Annual Report on Activities of the RSMC Tokyo – Typhoon Center 2002

Japan Meteorological Agency

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Introduction

The RSMC Tokyo - Typhoon Center (hereinafter referred to as "the Center") is the Regional Specialized Meteorological Centre (RSMC) with activity specialization in analysis, tracking and forecasting of western North Pacific tropical cyclones within the framework of the World Weather Watch (WWW) Programme of the World Meteorological Organization (WMO). The Center was established at the Headquarters of the Japan Meteorological Agency (JMA) in July 1989, following the designation by the WMO Executive Council at its 40th session held in Geneva in June 1988.

The Center conducts the following operations on a routine basis:

(1) Preparation of information on the formation, movement and development of tropical cyclones and associated meteorological phenomena;
(2) Preparation of information on synoptic scale atmospheric situations that affect the behavior of tropical cyclones; and
(3) Dissemination of the above information to National Meteorological Centers (NMCs), in particular to the Members of the ESCAP/WMO Typhoon Committee, in appropriate formats for operational processing.

In addition to the routine services mentioned above, the Center distributes a series of reports entitled “Annual Report on Activities of the RSMC Tokyo - Typhoon Center” to serve as operational references for the NMCs concerned. This report aims at summarizing the activities of the Center and reviewing tropical cyclones of the year.

In this 2002 issue, the outline of routine operations at the Center and its operational products are presented in Chapter 1. Chapter 2 reports the major activities of the Center in 2002. Chapter 3 describes atmospheric and oceanic conditions in the tropics and gives the highlights of tropical cyclone activities in 2002. In Chapter 4, verification statistics of operational forecasts and predictions of the two numerical weather prediction (NWP) models of the Center are presented. The best track data for the tropical cyclones in 2002 are shown in table and chart forms in appendices. All the texts, tables, charts and appendixes are included in the CD-ROM attached to this report.

The CD-ROM contains 3-hourly cloud images of all the tropical cyclones in 2002 of TS intensity or higher in the area of responsibility of the Center, and software to view them. The software has various functions for analyzing satellite imagery such as animation of images, which facilitates efficient post-analysis of tropical cyclones and their environments. A setup program and a users' manual for the software are also included in the CD-ROM. Appendix 7 shows an outline of the CD-ROM and how to use the software.

Chapter 1

Operations at the RSMC Tokyo - Typhoon Center in 2002

The area of responsibility of the Center covers the western North Pacific and the South China Sea (0° - 60°N, 100°E - 180°) including the marginal seas and adjacent land areas (see Figure 1.1). The Center makes analyses and forecasts of tropical cyclones when they are in or expected to move into the area and provides the National Meteorological Services (NMSs) concerned with the RSMC products through the GTS, the AFTN and the JMA radio facsimile broadcast (JMH).

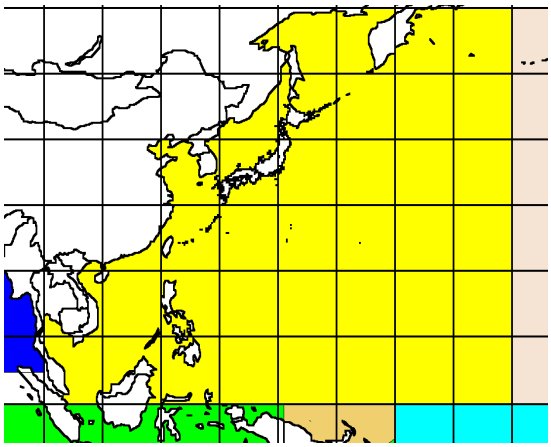


Figure 1.1
Area of responsibility (yellow) of the RSMC Tokyo – Typhoon

1.1 Analysis

Surface analyses are performed four times a day, at 00, 06, 12 and 18 UTC. The tropical cyclone analysis begins with the determination of the center position of a tropical cyclone. Cloud images from the Geostationary Meteorological Satellite (GMS) are the principal source for the determination of the center position, especially of tropical cyclones migrating over the data-sparse ocean area. The direction and speed of the movement of a tropical cyclone are determined primarily from the six-hourly displacement vectors of the center position.

The central pressure of a tropical cyclone is determined mainly from the CI-number, which is derived from the satellite imagery using Dvorak's method. The CI-number also gives the maximum sustained wind speed in the vicinity of the center. Radii of circles for the gale-force wind and the storm-force wind are determined from surface observations and low-level cloud motion winds (LCW) derived from cloud motion vectors of GMS images at fifteen-minute intervals in the vicinity of the tropical cyclone.

1.2 Forecast

Predictions of the two NWP models of JMA, Typhoon Model (TYM) and Global Spectral Model (GSM), are the primary bases for the forecast of tropical cyclone tracks. The Persistence-Climatology method (PC method) that uses statistical techniques on the basis of linear extrapolation and climatological properties of tropical cyclone movements is also

adopted for tropical cyclones particularly in lower latitudes. The central pressure and the maximum sustained wind speed are forecast based on the results of Dvorak's method, the PC method and NWP.

The range into which the center of a tropical cyclone is expected to move with 70% probability at each validation time is shown as the probability circle. The radius of the circle is statistically determined according to the speed of tropical cyclone movement.

1.3 Provision of RSMC Products

The Center prepares and disseminates the following RSMC bulletins and charts via the GTS, the AFTN or the JMH when:

- a tropical cyclone of tropical storm (TS) intensity or higher exists in the area of responsibility of the Center;
- a tropical cyclone is expected to reach TS intensity or higher in the area within 24 hours; or
- a tropical cyclone of TS intensity or higher is expected to move into the area within 24 hours.

The RSMC products are continually issued as long as the tropical cyclone keeps TS intensity or higher within the area of responsibility. Appendix 5 denotes the code forms of the bulletins transmitted through the GTS.

RSMC Tropical Cyclone Advisory (WTPQ20-25 RJTD: via GTS)

The RSMC Tropical Cyclone Advisory reports the following elements in the analysis, 24-hour, 48-hour and 72-hour forecasts of a tropical cyclone, respectively:

Analysis	Center position of a tropical cyclone Accuracy of determination of the center position Direction and speed of the movement Central pressure Maximum sustained wind speed (10-minute averaged) Radii of over 50- and 30-knot wind areas
24-and 48-hour forecasts	Center position and radius of the probability circle* Direction and speed of the movement Central pressure Maximum sustained wind speed (10-minute averaged)
72-hour forecast	Center position and radius of the probability circle* Direction and speed of the movement

* A circular range into which the tropical cyclone is expected to move with the probability of 70% at each validation time.

RSMC Guidance for Forecast (FXPQ20-25 RJTD: via GTS)

The RSMC Guidance for Forecast reports the results of predictions of GSM and TYM: GSM is run twice a day with initial analyses at 00 and 12 UTC and TYM four times a day with initial analyses at 00, 06, 12 and 18 UTC. The Guidance presents GSM's six-hourly predictions of a tropical cyclone up to 90 hours for 00 and 12 UTC and TYM's six-hourly predictions up to 84 hours for 00, 06, 12 and 18 UTC. It includes:

NWP prediction (T=06 to 84 or 90)
- Center position of a tropical cyclone
- Central pressure*
- Maximum sustained wind speed*

* Predictions of these parameters are given as deviations from those at the initial time.

SAREP (TCNA20/21 RJTD: via GTS)

The SAREP reports a tropical cyclone analysis using GMS imagery including intensity information (CI-number) based on Dvorak's method. It is issued a half to one hour after observations at 00, 03, 06, 09, 12, 15, 18 and 21 UTC and contains:

GMS imagery analysis
- Center position of a tropical cyclone
- Accuracy of determination of the center position
- Mean diameter of the cloud system
- CI-number**
- Apparent change in intensity in the last 24 hours**
- Direction and speed of the movement

** These parameters are reported at 00, 06, 12, 18 UTC while not at other times.

RSMC Prognostic Reasoning (WTPQ30-35 RJTD: via GTS)

The RSMC Prognostic Reasoning provides a brief reasoning for a tropical cyclone forecast. It is issued at 00 and 06 UTC following the issuance of the RSMC Tropical Cyclone Advisory. In the bulletin, general comments on the forecasting method, synoptic situation of the subtropical ridge, movement and intensity of the tropical cyclone, and some relevant remarks are given in plain language.

RSMC Tropical Cyclone Best Track (AXPQ20 RJTD: via GTS)

The RSMC Tropical Cyclone Best Track gives post-analyzed data of tropical cyclones. It contains the center position, central pressure and maximum sustained wind. The Best Track for a tropical cyclone is finalized usually one and a half months after the termination of issuance of above RSMC bulletins for the tropical cyclone.

Tropical Cyclone Advisory for SIGMET (FKPQ30-35 RJTD: via AFTN)

The Center, as one of the Tropical Cyclone Advisory Centres under the framework of the International Civil Aviation Organization (ICAO), provides the Tropical Cyclone Advisory for SIGMET for Meteorological Watch Offices (MWOs) concerned to support the preparation of SIGMET information on a tropical cyclone. It includes the following elements in the analysis, 12-hour, 24-hour forecasts of a tropical cyclone:

Analysis and 12- and 24-hour forecasts
- Center position of a tropical cyclone (analysis)
- Center position of the tropical cyclone (forecast)
- Direction and speed of the movement
- Central pressure
- Maximum sustained wind speed (ten-minute averaged)

Prognostic Charts of 850-hPa and 200-hPa Streamline
(FUXT852/202, FUXT854/204: via JMH)

Analysis and 24- and 48-hour prognostic charts of 850-hPa and 200-hPa streamlines are broadcast via the JMA's HF radio facsimile (JMH). These prognoses are produced with GSM at 00 and 12 UTC over the area spanning from 20°S to 60°N in latitude and from 80°E to 160°W in longitude.

1.4 RSMC Data Serving System

JMA has been operating the RSMC Data Serving System that allows NMCs concerned to retrieve NWP products such as predicted fields in grid-point-value (GPV) form and observational data through the Internet or the Integrated Service Digital Network (ISDN) since 1995. The products and data provided through the system are listed in Appendix 6.

Tropical Cyclone Web Site:

Tropical cyclone advisories are available on a real time basis through the Internet at:
http://ddb.kishou.go.jp/typhoon/cyclone/cyclone.html
http://www.jma.go.jp/JMA_HP/en/typh/typh.all.html

Chapter 2

Major Activities of the RSMC Tokyo - Typhoon Center in 2002

2.1 Dissemination of RSMC Products

In 2002, the RSMC Tokyo - Typhoon Center provided operational products for tropical cyclone forecasting to NMCs via the GTS, the AFTN and the JMA radio facsimile broadcast (JMH). Monthly and annual total numbers of issuance of the products are listed in Table 2.1.

Table 2.1 Monthly and annual total number of products issued by the RSMC Tokyo – Typhoon Center in 2002

Product	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
TCNA20	5	2	30	0	20	26	202	107	98	31	31	30	582
TCNA21	8	6	31	0	26	29	216	120	104	33	38	33	644
WTPQ20-25	9	7	31	0	27	35	363	249	211	71	79	67	1149
WTPQ30-35	4	3	16	0	13	18	111	62	53	18	18	17	333
FXPQ20-25	12	10	45	0	39	47	289	169	151	52	56	50	920
FKPQ30-35	8	7	30	0	26	35	219	124	102	34	38	33	656
AXPQ20	3	1	0	1	0	1	2	4	2	10	2	0	26
AUXT85/20	62	56	62	60	62	60	62	62	60	62	60	62	730
FUXT852/854	62	56	62	60	62	60	62	62	60	62	60	62	730
FUXT202/204	62	56	62	60	62	60	62	62	60	62	60	62	730

Notes:

- via the GTS or the AFTN -

SAREP	TCNA20/21 RJTD
RSMC Tropical Cyclone Advisory	WTPQ20-25 RJTD
RSMC Prognostic Reasoning	WTPQ30-35 RJTD
RSMC Guidance for Forecast	FXPQ20-25 RJTD
Tropical Cyclone Advisory for SIGMET	FKPQ30-35 RJTD
RSMC Tropical Cyclone Best Track	AXPQ20 RJTD

- via the JMH Meteorological Radio Facsimile -

Analysis of 850 and 200 hPa Streamline	AUXT85/AUXT20
Prognosis of 850 hPa Streamline	FUXT852/FUXT854
Prognosis of 200 hPa Streamline	FUXT202/FUXT204

2.2 Publication

The Center published:

1) “Technical Review (No. 5)” that contains a paper entitled “Verifications of Tropical Cyclone Predictions of the New Numerical Models at JMA” in March 2002; and

2) “Annual Report on Activities of the RSMC Tokyo-Typhoon Center in 2001” in November 2002.

2.3 Monitoring of Observational Data Availability

The Center carried out regular monitoring of the information exchange for enhanced observations of tropical cyclones in accordance with the standard procedures stipulated in Section 6.2, Chapter 6 of "The Typhoon Committee Operational Manual (TOM) - Meteorological Component." The monitoring for this season was conducted for the following two periods:

1. from 00UTC 1 July to 18UTC 5 July (for TY Rammasun (0205))
2. from 00UTC 2 August to 18UTC 6 August (for STS Kammuri (0212))

The results were distributed to all the Typhoon Committee Members in April 2003, and are available on the Distributed Database of JMA at:
ftp://ddb.kishou.go.jp/pub/monitoring/rsmc

Chapter 3

Atmospheric and Oceanographic Conditions in the Tropics and Tropical Cyclones in 2002

3.1 Summary of Atmospheric and Oceanographic Conditions in the Tropics

Sea surface temperatures (SSTs) were above normal in the western equatorial Pacific almost throughout the year 2002. In the South China Sea, positive SST anomalies were widely observed throughout the year except September. SSTs were above normal around 160°E during January to July and in November. The SST anomaly for a monitoring region (NINO.WEST: 0°-14°N, 130°E-150°E) was positive until June, then it kept 0.0 for three months from July to September and turned to be positive again from October. Charts of monthly mean SST anomalies for the western North Pacific are included in the attached CD-ROM.

Active convection areas over the western Pacific (150°E-180°) expanded to the central Pacific and the most active areas appeared near the International Date Line in November.

The center of the large-scale divergence at 200hPa shifted eastward from its normal position associated with eastward shift of active convection areas. Cyclonic anomalies appeared in lower level over the equatorial Pacific in the latter half of the year, while low level anti-cyclonic circulation anomalies persisted near the Philippines from October to December.

The subtropical jet near Japan was shifted northward in July and southward in August. It was stronger than normal in August. Westward expansion of the sub-tropical high in the western Pacific was weaker than normal in July and stronger than normal in August.

In consequence many tropical cyclones were generated east of 150°E and two tropical cyclones crossed the International Date Line to the west keeping the hurricane intensity. Monthly mean streamlines at 850hPa for August and tropical cyclone tracks in August are presented in Figure 3.1 and Appendix 3, respectively.

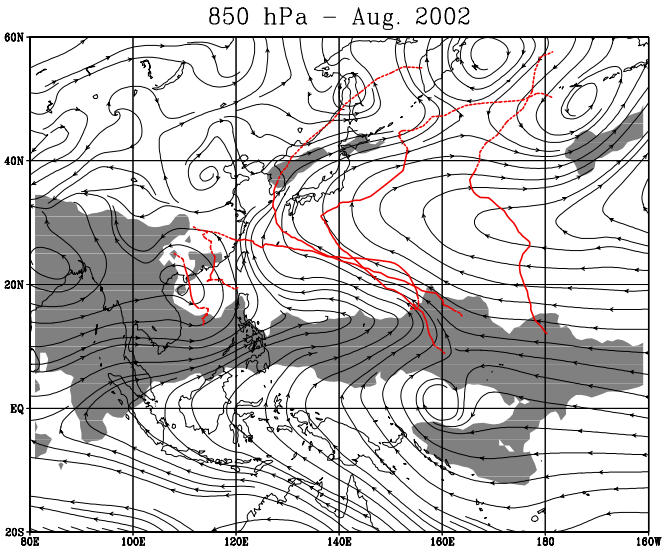


Figure 3.1 Monthly mean stream line at 850 hPa and area of high-cloud amount greater than 30% (shaded) in August 2002. Tracks of the tropical cyclones formed in August are superimposed (thick lines).

Charts of monthly mean streamlines at 850 hPa and 200 hPa, and high-cloud amounts for the months from January to December are included in the attached CD-ROM.

3.2 Tropical Cyclones in 2002

In 2002, 26 tropical cyclones of tropical storm (TS) intensity or higher were tracked in the western North Pacific and the South China Sea. The total number is normal compared to the thirty-year average of 26.7 for 1971-2000. Fifteen cyclones out of them (58% of the total) reached typhoon (TY) intensity. The percentage of 58% is a little bit larger than normal (54%; 24-year average for 1977-2000). Five out of the remainder attained severe tropical storm (STS) intensity and the others TS intensity (see Table 3.1).

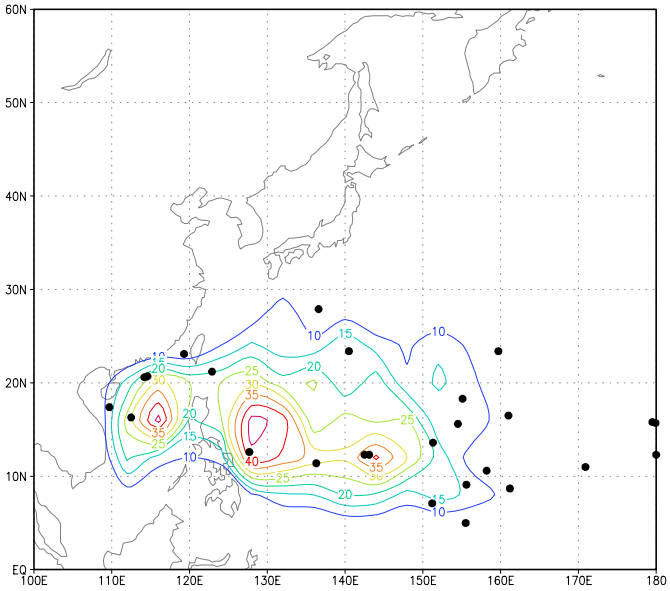


Figure 3.2 Genesis points of 26 TCs in 2002 (dots) and number of accumulated TC geneses per 4°x4° grid box for 1951-2001 (contours).

The tropical cyclone season of this year began in the middle of January with the development of TS Tapah (0201). However, tropical cyclone formation was not active in the first half of the year. No tropical cyclone of TS intensity or higher formed for about two and a half months after TY Mitag (0202) formed in late February.

In late June tropical cyclone formation became active and seven tropical cyclones of TS intensity or higher formed in total from late June to mid-July. As the sub-tropical high pressure over the western North Pacific was weaker than normal in its western end east off China, while stronger than normal east off Honshu of Japan in July, six out of the above seven tropical cyclones hit or passed Japan. Tropical cyclone formation was inactive from late July to mid-August.

From mid to late August, tropical cyclone formation became active again and the monthly formation was normal in August. TY Rusa (0215) hit Republic of Korea and brought heavy damage to the country from late August to early September.

Tropical cyclone formation was slightly below normal in September and nearly a half of normal in October. Among them TY Higos (0221) was one of the most intense typhoons ever approached the Kanto Region of Japan. Strong winds of Higos brought damage to the eastern and northern Japan.

Two and one typhoons were tracked in November and December, respectively. TY Pongsona (0226) passed near Guam and brought damage to the Island in December.

Other features of this tropical cyclone season were as follows:

- A mean formation latitude* of 15.5°N was lower than the 30-year (1971-2000) average of 16.2°N, while a mean formation longitude* of 145.9°E was the easternmost on record since 1951. (see the distribution of their formation points in Figure 3.2.)

*Mean formation latitude (longitude) here is defined as arithmetic average of latitudes (longitudes) of formation points of all the tropical cyclones of TS intensity or higher in the year.

- There were no tropical cyclones of TS intensity or higher which passed the Philippines. This is the first time since 1951.

RSMC best track data for the tropical cyclones in 2002 and maps of their tracks are shown in Appendices 1 and 3, respectively. Appendix 4 indicates the monthly and annual frequency of tropical cyclones that attained TS intensity or higher in the western North Pacific and the South China Sea for 1951- 2002.

Table 3.1 List of the tropical cyclones which attained TS intensity or higher in 2002

Tropical Cyclone			Duration (UTC)						Minimum Pressure & Max. Wind				
									(UTC)	(N)	(E)	(hPa)	(kt)
TS	TAPAH	(0201)	120000	Jan	-	130000	Jan		121200	13.8	125.6	996	40
TY	MITAG	(0202)	281200	Feb	-	081200	Mar		050600	13.7	130.1	930	95
TY	HAGIBIS	(0203)	161200	May	-	211800	May		191200	19.3	142.1	935	95
STS	NOGURI	(0204)	080600	Jun	-	102100	Jun		090600	23.3	124.8	975	60
TY	RAMMASUN	(0205)	290000	Jun	-	061200	Jul		030600	23.8	125.6	945	85
TY	CHATAAN	(0206)	290000	Jun	-	111500	Jul		080000	21.6	133.7	930	95
TY	HALONG	(0207)	071800	Jul	-	161800	Jul		121800	17.6	134.7	945	85
STS	NAKRI	(0208)	090000	Jul	-	121500	Jul		120900	26.3	126.7	983	50
TY	FENGSHEN	(0209)	140000	Jul	-	271200	Jul		210600	19.8	155.3	920	100
TS	KALMAEGI	(0210)	201200	Jul	-	210600	Jul		201200	15.8	179.5	1002	35
TY	FUNG-WONG	(0211)	201800	Jul	-	270300	Jul		231800	22.1	130.1	960	70
STS	KAMMURI	(0212)	031800	Aug	-	051200	Aug		041800	22.3	115.5	980	55
TY	PHANFONE	(0213)	120000	Aug	-	210000	Aug		160300	25.1	141.5	940	85
TS	VONGFONG	(0214)	180000	Aug	-	192100	Aug		180600	16.7	112.0	985	40
TY	RUSA	(0215)	230000	Aug	-	010000	Sep		261200	22.7	144.5	950	80
TY	SINLAKU	(0216)	290600	Aug	-	080000	Sep		310600	23.7	149.7	950	80
TY	ELE	(0217)	300300	Aug	-	091800	Sep		020000	21.8	175.1	940	90
TS	HAGUPIT	(0218)	110000	Sep	-	120000	Sep		110600	20.9	113.7	990	45
TS	CHANGMI	(0219)	211800	Sep	-	221200	Sep		220600	30.9	138.8	985	45
TS	MEKKHALA	(0220)	250000	Sep	-	280000	Sep		250600	17.9	109.3	990	45
TY	HIGOS	(0221)	261800	Sep	-	020600	Oct		291200	20.9	136.7	930	95
STS	BAVI	(0222)	091800	Oct	-	131200	Oct		111800	22.5	148.2	985	55
STS	MAYSAK	(0223)	271800	Oct	-	300000	Oct		290600	30.3	166.1	980	55
TY	HUKO	(0224)	031200	Nov	-	070000	Nov		031200	15.7	179.9	985	75
TY	HAISHEN	(0225)	201800	Nov	-	250000	Nov		231200	19.7	135.6	955	85
TY	PONGSONA	(0226)	031200	Dec	-	110600	Dec		081200	14.4	144.6	940	90

Chapter 4

Verification of Forecasts in 2002

4.1 Operational Forecast

Operational forecasts of the tropical cyclones of TS intensity or higher in 2002 were verified with the best track data. Verified elements are 24-hour and 48-hour forecasts of the center position, central pressure and maximum sustained wind, and 72-hour forecasts of the center position. Position and intensity errors of operational forecasts for each tropical cyclone in 2002 are indicated in Appendix 2.

4.1.1 Center Position

Figure 4.1 shows annual mean errors of 24-hour (1982 - 2002), 48-hour (1988 - 2002) and 72-hour (1997 - 2002) forecasts of center positions. Annual mean position errors in 2002 were 138km for 24-hour forecast, 239km for 48-hour forecast and 363km for 72-hour forecast. Annual mean position errors for operational 24-, 48- and 72-hour track forecasts for 2002 were all the smallest after each forecast started operationally.

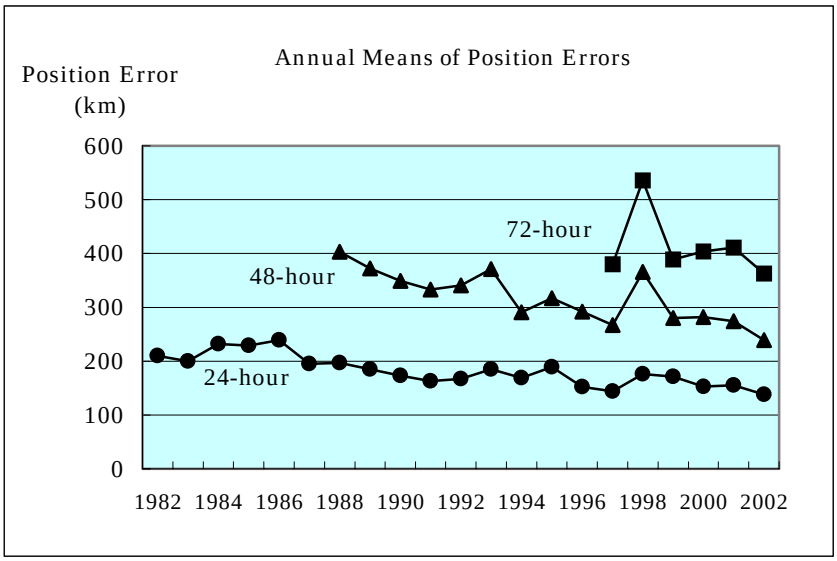


Figure 4.1 Annual means of position errors of 24-, 48- and 72-hour operational track forecasts.

Position errors of 24-, 48- and 72-hour track forecasts for each tropical cyclone in this season are summarized in Table 4.1. The forecast scores of TY Sinlaku, which took a steady west-northwestward course, were particularly well. TY Rammasun and TY Rusa, which moved northward over the East China Sea and made landfall on the Korean Peninsula, contributed to the scores to no small extent. On the other hand, The forecasts of TY Hagibis, Haishen etc., which recurved south of Japan, had rather large distance errors because of their rapid movement changes.

Position errors were also compared to those by the persistency (PER) method. The ratios of EO (position errors of operational forecasts) to EP (position errors of PER-method forecasts) in percentage are described in Table 4.1. EO/EP smaller (greater) than 100% means that operational forecasts are better (worse) than PER-method forecasts. Annual mean EO/EPs for the 24-, 48- and 72-hour forecasts in 2002 were 56% (70% in 2001), 43% (50%) and 42% (50%), respectively. Operational 24-, 48- and 72-hour forecasts were all better than PER-method forecasts in 2002.

Table 4.1 Mean position errors of 24-, 48- and 72-hour operational forecasts for each tropical cyclone in 2002

Tropical Cyclone			24-hour Forecast				48-hour Forecast				72-hour Forecast			
			Position Error & Number of Forecast				Position Error & Number of Forecast				Position Error & Number of Forecast			
			Mean (km)	S.D. (km)	Num.	EO/EP (%)	Mean (km)	S.D. (km)	Num.	EO/EP (%)	Mean (km)	S.D. (km)	Num	EO/EP (%)
TS	0201	TAPAH	-	-	0	-	-	-	0	-	-	-	0	-
TY	0202	MITAG	146	62	28	71	324	149	24	59	489	205	20	48
TY	0203	HAGIBIS	246	100	17	57	393	175	13	33	870	202	9	43
STS	0204	NOGURI	124	45	7	47	327	46	3	45	-	-	0	-
TY	0205	RAMMASUN	88	46	26	35	176	130	22	36	216	66	17	25
TY	0206	CHATAAN	169	98	47	69	257	113	43	50	377	239	38	47
TY	0207	HALONG	178	93	32	58	333	143	27	51	508	208	23	55
STS	0208	NAKRI	147	60	11	90	240	151	5	62	211	171	3	13
TY	0209	FENGSHEN	137	69	49	101	235	105	43	66	343	146	38	55
TS	0210	KALMAEGI	-	-	0	-	-	-	0	-	-	-	0	-
TY	0211	FUNG-WONG	126	78	22	40	239	156	17	29	406	162	13	34
STS	0212	KAMMURI	76	33	3	34	-	-	0	-	-	-	0	-
TY	0213	PHANFONE	117	58	32	42	197	107	28	30	224	142	24	21
TS	0214	VONGFONG	118	65	4	46	-	-	0	-	-	-	0	-
TY	0215	RUSA	93	57	32	58	176	97	28	49	317	145	24	63
TY	0216	SINLAKU	88	34	35	56	143	67	31	43	213	110	27	36
TY	0217	ELE	124	68	38	74	183	97	34	51	331	158	30	60
TS	0218	HAGUPIT	-	-	0	-	-	-	0	-	-	-	0	-
TS	0219	CHANGMI	-	-	0	-	-	-	0	-	-	-	0	-
TS	0220	MEKKHALA	51	45	7	61	101	62	3	11	-	-	0	-
TY	0221	HIGOS	138	104	17	35	270	189	13	25	551	370	8	33
STS	0222	BAVI	136	50	11	43	257	130	7	42	772	162	3	89
STS	0223	MAYSAK	183	69	6	24	196	-	1	-	-	-	0	-
TY	0224	HUKO	235	107	10	45	368	220	6	34	88	47	2	-
TY	0225	HAISHEN	213	75	13	58	476	255	9	52	557	110	5	26
TY	0226	PONGSONA	132	58	27	52	184	73	23	32	289	145	19	31
Annual Mean (Total)			138	83	474	56	239	146	380	43	363	225	303	42

Figure 4.2 presents the histograms of 24-, 48- and 72-hour forecast position errors. The ratio of 24-hour forecast errors smaller than 150 km was 62% (57% in 2001), the ratio of 48-hour forecast errors smaller than 300 km was 74% (67%) and the ratio of 72-hour forecast errors smaller than 450 km was 74% (68%).

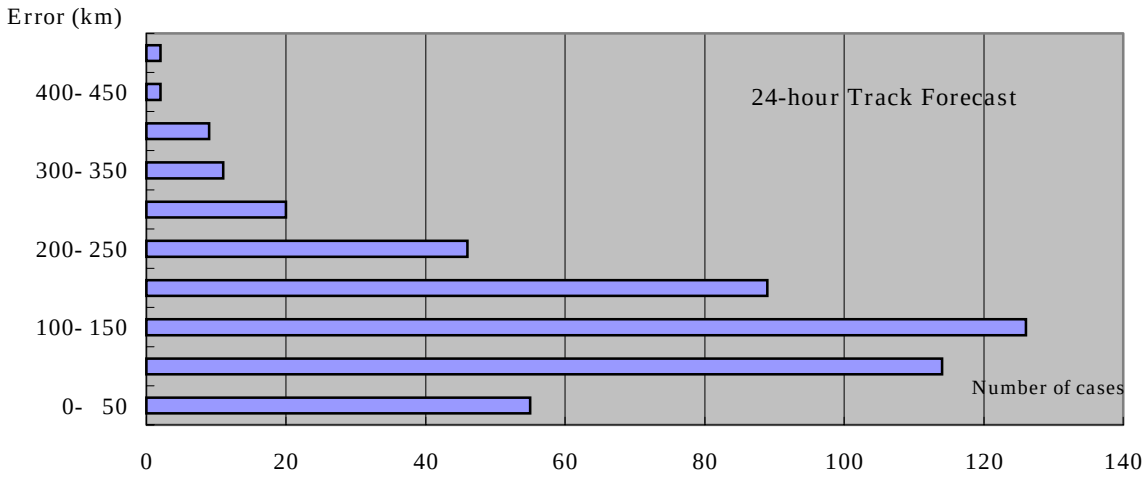


Figure 4.2 Histogram of 24-hour forecast position errors in 2002 (those for 48- and 72 hour forecasts are shown in the attached CD-ROM).

Table 4.2 presents mean hitting ratios and radii of 70% probability circles of operational forecasts for each tropical cyclone in 2002. The annual mean radius of 70% probability circles issued with 24-hour position forecasts was 191km, and their hitting ratio was 77% (in 365 out of 474 cases, a tropical cyclone actually located within the issued probability circle). As for 48-hour forecasts, those are 331km and 79% (in 300 out of 380 cases), respectively, and for 72-hour forecasts, 478km and 76% (in 230 out of 303 cases), respectively. These hitting ratios for 2002 were better than those for 2001.

Table 4.2 Mean hitting ratios (%) and radii (km) of 70% probability circles issued for 24-, 48- and 72-hour operational forecasts for each tropical cyclone in 2002

Tropical Cyclone			24-hour Forecast			48-hour Forecast			72-hour Forecast		
			Ratio (%)	Num.	Radius (km)	Ratio (%)	Num.	Radius (km)	Ratio (%)	Num.	Radius (km)
TS	TAPAH	(0201)	-	0	-	-	0	-	-	0	-
TY	MITAG	(0202)	71	28	186	62	24	322	60	20	473
TY	HAGIBIS	(0203)	24	17	189	54	13	372	11	9	565
STS	NOGURI	(0204)	86	7	177	67	3	327	-	0	-
TY	RAMMASUN	(0205)	96	26	192	91	22	316	100	17	460
TY	CHATAAN	(0206)	66	47	190	74	43	330	71	38	481
TY	HALONG	(0207)	56	32	196	67	27	338	57	23	467
STS	NAKRI	(0208)	73	11	172	80	5	345	100	3	537
TY	FENGSHEN	(0209)	76	49	189	72	43	322	82	38	460
TS	KALMAEGI	(0210)	-	0	-	-	0	-	-	0	-
TY	FUNG-WONG	(0211)	82	22	193	82	17	318	69	13	517
STS	KAMMURI	(0212)	100	3	167	-	0	-	-	0	-
TY	PHANFONE	(0213)	91	32	197	89	28	346	96	24	499
TS	VONGFONG	(0214)	75	4	185	-	0	-	-	0	-
TY	RUSA	(0215)	94	32	196	89	28	328	79	24	462
TY	SINLAKU	(0216)	100	35	190	100	31	323	100	27	473
TY	ELE	(0217)	84	38	185	94	34	323	87	30	468
TS	HAGUPIT	(0218)	-	0	-	-	0	-	-	0	-
TS	CHANGMI	(0219)	-	0	-	-	0	-	-	0	-
TS	MEKKHALA	(0220)	100	7	167	100	3	327	-	0	-
TY	HIGOS	(0221)	76	17	201	62	13	352	38	8	471
STS	BAVI	(0222)	100	11	204	57	7	318	0	3	457
STS	MAYSAK	(0223)	83	6	210	100	1	445	-	0	-
TY	HUKO	(0224)	30	10	196	67	6	411	100	2	602
TY	HAISHEN	(0225)	38	13	192	33	9	321	0	5	487
TY	PONGSONA	(0226)	85	27	194	96	23	330	89	19	473
Annual Mean (Total)			77	474	191	79	380	331	76	303	478

4.1.2 Central Pressure and Maximum Wind Speed

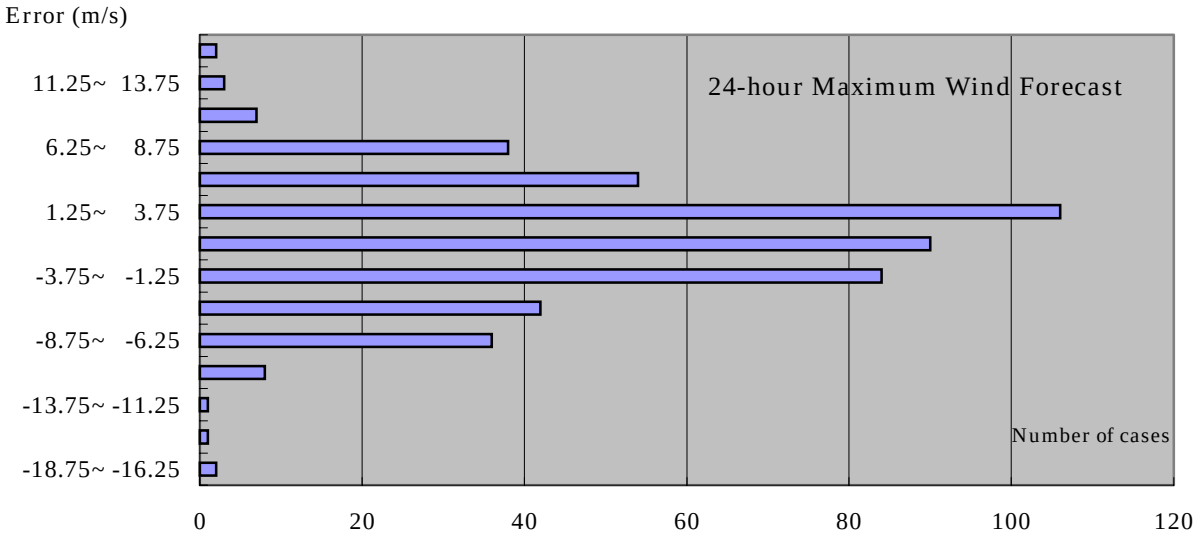
Table 4.3 gives root mean square errors (RMSEs) of 24- and 48-hour intensity forecasts for each tropical cyclone in 2002. Annual mean RMSEs of the central pressure and the maximum wind speed for 24-hour forecasts were 10.8hPa (10.9hPa in 2001) and 5.0m/s (5.2 m/s in 2001), respectively, while those for 48-hour forecasts were 15.3hPa (15.6hPa in 2001) and 7.0m/s (6.9m/s in 2001), respectively.

Figure 4.3 presents the histogram of maximum wind speed errors for 24- and 48-hour forecasts. The ratio of absolute errors smaller than 3.75 m/s for 24-hour forecasts was 59%

(54% in 2001) and 69% of total 48-hour forecasts had errors smaller than 6.25 m/s (70% in 2001). The overall performance of intensity forecasts in 2002 was almost same as that in 2001. However, relatively large errors were seen in rapid developing/decaying cases such as TY Higos, which made a rapid decay in October. (see Appendix 2 for individual cases).

Table 4.3 Mean intensity errors of 24- and 48-hour operational forecasts for each tropical cyclone in 2002.

Tropical Cyclone			24-hour Forecast					48-hour Forecast				
			Central Pressure		Max. Wind			Central Pressure		Max. Wind		
			Mean (hPa)	RMSE (hPa)	Mean (m/s)	RMSE (m/s)	Num.	Mean (hPa)	RMSE (hPa)	Mean (m/s)	RMSE (m/s)	Num.
TS	TAPAH	(0201)	-	-	-	-	0	-	-	-	-	0
TY	MITAG	(0202)	6.0	14.4	-2.0	5.7	28	11.4	24.4	-4.0	10.1	24
TY	HAGIBIS	(0203)	5.8	14.3	-2.7	6.8	17	9.2	21.8	-4.4	10.0	13
STS	NOGURI	(0204)	2.7	13.4	-1.1	7.3	7	4.0	8.0	-0.9	4.5	3
TY	RAMMASUN	(0205)	-4.4	8.5	3.0	5.3	26	-5.7	9.5	3.4	6.9	22
TY	CHATAAN	(0206)	-4.6	12.5	2.5	6.2	47	-5.9	15.7	3.7	7.8	43
TY	HALONG	(0207)	1.4	6.2	-0.6	2.9	32	-0.4	8.6	1.0	4.0	27
STS	NAKRI	(0208)	2.6	3.8	-2.3	3.3	11	1.6	2.8	-1.0	1.6	5
TY	FENGSHEN	(0209)	0.4	13.0	0.2	5.8	49	-5.0	20.4	2.8	8.8	43
TS	KALMAEGI	(0210)	-	-	-	-	0	-	-	-	-	0
TY	FUNG-WONG	(0211)	0.6	9.7	0.6	5.1	22	1.8	11.9	0.9	5.7	17
STS	KAMMURI	(0212)	6.3	7.6	-3.4	4.7	3	-	-	-	-	0
TY	PHANFONE	(0213)	-2.4	8.0	1.4	3.7	32	-4.8	9.9	1.7	4.0	28
TS	VONGFONG	(0214)	-9.2	9.6	4.5	5.3	4	-	-	-	-	0
TY	RUSA	(0215)	-2.8	7.5	1.0	3.2	32	-4.5	9.1	2.0	4.2	28
TY	SINLAKU	(0216)	0.5	9.3	-0.6	4.4	35	3.5	13.7	-2.7	6.2	31
TY	ELE	(0217)	-0.5	8.0	0.1	4.4	38	-5.3	11.1	2.8	5.3	34
TS	HAGUPIT	(0218)	-	-	-	-	0	-	-	-	-	0
TS	CHANGMI	(0219)	-	-	-	-	0	-	-	-	-	0
TS	MEKKHALA	(0220)	-3.1	4.3	0.4	2.2	7	-2.7	3.3	-0.9	1.5	3
TY	HIGOS	(0221)	5.2	15.5	-1.4	6.4	17	8.5	26.9	-2.2	11.1	13
STS	BAVI	(0222)	-11.4	11.8	5.8	6.1	11	-20.7	21.3	10.3	10.7	7
STS	MAYSAK	(0223)	4.2	6.9	-3.0	4.3	6	-4.0	4.0	2.6	2.6	1
TY	HUKO	(0224)	-19.6	20.3	2.6	3.6	10	-21.8	22.1	7.3	7.6	6
TY	HAISHEN	(0225)	-3.5	13.4	0.2	6.7	13	-4.4	8.2	0.0	4.2	9
TY	PONGSONA	(0226)	3.4	6.6	-1.9	3.4	27	7.6	9.8	-3.8	4.9	23
Annual Mean (Total)			-0.6	10.8	0.3	5.0	474	-1.4	15.3	0.9	7.0	380



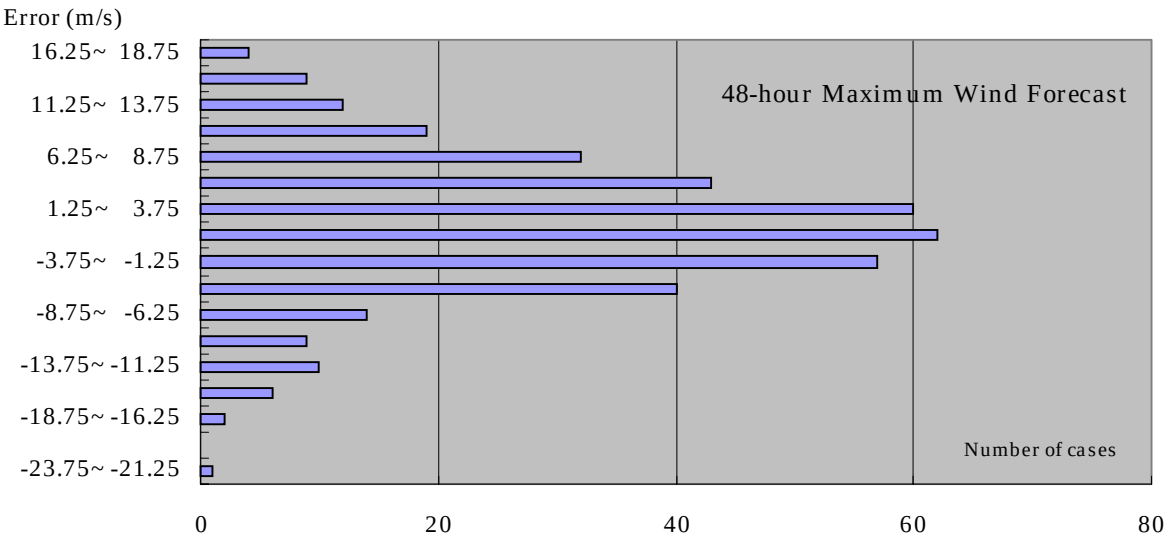


Figure 4.3 Histograms of maximum wind speed errors for 24- and 48- hour forecasts in 2002 (those of central pressure errors for 24- and 48-hour forecasts are included in the attached CD-ROM)

4.2 TYM and GSM Predictions

JMA implemented the following changes to the JMA Typhoon Model (TYM) in 2002:

- An upper bound (800km) was set to the radius of the tropical cyclone bogusing area in May 2002.
- The lower minimum value of the scale length, which characterizes the horizontal size of the synthesized initial tropical cyclone bogus vortex, was increased in order to ameliorate the dynamical balance in the initial field for small and intense tropical cyclones in July 2002.

TYM and GSM provide primary information for forecasters for the RSMC Tokyo – Typhoon Center to make operational track and intensity forecasts. Track predictions by TYM and GSM up to 84 and 90 hours, respectively, were verified with the best track data and predictions by the persistency (PER) method*. 30-hour, 54-hour and 78-hour intensity predictions by TYM and GSM were also verified with these data.

Note: The PER-method assumes that a tropical cyclone holds the same movement throughout the forecast period and forecasts are based upon the linear extrapolation of the latest 6-hour track of a tropical cyclone. Prediction errors by the PER-method are used to evaluate the relative performance of model predictions.

4.2.1 TYM Prediction

1) Center Position

Annual mean position errors of TYM predictions from 1996 are indicated in Figure 4.4.

Annual mean position errors for 30-hour*, 54-hour* and 78-hour* predictions in 2002 were 166km (185km in 2001), 286km (315km) and 424km (468km), respectively. The overall performance of the TYM track prediction in 2002 was better than the previous year. Mean position errors of 18-, 30-, 42-, 54-, 66- and 78-hour predictions for each tropical cyclone are also shown in Table 4.4.

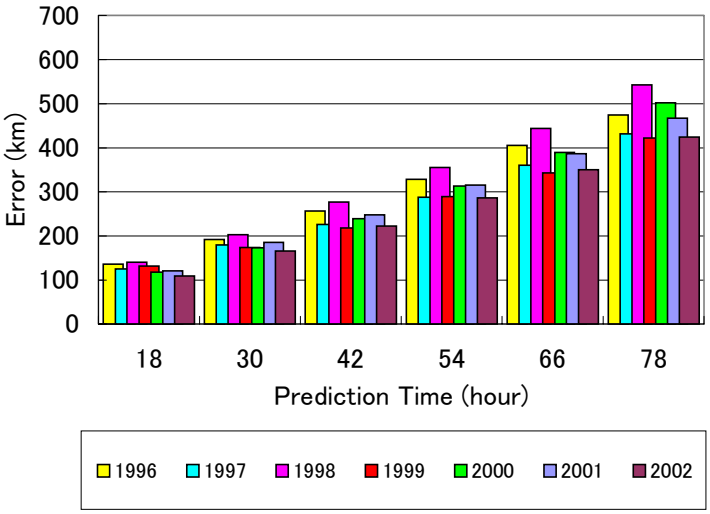


Figure 4.4 TYM annual mean position errors from 1996

Note: 30-, 54- and 78-hour predictions by TYM and GSM are the primary information for forecasters in preparing 24-, 48- and 72-hour operational forecasts, respectively.

Table 4.4 Mean position errors (km) of TYM for each tropical cyclone in 2002. Number of samples is given in parentheses.

Tropical Cyclone		T=18		T=30		T=42		T=54		T=66		T=78	
TS	0201 TAPAH	239.2	(6)	423.3	(4)	614.3	(2)	-	(-)	-	(-)	-	(-)
TY	0202 MITAG	96.1	(35)	156.3	(33)	228.6	(31)	309.3	(29)	370.9	(27)	421.3	(25)
TY	0203 HAGIBIS	200.5	(22)	318.0	(20)	419.5	(18)	540.8	(16)	651.2	(13)	807.0	(11)
STS	0204 NOGURI	109.3	(10)	170.2	(8)	284.0	(7)	379.1	(5)	589.4	(3)	902.8	(1)
TY	0205 RAMMASUN	84.9	(30)	110.4	(28)	144.3	(26)	203.4	(24)	217.1	(22)	245.5	(20)
TY	0206 CHATAAN	135.6	(46)	178.6	(44)	221.6	(42)	291.1	(40)	373.3	(38)	474.0	(36)
TY	0207 HALONG	159.1	(37)	278.1	(35)	409.9	(33)	506.5	(31)	595.5	(29)	662.1	(27)
STS	0208 NAKRI	67.1	(6)	156.2	(4)	209.7	(2)	-	(-)	-	(-)	-	(-)
TY	0209 FENGSHEN	101.8	(50)	154.9	(48)	197.3	(46)	251.4	(44)	324.8	(42)	401.5	(40)
TS	0210 KALMAEGI	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TY	0211 FUNG-WONG	81.2	(22)	147.1	(20)	246.2	(18)	288.5	(16)	305.6	(14)	360.3	(12)
STS	0212 KAMMURI	91.2	(8)	102.4	(6)	166.5	(4)	417.4	(2)	-	(-)	-	(-)
TY	0213 PHANFONE	86.8	(34)	125.6	(32)	142.4	(30)	195.8	(28)	212.5	(26)	258.5	(24)
TS	0214 VONGFONG	117.4	(16)	149.4	(14)	209.0	(12)	283.5	(10)	336.1	(8)	394.3	(6)
TY	0215 RUSA	86.2	(35)	117.9	(33)	161.9	(31)	215.5	(29)	274.5	(27)	360.9	(25)
TY	0216 SINLAKU	76.5	(38)	123.9	(36)	169.7	(34)	224.1	(32)	282.6	(30)	320.6	(28)
TY	0217 ELE	89.3	(31)	127.4	(29)	175.5	(27)	236.6	(25)	320.8	(23)	425.8	(21)
TS	0218 HAGUPIT	111.1	(5)	222.0	(3)	331.2	(1)	-	(-)	-	(-)	-	(-)
TS	0219 CHANGMI	60.2	(1)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TS	0220 MEKKHALA	82.2	(9)	112.0	(7)	140.8	(5)	157.0	(3)	196.8	(1)	-	(-)
TY	0221 HIGOS	91.1	(18)	149.2	(16)	185.9	(14)	238.0	(12)	336.3	(10)	513.2	(8)
STS	0222 BAVI	127.4	(16)	160.8	(14)	178.2	(12)	258.8	(10)	376.4	(8)	718.4	(6)
STS	0223 MAYSAK	152.6	(7)	186.6	(5)	192.1	(3)	280.4	(1)	-	(-)	-	(-)
STS	0224 HUKO	140.9	(12)	233.9	(10)	352.7	(8)	426.4	(6)	377.2	(4)	191.3	(2)
TY	0225 HAISHEN	97.6	(16)	196.0	(14)	300.8	(12)	426.2	(10)	519.0	(8)	517.3	(6)
TY	0226 PONGSONA	100.8	(30)	152.9	(28)	181.0	(26)	199.3	(24)	278.5	(22)	346.6	(20)
Annual Mean		109.0	(540)	165.8	(491)	222.6	(444)	286.4	(397)	350.0	(355)	424.2	(318)

Table 4.5 gives TYM's relative performance compared to the PER-method. In this comparison, life stages of tropical cyclones were classified into three categories, "Before", "During" and "After" recurvature. Each stage is defined with the direction of movement of each tropical cyclone at each prediction time concerned. The table indicates that TYM outperformed the PER-method throughout the whole forecast period beyond 18 hours from the initial time and improvement rates were roughly 35% for 18-hour, 50% for 30-hour and 55% for 42-hour to 78-hour predictions. These improvement rates in 2002 were greater than those in 2001 by about 10 to 15%. Looking at the results of respective stages, improvement rates were relatively higher in "After" stage in which position errors were larger compared with other two stages.

Figure 4.5 (in the attached CD-ROM) presents histograms of the position errors of 30-, 54- and 78-hour predictions of TYM. The ratio of 30-hour prediction errors smaller than 150km was 55% (40% in 2001), the ratio of 54-hour prediction errors smaller than 300km was 60% (58%) and the ratio of 78-hour prediction errors smaller than 450km was 61% (56%).

Table 4.5 Mean position errors (km) of TYM and PER predictions for the tropical cyclones in 2002 in each stage of motion. Number of samples is given in parentheses.

TIME	MODEL	Before (180° ~ 320°)	During (320° ~ 10°)	After (10° ~ 180°)	All (0° ~ 360°)
(moving direction)					
T=18	TYM	112.9 (287)	96.9 (127)	112.5 (126)	109.0 (540)
	PER	135.2 (287)	173.1 (127)	261.6 (126)	173.6 (540)
	IMPROV	16.5 %	44.0 %	57.0 %	37.2 %
T=30	TYM	176.7 (260)	137.0 (115)	169.8 (116)	165.8 (491)
	PER	231.8 (260)	327.9 (115)	518.5 (116)	322.1 (491)
	IMPROV	23.7 %	58.2 %	67.3 %	48.5 %
T=42	TYM	224.1 (233)	204.5 (101)	235.9 (110)	222.6 (444)
	PER	336.5 (233)	492.8 (101)	793.9 (110)	485.4 (444)
	IMPROV	33.4 %	58.5 %	70.3 %	54.1 %
T=54	TYM	279.2 (204)	255.6 (92)	329.0 (101)	286.4 (397)
	PER	469.2 (204)	575.0 (92)	1066.8 (101)	645.7 (397)
	IMPROV	40.5 %	55.5 %	69.2 %	55.6 %
T=66	TYM	335.8 (181)	308.0 (81)	414.0 (93)	350.0 (355)
	PER	574.1 (181)	727.5 (81)	1307.5 (93)	801.2 (355)
	IMPROV	41.5 %	57.7 %	68.3 %	56.3 %
T=78	TYM	399.1 (159)	376.1 (73)	511.4 (86)	424.2 (318)
	PER	726.9 (159)	817.3 (73)	1086.8 (86)	969.1 (318)
	IMPROV	45.1 %	54.0 %	66.9 %	56.2 %

2) Central Pressure and Maximum Wind Speed

Mean errors of 30- and 54-hour central pressure predictions by TYM were +3.9hPa (+1.3hPa in 2001) and +2.1hPa (+0.7hPa), respectively in 2002. Their root mean square errors (RMSEs) were 15.6hPa for 30-hour predictions (13.5hPa in 2001), and 17.0hPa for 54-hour predictions (15.1hPa). Meanwhile the bias for 30-hour maximum wind speed predictions was –2.4m/s (–0.8m/s in 2001) with a RMSE of 7.2m/s (6.7m/s), and the bias for 54-hour ones was –2.1m/s (–1.2m/s) with a RMSE of 7.5m/s (7.1m/s).

Figure 4.6 shows histograms of the errors of 30-hour central pressure and maximum wind speed predictions. About 43% (47% in 2001) of the central pressure predictions had errors with absolute values less than 7.5hPa, while 37% (43%) of the maximum wind speed predictions with absolute values less than 3.75m/s. As for 54-hour predictions, these ratios were 57% (68%) with absolute values less than 12.5hPa and 62% (64%) with absolute values less than 6.25m/s, respectively (Figures are shown in the attached CD-ROM).

Although JMA implemented changes to TYM, the overall performance of the Model in central pressure and maximum wind speed forecasts for 2002 was worse than that for 2001.

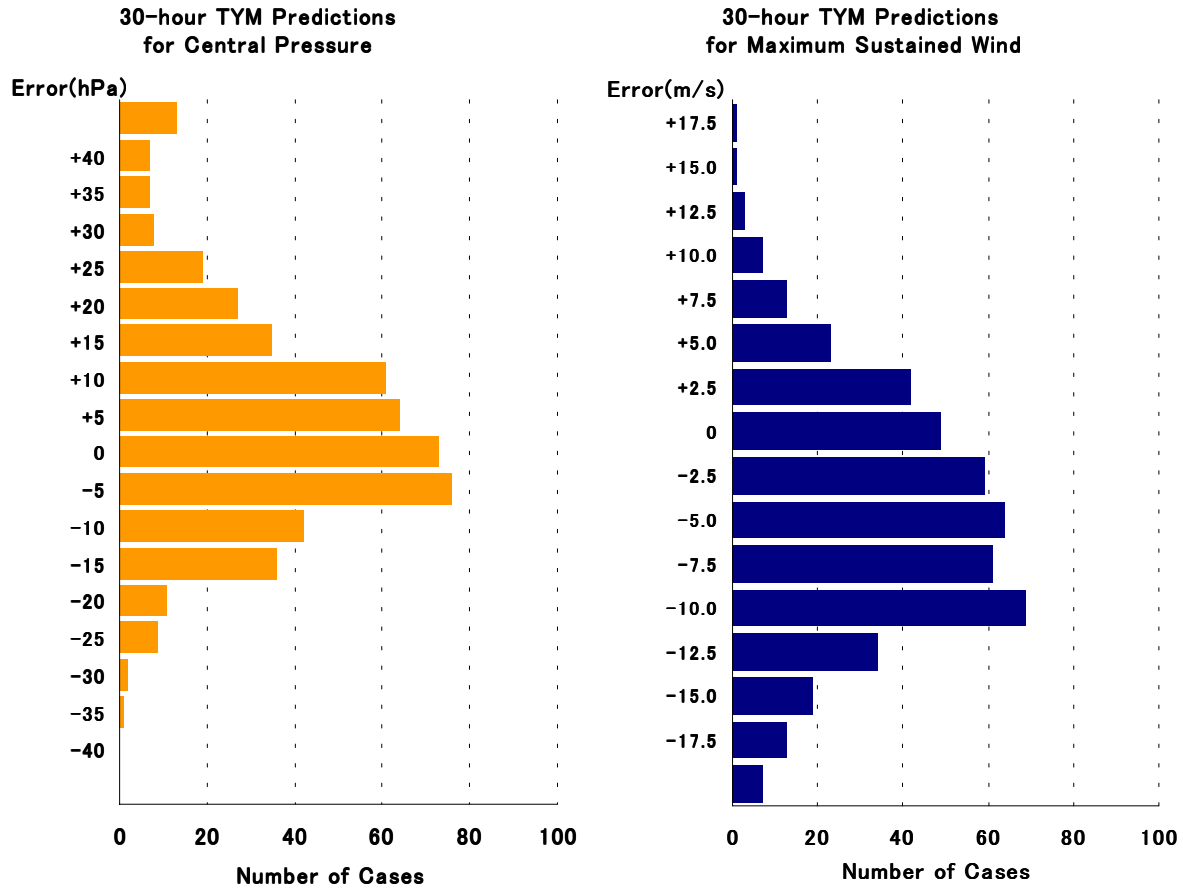


Figure 4.6 Error distribution of TYM 30-hour intensity predictions (left; for central pressure, right; for maximum wind speed, those for 54- and 78-hour predictions are included in the attached CD-ROM).

4.2.2 GSM Prediction

1) Center Position

GSM annual mean position errors from 1996 are presented in Figure 4.7. In 2001, a total of 278 predictions were made by GSM and the errors for 30-hour, 54-hour and 78-hour predictions were 156km (172km in 2001), 242km (283km) and 353km (425km), respectively. The overall performance of GSM was greatly better than that in 2001. The position errors of GSM were smaller than those of TYM throughout the forecast period except 18-hour forecast. Mean position errors of the 18-, 30-, 42-, 54-, 66- and 78-hour predictions for each tropical cyclone are given in Table 4.6.

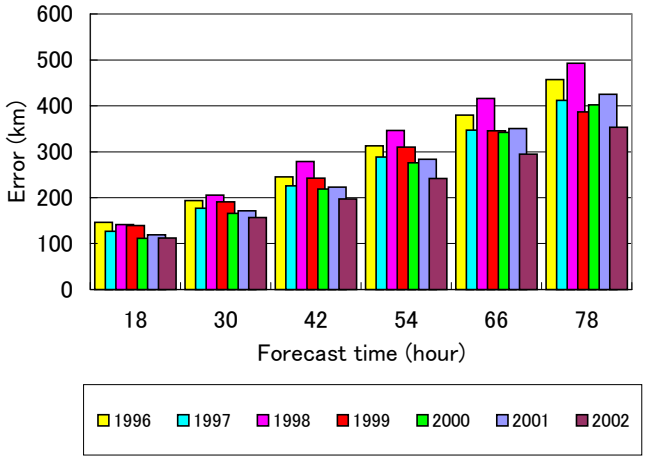


Figure 4.7 GSM annual mean position errors from 1996.

Table 4.6 Mean position errors (km) of GSM for each tropical cyclone in 2002

Tropical Cyclone		T=18		T=30		T=42		T=54		T=66		T=78	
TS	0201 TAPAH	271.4	(2)	416.5	(1)	-	(-)	-	(-)	-	(-)	-	(-)
TY	0202 MITAG	112.0	(17)	163.7	(16)	234.8	(15)	293.9	(14)	362.6	(13)	445.7	(12)
TY	0203 HAGIBIS	198.5	(11)	292.8	(10)	364.9	(9)	437.3	(8)	521.0	(7)	648.2	(6)
STS	0204 NOGURI	62.5	(4)	98.6	(4)	63.8	(2)	119.5	(2)	-	(-)	-	(-)
TY	0205 RAMMASUN	55.3	(15)	76.5	(14)	114.8	(13)	188.5	(12)	206.8	(11)	212.5	(10)
TY	0206 CHATAAN	149.1	(23)	193.8	(22)	223.4	(21)	270.6	(20)	311.7	(19)	353.8	(18)
TY	0207 HALONG	177.6	(19)	274.8	(18)	349.6	(17)	426.8	(15)	543.7	(13)	672.0	(12)
STS	0208 NAKRI	85.6	(8)	112.1	(6)	125.6	(5)	122.4	(4)	175.4	(3)	333.0	(3)
TY	0209 FENGSHEN	123.1	(25)	154.7	(24)	189.1	(23)	218.5	(22)	250.4	(21)	291.0	(20)
TS	0210 KALMAEGI	59.5	(1)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TY	0211 FUNG-WONG	88.5	(11)	136.6	(10)	195.3	(9)	201.2	(8)	237.0	(4)	331.3	(2)
STS	0212 KAMMURI	100.9	(4)	92.2	(3)	111.1	(2)	126.0	(1)	-	(-)	-	(-)
TY	0213 PHANFONE	75.1	(17)	113.0	(16)	175.1	(15)	217.8	(14)	251.1	(13)	288.7	(12)
TS	0214 VONGFONG	103.8	(8)	114.4	(7)	143.7	(6)	217.1	(5)	271.8	(4)	333.5	(3)
TY	0215 RUSA	81.0	(18)	98.9	(17)	131.0	(16)	172.4	(15)	220.6	(14)	276.5	(13)
TY	0216 SINLAKU	62.4	(19)	85.1	(18)	116.3	(17)	139.8	(16)	173.2	(15)	216.0	(14)
TY	0217 ELE	128.0	(20)	154.0	(19)	151.9	(18)	165.6	(17)	207.3	(16)	255.5	(15)
TS	0218 HAGUPIT	54.7	(2)	116.0	(1)	-	(-)	-	(-)	-	(-)	-	(-)
TS	0219 CHANGMI	116.7	(1)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TS	0220 MEKKHALA	40.4	(4)	88.7	(3)	46.3	(2)	45.6	(1)	-	(-)	-	(-)
TY	0221 HIGOS	97.7	(9)	158.7	(8)	212.7	(7)	238.0	(6)	318.1	(5)	517.2	(4)
STS	0222 BAVI	129.3	(8)	161.8	(7)	161.0	(6)	239.4	(5)	377.8	(4)	610.8	(3)
STS	0223 MAYSAK	149.5	(3)	133.8	(1)	-	(-)	-	(-)	-	(-)	-	(-)
STS	0224 HUKO	145.1	(6)	290.6	(5)	354.7	(4)	438.3	(3)	386.1	(2)	164.0	(1)
TY	0225 HAISHEN	137.1	(8)	238.8	(7)	323.0	(6)	486.0	(5)	585.5	(4)	634.2	(3)
TY	0226 PONGSONA	91.0	(15)	126.8	(14)	172.5	(13)	199.2	(12)	253.6	(11)	272.7	(10)
Annual Mean		111.9	(278)	156.3	(251)	196.7	(226)	241.7	(205)	294.5	(179)	353.3	(161)

Table 4.7 gives GSM's relative performance compared to the PER-method. Improvement rates were roughly 35 % (25% in 2001) for 18-hour, 50% (40%) for 30-hour, and 60% (50%) for 54-hour to 78-hour predictions. These improvement rates in 2002 were greater than those in 2001 by 10%. The percentage is relatively high in “After” stage and low in “Before” stage.

Table 4.7 Mean position errors (km) of GSM and PER predictions for the tropical cyclones in 2002 in each stage of motion.

TIME	MODEL	Before (180° ~ 320°)	During (320° ~ 10°)	After (10° ~ 180°)	All (0° ~ 360°)
(moving direction)					
T=18	GSM	112.8 (140)	108.0 (72)	114.2 (66)	111.9 (278)
	PER	140.0 (140)	174.7 (72)	245.2 (66)	174.0 (278)
	IMPROV	19.4 %	38.2 %	53.4 %	35.7 %
T=30	GSM	161.2 (127)	132.6 (65)	171.8 (59)	156.3 (251)
	PER	234.9 (127)	311.1 (65)	488.1 (59)	314.1 (251)
	IMPROV	31.4 %	57.4 %	64.8 %	50.2 %
T=42	GSM	206.8 (115)	159.0 (57)	215.2 (54)	196.7 (226)
	PER	342.9 (115)	500.9 (57)	710.3 (54)	470.5 (226)
	IMPROV	39.7 %	68.3 %	69.7 %	58.2 %
T=54	GSM	236.3 (102)	222.0 (52)	272.3 (51)	241.7 (205)
	PER	452.8 (102)	620.1 (52)	987.7 (51)	628.3 (205)
	IMPROV	47.8 %	64.2 %	72.4 %	61.5 %
T=66	GSM	279.1 (91)	269.4 (44)	351.6 (44)	294.5 (179)
	PER	578.7 (91)	711.8 (44)	1256.4 (44)	-778.0 (179)
	IMPROV	51.8 %	62.1 %	72.0 %	62.1 %
T=78	GSM	333.4 (80)	289.9 (39)	450.3 (42)	353.3 (161)
	PER	733.0 (80)	786.9 (39)	1446.9 (42)	932.3 (161)
	IMPROV	54.5 %	63.2 %	68.9 %	62.1 %

Figure 4.8 (in the attached CD-ROM) presents histograms of the position errors of 30-, 54- and 78-hour predictions of GSM. The ratio of 30-hour prediction errors smaller than 150km was 58% (49% in 2001), the ratio of 54-hour prediction errors smaller than 300km was 74% (67%) and the ratio of 78-hour prediction errors smaller than 450km was 75% (68%).

2) Central Pressure and Maximum Wind Speed

Figure 4.9 shows histograms of central pressure errors and the maximum wind speed errors of 30-hour predictions of GSM. The histograms show that in almost all cases GSM underestimated the intensity of tropical cyclones in its 30-hour predictions and has a considerable positive bias in the central pressure prediction.

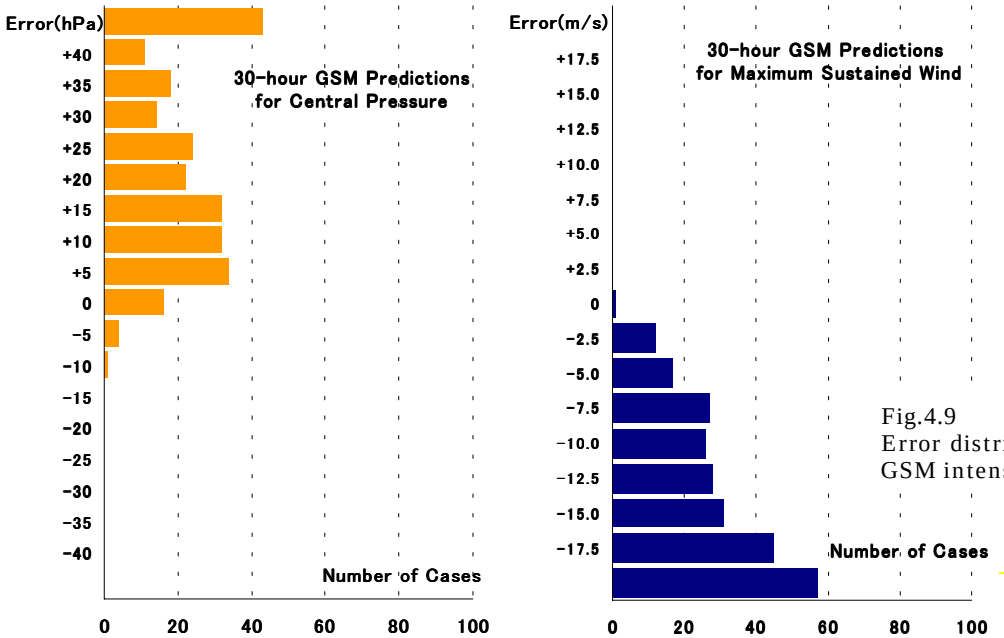
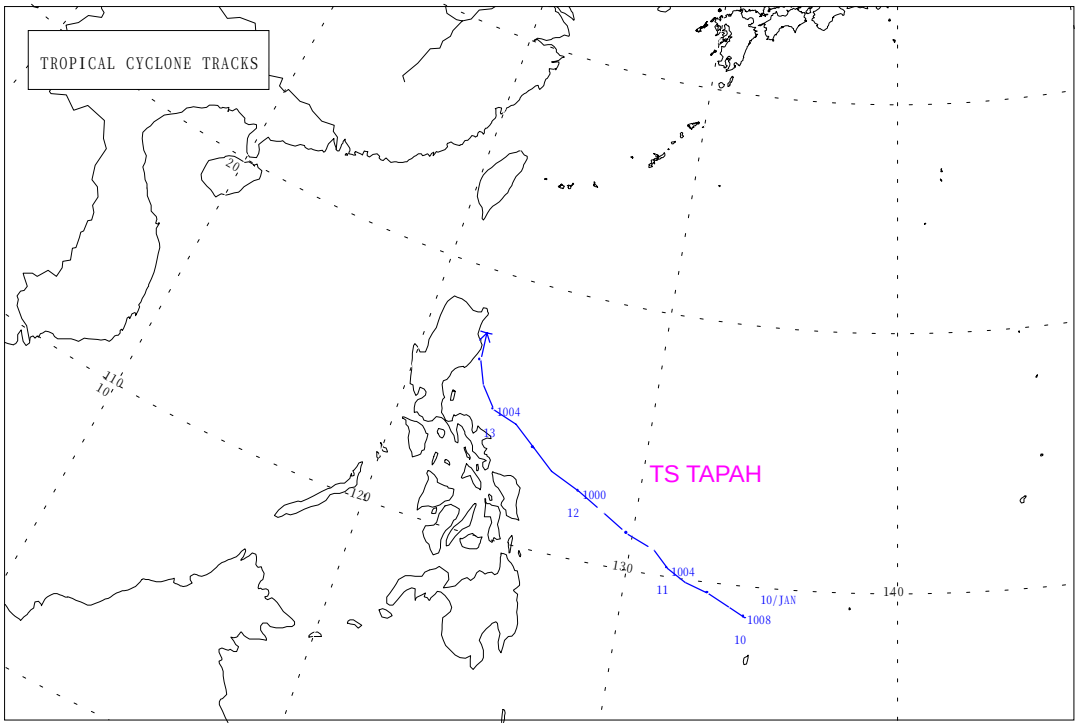


Fig.4.9
Error distribution of 30-hour GSM intensity predictions

TS TAPAH (0201)

Tapah formed as a tropical depression (TD) north of the Palau Islands at 00UTC 10 January 2002. Moving northwestward, it developed into a tropical storm (TS) east of Samar Island at 00UTC 12 January and attained the peak intensity north of the same island at 12UTC on the same day. Tapah then weakened and was downgraded into a TD at 00UTC 13 January east of Luzon Island, where it turned to the north around 12UTC on the same day. It dissipated near the eastern coasts of the same island at 00UTC 14 January.

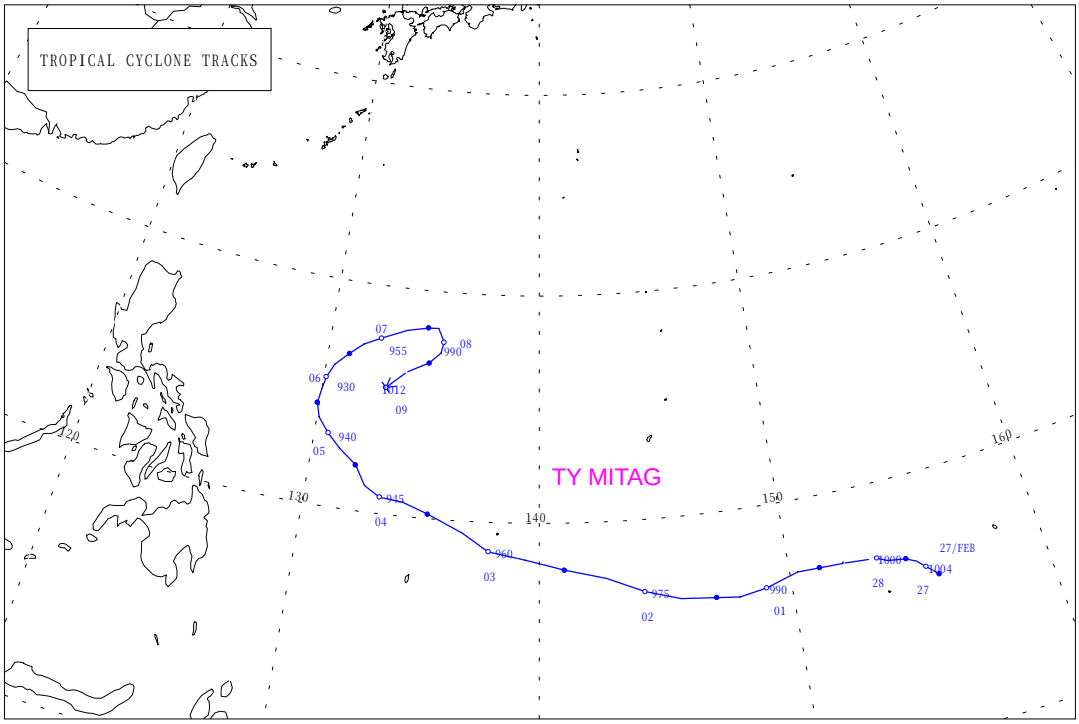
Date/Time (UTC)	Center Position Lat (N)	Lon (E)	Central pressure (hPa)	Max Wind (kt)	Grade
TS TAPAH (0201)					
Jan 10/00	9.0	134.5	1008	-	TD
10/06	9.3	133.9	1006	-	TD
10/12	9.7	133.1	1008	-	TD
10/18	10.0	132.2	1006	-	TD
11/00	10.4	131.5	1004	-	TD
11/06	11.0	130.9	1004	-	TD
11/12	11.4	129.8	1002	-	TD
11/18	12.0	128.8	1002	-	TD
12/00	12.6	127.7	1000	35	TS
Jan 12/06	13.1	126.5	1000	35	TS
12/12	13.8	125.6	996	40	TS
12/18	14.5	124.7	1000	35	TS
13/00	14.8	123.7	1004	-	TD
13/06	15.6	123.0	1004	-	TD
13/12	16.5	122.6	1006	-	TD
13/18	17.6	122.5	1008	-	TD
14/00					Dissip



TY MITAG (0202)

Mitag formed as a tropical depression southwest of Pohnpei Island at 12UTC 26 February. Moving northwest then westward, it developed into a tropical storm (TS) over the Truk Islands at 12UTC 28 February. On the westward track it became a severe tropical storm (STS) west of the Islands at 06UTC on the following day. Slightly turning to the west-northwest, it intensified into a typhoon (TY) over the same waters at 06UTC 2 March. After taking the west-northwest track for a few days with further development, Mitag reached its peak intensity east of the Philippines at 06UTC 5 March, where it started recurving. Holding the peak intensity for about one day on a northward track, it then turned to the northeast with gradual weakening over the same waters on 6 March. After it was downgraded into a STS at 12UTC 7 March, it began to move southward and rapidly weakened to a TS 12 hours later. Moving to the southwest, it became a tropical depression at 12UTC 8 March and dissipated at 06UTC on the following day over the same waters.

Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TY MITAG (0202)													
Feb	26/12	5.8	155.7	1006	-	TD	Mar	04/00	10.7	133.2	945	80	TY
	26/18	6.0	155.5	1004	-	TD		04/06	11.1	132.5	940	85	TY
	27/00	6.2	155.3	1004	-	TD		04/12	11.9	132.0	940	85	TY
	27/06	6.5	155.0	1002	-	TD		04/18	12.5	131.2	940	85	TY
	27/12	6.7	154.6	1002	-	TD		05/00	13.1	130.6	940	90	TY
	27/18	6.8	153.9	1000	-	TD		05/06	13.7	130.1	930	95	TY
	28/00	7.0	153.5	1000	-	TD		05/12	14.3	129.9	930	95	TY
	28/06	7.1	152.2	998	-	TD		05/18	14.9	130.0	930	95	TY
	28/12	7.1	151.2	998	35	TS		06/00	15.5	130.1	930	95	TY
	28/18	7.1	150.3	996	40	TS		06/06	16.1	130.4	935	95	TY
Mar	01/00	6.7	149.0	990	45	TS		06/12	16.7	131.0	940	85	TY
	01/06	6.5	147.9	985	50	STS		06/18	17.2	131.6	950	80	TY
	01/12	6.6	147.0	985	50	STS		07/00	17.6	132.4	955	75	TY
	01/18	6.7	145.6	980	55	STS		07/06	18.1	133.6	960	70	TY
	02/00	7.1	144.2	975	60	STS		07/12	18.3	134.6	970	60	STS
	02/06	7.7	142.7	970	65	TY		07/18	18.3	135.1	980	50	STS
	02/12	8.1	141.0	965	70	TY		08/00	17.7	135.4	990	45	TS
	02/18	8.5	139.4	960	75	TY		08/06	17.2	135.3	996	40	TS
	03/00	8.8	137.9	960	75	TY		08/12	16.7	134.8	1004	-	TD
	03/06	9.5	136.8	960	75	TY		08/18	16.2	133.8	1012	-	TD
	03/12	10.2	135.3	960	75	TY		09/00	15.4	132.9	1012	-	TD
	03/18	10.6	134.2	955	75	TY		09/06						Dissip


TROPICAL CYCLONE TRACKS
TY MITAG
07
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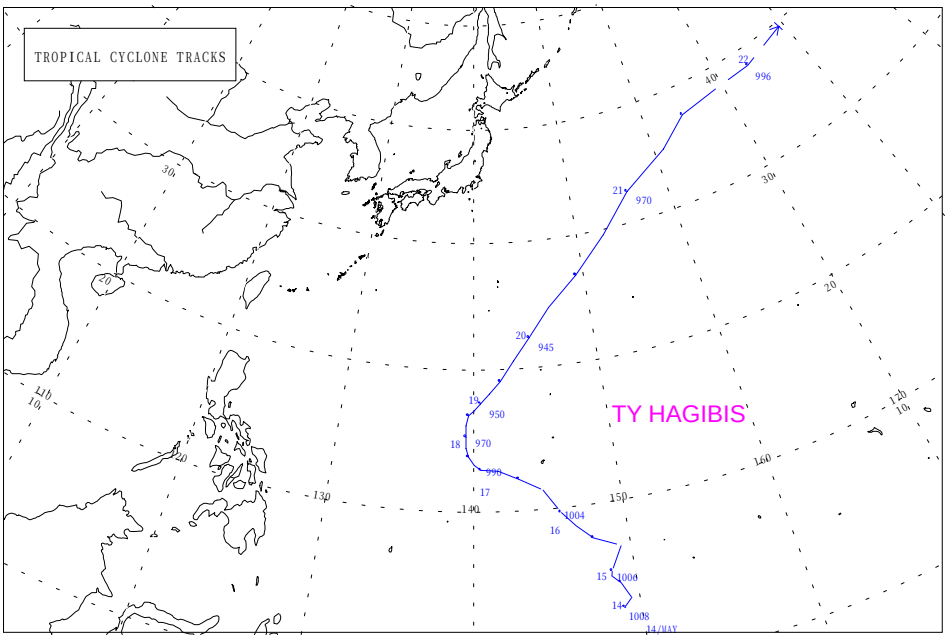
975
02
990
01
1000
28
1004
27
27/FEB
120
130
140
150
160

TY HAGIBIS (0203)

Hagibis formed as a tropical depression (TD) about 500km southwest of Truk Island at 0000UTC 14 May 2002. The TD moved toward the northwest and reached a tropical storm (TS) intensity at 1200 UTC 16 May about 200km southwest of Guam Island. Moving west-northwest, it reached a severe tropical storm (STS) at 0000UTC 17 May about 450km west of the same island. Then it turned to the north and reached a typhoon (TY) intensity at 0000UTC 18 May about 600km west-northwest of Saipan. Hagibis reached its peak intensity with maximum sustained wind of 95kt northwest of the same island at 1200UTC 19 May, when it started acceleration toward northeast. Weakening gradually, it reached far east of Japan, where it was downgraded to the STS intensity at 0600UTC 21 May and then became an extratropical cyclone at 1800UTC on the same day. It then moved eastward along the 40 ° N latitudinal circle and dissipated south of the Aleutian Islands.

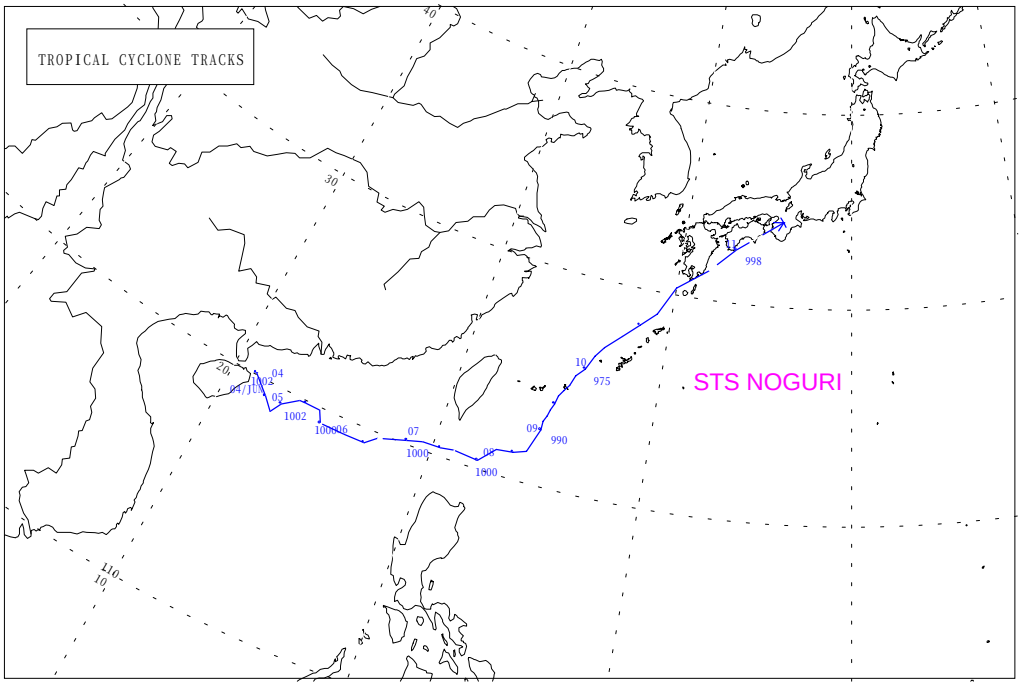
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TY HAGIBIS (0203)													
May	14/00	3.5	149.0	1008	-	TD	May	18/12	16.8	139.6	960	75	TY
	14/06	4.0	149.5	1006	-	TD		18/18	17.2	140.0	955	80	TY
	14/12	5.0	149.0	1006	-	TD		19/00	17.7	140.5	950	85	TY
	14/18	5.5	148.5	1006	-	TD		19/06	18.4	141.2	940	90	TY
	15/00	5.8	148.6	1006	-	TD		19/12	19.3	142.1	935	95	TY
	15/06	7.3	149.4	1006	-	TD		19/18	20.8	143.2	935	95	TY
	15/12	8.0	147.7	1006	-	TD		20/00	22.5	144.6	945	85	TY
	15/18	8.9	146.7	1004	-	TD		20/06	24.7	146.5	955	75	TY
	16/00	9.9	145.8	1004	-	TD		20/12	27.0	149.3	960	70	TY
	16/06	11.5	144.7	1004	-	TD		20/18	29.8	152.6	965	65	TY
	16/12	12.3	143.1	1000	35	TS		21/00	32.9	155.9	970	65	TY
	16/18	12.9	141.7	996	40	TS		21/06	35.4	161.0	975	60	STS
	17/00	13.0	140.5	990	50	STS		21/12	37.6	164.4	985	50	STS
	17/06	13.3	140.0	985	50	STS		21/18	38.3	169.1	990	-	L
	17/12	13.9	139.6	980	55	STS		22/00	38.6	173.7	996	-	L
	17/18	14.5	139.4	975	60	STS		22/06	39.8	179.4	996	-	L
	18/00	15.3	139.4	970	65	TY		22/12					Dissip
	18/06	16.1	139.4	965	70	TY							



STS NOGURI (0204)

A tropical depression (TD) formed east of Hainan Island at 00UTC 04 June 2002. Moving eastward, it developed into a tropical storm (TS) Noguri near the Batan Islands at 06UTC 08 June and changed its direction to the north-northeast at 18UTC on the same day. Noguri was upgraded to a severe tropical storm south of Miyako-jima at 03UTC 09 June, reached its peak intensity at 06UTC on the same day, and passed the island at around half past 17UTC on that day. It was downgraded to TS intensity on the following day and weakened to a TD at 21UTC 10 June soon after moving northeastward near east off the Osumi Peninsula. It passed Shikoku and dissipated over the Kii Peninsula at 12UTC 11 June.

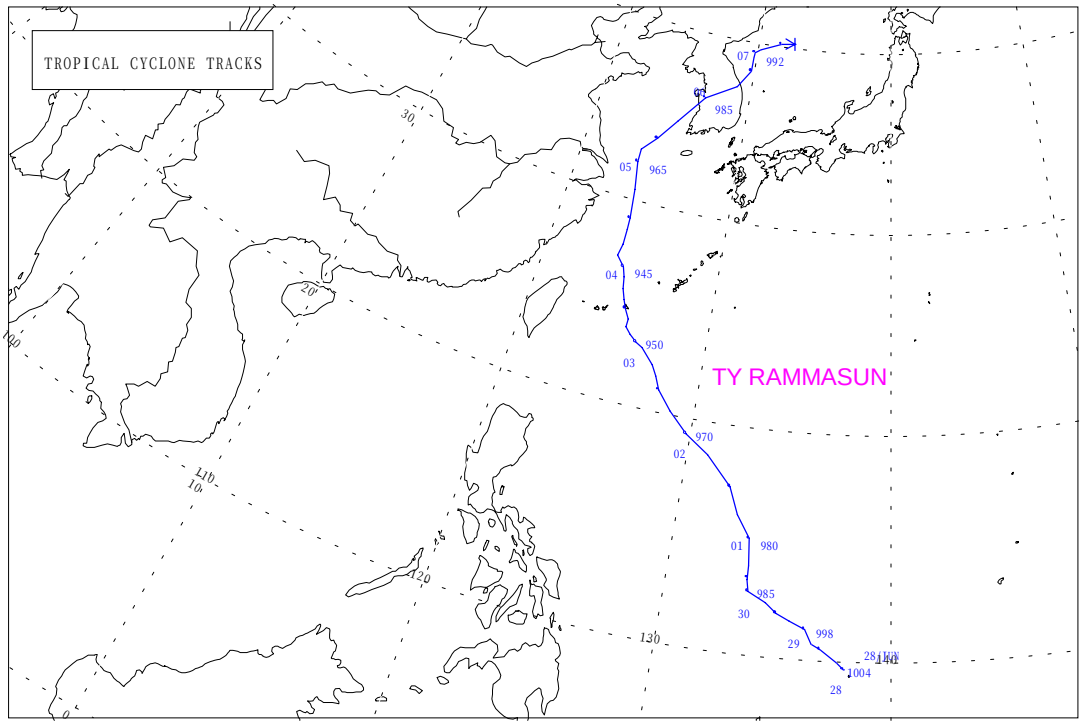
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
STS NOGURI (0204)													
Jun	04/00	20.2	111.1	1002	-	TD	Jun	09/00	22.6	124.7	990	45	TS
	04/06	19.8	111.6	1002	-	TD		09/03	23.0	124.7	985	50	STS
	04/12	19.5	112.0	1002	-	TD		09/06	23.3	124.8	975	60	STS
	04/18	19.0	112.5	1002	-	TD		09/09	23.6	124.9	975	60	STS
	05/00	19.5	112.8	1002	-	TD		09/12	23.9	125.0	975	60	STS
	05/06	20.0	113.5	1002	-	TD		09/15	24.3	125.1	975	60	STS
	05/12	20.0	113.8	1002	-	TD		09/17	24.6	125.3	975	60	STS
	05/18	20.0	114.5	1002	-	TD		09/18	24.9	125.5	975	60	STS
	06/00	19.5	114.8	1000	-	TD		09/21	25.4	125.7	975	60	STS
	06/06	19.5	116.0	1000	-	TD		10/00	25.8	126.1	975	60	STS
	06/12	19.5	117.0	1000	-	TD		10/03	26.5	126.4	975	60	STS
	06/18	19.9	117.5	1000	-	TD		10/06	27.0	126.8	980	55	STS
	07/00	20.3	118.8	1000	-	TD		10/09	27.7	127.6	980	55	STS
	07/06	20.5	119.5	1000	-	TD		10/12	28.4	128.4	985	50	STS
	07/12	20.5	120.4	1000	-	TD		10/15	29.1	129.2	985	50	STS
	07/18	20.6	121.0	1000	-	TD		10/18	30.5	130.0	990	40	TS
	08/00	20.5	122.2	1000	-	TD		10/21	31.6	131.7	996	-	TD
	08/06	21.2	122.9	998	35	TS		11/00	32.8	133.1	998	-	TD
	08/12	21.3	123.7	996	40	TS		11/06	34.4	135.8	999	-	TD
	08/18	21.5	124.3	992	40	TS		11/12					Dissip



TY RAMMASUN (0205)

Rammasun formed as a tropical depression near Yap Island at 00UTC 28 June 2002. It moved northwestward and became a tropical storm (TS) northwest of Yap Island at 00UTC 29 June. Moving almost northwestward far east of the Philippines, Rammasun developed into a severe tropical storm shortly and became a typhoon at 12UTC 01 July. Soon after reaching its peak intensity at 06UTC 03 July, it passed Miyako-jima around a quarter past 12UTC on that day, keeping the peak intensity. Rammasun then changed its direction from northwest to north, then to northeast gradually. It made landfall on the west coast of the Korean Peninsula with TS intensity around 22UTC 05 July. The storm transformed into an extratropical cyclone east of the Korean Peninsula at 12UTC 06 July and dissipated south of Vladivostok at 00UTC 08 July.

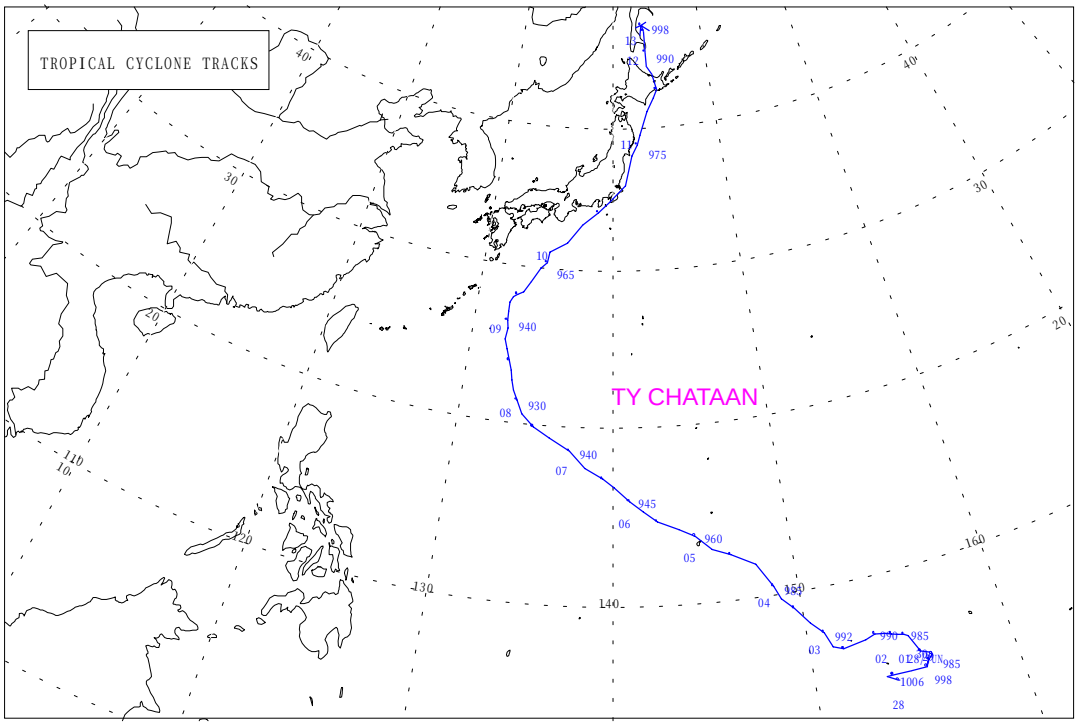
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TY RAMMASUN (0205)													
Jun	28/00	9.8	138.0	1004	-	TD	Jul	03/09	24.2	125.6	945	85	TY
	28/06	10.1	137.7	1000	-	TD		03/12	24.7	125.3	945	85	TY
	28/12	10.6	137.0	1000	-	TD		03/15	25.1	125.1	945	85	TY
	28/18	10.8	136.6	1000	-	TD		03/18	25.6	124.9	945	85	TY
	29/00	11.4	136.3	998	35	TS		03/21	26.2	124.8	945	85	TY
	29/06	11.7	135.6	996	40	TS		04/00	26.7	124.6	945	85	TY
	29/12	12.0	135.0	992	45	TS		04/03	27.2	124.1	945	85	TY
	29/18	12.4	134.5	985	50	STS		04/06	27.8	124.2	950	80	TY
	30/00	12.8	133.7	985	50	STS		04/09	28.6	124.2	950	80	TY
	30/06	13.3	133.6	985	50	STS		04/12	29.2	124.2	955	75	TY
	30/12	13.4	133.6	980	50	STS		04/18	30.7	124.0	960	70	TY
	30/18	13.9	133.6	980	55	STS		05/00	32.2	123.7	965	65	TY
Jul	01/00	15.1	133.5	980	55	STS		05/06	32.9	123.7	975	60	STS
	01/06	16.1	132.8	975	60	STS		05/12	33.7	124.5	980	55	STS
	01/12	17.3	132.3	970	65	TY		05/18	34.9	125.5	980	45	TS
	01/18	18.6	131.0	970	65	TY		06/00	36.5	127.0	985	40	TS
	02/00	19.4	129.8	970	65	TY		06/06	37.5	129.0	986	40	TS
	02/06	20.3	128.8	965	70	TY		06/12	38.5	129.8	988	-	L
	02/12	21.2	128.0	955	80	TY		06/18	39.3	129.8	990	-	L
	02/15	21.8	127.7	950	85	TY		07/00	39.6	129.8	992	-	L
	02/18	22.3	127.4	950	85	TY		07/06	39.8	130.2	996	-	L
	02/21	23.0	126.7	950	85	TY		07/12	40.3	131.7	1000	-	L
	03/00	23.2	126.3	950	85	TY		07/18	40.4	132.7	1002	-	L
	03/03	23.5	125.9	950	85	TY		08/00					Dissip
	03/06	23.8	125.6	945	85	TY							


TROPICAL CYCLONE TRACKS
TY RAMMASUN
07
992
985
05
965
04
945
950
03
970
02
01
980
985
30
998
29
1004
28
30
20
100
110
120
130
140

TY CHATAAN (0206)

Chataan, which formed as a tropical depression near the Mortlock Islands at 00UTC 28 June 2002, became a tropical storm northeast of the islands at 00UTC on the following day. Moving northwestward, it developed into a typhoon near southeast of Guam at 18UTC 04 July and passed Guam around 22UTC on that day. Moving west-northwestward, it reached the peak intensity west-northwest of Okinotori-shima at 00UTC 08 July. Chataan changed its direction to the north on 08 July and then to the northeast on 09 July with gradual weakening and made landfall on the Boso Peninsula in the southeast corner of Honshu around a quarter past 15UTC 10 July with severe tropical storm intensity. It then moved north-northeastward near east off Honshu and made the second landfall on the eastern part of Hokkaido around 12UTC on the next day. After it passed over Hokkaido with gradual weakening, Chataan became an extratropical cyclone in the southern Sea of Okhotsk at 15UTC 11 July and dissipated near Sakhalin at 06UTC 13 July.

Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TY CHATAAN (0206)													
Jun	28/00	4.7	154.0	1006	-	TD	Jul	07/18	20.8	134.1	935	90	TY
	28/06	5.0	153.5	1004	-	TD		08/00	21.6	133.7	930	95	TY
	28/12	5.0	153.8	1004	-	TD		08/03	22.2	133.4	930	95	TY
	28/18	5.0	154.7	1002	-	TD		08/06	22.8	133.2	930	95	TY
	29/00	5.0	155.5	998	35	TS		08/09	23.4	133.1	930	95	TY
	29/06	5.2	155.6	992	40	TS		08/12	24.0	132.9	930	95	TY
	29/12	5.3	155.7	992	45	TS		08/15	24.7	132.6	930	95	TY
	29/18	5.4	155.8	990	45	TS		08/18	25.3	132.4	930	95	TY
	30/00	5.5	155.9	985	50	STS		08/21	26.0	132.5	935	90	TY
	30/06	5.6	155.9	985	50	STS		09/00	26.5	132.4	940	85	TY
	30/12	5.8	155.4	985	50	STS		09/03	27.1	132.4	940	85	TY
	30/18	6.7	155.0	985	50	STS		09/06	27.7	132.4	950	75	TY
Jul	01/00	6.8	154.8	985	50	STS		09/09	28.1	132.6	950	75	TY
	01/06	6.9	154.5	985	50	STS		09/12	28.3	132.9	955	70	TY
	01/12	7.0	154.2	985	50	STS		09/15	28.5	133.3	955	70	TY
	01/18	7.1	153.9	985	50	STS		09/18	29.2	133.8	960	65	TY
	02/00	7.2	153.4	990	45	TS		09/21	30.2	134.4	965	60	STS
	02/06	7.0	152.9	992	40	TS		10/00	30.6	134.9	965	60	STS
	02/12	6.8	151.7	994	40	TS		10/03	31.3	135.0	965	60	STS
	02/18	7.0	151.2	994	40	TS		10/06	32.0	136.4	965	60	STS
	03/00	7.8	150.9	992	40	TS		10/09	33.3	137.5	965	60	STS
	03/06	8.4	150.3	990	45	TS		10/12	34.2	138.8	970	55	STS
	03/12	9.3	149.6	990	45	TS		10/15	34.9	139.7	970	55	STS
	03/18	9.9	149.0	985	50	STS		10/18	36.1	141.1	970	55	STS
	04/00	10.6	148.7	985	50	STS		10/21	38.2	141.8	975	55	STS
	04/06	11.9	147.9	985	50	STS		11/00	39.0	142.3	975	55	STS
	04/12	12.6	146.6	975	60	STS		11/03	39.7	142.6	980	50	STS
	04/18	13.0	145.6	965	70	TY		11/06	41.4	143.4	980	45	TS
	05/00	13.8	144.7	960	75	TY		11/09	42.4	144.1	980	45	TS
	05/06	14.2	143.8	955	75	TY		11/12	43.0	144.5	980	45	TS
	05/12	14.7	142.6	955	75	TY		11/15	44.2	144.1	984	-	L
	05/18	15.3	141.8	945	85	TY		11/18	44.8	143.6	986	-	L
	06/00	15.9	141.0	945	85	TY		12/00	45.9	143.6	990	-	L
	06/06	16.7	140.1	945	85	TY		12/06	46.6	143.6	992	-	L
	06/12	17.2	139.4	945	85	TY		12/12	47.5	143.5	996	-	L
	06/18	17.8	138.3	945	85	TY		12/18	47.8	143.4	996	-	L
	07/00	18.8	137.3	940	85	TY		13/00	48.0	143.3	998	-	L
	07/06	19.5	136.0	940	85	TY		13/06					Dissip
	07/12	20.1	134.9	935	90	TY							

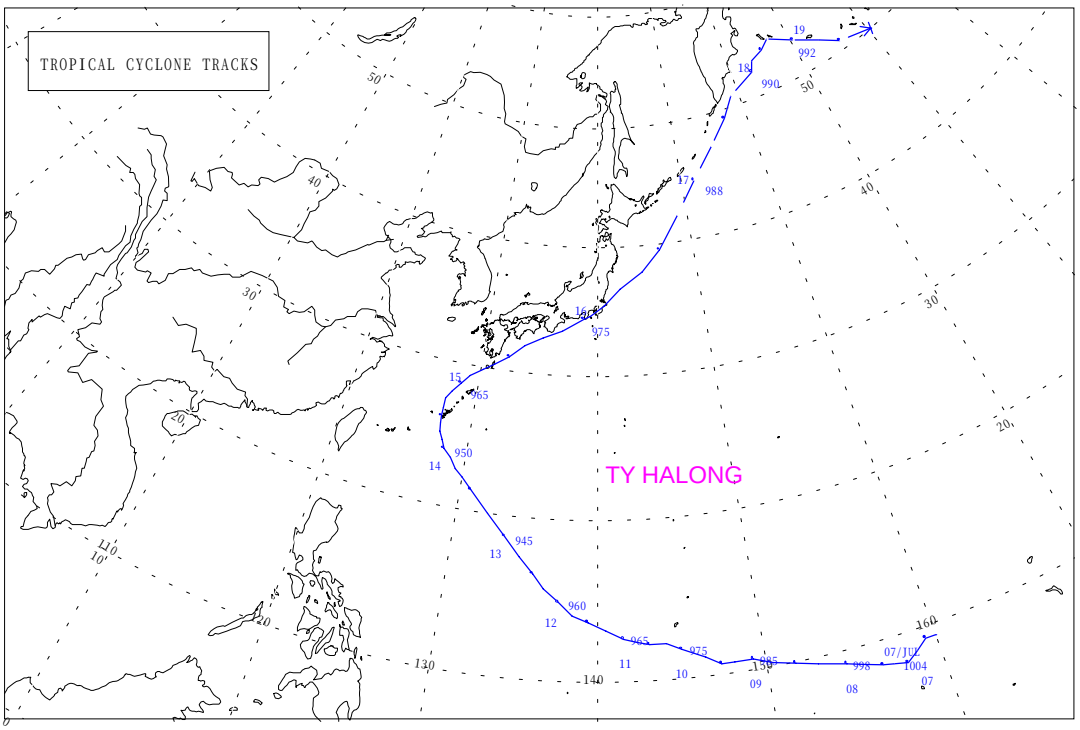

TROPICAL CYCLONE TRACKS
TY CHATAAN
998
990
975
965
940
930
940
945
960
992
990
985
985
1006
998
28

TY HALONG (0207)

Halong formed as a tropical depression (TD) near the Marshall Islands at 06UTC 6 July 2002. It moved westward and became a tropical storm (TS) at 18UTC 7 July northeast of Truk Island. Moving west-northwestward, it reached a severe tropical storm (STS) at 00UTC 9 July northwest of the same island. Then it held a fairly straight west-northwest track and reached a typhoon (TY) intensity at 18UTC 10 July near southwest of Guam Island. After it reached the TY intensity, it began to take on a northwestward course. Moving northwestward, it reached its peak intensity with maximum sustained wind of 85kt near southwest of Okinotorishima at 18UTC 12 July. Until it reached to the south of Okinawa Island, it moved northwestwards keeping the same intensity. Then it began to take on a northward course at about 00UTC 14 July. It advanced to the East China Sea after passing through the southern part of Okinawa Island at about 12UTC 14 July. After it turned gradually to the northeast, it advanced to the sea south of Kyushu and Shikoku. Moving northeastward over the sea south of Honshu, it made landfall over southern part of Izu Peninsula after 00UTC 16 July and made landfall again over southern part of Boso Peninsula before 02UTC 16 July. After it advanced to the sea east of Boso Peninsula, it passed through Choshi after 03UTC 16 July. It held a fairly straight northeastward track until it transformed into an extratropical cyclone on the sea east of Honshu at 18UTC 16 July. And it dissipated south of the Kuril Islands at 00UTC 17 July.

TY HALONG (0207)

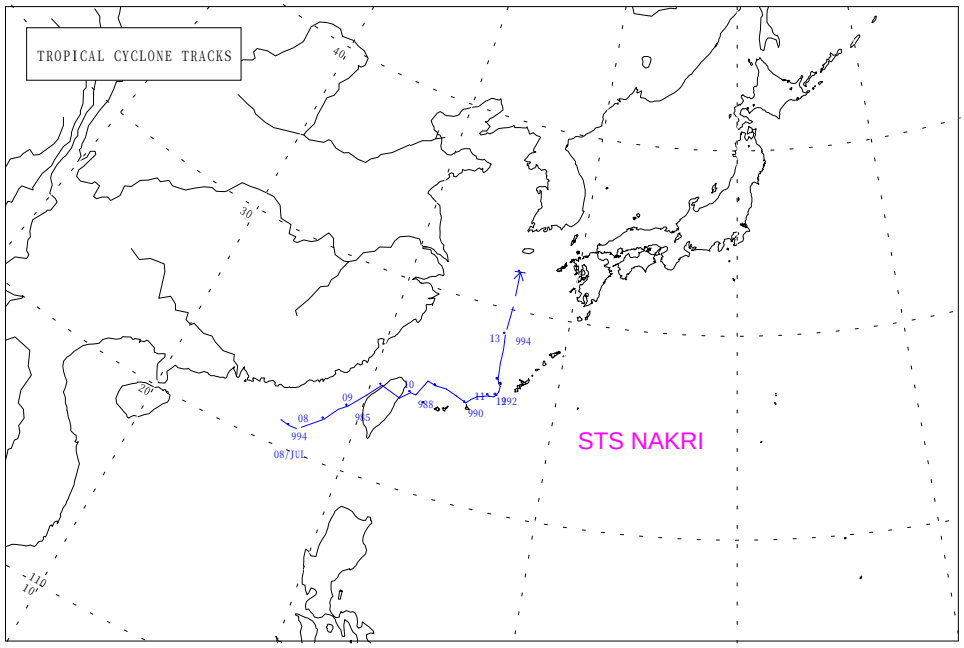
Date/Time (UTC)	Center Position Lat (N)	Lon (E)	Central pressure (hPa)	Max Wind (kt)	Grade
Jul 06/06	9.5	160.0	1006	-	TD
06/12	9.5	159.4	1006	-	TD
06/18	9.0	158.7	1004	-	TD
07/00	8.5	158.0	1004	-	TD
07/06	8.7	157.2	1004	-	TD
07/12	8.8	156.6	1004	-	TD
07/18	9.1	155.6	1000	35	TS
08/00	9.4	154.6	998	40	TS
08/06	9.8	153.0	994	40	TS
08/12	10.1	151.7	992	45	TS
08/18	10.4	150.4	990	45	TS
09/00	10.8	149.3	985	50	STS
09/06	10.8	148.2	985	50	STS
09/12	10.8	147.4	980	55	STS
09/18	11.3	146.5	980	55	STS
10/00	11.9	145.1	975	60	STS
10/06	12.3	144.2	975	60	STS
10/12	12.3	143.2	975	60	STS
10/18	12.5	142.4	970	65	TY
11/00	12.7	141.6	965	70	TY
11/06	13.2	140.5	960	75	TY
11/12	13.7	139.4	960	75	TY
11/18	14.1	138.4	960	75	TY
12/00	14.9	137.5	960	75	TY
12/06	15.7	136.5	955	80	TY
12/12	16.6	135.7	950	80	TY
12/18	17.6	134.7	945	85	TY
13/00	18.8	133.6	945	85	TY
13/06	20.2	132.2	945	85	TY
13/12	21.6	130.8	945	85	TY
13/15	22.3	130.0	945	85	TY
13/18	22.8	129.4	945	85	TY
13/21	23.5	128.9	945	85	TY
14/00	24.0	128.3	950	80	TY
Jul 14/03	24.6	128.0	950	80	TY
14/06	25.1	127.7	955	75	TY
14/09	25.7	127.6	955	75	TY
14/12	26.2	127.6	960	70	TY
14/15	26.8	127.6	960	70	TY
14/18	27.5	127.6	960	70	TY
14/21	28.1	128.0	960	70	TY
15/00	28.8	128.6	965	65	TY
15/03	29.5	129.2	965	65	TY
15/06	30.1	130.2	965	65	TY
15/09	30.6	131.1	970	65	TY
15/12	31.3	132.3	975	60	STS
15/15	32.3	133.5	980	55	STS
15/18	33.0	135.1	980	55	STS
15/21	33.6	136.8	980	55	STS
16/00	34.6	138.7	975	60	STS
16/01	34.8	139.3	975	60	STS
16/03	35.6	140.6	975	60	STS
16/06	36.9	142.2	975	55	STS
16/09	38.2	144.5	980	50	STS
16/12	39.8	146.5	985	50	STS
16/18	42.4	148.9	984	-	L
17/00	45.0	151.5	988	-	L
17/06	47.5	154.5	990	-	L
17/12	49.5	157.1	990	-	L
17/18	51.2	158.9	990	-	L
18/00	52.5	162.9	990	-	L
18/06	53.4	163.5	990	-	L
18/12	53.9	165.5	990	-	L
18/18	54.6	167.0	992	-	L
19/00	53.4	170.4	992	-	L
19/06	52.2	173.6	992	-	L
19/12	51.1	176.0	994	-	L
19/18	50.3	180.4	994	-	Out


TROPICAL CYCLONE TRACKS
TY HALONG
19
992
18
990
17
988
16
975
15
965
14
950
13
945
12
960
11
965
10
975
09
995
08
998
07/JUL
1004
07
50
40
30
20
10
110
120
130
140
150
160

STS NAKRI (0208)

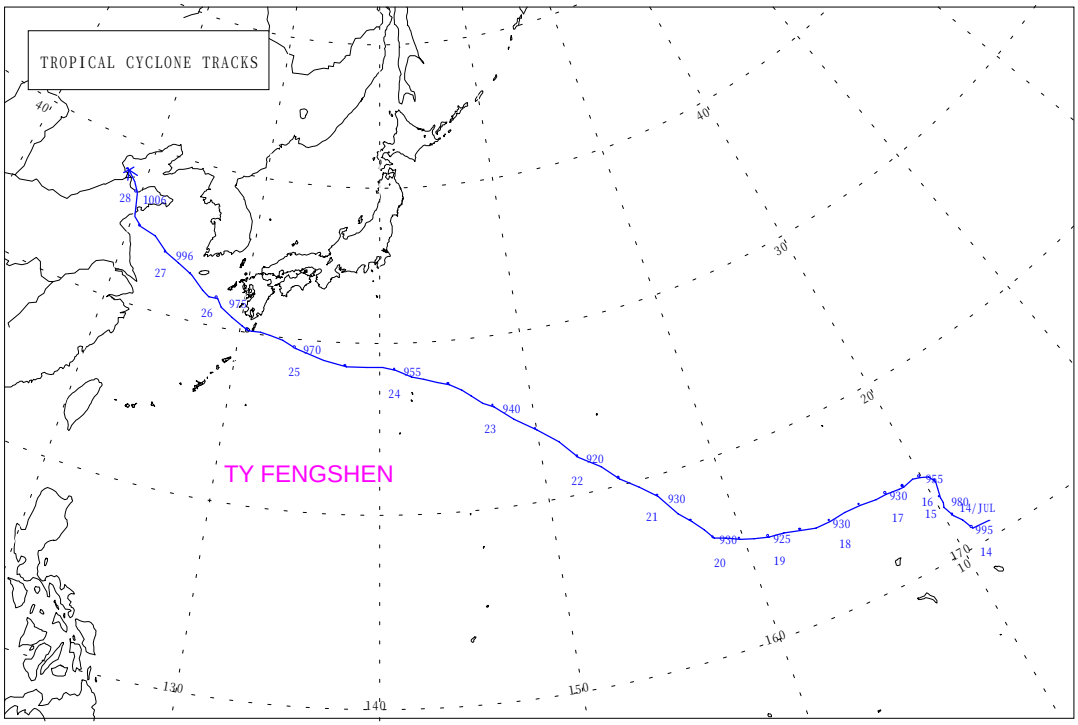
Nakri formed as a tropical depression (TD) over the sea southwest of Taiwan at 18UTC 7 July 2002. It moved northeastward and became a tropical storm (TS) the sea west of Taiwan at 00UTC 9 July. After making a landfall on the western coast of Taiwan at 12UTC 9 July, it advanced to the East China Sea. Moving to the northeast, it became a severe tropical storm (STS) and reached its peak intensity with maximum sustained wind of 50kt on the sea east of Taiwan at 12UTC 10 July. After its peak period of intensity it moved eastward. When it reached the sea southwest of Okinawa Island, it began to take on a northward course with a minor development. Then it held a fairly straight northward track until it weakened to a tropical depression on the sea west of Okinawa Island at 15UTC 12 July and dissipated over the sea west of Kyushu at 18UTC 13 July.

Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
STS NAKRI (0208)													
Jul	07/18	21.3	116.4	996	-	TD	Jul	11/03	25.2	125.4	990	40	TS
	08/00	21.2	116.9	994	-	TD		11/06	25.4	125.7	990	35	TS
	08/06	21.2	117.3	992	-	TD		11/09	25.5	126.0	990	35	TS
	08/12	22.1	118.4	992	-	TD		11/12	25.6	126.3	990	35	TS
	08/18	22.8	118.9	988	-	TD		11/15	25.6	126.4	990	35	TS
	09/00	23.1	119.3	985	40	TS		11/18	25.6	126.6	990	35	TS
	09/06	23.9	120.0	985	40	TS		11/21	25.7	126.7	992	35	TS
	09/12	24.6	120.6	990	40	TS		12/00	25.7	126.7	992	35	TS
	09/18	24.3	121.7	988	40	TS		12/03	25.9	126.8	992	35	TS
	10/00	24.7	122.2	988	40	TS		12/06	26.2	126.8	987	35	TS
	10/03	24.7	122.3	988	40	TS		12/09	26.3	126.7	983	40	TS
	10/06	24.7	122.5	988	40	TS		12/12	26.5	126.6	990	35	TS
	10/09	25.5	122.9	990	40	TS		12/15	27.3	126.5	994	-	TD
	10/12	25.4	123.4	990	50	STS		12/18	28.0	126.5	994	-	TD
	10/15	25.4	123.7	990	40	TS		13/00	28.8	126.4	994	-	TD
	10/18	25.4	124.0	990	40	TS		13/06	30.3	126.5	994	-	TD
	10/21	25.2	124.6	990	40	TS		13/12	32.1	126.4	996	-	TD
	11/00	25.0	125.2	990	40	TS		13/18					Dissip



TY FENGSHEN (0209)

Fengshen formed as a tropical depression (TD) near the Marshall Islands at 18UTC 13 JULY 2002. It moved westward and became a tropical storm (TS) at 00UTC 14 July over the same waters. Soon, it turned northward. Moving northward it reached the severe tropical storms (STS) intensity at 12UTC 14 July over the same waters. Keeping the northward track, it reached the typhoon (TY) intensity at 12UTC 15 July southeast of Wake Island. Then it turned to the west. Moving westward, it reached the first peak intensity with maximum sustained wind of 100kt southwest of Wake Island at 18UTC 18 July. After that it began to weaken slightly at 18UTC 19 July. Then it turned to the northwest at 00UTC 20 July southeast of Minamitorishima. Moving northwestward, it reached the second peak intensity with maximum sustained winds of 100kt south of Minamitorishima at 06UTC 21 July. It moved northwestward and then westward with a slow weakening but still keeping the TY intensity until it reached the sea south of Japan. It weakened to a STS at 00UTC 25 July over the same waters, Fengshen moved northwestward and passed through Yakushima south of Kyushu at around a quarter to 12UTC 25 July. It farther weakened to a TS at 12UTC 26 July near Cheju Island. It moved northwestward keeping the TS intensity until it reached to south off Shandong Peninsula, where it weakened into a tropical depression at 12UTC 27 July. Then it turned to the north and crossed the Peninsula on the same day. The tropical depression dissipated in Bohai at 18UTC 28 July.



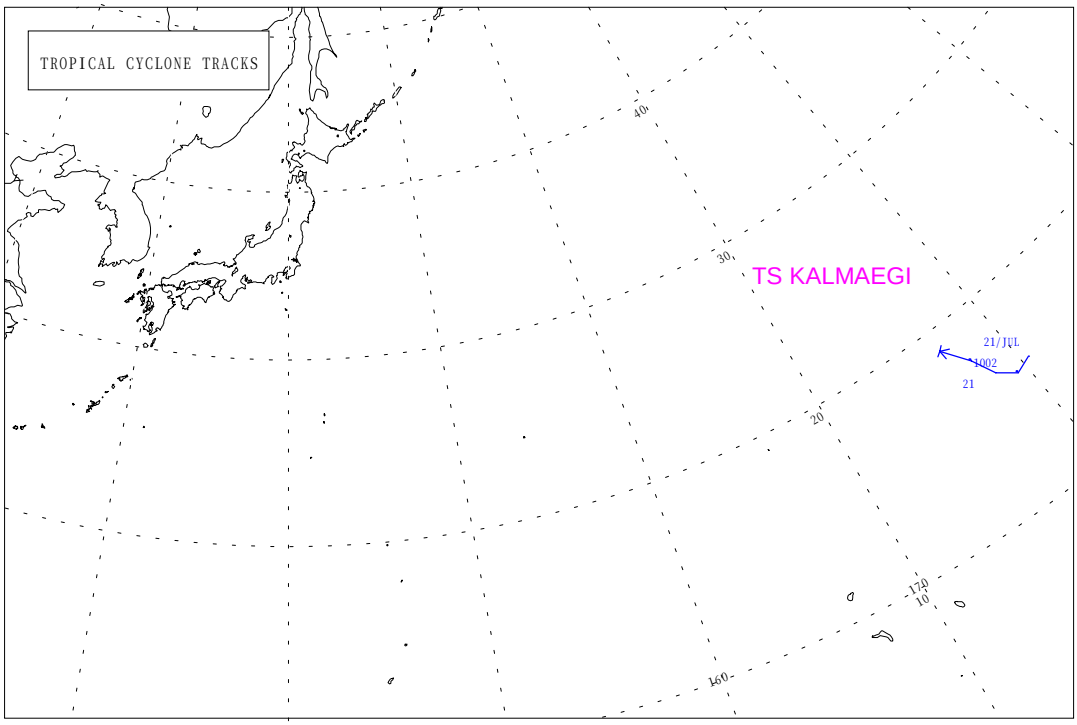
TY FENGSHEN (0209)

Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
Jul	13/18	10.9	171.8	1000	-	TD	Jul	22/18	25.0	148.7	930	90	TY
	14/00	11.0	170.9	995	35	TS		23/00	25.9	147.5	940	85	TY
	14/06	11.6	170.7	990	40	TS		23/03	26.2	146.8	940	85	TY
	14/12	12.0	170.4	985	50	STS		23/06	26.7	146.1	945	80	TY
	14/18	12.6	170.2	985	50	STS		23/09	27.1	145.5	945	80	TY
	14/21	12.8	170.3	1000	35	TS		23/12	27.5	144.7	945	80	TY
	15/00	13.1	170.3	980	55	STS		23/15	27.7	143.9	945	80	TY
	15/06	13.6	170.4	975	60	STS		23/18	27.9	143.0	945	80	TY
	15/12	13.9	170.5	970	65	TY		23/21	28.1	142.2	945	80	TY
	15/18	14.3	170.3	965	70	TY		24/00	28.5	141.1	955	75	TY
	16/00	14.5	169.9	955	75	TY		24/03	28.7	140.2	955	75	TY
	16/06	14.6	169.5	950	80	TY		24/06	28.7	139.1	960	70	TY
	16/12	14.5	168.9	940	85	TY		24/12	28.7	137.7	965	65	TY
	16/18	14.5	168.6	935	90	TY		24/18	29.0	136.1	965	65	TY
	17/00	14.6	167.9	930	90	TY		25/00	29.6	134.1	970	60	STS
	17/06	14.6	167.3	930	90	TY		25/03	30.0	133.1	970	60	STS
	17/12	14.7	166.4	930	90	TY		25/06	30.2	132.2	970	60	STS
	17/18	14.7	165.5	930	95	TY		25/09	30.3	131.5	970	60	STS
	18/00	14.6	164.6	930	95	TY		25/11	30.3	130.9	970	55	STS
	18/06	14.6	163.8	930	95	TY		25/12	30.3	130.6	970	55	STS
	18/12	14.8	163.0	930	95	TY		25/15	30.5	130.1	970	55	STS
	18/18	15.0	162.1	925	100	TY		25/18	30.9	129.3	975	55	STS
	19/00	15.1	161.3	925	100	TY		25/21	31.4	128.4	975	55	STS
	19/06	15.3	160.5	925	100	TY		26/00	31.9	128.0	975	55	STS
	19/12	15.5	159.8	925	100	TY		26/03	31.9	127.3	975	55	STS
	19/18	15.8	159.1	930	95	TY		26/06	32.2	126.8	980	50	STS
	20/00	16.0	158.5	930	95	TY		26/12	33.0	125.7	985	45	TS
	20/06	16.6	158.1	930	95	TY		26/18	33.5	124.5	990	40	TS
	20/12	17.2	157.6	930	95	TY		27/00	33.9	123.4	996	35	TS
	20/18	17.8	157.0	930	95	TY		27/06	34.7	122.2	998	35	TS
	21/00	19.0	156.2	930	95	TY		27/12	35.0	120.9	1002	-	TD
	21/06	19.8	155.3	920	100	TY		27/18	35.5	120.2	1004	-	TD
	21/12	20.5	154.3	920	100	TY		28/00	37.0	119.7	1006	-	TD
	21/18	21.4	153.4	920	100	TY		28/06	37.6	119.2	1006	-	TD
	22/00	22.2	152.2	920	100	TY		28/12	38.2	118.4	1006	-	TD
	22/06	23.3	151.2	925	95	TY		28/18					Dissip
	22/12	24.2	150.0	925	95	TY							

TS KALMAEGI (0210)

Kalmaegi crossed the international date line as a tropical depression (TD) over the sea far east of the Marshall Islands at around 07UTC 20 July 2002. Moving northwest, it developed into a tropical storm (TS) over the same waters at 12UTC 20 July. It held the TS intensity for 18 hours with maximum sustained wind of 35kt. It weakened to a TD over the same waters at 06UTC 21 July and dissipated at 12UTC 21 July.

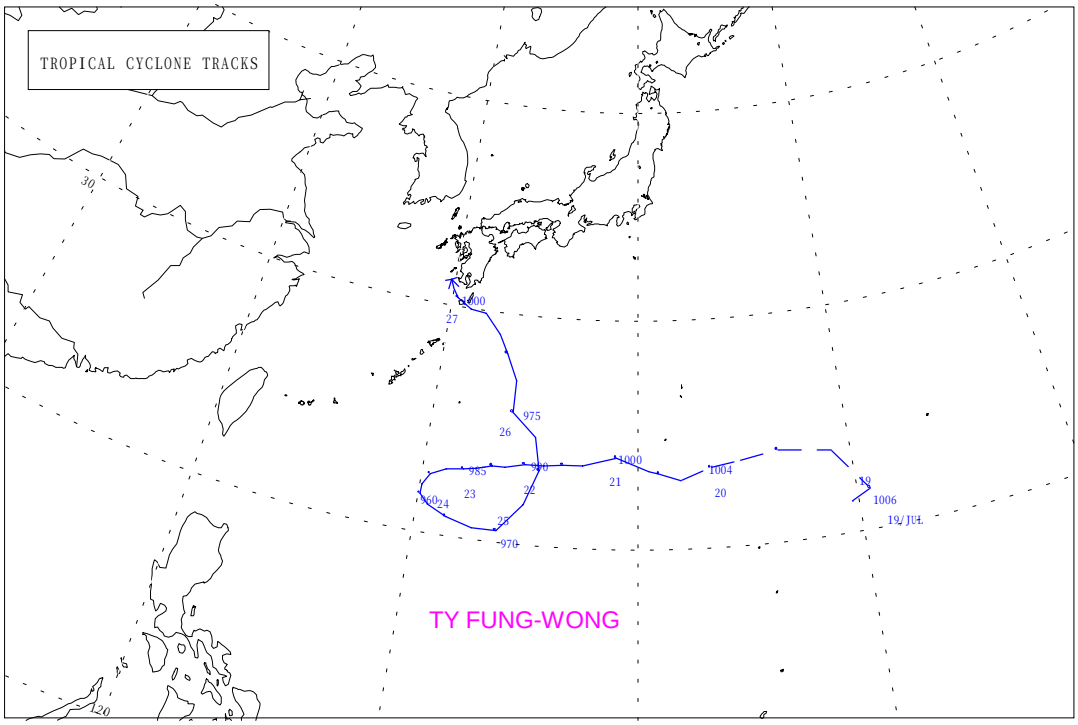
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TS KALMAEGI (0210)													
Jul	20/06	16.1	180.4	1004	-	TD	Jul	21/00	17.7	178.0	1002	35	TS
	20/12	15.8	179.5	1002	35	TS		21/06	19.0	177.0	1008	-	TD
	20/18	16.5	178.6	1002	35	TS		21/12					Dissip



TY FUNG-WONG (0211)

Fung-wong formed as a tropical depression (TD) southwest of Minamitorishima at 18UTC 18 July 2002. It moved to the northeast for the first six hours and then turned gradually to the west. Moving westward it reached a tropical storm (TS) over the sea south of Chichijima at 18UTC 20 July. Holding a fairly straight westward track, it intensified into a severe tropical storm (STS) over the sea southeast of Minamidaitojima at 00UTC 22 July. FUNG-WONG intensified into a typhoon (TY) and reached the peak intensity with sustained wind of 70kt south of the same island at 12UTC 23 July, when it started an anti-clockwise turn to make a circular track over the same waters. At the southernmost point of the circular track, it weakened into a STS at 00UTC 25 July. It then moved to the north and weakened into a TS east of Minamidaitojima at 06UTC 26 July. It held a fairly straight northwestward track and it weakened into a tropical depression over the sea south of Kyushu at 03UTC 27 July and dissipated over the same waters at 12UTC 27 July.

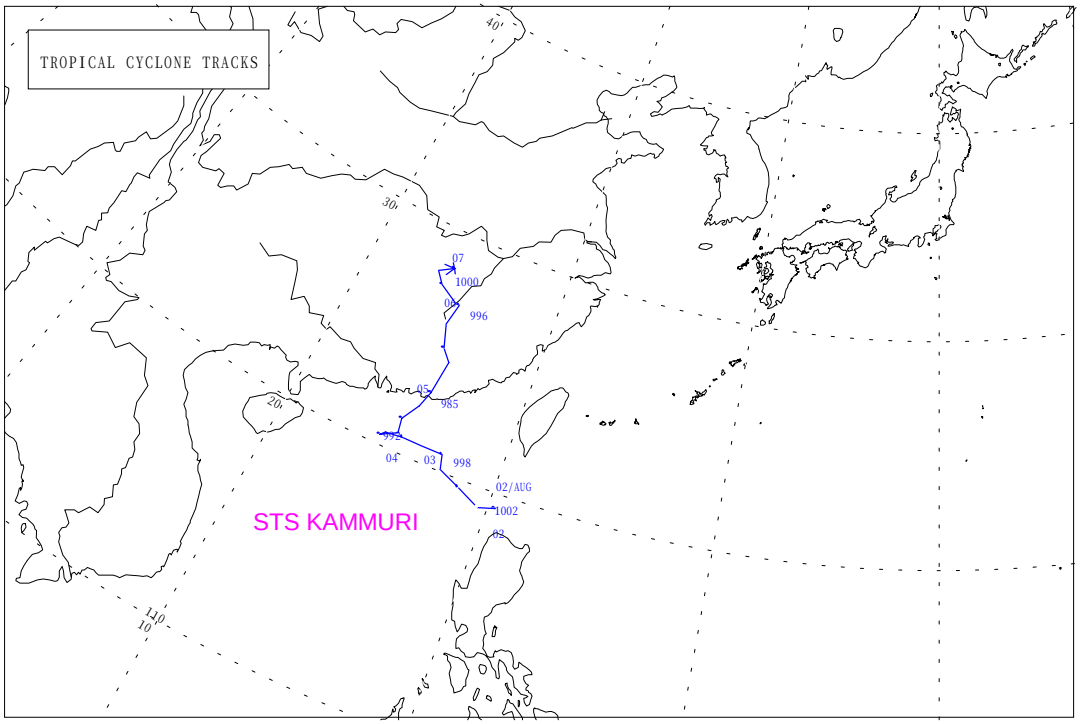
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TY FUNG-WONG (0211)													
Jul	18/18	21.4	149.7	1006	-	TD	Jul	23/18	22.1	130.1	960	70	TY
	19/00	21.8	150.6	1006	-	TD		24/00	21.7	130.1	960	70	TY
	19/06	23.7	149.1	1006	-	TD		24/06	21.3	130.5	960	70	TY
	19/12	24.0	146.6	1004	-	TD		24/12	20.9	131.4	965	65	TY
	19/18	23.7	144.8	1004	-	TD		24/18	20.6	132.6	965	65	TY
	20/00	23.5	143.4	1004	-	TD		25/00	20.6	133.7	970	60	STS
	20/06	23.0	142.0	1002	-	TD		25/06	21.8	134.8	970	60	STS
	20/12	23.3	141.0	1002	-	TD		25/12	23.3	135.4	975	55	STS
	20/18	23.4	140.5	1000	35	TS		25/18	24.7	135.1	975	55	STS
	21/00	24.0	139.0	1000	35	TS		26/00	25.7	133.9	975	55	STS
	21/06	23.6	137.4	996	40	TS		26/06	27.1	133.9	980	45	TS
	21/12	23.6	136.5	996	40	TS		26/12	28.3	133.3	985	45	TS
	21/18	23.5	135.6	992	45	TS		26/15	29.1	132.8	985	45	TS
	22/00	23.5	134.7	990	50	STS		26/18	30.0	131.9	990	40	TS
	22/06	23.3	133.8	985	50	STS		26/21	30.1	131.1	996	40	TS
	22/12	23.3	133.2	985	50	STS		27/00	30.5	130.3	1000	35	TS
	22/18	23.1	132.5	985	50	STS		27/03	30.9	130.0	1002	-	TD
	23/00	23.0	131.9	985	50	STS		27/06	31.3	129.8	1004	-	TD
	23/06	22.9	131.1	975	60	STS		27/12					Dissip
	23/12	22.6	130.4	965	70	TY							


TROPICAL CYCLONE TRACKS
30
1000
27
975
26
985
990
1000
1004
23
22
21
20
24
25
960
970
1006
19/ JUL
TY FUNG-WONG
20

STS KAMMURI (0212)

Kammuri formed as a tropical depression (TD) north of Luzon Island at 00UTC 2 August 2002. It moved west-northwestward into the South China Sea, then westward and became a tropical storm (TS) south off Hong Kong at 18UTC 3 August. After a short backward drift to the east-northeast, the storm changed its direction to the north and further developed into a severe tropical storm (STS) over the same waters at 12UTC 4 August. Kammuri reached its peak intensity 6 hours later and soon made landfall east of Hong Kong on the southern coast of Guangdong Province of China at around 23UTC on that day. After the landfall, it weakened to the TS intensity at 06UTC 5 August and further down to the TD intensity north of Hong Kong at 12 UTC on that day. It dissipated over the central part of China on 7 August.

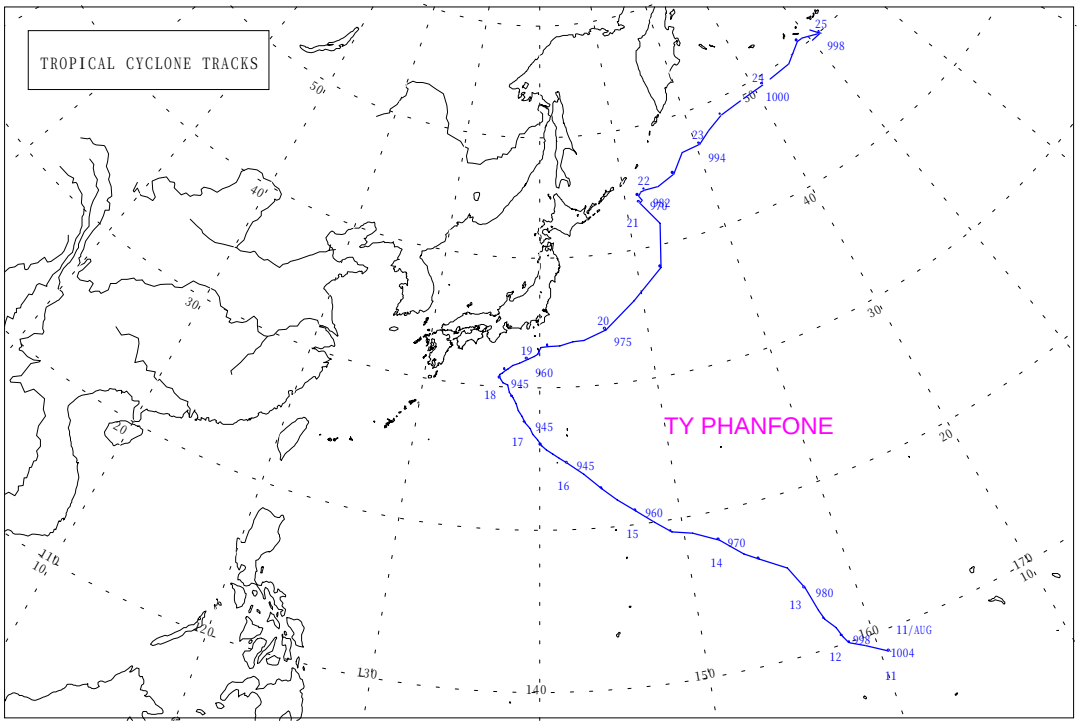
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
STS KAMMURI (0212)													
Aug	02/00	19.5	120.3	1002	-	TD	Aug	04/18	22.3	115.5	980	55	STS
	02/06	19.3	119.6	1000	-	TD		05/00	23.0	115.7	985	50	STS
	02/12	19.8	118.5	998	-	TD		05/06	24.5	115.9	990	40	TS
	02/18	20.2	117.5	998	-	TD		05/12	25.0	115.4	992	-	TD
	03/00	20.8	117.3	998	-	TD		05/18	26.0	115.0	994	-	TD
	03/06	20.8	116.3	994	-	TD		06/00	27.0	115.2	996	-	TD
	03/12	20.8	115.4	994	-	TD		06/06	27.0	115.0	996	-	TD
	03/18	20.7	114.6	992	35	TS		06/12	27.5	114.0	998	-	TD
	04/00	20.5	114.4	992	40	TS		06/18	28.0	113.5	998	-	TD
	04/06	20.9	115.1	990	45	TS		07/00	28.4	114.2	1000	-	TD
	04/12	21.5	115.0	985	50	STS		07/06					Dissip



TY PHANFONE (0213)

Phanfone formed as a tropical depression (TD) northeast of Pompei Island at 00UTC 11 August 2002. It moved northwestward and became a tropical storm (TS) north of Pompei Island at 00UTC on the following day. After moving north-northwestward, Phanfone turned its direction to the northwest and developed into a typhoon (TY) at 00UTC 14 August east of the Mariana Islands. Holding a northwestward track, Phanfone reached the peak intensity near Iwojima at 03UTC 16 August. It turned to the north-northwest again at around 12UTC on that day. Then it made an abrupt turn towards the northeast over the waters south of the Kii Peninsula shortly after 06UTC 18 August. After passing near Hachijojima just before 08UTC 19 August, it accelerated to the east-northeast. It downgraded into a severe tropical storm (STS) with gradual change of direction to the north and transformed into an extratropical cyclone east of Hokkaido at 00UTC 21 August. It moved on an east-northeast track and crossed the International Date Line on 24 August.

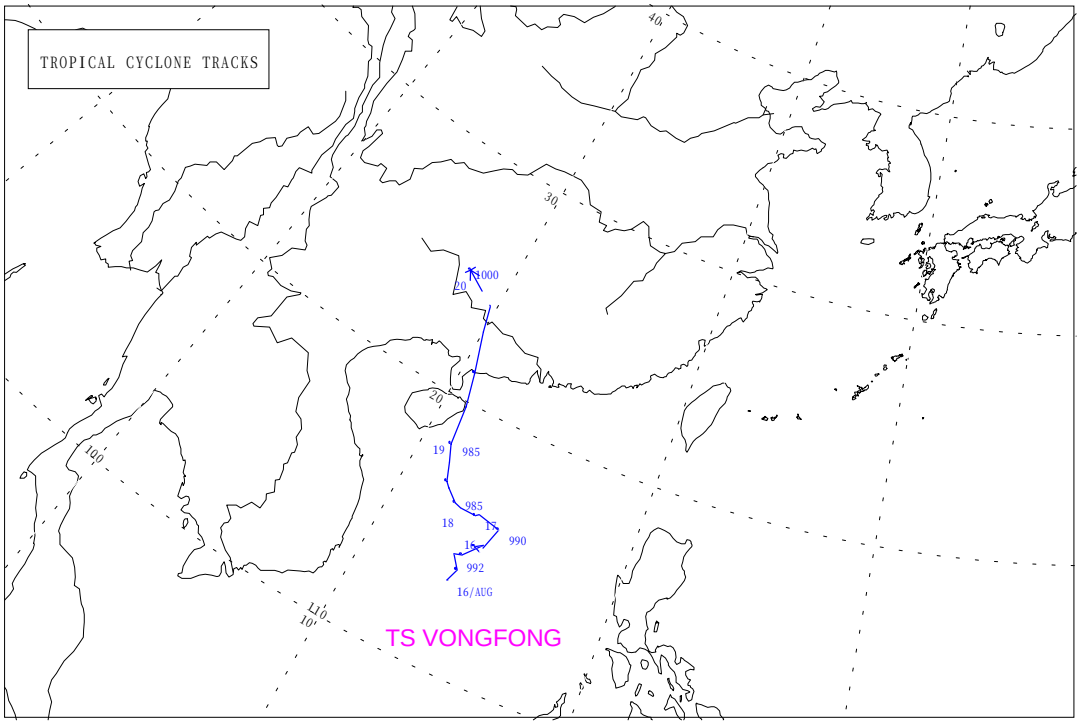
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TY PHANFONE (0213)													
Aug	11/00	8.9	160.5	1004	-	TD	Aug	18/03	30.9	136.5	945	80	TY
	11/06	9.7	159.3	1002	-	TD		18/06	31.1	136.5	945	80	TY
	11/12	10.1	158.5	1002	-	TD		18/09	31.2	136.7	950	80	TY
	11/18	10.2	158.4	1000	-	TD		18/12	31.4	137.0	955	75	TY
	12/00	10.6	158.2	998	35	TS		18/15	31.5	137.2	955	75	TY
	12/06	11.2	158.0	992	40	TS		18/18	31.8	137.6	955	75	TY
	12/12	11.9	157.5	990	45	TS		18/21	32.0	138.2	955	75	TY
	12/18	12.5	157.3	985	50	STS		19/00	32.3	138.9	960	70	TY
	13/00	14.0	156.9	980	55	STS		19/03	32.5	139.5	960	70	TY
	13/06	15.5	156.2	980	55	STS		19/06	32.7	139.8	965	65	TY
	13/12	16.5	154.6	975	60	STS		19/07	32.9	139.9	965	65	TY
	13/18	17.1	153.7	975	60	STS		19/09	33.2	140.1	965	65	TY
	14/00	18.3	152.3	970	65	TY		19/12	33.3	140.8	970	65	TY
	14/06	19.1	150.6	965	70	TY		19/15	33.3	141.8	970	65	TY
	14/12	19.4	149.2	965	70	TY		19/18	33.6	143.0	975	60	STS
	14/18	20.2	148.1	965	70	TY		19/21	33.6	144.0	975	60	STS
	15/00	21.1	146.9	960	75	TY		20/00	34.3	146.1	975	60	STS
	15/06	22.0	145.6	950	80	TY		20/06	36.2	149.1	975	60	STS
	15/12	22.8	144.6	945	85	TY		20/12	38.4	152.4	975	60	STS
	15/18	23.9	143.3	945	85	TY		20/18	41.9	153.3	970	60	STS
	16/00	24.7	142.1	945	85	TY		21/00	43.9	151.6	970	-	L
	16/03	25.1	141.5	940	85	TY		21/06	44.1	151.9	972	-	L
	16/06	25.4	141.0	940	85	TY		21/12	44.5	151.6	976	-	L
	16/09	25.7	140.5	940	85	TY		21/18	44.8	152.0	980	-	L
	16/12	26.0	140.1	945	85	TY		22/00	44.9	152.5	982	-	L
	16/15	26.4	139.8	945	85	TY		22/06	44.9	154.1	984	-	L
	16/18	26.8	139.4	945	80	TY		22/12	45.6	156.3	986	-	L
	16/21	27.2	139.2	945	80	TY		22/18	47.1	158.0	990	-	L
	17/00	27.6	138.8	945	80	TY		23/00	47.3	160.5	994	-	L
	17/03	28.1	138.5	945	80	TY		23/06	48.1	162.2	996	-	L
	17/06	28.5	138.2	945	80	TY		23/12	48.9	164.5	998	-	L
	17/09	29.0	138.0	945	80	TY		23/18	49.3	167.7	1000	-	L
	17/12	29.4	137.7	945	80	TY		24/00	49.5	171.2	1000	-	L
	17/15	29.8	137.4	945	80	TY		24/06	49.8	175.6	998	-	L
	17/18	30.3	137.2	945	80	TY		24/12	50.9	178.4	998	-	L
	17/21	30.5	136.8	945	80	TY		24/18	50.9	179.3	998	-	L
	18/00	30.8	136.6	945	80	TY		25/00	50.2	181.5	998	-	Out


TROPICAL CYCLONE TRACKS
TY PHANFONE
25
998
24
1000
23
994
22
21
20
975
19
960
18
945
17
945
16
945
15
960
14
970
13
980
12
1004
11
11/AUG
50
40
30
20
10
110
120
130
140
150
160
170
180

TS VONGFONG (0214)

Vongfong formed as a tropical depression (TD) east off the southern part of Viet Nam at 06UTC 15 August 2002. It moved northward, then westward and became a tropical storm (TS) southeast of Hainan Island at 00UTC 18 August. Keeping the TS intensity, Vongfong turned to the north-northwest and made landfall just east of the Leizhou Peninsula at around 12UTC 19 August. After the landfall, it weakened to the TD intensity south of Guilin at 21UTC 19 August. It dissipated west of Guilin on 20 August.

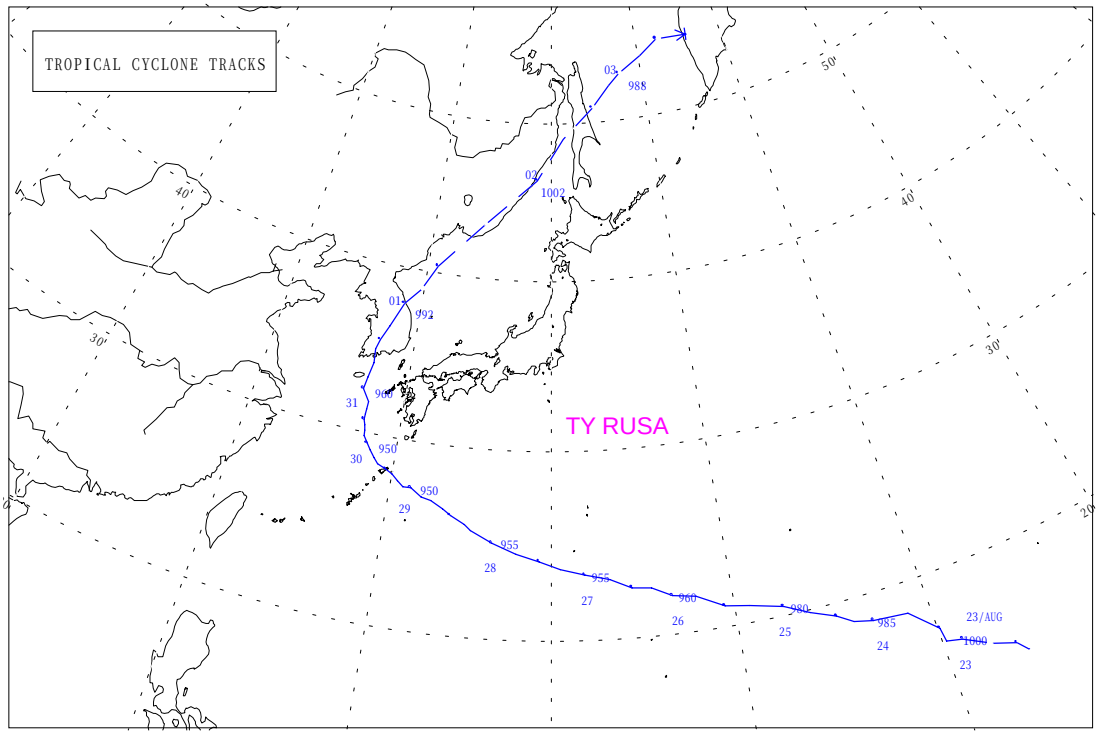
Date/Time (UTC)		Center Position Lat (N)	Lon (E)	Central pressure (hPa)	Max Wind (kt)	Grade
TS VONGFONG (0214)						
Aug	15/06	13.5	113.6	994	-	TD
	15/12	14.0	113.8	992	-	TD
	15/18	14.5	113.4	992	-	TD
	16/00	14.6	113.7	992	-	TD
	16/06	15.3	114.3	990	-	TD
	16/12	15.1	114.0	990	-	TD
	16/18	15.0	114.3	990	-	TD
	17/00	16.1	114.6	990	-	TD
	17/06	16.3	113.6	990	-	TD
	17/12	16.2	113.5	990	-	TD
	17/18	16.2	112.8	990	-	TD
Aug	18/00	16.3	112.5	985	35	TS
	18/06	16.7	112.0	985	40	TS
	18/12	16.9	111.8	985	40	TS
	18/18	17.6	111.5	985	40	TS
	19/00	18.3	111.2	985	40	TS
	19/06	19.9	111.0	985	40	TS
	19/12	21.3	110.6	985	40	TS
	19/18	23.0	110.0	992	35	TS
	19/21	24.1	109.7	996	-	TD
	20/00	25.0	108.0	1000	-	TD
	20/06					Dissip



TY RUSA (0215)

Rusa formed as a tropical depression (TD) north of Bikini Island at 06UTC 22 August 2002. It moved west-northwestward and became a tropical storm (TS) northwest of Bikini Island at 00UTC on the following day. Holding a west-northwestward track, Rusa developed into a typhoon (TY) northeast of the Mariana Islands at 18UTC 25 August. Rusa then reached its peak intensity at 12UTC on the following day and kept almost the same intensity until 15UTC 30 August. Rusa changed its direction to the northwest gradually and passed the northern part of Amamioshima at around 12UTC 29 August. After changing its direction to the north gradually, Rusa made landfall on the Korean Peninsula at around 08UTC 31 August. Then it changed its direction to the north-northeast with rapid weakening and downgraded into the TD intensity near the eastern coast of the Korean Peninsula at 00UTC 1 September. Moving northeastward, it transformed into an extratropical cyclone over Primorskiy at 18UTC on that day and dissipated over the Kamchatka Peninsula at 00UTC 4 September.

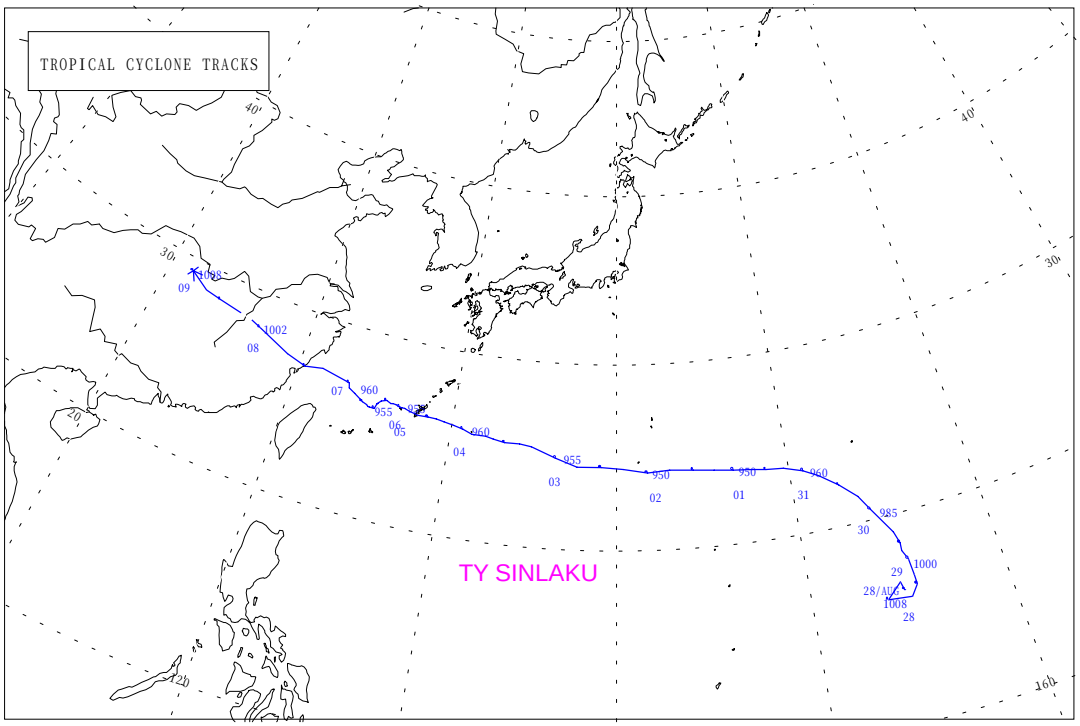
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TY RUSA (0215)													
Aug	22/06	14.9	163.8	1008	-	TD	Aug	29/09	28.2	130.0	950	75	TY
	22/12	15.4	163.4	1008	-	TD		29/12	28.4	129.6	950	75	TY
	22/18	15.8	162.3	1006	-	TD		29/15	28.6	129.0	950	75	TY
	23/00	16.5	161.0	1000	35	TS		29/18	28.9	128.7	950	75	TY
	23/06	16.7	160.2	996	40	TS		29/21	29.3	128.4	950	75	TY
	23/12	17.4	160.1	990	45	TS		30/00	29.6	128.1	950	75	TY
	23/18	18.6	158.8	985	50	STS		30/03	30.0	127.8	950	75	TY
	24/00	18.8	157.0	985	50	STS		30/06	30.3	127.8	950	75	TY
	24/06	19.0	156.0	985	50	STS		30/09	30.6	127.7	950	75	TY
	24/12	19.5	155.2	985	50	STS		30/12	30.9	127.6	950	75	TY
	24/18	20.0	153.9	980	55	STS		30/15	31.2	127.6	950	75	TY
	25/00	20.6	152.6	980	55	STS		30/18	31.5	127.6	955	70	TY
	25/06	21.0	150.8	975	60	STS		30/21	31.9	127.6	955	70	TY
	25/12	21.2	149.5	975	60	STS		31/00	32.6	127.1	960	70	TY
	25/18	21.9	148.0	970	65	TY		31/03	33.3	127.2	960	70	TY
	26/00	22.1	146.7	960	75	TY		31/06	34.2	127.4	960	70	TY
	26/06	22.6	145.6	955	75	TY		31/09	35.0	127.3	965	65	TY
	26/12	22.7	144.5	950	80	TY		31/12	35.6	127.5	975	50	STS
	26/18	23.2	143.3	950	80	TY		31/18	36.5	128.0	985	40	TS
	27/00	23.5	141.9	955	75	TY	Sep	01/00	38.0	128.7	992	-	TD
	27/06	23.8	140.5	955	75	TY		01/06	39.0	129.8	996	-	TD
	27/12	24.2	139.3	955	75	TY		01/12	40.6	130.8	1000	-	TD
	27/18	24.6	137.9	955	75	TY		01/18	43.5	134.2	1000	-	L
	28/00	25.1	136.5	955	75	TY		02/00	46.5	138.7	1002	-	L
	28/06	25.7	135.2	955	75	TY		02/06	49.2	141.2	996	-	L
	28/09	26.0	134.8	955	75	TY		02/12	51.2	144.3	992	-	L
	28/12	26.4	133.9	955	75	TY		02/18	52.6	146.3	990	-	L
	28/15	26.7	133.4	955	75	TY		03/00	53.3	147.5	988	-	L
	28/18	27.1	132.6	950	80	TY		03/06	54.3	150.3	984	-	L
	28/21	27.2	132.0	950	80	TY		03/12	55.2	152.5	984	-	L
	29/00	27.6	131.3	950	80	TY		03/18	55.0	156.0	984	-	L
	29/03	27.6	130.8	950	80	TY		04/00					Dissip
	29/06	27.9	130.4	950	75	TY							


TROPICAL CYCLONE TRACKS
TY RUSA
03
988
02
1002
01
992
31
960
30
950
29
950
28
955
27
955
26
960
25
980
24
985
23/AUG
1000
23
50°
40°
30°
20°

TY SINLAKU (0216)

Sinlaku formed as a tropical depression (TD) south of Minamitorishima at 12UTC 27 August 2002. After becoming a tropical storm (TS) over the same waters at 06UTC 29 August, Sinlaku moved northwestward and developed into a typhoon (TY) west-southwest of Minamitorishima at 00UTC 31 August. Then it changed its direction to the west and reached its peak intensity at 06UTC on that day. Keeping the TY intensity, Sinlaku changed its direction to the west-northwest at 18UTC 2 September and passed near Minamidaitojima at around half past 21UTC 3 September. Then it passed the southern part of Okinawa shortly before 16UTC 4 September and passed near Kumejima at around 23UTC on that day. Soon after Sinlaku was downgraded to a severe tropical storm at 12UTC 7 September over the East China Sea, it made landfall on the central part of China. It weakened to a TD at 00UTC 8 September and dissipated over the continent at 06UTC 9 September.

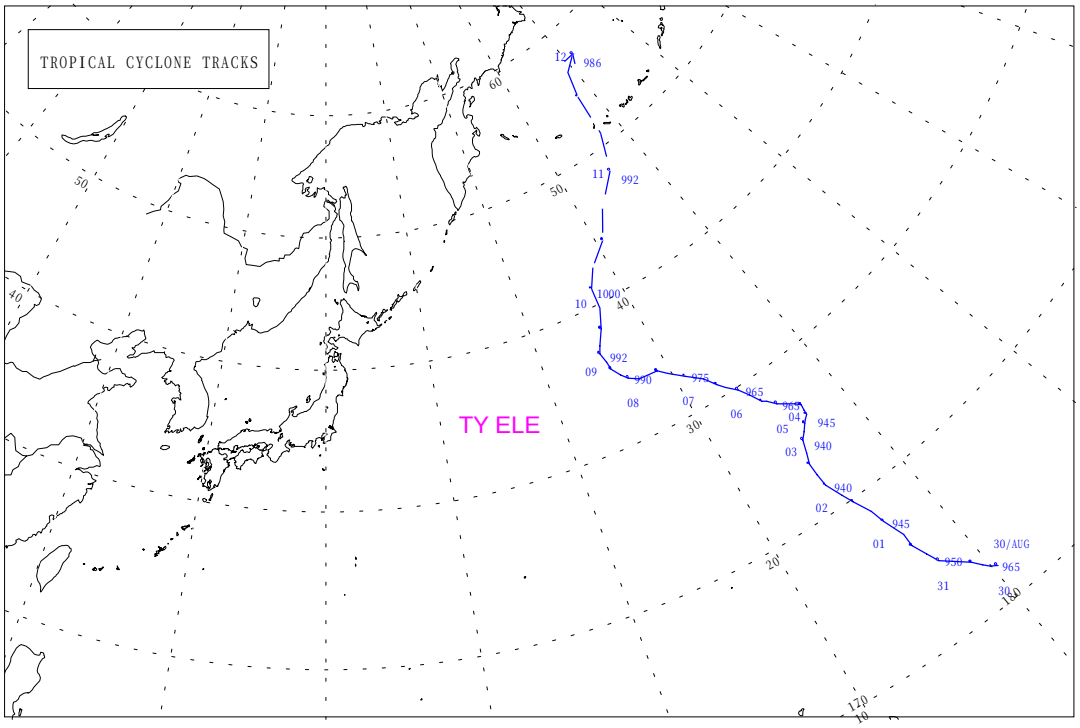
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TY SINLAKU (0216)													
Aug	27/12	16.4	154.7	1004	-	TD	Sep	04/03	26.0	130.1	960	75	TY
	27/18	16.8	154.6	1004	-	TD		04/06	26.1	129.5	960	75	TY
	28/00	16.1	153.8	1008	-	TD		04/09	26.2	129.0	960	75	TY
	28/06	16.0	155.0	1006	-	TD		04/12	26.2	128.5	955	80	TY
	28/12	16.5	155.4	1004	-	TD		04/15	26.2	127.9	955	80	TY
	28/18	17.0	155.4	1002	-	TD		04/18	26.3	127.3	955	80	TY
	29/00	17.8	155.3	1000	-	TD		04/21	26.4	127.0	955	80	TY
	29/06	18.3	155.1	996	35	TS		04/23	26.4	126.8	955	80	TY
	29/12	18.7	155.1	990	45	TS		05/00	26.4	126.7	955	80	TY
	29/18	19.3	154.9	990	45	TS		05/03	26.5	126.4	955	80	TY
	30/00	20.7	154.0	985	55	STS		05/06	26.5	126.2	955	80	TY
	30/06	21.5	153.5	980	55	STS		05/09	26.5	126.1	955	80	TY
	30/12	22.3	152.6	980	55	STS		05/12	26.6	125.8	955	80	TY
	30/18	23.0	151.6	975	60	STS		05/15	26.5	125.5	955	80	TY
	31/00	23.4	150.8	960	75	TY		05/18	26.3	125.3	955	80	TY
	31/06	23.7	149.7	950	80	TY		05/21	26.3	125.3	955	80	TY
	31/12	23.8	148.7	950	80	TY		06/00	26.0	125.2	955	80	TY
	31/18	23.9	147.9	950	80	TY		06/03	26.0	124.9	955	80	TY
Sep	01/00	24.0	146.8	950	80	TY		06/06	26.0	124.8	955	80	TY
	01/06	24.1	145.7	950	80	TY		06/09	26.1	124.7	955	80	TY
	01/12	24.2	144.5	950	80	TY		06/12	26.2	124.4	955	80	TY
	01/18	24.3	143.1	950	80	TY		06/15	26.3	124.2	955	80	TY
	02/00	24.2	141.8	950	80	TY		06/18	26.5	123.8	955	80	TY
	02/06	24.4	140.4	955	75	TY		06/21	26.7	123.4	955	80	TY
	02/12	24.5	139.1	955	75	TY		07/00	27.0	123.3	960	75	TY
	02/18	24.5	137.7	955	75	TY		07/06	27.3	121.5	965	70	TY
	03/00	24.9	136.4	955	75	TY		07/12	27.1	120.4	975	60	STS
	03/06	25.4	134.9	955	75	TY		07/18	27.4	119.1	990	45	TS
	03/09	25.5	134.2	955	75	TY		08/00	28.2	116.9	1002	-	TD
	03/12	25.5	133.3	955	75	TY		08/06	28.4	116.2	1004	-	TD
	03/15	25.6	132.6	955	75	TY		08/12	28.7	113.9	1006	-	TD
	03/18	25.7	132.1	955	75	TY		08/18	28.8	112.8	1008	-	TD
	03/21	25.7	131.3	960	75	TY		09/00	29.4	111.5	1008	-	TD
	04/00	25.9	130.7	960	75	TY		09/06						Dissip


TROPICAL CYCLONE TRACKS
TY SINLAKU
40°
30°
20°
12b
16b
1008
09
1002
08
07
960
955
06
05
04
960
955
03
950
02
950
01
960
31
985
30
1000
29
28/AU
1008
28

TY ELE (0217)

A tropical cyclone generated in the central North Pacific was named Ele by the Central Pacific Hurricane Center (CPHC), RSMC Honolulu. The tropical cyclone crossed the International Date Line with the typhoon (TY) intensity at 03UTC 30 August 2002 and moved into the western North Pacific, the area of responsibility of the RSMC Tokyo - Typhoon Center. Ele moved north-northwestward and reached its peak intensity with a central pressure of 940 hPa and a maximum sustained wind speed of 90 kt northeast of Wake Island at 00UTC 2 September. It changed its direction gradually to the northeast on 2 and 3 September, then to the northwest on 4 September with gradual weakening. Ele turned to the northeast again at around 00UTC 9 September and was downgraded to a tropical depression (TD) far east of Japan at 18UTC on that day. The depression transformed into an extratropical cyclone at 06UTC 10 September and moved into higher latitudes, crossing the Aleutian Islands. It moved back into the central North Pacific on 11 September.

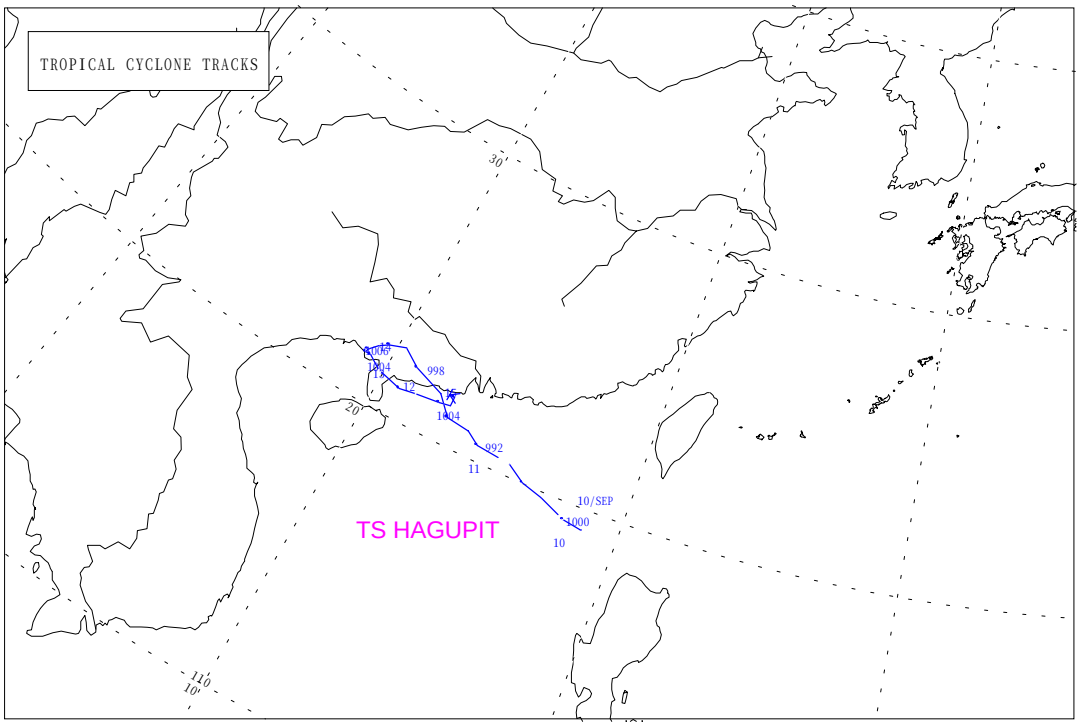
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TY ELE (0217)													
Aug	30/00	12.1	180.3	965	70	HR	Sep	05/12	28.5	174.8	970	65	TY
	30/03	12.3	180.0	960	75	TY		05/18	29.3	174.3	965	65	TY
	30/06	12.6	179.7	955	80	TY		06/00	30.0	173.8	965	65	TY
	30/12	13.1	179.3	950	85	TY		06/06	30.6	173.1	965	65	TY
	30/18	13.8	178.5	950	85	TY		06/12	31.1	172.6	970	65	TY
	31/00	14.3	177.9	950	85	TY		06/18	31.9	172.0	975	60	STS
	31/06	15.0	177.6	950	85	TY		07/00	32.7	170.8	975	60	STS
	31/12	15.9	177.2	950	85	TY		07/06	33.5	169.7	980	55	STS
	31/18	16.7	177.2	950	85	TY		07/12	34.0	169.0	985	50	STS
Sep	01/00	18.0	176.7	945	85	TY		07/18	34.1	167.4	990	50	STS
	01/06	18.9	176.5	945	85	TY		08/00	34.5	166.6	990	50	STS
	01/12	20.0	175.9	945	85	TY		08/06	34.9	166.1	992	45	TS
	01/18	20.7	175.6	945	85	TY		08/12	35.6	165.6	992	40	TS
	02/00	21.8	175.1	940	90	TY		08/18	36.2	165.5	992	40	TS
	02/06	22.6	175.0	940	90	TY		09/00	36.9	165.3	992	40	TS
	02/12	23.4	175.0	940	90	TY		09/06	37.4	165.6	992	40	TS
	02/18	24.1	175.3	940	90	TY		09/12	38.5	166.4	996	35	TS
	03/00	24.9	175.6	940	90	TY		09/18	39.9	167.2	1000	-	TD
	03/06	25.3	176.0	940	90	TY		10/00	41.4	167.3	1000	-	TD
	03/12	25.7	176.4	940	90	TY		10/06	42.8	168.4	998	-	L
	03/18	25.9	176.6	945	85	TY		10/12	44.2	170.7	998	-	L
	04/00	26.1	176.9	945	85	TY		10/18	46.3	172.5	994	-	L
	04/06	26.4	176.9	950	85	TY		11/00	48.4	175.6	992	-	L
	04/12	26.8	177.0	955	80	TY		11/06	51.2	177.4	992	-	L
	04/18	27.1	176.7	960	75	TY		11/12	54.6	178.0	992	-	L
	05/00	27.8	175.6	965	65	TY		11/18	56.7	179.0	988	-	L
	05/06	28.3	175.1	970	65	TY		12/00	57.6	181.4	986	-	Out


TROPICAL CYCLONE TRACKS
TY ELE
12
986
11
992
10
1000
09
992
990
975
965
08
07
06
04
945
05
940
03
940
02
945
01
30/AUG
950
965
31
60
50
40
30
20
10
120

TS HAGUPIT (0218)

Hagupit formed as a tropical depression (TD) over the sea northwest of Luzon Island at 18UTC 9 September 2002. It moved west-northwestward and became a tropical storm (TS) on the sea south of Hong Kong at 00UTC 11 September. Moving to the same direction, it reached peak intensity with maximum sustained wind of 45kt on the sea south of Hong Kong at 06UTC 11 September. After its peak period of intensity, it made landfall on the west of Macao at around 19UTC 11 September. After making landfall, it weakened to a tropical depression at 00UTC 12 September. Then it started a clockwise turn to make a circular track around north of Leizhou Peninsula and dissipated over the sea southwest of Hong Kong at 00UTC 16 September.

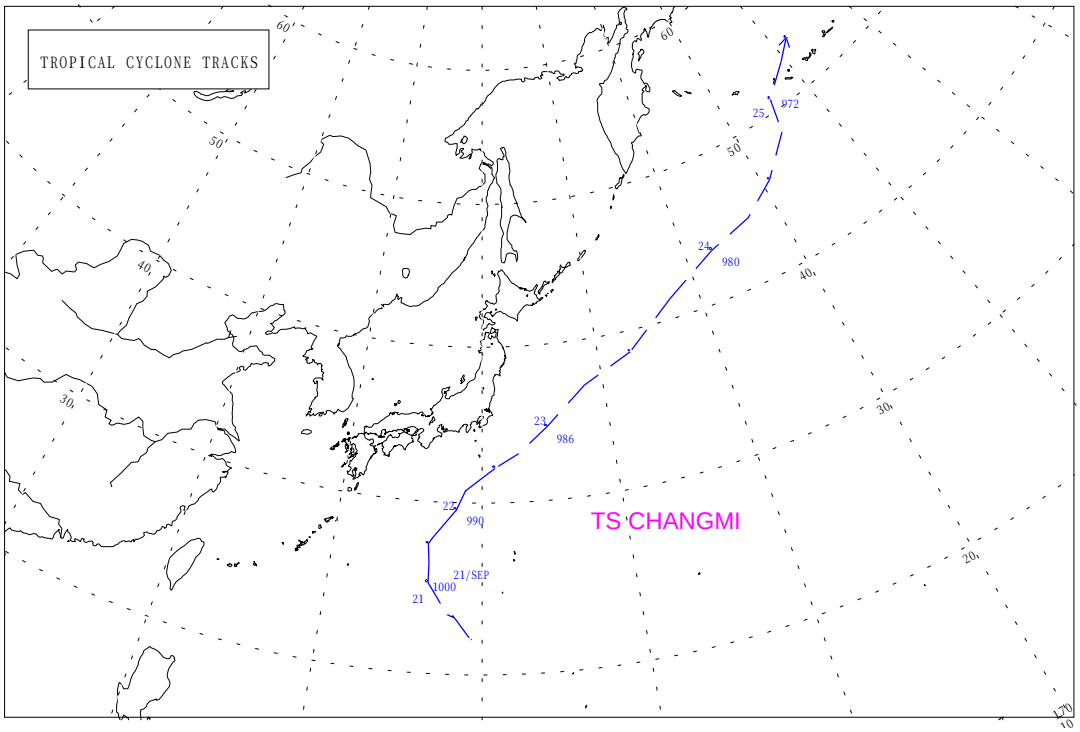
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TS HAGUPIT (0218)													
Sep	09/18	19.4	118.7	1002	-	TD	Sep	13/00	21.7	109.1	1006	-	TD
	10/00	19.5	118.0	1000	-	TD		13/06	21.7	109.1	1004	-	TD
	10/06	19.9	117.0	998	-	TD		13/12	21.6	109.1	1004	-	TD
	10/12	20.1	116.2	994	-	TD		13/18	21.6	109.1	1004	-	TD
	10/18	20.5	115.5	994	-	TD		14/00	21.6	109.3	1004	-	TD
	11/00	20.6	114.2	992	35	TS		14/06	21.3	109.8	1004	-	TD
	11/06	20.9	113.7	990	45	TS		14/12	21.1	110.8	1002	-	TD
	11/12	21.0	112.8	990	45	TS		14/18	21.2	111.4	1004	-	TD
	11/18	21.6	112.2	992	35	TS		15/00	21.3	112.3	1004	-	TD
	12/00	22.0	111.0	998	-	TD		15/06	21.4	112.7	1002	-	TD
	12/06	22.4	110.3	1000	-	TD		15/12	21.7	112.7	1004	-	TD
	12/12	22.2	109.7	1004	-	TD		15/18	21.7	112.5	1004	-	TD
	12/18	22.0	109.4	1004	-	TD		16/00					Dissip



TS CHANGMI (0219)

Changmi formed as a tropical depression (TD) over the sea east-northeast of Okinotorishima at 06UTC 20 September 2002. It moved northwestwards and became a tropical storm (TS) at 18UTC 21 September over the sea south of Honshu. Moving to the northeast, it reached its peak intensity with maximum sustained wind of 45kt over the same waters at 06UTC 22 September. Soon it transformed into an extratropical cyclone over the sea southeast of Honshu at 12UTC 22 September. Until it reached to the sea south of Kuril Islands, it held a fairly straight northeast track. It crossed the international date line by 12UTC 25 September.

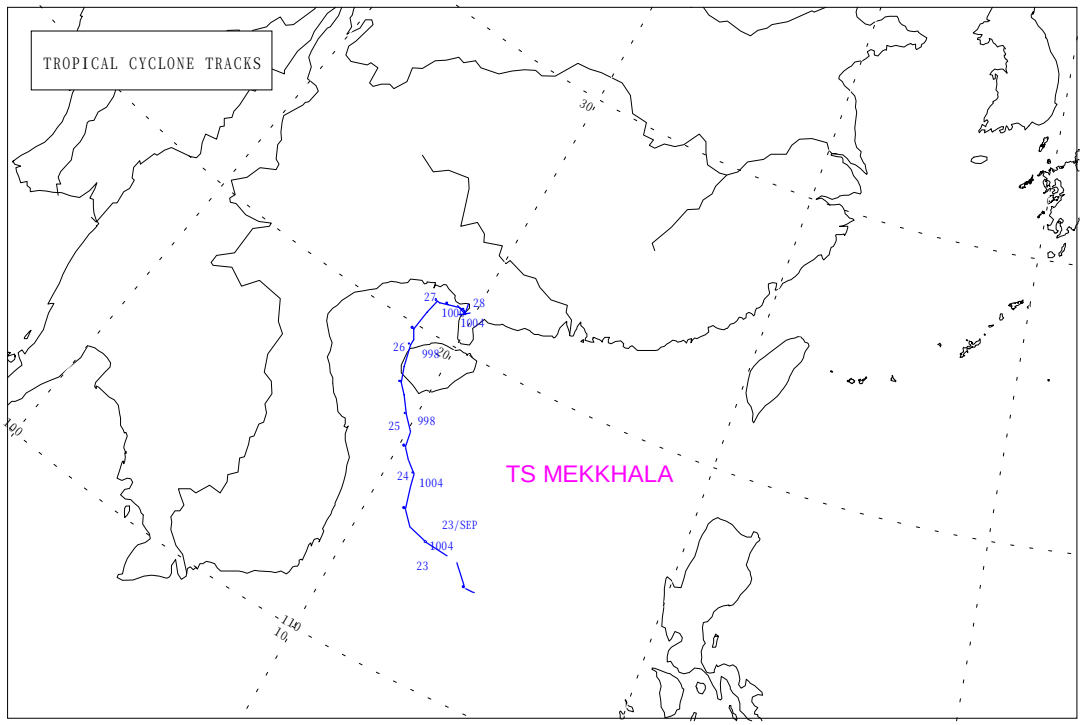
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TS CHANGMI (0219)													
Sep	20/06	22.1	139.3	1000	-	TD	Sep	23/00	34.8	145.1	986	-	L
	20/12	23.3	138.3	1000	-	TD		23/06	37.2	148.5	984	-	L
	20/18	23.5	137.8	1000	-	TD		23/12	38.8	152.8	980	-	L
	21/00	25.3	136.5	1000	-	TD		23/18	41.6	157.4	980	-	L
	21/06	26.5	136.5	1000	-	TD		24/00	43.7	162.6	980	-	L
	21/12	27.6	136.4	998	-	TD		24/06	44.7	167.1	980	-	L
	21/18	27.9	136.6	994	40	TS		24/12	46.3	170.8	980	-	L
	22/00	29.7	138.2	990	40	TS		24/18	48.7	174.7	976	-	L
	22/06	30.9	138.8	985	45	TS		25/00	51.1	175.7	972	-	L
	22/12	32.3	141.0	988	-	L		25/06	52.8	179.4	968	-	L
	22/18	33.2	142.8	988	-	L		25/12	53.9	181.8	960	-	Out



TS MEKKHALA (0220)

Mekkhala formed as a tropical depression (TD) over the middle of South China Sea at 06UTC 22 September 2002. It moved to the northwest and reached the sea south of Hainan Island. Then it intensified into a tropical storm (TS) at 00UTC 25 September. Moving to northwestward, it reached the peak intensity with maximum sustained wind of 45kt over the same waters at 06UTC 25 September. Then it started a clockwise track along the western edge of Hainan Island. Reaching the northern part of the Gulf of Tongking, it weakened into a TD at 00UTC 28 September. And it dissipated over the same waters at 12UTC 28 September.

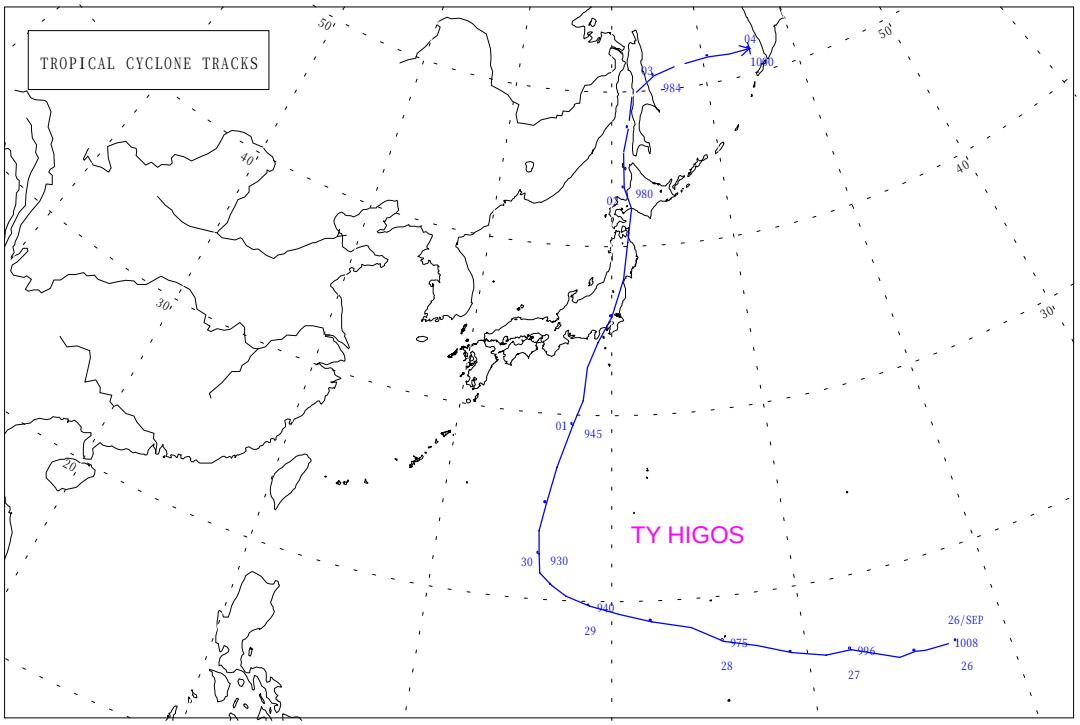
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TS MEKKHALA (0220)													
Sep	22/06	13.5	114.3	1004	-	TD	Sep	25/12	18.2	109.0	990	45	TS
	22/12	13.5	114.0	1004	-	TD		25/18	18.7	108.8	996	40	TS
	22/18	14.1	113.4	1004	-	TD		26/00	19.4	108.6	998	40	TS
	23/00	14.2	112.3	1004	-	TD		26/06	19.6	108.6	998	40	TS
	23/06	14.4	111.6	1004	-	TD		26/12	19.9	108.4	998	40	TS
	23/12	14.8	111.2	1004	-	TD		26/18	20.6	108.5	998	35	TS
	23/18	15.5	111.0	1004	-	TD		27/00	21.1	108.6	1000	35	TS
	24/00	15.9	110.9	1004	-	TD		27/06	21.1	108.7	1000	35	TS
	24/06	16.2	110.5	1004	-	TD		27/12	21.2	109.0	1000	35	TS
	24/12	16.5	110.2	1004	-	TD		27/18	21.3	109.4	1000	35	TS
	24/18	17.0	110.1	1002	-	TD		28/00	21.3	109.6	1004	-	TD
	25/00	17.4	109.7	998	35	TS		28/06	21.2	109.7	1008	-	TD
	25/06	17.9	109.3	990	45	TS		28/12					Dissip



TY HIGOS (0221)

Higos formed as a tropical depression (TD) over the sea southeast of Minamitorishima at 00UTC 26 September 2002. It moved westward and became a tropical storm (TS) on the sea south of Minamitorishima at 18UTC 26 September. Moving west-northwest, it reached a severe tropical storm (STS) over the sea east of Saipan at 06UTC 27 September and reached the typhoon (TY) intensity on the sea northwest of Saipan at 12UTC 28 September. Holding a fairly straight west-northwestward track, it reached its peak intensity with maximum sustained wind of 95kt at 12UTC 29 September. Then it made an abrupt turn to the northwards northeast of Okinotorishima at 18UTC on that day. After the abrupt turn, it accelerated significantly north-northeastwards and advanced over the sea south of Honshu. It passed Miura Peninsula at about 11UTC 1 October and made landfall east part of Kanagawa Prefecture at about half past 11UTC 1 October. After landfall, it moved on land along the northern part of Honshu and weakened to a STS at 18UTC 1 October. Moving northward, it left Honshu and advanced over the sea south of Hokkaido. It made landfall again Hokkaido (Tomakomai City) at 21UTC 1 October. After it went through Hokkaido, it advanced over the sea west of Sakhalin and transformed into an extratropical cyclone at 06UTC 2 October. It dissipated over the sea west of Kamchatka Peninsula at 06UTC 4 October.

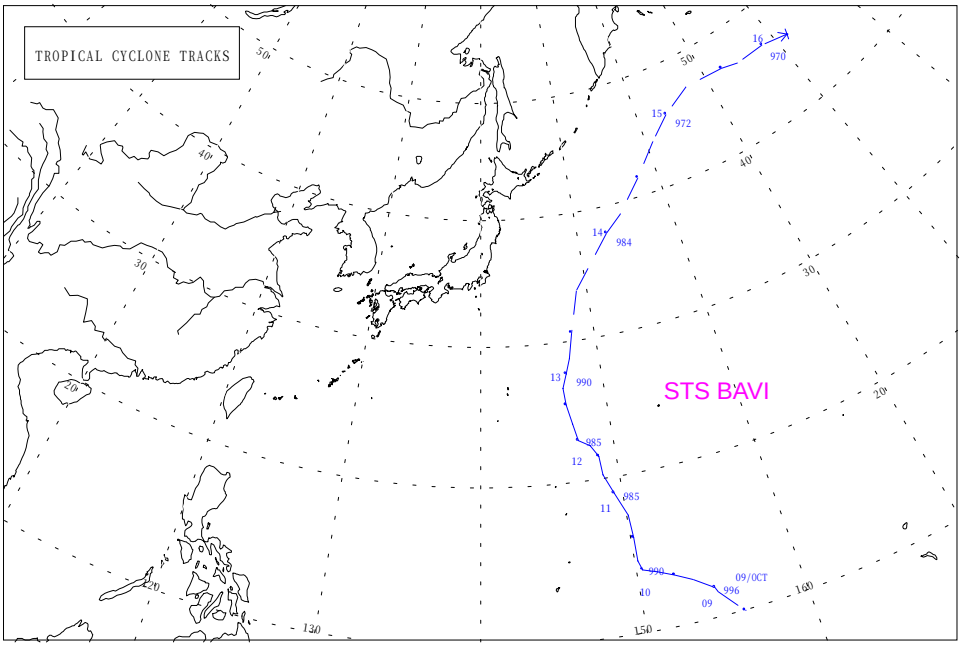
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TY HIGOS (0221)													
Sep	26/00	15.6	157.4	1008	-	TD	Oct	01/00	29.6	137.5	945	80	TY
	26/06	15.6	155.8	1004	-	TD		01/03	31.0	138.1	945	80	TY
	26/12	15.7	155.3	1004	-	TD		01/06	32.9	138.3	950	80	TY
	26/18	15.6	154.5	1000	40	TS		01/09	34.4	139.0	955	75	TY
	27/00	16.5	152.2	996	45	TS		01/11	35.3	139.6	960	70	TY
	27/06	16.5	150.9	990	50	STS		01/12	35.9	140.0	965	65	TY
	27/12	16.9	149.2	985	50	STS		01/15	38.2	140.9	970	65	TY
	27/18	17.5	147.5	980	55	STS		01/18	40.5	141.3	975	60	STS
	28/00	17.9	145.8	975	60	STS		01/21	42.6	141.7	980	55	STS
	28/06	18.7	144.2	970	60	STS		02/00	43.9	141.1	980	50	STS
	28/12	19.1	142.1	965	65	TY		02/06	46.2	141.1	980	-	L
	28/18	19.5	140.4	950	75	TY		02/12	47.8	141.6	980	-	L
	29/00	19.9	138.8	940	85	TY		02/18	49.9	142.1	984	-	L
	29/06	20.4	137.5	935	90	TY		03/00	51.2	144.5	984	-	L
	29/12	20.9	136.7	930	95	TY		03/06	51.7	146.9	988	-	L
	29/18	21.5	136.0	930	95	TY		03/12	52.0	150.6	992	-	L
	30/00	22.5	135.9	930	95	TY		03/18	51.9	153.0	996	-	L
	30/06	23.7	135.8	930	95	TY		04/00	51.9	155.2	1000	-	L
	30/12	25.2	136.1	940	85	TY		04/06					Dissip
	30/18	27.2	136.6	945	80	TY							


TROPICAL CYCLONE TRACKS
TY HIGOS
04
1000
03
984
02
980
01
945
30
930
29
940
28
975
27
996
26
1008
26/SEP
50
40
30
20

STS BAVI (0222)

Bavi formed as a tropical depression (TD) west of Eniwetok Island at 12UTC 8 October 2002. It moved to the northwest and became a tropical storm (TS) east of Guam at 18UTC 9 October. Bavi changed its direction to the north at 00UTC 10 October, and then to the north-northwest at 18UTC on the same day. It intensified into a severe tropical storm (STS) southwest of Minamitorishima at 00UTC 11 October and reached the peak intensity west-southwest of Minamitorishima at 18UTC on the same day. Shortly after it changed its direction to the north, it downgraded into TS west of Minamitorishima at 06UTC 12 October. Bavi transformed into an extratropical cyclone northeast of Chichijima at 12UTC 13 October. It changed its direction to the northeast at 18UTC 13 October, and then to the east at 06UTC 15 October. It crossed the International Date Line on the following day.

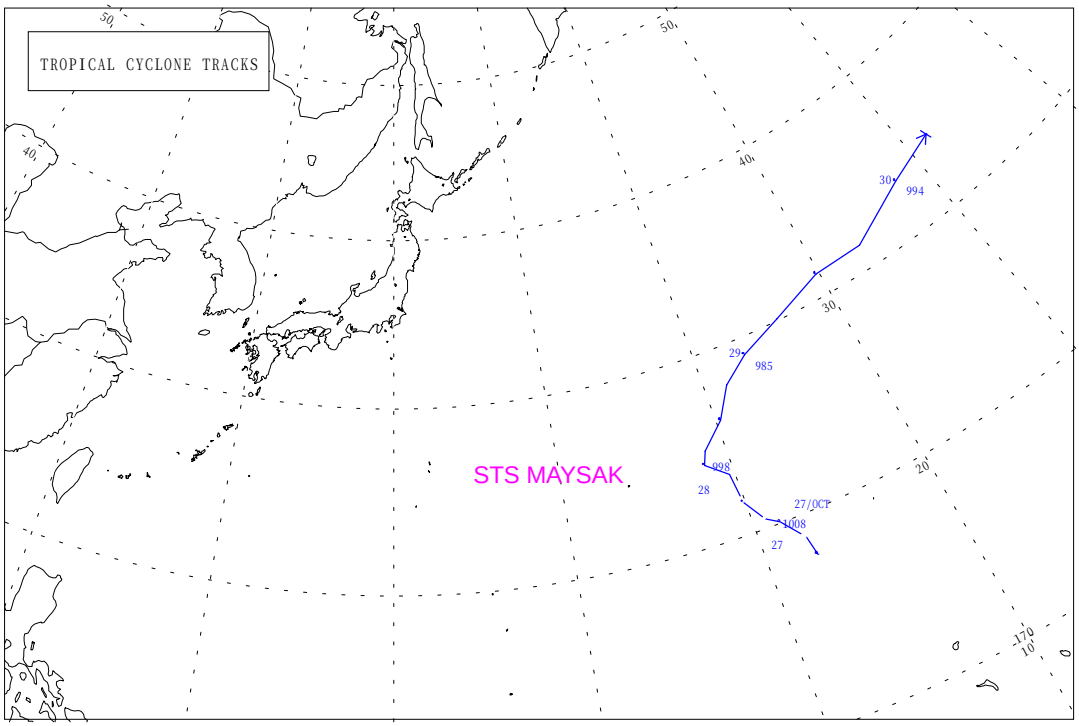
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
STS BAVI (0222)													
Oct	08/12	10.1	156.0	998	-	TD	Oct	12/12	25.6	146.8	990	45	TS
	08/18	11.6	154.7	996	-	TD		12/18	26.8	146.7	990	45	TS
	09/00	11.9	154.6	996	-	TD		13/00	27.8	147.1	990	45	TS
	09/06	12.7	153.4	996	-	TD		13/06	28.9	147.5	990	45	TS
	09/12	13.2	152.3	994	-	TD		13/12	30.8	148.0	990	-	L
	09/18	13.6	151.3	990	40	TS		13/18	34.0	149.0	988	-	L
	10/00	13.9	150.4	990	40	TS		14/00	38.0	153.0	984	-	L
	10/06	14.5	150.2	990	40	TS		14/06	39.2	154.8	976	-	L
	10/12	16.0	150.2	990	40	TS		14/12	41.7	157.8	976	-	L
	10/18	17.5	150.1	985	45	TS		14/18	44.2	160.8	972	-	L
	11/00	19.1	149.4	985	50	STS		15/00	45.9	163.5	972	-	L
	11/06	20.4	148.8	985	50	STS		15/06	47.3	167.3	972	-	L
	11/12	21.7	148.7	985	50	STS		15/12	47.2	172.4	972	-	L
	11/18	22.5	148.2	985	55	STS		15/18	46.8	174.5	972	-	L
	12/00	23.0	147.4	985	50	STS		16/00	46.8	178.3	970	-	L
	12/06	24.2	147.1	990	45	TS		16/06	46.1	181.6	972	-	Out



STS MAYSAK (0223)

Maysak formed as a tropical depression (TD) west-southwest of Wake Island at 12UTC 26 October 2002. It moved to the northwest and became a tropical storm (TS) east of Minamitorishima at 18UTC 27 October. After taking a northwestward track, it changed its direction to the northeast. It intensified into a severe tropical storm (STS) and changed the direction to the east-northeast at 18UTC 28 October. Maysak reached the peak intensity far east of Japan at 06UTC on the following day. It downgraded into TS intensity south of the Aleutian Islands at 00UTC 30 October and crossed the International Date Line keeping TS intensity on that day.

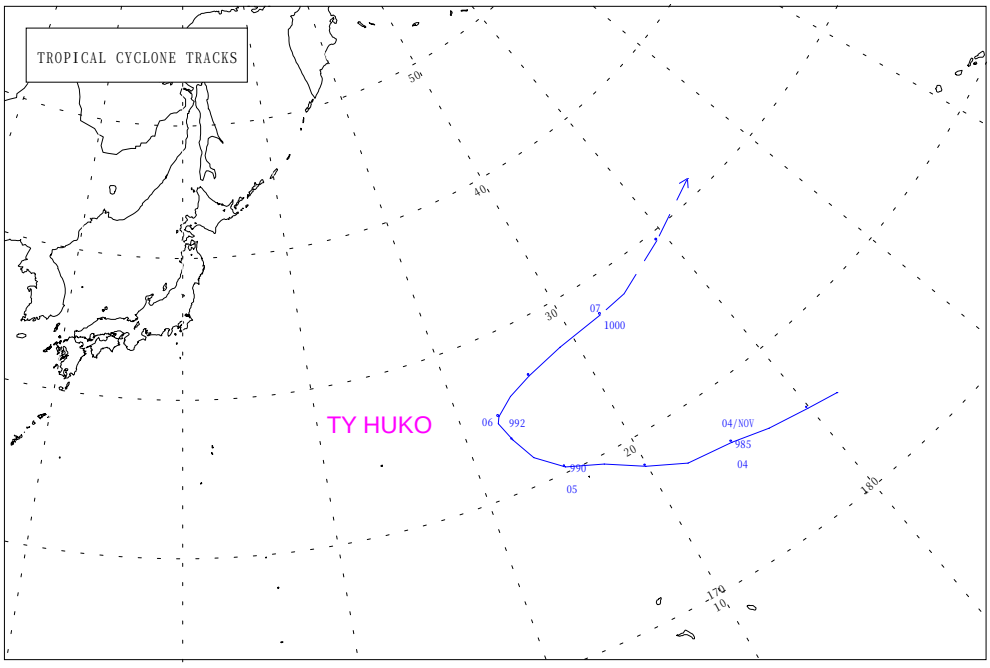
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
STS MAYSAK (0223)													
Oct	26/12	18.0	162.6	1008	-	TD	Oct	28/12	26.3	160.3	992	45	TS
	26/18	19.0	162.4	1008	-	TD		28/18	28.0	161.4	985	50	STS
	27/00	20.2	161.4	1008	-	TD		29/00	29.2	163.2	985	55	STS
	27/06	20.6	160.7	1008	-	TD		29/06	30.3	166.1	980	55	STS
	27/12	21.8	159.9	1006	-	TD		29/12	31.5	169.8	985	55	STS
	27/18	23.4	159.7	1002	35	TS		29/18	31.6	173.3	990	50	STS
	28/00	24.3	158.5	998	40	TS		30/00	33.4	177.9	994	40	TS
	28/06	25.0	158.8	996	45	TS		30/06	34.4	181.7	996	40	Out



TY HUKO (0224)

A tropical cyclone generated in the central North Pacific was named Huko by the Central Pacific Hurricane Center (CPHC), RSMC Honolulu. It crossed the International Date Line with typhoon intensity at around 12UTC 3 November 2002, and moved into the western North Pacific, the area of responsibility of the RSMC Tokyo-Typhoon Center. Maintaining typhoon intensity, it moved west-northwestward over the sea north of the Marshall Islands. It made a slow turn to the northwestward at 00UTC 5 November northwest of Wake Island. Starting recurvature to the north over the sea east of Minamitorishima, it was downgraded to a severe tropical storm (STS) at 18UTC 5 November. After the recurvature it kept the east-northeast track and downgraded to a tropical storm (TS) at 12 UTC 6 November over the sea east-northeast of Minamitorishima. It transformed into an extratropical cyclone at 00UTC 7 November over the sea west of Midway Island. It crossed the International Date Line after 12UTC 7 November and returned to the central North Pacific.

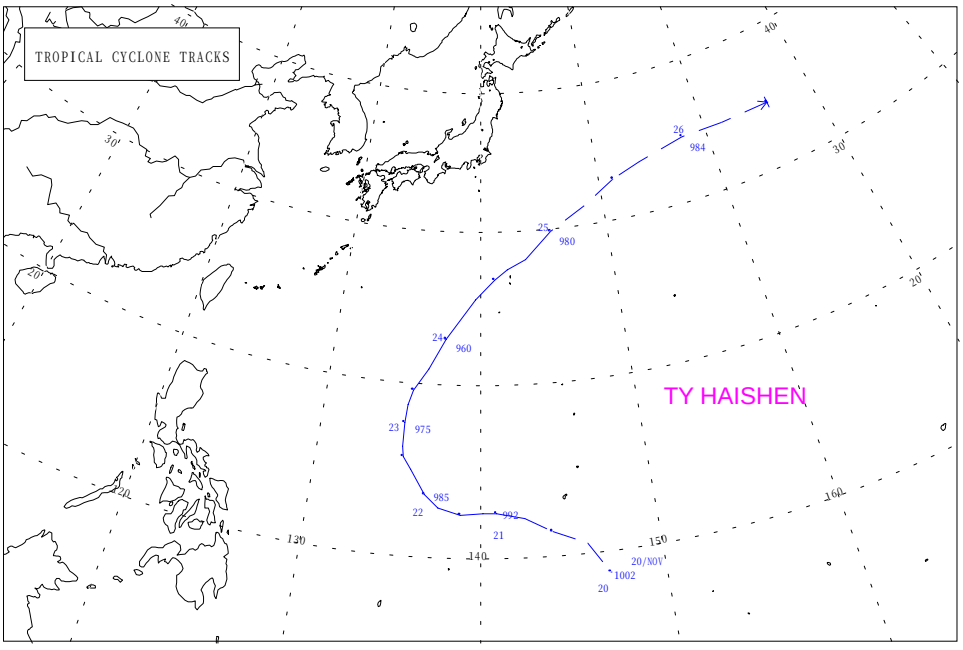
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TY HUKO (0224)													
Nov	03/06	15.3	181.8	985	75	HR	Nov	05/18	24.6	162.5	990	60	STS
	03/12	15.7	179.9	985	75	TY		06/00	25.0	162.7	992	55	STS
	03/18	16.2	177.4	985	75	TY		06/06	25.9	164.0	992	50	STS
	04/00	16.8	175.1	985	75	TY		06/12	26.6	165.9	996	45	TS
	04/06	17.2	172.2	985	75	TY		06/18	27.3	168.8	996	40	TS
	04/12	18.3	169.9	985	75	TY		07/00	27.8	172.6	1000	-	L
	04/18	19.6	167.7	985	75	TY		07/06	28.1	174.9	1004	-	L
	05/00	20.5	165.4	990	70	TY		07/12	29.6	179.3	1006	-	L
	05/06	21.8	163.8	990	65	TY		07/18	31.3	184.3	1008	-	Out
	05/12	23.3	163.0	990	65	TY							



TY HAISHEN (0225)

Haishen formed as a tropical depression (TD) over the sea northwest of the Truk Islands at 00UTC 20 November 2002. It moved northwestward and became a tropical storm (TS) southwest of Guam at 18UTC 20 November. Moving westward, it reached a severe tropical storm (STS) over the sea west of Guam at 18UTC 21 November. Then it made a turn to the north slowly and developed into typhoon intensity (TY) south of Okinotorishima at 00UTC 23 November. Holding a fairly straight north-northeastward track, it reached its peak intensity with maximum sustained wind of 85kt at 12UTC 23 November. Advancing over the sea northeast of Chichijima, it weakened to a STS at 18UTC 24 November. Maintaining east-northeastward direction, it transformed into an extratropical cyclone over the sea northeast of Chichijima at 00UTC 25 November. It dissipated over the sea far east of Japan at 18UTC 26 November.

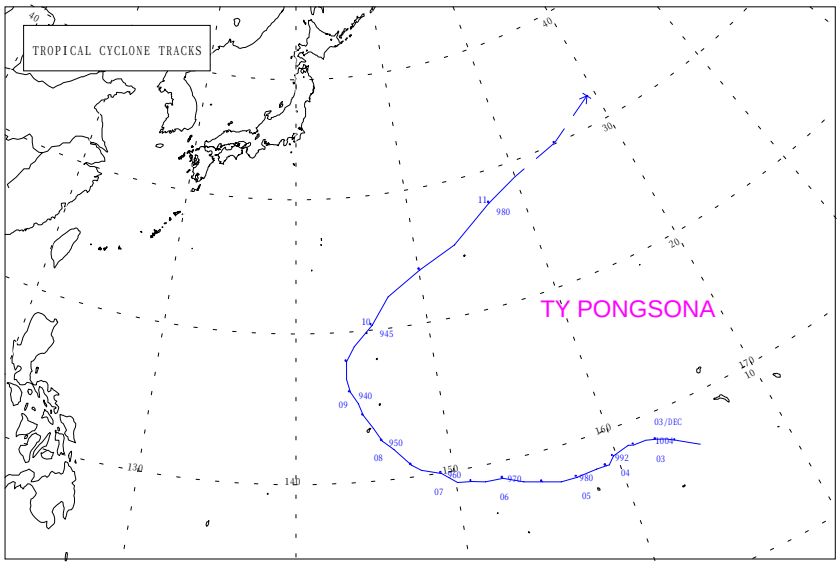
Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TY HAISHEN (0225)													
Nov	20/00	9.0	147.0	1002	-	TD	Nov	23/18	21.1	136.5	955	85	TY
	20/06	10.7	145.9	1000	-	TD		24/00	23.0	137.6	960	80	TY
	20/12	11.5	144.0	1000	-	TD		24/06	25.6	139.6	970	70	TY
	20/18	12.3	142.5	996	35	TS		24/12	26.9	141.0	970	70	TY
	21/00	12.6	140.9	992	40	TS		24/15	27.6	142.0	970	65	TY
	21/06	12.6	140.1	990	45	TS		24/18	28.2	143.4	975	60	STS
	21/12	12.5	138.8	990	45	TS		25/00	30.0	145.5	980	-	L
	21/18	12.9	137.5	985	50	STS		25/06	31.5	148.5	980	-	L
	22/00	13.6	136.7	985	50	STS		25/12	33.0	151.2	980	-	L
	22/06	15.0	135.8	985	50	STS		25/18	33.8	153.7	984	-	L
	22/12	15.7	135.3	980	55	STS		26/00	34.7	157.9	984	-	L
	22/18	16.3	135.2	980	55	STS		26/06	34.7	161.6	984	-	L
	23/00	17.7	135.2	975	65	TY		26/12	34.7	165.9	988	-	L
	23/06	18.8	135.3	960	75	TY		26/18					Dissip
	23/12	19.7	135.6	955	85	TY							



TY PONGSONA (0226)

Pongsona formed as a tropical depression (TD) near the Marshall Islands at 06UTC 2 December 2002. It moved to the west-northwest and became a tropical storm (TS) northeast of Pompei Island at 12UTC 3 December. It moved to the west and developed into a typhoon (TY) over the waters north of the Truk Islands at 18UTC 5 December. It changed its direction to the northwest and passed near Guam around 06UTC 8 December. It reached the peak intensity north of Guam at 12UTC on that day and changed the direction gradually to the north, then to the northeast. Moving to the northeast over the waters northeast of Minamitorishima, it rapidly downgraded to the severe tropical storm (STS) intensity at 00UTC 11 December. Pongsona transformed into an extratropical cyclone northeast of Minamitorishima at 06UTC 11 December and dissipated far east of Japan at 00UTC 12 December.

Date/Time		Center Position		Central pressure	Max Wind	Grade	Date/Time		Center Position		Central pressure	Max Wind	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)			(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)	
TY PONGSONA (0226)													
Dec	02/06	7.2	164.9	1004	-	TD	Dec	07/06	10.5	148.0	955	80	TY
	02/12	8.0	163.7	1004	-	TD		07/12	10.9	147.4	955	80	TY
	02/18	8.3	163.2	1004	-	TD		07/18	12.0	146.4	950	80	TY
	03/00	8.5	162.6	1004	-	TD		08/00	12.6	145.7	950	80	TY
	03/06	8.7	162.0	1002	-	TD		08/06	13.5	145.2	945	85	TY
	03/12	8.7	161.2	1000	35	TS		08/12	14.4	144.6	940	90	TY
	03/18	8.8	160.9	994	40	TS		08/18	15.2	144.3	940	90	TY
	04/00	8.5	159.8	992	40	TS		09/00	16.0	143.8	940	90	TY
	04/06	8.1	159.4	990	45	TS		09/06	16.9	143.6	940	90	TY
	04/12	8.1	159.2	990	45	TS		09/12	18.1	143.7	940	90	TY
	04/18	8.1	158.6	980	55	STS		09/18	19.1	144.3	940	90	TY
	05/00	8.0	157.3	980	55	STS		10/00	20.5	145.8	945	85	TY
	05/06	8.0	156.3	980	55	STS		10/06	22.4	147.3	945	85	TY
	05/12	8.3	155.2	975	60	STS		10/12	24.0	150.1	950	80	TY
	05/18	8.6	154.1	970	65	TY		10/18	25.3	153.3	965	70	TY
	06/00	9.1	152.9	970	65	TY		11/00	27.7	157.1	980	55	STS
	06/06	9.1	151.8	970	65	TY		11/06	29.0	160.0	996	-	L
	06/12	9.3	151.0	970	65	TY		11/12	30.3	164.5	1004	-	L
	06/18	9.4	150.1	965	70	TY		11/18	32.5	169.2	1006	-	L
	07/00	10.1	149.2	960	75	TY		12/00					Dissip



Appendix 5

Code Forms of RSMC Products

(a) RSMC Tropical Cyclone Advisory (WTPQ20-25 RJTD)

WTPQ i i RJTD YYGGgg
RSMC TROPICAL CYCLONE ADVISORY
NAME class ty-No. name (common-No.)
ANALYSIS
PSTN YYGGgg UTC LaLa.La N LoLoLo.Lo E (or W) confidence
MOVE direction SpSpSp KT
PRES PPPP HPA
MXWD VmVmVm KT
50KT RdRdRd NM (or 50KT RdRdRd NM octant RdRdRd NM octant)
30KT RdRdRd NM (or 30KT RdRdRd NM octant RdRdRd NM octant)
FORECAST
24HF YYGGgg$_F$ UTC LaLa.La$_F$ N LoLoLo.Lo$_F$ E (or W) FrFrFr NM 70%
MOVE direction SpSpSp KT
PRES PPPP HPA
MXWD VmVmVm KT
Ft1Ft1HF YYGGgg$_F$ UTC LaLa.La$_F$ N LoLoLo.Lo$_F$ E (or W) FrFrFr NM 70%
MOVE direction SpSpSp KT
PRES PPPP HPA
MXWD VmVmVm KT
Ft2Ft2HF YYGGgg$_F$ UTC LaLa.La$_F$ N LoLoLo.Lo$_F$ E (or W) FrFrFr NM 70%
MOVE direction SpSpSp KT =

Notes:

a. Underlined is fixed.

b. Abbreviations

PSTN	:	Position
MOVE	:	Movement
PRES	:	Pressure
MXWD	:	Maximum wind
HF	:	Hour forecast

c. Symbolic letters

i i	:	'20', '21', '22', '23', '24' or '25'.
YYGGgg	:	Time of observation submitting the data for analysis. Date(YY), hour(GG) and minute(gg) are given in UTC.
class	:	Intensity classification of the tropical cyclone. 'TY', 'STS', 'TS' or 'TD'.
ty-No.	:	Domestic identification number of the tropical cyclone adopted in Japan. Given in four digits and same as the international identification number.
name	:	Name assigned to the tropical cyclone from the name list prepared by the Typhoon Committee.
common-No.	:	International identification number of the tropical cyclones given in four digits.
LaLa.La	:	Latitude of the center position in "ANALYSIS" part.
LoLoLo.Lo	:	Longitude of the center position in "ANALYSIS" part.
confidence	:	Confidence of the center position. 'GOOD', 'FAIR' or 'POOR'.
direction	:	Direction of movement given in 16 azimuthal direction as 'N', 'NNE', 'NE', 'ENE' etc.
SpSpSp	:	Speed of movement.
PPPP	:	Central pressure.
VmVmVm	:	Maximum sustained wind.
RdRdRd	:	Radii of 30knots and 50knots wind.
octant	:	Eccentric distribution of wind given in 8 azimuthal direction as 'NORTH', 'NORTHEAST', 'EAST' etc.
Ft1Ft1	:	48 (00, 06, 12 and 18 UTC) or 45 (03, 09, 15 and 21 UTC)

Ft2Ft2	:	72 (00, 06, 12 and 18 UTC) or 69 (03, 09, 15 and 21 UTC)
$YYGGgg_F$	:	Time in UTC on which the forecast is valid.
$LaLa.La_F$	:	Latitude of the center of 70% probability circle in "FORECAST" part.
$LoLoLo.Lo_F$	:	Longitude of the center of 70% probability circle in "FORECAST" part.
FrFrFr	:	Radius of 70% probability circle.

d. MOVE is optionally described as 'ALMOST STATIONARY' or '(direction) SLOWLY' depending on the speed of movement.

Example:

WTPQ20 RJTD 180000
RSMC TROPICAL CYCLONE ADVISORY
NAME TY 0001 DAMREY (0001)
ANALYSIS
PSTN 180000UTC 14.8N 127.2E GOOD
MOVE W 12KT
PRES 905HPA
MXWD 105KT
50KT 180NM SOUTHEAST 150NM NORTHWEST
30KT 300NM
FORECAST
24HF 190000UTC 16.3N 125.7E 90NM 70%
MOVE NNW 06KT
PRES 910HPA
MXWD 100KT
48HF 200000UTC 18.5N 126.5E 180NM 70%
MOVE NNE 06KT
PRES 910HPA
MXWD 100KT
72HF 210000UTC 20.5N 129.0E 270NM 70%
MOVE NE 08KT =

(b) RSMC Guidance for Forecast (FXPQ20-25 RJTD)

FXPQ i i RJTD YYGGgg
RSMC GUIDANCE FOR FORECAST
NAME class ty-No. name (common-No.)
PSTN YYGGgg UTC LaLa.La N LoLoLo.Lo E (or W)
PRES PPPP HPA
MXWD WWW KT
FORECAST BY TYPHOON (or GLOBAL) MODEL
TIME PSTN PRES MXWD
(CHANGE FROM T=0)
T=06 LaLa.La N LoLoLo.Lo E (or W) appp HPA awww KT
T=12 LaLa.La N LoLoLo.Lo E (or W) appp HPA awww KT
T=18 LaLa.La N LoLoLo.Lo E (or W) appp HPA awww KT
:
:
T=78 (or 84) LaLa.La N LoLoLo.Lo E (or W) appp HPA awww KT=

Notes:

a. Underlined is fixed.

b. Symbolic letters

i i	:	'20', '21', '22', '23', '24' or '25'.
YYGGgg	:	Initial time of the model in UTC.
PPPP	:	Central pressure in hPa.
WWW	:	Maximum wind speed in knots.
a	:	Sign of ppp and www (+, - or blank).
ppp	:	Absolute value of change in central pressure from T=0, in hectopascals.
www	:	Absolute value of change in maximum wind speed from T=0, in knots.

c. The prediction terminates in T=78 for Typhoon Model and in T=84 for Global Model.

Example:

FXPQ20 RJTD 180600
RSMC GUIDANCE FOR FORECAST
NAME T 0001DAMREY (0001)
PSTN 180000UTC 15.2N 126.3E
PRES 905HPA
MXWD 105KT
FORECAST BY GLOBAL MODEL
TIME PSTN PRES MXWD
(CHANGE FROM T=0)
T=06 15.4N 125.8E +018HPA -008KT
T=12 15.5N 125.6E +011HPA -011KT
T=18 15.8N 125.7E +027HPA -028KT
:
:
T=78 20.7N 128.8E +021HPA -022KT=

(c) SAREP (TCNA20/21 RJTD)

TCNA i i RJTD YYGGgg
CCAA YYGGg 47644 name (common-No.) nt nt LaLaLa Qc LoLoLoLo 1At Wt at tm
2St St // (9ds ds fs fs)=

Notes:

a. Underlined is fixed.

b. Symbolic letters

i i	:	20 for the observation at 03, 09, 15 and 21 UTC. 21 for the observation at 00, 06, 12 and 18 UTC.
YYGGgg	:	Time of observation submitting the data for analysis. Date(YY), hour(GG) and minute(gg) are given in UTC.
nt nt	:	Serial number of the tropical cyclone in order of the time of its formation in the year. Given in '01' - '99' irrespective of TS attainment in intensity.
LaLaLa	:	Latitude given in 0.1N
Qc	:	Quadrant of the earth. 1:N/E, 2:S/E, 3:S/W and 4:N/W.
LoLoLo	:	Longitude given in 0.1E
At	:	Confidence. 0: ≦10km 1: ≦20km 2: ≦50km 3: ≦100km 4: ≦200km 5: ≦300km /: unable to determine
Wt	:	Mean diameter (d: degree in latitude) of cloud system. 0: d<1° 1: 1°≦d<2° 2: 2°≦d<3° 3: 3°≦d<4° 4: 4°≦d<5° 5: 5°≦d<6° 6: 6°≦d<7° 7: 7°≦d<8° 8: 8°≦d<9° 9: 9°≦d /: unable to determine
at	:	24-hour intensity inclination. 0: further weakening 1: weakening 2: no change 3: intensifying 4: further intensifying 9: no former observation /: unable to determine
tm	:	Time interval (t: hour) for determination of movement. 0: t<1 1: 1≦t<2 2: 2≦t<3 3: 3≦t<6 4: 6≦t<9 5: 9≦t<12 6: 12≦t<15 7: 15≦t<18 8: 18≦t<21 9: 21≦t<30 /: no (9dsdsfsfs) group
StSt	:	Intensity. 00: weakening 15, 20, 25 … 80: CI-number (in 0.1) 99: under extratropical transformation //: unable to determine
dsds	:	Direction of movement (in 10°).
fsfs	:	Speed of movement (in knots).

Example:

TCNA21 RJTD 180000
CCAA 18000 47644
DAMREY(0001) 29149 11272
11334 275// 92811=

(d) RSMC Prognostic Reasoning (WTPQ30-35 RJTD)

Example:

WTPQ30 RJTD 180000

RSMC TROPICAL CYCLONE PROGNOSTIC REASONING
REASONING NO. 9 FOR TY 0001 DAMREY (0001)
1.GENERAL COMMENTS
REASONING OF PROGNOSIS THIS TIME IS SIMILAR TO PREVIOUS ONE.
POSITION FORECAST IS MAINLY BASED ON NWP AND PERSISTENCY.
2.SYNOPTIC SITUATION
SUBTROPICAL RIDGE WILL NOT CHANGE ITS LOCATION AND STRENGTH FOR THE NEXT 24 HOURS.
3.MOTION FORECAST
POSITION ACCURACY AT 180000 UTC IS GOOD.
TY WILL DECELERATE FOR THE NEXT 12 HOURS.
TY WILL RECURVE WITHIN 60 HOURS FROM 180000 UTC.
TY WILL MOVE WEST FOR THE NEXT 12 HOURS THEN MOVE GRADUALLY TO WEST-NORTHWEST.
4.INTENSITY FORECAST
TY WILL KEEP PRESENT INTENSITY FOR NEXT 24 HOURS.
FI-NUMBER WILL BE 7.0 AFTER 24 HOURS.=

(e) Tropical Cyclone Advisory for SIGMET (FKPQ30-35 RJTD)

FKPQ i i RJTD YYGGgg
TROPICAL CYCLONE ADVISORY FOR SIGMET
TROPICAL CYCLONE ADVISORY CENTRE TOKYO
NAME class ty-No. name (common-No.)
ANALYSIS
TIME YYGGggUTC
PSTN LaLa.La N LoLoLo.Lo E
MOVE direction SpSpSp KT
PRES PPPPHPA
MXWD WWWKT
12HR-FCST
TIME YYGGggUTC
PSTN LaLa.La N LoLoLo.Lo E
MOVE direction SpSpSp KT
PRES PPPPHPA
MXWD WWWKT
24HR-FCST
TIME YYGGggUTC
PSTN LaLa.La N LoLoLo.Lo E
MOVE direction SpSpSp KT
PRES PPPPHPA
MXWD WWWKT=

Notes:

a. Underlined is fixed.

b. Abbreviations

PSTN	:	Position
MOVE	:	Movement
PRES	:	Pressure
MXWD	:	Maximum wind

c. Symbolic letters

i i	:	'30', '31', '32', '33', '34' or '35'.
YYGGgg	:	Time of observation submitting the data for analysis. Date(YY), hour(GG) and minute(gg) are given in UTC.
class	:	Intensity classification of the tropical cyclone. 'TY', 'STS', 'TS' or 'TD'.
ty-No.	:	Domestic identification number of the tropical cyclone adopted in Japan. Given in four digits

		and same as the international identification number.
name	:	Name assigned to the tropical cyclone by JTWC (Joint Typhoon Warning Center, Guam). But for assignment, this is indicated as 'NAMELESS'.
common-No.	:	International identification number of the tropical cyclones given in four digits.
LaLa.La	:	Latitude of the center position.
LoLoLo.Lo	:	Longitude of the center position.
direction	:	Direction of movement given in 16 azimuthal direction as 'N', 'NNE', 'NE', 'ENE' etc.
SpSpSp	:	Speed of movement.
PPPP	:	Central pressure.
WWW	:	Maximum sustained wind.

d. MOVE is optionally described as 'ALMOST STATIONARY' or '(direction) SLOWLY' depending on the speed of movement.

Example:

```
FKPQ30 RJTD 180000
TROPICAL CYCLONE ADVISORY FOR SIGMET
TROPICAL CYCLONE ADVISORY CENTRE TOKYO
NAME    TY 0001 DAMREY (0001)
ANALYSIS
TIME    180000UTC
PSTN    14.8N 127.2E
MOVE    WEST    012KT
PRES    0905HPA
MXWD    105KT
12HR-FCST
TIME    181200UTC
PSTN    15.5N 126.2E
MOVE    WNW     009KT
PRES    0910HPA
MXWD    105KT
24HR-FCST
TIME    190000UTC
PSTN    16.3N 125.7E
MOVE    NNW     006KT
PRES    0910HPA
MXWD    100KT =
```

(f) RSMC Tropical Cyclone Best Track (AXPQ20 RJTD)

AXPQ20 RJTD YYGGgg
RSMC TROPICAL CYCLONE BEST TRACK
NAME ty-No. name (common-No.)
PERIOD FROM MMMDDTTUTC TO MMMDDTTUTC
DDTT LaLa.LaN LoLoLo.LoE PPPHPA WWWKT DDTT LaLa.LaN LoLoLo.LoE PPPHPA WWWKT
DDTT LaLa.LaN LoLoLo.LoE PPPHPA WWWKT DDTT LaLa.LaN LoLoLo.LoE PPPHPA WWWKT
:
:
DDTT LaLa.LaN LoLoLo.LoE PPPHPA WWWKT DDTT LaLa.LaN LoLoLo.LoE PPPHPA WWWKT
REMARKS[1)]
TD FORMATION AT MMMDDTTUTC
FROM TD TO TS AT MMMDDTTUTC
:
:
DISSIPATION AT MMMDDTTUTC=

Notes:

a. Underlined is fixed.

b. [1)] REMARKS is given optionally.

c. Symbolic letters

MMM	:	Month in UTC. Given as 'JAN', 'FEB', etc.
DD	:	Date in UTC.
TT	:	Hour in UTC.
PPP	:	Central pressure.
WWW	:	Maximum wind speed.

Example:

AXPQ20 RJTD 020600

RSMC TROPICAL CYCLONE BEST TRACK
NAME 0001 DAMREY (0001)
PERIOD FROM OCT1300UTC TO OCT2618UTC
1300 10.8N 155.5E 1008HPA //KT 1306 10.9N 153.6E 1006HPA //KT
1312 11.1N 151.5E 1004HPA //KT 1318 11.5N 149.8E 1002HPA //KT
1400 11.9N 148.5E 1000HPA //KT 1406 12.0N 146.8E 998HPA 35KT
:
:
1712 14.6N 129.5E 905HPA 105KT 1718 14.7N 128.3E 905HPA 105KT
:
:
2612 32.6N 154.0E 1000HPA //KT 2618 33.8N 157.4E 1010HPA //KT
REMARKS
TD FORMATION AT OCT1300UTC
FROM TD TO TS AT OCT1406UTC
FROM TS TO STS AT OCT1512UTC
FROM STS TO TY AT OCT1600UTC
FROM TY TO STS AT OCT2100UTC
FROM STS TO TS AT OCT2112UTC
FROM TS TO L AT OCT2506UTC
DISSIPATION AT OCT2700UTC=

Appendix 6

List of GPV products and data on the RSMC Data Serving System

Area	20S-60N,80E-160W	20S-60N,60E-160W	global area	
Resolution	2.5×2.5 deg	1.25×1.25 deg	2.5×2.5 deg	
Level & Elements	surface(P,U,V,T,TTd,R) 850hPa(Z,U,V,T,TTd, ω) 700hPa(Z,U,V,T,TTd, ω) 500hPa(Z,U,V,T,TTd, ζ) 300hPa(Z,U,V,T) 250hPa(Z,U,V,T) 200hPa(Z,U,V,T) 150hPa(Z,U,V,T) 100hPa(Z,U,V,T)	surface(P,U,V,T,TTd,R) 1000hPa(Z,U,V,T,TTd) 925hPa(Z,U,V,T,TTd, ω) 850hPa(Z**,U**,V**,T**,TTd**, ω , ϕ , χ) 700hPa(Z**,U**,V**,T**,TTd**, ω) 500hPa(Z**,U**,V**,T**,TTd**, ζ) 400hPa(Z,U,V,T,TTd) 300hPa(Z,U,V,T,TTd) 250hPa(Z,U,V,T) 200hPa(Z**,U**,V**,T**, ϕ , χ) 150hPa(Z,U,V,T) 100hPa(Z,U,V,T) 70hPa(Z,U,V,T) 50hPa(Z,U,V,T) 30hPa(Z,U,V,T) 20hPa(Z,U,V,T) 10hPa(Z,U,V,T)	surface(P,U,V,T,R) 850hPa(Z,U,V,T,TTd)* 700hPa(Z,U,V,T,TTd)* 500hPa(Z,U,V,T)* 300hPa(Z,U,V,T) 250hPa(Z,U,V,T) 200hPa(Z,U,V,T)* 100hPa(Z,U,V,T)	surface(P,U,V,T,TTd) 1000hPa(Z,U,V,T,TTd) 850hPa(Z,U,V,T,TTd) 700hPa(Z,U,V,T,TTd) 500hPa(Z,U,V,T,TTd) 400hPa(Z,U,V,T,TTd) 300hPa(Z,U,V,T,TTd) 250hPa(Z,U,V,T) 200hPa(Z,U,V,T) 150hPa(Z,U,V,T) 100hPa(Z,U,V,T) 70hPa(Z,U,V,T) 50hPa(Z,U,V,T) 30hPa(Z,U,V,T) 20hPa(Z,U,V,T) 10hPa(Z,U,V,T)
FCST Hours	00,06,12,18,24,30,36,48, 60,72	00,06,12,18,24,30,36,42,48,54,60,66,72 12UTC: Surface(P,U,V,T,TTd,R), from 78 to 192 hours, every 6 hours ** ; 96,120,144,168,192(12UTC only)	00UTC : 24,48,72 12UTC : 00,24,48,72,96,120 * ; 144,168,192(12UTC only)	00UTC : 00
Time/Day	2 times (00 and 12 UTC)	2 times (00 and 12 UTC)	2 times (00 and 12 UTC)	

Note: P : pressure reduced to MSL Z : geopotential height ζ : relative vorticity U : u-component of wind
V : v-component of wind ϕ : stream function R : total precipitation T : temperature
χ : velocity potential TTd : dew point depression ω : vertical velocity

Products /Data	GMS Data	Typhoon Information	Global Wave Model	Observations data
Contents	(a) Digital data (GRIB) •Cloud amount •Convective cloud amount •Equivalent blackbody temperature (b) Satellite-derived high density cloud motion vectors (BUFR)	Tropical cyclone related information (BUFR) ・Position, etc.	•Wave height •Wave period •Prevailing wave direction Forecast Times: Initial,06,12,18,24,30,36, 42,48,54,60,72 (00&12UTC), 96,120,144,168,192 (12UTC)	(a) Surface data (SYNOP) (b) Upper air data (TEMP, Part A-D) (PILOT, Part A-D)
Frequency (initial time(s))	(a) 4 times (00, 06, 12 and 18UTC) a day (b) Once (04UTC) a day	4 times (00, 06, 12 and 18 UTC) a day	2 times (00 and 12 UTC) a day	(a) Mainly 4 times a day (b) Mainly 2 times a day

Appendix 7

User's Guide to the attached CD-ROM

1) This CD-ROM should not be reproduced and not be provided to any third party.
2) The source should be properly acknowledged in any work obtained with this CD-ROM.

JMA does not accept liability for any direct and/or indirect loss or damage to the user caused by the use of the software, data or documents in this CD-ROM.

Preface

This CD-ROM contains all the texts, tables, charts of this report and GMS-5 satellite images of the tropical cyclones that attained TS intensity or higher in the western North Pacific and the South China Sea in 2002. This document is a brief user's guide for the CD-ROM. The CD-ROM was mastered in ISO-9660 format.

Directory and File layout

```
|------ar405eng.exe (Acrobat Reader Installer)
|------Readme.txt (belief explanation about the CD-ROM)
|------TopMenu.exe (Start menu setup program)
|------Users_Manual.htm (user's manual of a satellite image viewer)
|------Annual_Report
        |---Text (text of Annual Report 2002 in PDF)
        |---Figure (figures for MS PowerPoint)
        |---Table (tables for MS Excel)
        |---Appendix (appendixes for MS Excel, PowerPoint)
|------Programs
        |---Gmslpd
                |--Gmslpd.exe (Viewer; tropical cyclone version in English)
                |--Gsetup.exe, etc. (Setup program, etc.)
|------Satellite_Image_Data
        |---2002_1 (3-hourly GMS image data)
        |---2002_2 (3-hourly GMS image data)
                :
        |---2002_26 (3-hourly GMS image data)

|------Users_Manual
        |--Gmanual.doc (User's Manual for MS Word)
|------Andata
        |--Best2002.txt (Best track data for the year 2002)
```

How to use this CD-ROM

When you set the CD-ROM, start menu will be presented automatically with a panel which has "Annual Report 2002", "GMS Satellite Images", "About CD-ROM" and "Close" buttons and a file list box for some introductory documents. Choose and click a button or file which you want to see and follow instructions on your display.

Required hardware/OS for the CD-ROM are:

Hardware : DOS-V, NEC PC-9800 Series or their compatible
OS : Microsoft Windows Ver. 3.1 or later

< Annual Report 2002 >

Annual Report 2002 is prepared in the following two formats: "PDF files" and "MS Word/Excel/PowerPoint files".

- PDF files:

Click the "Annual Report 2002" button to open the annual report 2002 in PDF. If you can not open the PDF file, install 'Adobe Acrobat Reader' with its installer (ar405eng.exe) in the file list box on a start menu window, and try again. 'Adobe Acrobat Reader' (or 'Adobe Acrobat') is required to view PDF files.

- Word/Excel/PowerPoint files:

Original figures and tables prepared with Microsoft Word, Excel or PowerPoint are stored in Annual_Report folder of the CD-ROM.

< GMS Satellite Images >

- Installation of a program for displaying satellite images:

Click the "GMS Satellite Image" button to run a setup program (Gsetup.exe) of a satellite image viewer. If you follow some instructions, the viewer 'Gmslpd.exe', which is a program for displaying satellite images, will be installed into the harddisk of your computer and a list of the tropical cyclones in 2002 is displayed in the 'Selection window' of satellite images for tropical cyclones.

- Displaying satellite images:

Choose a tropical cyclone from the list and click the name, and 3-hourly satellite images for the tropical cyclone will be displayed. You can display the track of the tropical cyclone superimposed on the satellite image and measure the intensity of the tropical cyclone using Dvorak's technique.

- User's manual for the viewer:

Besides the above functions, the viewer has many useful ones. See the User's Manual (Users_Manual.htm or /Users_Manual/Gmanual.doc) about further detailed operations.

- Explanation of satellite image data

Period : From Generating Stage to Weakening Stage of each tropical cyclone.
Images : Infrared images (00, 03, 06, 09, 12, 15, 18, 21UTC)
Visible images (00, 03, 06, 09, 21UTC)
Range : 40 degrees in both latitude and longitude.
(The image window moves following a tropical cyclone's track so that the center of a tropical cyclone is fixed at the center of the image window.)
Time interval : 3-hourly
Resolution : 0.08 degrees in both latitude and longitude.
Compression of file : Compressed using 'compress.exe' command of Microsoft Windows.

< About CD-ROM >

Click the "About CD-ROM" button to open ReadmeE.txt file.

< Close >

Click the "Close" button to close start menu window.

< File list box >

You can open document files from a file list box on the start menu window. Choose a file and click the "Open" button or double click the file name.

For further information, please contact the following address:

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