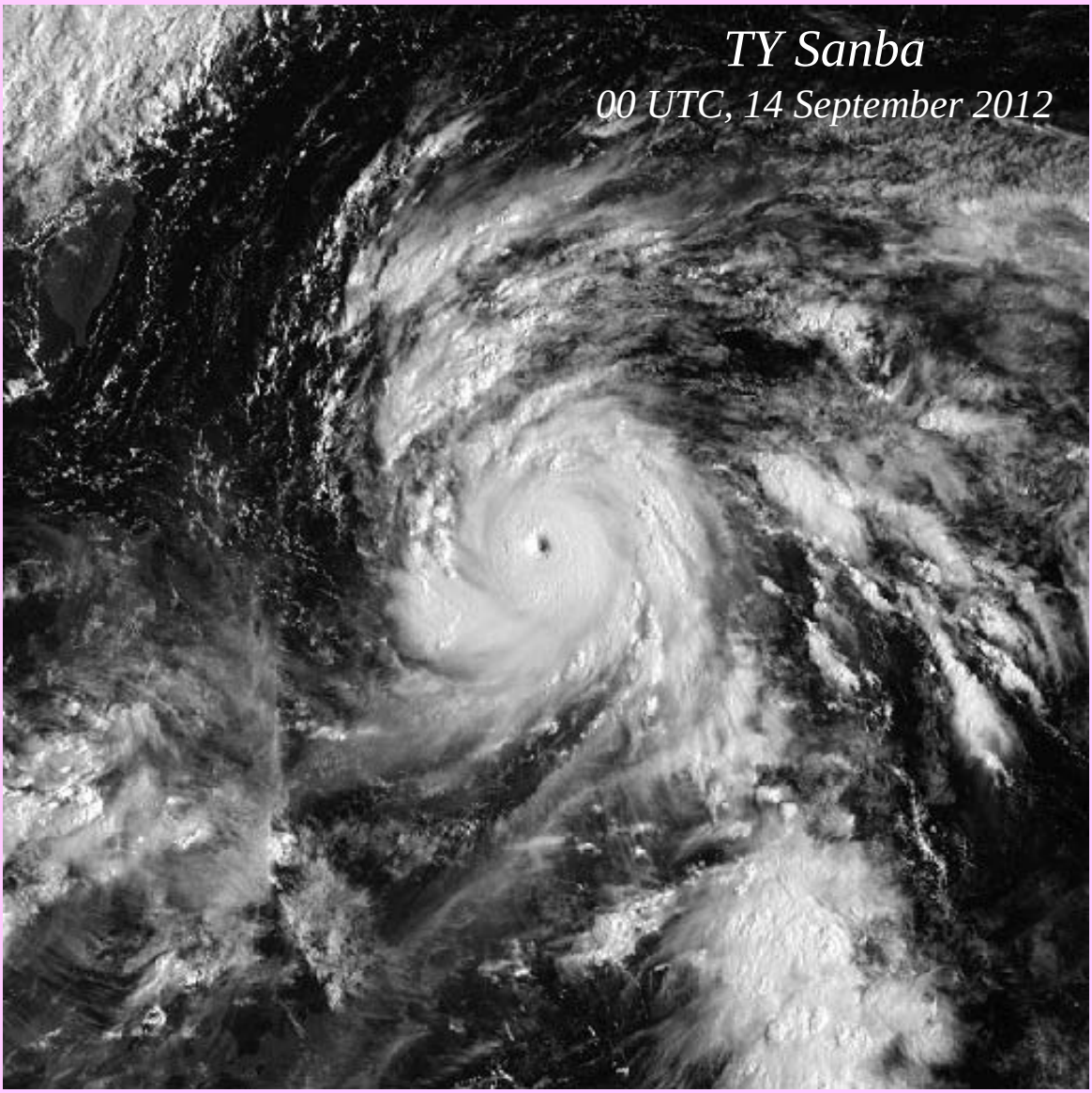
Annual Report on the Activities of the RSMC Tokyo - Typhoon Center 2012



Japan Meteorological Agency

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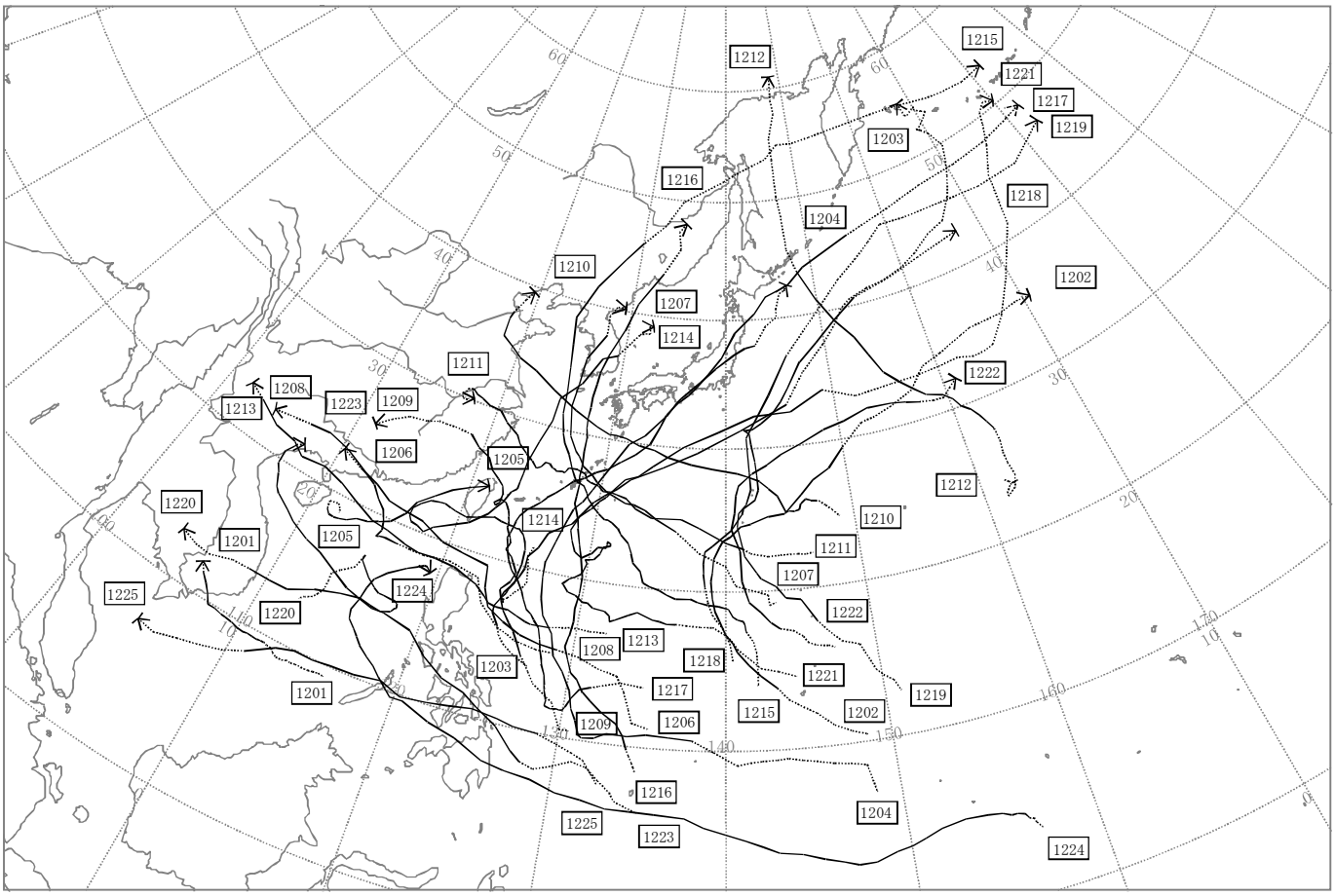

Japan Meteorological Agency

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Introduction

The RSMC Tokyo - Typhoon Center (referred to here as *the Center*) is a Regional Specialized Meteorological Centre (RSMC) that carries out specialized activities in analysis, tracking and forecasting of western North Pacific tropical cyclones (TCs) 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 a designation by the WMO Executive Council at its 40th session (Geneva, June 1988).

The Center conducts the following operations on a routine basis:

(1) Preparation of information on the formation, movement and development of TCs and associated meteorological phenomena
(2) Preparation of information on synoptic-scale atmospheric situations that affect the behavior of TCs
(3) Provision of the above information to National Meteorological Services (NMSs), and in particular to ESCAP/WMO Typhoon Committee Members, in appropriate formats for operational processing

In addition to the routine services outlined above, the Center distributes a series of reports entitled *Annual Report on the Activities of the RSMC Tokyo - Typhoon Center* as operational references for the NMSs concerned. The reports summarize the activities of the Center and review the TCs of the preceding year.

In this issue covering 2012, Chapter 1 outlines routine operations performed at the Center and its operational products, while Chapter 2 reports on its major activities in 2012. Chapter 3 describes atmospheric and oceanic conditions in the tropics and notes the highlights of TC activity in 2012. In Chapter 4, verification statistics relating to operational forecasts and the results of the Center's numerical weather prediction (NWP) models are presented. Best track data for 2012 TCs are shown in table and chart form in the appendices. All relevant text, tables, charts and appendices are included on the DVD provided with this report.

The DVD contains hourly cloud images of all 2012 TCs of TS intensity or higher within the Center's area of responsibility. Also included is the necessary viewer software, which features various functions for analyzing satellite imagery (such as image animations) and facilitates efficient post-analysis of TCs and their environments. A setup program and a user manual for the software are included on the DVD. Appendix 8 gives an outline of the DVD and instructions on using the software.

Chapter 1

Operations at the RSMC Tokyo - Typhoon Center in 2012

The Center's area of responsibility covers the western North Pacific and the South China Sea (0° – 60°N, 100° – 180°E) including marginal seas and adjacent land areas (Figure 1.1). The Center carries out analysis and forecasting in relation to tropical cyclones (TCs) in the area and also provides the relevant National Meteorological Services (NMSs) with RSMC products via the Global Telecommunication System (GTS), the Aeronautical Fixed Telecommunication Network (AFTN), the Internet and other media.

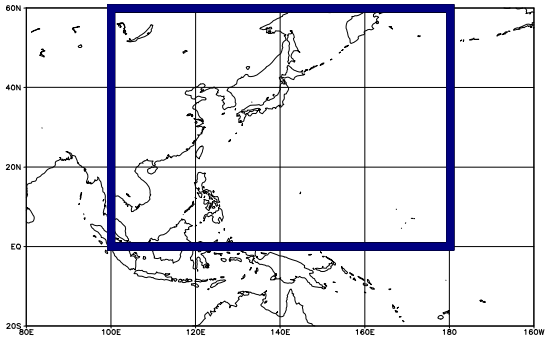


Figure 1.1
Area of responsibility of the RSMC Tokyo - Typhoon Center

1.1 Analysis

TC analysis is performed eight times a day at 00, 03, 06, 09, 12, 15, 18 and 21 UTC, and begins with determination of the TC's center position. Cloud images from the Multi-functional Transport Satellite (MTSAT) are the principal source for this determination, especially for TCs migrating over data-sparse ocean areas. Information on the TC's direction and speed of movement is extracted primarily from six-hourly displacement vectors of the center position.

The central pressure of TCs is determined mainly from the CI number, which is derived from satellite imagery using the Dvorak method. The CI number also gives the maximum sustained wind speed in the vicinity of the center. The radii of circles representing winds with speeds of more than 30 and 50 knots are determined mainly from surface observation, ASCAT observation and low-level cloud motion winds (LCW) derived from cloud motion vectors of satellite images in the vicinity of the TC.

1.2 Forecasts

As a primary basis for TC track forecasts, JMA implements NWP using the Global Spectral Model (GSM) and the Typhoon Ensemble Prediction System (TEPS). The GSM (TL959L60; upgraded on 21 November, 2007) has a horizontal resolution of approximately 20 km and 60 vertical layers, while TEPS (TL319L60; operational as of February 2008) has 11 members with a horizontal resolution of approximately 60 km and 60 vertical layers. Using mainly TEPS, JMA extended its TC track forecast up to five days ahead as of April 2009. Further details and recent model improvements are detailed in Appendix 6. In terms of TC intensity, central pressure and maximum sustained wind speeds are forecast using the results of NWP models and the Dvorak method.

A probability circle shows the range into which the center of a TC is expected to move with 70% probability at each validation time. The radius of the circle is statistically determined according to the speed of TC movement based on the results of recent TC track forecast verification.

1.3 Provision of RSMC Products

The Center prepares and distributes the RSMC bulletins listed below via the GTS and the AFTN when:

- a TC of tropical storm (TS) intensity or higher exists in the Center's area of responsibility
- a TC is expected to reach or exceed TS intensity in the area within 24 hours

RSMC products are continually issued while any TC of TS intensity or higher exists in the Center's area of responsibility. Appendix 5 denotes the code forms of the bulletins.

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

The RSMC Tropical Cyclone Advisory is issued eight times a day after observations made at 00, 03, 06, 09, 12, 15, 18 and 21 UTC, and reports the following elements in analysis, and in 24-, 48- and 72-hour forecasts for TCs:

Analysis	Center position Accuracy of center position determination Direction and speed of movement Central pressure Maximum sustained wind speed (10-minute average) Maximum gust wind speed Radii of wind areas over 50 and 30 knots
24-, 48- and 72-hour forecasts	Center position and radius of probability circle Direction and speed of movement Central pressure Maximum sustained wind speed (10-minute average) Maximum gust wind speed

(2) RSMC Tropical Cyclone Advisory for Five-day Track Forecast (WTPQ50-55 RJTD: via GTS)

The RSMC Tropical Cyclone Advisory for Five-day Track Forecast is issued four times a day after observations made at 00, 06, 12 and 18UTC, and reports the following elements in analysis and in 24-, 48-, 72-, 96- and 120-hour forecasts for TCs:

Analysis	Center position Accuracy of center position determination Direction and speed of movement Central pressure Maximum sustained wind speed (10-minute average) Maximum gust wind speed

	Radii of wind areas over 50 and 30 knots
24-, 48- and 72-hour forecasts	Center position and radius of probability circle Direction and speed of movement Central pressure Maximum sustained wind speed (10-minute average) Maximum gust wind speed
96- and 120-hour forecasts	Center position and radius of probability circle Direction and speed of movement

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

The RSMC Guidance for Forecast reports the results of predictions made by the GSM; which is run four times a day with initial analyses at 00, 06, 12 and 18 UTC. The guidance presents six-hourly GSM predictions for TCs up to 84 hours ahead and TEPS mean six-hourly predictions up to 132 hours ahead, and reports the following elements:

NWP prediction (T = 06 to 84 or 132)
- Center position
- Central pressure*
- Maximum sustained wind speed*

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

(4) SAREP (IUCC10 RJTD: via GTS)

The SAREP in BUFR format reports on the results of TC analysis including intensity information (i.e., the CI number) based on the Dvorak method. It is issued 30 minutes to an hour after observations made at 00, 03, 06, 09, 12, 15, 18 and 21 UTC, and reports the following elements:

MTSAT imagery analysis
- Center position
- Accuracy of center position determination
- Direction and speed of movement
- Mean diameter of overcast cloud
- Apparent past 24-hour change in intensity**
- Dvorak Intensity (CI, T, DT, MET, PT number) **
- Cloud pattern type of the DT number**
- Trend of past 24-hour change**
- Cloud pattern type of the PT number**
- Type of the final T-number**

*** Reported only at 00, 06, 12 and 18 UTC*

BUFR/CREX templates for translation into table-driven code forms are provided on the WMO website at http://www.wmo.int/pages/prog/www/WMOCodes.html

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

The RSMC Prognostic Reasoning report provides brief reasoning for TC forecasts, and 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, the synoptic situation of the subtropical ridge, the movement and intensity of the TC as well as relevant remarks are given in plain language.

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

The RSMC Tropical Cyclone Best Track report provides post-analysis data on TCs of TS intensity or higher. It reports the center position, the central pressure and the maximum sustained wind speed. The best track for each TC is usually finalized one and a half months after the termination of related issuance of the above RSMC bulletins.

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

As a Tropical Cyclone Advisory Centre within the framework of the International Civil Aviation Organization (ICAO), the Center provides Tropical Cyclone Advisory for SIGMET to Meteorological Watch Offices (MWOs) in order to support their preparations of SIGMET information on TCs. These advisories include the following elements in analysis and in 6-, 12-, 18- and 24-hour forecasts***:

*** *The 6- and 18-hour forecasts were added on 22 May, 2008.*

Analysis	Center position Direction and speed of movement Central pressure Maximum sustained wind speed (10-minute average)
Forecast	Center position Maximum sustained wind speed (10-minute average)

1.4 RSMC Data Serving System Upgrade to WMO Information System

As designated at the Sixteenth WMO Congress in June 2011, the Center introduced Data Collection or Production Center (DCPC) service under the Global Information System Center (GISC) Tokyo in August 2011. It provides NWP products such as data on predicted fields in grid-point-value (GPV) form and observational values through WIS Data Discovery, Access and Retrieval (DAR) via a new GISC Tokyo server (http://www.wis-jma.go.jp/). GSM products with resolution of 0.5 and 0.25 degrees (surface layer) and JMA SATAID Service (http://www.wis-jma.go.jp/cms/sataid/) are also available from the server through WIS DAR. All products available via the new server are listed in Appendix 7. In conjunction with the introduction of the DCPC service, the RSMC Data Serving System was terminated at the end of March 2012.

1.5 RSMC Tokyo - Typhoon Center Website

The RSMC Tokyo - Typhoon Center Website provides TC advisories on a real-time basis and a wide variety of products including TC analysis archives, technical reviews and annual reports on the Center's activities at http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/RSMC_HP.htm.

1.6 Numerical Typhoon Prediction Website

Since 1 October, 2004, JMA has operated the Numerical Typhoon Prediction (NTP) website (https://tynwp-web.kishou.go.jp/). The site provides TC track predictions from eight major NWP centers (BoM (Australia), CMA (China), CMC (Canada), DWD (Germany), ECMWF, KMA (Republic of Korea), NCEP (USA), UKMO (UK) and JMA) to assist the NMSs of Typhoon Committee Members in improving their TC forecasting and warning services. The site includes:

- Table/chart format TC track predictions from the participating NWP centers with several useful functions such as ensemble mean derivation from any combination of predictions
- Weather charts from NWP models of the participating NWP centers (up to 72 hours ahead)
- Results of JMA's operational TC analysis conducted using satellite images (conventional Dvorak analysis and Early-stage Dvorak analysis)
- Storm surge distribution maps for the Typhoon Committee region
- Time series charts of storm surges and tides

Chapter 2

Major Activities of the RSMC Tokyo - Typhoon Center in 2012

2.1 Provision of RSMC Products

The Center provides operational products for tropical cyclone (TC) forecasting to NMSs via the GTS, the AFTN and other networks. Monthly and annual totals of products issued in 2012 are listed in Table 2.1.

Table 2.1 Monthly and annual totals of products issued by the RSMC Tokyo - Typhoon Center in 2012

Product	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
IUCC10	0	13	26	9	52	161	96	214	140	197	44	97	1049
WTPQ20-25	0	26	30	9	57	190	154	361	224	292	56	102	1501
WTPQ30-35	0	7	7	2	4	46	38	91	51	75	14	26	361
WTPQ50-55	0	0	8	0	16	53	37	99	65	74	17	39	408
FXPQ20-25	0	26	29	8	56	184	152	354	220	286	56	100	1471
FKPQ30-35	0	13	15	4	28	93	76	177	111	143	28	50	738
AXPQ20	1	0	0	1	0	1	4	4	5	5	2	1	24

Notes:

IUCC10 RJTD	SAREP (BUFR format)
WTPQ20-25 RJTD	RSMC Tropical Cyclone Advisory
WTPQ30-35 RJTD	RSMC Prognostic Reasoning
WTPQ50-55 RJTD	RSMC Tropical Cyclone Advisory for Five-day Track Forecast
FXPQ20-25 RJTD	RSMC Guidance for Forecast
FKPQ30-35 RJTD	Tropical Cyclone Advisory for SIGMET
AXPQ20 RJTD	RSMC Tropical Cyclone Best Track

2.2 Publications

In March 2012, the 14th issue of the *RSMC Technical Review* was issued with the following areas of focus:

1. The Inactive Typhoon Season of 2010
2. JMA's Storm Surge Prediction for the WMO Storm Surge Watch Scheme (SSWS)

In December 2012, the Center published the *Annual Report on the Activities of the RSMC Tokyo - Typhoon Center in 2011*. Both publications are available on the website.

2.3 Monitoring of Observational Data Availability

The Center carried out regular monitoring of information exchanges for enhanced TC observation in accordance with the standard procedures stipulated in Section 6.2, Chapter 6 of *The Typhoon Committee Operational Manual (TOM) - Meteorological Component (WMO/TD-No. 196)*. Monitoring for the period from 1 November, 2010, to 31 October, 2012, was conducted for two tropical cyclones:

1. STS Vicente (1208), from 00 UTC on 23 July to 17 UTC on 24 July, 2012
2. TY Bolaven (1215), from 00 UTC on 25 August to 29 UTC on 29 August, 2012

The results were distributed to all Typhoon Committee Members in March 2013, and are also available on the WIS GISC Tokyo server at http://www.wis-jma.go.jp/monitoring/data/monitoring/.

Chapter 3

Summary of the 2012 Typhoon Season

In 2012, 25 TCs of tropical storm (TS) intensity or higher formed over the western North Pacific and the South China Sea. This total is almost the same as the 30-year average* frequency of 25.6. Among these 25 TCs, 14 reached typhoon (TY) intensity, 8 reached severe tropical storm (STS) intensity and 3 reached TS intensity (Table 3.1).

Table 3.1 List of tropical cyclones reaching TS intensity or higher in 2012

Tropical Cyclone			Duration (UTC) (TS or higher)				Minimum Central Pressure (UTC)	lat (N)	long (E)	(hPa)	Max Wind (kt)
TS	Pakhar	(1201)	291200	Mar	- 020000	Apr	300600	9.7	111.0	998	40
STS	Sanvu	(1202)	220600	May	- 271800	May	241800	21.4	139.0	975	60
TY	Mawar	(1203)	011800	Jun	- 060600	Jun	031800	20.8	125.7	960	75
TY	Guchol	(1204)	131200	Jun	- 200000	Jun	161200	14.9	128.8	930	100
STS	Talim	(1205)	170600	Jun	- 201800	Jun	190600	20.0	115.6	985	50
TS	Doksuri	(1206)	261800	Jun	- 300000	Jun	290000	20.8	117.7	992	40
STS	Khanun	(1207)	160600	Jul	- 190000	Jul	171800	28.7	127.5	985	50
TY	Vicente	(1208)	211200	Jul	- 241800	Jul	231800	21.7	113.4	950	80
TY	Saola	(1209)	280000	Jul	- 030600	Aug	010600	23.4	123.4	960	70
TY	Damrey	(1210)	281200	Jul	- 031200	Aug	020600	33.8	122.2	965	70
TY	Haikui	(1211)	030000	Aug	- 091200	Aug	060600	27.4	125.5	965	65
STS	Kirogi	(1212)	061200	Aug	- 100600	Aug	090600	36.0	154.1	990	50
TY	Kai-tak	(1213)	130000	Aug	- 180600	Aug	161200	19.5	114.3	970	65
TY	Tembin	(1214)	190600	Aug	- 301200	Aug	201200	18.8	125.2	950	80
TY	Bolaven	(1215)	200600	Aug	- 290600	Aug	251200	24.3	130.7	910	100
TY	Sanba	(1216)	110000	Sep	- 180000	Sep	131800	17.2	129.7	900	110
TY	Jelawat	(1217)	201800	Sep	- 011200	Oct	241800	15.2	127.9	905	110
STS	Ewiniar	(1218)	241200	Sep	- 300000	Sep	260600	26.3	142.4	985	50
STS	Maliksi	(1219)	010600	Oct	- 040600	Oct	030000	24.5	140.9	985	50
STS	Gaemi	(1220)	011200	Oct	- 061200	Oct	030600	15.3	117.7	990	50
TY	Prapiroon	(1221)	071200	Oct	- 191200	Oct	111200	19.5	128.4	940	90
STS	Maria	(1222)	140600	Oct	- 190000	Oct	150000	19.3	141.7	990	50
TY	Son-tinh	(1223)	231200	Oct	- 290600	Oct	271200	17.5	108.9	945	85
TY	Bopha	(1224)	261800	Nov	- 090600	Dec	031200	7.4	128.9	930	100
TS	Wukong	(1225)	250000	Dec	- 280600	Dec	250600	10.2	127.2	1000	40

3.1 Atmospheric and Oceanographic Conditions in the Tropics

The negative anomalies of sea surface temperature (SST) that prevailed over the tropics east of 150°E from autumn 2011 to winter 2011/2012 weakened in spring 2012 and turned positive in summer of the same year. In the South China Sea, positive SST anomalies prevailed late in the year.

Convective activity over the western equatorial Pacific was enhanced from spring to autumn 2012. This contributed to a near-normal number of TC formations in the year (25 in 2012 compared to 25.6 on average*). The monthly and annual frequencies of named TCs forming since 1951 are presented in Appendix 4.

To highlight atmospheric and oceanographic conditions, charts showing monthly mean SST anomalies for the western North Pacific and the South China Sea, monthly mean streamlines at 850 hPa

and 200 hPa and OLR for the months from January to December are included on the DVD provided with this report.

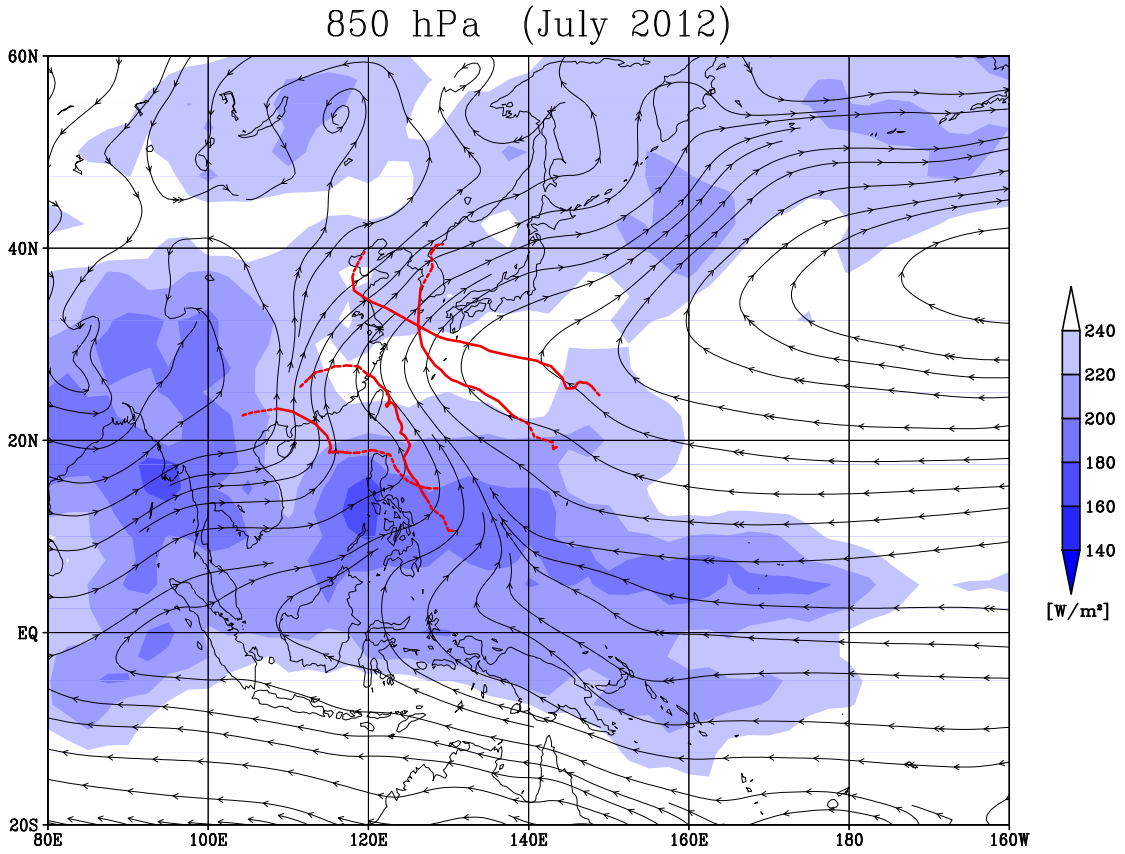


Figure 3.1 Monthly mean streamlines at 850 hPa (lines with arrows) and areas with OLR values of less than 240 W/m^2 (shaded) for July 2012. The tracks of the four named TCs that formed in July are superimposed onto the figure.

3.2 Tropical Cyclones in 2012

A total of 25 named TCs formed over the western North Pacific and the South China Sea in 2012. Monthly and 30-year average* TC formation numbers are shown in Figure 3.2, and tracks of the 25 TCs are shown in Figure 3.3. Figure 3.4 shows the genesis points of the 25 TCs (dots) and related frequency distribution for past years (1951 – 2011). The mean genesis point of named TCs forming in 2012 was at 16.2˚N and 133.7˚E, showing a westward deviation from the 30-year average* (16.2˚N and 137.4˚E).

The 2012 TC season began with the formation of Pakhar (1201) late in March, which formed over the South China Sea and hit Viet Nam. Nine named TCs hit the continent from June to August and three from September to October. The total of named TCs which hit the continent was 13 during the season. From November to December, two named TCs formed and caused damage in the Philippines. Detailed descriptions of each TC forming in 2012 are included on the DVD provided with this report.

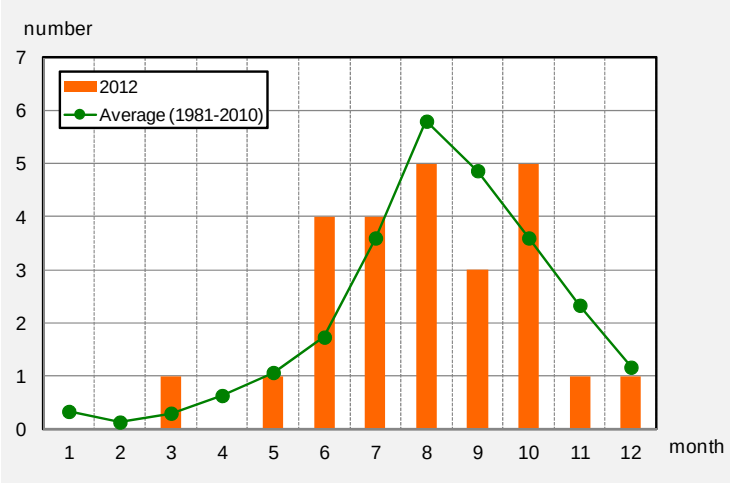


Figure 3.2 Monthly TC formation numbers for 2012 compared to the 30-year average*

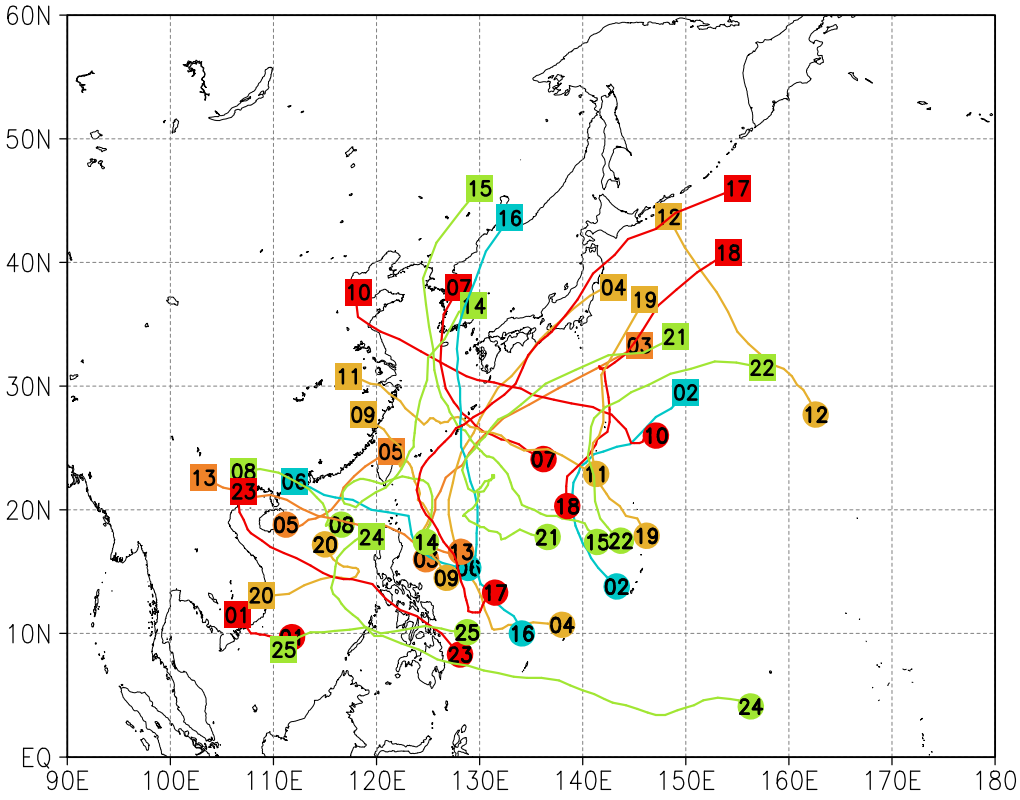


Figure 3.3 Tracks of the 25 named TCs forming in 2012. TC tracks for those with an intensity of TS or higher are shown.

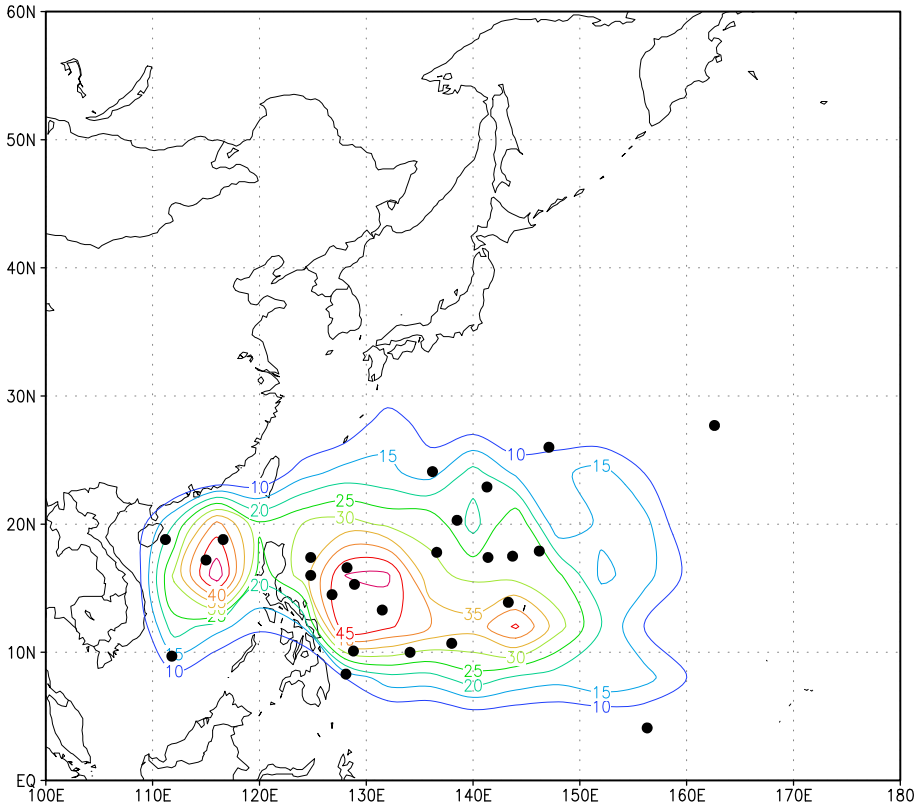


Figure 3.4 Genesis points of the 25 TCs forming in 2012 (dots) and related frequency distribution for 1951 – 2011 (lines)

* *The 30-year average is for the period from 1981 to 2010.*

Chapter 4

Verification of Forecasts in 2012

4.1 Verification of Operational Forecasts

Operational forecasts for the 25 TCs of TS intensity or higher that formed in 2012 were verified using RSMC TC best track data. The verified elements were forecasts of the center position (up to five days ahead), central pressure and maximum sustained wind (up to three days ahead). The position and intensity errors of operational forecasts for each TC forming in 2012 are indicated in Appendix 3.

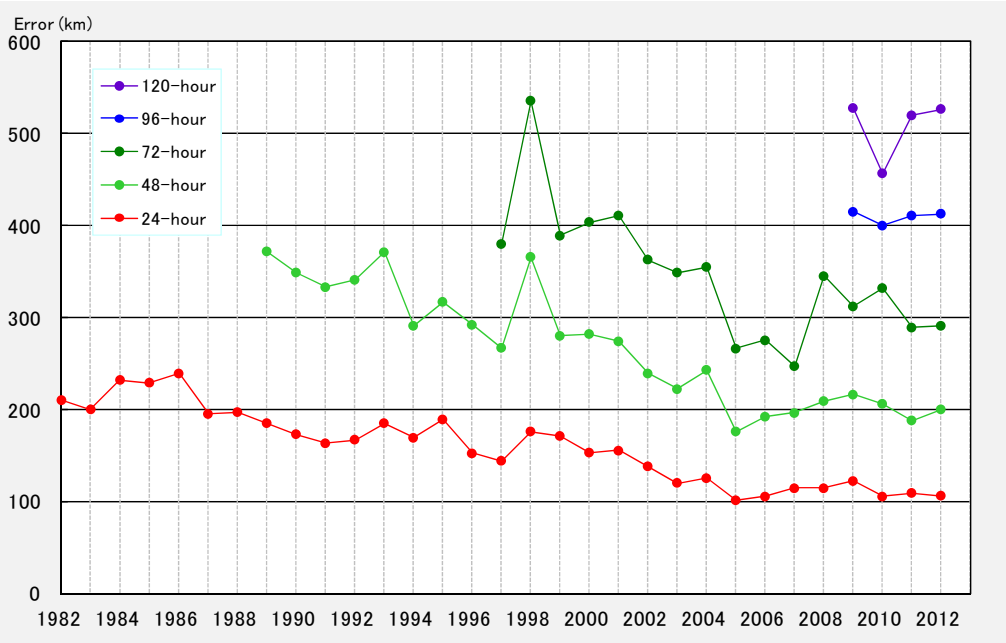


Figure 4.1 Annual mean position errors in 24-, 48-, 72-, 96- and 120-hour operational track forecasts

4.1.1 Center Position

Figure 4.1 shows annual mean errors in center position forecasts covering periods of 24 hours (since 1982), 48 hours (since 1989), 72 hours (since 1997), 96 hours and 120 hours (since 2009). The errors in 2012 were 106, 200, 291, 413 and 527 km for 24-, 48-, 72-, 96- and 120-hour forecasts, respectively.

The details of errors for each TC forming in 2012 are summarized in Table 4.1. The forecasts for Kai-tak (1213), which moved west-northwestward across the South China Sea, were characterized by large errors. The 96- and 120-hour forecasts for Guchol (1204) and Jelawat (1217), which recurved around Japan, also showed large errors, while forecasts for Saola (1209), Haikui (1211), Sanba (1216) and Ewiniar (1218) exhibited relatively small errors.

The position errors were also compared with those determined using the persistency (PER) method*. The ratios of EO (i.e., the position errors of operational forecasts) to EP (the position errors of PER method forecasts) as percentages are also shown in Table 4.1. An EO/EP value smaller/greater than 100% indicates that the operational forecast was better/worse than the PER method forecast. The annual mean EO/EP ratios

for 24-, 48-, 72-, 96- and 120-hour forecasts in 2012 were 44% (46% in 2011), 38% (37%), 36% (36%), 38% (38%) and 43% (39%), respectively. Figure 4.2 shows a histogram of 24-hour forecast position errors. About 78% (78% in 2011) of 24-hour forecasts, 82% (89%) of 48-hour forecasts, 82% (83%) of 72-hour forecasts, 72% (69%) of 96-hour forecasts and 75% (69%) of 120-hour forecasts had errors of less than 150, 300, 450, 500 and 600 km, respectively.

** The PER method is based on the assumption that a TC holds the same movement throughout the forecast period, and linear extrapolation for the latest 12-hour track of the TC is applied to create TC track forecasts. Position errors with the PER method are used to evaluate the relative performance of operational forecasts and model predictions.*

Table 4.1 Mean position errors of 24-, 48-, 72-, 96- and 120-hour operational forecasts for each TC forming in 2012. S.D., EO, EP, and EO/EP represent the standard deviation of operational forecast position error, the operational forecast position error, the position error with the PER method and the ratio of EO to EP, respectively.

Tropical Cyclone			24-hour Forecast				48-hour Forecast				72-hour Forecast				96-hour Forecast				120-hour 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 (%)	Mean (km)	S.D. (km)	Num	EO/EP (%)	Mean (km)	S.D. (km)	Num	EO/EP (%)
TS	Pakhar	(1201)	47	22	10	51	98	32	6	74	160	13	2	-	-	-	0	-	-	-	0	-
STS	Sanvu	(1202)	94	39	18	47	153	55	14	27	230	58	10	23	288	86	6	18	541	1	2	-
TY	Mawar	(1203)	105	94	14	41	229	178	10	38	383	180	6	32	827	66	2	-	-	-	0	-
TY	Guchol	(1204)	100	73	22	28	189	126	18	22	380	230	14	31	647	416	10	33	980	393	6	31
STS	Talim	(1205)	106	40	10	39	86	25	5	12	-	-	0	-	-	-	0	-	-	-	0	-
TS	Doksuri	(1206)	177	52	9	66	312	76	5	53	467	0	1	-	-	-	0	-	-	-	0	-
STS	Khanun	(1207)	125	28	7	34	155	78	3	23	-	-	0	-	-	-	0	-	-	-	0	-
TY	Vicente	(1208)	205	52	9	48	295	34	5	39	257	0	1	-	-	-	0	-	-	-	0	-
TY	Saola	(1209)	77	32	21	42	117	65	17	33	143	72	13	28	188	119	9	22	370	101	5	89
TY	Damrey	(1210)	114	53	20	42	228	85	16	35	317	123	12	27	611	90	8	29	872	31	4	43
TY	Haikui	(1211)	83	45	22	41	143	61	18	32	129	40	14	19	176	42	10	15	388	101	6	23
STS	Kirogi	(1212)	91	30	5	24	371	0	1	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Kai-tak	(1213)	163	86	17	84	371	121	13	85	662	77	9	79	998	60	5	67	1109	0	1	-
TY	Tembin	(1214)	74	42	41	33	129	104	37	25	218	195	33	25	304	202	29	25	480	302	25	35
TY	Bolaven	(1215)	91	43	32	49	169	92	28	39	236	134	24	38	356	160	20	46	383	156	16	31
TY	Sanba	(1216)	107	83	24	51	170	97	20	34	205	94	16	32	283	134	12	27	377	158	8	23
TY	Jelawat	(1217)	78	39	39	35	180	99	35	34	347	255	31	42	625	569	27	60	850	890	23	67
STS	Ewiniar	(1218)	110	47	18	27	157	86	14	20	195	99	10	28	180	77	6	20	202	73	2	-
STS	Maliksi	(1219)	110	43	8	24	459	120	4	51	-	-	0	-	-	-	0	-	-	-	0	-
STS	Gaemi	(1220)	125	59	16	54	182	61	12	31	196	61	8	20	240	63	4	29	-	-	0	-
TY	Prapiroon	(1221)	104	75	44	47	227	225	40	46	338	362	36	49	384	392	32	53	413	354	28	51
STS	Maria	(1222)	191	80	15	53	499	159	10	49	542	238	6	26	1038	479	2	23	-	-	0	-
TY	Son-tinh	(1223)	98	51	19	46	170	76	15	39	289	145	10	46	231	78	4	34	370	50	2	65
TY	Bopha	(1224)	114	44	46	65	230	92	42	55	328	156	38	46	414	196	34	41	470	184	30	41
TS	Wukong	(1225)	132	57	9	63	232	55	5	69	200	0	1	-	-	-	0	-	-	-	0	-
Annual Mean (Total)			106	64	495	44	200	140	393	38	291	224	295	36	413	348	220	38	527	455	158	43

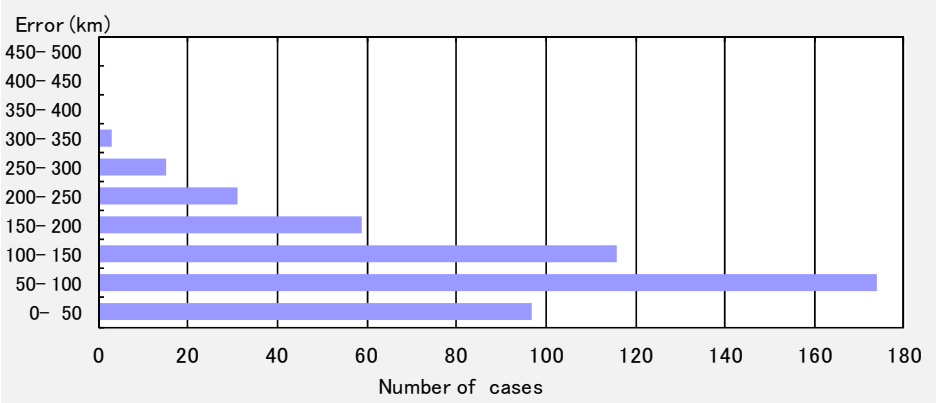


Figure 4.2 Histogram of 24-hour forecast position errors in 2012
(Histograms for 48-, 72-, 96- and 120-hour forecasts are included on the DVD provided with this report).

Table 4.2 presents the mean hitting ratios and radii of 70% probability circles* provided in operational forecasts for each TC forming in 2012. The term *hitting ratio* here is used to describe the ratio of forecasts of 70% probability circles within which the actual TC center fell. The annual mean radius of circles provided in 24-hour position forecasts was 142 km (142 km in 2011), and their hitting ratio was 76% (75%). The corresponding values for 48-hour forecasts were 250 km (247 km in 2011) and 71% (75%), those for 72-hour forecasts were 355 km (367 km in 2011) and 75% (71%), those for 96-hour forecasts were 501 km (508 km in 2011) and 72% (71%), and those for 120-hour forecasts were 647 km (651 km in 2011) and 75% (75%).

Table 4.2 Mean hitting ratios (%) and radii (km) of 70% probability circles provided in 24-, 48-, 72-, 96- and 120-hour operational forecasts for each TC forming in 2012

Tropical Cyclone			24-hour Forecast			48-hour Forecast			72-hour Forecast			96-hour Forecast			120-hour Forecast		
			Ratio (%)	Num.	Radius (km)	Ratio (%)	Num.	Radius (km)	Ratio (%)	Num.	Radius (km)	Ratio (%)	Num.	Radius (km)	Ratio (%)	Num.	Radius (km)
TS	Pakhar	(1201)	100	10	130	100	6	204	100	2	296	-	0	-	-	0	-
STS	Sanvu	(1202)	94	18	148	93	14	279	100	10	413	100	6	540	100	2	880
TY	Mawar	(1203)	71	14	157	80	10	322	67	6	444	0	2	648	-	0	-
TY	Guchol	(1204)	64	22	143	72	18	273	57	14	397	50	10	519	33	6	695
STS	Talim	(1205)	90	10	170	100	5	333	-	0	-	-	0	-	-	0	-
TS	Doksuri	(1206)	11	9	137	20	5	237	0	1	296	-	0	-	-	0	-
STS	Khanun	(1207)	71	7	139	100	3	259	-	0	-	-	0	-	-	0	-
TY	Vicente	(1208)	11	9	131	0	5	204	100	1	296	-	0	-	-	0	-
TY	Saola	(1209)	90	21	130	82	17	204	100	13	296	100	9	519	100	5	695
TY	Damrey	(1210)	70	20	136	63	16	245	75	12	373	63	8	583	25	4	833
TY	Haikui	(1211)	82	22	132	83	18	210	100	14	296	100	10	452	100	6	543
STS	Kirogi	(1212)	100	5	139	0	1	259	-	0	-	-	0	-	-	0	-
TY	Kai-tak	(1213)	35	17	138	15	13	246	0	9	358	0	5	544	0	1	695
TY	Tembin	(1214)	93	41	148	92	37	261	88	33	366	76	29	518	84	25	689
TY	Bolaven	(1215)	78	32	135	64	28	228	58	24	332	80	20	496	100	16	695
TY	Sanba	(1216)	83	24	139	85	20	240	100	16	368	83	12	463	75	8	556
TY	Jelawat	(1217)	97	39	153	77	35	278	68	31	378	67	27	638	65	23	829
STS	Ewiniar	(1218)	83	18	156	100	14	310	100	10	419	100	6	648	100	2	833
STS	Maliksi	(1219)	75	8	155	0	4	282	-	0	-	-	0	-	-	0	-
STS	Gaemi	(1220)	56	16	147	92	12	242	100	8	366	100	4	444	-	0	-
TY	Prapiroon	(1221)	75	44	137	80	40	241	81	36	345	81	32	440	79	28	550
STS	Maria	(1222)	40	15	154	0	10	309	33	6	426	0	2	482	-	0	-
TY	Son-tinh	(1223)	84	19	141	93	15	252	80	10	370	100	4	444	100	2	556
TY	Bopha	(1224)	74	46	134	45	42	220	55	38	306	50	34	405	60	30	516
TS	Wukong	(1225)	56	9	141	40	5	226	100	1	389	-	0	-	-	0	-
Annual Mean (Total)			76	495	142	71	393	250	75	295	355	72	220	501	75	158	647

* Probability circle: a circular range in which a TC is expected to be located with a probability of 70% at each forecast time

4.1.2 Central Pressure and Maximum Wind Speed

Table 4.3 gives the root mean square errors (RMSEs) of 24-, 48- and 72-hour operational central pressure forecasts for each TC forming in 2012. RMSE data for maximum wind speed forecasts are included on the DVD provided with this report. The annual mean RMSEs of central pressure and maximum wind speed for 24-hour forecasts were 12.8 hPa (11.7 hPa in 2011) and 5.7 m/s (5.6 m/s). For 48-hour forecasts, the corresponding values were 17.5 hPa (17.8 hPa in 2011) and 7.5 m/s (8.6 m/s), while those for 72-hour forecasts were 20.2 hPa (19.2 hPa in 2011) and 9.6 m/s (9.1 m/s).

Table 4.3 Mean intensity errors of 24-, 48- and 72-hour operational central pressure forecasts for each TC forming in 2012

Tropical Cyclone			24-hour Forecast			48-hour Forecast			72-hour Forecast		
			Error (hPa)	RMSE (hPa)	Num.	Error (hPa)	RMSE (hPa)	Num.	Error (hPa)	RMSE (hPa)	Num.
TS	Pakhar	(1201)	-2.6	3.9	10	-4.7	5.2	6	-4.0	4.5	2
STS	Sanvu	(1202)	0.3	5.2	18	1.2	9.1	14	1.1	12.9	10
TY	Mawar	(1203)	-3.6	6.0	14	-1.5	7.9	10	-7.5	9.4	6
TY	Guchol	(1204)	0.5	13.1	22	-1.4	15.5	18	-2.1	19.5	14
STS	Talim	(1205)	1.3	3.1	10	-2.4	6.9	5	-	-	0
TS	Doksuri	(1206)	-1.8	3.0	9	-7.6	7.9	5	-11.0	11.0	1
STS	Khanun	(1207)	2.4	5.4	7	6.0	6.6	3	-	-	0
TY	Vicente	(1208)	4.4	9.1	9	9.0	16.6	5	-10.0	10.0	1
TY	Saola	(1209)	-9.9	14.2	21	-18.2	23.0	17	-18.8	22.7	13
TY	Damrey	(1210)	3.0	5.8	20	5.4	9.1	16	6.3	9.9	12
TY	Haikui	(1211)	-1.2	5.8	22	-4.4	10.1	18	-0.3	3.4	14
STS	Kirogi	(1212)	7.6	7.8	5	6.0	6.0	1	-	-	0
TY	Kai-tak	(1213)	3.4	7.2	17	7.8	10.3	13	17.4	19.3	9
TY	Tembin	(1214)	-1.2	15.8	41	0.5	17.7	37	2.6	15.0	33
TY	Bolaven	(1215)	-8.2	19.0	32	-12.5	22.4	28	-9.6	19.1	24
TY	Sanba	(1216)	8.3	27.2	24	14.0	39.7	20	10.6	40.1	16
TY	Jelawat	(1217)	-2.3	13.1	39	-0.3	17.1	35	-0.3	22.3	31
STS	Ewiniar	(1218)	-1.6	4.4	18	-6.9	8.3	14	-12.4	13.7	10
STS	Maliksi	(1219)	-5.5	5.9	8	-7.5	8.7	4	-	-	0
STS	Gaemi	(1220)	-4.1	6.3	16	-9.0	11.1	12	-12.1	12.6	8
TY	Prapiroon	(1221)	-7.8	11.2	44	-13.3	16.7	40	-17.6	21.4	36
STS	Maria	(1222)	-2.1	8.1	15	-5.0	7.7	10	-4.7	6.8	6
TY	Son-tinh	(1223)	3.7	8.3	19	11.5	16.4	15	21.3	25.4	10
TY	Bopha	(1224)	-1.4	16.8	46	-1.8	17.0	42	2.7	21.2	38
TS	Wukong	(1225)	-2.4	3.1	9	-2.8	3.0	5	-12.0	12.0	1
Annual Mean (Total)			-1.6	12.8	495	-2.6	17.5	393	-2.3	20.2	295

Figure 4.3 shows a histogram of maximum wind speed errors for 24-hour forecasts. Approximately 62% (57% in 2011) of 24-hour forecasts had errors of less than ±3.75 m/s, with figures of ±6.25 m/s for 68% (55%) of 48-hour forecasts and ±6.25 m/s for 55% (56%) of 72-hour forecasts.

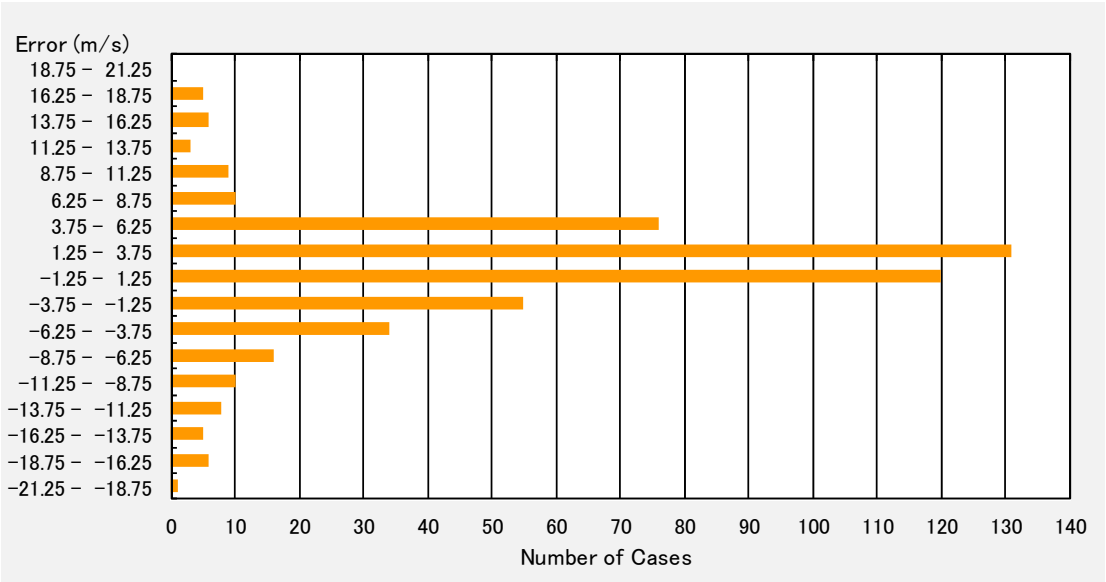


Figure 4.3 Histogram of 24-hour forecast maximum wind speed errors in 2012 (Histograms for 48-, 72-, 96- and 120-hour forecasts are included on the DVD provided with this report).

4.2 Verification of Numerical Models (GSM, TEPS)

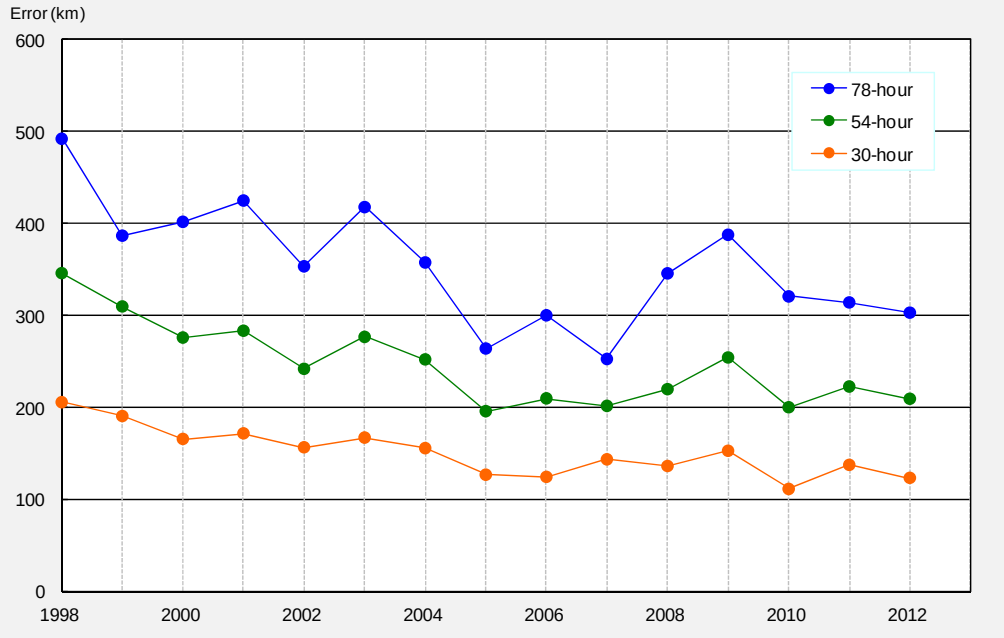


Figure 4.4 GSM annual mean position errors since 1998

The Global Spectral Model (GSM) and the Typhoon Ensemble Prediction System (TEPS) provide primary information for use by JMA forecasters in making operational TC track and intensity

forecasts. The details of GSM and TEPS and information on recent related improvements are given in Appendix 6. GSM and TEPS predictions were verified with RSMC TC best track data and predictions using the persistency (PER) method. All TC forecast verifications were conducted for both systems.

4.2.1 GSM Prediction

1) Center Position

GSM annual mean position errors observed since 1998 are presented in Figure 4.4. In 2012, the annual mean errors for 30-, 54- and 78-hour* predictions were 123 km (137 km in 2011), 209 km (223 km) and 303 km (314 km), respectively. The mean position errors of 18-, 30-, 42-, 54-, 66- and 78-hour predictions for each TC are given in Table 4.4.

** 30-, 54- and 78-hour GSM predictions are used as primary information by forecasters creating 24-, 48- and 72-hour operational forecasts, respectively.*

Table 4.4 GSM mean position errors (km) for each TC forming in 2012. The number of samples is given in parentheses.

Tropical Cyclone			T=18		T=30		T=42		T=54		T=66		T=78	
TS	Pakhar	(1201)	62.6	(16)	82.5	(12)	138.7	(11)	158.3	(10)	137.8	(7)	172.1	(6)
STS	Sanvu	(1202)	84.8	(22)	108.6	(20)	140.0	(18)	188.7	(16)	242.3	(14)	299.3	(12)
TY	Mawar	(1203)	78.2	(19)	103.2	(17)	142.9	(15)	183.5	(13)	192.6	(11)	189.7	(9)
TY	Guchol	(1204)	80.8	(29)	121.9	(27)	169.6	(25)	219.0	(23)	282.7	(21)	366.2	(19)
STS	Talim	(1205)	89.0	(14)	125.9	(12)	147.0	(10)	178.5	(8)	244.3	(5)	282.1	(3)
TS	Doksuri	(1206)	121.6	(16)	180.0	(14)	213.5	(12)	260.9	(10)	314.0	(8)	426.2	(6)
STS	Khanun	(1207)	138.1	(14)	140.9	(12)	129.7	(10)	183.2	(8)	204.7	(6)	121.9	(2)
TY	Vicente	(1208)	116.0	(16)	168.4	(14)	193.9	(12)	188.2	(10)	153.6	(8)	167.8	(6)
TY	Saola	(1209)	86.0	(26)	89.7	(24)	104.4	(22)	103.1	(20)	135.5	(18)	172.6	(16)
TY	Damrey	(1210)	105.3	(24)	143.2	(22)	188.1	(20)	249.0	(18)	270.2	(15)	273.3	(12)
TY	Haikui	(1211)	65.0	(29)	92.9	(27)	115.6	(25)	158.4	(23)	178.5	(21)	172.7	(19)
STS	Kirogi	(1212)	70.5	(6)	110.4	(4)	-	(-)	-	(-)	-	(-)	-	(-)
TY	Kai-tak	(1213)	142.2	(20)	198.9	(18)	260.6	(16)	319.4	(13)	389.4	(9)	548.0	(6)
TY	Tembin	(1214)	48.1	(44)	69.3	(42)	99.3	(39)	129.0	(37)	187.8	(35)	246.5	(32)
TY	Bolaven	(1215)	72.6	(34)	113.2	(32)	153.5	(30)	191.5	(28)	232.1	(26)	266.9	(24)
TY	Sanba	(1216)	97.6	(26)	141.7	(24)	174.7	(22)	195.1	(20)	203.3	(18)	187.1	(16)
TY	Jelawat	(1217)	70.3	(41)	108.3	(39)	160.6	(37)	222.2	(35)	305.0	(33)	394.7	(31)
STS	Ewiniar	(1218)	88.1	(22)	118.3	(20)	162.0	(18)	187.0	(16)	234.7	(14)	265.5	(12)
STS	Maliksi	(1219)	133.4	(16)	187.5	(14)	297.7	(12)	511.9	(10)	697.2	(8)	989.2	(6)
STS	Gaemi	(1220)	99.1	(25)	120.9	(23)	125.4	(21)	130.4	(19)	160.7	(17)	203.3	(15)
TY	Prapiroon	(1221)	83.0	(55)	119.8	(53)	180.6	(51)	249.0	(49)	306.2	(47)	353.2	(45)
STS	Maria	(1222)	106.8	(18)	189.5	(14)	297.9	(12)	443.0	(10)	475.3	(8)	428.9	(6)
TY	Son-tinh	(1223)	83.3	(26)	111.0	(23)	120.0	(21)	166.2	(19)	192.4	(14)	228.4	(12)
TY	Bopha	(1224)	84.2	(51)	122.8	(49)	172.2	(47)	226.9	(45)	286.9	(43)	350.2	(41)
TS	Wukong	(1225)	157.7	(14)	200.1	(10)	196.8	(6)	223.8	(4)	443.9	(1)	-	(-)
Annual Mean (Total)			88.8	(623)	123.0	(566)	162.4	(512)	209.2	(464)	255.4	(407)	302.8	(356)

Table 4.5 shows relative GSM performance compared with results obtained using the PER method. In this comparison, TCs were classified into the three life stages of before, during and after recurvature. The definition of the stages is based on the direction of movement of each TC at individual prediction times. The table indicates that GSM results outperformed those of the PER method throughout the forecast period beyond 18 hours from the initial time, and that the ratios of error reduction for the GSM compared to the PER method were about 46% (42% in 2011), 57% (52%), 63% (61%) and 64% (64%) for 18-, 30-, 54- and 78-hour predictions, respectively.

About 70% (71% in 2011) of 30-hour predictions had errors of less than 150 km, while 81% (79%) of 54-hour predictions had errors of less than 300 km, and 82% (80%) of 78-hour predictions had errors of less than 450 km. Histograms showing the position errors of 30-, 54- and 78-hour predictions are included on the DVD provided with this report.

Table 4.5 Mean position errors (km) of GSM and PER method predictions for the 25 TCs forming in 2012 in the stages before, during and after recurvature. The number of samples is given in parentheses. IMPROV is the ratio of error reductions in GSM results to those observed using the PER method.

TIME	MODEL	Before	During	After	All
T=18	GSM	97.4 (318)	77.4 (153)	82.1 (152)	88.8 (623)
	PER	151.2 (318)	155.5 (153)	203.9 (152)	165.1 (623)
	IMPROV	35.5 %	50.2 %	59.7 %	46.2 %
T=30	GSM	128.9 (281)	111.1 (135)	122.8 (150)	123.0 (566)
	PER	261.1 (281)	257.6 (135)	366.1 (150)	288.1 (566)
	IMPROV	50.6 %	56.9 %	66.5 %	57.3 %
T=42	GSM	159.5 (247)	151.4 (121)	176.7 (144)	162.4 (512)
	PER	374.3 (247)	365.2 (121)	552.9 (144)	422.4 (512)
	IMPROV	57.4 %	58.5 %	68.0 %	61.5 %
T=54	GSM	194.1 (216)	196.7 (113)	243.6 (135)	209.2 (464)
	PER	483.0 (216)	489.1 (113)	741.3 (135)	559.6 (464)
	IMPROV	59.8 %	59.8 %	67.1 %	62.6 %
T=66	GSM	228.9 (184)	214.1 (97)	325.9 (126)	255.4 (407)
	PER	588.0 (184)	628.7 (97)	912.5 (126)	698.2 (407)
	IMPROV	61.1 %	65.9 %	64.3 %	63.4 %
T=78	GSM	261.2 (162)	247.6 (80)	400.8 (114)	302.8 (356)
	PER	707.7 (162)	707.8 (80)	1114.2 (114)	837.9 (356)
	IMPROV	63.1 %	65.0 %	64.0 %	63.9 %

2) Central Pressure and Maximum Wind Speed

The mean errors of 30-, 54- and 78-hour GSM central pressure predictions in 2012 were +10.3 hPa (+4.4 hPa in 2011), +11.5 hPa (+3.0 hPa) and +13.8 hPa (+1.5 hPa), respectively. Their root mean square errors (RMSEs) were 19.7 hPa (16.1 hPa in 2011) for 30-hour predictions, 22.2 hPa (19.7 hPa) for 54-hour predictions and 26.1 hPa (23.9 hPa) for 78-hour predictions. The biases for 30-, 54- and 78-hour maximum wind speed predictions were -6.4 m/s (-5.4 m/s in 2011) with a RMSE of 9.7 m/s (9.2 m/s), -6.3 m/s (-4.2 m/s) with a RMSE of 10.9 m/s (10.5 m/s) and -6.9 m/s (-3.3 m/s) with a RMSE of 12.8 m/s (11.9 m/s), respectively.

Figure 4.5 shows histograms of central pressure errors and maximum wind speed errors in 30-hour GSM predictions. It can be seen that the GSM has a small positive bias for central pressure prediction (left) and tends to underestimate the wind speed of TCs (right). This underestimation occurs because the model's current horizontal resolution (about 20 km) is not fine enough to produce the TC core structure, especially when the TC is intense and small.

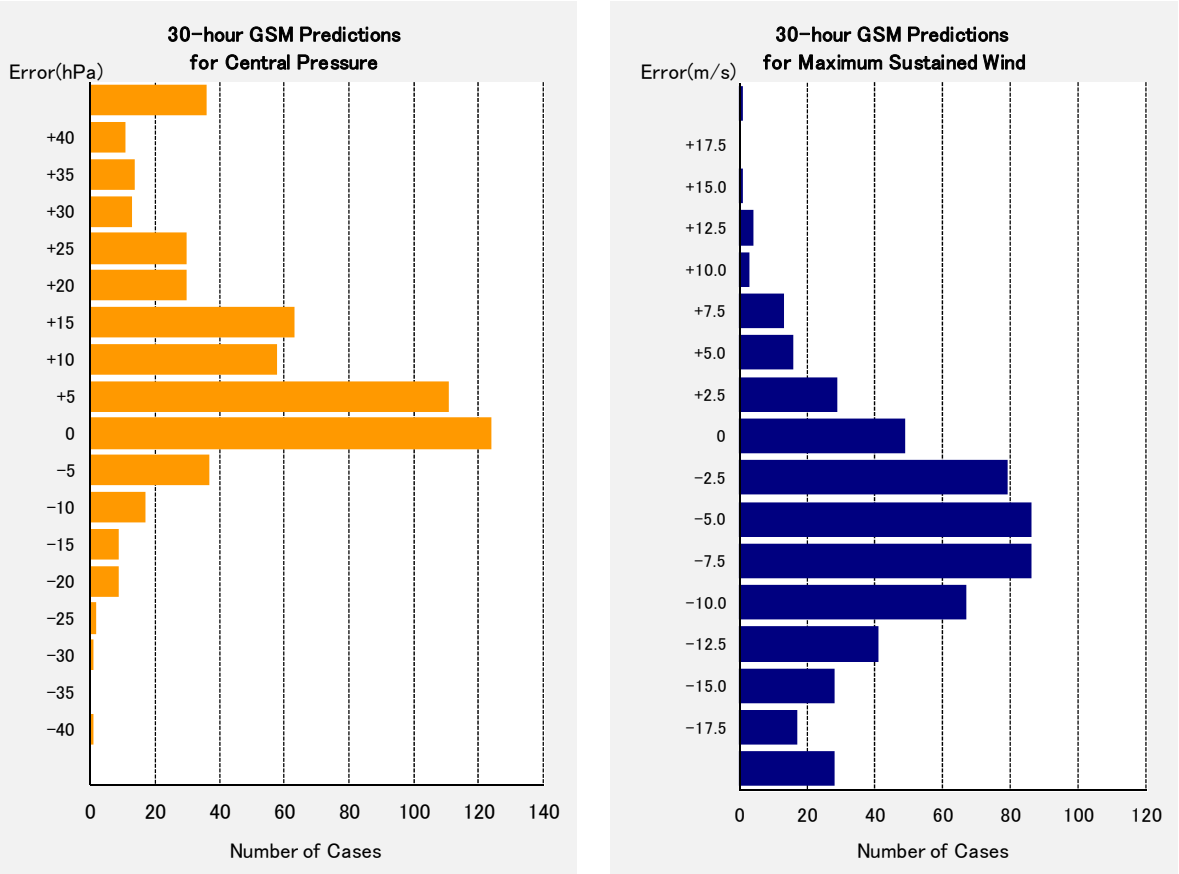


Figure 4.5 Error distribution of GSM 30-hour intensity predictions in 2012.
The figure on the left shows error distribution for central pressure, while the one on the right shows that for maximum wind speed (the error distributions of 54- and 78-hour predictions are included on the DVD provided with this report).

4.2.2 TEPS Prediction

1) Ensemble mean center position

The mean position errors of TEPS ensemble mean forecasts for 30-, 54-, 78-, 102- and 126-hour predictions for each TC are given in Table 4.6. The annual means of ensemble mean position errors for 30-, 54-, 78-, 102- and 126-hour predictions were 136 km (123 km with the GSM), 228 km (209 km), 322 km (303 km), 408 km and 492 km, respectively.

Table 4.6 Mean position errors (km) of TEPS ensemble mean forecasts for each TC forming in 2012. The number of samples is given in parentheses.

Tropical Cyclone			T=30		T=54		T=78		T=102		T=126	
TS	Pakhar	(1201)	108.8	(13)	130.7	(9)	224.4	(5)	391.7	(1)	-	(-)
STS	Sanvu	(1202)	120.9	(19)	197.9	(15)	313.2	(11)	573.1	(7)	706.2	(3)
TY	Mawar	(1203)	134.9	(17)	231.6	(13)	254.4	(9)	303.4	(5)	712.8	(1)
TY	Guchol	(1204)	146.7	(27)	256.2	(23)	357.7	(19)	453.2	(15)	511.8	(11)
STS	Talim	(1205)	124.2	(12)	246.3	(8)	434.3	(4)	-	(-)	-	(-)
TS	Doksuri	(1206)	239.3	(14)	390.7	(10)	592.2	(6)	-	(-)	-	(-)
STS	Khanun	(1207)	130.6	(12)	217.2	(6)	-	(-)	-	(-)	-	(-)
TY	Vicente	(1208)	194.6	(14)	203.8	(10)	191.2	(6)	252.3	(1)	-	(-)
TY	Saola	(1209)	111.3	(24)	107.5	(20)	143.3	(16)	183.4	(12)	171.9	(8)
TY	Damrey	(1210)	128.1	(21)	257.3	(16)	379.9	(9)	619.8	(5)	783.3	(1)
TY	Haikui	(1211)	79.6	(27)	165.0	(23)	184.5	(19)	199.4	(15)	463.9	(11)
STS	Kirogi	(1212)	157.0	(3)	-	(-)	-	(-)	-	(-)	-	(-)
TY	Kai-tak	(1213)	247.8	(18)	441.0	(13)	731.3	(5)	-	(-)	-	(-)
TY	Tembin	(1214)	72.0	(44)	121.2	(40)	188.7	(31)	327.2	(19)	491.6	(10)
TY	Bolaven	(1215)	135.6	(32)	238.2	(28)	329.7	(24)	396.8	(20)	425.5	(16)
TY	Sanba	(1216)	153.7	(24)	200.0	(20)	211.6	(16)	279.8	(12)	344.8	(8)
TY	Jelawat	(1217)	136.9	(39)	282.3	(35)	446.4	(31)	639.4	(27)	810.6	(23)
STS	Ewiniar	(1218)	123.5	(21)	210.9	(16)	283.2	(12)	254.3	(7)	456.5	(2)
STS	Maliksi	(1219)	197.3	(14)	437.0	(10)	820.4	(6)	1491.7	(2)	-	(-)
STS	Gaemi	(1220)	116.9	(21)	149.0	(17)	235.7	(13)	285.9	(9)	223.3	(5)
TY	Prapiroon	(1221)	114.3	(53)	237.1	(49)	354.3	(45)	423.0	(41)	469.3	(37)
STS	Maria	(1222)	241.3	(11)	437.2	(6)	517.6	(2)	-	(-)	-	(-)
TY	Son-tinh	(1223)	126.9	(21)	175.8	(14)	168.6	(7)	185.2	(4)	-	(-)
TY	Bopha	(1224)	139.6	(49)	250.2	(45)	362.0	(41)	432.2	(37)	451.7	(33)
TS	Wukong	(1225)	214.6	(10)	268.2	(1)	-	(-)	-	(-)	-	(-)
Annual Mean (Total)			136.2	(560)	228.1	(447)	321.5	(337)	407.8	(239)	492.0	(169)

2) Spread-skill relationship

Although position errors of TEPS ensemble mean forecasts were larger than those of the GSM in short-range forecasts, TEPS provides useful information on the reliability of TC track forecasts with its ensemble spread. Figure 4.6 shows the relationship between 6-hourly cumulative ensemble spreads in TC position forecasts and ensemble mean forecast position errors in 126-hour prediction. In an ideal EPS with a large number of samples, a significant position error is observed when the ensemble spread is large.

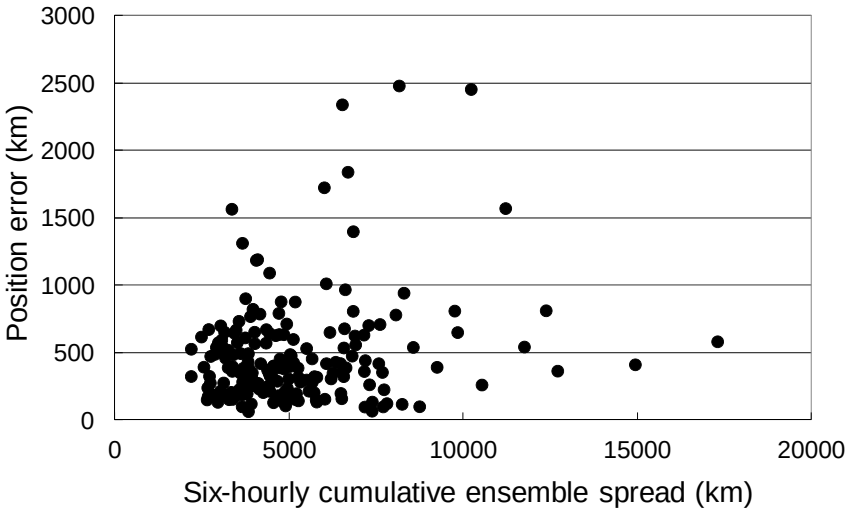


Figure 4.6 Relationship between six-hourly cumulative ensemble spread in TC position forecasts (km) and ensemble mean forecast position errors (km) in 126-hour predictions in 2012.

To add reliability information to TC track forecasts, JMA has introduced a reliability index in which the categories A, B and C represent the highest, middle and lowest levels of reliability, respectively. The index is based on the six-hourly cumulative ensemble spread at each forecast time. The category levels were set from the results of the pre-operational running of TEPS so that the category frequencies are 40%, 40% and 20%, respectively. Table 4.7 shows ensemble mean forecast errors classified with the reliability index. Theoretically, mean position errors with reliability level A should be smaller than those with levels B and C throughout the forecast times with a sufficient number of samples in an ideal EPS. These results suggest that TEPS provides appropriate reliability information on typhoon forecasts in 2012.

Table 4.7 Ensemble mean forecast position errors (km) in 2012 classified with six-hourly cumulative ensemble spread at each forecast time. The number of samples is given in parentheses.

	Reliabilty Index					
Time	A		B		C	
T=30	117.2	(197)	144.2	(320)	153.0	(70)
T=54	200.3	(159)	234.6	(251)	274.6	(57)
T=78	288.3	(165)	349.0	(157)	384.3	(34)
T=102	369.8	(142)	457.4	(99)	579.8	(21)
T=126	438.7	(108)	526.7	(65)	732.9	(13)

Appendices

RSMC Tropical Cyclone Best Track Data in 2012

Appendix 1

Pakhar (1201)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Mar. 26/00	9.5	115.7	1010	-	0.0	TD
26/06	9.5	115.4	1008	-	0.0	TD
26/12	9.5	115.1	1008	-	0.5	TD
26/18	9.4	114.8	1010	-	0.5	TD
27/00	9.4	114.5	1010	-	0.5	TD
27/06	9.4	114.3	1008	-	0.5	TD
27/12	9.4	114.0	1008	-	0.5	TD
27/18	9.4	113.7	1008	-	0.5	TD
28/00	9.4	113.4	1010	-	0.5	TD
28/06	9.3	113.1	1008	-	1.0	TD
28/12	9.3	112.8	1008	-	1.5	TD
28/18	9.4	112.5	1008	-	1.5	TD
29/00	9.6	112.3	1008	-	1.5	TD
29/06	9.7	112.0	1006	-	2.0	TD
29/12	9.7	111.8	1004	35	2.5	TS
29/18	9.7	111.6	1002	35	3.0	TS
30/00	9.7	111.3	1000	40	3.0	TS
30/06	9.7	111.0	998	40	3.0	TS
30/12	9.7	110.7	998	40	3.0	TS
30/18	9.7	110.4	998	40	3.0	TS
31/00	9.7	110.0	998	40	3.0	TS
31/06	9.8	109.5	998	40	3.0	TS
31/12	9.9	109.1	998	40	3.0	TS
31/18	9.9	108.7	998	40	3.0	TS
Apr. 01/00	10.0	108.3	998	40	3.0	TS
01/06	10.0	107.8	1000	40	3.0	TS
01/12	10.5	107.4	1002	35	3.0	TS
01/18	11.0	107.0	1004	35	2.5	TS
02/00	11.5	106.5	1006	-	2.0	TD
02/06	12.0	106.1	1008	-	-	TD
02/12					-	Dissip.

Sanvu (1202)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
May 20/18	10.5	148.5	1006	-	1.0	TD
21/00	10.9	147.7	1006	-	1.0	TD
21/06	11.4	146.7	1006	-	0.5	TD
21/12	12.2	145.6	1006	-	1.0	TD
21/18	12.7	144.8	1004	-	1.5	TD
22/00	13.2	144.0	1004	-	2.0	TD
22/06	13.9	143.3	1002	35	2.5	TS
22/12	14.6	142.3	1002	35	2.5	TS
22/18	15.4	141.5	998	40	2.5	TS
23/00	16.1	140.9	998	40	2.5	TS
23/06	16.7	140.5	996	40	2.5	TS
23/12	17.4	140.0	992	45	3.0	TS
23/18	18.1	139.7	990	45	3.0	TS
24/00	18.8	139.4	990	45	3.0	TS
24/06	19.6	139.1	985	50	3.5	STS
24/12	20.7	139.0	980	55	3.5	STS
24/18	21.4	139.0	975	60	3.5	STS
25/00	22.2	139.2	975	60	4.0	STS
25/06	23.0	139.6	975	60	4.0	STS
25/12	23.5	139.9	975	60	4.5	STS
25/18	23.9	140.4	975	60	4.5	STS
26/00	24.5	141.1	975	60	4.5	STS
26/06	24.8	142.0	975	60	4.5	STS
26/12	25.1	143.3	980	55	4.0	STS
26/18	25.4	144.6	985	50	3.5	STS
27/00	26.5	146.0	990	45	3.0	TS
27/06	27.5	147.1	992	45	3.0	TS
27/12	28.3	148.7	994	40	3.0	TS
27/18	29.5	150.0	994	-	2.5	L
28/00	31.0	152.0	1000	-	-	L
28/06	31.4	153.3	1002	-	-	L
28/12	31.8	154.9	1004	-	-	L
28/18	32.6	157.0	1008	-	-	L
29/00	34.0	158.7	1010	-	-	L
29/06	34.6	160.7	1012	-	-	L
29/12	35.2	163.0	1014	-	-	L
29/18	35.4	164.0	1016	-	-	L
30/00	35.4	167.4	1016	-	-	L
30/06	35.7	169.1	1016	-	-	L
30/12	35.5	170.6	1016	-	-	L
30/18						Dissip.

Mawar (1203)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
May 31/18	13.9	127.3	1002	-	1.0	TD
Jun. 01/00	14.3	126.3	1000	-	1.5	TD
01/06	14.9	125.5	998	-	2.0	TD
01/12	15.4	125.1	998	-	2.0	TD
01/18	16.0	124.8	996	35	2.5	TS
02/00	16.6	124.3	990	45	3.0	TS
02/06	17.1	124.3	985	50	3.5	STS
02/12	17.6	124.5	980	55	3.5	STS
02/18	18.1	124.7	980	55	4.0	STS
03/00	18.6	125.0	980	55	4.0	STS
03/06	19.3	125.4	975	60	4.0	STS
03/12	20.0	125.7	970	65	4.5	TY
03/18	20.8	125.7	960	75	5.0	TY
04/00	21.5	126.2	960	75	5.0	TY
04/06	22.6	126.7	960	75	5.0	TY
04/12	23.3	127.7	960	70	4.5	TY
04/15	23.6	128.3	965	70	-	TY
04/18	24.6	129.0	965	70	4.0	TY
04/21	25.4	129.7	970	70	-	TY
05/00	26.0	130.4	970	65	4.0	TY
05/03	26.6	131.3	970	65	-	TY
05/06	27.4	132.3	975	60	3.5	STS
05/12	28.5	134.8	975	60	3.5	STS
05/18	29.8	137.6	980	55	3.0	STS
06/00	31.4	141.3	980	55	2.5	STS
06/06	33.3	145.5	976	-	2.0	L
06/12	35.6	147.4	968	-	-	L
06/18	37.6	149.8	964	-	-	L
07/00	39.0	151.4	968	-	-	L
07/06	40.1	152.4	972	-	-	L
07/12	40.8	153.5	972	-	-	L
07/18	41.2	155.5	972	-	-	L
08/00	41.5	157.4	976	-	-	L
08/06	42.0	159.9	980	-	-	L
08/12	42.7	161.9	982	-	-	L
08/18	43.7	164.2	984	-	-	L
09/00	44.2	166.3	988	-	-	L
09/06	45.8	168.2	988	-	-	L
09/12	47.4	169.5	988	-	-	L
09/18	48.6	170.1	988	-	-	L
10/00	49.9	170.9	990	-	-	L
10/06	51.5	170.0	992	-	-	L
10/12	52.0	169.4	992	-	-	L
10/18	52.3	168.8	996	-	-	L
11/00	52.2	168.9	996	-	-	L
11/06	52.9	170.5	1000	-	-	L
11/12	53.3	171.4	1004	-	-	L
11/18	53.5	170.7	1004	-	-	L
12/00	54.0	169.8	1006	-	-	L
12/06	54.2	170.0	1006	-	-	L
12/12	53.7	168.6	1006	-	-	L
12/18	53.9	168.2	1006	-	-	L
13/00	55.1	168.2	1008	-	-	L
13/06						Dissip.

Guchol (1204)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jun. 10/12	7.2	148.6	1008	-	0.5	TD
10/18	8.8	148.2	1008	-	0.5	TD
11/00	9.0	147.3	1008	-	1.0	TD
11/06	9.1	146.4	1006	-	1.5	TD
11/12	9.3	145.5	1008	-	1.5	TD
11/18	9.4	144.6	1006	-	1.5	TD
12/00	9.6	143.7	1006	-	1.5	TD
12/06	9.5	143.0	1004	-	1.5	TD
12/12	9.5	142.2	1006	-	2.0	TD
12/18	9.4	141.5	1004	-	2.0	TD
13/00	9.3	140.7	1004	-	2.0	TD
13/06	10.0	139.3	1002	-	2.5	TD
13/12	10.7	138.0	1000	35	2.5	TS
13/18	10.8	136.6	992	45	3.0	TS
14/00	10.9	135.2	985	50	3.0	STS
14/06	10.7	134.1	985	50	3.5	STS
14/12	10.7	132.8	985	50	3.5	STS
14/18	10.4	132.2	980	55	3.5	STS
15/00	10.3	131.4	975	60	4.5	STS
15/06	10.4	131.2	975	60	4.5	STS
15/12	11.2	130.9	975	60	4.5	STS
15/18	11.9	130.5	975	60	4.5	STS
16/00	12.9	130.2	965	70	5.0	TY
16/06	14.0	129.6	950	85	6.0	TY
16/12	14.9	128.8	930	100	6.5	TY
16/18	16.2	128.4	930	100	6.5	TY
17/00	17.2	127.6	930	100	6.5	TY
17/06	18.3	127.3	930	100	6.5	TY
17/12	19.6	127.0	940	90	6.5	TY
17/18	20.8	127.0	950	85	5.5	TY
18/00	22.2	127.4	950	85	5.5	TY
18/03	23.0	127.6	950	85	-	TY
18/06	23.8	127.9	950	80	5.0	TY
18/09	24.6	128.2	950	80	-	TY
18/12	25.3	128.7	950	80	5.0	TY
18/15	26.2	129.4	950	80	-	TY
18/18	27.3	130.0	955	75	4.5	TY
18/21	28.6	130.9	955	75	-	TY
19/00	29.9	131.8	960	70	4.0	TY
19/03	30.8	133.1	960	70	-	TY
19/06	32.4	134.7	960	70	4.0	TY
19/08	33.4	135.5	960	70	-	TY
19/09	33.8	135.9	965	70	-	TY
19/11	34.7	137.0	970	65	-	TY
19/12	35.1	137.6	975	60	3.5	STS
19/15	36.2	139.0	980	55	-	STS
19/18	37.3	140.7	985	50	3.0	STS
19/21	37.9	142.0	985	50	-	STS
20/00	38.0	143.0	996	-	2.0	L
20/06	39.5	144.2	998	-	-	L
20/12	40.2	145.4	1000	-	-	L
20/18	40.9	145.4	1000	-	-	L
21/00	41.5	145.7	1004	-	-	L
21/06	42.0	146.0	1006	-	-	L
21/12	42.2	146.2	1008	-	-	L
21/18	42.3	146.4	1006	-	-	L
22/00	42.4	146.7	1008	-	-	L
22/06	42.7	146.9	1006	-	-	L
22/12						Dissip.

Talim (1205)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jun. 16/06	19.0	112.1	996	-	0.0	TD
16/12	19.2	112.1	996	-	0.0	TD
16/18	19.5	111.8	996	-	0.0	TD
17/00	19.4	111.2	996	-	0.5	TD
17/06	18.8	111.2	994	35	1.0	TS
17/12	18.6	111.5	994	35	1.0	TS
17/18	18.5	111.9	992	40	1.5	TS
18/00	18.6	112.3	992	40	2.0	TS
18/06	18.8	112.8	992	40	2.5	TS
18/12	19.2	113.4	992	40	2.5	TS
18/18	19.3	114.1	992	40	2.5	TS
19/00	19.6	114.9	990	45	3.0	TS
19/06	20.0	115.6	985	50	3.0	STS
19/12	20.8	116.4	985	50	3.0	STS
19/18	21.8	116.8	985	50	2.5	STS
20/00	22.7	117.8	990	45	2.5	TS
20/06	23.5	118.9	992	40	2.5	TS
20/12	24.2	120.2	994	35	2.5	TS
20/18	24.7	121.4	1000	-	2.0	TD
21/00						Dissip.

Doksuri (1206)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jun. 25/00	11.2	135.3	1008	-	0.5	TD
25/06	11.5	134.3	1006	-	0.5	TD
25/12	12.3	134.0	1006	-	1.0	TD
25/18	13.3	133.6	1004	-	1.0	TD
26/00	14.2	133.0	1006	-	1.5	TD
26/06	14.5	131.8	1004	-	1.5	TD
26/12	15.1	130.4	1004	-	2.0	TD
26/18	15.3	128.9	1000	35	2.0	TS
27/00	15.4	127.7	1000	35	2.5	TS
27/06	15.7	126.4	1000	35	2.5	TS
27/12	16.2	125.1	1000	35	2.5	TS
27/18	16.9	123.9	1000	35	2.5	TS
28/00	18.0	123.4	998	35	2.5	TS
28/06	19.5	123.1	994	40	2.5	TS
28/12	19.8	121.1	994	40	2.5	TS
28/18	20.0	119.5	994	40	2.5	TS
29/00	20.8	117.7	992	40	2.5	TS
29/06	21.0	116.0	992	40	2.5	TS
29/12	21.2	114.9	994	40	2.0	TS
29/18	21.8	113.6	996	35	1.5	TS
30/00	22.3	112.0	1000	-	1.5	TD
30/06	22.9	110.2	1000	-	1.0	TD
30/12						Dissip.

Khanun (1207)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jul. 14/18	19.3	143.5	1006	-	0.0	TD
15/00	19.1	143.1	1008	-	0.0	TD
15/06	19.8	143.0	1006	-	0.5	TD
15/12	20.4	140.7	1006	-	0.5	TD
15/18	21.7	140.0	1006	-	1.0	TD
16/00	22.6	138.0	1004	-	1.0	TD
16/06	24.1	136.2	1002	35	1.5	TS
16/12	24.8	134.6	1002	35	1.5	TS
16/15	25.3	133.8	1000	35	-	TS
16/18	25.6	132.8	998	40	2.0	TS
16/21	25.7	132.1	996	40	-	TS
17/00	26.1	131.1	994	40	2.5	TS
17/03	26.3	130.4	994	45	-	TS
17/06	26.8	129.6	992	45	3.0	TS
17/09	27.3	129.1	990	45	-	TS
17/12	27.8	128.3	990	45	3.0	TS
17/15	28.4	127.8	990	45	-	TS
17/18	28.7	127.5	985	50	3.5	STS
18/00	29.8	126.7	985	50	3.5	STS
18/06	31.9	126.2	990	45	3.5	TS
18/12	33.7	126.3	992	40	3.0	TS
18/18	35.8	126.5	994	35	3.0	TS
19/00	38.0	128.0	998	-	2.5	TD
19/06	39.5	127.8	1000	-	-	TD
19/12	39.8	128.1	1000	-	-	TD
19/18	40.3	128.4	1004	-	-	L
20/00	40.4	129.3	1006	-	-	L
20/06						Dissip.

Vicente (1208)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jul. 18/12	15.0	128.6	1006	-	0.0	TD
18/18	15.0	127.6	1004	-	0.0	TD
19/00	15.1	126.9	1004	-	0.5	TD
19/06	15.3	126.2	1004	-	0.5	TD
19/12	15.5	125.6	1004	-	0.0	TD
19/18	15.8	124.9	1004	-	0.0	TD
20/00	16.2	124.3	1004	-	0.5	TD
20/06	17.1	123.4	1002	-	1.5	TD
20/12	18.5	122.7	1002	-	1.5	TD
20/18	19.0	120.5	1000	-	1.5	TD
21/00	18.7	118.6	1000	-	1.5	TD
21/06	18.7	117.6	998	-	2.0	TD
21/12	18.8	116.6	996	35	2.0	TS
21/18	18.8	115.7	992	40	2.0	TS
22/00	18.8	115.3	990	45	2.5	TS
22/06	18.7	115.1	990	45	2.5	TS
22/12	18.8	115.1	990	45	2.5	TS
22/18	19.2	115.3	985	50	2.5	STS
23/00	19.7	115.2	985	50	3.0	STS
23/06	20.5	114.8	975	60	4.0	STS
23/12	21.0	114.2	965	70	4.5	TY
23/18	21.7	113.4	950	80	5.0	TY
24/00	22.3	112.1	970	60	4.0	STS
24/06	23.0	110.5	985	50	4.0	STS
24/12	23.3	108.7	990	40	3.5	TS
24/18	23.1	107.1	994	-	3.0	TD
25/00	22.9	105.5	996	-	-	TD
25/06	22.6	104.3	996	-	-	TD
25/12					-	Dissip.

Saola (1209)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jul. 26/18	10.6	130.5	1004	-	0.5	TD
27/00	10.6	130.0	1004	-	1.0	TD
27/06	12.0	129.3	1002	-	1.5	TD
27/12	12.9	127.9	1002	-	1.5	TD
27/18	13.6	127.5	1000	-	1.5	TD
28/00	14.5	126.8	1000	35	2.0	TS
28/06	15.3	126.3	996	40	2.5	TS
28/12	15.8	126.0	996	40	3.0	TS
28/18	16.2	125.5	990	45	3.0	TS
29/00	17.0	124.9	985	55	3.5	STS
29/06	17.5	124.7	985	55	3.5	STS
29/12	18.2	124.4	985	55	3.5	STS
29/18	18.9	124.9	985	55	3.5	STS
30/00	19.5	125.2	980	55	3.5	STS
30/06	20.1	124.8	980	55	3.5	STS
30/12	20.5	124.5	980	55	3.5	STS
30/18	20.8	124.0	975	60	3.5	STS
31/00	21.0	124.1	975	60	3.5	STS
31/06	21.3	124.2	970	60	3.5	STS
31/12	21.7	124.1	970	60	4.0	STS
31/15	22.0	123.9	970	60	-	STS
31/18	22.3	123.7	965	65	4.5	TY
31/21	22.4	123.7	965	65	-	TY
Aug. 01/00	22.7	123.6	965	65	5.0	TY
01/03	23.0	123.5	965	65	-	TY
01/06	23.4	123.4	960	70	5.0	TY
01/09	23.7	123.2	960	70	-	TY
01/12	23.9	123.0	960	70	5.0	TY
01/15	24.0	122.6	960	70	-	TY
01/18	23.7	122.2	965	70	4.5	TY
01/21	23.5	122.3	970	65	-	TY
02/00	23.8	122.6	975	60	4.0	STS
02/03	24.4	122.6	980	55	-	STS
02/06	25.0	122.4	980	50	3.5	STS
02/09	25.4	121.9	980	50	-	STS
02/12	25.8	121.3	985	45	3.0	TS
02/18	26.5	120.7	985	40	3.0	TS
03/00	27.0	119.7	990	35	2.5	TS
03/06	27.7	118.7	992	-	2.0	TD
03/12	27.8	117.3	992	-	-	TD
03/18	27.7	116.5	992	-	-	TD
04/00	27.7	115.8	994	-	-	TD
04/06	27.4	115.0	994	-	-	TD
04/12	27.1	113.5	996	-	-	TD
04/18	26.3	112.4	996	-	-	TD
05/00	25.5	111.4	998	-	-	TD
05/06						Dissip.

Damrey (1210)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jul. 27/06	24.7	148.8	1008	-	1.0	TD
27/12	25.2	148.3	1008	-	1.5	TD
27/18	25.6	147.9	1008	-	2.0	TD
28/00	25.9	147.4	1008	-	2.0	TD
28/06	26.0	147.2	1006	-	2.0	TD
28/12	26.0	147.1	1002	35	2.5	TS
28/18	26.0	146.8	1000	35	2.5	TS
29/00	26.1	146.4	996	40	2.5	TS
29/06	25.9	146.0	996	40	2.5	TS
29/12	25.5	145.8	996	40	2.5	TS
29/18	25.4	145.5	996	40	2.5	TS
30/00	25.4	145.0	996	40	2.5	TS
30/06	25.4	144.7	992	40	2.5	TS
30/12	26.5	144.2	990	40	2.5	TS
30/15	27.1	143.5	985	45	-	TS
30/18	27.7	142.8	975	55	2.5	STS
30/21	28.0	141.7	980	50	-	STS
31/00	28.3	141.0	980	50	2.5	STS
31/06	28.6	138.9	980	50	3.0	STS
31/12	28.9	137.2	980	50	3.0	STS
31/18	29.3	135.1	980	50	3.0	STS
31/21	29.8	134.0	975	55	-	STS
Aug. 01/00	30.0	132.7	975	55	3.0	STS
01/03	30.3	131.4	975	55	-	STS
01/06	30.4	130.5	975	55	3.5	STS
01/09	30.5	129.8	975	55	-	STS
01/12	30.8	128.7	975	55	3.5	STS
01/18	31.7	126.7	975	55	3.5	STS
02/00	32.8	124.3	970	65	4.5	TY
02/06	33.8	122.2	965	70	4.5	TY
02/12	34.4	120.4	970	65	4.5	TY
02/18	34.9	119.4	975	60	4.0	STS
03/00	35.6	118.2	992	45	3.5	TS
03/06	37.0	118.0	996	35	3.0	TS
03/12	37.6	118.2	1000	-	2.5	TD
03/18	38.8	118.9	1004	-	2.0	TD
04/00	39.6	119.5	1006	-	-	TD
04/06						Dissip.

Haikui (1211)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug. 01/12	22.4	146.5	1004	-	0.5	TD
01/18	22.4	146.0	1002	-	1.0	TD
02/00	22.4	145.4	1002	-	1.5	TD
02/06	22.4	144.0	1000	-	1.5	TD
02/12	22.4	143.2	996	-	1.5	TD
02/18	22.6	141.9	994	-	1.5	TD
03/00	22.9	141.3	992	35	2.0	TS
03/06	23.4	140.0	992	35	2.0	TS
03/12	24.4	138.0	992	35	2.0	TS
03/18	24.9	136.6	992	35	2.0	TS
04/00	24.8	134.3	990	35	2.5	TS
04/06	25.3	133.0	985	40	3.0	TS
04/09	26.0	132.1	985	40	-	TS
04/12	26.2	131.3	985	40	3.0	TS
04/15	26.3	130.7	985	40	-	TS
04/18	26.3	130.2	985	40	3.0	TS
04/21	26.6	129.8	985	45	-	TS
05/00	26.7	129.1	980	45	3.0	TS
05/03	26.9	128.8	980	45	-	TS
05/06	27.3	128.5	980	45	3.5	TS
05/09	27.5	127.9	980	45	-	TS
05/12	27.4	127.2	975	50	3.5	STS
05/15	27.1	126.9	975	50	-	STS
05/18	27.1	126.6	970	55	3.5	STS
05/21	27.0	126.2	970	55	-	STS
06/00	27.1	126.1	970	55	3.5	STS
06/03	27.2	125.8	970	55	-	STS
06/06	27.4	125.5	965	60	3.5	STS
06/09	27.4	125.2	965	60	-	STS
06/12	27.1	124.9	965	60	4.0	STS
06/18	26.9	124.6	965	60	4.0	STS
07/00	27.3	124.1	965	60	4.0	STS
07/06	27.7	123.5	965	60	4.0	STS
07/12	28.2	122.8	965	65	4.0	TY
07/18	28.8	122.3	965	65	4.0	TY
08/00	29.4	121.2	975	55	3.5	STS
08/06	30.1	120.3	980	45	3.5	TS
08/12	30.2	119.4	990	40	3.0	TS
08/18	30.5	118.6	990	35	2.5	TS
09/00	30.6	117.9	992	35	2.5	TS
09/06	30.8	117.6	992	35	2.5	TS
09/12	30.8	117.3	994	-	2.5	TD
09/18	30.7	117.0	994	-	2.0	TD
10/00	30.7	117.0	996	-	-	TD
10/06	30.2	116.9	996	-	-	TD
10/12	30.0	116.9	996	-	-	TD
10/18	29.9	117.1	998	-	-	TD
11/00	30.0	117.3	1000	-	-	TD
11/06	30.0	117.3	1000	-	-	TD
11/12						Dissip.

Kirogi (1212)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug. 03/06	24.0	161.8	1008	-	0.5	TD
03/12	23.8	162.1	1008	-	1.0	TD
03/18	23.6	162.4	1008	-	1.0	TD
04/00	23.7	162.7	1008	-	1.0	TD
04/06	23.7	162.5	1006	-	1.5	TD
04/12	23.6	162.1	1006	-	1.5	TD
04/18	23.1	161.6	1006	-	1.5	TD
05/00	22.9	161.7	1006	-	1.5	TD
05/06	23.3	162.3	1004	-	1.5	TD
05/12	24.1	162.7	1004	-	1.5	TD
05/18	25.1	162.5	1004	-	1.5	TD
06/00	25.9	162.5	1004	-	1.5	TD
06/06	26.8	162.7	1002	-	1.5	TD
06/12	27.7	162.6	998	35	1.5	TS
06/18	28.4	162.3	998	35	1.5	TS
07/00	29.0	161.9	998	35	1.5	TS
07/06	29.7	161.4	996	40	1.5	TS
07/12	30.1	160.8	996	40	1.5	TS
07/18	30.8	160.3	994	40	1.5	TS
08/00	31.4	159.5	994	40	2.0	TS
08/06	31.8	158.2	994	40	2.0	TS
08/12	32.6	157.2	994	40	2.0	TS
08/18	33.4	156.1	994	40	2.0	TS
09/00	34.4	155.0	994	40	2.0	TS
09/06	36.0	154.1	990	50	2.0	STS
09/12	37.6	153.0	992	45	2.5	TS
09/18	39.3	151.5	992	45	2.5	TS
10/00	41.2	149.9	994	45	2.5	TS
10/06	43.7	148.3	998	-	2.5	L
10/12	45.7	147.3	1000	-	-	L
10/18	48.6	147.2	998	-	-	L
11/00	50.4	146.9	998	-	-	L
11/06	53.7	146.9	998	-	-	L
11/12	55.5	146.9	994	-	-	L
11/18	57.8	148.1	994	-	-	L
12/00	59.0	147.9	992	-	-	L
12/06	61.2	148.2	992	-		Out

Kai-tak (1213)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug. 12/00	16.8	132.0	1004	-	1.0	TD
12/06	16.8	130.9	1002	-	1.0	TD
12/12	16.8	130.1	1000	-	1.5	TD
12/18	16.8	129.4	1000	-	2.0	TD
13/00	16.6	128.2	998	35	2.0	TS
13/06	16.5	127.0	998	35	2.0	TS
13/12	16.6	126.5	994	40	2.0	TS
13/18	16.8	125.9	992	40	2.5	TS
14/00	17.0	125.2	992	40	3.0	TS
14/06	17.0	124.4	992	40	3.0	TS
14/12	17.2	123.8	992	40	3.0	TS
14/18	17.5	123.4	992	40	3.0	TS
15/00	18.0	122.7	992	40	3.0	TS
15/06	18.7	120.9	990	45	3.0	TS
15/12	18.8	119.5	985	50	3.0	STS
15/18	18.8	118.2	975	60	3.5	STS
16/00	19.0	117.1	975	60	3.5	STS
16/06	19.3	115.7	975	60	3.5	STS
16/12	19.5	114.3	970	65	4.0	TY
16/18	20.1	112.7	970	65	4.0	TY
17/00	20.8	111.3	970	65	4.0	TY
17/06	21.2	109.7	975	60	3.5	STS
17/12	21.0	107.8	975	60	3.5	STS
17/18	21.5	106.8	985	50	3.0	STS
18/00	21.8	105.1	992	40	2.5	TS
18/06	22.6	103.2	996	-	2.5	TD
18/12	23.2	101.8	1000	-	-	TD
18/18						Dissip.

Tembin (1214)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug. 17/06	21.4	125.9	1008	-	0.0	TD
17/12	20.8	125.7	1008	-	0.5	TD
17/18	19.9	125.9	1008	-	0.5	TD
18/00	19.0	126.0	1008	-	0.5	TD
18/06	18.7	125.8	1006	-	1.0	TD
18/12	18.3	125.4	1006	-	1.5	TD
18/18	17.8	125.0	1006	-	2.0	TD
19/00	17.6	124.8	1004	-	2.0	TD
19/06	17.4	124.8	1000	35	2.0	TS
19/12	17.6	124.7	996	40	2.5	TS
19/18	17.7	124.6	992	45	3.0	TS
20/00	18.0	124.8	980	55	3.5	STS
20/06	18.4	124.9	965	70	4.5	TY
20/12	18.8	125.2	950	80	5.0	TY
20/18	19.5	125.3	950	80	5.0	TY
21/00	20.2	125.4	950	80	5.0	TY
21/06	21.1	125.4	950	80	5.0	TY
21/12	21.7	125.2	950	80	5.0	TY
21/18	22.1	125.0	955	75	5.0	TY
22/00	22.4	124.5	965	70	4.5	TY
22/06	22.4	124.3	965	70	4.5	TY
22/12	22.5	124.2	965	70	4.5	TY
22/18	22.5	123.9	965	70	4.5	TY
23/00	22.5	123.6	950	80	5.0	TY
23/06	22.6	123.1	950	80	5.0	TY
23/12	22.7	122.5	950	80	5.0	TY
23/18	22.4	121.3	955	75	5.0	TY
24/00	22.1	120.5	970	65	4.0	TY
24/06	22.3	119.7	970	65	4.0	TY
24/12	22.4	119.3	970	65	4.0	TY
24/18	22.5	118.7	970	65	4.0	TY
25/00	22.5	118.4	970	65	4.0	TY
25/06	22.3	117.8	970	65	4.0	TY
25/12	21.9	117.1	970	65	4.0	TY
25/18	21.4	116.7	970	65	4.0	TY
26/00	21.1	116.7	970	65	4.0	TY
26/06	20.8	116.7	965	70	4.5	TY
26/12	20.5	116.9	965	70	4.5	TY
26/18	20.4	117.4	965	70	4.5	TY
27/00	20.2	118.0	965	70	4.5	TY
27/06	20.7	118.6	965	70	4.5	TY
27/12	21.4	119.9	965	70	4.5	TY
27/18	21.8	120.9	965	70	4.5	TY
28/00	22.8	122.0	970	65	4.0	TY
28/03	23.3	122.4	970	65	-	TY
28/06	23.9	122.8	970	65	4.0	TY
28/09	24.7	123.2	970	65	-	TY
28/12	25.1	123.6	975	60	3.5	STS
28/15	25.6	123.6	975	60	-	STS
28/18	26.2	123.7	980	55	3.5	STS
29/00	27.1	123.8	980	55	3.0	STS
29/06	28.8	124.2	980	55	3.0	STS
29/12	30.5	124.9	980	55	3.0	STS
29/18	32.3	125.0	980	55	3.0	STS
30/00	33.8	126.6	985	50	3.0	STS
30/06	36.0	128.0	994	45	2.5	TS
30/12	36.5	129.4	1004	-	2.0	L
30/18	38.4	131.2	1004	-	-	L
31/00	38.5	131.4	1006	-	-	L
31/06	38.6	131.9	1008	-	-	L
31/12	38.6	132.2	1010	-	-	L
31/18	39.2	132.2	1010	-	-	L
Sep. 01/00	39.2	132.2	1012	-	-	L
01/06						Dissip.

Bolaven (1215)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug. 19/06	14.1	142.1	1006	-	0.0	TD
19/12	14.8	142.1	1008	-	0.5	TD
19/18	16.1	142.0	1006	-	1.0	TD
20/00	16.8	141.9	1004	-	1.5	TD
20/06	17.4	141.4	1000	35	2.0	TS
20/12	17.9	141.3	996	40	2.5	TS
20/18	18.1	141.2	992	45	3.0	TS
21/00	18.2	140.8	985	50	3.5	STS
21/06	18.4	140.5	985	50	3.5	STS
21/12	18.9	140.2	975	65	4.0	TY
21/18	19.1	139.5	970	70	4.0	TY
22/00	19.2	138.8	970	70	4.5	TY
22/06	19.3	138.0	965	70	5.0	TY
22/12	19.5	137.5	965	70	5.0	TY
22/18	19.5	136.5	965	70	5.0	TY
23/00	19.7	135.9	965	70	5.0	TY
23/06	20.0	135.3	960	75	5.0	TY
23/12	20.2	134.6	960	75	5.0	TY
23/18	20.4	134.1	960	75	5.0	TY
24/00	21.1	133.8	960	75	5.0	TY
24/06	21.7	133.2	955	75	5.0	TY
24/12	22.2	133.0	950	80	5.5	TY
24/18	22.9	132.7	940	80	5.5	TY
25/00	23.5	132.1	930	85	5.5	TY
25/03	23.8	131.8	925	85	-	TY
25/06	24.2	131.3	920	90	6.0	TY
25/09	24.3	130.9	915	95	-	TY
25/12	24.3	130.7	910	100	6.0	TY
25/15	24.5	130.4	920	95	-	TY
25/18	24.7	130.2	920	95	6.0	TY
25/21	25.0	129.8	920	95	-	TY
26/00	25.3	129.5	925	90	5.5	TY
26/03	25.6	129.2	925	90	-	TY
26/06	25.9	129.0	925	90	5.5	TY
26/09	26.4	128.6	925	90	-	TY
26/12	26.6	128.0	930	85	5.5	TY
26/15	26.9	127.8	935	85	-	TY
26/18	27.5	127.4	940	80	5.0	TY
26/21	27.9	127.1	945	75	-	TY
27/00	28.4	126.9	955	70	4.5	TY
27/03	29.1	126.3	955	70	-	TY
27/06	29.9	126.0	960	65	4.0	TY
27/12	31.3	125.6	960	65	4.0	TY
27/18	33.0	125.5	960	65	3.5	TY
28/00	34.8	125.1	960	65	3.5	TY
28/06	36.6	124.8	965	60	3.0	STS
28/12	38.7	124.5	975	55	2.5	STS
28/18	41.6	125.8	980	45	2.5	TS
29/00	44.3	128.3	980	45	2.5	TS
29/06	46.0	130.0	982	-	2.0	L
29/12	47.7	132.4	984	-	-	L
29/18	50.0	134.4	986	-	-	L
30/00	51.9	139.7	988	-	-	L
30/06	52.6	141.6	986	-	-	L
30/12	53.7	145.9	988	-	-	L
30/18	54.9	148.0	988	-	-	L
31/00	54.8	150.3	990	-	-	L
31/06	55.0	153.2	992	-	-	L
31/12	55.3	163.7	996	-	-	L
31/18	55.0	167.2	994	-	-	L
Sep. 01/00	54.2	172.4	994	-	-	L
01/06	53.9	174.9	992	-	-	L
01/12	53.5	178.3	990	-	-	L
01/18	53.7	181.9	990	-	-	Out

Sanba (1216)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep. 10/00	8.7	134.7	1008	-	0.0	TD
10/06	8.9	134.6	1004	-	0.0	TD
10/12	9.2	134.5	1006	-	0.5	TD
10/18	9.6	134.3	1004	-	1.0	TD
11/00	10.0	134.1	1002	35	2.0	TS
11/06	10.7	133.8	1000	35	2.0	TS
11/12	11.4	133.3	998	40	2.5	TS
11/18	11.9	132.4	996	40	2.5	TS
12/00	12.5	131.6	992	45	3.0	TS
12/06	13.0	131.1	985	55	3.5	STS
12/12	13.7	130.6	965	70	4.5	TY
12/18	14.0	130.1	955	75	5.0	TY
13/00	14.8	129.8	945	85	5.5	TY
13/06	15.6	129.5	930	95	6.0	TY
13/12	16.3	129.6	910	105	7.0	TY
13/18	17.2	129.7	900	110	7.5	TY
14/00	18.1	129.7	900	110	7.5	TY
14/06	19.1	129.8	900	110	7.5	TY
14/12	20.2	129.8	915	100	6.5	TY
14/18	21.4	129.5	915	100	6.5	TY
15/00	22.3	129.1	920	100	6.5	TY
15/06	23.4	128.8	920	100	6.5	TY
15/09	24.0	128.7	920	100	-	TY
15/12	24.5	128.5	925	95	6.0	TY
15/15	25.1	128.2	925	95	-	TY
15/18	25.6	128.2	935	90	5.5	TY
15/21	26.4	128.2	935	90	-	TY
15/22	26.6	128.2	935	90	-	TY
16/00	27.0	128.1	935	90	5.5	TY
16/03	27.8	128.2	935	90	-	TY
16/06	28.8	128.1	935	90	5.5	TY
16/09	29.8	128.1	935	90	-	TY
16/12	30.6	127.9	935	90	5.5	TY
16/15	31.4	127.8	940	85	-	TY
16/18	32.2	127.9	940	85	5.5	TY
16/21	33.0	127.8	940	85	-	TY
17/00	34.0	127.9	955	75	5.0	TY
17/03	34.9	128.0	965	70	-	TY
17/06	36.3	128.5	980	55	4.5	STS
17/12	38.6	129.6	990	45	4.0	TS
17/18	40.9	130.6	990	45	3.5	TS
18/00	43.6	132.9	992	-	3.0	L
18/06	45.8	134.6	996	-	-	L
18/12	47.4	134.2	1000	-	-	L
18/18	48.0	135.1	1002	-	-	L
19/00						Dissip.

Jelawat (1217)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep. 20/00	13.7	134.8	1010	-	1.5	TD
20/06	13.8	133.4	1006	-	1.5	TD
20/12	13.5	132.0	1006	-	2.0	TD
20/18	13.3	131.5	1002	35	2.5	TS
21/00	13.1	130.9	996	45	2.5	TS
21/06	12.5	130.4	992	45	3.0	TS
21/12	12.3	130.3	990	45	3.0	TS
21/18	11.9	130.1	990	45	3.0	TS
22/00	11.7	130.0	990	50	3.0	STS
22/06	11.7	129.8	990	50	3.0	STS
22/12	11.7	129.6	980	55	4.0	STS
22/18	11.7	129.3	975	60	4.5	STS
23/00	11.8	128.9	965	70	5.0	TY
23/06	12.1	128.9	940	85	5.5	TY
23/12	12.7	128.7	925	100	6.5	TY
23/18	13.0	128.6	925	100	6.5	TY
24/00	13.6	128.5	925	100	6.5	TY
24/06	14.2	128.2	925	100	6.5	TY
24/12	14.6	128.1	910	105	7.0	TY
24/18	15.2	127.9	905	110	7.0	TY
25/00	15.7	127.8	905	110	7.0	TY
25/06	16.4	127.5	905	110	7.0	TY
25/12	16.8	127.1	905	110	7.0	TY
25/18	17.1	126.8	905	110	6.5	TY
26/00	17.4	126.5	905	110	6.5	TY
26/06	18.0	126.1	905	110	6.5	TY
26/12	18.4	125.9	905	110	6.5	TY
26/18	19.1	125.4	915	105	6.5	TY
27/00	19.6	124.8	920	100	6.5	TY
27/06	20.2	124.4	920	100	6.5	TY
27/12	20.9	124.1	920	100	6.5	TY
27/18	21.6	123.9	920	100	6.5	TY
27/21	22.0	124.0	920	100	-	TY
28/00	22.4	124.1	920	100	6.0	TY
28/03	22.9	124.2	920	100	-	TY
28/06	23.4	124.4	925	95	5.5	TY
28/09	23.9	124.8	925	95	-	TY
28/12	24.2	125.1	925	90	5.5	TY
28/15	24.6	125.6	925	90	-	TY
28/18	25.0	126.0	930	90	5.5	TY
28/21	25.5	126.6	930	90	-	TY
29/00	26.0	127.2	930	90	5.5	TY
29/03	26.6	127.7	935	90	-	TY
29/06	26.9	128.5	935	90	5.5	TY
29/09	27.5	129.4	935	90	-	TY
29/12	27.9	130.3	940	90	5.0	TY
29/15	28.6	131.2	940	85	-	TY
29/18	29.3	132.4	945	85	4.5	TY
29/21	30.2	133.5	945	85	-	TY
30/00	31.5	134.2	950	80	4.5	TY
30/03	32.5	134.7	950	80	-	TY
30/06	33.5	135.7	965	70	4.0	TY
30/08	34.1	136.6	965	70	-	TY
30/09	34.4	137.0	970	70	-	TY
30/10	34.8	137.4	975	70	-	TY
30/12	35.7	138.3	980	65	3.5	TY
30/15	37.0	139.5	980	65	-	TY
30/18	39.1	141.0	985	55	3.5	STS
30/21	40.6	143.1	985	55	-	STS
Oct. 01/00	41.9	144.4	990	50	3.0	STS
01/03	42.7	147.1	990	50	-	STS
01/06	44.0	149.0	990	45	2.5	TS
01/12	46.0	155.0	992	-	2.0	L
01/18	47.1	160.7	992	-	-	L
02/00	47.8	165.7	984	-	-	L
02/06	48.0	170.7	984	-	-	L
02/12	48.2	175.5	982	-	-	L
02/18	48.6	179.8	982	-	-	L
03/00	48.7	182.2	982	-	-	Out

Ewiniar (1218)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep. 23/06	15.6	140.5	1004	-	1.0	TD
23/12	16.7	140.3	1004	-	1.5	TD
23/18	17.6	139.8	1004	-	1.5	TD
24/00	18.5	139.1	1004	-	1.5	TD
24/06	19.4	138.8	1004	-	1.5	TD
24/12	20.3	138.5	1000	35	2.0	TS
24/18	21.2	138.4	998	35	2.0	TS
25/00	21.9	138.4	996	40	2.5	TS
25/06	22.7	138.5	996	40	2.5	TS
25/12	23.1	139.0	994	40	2.5	TS
25/18	24.3	140.5	990	45	2.5	TS
26/00	25.3	141.3	990	45	2.5	TS
26/03	25.7	141.4	990	45	-	TS
26/06	26.3	142.4	985	50	3.0	STS
26/09	27.1	142.6	985	50	-	STS
26/12	28.1	142.6	985	50	3.0	STS
26/18	29.1	142.5	985	50	3.0	STS
27/00	30.4	142.2	985	50	3.0	STS
27/06	31.2	142.1	985	50	3.0	STS
27/12	31.6	141.6	985	50	3.0	STS
27/18	31.4	141.7	985	50	3.0	STS
28/00	31.5	142.4	985	50	3.5	STS
28/06	31.9	143.1	985	50	3.5	STS
28/12	32.6	144.2	985	50	3.5	STS
28/18	33.5	145.0	985	50	3.5	STS
29/00	34.5	145.8	992	45	3.5	TS
29/06	36.5	147.3	992	45	3.0	TS
29/12	37.8	149.1	994	45	2.5	TS
29/18	39.2	151.1	996	40	2.0	TS
30/00	40.8	154.1	1000	-	1.5	L
30/06	41.5	158.2	1004	-	-	L
30/12	42.3	162.0	1002	-	-	L
30/18	43.0	167.2	1002	-	-	L
Oct. 01/00						Dissip.

Maliksi (1219)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep. 29/12	12.8	151.0	1006	-	0.5	TD
29/18	13.5	150.6	1004	-	1.0	TD
30/00	13.9	150.0	1004	-	1.5	TD
30/06	14.3	149.6	1002	-	1.5	TD
30/12	16.0	148.9	1002	-	2.0	TD
30/18	16.4	147.7	1000	-	2.0	TD
Oct. 01/00	17.1	146.9	1002	-	2.0	TD
01/06	17.9	146.2	998	35	2.0	TS
01/12	19.3	145.3	996	40	2.0	TS
01/18	19.5	144.2	994	40	2.5	TS
02/00	20.3	143.6	992	40	2.5	TS
02/06	20.9	142.6	992	40	2.5	TS
02/12	21.3	142.3	992	40	2.5	TS
02/18	22.4	141.4	990	45	3.0	TS
03/00	24.5	140.9	985	50	3.0	STS
03/03	25.4	141.0	985	50	-	STS
03/06	26.0	141.6	985	50	3.0	STS
03/09	27.1	142.0	985	50	-	STS
03/12	28.4	142.0	985	50	3.0	STS
03/18	30.9	141.8	985	50	3.0	STS
04/00	34.1	144.0	985	50	2.5	STS
04/06	37.0	146.0	982	-	2.0	L
04/12	40.0	149.5	976	-	-	L
04/18	42.5	152.8	972	-	-	L
05/00	43.8	155.2	968	-	-	L
05/06	44.9	157.1	964	-	-	L
05/12	45.9	159.2	960	-	-	L
05/18	45.8	162.2	960	-	-	L
06/00	45.7	167.0	968	-	-	L
06/06	45.3	172.1	972	-	-	L
06/12	45.1	177.3	976	-	-	L
06/18	46.7	182.7	978	-	-	Out

Gaemi (1220)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep. 29/00	13.0	112.4	1008	-	-	TD
29/06	13.3	112.7	1006	-	-	TD
29/12	13.5	113.1	1006	-	0.0	TD
29/18	13.8	113.3	1006	-	1.5	TD
30/00	14.2	113.5	1008	-	1.5	TD
30/06	14.8	113.5	1006	-	1.5	TD
30/12	15.3	113.5	1006	-	1.5	TD
30/18	15.7	113.9	1006	-	1.5	TD
Oct. 01/00	16.3	114.7	1008	-	1.5	TD
01/06	17.1	115.0	1006	-	2.0	TD
01/12	17.2	115.0	1002	35	2.5	TS
01/18	16.9	115.0	1002	35	2.5	TS
02/00	16.5	115.4	1004	35	2.5	TS
02/06	16.0	115.8	1002	35	2.5	TS
02/12	15.6	116.4	1000	35	2.5	TS
02/18	15.4	116.8	996	40	3.0	TS
03/00	15.4	117.2	992	45	3.0	TS
03/06	15.3	117.7	990	50	3.0	STS
03/12	15.3	118.0	990	50	3.0	STS
03/18	15.2	118.2	992	45	3.0	TS
04/00	15.0	118.3	992	45	3.0	TS
04/06	14.9	118.2	992	45	3.0	TS
04/12	14.6	118.0	994	40	2.5	TS
04/18	14.4	117.4	994	40	2.5	TS
05/00	14.5	116.6	994	40	2.5	TS
05/06	14.6	115.8	996	35	2.5	TS
05/12	14.4	114.6	998	35	2.5	TS
05/18	13.9	113.0	998	35	2.5	TS
06/00	13.2	111.5	998	35	2.5	TS
06/06	13.1	110.2	1000	35	2.5	TS
06/12	13.1	108.8	1004	-	2.0	TD
06/18	13.0	107.6	1006	-	-	TD
07/00	12.6	106.2	1008	-	-	TD
07/06	12.6	105.2	1006	-	-	TD
07/12	12.9	104.0	1006	-	-	TD
07/18						Dissip.

Prapiroon (1221)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Oct. 05/00	14.5	144.5	1006	-	0.5	TD
05/06	14.8	143.4	1006	-	1.0	TD
05/12	15.1	142.3	1006	-	1.0	TD
05/18	15.6	141.6	1006	-	1.5	TD
06/00	16.3	140.8	1006	-	1.5	TD
06/06	16.9	140.4	1004	-	1.5	TD
06/12	17.3	139.9	1004	-	1.5	TD
06/18	17.7	139.1	1002	-	1.5	TD
07/00	17.7	138.3	1002	-	1.5	TD
07/06	17.8	137.3	1002	-	1.5	TD
07/12	17.8	136.6	1000	35	2.0	TS
07/18	17.8	136.0	994	40	2.5	TS
08/00	17.9	135.5	985	50	3.0	STS
08/06	18.0	135.0	980	55	3.5	STS
08/12	18.4	133.9	980	55	3.5	STS
08/18	18.1	133.3	970	65	4.0	TY
09/00	17.7	132.5	970	65	4.0	TY
09/06	17.6	132.1	970	65	4.0	TY
09/12	18.0	132.0	965	65	4.0	TY
09/18	18.2	131.7	960	70	5.0	TY
10/00	18.3	130.9	960	70	5.0	TY
10/06	18.6	130.4	950	80	5.0	TY
10/12	18.6	130.1	950	80	5.0	TY
10/18	18.9	129.5	950	80	5.0	TY
11/00	19.1	129.0	950	80	5.0	TY
11/06	19.5	128.6	950	80	5.0	TY
11/12	19.5	128.4	940	90	5.5	TY
11/18	19.5	128.4	940	90	5.5	TY
12/00	19.6	128.5	940	90	5.5	TY
12/06	19.9	128.9	940	90	5.5	TY
12/12	20.1	129.3	940	90	5.5	TY
12/18	20.4	129.6	950	80	5.0	TY
13/00	20.7	129.8	950	80	5.0	TY
13/06	21.1	129.9	955	75	5.0	TY
13/12	21.4	129.8	955	75	5.0	TY
13/18	21.5	130.4	955	75	5.0	TY
14/00	22.0	130.8	955	75	4.5	TY
14/06	22.4	130.9	955	75	4.5	TY
14/12	22.6	131.4	955	75	4.5	TY
14/18	22.8	131.4	960	70	4.5	TY
15/00	22.8	131.2	960	70	4.5	TY
15/06	22.6	131.2	960	70	4.5	TY
15/12	22.4	131.1	960	70	4.5	TY
15/18	22.3	130.5	965	65	4.0	TY
16/00	21.8	130.1	970	60	3.5	STS
16/06	21.4	129.5	970	60	3.5	STS
16/12	21.7	128.9	970	60	3.0	STS
16/18	22.5	128.6	975	55	3.0	STS
17/00	23.2	128.3	975	55	3.0	STS
17/06	24.2	128.7	980	55	3.0	STS
17/12	24.9	129.5	980	55	3.0	STS
17/15	25.5	130.0	980	55	-	STS
17/18	25.9	130.5	980	55	3.0	STS
17/21	26.6	131.1	980	55	-	STS
18/00	27.3	131.8	985	50	3.0	STS
18/03	27.7	132.8	985	50	-	STS
18/06	28.5	134.0	990	50	2.5	STS
18/12	30.2	136.4	990	50	2.5	STS
18/18	31.3	139.3	990	50	2.5	STS
19/00	32.5	142.5	994	50	2.5	STS
19/06	32.7	145.9	994	50	2.0	STS
19/12	34.0	149.0	998	-	2.0	L
19/18	33.1	151.9	1000	-	-	L
20/00	33.3	155.4	1004	-	-	L
20/06	33.4	157.9	1004	-	-	L
20/12	33.6	160.0	1004	-	-	L
20/18	33.6	162.0	1004	-	-	L
21/00	33.3	163.4	1004	-	-	L
21/06	33.3	164.6	1006	-	-	L
21/12	33.5	165.4	1004	-	-	L
21/18	35.2	167.4	1004	-	-	L
22/00	37.6	169.5	1004	-	-	L
22/06	41.3	172.6	1004	-	-	L
22/12	45.7	173.8	996	-	-	L
22/18	47.8	175.7	988	-	-	L
23/00	49.4	176.9	984	-	-	L
23/06	50.4	177.6	982	-	-	L
23/12	51.0	178.8	982	-	-	L
23/18	50.5	180.1	986	-	-	Out

Maria (1222)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Oct. 12/18	16.1	147.2	1010	-	-	TD
13/00	16.2	146.8	1008	-	0.5	TD
13/06	16.3	146.1	1008	-	1.0	TD
13/12	16.5	145.5	1008	-	1.0	TD
13/18	16.9	145.2	1008	-	1.5	TD
14/00	17.4	144.6	1006	-	1.5	TD
14/06	17.5	143.7	1002	35	2.0	TS
14/12	17.9	143.1	998	40	2.5	TS
14/18	18.6	142.4	994	45	2.5	TS
15/00	19.3	141.7	990	50	2.5	STS
15/06	20.7	141.2	990	50	2.5	STS
15/12	22.7	141.1	990	50	2.5	STS
15/18	24.3	140.5	990	50	2.5	STS
16/00	25.4	140.7	994	45	3.0	TS
16/06	26.7	140.8	994	45	3.0	TS
16/12	27.4	141.1	996	45	3.0	TS
16/18	28.3	142.2	996	45	3.0	TS
17/00	28.8	143.5	996	45	3.0	TS
17/06	29.5	144.7	996	45	3.0	TS
17/12	30.1	146.4	996	45	3.0	TS
17/18	31.0	148.5	996	45	3.0	TS
18/00	31.4	150.5	996	45	3.0	TS
18/06	32.0	152.8	998	45	3.0	TS
18/12	31.9	154.9	1000	40	3.0	TS
18/18	31.7	156.2	1004	35	2.5	TS
19/00	31.5	157.4	1006	-	2.0	TD
19/06	31.2	158.6	1008	-	-	TD
19/12	31.2	159.6	1010	-	-	TD
19/18	31.7	160.4	1010	-	-	TD
20/00	32.2	161.1	1010	-	-	TD
20/06						Dissip.

Son-tinh (1223)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Oct. 21/12	6.4	135.0	1008	-	0.0	TD
21/18	6.9	133.7	1004	-	0.0	TD
22/00	7.4	133.4	1006	-	0.5	TD
22/06	8.0	132.7	1004	-	1.5	TD
22/12	8.6	131.9	1004	-	1.5	TD
22/18	8.8	131.0	1004	-	1.5	TD
23/00	8.4	130.0	1004	-	1.5	TD
23/06	8.0	128.9	1000	-	1.5	TD
23/12	8.3	128.1	1000	35	2.0	TS
23/18	8.8	127.5	998	35	2.5	TS
24/00	10.0	126.3	998	35	2.5	TS
24/06	10.8	124.9	996	35	2.5	TS
24/12	11.4	123.9	998	35	2.5	TS
24/18	11.9	122.3	996	40	2.5	TS
25/00	12.8	120.9	998	40	2.5	TS
25/06	14.0	119.6	998	40	2.5	TS
25/12	14.4	117.6	998	40	2.5	TS
25/18	14.4	116.8	996	40	3.0	TS
26/00	14.6	115.6	990	45	3.5	TS
26/06	14.9	114.8	980	55	3.5	STS
26/12	15.5	113.6	980	55	3.5	STS
26/18	16.1	112.2	975	60	4.0	STS
27/00	16.5	111.0	975	60	4.5	STS
27/06	17.0	109.7	965	70	5.0	TY
27/12	17.5	108.9	945	85	6.0	TY
27/18	18.1	107.8	955	80	6.0	TY
28/00	18.4	107.5	965	75	6.0	TY
28/06	19.2	107.1	970	70	5.0	TY
28/12	19.8	106.7	980	60	5.0	STS
28/18	20.7	106.6	990	45	4.5	TS
29/00	21.3	107.0	1004	35	4.0	TS
29/06	21.5	107.1	1008	-	3.5	TD
29/12	21.8	107.6	1008	-	-	TD
29/18						Dissip.

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Bopha (1224)						
Nov. 25/18	3.4	156.9	1004	-	0.5	TD
26/00	3.7	156.7	1008	-	1.5	TD
26/06	3.9	156.6	1004	-	1.5	TD
26/12	4.0	156.4	1006	-	1.5	TD
26/18	4.1	156.3	1002	35	2.0	TS
27/00	4.3	156.2	1004	35	2.5	TS
27/06	4.4	155.8	1002	35	2.5	TS
27/12	4.4	155.5	1002	35	2.5	TS
27/18	4.6	155.1	998	40	2.5	TS
28/00	4.7	154.3	998	40	3.0	TS
28/06	4.8	153.1	998	40	3.0	TS
28/12	4.6	151.7	998	40	3.0	TS
28/18	4.2	150.8	994	45	3.0	TS
29/00	4.0	150.0	994	45	3.0	TS
29/06	3.8	149.2	994	45	3.0	TS
29/12	3.4	148.0	994	45	3.0	TS
29/18	3.4	147.1	994	45	3.0	TS
30/00	3.6	146.3	990	50	3.5	STS
30/06	3.9	145.3	980	60	4.0	STS
30/12	4.2	144.2	970	65	4.5	TY
30/18	4.4	142.9	965	75	5.0	TY
Dec. 01/00	4.7	142.1	945	90	6.0	TY
01/06	5.1	141.1	945	90	6.0	TY
01/12	5.4	140.0	945	90	6.0	TY
01/18	5.8	138.8	940	95	6.5	TY
02/00	6.2	137.7	935	100	6.5	TY
02/06	6.4	136.0	935	100	6.5	TY
02/12	6.4	134.6	935	100	6.0	TY
02/18	6.5	133.3	940	90	6.0	TY
03/00	6.8	131.8	940	90	6.0	TY
03/06	7.0	130.4	935	100	6.5	TY
03/12	7.4	128.9	930	100	6.5	TY
03/18	7.6	127.3	930	100	6.5	TY
04/00	7.9	125.9	945	85	5.5	TY
04/06	8.7	124.1	970	70	5.0	TY
04/12	9.2	122.4	975	65	4.0	TY
04/18	9.8	120.6	975	65	4.5	TY
05/00	9.8	119.8	975	65	4.5	TY
05/06	10.6	118.8	975	65	4.5	TY
05/12	11.2	118.2	975	65	4.5	TY
05/18	11.5	117.7	975	65	4.5	TY
06/00	12.0	117.0	975	65	4.5	TY
06/06	12.4	116.6	975	65	4.5	TY
06/12	12.8	116.3	975	65	4.5	TY
06/18	13.2	115.8	980	60	4.5	STS
07/00	13.7	115.6	965	70	5.0	TY
07/06	14.6	115.9	955	80	5.5	TY
07/12	15.4	116.0	945	90	6.0	TY
07/18	16.1	116.2	945	90	6.0	TY
08/00	16.8	116.9	950	85	6.0	TY
08/06	17.5	117.9	955	80	5.5	TY
08/12	17.9	118.6	970	65	5.0	TY
08/18	18.1	119.0	1000	40	4.5	TS
09/00	18.1	119.2	1004	35	4.0	TS
09/06	17.8	119.5	1006	-	3.5	TD
09/12						Dissip.

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Wukong (1225)						
Dec. 24/00	7.8	132.6	1006	-	1.0	TD
24/06	9.0	131.7	1002	-	1.5	TD
24/12	9.3	130.9	1004	-	1.5	TD
24/18	9.7	130.0	1004	-	2.0	TD
25/00	10.1	128.8	1002	35	2.0	TS
25/06	10.2	127.2	1000	40	2.5	TS
25/12	10.4	126.3	1000	40	2.5	TS
25/18	10.6	124.7	1000	40	2.5	TS
26/00	10.4	123.3	1002	35	2.5	TS
26/06	10.2	122.0	1002	35	2.5	TS
26/12	10.0	120.4	1002	35	2.5	TS
26/18	10.5	119.0	1002	35	2.0	TS
27/00	10.3	117.4	1002	35	1.5	TS
27/06	10.2	115.9	1002	35	1.5	TS
27/12	10.1	114.8	1002	35	1.5	TS
27/18	10.1	113.6	1002	35	2.0	TS
28/00	9.7	112.5	1002	35	2.0	TS
28/06	8.7	111.0	1004	-	2.0	TD
28/12	8.2	109.8	1004	-	-	TD
28/18	7.7	108.4	1004	-	-	TD
29/00	7.4	107.3	1004	-	-	TD
29/06	7.0	106.0	1006	-	-	TD
29/12	7.1	104.9	1006	-	-	TD
29/18						Dissip.

Appendix 2

Monthly Tracks of Tropical Cyclones in 2012

TROPICAL CYCLONE TRACKS
MARCH 2012

—— TS, STS or TY

---- TD or extratropical cyclone

○ Position at 0000 UTC with date & central pressure

● Position at 1200 UTC

YYNN Identification number

1201

02 1006

01 998

31 998

30 1000

29 1008

28 1010

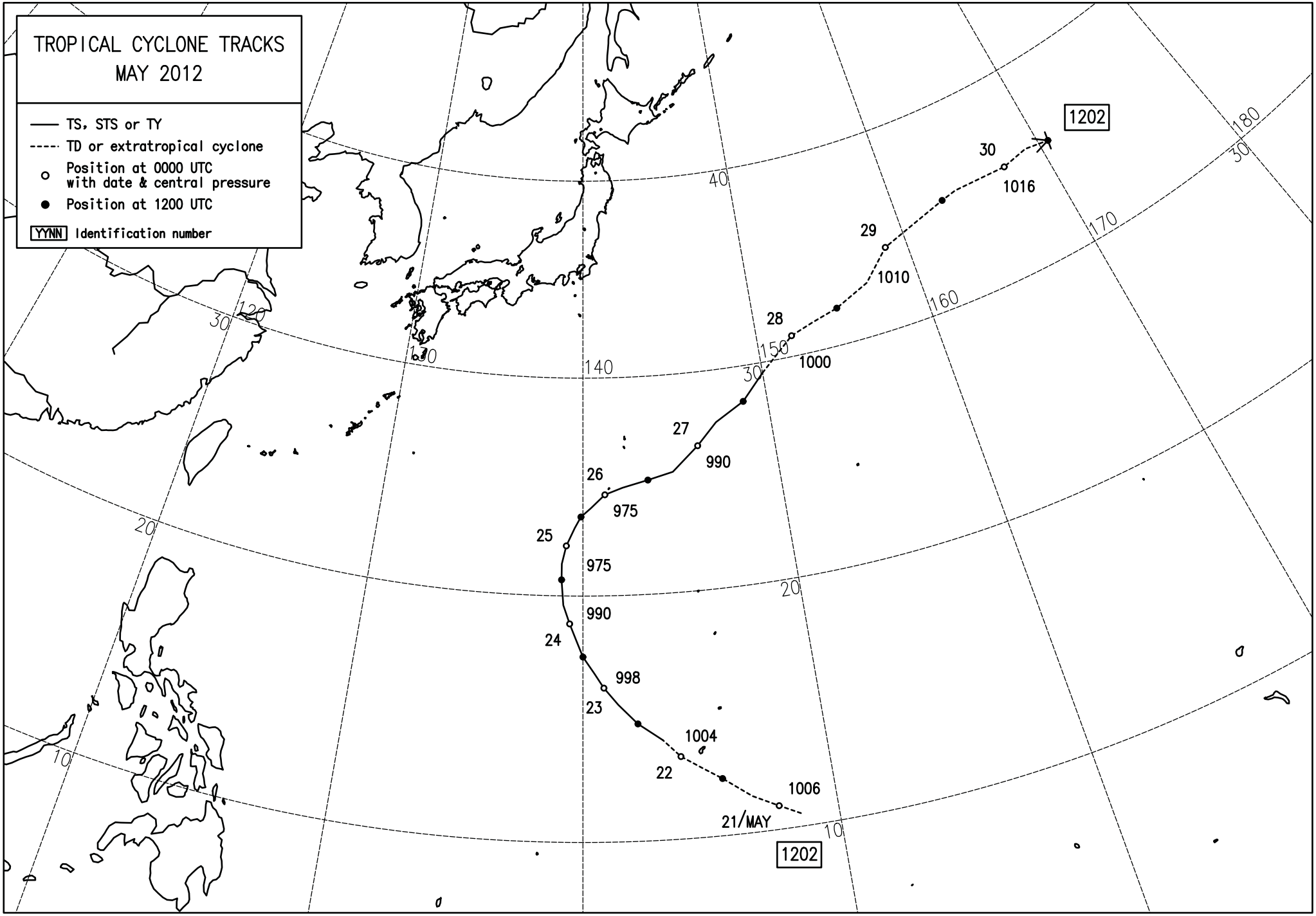
27 1010

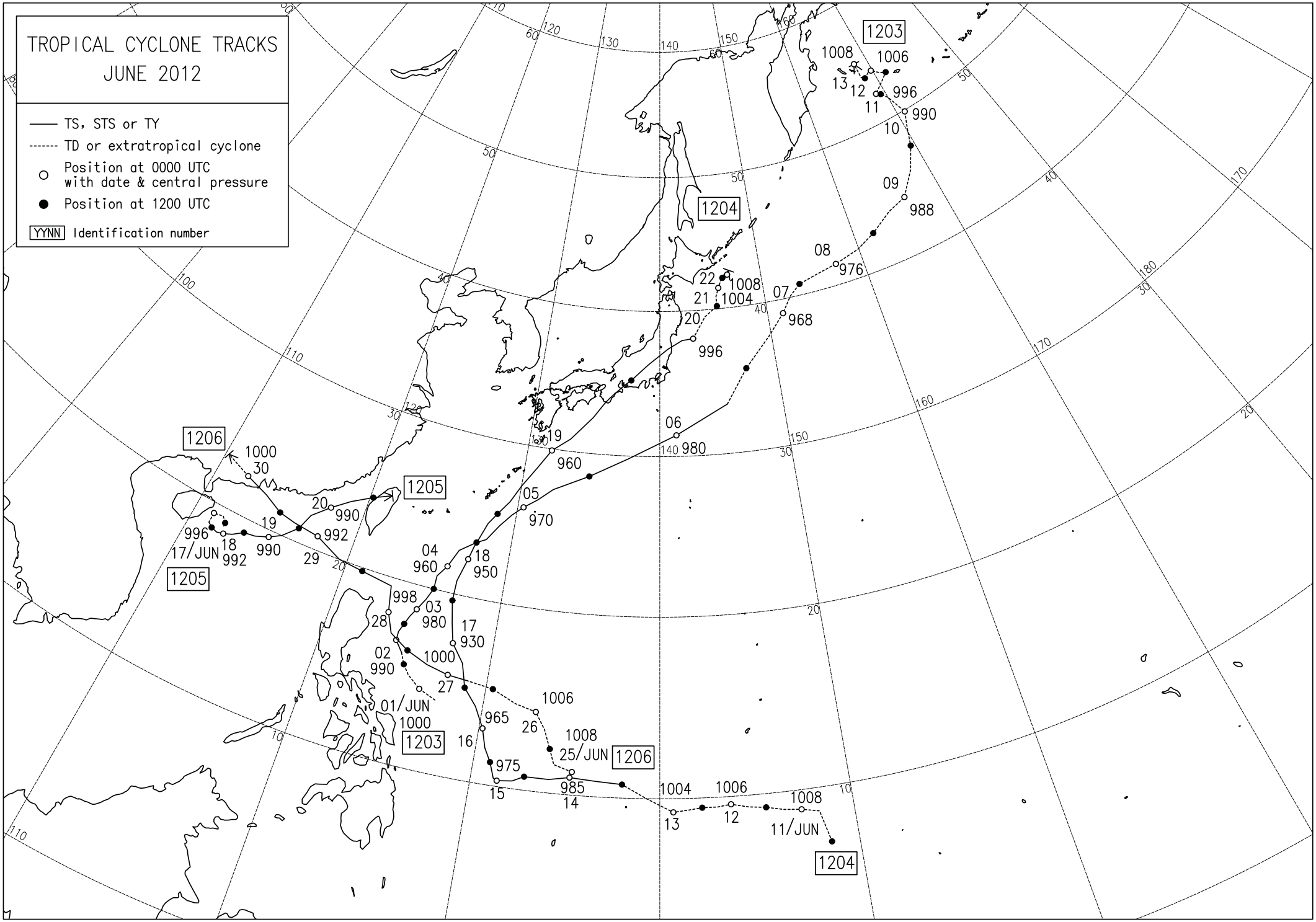
26/MAR 1010

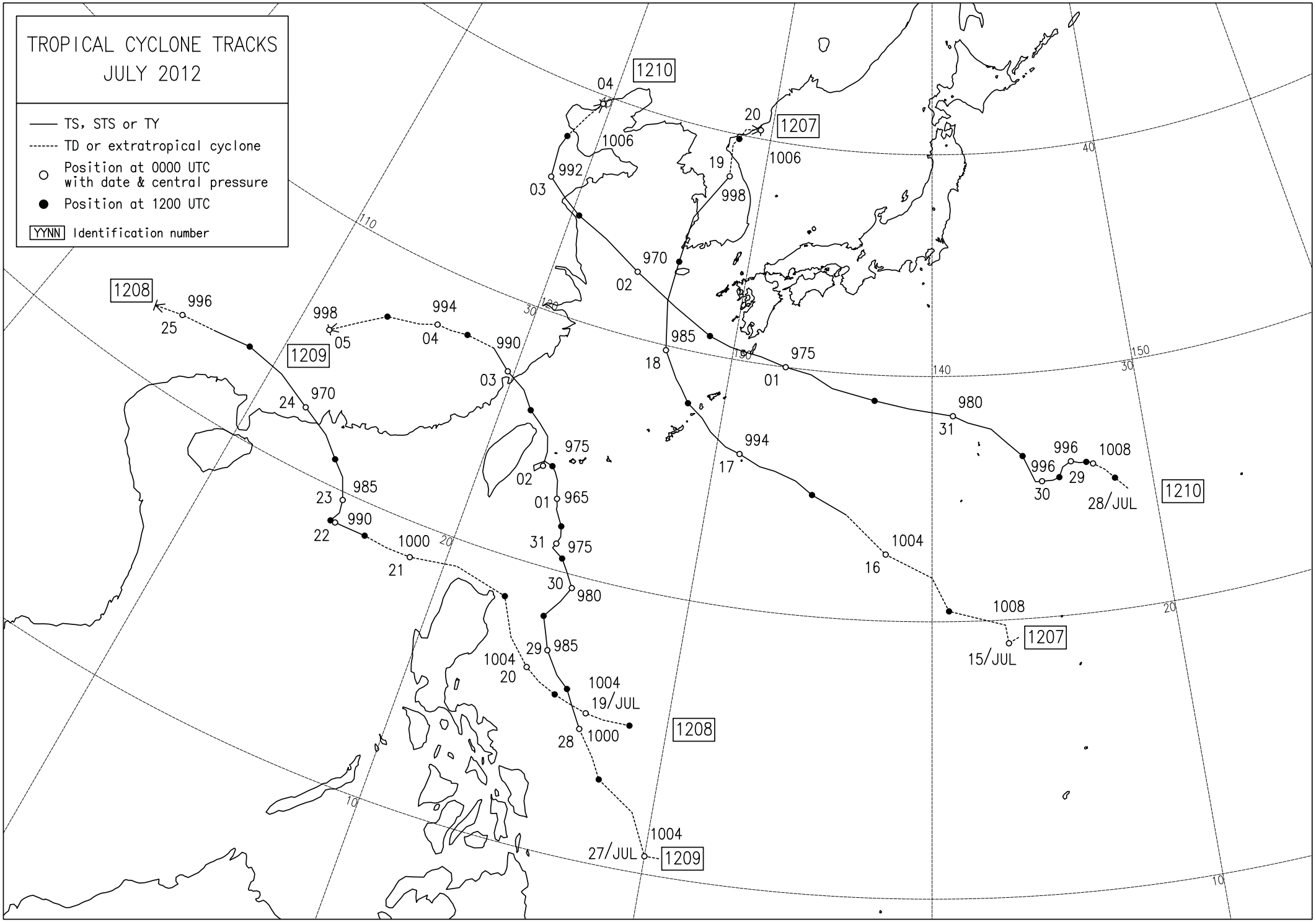
1201

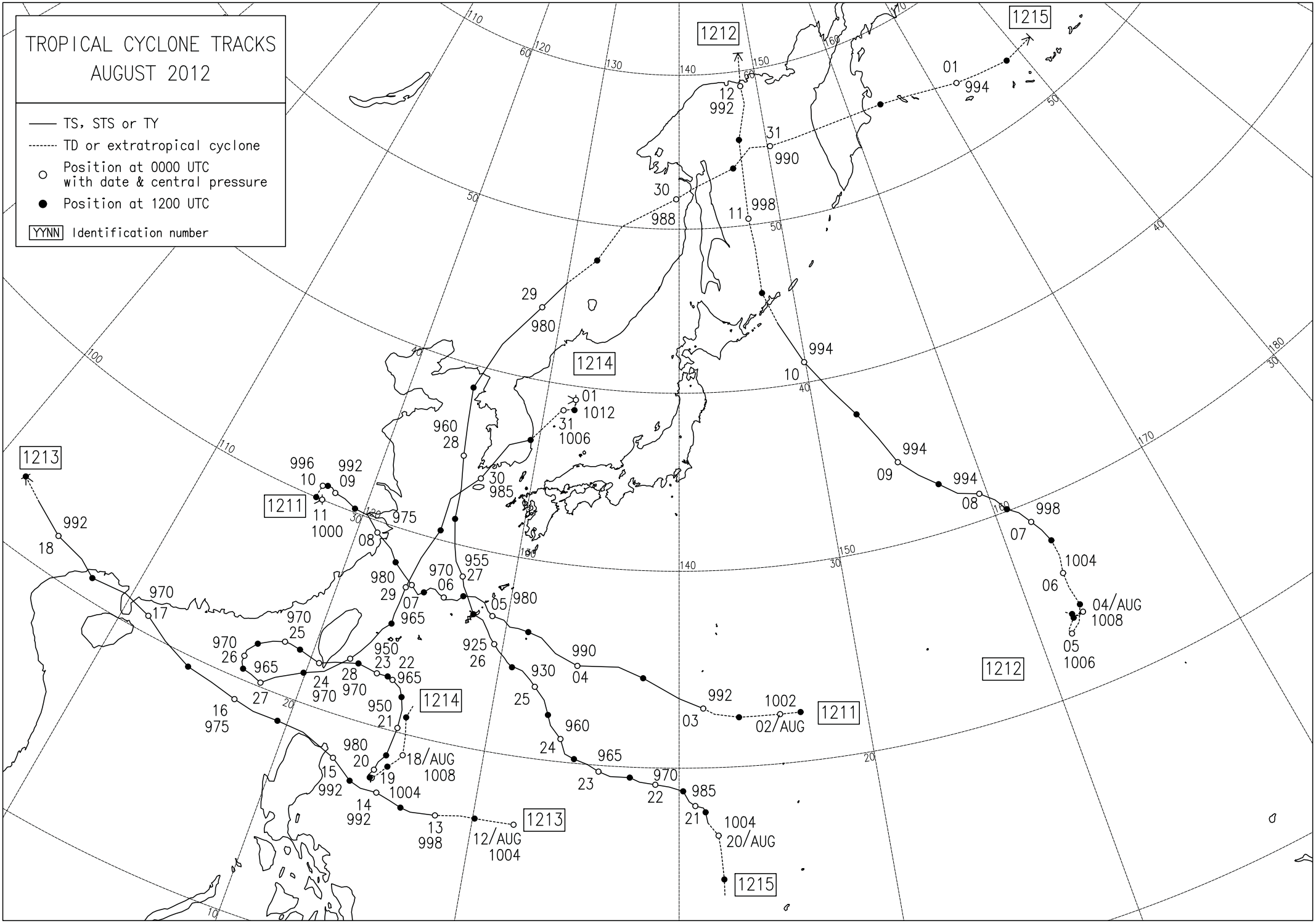
20

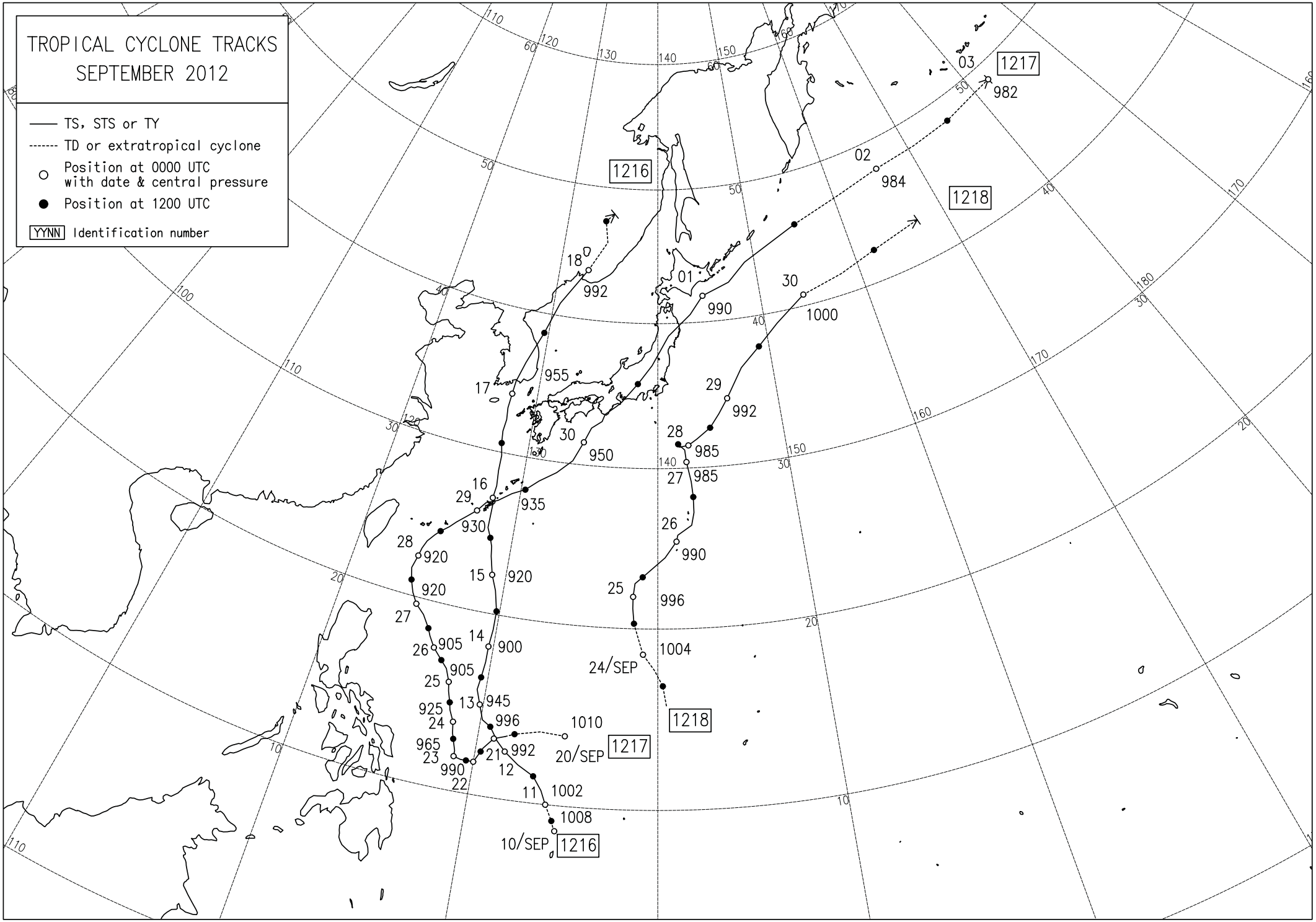
10

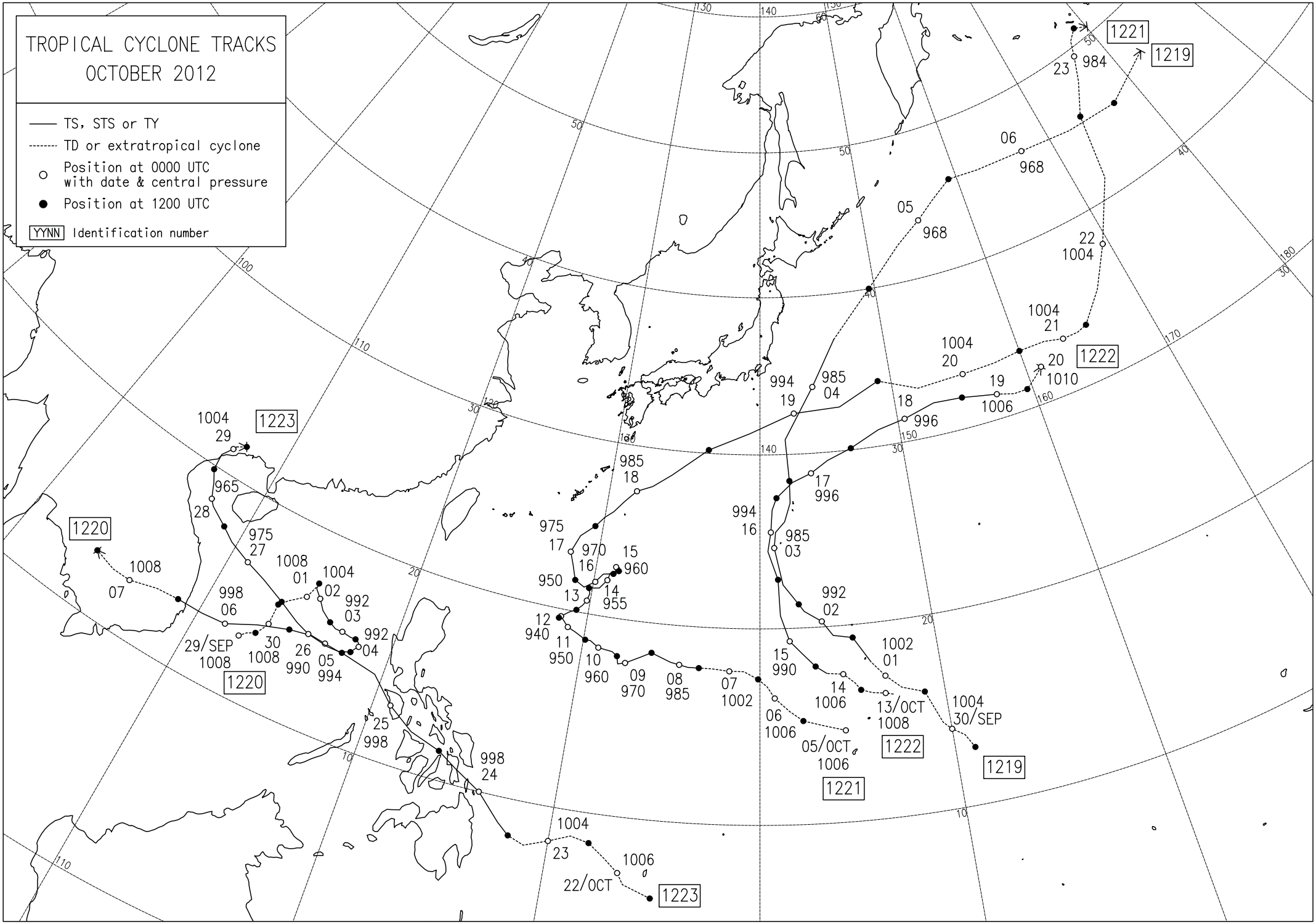

TROPICAL CYCLONE TRACKS
MAY 2012
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
1202
30
1016
29
1010
28
1000
27
990
26
975
25
975
990
24
998
23
1004
22
1006
21/MAY
1202
120
130
140
150
160
170
180
40
30
20
10

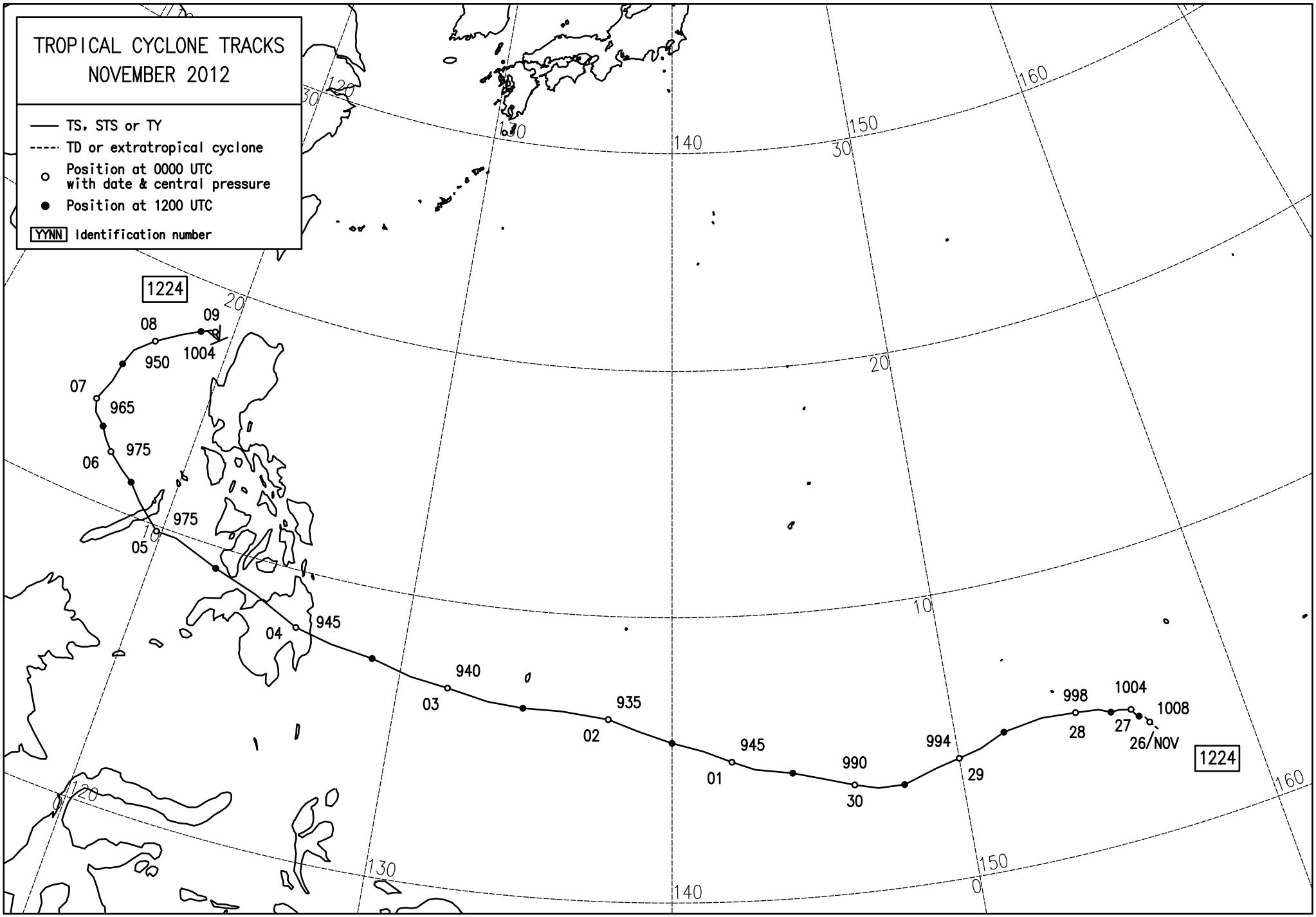

TROPICAL CYCLONE TRACKS
JUNE 2012
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
1203
1008
1006
13
12
11
996
990
10
09
988
1204
08
976
22
1008
21
1004
07
968
20
996
06
980
19
960
1206
1000
30
1205
05
970
20
990
19
996
992
18
17/JUN
992
990
29
04
960
18
950
998
03
980
28
17
930
02
990
1000
27
1006
01/JUN
1000
1203
965
26
1008
25/JUN
1206
16
975
985
15
14
1004
1006
1008
13
12
11/JUN
1204


TROPICAL CYCLONE TRACKS
JULY 2012
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
1210
04
1006
992
03
1207
20
1006
19
998
970
02
1208
996
25
998
05
994
04
990
03
1209
24
970
985
23
990
22
1000
21
975
02
965
01
975
31
980
30
985
29
1004
20
1004
19/JUL
1000
28
1004
27/JUL
1209
1208
985
18
975
01
980
31
994
17
1004
16
1008
15/JUL
1207
996
1008
996
29
30
28/JUL
1210
110
120
130
140
150
160
170
180
10
20
30
40


TROPICAL CYCLONE TRACKS
AUGUST 2012
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
1212
12 992
01 994
1215
31 990
30 988
11 998
29 980
1214
994 10
01 1012
31 1006
960 28
1213
996 10
992 09
1211
11 1000
30 985
994 09
994 08
998 07
1004 06
04/AUG 1008
05 1006
1212
992 18
975 08
970 17
980 29
970 06
955 27
07 965
05 980
970 25
970 26
965
950 23
22 965
925 26
990 04
930 25
992 03
1002 02/AUG
1211
24 970
28 970
1214
950 21
16 975
27
960 24
965 23
970 22
985 21
1004 20/AUG
1215
980 20
18/AUG 1008
19
1004
15 992
14 992
13 998
12/AUG 1004
1213


TROPICAL CYCLONE TRACKS
SEPTEMBER 2012
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
1216
1217
1218
18
992
17
955
16
29
935
930
28
920
15
920
920
27
14
900
26
905
905
25
13
945
925
24
996
1010
965
23
21
992
20/SEP
990
22
12
11
1002
1008
10/SEP
1216
1217
1218
24/SEP
1004
996
25
990
26
27
985
985
28
29
992
950
30
955
01
990
30
1000
02
984
03
982


TROPICAL CYCLONE TRACKS
OCTOBER 2012
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
1220
1223
1221
1219
1222
1004 29
965 28
975 27
1008 01
1004 02
992 03
992 04
998 06
1008 07
29/SEP 1008
30 1008
26 990
05 994
25 998
998 24
1004 23
1006 22/OCT
985 18
975 17
970 16
960 15
950 13
955 14
940 12
950 11
960 10
970 09
985 08
1002 07
1006 06
05/OCT 1006
994 19
985 04
994 16
985 03
992 02
990 15
1006 14
13/OCT 1008
1002 01
1004 30/SEP
968 06
968 05
1004 22
984 23
1004 21
1010 20
1006 19
996 18
996 17
1006 16
1004 29


TROPICAL CYCLONE TRACKS
NOVEMBER 2012
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
1224
08
09
950
1004
07
965
06
975
975
05
04
945
940
03
935
02
945
01
990
30
994
29
998
28
1004
27
1008
26/NOV
1224
120
130
140
150
160
30
20
10
0

TROPICAL CYCLONE TRACKS
DECEMBER 2012

TS, STS or TY

TD or extratropical cyclone

Position at 0000 UTC with date & central pressure

Position at 1200 UTC

YYNN Identification number

20

10

110

1225

1004

29

1002

28

1002

27

1002

26

1002

25

1006

24/DEC 1225

Appendix 3

Track and Intensity Analysis and Forecast Errors for Each Tropical Cyclone in 2012

TS Pakhar (1201)

Date/Time	Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
Mar. 29/12	16	55	128	173			2	-2	-6	0	5	10
29/18	16	78	138	147			2	-2	-2	0	5	0
30/00	11	78	117				-2	-6		5	10	
30/06	16	56	78				-4	-6		5	5	
30/12	22	56	80				-6	-8		10	10	
30/18	25	33	49				-6	-4		10	0	
31/00	11	25					-4			5		
31/06	35	50					-6			5		
31/12	40	11					0			0		
31/18	45	24					-2			0		
Apr. 01/00	69											
01/06	55											
01/12	44											
01/18	64											
mean	33	47	98	160	--	--	-3	-5	-4	4	6	5
sample	14	10	6	2	0	0	10	6	2	10	6	2

STS Sanvu (1202)

Date/Time	Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
May 22/06	0	130	185	257	231	540	4	11	17	0	-5	-10
22/12	22	78	192	234	249	542	4	12	15	0	-5	-5
22/18	46	81	204	233	260		4	15	15	5	-5	-5
23/00	70	94	204	202	324		0	10	10	5	-5	-5
23/06	60	79	178	133	204		5	10	10	0	-5	-5
23/12	84	168	226	248	462		5	5	-5	-5	-5	5
23/18	33	156	191	309			5	0	-10	-5	0	10
24/00	22	115	145	307			5	0	-15	-5	0	15
24/06	0	89	84	250			5	0	-17	-5	0	15
24/12	21	54	30	127			5	-5	-9	-5	5	10
24/18	22	30	103				0	-10		0	10	
25/00	0	32	129				0	-10		0	10	
25/06	15	38	89				0	-12		0	10	
25/12	22	83	177				-5	-9		5	10	
25/18	22	134					-5			5		
26/00	0	122					-10			10		
26/06	22	121					-7			5		
26/12	20	81					-9			10		
26/18	60											
27/00	92											
27/06	30											
27/12	29											
mean	32	94	153	230	288	541	0	1	1	1	1	3
sample	22	18	14	10	6	2	18	14	10	18	14	10

TY Mawar (1203)

Date/Time	Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
Jun. 01/18	33	33	156	264	761		5	15	0	0	-15	0
02/00	11	31	91	314	893		0	10	-10	0	-10	10
02/06	21	35	91	241			-10	0	-15	10	0	15
02/12	32	15	76	252			-10	0	-10	10	5	10
02/18	31	46	46	490			0	-5	-10	0	5	10
03/00	32	53	183	738			0	-5	0	0	5	0
03/06	0	67	268				0	-10		0	10	
03/12	15	10	297				0	-5		5	5	
03/18	15	78	468				0	-10		0	10	
04/00	11	135	617				-5	-5		5	5	
04/06	0	196					-10			10		
04/12	11	240					-5			5		
04/18	52	227					-10			10		
05/00	20	307					-5			5		
05/06	123											
05/12	153											
05/18	137											
06/00	80											
mean	43	105	229	383	827	--	-4	-1	-7	4	2	8
sample	18	14	10	6	2	0	14	10	6	14	10	6

TY Guchol (1204)

Date/Time	Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
Jun. 13/12	25	213	268	138	133	550	0	-5	30	0	5	-25
13/18	16	179	256	159	156	583	0	-10	25	0	10	-25
14/00	0	200	233	160	316	726	-5	-5	20	0	0	-20
14/06	0	159	157	186	420	1062	-5	10	20	0	-15	-20
14/12	0	44	15	115	488	1394	-5	30	10	0	-30	-10
14/18	0	0	84	191	610	1563	-10	25	-5	10	-25	-5
15/00	0	69	105	251	777		-5	20	-10	5	-20	0
15/06	0	119	164	362	904		10	20	-10	-10	-20	5
15/12	0	156	223	469	1280		30	5	-10	-25	-10	5
15/18	0	157	214	556	1390		25	-5	-10	-25	-5	5
16/00	0	74	150	613			20	-10	-15	-20	0	10
16/06	0	0	49	613			10	-10	-10	-10	10	10
16/12	0	15	52	766			-10	-20	-30	25	35	30
16/18	0	33	45	736			-20	-15	-35	30	25	35
17/00	0	47	162				-20	-20		30	30	
17/06	0	45	326				-20	-15		20	20	
17/12	0	32	426				-5	-15		5	15	
17/18	0	59	477				5	-5		0	5	
18/00	0	92					5			0		
18/06	0	81					5			0		
18/12	0	164					5			-5		
18/18	0	257					0			0		
19/00	0											
19/06	0											
19/12	0											
19/18	29											
mean	3	100	189	380	647	980	0	-1	-2	1	2	0
sample	26	22	18	14	10	6	22	18	14	22	18	14

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
STS Talim (1205)													
Jun.	17/06	76	123					2			-5		
	17/12	81	94	106				2	9		-5	-15	
	17/18	68	137	79				-2	0		5	0	
	18/00	39	92	99				0	-5		0	5	
	18/06	48	76	39				5	-7		-5	10	
	18/12	84	115	105				5	-9		-5	15	
	18/18	81	89					5			-5		
	19/00	71	63					0			0		
	19/06	42	65					-2			5		
	19/12	54	203					-2			10		
	19/18	69											
	20/00	70											
	20/06	31											
	20/12	23											
	mean	60	106	86	--	--	--	1	-2	--	0	3	--
	sample	14	10	5	0	0	0	10	5	0	10	5	0

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TS Toksuri (1206)													
Jun.	26/18	86	159	253	467			-4	-4	-11	5	5	10
	27/00	22	63	239				-6	-7		10	10	
	27/06	75	156	279				-2	-7		5	10	
	27/12	212	178	344				-2	-9		5	10	
	27/18	208	241	445				-4	-11		5	15	
	28/00	145	199					0			5		
	28/06	0	251					0			5		
	28/12	31	175					2			0		
	28/18	59	177					0			5		
	29/00	0											
	29/06	0											
	29/12	21											
	29/18	21											
	mean	68	177	312	467	--	--	-2	-8	-11	5	10	10
	sample	13	9	5	1	0	0	9	5	1	9	5	1

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
STS Khanun (1207)													
Jul.	16/06	0	172	228				6	8		-5	-5	
	16/12	0	113	48				8	8		-5	-5	
	16/18	0	113	190				9	2		-5	5	
	17/00	0	135					0			0		
	17/06	0	78					0			0		
	17/12	0	114					-2			5		
	17/18	0	149					-4			10		
	18/00	15											
	18/06	0											
	18/12	0											
	18/18	0											
	mean	1	125	155	--	--	--	2	6	--	0	-2	--
	sample	11	7	3	0	0	0	7	3	0	7	3	0

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TY Vicente (1208)													
Jul.	21/12	88	168	233	257			0	20	-10	0	-20	15
	21/18	94	195	315				0	30		0	-25	
	22/00	70	255	316				0	5		5	0	
	22/06	64	286	325				0	-5		0	5	
	22/12	67	269	285				10	-5		-10	10	
	22/18	81	213					25			-20		
	23/00	70	159					5			0		
	23/06	0	122					0			0		
	23/12	11	178					0			0		
	23/18	0											
	24/00	47											
	24/06	0											
	24/12	15											
	mean	47	205	295	257	--	--	4	9	-10	-3	-6	15
	sample	13	9	5	1	0	0	9	5	1	9	5	1

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TY Saola (1209)													
Jul.	28/00	0	40	161	182	235	174	7	5	0	-10	-5	0
	28/06	73	96	243	266	352	381	5	0	-5	-10	0	10
	28/12	43	54	216	261	352	459	0	-5	-10	-5	5	15
	28/18	0	152	214	245	230	429	-5	-5	-5	0	0	10
	29/00	0	122	109	160	251	409	0	-5	-5	0	0	10
	29/06	54	145	104	95	59		-15	-20	-20	10	15	15
	29/12	0	115	114	90	78		-15	-20	-20	10	15	15
	29/18	0	43	24	63	10		-10	-15	-25	5	10	15
	30/00	0	80	63	126	121		-10	-15	-35	5	10	25
	30/06	0	54	56	123			-5	-10	-40	5	5	35
	30/12	33	67	32	75			-10	-15	-35	15	10	35
	30/18	15	59	112	52			-10	-20	-20	10	10	30
	31/00	52	56	113	119			-10	-30	-25	10	20	35
	31/06	56	84	33				-5	-35		5	30	
	31/12	33	78	83				-5	-40		5	35	
	31/18	15	75	127				-10	-40		5	40	
Aug.	01/00	0	78	189				-25	-40		20	45	
	01/06	0	69					-30			30		
	01/12	20	39					-35			35		
	01/18	56	46					-15			25		
	02/00	88	63					-5			15		
	02/06	46											
	02/12	0											
	02/18	35											
	03/00	30											
	mean	26	77	117	143	188	370	-10	-18	-19	9	14	19
	sample	25	21	17	13	9	5	21	17	13	21	17	13

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TY Damrey (1210)													
Jul.	28/12	45	153	239	59	467	891	2	6	16	0	0	-10
	28/18	30	151	149	180	599	896	0	19	12	0	-10	-5
	29/00	35	129	94	373	613	818	-4	5	5	5	0	0
	29/06	20	107	162	423	710	884	-2	0	0	5	5	10
	29/12	33	64	122	326	734		0	0	0	5	5	10
	29/18	22	116	187	357	657		10	5	5	-5	0	0
	30/00	24	201	227	348	484		5	10	10	0	-5	-10
	30/06	0	244	408	555	627		5	10	15	0	-5	-15
	30/12	20	194	306	397			5	5	15	0	0	-15
	30/18	0	124	203	287			-5	5	10	5	-5	-15
	31/00	0	89	241	292			0	10	-7	0	-15	0
	31/06	0	84	262	201			0	15	-6	0	-20	10
	31/12	0	68	380				0	10		0	-15	
	31/18	0	47	292				0	5		0	-10	
Aug.	01/00	0	65	235				5	-12		-10	5	
	01/06	0	60	146				10	-6		-15	5	
	01/12	0	107					10			-15		
	01/18	28	78					15			-15		
	02/00	0	56					2			-10		
	02/06	0	145					2			-35		
	02/12	0											
	02/18	0											
	03/00	27											
	03/06	0											
	mean	12	114	228	317	611	872	3	5	6	-4	-4	-3
	sample	24	20	16	12	8	4	20	16	12	20	16	12

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TY Haikui (1211)													
Aug.	03/00	91	170	121	80	208	438	-5	-5	-5	10	10	10
	03/06	91	106	128	89	169	428	0	-5	0	5	10	5
	03/12	92	176	162	181	238	465	0	0	0	5	5	5
	03/18	55	60	80	145	147	434	5	5	0	0	0	5
	04/00	71	32	97	148	121	397	5	5	0	-5	0	5
	04/06	0	155	129	151	113	167	-5	5	0	10	0	5
	04/12	0	54	103	108	153		0	5	0	5	0	0
	04/18	0	68	127	82	204		5	5	0	0	0	0
	05/00	0	59	103	73	236		5	0	-5	0	5	5
	05/06	0	32	95	113	175		10	0	10	-5	5	0
	05/12	0	118	118	113			5	0	0	0	0	5
	05/18	0	74	96	198			0	-5	0	0	0	10
	06/00	0	32	101	188			0	-15	-2	0	10	10
	06/06	0	50	135	145			-5	-15	-2	5	15	10
	06/12	33	15	195				-5	-25		0	20	
	06/18	0	53	279				-5	-20		0	20	
	07/00	0	93	289				-15	-12		10	15	
	07/06	0	68	220				-5	-2		10	5	
	07/12	23	75					-10			5		
	07/18	0	92					-5			5		
	08/00	30	136					-2			0		
	08/06	22	114					0			0		
	08/12	22											
	08/18	0											
	09/00	0											
	09/06	19											
	mean	21	83	143	129	176	388	-1	-4	0	3	7	5
	sample	26	22	18	14	10	6	22	18	14	22	18	14

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
STS Kirogi (1212)													
Aug.	08/00	0	102	371				4	6		-5	-10	
	08/06	0	56					8			-15		
	08/12	48	104					8			-10		
	08/18	38	134					8			-10		
	09/00	47	58					10			-15		
	09/06	0											
	09/12	67											
	09/18	131											
	10/00	33											
	mean	41	91	371	--	--	--	8	6	--	-11	-10	--
	sample	9	5	1	0	0	0	5	1	0	5	1	0

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TY Kai-tak (1213)													
Aug.	13/00	34	245	339	652	915	1109	2	-2	10	0	5	-10
	13/06	0	201	348	660	939		2	0	10	0	0	-10
	13/12	53	238	404	690	1060		0	0	22	0	0	-25
	13/18	109	237	452	688	1025		-2	10	28	5	-10	-30
	14/00	149	252	577	784	1053		-2	10	28	5	-10	-30
	14/06	115	270	528	736			0	10	23	0	-10	-25
	14/12	57	231	471	670			5	15	21	-5	-15	-25
	14/18	11	154	334	512			15	15	11	-15	-15	-15
	15/00	0	148	330	568			15	10	4	-15	-10	-5
	15/06	0	246	431				10	5		-10	-5	
	15/12	25	218	280				10	21		-10	-25	
	15/18	0	69	109				10	7		-10	-10	
	16/00	0	84	227				5	0		-5	0	
	16/06	0	43					-5			5		
	16/12	0	62					0			0		
	16/18	0	25					-5			5		
	17/00	0	47					-2			5		
	17/06	11											
	17/12	22											
	17/18	0											
	18/00	15											
	mean	29	163	371	662	998	1109	3	8	17	-3	-8	-19
	sample	21	17	13	9	5	1	17	13	9	17	13	9

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TY Tembin (1214)													
Aug.	19/06	0	31	46	78	273	411	27	35	10	-25	-30	-10
	19/12	0	11	39	98	310	445	40	35	10	-35	-30	-10
	19/18	0	43	61	175	328	400	35	25	10	-30	-20	-10
	20/00	0	31	49	177	220	278	15	-10	0	-10	5	0
	20/06	0	52	101	213	356	478	-5	-25	-10	5	20	10
	20/12	0	76	57	156	267	434	-10	-35	-20	15	30	20
	20/18	0	22	41	46	84	235	-20	-35	-25	20	30	25
	21/00	31	11	125	168	168	337	-30	-20	-30	30	25	30
	21/06	0	30	113	93	85	68	-30	-20	-30	30	25	30
	21/12	33	114	140	146	108	242	-25	0	-10	20	5	10
	21/18	0	70	59	57	170	283	-15	5	0	10	0	0
	22/00	0	75	49	30	169	237	5	0	5	-5	0	-5
	22/06	0	38	35	39	130	132	5	15	15	-5	-15	-15
	22/12	15	24	38	62	115	292	10	15	15	-10	-15	-15
	22/18	0	108	63	257	213	183	5	20	20	-5	-20	-20
	23/00	0	140	105	254	185	429	-15	15	20	10	-15	-20
	23/06	0	160	136	259	112	527	-15	15	25	10	-15	-25
	23/12	0	95	132	152	83	528	15	22	27	-15	-20	-25
	23/18	0	89	118	42	179	576	22	22	27	-20	-20	-25
	24/00	0	91	109	35	172	498	10	5	10	-10	-5	-10
	24/06	0	47	90	43	284	656	5	10	10	-5	-10	-10
	24/12	21	83	84	174	434	877	5	10	10	-5	-10	-10
	24/18	51	119	84	192	532	1027	10	10	10	-10	-10	-10
	25/00	0	106	103	351	619	1206	10	10	5	-10	-10	-5
	25/06	0	94	24	341	624	1219	10	10	5	-10	-10	-5
	25/12	0	24	99	273	570		5	5	0	-5	-5	0
	25/18	0	57	109	282	685		0	0	-5	0	0	5
	26/00	0	46	42	122	580		-10	-10	0	10	10	-5
	26/06	21	15	84	257	761		-10	-10	0	10	10	0
	26/12	22	47	219	425			-15	-15	0	10	15	0
	26/18	21	89	263	598			-15	-20	0	10	20	0
	27/00	22	106	195	735			-15	-15	-5	10	15	5
	27/06	0	99	282	876			-5	-15	-14	5	15	10
	27/12	83	116	292				-10	-15		10	15	
	27/18	10	83	337				-5	0		10	0	
	28/00	0	41	389				-5	-5		10	5	
	28/06	39	59	456				0	-14		0	10	
	28/12	33	80					0			5		
	28/18	37	102					0			5		
	29/00	0	121					-10			15		
	29/06	37	191					-19			20		
	29/12	53											
	29/18	44											
	30/00	0											
	30/06	0											
	mean	13	74	129	218	304	480	-1	1	3	2	0	-3
	sample	45	41	37	33	29	25	41	37	33	41	37	33

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TY Bolaven (1215)													
Aug.	20/06	0	176	256	419	589	683	9	20	15	-10	-20	-15
	20/12	0	128	185	292	393	402	15	15	5	-20	-15	-5
	20/18	0	97	191	341	481	576	15	15	5	-20	-15	-5
	21/00	0	95	259	384	505	545	0	-15	-20	-5	10	10
	21/06	0	84	243	392	544	546	5	-10	-15	0	5	10
	21/12	0	139	284	432	585	515	-5	-20	-20	5	10	10
	21/18	0	164	292	410	555	508	-5	-20	-10	5	10	10
	22/00	0	157	303	377	511	353	-15	-20	0	10	10	5
	22/06	0	153	271	305	403	260	-20	-25	10	10	15	0
	22/12	0	133	285	348	399	335	-20	-20	20	10	10	-10
	22/18	0	142	304	356	318	240	-20	-10	10	10	10	-5
	23/00	0	83	245	261	235	201	-20	0	5	10	5	0
	23/06	0	66	174	220	189	207	-15	10	5	10	0	0
	23/12	52	115	153	140	101	185	-10	20	0	5	-10	5
	23/18	54	126	126	95	173	200	0	10	-10	5	-5	10
	24/00	35	91	74	82	168	379	10	5	-25	0	0	20
	24/06	0	84	120	150	170		10	-5	-40	0	5	30
	24/12	0	61	54	150	180		20	-10	-40	-10	10	30
	24/18	0	15	59	147	224		5	-20	-30	-5	15	25
	25/00	0	0	30	69	389		-5	-35	-20	5	25	20
	25/06	0	83	97	56			-5	-35	-20	10	30	20
	25/12	0	39	80	89			-20	-40	-25	15	30	20
	25/18	0	52	103	20			-30	-40	-20	20	30	20
	26/00	0	63	85	139			-45	-30	-10	30	25	15
	26/06	0	22	45				-50	-35		35	30	
	26/12	0	65	38				-40	-35		35	30	
	26/18	10	73	134				-25	-20		20	30	
	27/00	0	86	248				0	0		10	5	
	27/06	0	87					5			5		
	27/12	9	45					0			5		
	27/18	24	71					-5			10		
	28/00	14	111					0			5		
	28/06	9											
	28/12	0											
	28/18	56											
	29/00	0											
	mean	7	91	169	236	356	383	-8	-12	-10	7	10	9
	sample	36	32	28	24	20	16	32	28	24	32	28	24

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TY Sanba (1216)													
Sep.	11/00	68	256	344	169	314	562	6	45	80	-10	-40	-55
	11/06	45	329	353	90	122	325	11	55	75	-15	-45	-50
	11/12	56	325	300	91	177	178	27	70	55	-25	-50	-35
	11/18	0	170	126	135	164	296	35	75	50	-30	-50	-30
	12/00	24	85	85	126	149	279	35	65	35	-30	-40	-25
	12/06	0	55	77	160	177	316	45	65	35	-35	-40	-25
	12/12	0	43	53	112	191	363	55	35	15	-35	-20	-10
	12/18	25	34	137	164	293	698	65	35	5	-40	-20	-5
	13/00	0	92	191	258	479		45	15	-5	-20	-5	10
	13/06	0	71	162	234	374		25	0	-15	-10	5	15
	13/12	0	118	135	204	427		0	-5	-10	0	5	5
	13/18	0	123	104	211	525		-5	-15	-10	5	10	10
	14/00	0	70	89	231			-5	-15	-25	0	10	20
	14/06	0	112	161	389			-5	-15	-40	0	10	30
	14/12	0	38	53	418			-10	-5	-40	5	5	35
	14/18	0	46	66	284			-15	-5	-35	10	5	30
	15/00	0	23	138				-15	-20		10	15	
	15/06	0	37	234				-15	-40		10	30	
	15/12	0	53	330				-5	-40		0	35	
	15/18	0	79	252				0	-20		0	20	
	16/00	0	62					-15			10		
	16/06	0	124					-30			25		
	16/12	0	117					-20			10		
	16/18	0	101					-10			5		
	17/00	18											
	17/06	0											
	17/12	26											
	17/18	89											
	mean	13	107	170	205	283	377	8	14	11	-7	-8	-5
	sample	28	24	20	16	12	8	24	20	16	24	20	16

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TY Jelawat (1217)													
Sep.	20/18	31	212	310	263	154	87	2	5	45	0	-5	-35
	21/00	0	123	211	172	94	24	-10	0	20	5	0	-20
	21/06	33	102	194	148	135	190	-15	20	20	10	-10	-20
	21/12	47	114	145	105	131	272	-10	25	30	10	-20	-20
	21/18	69	71	95	97	160	334	-5	25	35	5	-20	-25
	22/00	44	57	45	97	132	264	0	20	30	0	-15	-20
	22/06	0	73	109	148	124	203	20	15	30	-10	-15	-20
	22/12	24	100	141	171	146	191	35	30	30	-25	-20	-20
	22/18	40	120	165	176	174	221	30	35	30	-25	-25	-20
	23/00	0	79	141	229	357	365	15	30	25	-15	-25	-20
	23/06	0	89	128	255	351	259	-5	10	5	-5	-10	5
	23/12	0	44	125	238	351	142	5	5	5	0	0	0
	23/18	0	25	54	116	212	308	10	5	-5	-5	0	5
	24/00	0	34	31	25	113	510	10	5	-10	-5	0	10
	24/06	0	68	34	49	196	566	10	5	-10	-5	0	10
	24/12	0	46	64	124	439	989	0	-5	-20	-5	0	10
	24/18	0	33	107	193	542	1268	-10	-20	-20	5	10	10
	25/00	0	11	70	211	682	1515	-10	-25	-20	5	15	10
	25/06	0	54	122	348	884	1851	-10	-25	-25	5	15	15
	25/12	0	96	167	422	1036	2097	-10	-25	-25	5	15	20
	25/18	0	101	206	495	1259	2508	-20	-20	-20	10	10	15
	26/00	0	114	235	581	1386	2699	-20	-10	-10	10	5	10
	26/06	0	124	256	601	1387	2691	-10	-10	-10	5	5	5
	26/12	0	91	197	624	1506		0	5	-10	-5	0	0
	26/18	0	68	264	664	1765		5	0	-15	-10	0	5
	27/00	0	53	298	738	1483		5	0	-20	-5	0	10
	27/06	0	76	261	779	1676		0	-5	-30	0	0	20
	27/12	0	49	171	389			0	-10	-20	5	0	10
	27/18	0	30	247	768			-5	-10	-25	5	0	20
	28/00	0	75	370	978			5	-10	-10	-5	0	5
	28/06	0	87	350	554			0	-15	-10	-5	5	10
	28/12	10	156	393				-5	-30		-5	10	
	28/18	0	112	353				-5	-10		0	5	
	29/00	0	29	90				-5	-10		0	5	
	29/06	0	83	137				-15	-10		5	10	
	29/12	0	62					-30			10		
	29/18	0	80					-15			10		
	30/00	0	62					-15			5		
	30/06	0	39					-10			10		
	30/12	0											
	30/18	0											
Oct.	01/00	0											
	01/06	0											
	mean	7	78	180	347	625	850	-2	0	0	0	-2	0
	sample	43	39	35	31	27	23	39	35	31	39	35	31

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TY Ewiniar (1218)													
Sep.	24/12	42	108	257	190	211	275	0	0	-5	5	0	5
	24/18	69	135	214	105	233	130	4	0	-5	0	0	5
	25/00	30	129	266	135	307		0	-5	-15	0	5	15
	25/06	23	187	278	182	100		5	-5	-15	-5	5	15
	25/12	0	189	197	178	94		0	-10	-15	0	10	15
	25/18	69	182	83	158	136		-5	-15	-20	5	15	20
	26/00	0	117	58	47			-5	-15	-22	5	15	20
	26/06	0	45	38	218			-5	-10	-12	5	10	10
	26/12	0	62	247	342			-10	-5	-9	10	5	5
	26/18	0	36	167	396			-10	-5	-6	10	5	5
	27/00	19	115	175				-5	-12		5	10	
	27/06	10	123	80				0	-7		0	5	
	27/12	19	93	37				0	-4		0	0	
	27/18	22	84	96				0	-4		0	5	
	28/00	22	35					0			-5		
	28/06	0	114					2			-5		
	28/12	22	147					0			-5		
	28/18	33	72					0			0		
	29/00	44											
	29/06	43											
	29/12	0											
	29/18	0											
	mean	21	110	157	195	180	202	-2	-7	-12	1	6	12
	sample	22	18	14	10	6	2	18	14	10	18	14	10

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
STS Maliksi (1219)													
Oct.	01/06	44	53	391				-2	0		5	0	
	01/12	0	179	334				-7	-10		10	10	
	01/18	0	125	461				-5	-10		5	10	
	02/00	0	146	652				-10	-10		10	10	
	02/06	0	83					-5			5		
	02/12	0	150					-5			5		
	02/18	0	67					-5			5		
	03/00	0	78					-5			5		
	03/06	0											
	03/12	59											
	03/18	175											
	04/00	0											
	mean	23	110	459	--	--	--	-5	-7	--	6	8	--
	sample	12	8	4	0	0	0	8	4	0	8	4	0

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
STS Gaemi (1220)													
Oct.	01/12	31	139	232	285	148		-4	0	-9	5	-5	10
	01/18	24	189	262	276	216		0	-2	-9	0	0	10
	02/00	39	184	274	233	288		4	-2	-9	-5	0	10
	02/06	46	97	191	169	308		4	-2	-11	-10	0	15
	02/12	64	72	151	116			4	-4	-13	-10	5	15
	02/18	0	78	141	119			-2	-9	-13	0	10	15
	03/00	24	123	131	168			-2	-9	-13	0	10	15
	03/06	32	150	120	205			-7	-16	-20	5	20	20
	03/12	43	165	77				-9	-18		10	20	
	03/18	131	189	148				-9	-18		10	20	
	04/00	21	44	201				-4	-13		5	15	
	04/06	0	15	260				-6	-15		10	15	
	04/12	0	34					-8			10		
	04/18	24	134					-8			10		
	05/00	0	190					-8			10		
	05/06	0	194					-10			10		
	05/12	0											
	05/18	0											
	06/00	64											
	06/06	34											
	mean	29	125	182	196	240	--	-4	-9	-12	4	9	14
	sample	20	16	12	8	4	0	16	12	8	16	12	8

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TY Prapiroon (1221)													
Oct.	07/12	0	108	63	146	253	148	14	20	25	-15	-20	-25
	07/18	0	33	77	236	337	216	15	10	5	-15	-5	-5
	08/00	44	24	89	157	161	100	0	0	0	0	5	0
	08/06	0	81	137	241	354	624	-5	0	-5	5	0	5
	08/12	0	90	131	224	368	602	0	0	5	5	0	-5
	08/18	39	77	71	110	160	376	0	0	0	5	0	-5
	09/00	0	39	84	74	77	176	-20	-25	-20	15	10	5
	09/06	0	84	134	115	115	146	-10	-25	-20	5	10	5
	09/12	0	87	158	76	91	98	-10	-15	-20	5	0	5
	09/18	0	95	115	39	103	191	-10	-15	-30	5	0	15
	10/00	0	25	61	217	366	443	-10	-15	-30	5	0	15
	10/06	0	81	142	279	428	497	-15	-15	-35	10	5	20
	10/12	0	67	142	198	397	411	-10	-20	-35	0	5	20
	10/18	0	24	146	210	343	326	-10	-20	-15	0	10	10
	11/00	0	38	125	188	248	280	-10	-20	-15	0	10	10
	11/06	0	86	137	197	240	355	-10	-25	-15	0	15	10
	11/12	0	125	156	300	309	298	-10	-25	-15	5	20	15
	11/18	0	113	217	369	257	250	-20	-25	-20	15	20	20
	12/00	0	147	282	335	158	99	-20	-25	-20	15	20	20
	12/06	0	129	258	252	129	74	-25	-25	-20	20	20	20
	12/12	0	68	205	117	152	168	-25	-25	-20	20	20	20
	12/18	0	49	151	30	181	228	-5	-10	-15	5	10	15
	13/00	0	64	84	140	221	352	-5	-10	-20	5	10	20
	13/06	0	88	33	235	163	490	-5	-10	-20	0	5	15
	13/12	0	121	75	225	15	751	-5	-10	-20	0	5	15
	13/18	0	106	54	137	184	1023	-10	-15	-25	5	10	20
	14/00	0	39	113	63	456	1303	-10	-20	-25	5	15	20
	14/06	0	33	133	195	681	1543	-10	-20	-30	5	15	20
	14/12	0	24	105	281	1016		-10	-20	-30	5	15	20
	14/18	0	0	31	413	1224		-10	-20	-20	5	15	10
	15/00	0	35	84	588	1462		-15	-15	-25	10	10	15
	15/06	0	57	190	804	1643		-15	-20	-30	10	10	15
	15/12	0	15	273	878			-10	-15	-25	10	10	15
	15/18	0	53	434	1108			-5	-10	-20	10	10	15
	16/00	0	153	630	1429			5	-5	-14	0	5	5
	16/06	0	220	735	1551			0	-10	-14	0	5	5
	16/12	0	219	832				0	-10		0	5	
	16/18	0	217	739				0	-5		0	0	
	17/00	0	230	703				-5	-9		5	0	
	17/06	0	251	731				-10	-9		5	0	
	17/12	0	242					-10			5		
	17/18	0	272					-5			0		
	18/00	0	233					-9			0		
	18/06	0	221					-4			0		
	18/12	0											
	18/18	0											
	19/00	0											
	19/06	0											
	mean	2	104	227	338	384	413	-8	-13	-18	4	8	11
	sample	48	44	40	36	32	28	44	40	36	44	40	36

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
STS Maria (1222)													
Oct.	14/06	0	187					12			-15		
	14/12	0	280	558	865	1518		8	0	-4	-10	-5	0
	14/18	0	178	328	717	559		0	-11	-11	-5	5	5
	15/00	0	103	322	177			-14	-16	-11	10	10	5
	15/06	33	141	375	323			-14	-11	2	10	5	-5
	15/12	0	202	435	483			-11	-6	0	5	0	0
	15/18	0	298	413	687			-11	-6	-4	5	0	5
	16/00	0	271	424				-6	-2		5	0	
	16/06	0	269	610				-6	-2		5	-5	
	16/12	0	294	717				4	4		5	0	
	16/18	0	243	809				4	0		0	5	
	17/00	33	152					4			0		
	17/06	0	112					2			0		
	17/12	58	87					0			0		
	17/18	58	44					-4			5		
	18/00	0											
	18/06	0											
	18/12	44											
	18/18	33											
	mean	14	191	499	542	1038	--	-2	-5	-5	1	2	2
	sample	19	15	10	6	2	0	15	10	6	15	10	6

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TY Son-tinh (1223)													
	23/12	0	149	350				0	-2		0	0	
	23/18	0	179	248	204	172	321	2	0	15	-5	0	-15
	24/00	0	122	141	132	140	420	-2	0	10	-5	0	-10
	24/06	0	68	55	123	283		-2	10	15	-5	-10	-15
	24/12	25	99	58	154	329		-2	10	35	-5	-10	-30
	24/18	0	73	170	294			-11	5	45	10	-5	-80
	25/00	34	43	122	255			-5	5	35	5	-5	-75
	25/06	0	128	68	295			5	15	30	-5	-15	-70
	25/12	0	217	173	369			10	35	20	-10	-30	-60
	25/18	39	107	185	483			10	30	10	-10	-30	-45
	26/00	0	49	177	586			0	27	-2	0	-35	-35
	26/06	58	46	193				0	22		0	-30	
	26/12	0	15	169				20	12		-15	-20	
	26/18	0	21	199				15	8		-15	-10	
	27/00	0	91	250				15	-4		-20	0	
	27/06	0	107					5			-10		
	27/12	0	128					5			-10		
	27/18	0	85					6			-5		
	28/00	0	130					0			-35		
	28/06	0											
	28/12	15											
	28/18	0											
	29/00	0											
	mean	7	98	170	289	231	370	4	12	21	-7	-13	-43
	sample	23	19	15	10	4	2	19	15	10	19	15	10

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TY Bopha (1224)													
Nov.	26/18	0	87	134	174	235	295	-4	-9	-19	0	5	15
	27/00	25	68	156	194	223	347	-6	-14	-15	5	10	10
	27/06	44	89	194	228	301	489	-6	-14	-5	5	10	0
	27/12	22	144	269	274	297	443	-8	-14	5	5	10	-5
	27/18	22	165	291	249	243	420	-4	-14	10	0	10	-15
	28/00	22	166	219	185	175	415	-9	-15	30	5	10	-30
	28/06	22	176	209	169	230	415	-9	-5	25	5	0	-25
	28/12	33	200	145	109	252	433	-9	0	25	5	0	-25
	28/18	60	135	118	119	279	398	-9	5	30	5	-10	-30
	29/00	0	75	92	104	287	395	-10	25	30	5	-25	-30
	29/06	0	87	159	260	405	569	0	25	30	-5	-25	-30
	29/12	35	116	211	388	510	659	10	25	30	-10	-25	-30
	29/18	31	105	156	308	473	670	15	30	25	-20	-30	-20
	30/00	0	144	289	499	647	880	35	35	25	-35	-35	-20
	30/06	0	122	287	482	663	823	30	30	30	-30	-30	-30
	30/12	22	89	289	477	713	763	25	30	35	-20	-25	-25
	30/18	0	35	206	361	583	602	10	5	15	-10	0	-10
Dec.	01/00	0	71	234	361	537	631	-5	-10	-10	-5	5	10
	01/06	0	124	230	378	507	555	-5	-5	-35	-5	-5	25
	01/12	0	100	147	276	376	380	-5	0	-20	-5	-5	10
	01/18	0	94	182	340	374	390	-10	0	-10	10	0	5
	02/00	0	123	213	343	382	231	-10	-15	-5	10	15	0
	02/06	0	78	237	339	283	108	-5	-20	0	0	10	-5
	02/12	0	55	252	295	241	165	5	-25	-5	0	15	0
	02/18	0	110	330	306	326	257	10	-25	-5	-10	15	0
	03/00	0	78	303	333	282	267	0	-15	-15	0	10	10
	03/06	0	121	287	273	233	357	-25	-15	-15	15	10	10
	03/12	0	121	180	143	218	506	-15	-5	-5	10	0	0
	03/18	0	132	131	155	323	616	-15	-5	-10	10	0	5
	04/00	0	101	193	241	398	614	-10	-20	-15	5	10	10
	04/06	0	109	175	233	518		-10	-20	-5	5	10	0
	04/12	55	76	11	292	764		-5	-15	15	5	10	-15
	04/18	0	79	88	420	883		-5	-20	15	5	15	-15
	05/00	0	64	165	560	918		-5	-5	10	5	5	-10
	05/06	25	101	248	609			-10	5	5	5	-5	-5
	05/12	31	109	324	694			-10	15	-10	5	-15	10
	05/18	66	83	348	728			-15	15	-40	10	-15	35
	06/00	22	34	333	582			0	10	-44	0	-10	40
	06/06	45	78	377				15	10		-15	-10	
	06/12	25	119	408				25	0		-25	0	
	06/18	0	148	446				35	-15		-30	15	
	07/00	0	185	371				30	-19		-25	20	
	07/06	0	232					25			-20		
	07/12	0	182					-15			15		
	07/18	0	202					-40			35		
	08/00	0	135					-39			35		
	08/06	0											
	08/12	32											
	08/18	77											
	09/00	25											
	mean	15	114	230	328	414	470	-1	-2	3	-1	-1	-5
	sample	50	46	42	38	34	30	46	42	38	46	42	38

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=96	=120	T=24	=48	=72	T=24	=48	=72
TS Wukong (1225)													
Dec.	25/00	0	88	128	200			-2	-2	-12	0	0	10
	25/06	0	86	247				-2	-2		0	0	
	25/12	22	137	249				-2	-4		0	5	
	25/18	0	60	242				-2	-4		0	5	
	26/00	123	145	293				-4	-2		5	0	
	26/06	135	179					-4			5		
	26/12	159	188					-4			5		
	26/18	158	236					-4			5		
	27/00	55	71					2			0		
	27/06												
	27/12												
	27/18												
	28/00												
	mean	50	132	232	200	--	--	-2	-3	-12	2	2	10
	sample	13	9	5	1	0	0	9	5	1	9	5	1

Appendix 4

Monthly and Annual Frequencies of Tropical Cyclones

Monthly and annual frequencies of tropical cyclones that attained TS intensity or higher in the western North Pacific and the South China Sea for 1951 - 2012

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1951		1	1	2	1	1	3	3	2	4	1	2	21
1952						3	3	5	3	6	3	4	27
1953		1			1	2	1	6	3	5	3	1	23
1954			1		1		1	5	5	4	3	1	21
1955	1	1	1	1		2	7	6	4	3	1	1	28
1956			1	2		1	2	5	6	1	4	1	23
1957	2			1	1	1	1	4	5	4	3		22
1958	1			1	1	4	7	5	5	3	2	2	31
1959		1	1	1			2	5	5	4	2	2	23
1960				1	1	3	3	10	3	4	1	1	27
1961	1		1		2	3	4	6	6	4	1	1	29
1962		1		1	2		5	8	4	5	3	1	30
1963				1		4	4	3	5	4		3	24
1964					2	2	7	5	6	5	6	1	34
1965	2	1	1	1	2	3	5	6	7	2	2		32
1966				1	2	1	4	10	9	5	2	1	35
1967		1	2	1	1	1	7	9	9	4	3	1	39
1968				1	1	1	3	8	3	5	5		27
1969	1		1	1			3	4	3	3	2	1	19
1970		1				2	3	6	5	5	4		26
1971	1		1	3	4	2	8	5	6	4	2		36
1972	1				1	3	7	5	4	5	3	2	31
1973							7	5	2	4	3		21
1974	1		1	1	1	4	4	5	5	4	4	2	32
1975	1						2	4	5	5	3	1	21
1976	1	1		2	2	2	4	4	5	1	1	2	25
1977			1			1	3	3	5	5	1	2	21
1978	1			1		3	4	8	5	4	4		30
1979	1		1	1	2		4	2	6	3	2	2	24
1980				1	4	1	4	2	6	4	1	1	24
1981			1	2		3	4	8	4	2	3	2	29
1982			3		1	3	3	5	5	3	1	1	25
1983						1	3	5	2	5	5	2	23
1984						2	5	5	4	7	3	1	27
1985	2				1	3	1	8	5	4	1	2	27
1986		1		1	2	2	4	4	3	5	4	3	29
1987	1			1		2	4	4	6	2	2	1	23
1988	1				1	3	2	8	8	5	2	1	31
1989	1			1	2	2	7	5	6	4	3	1	32
1990	1			1	1	3	4	6	4	4	4	1	29
1991			2	1	1	1	4	5	6	3	6		29
1992	1	1				2	4	8	5	7	3		31
1993			1			1	4	7	6	4	2	3	28
1994				1	1	2	7	9	8	6		2	36
1995				1		1	2	6	5	6	1	1	23
1996		1		1	2		6	5	6	2	2	1	26
1997				2	3	3	4	6	4	3	2	1	28
1998							1	3	5	2	3	2	16
1999				2		1	4	6	6	2	1		22
2000					2		5	6	5	2	2	1	23
2001					1	2	5	6	5	3	1	3	26
2002	1	1			1	3	5	6	4	2	2	1	26
2003	1			1	2	2	2	5	3	3	2		21
2004				1	2	5	2	8	3	3	3	2	29
2005	1		1	1	1		5	5	5	2	2		23
2006					1	2	2	7	3	4	2	2	23
2007				1	1		3	4	5	6	4		24
2008				1	4	1	2	4	4	2	3	1	22
2009					2	2	2	5	7	3	1		22
2010			1				2	5	4	2			14
2011					2	3	4	3	7	1		1	21
2012			1		1	4	4	5	3	5	1	1	25
Normal 1981-2010	0.3	0.1	0.3	0.6	1.1	1.7	3.6	5.8	4.9	3.6	2.3	1.2	25.6

Appendix 5

Code Forms of RSMC Products

(1) 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
GUST VgVgVg 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 YYGGggF UTC LaLa.LaF N LoLoLo.LoF E (or W) FrFrFr NM 70%
MOVE direction SpSpSp KT
PRES PPPP HPA
MXWD VmVmVm KT
GUST VgVgVg KT
Ft1Ft1HF YYGGggF UTC LaLa.LaF N LoLoLo.LoF E (or W) FrFrFr NM 70%
MOVE direction SpSpSp KT
PRES PPPP HPA
GUST VgVgVg KT
MXWD VmVmVm KT
Ft2Ft2HF YYGGggF UTC LaLa.LaF N LoLoLo.LoF E (or W) FrFrFr NM 70%
MOVE direction SpSpSp KT
PRES PPPP HPA
MXWD VmVmVm KT
GUST VgVgVg KT =

Notes:

a. Underlined parts are 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 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 (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 such as 'N', 'NNE', 'NE' and 'ENE'
SpSpSp	:	Speed of movement
PPPP	:	Central pressure

VmVmVm	:	Maximum sustained wind
VgVgVg	:	Maximum gust wind
RdRdRd	:	Radii of 30knots and 50knots wind
octant	:	Eccentric distribution of wind given in 8 azimuthal direction such as 'NORTH', 'NORTHEAST' and 'EAST'
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 150000
RSMC TROPICAL CYCLONE ADVISORY
NAME STS 0320 NEPARTAK (0320)
ANALYSIS
PSTN 150000UTC 12.6N 117.8E FAIR
MOVE WNW 13KT
PRES 980HPA
MXWD 055KT
GUST 080KT
50KT 40NM
30KT 240NM NORTHEAST 160NM SOUTHWEST
FORECAST
24HF 160000UTC 14.7N 113.7E 110NM 70%
MOVE WNW 11KT
PRES 965HPA
MXWD 070KT
GUST 100KT
48HF 170000UTC 16.0N 111.0E 170NM 70%
MOVE WNW 07KT
PRES 970HPA
MXWD 065KT
GUST 095KT
72HF 180000UTC 19.5N 110.0E 250NM 70%
MOVE NNW 09KT
PRES 985HPA
MXWD 050KT
GUST 070KT =

(2) RSMC Tropical Cyclone Advisory for Five-day Track Forecast (WTPQ50-55 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
GUST VgVgVg 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
GUST VgVgVg KT
48HF $YYGGgg_F$ UTC $LaLa.La_F$ N $LoLoLo.Lo_F$ E (or W) FrFrFr NM 70%
MOVE direction SpSpSp KT
PRES PPPP HPA
GUST VgVgVg KT
MXWD VmVmVm KT

72HF YYGGggF UTC LaLa.LaF N LoLoLo.LoF E (or W) FrFrFr NM 70%
MOVE direction SpSpSp KT
PRES PPPP HPA
MXWD VmVmVm KT
GUST VgVgVg KT
96HF YYGGggF UTC LaLa.LaF N LoLoLo.LoF E (or W) FrFrFr NM 70%
MOVE direction SpSpSp KT
120HF YYGGggF UTC LaLa.LaF N LoLoLo.LoF E (or W) FrFrFr NM 70%
MOVE direction SpSpSp KT=

Notes:

a. Underlined parts are fixed.

b. Abbreviations and symbolic letters are the same as those used in RSMC Tropical Cyclone Advisory (WTPQ20-25 RJTD).

Example:

WTPQ50 RJTD 060000
RSMC TROPICAL CYCLONE ADVISORY
NAME TY 0908 MORAKOT (0908)
ANALYSIS
PSTN 060000UTC 23.4N 128.3E FAIR
MOVE WNW 09KT
PRES 960HPA
MXWD 075KT
GUST 105KT
50KT 80NM
30KT 350NM SOUTH 300NM NORTH
FORECAST
24HF 070000UTC 24.0N 123.9E 70NM 70%
MOVE W 10KT
PRES 925HPA
MXWD 090KT
GUST 130KT
48HF 080000UTC 25.3N 121.8E 110NM 70%
MOVE WNW 06KT
PRES 950HPA
MXWD 080KT
GUST 115KT
72HF 090000UTC 26.5N 119.7E 160NM 70%
MOVE WNW 06KT
PRES 970HPA
MXWD 065KT
GUST 095KT
96HF 100000UTC 28.0N 118.8E 240NM 70%
MOVE NNW SLOWLY
120HF 110000UTC 29.6N 118.2E 375NM 70%
MOVE NNW SLOWLY =

(3) 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 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=84	LaLa.La N LoLoLo.Lo E (or W)	appp HPA	awww KT=

Notes:

a. Underlined parts are fixed.

b. Symbolic letters

i i	:	'20', '21', '22', '23', '24' or '25'
YYGGgg	:	Initial time of the model in UTC
class	:	Intensity classification of the tropical cyclone 'T', 'STS', 'TS' or 'TD'
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 hPa
www	:	Absolute value of change in maximum wind speed from T=0, in knots

Example:

FXPQ20 RJTD 180600
RSMC GUIDANCE FOR FORECAST
NAME TY 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=84 20.7N 128.8E +021HPA -022KT=

(4) 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.=

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

FKPQ i i RJTD YYGGgg
TC ADVISORY

DTG:	yyyymmdd/time Z
TCAC:	TOKYO
TC:	name
NR:	number
PSN:	N LaLa.LaLa E LoLoLo.LoLo
MOV:	direction SpSpSp KT
C:	PPPP HPA
MAX WIND:	WWW KT

FCST PSN +6HR:	YY/GGgg Z NLaLa.LaLa ELoLoLo.LoLo*
FCST MAX WIND +6HR:	WWW KT*
FCST PSN +12HR:	YY/GGgg Z NLaLa.LaLa ELoLoLo.LoLo
FCST MAX WIND +12HR:	WWW KT
FCST PSN +18HR:	YY/GGgg Z NLaLa.LaLa ELoLoLo.LoLo*
FCST MAX WIND +18HR:	YY/GGgg Z NLaLa.LaLa ELoLoLo.LoLo*
FCST PSN +24HR:	YY/GGgg Z N LaLa.LaLa E LoLoLo.LoLo
FCST MAX WIND +24HR:	WWW KT
RMK:	NIL =
NXT MSG:	yyyymmdd/time Z

* 6 hour and 18 hour forecasts are added from 22 May 2008.

Notes:

a. Underlined parts are fixed.

b. Abbreviations

DTG	:	Date and time
TCAC	:	Tropical Cyclone Advisory Centre
TC	:	Tropical Cyclone
NR	:	Number
PSN	:	Position
MOV	:	Movement
C	:	Central pressure
MAX WIND	:	Maximum wind
FCST	:	Forecast
RMK	:	Remarks
NXT MSG	:	Next message

c. Symbolic letters

i i	:	'30', '31', '32', '33', '34' or '35'
YYGGgg	:	Date(YY), hour(GG) and minute(gg) in UTC (Using “Z”)
yyyymmdd/time	:	Year(yyyy), month(mm), date(dd), hour and minute (time) in UTC (Using “Z”)
name	:	Name assigned to the tropical cyclone by RSMC Tokyo-Typhoon Center
Number	:	Advisory number (starting with “01” for each cyclone)
LaLa.LaLa	:	Latitude of the center position
LoLoLo.LoLo	:	Longitude of the center position
direction	:	Direction of movement given in 16 azimuthal direction such as 'N', 'NNE', 'NE' and 'ENE'
SpSpSp	:	Speed of movement. “SLW” for less than 3 kt “STNR” for less than 1 kt.
PPPP	:	Central pressure
WWW	:	Maximum sustained wind

Example:

FKPQ30 RJTD 271200
TC ADVISORY

DTG:	20080927/1200Z
TCAC:	TOKYO
TC:	JANGMI
NR:	15
PSN:	N2120 E12425
MOV:	NW 13KT
C:	910HPA
MAX WIND:	115KT
FCST PSN +6HR:	27/1800Z N2200 E12330
FCST MAX WIND +6HR:	115KT
FCST PSN +12HR:	28/0000Z N2240 E12250
FCST MAX WIND +12HR:	115KT
FCST PSN +18HR:	28/0600Z N2340 E12205
FCST MAX WIND +18HR:	95KT
FCST PSN +24HR:	28/1200Z N2440 E12105
FCST MAX WIND +24HR:	80KT
RMK:	NIL
NXT MSG:	20080927/1800Z =

(6) 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 parts are fixed.

b. [1)] REMARKS is given optionally.

c. Symbolic letters

MMM	:	Month in UTC given such as 'JAN' and 'FEB'
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

Specifications of JMA NWP (GSM, TEPS)

The Global Spectral Model (GSM) and the Typhoon Ensemble Prediction System (TEPS) are used in JMA as a primary basis for TC forecasts. Details on the operational numerical prediction and its application at JMA are found in JMA (2013). GSM (TL959L60) has about 20 km horizontal resolution and 60 vertical layers. TEPS (TL319L60) has 11 members with approximately 55 km horizontal resolution and 60 vertical layers. A singular vector (SV) method is employed for the initial perturbation setup. The stochastic physics scheme (Buizza et al. 1999) is also introduced in consideration of model uncertainties associated with physical parameterizations. The general specifications of GSM and TEPS are summarized in Table 6.1.

Table 6.1 Specifications of GSM and TEPS

NWP Models	GSM (Global Spectral Model), TL959L60	TEPS (Typhoon Ensemble Prediction System), TL319L60
Resolution	20 km, 60 layers (Top: 0.1hPa)	55 km, 60 layers (Top: 0.1hPa)
Area	Global	Global
Method for initial value	Global Data Assimilation System (4DVAR) Outer resolution: TL959L60 Inner resolution: TL319L60 Window: Init-3h to Init + 3h	Unperturbed condition: Truncated GSM initial condition Initial perturbation: SV-based perturbation Ensemble size: 11 (10 perturbed members and 1 control member) SV target areas: Northwestern Pacific (20°N -60°N, 100 °E -180°) and vicinities of up to 3 TCs in the Typhoon Center's area of responsibility (e.g. Fig 6.1)
Forecast time (and initials)	84h (00, 06, 18 UTC) 216h (12 UTC)	132h (00, 06, 12, 18 UTC)
Start of operation	21 November 2007	February 2008 (de facto from T0801)

[Recent upgrades on GSM and the Global Data Assimilation System]
GSM:

- The stratocumulus parameterization scheme was improved (December 2012).

Global Data Assimilation System:

- Assimilation of atmospheric motion vector from GOES-15 (January 2012)
- Upgrade of the linear radiative transfer model (RTTOV 9 to RTTOV 10: November 2012)
- A Revised process for assimilating the Global Navigation Satellite System (GNSS) Radio Occultation (RO) refractivity data was introduced (December 2012).

TEPS is an ensemble prediction system used mainly for TC track forecasts up to five days ahead. Two SV calculations are introduced into the system to efficiently capture the uncertainty of TC track forecasts. One produces SVs with a spatial target area fixed on the Northwestern Pacific (20°N -60°N, 100 °E -180°), and the other produces SVs whose spatial target area can be moved within a 750-km radius of a predicted TC's position in one-day forecasting. Up to three movable areas can be configured for different TCs at one initial time. If more than three TCs are present in the area of responsibility, three are selected in the order of concern as prioritized by the RSMC Tokyo – Typhoon Center. Figure 6.1 shows an example of SV spatial target areas. At this initial time, there were three TCs in the area. Figure 6.2 shows an example of TEPS forecast tracks for ROKE (TY1115). In this case, the forecasted TC track of the control member was entering into the Sea of Japan, which turned to be false, while some ensemble members predicted tracks appropriately following the observed one.

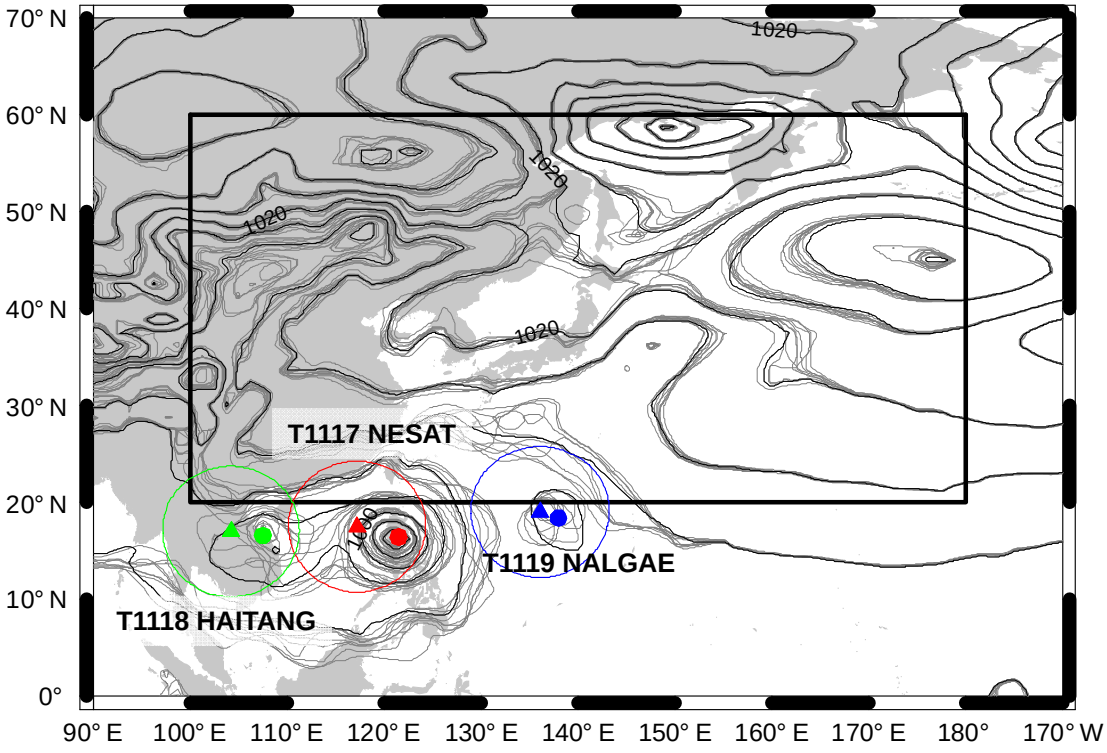


Figure 6.1 Example of SV spatial target areas of TEPS (Initial time: 00UTC 27 September 2011). The large thick rectangle shows the fixed area and the circles show the three movable areas which are set around a predicted TC's position. Filled circles and triangles show TCs' central positions at the initial time and in one-day forecasting, respectively. Gray contours show the initial sea level pressure of each member.

[References]

Buizza, R., M. Miller, and T. N. Palmer, 1999: Stochastic representation of model uncertainties in the ECMWF Ensemble Prediction System. Quart. J. Roy. Meteor. Soc., 125, 2887–2908.

JMA, 2013: Outline of the operational numerical weather prediction at the Japan Meteorological Agency. Appendix to WMO Technical Progress Report on the Global Data-processing and Forecasting System and Numerical Weather Prediction. Japan Meteorological Agency, Tokyo, Japan.
http://www.jma.go.jp/jma/jma-eng/jma-center/nwp/outline2013-nwp/

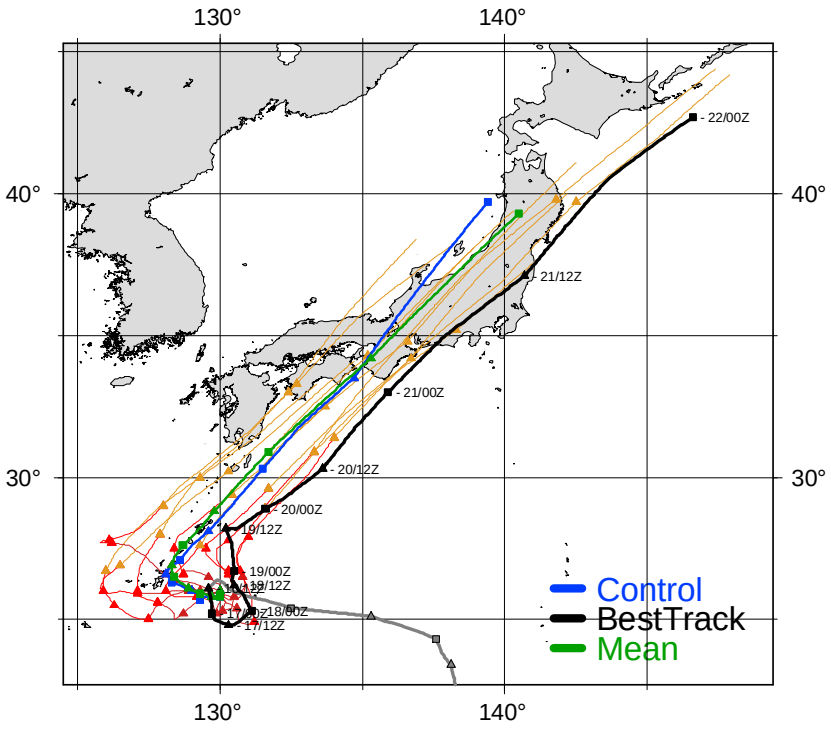


Figure 6.2 Example of TEPS forecast track (Initial time: 12UTC 16 September 2011). Black, blue, and green lines denote TC best track, forecast track of control member and ensemble mean respectively. Red (up to 96-hour) and yellow (up to 120-hour) lines show TC forecast tracks of all perturbed members.

Appendix 7

NWP (GSM and EPS) products on WIS GISC Tokyo server

(Available at http://www.wis-jma.go.jp/cms/)

Model	GSM	GSM	GSM
Area and resolution	Whole globe, 1.25°×1.25°	20°S–60°N, 60°E–160°W 1.25°×1.25°	Whole globe, 2.5°×2.5°
Levels and elements	10 hPa: Z, U, V, T 20 hPa: Z, U, V, T 30 hPa: Z, U, V, T 50 hPa: Z, U, V, T 70 hPa: Z, U, V, T 100 hPa: Z, U, V, T 150 hPa: Z, U, V, T 200 hPa: Z, U, V, T, ψ, χ 250 hPa: Z, U, V, T 300 hPa: Z, U, V, T, H, ω 400 hPa: Z, U, V, T, H, ω 500 hPa: Z, U, V, T, H, ω, ζ 600 hPa: Z, U, V, T, H, ω 700 hPa: Z, U, V, T, H, ω 850 hPa: Z, U, V, T, H, ω, ψ, χ 925 hPa: Z, U, V, T, H, ω 1000 hPa: Z, U, V, T, H, ω Surface: P, U, V, T, H, R†	10 hPa: Z, U, V, T 20 hPa: Z, U, V, T 30 hPa: Z, U, V, T 50 hPa: Z, U, V, T 70 hPa: Z, U, V, T 100 hPa: Z, U, V, T 150 hPa: Z, U, V, T 200 hPa: Z§, U§, V§, T§, ψ, χ 250 hPa: Z, U, V, T 300 hPa: Z, U, V, T, D 400 hPa: Z, U, V, T, D 500 hPa: Z§, U§, V§, T§, D§, ζ 700 hPa: Z§, U§, V§, T§, D§, ω 850 hPa: Z§, U§, V§, T§, D§, ω, ψ, χ 925 hPa: Z, U, V, T, D, ω 1000 hPa: Z, U, V, T, D Surface: P¶, U¶, V¶, T¶, D¶, R¶	10 hPa: Z*, U*, V*, T* 20 hPa: Z*, U*, V*, T* 30 hPa: Z°, U°, V°, T° 50 hPa: Z°, U°, V°, T° 70 hPa: Z°, U°, V°, T° 100 hPa: Z°, U°, V°, T° 150 hPa: Z*, U*, V*, T* 200 hPa: Z, U, V, T 250 hPa: Z°, U°, V°, T° 300 hPa: Z, U, V, T, D*‡ 400 hPa: Z*, U*, V*, T*, D*‡ 500 hPa: Z, U, V, T, D*‡ 700 hPa: Z, U, V, T, D 850 hPa: Z, U, V, T, D 1000 hPa: Z, U*, V*, T*, D*‡ Surface: P, U, V, T, D‡, R†
Forecast hours	0–84 (every 6 hours) 96–192 (every 12 hours) † Except analysis	0–84 (every 6 hours) § 96–192 (every 24 hours) for 12UTC initial ¶ 90–192 (every 6 hours) for 12UTC initial	0–72 (every 24 hours) 96–192 (every 24 hours) for 12UTC initial ° 0–120 for 12UTC † Except analysis * Analysis only
Initial times	00, 06, 12, 18UTC	00, 06, 12, 18UTC	00UTC and 12UTC ‡ 00UTC only

Model	One-week EPS
Area and resolution	Whole globe, 2.5°×2.5°
Levels and elements	250 hPa: μU, σU, μV, σV 500 hPa: μZ, σZ 850 hPa: μU, σU, μV, σV, μT, σT 1000 hPa: μZ, σZ Surface: μP, σP
Forecast hours	0–192 (every 12 hours)
Initial times	12UTC

Model	GSM	GSM
Area and resolution	5S-90N and 30E-165W, Whole globe 0.25° × 0.25°	5S-90N and 30E-165W, Whole globe 0.5° × 0.5°
Levels and elements	Surface: U, V, T, H, P, Ps, R, Cla, Clh, Clm, Cll	10 hPa: Z, U, V, T, H, ω 20 hPa: Z, U, V, T, H, ω 30 hPa: Z, U, V, T, H, ω 50 hPa: Z, U, V, T, H, ω 70 hPa: Z, U, V, T, H, ω 100 hPa: Z, U, V, T, H, ω 150 hPa: Z, U, V, T, H, ω 200 hPa: Z, U, V, T, H, ω, ψ, χ 250 hPa: Z, U, V, T, H, ω 300 hPa: Z, U, V, T, H, ω 400 hPa: Z, U, V, T, H, ω 500 hPa: Z, U, V, T, H, ω, ζ 600 hPa: Z, U, V, T, H, ω 700 hPa: Z, U, V, T, H, ω 800 hPa: Z, U, V, T, H, ω 850 hPa: Z, U, V, T, H, ω, ψ, χ 900 hPa: Z, U, V, T, H, ω 925 hPa: Z, U, V, T, H, ω 950 hPa: Z, U, V, T, H, ω 975 hPa: Z, U, V, T, H, ω 1000 hPa: Z, U, V, T, H, ω Surface: U, V, T, H, P, Ps, R, Cla, Clh, Clm, Cll
Forecast hours	0– 84 (every 6 hours) 90–216 (every 24 hours) for 12 UTC initial	0– 84 (every 6 hours) 90–216 (every 24 hours) for 12 UTC initial
Initial times	00, 06, 12, 18 UTC	00, 06, 12, 18 UTC

Notes: Z: geopotential height U: eastward wind V: northward wind
T: temperature D: dewpoint depression H: relative humidity
ω: vertical velocity ζ: vorticity ψ: stream function
χ: velocity potential P: sea level pressure Ps: pressure
R: rainfall Cla: total cloudiness Clh: cloudiness (upper layer)
Clm: cloudiness (middle layer) Cll: cloudiness (lower layer)

The prefixes μ and σ represent the average and standard deviation of ensemble prediction results respectively.
The symbols °, *, ¶, §, ‡ and † indicate limitations on forecast hours or initial time as shown in the tables.

Other products on WIS GISC Tokyo server
(Available at http://www.wis-jma.go.jp/cms/)

Data	Contents / frequency (initial time)
Satellite products	High density atmospheric motion vectors (BUFR) (a) MTSAT-2 (VIS, IR, WV), 60S-60N, 90E-170W VIS: every hour (00-09, 21-23 UTC), IR and WV: every hour (b) METEOSAT-7 (VIS, IR, WV) VIS: every 1.5 hours between 0130 and 1500 UTC IR and WV: every 1.5 hours Clear Sky Radiance (CSR) data (BUFR) MTSAT-2 (IR, WV) radiances and brightness temperatures averaged over cloud-free pixels: every hour
Tropical cyclone Information	Tropical cyclone related information (BUFR) • tropical cyclone analysis data (00, 06, 12 and 18 UTC)
Wave data	Global Wave Model (GRIB2) • significant wave height • prevailing wave period • wave direction Forecast hours: 0–84 every 6 hours (00, 06 and 18UTC) 0–84 every 6 hours and 96-192 every 12 hours (12 UTC)
Observational data	(a) Surface data (TAC/TDCF) SYNOP, SHIP, BUOY: Mostly 4 times a day (b) Upper-air data (TAC/TDCF) TEMP (parts A-D), PILOT (parts A-D): Mostly twice a day
Storm surge	Storm surge model for Asian area (map image) • storm surge distribution Forecast hours: 0–72 every 3 hours (00, 06 12, and 18UTC) Only in the case of a tropical cyclone being in the forecast time (Available at https://tynwp-web.kishou.go.jp/)

Appendix 8

User's Guide to the DVD

Preface

This DVD contains all the texts, tables and charts of the RSMC Annual Report 2012 along with satellite images of the tropical cyclones that attained TS intensity or higher in the western North Pacific and the South China Sea in 2012. This document is a brief user's guide on how to use the DVD, which was mastered in ISO-9660 format.

Directory and File layout

```
[Root]
|------Readme.txt (brief explanation of the DVD)
|------TopMenu.exe (start menu setup program)
|------SATAIDmanual.pdf (user manual for the satellite image viewer)
|------Annual_Report
        |---Text (text of Annual Report 2012 in PDF)
        |---Figure (figures in PDF)
        |---Table (tables in PDF)
        |---Appendix (appendices for MS Word, Excel and PDF)
|------Programs
        |---Gmslpd
            |--Gmslpd.exe (viewer; tropical cyclone version in English)
            |--Gsetup.exe (setup program)
|------Satellite_Image_Data
        |---T1201 (hourly satellite image data)
        |---T1202 (hourly satellite image data)
                :
        |---T1225 (hourly satellite image data)
|------Andata
        |--Besttrack
            |--E_BST_2012.txt (best track data for 2012)
            |--E_BST_201203.txt (best track data for TCs generated in March 2012)
                        :
            |--E_BST_201212.txt (best track data for TCs generated in December 2012)
```

How to use the DVD

A start menu will be launched if you enter the DVD or click TopMenu.exe file. The start menu includes buttons marked Annual Report 2012, MTSAT Satellite Image, About DVD and Close, as well as File List Box for introductory documents. Click the button or the file name of the content you wish to see and follow the instructions on the display.

Hardware/OS requirements for using the DVD:

Hardware : PC/AT compatible
OS : Microsoft Windows ver. 3.1 or later

< Annual Report 2012 >

Annual Report 2012 is provided in two formats as PDF files and MS Word/Excel files.

- PDF files:

Click the *Annual Report 2012* button to open the text in PDF. If you cannot open it, download Adobe Reader from Adobe's website (http://www.adobe.com/). Adobe Reader (or Adobe Acrobat) is required to view PDF files.

- MS Word/Excel files:

The original figures and tables prepared with Microsoft Word or Excel are contained in the Annual Report folder of the DVD.

< MTSAT Satellite Image >

- Installation of the program for displaying satellite images

Click the *MTSAT Satellite Image* button to run the setup program (Gsetup.exe) for the satellite image viewer. Follow the instructions, and the satellite image viewer *Gmslpd.exe* will be installed onto the computer's hard disk. A list of the tropical cyclones occurring in 2012 is displayed in the selection window of the satellite images for tropical cyclones.

- Displaying satellite images

Choose and click a tropical cyclone from the list to see hourly satellite images of it. You can also display the track of the tropical cyclone superimposed onto the satellite image and measure its intensity using the Dvorak method.

- User manual for the viewer

Besides the above features, the viewer has many other useful functions. See the User Manual (SATAIDmanual.pdf) for further details on its use.

- Explanation of satellite image data

Period : From the TD formation to the time of dissipation

Images	: Infrared images (00 to 23 UTC) Visible images (00 to 09 and 21 to 23 UTC)
Range	: 40 degrees in both latitude and longitude (The image window moves to follow the track of the tropical cyclone so that its center remains in the middle of the window.)
Time interval	: Hourly
Resolution	: 0.05 degrees in both latitude and longitude
Compression of file	: Compressed using the *compress.exe* command of Microsoft Windows

< About DVD >

Click the *About DVD* button to open the *Readme.txt* file.

< Close >

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

< File list box >

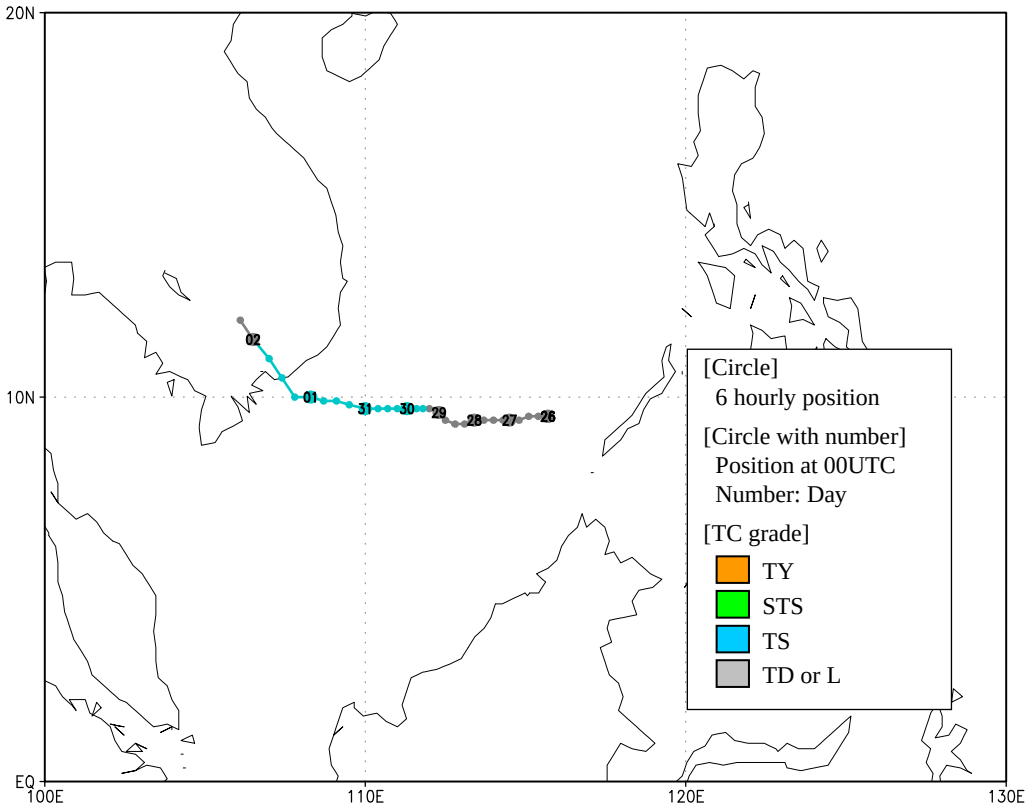
Document files can be opened from the file list box in the start menu window. Choose a file and click the *Open* button, or simply double-click the file name.

For further information, please contact:

RSMC Tokyo - Typhoon Center
Forecast Division
Forecast Department
Japan Meteorological Agency
1-3-4 Otemachi, Chiyoda-ku, Tokyo 100-8122, Japan
FAX: +81-3-3211-8303
E-mail: rsmc-tokyo@met.kishou.go.jp

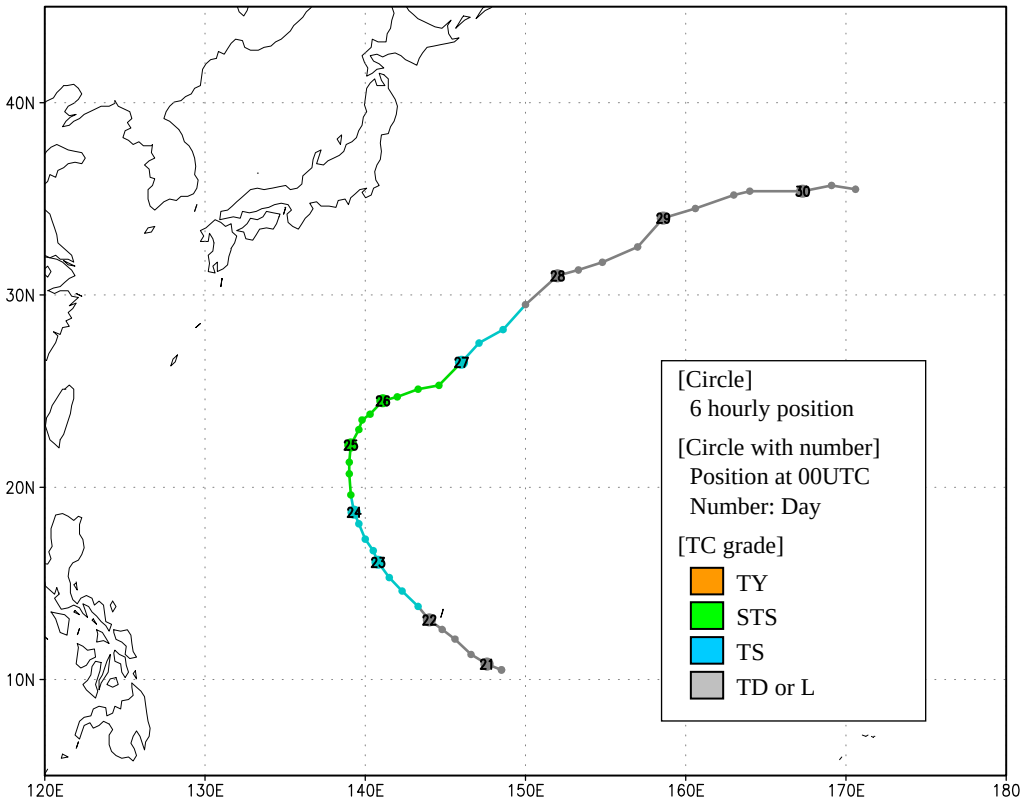
PAKHAR (1201)

Pakhar formed as a tropical depression (TD) over the South China Sea at 00 UTC on 26 March 2012. Slowly moving westward, it was upgraded to tropical storm (TS) intensity over the same waters at 12 UTC on 29 March. Moving westward and developing slowly, Pakhar reached its peak intensity with maximum sustained winds of 40 kt and a central pressure of 998 hPa at 06 UTC on 30 March. It turned northwestward before hitting Viet Nam with TS intensity on 1 April. Pakhar weakened to TD intensity over Viet Nam at 00 UTC on 2 April and dissipated 12 hours later.



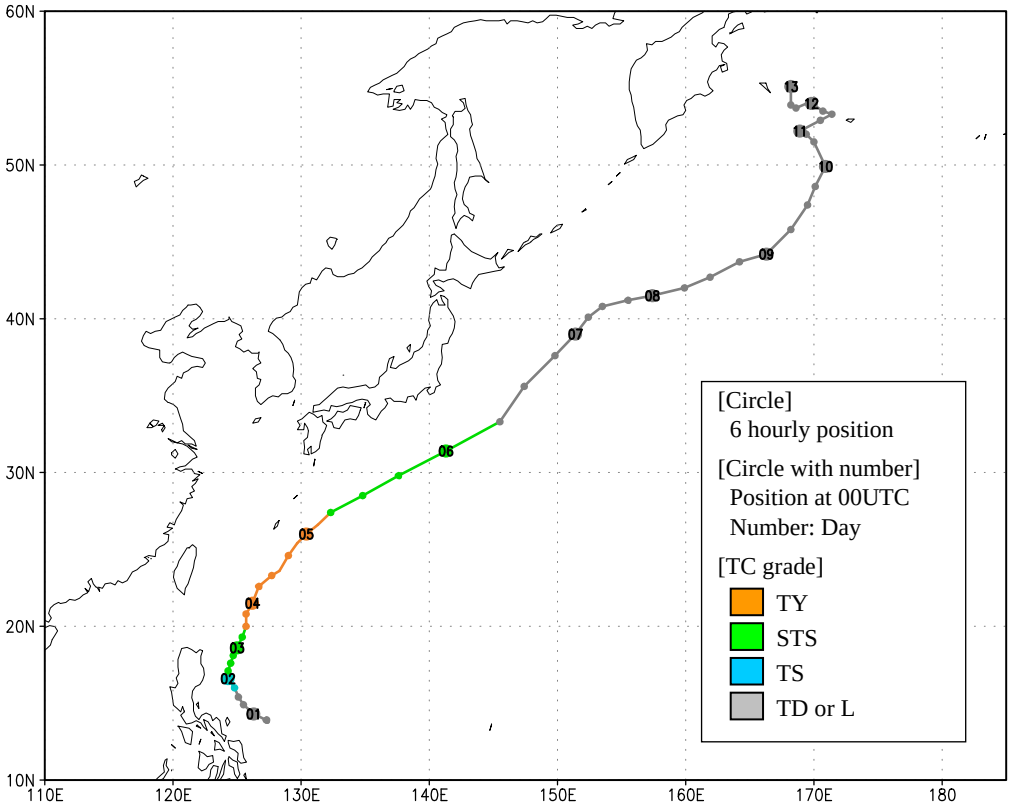
SANVU (1202)

Sanvu formed as a tropical depression (TD) north of the Caroline Islands at 18 UTC on 20 May 2012. Moving northwestward, it was upgraded to tropical storm (TS) intensity northwest of Guam Island at 06 UTC on 22 May. Gradually turning northward, Sanvu was upgraded to severe tropical storm (STS) intensity southwest of Iwoto Island at 06 UTC on 24 May and reached its peak intensity with maximum sustained winds of 60 kt and a central pressure of 975 hPa 12 hours later. After turning northeastward, it was downgraded to TS intensity east of the Ogasawara Islands at 00 UTC on 27 May and transformed into an extratropical cyclone 18 hours later. Moving east-northeastward, Sanvu dissipated far east of Japan at 18 UTC on 30 May.



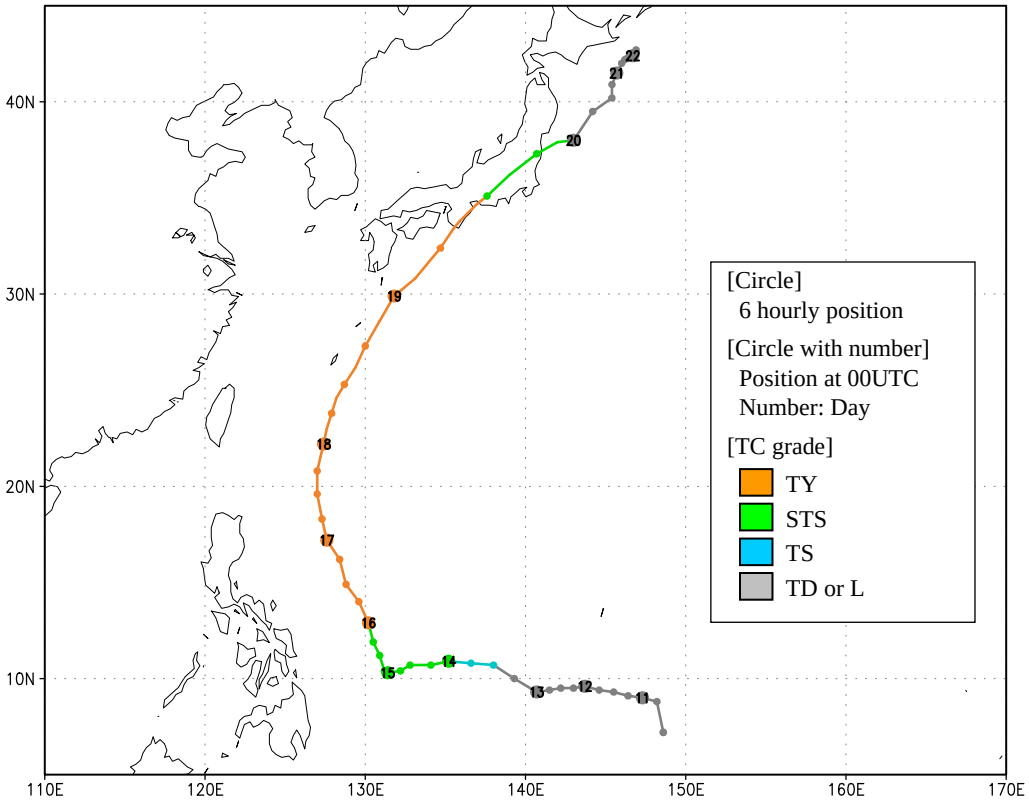
MAWAR (1203)

Mawar formed as a tropical depression (TD) east of Luzon Island at 18 UTC on 31 May 2012. Keeping its northwestward track, it was upgraded to tropical storm (TS) intensity over the same waters at 18 UTC on 1 June. After turning north-northeastward the next day, Mawar was upgraded to typhoon (TY) intensity south of Okinawa Island at 12 UTC on 3 June and reached its peak intensity with maximum sustained winds of 75 kt and a central pressure of 960 hPa at 18 UTC the same day. Accelerating northeastward, it transformed into an extratropical cyclone east of Hachijojima Island at 06 UTC on 6 June and dissipated east of the Kamchatka Peninsula at 06 UTC on 13 June.



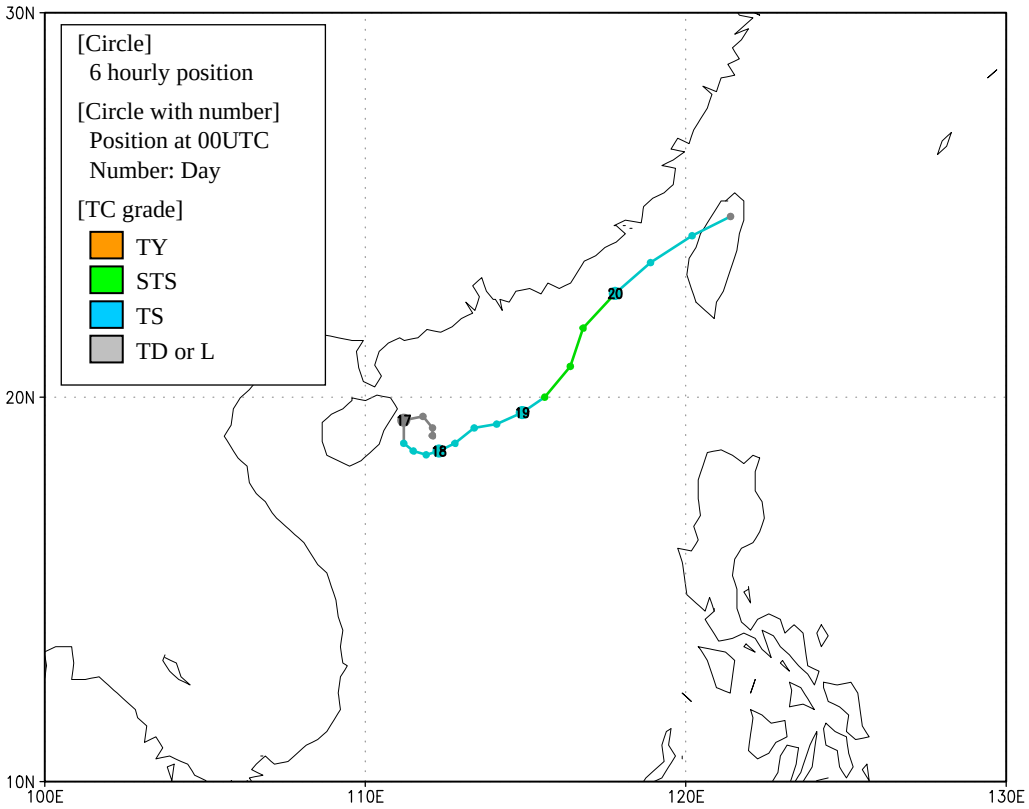
GUCHOL (1204)

Guchol formed as a tropical depression (TD) near the Caroline Islands at 12 UTC on 10 June 2012 and moved north-northwestward. It turned westward before being upgraded to tropical storm (TS) intensity north of the Yap Islands at 12 UTC on 13 June. After turning sharply north-northwestward, Guchol was upgraded to typhoon (TY) intensity east of the Philippines at 00 UTC on 16 June and reached its peak intensity with maximum sustained winds of 100 kt and a central pressure of 930 hPa 12 hours later. Moving northeastward, it made landfall on Honshu Island with TY intensity early on 19 June. Keeping its northeastward track, Guchol transformed into an extratropical cyclone east of Japan at 00 UTC on 20 June and dissipated over the same waters at 12 UTC on 22 June.



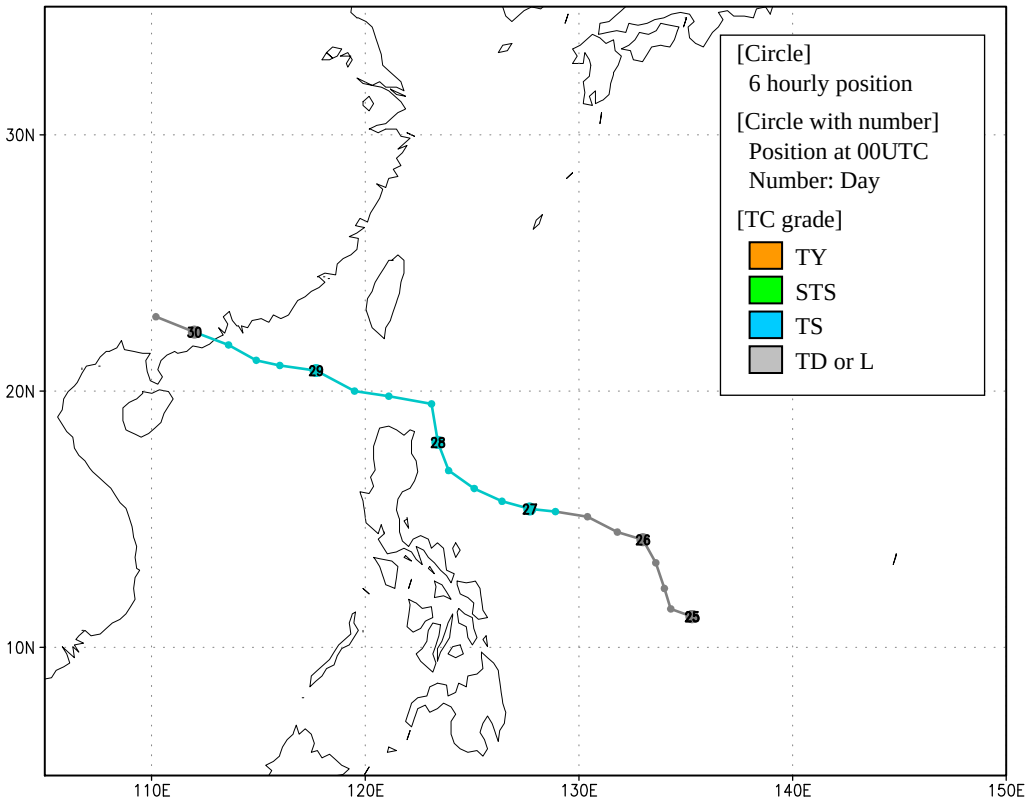
TALIM (1205)

Talim formed as a tropical depression (TD) east of Hainan Island at 06 UTC on 16 June 2012. Turning in a counterclockwise direction, it was upgraded to tropical storm (TS) intensity over the same waters at 06 UTC the next day. Moving east-northeastward, Talim was further upgraded to severe tropical storm (STS) intensity and reached its peak intensity with maximum sustained winds of 50 kt and a central pressure of 985 hPa at 06 UTC on 19 June. After hitting Taiwan Island with TS intensity late on 20 June, it weakened to TD intensity at 18 UTC the same day and dissipated six hours later.



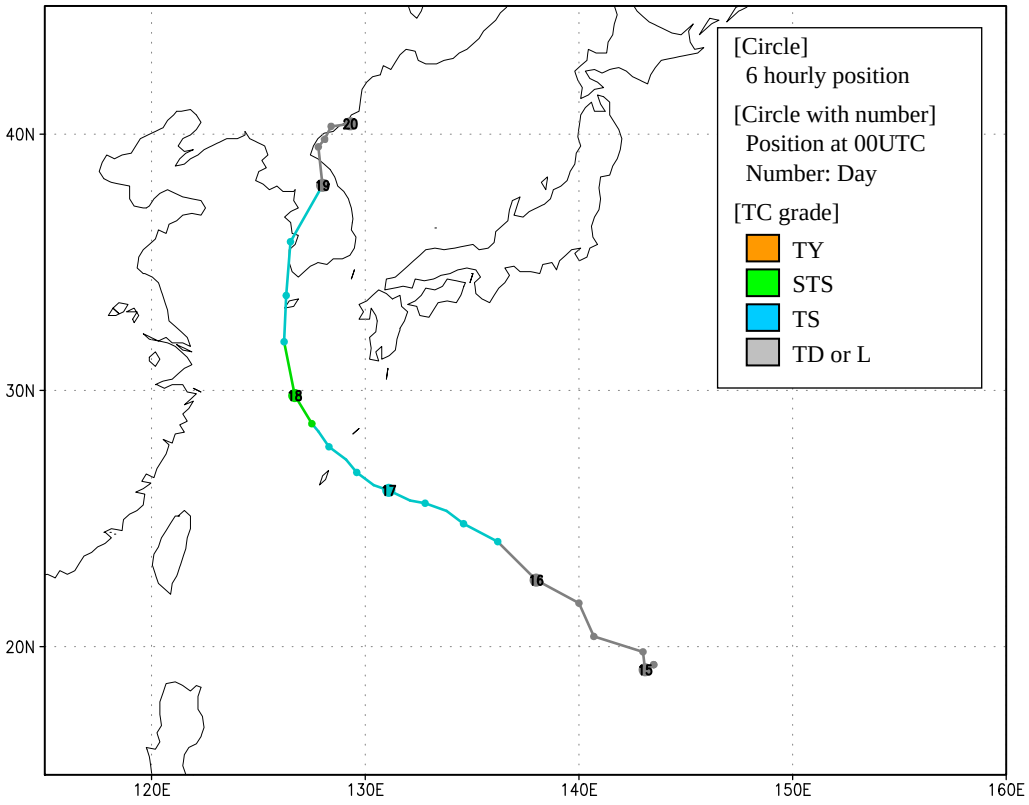
DOKSURI (1206)

Doksuri formed as a tropical depression (TD) north of the Palau Islands at 00 UTC on 25 June 2012. Moving northwestward, it was upgraded to tropical storm (TS) intensity east of Luzon Island at 18 UTC on 26 June. After passing through the Luzon Strait on 28 June, Doksuri reached its peak intensity with maximum sustained winds of 40 kt and a central pressure of 992 hPa 00 UTC the next day. Moving west-northwestward, it weakened to TD intensity at 00 UTC on 30 June after hitting the southern part of China and dissipated 12 hours later.



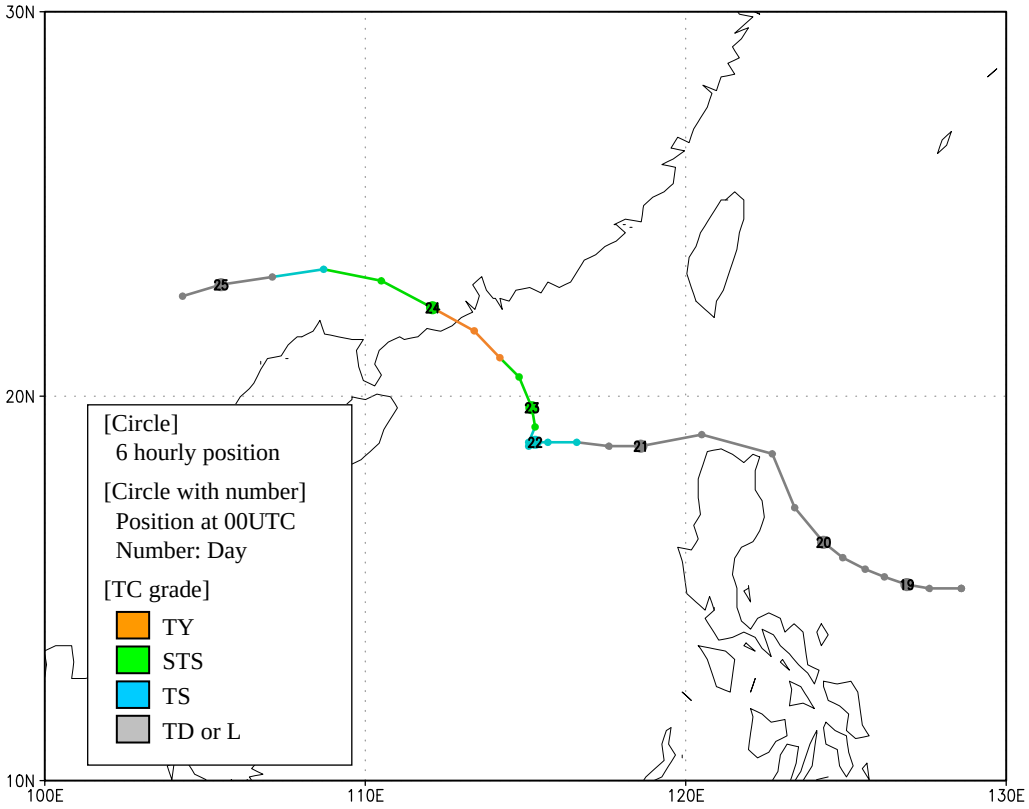
KHANUN (1207)

Khanun formed as a tropical depression (TD) west of the Mariana Islands at 18 UTC on 14 July 2012. Moving northwestward, it was upgraded to tropical storm (TS) intensity west of Iwoto Island at 06 UTC on 16 July. Keeping its northwestward track, Khanun reached its peak intensity with maximum sustained winds of 50 kt and a central pressure of 985 hPa over the East China Sea at 18 UTC the next day and then turned northward. It hit the Korean Peninsula late on 18 July after crossing Jeju Island and weakened to TD intensity at 00 UTC the next day. Khanun transformed into an extratropical cyclone at 18 UTC the same day and dissipated at 06 UTC on 20 July.



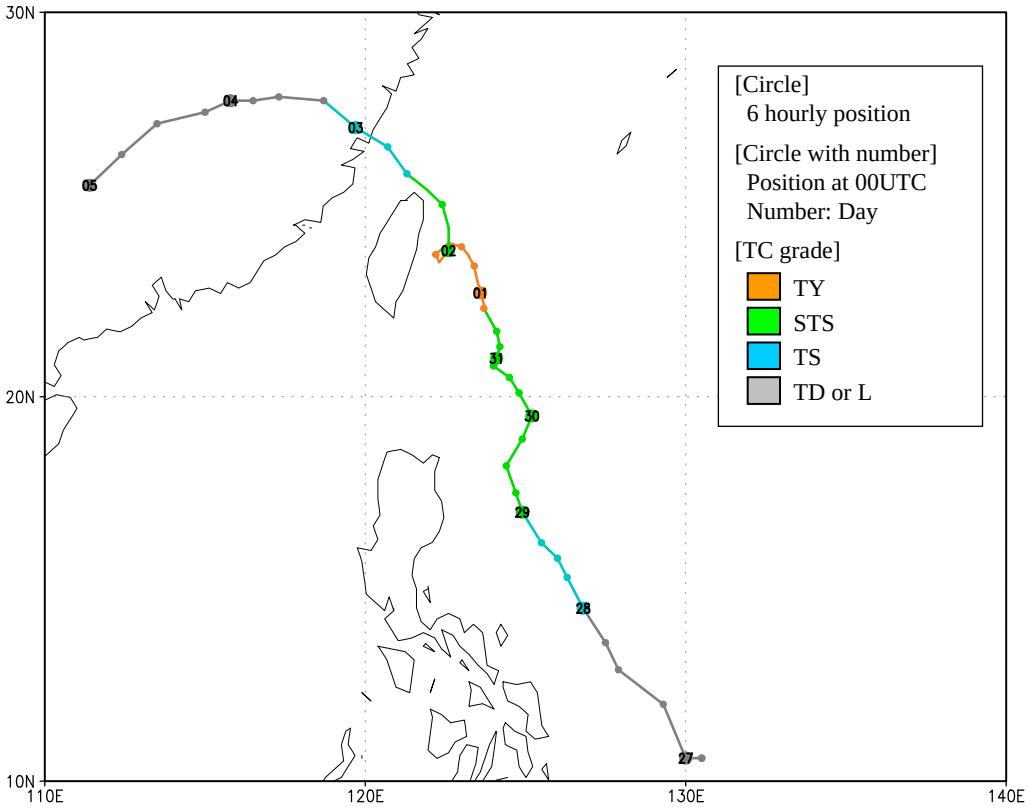
VICENTE (1208)

Vicente formed as a tropical depression (TD) east of the Philippines at 12 UTC on 18 July 2012 and moved westward. It gradually turned northwestward and then passed through the Luzon Strait on 20 July. After entering the South China Sea, Vicente moved westward and was upgraded to tropical storm (TS) intensity at 12 UTC the next day. Turning northward on 22 July, it was upgraded to typhoon (TY) intensity over the same waters at 12 UTC the next day and reached its peak intensity with maximum sustained winds of 80 kt and a central pressure of 950 hPa six hours later before hitting the southern part of China. Moving westward over the continent, Vicente weakened to TD intensity on 18 UTC on 24 July and dissipated at 12 UTC the next day.



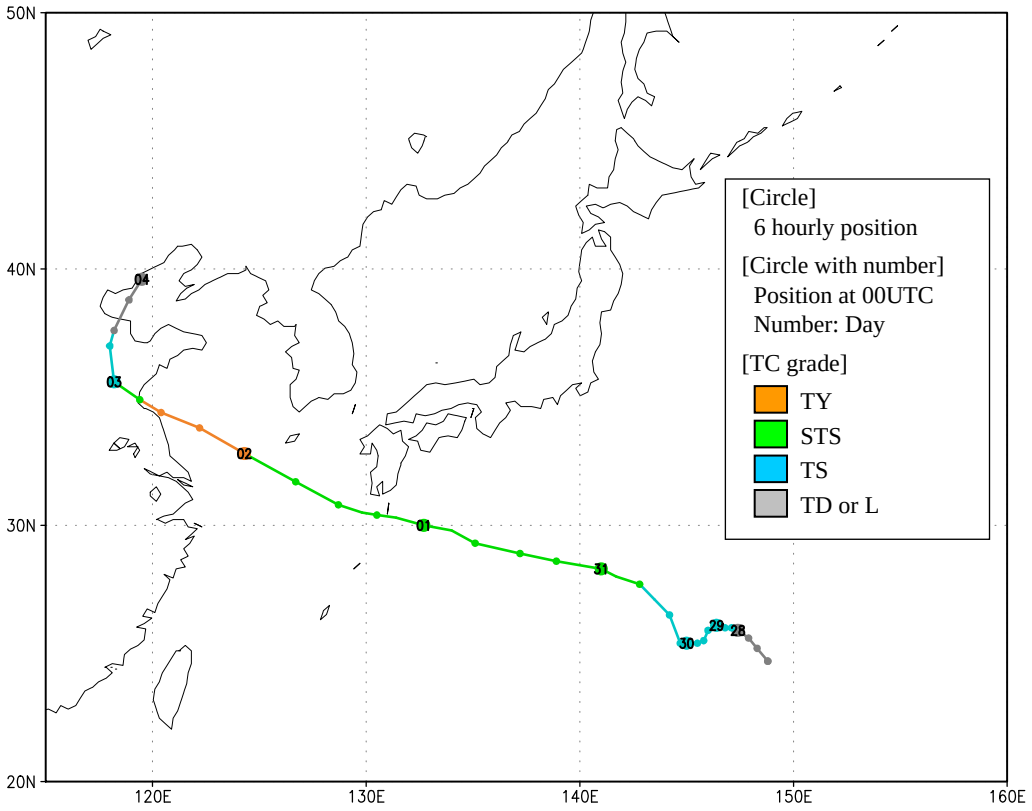
SAOLA (1209)

Saola formed as a tropical depression (TD) east of the Philippines at 18 UTC on 26 July 2012. Moving north-northwestward, it was upgraded to tropical storm (TS) intensity at 00 UTC on 28 July. Saola was upgraded to typhoon (TY) intensity south of Ishigakijima Island at 18 UTC on 31 July and reached its peak intensity with maximum sustained winds of 70 kt and a central pressure of 960 hPa 12 hours later. After turning in a counterclockwise direction and circling the area near Taiwan Island, it accelerated northwestward and hit the eastern coast of China with TS intensity before 00 UTC on 3 August and then weakened to TD intensity at 06UTC on the same day. Saola dissipated over the southern part of China at 06 UTC on 5 August.



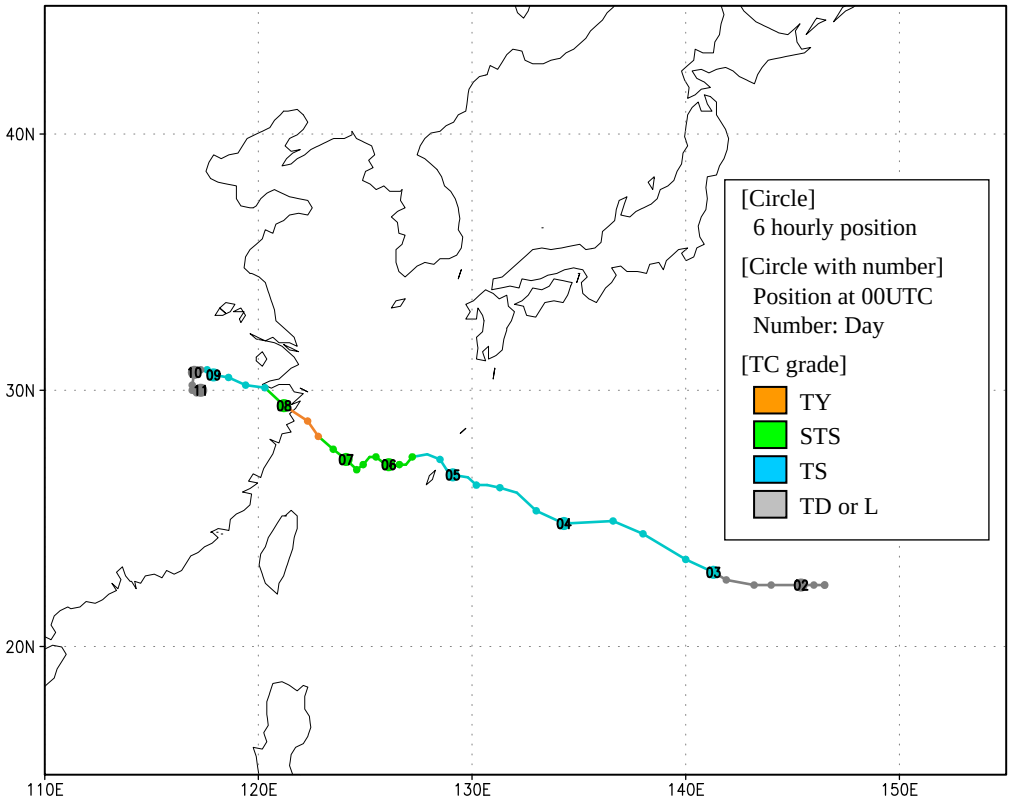
DAMREY (1210)

Damrey formed as a tropical depression (TD) west of Minamitorishima Island at 06 UTC on 27 July 2012. Moving northwestward, it was upgraded to tropical storm (TS) intensity over the same waters at 12 UTC the next day. Keeping its west-northwestward track after drifting southwestward, Damrey was upgraded to severe tropical storm (STS) intensity north of Chichijima Island at 18 UTC on 30 July and passed around Yakushima Island early on 1 August. Moving northwestward, it was upgraded to typhoon (TY) intensity over the Yellow Sea at 00 UTC the next day and reached its peak intensity with maximum sustained winds of 70 kt and a central pressure of 965 hPa six hours later. After hitting the area near the Shandong Peninsula and turning north-northeastward, Damrey weakened to TD intensity around the Bohai Sea at 12 UTC on 3 August and dissipated 18 hours later.



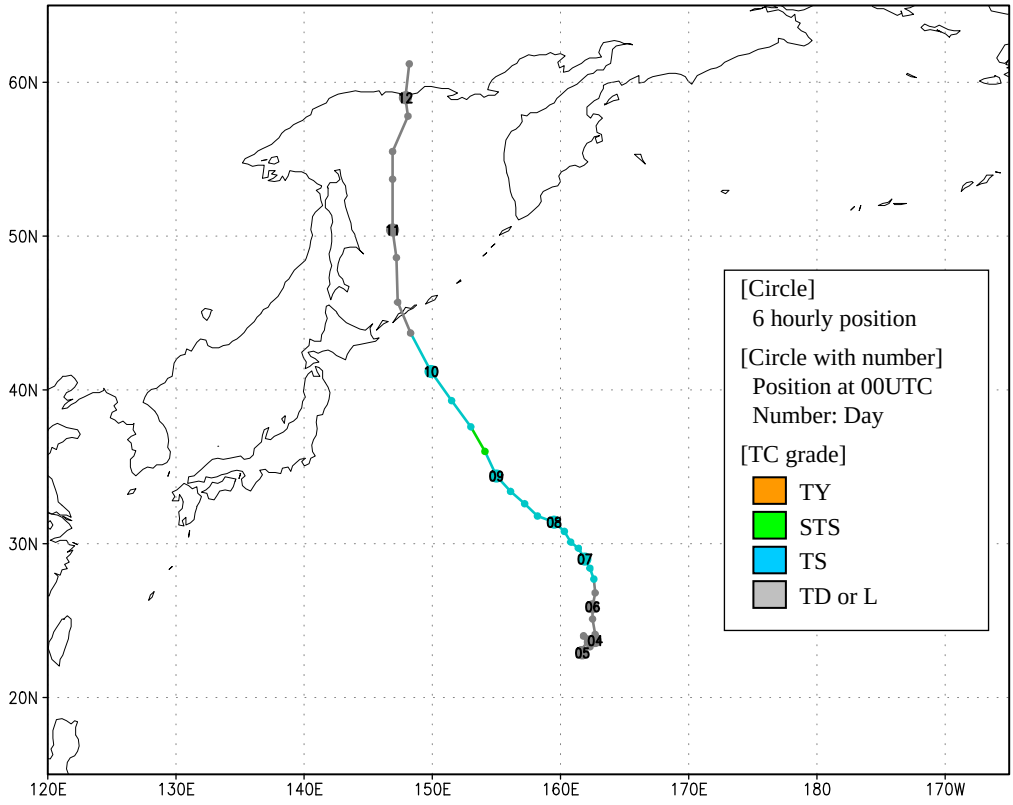
HAIKUI (1211)

Haikui formed as a tropical depression (TD) north of the Northern Mariana Islands at 12 UTC on 1 August 2012 and moved westward. It was upgraded to tropical storm (TS) intensity south of Iwoto Island at 00 UTC on 3 August and then turned west-northwestward. Haikui was upgraded to severe tropical storm (STS) intensity northwest of Okinawa Island at 12 UTC on 5 August. After slowly moving westward over the East China Sea, it was upgraded to typhoon (TY) intensity and reached its peak intensity with maximum sustained winds of 65 kt and a central pressure of 965 hPa over the same waters at 12 UTC on 7 August. Moving northwestward, Haikui hit the eastern part of China late the same day. After weakening to TD intensity at 12 UTC on 9 August, it remained almost stationary and dissipated at 12 UTC on 11 August.



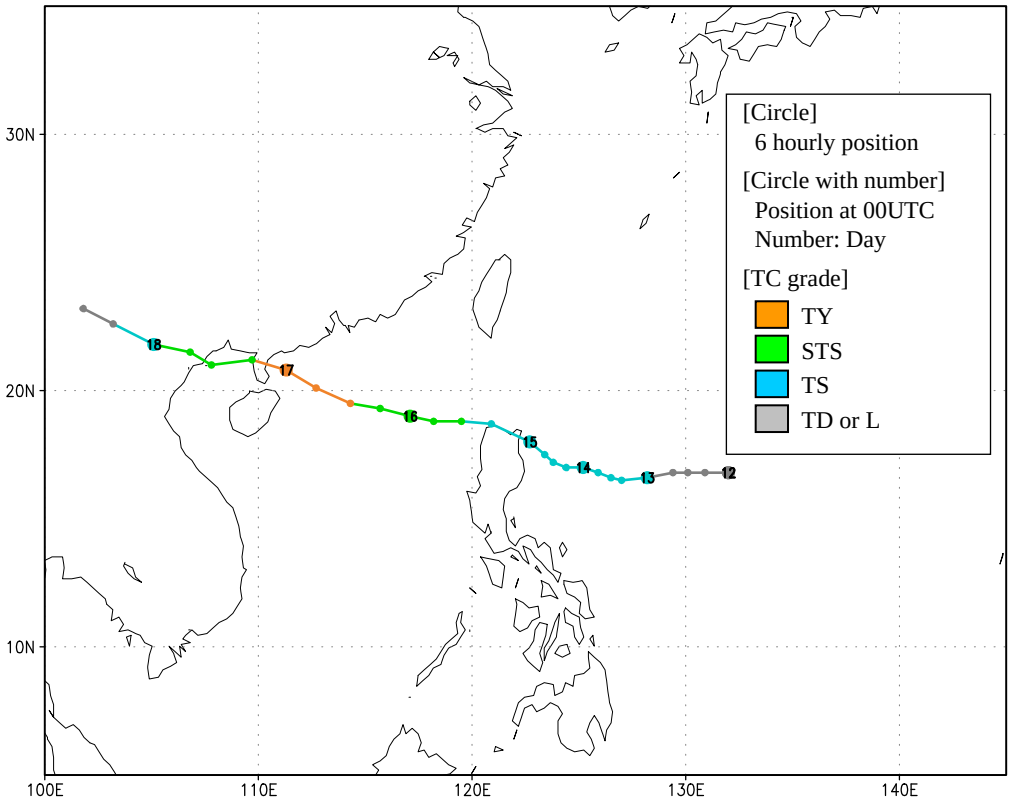
KIROGI (1212)

Kirogi formed as a tropical depression (TD) northwest of Wake Island at 06 UTC on 3 August 2012 and slowly moved southeastward and then southwestward. After turning northward on 5 August, it was upgraded to tropical storm (TS) intensity over the same waters at 12 UTC the next day. Gradually turning northwestward, Kirogi was further upgraded to severe tropical storm (STS) intensity and reached its peak intensity with maximum sustained winds of 50 kt and a central pressure of 990 hPa east of Japan at 06 UTC on 9 August. It transformed into an extratropical cyclone east of Hokkaido Island on 06 UTC the next day and then turned northward. After moving across the Sea of Okhotsk, it crossed latitude 60 degrees north before 06UTC on 12 August.



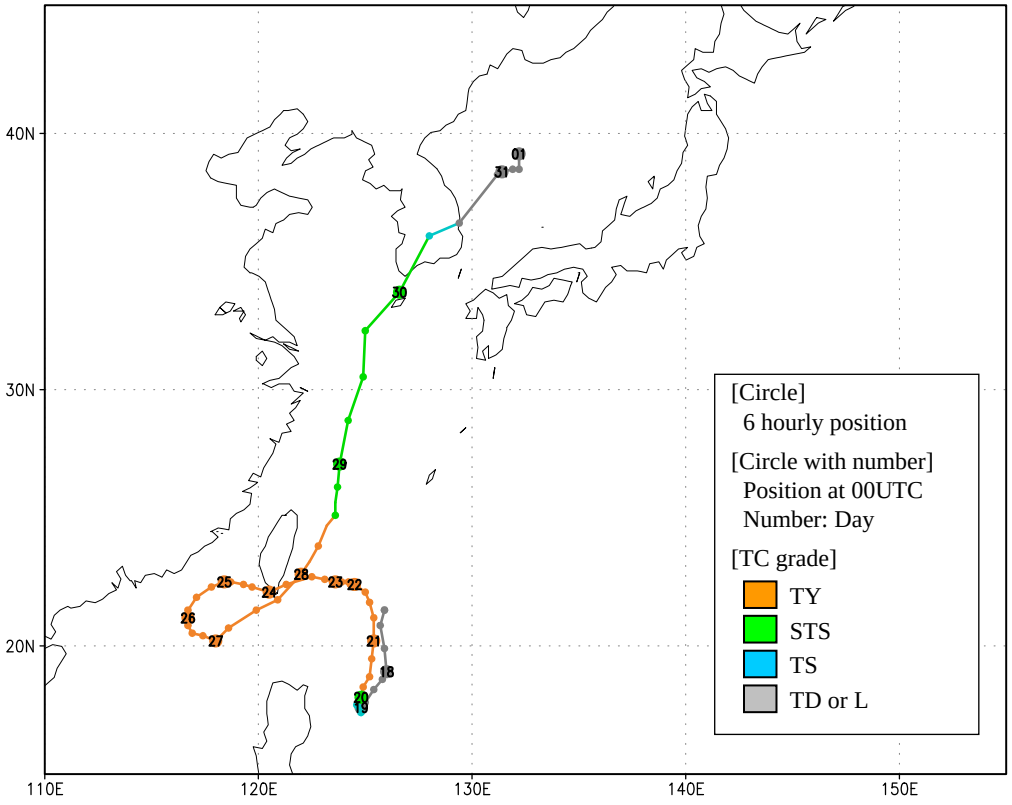
KAI-TAK (1213)

Kai-tak formed as a tropical depression (TD) east of the Philippines at 00 UTC on 12 August 2012. Moving westward, it was upgraded to tropical storm (TS) intensity over the same waters at 00 UTC on 13 August. Kai-tak hit Luzon Island with TS intensity early on 15 August and then it reached its peak intensity with maximum sustained winds of 65 kt and a central pressure of 970 hPa over the South China Sea at 12 UTC on 16 August. Moving west-northwestward, Kai-tak entered the Gulf of Tonkin and hit Viet Nam with severe tropical storm (STS) intensity late on 17 August. It weakened to TD intensity around the border between Viet Nam and China at 06 UTC on 18 August and dissipated 12 hours later.



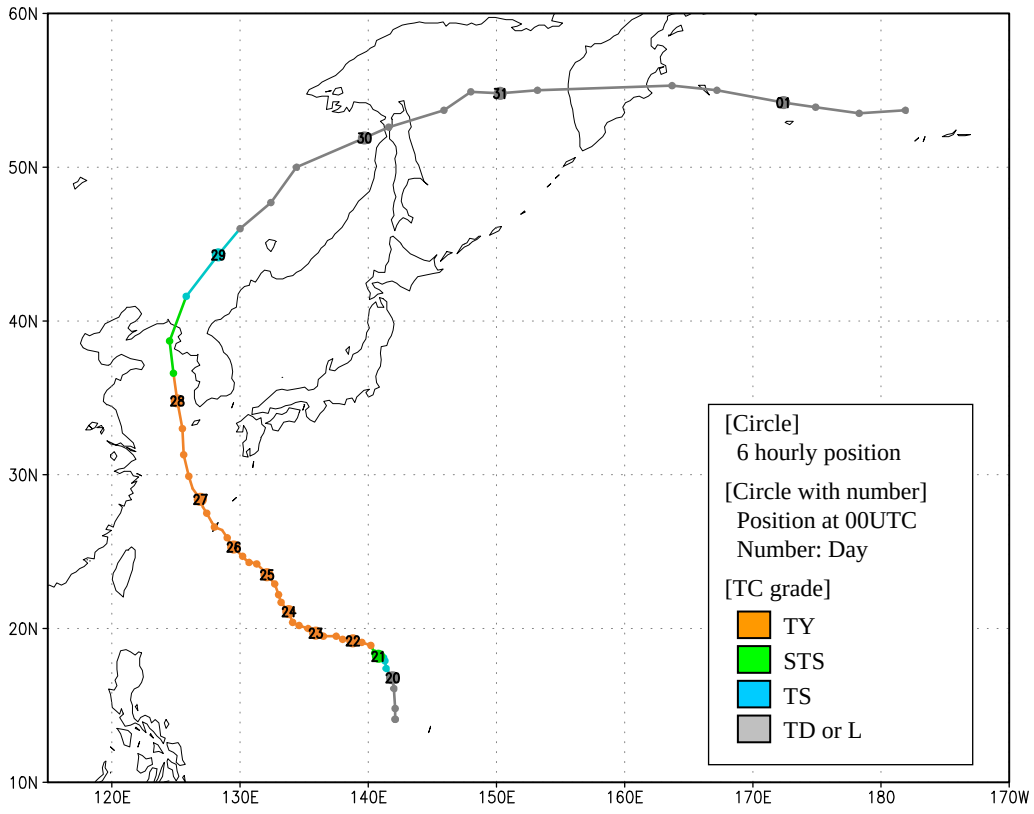
TEMBIN (1214)

Tembin formed as a tropical depression (TD) south of Okinawa Island at 06 UTC on 17 August 2012. Moving southward, it was upgraded to tropical storm (TS) intensity east of Luzon Island at 06 UTC on 19 August. After turning sharply northward, Tembin was upgraded to typhoon (TY) intensity over the same waters at 06 UTC the next day and reached its peak intensity with maximum sustained winds of 80 kt and a central pressure of 950 hPa six hours later. Gradually turning westward, it again reached its peak intensity with maximum sustained winds of 80 kt and a central pressure of 950 hPa south of the Sakishima Islands at 00 UTC on 23 August. After crossing the southern part of Taiwan Island, turning in a counterclockwise direction and circling, Tembin was downgraded to severe tropical storm (STS) intensity north of the Sakishima Islands at 12 UTC on 28 August. Moving north-northeastward, it transformed into an extratropical cyclone at 12 UTC on 30 August after hitting the Korean Peninsula and dissipated over the Sea of Japan at 06 UTC on 1 September.



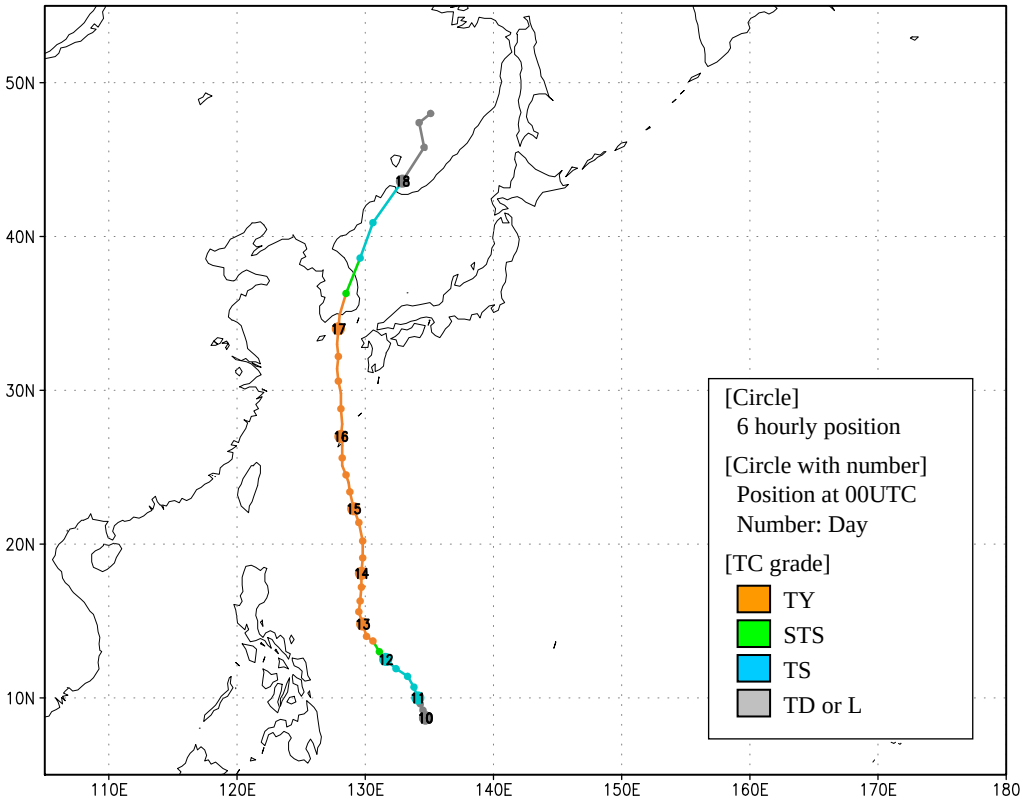
BOLAVEN (1215)

Bolaven formed as a tropical depression (TD) west of the Mariana Islands at 06 UTC on 19 August 2012 and was upgraded to tropical storm (TS) intensity over the same waters 24 hours later. Turning west-northwestward, it was upgraded to typhoon (TY) intensity over the same waters at 12 UTC on 21 August. Bolaven reached its peak intensity with maximum sustained winds of 100 kt and a central pressure of 910 hPa south of Minamidaitojima Island at 12 UTC on 25 August It passed around Okinawa Island with TY intensity around 12 UTC the next day. While moving north-northwestward over the East China Sea and the Yellow Sea, Bolaven gradually weakened before hitting the northern part of the Korean Peninsula late on 28 August. Moving northeastward, it transformed into an extratropical cyclone over northeastern China at 06 UTC the next day. After moving eastward across the Sea of Okhotsk and the Kamchatka Peninsula, Bolaven crossed longitude 180 degrees east over the Bering Sea before 18 UTC on 1 September.



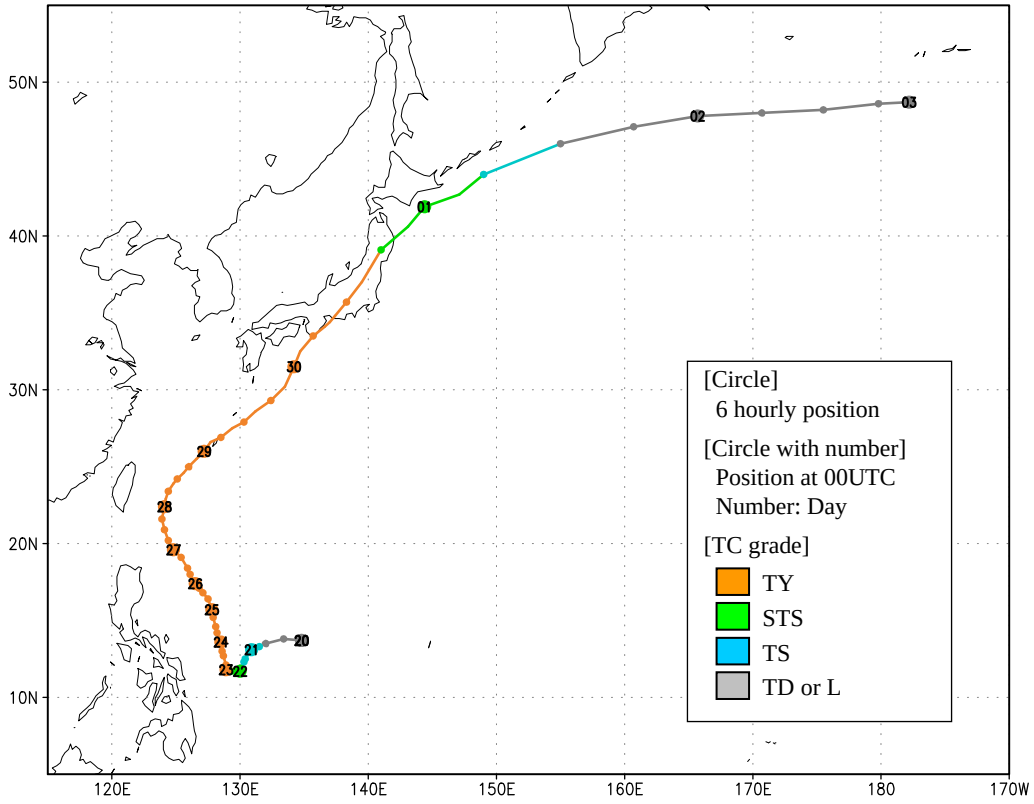
SANBA (1216)

Sanba formed as a tropical depression (TD) north of the Palau Islands at 00 UTC on 10 September 2012 and slowly moved northward. It was upgraded to tropical storm (TS) intensity over the same waters at 00 UTC the next day before turning northwestward. Developing rapidly, Sanba was upgraded to typhoon (TY) intensity east of the Philippines at 12 UTC on 12 September. After turning northward, it reached its peak intensity with maximum sustained winds of 110 kt and a central pressure of 900 hPa over the same waters at 18 UTC the next day. Keeping its northward track, Sanba passed around Okinawa Island with TY intensity late on 15 September. It continued moving northward over the East China Sea and hit the Korean Peninsula early on 17 September. Sanba was downgraded to severe tropical storm (STS) intensity at 06 UTC the same day while moving across the peninsula before entering the Sea of Japan. Soon after hitting Russia, it transformed into an extratropical cyclone at 00 UTC on 18 September and dissipated 00 UTC the next day.



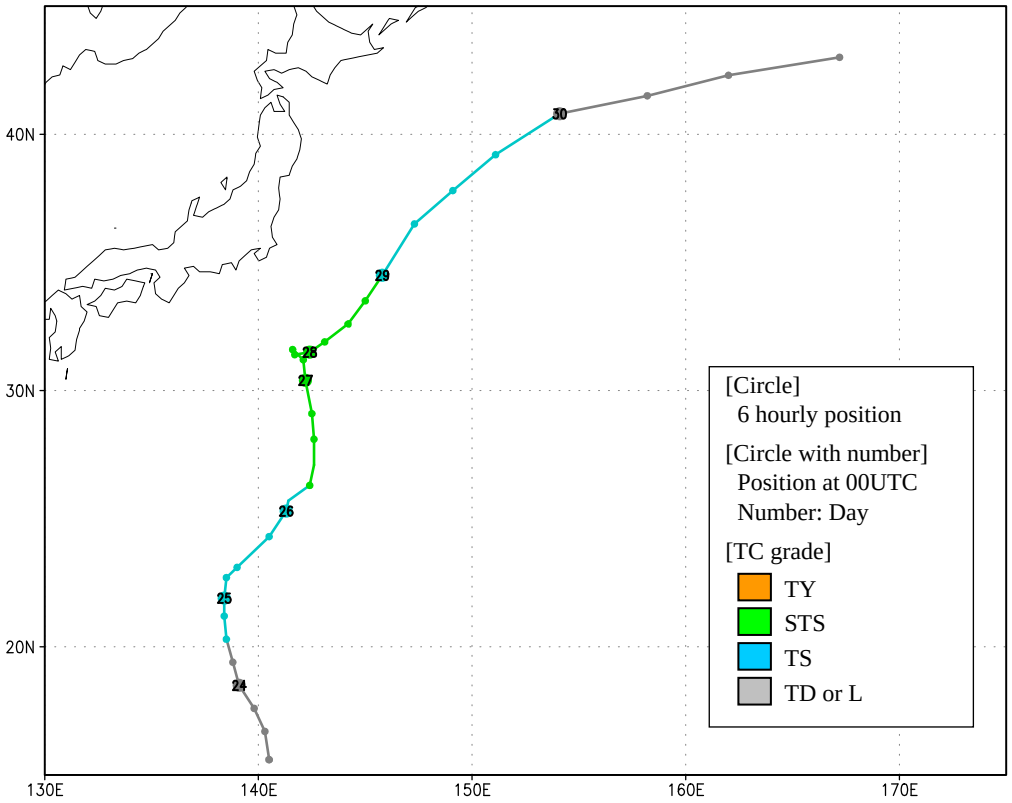
JELAWAT (1217)

Jelawat formed as a tropical depression (TD) east of the Philippines at 00 UTC on 20 September 2012 and was upgraded to tropical storm (TS) intensity over the same waters 18 hours later after moving westward. It was upgraded to typhoon (TY) intensity over the same waters at 00 UTC on 23 September before turning north-northwestward. Jelawat developed rapidly and reached its peak intensity with maximum sustained winds of 110 kt and a central pressure of 905 hPa over the same waters at 18 UTC the next day. It turned northeastward south of Ishigakijima Island at 00UTC on 28 September. Accelerating northeastward, Jelawat landed on Honshu Island with TY intensity early on 30 September. After landing, it weakened rapidly and transformed into an extratropical cyclone east of Hokkaido Island at 12 UTC the next day. After moving eastward, Jelawat crossed longitude 180 degrees east over the sea south of the Aleutian Islands before 00 UTC on 3 October.



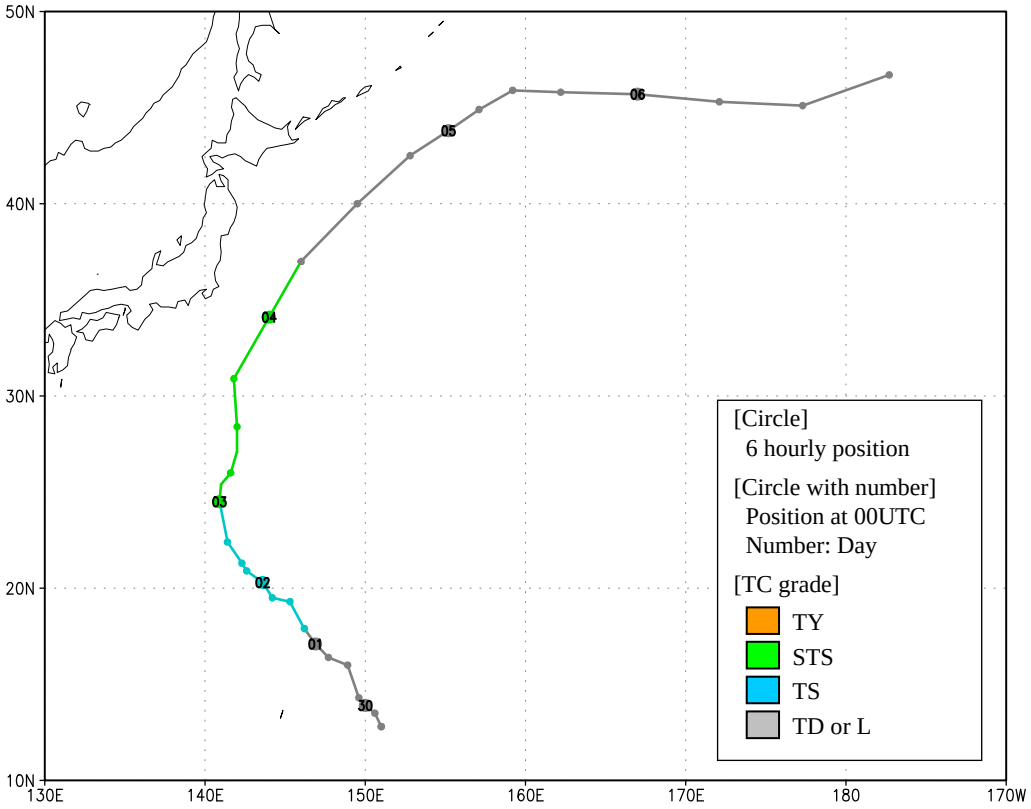
EWINIAR (1218)

Ewiniar formed as a tropical depression (TD) west of the Northern Mariana Islands at 06 UTC on 23 September 2012. Moving north-northwestward, it was upgraded to tropical storm (TS) intensity east of Okinotorishima Island at 12 UTC the next day. After turning northeastward, Ewiniar was upgraded to severe tropical storm (STS) intensity and reached its peak intensity with maximum sustained winds of 50 kt and a central pressure of 985 hPa southwest of Chichijima Island at 06 UTC on 26 September. Moving northward with STS intensity, it remains almost stationary southeast of Hachijojima Island late on the next day. Moving northeastward again, Ewiniar transformed into an extratropical cyclone east of Hokkaido Island at 00 UTC on 30 September and dissipated far east of Hokkaido Island 24 hours later.



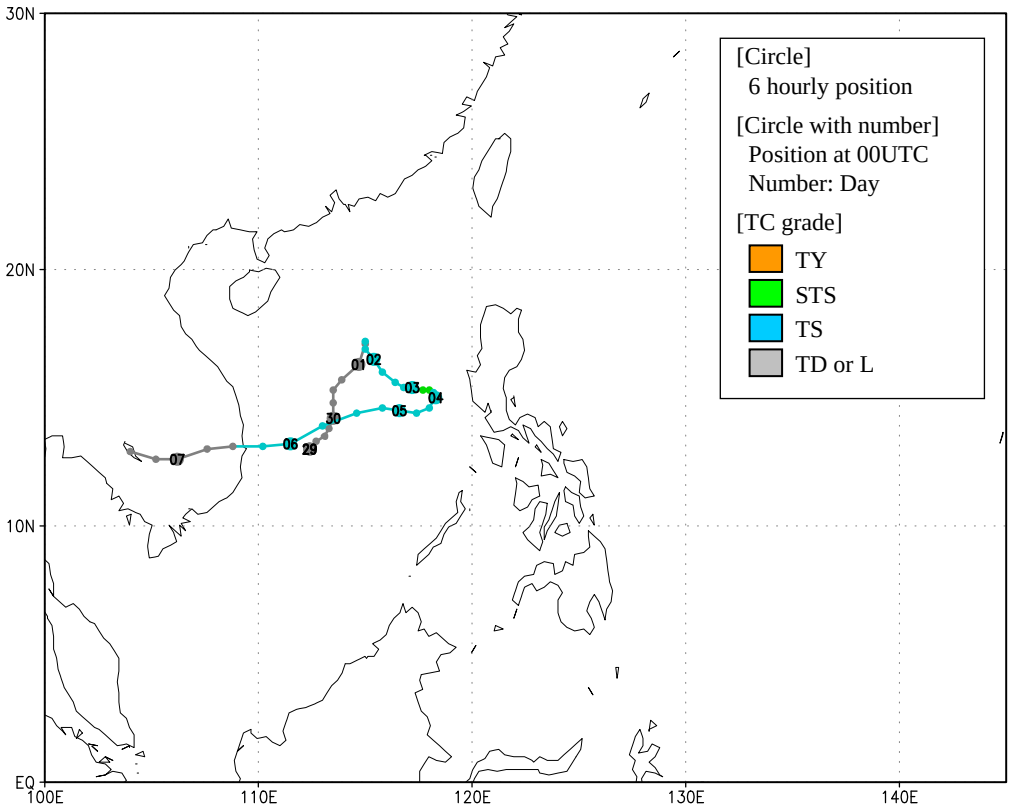
MALIKSI (1219)

Maliksi formed as a tropical depression (TD) east of the Mariana Islands at 12 UTC on 29 September 2012. Moving northwestward, it was upgraded to tropical storm (TS) intensity at 06 UTC on 1 October around the Mariana Islands. Before turning north-northeastward, Maliksi was upgraded to severe tropical storm (STS) intensity and reached its peak intensity with maximum sustained winds of 50 kt and a central pressure of 985 hPa near Iwoto Island at 00 UTC on 3 October. Maliksi moved northeastward with STS intensity and then transformed into an extratropical cyclone east of Japan at 06 UTC on 4 October. After turning eastward over the sea south of Kamchatka Peninsula, Maliksi crossed longitude 180 degrees east over the sea south of the Aleutian Islands before 18 UTC on 6 October.



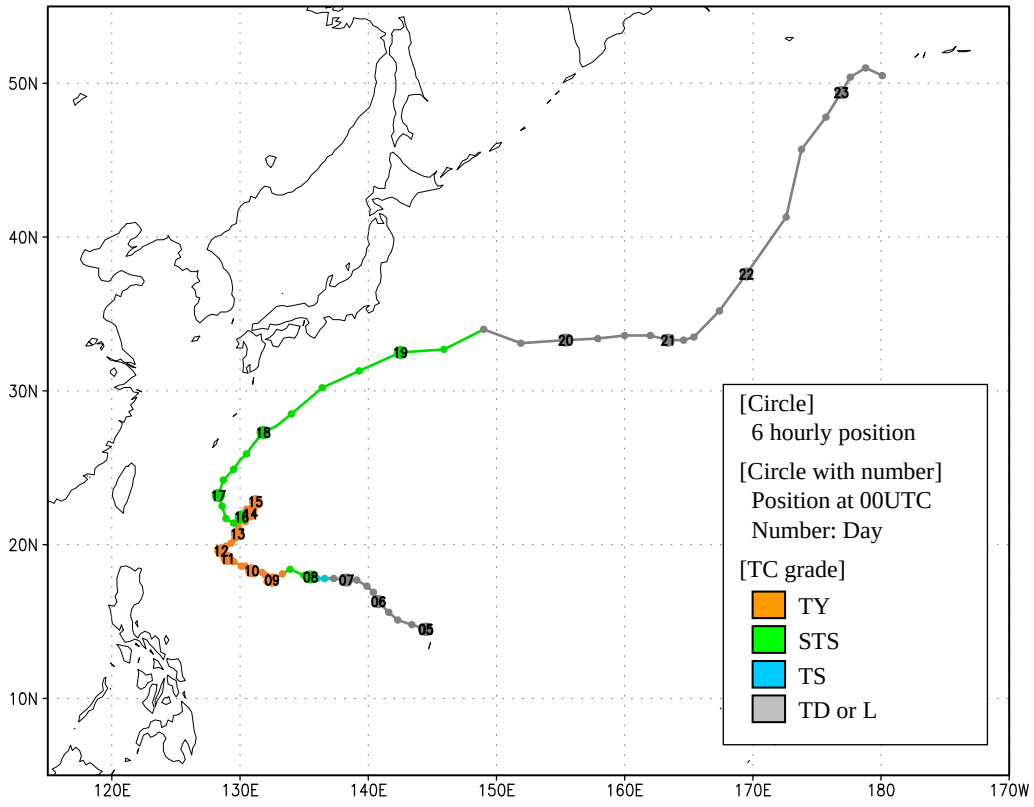
GAEMI (1220)

Gaemi formed as a tropical depression (TD) over the South China Sea at 00 UTC on 29 September 2012 and slowly moved northeastward. It was upgraded to tropical storm (TS) intensity at 12 UTC on 1 October over the same waters before turning southeastward. Gaemi was upgraded to severe tropical storm (STS) intensity and reached its peak intensity with maximum sustained winds of 50 kt and a central pressure of 990 hPa west of the Luzon Island at 06 UTC on 3 October. It was downgraded to TS intensity over the same waters 12 hours later before turning westward on 4 October. Keeping its westward track, Gaemi weakened to TD intensity at 12 UTC on 6 October soon after hitting Viet Nam and dissipated 18 UTC the next day.



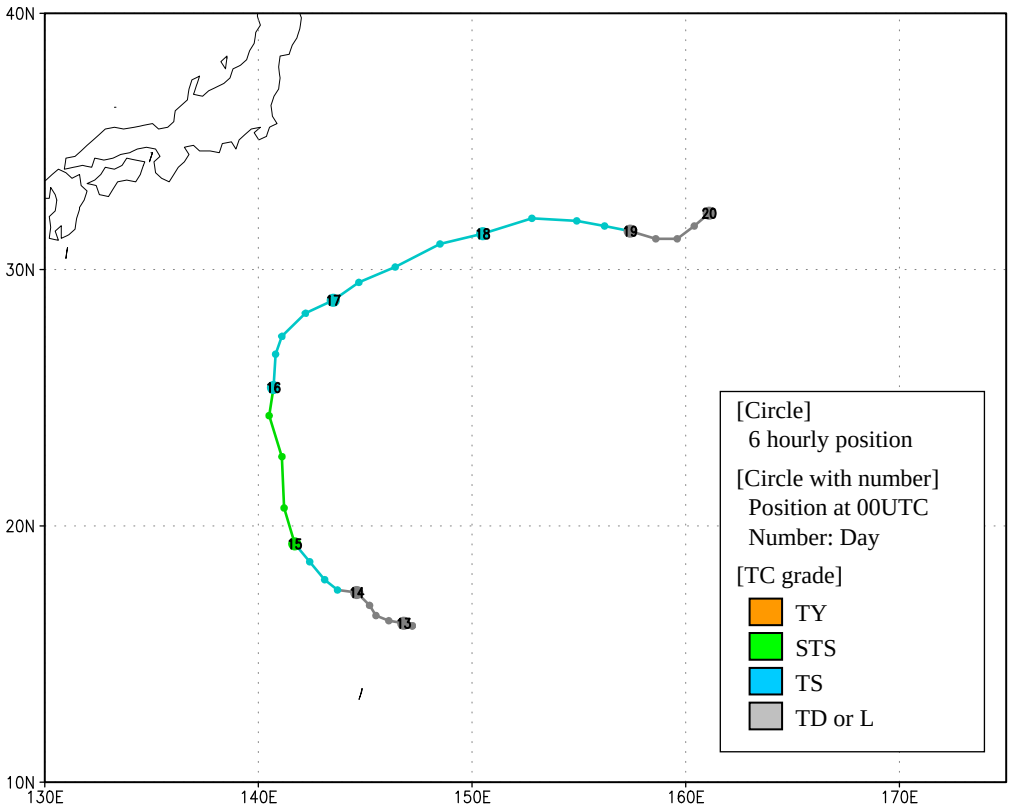
PRAPIROON (1221)

Prapiroon formed as a tropical depression (TD) west of the Mariana Islands at 00 UTC on 5 October 2012 and slowly moved westward. It was upgraded to tropical storm (TS) intensity east of the Philippines at 12UTC on 7 October and was further upgraded to typhoon intensity (TY) over the same waters at 18UTC the next day. Continuing westward, Prapiroon reached its peak intensity with maximum sustained winds of 90 kt and a central pressure of 940 hPa east of the Philippines at 12 UTC on 11 October and turned northeastward 12 hours later. It turned again sharply southwestward over the sea south of Minamidaitojima Island early on 15 October. After moving southwestward, Prapiroon turned northward over the sea south of Okinawa Island late the next day and then turned again northeastward over the same waters early on 17 October. It accelerated northeastward and transformed into an extratropical cyclone east of Japan at 12 UTC on 19 October. After moving eastward, Prapiroon turned northeastward late on 21 October and then it crossed longitude 180 degrees east near the Aleutian Islands before 18 UTC on 23 October.



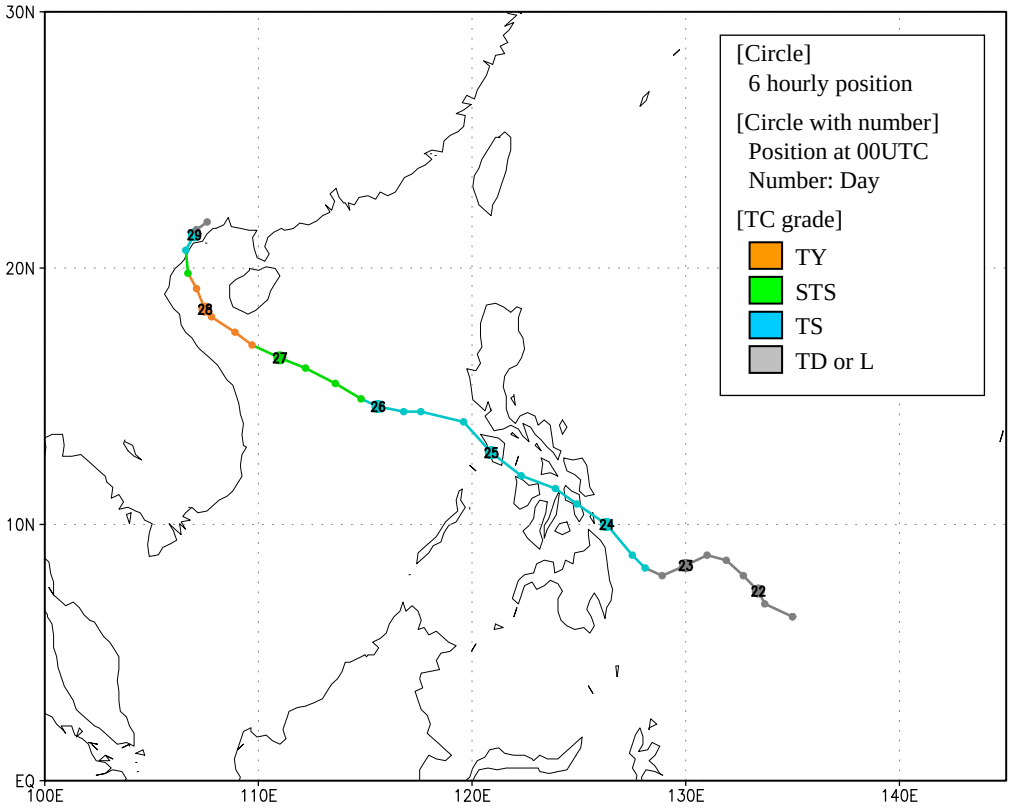
MARIA (1222)

Maria formed as a tropical depression (TD) east of the Northern Mariana Islands at 18 UTC on 12 October 2012. Moving west-northwestward, it was upgraded to tropical storm (TS) intensity west of the islands at 06 UTC on 14 October. Keeping its northwestward track, Maria was upgraded to severe tropical storm (STS) intensity and reached its peak intensity with maximum sustained winds of 50 kt and a central pressure of 990 hPa over the same waters at 00 UTC the next day. Moving northward, it was downgraded to TS intensity northwest of Iwoto Island 24 hours later. Turning east-northeastward, Maria weakened to TD intensity far east of Japan at 00 UTC on 19 October and dissipated over the same waters 06 UTC the next day.



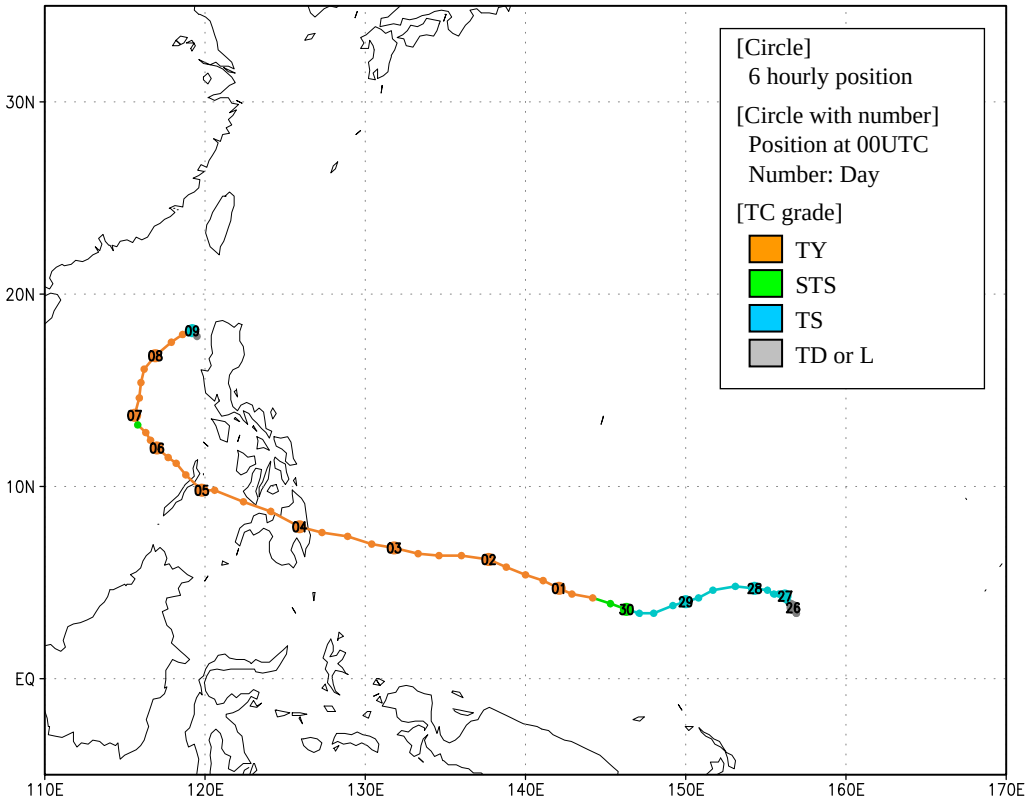
SON-TINH (1223)

Son-tinh formed as a tropical depression (TD) southeast of the Palau Islands at 12 UTC on 21 October 2012 and moved northwestward. It was upgraded to tropical storm (TS) intensity east of Mindanao Island at 12 UTC on 23 October. Keeping its northwestward track, Son-tinh crossed the Philippines the next day. It was upgraded to severe tropical storm (STS) intensity over the South China Sea at 06 UTC on 26 October. Son-tinh was further upgraded to typhoon (TY) intensity east of Viet Nam at 06 UTC the next day and reached its peak intensity with maximum sustained winds of 85 kt and a central pressure of 945 hPa six hours later. Moving northward over the Gulf of Tonkin, it weakened rapidly and was downgraded to TS intensity at 18 UTC on 28 October after hitting the northern part of Viet Nam. Son-tinh rapidly weakened to TD intensity at 06 UTC the next day and dissipated 12 hours later.



BOPHA (1224)

Bopha formed as a tropical depression (TD) southwest of Pohnpei Island at 18 UTC on 25 November 2012. Slowly moving northwestward, it was upgraded to tropical storm (TS) intensity over the same waters at 18 UTC the next day. Moving westward, Bopha was upgraded to typhoon (TY) intensity at 12 UTC on 30 November. It reached its peak intensity with maximum sustained winds of 100 kt and a central pressure of 930 hPa east of Mindanao Island at 12 UTC on 3 December. After crossing the island and the Sulu Sea, Bopha gradually turned northward and was downgraded to severe tropical storm (STS) intensity over the South China Sea at 18 UTC on 6 December. It developed again and was upgraded to TY intensity six hours later before turning northeastward over the sea west of Luzon Island. Bopha rapidly weakened late on 8 December and remained almost stationary over the same waters. It weakened to TD intensity at 06 UTC the next day and dissipated six hours later.



WUKONG (1225)

Wukong formed as a tropical depression (TD) west of the Palau Islands at 00 UTC on 24 December 2012 and moved northwestward. It was upgraded to tropical storm (TS) intensity east of the Philippines at 00 UTC the next day before turning westward. Wukong reached its peak intensity with maximum sustained winds of 40 kt and a central pressure of 1000 hPa six hours later and then crossed the Philippines. It weakened to TD intensity over the South China Sea at 06 UTC on 28 December and dissipated over the same waters 18UTC the next day.