 128	ENE 135	-	-	-	-
Wanda	1 Sep 1962	SSW 20	955.1	953.2	N 133	N 108	NW 148	NW 118	SE 189	-	-	-	N 259	N 229	NNW 216	NW 232	ESE 284	-	-	-
Ruby	5 Sep **1964**	SW 30	971.0	968.2	E 110	N 118	ENE 148	NE 113	ESE 167	SSE 153	-	-	NNE 227	NW 203	E 230	NNE 216	E 268	S 221	-	-
Dot	13 Oct **1964**	E 35	978.9	977.3	NNW 88	N 67	N 117	NNW 96	NNE 157	N 101	-	-	N 175	N 198	N 184	WNW 205	NE 220	NNE 187	-	-
Shirley	21 Aug 1968	0	968.7	968.6	N 68	N 75	NNE 124	SSW 90	NNE 126	SSW 85	-	-	N 133	N 151	NE 209	SSW 167	NNE 203	N 173	-	-
Rose	17 Aug 1971	WSW 20	984.5	982.8	SE 103	SE 122	ESE 140	SE 131	S 148	SSW 137	-	-	ESE 224	ESE 211	ESE 189	SE 194	S 221	S 191	-	-
Elsie	14 Oct 1975	S 50	996.4	996.2	ENE 58	NNW 67	NNE 118	N 106	NE 130	-	NNW 118	N 65	NE 140	N 140	ENE 176	NE 158	NNE 180	-	NE 167	N 121
Hope	2 Aug 1979	NNW 10	961.8	961.6	W 75	W 115	SW 144	SSW 117	NW 115	-	W 108	- 96	W 175	WNW 182	SW 198	WSW 185	WNW 229	-	W 167	- 173
Ellen	9 Sep 1983	SW 45	983.9	983.1	E 92	E 112	ESE 169	ESE 171	E 126	-	S 137	SE 94	E 185	E 203	E 227	SSE 238	ENE 218	-	S 220*	SE 171

* estimated, exceeding upper limit of anemogram.

TABLE 8. CASUALTIES AND DAMAGE CAUSED BY TROPICAL CYCLONES IN HONG KONG : 1957-1990

Year	Date	Name of tropical cyclone	Ocean-going vessels in trouble	Small craft sunk or wrecked	Small craft damaged	Persons dead	Persons missing	Persons injured
1957	20 - 23 Sep	T. Gloria	5	2	Several	8	*	111
1960	4 - 12 Jun	T. Mary	6	352	462	45	11	127
1961	17 - 21 May	T. Alice	*	*	*	4	0	20
	7 - 10 Sep	S.T.S. Olga	0	1	0	7	0	0
1962	28 Aug - 2 Sep	T. Wanda	36	1 297	756	130	53	*
1963	1 - 9 Sep	T. Faye	0	2	0	3	0	51
1964	26 - 28 May	T. Viola	5	18	18	0	0	41
	2 - 9 Aug	T. Ida	3	7	60	5	4	56
	2 - 6 Sep	T. Ruby	20	32	282	38	6	300
	4 - 10 Sep	T. Sally	0	0	0	9	0	24
	7 - 13 Oct	T. Dot	2	31	59	26	10	85
1965	6 - 16 Jul	T. Freda	0	1	0	2	0	16
	25 - 28 Sep	T.S. Agnes	0	0	0	5	0	3
1966	12 - 14 Jul	S.T.S. Lola	0	*	6	1	0	6
1967	19 - 22 Aug	S.T.S. Kate	3	1	0	0	0	3
1968	17 - 22 Aug	T. Shirley	1	*	3	0	0	4
1969	22 - 29 Jul	T. Viola	0	3	0	0	0	0
1970	1 - 3 Aug	T.D.	0	0	0	2+	0	0
	8 - 14 Sep	T. Georgia	2	0	*	0	0	0
1971	15 - 18 Jun	T. Freda	8	0	0	2	0	30
	16 - 22 Jul	T. Lucy	10	2	13	0	0	38
	10 - 17 Aug	T. Rose	33**	303	*	110	5	286
1972	4 - 9 Nov	T. Pamela	3	0	0	1	0	8
1973	14 - 20 Jul	T. Dot	14	*	*	1	0	38
1974	7 - 14 Jun	T. Dinah	1	*	*	0	0	0
	18 - 22 Jul	T. Ivy	2	*	*	0	0	0
	15 - 19 Oct	T. Carmen	5	*	*	1	0	0
	21 - 27 Oct	T. Della	2	*	*	0	0	0
1975	10 - 14 Aug	T.D.	3	1	*	2	1	0
	9 - 14 Oct	T. Elsie	7	2	1	0	0	46
	16 - 23 Oct	S.T.S. Flossie	1	*	*	0	0	0
1976	22 Jun - 4 Jul	T. Ruby	0	0	0	3	2	2
	21 - 26 Jul	S.T.S. Violet	0	0	0	2	1	1
	5 - 6 Aug	S.T.S. Clara	0	0	0	0	0	4
	21 - 24 Aug	T.S. Ellen	0	4	7	27	3	65
	15 - 21 Sep	T. Iris	6	0	1	0	0	27
1977	4 - 6 Jul	T.D.	0	0	0	0	0	2
	3 - 5 Sep	T.S. Carla	1	0	0	0	0	1
	22 - 25 Sep	S.T.S. Freda	2	0	0	1	0	37
1978	24 - 30 Jul	S.T.S. Agnes	0	25	42	3	0	134
	9 - 12 Aug	T.S. Bonnie	2	0	0	0	0	0
	23 - 28 Aug	S.T.S. Elaine	8	5	8	1	0	51
	22 - 26 Sep	S.T.S. Kit	0	1	0	0	7	0
	7 - 16 Oct	S.T.S. Nina	0	0	0	0	0	2
	17 - 29 Oct	T. Rita	1	5	0	0	0	3
1979	1 - 6 Jul	T. Ellis	0	2	0	0	0	0
	26 - 30 Jul	T.S. Gordon	0	2	0	0	0	0
	28 Jul - 3 Aug	T. Hope	29	167	207	12	0	260
	6 - 9 Aug	T.D.	0	3	0	0	0	0
	16 - 24 Sep	S.T.S. Mac	2	12	0	1	0	67
1980	5 - 12 Jul	S.T.S. Ida	1	0	0	0	0	0
	18 - 23 Jul	T. Joe	4	0	1	2	1	59
	20 - 28 Jul	T. Kim	0	2	1	0	0	0
	29 Oct - 2 Nov	T.S. Cary	0	0	2	0	0	0
1981	3 - 7 Jul	S.T.S. Lynn	0	0	3	0	0	32
1982	27 Jun - 2 Jul	T.S. Tess	0	1	0	0	0	16
	22 - 30 Jul	T. Andy	0	0	1	0	0	0
	5 - 16 Sep	T. Irving	0	0	2	0	0	0
1983	12 - 19 Jul	T. Vera	0	1	0	0	0	0
	29 Aug - 9 Sep	T. Ellen	44	135	225	10	12	333
	10 - 14 Oct	T. Joe	2	0	3	0	0	58
	20 - 26 Oct	S.T.S. Lex	0	0	1	0	0	0
1984	27 Aug - 7 Sep	T. Ike	0	0	0	0	0	1
1985	19 - 25 Jun	T. Hal	0	4	2	0	1	13
	1 - 7 Sep	T. Tess	6	1	3	2	0	12
	13 - 22 Oct	T. Dot	0	0	0	0	0	1
1986	3 - 12 Jul	T. Peggy	3	0	3	1	0	26
	9 - 12 Aug	T.D.	0	1	5	0	0	3
	18 Aug - 6 Sep	T. Wayne	0	3	0	3	1	15+
	11 - 19 Oct	T. Ellen	1	2	1	0	0	4
1987	16 - 27 Oct	T. Lynn	0	0	0	0	0	1
1988	14 - 20 Jul	T. Warren	1	2	1	0	1	12
	19 - 22 Sep	T. Kit	0	0	1	0	0	0
	18 - 23 Oct	T. Pat	0	0	0	2	0	1
	21 - 29 Oct	T. Ruby	0	0	0	0	0	4
1989	16 - 21 May	T. Brenda	0	3	5	6	1	119
	11 - 19 Jul	T. Gordon	1	0	8	2	0	31
	8 - 14 Oct	T. Dan	1	0	1	0	0	0
1990	15 - 19 May	T. Marian	0	0	1	0	0	0
	15 - 19 Jun	S.T.S. Nathan	1	0	2	5	1	1
	21 - 30 Jun	T. Percy	0	0	0	1	0	0
	27 - 31 Jul	S.T.S. Tasha	0	1	0	0	0	1
	25 - 30 Aug	T. Becky	0	0	0	0	1	0
	10 - 20 Sep	T. Ed	0	0	0	0	0	1

N.B. Information compiled from Hong Kong newspapers and from Marine Department's records
* Data unavailable
\+ Struck by lightning

**Note: Number of Ocean-going vessels in trouble is revised on 30 Jul 2021.

TABLE 9. DAMAGE CAUSED BY TROPICAL CYCLONES IN HONG KONG, 1990

Name of tropical cyclone	Month	Damage in physical terms					Damage in monetary terms (million HK$)					
		Agricultural	Public works facilities	Public utilities	Private property	Landslip & collapse of slope	Agricultural	Public works facilities	Public utilities	Private property	Others	Total
S.T.S. Nathan	Jun	-	-	-	6 units	-	-	-	-	-	-	-
T. Percy	Jun	2 hectares	-	-	-	3	-	-	-	-	-	-
T. Ed	Sep	-	-	-	23 units	-	-	-	-	-	-	-

TABLE 10. A SUMMARY OF METEOROLOGICAL OBSERVATIONS RECORDED IN HONG KONG DURING THE PASSAGES OF TROPICAL CYCLONES IN 1990

(a)

Name of tropical cyclone	Month	Nearest approach to Hong Kong						Minimum hourly M.S.L. pressure at the Royal Observatory			Maximum storm surge (metres)							
		Day	Hour*	Direction	Distance (km)	Movement (km/h)	Estimated minimum central pressure (hPa)	Day	Hour*	Pressure (hPa)	Chi Ma Wan	Ko Lau Wan	Lok On Pai	Quarry Bay	Tai O	Tai Po Kau	Tsim Bei Tsui	Waglan Island
T. Marian	May	18	15	SSE	280	NE 34	980	18	17	1004.5	-	0.34	0.39	0.30	0.26	0.41	0.57	0.22
S.T.S. Nathan	Jun	17	24	SW	390	NW 16	985	17	18	1000.7	-	0.67	0.48	0.46	0.54	0.67	0.46	0.45
T. Percy	Jun	29	11	ENE	350	N 12	965	28	17,18	999.5	-	0.43	0.27	0.20	0.20	0.30	-	0.18
S.T.S. Tasha	Jul	31	3	ENE	160	N 22	970	31	3	990.9	0.70	1.00	0.59	0.73	-	0.74	-	0.89
T. Becky	Aug	28	6	S	510	W 22	960	28	5,7	1002.2	0.59	0.64	0.63	0.64	-	0.77	-	-
T. Ed	Sep	16	2	SSE	620	WSW 19	965	16	16	1006.2	0.39	0.58	0.36	0.28	0.30	0.20	-	-

(b)

Name of tropical cyclone	Month	Maximum 60-min mean wind in points and km/h		Maximum 10-min mean wind in points and km/h		Maximum gust peak speed in km/h with direction in points	
		Royal Observatory	Waglan Island	Royal Observatory	Waglan Island	Royal Observatory	Waglan Island
T. Marian	May	NE 19	N 52	NE 22	N 54	NE 43	N 67
S.T.S. Nathan	Jun	E 41	E 63	ESE 41	ESE 67	E 75	ESE 85
T. Percy	Jun	W 20	WSW 34	W 22	WSW 36	W 30	W 45
S.T.S. Tasha	Jul	W 36	ENE 68	W 40	ENE 85	NE 72	ENE 96
T. Becky	Aug	E 38	E 72	E 41	E 77	E 81	E 96
T. Ed	Sep	E 22	E 56	E 23	E 62	E 45	E 72

* Hong Kong Time (UTC + 8)

TABLE 11 (a). Rainfall associated with tropical cyclones that came within 600 km of Hong Kong (with or without hoisting of tropical cyclone warning signals) in 1990

Name of tropical cyclone	Month	Rainfall at the Royal Observatory (mm)				
		(i) 600 km	(ii) 24 hours	(iii) 48 hours	(iv) 72 hours	(i) + (iv)
T. Marian	May	17.6	Nil	Nil	Nil	17.6
S.T.S. Nathan	Jun	124.7	1.1	1.1	1.1	125.8
T. Percy	Jun	12.6	83.1	83.1	83.1	95.7
S.T.S. Tasha	Jul	69.0	20.3	96.6	126.4	195.4
T. Yancy #	Aug	Trace	0.3	0.3	0.7	0.7
T. Becky	Aug	22.7	2.9	2.9	2.9	25.6
T. Dot #	Sep	32.2	10.2	192.2	196.8	229.0

(b). THE 10 WETTEST TROPICAL CYCLONES IN HONG KONG (1884-1939, 1947-1990)

Tropical Cyclone			Rainfall at the Royal Observatory (mm)				
Year	Month	Name	(i) 600 km	(ii) 24 hours	(iii) 48 hours	(iv) 72 hours	(i) + (iv)
* 1926	Jul	-	34.8	534.0	561.1	562.2	597.0
* 1916	Jun	-	494.8	27.9	59.4	67.2	562.0
1965	Sep	Agnes	404.6	8.9	64.3	126.1	530.7
1978	Jul	Agnes	502.4	12.3	12.3	16.6	519.0
1976	Aug	Ellen	90.7	394.2	421.0	425.4	516.1
1982	Aug	Dot	41.2	322.5	403.1	450.5	491.7
* 1904	Aug	-	446.5	NIL	3.7	26.7	473.2
1974	Oct	Carmen	307.6	150.3	161.7	162.1	469.7
* 1960	Jun	Mary	427.5	NIL	2.6	13.3	440.8
1989	May	Brenda	410.2	22.5	22.9	29.4	439.6

N.B. (i) during the period in hours when the tropical cyclone was centred within 600 km of Hong Kong.

(ii) during the 24-hour period after the tropical cyclone moved outside (or dissipated within) the 600 km radius.

(iii) during the 48-hour period after the tropical cyclone moved outside (or dissipated within) the 600 km radius.

(iv) during the 72-hour period after the tropical cyclone moved outside (or dissipated within) the 600 km radius.

Tropical cyclones without hoisting of tropical cyclone warning signals.

* For years prior to 1961, (i) is the sum of daily rainfall on those days when the tropical cyclone was centred within 600 km of Hong Kong, (ii) to (iv) are correspondingly the sum of daily rainfall figures of the following days.

5. TROPICAL CYCLONE POSITION AND INTENSITY DATA, 1990

Six-hourly position and intensity data are tabulated. for the following tropical cyclones in 1990 in the western North Pacific and the South China Sea (i.e. the area between the Equator and 45°N, and between 100°E and 180°).

Surface winds in this section refer to wind speeds averaged over a period of 10 minutes.

SIX-HOURLY POSITION AND INTENSITY DATA OF
SEVERE TROPICAL STORM KORYN (9001)

Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
12	0600	T.D.	1000	13	6.8	152.5
	1200	T.D.	1000	13	7.6	151.8
	1800	T.D.	995	16	8.3	150.7
13	0000	T.D.	995	16	8.9	149.4
	0600	T.D.	995	16	9.8	148.1
	1200	T.S.	990	21	11.3	146.7
	1800	T.S.	985	23	12.3	145.9
14	0000	T.S.	985	23	13.3	145.5
	0600	S.T.S.	980	25	13.9	145.4
	1200	S.T.S.	970	31	14.5	145.4
	1800	S.T.S.	975	28	15.0	145.5
15	0000	S.T.S.	980	25	15.5	145.8
	0600	S.T.S.	980	25	16.0	146.0
	1200	T.S.	985	23	16.6	146.2
	1800	T.S.	985	23	17.2	146.2
16	0000	T.S.	985	23	18.0	146.2
	0600	T.S.	990	23	19.6	146.5
	1200	T.S.	990	21	21.1	147.2
	1800	T.S.	990	18	22.9	148.9
17	0000	T.S.	990	21	24.4	151.2

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF
TROPICAL DEPRESSION LEWIS (9002)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Apr	28	1200	T.D.	1002	13	7.1	151.5
		1800	T.D.	1002	13	7.7	151.0
	29	0000	T.D.	1000	13	8.4	150.6
		0600	T.D.	1000	13	9.3	150.4
		1200	T.D.	1000	13	10.4	150.7
		1800	T.D.	995	16	10.7	150.8
	30	0000	T.D.	995	16	11.1	150.9
		0600	T.D.	1000	13	11.3	151.1
		1200	T.D.	1000	13	11.6	151.2
		1800	T.D.	1000	13	11.8	151.4
May	1	0000	T.D.	1000	13	12.0	151.5
		0600	T.D.	995	16	12.4	151.9
		1200	T.D.	995	16	12.9	152.2
		1800	T.D.	995	16	13.1	152.2
	2	0000	T.D.	1000	13	13.3	152.2
		0600	T.D.	1000	13	13.7	152.0
		1200	T.D.	995	16	14.1	151.8
		1800	T.D.	995	16	14.5	151.5

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF TYPHOON MARIAN (9003)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
May	15	0600	T.D.	1000	13	9.9	117.3
		1200	T.D.	1000	16	10.3	116.3
		1800	T.S.	995	18	10.9	115.2
	16	0000	T.S.	990	21	11.5	114.2
		0600	T.S.	990	23	12.1	113.4
		1200	S.T.S.	985	25	12.8	112.8
		1800	S.T.S.	980	28	13.9	112.5
	17	0000	S.T.S.	975	31	14.8	112.4
		0600	S.T.S.	975	31	16.0	112.5
		1200	T.	970	36	17.1	112.7
		1800	T.	970	36	18.1	113.2
	18	0000	T.	975	33	19.0	114.0
		0600	S.T.S.	980	31	20.0	115.3
		1200	S.T.S.	985	28	20.9	116.9
		1800	T.S.	990	23	21.8	118.5
	19	0000	T.S.	995	18	22.9	119.9
		0600	T.D.	1000	16	24.3	122.3

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF
THE TROPICAL DEPRESSION OF 14-16 JUNE

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Jun	14	0000	T.D.	1000	13	14.5	112.9
		0600	T.D.	1000	13	14.3	112.8
		1200	T.D.	1000	13	14.0	112.6
		1800	T.D.	998	13	13.6	112.1
	15	0000	T.D.	998	13	13.9	111.9
		0600	T.D.	995	16	13.6	112.5
		1200	T.D.	995	16	13.4	111.9
		1800	T.D.	997	13	13.6	111.3

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF
SEVERE TROPICAL STORM NATHAN (9004)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Jun	15	0600	T.D.	995	16	17.6	117.5
		1200	T.D.	995	16	17.7	115.7
		1800	T.D.	995	16	17.7	113.8
	16	0000	T.S.	990	18	17.3	112.3
		0600	T.S.	985	21	17.0	112.1
		1200	T.S.	985	21	16.8	112.2
		1800	T.S.	985	23	17.2	112.3
	17	0000	S.T.S.	980	25	17.9	112.0
		0600	S.T.S.	980	25	18.7	112.0
		1200	S.T.S.	980	25	19.6	111.6
		1800	T.S.	985	23	20.4	111.0
	18	0000	T.S.	985	21	20.8	110.5
		0600	T.S.	985	18	21.5	109.5
		1200	T.D.	990	16	21.9	108.7
		1800	T.D.	995	13	22.3	107.4

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF
TYPHOON OFELIA (9005)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Jun	17	1200	T.D.	1000	13	9.2	134.5
		1800	T.D.	1000	16	9.2	133.7
	18	0000	T.D.	1000	16	9.2	132.8
		0600	T.S.	995	18	9.3	131.7
		1200	T.S.	990	21	9.5	130.7
		1800	T.S.	990	21	9.6	130.4
	19	0000	T.S.	990	21	9.6	130.2
		0600	T.S.	990	21	9.7	130.0
		1200	T.S.	990	21	9.9	129.5
		1800	T.S.	985	23	10.2	129.0
	20	0000	S.T.S.	980	28	10.6	128.6
		0600	S.T.S.	980	28	11.4	128.1
		1200	S.T.S.	980	28	12.4	127.5
		1800	S.T.S.	975	31	13.7	126.7
	21	0000	S.T.S.	975	31	15.0	125.7
		0600	S.T.S.	980	28	16.5	124.5
		1200	S.T.S.	975	31	17.3	123.9
		1800	T.	970	36	18.0	123.3
	22	0000	T.	965	39	18.9	122.5
		0600	T.	960	41	19.8	121.8
		1200	T.	960	43	20.3	121.5
		1800	T.	955	46	20.9	121.5
	23	0000	T.	955	46	22.4	121.6
		0600	T.	965	41	23.8	121.6
		1200	T.	975	33	24.9	121.1
		1800	S.T.S.	980	28	26.4	120.7
	24	0000	S.T.S.	990	25	28.2	120.4
		0600	T.S.	990	23	29.9	120.2
		1200	T.S.	995	21	31.5	120.0
		1800	T.S.	995	18	33.1	120.3

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF
TYPHOON PERCY (9006)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Jun	20	1800	T.D.	1005	13	11.0	146.6
	21	0000	T.D.	1002	16	10.9	146.2
		0600	T.S.	997	21	10.8	145.8
		1200	T.S.	995	21	10.4	145.2
		1800	T.S.	990	23	9.7	144.7
	22	0000	T.S.	987	23	8.8	144.2
		0600	S.T.S.	985	25	7.5	143.8
		1200	S.T.S.	985	25	7.1	142.9
		1800	S.T.S.	980	28	7.1	142.0
	23	0000	S.T.S.	975	31	7.3	141.4
		0600	S.T.S.	975	31	7.6	140.4
		1200	S.T.S.	975	31	8.0	139.2
		1800	T.	965	36	8.4	137.8
	24	0000	T.	955	39	8.9	136.5
		0600	T.	945	43	9.6	135.2
		1200	T.	935	49	10.6	133.7
		1800	T.	925	54	11.3	132.6
	25	0000	T.	925	54	11.9	131.1
		0600	T.	930	51	12.2	130.0
		1200	T.	940	49	13.1	129.1
		1800	T.	940	49	14.0	128.2
	26	0000	T.	935	51	14.8	126.8
		0600	T.	935	51	15.3	125.7
		1200	T.	935	51	15.8	124.6
		1800	T.	940	49	16.3	123.7
	27	0000	T.	940	49	17.0	122.7
		0600	T.	950	43	18.1	121.9
		1200	T.	960	39	19.0	121.0
		1800	T.	960	39	19.7	119.7
	28	0000	T.	955	41	20.2	119.0
		0600	T.	955	41	20.9	118.6
		1200	T.	960	39	21.8	118.0
		1800	T.	960	39	22.5	117.7
	29	0000	T.	965	36	23.0	117.5
		0600	S.T.S.	970	31	23.5	117.4
		1200	S.T.S.	980	28	24.3	117.5
		1800	T.S.	990	21	25.1	117.7

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF
TROPICAL STORM ROBYN (9007)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Jul	4	1800	T.D.	1000	13	9.6	141.0
	5	0000	T.D.	1000	13	10.4	139.5
		0600	T.D.	1000	13	10.9	138.2
		1200	T.D.	1000	13	11.2	137.0
		1800	T.D.	1000	13	11.6	135.5
	6	0000	T.D.	1000	16	12.0	134.0
		0600	T.D.	1000	16	12.5	133.0
		1200	T.D.	1000	13	13.0	132.0
		1800	T.D.	1000	16	13.5	131.1
	7	0000	T.D.	1000	16	14.1	130.2
		0600	T.D.	1000	13	14.9	129.4
		1200	T.D.	1000	13	15.6	128.8
		1800	T.D.	1000	16	16.4	128.0
	8	0000	T.D.	1000	16	17.2	127.3
		0600	T.D.	1000	16	18.1	126.6
		1200	T.D.	1000	16	19.0	125.9
		1800	T.S.	995	18	19.6	125.5
	9	0000	T.S.	995	18	20.6	124.9
		0600	T.S.	995	18	21.9	124.6
		1200	T.S.	995	18	23.2	124.5
		1800	T.S.	990	21	24.6	124.4
	10	0000	T.S.	990	21	26.1	124.3
		0600	T.S.	990	21	27.4	124.1
		1200	T.S.	990	21	28.7	124.3
		1800	T.S.	990	18	29.6	124.4
	11	0000	T.D.	990	16	30.9	125.0
		0600	T.D.	990	16	32.4	125.8

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF
TYPHOON STEVE (9008)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Jul	24	1200	T.D.	1000	13	17.0	141.2
		1800	T.D.	1000	16	17.2	141.4
	25	0000	T.D.	1000	13	17.5	141.6
		0600	T.D.	1000	13	17.8	141.8
		1200	T.D.	1000	16	18.2	142.2
		1800	T.S.	995	18	18.7	142.7
	26	0000	T.S.	995	18	19.0	143.2
		0600	T.S.	990	21	19.2	143.6
		1200	T.S.	985	23	19.4	144.0
		1800	S.T.S.	980	25	19.6	144.3
	27	0000	S.T.S.	975	28	20.0	144.6
		0600	T.	965	33	20.5	144.9
		1200	T.	955	39	21.0	145.0
		1800	T.	945	43	21.5	145.0
	28	0000	T.	935	49	22.2	145.0
		0600	T.	925	54	22.9	145.0
		1200	T.	930	49	23.5	144.9
		1800	T.	940	43	24.0	144.9
	29	0000	T.	935	46	24.5	144.9
		0600	T.	935	46	25.0	145.1
		1200	T.	945	41	25.5	145.4
		1800	T.	955	36	26.0	146.0
	30	0000	T.	955	36	26.4	146.6
		0600	T.	950	39	26.7	147.3
		1200	T.	950	39	27.0	148.2
		1800	T.	960	36	27.4	149.4
	31	0000	T.	965	33	28.0	150.6
		0600	T.	965	33	28.8	152.0
		1200	S.T.S.	970	31	29.9	153.8
		1800	S.T.S.	975	28	31.3	155.5
Aug	1	0000	S.T.S.	975	28	33.0	156.8
		0600	S.T.S.	975	28	34.6	157.5

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF
SEVERE TROPICAL STORM TASHA (9009)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Jul	27	0000	T.D.	998	13	19.5	119.5
		0600	T.D.	998	13	19.1	119.3
		1200	T.D.	998	13	18.7	119.2
		1800	T.D.	995	16	18.4	118.9
	28	0000	T.S.	994	18	18.4	118.4
		0600	T.S.	992	18	18.4	118.0
		1200	T.S.	990	21	18.3	117.6
		1800	T.S.	990	21	18.3	117.2
	29	0000	T.S.	985	23	18.3	116.6
		0600	T.S.	985	23	18.4	116.3
		1200	S.T.S.	980	25	18.5	116.1
		1800	S.T.S.	980	25	18.7	115.9
	30	0000	S.T.S.	975	28	19.4	115.9
		0600	S.T.S.	975	28	20.3	115.9
		1200	S.T.S.	970	31	21.3	115.9
		1800	S.T.S.	970	31	22.4	115.7
	31	0000	T.S.	980	23	23.5	115.4
		0600	T.D.	992	16	24.9	114.9

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF
TYPHOON VERNON (9010)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Jul	29	0600	T.D.	1000	13	18.4	136.3
		1200	T.D.	995	16	18.7	136.6
		1800	T.S.	990	21	19.1	136.9
	30	0000	T.S.	985	23	19.4	137.2
		0600	T.S.	985	23	19.5	137.4
		1200	S.T.S.	980	25	19.7	137.6
		1800	S.T.S.	975	28	20.0	137.9
	31	0000	S.T.S.	975	31	20.3	138.2
		0600	T.	970	33	21.0	138.7
		1200	T.	965	36	21.9	139.1
		1800	T.	965	36	22.9	139.2
Aug	1	0000	T.	960	39	23.9	139.2
		0600	T.	950	43	24.8	139.2
		1200	T.	960	39	25.7	139.2
		1800	T.	965	36	26.6	139.1
	2	0000	T.	965	36	27.5	139.1
		0600	T.	970	33	28.5	139.2
		1200	T.	965	36	29.4	139.3
		1800	T.	965	36	30.2	139.6
	3	0000	T.	970	33	31.0	139.8
		0600	T.	970	33	31.6	140.0
		1200	T.	965	36	32.0	140.1
		1800	T.	965	33	32.4	140.3
	4	0000	T.	965	33	32.8	140.6
		0600	T.	965	33	33.1	141.1
		1200	S.T.S.	970	31	33.3	141.8
		1800	S.T.S.	970	28	33.4	142.5
	5	0000	S.T.S.	975	25	33.5	143.1
		0600	S.T.S.	975	25	33.6	143.6
		1200	S.T.S.	975	25	33.6	144.0
		1800	S.T.S.	975	25	33.7	144.3
	6	0000	S.T.S.	975	25	33.7	144.6
		0600	S.T.S.	975	25	33.8	145.1
		1200	T.S.	980	23	34.1	145.7
		1800	T.S.	980	23	34.5	146.1
	7	0000	T.S.	980	23	35.0	146.5
		0600	T.S.	980	23	35.5	146.9
		1200	T.S.	980	23	36.0	147.4
		1800	T.S.	985	21	36.4	148.0
	8	0000	T.S.	985	21	37.0	149.7
		0600	T.S.	985	21	37.5	151.8
		1200	T.S.	985	21	38.0	154.0
		1800	T.S.	985	21	38.6	156.2
	9	0000	T.S.	985	21	39.1	158.3
		0600	T.S.	985	21	39.5	160.5

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF
SEVERE TROPICAL STORM WINONA (9011)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Aug	6	1200	T.D.	995	13	28.9	132.5
		1800	T.D.	995	16	28.0	133.4
	7	0000	T.D.	995	16	26.8	134.2
		0600	T.D.	995	16	26.2	135.3
		1200	T.S.	990	18	26.1	136.0
		1800	T.S.	985	21	26.1	136.4
	8	0000	T.S.	985	23	26.2	136.8
		0600	T.S.	985	23	27.0	137.4
		1200	S.T.S.	980	25	27.8	137.4
		1800	S.T.S.	980	25	28.6	137.4
	9	0000	S.T.S.	980	25	29.7	137.4
		0600	S.T.S.	975	28	31.0	137.3
		1200	S.T.S.	970	31	32.3	137.3
		1800	S.T.S.	970	31	33.6	137.6
	10	0000	S.T.S.	975	28	34.8	138.4
		0600	S.T.S.	985	25	36.5	139.6
		1200	T.S.	990	23	38.4	141.1
		1800	T.S.	990	21	40.4	142.4
	11	0000	T.S.	990	21	42.3	144.1

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF
TROPICAL STORM AKA (9013)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Aug	13	0600	T.S.	995	18	15.0	180.0
		1200	T.D.	1000	16	15.0	178.5
		1800	T.S.	995	18	15.0	177.0
	14	0000	T.D.	1000	16	15.2	175.6
		0600	T.D.	1000	13	15.8	174.4
		1200	T.D.	1000	13	16.3	173.2
		1800	T.D.	1000	13	16.5	172.0

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF
TYPHOON YANCY (9012)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Aug	13	1200	T.D.	995	13	19.0	147.0
		1800	T.D.	990	16	19.1	145.0
	14	0000	T.D.	990	16	18.7	142.8
		0600	T.D.	990	16	18.0	140.8
		1200	T.S.	985	18	18.4	138.8
		1800	T.S.	980	21	18.4	137.0
	15	0000	T.S.	975	23	18.0	135.6
		0600	T.S.	975	23	18.4	134.1
		1200	T.S.	975	23	18.9	133.3
		1800	S.T.S.	970	28	19.3	132.6
	16	0000	S.T.S.	970	25	19.6	131.8
		0600	S.T.S.	970	25	19.6	130.5
		1200	S.T.S.	970	25	19.5	129.2
		1800	S.T.S.	965	28	19.7	127.9
	17	0000	S.T.S.	965	31	20.5	127.5
		0600	T.	960	33	21.0	127.4
		1200	T.	955	36	21.3	126.4
		1800	T.	955	36	21.3	125.3
	18	0000	T.	955	36	21.6	124.8
		0600	T.	950	39	22.1	124.5
		1200	T.	945	41	22.7	124.3
		1800	T.	945	41	24.0	123.7
	19	0000	T.	950	39	24.7	122.7
		0600	T.	950	39	24.8	121.0
		1200	T.	960	33	24.7	121.3
		1800	S.T.S.	970	31	25.4	120.6
	20	0000	S.T.S.	970	31	25.5	119.6
		0600	T.S.	975	23	25.3	118.7
		1200	T.S.	975	21	25.0	118.6
		1800	T.S.	980	18	25.0	118.7
	21	0000	T.S.	980	18	25.3	118.6
		0600	T.S.	980	18	25.3	118.5
		1200	T.S.	980	18	25.0	118.1
		1800	T.S.	980	21	24.2	117.8
	22	0000	T.S.	980	21	24.3	118.4
		0600	T.S.	985	21	24.7	118.3
		1200	T.D.	990	16	24.8	118.0
		1800	T.D.	995	13	24.5	117.5

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF TYPHOON ZOLA (9014)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Aug	16	1200	T.D.	1000	13	15.5	145.0
		1800	T.D.	1000	13	15.9	144.7
	17	0000	T.D.	995	16	16.5	144.6
		0600	T.D.	995	16	17.0	144.7
		1200	T.D.	995	16	17.5	144.9
		1800	T.S.	990	21	18.0	145.1
	18	0000	S.T.S.	985	25	18.6	145.4
		0600	S.T.S.	985	25	19.2	145.6
		1200	S.T.S.	985	25	20.1	145.9
		1800	S.T.S.	985	25	21.1	146.1
	19	0000	S.T.S.	985	25	21.9	145.4
		0600	S.T.S.	985	25	22.1	144.2
		1200	S.T.S.	980	28	22.2	143.4
		1800	S.T.S.	975	31	22.5	142.6
	20	0000	S.T.S.	975	31	23.0	141.8
		0600	T.	970	33	23.7	140.7
		1200	T.	965	36	24.7	139.3
		1800	T.	965	36	25.8	137.8
	21	0000	T.	960	39	27.0	136.3
		0600	T.	965	36	28.3	134.9
		1200	T.	970	33	29.6	133.6
		1800	S.T.S.	975	31	31.1	132.5
	22	0000	S.T.S.	975	31	33.0	132.2
		0600	S.T.S.	980	25	35.7	132.7
		1200	T.S.	985	21	39.0	134.7

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF
TYPHOON ABE (9015)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Aug	24	1800	T.D.	995	13	13.0	144.0
	25	0000	T.D.	995	13	13.3	143.5
		0600	T.D.	990	13	13.4	143.0
		1200	T.D.	990	13	13.6	142.5
		1800	T.D.	990	16	13.8	142.1
	26	0000	T.D.	990	16	14.1	141.6
		0600	T.S.	985	18	14.6	141.3
		1200	T.S.	985	18	15.2	141.1
		1800	T.S.	985	18	15.8	140.9
	27	0000	T.S.	985	18	17.7	140.3
		0600	T.S.	980	21	19.2	139.7
		1200	T.S.	980	23	20.6	138.5
		1800	S.T.S.	975	25	21.4	136.5
	28	0000	S.T.S.	975	28	21.7	135.2
		0600	S.T.S.	970	31	22.1	134.0
		1200	T.	965	33	22.5	132.7
		1800	T.	965	33	23.2	130.8
	29	0000	T.	960	36	23.7	129.0
		0600	T.	960	39	23.9	127.6
		1200	T.	955	41	24.2	126.4
		1800	T.	950	43	24.6	125.5
	30	0000	T.	945	46	25.2	124.6
		0600	T.	950	43	25.9	123.7
		1200	T.	950	43	26.6	122.9
		1800	T.	955	41	27.5	122.2
	31	0000	T.	960	39	28.4	121.6
		0600	S.T.S.	970	31	29.2	121.1
		1200	S.T.S.	975	25	29.8	120.6
		1800	T.S.	980	23	30.4	120.3
Sep	1	0000	T.S.	985	21	31.5	120.4
		0600	T.S.	990	18	32.7	121.2
		1200	T.S.	990	18	34.0	122.2

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF
TYPHOON BECKY (9016)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Aug	24	1800	T.D.	995	13	18.3	128.6
	25	0000	T.D.	995	13	18.8	128.0
		0600	T.S.	990	18	19.5	127.2
		1200	T.S.	985	21	19.8	125.8
		1800	T.S.	985	21	19.2	124.3
	26	0000	S.T.S.	980	25	18.8	123.1
		0600	S.T.S.	975	28	18.4	122.0
		1200	S.T.S.	980	25	18.1	121.0
		1800	S.T.S.	980	25	17.9	120.0
	27	0000	S.T.S.	975	28	17.7	118.9
		0600	T.	965	33	17.6	117.6
		1200	T.	960	36	17.6	116.3
		1800	T.	965	33	17.7	115.0
	28	0000	T.	960	36	17.7	113.7
		0600	T.	960	36	17.7	112.6
		1200	T.	960	36	17.7	111.3
		1800	T.	960	36	17.7	110.1
	29	0000	T.	960	36	17.7	108.8
		0600	T.	965	33	17.7	107.6
		1200	S.T.S.	970	31	17.7	106.6
		1800	S.T.S.	975	25	17.8	104.9
	30	0000	T.S.	985	18	18.0	103.5
		0600	T.D.	995	13	17.6	102.3

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF
TROPICAL STORM CECIL

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Sep	3	0600	T.D.	1000	13	23.8	122.5
		1200	T.D.	1000	16	25.0	122.4
		1800	T.S.	995	18	25.7	121.5
	4	0000	T.S.	995	18	26.3	120.9
		0600	T.S.	990	23	26.7	120.6
		1200	T.S.	995	21	27.0	120.4
		1800	T.D.	1000	13	27.2	120.4

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF TYPHOON DOT (9017)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Sep	4	0000	T.D.	1000	13	13.7	139.0
		0600	T.D.	995	16	13.9	138.4
		1200	T.S.	990	18	14.1	137.7
		1800	T.S.	990	21	15.4	137.0
	5	0000	T.S.	985	23	16.8	135.8
		0600	T.S.	985	23	17.5	134.3
		1200	S.T.S.	980	25	18.0	132.8
		1800	S.T.S.	975	31	18.4	131.3
	6	0000	S.T.S.	975	31	19.0	129.8
		0600	T.	970	33	19.7	128.2
		1200	T.	965	36	20.4	126.7
		1800	T.	965	36	21.0	125.4
	7	0000	T.	960	39	21.6	124.1
		0600	T.	965	36	22.3	123.0
		1200	T.	970	33	22.8	122.1
		1800	S.T.S.	975	31	23.5	120.6
	8	0000	S.T.S.	980	28	23.5	119.1
		0600	S.T.S.	980	25	24.2	118.7
		1200	T.S.	985	23	24.7	117.3
		1800	T.S.	990	18	24.5	116.0
	9	0000	T.D.	990	16	24.4	115.8

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF
TYPHOON ED (9018)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Sep	10	1200	T.D.	1000	13	19.5	145.5
		1800	T.D.	1000	13	19.7	143.7
	11	0000	T.D.	1000	13	19.8	141.9
		0600	T.D.	1000	13	19.8	140.1
		1200	T.D.	1000	13	19.9	138.3
		1800	T.D.	1000	16	19.9	137.5
	12	0000	T.S.	995	18	20.0	136.7
		0600	T.S.	990	21	20.0	135.8
		1200	T.S.	985	23	20.2	134.6
		1800	T.S.	990	21	20.4	132.7
	13	0000	T.S.	995	18	19.9	131.7
		0600	T.S.	990	21	19.6	130.1
		1200	T.S.	985	23	19.8	128.5
		1800	S.T.S.	980	25	19.8	126.6
	14	0000	S.T.S.	975	28	19.3	124.6
		0600	S.T.S.	970	31	19.2	123.4
		1200	S.T.S.	970	31	19.1	121.7
		1800	S.T.S.	970	31	18.5	120.1
	15	0000	S.T.S.	970	31	18.0	119.1
		0600	S.T.S.	970	31	17.6	118.1
		1200	T.	965	33	17.3	117.0
		1800	T.	965	33	17.0	116.0
	16	0000	T.	965	33	16.7	115.0
		0600	T.	960	36	16.5	114.2
		1200	T.	960	36	16.2	113.6
		1800	T.	960	36	16.1	113.0
	17	0000	T.	960	36	16.1	112.6
		0600	T.	960	36	16.1	111.9
		1200	T.	965	33	16.1	111.2
		1800	T.	965	33	16.2	110.4
	18	0000	T.	965	33	16.3	109.6
		0600	T.	965	33	16.5	108.8
		1200	S.T.S.	970	31	16.6	108.1
		1800	S.T.S.	975	28	16.8	107.7
	19	0000	S.T.S.	980	28	17.0	107.3
		0600	S.T.S.	985	25	17.3	106.9
		1200	T.S.	995	21	17.9	106.7
		1800	T.S.	995	18	18.7	106.4
	20	0000	T.S.	995	18	19.2	105.6
		0600	T.D.	1000	16	19.6	105.2

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF TYPHOON FLO (9019)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Sep	12	0600	T.D.	1000	13	12.0	148.5
		1200	T.D.	1000	16	12.5	147.5
		1800	T.S.	995	18	13.2	146.0
	13	0000	T.S.	995	18	14.2	144.5
		0600	T.S.	990	18	15.0	143.2
		1200	T.S.	990	18	15.7	142.2
		1800	T.S.	985	21	16.4	141.2
	14	0000	T.S.	980	23	17.2	140.2
		0600	T.S.	980	23	18.0	139.1
		1200	S.T.S.	975	25	18.8	138.0
		1800	S.T.S.	970	28	19.5	136.8
	15	0000	S.T.S.	965	31	20.2	135.6
		0600	S.T.S.	965	31	20.9	134.4
		1200	T.	960	33	21.5	133.4
		1800	T.	950	39	22.1	132.4
	16	0000	T.	940	43	22.7	131.5
		0600	T.	935	49	23.3	130.6
		1200	T.	925	54	23.7	130.1
		1800	T.	930	51	24.2	129.6
	17	0000	T.	930	51	24.9	129.1
		0600	T.	930	51	25.6	128.9
		1200	T.	935	49	26.2	128.9
		1800	T.	935	49	26.9	129.2
	18	0000	T.	940	46	27.7	129.7
		0600	T.	940	46	28.5	130.2
		1200	T.	945	43	29.3	130.9
		1800	T.	945	43	30.3	131.6
	19	0000	T.	945	43	31.2	132.5
		0600	T.	955	41	32.3	133.9
		1200	S.T.S.	965	31	33.9	135.7
		1800	T.S.	975	23	36.0	137.6
	20	0000	T.S.	985	21	38.9	140.8
		0600	T.S.	990	21	40.6	145.3

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF TYPHOON GENE (9020)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Sep	23	1200	T.D.	1000	13	16.6	132.3
		1800	T.D.	1000	16	17.3	131.7
	24	0000	T.S.	995	18	18.0	131.0
		0600	T.S.	995	18	18.6	130.2
		1200	T.S.	990	21	19.0	129.3
		1800	T.S.	990	21	19.4	128.6
	25	0000	T.S.	985	23	20.0	127.9
		0600	T.S.	985	23	20.8	127.3
		1200	S.T.S.	980	25	21.6	126.9
		1800	S.T.S.	975	31	22.3	126.7
	26	0000	T.	970	33	23.0	126.5
		0600	T.	965	36	23.6	126.5
		1200	T.	965	36	24.2	126.3
		1800	T.	970	33	24.7	126.2
	27	0000	T.	970	33	25.5	125.9
		0600	T.	970	33	26.1	125.8
		1200	T.	970	33	26.7	125.9
		1800	T.	970	33	27.3	126.1
	28	0000	T.	965	36	27.9	126.5
		0600	T.	965	36	28.5	127.1
		1200	T.	970	33	29.1	127.7
		1800	S.T.S.	975	31	29.7	128.4
	29	0000	S.T.S.	975	31	30.4	129.6
		0600	T.	970	33	31.0	130.9
		1200	S.T.S.	975	31	31.8	132.2
		1800	S.T.S.	975	31	32.6	133.6
	30	0000	S.T.S.	980	28	33.5	135.2
		0600	T.S.	995	23	34.6	137.3
		1200	T.D.	1000	16	35.3	139.8

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF
TYPHOON HATTIE (9021)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Oct	1	1200	T.D.	995	16	16.0	147.2
		1800	T.D.	995	16	16.5	145.9
	2	0000	T.D.	995	16	16.8	144.6
		0600	T.S.	990	18	17.1	143.3
		1200	T.S.	985	23	17.5	142.0
		1800	S.T.S.	980	25	18.2	140.6
	3	0000	S.T.S.	975	28	18.8	139.0
		0600	S.T.S.	975	28	19.6	137.2
		1200	S.T.S.	975	28	20.5	135.4
		1800	S.T.S.	975	28	21.3	133.9
	4	0000	S.T.S.	975	31	22.2	132.5
		0600	S.T.S.	975	31	23.0	131.1
		1200	T.	970	33	23.5	130.0
		1800	T.	970	33	24.0	128.9
	5	0000	T.	965	36	24.5	128.1
		0600	T.	965	36	25.0	127.7
		1200	T.	960	39	25.8	127.2
		1800	T.	960	39	26.8	126.9
	6	0000	T.	960	39	27.6	127.0
		0600	T.	965	36	28.2	127.3
		1200	S.T.S.	970	31	28.6	127.7
		1800	S.T.S.	975	28	28.8	127.9
	7	0000	T.S.	980	23	28.9	128.1
		0600	T.S.	980	23	29.5	128.8
		1200	S.T.S.	975	25	30.4	130.0
		1800	S.T.S.	975	25	31.7	131.8
	8	0000	T.S.	980	23	33.2	134.5
		0600	T.S.	985	18	34.9	138.2

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF
TROPICAL STORM IRA (9022)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Oct	1	1800	T.D.	1000	13	13.4	113.6
	2	0000	T.D.	1000	16	13.2	112.8
		0600	T.D.	1000	16	13.0	111.8
		1200	T.D.	1000	16	13.1	110.8
		1800	T.S.	995	18	13.3	109.9
	3	0000	T.S.	995	18	13.7	108.9
		0600	T.D.	1000	16	14.0	107.6

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF
TROPICAL DEPRESSION JEANA

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Oct	12	0600	T.D.	1005	13	13.4	114.6
		1200	T.D.	1005	13	13.4	113.1
		1800	T.D.	1000	16	13.1	112.4
	13	0000	T.D.	1000	16	12.6	111.8
		0600	T.D.	1000	16	12.3	111.1
		1200	T.D.	1000	13	12.8	110.9
		1800	T.D.	1000	13	12.9	111.3
	14	0000	T.D.	1000	16	12.6	111.2
		0600	T.D.	1000	16	13.2	110.1
		1200	T.D.	1000	16	13.6	108.8

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF TYPHOON KYLE (9023)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Oct	15	1800	T.D.	1000	13	14.2	148.4
	16	0000	T.D.	1000	13	14.5	147.6
		0600	T.D.	1000	16	14.8	146.9
		1200	T.S.	995	18	15.1	146.7
		1800	T.S.	995	18	15.5	146.6
	17	0000	T.S.	995	18	15.8	146.6
		0600	T.S.	990	21	16.4	146.2
		1200	T.S.	990	23	16.8	145.9
		1800	T.S.	990	23	17.2	145.5
	18	0000	T.S.	990	23	17.6	145.2
		0600	T.S.	990	23	18.1	144.8
		1200	S.T.S.	985	25	18.8	144.3
		1800	S.T.S.	985	25	19.4	143.8
	19	0000	S.T.S.	980	28	19.9	143.4
		0600	S.T.S.	980	28	20.3	143.0
		1200	S.T.S.	980	28	20.7	142.7
		1800	S.T.S.	975	31	21.2	142.4
	20	0000	S.T.S.	975	31	21.7	142.2
		0600	T.	970	33	22.4	142.2
		1200	T.	965	36	23.0	142.5
		1800	T.	965	36	24.0	143.4
	21	0000	T.	965	36	25.1	144.5
		0600	T.	960	39	26.3	145.7
		1200	T.	970	33	27.9	147.2
		1800	S.T.S.	975	31	30.2	149.0
	22	0000	S.T.S.	980	28	32.5	150.6
		0600	T.S.	985	23	34.3	152.2

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF
TROPICAL STORM LOLA (9024)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Oct	16	1800	T.D.	1000	13	14.6	114.5
	17	0000	T.D.	1000	16	14.5	113.6
		0600	T.S.	995	18	14.3	112.6
		1200	T.S.	995	18	14.0	111.6
		1800	T.S.	990	21	13.8	110.6
	18	0000	T.S.	995	18	13.9	109.6
		0600	T.D.	1000	16	13.7	108.4
		1200	T.D.	1000	13	14.2	107.0

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF TYPHOON MIKE (9025)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Nov	6	0600	T.D.	1000	13	6.7	151.0
		1200	T.D.	1000	13	6.3	150.0
		1800	T.D.	995	16	5.7	148.6
	7	0000	T.D.	995	16	5.9	147.1
		0600	T.D.	995	16	6.4	146.2
		1200	T.D.	995	16	6.9	145.4
		1800	T.S.	990	18	7.4	144.6
	8	0000	T.S.	990	21	7.8	143.8
		0600	T.S.	985	23	8.1	142.9
		1200	S.T.S.	980	25	8.5	142.0
		1800	S.T.S.	975	28	8.7	141.1
	9	0000	S.T.S.	970	31	9.0	139.8
		0600	T.	965	33	8.9	138.5
		1200	T.	965	33	8.8	137.7
		1800	T.	960	36	8.7	136.9
	10	0000	T.	945	43	8.4	135.9
		0600	T.	930	51	7.9	135.1
		1200	T.	920	57	7.9	134.8
		1800	T.	915	59	8.0	134.2
	11	0000	T.	910	61	8.1	133.5
		0600	T.	910	61	8.4	132.7
		1200	T.	910	61	8.8	131.6
		1800	T.	920	57	9.1	130.4
	12	0000	T.	925	54	9.5	129.2
		0600	T.	935	49	9.8	128.0
		1200	T.	945	43	10.1	126.7
		1800	T.	955	39	10.4	124.9
	13	0000	S.T.S.	965	31	10.6	123.4
		0600	S.T.S.	965	31	10.8	121.8
		1200	S.T.S.	965	31	11.2	120.2
		1800	T.	960	33	12.3	119.0
	14	0000	T.	955	36	12.8	117.5
		0600	T.	955	36	13.2	115.6
		1200	T.	955	36	13.5	113.8
		1800	T.	960	33	13.7	112.8
	15	0000	T.	960	33	13.9	111.9
		0600	S.T.S.	965	31	14.2	111.1
		1200	S.T.S.	965	31	14.6	110.5
		1800	S.T.S.	970	31	15.2	110.0
	16	0000	S.T.S.	975	28	15.9	109.7
		0600	S.T.S.	985	25	16.7	109.6
		1200	S.T.S.	985	25	17.5	109.5
		1800	S.T.S.	985	25	18.3	109.0
	17	0000	T.S.	995	21	19.2	108.5
		0600	T.S.	995	21	19.8	108.4
		1200	T.S.	1000	18	20.3	108.3
		1800	T.S.	1000	18	20.6	108.2

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF
TROPICAL STORM NELL (9026)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Nov	9	1800	T.D.	1000	13	13.0	114.0
	10	0000	T.D.	1000	16	13.0	113.1
		0600	T.S.	995	18	13.0	112.3
		1200	T.S.	990	23	12.6	112.4
		1800	T.S.	990	23	12.8	112.6
	11	0000	T.S.	990	23	12.8	112.3
		0600	T.S.	990	23	12.8	112.0
		1200	T.S.	990	23	12.7	111.5
		1800	T.S.	990	23	12.7	111.0
	12	0000	T.S.	995	18	12.7	109.9
		0600	T.D.	1000	16	12.7	108.7

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF
TYPHOON OWEN (9027)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Nov	19	1200	T.D.	1000	13	8.9	174.5
		1800	T.D.	1000	13	9.0	173.6
	20	0000	T.D.	1000	13	9.0	172.7
		0600	T.D.	1000	16	9.1	171.7
		1200	T.S.	995	18	9.2	170.6
		1800	T.S.	995	18	9.4	169.4
	21	0000	T.S.	995	21	9.7	168.1
		0600	T.S.	990	23	9.9	167.0
		1200	S.T.S.	985	25	10.0	165.9
		1800	S.T.S.	975	31	10.1	164.8
	22	0000	T.	970	33	10.1	163.9
		0600	T.	965	36	10.0	163.0
		1200	T.	955	41	9.7	162.5
		1800	T.	950	41	9.3	162.1
	23	0000	T.	940	46	9.0	161.7
		0600	T.	930	51	8.8	161.4
		1200	T.	935	49	8.6	161.1
		1800	T.	945	43	8.6	160.8
	24	0000	T.	955	39	8.6	160.6
		0600	S.T.S.	965	31	8.7	160.3
		1200	S.T.S.	970	28	8.9	160.0
		1800	S.T.S.	975	25	9.0	159.7
	25	0000	S.T.S.	970	28	9.1	159.0
		0600	S.T.S.	970	28	9.2	158.2
		1200	S.T.S.	965	31	9.2	157.5
		1800	S.T.S.	965	31	9.1	156.9
	26	0000	S.T.S.	965	31	8.8	156.3
		0600	T.	960	36	8.5	155.7
		1200	T.	950	41	8.3	155.0
		1800	T.	930	51	8.2	154.2
	27	0000	T.	920	57	8.2	153.2
		0600	T.	920	57	8.2	152.0
		1200	T.	930	51	8.2	150.7
		1800	T.	940	46	8.0	149.3
	28	0000	T.	940	46	7.9	148.1
		0600	T.	950	41	7.8	146.9
		1200	T.	955	39	7.9	145.6
		1800	T.	960	36	8.0	144.4
	29	0000	T.	965	33	8.3	143.2
		0600	S.T.S.	970	31	8.8	142.0
		1200	S.T.S.	970	31	9.5	141.3
		1800	S.T.S.	975	28	10.2	140.8
	30	0000	S.T.S.	980	25	11.0	140.4
		0600	T.S.	990	18	11.8	140.1

Dissipated

SIX-HOURLY POSITION AND INTENSITY DATA OF
TYPHOON PAGE (9028)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Nov	22	0600	T.D.	995	13	11.9	142.8
		1200	T.D.	995	13	11.9	141.5
		1800	T.D.	995	13	11.9	140.6
	23	0000	T.D.	990	16	11.9	140.1
		0600	T.S.	985	18	11.9	139.7
		1200	T.S.	980	21	11.9	139.3
		1800	S.T.S.	975	25	11.9	138.9
	24	0000	S.T.S.	975	25	11.9	138.1
		0600	S.T.S.	970	28	11.8	137.3
		1200	T.	965	33	11.8	136.4
		1800	T.	960	36	11.7	135.5
	25	0000	T.	955	39	11.7	134.4
		0600	T.	950	43	11.7	133.4
		1200	T.	940	49	11.9	132.5
		1800	T.	930	51	12.1	131.7
	26	0000	T.	920	57	12.3	130.8
		0600	T.	910	61	12.7	130.0
		1200	T.	910	61	13.1	129.2
		1800	T.	915	59	13.7	128.2
	27	0000	T.	920	57	14.5	127.3
		0600	T.	930	54	15.4	126.7
		1200	T.	935	51	16.4	126.2
		1800	T.	940	46	17.3	126.0
	28	0000	T.	945	43	18.4	126.1
		0600	T.	950	41	19.5	126.5
		1200	T.	950	39	21.0	127.3
		1800	T.	955	33	22.4	128.4
	29	0000	S.T.S.	960	31	24.0	129.6
		0600	S.T.S.	965	28	25.9	131.0
		1200	S.T.S.	970	28	28.0	132.6
		1800	S.T.S.	970	28	30.0	134.1
	30	0000	S.T.S.	970	28	31.8	135.1
		0600	T.S.	975	23	33.6	135.8
		1200	T.S.	980	18	35.6	137.1

Became Extratropical

SIX-HOURLY POSITION AND INTENSITY DATA OF
TYPHOON RUSS (9029)

Month	Day	Time UTC	Intensity	Estimated minimum central pressure (hPa)	Estimated maximum surface wind (m/s)	Lat. °N	Long. °E
Dec	14	0000	T.D.	1000	13	5.4	172.5
		0600	T.D.	1000	16	5.3	171.0
		1200	T.S.	995	18	5.3	169.4
		1800	T.S.	990	21	5.4	168.4
	15	0000	T.S.	990	21	5.6	167.5
		0600	T.S.	990	21	6.0	166.2
		1200	T.S.	985	23	6.4	164.9
		1800	S.T.S.	980	25	6.9	163.4
	16	0000	S.T.S.	980	25	7.3	161.9
		0600	S.T.S.	980	25	7.8	160.6
		1200	S.T.S.	975	28	8.1	159.8
		1800	S.T.S.	970	31	8.5	159.1
	17	0000	T.	965	33	8.9	158.2
		0600	T.	960	36	9.3	157.2
		1200	T.	955	39	9.7	156.2
		1800	T.	950	41	10.0	155.1
	18	0000	T.	940	46	10.2	154.0
		0600	T.	930	51	10.4	153.0
		1200	T.	920	57	10.6	152.0
		1800	T.	915	59	10.8	151.0
	19	0000	T.	915	59	11.0	150.2
		0600	T.	920	57	11.1	149.5
		1200	T.	930	51	11.4	148.8
		1800	T.	940	49	11.6	148.1
	20	0000	T.	945	46	11.8	147.3
		0600	T.	950	43	12.1	146.3
		1200	T.	950	43	12.4	145.2
		1800	T.	950	43	12.7	144.0
	21	0000	T.	945	46	13.1	142.8
		0600	T.	945	46	13.8	141.5
		1200	T.	945	46	14.6	140.1
		1800	T.	950	43	15.5	138.9
	22	0000	T.	950	43	16.3	138.1
		0600	T.	950	43	17.4	137.6
		1200	T.	955	39	18.9	137.7
		1800	T.	960	36	20.3	138.3
	23	0000	S.T.S.	970	31	21.6	139.2
		0600	T.S.	980	23	23.0	140.3
		1200	T.S.	990	18	24.1	142.0

Dissipated